A Non-Geek's A-to-Z Guide to the Internet of Things

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Introduction

Defining the Internet of Things isn't easy. When it's defined in terms of market size, some focus on the potential revenue (it's in the trillions), while others focus on the number of potential "things" (it's in the billions). Some definitions focus on the exponential growth of sensors, excluding smartphones, tablets and desktop computers, while others only consider devices with an IP address. Whether these definitions and forecasts are accurate or not, it can be downright confusing.

How would you define the Internet of Things (or IoT, as it is commonly called)? If you were to ask 20 people, you would most likely end up with 21 different definitions, including yours. And guess what? That's OK. It's not important that we all agree on a single definition. What's important is that we understand the context or frame of reference in which the Internet of Things is being discussed.

A good case in point is "big data." When the term started to become popular in 2011, almost every article, research report, interview and panel discussion for the next few years began with a definition of big data. Was it necessary to define each time? Yes. And it still is. Because authors and speakers are responsible for providing the proper context for readers and listeners – especially when it involves complex terms like big data and the Internet of Things.

Different Ways to View IoT

While you won't find a canonical definition of IoT in this guide, it's still interesting to note how different organizations describe it. Here are a few:

- IoT is about extending the power of the internet beyond computers and smartphones to a whole range of other things, processes and environments. *(IoT for All)*

- IoT is the extension of internet connectivity into physical devices and everyday objects. Embedded with electronics, internet connectivity and other forms of hardware (such as sensors), these devices can communicate and interact with others over the internet, and they can be remotely monitored and controlled. *(Wikipedia)*

- IoT refers to a vast number of "things" that are connected to the internet so they can share data with other things – IoT applications, connected devices, industrial machines and more. Internet-connected devices use built-in sensors to collect data and, in some cases, act on it. *(SAS)*

These descriptions highlight IoT's common traits – connectivity, "things" and data (or information) – while giving us a good sense of the tremendous impact IoT has on life as we know it.

About This Guide

This A-to-Z guide includes 101 common terms related to the Internet of Things. It's not an exhaustive list of terms, given that IoT is evolving so quickly, but rather a quick go-to resource for the anyone who wants to get a handle on this vast IoT ecosystem. Even though this guide is for the "non-geek," it does include some technical terms – but they are explained sans technical "geek speak."

We also want to help you understand how a term may be connected to a larger discussion. The index on the next page will help you with that. It groups the terms by category, such as "analytics" or "connectivity," so that it's easier to quickly grasp a group of related terms (and their broader categories).

Each category also has a colored icon to represent it – and throughout the guide, each term is tagged with the relevant category icon. For example, indicates all terms in the "wireless" category.

TAKE A DEEPER DIVE
on the Internet of Things

Click the links to check out our in-depth pages and learn more about:

- The Internet of Things: What it is and why it matters.
- Getting started with the Internet of Things.
- IoT solutions from SAS.
- SAS IoT ecosystem partners.

ANALYTICS

Advanced algorithms
Advanced analytics
APIs
Big data analytics
Descriptive analytics
Platform
Predictive analytics
Prescriptive analytics
Streaming analytics

APPLICATIONS

Connected customer
Connected factory
Connected vehicle
Smart city
Smart grid
Smart home

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI)
Artificial Intelligence of Things (AIoT)
Augmented reality (AR)
Chat(ter)bot
Cognitive computing
Computer vision
Deep learning
Edge AI
Facial recognition
Machine learning
Machine-to-machine (M2M)
Natural language processing (NLP)
Neural network
Speech recognition
Vehicle-to-vehicle (V2V)
Voice assistant

CAPABILITIES

Automation
Digital transformation
Legacy
Monetization
Optimization
Real time
Smart
Ubiquitous

COMPUTING

Cloud computing
Edge computing
Fog computing
Graphics processing units (GPUs)
Grid computing
Integration
Virtual reality (VR)
Yottabyte

CONNECTIVITY

Botnet
Connected
Geofencing
GPS
Internet of Everything (IoE)
Interoperability
Mirai
Network
Protocol
Proximity network
RFID
Standards

DATA

Big data
Data lake
Data streaming
Governance
Privacy
Quality
Security

DIGITAL CURRENCY

Bitcoin
Blockchain
Cryptocurrency
Digital currency
Ethereum

INDUSTRIES

Health care
Industrial IoT
Manufacturing
Retail
Telecommunications
Transportation
Utilities

PEOPLE

Collaboration
Data scientist
Hacker
Innovation
Jobs
Kevin Ashton
Talent

THINGS

Drone
Mobile device
Quantified self
Sensor
Things
Wearables
Xcoffee

WIRELESS

4G LTE
5G
Bluetooth
LoRa
Mesh networking
Wi-Fi
Wireless
Zigbee
Z-wave

Jump to Entries: A-C | D-H | I-M | N-R | S-Z | Return to Introduction

The 101 TERMS in Alphabetical Order

4G LTE

4G LTE is a high-speed wireless network. On mobile devices, connection speeds are at least 100MB/second; on stationary devices, speeds are at least 1GB/second.

5G

5G is the next generation of mobile networks beyond LTE. 5G supports more users and IoT data in a given density versus making speeds faster. 5G is needed to handle expanded network volumes due to the enormous growth of IoT devices.

ADVANCED ALGORITHMS

An algorithm is a software procedure (i.e., a set of instructions designed to perform a specific task). Consider that algorithms determine what data you see in your Google search results or Facebook news feed. Over time, algorithms are modified to improve performance, efficiency or accuracy. Advanced algorithms are developed and combined in new ways to analyze more IoT data faster, and at multiple levels – which is key to identifying and predicting rare events, understanding complex systems and optimizing unique scenarios.

ADVANCED ANALYTICS

As SAS Chief Technology Officer Oliver Schabenberger puts it, "Data without analytics is value not yet realized. Wherever there is data, there should be analytics." This is especially true of IoT data. For example, advanced analytics allows companies to conduct what-if analyses and understand the impact of changing a business strategy. Advanced analytics includes artificial intelligence and related technologies like machine learning, predictive analytics, data mining, big data analytics, forecasting, text analytics, optimization and simulation.

APIs

APIs, or application programming interfaces, are portable packages of code that make it possible to add AI functionality to existing products and software packages. They can add image recognition capabilities to home security systems, Q&A capabilities to describe IoT data, create captions and headlines, or call out interesting patterns and insights in IoT data.

ARTIFICIAL INTELLIGENCE (AI)

Artificial intelligence makes it possible for machines to learn from experience, adjust to new inputs and perform humanlike tasks. Most AI examples that you hear about today – from chess-playing computers to self-driving cars – rely heavily on deep learning and natural language processing (NLP). Using these technologies, computers can be trained to accomplish specific tasks by processing large amounts of IoT data and recognizing patterns in that data.

ARTIFICIAL INTELLIGENCE OF THINGS (AIoT)

AIoT refers to the merging of AI and IoT. We can use advanced analytics and AI to gain intelligence from high volumes of diverse data that's generated by IoT sensors, devices and machines. But there's no need to collect the data if you don't have an aggressive plan to analyze it and act on it. IoT and AI together (AIoT) accelerate insights that drive business performance.

SAS and AIoT

Read about SAS and the Artificial Intelligence of Things to discover how AI and IoT work hand-in-hand to transform industries, elevate customer experience and accelerate business performance.

AUGMENTED REALITY (AR)

AR is the blending of virtual reality and real life. AR appeals to the senses by inserting computer-generated sounds, videos, graphics or GPS data into an existing real-life setting. AR is converging with IoT; for example, data from hundreds of sensors can be visualized simultaneously, overlaying relevant and useful information from your environment through a headset.

AUTOMATION

The automation of data-driven decisions and actions is an obvious direction for the Internet of Things (and Industrial IoT). Analyzing all this IoT data will be a hefty task in itself, but the ability to automate decisions and actions based on this analysis will separate the leaders from the laggards in this IoT race.

BIG DATA

Big data refers to exponentially increasing volumes, varieties and velocities of data, which has pushed computing systems and processes to their limits. Big data became all the rage in 2011. What we know now is that it was just the opening act for what we now call IoT data.

BIG DATA ANALYTICS

Big data analytics is a subset of advanced analytics. It allows you to examine large volumes of data to uncover hidden patterns, correlations, market trends and other insights. With today's big data technology, you can get answers to your business questions a lot quicker than with your traditional BI tools.

Here's a Handy List of Our Primer Pages on Hot Topics (A–C)

- Artificial intelligence.
- Big data.
- Big data analytics.
- Blockchain.
- Cloud computing.
- Computer vision.

BITCOIN

Bitcoin is a cryptocurrency powered by the blockchain. Unlike government-issued currencies, bitcoin is operated by a decentralized authority and provides lower transaction fees than traditional payment mechanisms.

BLOCKCHAIN

Blockchain is the technology that powers bitcoin. It's a type of data store that stores everything of digital value. Each new transaction is stored in a block that gets added to a chain of existing records, so it serves as a public ledger of all transactions. Updates are validated through a public verification process. Blocks of transactions are added in a linear, chronological order through cryptography, ensuring that the blockchain is a tamper-proof record of all transactions on the network.

BLUETOOTH

A radio broadcast communication system that allows you to exchange data over a short distance, typically 30 feet (but it can range from three to 300 feet). Bluetooth is commonly used with portable devices, many of which are IoT devices.

BOTNET

Also called a zombie army, a botnet is a collection of connected things (basically anything with an IP address) that has been set up to forward transmissions – typically spam or viruses – to another unsuspecting machine or device on the internet. This often forces the machine or device offline. The owners of these connected things are not aware that their thing has been part of a botnet – highlighting a key reason why IoT security is so important.

CHAT(TER)BOT

Similar to a voice assistant, chatbots are services you access through a chat interface. Some chatbots are powered by AI and some by a set of rules. Typically, a chatbot provides you with a single service, like updating the latest weather or news, helping pick out groceries or scheduling a meeting.

CLOUD COMPUTING

Cloud computing is a major player in IoT. Like grid computing, cloud computing reduces costs by maximizing existing resources. The difference is that in cloud computing, an app doesn't access these resources directly. Instead, it accesses resources indirectly through a service, which in turn engages the physical resources necessary to respond to the app. Cloud is essential when actions require significant computing power; it's the logical choice when time to insight is not critical.

COGNITIVE COMPUTING

Imagine asking a machine a question (like you do with Siri® or Alexa) and having the machine answer in a natural, humanlike manner. Then imagine the machine providing you with additional information about your question that you never thought to ask, along with a narrative summary and suggestions on how to analyze further. This is how cognitive computing works. It brings the "smarts" to IoT.

COLLABORATION

Collaboration can be tough, especially within your organization. But it's only going to get tougher as IoT matures. IoT not only requires increased collaboration and cooperation within your own organization, but also between technology vendors, the developer community, security firms, the open source community and government agencies. IoT is changing the game of how we all get along.

COMPUTER VISION

Computer vision enables computers to gain a high-level understanding from digital images or videos. It relies on pattern recognition and deep learning to recognize what's in a picture or video. When machines can process, analyze and understand images, they can be set up to capture images or video in real time and interpret their surroundings.

For IoT, "connected" rules the world.

Check out these "connected" articles to learn more.

- Connected consumer.
- Connected (or "smart") factory.
- Connected supply chain.
- Connected vehicles.

CONNECTED CUSTOMER

Have a smartphone? Then consider yourself connected. Whether you're commuting to work, shopping or eating at a great restaurant, your favorite businesses and sites are using IoT to make sure you remain a connected customer, 24/7.

CONNECTED FACTORY

Industrial IoT is improving how factories operate. By using streaming data in real time, manufacturers with connected factories can respond faster to changing conditions, tune their operations for peak performance and maximize the value gained from factory investments.

CONNECTED VEHICLE

The race is on. Automakers and tech companies alike are building out a new generation of smart, connected vehicles. Not only are they making cars safer to drive, they're also accessing and analyzing data directly from the vehicle to enhance customer experience, improve product development and manufacturing processes, and accelerate business performance.

CONNECTED AND CONNECTIVITY

Ease and effectiveness characterize the quality of being connected. This is especially important for consumers as the world becomes smarter and more connected, one step at a time. IoT connectivity boils down to how things connect to each other. Connections can be wired or wireless. This guide highlights some of the more popular "non-geek" connections: 4G LTE, 5G, Bluetooth, GPS, LoRa, mesh networking, RFID, Wi-Fi, Zigbee and Z-Wave.

CRYPTOCURRENCY

It's a type of digital currency that uses cryptography for security and anti-counterfeiting measures. Public and private keys are often used to transfer cryptocurrency between people. Bitcoin is a popular cryptocurrency.

DATA LAKE

A data lake is essentially a storage repository that can hold all types of data in its original format. Unlike a data warehouse, the data doesn't have to be cleaned up or structured before it's stored. This makes it easy for organizations to quickly capture and store all their big IoT data.

DATA SCIENTIST

SAS defines data scientists as a new breed of analytical data experts who have the technical skills to solve complex problems and the curiosity to explore what problems still need to be solved. There are good reasons to learn more about data scientists and what they do – you might even decide to become one.

DATA STREAMING

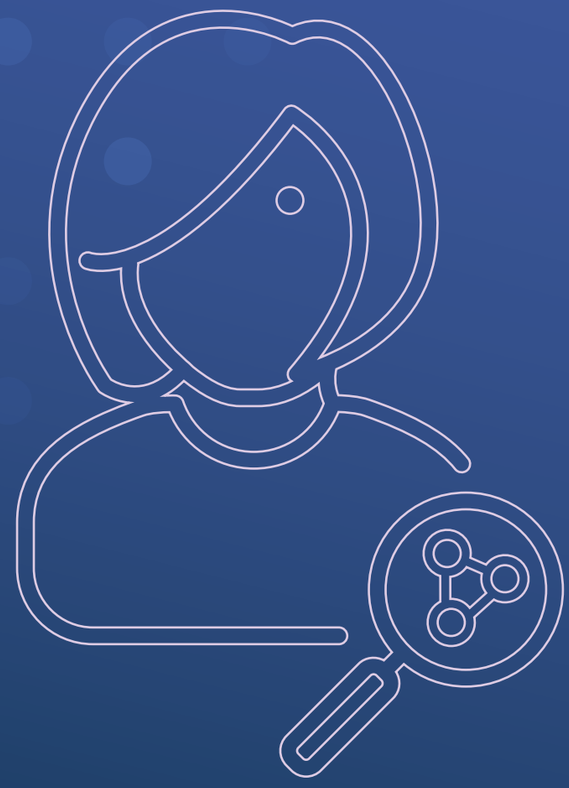
Real-time data streaming processes data on the fly instead of waiting to process it after it's been stored in a database. Data streaming is important, because waiting could mean that it's too late to respond. Fraud detection, network monitoring, e-commerce and risk management are popular applications of data streaming.

Data scientists: Who are they – and would you like to be one?

These analytical data experts are part mathematician, part computer scientist and part trend-spotter.

Check out the SAS® Academy for Data Science.

By the way, students, teachers and professors can get SAS University Edition for free!



DEEP LEARNING

Deep learning is a type of machine learning that trains a computer to perform humanlike tasks, such as recognizing speech, identifying images or making predictions. Instead of organizing data to run through predefined equations, deep learning sets up basic parameters about the data and trains the computer to learn on its own by recognizing patterns using many layers of processing.

DESCRIPTIVE ANALYTICS

Descriptive analytics is the simplest form of analytics. Its primary purpose is to answer the question: "What has happened?" It transforms large volumes of stored data into useful summaries of insightful information. Descriptive analytics is a foundational component in many BI/data visualization environments.

DIGITAL CURRENCY

Digital currencies are intangible, electronic payment methods that can be used to purchase goods and services through the internet. They allow for instantaneous transactions and borderless transfer of ownership and they eliminate the middle man, such as a bank. Cryptocurrencies and virtual currencies are two types of digital currencies.

What do drones, AI and proactive policing have in common? Data.

What if you could use smart machines to fight crime and make communities safer? It's no longer futuristic. This type of proactive policing may be coming soon to a community near you.

Read more about it in the article.

DIGITAL TRANSFORMATION

Digital transformation refers to using digital technology to drastically change how businesses operate and serve customers. This parallels what the IoT journey is all about: transforming our analog world into a digital one. So, whether we're digitizing a document (e.g., scanning a PDF) or digitalizing our city, it's all part of making our world smarter and more connected.

DRONE

A drone is essentially a flying robot. Specifically, it's an unmanned aircraft guided by remote control. Drones started with the military. But today, consumers are buying drones with cameras; delivery companies use drones to deliver groceries; insurance companies use them to simplify damage assessments; utilities use drones to reduce operations and maintenance costs; and farmers use them to help with crop management.

EDGE AI

Edge AI happens when AI techniques are embedded in IoT endpoints, gateways and other devices at the point of use. Devices must be able to process data on their own to use edge AI. Self-driving cars are an example of edge AI at use in the everyday world.

EDGE COMPUTING

In a traditional IoT architecture, the data that's collected or generated by a thing is often sent to the cloud for storage and analysis. This sends a lot of unnecessary data, so it takes up bandwidth and slows response times. Edge computing helps reduce IT costs because you can select which data to move and which to store for deeper analysis. Edge computing focuses on physical devices (such as routers, switches, integrated access devices (IADs), multiplexers and network access devices) that are attached to or embedded into a thing, such as a cell tower, industrial machinery or other physical asset.

Edge Computing: Delivering a Competitive Boost in the Digital Economy

Learn more about how edge computing – including AI and machine learning – allows companies to process data on the spot and get ahead of their competitors.

Read the article now.

ETHEREUM

Ethereum is a platform that offers many benefits for IoT. It uses its own decentralized public blockchain to store, execute and protect smart contracts securely. For example, with Ethereum, your washing machine could request more detergent from your grocery store and provide an automated payment.

FACIAL RECOGNITION

How would you like to unlock your door with your face? It's possible with facial recognition software, which uses facial features in a digital image or video frame to identify a person. Making our smart homes more secure is just the beginning of how facial recognition is converging with the Internet of Things.

FOG COMPUTING

Fog computing works with a local area network (LAN). Data is gathered, processed and stored within the network via an IoT gateway or fog node. Fog computing allows companies to logically and efficiently distribute data, compute, storage and applications between data source and cloud – based on what makes sense for the desired outcome. Both fog and edge computing tackle the same problem – in different ways.

GEOFENCING

Geofencing uses GPS and RFID technologies to create a virtual geographic boundary, like around your home property. A response is then triggered any time a mobile device enters or leaves the area. It's another smart way to turn the lights off when you leave and on when you get back home.

GOVERNANCE

When big data arrived on the scene, companies began asking about big data governance frameworks. That was the wrong question. What they needed to do was extend their existing data governance framework to address big data. The same holds true for IoT data.

GPS

GPS is another way our things – like our smartphones, fitness bands and connected cars – keep track of where we are and where we're going. The Global Positioning System (GPS), originally developed by the US Department of Defense, is a free satellite-based navigation system that works anywhere, at any time, under all weather conditions.

GRAPHICS PROCESSING UNITS (GPUs)

Graphics processing units provide the heavy compute power that's required for iterative processing in AI. Training neural networks requires big data (IoT data) plus compute power.

GRID COMPUTING

Grid computing is another major player in IoT. Like cloud computing, grid computing reduces costs by maximizing existing resources. This is accomplished with multiple machines working together to solve a specific problem. It's especially powerful with number-crunching problems.

HACKER

A hacker is a highly skilled computer expert capable of breaking into computer systems and networks using bugs and exploits. "White Hats" are ethical hackers who specialize in making sure an organization's information systems are secure. "Black Hats" are hackers who maliciously break into a system to destroy files, steal data, etc., for some future purpose, like blackmail or ransom. "Grey Hats" may violate laws or ethical standards, but not with malicious intent like a Black Hat. The weak (or missing) security within the IoT ecosystem, existing and future, makes it a rich playground for the hacker community.

HEALTH CARE

IoT is affecting the health care industry in a major way. Many of us use wearables to monitor our physical activity, sleep patterns and other health-related habits. Hospitals use IoT sensors to better monitor patients and track equipment. This is just the beginning of how IoT will be used to improve our health and help save lives.

Watch a video to learn why data, analytics, AI and IoT are at the heart of innovation.

IoT in Health Care: Unlocking True, Value-Based Care

The connectivity enabled by IoT is rapidly reshaping how medical care is delivered – through value-based health care, personalized medicine and patient centricity. The results? Better patient outcomes and lower costs.

Read the article to learn more.

INDUSTRIAL INTERNET OF THINGS (IIoT)

IIoT is the use of IoT technologies in manufacturing and is part of the Industry 4.0 trend. It incorporates machine learning, big data technologies, sensor data, M2M communication and automation technologies. By connecting all phases of the IIoT process, manufacturers get a cohesive view of production, process and product data – helping prevent downtime, maximize equipment performance, enhance customer experience and more.

INNOVATION

When it comes to IoT, the truth is that innovation is less about technology and more about the creative and disruptive transformation of business processes, many of which are decades old. Process innovation – for instance, streaming a patient's secure vital signs to the smart device of a specialist thousands of miles away – can not only save time and money. It can save lives.

INTEGRATION

Data silos are an age-old issue and data integration is an age-old challenge. With the growing volumes of big data, IoT data and data silos, organizations are being forced to address integration in a more comprehensive way. This is a must-do for any data-driven organization.

INTERNET OF EVERYTHING (IoE)

A term originally coined by Cisco, IoE is the intelligent connection of people, data, processes and things. In essence, IoE adds network intelligence to IoT.

INTEROPERABILITY

The success of IoT in your organization may very well be dependent on your ability to get your ecosystem of IT systems and software applications communicating and exchanging data more efficiently and effectively with each other. This is called interoperability. Your systems have to talk to each other for the data to be combined.

JOBS

The projected growth of IoT (market size, number of devices) over the next five years is mind-blowing. Not only will data scientists continue to be in high demand – but watch for jobs in data security and cloud computing to increase, too. We'll also see a whole host of new roles rise. Does anyone want to be a wearable tech designer?

KEVIN ASHTON

The term "Internet of Things" was coined by entrepreneur Kevin Ashton, one of the founders of the Auto-ID Center at MIT. Ashton was part of a team that discovered how to link objects to the internet through an RFID tag. He first used the phrase Internet of Things in a 1999 presentation – and it has stuck around ever since.

LEGACY

If IoT is about getting things connected to the internet, what are organizations doing if they have value-adding things that weren't designed to connect? One approach is to develop IoT strategies that drive technology/process improvements and enhancements for existing (legacy) investments. Whatever your approach, one thing is certain: Doing nothing is not a sustainable option.

More Primer Pages on Hot Topics (D–M)

- Data scientist.
- Deep learning.
- Digital transformation.
- Machine learning.

LORA

LoRa is a long-range, low-power wireless platform that's being used to build IoT networks worldwide, especially by smart cities and communities. It securely transmits data and is being integrated into many things, including connected vehicles, street lights and home appliances.

MACHINE LEARNING

Machine learning (ML) automates analytical model building. It uses methods from neural networks, operations research and physics to find hidden insights in IoT data without being explicitly programmed where to look or what to conclude. For example, Facebook uses ML to dynamically personalize your news feed based on what you're stopping to read, like and comment on. ML helps make our IoT data smart.

MACHINE-TO-MACHINE (M2M)

Some say this is where IoT got its start. M2M began when mobile devices started to become smart and were able to connect and send data to other devices through cellular (or wired) networks. M2M typically refers to isolated instances of device-to-device communication, while IoT has a broader scope by automating and managing communication between multiple devices.

MANUFACTURING

Manufacturing is one of the early adopters of IoT and is often referred to as Industrial IoT. Data-collecting sensors embedded in smart factory machinery or warehouse shelves can communicate problems or track resources in real time, making it easy to work more efficiently and keep costs down.

MESH NETWORKING

In a wireless mesh network, the network is spread out among dozens of things that communicate with each other. The more things in the mesh network, the stronger the network. Only one thing, called the controller, needs to be hardwired to the internet via a modem/router. Mesh networks are growing in popularity in smart homes, especially Zigbee and Z-Wave.

MIRAI

Mirai is popular malware program that turns Linux-based machines into bots that can be used as part of a botnet in a large-scale network attack. Mirai tends to target remote cameras and home routers by using the default passwords that come with the devices. It's a cautionary reminder to always change the password on all devices that are added to your network, at work or home.

MOBILE DEVICE

A mobile device is a portable, handheld computer, like a smartphone, tablet or DSLR camera. They are battery powered and typically connect via Wi-Fi, Bluetooth and/or a cellular network.

MONETIZATION

Companies are looking for ways to monetize their IoT data. Here are four possible approaches: (1) improve internal processes, (2) enhance existing products/services, (3) enhance the customer experience, and (4) develop new digital products/services.

NATURAL LANGUAGE PROCESSING (NLP)

Natural language processing is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language. NLP draws from many disciplines, including computer science and computational linguistics, in its pursuit to fill the gap between human communication and computer understanding.

NETWORK

A computer network, also called a data network, uses a mix of wired and wireless technologies to connect "endpoints" (servers, personal computers, phones, etc.) so they can transmit, receive and exchange data, voice and video traffic. Each endpoint has a unique identifier, often an IP address or media access control (MAC) address, to identify the source and destination of the transmission. This is the foundation upon which the Internet of Things is built.

NEURAL NETWORK

Neural networks are computing systems with interconnected nodes that work much like neurons in the human brain. Using algorithms, they can recognize hidden patterns and correlations in raw data, cluster and classify it, and – over time – continuously learn and improve. Neural networks support diverse tasks like computer vision, speech recognition, machine translation and medical diagnosis.

OPTIMIZATION

Optimization happens when business scenarios are improved mathematically using data. Improvements in data collection, storage and processing have made analytics more responsive, scalable and efficient just at the time when IoT data is making big data even bigger. The result is that organizations can realistically use real-time available data (as opposed to sampling and extrapolation) to optimize their operations.

More Primer Pages on Hot Topics (N–P)

- Natural language processing.
- Neural networks.
- Predictive analytics.

PLATFORM

An analytics platform is a must-have for the data-driven organization, especially if IoT data is involved. It's a software foundation that makes it easier to derive insights from your data in any computing environment and supports every phase of the analytics life cycle – data, discovery and deployment. SAS® Viya® is a strong example.

PREDICTIVE ANALYTICS

Predictive analytics is the next step after descriptive analytics. Its primary purpose is to answer the question: "What could happen?" It uses the data you have to predict the data you don't have. It's not a fortune teller, though. Its job is to help you understand the future based on the data you provide.

PRESCRIPTIVE ANALYTICS

Prescriptive analytics comes after predictive analytics. Its primary purpose is to answer the question: "What should we do?" It can recommend one or more courses of action and show you the likely outcome of each decision. Self-driving cars live and breathe off of prescriptive analytics.

PRIVACY

Big data privacy isn't a discussion reserved for data geeks and privacy freaks anymore. It's for all of us. With data and things growing at an alarming rate, we can no longer afford to sit on the sidelines. We each need to take proactive steps to protect our data and our privacy.

PROTOCOL

A protocol is a set of communication rules for hardware and/or software that define how two or more entities are to communicate with each other. For example, HTTP is a protocol. For a protocol to be accepted, the participating parties must agree on the rules. A protocol may be developed into a standard to help reach an agreement.

PROXIMITY NETWORK

Also called a near-me area network (NAN), a proximity network allows devices in close proximity to wirelessly communicate with one another. For example, two smartphones with different mobile carriers can communicate, even though the communication path could be a long distance (i.e., going from one phone's LAN through the internet to the other phone's LAN).

QUALITY

One of the challenges of IoT data, such as sensor data, is the sheer volume and velocity at which it's being created. The tricky part is to quickly identify and isolate the "right" data for analysis. Once identified, this is the data you'll want to act on for accurate and timely decision making.

QUANTIFIED SELF

The quantified self is all about self-tracking and lifelogging. Equipped with wearables and body sensors, an individual can keep track of every aspect of his life – from exercise to sleep, heart activity to calorie expenditure, and nutrition to food consumption. And that's just for starters. The IoT is changing how we perceive and interact with our bodies.

REAL TIME

Real time describes an immediate (or nearly immediate) level of responsiveness by a device or machine. If the response is sufficiently immediate or if the machine is keeping up with some external process (like showing us up-to-the-minute weather changes), we say it's functioning in "real time." Note that real time describes our sense of time, not a machine's.

RETAIL

As consumers, retailers can take advantage of our mobile devices to provide us with a better, more personalized shopping experience. Retailers can also use IoT sensors and devices for inventory tracking or security purposes.

RFID

RFID (radio-frequency identification) uses electromagnetic fields to identify and track tags attached to objects automatically. These tags can carry up to 2,000 bytes of data. Kevin Ashton, who coined the term Internet of Things, studied RFID technology while at MIT.

SECURITY

Security is a hot topic, and it could make or break the Internet of Things. It's not only about securing the things in IoT, but also all the data, devices and networks that tie everything together. Security by design is one of the rallying cries for IoT.

SENSOR

A sensor is a device that can detect an event or change in the environment and send that information to a machine that can then act (or not) on the data it has received. Sensors have become ubiquitous and contribute significantly to the things population.

SMART

Any physical entity that can exchange data with another entity through a wired/wireless connection is said to be "smart." From smartphones to smart homes to smart cities, it is hard to ignore or escape the transformational changes being ushered in by IoT.

Watch a video: Consider What Happens When Machine Learning, Data Science and AI Meet IoT

SMART CITY

Local governments developing smart cities can take advantage of all the IoT data coming from water and energy resources, housing, traffic, parking and social media – not to mention open data. Today's technologies are not only cheaper, they're also faster and help governments do more with less.

SMART GRID

You may already have a smart meter collecting your energy usage data. This is just a small slice of the IoT data utility companies need to manage. With smart grid analytics, it's faster and easier to predict equipment failures before they occur, efficiently integrate renewable resources and restore power after a storm.

SMART HOME

There's no easier way to experience IoT than to bring it into your home. Add a voice assistant like Amazon Echo or Google Home to the mix, and you're now controlling your home access, lighting, temperature, entertainment system, window coverings and security system with your voice.

SPEECH RECOGNITION

It's the ability for a machine to listen to spoken words and phrases and convert them into machine-readable text. Natural language processing (NLP) can then take this text and extract its meaning. Voice assistants, like Siri, use both speech recognition and NLP techniques to respond to you.

STANDARDS

Standards are developed to establish consistent protocols that can be universally understood and accepted, maximizing the reliability and safety of a product, method or service. Per the IEEE Standards Association, "It is only through the use of standards that the requirements of interconnectivity and interoperability can be assured." Many standards apply to IoT. Some of those standards compete, while others overlap. It's still not clear which standards will prevail for IoT.

STREAMING ANALYTICS

Streaming analytics makes use of data in motion just as traditional analytics makes use of data at rest. Streaming analytics works in real time on data streaming from applications, sensors, social media, devices and more – handling up to 1GB of data per second. Streaming analytics can be used to issue alerts immediately when fraud is detected or to trigger a speeding ticket for a fast driver.

Take a Look at How These Industries Are Taking Advantage of IoT Analytics

- Utilities.
- Government/smart cities.
- Health care.
- Manufacturing.
- Retail.
- Transportation.

TALENT

The Internet of Things is forcing companies to ask this question: Do we have the right talent onboard to take on the opportunities and challenges of IoT? Whether the talent is internal or external, getting the right people in place should be a key priority for any data-driven organization.

TELECOMMUNICATIONS

The telecommunications industry will be significantly affected by IoT since it will be charged with keeping all the data the IoT uses. It's crucial for smartphones and other personal devices to maintain a reliable connection to the internet so that IoT can work effectively.

THINGS

When we talk about the Internet of Things, what exactly is a "thing?" The answer depends on who you ask. There's no single right answer because it depends on context – and it's your job to understand that context. Generally speaking, a thing could be a sensor, a device (mobile or not) and/or anything with an IP address. One point of consensus is that the things population is exploding. Soon there will tens of billions of things on the planet. Things depend on connectivity to be "smart."

TRANSPORTATION

In addition to connected vehicles and vehicle-to-vehicle communication, IoT is changing how delivery companies manage their fleets and how roadways are monitored. IoT is not only making the transportation industry more efficient, it's making our roadways safer for all.

UBIQUITOUS

Inherent in the concept of connecting things, IoT is transforming our world into one where lines blur between online and offline. As connected devices grow, IoT is fast becoming ubiquitous. That ubiquity by its sheer size is synonymous with big data, so it's no surprise that IoT is making big data bigger. As the importance of data management grows (along with data integration, data quality and data governance), so do the opportunities for value creation with analytics.

55 Billion IoT Devices

There will be more than 55 billion IoT devices by 2025 – more than four devices for every person on earth – according to Business Insider Intelligence. That's up from about 9 billion in 2017.

UTILITIES

Smart meters not only collect data automatically, they also make it possible to apply analytics that can track and manage energy use. Likewise, sensors in devices such as windmills can track data and use predictive modeling to schedule downtime for more efficient energy use.

VEHICLE-TO-VEHICLE (V2V)

This technology will allow vehicles – including cars, trucks, buses and trains – to "talk" with one another. By exchanging important safety and mobility information, these vehicles could help save lives, ease traffic congestion and improve the environment.

VIRTUAL REALITY (VR)

VR is the term used to describe a three-dimensional, computer-generated environment that you can explore and interact with. It's an immersive experience that makes you feel like you're actually interacting with your digital environment. For example, IoT innovators are integrating VR into urban planning for smart cities.

VOICE ASSISTANT

Also known as an intelligent personal assistant. With your voice, you can ask an "assistant" to perform a task or service for you, like manage your schedule or provide traffic info. Many assistants are integrated with IoT – like Alexa (Amazon Echo), Google Home and Apple® Siri® – but some are not (such as Microsoft Cortana).

WEARABLES

Wearables are things that are worn under, with, or on top of clothing. They are a primary tool for the quantified self. They're also being used for law enforcement, emergency management, public safety and other purposes.

Preventing Domestic Violence With Wearables

Using geolocation, the IoT and wearables to keep violent offenders away from victims

In many cases, authorities can't protect victims from domestic violence for two basic reasons: By the time the protective order is violated, it's too late. And there's often not enough admissible evidence to enforce the order and convict the offender. New technology based on wearables just might change that.

Read the article to learn more.

WI-FI

A popular networking technology that allows you to connect to the internet or other devices wirelessly. It's similar in concept to Bluetooth. This is how many, if not most, IoT devices communicate with one another. Even though connecting is easy, you need to make sure your device is secure.

WIRELESS

It's a form of communication that uses electromagnetic waves, not physical wires or cables, to transmit a signal. Popular wireless technologies include Wi-Fi, Bluetooth and mesh networking.

XCOFFEE

Also called the Trojan Room coffee pot, it's one of the first examples of IoT in action. It was 1991, and the first webcam was set up outside the Trojan Room at CERN to watch a coffee pot. Read the story, written by one of the academics who wrote the code.

YOTTABYTE

A yottabyte is 1 septillion bytes, or 1024. It's bigger than a zettabyte, which only has 21 zeros. For you *Star Wars* fans, the yottabyte was named after Yoda.

ZIGBEE

A wireless mesh networking protocol popular for in-home automation. It provides a way for all the smart things in your smart home to communicate with one another. It competes with Z-Wave.

Z-WAVE

Another wireless mesh networking protocol popular for in-home automation. It competes with Zigbee.

Summary

The term "Internet of Things" may shift as we progress toward a more connected planet, but we can count on its ubiquity. Regardless of the label, IoT is changing life as we know it.

The 101 terms (and categories) in this A-to-Z guide have provided you with IoT's building blocks. It's a good start, but it's just the beginning of a richer and quite complex discussion of what IoT means for you and your company.

Learn how SAS works with companies around the world to give context to the Internet of Things, so they can digitally transform their businesses, increase customer satisfaction and improve the bottom line.

If you're still looking for more information, click on the links below to dig deeper into some of these cool topics.

Additional Resources

- Advanced analytics
- Application programming interfaces (APIs)
- Chatbots
- Data lake
- Data streaming
- Data governance framework
- Graphics processing units (GPUs)
- Industrial Internet of Things (IIoT)
- Platform (as in, *analytics platform*)
- Privacy
- RFID (radio frequency identification)
- Security
- Smart grid analytics
- Streaming analytics

Regardless of the label,
IoT is **changing life** as we know it.

Learn about SAS IoT solutions at sas.com/iotsolutions

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