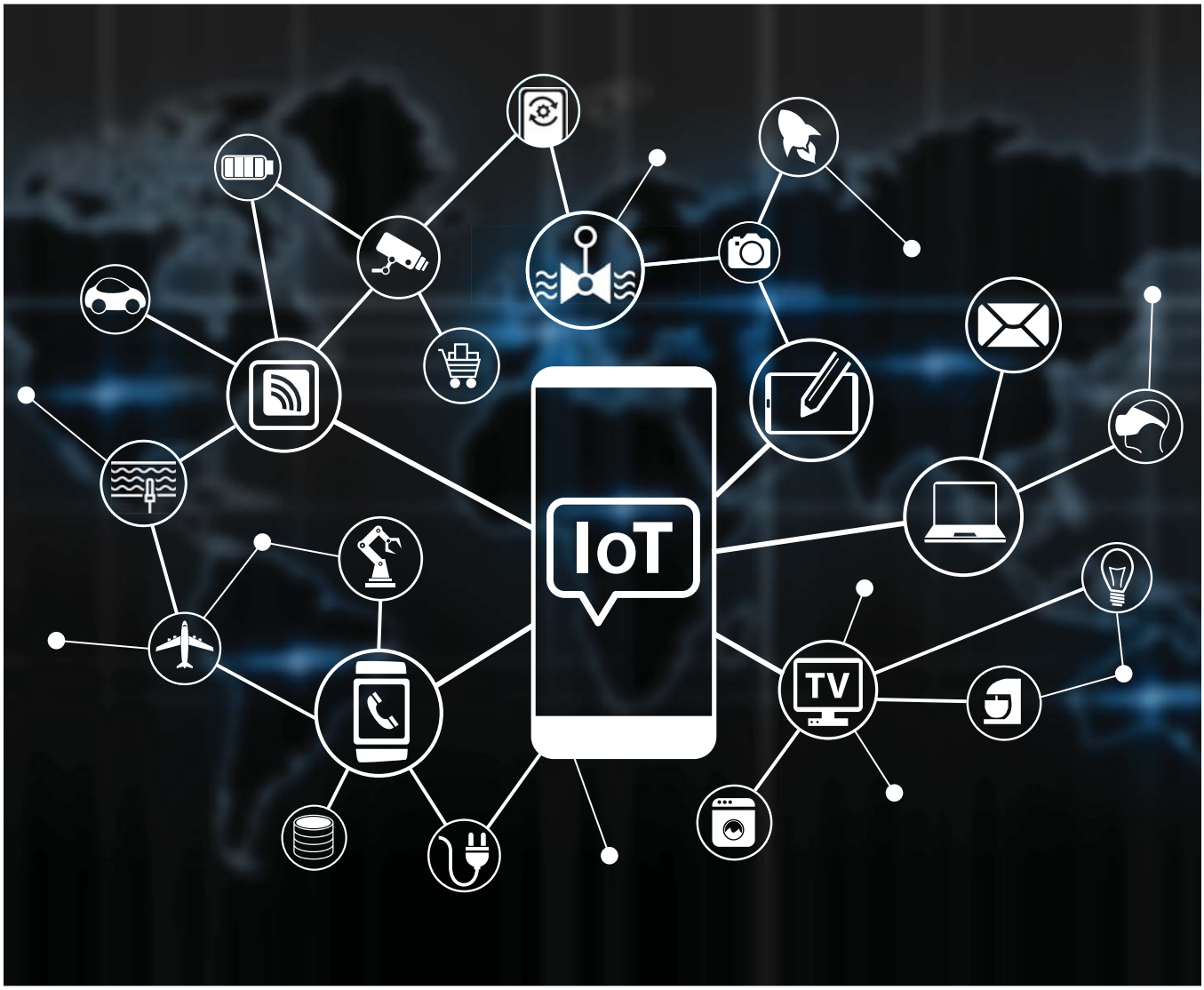

Internet of Things (IoT)
Glossary of Terms

BELIMO®

IoT Term	Description	Belimo Interest or Expanded Reference
3G (Third Generation)	Mobile communications technology which among others includes the UMTS standard.	Used with NFC connection to Belimo Cloud for temporary updates to devices like PR actuator.
4G (Fourth Generation)	Mobile communications that goes beyond 3G and is chiefly meant for ultra-broadband Internet connection with speeds of 100 megabit per second to mobile users.	Used with NFC connection to Belimo Cloud for temporary updates to devices like PR actuator.
6LoWPAN	A communication protocol which compresses Ipv6 packages for small, low power devices enabling them to communicate within the IoT.	Possible protocol to consider for sensors or edge devices.
Actuator	Actuators transform electrical signals (energy, usually transported by air, electric current, or liquid) into different forms of energy such as motion or pressure. This is the opposite of what sensors do, which is to capture physical characteristics and transform them into electrical signals.	Obviously important that we are part of IoT because we manufacture actuators.
Address of Device	An address is used for locating and accessing – “talking to” – a device, a resource or a service. In some cases, the ID and the address can be the same, but conceptually they are different.	We have address capabilities in the Energy Valve when it is connected to the internet.
API (Application Programming Interface)	One way for an application to present itself to another, typically remote, applications so that they can interact with it (for example, to read or write data to it). Often used as another term for a Web Service. Also refer to Open API.	Belimo's API can allow remote devices to speak through the Belimo cloud and to our smart devices. An example shown in the past, a Nest thermostat and a CM actuator.
Architecture	The fundamental organization of a system embodied in its components, their relationships to each other and to the environment, and the principles guiding its design and evolution.	

IoT Glossary

ARP (Address Resolution Protocol)	A communication protocol that is used to convert an IP-address into a physical address. With this ability computers can communicate with each other, despite only knowing each other's IP addresses, by sending an ARP request which informs them about the other computer's MAC address.	
Big Data	Describes the always-growing sums of data, as well as the problems that come with processing this massive flood of information.	All Belimo Smart devices contribute data to the stream of Big Data available to Building owners. It is both an opportunity and a challenge for Building Owners and System Integrators.
BTLE or BLE (Bluetooth Low Energy)	BTLE (Bluetooth 4.0) is a lower-energy-consumption version of Bluetooth wireless communications standard, which runs constantly, announcing a device's presence to local sensors and optimizing battery life for the device in question. In IoT, BLE allows for precise location and feature tracking without reduced battery life.	Possible connectivity method for Sensors.
Brownfield	An IT environment in which there are existing systems to be considered when implementing any new solutions.	
Business Logic	The code in an application that processes and executes the functional requirements of the application. Typically sits between any data stores and the end-user experience. In IoT the end user maybe another system.	This logic would be part of Belimo's Cloud Ecosystem where we have a Business application using Data stored in our Cloud.
Cloud	Highly scalable computer storage and memory capabilities located in a data center that enables flexible and rapid scale-up and scale-down of application resources. Cloud services can be public, private or a hybrid.	Belimo has our Cloud services based in Switzerland that serves as both our core Cloud and as our Business Application cloud. We are offering services related to our Energy Valve 3.0 currently.
Cloud Communication	Communication services being provided by third parties which can be accessed and used through the internet. The program Skype is the best-known cloud communication software.	

Connected Home	Where items within the home such as utilities are connected to the internet in order to derive greater value and benefit for the home owner(s) or product/service providers.	Belimo's residential solutions could be part of a connected home.
Connectivity	A generic term for connecting devices to each other in order to transfer data back and forth. It often refers to network connections, which embraces bridges, routers, switches and gateways as well as backbone networks. It may also refer to connecting a home or office to the internet or connecting a digital camera to a computer or printer. There are many methods in the world today. Some examples can be found in the glossary, look for Ethernet, 3G, 4G, LTE, BTLE, EnOcean, GSM, LTE, NFC, WiFi, Zigbee. Newer method being developed is LiFi.	In Belimo IoT Terms our current methods are hardwired Ethernet cable, NFC and WiFi. BACnet connections and Internet connection are not the same. A BACnet IP connection does not mean a devices is connecting to the Internet.
Controller	Anything that has the capability to affect a physical entity, like changing its state or moving it.	Both our Energy Valve and Zip Economizer are examples of specific task related controllers.
Credential	A record that contains the authentication information (credentials) required to connect to a resource. Most credentials contain a user name and password.	The security built into Belimo's IoT devices requires credentials. For example EV3 requires a Username and Password to get in to adjust parameters in the Webview.
Data Centre (center)	A data centre (center) is a location where most of the computer systems and the computing power of companies, or other large entities, are bundled.	
Device	Technical physical component (hardware) with communication capabilities to other IT systems. A device can be either attached, embedded inside a physical entity, or monitor a physical entity in its vicinity.	A device could be an actuator.
Device Discovery	The process of discovering devices within a network from the seed devices.	
Discovery	Discovery is a mechanism that will enable an application to access the IoT data without the need to know the actual source of data, sensor description, or location.	

Domain Model	A domain model describes objects belonging to a particular area of interest. The domain model also defines attributes of those objects, such as name and identifier. The domain model defines relationships between objects such as instruments produce data sets. Domain models help to facilitate correlative use and exchange of data between domains.	
Eccobee	A Canadian company that made the world's first WiFi-connected thermostat, only to spend the past three years watching the world fawn over its competitor Nest's futuristic design. Co-leader in the WiFi thermostat market, they are now broadening solutions for the commercial HVAC space. Their smart thermostat should be now an IoT hub because it can connect to multiple sensors in a building.	
Ecosystem (IoT)	Refers to the multi-layers that go from devices on the edge to the middleware. The data is transported to a place that has applications that can do the processing and analytics.	See the Belimo Ecosystem Diagram that shows our particular Ecosystem for the core cloud and the Business Applications Cloud.
Edge Computing	A method of optimizing cloud computing systems by performing data processing at the edge of the network, near the source of the data. Edge computing pushes applications, data and computing power (services) away from centralized points to the logical extremes of a network.	Belimo Intelligent (Smart) Devices like the Energy Valve are performing edge computing when things like the Delta T manager are utilized.
Edge Device	A type of networking device that connects an internal local area network (LAN) with an external wide area network (WAN) or the Internet.	When our PR actuator uses NFC to establish a connection through the cellular network to the internet the PR acts as an Edge device.
Edge of IoT	The edge of the IoT is where the action is. It includes a wide array of sensors, actuators, and devices—those system end-points that interact with and communicate real-time data from smart products and services.	All Belimo Smart devices that interact and communicate with the Internet are operating at the Edge of IoT.
eDiscovery	The collection, identification, archiving, and delivery of Electronically Stored Information (ESI) requested by legal teams and courts as part of an investigation, litigation, audit, industry compliance or other activity.	

Embedded Computing / Systems	A term for computing that is dedicated to a single purpose, as opposed to general-purpose computing. Embedded computer systems are special purpose and contain only the software and hardware needed to achieve those ends. In IoT, many systems are developed for specific purposes and made to work in concert with other systems.	
Energy-Harvesting Technologies	This (also known as power harvesting or energy scavenging) is the process by which energy is derived from external sources (e.g., solar power, thermal energy, wind energy, salinity gradients, and kinetic energy), captured, and stored. Frequently, this term is applied when speaking about small, wireless autonomous devices, like those used in wearable electronics and wireless sensor networks. Traditionally, electrical power has been generated in large, centralized plants powered by fossil fuels, nuclear fission or flowing water. Large scale ambient energy, such as sun, wind and tides, is widely available but technologies do not exist to capture it with great efficiency. Energy harvesters currently does not produce sufficient energy to perform mechanical work, but instead provides very small amount of power for powering low-energy electronics. While the input fuel to large scale generation costs money (oil, coal, etc.), the 'fuel' for energy harvesters is naturally present and is therefore considered free. For example, temperature gradients exist from the operation of a combustion engine and in urban areas, there is also a large amount of electromagnetic energy in the environment because of radio and television broadcasting.	Some sensors that use technologies like EnOcean have this capability.
EnOcean	An energy harvesting wireless technology used primarily in building automation systems, and is also applied to other applications in industry, transportation, logistics and smart homes.	Thermokon has some sensors that utilize EnOcean.
Fog Computing	Describes an approach where compared with Cloud Computing, IT performances are performed at the edge of the network, thus creating user proximity. This leads to lower service latency and denser geographical distribution. This is a CISCO term equivalent to Edge computing.	Fog Computing would be useful where Belimo Business Applications and Analytics need to stay inside a customer's buildings or network due to security requirements.

IoT Glossary

Gateway	A network device or software run on a computer in the network that can communicate with other networks, even if these use a different protocol. Offering the ability to share information.	
Geotagging	The process of tagging a photo, video or other types of media with coordinates such as marking its location.	
Global Storage	Storage that contains global information about many entities of interest. Access to the global storage is available over the Internet.	
GSM (Global System for Mobile Communications)	The most widely used digital cellular network and the basis for mobile communication such as phone calls and the short message service (SMS).	
Haystack (Project Haystack)	An open source initiative to streamline working with data from the Internet of Things. We standardize semantic data models and web services with the goal of making it easier to unlock value from the vast quantity of data being generated by the smart devices that permeate our homes, buildings, factories, and cities. Applications include automation, control, energy, HVAC, lighting, and other environmental systems. Haystack creates a data tag and definition that all the parties in the Haystack community agree on.	Belimo's Americas IoT Committee is looking at ways that our data tags can conform to Haystack naming to make our data more easily analyzed and identified.
Hosts	Computers that provide (host) certain services or resources within a network, which other participants within the network can then access and use.	
Hybrid Cloud	A mix of public and private cloud.	

IAAS (Infrastructure As A Service)	Refers to an on-demand business model for IT capacities. Instead of owning an IT infrastructure or server space you rent it and pay for it on a per-use basis. Those capacities are usually owned, maintained and provided by a cloud service. These are specific services that are essential for any IoT implementation to work properly. Such services provide support for essential features of the IoT.	
Identity	Consists of recognizable properties that are linked to an object, a person, etc. Those attributes expose the entity and allow for clear identification. If two things have the exact same attributes, they usually have the same identity because they can't be distinguished from each other.	
Industrial Internet	A term introduced by General Electric (GE) and stands for the convergence of machinery and smart data. It allows for constant and real time adjustments.	Could also be called Internet 4.0.
Internet 4.0	Used to describe the Internet of Things also stated as Ambient Internet.	
Internet of Everything	A term defined by Cisco Systems and basically means applying the IoT to everything, thus creating new capacities and smart processes in virtually every field we can think of. Cisco calls it the connection of “people, process, data and things”.	Belimo has 1500 VAV actuators connected to the IoT network at Cisco's innovation center in Toronto, Canada.
Interoperability	The term describes a system’s ability to share information and services with another system ideally based upon common standards. Much of the success of the IoT relies on the ability of connected devices to operate seamlessly and effectively together.	

IoT Glossary

IoT (Internet of Things)	A development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data. A state in which physical objects (things) having embedded technology to sense and communicate, being connected via an identifier such as a micro-chip/SIM. This will serve the communication among those things, closing the gap between the real and the virtual world and creating smarter processes and structures that can support us without needing our attention. It can be compared with the digital connection on the internet.	Belimo is already a part of the Internet of Things.
IoT Service	Software component enabling interaction with resources through a well-defined interface. Can be orchestrated together with non-IoT services (e.g. enterprise services). Interaction with the service is done via the network.	
IP (Internet Protocol)	One of the most fundamental protocols used for data communication on the Internet. Any device utilizing Internet Protocol can be referred to as an IP Device.	The Belimo Energy Valve is an Example of an IP device.
IPv6 (Internet Protocol Version 6)	A new version of IP, where the addresses are made up of 128 bits and the number of addresses possible is huge.	
Local Storage	Special type of electronic data storage that contains information about one or only a few entities in the vicinity of a device.	
Location Technologies	Location technologies like Global Positioning Systems (GPS) work to establish and communicate the location of a device to sensors around it. In the IoT, this capability serves to position a device or user within a system.	
Low-Power Radio Network	A network with limited range that enables smart objects to communicate with each other wirelessly; also referred to as Wireless Personal Area Network (WPAN). The standard IEEE 802.15.4, Bluetooth is another example of a low-power radio standard.	Possibly connectivity for sensors to smart devices.

LoRa Protocol (LoRaWAN)	A LPWAN specification deployed internally to enable IoT and M2M, intended for carrier networks of wireless, battery-operated things.	Many carriers are testing LoRaWAN as a possible technology to support IoT networks.
LTE (Long Term Evolution)	A mobile cellular standard that provides faster Down- and Upload speeds. Despite being marketed as a fourth generation standard it does not fulfill all of the technical requirements.	Used as part of NFC connection to Belimo Cloud for temporary updates to devices like PR BFV actuator.
M2M (Machine to Machine)	A typically closed network of devices in which they can communicate with one another and/ or other control systems located on the same network.	
Machine Learning	An application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.	An example would be IBM's Watson.
Machine Learning Algorithm	A mathematical model of data analysis that automates analytical model building. Using algorithms that iteratively learn from data, machine learning allows computers to find hidden insights without being explicitly programmed where to look.	This algorithm is very useful in both Cloud and edge computing. An example would be the heavily hyped, self-driving Google car.
Message Queueing Telemetry Transport (MQTT)	A lightweight messaging protocol for small sensors and mobile devices. Useful for connections with remote locations where a small code footprint is required.	Possibly protocol for sensors to Smart Devices.

Microcontroller	A small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of NOR flash or OTP ROM is also often included on-chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared with a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to control digitally even more devices and processes. Mixed signal microcontrollers are common, integrating analogue components needed to control non-digital electronic systems.	This type of device could be found in Belimo performance devices like an Energy Valve.
Modbus	A communication protocol that is mainly used to connect electronic devices. The Modbus Master (for example a computer) requests information from the Modbus Slaves (for example electronic thermometers). Up to 247 Slaves can transmit their information to one Master.	Available on some Belimo devices.
Nest	The Nest Learning Thermostat represents Google's first foray into the automated home market. Through regular use, the Nest learns your schedule, programs itself, and can be controlled from your phone, lowering heating and cooling bills by up to 20 percent.	Belimo's residential solutions interacted with the Nest cloud on some applications we have installed.
Body Area Network (BAN)	Body Area Network, also referred to as a Wireless Body Area Network (WBAN) or a Body Sensor Network (BSN), is a wireless network of wearable computing devices. BAN devices may be embedded inside the body, implants, or may be surface-mounted on the body in a fixed position, wearable technology, or may be accompanied devices which humans can carry in different positions, in clothes pockets, by hand or in various bags.	

Cellular Network	A radio network distributed over land through cells where each cell includes a fixed-location transceiver known as a base station. These cells together provide radio coverage over larger geographical areas. User equipment (UE), such as mobile phones, is therefore able to communicate even if the equipment is moving across cells during transmission.	
Low Power Wireless Network	Low power wireless network or 6LoWPAN concept originated from the idea that 'the Internet Protocol could and should be applied even to the smallest devices, and that low-power devices with limited processing capabilities should be able to participate in the IoT'. The 6LoWPAN group has defined encapsulation and header compression mechanisms that allow IPv6 packets to be sent and received over IEEE 802.15.4 networks. IPv4 and IPv6 are the work-horses for data delivery for local-area networks, metropolitan-area networks, and wide-area networks such as the Internet. Likewise, IEEE 802.15.4 devices provide sensing communication-ability in the wireless domain. The inherent natures of the two networks are, however, different.	
Personal Area Network (PAN)	The interconnection of information technology devices within the range of an individual person, typically within a range of 10 meters. For example, a person traveling with a laptop, a personal digital assistant (PDA), and a portable printer could interconnect them without having to plug anything in, using some form of wireless technology. Typically, this kind of personal area network could also be interconnected without wires to the Internet or other networks.	
NFC (Near Field Communication)	A set of wireless technologies which allows for simple and contactless exchange of data within very close distance.	Used on some Belimo products for several years globally. Recently introduced in the Americas on the new PR Butterfly Valve Actuator as a means to connect a Mobile device like a Smart Phone to the Actuator for the purpose of programming and creating a temporary Internet connections for updates and possibly to share data.

IoT Glossary

Node	A connection point, a redistribution point or a communication endpoint. The definition depends on the network and the protocol layer referred to. A network node is an active electronic device that is attached to a network and is capable of creating, receiving or transmitting information over a communications channel.	
Object	A 'thing' in IoT (in contrast to the digital and network connection shared between these systems). This could be household appliances, wearable technology, security systems or other connected devices. Refer to Thing.	Similar term used in BACnet to identify a device like a actuator or Sensor.
Observer	Anything that has the capability to monitor a physical entity, like its state or location.	
Open API	A publicly available application programming interface that provides developers with programmatic access to a proprietary software application or web service.	Belimo has an Open API that could allow other developers to create applications that analyze the data in a Belimo intelligent device.
Open Source	Code freely available for anyone to modify and redistribute. This stands in contrast to a proprietary system. Readily available Open Source software is fueling a great deal of advancement in the IoT, as developers from all walks of life try their hand at innovation.	
Pervasive Computing	Pervasive computing (also called ubiquitous computing) is the growing trend towards embedding microprocessors in everyday objects so they can communicate information. Such computing devices are completely connected and constantly available.	An example is the smart refrigerator.
Pervasive Sensing	The ubiquitous capabilities in sensing device activity or condition changes: regarded as essential in IoT, often applied to the sensing of human activity by a system.	
Platform As A Service (PAAS)	Cloud service platform which provides web developers with all the infrastructure they need to develop and run an application.	

Power over Ethernet (PoE)	Technology for wired Ethernet LANs (local area networks) that allows the electrical current necessary for the operation of each device to be carried by the data cables rather than by power cords. Doing so minimizes the number of wires that must be strung in order to install the network.	Some BAS control manufacturers have started to introduce this in their product line. Currently offered in North America by Delta Controls and Distech, but others will follow soon.
Power over WiFi (PoWiFi)	Technology that can convert signals sent by wireless routers into direct current. A continuous stream of low power signals can be harvested from inactive WiFi hotspots.	
Raspberry Pi	A credit-card sized personal computer that plugs into a TV and a keyboard.	
Remote Monitoring and Control	Automated monitoring and control of devices, technologies and or processes.	
Representational State Transfer (REST)	An architecture for web standards, especially for the HTTP protocol. It is supposed to simplify the design of network applications compared with, for example, SOAP. An architecture for representing entities exposed by a Web Service in order to interact with them (Create, Read, Write, Delete). Has become very popular as a more efficient alternative to traditional SOAP Web Services.	Currently used on Energy Valve 3.0.
Radio Frequency Identification (RFID)	The use of electromagnetic or inductive coupling in the radio frequency portion of the spectrum to communicate to or from a tag through a variety of modulation and encoding schemes uniquely to read the identity of an RFQ Tag. A method to identify objects (including humans) through electromagnetic waves without actual physical contact. This way, data can be gathered more easily. An object or creature is equipped with a transponder which transmits data to an electronic reader. Other than, for example, barcodes, the information can be read without a line of sight and in some cases operating distance can be over a kilometer.	
Supervisory Control And Data Acquisition (SCADA)	A computer system which gathers real-time data to monitor and control systems or processes.	Mostly used in industrial control applications.

IoT Glossary

Sensor	To determine certain physical or chemical characteristics and transform them into an electrical signal to make them digitally process able. Sensors form the backbone of the IoT, helping to bridge the gap between digital and physical.	
Sensor Hub	A technology which connects sensor data and processes it. The hub does part of a data-processing job.	
Single Sign-On	Ability to enter a name and password only once to get to several password protected systems in one working period. Once the user has logged in, a central network application grants access to all the resources to which the user is entitled.	
Smart Buildings	Buildings designed and equipped to try to minimize costs and environmental impact. This is achieved by connected systems and efficient use of energy through new, automated technology that intelligently responds to certain circumstances (available solar energy, temperature inside the building, etc.)	
Smart Cities	A concept that tries to create a more intelligent city infrastructure by using modern information and communication technologies. Smart cities are about a more flexible adaptation to certain circumstances, more efficient use of resources, improved quality of life, fluent transportation and more. This will be achieved through networking and integrated information exchange between humans and things.	
Smart Grids	Grids which coordinate energy use and distribution. This enhances efficiency and becomes more and more important because of renewable energies which are not always as reliable as other forms of energy.	

Smart Home	Refers to the networking of household devices and systems through information and communication technology. This way, processes within a household can be monitored and controlled automatically to optimize quality of life, costs, security and environmental impact.	
Smart Meters	Electronic devices which measure and display resource consumption (of water, gas, electricity, etc.) and communicate this information to third parties (mainly control systems). This allows for a more efficient distribution, usage and control of these resources.	
Software As A Service (SaaS)	Software delivered to the user and updated via the internet. Typically enabled by a cloud service that hosts the software. Often there is no software installed on the user's device but it is accessed via a web browser. Although this is not a requirement of SaaS, for example, Adobe and Microsoft both deliver applications that are installed on the user's device through a SaaS model.	
Tag	A label or other object used to identify the physical entity to which it is attached.	
Thing	In the phrase 'IoT', the word 'thing' denotes a physical entity (in contrast to the digital and network connection shared between these systems). This could be household appliances, wearable technology, security systems, or other connected/connectable devices.	
Unconstrained Network	A network of devices with no restriction on capabilities such as storage, computing power, and/or transfer rate.	
Virtual Entity	Computational or data element representing a physical entity. Virtual entities can be either active or passive.	

Wearable Technology (aka Wearable Tech)	Technologies or computers integrated into articles of clothing or accessories. The most prominent example, the Apple watch. Wearable technology, like the Jawbone Up and Fitbit activity trackers are the main focus areas of the IoT. Devices like these often work by gamifying real-life tasks, bringing people into the device's ecosystem, and generating data that can be analyzed to improve products and lifestyles.	
Wireless Communication Technologies	The transfer of information over a distance without the use of enhanced electrical conductors or 'wires'. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications). When the context is clear, the term is often shortened to 'wireless'. Wireless communication is generally considered to be a branch of telecommunications.	Currently Belimo has both NFC and WiFi technologies used for wireless communication.
Wireless Sensors And Actuators Network (WSAN)	Networks of nodes that sense and potentially control their environment. They communicate the information through wireless links enabling interaction between people or computers and the surrounding environment.	
ZigBee	A low-power radio protocol for small amounts of data, based on the IEEE 802.15.4 standard. It has low power consumption, a range of about a 100 meters and a bandwidth of 250 kbps. IoT staples like the Nest thermostat and Hue light bulb both use Zigbee chips.	Used more on consumer products but could migrate to commercial sensors and devices.

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