by Robert Dolin, VP and Chief Technology Officer, Echelon Corp.

The Internet of Things will be an important part of the future in most industries and especially Smart Buildings. Here Robert Dolin, CTO of Echelon Corp., shares a vision on how IoT will come in “different flavours.”

Echelon Corporation develops, markets and supports the world's most proven, open standard, multi-application energy control networking platform. Echelon’s vision from its inception 20 years ago is one of low-cost embedded monitoring and control technology in every electrically controlled device in the world. Today Echelon’s technology platform is embedded in more than 100 million devices, 35 million homes, and 300,000 buildings.

The Internet of Things (IoT) has become an expansive concept, encompassing a broad range of application areas. **The IoT is not a single, homogenous entity, however. It can be broken down into the human IoT (HIoT) and the commercial and industrial IoT (IIoT).**
The IIoT can be further divided into machine-to-machine (M2M) and machines-to-machines (Ms2Ms) segments.

It’s easy to imagine that the HIoT and IIoT would have different characteristics and requirements: People are crucial to the interaction with the Internet in the HIoT but not in the IIoT, so they differ in areas such as reliability, ability to self-heal, and protocols used. But here, we take a look at the more subtle differences between the various segments of the IIoT.

M2M vs. “Ms2Ms”

Machine-to-machine (M2M) applications use client/server communications, sending data to a server or the cloud. M2M uses predominantly web services technologies, which are TCP-based with point-to-point sessions and built-in error detection and recovery. The data destination is a server-class machine, so multiple, different data representations can be converted and stored in a canonical format for implementation of business rules. On top of the easy-to-use TCP, system developers can use protocols that provide self-describing data streams, e.g., HTTP with XML.

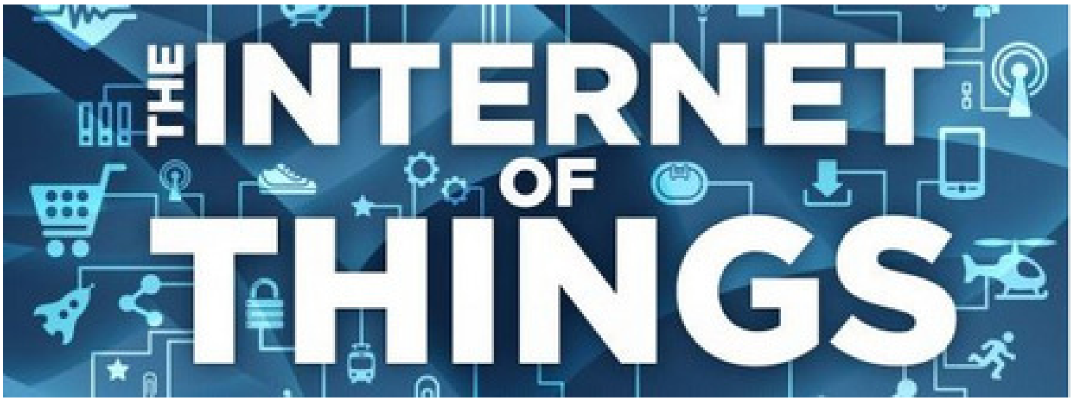
Examples of M2M applications are a vehicle tracking system; a system that monitors a building’s mechanical systems for signs of wear; or a system that tracks mobile hospital equipment.

In contrast, other IIoT applications use autonomous, peer-to-peer distributed control, with groups of nodes working together to accomplish a single task. We call these machines-to-machines (Ms2Ms) applications, often simplified to communities of devices. An example of an Ms2Ms application or community of devices is baggage handlers in an airport that sense luggage moving on various conveyor belts, identify luggage by reading bar codes, and nudge each piece of luggage to the correct next conveyer belt based on its bar code.

Not all IIoT applications require an always-on Internet connection

The IIoT is the integration of physical machinery (mechanical systems) with sensors and software. The value propositions of the IIoT are analytics, remote access and management, collaboration, speed and accuracy of intelligence, and the easy capture and transfer of knowledge (not just data).

Notice that information transfer in the IIoT is not just from machines to the cloud, in a client/server fashion. Instead, machines in the IIoT often need to cooperate autonomously as peers, performing data analysis and reduction locally (i.e., Ms2Ms communications). These communities of devices handle small data — which when aggregated becomes part of big data.



But IIoT value depends on IP all the way to each device

In the IIoT, economic value is not synonymous with node counts, which is how many experts rate IoT contributions. Instead, IIoT value is derived from analytics that rely on big data.

Historically in industrial protocols, instead of IP or an IP-compatible transport, manufacturers provided gateways to expose the “necessary” data, based upon the requirements at the time. But gateways filter out any data that is not considered necessary to the specific task at hand—and filtering data hampers big data analytics, a primary driver of value for the IIoT.

Big data depends on collecting as much data as possible, then looking for non-intuitive correlations to uncover efficiency gains. Because the correlations are non-intuitive, a gateway filtering out some “unnecessary” data might instead discard key data needed for an important insight, thus diminishing the value of the system.

Moving to IP promises the elimination of gateways, opening the potential for the IIoT to generate enormous economic value — in particular if IP goes down to every device, including those in peer-to-peer communities of devices. Achieving IP all the way requires:

- An industrial-strength protocol that meets the industry requirements and uses IP and standard IP infrastructure
- An evolutionary path so that infrastructure can be replaced gradually
- Integration with wireless IP links: IEEE 802.15.4/6LoWPAN, IEEE 802.11b/g/n
- A common application architecture that is not link-specific

- Connectivity to the Internet's client/server architecture to provide enterprise and big data integration

Peer-to-peer applications have special requirements

Peer-to-peer communications in the IIoT permits local analytics, distributed control, and local data reduction to actionable facts.

All IIoT applications share the need for no-compromise control, to enable doing and not just talking; industrial-strength reliability; ability to co-exist and evolve with legacy protocols, connectivity (both wired and wireless), and wiring; and hardened security.

Autonomous communities of devices, however, have a unique set of requirements that are not shared across the broader IoT space. Specifically, IIoT peer-to-peer networking requires:

- Multiple link technologies integrated into a single network
- Robustness in the face of failure, because failures have cost and safety implications
- Equivalent capabilities (e.g., security, acknowledgements and responses) whether multicasting or unicasting
- Data exchange without complex parsing and provisioned contracts or custom drivers, because the constrained devices that make up the network cannot support multiple data conversions based upon the sources of the data
- Legacy integration

In summary, the answer to the question, "Does the IIoT have a single set of requirements?" is no, there are different requirements. Echelon is taking important steps to meet the new requirements of peer-to-peer Ms2Ms applications.

Building on our 20+ years of control networking technology experience, Echelon has introduced the IzoT™ platform, which will be made available as source code, embedded in SoCs, and in modules. Adapting the upper layers of ISO-IEC 14908-1 to use UDP over IPv4 and IPv6, the IzoT platform is compatible with a common, standard IP infrastructure. Around this platform, Echelon intends to spur development of a rich ecosystem designed to meet the needs of all the segments of the emerging IIoT market.

***Robert Dolin**, Echelon's system architect, has worked for the company since 1989. He is the principal or co-inventor of fourteen Echelon patents, and is one of the designers of the LonWorks protocol, the network development system environment, the Neuron C programming model, and LonWorks network management. In 1995 he was named chief technology officer.*

Before joining Echelon, Dolin spent 11 years at ROLM Corporation, where he was one of the main developers of its fully distributed PBX telephone system. He also held positions of first- and second-line management as well as system architecture. Dolin has a B.S. degree in Electrical Engineering and Computer Science from the University of California at Berkeley.

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