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IoT glossary

Plain definitions of the terms used in IoT, industrial IoT and SCADA: connectivity, protocols, automation, data, security, energy, water, buildings and more.

1,000
terms

27
letters

Edition November 2026

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0–9

0–10 V signal
Devices and sensors

An analogue control or measurement signal in which a voltage between 0 and 10 volts stands for the range of a value, such as 0 to 100 % damper position or lamp brightness. It is common in building automation because it is simple, but a long cable lowers the voltage that arrives, which a 4–20 mA loop does not suffer from.

Related: Current loop, Analog input, Actuator

2.4 GHz band
Connectivity

A licence-free radio band available almost worldwide, used by Wi-Fi, Bluetooth, Zigbee and Thread. It allows faster data than sub-gigahertz bands but is crowded and passes through walls less well, so ranges are shorter.

Related: ISM band, Wi-Fi, BLE, Zigbee

2FA (two-factor authentication)
Security

Signing in with two different kinds of proof, typically a password plus a code from an app or a security key. A stolen password alone is then not enough to take over the account. See also multi-factor authentication.

> **In Hermetry** Hermetry supports passkeys and one-time codes as second factors, and can require two-step verification for an organisation.
> hermetry.com/docs/security/two-factor-and-passkeys/

Related: MFA, TOTP

2G and 3G switch-off
Connectivity

Mobile operators are switching off their 2G and 3G networks to reuse the radio spectrum for 4G and 5G. Devices that can only use those networks, such as older alarm panels, meters and trackers, stop working when the network in their area goes off, so fleets need a plan to move to LTE-M, NB-IoT or 4G.

Related: GSM, LTE-M, NB-IoT, Cellular IoT

3GPP (3rd Generation Partnership Project)
Standards

The partnership of telecommunications standards bodies that writes the specifications for mobile networks, from GSM to 5G. Its work comes out in numbered releases; NB-IoT and LTE-M arrived in Release 13 and RedCap in Release 17.

Related: 5G, NB-IoT, LTE-M, RedCap

4–20 mA
Devices and sensors

The most common analogue signal in industrial instruments: a current of 4 mA stands for the bottom of the range and 20 mA for the top. See current loop for how it works and why the live zero at 4 mA matters.

Related: Current loop, Analog input, Scaling

4G (LTE)
Connectivity

The fourth generation of mobile networks, based on Long Term Evolution. Besides fast phone data it carries the IoT device categories LTE-M and NB-IoT and the low-rate Cat 1 used by many gateways and trackers.

Related: LTE Cat 1, LTE-M, NB-IoT, 5G

5G
Connectivity

The fifth generation of mobile networks. It is designed for three kinds of use: fast mobile broadband, ultra-reliable low-latency links for control, and massive numbers of simple devices. For most IoT today that last role is filled by NB-IoT and LTE-M, which are recognised as 5G technologies, while RedCap serves mid-range devices.

Related: RedCap, NB-IoT, LTE-M, 3GPP

6LoWPAN (IPv6 over low-power wireless personal area networks)
Protocols

An adaptation layer that lets IPv6 packets travel over small, low-power radios such as IEEE 802.15.4 by compressing headers and splitting large packets. It gives every tiny sensor its own IP address and is the basis of Thread networks.

Related: Thread, Border router, Mesh network

868 MHz and 915 MHz bands
Connectivity

The licence-free sub-gigahertz radio bands most used by LPWAN devices: around 868 MHz in Europe and around 915 MHz in the Americas and some other regions. Each region has its own rules, such as duty-cycle limits in Europe and frequency hopping or dwell-time limits in the Americas, which is why devices are built for a regional frequency plan.

Related: ISM band, Frequency plan, Duty cycle, LoRaWAN

A

ABP (activation by personalisation) Connectivity

A way to put a LoRaWAN device on a network with its device address and session keys written into it in advance, so it never sends a join request. It is quick to set up, but the keys stay the same until someone changes them by hand, which makes OTAA the safer choice for most fleets.

> **In Hermetry** Hermetry supports ABP devices, though OTAA is the usual choice.
> hermetry.com/docs/lorawan/add-an-abp-device/

Related: OTAA, Session keys, LoRaWAN

Absolute, gauge and differential pressure

Devices and sensors

Three ways to state a pressure. Absolute pressure is measured against a perfect vacuum, gauge pressure against the surrounding atmosphere, and differential pressure between two points. Mixing them up gives readings about one bar off, so a sensor's type must match what the process needs.

Related: Differential pressure, Sensor, Scaling

Accelerometer Devices and sensors

A sensor that measures acceleration along one, two or three axes, usually as a small MEMS chip. IoT devices use it to detect movement, tilt, shocks and falls, and machines use it to measure vibration.

Related: Vibration monitoring, Asset tracking, Condition monitoring

Access control Security

Deciding who may enter a place or use a system, and recording when they did. Physical access control uses badges, keypads and door controllers; logical access control uses accounts, roles and keys.

Related: RBAC, Authentication, Authorisation, Audit log

Access point Connectivity

A device that connects wireless clients to a wired network, most often for Wi-Fi. Industrial sites place access points so that machines and handhelds have coverage everywhere they move.

Related: Wi-Fi, Gateway, Backhaul

Accuracy and precision Devices and sensors

Accuracy is how close a reading is to the true value; precision is how close repeated readings are to each other. Datasheets often state accuracy as a percentage of the reading or of full scale, which makes a big difference at the low end of the range.

Related: Calibration, Sensor drift, Sensor

Acknowledgement (alarm) Automation and control

The step in which a person confirms they have seen an alarm. Acknowledging does not clear the alarm; it records who took it on and when, and usually stops repeat notifications while the condition is still present.

> **In Hermetry** Operators acknowledge Hermetry alarms one by one or in bulk, add notes, and every step lands on the alarm's timeline.
> hermetry.com/docs/rules-and-alarms/working-with-alarms/

Related: Alarm, Alarm shelving, ISA-18.2

Acoustic monitoring Operations

Listening to equipment or pipes with microphones or contact sensors to spot faults by sound, such as a leaking valve, a failing bearing or water escaping from a buried main. The sound is usually turned into features like level and frequency content before it is sent.

Related: Leak detection, Vibration monitoring, Condition monitoring

Actuator Devices and sensors

A device that turns a control signal into a physical action: opening a valve, moving a damper, starting a motor or switching a relay. Sensors tell a system what is happening; actuators let it do something about it.

Related: Sensor, Relay, Control valve

Adaptive sampling Data and analytics

Changing how often a device measures or reports according to what is happening, for example every hour when a tank level is steady and every minute while it is filling. It saves battery and data without missing the moments that matter.

Related: Sampling rate, Report by exception, Battery life

ADC (analog-to-digital converter) Devices and sensors

The circuit that turns an analogue voltage into a number a processor can use. Its resolution in bits sets how fine the steps are: a 12-bit converter divides its range into 4,096 steps.

Related: Analog input, Sampling rate, Scaling

ADR (adaptive data rate) Connectivity

A LoRaWAN mechanism in which the network server tells a device which data rate and transmit power to use, based on how well its recent uplinks were received. Devices close to a gateway then send faster and use less airtime and battery.

> **In Hermetry** Hermetry's network server runs ADR and sends the MAC commands for it.
> hermetry.com/docs/lorawan/adr-data-rates-and-mac-commands/

Related: Data rate, Spreading factor, MAC command

AES-128 Security

A symmetric block cipher with a 128-bit key, standardised as the Advanced Encryption Standard. LoRaWAN uses it to encrypt payloads and to compute the message integrity code, and many sensors use it for their own payload encryption.

Related: MIC, Session keys, TLS

Agent (device agent) Operations

A piece of software on a device or gateway that keeps the connection to a platform, sends data, carries out commands and installs updates. A good agent recovers on its own after a power cut or a lost network.

Related: Edge gateway, OTA, Heartbeat

AHU (air handling unit) Buildings

The part of a building's HVAC system that takes in air, filters it, heats or cools it and pushes it through the ducts. Typical readings are supply and return temperature, filter pressure drop, fan speed and damper position.

Related: HVAC, BMS, VAV

AIoT (artificial intelligence of things) Data and analytics

The combination of connected devices with artificial intelligence, so that data from sensors is used to recognise patterns, predict faults or decide actions. The intelligence can run in the cloud, on a gateway or on the device itself.

Related: Edge AI, Anomaly detection, Predictive maintenance

Air gap Security

Keeping a network physically separated from all other networks, often done for safety and control systems. In practice gaps are often bridged by USB sticks, laptops or remote-access links, so an air gap needs rules and checks as well as cables.

Related: Data diode, OT, Defence in depth

Air quality sensor Devices and sensors

A sensor that measures pollutants or indicators of air quality, such as CO_2, volatile organic compounds, fine particles (PM2.5 and PM10), nitrogen dioxide or ozone. Indoors it guides ventilation; outdoors it feeds pollution maps and alerts.

Related: CO_2 sensor, AQI, HVAC

Alarm Automation and control

A record that something is abnormal: a reading out of range, a device that stopped reporting, a fault signal. An alarm usually has a severity, opens when its condition is met and clears when the condition goes away.

> **In Hermetry** Alarm rules on a device profile open and clear alarms, each with one of five severities, a status (open, acknowledged, resolved) and a timeline.
> hermetry.com/docs/rules-and-alarms/alarms/

Related: Acknowledgement, Alarm flood, Threshold, Hysteresis

Alarm escalation Automation and control

Passing an alarm on to the next person or channel when nobody responds in time, for example from the on-call technician by app to the supervisor by phone after 15 minutes. Escalation makes sure an alarm cannot be silently missed.

Related: Alarm, Acknowledgement, Alarm priority

Alarm flood Automation and control

A burst of more alarms than an operator can handle, typically ten or more in ten minutes for one person. Floods hide the alarm that matters and usually point to missing deadbands, repeated alarms for one cause or alarms with no action behind them.

> **In Hermetry** Hermetry's alarm settings protect people from floods with a repeat window and storm digests.
> hermetry.com/docs/notifications/alarm-notifications-in-depth/

Related: Alarm, Deadband, ISA-18.2

Alarm management Automation and control

The work of designing, operating and reviewing alarms so that operators get only alarms that need an action, with the right priority. Standards such as ISA-18.2 and IEC 62682 describe it as a lifecycle, from philosophy to regular audits.

Related: ISA-18.2, Alarm rationalisation, Alarm flood

Alarm priority Automation and control

The rank of an alarm, such as critical, high, medium or low, based on how serious the consequence is and how quickly someone must act. When most alarms are high priority, priority stops meaning anything, so good practice keeps the top levels rare.

Related: Alarm, Alarm management, Alarm escalation

Alarm rationalisation Automation and control

Reviewing every alarm one by one: what causes it, what happens if nobody acts, what the operator should do, its priority and its limit. Alarms with no clear action are removed or turned into events.

Related: Alarm management, ISA-18.2, Alarm priority

Alarm shelving Automation and control

Putting an alarm aside for a set time, for example while a known fault is being repaired, so it stops demanding attention without being deleted. A shelved alarm returns when the time runs out.

> **In Hermetry** Hermetry mutes a device's alarm notifications for up to 90 days, for example during maintenance; the alarms are still opened and recorded.
> hermetry.com/docs/rules-and-alarms/maintenance-mutes/

Related: Alarm, Acknowledgement

Alarm suppression Automation and control

Automatically holding back alarms that are expected in the current situation, for example low-flow alarms while a pump is stopped for maintenance. Unlike shelving, which a person does by hand, suppression follows rules based on the state of the plant.

Related: Alarm shelving, Alarm flood, Interlock

Ambient IoT Connectivity

An emerging class of very low-cost devices that have no battery and run on energy harvested from radio waves, light or motion, sending data by reflecting signals. Mobile network standards are adding support for it so such tags can be read across large areas.

Related: Backscatter communication, Energy harvesting, RFID

AMI (advanced metering infrastructure) Energy

A complete two-way metering system: smart meters, the network that links them and the head-end software that collects their data. Besides frequent readings it supports remote connect and disconnect, tariff changes and outage alerts.

Related: Smart meter, AMR

AMQP (Advanced Message Queuing Protocol) Protocols

An open standard protocol for passing messages between applications through queues, with delivery guarantees and routing. It is common between back-end systems, while constrained devices more often use MQTT or CoAP.

Related: MQTT, Publish-subscribe, Message broker

AMR (automatic meter reading) Energy

Reading meters without visiting each one by hand, using walk-by, drive-by or fixed radio networks. Unlike AMI, classic AMR is one-way: the meter sends readings but cannot receive commands.

Related: AMI, Drive-by meter reading, Smart meter

Analog input Devices and sensors

An input that reads a continuous signal, such as a 4–20 mA current loop or a 0–10 V voltage, and turns it into a number. The number is then scaled to the engineering unit of the sensor, for example bar or °C.

Related: Current loop, Digital input, Scaling

Anemometer Devices and sensors

An instrument that measures wind speed, often together with direction. Cup and vane designs have moving parts, while ultrasonic anemometers measure the travel time of sound and need little maintenance.

Related: Weather station, Sensor

Anomaly detection Data and analytics

Finding readings or patterns that do not fit the usual behaviour, such as a night consumption that is higher than every other night. It can be as simple as a band around a moving average or as complex as a trained model.

Related: Predictive maintenance, Threshold, Time series

Antenna Connectivity

The part of a radio that turns electrical signals into radio waves and back. Its type, size and position often matter more for range than the radio itself: an antenna inside a metal cabinet can lose most of the signal.

Related: Antenna gain, Link budget, Attenuation

Antenna gain Connectivity

How strongly an antenna focuses its energy in one direction compared with an ideal antenna that radiates equally everywhere, stated in dBi. More gain reaches further in the favoured direction but less well elsewhere, and regulations cap the total radiated power.

Related: dBi, Antenna, Link budget

APC (advanced process control) Automation and control

Control methods that sit above basic PID loops and coordinate several of them, often using a model of the process to predict its behaviour. APC keeps a plant closer to its best operating point, saving energy and raw material.

Related: PID controller, Control loop, DCS

API (application programming interface) Data and analytics

A defined way for one program to ask another for data or actions. In IoT, platforms usually offer a REST API for people and systems and a device API (often MQTT or HTTP) for devices.

> **In Hermetry** Hermetry offers a management REST API, webhooks and MCP servers for your own systems, alongside the device API.
> hermetry.com/docs/api/

Related: REST API, Webhook, API key

API gateway Data and analytics

A service that sits in front of a set of APIs and handles the common work for all of them: checking keys, limiting request rates, routing and logging. Clients talk to one address instead of many.

Related: API, REST API, API key

API key Security

A secret string that identifies a program calling an API. Good practice is one key per integration, with only the rights it needs, an expiry date and the option to revoke it at any time.

> **In Hermetry** Hermetry API keys carry only the permissions you give them and can be pinned to networks, given an expiry and rotated.
> hermetry.com/docs/api/authentication/

Related: API, RBAC, REST API

APM (asset performance management) Operations

Software and practice for keeping physical assets reliable at the lowest cost, combining condition data, failure history and risk to decide when and how to maintain each asset. It helps decide where maintenance money brings the most reliability.

Related: Predictive maintenance, CBM, Asset management

APN (access point name) Connectivity

The name a cellular device uses to choose the data network it connects through. A private APN can keep device traffic off the public internet and give devices fixed private addresses.

> **In Hermetry** A router on its own SIM connects to Hermetry with the APN set on the router itself; Hermetry needs no special setting for it.
> hermetry.com/docs/edge/cellular-and-esim/

Related: Cellular IoT, SIM, eSIM

AppKey Security

In LoRaWAN 1.0.x, the root key a device shares with the network for over-the-air activation; fresh session keys are derived from it at every join. LoRaWAN 1.1 adds a separate network root key. Root keys must never be sent in clear text or reused across devices.

> **In Hermetry** You register a LoRaWAN device that joins over the air in Hermetry with its DevEUI, JoinEUI and AppKey.
> hermetry.com/docs/lorawan/add-an-otaa-device/

Related: OTAA, Session keys, Join procedure

Application server (LoRaWAN) Connectivity

In a LoRaWAN network, the component that decrypts application payloads and passes the data on to the user's systems. The network server handles the radio side and forwards each message to the right application server.

Related: Network server, LoRaWAN, Session keys

AQI (air quality index) Smart city

A single number that summarises how polluted the air is, calculated from the concentrations of several pollutants and shown in colour bands with health advice. Different countries use different formulas and bands, so indexes are not directly comparable.

Related: Air quality sensor

Asset hierarchy Data and analytics

A tree that organises assets from the top down, such as company, site, area, line, machine and component. It lets data roll up from a single sensor to a whole plant and lets people find things where they expect them.

> **In Hermetry** In Hermetry Twin the asset hierarchy is a tree of sites, buildings, floors, rooms, lines and machines, and devices are placed on its assets.
> hermetry.com/docs/twin/asset-hierarchy/

Related: ISA-95, Zone, Data model

Asset management Operations

Managing physical assets over their whole life, from purchase through operation and maintenance to disposal, to get the most value at acceptable risk. ISO 55000 describes it as a management system.

Related: APM, Asset tracking, Work order

Asset tracking Operations

Knowing where movable things are and in what state: containers, tools, vehicles, people's badges. Location comes from GNSS outdoors or from radio beacons and gateways indoors, often with temperature or shock readings alongside.

Related: GNSS, Geofence, Beacon

Asset utilisation Operations

The share of available time an asset is actually used productively, such as hours a machine runs or days a container is in transit. Low utilisation shows where equipment can be shared, moved or sold.

Related: OEE, Asset tracking, KPI

AT commands Devices and sensors

Short text commands, each beginning with "AT", used to control cellular modems and some other radio modules: to check signal, attach to a network or send data. The convention dates back to early dial-up modems and is still used by most modules.

Related: Cellular IoT, UART, APN

ATEX Standards

The European rules for equipment and work in potentially explosive atmospheres, such as gas in refineries or dust in grain silos. Areas are divided into zones by how often an explosive atmosphere occurs, and devices installed there must be certified for that zone.

Related: IP rating, SIL

ATS (automatic transfer switch) Energy

A switch that moves an electrical load from the normal supply to a backup, such as a generator, when the normal supply fails, and back again when it returns. Monitoring its position and transfers shows how often a site runs on backup.

Related: UPS, Generator monitoring, Redundancy

Attack surface Security

All the points where an attacker could try to get in: open ports, services, interfaces, user accounts, debug connectors and update channels. Shrinking it, by closing what is not needed, is one of the cheapest security measures.

Related: Defence in depth, Zero trust, IEC 62443

Attenuation Connectivity

The loss of signal strength as it travels, through distance, walls, water, vegetation, cables and connectors. It is measured in decibels, and every added decibel of loss shortens the range of a radio link.

Related: Link budget, dBm, Antenna

Audit log Security

A tamper-evident record of who did what and when: sign-ins, changed settings, sent commands, approved actions. It answers questions after an incident and is often required by security standards.

> **In Hermetry** Hermetry's audit log records sign-ins, member and role changes, key changes, high-impact commands and more, with a hash chain check.
> hermetry.com/docs/administration/audit-log/

Related: RBAC, IEC 62443

Authentication Security

Proving who or what you are: a person with a password and a second factor, a device with a certificate or key, a program with an API key. Authentication comes before authorisation, which decides what you may then do.

Related: Authorisation, mTLS, SSO

Authorisation Security

Deciding what an authenticated person, device or program is allowed to do, such as read data, change settings or send commands. Roles and policies keep authorisation consistent across many users.

Related: Authentication, RBAC, API key

Automation pyramid Automation and control

A model of industrial systems in levels: field devices at the bottom, then control (PLCs), supervision (SCADA), manufacturing operations (MES) and business planning (ERP) at the top. IIoT platforms often connect several levels directly instead of passing data up one layer at a time.

Related: ISA-95, SCADA, MES, PLC

Availability Operations

The share of planned time that a machine or system is actually able to run. In OEE it is run time divided by planned production time; for IT services it is usually stated as a percentage of uptime.

Related: OEE, MTBF, MTTR

B

Backhaul Connectivity

The link that carries a gateway's traffic to the network or the cloud, such as Ethernet, cellular or satellite. A gateway with a weak backhaul can hear every sensor and still lose their data.

Related: Gateway, LoRaWAN gateway, Cellular IoT

Backoff (retry) Protocols

Waiting before trying again after a failed connection or message, usually waiting longer after each failure and adding a random delay. Without it, thousands of devices reconnecting at the same moment after an outage can overload the server they are trying to reach.

> **In Hermetry** Hermetry's docs tell firmware authors what a device receives when a connection is refused or ended, and how long it should wait before trying again.
> hermetry.com/docs/devices/reconnection-and-back-off/

Related: Keep-alive, Store and forward, Jitter

Backscatter communication Connectivity

Sending data by reflecting an existing radio signal and changing how much is reflected, instead of producing a signal of one's own. It needs very little power, which is how passive RFID tags and battery-less sensors work.

Related: Ambient IoT, RFID, Energy harvesting

BACnet Protocols

A standard data communication protocol for building automation, used by HVAC, lighting and access systems. It runs over IP networks (BACnet/IP) or over RS-485 serial lines (BACnet MS/TP).

> **In Hermetry** Hermetry Edge, on the gateways Hermetry supports, can read BACnet/IP devices, depending on the gateway model.
> hermetry.com/docs/edge/licensed-gateways-and-hermetry-edge/

Related: BMS, Modbus TCP, RS-485

BACnet object Buildings

The way BACnet describes the data of a device: as objects of standard types, such as Analog Input, Binary Output or Schedule, each with properties like Present Value and Status Flags. A client reads and writes those properties instead of raw registers.

Related: BACnet, COV, BMS

BACnet/SC (Secure Connect) Buildings

A newer way to carry BACnet traffic over encrypted, certificate-authenticated connections, using secure WebSocket links through a hub. It makes building networks easier to protect and to run across IT networks.

Related: BACnet, TLS, X.509 certificate

BACS (building automation and control system) Buildings

The controllers, sensors and software that run a building's heating, cooling, ventilation, lighting and shading automatically. European building rules increasingly require such systems in larger non-residential buildings to cut energy use.

Related: BMS, BACnet, BEMS

Bandwidth (radio) Connectivity

The width of the frequency band a radio signal occupies, such as 125 kHz in LoRa. A wider bandwidth sends data faster but reaches less far for the same power.

Related: Spreading factor, Data rate, Link budget

Barcode Logistics

A printed code that a scanner or camera reads optically: one-dimensional lines or two-dimensional codes such as QR. It is cheap and universal but needs a line of sight, which is why some logistics flows use RFID instead.

Related: RFID, Asset tracking, Traceability

Base station Connectivity

The radio site of a mobile network that devices connect to, called an eNodeB in 4G and a gNodeB in 5G. A device's signal quality depends on its distance to the nearest base station and what stands in between.

Related: Cellular IoT, Cell ID positioning, RSSI

Basics Station Connectivity

Open gateway software that connects a LoRaWAN gateway to a network server over a secure WebSocket connection, instead of the older UDP packet forwarder. Because the connection is encrypted and the gateway authenticates itself, it is the safer way to run gateways over the public internet.

> **In Hermetry** Hermetry's network server accepts Basics Station gateways, which connect over a secure WebSocket (wss://).
> hermetry.com/docs/lorawan/your-network-server-address/

Related: LoRaWAN gateway, Packet forwarder, Network server

Batch control Automation and control

Controlling processes that make products in batches, such as food, drinks, medicines and chemicals, by following recipes split into steps. The ISA-88 standard defines a common model for recipes, equipment and procedures.

Related: ISA-95, MES, Traceability

Battery life Devices and sensors

How long a battery-powered device runs before its battery needs replacing. It depends on the sleep current, how often and how long the radio transmits, the temperature and the battery's own self-discharge, and it is often the deciding cost of a wireless deployment.

Related: Deep sleep, Duty cycle, Energy harvesting

Battery management system Devices and sensors

The electronics that watch over a rechargeable battery pack: cell voltages, temperatures, state of charge and health. It balances the cells and disconnects the pack before it is damaged.

Related: BESS, SoC, UPS

Baud rate Protocols

The number of signal changes per second on a serial line; on simple serial links it equals bits per second. Every device on an RS-485 bus must use the same baud rate, parity and stop bits, or no one understands anyone.

Related: RS-485, Modbus RTU, UART

Beacon Connectivity

A small radio transmitter, usually Bluetooth Low Energy, that repeats a short identifier. Receivers use beacons to work out which room or zone something is in.

Related: BLE, Asset tracking, RSSI

Beamforming Connectivity

Using several antennas together to point radio energy towards a receiver rather than in all directions. It improves range and capacity and is used in 5G and modern Wi-Fi.

Related: Antenna, Antenna gain, 5G

BEMS (building energy management system) Buildings

A system that monitors and controls the energy use of a building, often part of or connected to the BMS. It collects meter data, compares it with targets and runs measures such as schedules and setpoint changes.

Related: BMS, Sub-metering, Energy monitoring

BER (bit error rate) Connectivity

The share of transmitted bits that arrive wrong. It rises as the signal weakens or interference grows, and protocols use error-correcting codes and checks to cope with it.

Related: SNR, CRC, Coding rate

BESS (battery energy storage system) Energy

A large battery system with its inverters and controls that stores electrical energy and releases it later. It is used to shave peaks, store solar power, support the grid and keep sites running during outages.

Related: Peak shaving, Battery management system, DER

BIM (building information modelling) Buildings

A shared digital model of a building that holds its geometry along with information about its spaces, equipment and systems. Linking sensor data to the model turns it into a digital twin that shows live conditions room by room.

Related: Digital twin, BMS, Asset hierarchy

Binary payload Protocols

A message whose content is raw bytes rather than readable text, used to keep radio messages short. Each byte or bit has a meaning defined by the device maker, so the receiver needs a decoder to turn it into named values.

Related: Codec, Payload, Byte order

Bitmask Protocols

Using individual bits of a number as separate yes-or-no flags, as many status registers do: bit 0 might mean "running", bit 3 "fault". A program tests a flag by combining the number with a mask that has only that bit set.

Related: Modbus register, Quality code, Binary payload

Black start Energy

Restarting a power station or part of the grid after a total blackout without power from the grid, using generators or batteries on site. Monitoring and testing black-start equipment matters because it is rarely used but must work when needed.

Related: UPS, BESS, ATS

BLE (Bluetooth Low Energy) Connectivity

A short-range, low-power radio used by small battery sensors, beacons and tags. BLE sensors usually reach the internet through a nearby gateway or phone.

> **In Hermetry** A gateway can bring BLE sensors into Hermetry, where each becomes a child device with its own readings and alarms.
> hermetry.com/docs/edge/devices-behind-a-gateway/

Related: Beacon, Gateway, Mesh network

Blockchain Data and analytics

A shared ledger in which records are chained together so that changing an old record is detectable. It has been proposed for proving where IoT data came from, but it adds cost and complexity, and many systems get similar assurance from signed data and audit logs.

Related: Digital signature, Audit log, Traceability

Bluetooth mesh Connectivity

A way for many Bluetooth Low Energy devices to pass messages to each other so they can cover a whole building without a central hub. It is used mainly for lighting control and building sensors.

Related: BLE, Mesh network, Lighting control

BMS (building management system) Buildings

The control system that runs a building's HVAC, lighting, pumps and often access and fire panels from one place. BMS controllers commonly speak BACnet or Modbus.

> **In Hermetry** The building HVAC and energy use case reads the existing BMS or plant controllers through a gateway per building.
> hermetry.com/use-cases/building-hvac-and-energy-overview/

Related: BACnet, AHU, HVAC

Bootloader Devices and sensors

The small program that runs first when a device powers up and starts the main firmware. A well-designed bootloader checks the firmware's signature and can fall back to the previous version if an update fails.

Related: Firmware, OTA, Firmware signing

Bootstrapping (device) Operations

The first step in a device's life on a network, in which it receives the credentials and server addresses it needs to connect. Some protocols, such as LwM2M, have a dedicated bootstrap server for this.

Related: Provisioning, LwM2M, Zero-touch provisioning

Border router Connectivity

A device that connects a low-power mesh network, such as Thread or another 6LoWPAN network, to a regular IP network like Ethernet or Wi-Fi. Without it the mesh devices cannot reach the internet.

Related: Thread, 6LoWPAN, Gateway

Broadcast Connectivity

Sending one message that every device on a network receives. It is useful for discovery and for sending the same setting to many devices, but it costs airtime and is usually limited on radio networks.

Related: Multicast, Device discovery, Downlink

Brownfield Operations

A site with existing equipment and systems that a new project has to work with rather than replace. Brownfield IoT is mostly about reading what controllers and meters already offer, without stopping them.

Related: Greenfield, Retrofit, Protocol converter

Brownout Devices and sensors

A drop in supply voltage that is not a full outage, from a weak mains supply or a battery near the end of its life. It can make electronics behave unpredictably, so devices use a brownout detector that resets them cleanly.

Related: Watchdog, Battery life, UPS

Brute-force attack Security

Guessing passwords or keys by trying very many of them. Rate limits, lockouts, long random keys and multi-factor sign-in make brute force impractical.

Related: Authentication, API key, Audit log

Bulk provisioning Operations

Registering many devices at once, usually from a file with their identifiers and keys, instead of adding them one by one. It is what makes rolling out thousands of meters or sensors practical.

> **In Hermetry** Hermetry adds or updates up to 1,000 devices from a CSV file, checks every import before anything is written, and can undo it.
> hermetry.com/docs/devices/importing-devices-in-bulk/

Related: Provisioning, Zero-touch provisioning, CSV

Bus topology Protocols

A wiring layout in which devices hang off one shared line, as on an RS-485 network. A bus needs termination at both ends and only one device should talk at a time.

Related: RS-485, Fieldbus, Modbus RTU

Busbar Energy

A thick metal bar inside a switchboard that distributes power to many circuits. Monitoring busbar temperature catches loose connections before they overheat and fail.

Related: Circuit breaker, Energy meter

Byte order Protocols

The order in which the bytes of a multi-byte number are sent or stored. Getting it wrong turns a value of 20.5 into nonsense; see endianness.

Related: Modbus register, Binary payload

C

CA (certificate authority) Security

The trusted party that issues and signs digital certificates, vouching that a public key belongs to a named device, server or person. A private CA lets an organisation issue certificates for its own devices.

> **In Hermetry** Supported devices sign in with X.509 client certificates issued by Hermetry's own certificate authority, with offline roots, renewal and revocation.
> hermetry.com/docs/security/device-certificate-authority/

Related: PKI, X.509 certificate, CSR

Calibration Devices and sensors

Comparing an instrument with a more accurate reference and adjusting or correcting it so its readings are right. Calibrations are repeated at set intervals and recorded, often with traceability back to national standards.

Related: Accuracy and precision, Sensor drift, Scaling

CAN bus (controller area network) Protocols

A robust two-wire bus on which electronic units in vehicles and machines exchange short messages. Messages carry an identifier instead of an address, and every unit decides which identifiers it cares about.

Related: J1939, Fieldbus

Cathodic protection Energy

Protecting buried or submerged steel, such as pipelines and tanks, from corrosion by making it the cathode of an electrochemical cell, with sacrificial anodes or an impressed current. Remote monitoring of rectifiers and test-point potentials replaces long drives to check them by hand.

> **In Hermetry** The remote wellhead use case brings cathodic protection readings into Hermetry next to well and pipeline pressures.
> hermetry.com/use-cases/remote-wellhead-and-pipeline-pressure/

Related: Corrosion monitoring, RTU

CBM (condition-based maintenance) Operations

Maintaining equipment when its measured condition shows it is needed, rather than on a fixed calendar. Vibration, temperature, oil quality or run hours trigger the work.

Related: Predictive maintenance, Preventive maintenance, Condition monitoring

CBOR (Concise Binary Object Representation) Protocols

A compact binary data format with the same kind of structure as JSON: numbers, text, arrays and maps. It is much smaller and faster to parse, which suits constrained devices, and is often used with CoAP.

Related: JSON, CoAP, Binary payload

Cell ID positioning Connectivity

Estimating where a cellular device is from the identity of the base station it is connected to. It needs no extra hardware or power, but the accuracy is coarse, from a few hundred metres in cities to several kilometres in the country.

Related: Base station, GNSS, Asset tracking

Cellular IoT Connectivity

Devices that connect through mobile networks: LTE Cat 1, LTE-M, NB-IoT and 5G. It needs no private gateway, only coverage and a subscription, which makes it the usual choice for scattered sites.

Related: LTE-M, NB-IoT, RedCap

CEMS (continuous emissions monitoring system) Energy

Equipment that continuously measures pollutants such as sulphur dioxide, nitrogen oxides and dust in the flue gas of power plants and factories. Its data is used to prove that emission limits are kept.

Related: Air quality sensor, Audit log, Data logger

Certificate pinning Security

Making a device accept only one specific certificate or key for its server, instead of any certificate a trusted authority has signed. It blocks some interception attacks but needs a plan for when the pinned certificate changes.

Related: TLS, X.509 certificate, Certificate rotation

Certificate revocation Security

Declaring a certificate invalid before it expires, for example when a device is stolen or its key is exposed. Clients learn about revocations from revocation lists (CRLs) or online status checks (OCSP).

Related: PKI, X.509 certificate, CA

Certificate rotation Security

Replacing certificates and keys before they expire or whenever they may be exposed. Automating rotation across a fleet avoids devices going offline on the day a certificate runs out.

Related: X.509 certificate, PKI, Certificate revocation

Checksum Protocols

A small value calculated from a block of data and sent with it, so the receiver can tell whether the data arrived intact. Simple checksums add or XOR the bytes; a CRC catches many more errors.

Related: CRC, Binary payload, Modbus RTU

Child device (device behind a gateway)

Devices and sensors

A device that does not talk to the platform itself but through a gateway, for example a Modbus meter on the gateway's RS-485 port. The gateway reports for it, and the platform shows it as a device of its own.

> **In Hermetry** Hermetry turns each field device behind a gateway into a child device with its own readings, attributes, alarms and dashboards.
> hermetry.com/docs/edge/devices-behind-a-gateway/

Related: Gateway, Edge gateway, Modbus RTU

Chiller

Buildings

A machine that removes heat from a liquid, usually water, which then cools air handling units or processes. Key readings are supply and return water temperature, power and the coefficient of performance.

> **In Hermetry** The building HVAC and energy use case watches chillers in Hermetry next to air handling units and meters.
> hermetry.com/use-cases/building-hvac-and-energy-overview/

Related: HVAC, COP, AHU

Chlorine residual

Water

The amount of free chlorine still left in drinking water after disinfection, measured in milligrams per litre. Utilities monitor it across the network because too little lets bacteria grow and too much causes taste complaints.

Related: Water quality monitoring, DMA, Sensor

CHP (combined heat and power)

Energy

A plant that generates electricity and uses the heat that would otherwise be wasted, for heating buildings or processes. Monitoring output, run hours and efficiency shows whether it pays off.

Related: District heating, DER, Energy monitoring

CIP (Common Industrial Protocol)

Protocols

An object-based application protocol for industrial automation that describes devices as objects with attributes and services. It is carried by EtherNet/IP and by older industrial networks.

Related: EtherNet/IP, Fieldbus, PLC

Cipher suite

Security

The set of algorithms a secure connection agrees on: how keys are exchanged, how data is encrypted and how integrity is checked. Old, weak suites should be switched off on servers and devices.

Related: TLS, DTLS, AES-128

Circuit breaker

Energy

A switch that opens automatically when the current is too high, protecting cables and equipment, and can be reset afterwards. Monitoring breaker status and trips shows where faults happen and which circuits are overloaded.

Related: Busbar, Energy meter, Power quality

Cleanroom monitoring

Manufacturing

Continuous measurement of particle counts, pressure differences between rooms, temperature and humidity in cleanrooms, such as in medicine and electronics production. Records must be complete and tamper-evident because they prove each batch was made under the right conditions.

Related: Differential pressure, Audit log

Clock drift

Devices and sensors

The gradual difference between a device's clock and the real time, because no oscillator runs perfectly. A few seconds a day is common, so devices resynchronise from the network or a time server.

Related: NTP, Timestamp, PTP

Cloud computing

Data and analytics

Using computing, storage and services over the internet from a provider instead of running your own servers. IoT platforms often run in the cloud so they can grow with the number of devices without buying hardware.

Related: On-premises, IoT platform, Data residency

Cloud-to-device message

Protocols

A message sent from the platform to a device, such as a command, a new setting or a firmware notice. Devices that sleep receive these messages only when they next wake up and check in.

Related: Downlink, Command, Device-to-cloud message

CMP (connectivity management platform)

Connectivity

Software for managing the SIM cards of a device fleet: activating and suspending them, watching data use, setting limits and finding devices that have stopped connecting. Such a platform is used where fleets have hundreds or thousands of SIMs, often with several operators.

Related: SIM, eSIM, Cellular IoT

CO_2 sensor

Buildings

A sensor that measures carbon dioxide in parts per million, usually by how much infrared light the gas absorbs (NDIR). Indoors, CO_2 shows how well a room is ventilated for the people in it.

Related: Air quality sensor, HVAC, Demand-controlled ventilation

CO_2e (carbon dioxide equivalent)

Energy

A way to express different greenhouse gases as the amount of CO_2 that would warm the climate as much. Energy data from meters is turned into CO_2e with emission factors for carbon reporting.

Related: Energy monitoring, kWh, Sub-metering

CoAP (Constrained Application Protocol)

Protocols

A light web protocol for very small devices, with GET, PUT, POST and DELETE like HTTP but over UDP and with tiny headers. It is the transport under LwM2M.

Related: LwM2M, UDP, HTTP

Codec (payload decoder) Data and analytics

A small piece of logic that turns a device's compact binary payload into named values, such as bytes 01 0A 3F into "temperature 21.5". Every LoRaWAN sensor model needs one, because each packs its data differently.

> **In Hermetry** Hermetry comes with a library of 106 codecs for common LoRaWAN sensors, and you can write your own. hermetry.com/docs/lorawan/the-codec-library/

Related: Payload, LoRaWAN, Uplink

Coding rate Connectivity

The share of extra bits a radio adds to correct errors, written as 4/5 to 4/8 in LoRa. More correction makes a frame sturdier against interference but longer on air.

Related: Spreading factor, Time on air, Bandwidth

Cold chain Logistics

The unbroken chain of refrigerated storage and transport that keeps food, vaccines and medicines within their temperature range from production to use. Data loggers and connected sensors prove the range was kept and raise an alarm when it is not.

Related: Cold room, Data logger, MKT

Cold room Logistics

A walk-in refrigerated room for storing food or medicines. Typical monitoring covers air temperature, door openings, defrost cycles and the compressor, with alarms before the stock is at risk.

> **In Hermetry** The cold room use case watches air and product temperatures, door contacts, defrost and compressor states in Hermetry. hermetry.com/use-cases/cold-room-temperature-monitoring/

Related: Cold chain, Door contact sensor, Threshold

Command (RPC) Automation and control

An instruction sent from the platform to a device, such as "open valve 2" or "restart", often with a reply that says whether it worked. Good systems record who sent it and may require a second person to approve risky ones.

> **In Hermetry** Hermetry stores every command as a request, follows its state until it ends or expires, and keeps a catalogue of the commands a device accepts. hermetry.com/docs/devices/sending-commands-to-devices/

Related: Downlink, RPC, Setpoint

Commissioning Operations

Checking that a newly installed system works as designed before handing it over: every sensor reads correctly, every alarm reaches the right person and every command does what it should. Good commissioning records become the baseline for later troubleshooting.

> **In Hermetry** While a device is being commissioned or maintained, Hermetry can mute its alarm notifications for up to 90 days; its alarms are still recorded. hermetry.com/docs/rules-and-alarms/maintenance-mutes/

Related: Provisioning, Calibration, Decommissioning

Compressed air monitoring Manufacturing

Measuring the flow, pressure and power of compressed air systems, one of the most expensive utilities in a factory. Flow at night or at weekends usually reveals leaks that can be fixed cheaply.

Related: Flow meter, Energy monitoring, Leak detection

Condition monitoring Operations

Watching the health of machines through readings such as vibration, temperature and current, so wear shows up before a breakdown. It is the data side of predictive maintenance.

Related: Predictive maintenance, Vibration monitoring, Anomaly detection

Conductivity sensor Water

A sensor that measures how well water conducts electricity, in microsiemens per centimetre, which rises with the amount of dissolved salts. It is used for water quality, cooling towers and in irrigation, where it is often called EC.

Related: Water quality monitoring, Sensor, Cooling tower

Confirmed uplink Connectivity

A LoRaWAN uplink that asks the network for an acknowledgement and is repeated if none comes. It costs gateway airtime for the reply, so it is kept for the few messages that must not be lost.

Related: Uplink, Downlink, Duty cycle

Connected worker Manufacturing

Giving field and factory staff connected devices, such as phones, wearables and tablets, so they receive alarms, instructions and data where they work, and so their safety can be watched when they work alone. The aim is faster response, fewer trips and safer work.

Related: Work order

Constrained device Devices and sensors

A device with little memory, processing power or energy, such as a battery sensor on a microcontroller. Protocols for such devices, like CoAP and CBOR, are designed to keep messages and code small.

Related: MCU, CoAP, CBOR

Contactor Devices and sensors

An electrically controlled switch for large loads such as motors, heaters and lighting circuits. A small control signal from a controller or relay closes it and switches the heavy current.

Related: Relay, Digital output, Actuator

Container (software) Data and analytics

A package that holds an application with everything it needs to run, isolated from other applications on the same machine. Edge gateways use containers to run several independent applications and to update them safely.

Related: Edge computing, Edge gateway, OTA

Control loop Automation and control

A cycle in which a controller measures a value, compares it with the setpoint and adjusts an output to close the gap, again and again. In a closed loop the measurement feeds back; in an open loop the output is set without checking the result.

Related: PID controller, Setpoint, Actuator

Control valve Automation and control

A valve that a controller moves to any position, not just open or closed, to regulate flow, pressure or level. Its position feedback and travel are useful signals for spotting wear and sticking.

Related: Actuator, Control loop, PID controller

Cooling tower Buildings

A structure that cools water by letting part of it evaporate into a stream of air, removing heat from buildings and industrial processes. Its water needs monitoring for conductivity, temperature and treatment to prevent scaling and bacteria.

Related: Chiller, Conductivity sensor, HVAC

COP (coefficient of performance) Buildings

Useful heat moved divided by electrical energy used, for a heat pump or a chiller. A COP of 4 means four units of heat for one unit of electricity; a falling COP often means fouled coils or a refrigerant problem.

Related: Chiller, HVAC, Energy monitoring

Coriolis flow meter Devices and sensors

A flow meter that measures the mass flow of a liquid or gas directly, from the way vibrating tubes twist as the fluid moves through them. It also measures density and is very accurate, but costs more than most other types.

Related: Flow meter, Custody transfer, Totalizer

Corrosion monitoring Operations

Measuring how fast metal is being lost in pipes, tanks and structures, with probes, coupons or wall-thickness sensors. Trends tell when to inspect, treat or replace before a leak happens.

Related: Cathodic protection, Condition monitoring

Counter rollover Data and analytics

What happens when a counter, such as a meter's total or a pulse count, reaches its highest value and starts again from zero, for example after 65,535 in a 16-bit register. Consumption calculations must recognise rollover so a jump to zero is not read as a huge negative use.

Related: Pulse counter, Totalizer, Modbus register

COV (change of value) Buildings

A way for a device to send a value only when it changes by more than a set amount, instead of being asked again and again. BACnet uses COV subscriptions to cut network traffic.

Related: Report by exception, Deadband, BACnet

Coverage dead zone Connectivity

A place where a wireless network cannot be reached, such as a basement, a lift shaft or behind thick concrete. Site surveys before installation find dead zones so that antennas, repeaters or a different network can be planned.

Related: Link budget, Attenuation, Coverage enhancement

Coverage enhancement Connectivity

Modes of LTE-M and NB-IoT in which a device repeats its transmissions many times so that it can be heard deep indoors or underground. It extends reach at the cost of more airtime, latency and battery use.

Related: NB-IoT, LTE-M, Link budget

CRA (Cyber Resilience Act) Standards

A European Union regulation that sets cybersecurity requirements for products with digital elements sold in the EU, including connected devices and their software. Makers must design products securely, handle vulnerabilities and provide security updates; its obligations phase in from 2026 to 2027.

Related: IEC 62443, Firmware signing, Vulnerability management

CRC (cyclic redundancy check) Protocols

An error-detecting code calculated from a block of data with polynomial division and sent along with it. It catches common transmission errors such as flipped bits and bursts, and Modbus RTU, for example, ends every frame with a 16-bit CRC.

Related: Checksum, Modbus RTU, BER

Critical infrastructure Security

Systems a society depends on, such as power, water, transport, health and communications. Operators of critical infrastructure face stricter cybersecurity rules, such as the EU NIS2 directive.

Related: OT, IEC 62443, SCADA

Crop monitoring Agriculture

Following the condition of crops with soil moisture, weather, leaf wetness and imaging data to decide when to irrigate, spray or harvest. Connected sensors turn field walks into alerts.

Related: Soil moisture sensor, Weather station, Precision agriculture

CSR (certificate signing request) Security

A message a device creates, holding its public key and identity, asking a certificate authority to issue a certificate. The private key never leaves the device, which is the point of the request.

Related: CA, X.509 certificate, PKI

CSS (chirp spread spectrum) Connectivity

A radio modulation that sends each symbol as a chirp, a signal sweeping up in frequency. It can be received below the noise level and resists interference and Doppler shift, which is why it underlies LoRa.

Related: LoRa, Spreading factor, SNR

CSV (comma-separated values) Data and analytics

A plain text format for tables: one line per row and a separator between columns. It is the common way to import device lists and export readings to spreadsheets.

> **In Hermetry** Hermetry imports devices from CSV files and exports readings and lists as CSV.
> hermetry.com/docs/devices/importing-devices-in-bulk/

Related: Bulk provisioning, JSON, Data pipeline

CT (current transformer) Devices and sensors

A sensor that measures the current in a cable without cutting it, usually a ring or a split core around the conductor. Energy meters use CTs to measure circuits larger than they could carry themselves.

Related: Energy meter, Sub-metering, Power factor

Current loop (4–20 mA) Devices and sensors

The industrial standard for analog sensors: the sensor sets a current between 4 and 20 mA in proportion to its reading. Zero is 4 mA, so a reading of 0 mA means a broken wire, not a zero value.

Related: Analog input, Scaling, HART

Curtailment Energy

Reducing generation or consumption on request, such as limiting a wind or solar plant's output when the grid cannot take it, or cutting a factory's load during a peak. Measured curtailment is often paid for.

Related: Demand response, DER, Peak shaving

Custody transfer Energy

Measuring a product at the point where ownership changes hands, such as oil, gas or water sold between companies. These meters must meet strict accuracy and approval rules because the readings become invoices.

Related: Coriolis flow meter, Flow meter, Totalizer

Cyber-physical system Automation and control

A system in which computing and physical processes are tightly linked, so software decisions move real things and physical events change the software's behaviour. Factories, power grids and connected vehicles are examples.

Related: OT, Digital twin, PLC

Cycle time Manufacturing

The time it takes to complete one unit or one operation, from start to finish. Comparing actual with ideal cycle time shows speed losses, one of the three parts of OEE.

Related: OEE, Takt time, MES

D

DALI (Digital Addressable Lighting Interface)

Buildings

A standard two-wire bus for lighting control, defined in IEC 62386, on which each driver or ballast has its own address. Controllers can dim lamps individually and read back faults and lamp hours.

Related: Lighting control, BMS, Fieldbus

DAQ (data acquisition)

Automation and control

Measuring signals from sensors and turning them into digital data a computer can store and analyse, often at high sampling rates. DAQ systems are used for testing and for capturing fast events that slower telemetry would miss.

Related: Sampling rate, ADC, Data logger

Dashboard

Data and analytics

A screen that shows live readings, trends, alarms and controls together, so people see a site's state at a glance. Good dashboards are built for one job or one role rather than showing every value.

> **In Hermetry** Hermetry boards show live device data, alarms, maps, process drawings and 3D views.
> hermetry.com/docs/dashboards/

Related: HMI, SCADA, Widget

Data aggregation

Data and analytics

Combining many readings into fewer values, such as an hourly average, a daily total or the minimum and maximum of a shift. Aggregation makes long periods fast to chart and cheap to store, at the cost of detail.

Related: Rollup, Downsampling, Time series

Data compression

Data and analytics

Making data smaller for sending or storing, by encoding it more efficiently or by keeping only changes. In time-series data, compression often removes points that lie on a straight line between their neighbours.

Related: Downsampling, Binary payload, Time-series database

Data contextualisation

Data and analytics

Attaching meaning to raw values: which machine, which unit, which product batch and which shift a reading belongs to. Context turns a column of numbers into data people can compare and act on.

Related: Data model, Asset hierarchy, Tag

Data diode

Security

A hardware device that lets data flow in one direction only, for example from a control network out to a business network, with no physical path back. It lets data be shared without opening a way in.

Related: Air gap, OT, Defence in depth

Data lake

Data and analytics

A store that keeps large amounts of raw data in its original form, from many sources, for later analysis. It is flexible but needs good naming and metadata, or it turns into a pile nobody can use.

> **In Hermetry** To keep every reading in a data lake of your own, a Hermetry flow can forward it after saving, by HTTP request, MQTT out or webhook.
> hermetry.com/docs/telemetry-and-data/exporting-data/

Related: Data pipeline, Time-series database, Data retention

Data logger

Devices and sensors

A device that records readings at intervals and stores them, for later download or for sending in batches. In IoT, data loggers often double as gateways that also send live values.

Related: Store and forward, Gateway, Sampling rate

Data model

Data and analytics

The agreed structure of data: what kinds of things exist, what properties they have and how they relate. A shared data model lets dashboards, rules and integrations work the same across thousands of devices.

Related: Device profile, Asset hierarchy, Data contextualisation

Data normalisation

Data and analytics

Bringing data from different devices into one consistent form: the same units, names, time zone and number formats. It is needed before data from different makers can be compared or combined.

Related: Codec, Data model, Scaling

Data pipeline

Data and analytics

The chain of steps that moves data from devices to where it is used: ingestion, decoding, checking, enrichment, storage and forwarding. Each step can be watched for delays and errors.

Related: Ingestion, Message broker, Data quality

Data point

Data and analytics

A single value with its time, such as one temperature reading. In building automation the term also means a named signal, like a room temperature or a valve position, that a controller exposes.

Related: Tag, Telemetry, Timestamp

Data quality

Data and analytics

How fit data is for use: complete, accurate, on time and consistent. Missing readings, stuck values and wrong units are common IoT quality problems, and quality flags help users know which data to trust.

Related: Quality code, Stale data, Data normalisation

Data rate (LoRaWAN DR) Connectivity

A numbered setting in LoRaWAN, DR0 to DR15, that stands for a spreading factor and bandwidth pair in a given region. Higher data rates send faster and use less airtime but reach less far.

> **In Hermetry** Hermetry's network server manages data rates with ADR and the MAC commands that go with it. hermetry.com/docs/lorawan/adr-data-rates-and-mac-commands/

Related: Spreading factor, ADR, Bandwidth

Data residency Operations

The requirement that data is stored and processed in a particular country or region, often set by law or by a customer's policy. It decides which cloud region or on-premises installation a project can use.

> **In Hermetry** Every Hermetry organisation has one home region, where its data lives; the docs explain what stays in it and how to check. hermetry.com/docs/administration/regions-and-data-residency/

Related: On-premises, Data retention

Data retention Data and analytics

How long readings and events are kept before they are deleted or reduced to summaries. Raw readings are often kept for months and hourly or daily summaries for years.

> **In Hermetry** Hermetry has retention classes of 7, 30, 90, 365 and 1,095 days: raw readings are kept short, and their summaries are kept for the whole retention period. hermetry.com/docs/telemetry-and-data/retention/

Related: Rollup, Downsampling, Time-series database

dBi Connectivity

Antenna gain in decibels compared with an isotropic antenna, an ideal antenna that radiates equally in all directions. A 3 dBi antenna sends twice the power in its best direction as the isotropic one would.

Related: Antenna gain, dBm, Link budget

dBm Connectivity

Power in decibels relative to one milliwatt: 0 dBm is 1 mW, 14 dBm about 25 mW and −120 dBm a tiny received signal. Each 3 dB step doubles or halves the power, which makes link budgets easy to add up.

Related: RSSI, Link budget, dBi

DCS (distributed control system) Automation and control

A control system for large continuous processes, such as refineries and power plants, in which controllers are spread across the plant but engineered and operated as one system. It combines control, operator screens and history in one integrated package.

Related: PLC, SCADA, APC

DDS (Data Distribution Service) Protocols

A standard publish-subscribe middleware for real-time systems, in which applications share data by topics with quality-of-service settings. It is used in robotics, vehicles and defence systems where timing matters.

Related: Publish-subscribe, MQTT, Real time

Dead reckoning Logistics

Estimating position from the last known point, the direction and the distance travelled, using motion sensors when satellite positioning is lost, such as in tunnels or warehouses. Its error grows with distance, so the estimate is corrected as soon as a satellite fix or a known landmark is available again.

Related: GNSS, Accelerometer, Asset tracking

Deadband Automation and control

A band around a value inside which changes are ignored. In reporting, a device sends only when the value moves more than the deadband; in alarms, a deadband stops an alarm from switching on and off around its limit.

Related: Hysteresis, Report by exception, Alarm flood

Debounce Automation and control

Waiting until a condition has held for a set time before acting on it, so a single spike or a contact bounce does not raise an alarm. A debounce of 2 minutes means "only if it stays above the limit for 2 minutes".

> **In Hermetry** Hermetry alarm rules can debounce by readings in a row or by seconds of device time. hermetry.com/docs/rules-and-alarms/debounce-hysteresis-and-dampening/

Related: Hysteresis, Deadband, Alarm

Decommissioning Operations

Taking a device out of service properly: removing it from the platform, revoking its credentials and keys, and keeping or deleting its data as required. Forgotten devices with live credentials are a security risk.

Related: Certificate revocation, Commissioning, Device management

Deep sleep Devices and sensors

A low-power state in which a device switches off almost everything except a timer or wake-up input, drawing only microamps. Battery sensors spend most of their life in deep sleep and wake briefly to measure and send.

Related: Battery life, PSM, Duty cycle

Defence in depth Security

Protecting a system with several independent layers, such as network segmentation, strong sign-in, encryption, monitoring and backups, so that one failed layer does not expose everything. It is a central idea of industrial security standards such as IEC 62443.

Related: Zero trust, IEC 62443, Attack surface

Delta T Buildings

The temperature difference between the supply and return of a heating or cooling circuit. A delta T well below design usually means too much water is being pumped, wasting energy in pumps and chillers.

Related: Chiller, HVAC, Flow meter

Demand charge Energy

The part of an electricity bill based on the highest power drawn in a short interval, often 15 minutes, rather than on energy used. One short peak can set the charge for a whole month, which is why sites watch their load curve.

> **In Hermetry** The energy meter use case shows Hermetry reading a store's main meter as demand nears its contracted maximum.
> hermetry.com/use-cases/energy-meter-reading-across-sites/

Related: Load profile, Peak shaving, Energy monitoring

Demand response Energy

Changing electricity use in answer to a signal from the grid or a price, for example by switching off non-essential loads during a peak. Connected meters and controls make it possible to respond automatically and to prove the reduction.

Related: Curtailment, Peak shaving, Smart meter

Demand-controlled ventilation Buildings

Adjusting how much outside air a building takes in according to how many people are there, usually measured by CO_2 sensors. Rooms get fresh air when they are used and save energy when they are empty.

Related: CO_2 sensor, AHU, HVAC

DER (distributed energy resource) Energy

A small energy source or store connected near where energy is used, such as rooftop solar, batteries, small generators and controllable loads. Grids increasingly monitor and coordinate many DERs together.

Related: BESS, Solar PV, Curtailment

DevAddr (device address) Connectivity

The 32-bit address a LoRaWAN device uses in every message during a session, assigned at join for OTAA or set beforehand for ABP. Unlike the DevEUI it is not globally unique, so the network also checks each message's integrity code.

> **In Hermetry** An ABP device is registered in Hermetry with its DevAddr and its two session keys, and Hermetry handles its frame counters.
> hermetry.com/docs/lorawan/add-an-abp-device/

Related: EUI-64, OTAA, ABP

Device attestation Security

A device proving to a server that it is genuine and running approved software, using keys kept in protected hardware such as a secure element or TPM. It stops cloned devices and tampered firmware from joining a fleet.

Related: Secure element, Device identity, Firmware signing

Device class (LoRaWAN class A, B, C) Connectivity

How a LoRaWAN device listens for downlinks. Class A listens only briefly after each uplink and saves the most battery; class B also listens at scheduled times; class C listens almost always and is usually mains-powered.

> **In Hermetry** Hermetry supports class A and class C; class B is not supported.
> hermetry.com/docs/lorawan/device-classes/

Related: LoRaWAN, Downlink, Uplink

Device discovery Operations

Finding devices on a network automatically, such as scanning a Modbus bus for responding addresses or asking BACnet devices to announce themselves. It speeds up installation on sites with many devices.

Related: Broadcast, BACnet, Modbus RTU

Device identity Security

What lets a platform know which device it is talking to, such as a unique identifier backed by a key or certificate that cannot be copied. Strong identity is the base of secure provisioning, data trust and access control.

> **In Hermetry** Hermetry protects both steps: a device must prove who it is before its data is accepted, and an organisation must prove it owns a device before adding it.
> hermetry.com/docs/security/device-identity-and-claiming/

Related: X.509 certificate, Device attestation, Secure element

Device management Operations

Everything needed to run a fleet of devices: registering them, configuring them, watching their health, updating firmware and retiring them. It is often harder than collecting the data itself.

Related: OTA, Provisioning, Fleet management

Device profile Operations

A template describing a type of device: its data fields, units, decoder, alarms and commands. Every device of that type inherits the profile, so a change is made once instead of per device.

> **In Hermetry** In Hermetry a device profile describes how one kind of device behaves; every device uses exactly one, and follows it when it changes.
> hermetry.com/docs/devices/device-profiles/

Related: Data model, Codec, Provisioning

Device shadow Data and analytics

A stored copy of a device's last reported state and its desired state on the server. Applications read and write the shadow, and the device catches up with the desired state when it next connects.

Related: Digital twin, Setpoint

Device twin Data and analytics

Another name for a device shadow: the platform's copy of a device's reported state and desired settings. See device shadow.

Related: Device shadow, Digital twin

Device-to-cloud message Protocols

A message sent from a device to the platform, such as a reading, an event or a status report. It is the most common direction of traffic in IoT.

Related: Uplink, Telemetry, Cloud-to-device message

Dew point Buildings

The temperature at which air becomes saturated and water starts to condense, calculated from temperature and relative humidity. It matters for cold stores, compressed air, buildings and electronics, where condensation causes damage.

Related: Humidity sensor, Cold room, HVAC

DGA (dissolved gas analysis) Energy

Analysing the gases dissolved in a transformer's insulating oil to detect faults such as overheating and arcing long before failure. Online DGA monitors send these readings continuously.

Related: Transformer monitoring, Condition monitoring, Predictive maintenance

DHCP (Dynamic Host Configuration Protocol) Connectivity

The protocol that gives devices on an IP network their address and network settings automatically when they connect. Industrial devices are often given fixed addresses or DHCP reservations so they can always be found.

Related: DNS, Ethernet, VLAN

Differential pressure Devices and sensors

The difference in pressure between two points, used to measure flow across an orifice, how clogged a filter is, the level in a closed tank or whether a cleanroom is kept at higher pressure than its neighbours. A differential pressure transmitter has two pressure ports and reports the difference between them.

> **In Hermetry** The cleanroom use case watches room pressure cascades in Hermetry, with door-aware alarms and named acknowledgements. hermetry.com/use-cases/cleanroom-pressure-and-climate-monitoring/

Related: Absolute, gauge and differential pressure, Cleanroom monitoring, Flow meter

Digital input Devices and sensors

An input that reads an on or off signal, such as a door contact, a pump's running signal or an alarm relay. Many digital inputs can also count pulses from meters.

Related: Dry contact, Pulse counter, Digital output

Digital output Devices and sensors

An output that switches something on or off, usually through a relay or a transistor: a pump, a siren, a valve. Remote control of an output is a command and deserves the same care as any action on equipment.

Related: Relay, Command, Digital input

Digital signature Security

A value made with a private key that proves who created data and that it has not been changed since. Anyone with the matching public key can check it; firmware updates and certificates rely on signatures.

Related: Firmware signing, PKI, X.509 certificate

Digital thread Manufacturing

A connected record of a product's data across its life, from design and production to service, so information flows between stages instead of being re-entered. IoT data from products in use closes the loop back to design.

Related: Digital twin, Traceability, MES

Digital twin Data and analytics

A live digital model of a physical asset or site, kept up to date with its readings, so people can see and analyse it as it is now. The word is used for anything from a 3D drawing with live values to a full physics simulation.

> **In Hermetry** Hermetry Twin models your sites as a tree of buildings, floors, rooms, lines and machines, with each device placed in it and live status on tables, maps and views. hermetry.com/docs/twin/

Related: Device shadow, SCADA

DIN rail Devices and sensors

A standard 35 mm metal rail used to mount controllers, gateways, power supplies and terminal blocks inside electrical cabinets. Most industrial IoT hardware is made to clip onto it.

Related: Edge gateway, PLC, RTU

Direct-to-device satellite Connectivity

Satellite connectivity that reaches ordinary or lightly modified IoT devices directly, without a dish or ground terminal, often using mobile network standards. It covers places with no mobile network, such as oceans, deserts and remote farms.

Related: Satellite IoT, NB-IoT, LPWAN

Disaster recovery Operations

Planning and practising how to restore a system after a serious failure, such as a data centre loss. Two figures define it: how much recent data may be lost (RPO) and how quickly service must return (RTO).

Related: High availability, Redundancy, Data retention

Discrete manufacturing Manufacturing

Making distinct items that can be counted, such as cars, phones and furniture, as opposed to process industries that make products in continuous flows or batches. Monitoring focuses on part counts, cycle times and machine states.

Related: OEE, Cycle time, MES

Dissolved oxygen Water

The amount of oxygen dissolved in water, in milligrams per litre. Wastewater plants control aeration by it, one of their largest energy uses, and fish farms and rivers need enough of it for life.

Related: Water quality monitoring, Sensor, Wastewater treatment

District heating Energy

A network that supplies heat from central plants to many buildings through insulated pipes carrying hot water. Heat meters, temperatures and pressures across the network show losses and customer use.

Related: CHP, Heat meter, Delta T

DMA (district metered area) Water

A part of a water network with metered inlets and outlets, so the water going in can be compared with the water used. DMAs are the standard way to find which part of a network is leaking.

> **In Hermetry** The water network use case shows DMA inflow and minimum night flow watched in Hermetry, with a burst alarm.
> hermetry.com/use-cases/water-network-pressure-and-night-flow/

Related: Night flow, NRW, Leak detection

DNP3 Protocols

A protocol used between control centres and outstations in electricity and water utilities. It handles unreliable links well, reports by exception and can time-stamp events at the source.

Related: SCADA, RTU, IEC 60870-5-104

DNS (Domain Name System) Connectivity

The system that turns names like a server's address into IP addresses. Devices that rely on fixed IP addresses instead of names can break when a service moves.

> **In Hermetry** To use your own domain with Hermetry, you create the DNS records the docs list; Hermetry verifies them and gets the certificate itself.
> hermetry.com/docs/administration/web-addresses-and-custom-domains/

Related: DHCP, TLS, HTTP

Door contact sensor Devices and sensors

A sensor, usually a magnet and a reed switch, that reports whether a door, lid or hatch is open or closed. In cold rooms and cabinets it explains temperature rises and shows unauthorised access.

Related: Dry contact, Cold room, Digital input

DoS (denial of service) Security

An attack that makes a service unavailable by overloading it or a network link, often from many sources at once (a distributed attack). Badly secured IoT devices have been recruited in large numbers to carry out such attacks.

Related: Attack surface, Rate limiting, Zero trust

Downlink Connectivity

A message from the network or the platform to a device, such as a command or a new setting. In LoRaWAN, a class A device can only receive a downlink right after it sends an uplink.

> **In Hermetry** Hermetry queues LoRaWAN downlinks as commands and sends them through its network server; a downlink can ask the device to confirm it.
> hermetry.com/docs/lorawan/downlinks/

Related: Uplink, Command, Device class

Downsampling Data and analytics

Reducing data to fewer points, for example turning one reading a minute into hourly averages, minimums and maximums. It keeps long-term charts fast and storage small while keeping the shape of the data.

> **In Hermetry** Hermetry reads minute, hour or day summaries depending on the time window, so long charts stay fast.
> hermetry.com/docs/telemetry-and-data/aggregates-and-rollups/

Related: Rollup, Data retention, Time series

Downtime Operations

Time when a machine, line or service is not available. Planned downtime is scheduled, such as maintenance; unplanned downtime comes from failures and is what monitoring aims to reduce.

Related: Availability, MTTR, OEE

Drive-by meter reading Water

Reading radio-equipped meters from a vehicle that drives past them, collecting many readings in one trip. It is cheaper than visiting each meter but gives only occasional readings, unlike fixed networks.

Related: AMR, Smart meter, Wireless M-Bus

Dry contact (volt-free contact) Devices and sensors

A switch contact that carries no voltage of its own, such as an alarm relay inside a panel. Whatever reads it supplies the voltage, so it can be wired to almost any digital input.

Related: Digital input, Relay

DTLS (Datagram Transport Layer Security) Security

The version of TLS for connectionless traffic such as UDP. It secures CoAP and other lightweight protocols that do not use TCP.

Related: TLS, CoAP, UDP

Dual SIM Connectivity

A device that holds two SIM cards, or profiles, from different networks so it can switch if one fails. It is common in gateways and routers that must stay online.

Related: SIM, eSIM, Redundancy

Duty cycle Connectivity

The share of time a radio may transmit on a channel. Many channels of the European 868 MHz band allow 1 %, about 36 seconds of transmitting in any hour, which limits how often a LoRaWAN device can send.

> **In Hermetry** The LoRaWAN airtime calculator on our tools page shows how many messages fit in a 1 % duty cycle.
> hermetry.com/tools/lorawan-airtime-calculator/

Related: Time on air, ISM band, Spreading factor

Dwell time Logistics

How long something stays in one place, such as a container at a port, a truck at a dock or a pallet in a zone. Long dwell times point to bottlenecks; in radio regulations the term also means how long a transmitter may stay on one channel.

Related: Geofence, Asset tracking, Zone

E

EAP-TLS Security

A network sign-in method in which a device proves its identity with a certificate instead of a password, using TLS inside the Extensible Authentication Protocol. It is the usual choice for putting unattended devices on an enterprise Wi-Fi or wired network that checks every client.

Related: X.509 certificate, PKI, TLS

ECC (elliptic-curve cryptography) Security

A family of public-key algorithms that reach the same strength as RSA with much shorter keys. Short keys and fast signatures make ECC the common choice for device certificates and secure elements on small microcontrollers.

Related: X.509 certificate, PKI, Secure element

Edge AI Data and analytics

Running a trained machine-learning model on the device or gateway itself instead of in the cloud. It cuts latency and data volume, keeps working when the connection drops, and lets a camera or vibration sensor send a result rather than raw data.

Related: Edge computing, TinyML, Inference

Edge computing Data and analytics

Processing data close to where it is produced, on a gateway or a local server, instead of sending everything to the cloud. It cuts traffic, keeps working when the connection drops and reacts faster.

Related: Edge gateway, Store and forward, Gateway

Edge gateway Devices and sensors

A device on site that reads local equipment over serial, fieldbus or local network protocols and forwards the data, often after filtering or buffering it. It is the bridge between the field and the platform.

> **In Hermetry** Hermetry Edge runs on the gateways and routers Hermetry supports, reads field devices and can keep data locally during outages, depending on the model. hermetry.com/docs/edge/licensed-gateways-and-hermetry-edge/

Related: Gateway, Edge computing, Protocol converter

eDRX (extended discontinuous reception) Connectivity

A cellular power-saving feature of LTE-M and NB-IoT in which a device listens for the network only at long, agreed intervals, from seconds to hours. It saves battery while still letting the network reach the device, unlike PSM where the device cannot be reached at all.

Related: PSM, LTE-M, NB-IoT

EEPROM Devices and sensors

Non-volatile memory that keeps small amounts of data, such as settings, calibration values and counters, when the power is off, and can be rewritten byte by byte. It wears out after a limited number of writes, so firmware avoids writing it too often.

Related: Flash memory, MCU, Firmware

EER (energy efficiency ratio) Buildings

The cooling output of an air conditioner or chiller divided by its electrical input, at stated test conditions. In imperial units it is BTU per hour per watt; a higher EER means less electricity for the same cooling.

Related: COP, Chiller

Electrical conductivity (EC) Agriculture

How easily a liquid carries an electric current, which rises with the amount of dissolved salts. It is used to check nutrient strength in hydroponics and fertigation, and salinity and contamination in water.

Related: pH sensor, Water quality monitoring

Electromagnetic flow meter Water

A flow meter that measures the voltage induced when a conductive liquid flows through a magnetic field, which is proportional to its velocity. It has no moving parts and no pressure loss, which is why water and wastewater networks use it widely.

Related: Flow meter, Ultrasonic flow meter, Totalizer

Embedded system Devices and sensors

A computer built into a product to do one job, such as a sensor, meter or controller, usually around a microcontroller with fixed firmware. Most IoT devices are embedded systems with a radio or network port added.

Related: MCU, Firmware

EMC (electromagnetic compatibility) Devices and sensors

The ability of an electronic device to work properly near other equipment without disturbing it or being disturbed. Industrial devices are tested for emissions and immunity to standard levels before they may be sold in most markets.

Related: Surge protection

Emission factor Energy

A number that converts an activity into greenhouse gas emissions, such as kilograms of CO_2 per kWh of grid electricity or per litre of diesel. Energy data multiplied by the right factors gives a site's carbon footprint.

Related: kWh, EMS

EMS (energy management system) Energy

Software, often with meters and controllers, that measures, reports and controls energy use across a site or a group of sites. It shows where energy goes, finds waste and can shift or limit loads to cut peaks and cost.

Related: Sub-metering, Peak shaving, ISO 50001

Encoder (rotary) Devices and sensors

A sensor that turns the rotation of a shaft into pulses or a digital position, so a controller knows speed, direction and angle. Incremental encoders count steps from a reference; absolute encoders report the exact position even after a power loss.

Related: Pulse counter, VFD

Encryption at rest Security

Encrypting stored data, such as databases, backups and files, so that a stolen disk or copy cannot be read without the key. It complements encryption in transit, which protects data while it moves.

Related: Encryption in transit, Key management, AES-128

Encryption in transit Security

Encrypting data while it travels between a device, a gateway and the cloud, usually with TLS or a VPN. It stops anyone on the path from reading or changing readings and commands.

Related: TLS, VPN, Encryption at rest

End device (LoRaWAN) Connectivity

A sensor or actuator that talks to a LoRaWAN network over the air, as opposed to the gateways that relay its frames. End devices are identified by their DevEUI and join the network through OTAA or ABP.

Related: LoRaWAN, OTAA, Device class

End-to-end encryption Security

Encryption that is applied by the sender and removed only by the final recipient, so no system in between, such as a gateway or broker, can read the content. LoRaWAN payloads, for example, are encrypted end to end between the device and the application.

Related: Encryption in transit, Session keys, TLS

Energy baseline Energy

A reference figure for how much energy a site or machine uses under normal conditions, against which savings are measured. A fair baseline adjusts for things like weather and production volume, so savings are not confused with a warm winter.

Related: Energy monitoring, KPI, Load profile

Energy harvesting Devices and sensors

Powering a device from its surroundings, such as light, heat differences, vibration or radio waves, instead of from a battery alone. It suits sensors that send small amounts of data in places where changing batteries is costly.

Related: Battery life, Low-power mode, Supercapacitor

Energy meter Energy

A meter that measures electrical energy in kWh and often power, voltage, current and power factor too. Meters with a communication port, usually Modbus or M-Bus, can be read remotely.

> **In Hermetry** The energy meter use case reads site meters into Hermetry, with demand, power factor and data completeness alarms.
> hermetry.com/use-cases/energy-meter-reading-across-sites/

Related: Sub-metering, CT, Smart meter

Energy monitoring Energy

Measuring energy use by site, building, line or machine over time, so waste and peaks can be found. It is the basis of energy management and of savings that can be proven.

Related: Sub-metering, Demand charge, Load profile

EnPI (energy performance indicator) Energy

A measure of energy performance chosen by an organisation, such as kWh per tonne produced or per square metre. ISO 50001 uses EnPIs, compared with a baseline, to show whether energy performance is really improving.

Related: ISO 50001, EMS, KPI

Epoch time (Unix time) Data and analytics

A way of writing a moment as the number of seconds, or milliseconds, since 1 January 1970 at 00:00 UTC. Devices and APIs use it because it is a single number, free of time zones and date formats.

Related: Timestamp, NTP

Escalation (alarm) Operations

Passing an alarm on to further people or teams when nobody acknowledges or resolves it within a set time. Escalation chains make sure a critical alarm at night reaches someone who can act.

Related: Alarm, Acknowledgement, Alarm escalation

eSIM Connectivity

A SIM that is built into the device and can receive operator profiles over the air, so changing operator does not require a visit to swap a card. Industrial devices usually use it in a soldered form.

> **In Hermetry** Hermetry manages the eSIM profiles of supported routers, which reach it over their mobile uplink.
> hermetry.com/docs/edge/cellular-and-esim/

Related: eUICC, SIM, Cellular IoT

Ethernet Connectivity

The common family of wired network standards (IEEE 802.3) for local networks, from 10 Mbit/s to many Gbit/s over copper or fibre. Industrial Ethernet variants, rugged switches and Power over Ethernet make it the backbone of most plant and building networks.

Related: PoE, Industrial Ethernet, LAN

Ethernet-APL (advanced physical layer) Protocols

A two-wire Ethernet physical layer for process plants that carries data and power over long cable runs and can be made intrinsically safe. It brings Ethernet down to field instruments in hazardous areas, where 4–20 mA and HART used to be the only options.

Related: Ethernet, Intrinsic safety, HART

EtherNet/IP Protocols

An industrial Ethernet protocol that carries the Common Industrial Protocol over standard Ethernet and IP. It connects controllers, drives and I/O on the plant floor.

Related: PROFINET, Fieldbus, PLC

ETL (extract, transform, load) Data and analytics

The process of taking data out of one system, reshaping and cleaning it, and loading it into another, such as a data warehouse. In IoT it often means moving cleaned telemetry from an operational platform into analytics or reporting tools.

Related: Data pipeline, Ingestion

EU868 Connectivity

The LoRaWAN regional plan for the 863–870 MHz band used in Europe, with three default 125 kHz channels and duty-cycle limits per sub-band. Devices and gateways must use the plan of the region where they operate.

> **In Hermetry** Hermetry's LoRaWAN docs use the EU868 plan (Europe, 863–870 MHz) to show channels, data rates, payload sizes and duty-cycle limits.
> hermetry.com/docs/lorawan/regions-and-frequency-plans/

Related: Frequency plan, Duty cycle, ISM band

EUI-64 (DevEUI, JoinEUI) Connectivity

A globally unique 64-bit identifier. In LoRaWAN, each device has a DevEUI and points to a JoinEUI; together with the device's root key they identify it when it joins a network.

> **In Hermetry** A LoRaWAN device that joins over the air is registered in Hermetry with its DevEUI, JoinEUI and AppKey.
> hermetry.com/docs/lorawan/add-an-otaa-device/

Related: OTAA, Join procedure, LoRaWAN

eUICC Connectivity

The secure chip inside an eSIM that can hold several operator profiles and switch between them remotely, following standard procedures for consumer or machine devices. It is what lets a device in the field change mobile operator without anyone swapping a card.

Related: eSIM, SIM

EV charger (charging point) Energy

Equipment that delivers electricity to an electric vehicle, from slow AC wall boxes to fast DC chargers. Connected chargers report their state, energy and faults and accept limits from a back office or a site energy manager.

Related: OCPP, Load management, Demand charge

Evapotranspiration (ET) Agriculture

The water lost from soil and plants to the air through evaporation and plant transpiration, usually given in millimetres per day. Irrigation systems use it, together with rainfall and soil moisture, to decide how much water a crop actually needs.

Related: Soil moisture sensor, Irrigation controller, Weather station

Event Data and analytics

Something that happened at a point in time, such as a door opening, a status change or an alarm, as opposed to a regular reading. Events usually carry a type, a time and a few details.

Related: Telemetry, Alarm, Webhook

Event-driven architecture Data and analytics

A design in which systems react to events, such as a new reading, a door opening or an alarm, as they happen, instead of asking each other at fixed times. It keeps traffic low and reactions fast, which suits large fleets of devices.

Related: Publish-subscribe, Message broker, Webhook

Explosion-proof enclosure (flameproof, Ex d) Devices and sensors

A housing strong enough to contain an explosion inside it and built so that hot gases cool before they escape, so the surrounding atmosphere is not ignited. It is one of the protection methods allowed for electrical equipment in hazardous areas.

Related: Hazardous area, Intrinsic safety, IP rating

Exponential smoothing Data and analytics

A way of smoothing a noisy series in which each new value is a weighted mix of the latest reading and the previous smoothed value. Recent readings count most, older ones fade gradually, and it needs almost no memory, so it fits small devices well.

Related: Moving average, Kalman filter

Extended coverage (coverage enhancement) Connectivity

A feature of LTE-M and NB-IoT in which a device in a poor spot, such as a basement, repeats its transmissions many times so the network can still decode them. It extends reach deep indoors at the cost of extra airtime and battery.

Related: NB-IoT, LTE-M, Link budget

F

Fail-safe
Automation and control

Designed so that a failure leads to a safe state. A valve that closes when it loses power and a control loop that stops when it loses its signal are fail-safe.

Related: Interlock, Watchdog, SIL

Failover
Operations

Switching automatically to a standby component, such as a second server, link or gateway, when the active one fails. Good failover is fast and keeps data, and is tested regularly rather than assumed to work.

Related: Redundancy, High availability, Hot standby

Fault tolerance
Operations

The ability of a system to keep working, possibly at reduced capacity, when one of its parts fails. It is built with redundancy, failover and designs that avoid a single point of failure.

Related: Redundancy, High availability, Failover

FCU (fan coil unit)
Buildings

A small HVAC unit with a fan and a water coil that heats or cools one room or zone, fed by a central boiler or chiller. Its valve, fan speed and room temperature are typical points read and controlled by a BMS.

Related: HVAC, BMS, Chiller

FDD (fault detection and diagnostics)
Buildings

Software that analyses building or equipment data against rules and models to find faults, such as a valve leaking by or heating and cooling fighting each other, and suggests their cause. It turns BMS data into a list of things to fix.

Related: BMS, Anomaly detection, Condition monitoring

Feature engineering
Data and analytics

Turning raw sensor data into the inputs a model learns from, such as hourly averages, peaks, rates of change or frequency bands. Good features often matter more for predictive maintenance than the choice of model.

Related: Predictive maintenance, FFT, Machine learning

FEC (forward error correction)
Connectivity

Adding redundant bits to transmitted data so the receiver can correct some errors itself without asking for a resend. LoRa's coding rate is a form of FEC: more redundancy makes a link more robust but longer on air.

Related: Coding rate, Link budget, Time on air

Feeder (electrical)
Energy

A circuit that carries power from a substation or main switchboard to a group of loads or a distribution board. Monitoring each feeder's current, power and breaker state shows where load and faults are on a site or network.

Related: Sub-metering, Circuit breaker, Energy meter

FFT (fast Fourier transform)
Data and analytics

An algorithm that turns a signal over time into its frequency content. Vibration monitoring uses it to find the frequencies of unbalance, misalignment or bearing faults that a single overall value would hide.

Related: Vibration monitoring, Sampling rate, Predictive maintenance

FHSS (frequency-hopping spread spectrum)
Connectivity

A radio technique in which the transmitter switches between many channels in a known pattern during transmission. It makes a link robust against interference on any one channel and is used in several industrial and LPWAN radios.

Related: ISM band, LBT

Fibre-optic link
Connectivity

A connection that carries data as light through glass or plastic fibre, over long distances and immune to electrical interference and lightning. Plants, substations and campuses use it between buildings and in electrically noisy areas.

Related: Ethernet, Backhaul, EMC

Field device
Automation and control

An instrument or actuator installed out on the process, such as a transmitter, valve, pump starter or meter, as opposed to controllers and servers in the control room. Field devices are where data starts and where commands finally act.

Related: Sensor, PLC, Fieldbus

Fieldbus
Protocols

A family of digital networks that connect sensors, actuators and controllers in a plant, replacing a wire per signal. Modbus, PROFIBUS, CAN and their Ethernet successors are all fieldbuses.

Related: Modbus RTU, CAN bus, PROFINET

Filter differential pressure
Buildings

The pressure drop across an air or liquid filter, which rises as the filter clogs. Measuring it lets maintenance change filters when they are actually dirty instead of on a fixed calendar.

Related: AHU, Condition monitoring, Differential pressure

Firewall
Security

A network device or software that allows or blocks traffic according to rules, for example letting devices only make outgoing connections to one platform. Firewalls between office and control networks are a basic part of OT security.

Related: Zero trust, Network segmentation, VLAN

Firmware
Devices and sensors

The software that runs on a device itself. Keeping firmware up to date fixes bugs and security holes, which is why remote updates matter for fleets in the field.

Related: OTA, Firmware signing, FUOTA

Firmware rollback Operations

Returning a device to its previous firmware when a new image fails to start or behaves badly. Devices with two firmware slots can roll back on their own, which makes over-the-air updates far safer.

Related: OTA, Firmware, Watchdog

Firmware signing Security

Attaching a cryptographic signature to a firmware image so a device installs it only if it comes from the maker and has not been changed. It protects fleets from tampered updates.

> **In Hermetry** Hermetry accepts update images with a detached Ed25519 signature or signed for ESP32 Secure Boot V2; unsigned images are only for test devices. hermetry.com/docs/devices/build-and-sign-firmware/

Related: OTA, PKI, Firmware

Flash memory Devices and sensors

Non-volatile memory that holds firmware and stored data in a device and keeps it without power. It is erased in blocks and wears out after a number of write cycles, so data logging firmware spreads writes across it.

Related: EEPROM, Firmware, Store and forward

Fleet management (devices) Operations

Running many devices as one population: their versions, settings, health, certificates and updates. It turns a hundred individual devices into one job.

> **In Hermetry** Every Hermetry device uses one device profile: change the profile, and every device of it follows. hermetry.com/docs/devices/device-profiles/

Related: OTA, Provisioning, Heartbeat

Flow computer Energy

A dedicated device that calculates corrected volume, mass or energy of gas or liquid from flow, pressure and temperature readings, following measurement standards. It is used where the flow is sold or taxed, such as pipelines and custody transfer.

Related: Custody transfer, Flow meter, Gas volume correction

Flow meter Devices and sensors

A meter that measures how much liquid or gas passes through a pipe, as a rate (m^3/h) and often as a running total. Common types are electromagnetic, ultrasonic and mechanical.

Related: Totalizer, Pulse counter, DMA

FMEA (failure mode and effects analysis) Operations

A structured review of how each part of a system can fail, what the effect would be and how likely and detectable it is. It is used to decide which failures to monitor, prevent or design out first.

Related: Predictive maintenance, RCM, MTBF

Fog computing Data and analytics

Spreading computing and storage between devices and the cloud, on gateways, local servers and network equipment. It is close to edge computing; the term stresses a layered network of such nodes rather than single edge devices.

Related: Edge computing, Edge gateway, Hybrid cloud

Forecasting (time series) Data and analytics

Predicting future values of a measurement, such as demand, consumption or a tank level, from its history and related factors like weather or calendar. Forecasts let operators plan pumping, energy purchase and maintenance ahead.

Related: Time series, Predictive maintenance, Anomaly detection

FOTA (firmware over the air) Operations

Updating a device's firmware remotely over its network connection. It is the firmware case of OTA updates; see OTA and FUOTA.

Related: OTA, FUOTA

FOUNDATION Fieldbus Protocols

A digital fieldbus for process plants in which instruments share one two-wire bus that carries power and data, and can even run control functions in the field. Its H1 variant links instruments; HSE is its Ethernet backbone.

Related: Fieldbus, HART, PROFIBUS

FPGA (field-programmable gate array) Devices and sensors

A chip whose logic can be configured after manufacture, so it can run custom digital circuits in parallel at high speed. It is used in edge devices for fast signal processing, protocol handling and machine vision.

Related: MCU, Edge AI, Embedded system

Frame counter (FCnt) Connectivity

A number in every LoRaWAN frame that goes up with each message. The network rejects a frame whose counter it has already seen, which stops recorded messages from being replayed.

Related: LoRaWAN, Session keys, MIC

Frequency converter Devices and sensors

Another name for a variable frequency drive (VFD): a device that changes the frequency and voltage fed to a motor to control its speed. See VFD.

Related: VFD

Frequency plan Connectivity

The set of radio channels, data rates and power limits a LoRaWAN network uses in a region, such as EU868 or US915. Devices, gateways and the network server must all use the same plan.

> **In Hermetry** Hermetry's network server works with the LoRaWAN regions and frequency plans listed in the docs. hermetry.com/docs/lorawan/regions-and-frequency-plans/

Related: ISM band, LoRaWAN, Duty cycle

Fresnel zone Connectivity

The football-shaped space around the direct line between two antennas that radio waves need mostly free of obstacles. A link can have clear line of sight and still lose strength if trees or roofs block much of this zone.

Related: Line of sight, Link budget, Path loss

Frost protection Agriculture

Measures that keep crops, pipes or equipment from freezing, such as wind machines, sprinklers or heating, triggered when temperature sensors approach 0 °C. Fast, reliable alarms matter because damage can happen within an hour.

Related: Weather station, Threshold, Irrigation controller

FSK (frequency-shift keying) Connectivity

A simple radio modulation that sends bits by switching between two or more frequencies. Many sub-GHz sensors, older remote controls and the FSK mode of LoRaWAN radios use it.

Related: LoRa, ISM band, Data rate

FSPL (free-space path loss) Connectivity

The loss of radio signal strength over distance in open space, with nothing in the way, which grows with both distance and frequency. It is the starting point of every link-budget estimate; real links lose more because of terrain, buildings and foliage.

Related: Path loss, Link budget, Fresnel zone

Fuel level sensor Logistics

A sensor that measures the fuel in a tank, for example with a capacitive probe or float, so fleets and generator sites can track consumption, refills and theft. Sudden drops while a vehicle is parked are a typical theft alarm.

Related: Fleet management, Level sensor, Generator monitoring

Functional safety Standards

The part of overall safety that depends on control systems working correctly, such as an emergency shutdown acting when needed. Standards like IEC 61508 and IEC 61511 set how such systems are specified, built and tested.

Related: SIL, IEC 61508, SIS

FUOTA (firmware update over the air) Operations

Sending new firmware to devices by radio, in LoRaWAN usually by multicast in many small fragments. It is slow on low-power networks, so images are kept small and sent in planned windows.

Related: OTA, Firmware, Multicast

G

Galvanic isolation
Devices and sensors

Separating two circuits so no direct current can flow between them, while signals still pass through a transformer, optocoupler or capacitor. Isolated inputs and RS-485 ports protect devices from ground loops and voltage spikes.

Related: Ground loop, Surge protection, RS-485

Gas chromatograph
Energy

An analyser that separates a gas sample into its components and measures each one, giving the full composition and heating value. In gas networks its results feed energy billing and gas quality checks.

Related: Flow computer, Custody transfer, Gas volume correction

Gas detector
Devices and sensors

A sensor that measures the concentration of a gas, such as methane, carbon monoxide, hydrogen sulphide or oxygen, and raises an alarm above or below set levels. Fixed detectors protect plants and car parks; portable ones protect people.

Related: Hazardous area, Threshold, CO_2 sensor

Gas meter
Energy

A meter that measures the volume of gas delivered to a home, building or plant, increasingly with a pulse output or a built-in radio for remote reading. Volume is usually corrected to reference conditions before billing.

Related: Smart meter, Gas volume correction, Pulse counter

Gas volume correction
Energy

Converting a measured gas volume to the volume it would have at reference pressure and temperature, because gas expands and compresses. Volume correctors and flow computers do it so that billing and balances compare like with like.

Related: Gas meter, Flow computer, Custody transfer

Gateway
Devices and sensors

A device that connects other devices to a network or the platform. A LoRaWAN gateway relays radio frames; an industrial gateway reads local equipment and sends its data on.

> **In Hermetry** A Hermetry gateway reports for its child devices, up to 500 by default.
> hermetry.com/docs/edge/devices-behind-a-gateway/

Related: Edge gateway, LoRaWAN gateway, Child device

Gauge pressure
Devices and sensors

Pressure measured relative to the surrounding atmosphere, so an open tank reads zero. Absolute pressure adds the atmospheric pressure; mixing the two up is a common source of wrong readings.

Related: Absolute, gauge and differential pressure, Pressure transmitter, Scaling

GDPR (General Data Protection Regulation)
Standards

The European Union regulation on the protection of personal data, which applies wherever data about people in the EU is processed. IoT data counts when it can be linked to a person, such as a tracker on a vehicle someone drives.

Related: Data residency, Data retention

Generator monitoring
Energy

Watching standby or prime generators remotely: running state, fuel level, battery voltage, run hours, alarms and test runs. It confirms that backup power will actually start when the grid fails.

Related: Fuel level sensor, UPS, Run hours

Geofence
Operations

A virtual boundary on a map, such as a yard, a route corridor or a region. Crossing it can raise an event, for example a trailer leaving the depot outside working hours.

Related: GNSS, Asset tracking

Geofence dwell time
Logistics

How long a tracked asset stays inside a geofence, such as a truck at a customer site or a container in a port. Dwell time alarms reveal waiting, detention and assets left behind.

Related: Geofence, Asset tracking, Fleet management

Geolocation (network-based)
Connectivity

Working out where a device is from the radio network rather than from GNSS, for example from which gateways heard it and the time differences of arrival. It costs no extra battery, but is less precise than satellite positioning.

Related: GNSS, Asset tracking

GIS (geographic information system)
Smart city

Software that stores, analyses and draws data tied to places on a map, such as pipes, valves, cables and assets. Linking live sensor data to GIS layers shows where in a network a problem is.

Related: Digital twin, Asset tracking, DMA

GNSS (global navigation satellite system)
Data and analytics

Satellite positioning, the general term for the global and regional systems that give a receiver its position and accurate time. It works outdoors and needs a view of the sky.

Related: Asset tracking, Geofence, NTP

Golden batch
Manufacturing

A production batch with an ideal result whose process data becomes the reference for later batches. Comparing live batches with the golden profile shows drift early, before quality suffers.

Related: ISA-88, Historian, SPC

GPIO (general-purpose input/output)

Devices and sensors

A pin on a chip or board that software can set as an input or an output. Small devices use GPIO to read buttons and contacts and to drive LEDs and relays.

Related: Digital input, Digital output

GPRS (general packet radio service) Connectivity

The packet data service of 2G GSM networks, with low speeds of tens of kbit/s. Many older meters and alarms still use it, and they need replacing where operators switch 2G off.

Related: GSM, LTE-M, 2G and 3G switch-off

GPS tracker Logistics

A device that reports its position from GNSS, often with movement, temperature or door sensors, over cellular or LPWAN. Battery trackers sleep and report on a schedule or when they move; vehicle trackers are powered and report continuously.

Related: GNSS, Asset tracking, Geofence

Graceful degradation Operations

Designing a system so that when part of it fails it keeps doing the most important things instead of stopping entirely. A gateway that keeps local control and stores data while offline degrades gracefully.

Related: Fault tolerance, Store and forward, Fail-safe

Green wave Smart city

Timing traffic signals along a road so that vehicles at a set speed meet a series of green lights. Connected signal controllers can adjust the timing to traffic measured in real time.

Related: Traffic signal controller

Greenfield Operations

A new site or system built from scratch, where the devices and network can be chosen freely. The opposite of brownfield.

Related: Brownfield

Grid frequency Energy

The frequency of the alternating current on the electricity grid, nominally 50 Hz in Europe and Türkiye and 60 Hz in the Americas. It drops when demand exceeds supply, so frequency monitoring is used for grid balancing and frequency-response services.

Related: Demand response, Power quality, THD

Ground loop Devices and sensors

An unwanted current that flows when two connected devices are earthed at points with slightly different potential. It shows up as noise or drifting readings on analogue signals and can damage communication ports; isolation breaks it.

Related: Galvanic isolation, Current loop, RS-485

Groundwater monitoring Water

Measuring the level and quality of water in wells and boreholes over time, usually with submersible pressure sensors and loggers. It tracks how aquifers respond to pumping, rainfall and drought.

Related: Hydrostatic level sensor, Data logger, Water quality monitoring

Growing degree days (GDD) Agriculture

A measure of accumulated heat above a crop's base temperature, summed day by day. It predicts plant and pest development stages better than calendar dates, so growers use it to time spraying and harvest.

Related: Weather station, Evapotranspiration, Crop monitoring

gRPC Protocols

An open-source framework for remote procedure calls between services, using HTTP/2 and compact binary messages defined in a schema. It is common between back-end services and sometimes between gateways and the cloud.

Related: RPC, Protocol Buffers, REST API

GSM (2G) Connectivity

The second generation of mobile networks. Many countries have switched 2G off or plan to, so devices that still rely on it need replacing with LTE-M, NB-IoT or LTE devices.

Related: Cellular IoT, LTE-M, NB-IoT

H

Half-duplex Connectivity

A link on which both sides can transmit, but not at the same time, such as two-wire RS-485 or most radios. Protocols on half-duplex links take turns, for example a Modbus master that asks and then waits for the answer.

Related: RS-485, Modbus RTU

Hall-effect sensor Devices and sensors

A sensor that measures a magnetic field, used to detect position, speed and proximity, or to measure current without touching the conductor. It is common in flow meters, wheel speed sensors and clamp-on current sensors.

Related: CT, Encoder, Proximity sensor

Harmonics Energy

Currents and voltages at multiples of the grid frequency, caused by non-linear loads such as drives, chargers and LED drivers. They heat transformers and cables and disturb other equipment; THD sums them up.

Related: THD, Power quality, VFD

HART Protocols

A protocol that sends digital data on top of a 4–20 mA current loop, so a field instrument can report diagnostics and extra values over the same two wires as its analog signal. Existing loop wiring and analog inputs keep working, while a handheld or a HART-capable input can read the extra data.

Related: Current loop, Analog input, Fieldbus

Hash function Security

A function that turns any input into a fixed-length fingerprint, such that a tiny change gives a completely different result. Cryptographic hashes such as SHA-256 are used to check firmware integrity, store passwords and build signatures.

Related: HMAC, Firmware signing, Digital signature

Hazardous area (Ex zone) Standards

A place where flammable gas, vapour or dust may be present, classified into zones by how often and how long it is there. Equipment used there must be certified for that zone and gas group, for example as intrinsically safe or flameproof.

Related: Intrinsic safety, ATEX, Explosion-proof enclosure

Head (pump) Water

The height to which a pump can lift water, or the pressure it adds expressed as metres of water column. A pump's duty point is where its head-flow curve meets the system curve of the network.

Related: Pump curve, VFD, Pressure transmitter

Health check Operations

A regular automatic test that a service, device or connection is working, such as an endpoint that answers when all is well. Monitoring systems poll health checks and raise alarms or restart components when they fail.

Related: Heartbeat, Watchdog, High availability

Heartbeat (offline detection) Operations

A regular message, or simply the regular arrival of data, that shows a device is alive. When it stops for longer than expected, the device is treated as offline.

> **In Hermetry** A Device offline rule on the device profile raises an alarm when a device stops talking.
> hermetry.com/docs/rules-and-alarms/offline-alarms/

Related: Keep-alive, Watchdog, Alarm

Heat index Buildings

A measure of how hot it feels to people when relative humidity is combined with air temperature. It is used for worker safety and comfort alarms, since high humidity stops the body cooling through sweat.

Related: Humidity sensor, Dew point

Heat meter Energy

A meter that measures thermal energy delivered by hot or chilled water, from the flow and the temperature difference between supply and return. It is used for billing in district heating and for sub-metering in buildings.

Related: Sub-metering, M-Bus, District heating

Heat pump Buildings

A machine that moves heat from a colder place to a warmer one using a refrigeration cycle, for heating or cooling buildings and water. Its efficiency is given as COP; monitoring shows whether it runs as efficiently as designed.

Related: COP, HVAC

Hermetry Operations

Hermetry is a secure industrial IoT and SCADA platform, made with love by Roltek. It connects your devices, shows them live on dashboards and SCADA screens, and acts before small problems grow.

> **In Hermetry** See what it does on the platform overview, or try it with your own devices.

Related: IIoT, SCADA, Digital twin, MQTT, LoRaWAN

Hierarchy (asset) Operations

The tree that organises assets from the enterprise down to sites, areas, lines, machines and parts. Data and alarms rolled up along the hierarchy let people see a whole site or drill down to one pump.

Related: ISA-95, Digital twin, Multi-tenancy

High availability Operations

Designing a system so it keeps running when a part fails, usually by running parts in duplicate with automatic switch-over. It is measured as the share of time the service is up.

Related: Redundancy, Availability

High-performance HMI Automation and control

A style of operator screen that uses greys and muted colours, saving bright colour for abnormal states, and shows trends and context instead of pictures of equipment. It helps operators spot problems faster; ISA-101 describes it.

Related: HMI, ISA-101, Alarm flood

Histogram Data and analytics

A chart that shows how often values fall into each range, such as how many hours a temperature spent in each band. It reveals spread and outliers that an average hides.

> **In Hermetry** Hermetry's chart cards include a histogram, next to line, bar, area, pie, scatter and heatmap charts.
> hermetry.com/docs/dashboards/chart-cards/

Related: Time series, Dashboard

Historian Data and analytics

A database built to store process values over time at high rates and to return them quickly for trends and reports. It is the long-term memory of a SCADA system.

> **In Hermetry** To keep every reading in a historian of your own, a Hermetry flow can forward it after saving, by HTTP request, MQTT out or webhook.
> hermetry.com/docs/telemetry-and-data/exporting-data/

Related: Time-series database, SCADA, Trend

HMAC (hash-based message authentication code) Security

A short code computed from a message and a shared secret with a hash function, which proves that the message came from someone with the secret and was not changed. Webhooks are often signed with HMAC-SHA256.

> **In Hermetry** Hermetry signs every webhook with HMAC-SHA256 of the timestamp and body, using your secret.
> hermetry.com/docs/api/webhooks/

Related: Hash function, Webhook, API key

HMI (human-machine interface) Automation and control

The screen through which operators see and control a machine or process: process drawings, values, alarms and buttons. A SCADA system shows HMI screens for a whole site or for many sites.

> **In Hermetry** Hermetry draws process screens in the browser from a library of animated SCADA symbols.
> hermetry.com/scada/

Related: SCADA, Dashboard, P&ID

Home automation Buildings

Control of lighting, heating, blinds, locks and appliances in a home from apps, schedules and sensors. It uses short-range radios such as Zigbee, Z-Wave, Thread and Wi-Fi, increasingly tied together by the Matter standard.

Related: Matter, Zigbee, Z-Wave

Horizontal scaling Data and analytics

Handling more load by adding more machines rather than making one machine bigger. IoT back ends scale horizontally so that the number of devices and messages can grow without a ceiling.

Related: Load balancing, High availability, Message broker

Hot standby Operations

A redundant component that runs alongside the active one, with its data kept in step, so it can take over almost instantly. Redundant PLCs, servers and SCADA nodes are often run in hot standby.

Related: Failover, Redundancy, High availability

HSM (hardware security module) Security

A tamper-resistant device that stores cryptographic keys and performs operations with them, so private keys never leave it. Certificate authorities and key servers use HSMs to protect the keys that sign device certificates and firmware.

Related: PKI, Firmware signing, Secure element

HTTP (Hypertext Transfer Protocol) Protocols

The request and response protocol of the web. Devices that wake up, send and sleep often use HTTPS POST requests, because they need no permanent connection.

> **In Hermetry** Devices that wake up, send and sleep can use Hermetry's HTTPS device API, handled exactly like MQTT messages.
> hermetry.com/docs/devices/device-http-api/

Related: REST API, MQTT, TLS

HTTPS Security

HTTP carried over TLS, so the connection is encrypted and the server proves its identity with a certificate. Devices and APIs should only use HTTPS on public networks.

> **In Hermetry** Devices that cannot keep an MQTT connection can send over Hermetry's HTTPS device API, with the same payloads and limits as MQTT.
> hermetry.com/docs/devices/device-http-api/

Related: HTTP, TLS, X.509 certificate

Humidity sensor Devices and sensors

A sensor that measures the moisture in air, usually as relative humidity in percent, often combined with temperature. It matters for comfort, mould prevention, storage of goods and many industrial processes.

Related: Dew point, IAQ, Cold chain

HVAC (heating, ventilation and air conditioning) Buildings

The systems that keep a building's temperature, humidity and air quality right. They are usually the largest energy user in a building.

> **In Hermetry** The building HVAC and energy use case brings air handling units, chillers, boilers and heat pumps into Hermetry with the meters that serve them.
> hermetry.com/use-cases/building-hvac-and-energy-overview/

Related: AHU, Chiller, BMS

Hybrid cloud Data and analytics

An arrangement that combines on-premises or private infrastructure with public cloud services, with data and workloads moving between them. In IoT it often means local edge or plant servers for control and a cloud platform for fleet-wide analysis.

Related: On-premises, Edge computing, Data residency

Hydraulic model Water

A computer model of a pipe network that calculates flows and pressures from the pipes, pumps, valves and demands. Calibrated with live meter and pressure data, it helps plan works, find leaks and test what-if changes.

Related: Digital twin, DMA, GIS

Hydrostatic level sensor Water

A submersible pressure sensor that measures liquid level from the weight of the liquid above it. It is simple and reliable for wells, tanks and channels, but needs the liquid density and, for sealed versions, compensation for air pressure.

Related: Level sensor, Gauge pressure, Groundwater monitoring

Hysteresis (alarm deadband) Automation and control

A gap between the value that raises an alarm and the value that clears it, such as on at 80 °C and off at 75 °C. It stops a reading hovering at the limit from switching the alarm on and off.

> **In Hermetry** Hermetry alarm rules have a hysteresis (clear margin) setting.
> hermetry.com/docs/rules-and-alarms/debounce-hysteresis-and-dampening/

Related: Deadband, Debounce, Alarm

IAQ (indoor air quality) Buildings

The condition of air inside buildings, judged by carbon dioxide, particulates, volatile organic compounds, temperature and humidity. Monitoring it drives ventilation that keeps people comfortable and alert without wasting energy.

Related: CO_2 sensor, Humidity sensor, Demand-controlled ventilation

ICCID (integrated circuit card identifier) Connectivity

The unique serial number of a SIM card or eSIM profile, up to 20 digits, printed on the card. Connectivity platforms use it to identify, activate and manage each SIM in a fleet.

Related: SIM, IMSI, eSIM

Idempotency Data and analytics

The property that doing the same operation twice has the same effect as doing it once. IoT systems need it because messages can be delivered more than once; a command with an id can then be safely retried.

Related: MQTT QoS, REST API

IEC 60870-5-104 Protocols

A telecontrol standard that carries control-centre messages over TCP/IP, widely used in electricity grids. It reports measurements and events and sends commands to substations.

Related: DNP3, IEC 61850, SCADA

IEC 61131-3 Standards

The standard for programmable controller languages, including ladder diagram, function block diagram and structured text. Most PLC programs are written in one of its languages.

Related: PLC, PID controller

IEC 61499 Standards

An international standard for distributed control applications built from function blocks that react to events and can be spread across several devices. It aims at portable, reconfigurable control beyond the scan-based model of IEC 61131-3.

Related: IEC 61131-3, PLC

IEC 61508 Standards

The basic international standard for functional safety of electrical, electronic and programmable electronic safety systems. It defines safety integrity levels and the lifecycle for designing and verifying such systems; sector standards build on it.

Related: Functional safety, SIL, IEC 61511

IEC 61511 Standards

The functional safety standard for safety instrumented systems in the process industries, based on IEC 61508. It covers how safety functions are specified, designed, installed, operated and tested over the plant's life.

Related: IEC 61508, SIS, SIL

IEC 61850 Protocols

A standard for communication in electrical substations, with data models of the equipment and fast messages between protection devices. It is used for protection, control and monitoring inside substations and between them and the control centre.

Related: IEC 60870-5-104, DNP3, SCADA

IEC 62056 (DLMS/COSEM) Standards

The international standard series for electricity meter data exchange, defining a data model (COSEM) and a protocol (DLMS) that many smart meters speak. It lets meters from different makers be read in the same way.

Related: Smart meter, Energy meter

IEC 62351 Standards

An international standard series that adds security, such as authentication and encryption, to power-system communication protocols including IEC 61850 and IEC 60870-5-104. It addresses the threats that arose once substations were networked.

Related: IEC 61850, IEC 60870-5-104, IEC 62443

IEC 62443 Standards

A series of standards for the security of industrial automation and control systems. It covers the duties of asset owners, system integrators and product makers, with zones, conduits and security levels.

Related: Zero trust, OT, Audit log

IEEE 802.15.4 Connectivity

The standard for low-rate, low-power wireless personal area networks on which Zigbee, Thread, Wi-SUN and several industrial radios are built. It defines the radio and basic frame format; the protocols above add networking and applications.

Related: Zigbee, Thread, Wi-SUN

IIoT (industrial internet of things) Operations

Connected sensors, machines and controllers in industry, utilities and infrastructure, whose data is collected and used to monitor and run them. It differs from consumer IoT in its protocols, lifetimes and stakes.

> **In Hermetry** Hermetry is an industrial IoT and SCADA platform. hermetry.com/platform/

Related: IoT, OT, SCADA

IMEI (international mobile equipment identity) Connectivity

The unique 15-digit number of a cellular modem or phone. It identifies the hardware, while the IMSI and ICCID identify the SIM; device platforms often use the IMEI as a device serial.

Related: IMSI, ICCID, Cellular IoT

IMSI (international mobile subscriber identity)

Connectivity

The number stored on a SIM or eSIM profile that identifies the subscription to the mobile network. The network uses it to authenticate the device and decide which services and roaming it gets.

Related: ICCID, IMEI, SIM

Incident management

Operations

The process of recording, assigning, fixing and closing unplanned disruptions, from a failed pump to a platform outage. Linking alarms to incidents and work orders shows how quickly problems are really solved.

Related: Alarm, Work order, Escalation

Inclinometer (tilt sensor)

Devices and sensors

A sensor that measures angle relative to gravity. It is used to watch poles, walls, slopes, bridges and cranes for movement, and to detect that a bin or container has been tipped.

Related: Accelerometer, Structural health monitoring, Vibration monitoring

Inductive proximity sensor

Devices and sensors

A sensor that detects metal objects nearby without touching them, using a changing magnetic field. It is the standard way to count parts, detect positions and check that a guard or valve is closed.

Related: Digital input, Limit switch, Proximity sensor

Industrial Ethernet

Protocols

Ethernet adapted for factories and plants, with rugged hardware, deterministic timing and protocols for control such as PROFINET, EtherNet/IP and Modbus TCP. It has largely replaced older fieldbuses between controllers and devices.

Related: Ethernet, PROFINET, EtherNet/IP

Industry 4.0

Manufacturing

A term for the digitalisation of manufacturing: connected machines, data shared across the plant and with partners, and decisions supported by analytics. It is often called the fourth industrial revolution; IIoT is its technical foundation.

Related: IIoT, Digital twin

Inference (machine learning)

Data and analytics

Using a trained model to make a prediction from new data, such as classifying a vibration pattern as normal or faulty. Inference can run in the cloud or, with edge AI, on the device itself.

Related: Edge AI, Machine learning, TinyML

Infrared temperature sensor

Devices and sensors

A sensor that measures surface temperature from a distance by reading the infrared radiation an object emits. It suits moving, hot or hard-to-reach surfaces; the material's emissivity must be set for accurate readings.

Related: Thermocouple, RTD, Thermal imaging

Ingestion

Data and analytics

Taking in data from devices: receiving, checking, decoding and storing each message. An ingestion pipeline has to cope with bursts, duplicates and late data.

Related: Telemetry, Codec, Time-series database

Inrush current

Energy

The brief, high current a motor, transformer or power supply draws when switched on, often many times its normal current. Breakers and relays must be sized for it, and monitoring spots starts that last too long.

Related: VFD, Circuit breaker

Integrator (system integrator)

Operations

A company or engineer who designs and builds a complete solution from devices, networks, controllers and software from several suppliers. In IoT projects integrators connect field equipment to a platform and configure the dashboards and rules.

Related: Brownfield, Commissioning, Protocol converter

Interlock

Automation and control

A rule that stops an action unless conditions are safe, such as a pump that cannot start while its suction valve is shut. Safety-relevant interlocks belong in the local controller, not in a remote system.

Related: Fail-safe, PLC, SIL

Interoperability

Standards

The ability of devices and systems from different makers to work together without custom adaptation. Open standards, shared data models and certification programmes are how IoT achieves it.

Related: OPC UA, Matter, LwM2M

Interrupt

Devices and sensors

A signal that makes a processor stop what it is doing and handle an event straight away, such as a pulse arriving or a timer expiring. Battery devices sleep until an interrupt wakes them, which saves energy.

Related: MCU, Low-power mode, Pulse counter

Intrinsic safety (Ex i)

Standards

A protection method that keeps the energy in a circuit too low to ignite an explosive atmosphere, even when something fails. It lets instruments be worked on live in hazardous areas, using barriers or isolators at the boundary.

Related: Hazardous area, Explosion-proof enclosure, ATEX

IO-Link

Protocols

A standard point-to-point link between a sensor or actuator and a master port, over the usual three-wire cable. It adds digital values, parameters and diagnostics to simple sensors.

Related: Fieldbus, PLC

IoT (internet of things)

Operations

Physical things with sensors, software and a network connection that exchange data with other systems. The term covers everything from home devices to industrial meters.

Related: IIoT, Telemetry

IoT analytics Data and analytics

Turning device data into answers: what happened, why it happened, what is likely to happen next and what to do about it. It ranges from simple charts and thresholds to statistical models and machine learning.

Related: Dashboard, Anomaly detection, Time series

IoT platform Operations

Software that connects devices and turns their data into something people can use: device management, data storage, dashboards, rules, alarms and integrations in one place. It sits between the devices in the field and the people and business systems that use their data.

Related: IoT, SCADA, Dashboard

IP camera Devices and sensors

A video camera that sends its stream over an IP network and can be configured and powered over Ethernet. Besides video, many give events such as motion or line crossing that monitoring systems can turn into alarms.

> **In Hermetry** Hermetry adds network cameras like any device and plays their H.264 video live in the browser, without converting it.
> hermetry.com/docs/cameras/live-view/

Related: PoE, Video analytics

IP rating (ingress protection) Devices and sensors

A two-digit code from IEC 60529 for how well an enclosure keeps out dust and water. IP67 means dust-tight and protected against temporary immersion.

Related: Sensor

IPsec Security

A suite of protocols that encrypts and authenticates IP traffic between two network points, often used to build site-to-site VPN tunnels. Routers use it to link remote sites securely to a central network.

Related: VPN, TLS, Remote access

IPSO objects Standards

A set of standard object definitions, such as temperature, humidity or a digital input, used with LwM2M so that devices describe their data the same way. Each object has a number and defined resources like value, unit and min/max.

Related: LwM2M, Data model, Interoperability

IPv6 Connectivity

The current version of the Internet Protocol, with 128-bit addresses that give enough for every device to have its own. Low-power networks such as Thread and 6LoWPAN use it so that sensors are reachable end to end.

Related: 6LoWPAN, Thread, UDP

Irrigation controller Agriculture

A device that opens and closes irrigation valves on a schedule or from sensor data, such as soil moisture, rain and evapotranspiration. Connected controllers let growers and park managers change watering remotely and save water.

Related: Soil moisture sensor, Evapotranspiration

ISA-18.2 (alarm management) Standards

A standard for managing alarms in process industries: what an alarm is, how to design, rationalise and review alarms, and how to measure alarm system performance. Its alarm lifecycle, from philosophy to audit, is widely used to cut nuisance alarms and alarm floods.

Related: Alarm, Alarm flood, Acknowledgement

ISA-88 (batch control) Standards

A standard (also IEC 61512) for batch process control that separates equipment from recipes and defines a common model and terms for batches. It is widely used in pharma, food and chemicals.

Related: Golden batch, ISA-95, MES

ISA-95 Standards

A standard for integrating plant-floor systems with business systems. Its levels, from sensors (0) to business planning (4), are used to describe where each system sits.

Related: MES, SCADA, PLC

ISA-101 Standards

A standard for human-machine interfaces in process automation, covering screen design, navigation, alarms on screens and the HMI lifecycle. It promotes high-performance HMI design.

Related: High-performance HMI, HMI, ISA-18.2

ISM band Connectivity

Radio bands open to unlicensed use, such as 868 MHz in Europe and 915 MHz in the Americas. Anyone may use them within power and duty-cycle limits.

Related: Duty cycle, Frequency plan, LoRaWAN

ISO 50001 Standards

The international standard for energy management systems, which sets how an organisation measures energy use, sets targets and improves energy performance over time. Metering and monitoring data are the evidence it relies on.

Related: EMS, EnPI, Sub-metering

ISO/IEC 27001 Standards

The international standard for information security management systems: the policies, risk assessment and controls an organisation uses to protect information. Certification shows customers that security is managed systematically.

Related: IEC 62443, Audit log, GDPR

J

J1939 Protocols

A higher-layer protocol on CAN used in trucks, buses and off-road machines. It defines standard parameters such as engine speed, fuel rate and fault codes.

Related: CAN bus

Jamming (radio) Security

Deliberately transmitting noise or signals to block a radio channel, so devices cannot communicate. Alarm and tracking devices detect jamming and report it, because criminals use jammers to defeat them.

Related: GNSS, Cellular IoT

Jitter Data and analytics

Variation in the delay of messages that should arrive at regular intervals. High jitter makes real-time control hard and can make healthy devices look late.

Related: Latency, Real time

Join procedure (LoRaWAN) Connectivity

How an OTAA device gets onto a network: it sends a join request, the network checks it and answers with a join accept, and both sides derive fresh session keys. Until it completes, the device cannot send data; if it fails, the device usually retries with growing pauses to save battery.

Related: OTAA, EUI-64, Session keys

Join server (LoRaWAN) Connectivity

The LoRaWAN component that holds a device's root keys, handles its join requests and gives the network and application servers their session keys. Keeping it separate means no single server holds every key.

Related: Join procedure, OTAA, Session keys

JSON (JavaScript Object Notation) Protocols

A text format for structured data made of named values and lists. It is easy to read and is the most common payload format for devices on IP networks.

> **In Hermetry** On custom topics, Hermetry turns a JSON object into named keys and keeps anything else as a single raw value. hermetry.com/docs/devices/mqtt-topics-and-payloads/

Related: Payload, MQTT, REST API

JSON Schema Data and analytics

A vocabulary for describing the structure of JSON documents: which fields exist, their types and allowed values. It is used to validate payloads and configurations and to generate forms and documentation.

Related: JSON, Payload, Data model

JSONPath Data and analytics

A short query language for picking values out of a JSON document, such as $.sensors[0].temperature. It is used to map fields of incoming payloads to device readings without writing code.

Related: JSON, Payload, Codec

Jump server (bastion host) Security

A hardened server that people must go through to reach machines on a protected network, with every session logged. It is a common way to give engineers controlled remote access to OT systems.

Related: Remote access, Audit log, Zero trust

Junction box Devices and sensors

An enclosure where field cables are joined or split, for example where many sensor cables meet a multi-core cable to the control room. In outdoor and hazardous areas it must have the right IP and Ex rating.

Related: IP rating, Field device, Hazardous area

JWT (JSON Web Token) Security

A signed token that carries claims such as who a user is and when the token expires. Services can check it without asking the issuer each time.

Related: API key, SSO

K

K-factor (flow meter) Water

The number of pulses a pulse-output flow meter gives per unit of volume, such as 100 pulses per litre. A counter divides the pulses by the K-factor to get volume and by time to get flow rate.

Related: Pulse counter, Flow meter, Totalizer

Kalman filter Data and analytics

An algorithm that estimates a changing value from noisy measurements by combining a model of how the value moves with each new reading. It is used for smoothing positions, fusing sensors and tracking quantities that cannot be measured directly.

Related: Sensor fusion, Exponential smoothing

Kanban Manufacturing

A production control method in which signals, often cards or bins, trigger the making or delivery of parts only when they are needed. Connected bins and counters can raise kanban signals automatically.

Related: Lean manufacturing, Takt time, MES

Keep-alive (MQTT) Protocols

The longest time a client may stay silent on an MQTT connection. If nothing arrives in about one and a half times that period, the broker treats the client as gone and may publish its last will.

> **In Hermetry** Hermetry serves a keepalive of 0, or one above the broker's maximum (300 seconds by default), at the maximum. hermetry.com/docs/devices/mqtt/

Related: Last will, MQTT, Heartbeat

Key management Security

Everything about cryptographic keys over their life: creating, storing, distributing, rotating and destroying them. Weak key management, such as one shared key for every device, undoes strong encryption.

Related: Key rotation, HSM, PKI

Key rotation Security

Replacing a cryptographic key or credential with a new one at intervals or after a suspected leak. Fleets need it to be automatic, so that rotating keys on thousands of devices does not need a site visit.

Related: Key management, API key, X.509 certificate

KNX Protocols

An open standard (EN 50090, ISO/IEC 14543-3) for home and building control of lighting, blinds, heating and more, over twisted pair, IP or radio. Devices from many makers are configured with common tools and work on one bus.

Related: BMS, BACnet, Home automation

KPI (key performance indicator) Data and analytics

A number that shows how well something is doing against a goal, such as OEE, energy per unit or water loss per kilometre of pipe. A good KPI is measured the same way every time, has an owner and points to an action when it moves.

Related: OEE, Dashboard

kVA (kilovolt-ampere) Energy

The unit of apparent power, the product of voltage and current regardless of phase. Transformers, generators and UPS units are rated in kVA because they must carry the full current even when part of it does no useful work.

Related: Power factor, kvar, kWh

kvar (kilovolt-ampere reactive) Energy

The unit of reactive power, which flows back and forth between source and loads such as motors without doing useful work. Utilities may charge for it, and capacitor banks reduce it by improving the power factor.

Related: Power factor, kVA

kWh (kilowatt-hour) Energy

A unit of energy: one kilowatt for one hour. Electricity is billed in kWh, and meters count kWh as a running total.

Related: Energy meter, Demand charge

L

Ladder logic
Automation and control

A graphical PLC programming language that looks like electrical relay diagrams, with contacts and coils on rungs. It is one of the IEC 61131-3 languages and is still the most common in machine control.

Related: PLC, IEC 61131-3

LAN (local area network)
Connectivity

A network that connects devices within a building, site or plant, usually over Ethernet and Wi-Fi. Industrial sites often split their LAN into separate segments for office, control and devices.

Related: Ethernet, VLAN, WAN

Last mile (delivery)
Logistics

The final step of delivering goods from a local hub to the customer, often the most expensive part of logistics. Vehicle tracking, temperature monitoring and proof of delivery data help manage it.

Related: Fleet management, Cold chain, Asset tracking

Last will (MQTT LWT)
Protocols

A message an MQTT client leaves with the broker when it connects. If the client disappears without saying goodbye, the broker publishes the message, so others learn the device went offline.

> **In Hermetry** Hermetry allows a will message but ignores it; it decides a device's connection state itself.
> hermetry.com/docs/devices/mqtt/

Related: Keep-alive, MQTT, Heartbeat

Latched alarm
Automation and control

An alarm that stays active after its condition has gone away, until someone acknowledges or resets it. Latching makes sure brief events, such as a short pressure spike, are not missed.

Related: Alarm, Acknowledgement

Latency
Data and analytics

The time between something happening and the data about it arriving where it is used. Monitoring can live with seconds; closed-loop control needs milliseconds and stays local.

Related: Jitter, Real time, Edge computing

LBT (listen before talk)
Connectivity

A rule that a radio must check that a channel is free before transmitting, instead of or as well as obeying a duty-cycle limit. Some regions require it in licence-free bands to share the spectrum fairly.

Related: Duty cycle, ISM band, FHSS

LDAP (Lightweight Directory Access Protocol)
Security

A protocol for reading and managing a directory of users, groups and devices. Applications use it to check sign-ins and group membership against a company's central directory.

Related: SSO, RBAC

Leachate monitoring
Water

Measuring the level and quality of liquid that drains through a landfill, which must be collected and treated before it reaches groundwater. Level sensors and pumps in leachate wells are monitored remotely.

Related: Groundwater monitoring, Level sensor, Water quality monitoring

Leak detection
Water

Finding leaks from data: flow at times when nothing should flow, water balance gaps, pressure drops or acoustic signals. Fast detection limits damage and water loss.

> **In Hermetry** The server room use case brings leak detection into Hermetry next to temperatures, humidity and UPS values.
> hermetry.com/use-cases/server-room-critical-environment-monitoring/

Related: Night flow, DMA, NRW

Leak noise logger
Water

A small acoustic sensor attached to water pipes or valves that listens at night for the noise of leaks. Comparing loggers along a pipe narrows down where a leak is, before it surfaces.

Related: Leak detection, Night flow, NRW

Lean manufacturing
Manufacturing

A way of running production that removes waste, such as waiting, overproduction and defects, and keeps work flowing to customer demand. Machine data shows where the waste really is.

Related: Kanban, OEE, Takt time

Legionella
Buildings

Bacteria that grow in warm water systems and cause a serious lung infection when inhaled in droplets. Water systems are kept below 20 °C or above 50–60 °C, and temperature monitoring of outlets and tanks proves it.

Related: Water quality monitoring, Heat meter

Level crossing
Smart city

A place where a road or path crosses a railway at the same level, protected by barriers, lights and train detection. Remote monitoring reports barrier position, lamp failures, power and faults to maintenance teams.

> **In Hermetry** The level crossing use case watches crossings and signalled junctions in Hermetry through their controllers' status outputs.
> hermetry.com/use-cases/level-crossing-and-traffic-signal-monitoring/

Related: Interlock, Traffic signal controller

Level sensor
Devices and sensors

A sensor that measures how full a tank, well, silo or channel is, using pressure, radar, ultrasound, float, capacitance or other methods. Level is one of the most monitored values in water, fuel and process plants.

Related: Hydrostatic level sensor, Ultrasonic level sensor, Radar level sensor

LiDAR
Devices and sensors

A sensor that measures distance by timing laser pulses reflected from objects, building a precise 3D picture of its surroundings. It is used for people counting, traffic, volume measurement of stockpiles and autonomous vehicles.

Related: Radar level sensor, People counting, Machine vision

Lifecycle management (device)
Operations

Managing a device from manufacture and provisioning through configuration, updates and monitoring to decommissioning. Platforms track each stage so that nothing is forgotten, such as revoking the credentials of a retired device.

Related: Provisioning, OTA, Decommissioning

Lighting control
Buildings

Switching and dimming lights by schedule, occupancy, daylight or command, from single rooms to whole streets. Connected lighting also reports burning hours, energy use and failed lamps.

Related: Occupancy sensor, DALI, Smart lighting

Lightning surge
Devices and sensors

A short, very high voltage pulse induced in cables by a nearby lightning strike or switching event. Outdoor sensors, antennas and long field cables need surge protection on power and signal lines.

Related: Surge protection, Galvanic isolation, EMC

Limit switch
Devices and sensors

A switch operated by the movement of a machine part, used to detect end positions of doors, valves, gates and conveyors. Its contact is wired to a digital input and often to safety interlocks.

Related: Digital input, Inductive proximity sensor, Interlock

Line of sight
Connectivity

A clear straight path between two antennas. Higher-frequency and long-range links need it, while lower frequencies bend and pass through obstacles better; see also the Fresnel zone.

Related: Fresnel zone, Link budget, Antenna

Linearisation (sensor)
Devices and sensors

Correcting a sensor whose output is not proportional to the measured value, using a formula or a lookup table. Thermocouples, tank volume from level and some flow devices all need it.

Related: Scaling, Calibration, Thermocouple

Link budget
Connectivity

The sum of gains and losses between a transmitter and a receiver, in dB: transmit power, antenna gains, cable and path losses against the receiver's sensitivity. It shows whether, and with how much margin, a link will work.

Related: RSSI, SNR, Spreading factor

Lithium thionyl chloride battery (Li-$SOCl_2$)
Devices and sensors

A primary (non-rechargeable) battery with very high energy density and very low self-discharge, which lasts more than ten years in sensors that send little. It cannot deliver large current pulses on its own, so it is often paired with a capacitor.

Related: Battery life, Supercapacitor, Low-power mode

Lithium-ion battery
Devices and sensors

A rechargeable battery with high energy density, used in trackers, phones and devices with solar panels. It ages with charge cycles and heat and must not be charged below freezing.

Related: Battery life, Energy harvesting, Battery management system

Load balancing
Data and analytics

Spreading incoming connections or requests across several servers so no single one is overloaded and a failed server is bypassed. Device brokers and APIs are load balanced to handle large fleets.

Related: Horizontal scaling, High availability, Message broker

Load cell
Devices and sensors

A sensor that converts force or weight into an electrical signal, usually with strain gauges. Load cells weigh silos, tanks, trucks and bins, and monitor loads on cranes and structures.

Related: Strain gauge, Weighbridge, Level sensor

Load factor
Energy

Average power over a period divided by peak power in the same period, in percent. A low load factor means short, high peaks, which raise demand charges and the size of the connection a site needs.

Related: Peak shaving, Demand charge, Load profile

Load management
Energy

Controlling when and how much power loads draw, such as EV chargers, heat pumps or pumps, to stay within a limit or use cheaper hours. It lets a site add loads without a bigger grid connection.

Related: EV charger, Load shedding, Demand response

Load profile
Energy

A record of power demand over time, usually in 15-minute or hourly steps. It shows when a site uses energy and where peaks come from.

Related: Demand charge, Energy monitoring, Peak shaving

Load shedding Energy

Switching off less important loads on purpose to keep total demand under a limit, such as a contract peak or the capacity of a generator. Automatic load shedding acts in seconds based on live power readings.

Related: Peak shaving, Demand response, EMS

Local/remote mode Automation and control

A switch or setting that decides whether equipment takes commands from the panel next to it or from a remote control system. Remote commands are refused in local mode, so people working on a machine are not surprised.

Related: Interlock, Command, SCADA

Log management Operations

Collecting, storing and searching the event logs of devices, gateways and servers in one place. It helps engineers find the cause of faults and security teams spot attacks.

Related: Audit log, Data retention

Long polling Protocols

A way for a client to get updates over plain HTTP: it sends a request that the server holds open until there is news or a timeout, then sends another. Devices that cannot keep a socket open can receive commands this way.

Related: HTTP, WebSocket, Polling

Loop tuning Automation and control

Adjusting the settings of a control loop, usually the PID gains, so the process reaches its setpoint quickly without overshoot or oscillation. Badly tuned loops waste energy and wear valves and pumps.

Related: PID controller, Setpoint, Control loop

Loop-powered device Devices and sensors

A transmitter that takes its operating power from the same two wires as its 4–20 mA signal, so it needs no separate supply. The 4 mA live zero is what leaves enough current to run the electronics.

Related: Current loop, HART, Analog input

LoRa Connectivity

A spread-spectrum radio modulation that reaches several kilometres at very low power by trading speed for range. LoRaWAN is the network protocol built on top of it.

Related: LoRaWAN, Spreading factor, LPWAN

LoRaWAN Connectivity

An open low-power wide-area network protocol on top of LoRa radio. Battery sensors send small messages over kilometres to gateways, which pass them to a network server.

> **In Hermetry** Hermetry runs its own LoRaWAN network server, so LoRaWAN gateways and devices connect to it directly.
> hermetry.com/docs/lorawan/how-lorawan-works-in-hermetry/

Related: LoRa, LoRaWAN gateway, Network server

LoRaWAN gateway Connectivity

A radio receiver that hears LoRaWAN devices nearby and forwards their frames to a network server, and sends downlinks back. One gateway can serve thousands of devices.

> **In Hermetry** You add LoRaWAN gateways to Hermetry and watch their status and position on a map.
> hermetry.com/docs/lorawan/add-a-gateway/

Related: Gateway, Basics Station, Backhaul

LoRaWAN relay Connectivity

A LoRaWAN feature in which a battery device forwards frames between end devices out of gateway range and a gateway. It extends coverage into basements and remote corners without adding a full gateway.

> **In Hermetry** Hermetry shows LoRaWAN relays and routers running in local mode, which run a network server on the router itself.
> hermetry.com/docs/lorawan/local-mode-and-relays/

Related: LoRaWAN, LoRaWAN gateway, Extended coverage

Lot traceability Manufacturing

Being able to follow a batch of product or material forward to where it went and back to where it came from, together with its process data. Food and pharma regulations require it for recalls.

Related: MES, Golden batch, Cold chain

LOTO (lockout/tagout) Operations

A safety procedure that isolates machines from energy sources and locks and tags the isolation before maintenance, so nobody can restart them by accident. Digital LOTO records who isolated what and when.

Related: Interlock, Work order, Functional safety

Low-code Data and analytics

Building applications, flows or dashboards by configuring visual blocks instead of writing much code. In IoT it lets engineers create rules and automations themselves, with code kept for the unusual cases.

Related: Rules engine, Dashboard

Low-power mode (sleep) Devices and sensors

A state in which a device switches off most of its circuits and wakes only on a timer or an interrupt. Battery sensors spend nearly all their time asleep; the sleep current largely decides how many years a battery lasts.

Related: Battery life, PSM, Interrupt

LPWAN (low-power wide-area network) Connectivity

A class of networks that send small amounts of data over long distances with very little energy, so sensors run for years on a battery. LoRaWAN, NB-IoT and LTE-M are examples.

Related: LoRaWAN, NB-IoT, LTE-M

LTE (Long Term Evolution) Connectivity

The 4G cellular standard that provides most mobile data today. IoT uses its low-power variants, LTE-M and NB-IoT, and categories such as Cat 1 for devices that need more bandwidth.

Related: LTE-M, NB-IoT, LTE Cat 1

LTE Cat 1 Connectivity

A low-rate LTE device category, up to about 10 Mbit/s down, that works on ordinary 4G networks. It suits gateways and trackers that need more speed than LTE-M but not a full smartphone modem.

Related: LTE-M, NB-IoT, Cellular IoT

LTE Cat-M1 Connectivity

The device category name for LTE-M in the mobile network specifications. See LTE-M.

Related: LTE-M, Cellular IoT

LTE Cat-NB1 Connectivity

The device category name for the first release of NB-IoT in the mobile network specifications; later releases added Cat-NB2. See NB-IoT.

Related: NB-IoT, Cellular IoT

LTE-M (LTE Cat-M1) Connectivity

A low-power cellular technology for IoT on 4G networks. It allows mobility and voice and has more bandwidth than NB-IoT, while still saving energy with sleep modes.

> **In Hermetry** Gateways and devices with LTE-M connectivity are listed in Hermetry's device catalogue.
> hermetry.com/licensed-devices/connectivity/cat-m1/

Related: NB-IoT, Cellular IoT, PSM

Lux Buildings

The unit of illuminance, the amount of light falling on a surface. Light sensors measure lux so lighting control can dim lights when daylight is enough and keep workplaces at the required level.

Related: Lighting control, Occupancy sensor

LwM2M (Lightweight M2M) Protocols

An open device management standard built on CoAP, with standard objects for things like firmware, connectivity and sensors. It covers registration, reading, writing and updates of constrained devices.

Related: CoAP, Fleet management, OTA

M

M-Bus (Meter-Bus) Protocols

A European standard (EN 13757) for reading utility meters, such as water, heat, gas and electricity, over a two-wire bus. Wireless M-Bus is its radio variant, used for walk-by and fixed-network meter reading.

Related: Smart meter, Energy meter, Modbus RTU

M2M (machine-to-machine) Connectivity

Communication between devices without a person in the loop, such as a meter reporting to a utility or a pump controller talking to a tank sensor. The term is older than IoT and is still used by mobile operators for device SIM plans and networks.

Related: IoT, Cellular IoT, Telemetry

MAC address Connectivity

A hardware address, usually 48 bits written as six pairs of hex digits, that identifies a network interface on Ethernet, Wi-Fi or Bluetooth. It is used to deliver frames on the local network and is often printed on device labels for provisioning.

Related: Ethernet, Wi-Fi, EUI-64

MAC command (LoRaWAN) Connectivity

A control message between a LoRaWAN device and the network server, carried inside normal frames. MAC commands set data rates and power, add channels and check the link, without involving the application.

Related: ADR, LoRaWAN, Network server

Machine learning Data and analytics

Building models that learn patterns from data instead of following hand-written rules. In IoT it is used to spot anomalies, forecast consumption or failures and classify events from sensor readings, and it needs clean, well-labelled history to work.

Related: Anomaly detection, Predictive maintenance, Time series

Machine vision Manufacturing

Using cameras and image processing to inspect, measure or count things automatically, for example checking labels, reading codes or finding defects on a line. Results are usually passed to the line controller or MES as pass/fail signals and counts.

Related: Object detection, MES, Edge computing

Magnetic flow meter (magmeter) Water

A flow meter that measures the voltage induced when a conductive liquid moves through a magnetic field. It has no moving parts and no pressure loss, which makes it common for water, wastewater and slurries; it cannot measure non-conductive liquids such as oils.

Related: Flow meter, Totalizer, Pressure transmitter

Magnetometer Devices and sensors

A sensor that measures magnetic field strength and direction. In IoT it serves as an electronic compass, detects vehicles above parking bays and senses whether a door or lid is open when paired with a magnet.

Related: Parking sensor, Accelerometer

Mains power monitoring Energy

Watching whether a site or cabinet still has mains power, often with voltage and frequency readings. A device on battery or UPS can report the loss at once, which separates a power cut from a communications fault.

Related: UPS, Heartbeat, Power quality

Maintenance window Operations

An agreed period in which updates, restarts or repairs may interrupt a service. Scheduling firmware updates and server work inside such windows keeps unexpected downtime away from operating hours.

Related: OTA, Availability, Patch management

Man-in-the-middle attack Security

An attack in which someone secretly sits between two parties, reading or altering their messages while each believes it talks to the other. Mutual authentication and properly checked certificates are the main defence, which is why devices must not skip certificate validation.

Related: mTLS, TLS, X.509 certificate

Mass flow meter (Coriolis) Devices and sensors

A flow meter that measures mass flow directly from the twisting of vibrating tubes as fluid passes through them. It is accurate for liquids and gases regardless of density and also reports density and temperature, so it is used for custody transfer and dosing.

Related: Flow meter, Magnetic flow meter, Totalizer

Matter Connectivity

An open application standard for smart home devices that runs over Wi-Fi, Ethernet and Thread, so devices from different makers work with the same controllers. Devices are set up with a QR code and controlled locally, without needing a particular cloud service.

Related: Thread, Zigbee, Wi-Fi

Maximum demand Energy

The highest average power drawn over a billing interval, typically 15 or 30 minutes, within a month or year. Many tariffs charge for it separately, so a short peak can cost as much as days of normal use.

Related: Demand charge, Peak demand, Load profile

MCP (Model Context Protocol) Protocols

An open protocol through which AI assistants connect to tools and data. A system offers MCP servers that describe what an assistant may read or do, and the assistant calls them on the user's behalf.

> **In Hermetry** Hermetry offers MCP servers; an assistant acts as the person who connected it and never gets more rights than that person or API key.
> hermetry.com/docs/api/ai-assistants-and-mcp/

Related: API, API key, REST API

MCSA (motor current signature analysis) Operations

Finding motor and load faults by analysing the frequency content of the motor's supply current. Broken rotor bars, bearing wear and misalignment leave typical patterns, and the measurement needs only clamp-on current sensors.

Related: Condition monitoring, CT, Vibration monitoring

MCU (microcontroller) Devices and sensors

A small computer on a single chip with processor, memory and peripherals such as timers, ADCs and serial ports. Most sensors and battery devices run on an MCU because it can sleep at microamps and wake in microseconds.

Related: Firmware, GPIO, Sleep mode

MDM (meter data management) Energy

Software that collects, validates, estimates and stores readings from many utility meters before they go to billing and analysis. It fills gaps, flags suspicious values and keeps the history that settlement and disputes depend on.

Related: Smart meter, AMR, Data quality

Measurement uncertainty Standards

The range within which the true value of a measurement is expected to lie, such as 20.3 °C ± 0.2 °C. Every reading has some; stating it honestly is what makes comparisons and alarm limits meaningful.

Related: Accuracy and precision, Calibration, Resolution

Medium voltage (MV) Energy

The voltage range between low-voltage consumer supply and high-voltage transmission, commonly about 1 kV to 36 kV. Distribution networks, larger factories and substations run at medium voltage, and their switchgear and transformers are frequent monitoring targets.

Related: Substation, Transformer monitoring, IEC 61850

MEMS (micro-electro-mechanical systems) Devices and sensors

Tiny mechanical structures built on silicon chips alongside electronics. Most low-cost accelerometers, gyroscopes, pressure sensors and microphones in IoT devices are MEMS parts.

Related: Accelerometer, Sensor, Vibration monitoring

MES (manufacturing execution system) Manufacturing

The software layer that runs and tracks production on the shop floor: orders, materials, quality and output, between the machines and the business systems. It records what was made, when, from which materials and with what quality results.

Related: ISA-95, OEE, SCADA

Mesh network Connectivity

A network in which devices pass each other's messages along, so data can hop around obstacles and the network heals when one node fails. Zigbee, Thread and BLE mesh work this way.

Related: Zigbee, Thread, BLE

Message broker Protocols

A server that receives messages from senders and delivers them to the receivers that subscribed to them. In MQTT it is simply called the broker.

Related: MQTT, Publish-subscribe, AMQP

Message deduplication Data and analytics

Discarding copies of a message that arrive more than once, for example when several LoRaWAN gateways hear the same uplink or an MQTT QoS 1 message is resent. Without it, counters and totals are counted twice.

Related: MQTT QoS, LoRaWAN gateway, Network server

Message queue Data and analytics

A buffer that holds messages until a consumer takes them, so senders and receivers do not have to be online or equally fast at the same time. Queues smooth bursts of telemetry and keep data safe while a back-end service restarts.

Related: Message broker, Queue, AMQP

Metadata Data and analytics

Data about data: a device's location, model, installation date, unit of measure or the meaning of a register. Good metadata lets readings be found, compared and trusted long after the people who installed the device have moved on.

Related: Tag, Digital twin, Data model

Methane leak detection Energy

Finding escaping methane at wells, pipelines, compressor stations, landfills or biogas plants with fixed gas sensors, optical cameras or periodic surveys. Continuous sensors with alarms shorten the time a leak runs, which matters for safety and for emissions reporting.

Related: Pipeline leak detection, Gas detector, Alarm

MFA (multi-factor authentication) Security

Signing in with two or more independent proofs, such as a password plus a code from an app or a security key. It stops most account takeovers that start with a stolen or guessed password.

Related: SSO, OTP, RBAC

MIC (message integrity code) Security

A short code computed from a message and a secret key, added to the message so the receiver can check it was not changed and came from a key holder. Every LoRaWAN frame carries one.

Related: AES-128, Session keys, Frame counter

Microgrid Energy

A local group of generators, storage and loads that can run connected to the main grid or on its own. Campuses, ports and remote sites use microgrids for resilience and to use more local solar or wind.

Related: PV (photovoltaic) system, BESS, Peak shaving

Microservices Data and analytics

An architecture in which an application is built from small, separately deployed services that talk over the network. IoT platforms often split ingestion, rules, storage and user interfaces this way so each can scale on its own.

Related: IoT platform, Ingestion, Orchestration

Middleware Data and analytics

Software that sits between devices or applications and handles common jobs such as messaging, protocol conversion, security and data routing. An IoT platform is largely middleware between field devices and business systems.

Related: IoT platform, Message broker, Protocol converter

Milk cooling monitoring Agriculture

Watching the temperature of milk in farm bulk tanks and how fast it cools after each milking. Alerts on slow cooling or a failed compressor protect milk quality before collection.

Related: Cold chain, Threshold, Data logger

MIMO (multiple input, multiple output) Connectivity

A radio technique that uses several antennas at both ends to send parallel streams or make a link more robust. It raises throughput in Wi-Fi and LTE/5G, while most low-power IoT devices use a single antenna to save cost and energy.

Related: Antenna, Wi-Fi, Cellular IoT

MKT (mean kinetic temperature) Logistics

A single temperature that has the same overall effect on product degradation as the varying temperatures actually recorded. It weights warm periods more than a plain average and is used to judge temperature excursions in pharma storage and transport.

Related: Cold chain, Temperature excursion, Data logger

MNO (mobile network operator) Connectivity

A company that owns and runs a cellular network and its radio licences. IoT SIMs come either directly from an MNO or from an MVNO that resells access, sometimes across several MNOs.

Related: MVNO, SIM, Roaming

Modbus coil Protocols

A single on/off value in a Modbus device that can be read and written, typically mapped to a relay output or a command bit. Coils are read with function code 01 and written with 05 or 15.

Related: Modbus register, Modbus function code, Digital output

Modbus exception code Protocols

The error a Modbus device returns when it cannot carry out a request, for example 02 for an illegal data address or 04 for a device failure. Logging these codes quickly shows wrong register maps or overloaded slaves.

Related: Modbus function code, Modbus register, Modbus RTU

Modbus function code Protocols

The number in a Modbus request that says what to do, such as 03 read holding registers, 04 read input registers, 06 write one register or 16 write several. Devices support only some codes, so the device manual decides which can be used.

Related: Modbus register, Modbus coil, Modbus exception code

Modbus gateway (TCP to RTU) Protocols

A device that lets Modbus TCP clients on Ethernet talk to Modbus RTU devices on an RS-485 line, translating frames and addresses. It is the usual way to bring serial meters and drives onto an IP network.

Related: Modbus TCP, Modbus RTU, Protocol converter

Modbus register Protocols

A numbered 16-bit slot in a Modbus device's data table. Holding registers can be read and written, input registers only read; a 32-bit value spans two registers, and devices differ in the order of their words and bytes.

> **In Hermetry** Try the Modbus register decoder on our tools page to read 16- and 32-bit values in every word and byte order. hermetry.com/tools/modbus-register-decoder/

Related: Modbus RTU, Modbus TCP, Scaling

Modbus RTU Protocols

The serial form of Modbus, usually over RS-485: one master asks numbered devices for register values in turn. It is simple, old and still on almost every meter, drive and controller.

> **In Hermetry** Gateways read Modbus RTU devices and bring each one into Hermetry as a child device. hermetry.com/docs/edge/devices-behind-a-gateway/

Related: Modbus TCP, RS-485, Modbus register

Modbus RTU over TCP Protocols

Sending complete Modbus RTU frames, including their CRC, inside a TCP connection, often through a serial-to-Ethernet converter. It differs from Modbus TCP, which drops the CRC and adds its own header, so both sides must agree on which form they use.

Related: Modbus RTU, Modbus TCP, Protocol converter

Modbus TCP Protocols

Modbus over Ethernet and IP, normally on TCP port 502. The registers and functions are the same as in Modbus RTU; only the framing and the network differ.

> **In Hermetry** Hermetry Edge, on the gateways Hermetry supports, can read Modbus TCP devices, depending on the gateway model.
> hermetry.com/docs/edge/licensed-gateways-and-hermetry-edge/

Related: Modbus RTU, Modbus register, Protocol converter

Modbus unit ID (slave address) Protocols

The address, 1 to 247, that tells devices on a Modbus RTU bus which one a request is for. Every device on one line needs a different address; on Modbus TCP the field selects a device behind a gateway.

Related: Modbus RTU, Modbus gateway, RS-485

Modulation Connectivity

The way information is put onto a radio carrier, by changing its amplitude, frequency or phase. Different modulations trade data rate against range and robustness, for example chirp spread spectrum in LoRa or narrowband modulation in cellular IoT.

Related: LoRa, Bandwidth, Data rate

Motion sensor Devices and sensors

A sensor that detects movement, most often a passive infrared sensor that reacts to body heat. In buildings it switches lights and ventilation; in security it raises alerts; in IoT it often wakes a sleeping device.

Related: PIR sensor, Occupancy sensor, Accelerometer

Moving average Data and analytics

An average taken over a sliding window of recent readings, such as the last ten samples or the last hour. It smooths noise so trends and alarm thresholds react to real changes rather than single spikes.

Related: Downsampling, Deadband, Anomaly detection

MPC (model predictive control) Automation and control

An advanced control method that uses a model of the process to predict the next steps and choose the best control moves within limits. It is used where several variables interact, such as in chemical plants or building energy optimisation.

Related: PID controller, Process control, Setpoint

MPPT (maximum power point tracking) Energy

A control method in solar charge controllers and inverters that keeps panels at the voltage where they deliver most power. Small MPPT chargers also make solar-powered IoT devices work better in poor light.

Related: PV (photovoltaic) system, Energy harvesting

MQTT Protocols

A light publish-subscribe messaging protocol over TCP. Devices keep one connection to a broker, publish readings on topics and receive commands on the topics they subscribe to.

> **In Hermetry** Devices connect to Hermetry over MQTT 3.1.1 with TLS on port 8883.
> hermetry.com/docs/devices/mqtt/

Related: MQTT topic, MQTT QoS, Message broker

MQTT 5 Protocols

The current major version of MQTT, adding reason codes, user properties, message and session expiry, shared subscriptions and request/response patterns. Many devices still use version 3.1.1, and brokers usually support both.

Related: MQTT, MQTT shared subscription, MQTT persistent session

MQTT bridge Protocols

A link between two MQTT brokers that forwards chosen topics from one to the other. It connects a site broker to a cloud broker, so local systems keep working when the connection drops and data catches up afterwards.

Related: Message broker, MQTT topic, Store and forward

MQTT persistent session Protocols

A session the broker keeps after a client disconnects, with its subscriptions and the QoS 1 and 2 messages it missed. The client asks for it with clean session off (MQTT 3.1.1) or a session expiry (MQTT 5).

> **In Hermetry** Hermetry asks devices to connect with a clean session and serves a request for a persistent one as clean.
> hermetry.com/docs/devices/mqtt/

Related: MQTT QoS, MQTT 5, Keep-alive

MQTT QoS (quality of service) Protocols

The delivery guarantee of an MQTT message: 0 at most once, 1 at least once (duplicates possible), 2 exactly once. Higher levels cost more round trips.

> **In Hermetry** Hermetry asks devices to publish with QoS 1, accepts QoS 0 and handles QoS 2 as QoS 1; it acknowledges a message only after it is safely queued.
> hermetry.com/docs/devices/mqtt/

Related: MQTT, MQTT retained message

MQTT retained message Protocols

A message the broker keeps as the last known value of a topic and hands to every new subscriber at once. It is useful for states such as "online" or a current setting.

> **In Hermetry** Hermetry ignores the retain flag on device messages: the message is processed, not retained.
> hermetry.com/docs/devices/mqtt/

Related: MQTT, MQTT topic, Last will

MQTT shared subscription Protocols

A subscription shared by a group of clients, where the broker hands each message to only one of them. It spreads the processing of a busy topic across several back-end workers.

Related: MQTT 5, Message broker, MQTT topic

MQTT topic Protocols

The address of an MQTT message, a path such as site/pump-3/temperature. Subscribers can use wildcards: + matches one level, # matches all levels below.

> **In Hermetry** All topics of Hermetry's default scheme start with v1/, such as v1/telemetry for readings.
> hermetry.com/docs/devices/mqtt-topics-and-payloads/

Related: MQTT, Publish-subscribe

MQTT wildcard Protocols

A placeholder in an MQTT subscription: + matches exactly one topic level and # matches all remaining levels. Wildcards let one subscription cover many devices, but they cannot be used when publishing.

Related: MQTT topic, Publish-subscribe, MQTT

MQTT-SN (MQTT for sensor networks) Protocols

A variant of MQTT for devices on non-TCP networks such as UDP, Zigbee or other low-power radios. It shortens topic names to numeric IDs and needs a gateway that translates to standard MQTT.

Related: MQTT, UDP, Gateway

MTBF (mean time between failures) Operations

The average running time between one failure and the next for equipment that is repaired. Rising MTBF means the equipment is getting more reliable.

Related: MTTR, Availability, Predictive maintenance

mTLS (mutual TLS) Security

A TLS connection in which both sides prove who they are with certificates, not only the server. A device with its own certificate cannot be impersonated by someone who only knows a password.

> **In Hermetry** Supported devices log in to Hermetry with an X.509 client certificate from Hermetry's own device certificate authority.
> hermetry.com/docs/devices/device-certificates/

Related: TLS, X.509 certificate, PKI

MTTD (mean time to detect) Operations

The average time between a fault or incident starting and someone noticing it. Monitoring with good alarms shortens it, and in remote assets it is often the largest part of the total outage.

Related: MTTR, Alarm, Heartbeat

MTTF (mean time to failure) Operations

The average time a non-repairable item runs before it fails, such as a battery or a sensor that is replaced rather than repaired. For repairable equipment the related figure is MTBF.

Related: MTBF, MTTR

MTTR (mean time to repair) Operations

The average time from a failure until the equipment works again, including finding, travelling and fixing. Faster alarms and remote diagnosis shorten it.

Related: MTBF, Availability, Remote access

MTU (maximum transmission unit) Connectivity

The largest packet a network link carries without splitting it. Cellular IoT, VPN tunnels and satellite links often have smaller MTUs, and oversized packets then fragment or get dropped.

Related: UDP, VPN, Packet loss

Multi-tenancy Operations

One system serving several customers or organisations, each seeing only its own devices, data and users. It matters for service providers that run many clients on one platform.

> **In Hermetry** Hermetry keeps organisations apart in the database with row-level security, so one organisation can never read another's rows.
> hermetry.com/platform/multi-tenancy/

Related: RBAC, Data residency

Multicast Connectivity

Sending one message to a group of devices at once instead of to each in turn. LoRaWAN uses it for firmware updates and group commands.

Related: FUOTA, Downlink

Multipath propagation Connectivity

Radio signals arriving by several paths, reflected by buildings, ground or metal, and interfering with each other at the receiver. It causes fades that shift when someone or something moves, which is why signal strength in factories and cities varies from metre to metre.

Related: Path loss, Antenna

MVNO (mobile virtual network operator) Connectivity

An operator that sells mobile service over other operators' networks without owning radio infrastructure. IoT-focused MVNOs often offer one SIM that roams on several networks, plus management tools for large fleets.

Related: MNO, SIM, Roaming

N

N+1 redundancy Operations

Having one more unit than needed, such as five pumps where four carry the load, so one can fail or be serviced without loss. The same idea applies to servers, power supplies and gateways.

Related: Redundancy, High availability, Availability

Nameplate data Devices and sensors

The ratings printed on a motor, pump, transformer or meter: rated power, voltage, current, speed, serial number. Recording them with the device gives monitoring its limits, such as the current at which a motor is overloaded.

Related: Metadata, Digital twin, Condition monitoring

NAT (network address translation) Connectivity

A router function that lets many devices with private addresses share one public address. It also means devices behind NAT cannot be reached from outside, which is why IoT devices open the connection outwards to the platform.

Related: VPN, Remote access, Private network

NB-IoT (Narrowband IoT) Connectivity

A cellular technology for IoT that uses a narrow 200 kHz band, giving deep indoor and underground coverage and long battery life. It suits fixed devices that send little data, such as meters.

> **In Hermetry** Gateways and devices with NB-IoT connectivity are listed in Hermetry's device catalogue.
> hermetry.com/licensed-devices/connectivity/nb-iot/

Related: LTE-M, Cellular IoT, PSM

Net metering Energy

A billing arrangement in which electricity a customer exports from solar panels offsets what they import, measured by a meter that counts both directions. Monitoring import and export separately shows how much self-generated power is used on site.

Related: PV (photovoltaic) system, Smart meter

Network segmentation Security

Splitting a network into separate zones with controlled traffic between them, for example keeping controllers apart from office PCs. In OT security it limits how far an attacker or a fault can spread.

Related: VLAN, Purdue model, Zone

Network server (LNS) Connectivity

The server at the centre of a LoRaWAN network. It removes duplicate frames heard by several gateways, checks and decrypts them, manages data rates and sends downlinks through the best gateway.

> **In Hermetry** Hermetry includes its own LoRaWAN network server; each organisation has its own server address.
> hermetry.com/docs/lorawan/your-network-server-address/

Related: LoRaWAN, LoRaWAN gateway, ADR

Network slicing Connectivity

A 5G feature that runs several virtual networks with different performance guarantees on the same physical network. A slice can, for example, give a utility's devices reserved capacity and low latency apart from public traffic.

Related: Private network, RedCap, Latency

Network topology Connectivity

The way the nodes of a network are arranged and connected: star, bus, ring, tree or mesh. Topology decides how far a failure spreads and how messages travel, for example star for LoRaWAN and mesh for many building radios.

Related: Mesh network, Star topology, Fieldbus

Neural network Data and analytics

A machine-learning model made of layers of simple connected units that learn weights from examples. Small neural networks can run on edge devices to recognise sounds, images or vibration patterns without sending raw data to the cloud.

Related: Machine learning, TinyML, Edge computing

NFC (near-field communication) Connectivity

A very short-range radio, a few centimetres, used to tap a phone against a device to read it or set it up. Many sensors use NFC for commissioning.

Related: Provisioning, BLE

Night flow (minimum night flow) Water

The lowest flow into a water area at night, typically between 2 and 4 a.m., when almost no one uses water. Most of it is leakage, so a rising night flow is the classic sign of a new leak.

> **In Hermetry** The water network use case shows minimum night flow per DMA watched in Hermetry.
> hermetry.com/use-cases/water-network-pressure-and-night-flow/

Related: DMA, Leak detection, NRW

Night setback Buildings

Lowering heating setpoints, or raising cooling ones, outside occupied hours to save energy. Monitoring checks that setback really happens and that rooms recover in time before people arrive.

Related: Setpoint, BMS, HVAC

NIS2 Directive Standards

The European Union directive on the security of network and information systems, replacing the first NIS Directive. It covers many essential and important sectors, including energy, water and manufacturing, and requires risk management, incident reporting and supply-chain security.

Related: IEC 62443, Audit log, Zero trust

NIST Cybersecurity Framework Standards

A widely used framework from the US National Institute of Standards and Technology that organises security work into functions such as govern, identify, protect, detect, respond and recover. Organisations use it to structure and compare their security programmes, including for OT.

Related: IEC 62443, NIS2 Directive, OT security

NMEA 0183 Protocols

A simple serial text format, standardised by the marine electronics association, in which GNSS receivers and marine instruments send sentences such as position and speed. Many GPS modules in trackers still output NMEA 0183 sentences.

Related: GNSS, UART, NMEA 2000

NMEA 2000 Protocols

A CAN-based network standard for connecting marine instruments, engines and displays on a vessel. Gateways read it to bring boat and engine data into remote monitoring.

Related: CAN bus, NMEA 0183, J1939

NO_2 (nitrogen dioxide) monitoring Smart city

Measuring nitrogen dioxide in outdoor air, mainly from road traffic and combustion. Low-cost sensor networks map street-level pollution between official reference stations, provided they are calibrated and corrected for temperature and humidity.

Related: PM2.5 and PM10, Air quality sensor, Calibration

Node Connectivity

Any device on a network that sends, receives or forwards data: a sensor, a gateway, a router or a server. In LoRaWAN and mesh networks the word often means an end device.

Related: Gateway, Mesh network, End device

Noise floor Connectivity

The level of background radio noise at a receiver, below which signals cannot be told apart from noise. A raised noise floor from nearby equipment shrinks range even when the signal itself has not changed.

Related: SNR, RSSI, Link budget

Noise monitoring Smart city

Measuring sound levels with sensors, usually as A-weighted decibels averaged over set periods. Cities, construction sites and venues use it to check limits at night and to answer complaints with data.

Related: Sensor, Threshold

Nominal capacity (battery) Devices and sensors

The capacity a battery is rated for, in mAh or Ah, under the manufacturer's test conditions. Real devices see less because of cold, high pulse currents and self-discharge, so battery-life estimates should include a margin.

Related: Battery life, Primary cell

Non-repudiation Security

Assurance that someone cannot later deny an action they took, such as sending a command or approving a change. It rests on strong authentication, digital signatures and tamper-evident audit logs.

Related: Audit log, Digital signature, PKI

Non-volatile memory Devices and sensors

Memory that keeps its contents without power, such as flash or EEPROM. Devices store settings, keys, counters and buffered readings there so they survive resets and battery changes; it has a limited number of write cycles.

Related: Firmware, Store and forward, MCU

Nonce Security

A number used only once in a security protocol, so that an old message cannot be replayed as if new. LoRaWAN join requests, for example, carry a device nonce that the network checks has not been seen before.

Related: Join procedure, Frame counter

Normally open / normally closed (NO/NC) Automation and control

Whether a contact is open or closed when it is at rest. Alarm circuits are often normally closed, so a broken wire looks like an alarm instead of looking like calm.

Related: Dry contact, Relay, Fail-safe

Northbound interface Data and analytics

The interface a system offers upwards to higher-level applications, such as a platform's REST API, webhooks or data export. The southbound side faces the devices and field networks.

Related: REST API, Webhook

Notification Operations

A message that tells a person something happened, sent by e-mail, SMS, push, chat or voice. Good notifications go to the right person, say what to do and are not sent so often that people learn to ignore them.

> **In Hermetry** Hermetry offers each notification to its recipients on every channel that applies: in-app, e-mail, SMS, push and chat apps, with quiet hours.
> hermetry.com/docs/notifications/channels/

Related: Alarm, Push notification, Escalation

NR (New Radio) Connectivity

The radio interface of 5G as defined by 3GPP. NR covers everything from high-speed broadband to reduced-capability devices for IoT, and it is used in public and private 5G networks.

Related: RedCap, Cellular IoT, Network slicing

NRW (non-revenue water) Water

Water that is put into a network but never billed: leaks, theft, meter errors and unbilled use. It is the main loss figure of a water utility.

Related: Night flow, DMA, Leak detection

NTC thermistor Devices and sensors

A temperature-sensing resistor whose resistance falls as temperature rises. It is cheap and sensitive, so it appears in many sensors and appliances, but it needs a curve or table to convert resistance to degrees.

Related: Pt100, Analog input

NTN (non-terrestrial network) Connectivity

A cellular network that uses satellites or high-altitude platforms instead of, or alongside, ground towers, as specified by 3GPP for NB-IoT and NR. It extends IoT coverage to seas, deserts and remote pipelines.

Related: Satellite IoT, NB-IoT, NR

NTP (Network Time Protocol) Data and analytics

A protocol that sets device clocks from time servers over the network. Accurate clocks matter because every reading and event is time-stamped.

> **In Hermetry** When readings drift a little more every day, Hermetry's troubleshooting guide points to the device clock: use NTP, or leave the timestamp out.
> hermetry.com/docs/troubleshooting/wrong-times-and-gaps/

Related: Timestamp, GNSS

Nuisance alarm Automation and control

An alarm that fires often without needing any action, for example from a noisy reading near its threshold. Nuisance alarms train operators to ignore alarms and are a main target of alarm management.

Related: Alarm flood, Deadband, ISA-18.2

NVR (network video recorder) Devices and sensors

A device that records video streams from IP cameras on the network and serves them for playback. Monitoring its disks, recording state and camera connections catches gaps before footage is needed.

> **In Hermetry** Hermetry adds a network video recorder's channels from the Devices page and tests the connection before it stores anything.
> hermetry.com/docs/cameras/add-a-camera-or-recorder/

Related: IP camera, Heartbeat

NwkSKey (network session key) Security

The LoRaWAN session key used by the network server to check message integrity and handle MAC commands. It is one of the session keys created at join (or set by hand with ABP); see session keys.

Related: Session keys, MIC

O

OAuth 2.0 Security

An authorisation framework in which an application gets a limited access token instead of the user's password. It is the usual way third-party tools and integrations get scoped, revocable access to an IoT platform's API.

Related: OpenID Connect, JWT, API key

OBD-II (on-board diagnostics) Logistics

The standard diagnostic port and protocol set in passenger cars and light vehicles, giving access to fault codes and live data such as speed and engine load. Plug-in telematics devices read it for fleet monitoring.

Related: CAN bus, J1939, Telematics

Object detection Data and analytics

A computer vision task that finds and labels objects in an image, such as vehicles, people or parcels, with their positions. Running it on cameras or edge devices turns video into counts and events without storing footage.

Related: Machine vision, Neural network, Edge computing

Object storage Data and analytics

Storage that keeps data as objects in buckets, each with an address and metadata, rather than as files in folders or rows in tables. It is cheap and scales well, so it is used for archives, exports, images and firmware files.

Related: Data retention, Time-series database, Firmware

Observability Operations

How well the inside state of a system can be understood from what it emits: metrics, logs and traces. For an IoT fleet it also means device health data such as uptime, signal and battery, so problems can be found without a site visit.

Related: Heartbeat, Device management, Audit log

Occupancy sensor Buildings

A sensor that tells whether a space is in use, using infrared, radar, CO_2, sound or camera-based counting. Occupancy data drives lighting and HVAC, and shows how rooms and desks are actually used.

Related: Motion sensor, People counting, Demand-controlled ventilation

OCPP (Open Charge Point Protocol) Protocols

An open protocol between electric vehicle chargers and the back-end systems that manage them: starting and stopping sessions, reporting meter values and status, and setting charging limits. Because it is open, chargers and management systems from different suppliers can work together.

Related: Energy monitoring, Load profile

Odour monitoring Smart city

Measuring gases such as hydrogen sulphide and ammonia around wastewater works, landfills and farms with electronic sensors. Continuous data links complaints to actual events and to wind direction.

Related: NO_2 (nitrogen dioxide) monitoring, Gas detector, Weather station

OEE (overall equipment effectiveness) Manufacturing

A measure of how well a machine or line uses its planned time: availability × performance × quality. An OEE of 85 % is usually called world class; many lines run far below it.

> **In Hermetry** Hermetry collects the run, stop and counter signals OEE is built from; the production tracking use case shows how.
> hermetry.com/use-cases/production-tracking-with-machine-counters/

Related: Availability, KPI, MES

Offset error Devices and sensors

A constant difference between a sensor's reading and the true value, the same across the range. It is corrected with a single calibration point, unlike gain errors that grow with the reading.

Related: Calibration, Scaling, Sensor drift

Ohm's law Devices and sensors

The relation between voltage, current and resistance in a conductor: V = I × R. It is the basis for sizing resistors, working out cable losses and turning a 4–20 mA loop current into a voltage at an input.

Related: Current loop, Analog input

Oil condition monitoring Operations

Tracking the state of lubricating or insulating oil, through sensors for water content, particles, viscosity or dielectric strength, or by lab samples. Worsening oil warns of wear or leaks in gearboxes, engines and transformers before they fail.

Related: Condition monitoring, Predictive maintenance, Transformer monitoring

On-premises Operations

Software installed on the customer's own servers or private cloud rather than used as a hosted service. It is chosen when data must stay on site or the network has no internet.

> **In Hermetry** The same Hermetry platform can be installed on your own servers, with telemetry, dashboards, users and audit logs kept inside your network.
> hermetry.com/on-premises/

Related: Data residency, High availability

On/off control Automation and control

The simplest control method: switch the output fully on below the setpoint and fully off above it, usually with a hysteresis band to avoid rapid switching. Thermostats and level controls with pumps often work this way.

Related: Hysteresis, Setpoint, PID controller

OPC DA (OPC Classic) Protocols

The older OPC standard for real-time data access between Windows applications, built on the operating system's component technology. It is still found in many plants, often bridged to OPC UA by a wrapper or gateway.

Related: OPC UA, SCADA, Protocol converter

OPC UA Protocols

A platform-independent standard for industrial data exchange, with an information model, built-in security and client-server or publish-subscribe communication. Many modern controllers and machines offer an OPC UA server.

> **In Hermetry** Hermetry Edge, on the gateways Hermetry supports, can read OPC UA servers, depending on the gateway model.
> hermetry.com/docs/edge/licensed-gateways-and-hermetry-edge/

Related: PLC, SCADA, Protocol converter

OPC UA companion specification Standards

A standard information model built on OPC UA for a particular kind of equipment or industry, such as machine tools, robots or pumps. Devices that follow one describe themselves the same way, so software can use them without custom mapping.

Related: OPC UA, Data model, Interoperability

OPC UA PubSub Protocols

The publish-subscribe part of OPC UA, in which data is sent to subscribers through a broker such as MQTT or directly over UDP, instead of client-server sessions. It suits sending plant data to the cloud and fast machine-to-machine exchange.

Related: OPC UA, Publish-subscribe, MQTT

Open protocol Protocols

A communication protocol whose specification is public and can be implemented by anyone, often without fees. Open protocols such as MQTT, Modbus and BACnet reduce lock-in and let devices from different makers work together.

Related: Interoperability, MQTT, Modbus TCP

Open source Data and analytics

Software whose source code is published under a licence that lets others use, study, change and share it. Much IoT infrastructure, from brokers to databases and device libraries, is open source, and its licence terms still have to be followed.

Related: Firmware, Middleware, Interoperability

Open window detection Buildings

Recognising an open window, from a contact sensor or a sudden temperature drop, so heating or cooling in that room pauses. It saves energy and shows up repeated causes of discomfort.

Related: BMS, HVAC

Open-collector output Devices and sensors

An output that switches a connection to ground through a transistor but supplies no voltage of its own, so the receiving side needs a pull-up. Many meters use open-collector pulse outputs.

Related: Pulse counter, Digital input, Dry contact

Open-loop control Automation and control

Control that sets an output without measuring the result, such as running a pump for a fixed time. It is simple but cannot correct for disturbances, unlike closed-loop control with feedback.

Related: Control loop, PID controller, On/off control

OpenID Connect (OIDC) Security

An identity layer on top of OAuth 2.0 that lets applications sign users in through an identity provider and learn who they are. It is a common basis for single sign-on to IoT platforms.

> **In Hermetry** Each Hermetry organisation can connect its own SAML 2.0 or OpenID Connect identity provider.
> hermetry.com/docs/security/single-sign-on/

Related: OAuth 2.0, SSO

Operating hours counter Operations

A running total of the hours a machine has been on, counted from a run signal or a current threshold. Service intervals for pumps, compressors and engines are often based on it rather than on calendar time.

Related: Work order, Preventive maintenance, Totalizer

Optimum start Buildings

A building control that works out how early to start heating or cooling so rooms reach their setpoint just as people arrive, using indoor and outdoor temperatures. It saves energy compared with fixed early start times.

Related: Night setback, BMS, Setpoint

Optocoupler (opto-isolator) Devices and sensors

A component that passes a signal through light between two electrically separate circuits. Inputs on industrial controllers use optocouplers so faults and noise on field wiring do not reach the electronics.

Related: Digital input, Galvanic isolation, Surge protection

Orchestration (containers) Data and analytics

Automatically deploying, scaling and restarting software containers across servers. Platforms and edge gateways use orchestration so services recover from failures and can be updated without manual steps.

Related: Microservices, High availability, Edge computing

Orifice plate Devices and sensors

A plate with a hole placed in a pipe; the pressure difference across it, measured by a transmitter, gives the flow rate. It is simple and robust and still common in oil, gas and steam measurement.

Related: Differential pressure, Flow meter, Pressure transmitter

ORP (oxidation-reduction potential) Water

A measurement in millivolts of a water's tendency to oxidise or reduce substances. It is used to monitor disinfection in pools and drinking water and treatment stages in wastewater.

Related: pH sensor, Water quality monitoring, Chlorine residual

OSI model Connectivity

A seven-layer reference model of network communication, from the physical layer (cables, radio) up to the application layer. It helps place protocols, for example LoRa at the physical layer and MQTT at the application layer.

Related: TCP, UDP, MQTT

OT (operational technology) Operations

The hardware and software that monitor and control physical processes: controllers, SCADA, drives and safety systems. OT puts availability and safety first, which shapes how it is secured.

Related: IIoT, IEC 62443, SCADA

OT security Security

Protecting operational technology such as controllers, SCADA and safety systems from cyber attack, where availability and safety come before confidentiality. It relies on segmentation, controlled remote access, inventory and standards such as IEC 62443.

Related: OT, IEC 62443, Purdue model

OTA (over-the-air update) Operations

Updating a device's firmware or settings remotely over its network connection. Safe OTA checks the image's signature and can roll back if the new version fails to start.

> **In Hermetry** Hermetry sends signed firmware packages to devices, follows each device's update state and can roll updates out in waves.
> hermetry.com/docs/devices/firmware-updates-ota/

Related: Firmware, Firmware signing, FUOTA

OTAA (over-the-air activation) Connectivity

The usual way a LoRaWAN device joins a network: it sends a join request and receives fresh session keys. Keys change with every join, which is safer than ABP.

> **In Hermetry** Hermetry supports OTAA devices and shows where a failing join stops.
> hermetry.com/docs/lorawan/add-an-otaa-device/

Related: ABP, Join procedure, Session keys

OTP (one-time password) Security

A code valid for a single sign-in or a short time, generated by an app or a security token or sent by message. It is a common second factor in multi-factor authentication.

Related: MFA, SSO, JWT

Out-of-band management Operations

A separate path for managing devices, such as a cellular modem or console line, that works even when the main network is down. It lets a team reach a stuck router or gateway without travelling to site.

Related: Remote access, Cellular IoT, Watchdog

Outdoor reset (weather compensation) Buildings

Adjusting the heating water temperature to the outdoor temperature: warmer water on cold days, cooler water in mild weather. It keeps rooms comfortable and lets boilers and heat pumps run more efficiently.

Related: Setpoint, HVAC, BMS

Outlier Data and analytics

A reading far from the others, caused by a real event, a sensor fault or a transmission error. Detecting outliers before averaging or alarming keeps single bad values from distorting reports.

Related: Anomaly detection, Data quality, Quality code

Overcurrent protection Energy

Devices such as fuses, circuit breakers and protection relays that disconnect a circuit when current exceeds safe limits. Monitoring their trips and states shows faults and overloads on feeders and motors.

Related: Relay, CT, Medium voltage

Overflow monitoring Water

Measuring when and how much a tank, sewer or storm overflow discharges, using level sensors and alarms. Utilities report overflow events to regulators and use the data to plan network upgrades.

Related: Level sensor, Sewer overflow monitoring, Alarm

P

P&ID (piping and instrumentation diagram)

Automation and control

A detailed drawing of a process plant: pipes, vessels, pumps, valves, instruments and control loops, each with its tag. SCADA process screens are often drawn after it.

Related: Tag, HMI, SCADA

PAC (programmable automation controller)

Automation and control

A controller that combines the robustness of a PLC with the processing, networking and multi-language programming of a PC. It suits applications that mix control, data handling and communications.

Related: PLC, RTU, IEC 61131-3

Packet collision

Connectivity

Two devices transmitting on the same channel at the same time so that neither message is received. On simple radio networks the chance of collisions grows with the number of devices and how long each message is on air.

Related: Time on air, Duty cycle, Radio channel

Packet forwarder

Connectivity

The software on a LoRaWAN gateway that passes received frames to the network server. The older UDP packet forwarder has no encryption or authentication of its own; newer gateway software uses secure connections.

Related: Basics Station, LoRaWAN gateway

Packet loss

Connectivity

Packets that never reach their destination because of interference, collisions, congestion or weak signal. Telemetry protocols handle it with retries, acknowledgements or by accepting occasional gaps.

Related: Confirmed uplink, MQTT QoS, PER

Paging (cellular)

Connectivity

The way a cellular network tells an idle device that data is waiting for it. Longer paging intervals save battery but delay commands sent to the device.

Related: PSM, eDRX, Downlink

Pairing (Bluetooth)

Connectivity

The process in which two Bluetooth devices exchange keys so they can recognise each other and communicate securely later. Installers often pair a sensor with a phone app to configure it.

Related: BLE, Provisioning, Session keys

Pallet tracking

Logistics

Following pallets and returnable containers through warehouses, trucks and customers with tags, barcodes or low-power trackers. It cuts losses of returnable assets and shows dwell times at each site.

Related: Asset tracking, Geofence, Beacon

Parity (serial)

Protocols

An extra bit in each serial character that lets the receiver detect single-bit errors: even, odd or none. Every device on a Modbus RTU line must use the same parity, or messages fail.

Related: Baud rate, RS-485, UART

Parking sensor

Smart city

A sensor in or above a parking bay that detects whether a vehicle is there, usually by magnetic field change, radar or both. Bay-level data feeds guidance signs, apps and enforcement.

Related: Magnetometer, Smart parking, LPWAN

Partial discharge monitoring

Energy

Detecting small electrical sparks inside the insulation of cables, transformers and switchgear, which signal ageing before a full breakdown. Sensors pick up the high-frequency, acoustic or ultrasonic signals these discharges make.

Related: Condition monitoring, Medium voltage, Transformer monitoring

Particle counter (cleanroom)

Manufacturing

An instrument that counts airborne particles by size, used to show that a cleanroom stays within its ISO 14644 class. Continuous counters in pharma and electronics plants raise alarms when counts climb.

Related: PM2.5 and PM10, Cleanroom monitoring, Differential pressure

Passenger information display

Smart city

A screen or sign at a stop or station showing departures, delays and messages, fed with real-time vehicle data. Monitoring its power, connection and content catches dark or frozen displays.

Related: Public transport priority, Heartbeat

Pasteurisation monitoring

Manufacturing

Recording temperature and holding time in a pasteuriser to prove each batch reached the required heat treatment, such as 72 °C for 15 seconds in high-temperature short-time milk pasteurisation. Diversion valves and records are checked for food safety.

Related: Data logger, Interlock

Patch management

Security

Finding, testing and installing software and firmware updates that fix flaws, and keeping track of which devices still lack them. In OT, patches are often staged and timed around production to avoid disruption.

Related: OTA, Firmware, Vulnerability management

Path loss Connectivity

The reduction of radio signal strength between transmitter and receiver, from distance, obstacles and absorption. It is the largest term in a link budget and grows with frequency, which is one reason sub-GHz radios reach further.

Related: Link budget, FSPL

Payload Data and analytics

The actual data inside a message, without the protocol's headers. LoRaWAN payloads are usually a few bytes of packed binary; IP devices often send JSON.

Related: Codec, JSON, Uplink

Payload encryption Security

Encrypting the content of a message end to end, separately from the transport link. In LoRaWAN the application payload is encrypted with its own key, so the network operator can route it but not read it.

Related: AES-128, Session keys, TLS

Peak demand Energy

The highest power drawn by a site or network over a period, often measured as the highest 15-minute average. It sizes connections and transformers and often drives part of the electricity bill.

Related: Maximum demand, Demand charge, Load factor

Peak shaving Energy

Lowering the highest power peaks of a site, by shifting or stopping loads or by using batteries or generators at peak times. It cuts demand charges.

Related: Demand charge, Load profile

Penetration test Security

An authorised, simulated attack on a system to find weaknesses before real attackers do. For IoT it covers devices, radio links, APIs, apps and the cloud platform, and its findings feed fixes and retests.

Related: Vulnerability management, IEC 62443, Threat model

People counting Buildings

Counting people entering, leaving or present in a space, with sensors such as thermal arrays, time-of-flight, radar or cameras. Buildings use the counts for cleaning, ventilation, space planning and occupancy limits.

Related: Occupancy sensor, PIR sensor, Demand-controlled ventilation

PER (packet error rate) Connectivity

The share of packets received with errors or lost, out of all sent. It is a direct measure of link quality and rises quickly as a radio link nears the edge of its range.

Related: Packet loss, SNR, Link budget

Performance (OEE) Manufacturing

The OEE factor that compares actual output with the output possible at the ideal cycle time during run time. Slow cycles and short stops that are not recorded as downtime lower it.

Related: OEE, Availability, Takt time

Performance ratio (PV) Energy

The ratio of a solar plant's actual energy output to what it would produce at its rated power under the measured sunlight. Typical values are about 0.75 to 0.9; a falling ratio points to soiling, faults or shading.

Related: PV (photovoltaic) system

Perishable goods monitoring Logistics

Recording temperature, and sometimes humidity and door openings, for food, flowers or medicines from producer to shelf. Alerts during transport give time to act before goods spoil, and the record supports claims and audits.

Related: Cold chain, Temperature excursion, MKT

Pest trap monitoring Agriculture

Remote traps with cameras or counters that report insect or rodent catches, so growers and food sites see pressure building without checking every trap by hand. Counts over a threshold trigger treatment or inspection.

Related: Precision agriculture, Threshold, LPWAN

pH sensor Water

A sensor that measures how acidic or alkaline water is on the 0–14 pH scale, usually with a glass electrode. It drifts and needs regular calibration with buffer solutions, which monitoring should remind people to do.

Related: ORP, Water quality monitoring, Calibration

Phase imbalance Energy

Unequal voltages or currents on the three phases of a supply. It overheats motors and transformers and wastes energy, so three-phase meters report the imbalance as a percentage.

Related: Energy meter, Power quality

Phase unbalance Energy

Unequal voltages or currents on the three phases of a supply. Even a few percent of voltage unbalance makes three-phase motors run hotter, so it is a standard reading in power quality monitoring.

Related: Power quality, Energy meter, VFD

Photoelectric sensor Devices and sensors

A sensor that detects objects by a light beam being interrupted or reflected. It counts products on conveyors, checks presence at stations and is a common input for production counters.

Related: Proximity sensor, Digital input, Pulse counter

Pick-to-light Logistics

A picking system in which lights on shelf locations show workers which item to take and how many, confirmed by a button press. It speeds up order picking and assembly kitting and reduces errors.

Related: Poka-yoke, MES, Digital input

PICV (pressure-independent control valve) Buildings

A valve that holds the flow to a heating or cooling coil steady whatever the pressure in the pipework, and also controls it. It makes hydronic systems easier to balance and saves pump energy.

Related: VAV, HVAC, AHU

PID controller Automation and control

A control loop that adjusts an output, such as a valve or a pump speed, to keep a measured value at its setpoint, using proportional, integral and derivative terms. It runs in the local controller.

Related: Setpoint, PLC, VFD

PID tuning Automation and control

Choosing the proportional, integral and derivative settings of a PID controller so the process settles quickly without overshoot or oscillation. Poor tuning shows up in trends as hunting valves and wasted energy.

Related: PID controller, Process variable, Setpoint

Piezoelectric sensor Devices and sensors

A sensor using materials that produce a voltage when squeezed or strained. Piezoelectric accelerometers are standard for machine vibration because they handle high frequencies, and piezo elements can also harvest small amounts of energy.

Related: Vibration monitoring, Accelerometer, Energy harvesting

Piezometer Water

An instrument that measures groundwater pressure or water level in a borehole or soil. Dams, mines and embankments use networks of piezometers to watch pore pressure for stability.

Related: Pressure transmitter, Level sensor, Data logger

Pipe freeze protection Buildings

Preventing pipes and coils from freezing, with temperature sensors, trace heating, frost thermostats or pump runs. Remote alerts on low temperatures in unheated spaces avoid burst pipes and water damage.

Related: Threshold, Plant room monitoring, Leak detection

Pipeline leak detection Energy

Finding leaks in oil, gas or water pipelines from pressure, flow balance, acoustic or fibre-optic measurements. Comparing inflow and outflow, or watching for sudden pressure drops, can locate a leak within minutes.

Related: Leak detection, Pressure transmitter, Flow meter

PIR sensor (passive infrared) Devices and sensors

A sensor that detects changes in infrared radiation caused by warm bodies moving across its field of view. It draws very little power, so it is the usual presence and motion sensor in battery devices.

Related: Motion sensor, Occupancy sensor, Battery life

PKI (public key infrastructure) Security

The certificates, authorities and rules that let devices and servers prove who they are with key pairs. A device PKI issues, renews and revokes device certificates.

Related: X.509 certificate, mTLS, Firmware signing

Planned downtime Manufacturing

Time a machine is deliberately stopped for maintenance, changeovers or breaks. OEE separates it from unplanned stops; recording stop reasons shows where production time really goes.

Related: OEE, Availability, Preventive maintenance

Plant room monitoring Buildings

Watching the equipment rooms of a building, such as boilers, chillers, pumps, tanks and water heaters, for temperatures, pressures, leaks and faults. It catches problems in rooms people rarely visit.

Related: BMS, Leak detection, Chiller

PLC (programmable logic controller) Automation and control

A rugged industrial computer that reads inputs, runs a control program in a fixed cycle and drives outputs. PLCs run machines and processes; SCADA and IoT systems watch and steer them.

Related: IEC 61131-3, SCADA, Interlock

PLC scan cycle Automation and control

The repeating loop in which a PLC reads its inputs, runs its program and writes its outputs, typically every few to a few hundred milliseconds. Signals shorter than the scan time can be missed unless captured by fast inputs.

Related: PLC, IEC 61131-3, Digital input

Plug and play Devices and sensors

Devices that are recognised and configured automatically when connected, without manual setup. In IoT it usually means a device that, once powered, claims its identity and fetches its settings from the platform.

Related: Zero-touch provisioning, Provisioning, Device profile

PM2.5 and PM10 (particulate matter) Smart city

Airborne particles smaller than 2.5 or 10 micrometres, harmful when breathed in. Indoor and outdoor air-quality sensors report them in micrograms per cubic metre, usually with optical sensors that need humidity correction.

Related: NO_2 (nitrogen dioxide) monitoring, Air quality sensor, IAQ

PoE (Power over Ethernet) Devices and sensors

Sending power and data over the same Ethernet cable, so cameras, access points and sensors need no separate power supply. The switch or an injector supplies the power, and one cable to a ceiling or a pole replaces two.

Related: Wi-Fi, Gateway

Poka-yoke (error-proofing) Manufacturing

A lean manufacturing method that makes mistakes impossible or immediately visible, such as a fixture that only fits one way or a sensor that stops the line when a part is missing. Sensor signals from such checks also give quality data.

Related: Interlock, Machine vision, MES

Polarisation (antenna) Connectivity

The orientation of a radio wave's electric field, such as vertical or horizontal. Antennas at both ends should share the same polarisation; a mismatch can cost much of the signal.

Related: Antenna, Link budget, Path loss

Polling Data and analytics

Asking devices for their values at fixed intervals, as a Modbus master or an SNMP manager does. It is simple and predictable but sends traffic even when nothing has changed.

> **In Hermetry** Hermetry can poll devices that cannot connect themselves, such as SNMP agents, through protocol endpoints. hermetry.com/docs/edge/protocol-endpoints/

Related: Report by exception, Modbus RTU, SNMP

Poultry house climate monitoring Agriculture

Measuring temperature, humidity, ammonia, carbon dioxide and ventilation in poultry houses, where young birds are very sensitive to climate. Alarms on ventilation or heating failure must reach someone within minutes.

Related: Precision livestock farming, Alarm, HVAC

Power budget Devices and sensors

An estimate of a device's energy use, adding sleep current, sensor readings, radio transmissions and other activity over a day. It shows which part of the design drains the battery and how long the battery will last.

Related: Battery life, Sleep mode, Duty cycle

Power factor Energy

The ratio of real power to apparent power in an AC circuit, between 0 and 1. A low power factor means more current for the same work, and utilities often charge for it.

> **In Hermetry** The energy meter use case shows power factor alarms on site meters in Hermetry. hermetry.com/use-cases/energy-meter-reading-across-sites/

Related: Energy meter, THD, CT

Power line communication (PLC) Connectivity

Sending data over existing electricity cables instead of separate wiring or radio. Smart meters and street lighting controllers often use it, though noise on the grid can limit reliability.

Related: Smart meter, Smart lighting

Power quality Energy

How closely a supply's voltage and current match their ideal form: steady voltage, correct frequency, low harmonics and few dips or interruptions. Poor power quality trips machines, damages electronics and wastes energy.

Related: THD, Phase imbalance, Voltage sag

Precision agriculture Agriculture

Managing fields zone by zone instead of uniformly, using data on soil, weather, crop health and machinery positions. Sensors, GNSS-guided machines and satellite images let farmers vary water, seed and fertiliser where they are needed.

Related: Soil moisture sensor, GNSS, Irrigation controller

Precision livestock farming Agriculture

Using sensors on animals and in barns, such as collars, scales, feeders and climate sensors, to monitor health, feeding and welfare individually. Early signs of illness or heat stress can be seen in the data before they are visible by eye.

Related: Precision agriculture, Geofence, Poultry house climate monitoring

Predictive maintenance Operations

Servicing equipment when data shows it is wearing, rather than on a fixed schedule or after it breaks. Vibration, temperature and current trends are the usual signs.

Related: Condition monitoring, Preventive maintenance, Anomaly detection

Prepaid metering Energy

Metering in which customers pay for electricity, gas or water in advance and the meter supplies until the credit runs out. Smart prepaid meters receive top-ups and tariffs remotely and warn when credit is low.

Related: Smart meter, MDM, Downlink

Pressure management Water

Lowering and steadying pressure in a water network, mostly at night, with pressure-reducing valves controlled by time or flow. It cuts leakage and pipe bursts and is a main tool against non-revenue water.

Related: NRW, Night flow

Pressure transmitter Devices and sensors

A sensor that measures pressure and sends it as a standard signal such as 4–20 mA, 0–10 V or a digital protocol. It is one of the most common instruments in water, oil, gas and process plants.

Related: Current loop, Differential pressure, Scaling

Pressure zone Water

A part of a water network supplied at one pressure level, separated from others by valves, pumps or reservoirs at different heights. Zones keep pressure within limits across hilly terrain.

Related: DMA, Pumping station

Preventive maintenance Operations

Servicing equipment on a schedule, by time, by run hours or by cycles, to prevent failures. Counting real run hours instead of calendar time avoids servicing machines that hardly ran.

Related: Predictive maintenance, Work order, MTBF

Primary cell (non-rechargeable battery)

Devices and sensors

A battery made to be used once, such as lithium thionyl chloride cells common in meters and sensors. They store a lot of energy and self-discharge slowly, but handle high pulse currents poorly without a buffer capacitor.

Related: Battery life, Nominal capacity

Privacy by design

Security

Building data protection into a system from the start: collecting only what is needed, keeping it no longer than necessary and limiting who can see it. Data protection laws such as the GDPR expect it, including for sensors that can reveal people's behaviour.

Related: Pseudonymisation, Data retention, RBAC

Private key

Security

The secret half of a public-key pair, used to sign data or decrypt it. A device's private key should be generated on the device or in a secure element and never leave it.

Related: Public-key cryptography, X.509 certificate, Secure element

Private network (private LTE/5G)

Connectivity

A cellular network built for one organisation's site, such as a port, mine or factory, with its own coverage and capacity. It gives devices reliable connectivity and keeps traffic on site.

Related: NR, Network slicing, Cellular IoT

Process control

Automation and control

Keeping a physical process such as temperature, flow, level or pressure at the desired value by measuring it and adjusting valves, pumps or heaters. It ranges from simple on/off loops to multi-variable optimisation.

Related: PID controller, Setpoint, Process variable

Process variable (PV)

Automation and control

The measured value a control loop is trying to keep at its setpoint, such as a tank level or a room temperature. Trends of PV, setpoint and controller output together show how well the loop works.

Related: Setpoint, PID controller, Process control

PROFIBUS

Protocols

A long-established fieldbus for factory and process automation, standardised in IEC 61158. PROFIBUS DP connects controllers to remote I/O and drives, and PROFIBUS PA reaches field instruments in hazardous areas.

Related: Fieldbus, PROFINET, RS-485

PROFINET

Protocols

An industrial Ethernet standard for real-time communication between controllers and field devices in automation. It carries cyclic I/O data with tight timing as well as diagnostics and parameters over standard Ethernet cabling.

Related: EtherNet/IP, Fieldbus, PLC

Proof of delivery (ePOD)

Logistics

A record that goods reached the right place, such as a signature, photo, scan or GNSS position at hand-over. Linked with temperature or shock data, it shows not only that something arrived but in what condition.

Related: Asset tracking, Cold chain, GNSS

Protocol Buffers

Protocols

A compact binary format for structured data, defined by a schema that both sides share. It produces much smaller messages than JSON, which saves bandwidth and power for devices that send often.

Related: JSON, CBOR, Payload

Protocol converter

Devices and sensors

A device or software that translates between protocols, for example from Modbus RTU on a serial line to MQTT over the network. It is often the quickest way to connect brownfield equipment that speaks an older protocol.

Related: Edge gateway, Gateway, Modbus RTU

Provisioning

Operations

Getting a device ready to work on a platform: creating its identity, giving it credentials and settings, and assigning it to an owner. At scale it is done in batches or by the device claiming itself.

> **In Hermetry** Hermetry adds devices by hand, lets them register themselves with their profile's provisioning key, or claims a device by its serial and claim code. hermetry.com/docs/devices/adding-and-claiming-devices/

Related: Fleet management, X.509 certificate, NFC

Proximity sensor

Devices and sensors

A sensor that detects an object nearby without touching it, by inductive, capacitive, magnetic or optical means. Inductive proximity sensors on machines detect metal parts, end positions and shaft rotations.

Related: Photoelectric sensor, Digital input, Pulse counter

Pseudonymisation

Security

Replacing names and direct identifiers with codes, so data can be analysed without showing who it belongs to. The key linking codes to people is kept separately; pseudonymised data is still personal data under laws such as the GDPR.

Related: Privacy by design, Data retention, RBAC

PSK (pre-shared key)

Security

A secret placed on both ends of a connection in advance and used to authenticate or encrypt it, as in TLS-PSK or Wi-Fi home security. It is simpler than certificates but harder to rotate and to keep unique per device.

Related: TLS, X.509 certificate, Session keys

PSM (power saving mode)

Connectivity

A cellular sleep mode in which an LTE-M or NB-IoT device stays registered to the network but switches its radio off for long periods, which gives years of battery life. While asleep the device cannot be reached; downlinks wait until it next wakes up to send.

Related: LTE-M, NB-IoT

Pt100 (platinum resistance thermometer)

Devices and sensors

A resistance temperature detector made of platinum with 100 ohms at 0 °C, whose resistance rises steadily with temperature. It is accurate and stable, so it is the standard industrial temperature sensor; three- or four-wire connections cancel cable resistance.

Related: NTC thermistor, Analog input

PTP (Precision Time Protocol)

Protocols

A network time protocol, standardised as IEEE 1588, that synchronises clocks to within microseconds or better. Substations, motion control and measurement systems use it where NTP's millisecond accuracy is not enough.

Related: NTP, Timestamp, IEC 61850

Public cloud

Data and analytics

Computing and storage rented from a provider and shared, logically separated, among many customers. IoT platforms run there for scale and easy access, while on-premises or private cloud set-ups suit strict data or network rules.

Related: On-premises, Data residency, Multi-tenancy

Public transport priority

Smart city

Giving buses and trams green lights or shorter waits at junctions, triggered by vehicle position or a request message to the signal controller. It makes services more punctual without new lanes.

Related: Traffic signal controller, GNSS, Passenger information display

Public-key cryptography

Security

Cryptography that uses a key pair: a public key anyone may know and a private key kept secret. It underpins certificates, TLS and firmware signing, letting devices prove identity without sharing secrets.

Related: Private key, PKI, X.509 certificate

Publish-subscribe

Protocols

A messaging pattern in which senders publish to topics and receivers subscribe to the topics they want, without knowing each other. A broker in the middle delivers the messages.

Related: MQTT, Message broker, MQTT topic

PUE (power usage effectiveness)

Buildings

A data-centre efficiency figure: total facility energy divided by the energy used by IT equipment. A PUE of 1.5 means half as much energy again goes on cooling, power conversion and lighting.

Related: Energy monitoring, Sub-metering, Chiller

Pulse counter

Devices and sensors

An input that counts pulses from a meter, where each pulse stands for a fixed amount, such as 10 litres or 1 Wh. The count times the pulse value gives the total.

Related: Digital input, Flow meter, Totalizer

Pump curve

Water

A graph of a pump's flow against the head it delivers, usually with efficiency and power. Comparing live flow, pressure and power with the curve shows wear, blockage or a pump running far from its best point.

Related: Pumping station, VFD, Flow meter

Pumping station

Water

A facility with pumps that lift or move water or wastewater, with controls, level sensors and often backup power. Remote monitoring of levels, pump runs, faults and energy is one of the most common water-utility IoT uses.

> **In Hermetry** The pumping station use case reads reservoir level, pump states, pressures, flow and energy into Hermetry through a gateway in each station panel.
> hermetry.com/use-cases/pumping-station-remote-monitoring/

Related: Pump curve, Level sensor, SCADA

Pumpjack (sucker rod pump)

Energy

The beam pumping unit on top of many oil wells that drives a rod pump downhole. Monitoring strokes, motor load and dynamometer cards shows pump wear, gas lock or a failed rod without sending crews to each well.

Related: Condition monitoring, VFD, RTU

Purdue model

Security

A reference architecture that arranges industrial systems in levels, from field devices and controllers up to site operations and business systems, with zones between them. It is widely used to plan network segmentation and where data may cross between OT and IT.

Related: Network segmentation, ISA-95, OT security

Push notification

Operations

A message sent to a phone or browser by an app's server, shown even when the app is not open. Alarm systems use push for fast alerts that a user can open straight into the right screen.

> **In Hermetry** Hermetry's push channel shows a notification on a member's registered browsers and app installs even when Hermetry is not open.
> hermetry.com/docs/notifications/browser-push/

Related: Notification, Alarm, Escalation

PV (photovoltaic) system

Energy

A system of solar panels that converts sunlight into electricity, with inverters and often batteries. Monitoring tracks output, inverter faults and string currents so lost production is found quickly.

Related: Performance ratio, MPPT

PWM (pulse-width modulation)

Devices and sensors

Switching an output on and off quickly and varying the share of on-time to control average power. It dims LEDs, sets fan and motor speeds and drives valves from simple digital outputs.

Related: Digital output, VFD, MCU

Q

QoS (quality of service, networks) Connectivity

Rules that give some network traffic priority over the rest, for example by marking packets so routers forward control traffic before bulk uploads. On shared links it keeps commands and alarms responsive when cameras or file transfers fill the line. MQTT has its own, separate delivery QoS levels.

Related: MQTT QoS, Latency, VLAN

QR code onboarding Operations

Adding a device to a platform or network by scanning a code printed on it, which carries its identifier and often a claim or join secret. It removes typing errors and lets an installer register a device in seconds on site.

> **In Hermetry** To claim a supported device, you can scan the QR code on its own Cloud page with a phone, or type its serial and claim code.
> hermetry.com/docs/devices/adding-and-claiming-devices/

Related: Provisioning, Zero-touch provisioning

Quadrature encoder Devices and sensors

A rotary or linear encoder with two output channels a quarter of a cycle apart, so a counter can tell both how far a shaft has turned and in which direction. It is common on motors, conveyors and valve positioners.

Related: Pulse counter, Digital input, VFD

Quality code (data quality) Data and analytics

A flag next to a value that says whether it can be trusted: good, uncertain or bad, for example because the sensor failed or the value is stale. Industrial protocols such as OPC UA carry one with every value.

Related: OPC UA, Tag, Stale data

Quantisation Devices and sensors

Turning a continuous value into one of a fixed number of steps, as an analogue-to-digital converter does. A 12-bit converter over 0–10 V has 4,096 steps of about 2.4 mV, so smaller changes are invisible. Quantisation also describes shrinking machine learning models to small integers so they fit on microcontrollers.

Related: ADC, Resolution, TinyML

Quarantine (device) Security

Isolating a device that is suspected of being compromised or misbehaving, so it can no longer send data or receive commands until someone checks it. Quarantine is gentler than deleting the device, because its history and identity are kept for investigation.

> **In Hermetry** Devices that register themselves in Hermetry can be held in quarantine until they are approved.
> hermetry.com/docs/security/device-identity-and-claiming/

Related: Zero trust, Anomaly detection, Audit log

Quarter-wave antenna Connectivity

A monopole antenna about a quarter of a wavelength long, the most common simple antenna on IoT devices. At 868 MHz that is roughly 8.6 cm. It needs a ground plane under it to work as intended, so the same whip performs differently on a metal cabinet and on a plastic box.

Related: Antenna gain, Link budget, ISM band

Queue Data and analytics

A list of messages waiting to be processed or delivered, in order. Queues let systems absorb bursts and keep commands for devices that are asleep or offline.

Related: Message broker, Store and forward, Downlink

Quiescent current Devices and sensors

The current a circuit draws while doing nothing, for example a voltage regulator with no load. On a battery device that sleeps most of the time, a few microamps of quiescent current can matter more than the current used while sending.

Related: Sleep mode, Battery life, Voltage regulator

Quorum Data and analytics

The minimum number of members of a cluster that must agree before it acts, usually more than half. Quorum stops two halves of a split cluster from both believing they are in charge and writing conflicting data.

Related: Split brain, High availability, Redundancy

R

Radar level sensor
Devices and sensors

A sensor that measures the level of a liquid or bulk solid by timing a microwave signal reflected from the surface. It does not touch the medium and is barely affected by vapour, dust or temperature, which makes it common on tanks, silos and open channels.

Related: Ultrasonic level sensor, Tank level monitoring, Current loop

Radio channel
Connectivity

A slice of a frequency band that one transmission uses. Devices spread their messages over several channels so that one busy or noisy channel does not block them.

Related: Frequency plan, Bandwidth, Packet collision

Rain gauge
Agriculture

An instrument that measures rainfall. The common tipping-bucket type sends a pulse each time a small bucket fills, often for every 0.2 mm of rain, so a pulse counter can record both totals and intensity.

Related: Pulse counter, Weather station, Smart irrigation

Ramp rate
Automation and control

How fast a value is allowed to change, such as a heating set point rising 2 °C per minute or a generator increasing output in kW per second. Ramp limits protect equipment and processes from sudden changes.

Related: Setpoint, PID controller, Rate-of-change alarm

Rate limiting
Data and analytics

Capping how many requests or messages a client may send in a period, and rejecting or delaying the rest. It protects a service from overload and from a single faulty or hostile client, and devices should be written to back off when they hit a limit.

> **In Hermetry** Hermetry's REST API answers 429 when a rate limit is reached, and the docs list each limit and how to retry safely.
> hermetry.com/docs/api/errors-and-rate-limits/

Related: Retry policy, API, Message broker

Rate-of-change alarm
Automation and control

An alarm that fires when a value rises or falls faster than expected, rather than when it crosses a fixed limit. A tank level dropping 10 cm a minute may still be well within range but already signals a burst or an open valve.

Related: Alarm, Threshold, Ramp rate

RBAC (role-based access control)
Security

Giving rights by role rather than person by person: an operator may acknowledge alarms, an engineer may change rules, an admin may add users. It keeps rights consistent as people join, move and leave, because only the role assignment changes.

> **In Hermetry** A Hermetry member's rights come from their role, their groups and access policies, with ready IoT operator and IoT viewer templates.
> hermetry.com/docs/administration/groups-and-permissions/

Related: Multi-tenancy, SSO, Audit log

RCD (residual current device)
Energy

A safety switch that cuts power when the current going out on the live conductor differs from the current coming back, a sign that it is leaking to earth, possibly through a person. Devices for personal protection usually trip at 30 mA. Monitoring can report trips at remote sites.

Related: Surge protection, Energy monitoring, Dry contact

RCM (reliability-centred maintenance)
Operations

A structured method for deciding how each asset should be maintained, based on how it can fail and what the failure would cost. It chooses between condition-based, time-based and run-to-failure approaches item by item, instead of servicing everything on the same schedule.

Related: Predictive maintenance, Preventive maintenance, FMEA

Reactive power
Energy

Power that moves back and forth between the supply and inductive or capacitive loads, such as motors, without doing useful work, measured in kvar. It loads cables and transformers, and many utilities charge for it, which is why sites correct their power factor.

Related: Power factor, kWh, Energy meter

Real time
Data and analytics

In monitoring, data that arrives within seconds; in control, a guaranteed response within a fixed deadline. The two meanings differ by several orders of magnitude.

Related: Latency, Jitter

Receiver sensitivity
Connectivity

The weakest signal a receiver can still decode reliably, in dBm. The lower the number the better: LoRa at its slowest settings can decode signals near −137 dBm, which is why it reaches so far. Sensitivity is one side of every link budget.

Related: Link budget, Spreading factor, RSSI

Recipe (batch control)
Manufacturing

A set of parameters and steps for making a product, such as temperatures, times and quantities, that a control system loads before a batch starts. ISA-88 describes how recipes are structured. Recording which recipe each batch used is part of traceability.

Related: Traceability, Setpoint, MES

Recloser Energy

A circuit breaker on overhead power lines that opens on a fault and then closes again automatically a few times, because most faults, such as a branch touching a line, clear on their own. Remote monitoring shows its state, counts operations and reports lockouts.

Related: Substation, SCADA

RedCap (5G reduced capability) Connectivity

A lighter class of 5G devices with less bandwidth, fewer antennas and lower power than full 5G, for wearables, industrial sensors and gateways that need more than LTE-M. It suits devices that need moderate data rates and the low latency of 5G networks, without the cost and power of a smartphone modem.

Related: Cellular IoT, LTE-M, LTE Cat 1

Redundancy Operations

Having a second unit, link or path ready to take over when the first fails, such as two network links on a gateway or two power supplies. It raises availability, but only if the switch-over itself is tested and the second unit does not share the first one's weak point.

Related: High availability, Fail-safe

Reefer container Logistics

A refrigerated shipping container with its own cooling unit. Remote reefer monitoring reports set point, supply and return air temperature, door state and alarms during the journey, so a failing unit can be dealt with before the cargo spoils.

Related: Cold chain, Temperature excursion, Telematics

Refrigeration monitoring Logistics

Continuous measurement of cold rooms, freezers and display cases, usually air temperature plus door contacts, defrost state and compressor status. It catches failing equipment and doors left open early, and produces the temperature records food and pharma rules require.

Related: Cold chain, Temperature excursion, Door contact sensor

Regional parameters (LoRaWAN) Connectivity

The part of the LoRaWAN specifications that sets, for each region, the frequency plan, channels, data rates, maximum payloads, transmit power and duty-cycle rules, for example EU863-870 or US902-928. A device and its network must use the same regional settings.

Related: Frequency plan, LoRaWAN, Duty cycle

Relative humidity (RH) Buildings

How much water vapour air holds compared with the most it could hold at that temperature, in percent. Because warm air holds more, the same air shows a lower RH when heated, so humidity readings are almost always paired with temperature.

Related: Dew point, Wet-bulb temperature, VPD

Relay Automation and control

An electrically operated switch: a small control signal opens or closes a separate circuit, such as a pump contactor. Relays also give galvanic separation, so a low-voltage controller can switch mains-powered equipment safely.

Related: Digital output, Dry contact, Normally open / normally closed

Remote access Security

Reaching a device or a local network from afar, for example to open a controller's web panel or change a PLC program, without driving to the site. It saves time and travel, but it is also a way in for attackers, so it needs strong sign-in, narrow rights and a record of every session.

> **In Hermetry** Hermetry opens the web panel of a claimed router through a tunnel the router dials out to, so the router needs no fixed IP address and no open ports.
> hermetry.com/docs/edge/remote-access/

Related: VPN, Zero trust, MTTR

Remote I/O Automation and control

Input and output modules placed near the equipment they connect to and linked back to a controller or gateway by a network, instead of running every signal cable to a central panel. It cuts wiring and makes it easy to add points at distant sites.

Related: Digital input, Analog input, Fieldbus

Repeater Connectivity

A device that receives a radio signal and sends it out again to extend its reach, or that regenerates a signal on a long wired bus. In mesh networks many devices act as repeaters for each other; in star networks such as LoRaWAN, extra gateways are used instead.

Related: Mesh network, RS-485, Gateway

Report by exception Data and analytics

Sending a value only when it changes by more than a deadband, or when a status changes, instead of at fixed intervals. It saves bandwidth and battery.

Related: Deadband, Polling, Heartbeat

Resolution (measurement) Devices and sensors

The smallest change a sensor or converter can show, such as 0.1 °C. Resolution is not accuracy: a reading can change in steps of 0.01 °C and still be 0.5 °C away from the true value.

Related: Accuracy and precision, Quantisation, Measurement uncertainty

REST API Protocols

A web API built around resources at addresses, read and changed with HTTP methods such as GET, POST and DELETE, usually with JSON bodies. Most IoT platforms offer one so that other systems can read data and manage devices.

> **In Hermetry** Every Hermetry management path is scoped to your organisation and called with an API key as a bearer token.
> hermetry.com/docs/api/rest-api-basics/

Related: API, HTTP, API key

Retrofit Operations

Adding sensors, meters or connectivity to existing equipment, such as clamp-on current sensors on an old motor. It brings old equipment into monitoring without replacing it, often in hours rather than months.

Related: Brownfield, CT

Retry policy Data and analytics

The rules a device or service follows when a request fails: how many times to try again and how long to wait in between. Good policies wait longer after each failure and add some randomness, so thousands of devices do not all reconnect in the same second after an outage.

Related: Backoff, Rate limiting, Store and forward

Reverse osmosis (RO) Water

A water treatment process that pushes water through a membrane fine enough to hold back salts and most contaminants. Monitoring feed pressure, differential pressure, conductivity and flow shows membrane fouling early and tells operators when to clean.

Related: Water quality monitoring, Electrical conductivity, Differential pressure

RFID (radio-frequency identification) Devices and sensors

Identifying tags by radio, usually without a battery in the tag: the reader powers it and reads its identifier. Common bands are 13.56 MHz for short range and 860–960 MHz (UHF) for reading at a few metres. It is used for inventory, access control and tracking returnable assets.

Related: NFC, Asset tracking, Traceability

Ring topology Connectivity

A network in which devices are connected in a closed loop. Industrial Ethernet rings can recover from one broken cable within milliseconds by sending traffic the other way round, which makes them popular in plants and substations.

Related: Redundancy, Star topology, Mesh network

Risk assessment (cyber security) Security

Identifying what could go wrong in a system, how likely it is and how bad the result would be, then choosing measures in proportion. IEC 62443 describes it for industrial systems, dividing a site into zones and conduits with a target security level for each.

Related: IEC 62443, Threat model, Zero trust

Roaming Connectivity

Using another operator's network outside your own coverage. Cellular devices roam between mobile networks; LoRaWAN devices can roam when network servers exchange traffic over agreed back-end interfaces. Some countries restrict devices that roam permanently.

Related: Cellular IoT, eSIM, Network server

Rolling update Operations

Updating a fleet or a server cluster a few members at a time instead of all at once, checking each batch before moving on. If something goes wrong, only part of the fleet is affected and the update can be stopped.

Related: OTA, FUOTA

Rollup (aggregate) Data and analytics

A summary of readings over a period, such as the hourly average, minimum, maximum or total. Rollups make long charts and reports fast.

> **In Hermetry** Hermetry summarises numeric readings per minute, hour and day and reads the summary that fits a chart's time window. hermetry.com/docs/telemetry-and-data/aggregates-and-rollups/

Related: Downsampling, Data retention, Time series

Root cause analysis (RCA) Operations

Working back from a failure to the underlying reason it happened, rather than the first symptom seen. Time-stamped readings, alarm histories and sequence-of-events records from monitoring are the raw material for most root cause analyses.

Related: SOE, Alarm flood, Historian

Root of trust Security

The small, highly protected part of a device that everything else relies on for security, such as an immutable boot loader or a secure element holding the device key. If the root of trust is sound, the device can prove its identity and verify its own firmware.

Related: Secure boot, Secure element, TPM

Router Connectivity

A device that forwards traffic between networks, for example between a site's local network and a cellular or fibre connection. Industrial routers add serial ports, digital inputs, VPN and firewall functions, and often act as the site's IoT gateway as well.

Related: Gateway, VPN, WAN

RPC (remote procedure call) Protocols

Calling a function on another system as if it were local. Device platforms use RPC for commands that expect an answer, such as "read the current setting".

> **In Hermetry** In Hermetry a command, also called RPC, asks a device to do something, such as reboot or switch an output, and is followed until it ends. hermetry.com/docs/devices/sending-commands-to-devices/

Related: Command, Downlink

RPO and RTO (recovery point and recovery time objectives) Data and analytics

Two targets for recovering from a failure. The recovery point objective is how much recent data you can afford to lose, such as five minutes; the recovery time objective is how long the service may be down. Together they decide how backups and replicas are designed.

Related: High availability, Redundancy, SLA

RS-232 Protocols

An old point-to-point serial interface for short cables, still found on instruments, modems and older equipment. It links two devices only and over short distances, usually up to about 15 metres.

Related: RS-485, UART, Baud rate

RS-422 Protocols

A serial standard that sends each signal as a voltage difference on a pair of wires, for long cable runs with little noise. Unlike RS-485 it has one transmitter per pair, so it is used for point-to-point links and full-duplex connections rather than shared buses.

Related: RS-485, RS-232, Twisted pair

RS-485 Protocols

A serial interface on a two-wire twisted pair that links many devices on one bus over up to about 1,200 metres. Modbus RTU and BACnet MS/TP run on it.

> **In Hermetry** Gateways with RS-485 ports are listed in Hermetry's device catalogue.
> hermetry.com/licensed-devices/protocols/rs485/

Related: Modbus RTU, Baud rate, RS-232

RSSI (received signal strength indicator) Connectivity

How strong a received radio signal is, usually in dBm. Values nearer zero are stronger; in LoRa, signals far below the noise can still be decoded, which is why SNR matters too.

Related: SNR, Link budget

RTC (real-time clock) Devices and sensors

A small clock chip, often with its own backup battery, that keeps date and time while the rest of a device is off. Devices that log data offline need a reliable RTC so their readings carry the right timestamps when they are finally sent.

Related: Timestamp, NTP, Data logger

RTD (resistance temperature detector) Devices and sensors

A temperature sensor whose resistance rises predictably with temperature, usually made of platinum. A Pt100 reads 100 Ω at 0 °C and changes by about 0.385 Ω per °C. RTDs are more accurate and stable than thermocouples but cover a narrower range.

Related: Thermocouple, Transducer, Signal conditioning

RTSP (Real Time Streaming Protocol) Protocols

A protocol for controlling live video streams from IP cameras and recorders, with commands to start, pause and stop a stream. It usually runs on port 554 and carries the video itself over RTP. Most monitoring software that shows camera images speaks RTSP.

Related: Video analytics, TCP, UDP

RTU (remote terminal unit) Automation and control

A rugged field device at a remote site that collects data from sensors and equipment and talks to a control centre, often over telemetry protocols such as DNP3. RTUs are built for harsh, unmanned sites and usually have their own power backup and local logic.

Related: PLC, SCADA, DNP3

RUL (remaining useful life) Operations

An estimate of how long an asset can keep working before it needs repair or replacement, based on its condition data and how similar assets aged. RUL turns monitoring into a planning figure, such as a bearing likely to last another six weeks.

Related: Predictive maintenance, Condition monitoring, Time-series forecasting

Rules engine Automation and control

The part of a platform that evaluates conditions on incoming data and runs actions when they are met: raising alarms, sending notifications, writing values or calling other systems. Rules let a platform react to data at once and in the same way every time, without a person watching the screens.

> **In Hermetry** You write Hermetry rules in sentences in the Rules card on a dashboard; each rule runs as a flow behind the scenes.
> hermetry.com/docs/rules-and-alarms/the-rules-engine/

Related: Alarm, Threshold, Webhook

Run hours Operations

The total time a machine has actually been running, counted from a running signal or current reading. Many maintenance schedules are based on run hours rather than calendar time, such as an oil change every 2,000 hours.

Related: Preventive maintenance, Totalizer, Utilisation

RX window (LoRaWAN receive window) Connectivity

A short time after each uplink during which a LoRaWAN class A device listens for a reply. By default the first window opens one second after the uplink and the second window a second later. Outside these windows a sleeping class A device cannot be reached.

Related: Device class, Downlink, Uplink

S

Sampling rate
Data and analytics

How often a value is measured, such as once a second or once every 15 minutes. It should follow how fast the thing changes and what the data is used for.

Related: Telemetry, Report by exception, Downsampling

Satellite IoT
Connectivity

Connecting devices through satellites where there is no cellular or radio coverage, such as at sea, on pipelines or in remote farmland. Low-earth-orbit services suit small, infrequent messages; 3GPP has also added satellite links (non-terrestrial networks) to NB-IoT and LTE-M.

Related: NTN, LPWAN, Backhaul

SBOM (software bill of materials)
Security

A list of every software component and version inside a product, including open-source libraries. When a new vulnerability is published, an SBOM tells you at once which devices contain the affected component.

Related: Vulnerability management, Firmware

SCADA (supervisory control and data acquisition)
Automation and control

A system that collects data from field equipment across a site or many sites, shows it on process screens, raises alarms and lets operators send commands. It sits above the local controllers, which keep running the process if the SCADA connection is lost.

> **In Hermetry** Hermetry has a SCADA designer with an animated symbol library, in 2D and 3D, in the browser.
> hermetry.com/scada/

Related: HMI, Historian, PLC

Scaling (engineering units)
Devices and sensors

Converting a raw value into a real unit, such as turning a 4–20 mA signal or a register value of 0–4095 into 0–10 bar. A wrong scale gives plausible-looking but wrong numbers.

Related: Analog input, Modbus register, Current loop

Schema (data)
Data and analytics

A description of the shape data must have: which fields exist, their types, units and allowed ranges. Agreeing on a schema between devices and the platform catches malformed messages early and lets dashboards and rules rely on the data.

Related: JSON, Payload, Codec

SDK (software development kit)
Data and analytics

A set of libraries, examples and tools for building software against a platform or a chip. Device SDKs typically handle connecting, authentication and message formatting, so firmware developers can focus on the sensor logic.

Related: API, Firmware, MQTT

Secure boot
Security

A start-up check in which each piece of firmware verifies the digital signature of the next before running it, starting from code that cannot be changed. A device with secure boot refuses to run firmware that was tampered with or not signed by its maker.

Related: Firmware signing, Root of trust, OTA

Secure element
Security

A tamper-resistant chip that stores keys and performs cryptographic operations without ever exposing the keys to the main processor. It gives a device a strong, hard-to-copy identity and is common in smart meters, payment terminals and SIM cards.

Related: Root of trust, TPM, X.509 certificate

Sensor
Devices and sensors

A device that measures a physical quantity, such as temperature, pressure, level, flow or vibration, and turns it into a signal or a number. Many sensors include electronics that linearise, compensate and digitise the reading before sending it on.

Related: Analog input, Telemetry

Sensor drift
Devices and sensors

A slow change in a sensor's readings over time even though the measured quantity has not changed, caused by ageing, fouling or temperature. Drift is caught by comparing against a reference or a neighbouring sensor and corrected by recalibration.

Related: Calibration, Measurement uncertainty, Anomaly detection

Sensor fusion
Data and analytics

Combining readings from several sensors to get a better estimate than any one alone, such as an accelerometer and gyroscope giving a stable orientation, or GNSS and wheel speed giving position in a tunnel. Filters such as the Kalman filter weigh each sensor by how much it can be trusted at that moment.

Related: GNSS, Virtual sensor

Sensor hub
Devices and sensors

A low-power processor that reads several sensors continuously and only wakes the main processor when something interesting happens. It lets a device notice movement or a threshold without the power cost of running everything all the time.

Related: MCU, Sleep mode

Service discovery
Connectivity

Letting devices and applications find each other on a network without fixed addresses, for example through multicast DNS on a local network. It makes plug-in setup easier but should be limited on industrial networks for security.

Related: DNS, Zero-touch provisioning, UDP

Session keys (LoRaWAN) Connectivity

The keys a LoRaWAN device and the network use for one session: one for network integrity and one for application payload encryption. OTAA derives new ones at every join.

Related: OTAA, ABP, AES-128

Setpoint Automation and control

The target value a control loop works to hold, such as 21 °C or 3.5 bar. Changing a setpoint remotely changes how equipment runs, so it deserves rights and logging.

> **In Hermetry** A set point card on a Hermetry board sends a new set point to a device as a command.
> hermetry.com/docs/dashboards/control-cards/

Related: PID controller, Command, Device shadow

Sewer overflow monitoring Water

Measuring level and spills at points where a sewer can overflow into rivers or streets, especially in combined sewers that carry rainwater too. Regulators increasingly require spill counts and durations, which only continuous monitoring can provide.

Related: Ultrasonic level sensor, Wastewater treatment, Rain gauge

Shelf-life monitoring Logistics

Using the temperature history of perishable goods to estimate how much of their shelf life is left, instead of relying on a fixed date. A product that spent hours too warm in transit can be sold or used first.

Related: Cold chain, Temperature excursion, MKT

Shunt resistor Devices and sensors

A small, precise resistor in a current path whose voltage drop shows how much current flows. It is a simple, cheap way to measure DC current in batteries, solar systems and power supplies, but unlike a current transformer it is in contact with the circuit.

Related: CT, Energy meter, SoC

Signal conditioning Devices and sensors

Preparing a raw sensor signal for measurement: amplifying it, filtering noise, isolating it electrically and converting it to a standard form such as 4–20 mA. Thermocouples, strain gauges and RTDs all need conditioning before a converter can read them.

Related: Current loop, Thermocouple, Analog input

Signal tower (stack light) Manufacturing

The column of coloured lights on a machine that shows its state, typically green running, yellow warning and red stopped or faulted. Reading the tower's signals is one of the simplest ways to monitor older machines without touching their controllers.

Related: Digital input, OEE, Retrofit

SIL (safety integrity level) Standards

A level from 1 to 4 in IEC 61508 and IEC 61511 for how much risk reduction a safety function must provide. Safety functions are handled by certified local systems, not by monitoring software.

Related: Interlock, Fail-safe

SIM Connectivity

The module that identifies a device to a mobile network and holds its subscription. IoT SIMs come as removable cards, soldered chips or eSIMs.

Related: eSIM, APN, Cellular IoT

Single-board computer Devices and sensors

A complete small computer on one circuit board, running a full operating system such as Linux. It is often used for prototypes and as an edge gateway, where it can run protocol converters and local logic.

Related: Edge gateway, MCU, SoC

SIS (safety instrumented system) Automation and control

An independent control system whose only job is to bring a process to a safe state when it goes dangerously wrong, for example by closing a valve on high pressure. It is designed to IEC 61511 and kept separate from the normal control system and from remote monitoring.

Related: SIL, Interlock, Fail-safe

SLA (service level agreement) Operations

A written commitment from a provider about the level of service, such as 99.9 % availability per month, support response times and what happens if they are missed. Reading what counts as downtime is as important as the percentage.

Related: Uptime, Availability, RPO and RTO

SLD (single-line diagram) Energy

A simplified drawing of an electrical system in which each three-phase circuit is shown as one line, with its breakers, transformers, busbars and loads. SCADA screens for power distribution are usually built on the single-line diagram.

Related: Substation, SCADA, P&ID

Sleep mode Devices and sensors

A low-power state in which a device turns off most of its circuits and wakes on a timer or an event. Battery sensors spend nearly all their life asleep, drawing a few microamps, so the sleep current largely decides battery life.

Related: Quiescent current, PSM, Battery life

Smart building Buildings

A building whose systems, such as HVAC, lighting, access, metering and occupancy sensing, share data so they can be monitored and run together. The usual goals are lower energy use, comfort and less time spent finding faults.

Related: BMS, HVAC, Occupancy sensor

Smart grid Energy

An electricity network that uses measurement and communication throughout, from substations to meters, to balance supply and demand, find faults faster and connect distributed generation such as rooftop solar and batteries. Smart meters, automated substations and grid sensors are its typical IoT devices.

Related: Smart meter, Demand response

Smart irrigation Agriculture

Watering based on measured need rather than a fixed timetable, using soil moisture, weather data and evapotranspiration. Valves and pumps are controlled remotely, and flow meters confirm that the water actually went where it was sent.

Related: Soil moisture sensor, Evapotranspiration, Flow meter

Smart lighting Smart city

Lighting that can be dimmed, scheduled and monitored remotely, from office luminaires to street lights. Each controller reports power, burning hours and faults, so failed lamps are found without patrols and energy use drops through dimming.

Related: DALI, Energy monitoring

Smart meter Energy

A utility meter that records consumption in short intervals and sends it remotely, often with two-way communication for tariffs and remote disconnection. Utilities use smart meter data for accurate billing, load planning and finding losses in the network.

Related: Energy meter, M-Bus, Load profile

Smart parking Smart city

Detecting whether each parking bay is free, with magnetic or radar sensors in the bay or with cameras, and guiding drivers to free spaces. Occupancy data also helps cities set prices and enforcement times.

Related: Occupancy sensor, Video analytics

Smart waste management Smart city

Measuring how full bins and containers are, usually with ultrasonic or radar sensors, so collection routes visit only the ones that need emptying. It saves truck kilometres and avoids overflowing bins.

Related: Ultrasonic level sensor

Smoke detector Buildings

A sensor that detects smoke, optically by light scattering or by ionisation. Connected detectors report alarms, faults and low batteries remotely, but they complement rather than replace a certified fire alarm system.

Related: Smart building, Alarm

SMS (short message service) Connectivity

Text messages over the mobile network. In IoT, SMS is used to send alarms to people without a data connection or app, and some devices accept SMS commands or wake-up messages when their data session is down.

> **In Hermetry** Hermetry sends SMS only to phone numbers you name explicitly, with a per-number throttle, quiet hours and opt-outs.
> hermetry.com/docs/notifications/sms/

Related: Cellular IoT, Alarm, Notification

SNMP (Simple Network Management Protocol) Protocols

A protocol for reading and changing the status of network equipment, UPS units and servers. Version 3 adds authentication and encryption, which earlier versions lack.

> **In Hermetry** Hermetry polls SNMP agents, with SNMPv3 recommended and SNMPv2c available, and needs no MIB file.
> hermetry.com/docs/edge/snmp-polling/

Related: SNMP trap, Polling, UPS

SNMP trap Protocols

A message a device sends on its own to report an event, such as a UPS switching to battery, instead of waiting to be polled. Traps arrive at once, but are usually sent only once, so many systems also poll to catch any that were lost.

Related: SNMP, Event

SNR (signal-to-noise ratio) Connectivity

How far a signal stands above the background noise, in dB. LoRa can decode signals below the noise level, down to about −20 dB at the slowest spreading factor.

Related: RSSI, Link budget, Spreading factor

SNTP (Simple Network Time Protocol) Protocols

A lighter version of NTP for devices that only need to set their clock from a server, without NTP's full filtering and clock steering. It gives accuracy in the tens of milliseconds, which is enough for most telemetry timestamps.

Related: NTP, RTC, Timestamp

SoC (state of charge) Energy

How full a battery is, as a percentage of its current capacity. It is estimated from voltage, counted charge and temperature, and is the basic reading for battery storage, electric vehicles and battery-powered devices.

Related: SoH, BESS, Battery life

SoC (system on chip) Devices and sensors

A single chip that combines a processor, memory, radio and peripherals. Many IoT modules are built on one, which keeps devices small, cheap and low-power. Do not confuse it with SoC as state of charge.

Related: MCU, Firmware, Single-board computer

SOE (sequence of events) Automation and control

A record of state changes, such as breaker trips and alarms, time-stamped at the source with millisecond precision. It shows exactly which event came first during a fast incident, which ordinary polling every few seconds cannot do.

Related: Timestamp, Root cause analysis, IEC 61850

SoH (state of health) Energy

How much capacity a battery has left compared with when it was new, as a percentage. A battery at 80 % SoH holds four fifths of its original energy; tracking SoH tells you when to replace batteries in backup systems and devices.

Related: SoC, UPS, BESS

Soil moisture sensor Agriculture

A probe that measures how much water the soil holds, usually as volumetric water content from the soil's electrical properties, or as tension, which shows how hard roots must pull. Readings at several depths show whether irrigation reaches the root zone.

Related: Smart irrigation, Evapotranspiration, Precision agriculture

Solar PV (photovoltaics) Energy

Panels that turn sunlight directly into electricity. Monitoring a PV system compares inverter output with irradiance and temperature, so dirty panels, failed strings and inverter faults show up as lost energy rather than going unnoticed.

Related: Performance ratio

Sound level monitoring Smart city

Measuring noise continuously, usually as A-weighted decibels, dB(A), which follow how people hear. Cities and sites use it to check night-time limits near homes and to find machines that have become noisier, often an early sign of wear.

Related: Vibration monitoring, Threshold

Sparkplug B Protocols

An open specification for using MQTT in industrial systems. It fixes the topic structure, a compact binary payload and birth and death messages, so every subscriber knows which devices exist, what they report and whether their data is still current.

Related: MQTT, UNS, Last will

SPC (statistical process control) Manufacturing

Watching a process with statistics, typically control charts with upper and lower control limits, to tell normal variation from a real change. A run of points trending one way can show a drifting machine before it makes bad parts.

Related: OEE, Trend

SPI (serial peripheral interface) Devices and sensors

A fast, short-distance bus between a microcontroller and chips on the same board, such as radios, flash memory and sensors. It uses separate lines for clock, data out, data in and chip select, and is not meant for cables between devices.

Related: UART, MCU

Split brain Data and analytics

A failure in a redundant system in which the members lose contact with each other and each believes it is the active one, so both accept writes or issue commands. Quorum rules and fencing are used to prevent it.

Related: Quorum, High availability, Redundancy

Spreading factor (SF) Connectivity

In LoRa, how long each symbol is stretched, from SF7 to SF12. Each step up roughly doubles time on air and adds range, at the cost of battery and network capacity.

> **In Hermetry** The LoRaWAN airtime calculator on our tools page shows how time on air grows with each spreading factor.
> hermetry.com/tools/lorawan-airtime-calculator/

Related: Data rate, Time on air, ADR

SSL (Secure Sockets Layer) Security

The predecessor of TLS. All SSL versions are obsolete and insecure; the name lives on in everyday speech, as in SSL certificate, but current connections use TLS 1.2 or 1.3.

Related: TLS, X.509 certificate, mTLS

SSO (single sign-on) Security

Signing in once with a company identity and using several applications without new passwords, through standards such as SAML 2.0 and OpenID Connect. When someone leaves the company and their account is switched off, they lose access to every connected application at once.

> **In Hermetry** Each Hermetry organisation can connect its own SAML 2.0 or OpenID Connect identity provider and keep members in step with SCIM 2.0.
> hermetry.com/docs/security/single-sign-on/

Related: RBAC, JWT

Stale data Data and analytics

A value that is still shown but is no longer current, because the device stopped reporting. Showing the age of a value, or greying it out, keeps people from acting on old data.

Related: Heartbeat, Quality code, Timestamp

Star topology Connectivity

A network in which every device connects to a central point, such as sensors to a gateway or switches to a core switch. It is simple to manage, and a failed device does not affect the others, but the centre is a single point of failure.

Related: Mesh network, Ring topology, LoRaWAN

State machine Automation and control

A model in which a system is always in one of a set of states and moves between them on defined events, such as a pump going from stopped to starting to running. Firmware, alarm handling and process sequences are often written as state machines.

Related: Interlock, Event, IEC 61131-3

Static IP address Connectivity

An address that stays the same instead of being assigned anew on each connection. Devices that must be reached from outside, such as a site router, often need one, or a private network or VPN that provides fixed addresses.

Related: APN, VPN, Remote access

Store and forward Data and analytics

Keeping readings in local memory while the connection is down and sending them, with their original time stamps, once it is back, so no data is lost. How much can be kept depends on the device's memory and how long the outage lasts.

> **In Hermetry** Readings a device buffers during an outage still land in Hermetry's history; alarms opened from them are marked Backfilled, and nobody is paged for the past.
> hermetry.com/docs/troubleshooting/wrong-times-and-gaps/

Related: Data logger, Edge computing, Queue

Strain gauge
Devices and sensors

A sensor whose electrical resistance changes as it is stretched or compressed, bonded to a structure or built into a load cell. It is the basis of most weighing systems and of stress measurement on bridges and machines.

Related: Load cell, Structural health monitoring, Signal conditioning

Stream processing
Data and analytics

Handling data as it arrives, message by message or in short windows, instead of storing it first and querying it later. Rules engines, live aggregates and real-time alarm checks are forms of stream processing.

Related: Rules engine, Ingestion, Time series

Structural health monitoring
Smart city

Measuring bridges, buildings, tunnels and dams over time with strain gauges, tilt sensors, crack meters and accelerometers, to see how a structure behaves and spot damage early. Long-term data shows slow changes, such as settlement or growing cracks, that inspections can miss.

Related: Strain gauge, Tilt sensor, Vibration monitoring

Sub-metering
Energy

Metering parts of a site separately, such as a floor, a line or a tenant, under the main meter. It shows where energy or water actually goes and allows fair cost splitting.

> **In Hermetry** The building HVAC and energy use case brings main and sub-meters into Hermetry with the plant they serve. hermetry.com/use-cases/building-hvac-and-energy-overview/

Related: Energy meter, Energy monitoring, CT

Submersible pump
Water

A pump whose motor and pump sit together under the liquid, in boreholes, wells and sewage pits. Because it cannot be seen, monitoring current, run hours, starts per hour and temperature is the main way to spot clogging and wear.

Related: Run hours, VFD, Pumping station

Substation
Energy

Part of an electricity network where voltage is transformed and circuits are switched and protected. Substation automation collects breaker states, measurements and protection events, increasingly over IEC 61850.

> **In Hermetry** The substation use case brings power analysers, transformer temperature, fault indicators and switch positions of secondary substations into Hermetry. hermetry.com/use-cases/substation-and-transformer-monitoring/

Related: IEC 61850, SLD, Transformer monitoring

Supercapacitor
Devices and sensors

A capacitor that stores far more energy than an ordinary one and can be charged and discharged hundreds of thousands of times. In IoT it buffers energy-harvesting sources and covers short current peaks, such as a radio transmission, that a small battery cannot supply.

Related: Energy harvesting, Battery life, UPS

Surge protection (SPD)
Devices and sensors

Devices that divert short voltage spikes, such as those from lightning or switching, safely to earth before they reach equipment. Outdoor sensors, antennas and long signal cables at remote sites need surge protection on power, data and antenna lines.

Related: RCD, IP rating, Antenna gain

Symmetric encryption
Security

Encryption in which the same secret key locks and unlocks the data, such as AES. It is fast and suits small devices, but both sides must already share the key securely, which is why it is often combined with public-key methods during a handshake.

Related: AES-128, PKI, TLS

Syslog
Security

A standard way for devices and servers to send log messages to a central collector, defined in RFC 5424. Routers, firewalls and gateways commonly use syslog, which makes it a simple source for security monitoring.

Related: Audit log, SNMP trap

T

Tachograph Logistics

A device in commercial vehicles that records driving time, rest periods, speed and distance, as required by road transport rules in many countries. Fleet systems download its data remotely to plan driver hours and stay compliant.

Related: Telematics, Fleet management, CAN bus

Tag Automation and control

A named data point in an industrial system, such as PT-101 for a pressure transmitter. Tags link the value in the controller, the symbol on the screen and the record in the historian.

Related: P&ID, Historian, Quality code

Takt time Manufacturing

The pace at which products must be finished to meet customer demand: available working time divided by the number of units needed. If takt is 60 seconds, each station on the line must finish its work in under a minute.

Related: Cycle time, OEE

Tamper detection Security

Sensing that someone has opened, moved or interfered with a device, through a case switch, a light sensor, a tilt sensor or a broken seal. A tamper alarm on a meter or cabinet is often the first sign of theft or fraud.

Related: Alarm, Tilt sensor, Secure element

Tank level monitoring Logistics

Measuring the contents of tanks remotely with level sensors, so deliveries are planned from real levels instead of fixed rounds and leaks or theft show up as unexpected drops. It is common for fuel, chemicals, water and agricultural liquids.

Related: Radar level sensor, Ultrasonic level sensor, Hydrostatic level sensor

TCP (Transmission Control Protocol) Protocols

The internet protocol that delivers data reliably and in order over a connection, resending anything lost. MQTT, HTTP and Modbus TCP run on it. Its handshakes and retransmissions cost data and battery, which is why some constrained devices use UDP.

Related: UDP, MQTT, Keep-alive

TDMA (time division multiple access) Connectivity

Sharing a radio channel by giving each device its own time slot. Devices never transmit over each other, which makes timing predictable; it is used in some industrial wireless and cellular systems.

Related: Mesh network, Latency, Duty cycle

Telematics Logistics

Collecting data from vehicles, such as position, speed, fuel, engine data and driver behaviour, and sending it to a central system. It is the basis of fleet management, usage-based maintenance and cold-chain transport monitoring.

Related: Fleet management, GNSS, CAN bus

Telemetry Data and analytics

Measurements sent automatically from remote devices, such as temperature, pressure, level or energy, usually with a time stamp. It is the raw material of IoT.

> **In Hermetry** Hermetry stores each reading as a time series under a telemetry key.
> hermetry.com/docs/telemetry-and-data/how-readings-are-stored/

Related: Time series, Sampling rate, Event

Temperature excursion Logistics

A period in which goods are kept outside their allowed temperature range, such as a vaccine above 8 °C. Each excursion must be recorded with its duration and peak, then assessed to decide whether the product can still be used.

Related: Cold chain, MKT, Alarm

Temperature mapping Logistics

Measuring temperature at many points in a warehouse, cold room or vehicle over time to find hot and cold spots, as good distribution practice for medicines requires. The map decides where permanent monitoring sensors go.

Related: Cold chain, Temperature excursion

THD (total harmonic distortion) Energy

How much a voltage or current waveform departs from a clean sine wave, as a percentage. High THD from drives and power electronics heats equipment and trips protection.

Related: Power factor, VFD, Energy meter

Thermal imaging Devices and sensors

Cameras that see infrared radiation and show surface temperatures as an image. Fixed thermal cameras watch electrical panels, conveyors and stockpiles for hot spots; handheld ones are used in inspection rounds.

Related: Condition monitoring, Video analytics, Predictive maintenance

Thermocouple Devices and sensors

A temperature sensor made of two different metals joined at the tip, which produces a small voltage depending on temperature. Thermocouples cover very wide ranges, type K up to well over 1,000 °C, but need cold-junction compensation and careful signal conditioning.

Related: RTD, Signal conditioning, Transducer

Thermostat Buildings

A controller that switches heating or cooling to keep a space at a set temperature. Connected thermostats report temperature and demand, accept remote set points and schedules, and are a common first step in building energy savings.

Related: Setpoint, HVAC, Smart building

Thing Description (Web of Things) Standards

A W3C standard format, written in JSON, that describes what a device offers: its properties, actions and events, and how to reach them. It lets applications use devices from different makers without custom code for each.

Related: JSON, Device profile, Interoperability

Thread Connectivity

A low-power IPv6 mesh network for smart home and building devices. It carries Matter and other application protocols.

Related: Matter, Mesh network, Zigbee

Threat model Security

A structured look at a system from an attacker's point of view: what is worth stealing or disrupting, how someone could get in and which defences stop them. Doing it early in design is far cheaper than fixing weaknesses after devices are in the field.

Related: Risk assessment, Zero trust, IEC 62443

Threshold Automation and control

A limit that triggers something when a value crosses it, such as "high temperature above 80 °C". Good thresholds come with a deadband or a delay so they do not chatter.

> **In Hermetry** In Hermetry's Rules card, pairing an on rule and an off rule with a gap between their thresholds avoids cycling.
> hermetry.com/docs/rules-and-alarms/rules-card-cookbook/

Related: Alarm, Hysteresis, Debounce

Tilt sensor Devices and sensors

A sensor that measures inclination, usually with an accelerometer. It is used to watch poles, walls, slopes and bins, and as a tamper or theft trigger on equipment that should never be moved.

Related: Accelerometer, Structural health monitoring, Tamper detection

Time on air Connectivity

How long one radio frame takes to transmit. In LoRaWAN it grows with spreading factor and payload size and decides battery use, duty-cycle limits and network capacity.

Related: Spreading factor, Duty cycle, Coding rate

Time series Data and analytics

A sequence of values each with a time stamp, such as a temperature every minute. Most IoT data is time series.

Related: Time-series database, Telemetry, Trend

Time-series database Data and analytics

A database built to store and query time-stamped values efficiently: fast writes, compression and queries by time range with aggregates. IoT and SCADA systems use one because readings arrive constantly and are almost always queried by time.

Related: Historian, Time series, Rollup

Time-series forecasting Data and analytics

Predicting future values of a measured series, such as tomorrow's energy demand or when a tank will be empty, from its history and patterns such as daily cycles and weather. Forecasts turn monitoring data into plans.

Related: Time series, RUL, Trend

Timestamp Data and analytics

The date and time attached to a reading or an event. Taking it at the source rather than on arrival keeps buffered or late data in the right place.

> **In Hermetry** Hermetry stores each record with its timestamp in milliseconds, UTC.
> hermetry.com/docs/telemetry-and-data/how-readings-are-stored/

Related: NTP, Store and forward, Time series

TinyML Data and analytics

Running machine learning models directly on microcontrollers that use milliwatts of power. Small models can recognise sounds, vibration patterns or gestures on the device, so only results, not raw data, need to be sent.

Related: Edge computing, Quantisation, MCU

TLS (Transport Layer Security) Security

The protocol that encrypts and authenticates connections, as in HTTPS and MQTT over port 8883. It protects data on the way and proves the server's identity.

> **In Hermetry** Hermetry's MQTT broker takes MQTT 3.1.1 over TLS on TCP port 8883.
> hermetry.com/docs/reference/hostnames-ports-and-ips/

Related: mTLS, X.509 certificate, PKI

Totalizer Data and analytics

A running total kept by a meter, such as total m³ of water or kWh of energy. Consumption over a period is the difference between two totalizer readings.

Related: Flow meter, Pulse counter, Energy meter

TOTP (time-based one-time password) Security

A six-digit code that changes every 30 seconds, generated by an authenticator app from a shared secret and the current time (RFC 6238). It is the most common second factor for signing in to web platforms.

> **In Hermetry** Hermetry accepts time-based codes from an authenticator app as a second factor, with backup codes.
> hermetry.com/docs/security/two-factor-and-passkeys/

Related: 2FA, SSO, MFA

TPM (trusted platform module) Security

A security chip, standardised as ISO/IEC 11889, that stores keys, measures what software booted and can prove the device's state to a remote server. It is common in industrial PCs and gateways.

Related: Secure element, Root of trust, Secure boot

Traceability Manufacturing

Being able to follow a product, batch or part through every step of making and moving it: which materials, machines, settings and people were involved. When a fault is found, traceability shows exactly which products are affected.

Related: Recipe, MES, RFID

Traffic signal controller Smart city

The roadside cabinet that runs a junction's traffic lights: it holds the signal plans, reads vehicle detectors and switches the lamps. Remote monitoring reports lamp failures, mains loss, door openings and the controller's operating mode.

Related: Remote I/O, Dry contact

Transducer Devices and sensors

A device that converts one form of energy into another, such as pressure into an electrical signal. In instrumentation the word is often used for a sensor with built-in conditioning that outputs a standard signal like 4–20 mA.

Related: Sensor, Current loop, Signal conditioning

Transformer monitoring Energy

Watching a power transformer's load, oil and winding temperatures, oil level and, for large units, dissolved gases in the oil. Overheating and gas trends warn of insulation damage long before a failure.

> **In Hermetry** The substation use case watches transformer load and temperature in Hermetry, with an alarm before a transformer overheats.
> hermetry.com/use-cases/substation-and-transformer-monitoring/

Related: Substation, Condition monitoring, Energy monitoring

Transmit power Connectivity

How strongly a radio transmits, in dBm or milliwatts. Higher power reaches further but costs battery and is limited by regional rules, for example to about 14 dBm (25 mW) in much of the European 868 MHz band.

Related: Link budget, dBm, Regional parameters

Trend Data and analytics

A chart of a value over time, the basic tool for seeing drift, cycles and faults in process data. Comparing trends of related values, such as current and temperature, often shows the cause of a problem.

Related: Time series, Historian, Dashboard

Trickle charging Energy

Charging a battery with a small, continuous current to keep it full once it is charged. Standby batteries in UPS units and alarm panels are kept ready this way, though modern chargers use smarter float and maintenance modes.

Related: UPS, SoC, Battery life

Trigger (rule) Data and analytics

The condition that starts a rule or automation, such as a reading crossing a limit, a device going offline or a scheduled time. A trigger is followed by actions, such as raising an alarm, sending a message or a command.

Related: Rules engine, Event, Threshold

TTL (time to live) Data and analytics

A limit on how long something stays valid: how many hops a network packet may travel, how long a cached answer may be used, or how long a queued message waits before being discarded. An expired command should never reach a device hours later.

Related: Queue, Downlink, Message broker

Turbidity sensor Water

A sensor that measures how cloudy water is by how much light particles scatter, in NTU (nephelometric turbidity units). Turbidity is a key drinking-water quality reading and an early sign of filter problems or a disturbed source.

Related: Water quality monitoring, Reverse osmosis, Threshold

TWA (time-weighted average) Data and analytics

An average in which each reading counts in proportion to how long it lasted, which is correct when samples come at uneven intervals. Exposure limits for gases and noise at work are stated as time-weighted averages over a shift.

Related: Rollup, Downsampling, Gas detector

Twisted pair Connectivity

A cable in which two wires are twisted round each other, so outside interference affects both equally and cancels out. RS-485 buses, Ethernet and most fieldbuses run on twisted pair, often shielded.

Related: RS-485, RS-422, Ethernet

U

UART Protocols

The serial communication block in a microcontroller that sends and receives bytes one bit at a time. RS-232 and RS-485 add the electrical layer on top of it.

Related: RS-485, RS-232, Baud rate

UDP (User Datagram Protocol) Protocols

A simple internet transport that sends independent packets without connections or delivery guarantees. It suits small, frequent messages and is used under CoAP.

Related: CoAP, HTTP

Ultrasonic flow meter Water

A meter that measures flow by sending sound pulses through the liquid, comparing the travel time with and against the flow. Clamp-on versions mount outside the pipe, so flow can be measured without cutting into it.

Related: Flow meter, Water balance

Ultrasonic level sensor Devices and sensors

A sensor that measures distance to a surface by timing an ultrasonic echo, used for tanks, wells, channels and bins. It is cheaper than radar but more affected by foam, vapour, temperature and dust.

Related: Radar level sensor, Tank level monitoring, Smart waste management

UNB (ultra-narrowband) Connectivity

A low-power wide-area radio technique that sends very slow messages in a very narrow band, reaching long distances with tiny amounts of energy and data. Because each message is tiny and slow, such networks suit sensors that send a few short reports a day.

Related: LPWAN, LoRaWAN

Unconfirmed uplink Connectivity

A LoRaWAN message sent without asking the network to acknowledge it. It saves airtime and battery, and since lost messages are usually followed by the next reading anyway, most sensor data is sent this way.

Related: Confirmed uplink, Uplink, Frame counter

Undervoltage Energy

A supply voltage below its normal range for longer than a brief dip. It makes motors draw more current and overheat, and can reset electronics, so monitoring and alarming on it protects equipment at the end of long supply lines.

Related: Voltage sag, Power quality, Energy monitoring

Unlicensed spectrum Connectivity

Radio bands anyone may use without a licence, as long as devices follow rules on power and duty cycle, such as the 868 MHz and 2.4 GHz bands. LoRaWAN, Wi-Fi and Bluetooth use unlicensed spectrum; cellular IoT uses bands licensed to operators. See ISM band.

Related: ISM band, Duty cycle, LPWAN

UNS (unified namespace) Data and analytics

An architecture in which every system, from machines and controllers to MES and ERP, publishes its current state into one shared, hierarchical structure of topics, usually on an MQTT broker organised by site, area and line. Any application can then find the data it needs in one place.

Related: MQTT, Sparkplug B, ISA-95

Uplink Connectivity

A message from a device to the network, such as a reading or an event. Most IoT traffic is uplink.

> **In Hermetry** Hermetry's frames log shows what your gateways heard, uplinks included, with data rate, frequency and signal strength.
> hermetry.com/docs/lorawan/the-frames-log/

Related: Downlink, Confirmed uplink, Payload

UPS (uninterruptible power supply) Energy

A battery unit that keeps equipment running through power cuts and smooths the supply. Its status, battery charge and runtime are typical SNMP readings.

> **In Hermetry** The server room use case reads UPS and power distribution values in Hermetry.
> hermetry.com/use-cases/server-room-critical-environment-monitoring/

Related: SNMP, SNMP trap

Uptime Operations

The time a system or device is running and reachable, often given as a percentage of a period. 99.9 % uptime still allows about 43 minutes of downtime a month, so the exact figure matters.

> **In Hermetry** Hermetry's status page shows the state of every part of the platform in each region, with the last 90 days.
> hermetry.com/status/

Related: Availability, SLA, Heartbeat

USB (Universal Serial Bus) Devices and sensors

The common connector and bus for attaching peripherals and power. On IoT devices it is used for power, configuration and firmware updates in the field, and on gateways for cellular modems and serial adapters.

Related: UART, Firmware, RS-232

Utilisation (asset) Operations

How much of the available time an asset is actually in use. Low utilisation shows equipment that could be moved or sold; high utilisation shows where wear and the next bottleneck will come from.

Related: Run hours, OEE, Asset tracking

UUID (universally unique identifier) Data and analytics

A 128-bit identifier designed to be unique without a central authority, written as 32 hexadecimal digits in five groups. Platforms use UUIDs as identifiers for devices, messages and records so they never collide.

Related: EUI-64, Device identity, JSON

UV disinfection Water

Treating water by passing it under ultraviolet light, which stops microorganisms from reproducing without adding chemicals. Monitoring lamp intensity, run hours and water transmittance shows whether the dose is still enough.

Related: Water quality monitoring, Run hours, Wastewater treatment

UWB (ultra-wideband) Connectivity

A short-range radio that sends very short pulses over a wide band, so the time of flight between devices can be measured to within centimetres. It is used for precise indoor positioning of tags, people and vehicles.

Related: BLE, Asset tracking

V

V2G (vehicle-to-grid) Energy

Letting electric vehicles not only charge from the grid but also send energy back when the grid needs it. It needs bidirectional chargers and communication between charger, vehicle and grid operator.

Related: OCPP, Demand response, Smart grid

Valve actuator Automation and control

The motor, pneumatic or hydraulic unit that opens and closes a valve on command. Remote actuators report position, torque and faults, so an operator can confirm that a valve actually moved, not just that the command was sent.

Related: Digital output, Interlock, Remote I/O

VAV (variable air volume) Buildings

An HVAC system, and the box in each zone, that controls temperature by varying how much conditioned air flows into a room. VAV systems save fan energy compared with constant-volume systems, because air flow follows the actual demand of each zone.

Related: AHU, HVAC, BMS

Vector database Data and analytics

A database that stores items as lists of numbers that capture their meaning, so it can find the most similar items quickly. AI assistants use it to look up relevant documents, manuals or past incidents before answering a question.

Related: MCP, Time-series database, Anomaly detection

Vendor lock-in Operations

Depending on one supplier so heavily that switching becomes difficult or expensive, for example because data cannot be exported or devices only talk to one platform. Open protocols, data export and standard formats reduce it.

Related: Interoperability, MQTT, OPC UA

Vertical farming Agriculture

Growing crops in stacked layers indoors under artificial light, with closely controlled climate, water and nutrients. It depends heavily on sensors and automation for temperature, humidity, CO_2, light and nutrient solution.

Related: VPD, Conductivity sensor

VFD (variable frequency drive) Devices and sensors

An electronic drive that controls a motor's speed by changing the frequency of its supply. Slowing pumps and fans with a VFD saves a large share of their energy.

Related: PID controller, THD, Modbus RTU

Vibration monitoring Manufacturing

Measuring how a machine shakes, as velocity, acceleration and frequency content. Rising vibration is often the first sign of imbalance, misalignment or bearing wear.

Related: Condition monitoring, Predictive maintenance

Vibration velocity Manufacturing

The speed of a machine surface's vibration, usually given as an RMS value in mm/s. ISO 20816 groups velocity levels into zones from good to unacceptable for different machine classes, which makes it the most common figure for judging machine health.

Related: Vibration monitoring, Condition monitoring, Predictive maintenance

Video analytics Data and analytics

Software that analyses camera images automatically, for example to count vehicles, detect intruders or check that people wear protective equipment. Running it at the edge means only events and snapshots need to be sent, not continuous video.

Related: RTSP, Edge computing, Smart parking

Virtual sensor (computed value) Devices and sensors

A value calculated from other readings instead of measured, such as power from current and voltage or efficiency from flow and energy. It adds a value without adding hardware, as long as the readings it is built from are trustworthy.

Related: Telemetry, Rules engine

VLAN (virtual LAN) Security

A way to split one physical network into separate logical networks, for example to keep control devices apart from office computers. VLANs are a basic step in network segmentation for control systems.

Related: OT, Zero trust, IEC 62443

VOC (volatile organic compounds) Buildings

Carbon-based chemicals that evaporate easily at room temperature, released by paints, cleaning products, furniture and people. Indoor air quality sensors often report a total VOC index alongside CO_2 and particles.

Related: IAQ, CO_2 sensor, HVAC

Voltage divider Devices and sensors

Two resistors in series that produce an output voltage that is a fixed fraction of the input. It is used to scale a voltage down to what an analogue input can read, for example to measure a 24 V battery with a 3.3 V converter.

Related: Analog input, ADC, Signal conditioning

Voltage regulator Devices and sensors

A circuit that keeps a steady output voltage from a varying input, such as 3.3 V from a battery that falls from 4.2 V to 3.0 V. On battery devices, a regulator with very low quiescent current is essential for long life.

Related: Quiescent current, Battery life

Voltage sag (dip) Energy

A short drop in supply voltage, typically lasting from half a cycle to a few seconds, often caused by a fault elsewhere on the network or a large motor starting. Sags can stop production lines and reset controllers, so power quality monitors record them.

Related: Power quality, Undervoltage, UPS

VPD (vapour pressure deficit) Agriculture

The difference between how much moisture air could hold at its temperature and how much it actually holds, in kPa. It drives how fast plants transpire; growers in greenhouses often aim for roughly 0.8–1.2 kPa during growth and adjust ventilation, heating and misting to keep it there.

Related: Relative humidity, Dew point

VPN (virtual private network) Security

An encrypted tunnel that joins a device or a network to another network across the internet. A classic VPN gives access to a whole network, so it is limited to the people and devices that need it.

Related: Remote access, Zero trust

VPP (virtual power plant) Energy

Many small energy resources, such as batteries, solar inverters, heat pumps and backup generators, controlled together so they act like one power plant. Their combined flexibility is offered to grid operators and energy markets.

Related: Demand response, Smart grid

Vulnerability management Security

The ongoing work of finding, ranking and fixing security weaknesses in devices and software, from tracking published vulnerabilities and severity scores to rolling out patches. For IoT fleets it depends on knowing every device's firmware version and being able to update it remotely.

Related: SBOM, OTA

W

Wake-on-radio Connectivity

A technique in which a sleeping device listens briefly at intervals for a wake-up signal, so it can be reached without keeping its receiver on all the time. It trades a little battery for much faster reaction to downlink commands.

Related: Sleep mode, Device class, Downlink

WAN (wide area network) Connectivity

A network that links sites over long distances, such as the internet, a cellular network or leased lines. In IoT the WAN is the connection from a site's gateway to the platform, and its reliability decides whether data needs to be buffered locally.

Related: LAN, Backhaul, Store and forward

Warm standby Data and analytics

A backup system that runs and receives updates but does not serve users until the main system fails, then takes over within minutes. It sits between cold standby, which must be started first, and hot standby, which takes over immediately.

Related: High availability, Redundancy, RPO and RTO

Wastewater treatment Water

Cleaning used water in stages, typically screening, settling, biological treatment and sometimes disinfection, before it is returned to the environment. Monitoring flows, dissolved oxygen, sludge levels and blower energy keeps treatment within limits at the lowest energy cost.

Related: Dissolved oxygen, Sewer overflow monitoring, UV disinfection

Watchdog Automation and control

A timer that restarts a device or raises an alarm if the software stops resetting it in time, so a hung device recovers on its own. Hardware watchdogs keep working even when the main software has crashed, which is why embedded devices rely on them.

Related: Heartbeat, Fail-safe

Water balance Water

An accounting of all water entering and leaving a network or zone over a period: what was produced, sold, used for operations and lost. The standard water balance splits losses into real losses (leaks) and apparent losses (meter errors and theft).

Related: NRW, DMA, Night flow

Water hammer Water

A pressure surge that occurs when flow in a pipe stops or changes direction suddenly, for example when a valve slams shut or a pump trips. It can burst pipes and joints; fast pressure logging catches surges that ordinary readings every minute miss.

Related: Pressure transmitter, Pumping station, Sampling rate

Water quality monitoring Water

Measuring water continuously with sensors such as chlorine, pH, turbidity, conductivity and temperature, at treatment plants, reservoirs and points in the network. It shows treatment problems and contamination in minutes instead of waiting for lab samples.

Related: Turbidity sensor, pH sensor

Wearable Devices and sensors

A device worn on the body, such as a badge, wristband or smart helmet. Industrial wearables report location, falls, man-down alarms, heat stress or gas exposure for lone and field workers.

Related: UWB, BLE, Asset tracking

Weather station Agriculture

A set of sensors for air temperature, humidity, pressure, wind, rain and often solar radiation, at a single site. Local weather data drives irrigation, frost protection, solar performance analysis and building control.

> **In Hermetry** Hermetry's weather stations solution shows a network of automatic weather stations on a map and in a table, with a page for each station.
> hermetry.com/docs/ready-solutions/weather-stations/

Related: Rain gauge, Smart irrigation

Webhook Data and analytics

An HTTP request a system sends to another system's address when something happens, such as an alarm opening. The receiver does not need to keep asking.

> **In Hermetry** Hermetry sends signed webhooks (HMAC-SHA256) when devices, alarms, commands, firmware and rules change, with CloudEvents as an option.
> hermetry.com/docs/api/webhooks/

Related: REST API, Event, Rules engine

WebSocket Protocols

A protocol that keeps a two-way connection open between a browser or device and a server, so both can send messages at any time. It starts as an ordinary HTTP request and then switches protocol, so it passes most firewalls and proxies.

> **In Hermetry** LoRaWAN gateways reach Hermetry's network server only over a secure WebSocket (wss://), never over a plain connection.
> hermetry.com/docs/lorawan/your-network-server-address/

Related: HTTP, MQTT

Weighbridge Logistics

A large scale built into the road that weighs whole vehicles, with or without their load. Linking it to a monitoring system records every weighing with vehicle and time, for quarries, waste sites, farms and ports.

Related: Load cell, Traceability

Wet-bulb temperature Buildings

The temperature a wetted thermometer reaches as water evaporates from it, which is lower than air temperature unless the air is saturated. It shows how well evaporation can cool, so it matters for cooling towers, heat stress and evaporative cooling.

Related: Relative humidity, Dew point, Cooling tower

Wi-Fi Connectivity

Wireless local networking under the IEEE 802.11 standards. It is fast and everywhere, but uses more power and reaches less far than low-power IoT radios.

Related: Wi-Fi HaLow, PoE

Wi-Fi 6 (IEEE 802.11ax) Connectivity

A Wi-Fi generation designed for crowded networks with many devices. Its target wake time feature lets battery devices agree when to wake up, which makes Wi-Fi more practical for low-power IoT than before.

Related: Wi-Fi, Wi-Fi HaLow, Sleep mode

Wi-Fi HaLow (802.11ah) Connectivity

A Wi-Fi standard in the sub-1 GHz bands that reaches further and passes walls better than ordinary Wi-Fi, at lower data rates. It aims at sensors and cameras on large sites.

Related: Wi-Fi, LPWAN

Wi-SUN Connectivity

A standard wireless mesh network for utilities and cities, used for smart meters and street lighting over large areas. Its nodes relay each other's traffic, so a network can grow across a whole city with few access points.

Related: Mesh network, Smart meter, LPWAN

Widget Data and analytics

A building block of a dashboard: a gauge, a chart, a table, a map, a switch. Each widget shows one view of the data.

> **In Hermetry** Hermetry ships a catalogue of built-in widgets, and your organisation can create its own.
> hermetry.com/docs/dashboards/widgets/

Related: Dashboard, Trend

Wind turbine monitoring Energy

Collecting a turbine's power output, wind speed, rotor speed, pitch, yaw and gearbox and bearing temperatures and vibration. Comparing power against wind speed shows underperformance, and condition data warns of gearbox and bearing damage.

Related: Condition monitoring, Vibration monitoring, Performance ratio

Wireless M-Bus Protocols

The radio variant of the M-Bus meter-reading standard (EN 13757-4), common for water and heat meters in Europe. Meters broadcast readings in modes such as S, T or C, usually at 868 MHz, to walk-by receivers or fixed gateways.

Related: M-Bus, Smart meter, AES-128

Work order Operations

A task given to a maintenance crew: what to do, where, by when, and what was done. Linking alarms to work orders closes the loop from detection to repair.

Related: Alarm, Preventive maintenance, MTTR

WPA3 Security

The current security standard for Wi-Fi networks. It replaces the older password exchange with one that resists offline guessing, and should be used for any Wi-Fi network that carries device or control traffic.

Related: Wi-Fi, TLS, Zero trust

WSN (wireless sensor network) Connectivity

A group of battery-powered sensor nodes that report wirelessly, either directly to a gateway or by passing messages between each other. The main design trade-offs are range, battery life and how often data is sent.

Related: Mesh network, LPWAN, Gateway

X

X.509 certificate Security

A standard digital certificate that binds a public key to an identity and is signed by a certificate authority. Devices use X.509 certificates to prove who they are without passwords.

> **In Hermetry** Hermetry runs its own certificate authority for device certificates.
> hermetry.com/docs/security/device-certificate-authority/

Related: PKI, mTLS, TLS

xDSL (digital subscriber line) Connectivity

The family of technologies that send broadband over telephone copper lines. Many remote sites still connect this way; because copper networks are being retired in many countries, sites often move to fibre or cellular.

Related: WAN, Backhaul, Cellular IoT

XML (Extensible Markup Language) Protocols

A text format that marks up data with nested, named tags. Older industrial and enterprise systems often exchange data as XML, where newer ones use JSON.

> **In Hermetry** Hermetry's flows have transform blocks that read and write XML, JSON, CSV, hex and Base64.
> hermetry.com/docs/flows/data-transform-blocks/

Related: JSON, REST API

XMPP (Extensible Messaging and Presence Protocol) Protocols

An open, XML-based protocol for real-time messaging and presence, defined in RFC 6120. It was designed for chat but has been used for device messaging; in IoT it has largely given way to MQTT, which is lighter.

Related: MQTT, XML, WebSocket

XOR checksum Protocols

A simple check value made by combining all bytes of a message with exclusive OR. It catches single-bit errors but misses many others, so many serial protocols use a CRC instead; the tools section has a checksum calculator.

Related: CRC, Modbus RTU

Y

Yagi antenna Connectivity

A directional antenna with a row of parallel elements, which concentrates the signal in one direction and gains several dB over a simple whip. It is used to reach a distant gateway or tower from a site with poor coverage.

Related: Antenna gain, Link budget, Quarter-wave antenna

YAML Data and analytics

A human-readable text format for configuration and structured data, which uses indentation instead of brackets. Gateways, edge software and deployment tools often keep their settings in YAML files.

Related: JSON, XML, Schema

Yaw, pitch and roll Devices and sensors

The three angles that describe how an object is oriented: turning left and right (yaw), tipping nose up and down (pitch) and tilting side to side (roll). Motion sensors report them for vehicles, cranes, antennas and wearables.

Related: Tilt sensor, Sensor fusion

Yield (production) Manufacturing

The share of products that come out good. First-pass yield counts only those that are right the first time, without rework, and shows process quality more honestly than final yield. In OEE, yield appears as the quality factor.

Related: OEE, SPC, Traceability

Z

Z-score Data and analytics

How many standard deviations a reading lies from the average. A z-score above 3 or below −3 is rare under normal conditions, which makes it a simple first test for anomalies in sensor data.

Related: Anomaly detection, SPC, Threshold

Z-Wave Connectivity

A low-power sub-1 GHz mesh network for home automation devices such as locks, switches and sensors. It uses lower frequencies than 2.4 GHz networks, which helps it pass walls and avoid Wi-Fi interference.

Related: Zigbee, Mesh network

Zero offset Devices and sensors

The reading a sensor gives when the true value is zero, such as a pressure sensor showing 0.02 bar on an empty line. Zero offsets are corrected by calibration or by adjusting the scaling, otherwise every reading is shifted.

Related: Calibration, Sensor drift, Scaling

Zero trust Security

A security approach in which no connection is trusted for being on the internal network: every user, device and request has to prove its identity and right to access each time. In practice it means strong identity for users and devices, least privilege and checking every connection.

Related: mTLS, VPN, IEC 62443

Zero-day vulnerability Security

A security weakness that is being exploited before the maker has released a fix, so defenders have had zero days to patch it. Network segmentation and least-privilege access limit the damage a zero-day can do.

Related: Vulnerability management, Zero trust, VLAN

Zero-touch provisioning Operations

Bringing a new device into service without anyone configuring it by hand on site: it connects, proves its identity, for example with a certificate or a claim code, and receives its settings automatically. It is what makes rolling out hundreds of devices practical, because installers only mount and power them.

> **In Hermetry** Devices can register themselves in Hermetry with their profile's provisioning key; self-registered devices can be held in quarantine.
> hermetry.com/docs/security/device-identity-and-claiming/

Related: Provisioning, X.509 certificate, Fleet management

Zigbee Connectivity

A low-power mesh network standard for short-range devices such as lighting, sensors and meters in homes and buildings. It runs in the 2.4 GHz band in most of the world and needs a coordinator or a gateway to reach other networks.

Related: Thread, Mesh network, Matter

Zinc-air battery Devices and sensors

A battery that takes oxygen from the air as one of its reactants, giving high energy for its size. It must be exposed to air to work and has a limited life once activated, so it suits some small, short-lived devices more than long-life sensors.

Related: Battery life, Energy harvesting, SoC

Zone Buildings

A part of a site or system treated as one unit, for example a fire zone, an HVAC zone or a security zone in IEC 62443, with its own rules and boundaries. Grouping by zone keeps rules, alarms and access manageable on large sites.

Related: IEC 62443, Geofence, VAV

Zoning (HVAC) Buildings

Dividing a building into areas, each with its own temperature control, because rooms facing the sun, crowded rooms and empty rooms need different heating and cooling. More zones mean better comfort and less energy wasted on empty space.

Related: VAV, Thermostat, Occupancy sensor