ARC VIEW

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Internet of Things (IoT) Enables $3.88 Trillion in Potential Value to Manufacturers

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Summary

ARC Advisory Group believes that the emerging Internet of Things (IoT) will offer value across multiple industrial sectors and applications. Cisco expands on this, using the term, "Internet of Everything" (IoE) to describe its vision of bringing people, process, and data together via the Internet of Things. The company predicts that the IoE could enable manufacturers to generate $3.88 trillion of value through a combination of increased revenues and lower costs over the next ten years.

Many connected – and increasingly small – IP devices are emerging, and even more will become part of the Internet of Things over the next 10 to 15 years.

Innovative, forward-thinking manufacturers are realigning their technology and business imperatives to capture this value by leveraging Internet Protocol (IP) technology. Pivoting the business to take advantage of this paradigm shift is not trivial. It requires a sound incremental strategy built around business use cases applied throughout the manufacturing and business value chain.

Today, IP-enabled microprocessors – the brains inside many digital devices – can seamlessly connect conventional automation equipment, such as I/O modules and variable frequency drives. But the explosive growth of other IP-enabled devices – many adopted from other disciplines – is transforming the industrial landscape.

Video cameras, RFID readers, digital tablets, security swipe cards – these open-standard, IP-enabled devices can help manufacturing operations reach new heights of production quality, efficiency, security, and safety. Over the next ten years, new innovation will dramatically extend the reach of IoT devices, enabling early adopter manufacturers to gain a competitive advantage.

Cisco, Panduit, and Rockwell Automation recently briefed ARC Advisory Group on their efforts to provide the tools and resources needed to holistically deploy IP from the enterprise to the plant. This coalition of like-minded companies established a community, Industrial IP Advantage, to promote the idea that manufacturing and industrial companies can build more successful businesses by deploying a secure, converged, digital communications fabric based on standard, unmodified Ethernet and IP.

Key findings from this briefing involve:

- Accelerating time to IoT value by connecting IP-enabled devices
- Reduced costs associated with converged IP networking
- Reduced risks associated with the right technology platform

Market Trends Driving IP Adoption

The transformative, industry-changing power of IoT is visible in how the Internet is merging people, process, data and things (IoT) to build bridges between previously separate systems and devices. A variety of powerful market and technological trends now make it possible to holistically deploy IP and integrate these data bridges.

By replacing a complex, multi-tier networking strategy with a single network architecture, it's easier for users to gain access to process and device information.

Powerful technology trends including the dramatic increase in processing power, storage, and bandwidth at ever-lower costs (Moore's Law still at work); the rapid growth of cloud, social media, and mobile computing; the ability to analyze Big Data and turn it into actionable information; and an improved ability to combine technologies (both hardware and software) in more powerful ways — make it possible for manufacturers to realize more value from the IoT revolution.

In addition, technology transitions revolving around the form factor, cost, and improved power consumption of silicon are key technology enablers. Silicon form factors continue to shrink. Today, a computer the size of a grain of salt (1x1x1 mm) includes a solar cell, thin-film battery, memory, pressure sensor, and wireless radio and antenna. Cameras with similar dimensions now have 250x250-pixel resolution. And sensors the size of a speck of dust (0.05x0.005 mm) detect and communicate temperature, pressure, and movement.

High-quality Internet access derived from the telecommunications infrastructure provides broad network support. Hundreds of millions of connected devices provide economy of scale that to help significantly decrease the price for performance. And the change to the cloud computing model can accommodate any number of geographically distributed sensors.

Advances in the industrial physical infrastructure also ease deployment, helping ensure reliability and system availability across a unified communication platform. Standards for wired and wireless IP communications mean that, today, no sensor, machine or person is too far away, out of reach, or constrained in ability to add value. For example, 802.11N wireless is becoming a key part of a comprehensive control and information infrastructure, while new copper and fiber optic media developments mean IP connections can reach into the harshest environments with ever higher bandwidths. Adoption of distributed and zone architectures also simplify and help accelerate deployment of managed industrial switches and structured cabling, reducing costs to scale and converge networks.

Consumerization, largely influenced by smartphones, drives expectations about how often products are refreshed. Aggressive consumer demands reverberate throughout the value chain – shortening the R&D lifecycle and requiring a more agile supply chain and production processes. The changing workforce and skills gap also forces manufacturers and other industrial organizations to consolidate technologies, disciplines, and people.

Cisco, Panduit and Rockwell Automation Align Efforts

Cisco, Panduit, and Rockwell Automation, in cooperation with ODVA, are promoting standard, unmodified Ethernet and IP; a leading open industrial Ethernet standard EtherNet/IP; and complimentary communications data streams that can be used on standard IP networks in industrial facilities.

These organizations are working together to advance IT and OT convergence and have demonstrated success with market education and collaborative product development. For example, the Stratix family of industrial networking infrastructure solutions, jointly developed by Rockwell Automation and Cisco, uses the Cisco IOS (Internetworking Operating System) architecture and feature set to help IT professionals feel at home, as well as the Rockwell Automation Integrated Architecture features to help controls and automation professionals integrate systems and solutions. Panduit is also taking an active role in accelerating the market transition to

IP connectivity. Its introduction of the Integrated Network Zone System, for example (featured in the InformationWeek 500), simplifies communications between control rooms and the manufacturing floors and incorporates all active and passive equipment required for deployment, including a Stratix switch pre-wired with redundant power input and optional UPS. Meanwhile, ODVA continues to develop and add IP-centric networking capabilities to EtherNet/IP, most recently focusing on optimizing process integration.

These collaborative product and service development efforts – combined with the launch of the online community – www.industrial-ip.org – should help maintain EtherNet/IP's position as a leading open industrial Ethernet network.

EtherNet/IP Provides a Single Network Architecture

Despite all the business advantages of industrial network convergence, a portion of the automation world still deploys device networks for individual applications.

But there is a cost associated with running multiple networks and supporting the equipment required to connect these to the main IP-centric operation. Both the cost and complexity of network infrastructures are likely to rise if non-IP devices continue to multiply within plants, requiring a profusion of additional gadgetry and engineering to integrate them.

As highlighted in the recent briefing, the consequences of separate networks go well beyond unnecessary cost and complexity. Two or three networks consume more physical space than just one. Managing and maintaining multiple networks requires more people and training than a single system. Most importantly, such a complex network infrastructure lacks the scalability and flexibility that will be necessary to meet the digital demands of the future – and take full advantage of the opportunities.

ODVA – the international association that manages EtherNet/IP as an open communications protocol – believes that Industrial IP - that is standard, unmodified Internet Protocol (IP) for industrial applications - provides the best potential path to the future. Specifically, EtherNet/IP was designed to support the interoperability of many machines and devices in a manufacturing plant, while providing connectivity across the enterprise. Along with

those technical capabilities, EtherNet/IP comes with hardened hardware, ruggedized cabling, and other industrial-strength equipment.

Today, EtherNet/IP – combined with ODVA's Common Industrial Protocol (CIP) – supports even the most complex manufacturing operations. Moreover, manufacturers that rely on EtherNet/IP can take advantage of many of the innovative IP technologies already developed for the commercial world, some of which are quickly migrating to the plant floor.

High-Value Use Cases

1. **Automation**: Today's manufacturing companies must become more responsive to changing market and operational conditions without sacrificing automation efficiency. This has created urgency for manufacturers to converge and connect the multitude of isolated production systems and processes throughout their value chain. Manufacturers can converge their network infrastructure and tightly integrate technical and business systems using EtherNet/IP.
2. **Security and Compliance:** By implementing Industrial IP across the entire enterprise, organizations can increase network security through a common architecture that decreases inconsistencies in network protocols, security practices and training.
3. **Mobility:** Manufacturing and industrial users recognize the risks and rewards of proliferating mobile devices in production environments. The desire for context-based information – available on whatever device the user chooses – requires a converged communication fabric that supports both industrial and commercial technologies.
4. **Video**: Video technology has historically been underutilized in manufacturing and production, largely because it required its own network infrastructure. Building digital communications fabrics based on Industrial IP allows video to be used to its fullest potential.
5. **Industrial Compute**: Migrating from monolithic servers and databases with isolated islands of processing to virtualized computing and cloud resources creates new opportunities for manufacturers. Internet Protocol provides an appropriate environment for building tomorrow's cloud-based information architectures.
6. **Remote Assets and Services**: Diverse manufacturing environments and shrinking in-house engineering staffs mean it's much more difficult to have direct line-of-sight to all machines and processes. Connecting these assets to an Industrial IP communications fabric greatly improves

the ability to monitor and respond to changing conditions and more effectively leverage intellectual capital.

7. **Energy Management:** Energy is one of the most volatile and fastest-growing costs of production, but until recently, energy data was locked away inside automation systems. By leveraging Industrial IP across the enterprise, manufacturers can use the same networking platform as their enterprise network to access energy data at the load and device levels, and up through the enterprise.

Conclusion

Manufacturers and other industrial organization need to prepare their plants for the emerging, connected world of the Internet of Things.

There is a critical need for a more manageable, scalable, robust, and secure network fabric to accommodate the growing number of IP-enabled devices connecting to the networks. Industrial networks have outgrown the isolated silo, "point to point" approach of many current industrial network deployments. Manufacturers must also explore opportunities to simplify their network architectures to avoid "network sprawl" and associated security vulnerabilities.

Many leading manufacturers are re-architecting to create an industrial network fabric for fast IoT value creation by specifying a robust physical network and virtual computing infrastructure foundation to transport, store, and analyze the data available with pervasive standard IP connectivity. The Industrial IP Advantage community makes a persuasive argument that the rapid evolution of secure, high performance IP infrastructure reduces design, deployment, and overall lifecycle costs and risks.

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