Explaining the Jargon behind the ‘Internet of Things’

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My previous post, The Upside of Networked Lighting Controls, focused on the value that networked lighting controls create. Networking is not only changing how our ‘things’ communicate, it is also changing our vocabularies. Networking has developed its own lexicon and often authors do not fully explain their jargon in simple context. As a lighting and controls consultant, I read a variety of technical publications to keep current on the changes in the lighting market. A major challenge I encounter is explaining the technical jargon used by industry insiders to decision makers. Often, these people are familiar with the concepts but puzzled by the jargon. This post is my attempt to translate the most common terms used in networking into a language that is easy to understand.

The Internet of Things (IoT): A buzzword to describe the phenomenon of connecting devices, like toasters and lighting, to the internet. IoT devices are often referred to as ‘Smart Devices’ because they can have sensors embedded in them for collecting and exchanging data. Tech research firm Gartner estimates that there will be more than 20 billion smart devices online by 2020.

The Internet of People (IoP): The concept of turning a living, breathing human being into a digital network. A portion of the billions of IoT devices will be sensors that humans wear, like a smart watch. These devices collect data about our physical bodies, like our sleep patterns or

activity level. How this data is stored and who analyzes this data has not been addressed–yet. Wearables are currently an annual 5 billion dollar market and growing.

The Internet of Energy (IoE): In the United States, we commonly call this concept the "Smart Grid." The idea computerizes the electric grid to automate and update infrastructure. Smart Grid networks rely on IoT devices to collect and share data that makes electricity more reliable, efficient, and affordable. The growth of Smart Grid networks will become more important as more renewables are brought online.

Applications Programming Interface (API): A set of routines and tools that specify how different types of software talk with each other. APIs are the building blocks of the IoT revolution and allow third party developers to make apps. An example of an API is when a business website has a Google map showing the firm's location. Here the web developer used Google Maps API to embed the map using an interface, like Flash. Additionally, APIs are used to program Graphical User Interfaces (GUI).

Though hard to imagine, apps are coming to commercial lighting and these apps will rely on API's. An example of a lighting specific API would be an app that connected an occupancy sensor in a conference room to an Outlook calendar. Though the space may show as booked, actual occupancy will be determined by the sensor, which will relate this information to the Outlook calendar. As the functionality of installed sensor grows, we can expect more API's and apps.

Big Data: Refers to the massive amount of data that the billions of interconnected IoT devices collect and the analytics used to understand it. These data sets are so large that they cannot be used by traditional database tools. Big data is not a fad, is still in its infancy and will impact every person! To put the issue in perspective, from 2015-2016 more data was collected in a two-year period than in the entirety of all human civilization. We add about 1.7 megabytes of new information every second to the cloud. For more information on the impact of this exponential growth of data on data center energy use visit our Data Center Knowledge Hub.

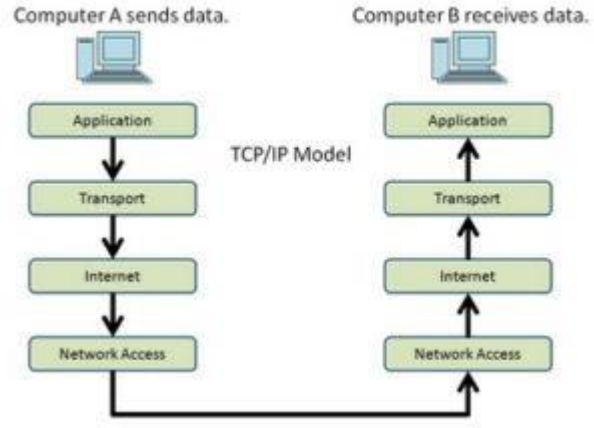
Cloud Computing: The idea of separating some functions that a computer can handle, like storage or applications, and providing those functions via the internet. The term cloud comes from how connections to the internet are represented in network diagrams. Cloud computing is the backend of many IoT devices.

Gateway: A device that interfaces between two or more networks that use different 'protocols.' Gateways can simply pass traffic off to the next node or preform complex translations across different network layers. All digital networks must go through at least one gateway to connect to the internet. A router is a common gateway connecting a home network to the internet. In lighting, people are excited about advances in Bluetooth because smart phones are Bluetooth enabled meaning that everyone is walking around with a gateway in their pocket!

Interface and/or Graphical User Interface (GUI): Simply put, it is the device that allows a user to interact with a computer. The most popular type of interface is a Graphical User interface (GUI). A GUI is screen based, often touch enabled, that allows a user to interact through graphical icons, not just text. For example, Microsoft Windows is a GUI, while MS-DOS is an interface.

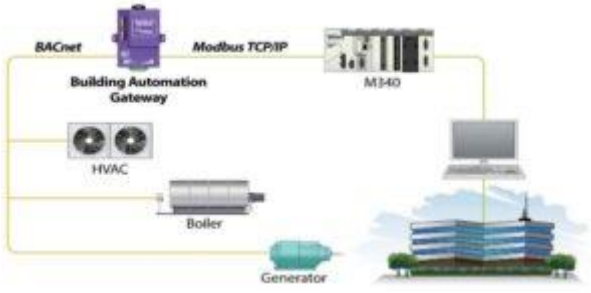
Network Node: In IoT, a network node is the physical smart device that is connected to the network. Each connected node is given an address which identifies it on the network. For example, if your home network has one file server, two laptops and one printer, your network has four nodes. When people speak about 'terminal nodes', they mean the node that is at the end of the line.

Machine to Machine (M2M): Refers to a technology that is similar, but more limited than IoT technology. M2M was the forerunner to IoT and allowed for remote device access. The major difference between the technologies is that IoT can integrate data with enterprise applications to improve whole business performance, whereas M2M is limited to point solutions that solve problems like service outages.

Machine Learning: A type of AI (Artificial Intelligence) where machines can learn without being 

programmed. Machine Learning is like data mining in that it uses a predict/classify model based on historical data. When exposed to new data, the machine studies the data for patterns to predict improved outcomes. Machine learning is how we will process the big data sets that the sensor networks collect. Machine Learning is very useful for predicting rare events, like identifying fraudulent transactions. For lighting specifically, Machine Learning enables the predictive analytical capability of a system to report a failure before it occurs.

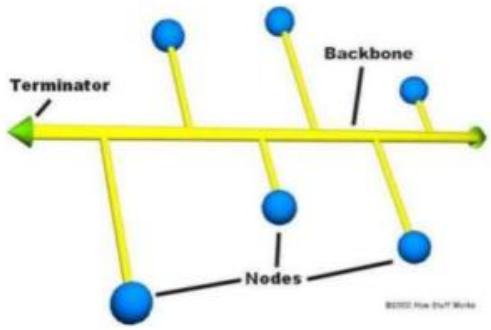
Protocol(s): The set of rules that govern communication between two or more devices. Protocols act the way grammar does in our languages and provides structure and order. Protocols are necessary for network communication. Below are examples of some common protocols.



TCP/IP: The protocol used by the world-wide web and nearly every networked computer. At its most basic, TCP/IP acts as the operating system for the internet.

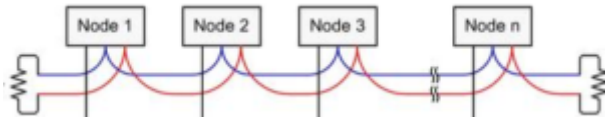
BACnet: The standard protocol used to govern communication for Building Automation Systems (BAS). Integrating these various BAS into a single dashboard is a step in achieving a 'Smart Building'.

ZigBee: A protocol used in wireless communication that relies on small, low power digital radios. ZigBee is an alternative to Wi-Fi or Bluetooth. The ZigBee protocol is popular in IoT devices used for home automation.



Bus network topology

Topology: Describes how the network nodes are interconnected for communication. Topologies can be physical, like the wires that connect nodes, or logical, which are used to model data flows between nodes. Below are some common network topologies



Daisy Chain: A type of wiring where connections do not form webs and communications must pass through each node. In a Daisy Chain, device A is wired to device B, device B is wired to device C…etc. A good example of daisy chaining is how utility poles are connected

Bus: All nodes in the network are connected to a central source. Communication does not need to pass through each successive node, but all nodes are feed by a common input. Bus topology is popular in the wiring of theatrical lighting and controls.

Star (Hub & Spoke): A network that has one central hub that communicates data to and from nodes. Star topologies are common and help reduce the chance of network failure because all nodes can communicate with each other through the central host. This topology is common for many hard-wired Smart Lighting Solutions (SLS) systems.

Mesh: A type of network where each node is an independent router, regardless of its connected to another network. Mesh networks are self-healing, which means the network can continue to operate when a node is broken. Nodes continuously reconfigure the network to skip broken connection. Mesh networking is popular in wireless networks.

XaaS (Everything as a Service): The idea of delivering any service over the internet rather than locally. Cloud computing makes delivering a range of services possible and the ‘X’ in the name serves as place holder for the actual service. Netflix is a good example of this business model and can thought of as Entertainment as a Service (EaaS).

I hope that you now have a better understanding of some of the basic terminology used in networking. As we progress in this blog series, many of these concepts will be explained in detail to how they relate to Smart Lighting Solutions (SLS). For my next blog, we will

explore the benefits of smart lighting and going wireless. For more information on Smart Lighting Solutions, please visit our Knowledge Hub or reach out to me directly.

DNV GL has successfully designed and implemented Smart Lighting Solutions projects on behalf of our utility clients for four years. Our team has significant project experience in both retrofitting and new construction of lighting projects. We work through the project life-cycle to identify, justify and evaluate energy saving measures and provide post-installation engineering review to verify savings.

Our team is available to work directly with large institutions to assist them with Smart Lighting Solutions projects. For more information, please contact Wesley Whited. Wesley Whited is a Senior Consultant for Smart Lighting Solutions at DNV GL. Mr. Whited has seven years' experience in the commercial lighting market ranging from project management to sales. Mr. Whited is a graduate of West Virginia University (WVU) and holds a MBA from Capital University in Columbus, OH.