IoT World

Where are the missing 41 billion IoT devices?

The biggest prediction miss in the history of it. IoT growth has fallen significantly short of predictions due to unforseen complexities.

Headlines

- Five Steps for Global IoT Success
- Pros and Cons of Smart Electric Meters
- Enel Italy was the first to deploy massively Smart Meters
- LoRa® Development Packs for Large-Scale LPWAN
- Future Impacts of New Sensor Technologies
- Securing the Edge Cybersecurity in the Age of IoT

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Where are the missing 41 billion IoT devices?

How to overcome global IoT deployment challenges and ensure your project achieves its goals

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ATCA World

SkyFive completes the purchase of Nokia's Air-to-Ground (A2G) assets, to create world's first specialist for digital broadband networks for the aviation industry.

Press Release

Nokia and SkyFive, world's first specialist for Air-to-Ground (A2G) communications, have closed a transaction on the sale and transfer of Nokia's A2G assets.

A substantial part of Nokia's A2G patents, portfolio, and employees are transferring to SkyFive, an independent A2G communications specialist previously created by former Nokia Senior Executives.

With the transferred assets, SkyFive is in a unique position to address the needs of the aviation industry for true broadband connectivity in the sky, based on a comprehensive end-to-end solution and the proven capabilities of the enlarged team.

Following the successful deployment and launch of the European Aviation Network, SkyFive and Nokia are planning to expand A2G into other regions, with SkyFive taking responsibility for the end-to-end solution, and Nokia continuing to be the provider of the ground network technology.

October 21st, 2019 | Munich, Germany – SkyFive today announced that it successfully acquired a substantial part of Nokia's Air-to-Ground (A2G) assets and capabilities.

SkyFive combines the aviation and telecommunications worlds in a unique way, to enable a breakthrough in aviation digitization and address the airlines' increasing needs for connectivity with a high-performance, future-proof, and cost-effective solution based on 4G and 5G standards.

With the purchased assets, SkyFive becomes world's first A2G communications specialist. SkyFive assumes responsibility for the end-to-end solution, which comprises avionics, telecommunications, and IT systems. Nokia continues to be responsible for sales and implementation of the ground network – an integral part of the solution – to Communication Service Providers, based on its strong technology and delivery capabilities.

Thorsten Robrecht, CEO at SkyFive: "SkyFive is truly excited by this acquisition of Nokia's market-leading A2G assets and portfolio. For us, this transaction constitutes a major step forward on our journey to provide true broadband connectivity services in the sky, and it serves as a springboard for global expansion."

Chris Johnson, Vice President of Nokia Enterprise at Nokia: "For network operators and other A2G customers the collaboration between SkyFive and Nokia ensures that we continue to lead the A2G market with the focus that is needed to be successful in this innovative area."

Dubai Airshow - At the Dubai Airshow SkyFive presented their plans for expanding A2G into the Middle East and other high density airspaces worldwide.

About SkyFive

SkyFive was created by Nokia Senior Executives in 2019 to create the Internet of the Skies. The company's mission is to deliver true broadband services to airline passengers, enable the real-time transfer and analysis of vast amounts of aircraft data, and support low latency communications required for the mass proliferation of professional drones. SkyFive creates giant cells in the sky, with a solution that fully leverages the benefits of the 4G and 5G ecosystem.

Learn more at www.SkyFive.world.

Pros and Cons of Smart Electric Meters

BY WENDY LYONS SUNSHINE | Updated October 07, 2019

Smart meters are tools used to manage and record electricity and performance of electronic devices in the home. What makes the meters "smart" is their ability to provide detailed and accurate analytics on electrical usage in real-time or at predetermined intervals, all without a technician.

The U.S. Department of Energy estimates that nearly 70 million American homes are already using a smart meter, and electric utility companies have enthusiastically replaced analog meters (which are read manually each month) whenever possible.

The strategic potential of collecting a broad spectrum of information about electricity consumption includes the value of quick, accurate measurements and the elimination of monthly estimates and meter-reading home visits.

Despite being the most energy-efficient and profitable means to manage an electrical grid, there are concerns over the personal data that smart meters are collecting in real-time, including what may be unnecessary information about hourly electricity use. This collection of data could, potentially, be a violation of users' privacy.

Here's a look at the benefits and challenges that smart meters present to electric utilities, customers, and the environment:

Advantages of Smart Meters for Consumers
Far greater and more detailed feedback regarding energy use
Ability to adjust habits in order to lower electricity bills
Reduces the number of blackouts and system-wide electricity failures

Disadvantages of Smart Meters for Consumers
Additional fees for the installation of the new meter
Privacy concerns for the personal data collected and how it will be used
More responsibility placed upon the consumer for maintenance

Advantages of Smart Meters for Electric Companies
Eliminates manual monthly meter readings
Monitors the electric system in real time
Encourages more efficient use of power resources
Provides responsive data for balancing electric loads while reducing blackouts
Enables dynamic pricing
Avoids the capital expense of building new power plants
Helps to optimize the profit with existing resources

Disadvantages of Smart Meters for Electric Companies
The additional cost to train personal, develop equipment, and implement new processes for data storage
Managing public reaction and feedback concerning new meters
Making a long-term financial commitment to new hardware/software
Ensuring the security and privacy of metering data

The Disadvantages Are Short Term
With new, resource-saving technology comes new challenges that will arise regarding expensive, energy-intensive data storage and the privacy issues that loom large over these domestic and commercial technologies. If consumers are not familiar with managing new energy systems on their own, they are less likely to pay close attention to the energy-saving potential of such smart meters (or how their personal data is being used).
The majority of the smart meter's disadvantages may seem short term, but such challenges will slow down the rate of adoption for these technologies in some cases, especially in rural and presently off-grid areas.
Promises to protect and value the personal data of users are crucial but unfeasible if electric companies don't place cybersecurity and technical leadership squarely in the charter of their organizations. Consumer protections are as essential to the product as the responsive features that make them useful to utility companies.

Enel Italy was the first to deploy massively Smart Meters for Electricity
A Big Story in short: World-class design-win, huge business and a decade ahead.

In 2000 Enel decided to design (co-engineering) its own smart meter as there was nothing available in the market. At that time Enel was supplying electricity to 32,000,000 customers in Italy.
I discovered that big project in a very early stage and did act as a consultant for Enel to look at the architecture and recommend suppliers for the major Hi-tech chips including: the MCU, Modem, RTC, Memories, battery, a custom LCD display and more. First orders (startup) were awarded to two CEMs (Contract Electronic Manufacturers) one in Italy and a second one in China for a total of 6,000,000 smart meters (first order).

Today Enel owns over 90% of the smart meters deployed in Italy, the second generation is being installed.
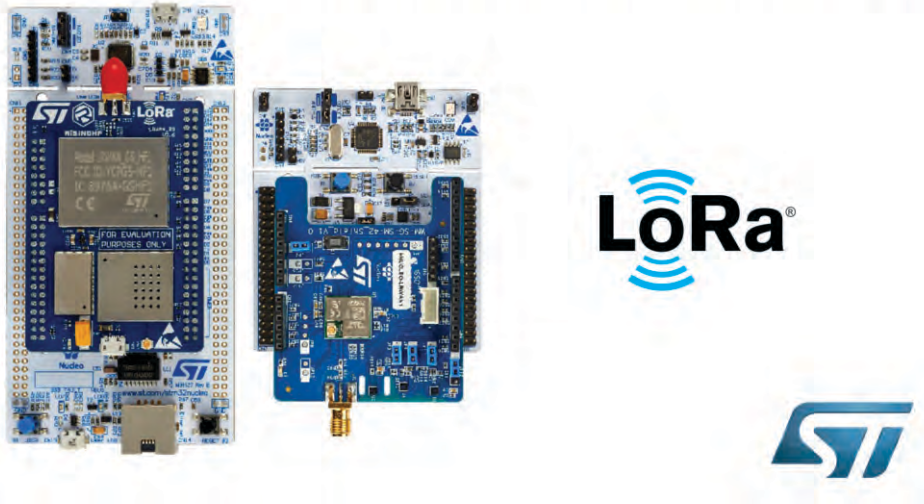**Worldwide:** Enel is active in the Americas, EMEA & Asia, a huge business. **_Daniel Dierickx, e2mos**

For more info please contact us at mgt@e2mos.com -- www.e2mos.com.

Affordable LoRa® Development Packs from STMicroelectronics Jump-Start Projects Leveraging Large-Scale LPWAN Connectivity

Geneva, October 17, 2019 -- STMicroelectronics has introduced two $99 ready-to-use development packs that enable all types of users from large corporations to smaller companies, independent designers, hobbyists, and schools to utilize LoRa®'s long-range, low-power wireless IoT connectivity for tracking, positioning, metering, and many other applications.

The two packs provide a complete LoRaWAN® development chain including gateway and end-node boards, firmware, and tools, leveraging ST's convenient and proven STM32* Nucleo evaluation boards. Catering separately for regions with 868MHz/915MHz/923MHz and sub-550MHz ISM frequency bands, each pack includes proprietary gateway software and ST's I-CUBE-LRWAN end-node software. The node and gateway boards come with an antenna and on-board debugger.

The LoRa gateway included in each pack is built with an STM32 Nucleo-144 development board, NUCLEO-F746ZG, which contains an STM32F746ZGT6 microcontroller (MCU). Unlike with a commercial gateway, users can easily access device pins to assist development. The gateway acts as a basic packet forwarder to enable data coming from the development node to reach LoRaWAN network servers. ST has established agreements with LoRaWAN network-server providers LORIOT, Actility, and The Things Network to let users connect their gateways to basic network-server capabilities free of charge. Users can also visualize sensor data and control devices with the myDevices Cayenne for LoRa IoT Builder dashboard.

Nodes are based on the NUCLEO-L073RZ Nucleo-64 board that features the STM32L073RZT6 ultra-low-power MCU and come with a battery socket for easy mobility. Each pack includes a LoRa node expansion board, which contains an ultra-low-power STM32-powered module running an AT-command stack. A selection of motion and environmental sensors is also provided on-board.

The P-NUCLEO-LRWAN2 pack is for high-frequency (868MHz/915MHz/923MHz) ISM bands. It comes with the I-NUCLEO-LRWAN1 node expansion board designed by USI, which combines an STM32L0-powered module with ST's sensor devices including the LSM303AGR MEMS e-compass (accelerometer/magnetometer), LPS22HB pressure sensor, and ST HTS221 temperature and humidity sensor. The P-NUCLEO-LRWAN3 pack for low-frequency (433/470MHz) ISM regions comes with a node expansion board embedding the STM32L0-powered RisingHF module RHF0M003, together with an ST LSM6DS33D accelerometer, ST LPS22HB pressure sensor, and HTS221 temperature and humidity sensor.

Both development packs are available now and developers can benefit from the market-proven STM32 ecosystem bringing LoRaWAN protocol stacks, free integrated development environments (IDEs) such as Keil MDK-ARM, as well as a comprehensive software toolset including the STM32CubeMX MCU initializer and configurator.

For further information please go to www.st.com/stm32-lrwan
You can also read our blogpost at https://blog.st.com/lora-nucleo-packs/

Five Steps for Global IoT Success

How to overcome global IoT deployment challenges and ensure your project achieves its goals

Introduction

It's now accepted that IoT has not achieved the level of success expected by enterprises and analysts, even though growth has been exponential and IoT is here to stay with billions of devices now active[1]. Enthusiasm about the transformative effect of IoT led to projections of tens of billions of IoT connected devices[2] but it's now clear that IoT deployments are much harder to do successfully than previously thought and substantial complexities have been glossed over.

IoT deployment experiences

This is borne out by recent research from Cisco Systems which has found that more than 75% of IoT deployments fail[3]. A lot of the damage happens before services even go live. Microsoft estimates that 30% of IoT projects fail at the Proof of Concept (PoC) stage[4], while eight out of ten IoT projects fail before they are even launched[5], says Ganesh Ramamoorthy, principal research analyst at Gartner.

These stark figures come before IoT propositions that don't attract customers, don't work smoothly or simply can't generate sufficient profit to justify their continued operation are taken into account. This demonstrates exactly how much there is to get wrong in IoT.

Now, reality bites and organisations increasingly recognise that IoT involves far more than putting a SIM in a device to add connectivity. Instead, preparation is a comprehensive process that encompasses device design and applications development, expertise in data collection and management, security capability, understanding of global connectivity options and efficient management of these, plus the ability to proactively manage and maintain IoT devices in deployment, anywhere in the world.
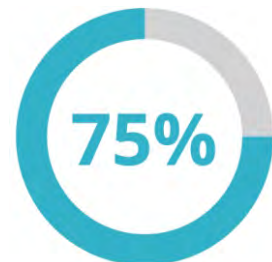
Each of these are new areas of opportunity for the vast majority of enterprises which, although they have read about digital transformation, are not ready to dive in with both feet. In addition, most businesses are not technical experts in these areas and neither have the resources inhouse, nor have budget to invest heavily in this area. As is typical in any new technology deployment, early adopters of IoT have faced challenges, however, the technologies available now are far more effective. As a consequence, caution exists in the market place as organisations want to be sure they are investing in optimal solutions for the long term.

However, the prize for getting IoT right is still glittering. Transforming a product-based business composed of one-time sales of devices into a service business generating monthly recurring profits holds enormous appeal, as does being first into a massive new market or creating a whole new customer experience. All of these opportunities, and many more besides, are still open but to succeed organisations need to address and plan for a variety of challenges. These include long device development cycles, data management at hyperscale, cost effective management and maintenance and the need to ensure IoT is secure.

This paper sets out the common pitfalls that cause IoT initiatives to fail and explains how new technologies,processes and strategies can be harnessed to put an end to unnecessary project failure. The sections below detail five key areas in which improvements can be made to IoT operations.

60% of organisations substantially underestimate the complexities of building an IoT service

75% of self-initiated IoT projects were considered a failure

Source: Cisco 2017 Industry Survey

1 https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/
2 https://www.ericsson.com/en/press-releases/2010/4/ceo-to-shareholders-50-billion-connections-2020
3 https://newsroom.cisco.com/press-release-content?articleId=1847422
4 https://venturebeat.com/2019/07/30/microsoft-30-of-iot-projects-fail-in-the-proof-of-concept-stage/
5 https://www.techrepublic.com/article/iot-projects-allow-for-failure-but-plan-for-success/

1. Invest in device design and prototyping

Several activities within device design, development and prototyping have created bottlenecks and unexpected costs for IoT service deployment. One area with significant headroom for improvement is prototyping of devices, which currently presents a substantial delay for the time to market of IoT enabled services. Late market entry is a potential point of failure for IoT because being first to market can be an enormous advantage in attracting and retaining customers for new services.

In addition, if a competitor launches a new IoT service, the idea of having to wait while your own device is developed – typically for a period of 18 months – is unacceptable. Such delay in effect gives the market place to your competitor for an extended period. It is also limiting in terms of innovation. If device design decisions have to be made 18 months in advance, new innovations may not be possible to be added to the offering and the development cycle is continually hampered.

Device design also needs to take into account the need to standardise and simplify production and deployment. It's counter-productive to have market specific devices that require versioning of appliances for regional or national markets, for example. Instead, appliances should incorporate IoT devices added that have a single stock-keeping unit, one SIM and are suited to global deployment, in order to handle any future changes in IoT device or connectivity requirements.

2. Choose the right connectivity partner

Although connectivity has always been a central requirement of IoT, fragmentation across different technologies, nations and standards has proved a substantial challenge to organisations that are deploying connected devices. Aside from the basic decisions of whether to select cellular, low power or satellite technology, different technological generations, national regulations and coverage availability have been important concerns to address.

For many, the complexity of managing a web of mobile network operators (MNOs) has proven to be costly, challenging and often a wasted effort. Organisations on their own can't access the economies of scale available to larger providers of IoT connectivity, so managing IoT connections yourself can prove to be a barrier to operational efficiency.

In addition, connectivity decisions often have to be made at the device build stage because traditionally at least, modem functionality needs to be built-in to a device at the factory. This is changing with the emergence of the embedded universal integrated circuit card (eUICC), a technology that enables the subscriber identity module (SIM) with multiple options or profiles to enable network switching according to requirements. However, the need for ubiquitous, global connectivity that is simple to manage is a key requirement for many organisations that has been missing up until now. Inflexible contract terms, different conditions from different suppliers, the need for multiple MNOs to supply connectivity and prohibitive conditions have left Iorganisations unsure of their connectivity costs and cautious of moving to large-scale deployments where the business case is unclear.

3. Enable scalable data management

Data is the lifeblood of IoT and in many respects the reason for its existence and large-scale analytics and security capabilities must go hand-in-hand with the data itself. The data gathered and then transmitted to the cloud for analysis and action is the core value proposition of IoT. However, it's often glossed over as a utility activity when in fact managing the volume and velocity of data at hyperscale is both challenging and costly. Nevertheless, the costs of not managing data at hyperscale can be far greater if communication and processing loads are not managed for efficiency. It's easier to perform analytics on well-managed data and it is easier to secure because anomalies, frauds and attacks can be more easily identified.

Costs of data management need to be carefully assessed to ensure only relevant data is stored and analysed. Without doing so, the costs of processing unnecessary or less valuable data become prohibitive as computing and storage resources are necessities in addition to the costs of transporting vast volumes of traffic.

Exabytes of data will make up the foundations of IoT services – some will need to be acted upon instantly for time-specific services while others will be able to be handled with less urgency. Relationships between organisations and suppliers such as cloud providers will need to be carefully managed to ensure outcomes match inputs and costs are not incurred wastefully.

4. Design-in security as part of a holistic strategy

Security is another fundamental consideration when deploying IoT. Without it, IoT becomes a liability instead of an asset. Organisations naturally take extreme care in specifying security because of the potential for loss by themselves and their customers and the ensuing damage to their reputation.

The foundations of security rely on tamper-proof physical hardware with an embedded SIM, no programming interfaces and which are write-protected with no debug code. On top this comes application security enabled by transport layer security (TLS) and HTTPS, network security via the GSM network or VPN security and side band security such as via SMS. Further security is supported by threat detection, typically with intrusion and anomaly detection capability, and threat management, achieved via alerting, suspension and quarantine capabilities.

One flaw often encountered in IoT is that security strategies have been approached retrospectively by organisations requiring security solutions to be retrofitted to devices and associated systems. In addition, there are variations to take into account depending on the infrastructure adopted and the security capabilities offered by different providers. AWS, for example, combined with Eseye connectivity enables security certification to happen automatically, over the air (OTA) with zero touch.

This is valuable to organisations because, without OTA capability, a security certificate needs to be set at manufacture and this can be a challenge if a device is being manufactured remotely in different countries. With OTA, zero touch functionality, the device simply connects to the service provider on power up and downloads the security certificate. This makes it more secure and means that security certificates don't have to be manually assigned, which would be an enormous burden for deployments involving thousands of devices.

Efficient security needs to be designed-in and, given the lifespans of many IoT devices, able to be updated and strengthened in deployment. The ability to update and strengthen security through OTA software upgrades is very useful and provides a means to resolve flaws as they are identified. OTA security therefore should be used to augment and enhance the built-in security that has been incorporated into IoT solutions at the design stage to help make devices tamper-proof, for example. Costly delays, or worse actual security breaches, can be avoided by carefully considering the security implications of an IoT services and designing the correct products and processes from the outset.

5. Plan for flexible device management

One of the greatest challenges of an IoT deployment is that the more successful it is the harder it gets to manage. While small, trial deployments are relatively easy to manage with limited numbers of devices to maintain and a proportionally lower volume of data, the success of an IoT project brings growth which creates its own complications. Systems that worked for a few thousand trial connections won't work so efficiently for 250,000 connections across different geographical regions.

It's therefore vital for organisations to consider whether they would be able to roll-out their connected devices to other regions or countries as their footprint grows. In addition, organisations need to know if the device will work in its current format across all deployment areas or if they will be left having to manage multiple device versions. Finally, as scale arrives, organisations need a better understanding of the impact of larger volumes of devices on cost and resources.

Organisations should therefore design for growth with the flexibility to rapidly scale up if the service is successful. The management burden is multi-faceted and requires organisation to have visibility and control of the device estate, the connectivity and the data. Much of this will be handled over the air with the IoT connection informing the operator of its requirements. This extends from predictive maintenance to more urgent fault identification.

Of course, physical maintenance is often cost-prohibitive so minimising human interaction and managing in an automated way is an essential ingredient of IoT success. Lessons learned in pilot or trial projects must be scaled up for mainstream IoT if deployments are to be successful but often this is not considered in sufficient depth leading to service failure on either a performance or cost basis.

Organisations instead should focus on utilising IoT managed services that are suitable for large scale success. This starts from the initiation of a project and therefore should mean the project runs far more smoothly and also IoT time to market is reduced.

How Eseye Helps

Across IoT Eseye is helping organisations with connectivity, hardware, consulting and services to help ensure that customers' deployments buck the trend and succeed. The company has offerings in connectivity, hardware and consulting and services to enable this which are detailed below.

Rapid device design and prototyping

Successful IoT business outcomes begin at the device level, so Eseye has pioneered technology that provides absolute control and visibility into devices post-deployment. The company has also invested for more than a decade in research, development and deployment innovation which has led to the creation of out-of-the-box, customisable hardware that accelerates IoT Implementation. Easily integrated into a range of IoT products, as an off-the-shelf solution configurable for specific needs, Eseye's hardware products are deal for wide-reaching roll-outs and delivering near 100% connectivity.

The portfolio includes Eseye's HERA600 Series cellular routers which deliver out-of-the-box adaptable M2M connectivity in rapid time and the HERA300 Rapid Device Development Platform which enables rapid prototyping, accelerating the process from an initial idea to a working prototype in a matter of weeks. In fact, HERA300 can reduce device development time from 12 months to less than three months.

HERA300 Rapid Device Development Platform

> **Eseye's rapid prototyping methodology approach is cutting our time to market by about 50%, which, in a fast-moving industry is very important"**
>
> Declan O'Brien, director, Aldodex

Secure, universally available connectivity

Eseye's intelligent patented network switching AnyNet Secure technology helps organisations achieve near 100% universal connectivity for their IoT or M2M-enabled devices. The company works in close partnership with several major global MNOs that are members of the AnyNet Federation to ensure maximum geographic reach, while delivering network agnostic global connectivity. The AnyNet Secure offering means organisations only need to design, deploy and manage a single stock-keeping unit (SKU) which works globally.

This massively reduces the time, cost and complexity of an IoT development and deployment when compared with the standard, fixed-network approach. In addition, thanks to innovative over the air (OTA) switching, organisations can manage all the devices in their network from a single, remote location. AnyNet Secure delivers maximised 2G, 3G or 4G, and in the future 5G, cellular coverage across GSM, LTE CAT M, Cat 1 networks, reinforced by Eseye's global MNO partnerships.

The company has pioneered new device-based connectivity capabilities and has been offering an eUICC equivalent, future-proofed technology for 12 years in the form of its multi-IMSI offering that enables devices to work out of the box, anywhere in the world using the same SIM card, software and configuration. Eseye has also enabled AnyNet Secure for AWS to provide a powerful and comprehensive IoT solution, enabling it to become the first cellular connectivity company to be chosen as an AWS Advanced IoT Technology Partner.

We automatically provision the device data onto the AWS IoT Core.

1 SIM
1 SKU
100% connectivity

Zero touch security certificates sent OTA to your devices

Your AWS account

Unified Billing

Single pane of glass management

Single support interface

Expert device optimisation and consultancy

To get the best results from their IoT deployment, organisations need to ensure every detail of your project leads directly to the business outcomes they want. Selecting Eseye delivers access to in-depth technical expertise developed across some of the most innovative and challenging IoT projects the world has seen so far. Shortening development time and costs, while simultaneously optimising IoT performance and security, enables Eseye to take an idea to the prototype stage in as little as 30 days.

This capability is backed by global technical support and customer service to keep organisations connected round the clock. Following IoT deployment, Eseye monitors the M2M network to ensure it delivers what is needed. The company's team of qualified engineers proactively and routinely check networks and applications so, if the device connectivity is not performing effectively, they will know and deal with it before it impacts on business.

Conclusion:

What Does Success Look Like?

IoT in general is yet to reach the scale and success projected during the market's infancy and this is entirely normal for a new technological area in which enthusiasm outstrips the realities and challenges of large-scale deployments. As IoT has moved from pilot projects, proof of concepts and early trials, the multi-layered complexity of IoT services has contributed to the large number of project failures. However, these have been a learning process and the current wave of deployments will see many of the early problems addressed.

Focusing on the foundation of successful IoT is vital to enable rapid, hyperscale growth so Eseye's capability to provide rapid, reliable, end-to-end solutions that ensure continuity and consistency in managing while IoT while accelerating time to market by rapid device design and development provide key ingredients for success.

Importantly, Eseye can make the complex simple by providing easy to manage global and agnostic IoT connectivity, supported by devices with one SIM for global connection, providing a single bill for all IoT connectivity and one global support contract. Partnerships with global MNOs and hyperscale cloud providers such as AWS ensure resilient, secure yet also simple access to critical IoT infrastructure, leaving organisations free to focus on the business value of IoT and to drive the success of their deployments.

As IoT continues to develop, organisations' focus should be less on the complexities of managing connectivity, data and devices and more on what they are doing with the insights to serve customers better and monetise the experiences they provide to deliver more business value. Doing so will radically change the success-rate of IoT projects and start to deliver on the promise of IoT in the form of billions of devices generating trillions of dollars of profit.

To learn more about how Eseye can help your IoT projects from idea to deployment visit: www.eseye.com

eseye
INTELLIGENTLY CONNECTED
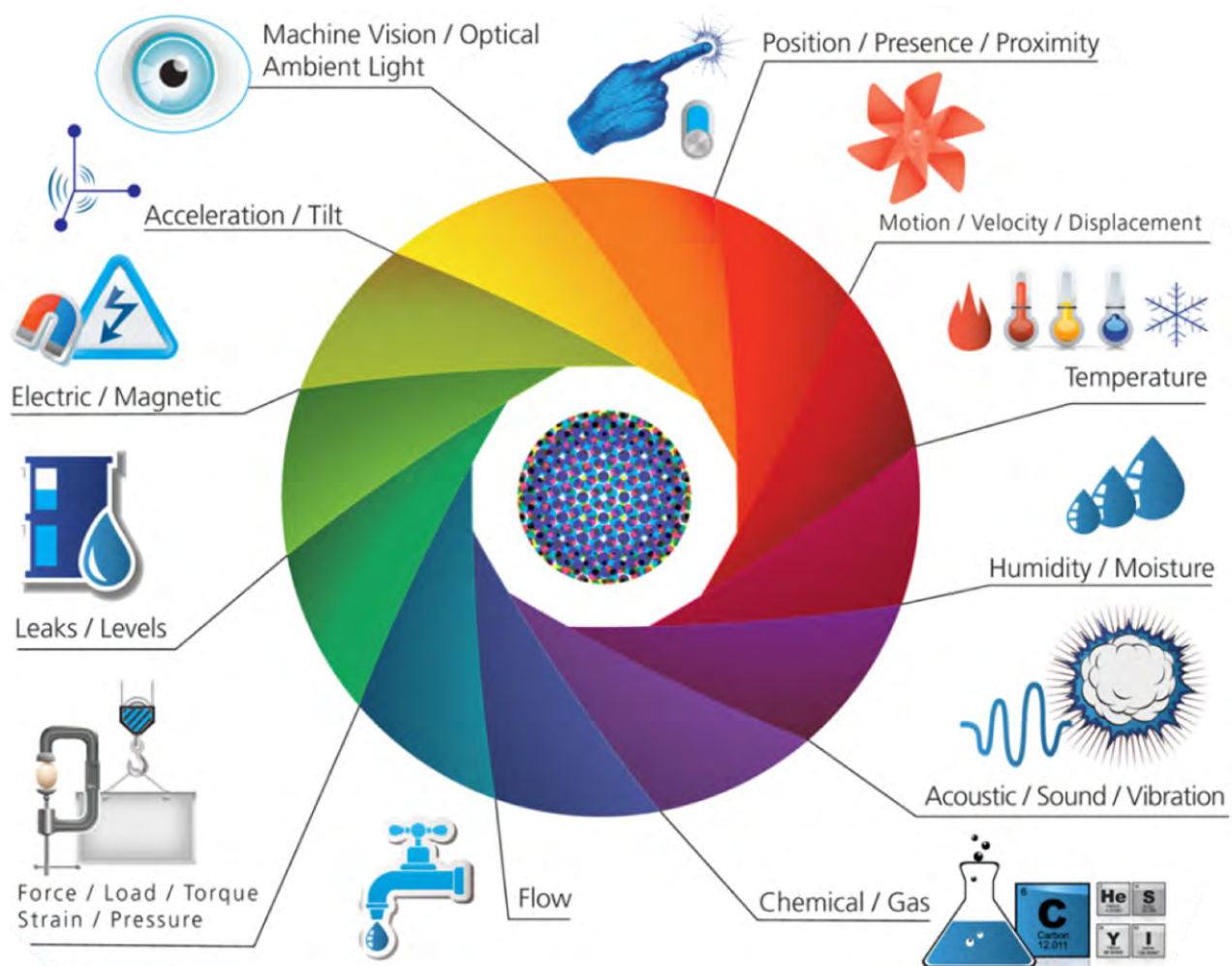
Future Impacts of New Sensor Technologies

As more and more companies delve into developing smart systems, they are quickly finding that competitive differentiation shifts away from unique, vertically focused product features. The new focus will be on how the product is actually used—how it fosters interactions between and among users in a networked context.

SENSING TINY THINGS

Do you understand how fast the world is changing? One indication of the speed is the fact that we're drowning in unprocessed information. We're creating data at 2X the rate we're deploying traditional bandwidth to carry it, but almost all the data created to date has never been analyzed. More than half the data created by physical or operational systems loses any value that could be derived through analysis in less than a single second.

Yet by 2020, according to the National Science Foundation, there will be trillions of sensors on the earth. And forecasters predict that in just a few more years there will be more processing power in smart phones than in all the servers and storage devices in data centers on the earth today. Ready or not, we're rushing into the future of truly distributed systems and intelligence.

We are giving our World a Digital Nervous System

Source: Harbor Research

Revolutions always begin by sensing small things and drawing inferences. For example, there is great value in knowing how people use "white goods" like home appliances. If you embedded a microprocessor in the plastic of an electrical outlet, you'd have true local processing as opposed to processing in a remote cloud. From there, you could infer almost anything by sensing the electrical current "signature" and its usage profile—not just energy used, and whether a washing machine's motor is about to fail, but the fact that the consumer just washed a load of whites versus a load of colored clothes. If you had an inkjet printer plugged into that same outlet, you could know whether the consumer was printing colored pages versus black-and-white.

Analysis of data from a "sweat patch" for measuring human perspiration can reveal the emotional state of an athlete wearing it, as well as the level of physical stress she's under. If a worker is wearing the patch, you can see if they're being exposed to the many dangerous substances that exist in factories, farms, and other workplaces.
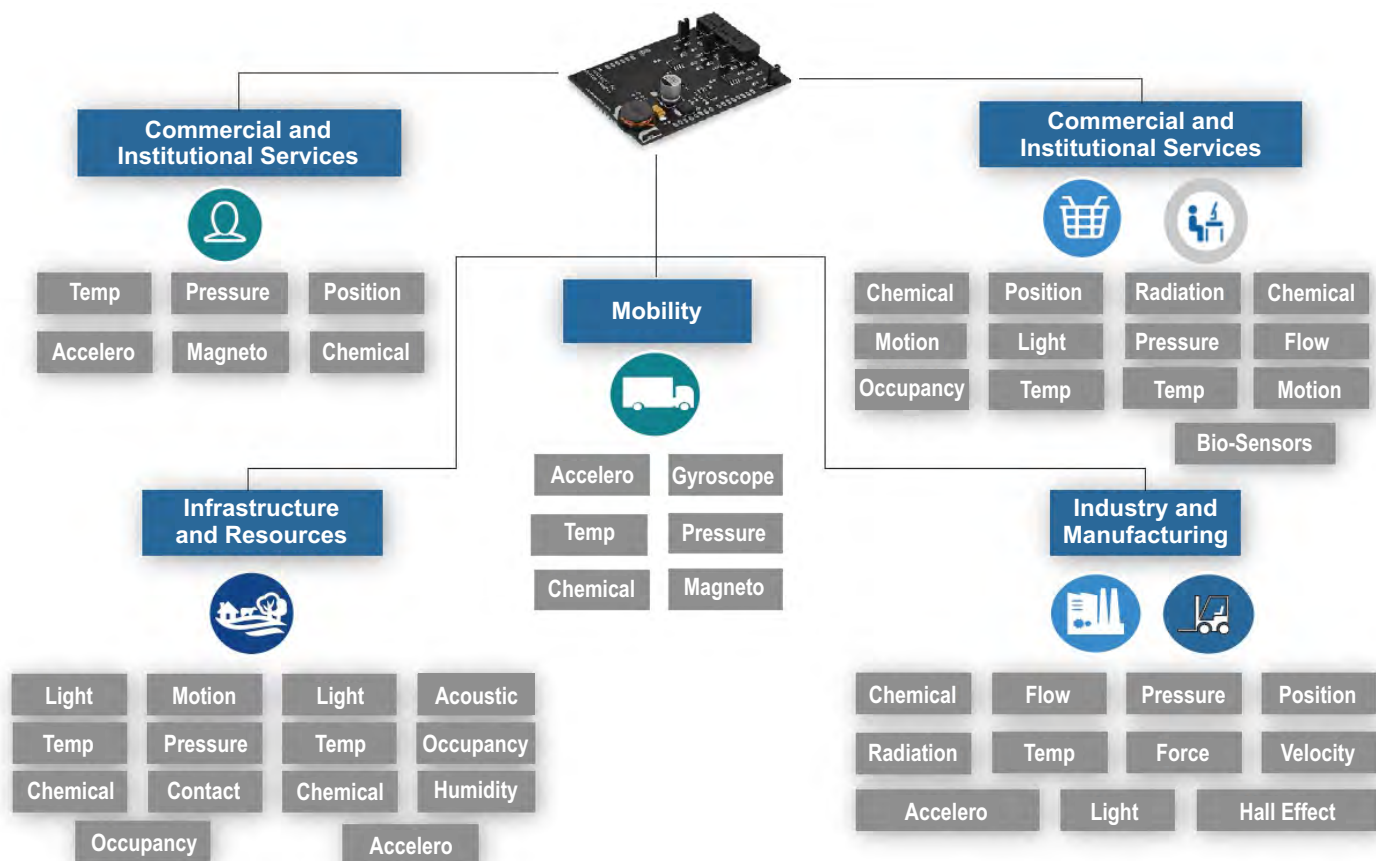
Weather is another complex phenomenon that can be greatly understood by correlating data values collected from simple pressure, temperature, and moisture sensors with additional spatial and temporal parameters that place the data into a richer context. I could be running a fleet based on weather forecasts, but if I add the data from sensor packs mounted directly on my vehicles, I'm less likely to be impacted by unexpected weather conditions. The closer that systems are to real-time, the more efficient and cost effective they can be. All such data, with its related context, has extraordinary value to everyone.

NEW VALUE FROM GROWING INTERACTION

As networks have invaded the "physical" world, system and solution designers are seeing the new values that come from the growing interactions between sensors, machines, systems and people. Electronic, mechanical and other related systems that used to have unique physical interfaces and components are now becoming digital and standardized.

The convergence of collaborative systems and machine communications will enable entirely new modes of services delivery and customer interactions, and the implications are enormous. No product development organization will be able to ignore these forces, nor will their suppliers. Product and service design will increasingly be influenced by the use of common components and subsystems. Vertically defined, stand-alone products and application markets will become part of a larger "horizontal" set of standards for hardware, software and communications.

Trillions of Sensors Will integrate and Inform Future Smart Systems
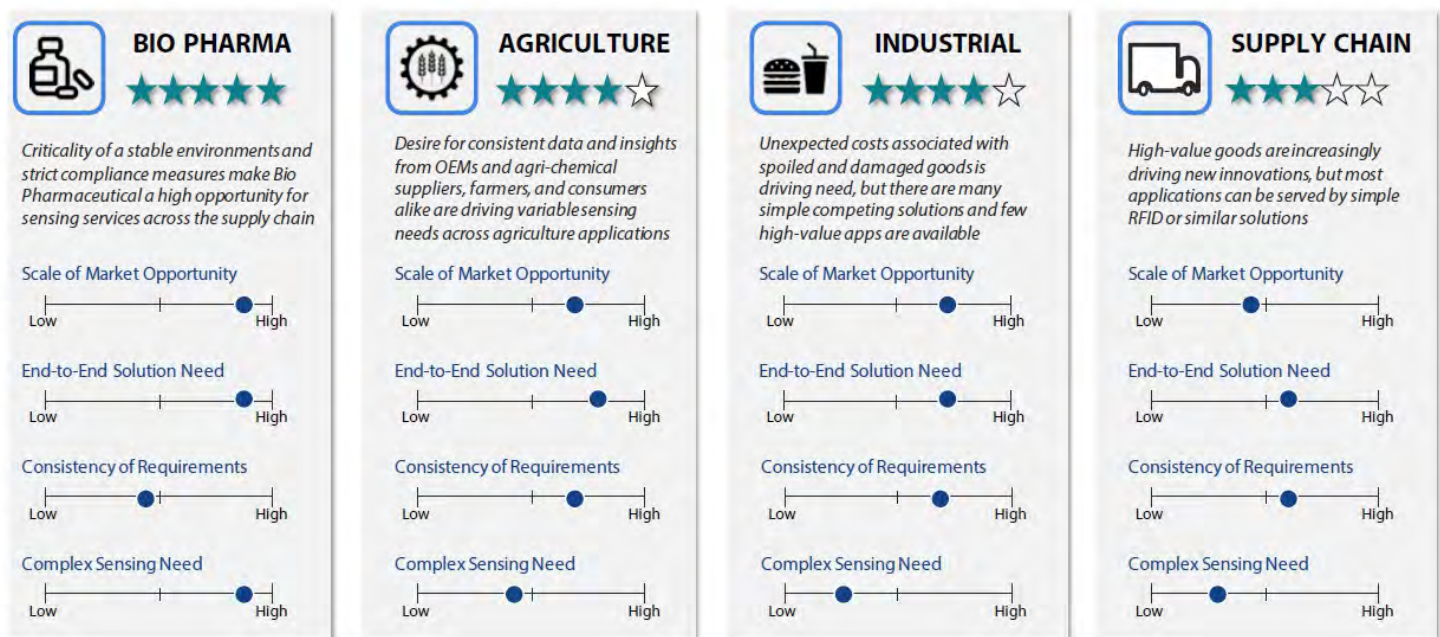

Source: Harbor Research

Further, efficient support of products and equipment is only the first benefit of this trend. To conserve precious resources on this tiny planet, the world desperately needs better sensing, and soon. But it's not happening because the big attention and glamor continues to reside with IT, and IT wouldn't know a sensor if it tripped over one. They understand the data that runs the corporation, but not the gargantuan accumulation of tiny data emanated by the systems that run the world. All those systems interact, which creates context, which adds to the value. It's not that the IT guys are stopping the world from innovating, it's that they have no interest in integrating real-time inputs.

All of these trends lead us to the simple question: How well-prepared are manufacturers for the advent of smart systems and services, sometimes called the Internet of Things? We may think we know how to design smart systems, but many companies are finding this to be a serious challenge. For all the talk about silicon-based "intelligence" permeating every aspect our lives, we still live in a brutally dumb world.

Arenas With Significant New Sensor innovation Opportunities

Top opportunities all require better end-to-end sensing solutions.
Biopharma and agriculture are the most attractive opportunities
for new multi-variate, flexible sensors

BIO PHARMA ★★★★★

Criticality of a stable environments and strict compliance measures make Bio Pharmaceutical a high opportunity for sensing services across the supply chain

Scale of Market Opportunity — Low / High
End-to-End Solution Need — Low / High
Consistency of Requirements — Low / High
Complex Sensing Need — Low / High

AGRICULTURE ★★★★☆

Desire for consistent data and insights from OEMs and agri-chemical suppliers, farmers, and consumers alike are driving variable sensing needs across agriculture applications

Scale of Market Opportunity — Low / High
End-to-End Solution Need — Low / High
Consistency of Requirements — Low / High
Complex Sensing Need — Low / High

INDUSTRIAL ★★★★☆

Unexpected costs associated with spoiled and damaged goods is driving need, but there are many simple competing solutions and few high-value apps are available

Scale of Market Opportunity — Low / High
End-to-End Solution Need — Low / High
Consistency of Requirements — Low / High
Complex Sensing Need — Low / High

SUPPLY CHAIN ★★★☆☆

High-value goods are increasingly driving new innovations, but most applications can be served by simple RFID or similar solutions

Scale of Market Opportunity — Low / High
End-to-End Solution Need — Low / High
Consistency of Requirements — Low / High
Complex Sensing Need — Low / High

Source: Harbor Research

TOO MUCH DISCONNECTION

We believe that in most companies there is too much disconnection between people, functions, processes and knowledge to design and create organic smart systems growth opportunities. Large organizations have many rules and policies that often seem completely disconnected. They have been creating language, processes and systems that seem to be a triumph of technique over originality. General managers, like cost accountants, claim to have developed uniform approaches for just about everything–including "organic" growth.

Mounting evidence suggests that most of the existing approaches to creating new growth businesses are of little value when it comes to emergent and disruptive opportunities like the Internet of Things. These days all large manufacturers have a so-called "business system" which seems to have severely diminished managers' ability to focus on new smart systems opportunities, take risks, or do just about anything creative. These robotic processes lead organizations further and further away from any kind of innovation and blur management's vision.

Most knowledge comes from human experience and expertise. But today, knowledge and expertise largely reside in functional silos dispersed across organizations. Acting singularly, those siloed systems are constrained by the resources under their control. Legacy processes and habits inhibit any natural ability to communicate and collaborate on solving big problems or creating new solutions. In many companies, lean practices have been applied so aggressively that people are simply consumed by "running the business." They fail to harness the collective intelligence available throughout the company and its networks. Thus, they fail to develop creative products, systems and solutions.

So how have manufacturers been able to continue to grow and create value in the equity markets? Several ways: global expansion, re-engineering, lean practices, mergers and acquisitions—all reasonable strategies for growth and value creation. But the marketplace is rapidly consolidating, and the world is increasingly driven by new and unfamiliar technologies. What worked in the past is less likely to work now or in the future. For many companies, those strategies have already reached the point of diminishing returns. Besides which, almost every major manufacturing segment has gone through twenty plus years of consolidation and there are not enough acquisition candidates left to "move the value needle."
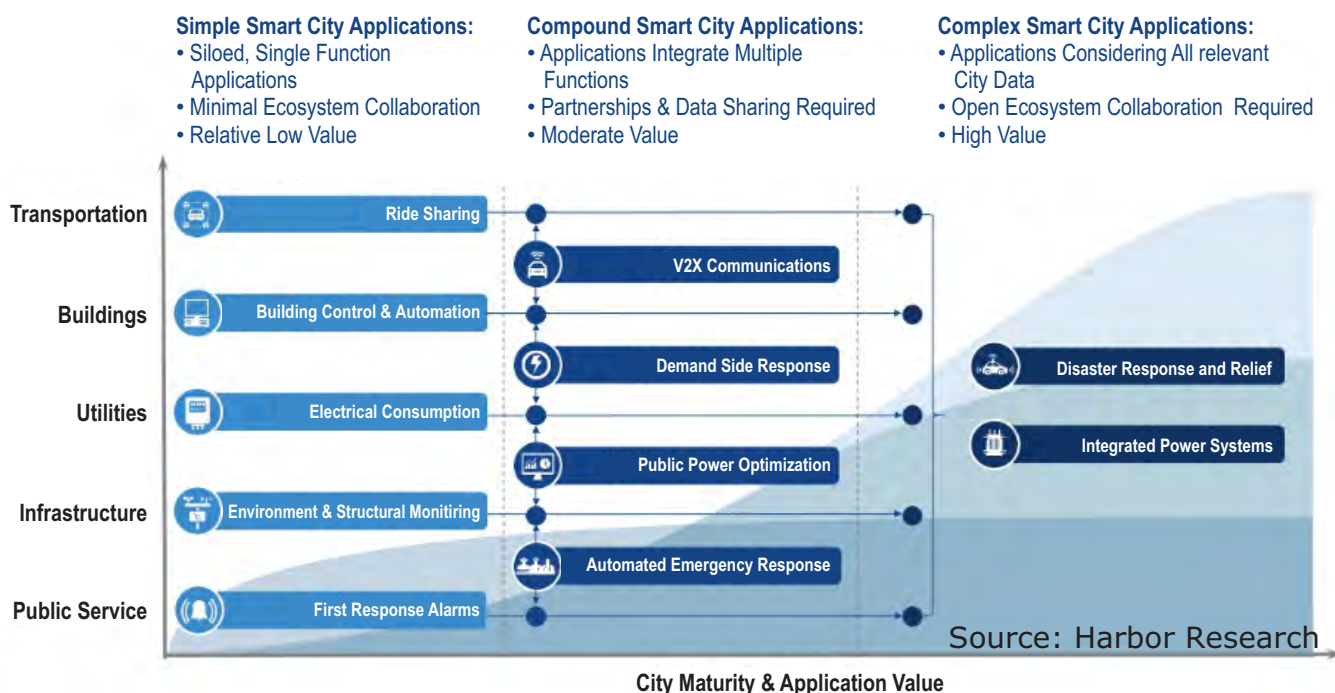
THE BLIND LEADING THE VISION-IMPAIRED

This evolution reminds us of a story by H. G. Wells, "The Country of the Blind." The story concerns a group of people living in total isolation in a valley of the Andes Mountains. For an unknown reason, the inhabitants of the valley have been congenitally blind for two or three generations.

The people in the valley have re-evaluated much of the information handed down through oral tradition. New impressions have been forged based on subjective experience. For example, they have decided there is no difference between angels and birds. The people have reasoned that they can hear both birds and angels sing, and they can feel the wings of both brush their faces—so there must be no difference.

The story depicts a group of people who, as long as they remain in isolation, can rationalize any type of behavior—no matter how absurd the behavior appears to an outsider. Isolation and blindness lead the inhabitants further and further away from the truth.

New Sensor Integration Enables New Value Cretion Through Complex Interactions

Simple Smart City Applications:
- Siloed, Single Function Applications
- Minimal Ecosystem Collaboration
- Relative Low Value

Compound Smart City Applications:
- Applications Integrate Multiple Functions
- Partnerships & Data Sharing Required
- Moderate Value

Complex Smart City Applications:
- Applications Considering All relevant City Data
- Open Ecosystem Collaboration Required
- High Value

Transportation — Ride Sharing — V2X Communications

Buildings — Building Control & Automation — Demand Side Response — Disaster Response and Relief

Utilities — Electrical Consumption — Public Power Optimization — Integrated Power Systems

Infrastructure — Environment & Structural Monitiring — Automated Emergency Response

Public Service — First Response Alarms

Source: Harbor Research

City Maturity & Application Value

In our opinion, existing schemas, institutions and approaches for new growth development are, for the most part, broken. In the Internet of Things arena, the complexity of interdependent relationships required for new growth ventures only compounds the challenges. In this environment, growth depends on interacting in new and creative ways. Linking functions by breaking down the barriers to communication is the first step, but it can't stop there. The key is building truly collaborative networks.

LESS MANAGERIAL HIERARCHY, MORE CUSTOMER VALUE

For those brave enough to have invested in smart systems and services opportunities, progress has been slow to come. In many ways, most of the larger diversified industrials have not gone beyond "first base" in capitalizing on the value of connected smart systems and services.

We believe they have focused too much attention on captive OEM services. While many manufacturers have begun to build remote services programs, they are mostly directed at productivity and efficiency. These remote services programs are focused inwardly; they're not focused on creating new customer value.

Based on Harbor Research analysis, many of these systems barely utilize the data they collect. While many players are talking a "Big Data" game, few are realizing any significant new value from machine data and analytics. To date, the remote services opportunity has been comprised of monitoring applications and related tracking and location services—what we like to call the "alerts and alarms" syndrome. Manufacturers are stalled, wondering how to get to a future focused on collaboration between devices, data, people and systems.

Given the apparent speed that corporate leadership can absorb new management theories maybe this isn't a real problem; just a work in progress. With all the fads and fashion of management concepts, from empowerment to re-engineering to innovation and, more recently, design thinking, it's a wonder we haven't met the challenge of Smart Systems Design by now. Just observe how many consulting firms have acquired design firms in the last three years. Help is surely on the way.

Compared to what is evolving in the marketplace—design thinking or not— the solutions we are describing here will have far less managerial hierarchy, less command-and-control decision-making, less stage gate process, and less proprietary ownership of ideas. These networked—that is, "smart"—systems will be self-organized by manufacturers, partners and customers who are motivated to explore and develop ideas they care deeply about. Collaborative innovation will go beyond ideas a bout new products and services. They will extend to ideas about the very manner in which business is conducted.
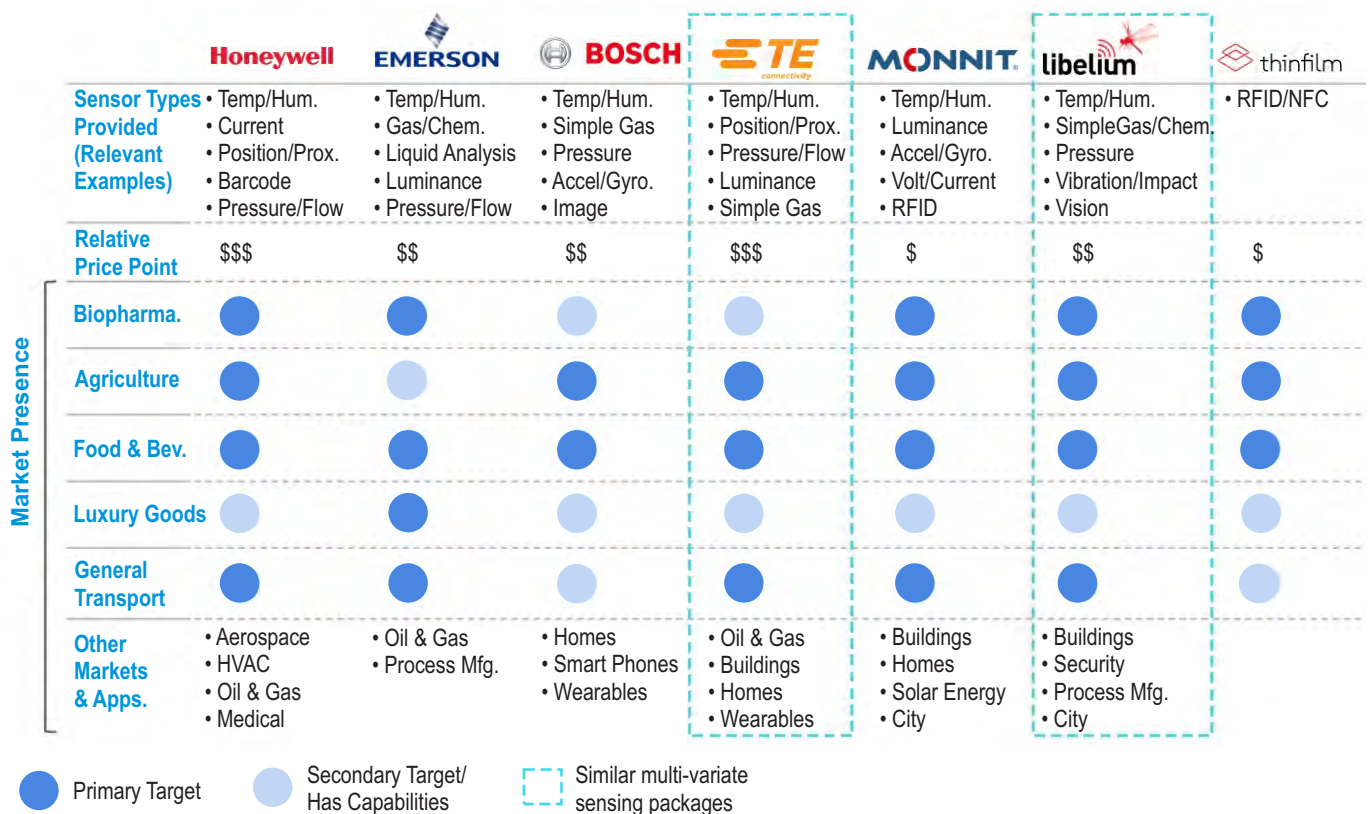
WHAT ARE SMART SYSTEMS?

Our practice focuses on what we've come to call "Smart Systems," the convergence of pervasive and embedded computing with the Internet; what many refer to as "the Internet of Things (IoT)." We prefer Smart Systems over other terms in common use because it captures the profound enormity of the phenomenon; something much greater in scale, scope and impact than just machine connectivity.

"Smart Systems" is a new generation of computing and information architecture that looks very different from classical information, computing, and telecom (ICT) paradigms. In Smart Systems, the physical world dovetails with machine learning and artificial intelligence to produce previously unimagined capabilities for both the B2B and B2C worlds. After years of frustrating fits and starts, the technology is here to integrate people, processes, and data in ways that enable collective awareness and better decision making.

Competing Suppliers Target Segments With an Array of Sensor Types

Competing hardware suppliers are approaching the top segments from
two distinct backgrounds: **industrial sensing**, or **low-cost IoT-focused applications**.
Few offer multi-sensing solutions in a single device

Market Presence		Honeywell	EMERSON	BOSCH	TE connectivity	MONNIT	libelium	thinfilm
	Sensor Types Provided (Relevant Examples)	• Temp/Hum. • Current • Position/Prox. • Barcode • Pressure/Flow	• Temp/Hum. • Gas/Chem. • Liquid Analysis • Luminance • Pressure/Flow	• Temp/Hum. • Simple Gas • Pressure • Accel/Gyro. • Image	• Temp/Hum. • Position/Prox. • Pressure/Flow • Luminance • Simple Gas	• Temp/Hum. • Luminance • Accel/Gyro. • Volt/Current • RFID	• Temp/Hum. • SimpleGas/Chem. • Pressure • Vibration/Impact • Vision	• RFID/NFC
	Relative Price Point	$$$	$$	$$	$$$	$	$$	$
	Biopharma.	Primary	Primary	Secondary	Secondary	Primary	Primary	Primary
	Agriculture	Primary	Secondary	Primary	Primary	Primary	Primary	Primary
	Food & Bev.	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Luxury Goods		Primary	Secondary	Secondary	Secondary	Secondary	Secondary
	General Transport	Primary	Primary	Secondary	Primary	Primary	Primary	Secondary
	Other Markets & Apps.	• Aerospace • HVAC • Oil & Gas • Medical	• Oil & Gas • Process Mfg.	• Homes • Smart Phones • Wearables	• Oil & Gas • Buildings • Homes • Wearables	• Buildings • Homes • Solar Energy • City	• Buildings • Security • Process Mfg. • City	

● Primary Target   ◔ Secondary Target/ Has Capabilities   ⬚ Similar multi-variate sensing packages

Source: Harbor Research

ABOUT HARBOR RESEARCH

An internationally recognized strategy consulting, design and technology research firm, Harbor Research has predicted, tracked, and driven the development of Smart Systems, Services and the Internet of Things since our inception in 1984.
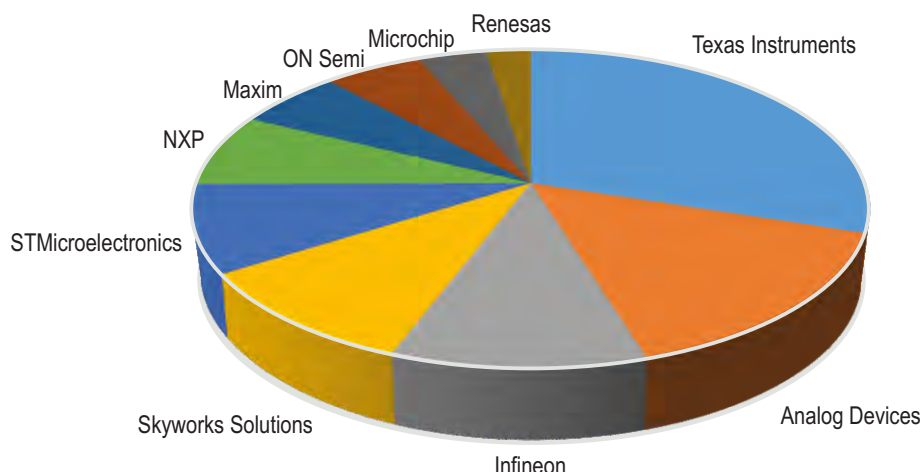
While our history is long, our strategy is simple: create value for our clients by combining creative facilitation with structured methods, rigorous analysis and systems-focused thinking. It is this mindset that has given us the privilege of working with leaders in some of the greatest companies in the world. We work with clients in a variety of ways including growth strategy consulting, business model development, and solution design services supported by our independent research focused on emerging technologies and human sciences.

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Top Analog ICs Vendors are also Leaders in Tiny Sensors

Global Top 10 Analog IC Vendors

See details in Semiconductor Update World of May-June 2019 CLICK HERE

Examples of Sensors from Texas Instruments

| TO-92 | SOT-23 | DSBGA | SOIC | FCBGA |

Small-size sensors to enable new form-factor possibilities

TMP390: Temperature Switch « Industry's first dual-channel »
Ultra-small, dual-channel (hot & cold trip), 0.5-µA, resistor-programmable temperature switch

DRV5011: Magnetic Sensor - Hall Effect « Industry's smallest low-voltage, digital Hall-effect sensor »
The DRV5011 device is a digital-latch Hall effect sensor designed for motors and other rotary systems.
Small size (available in WCSP and X2SON), low voltage (up to 5.5-V) Hall effect latch

IWR6843: mmWave « Industry's only single-chip sensor with a 75% smaller footprint »
Single-chip 60-GHz to 64-GHz intelligent mmWave sensor integrating processing capability based on FMCW radar technology. It is built with TI's low power 45-nm RFCMOS process and enables unprecedented levels of integration in an extremely small form factor. The IWR6843 is an ideal solution for low power, self-monitored, ultra-accurate radar systems in the industrial space.

Highly accurate sensors to achieve automation you can trust

TMP61: Thermistor
±1% tolerance 10kΩ silicon-based linear thermistor with 0.6 s thermal response time and 0.5% typical long-term sensor drift starting at US $0.05 in 1,000-unit quantities

TMP117: Temperature Sensor
CMOS single-chip mmWave sensor that enables implementation of short-and-medium range automotive radar applications such as automated parking and obstacle detection using 76 to 81 GHz band

PART NUMBER	PACKAGE	PIN COUNT	BODY SIZE (NOM)
TMP390	SOT-563	6	1.60 mm × 1.20 mm
DRV5011	DSBGA	4	0.80 mm × 0.80 mm
	SOT-23	3	2.92 mm × 1.30 mm
	X2SON	4	1.10 mm × 1.40 mm
	TO-92	3	4.00 mm × 3.15 mm
IWR6843	FCBGA	161	10.4 mm × 10.4 mm
	FCBGA	209	15 mm × 15 mm
TMP61	X1SON	2	0.60 mm × 1.00 mm
	TO-92S	2	4.00 mm × 3.15 mm
	SOT-5×3	2	0.80 mm × 1.20 mm
TMP117	WSON	6	2.00 mm × 2.00 mm
	DSBGA	6	1.53 mm × 1.00 mm
TMCS1100	SOIC	8	4.90 mm x 3.90 mm

TMCS1100: Magnetic Current Sensor - High-Precision, Isolated Current Sensor With External Reference
« Industry's highest accuracy (0.5%), zerø-drift, galvanically isolated magnetic current sensor »
Galvanically isolated Hall-effect current sensor capable of dc or ac current measurement with high accuracy, excellent linearity, and temperature stability. A low-drift, temperature-compensated signal chain provides < 1% full-scale error across the entire device temperature range.

Direct Link to TI Sensors - Demo Board - Application Notes

Top 10 IoT Startups 2019 (alphabetic order)

A report from IOT ANALYTICS - Source

There are now more than 1,000 startups creating Internet of Things (IoT) products or services, according to the IoT Startups Report & Database 2019 by IoT Analytics.

Starting with a long-list of more than 3,000 companies that claim they work on Internet of Things solutions, the analyst team at IoT Analytics verified and classified 1,018 upcoming firms around the world that are active today, no older than 6 years and fit the definition of Internet of Things (see definition below).

The analyst team then picked the top 10, based on 6 criteria:
1. Size of existing investment (>$10M or more)
2. Employee growth (>~50% in last 2 years)
3. Quality of partnerships/investors (Reputed companies / organizations)
4. Quality of team (Experience of board members)
5. Quality of customers (Reputed companies)
6. Analyst opinion (Known customer sentiment, market disruption potential, others)

Company Name	IoT Focus	Country	Highlights
ARUNDO	Data Analytics	Norway	+ Strong partnerships + Outstanding team
Bright Machines	Microfactories	USA	+ Impressive employee growth + Outstanding team
DRAGOS	Cybersecurity	USA	+ Impressive employee growth + Strong partnerships
ELEMENT	Data Analytics	USA	+ Impressive list of investors + Strong partnerships
FOGHORN	Edge Intelligence	USA	+ Strong customer portfolio + Positive customer sentiment
iguazio	Data Science Platform	Israel	+ Strong customer portfolio + Strong disruption potential
IoTium	Secure Network Infrastructure	USA	+ Impressive list of investors + Strong disruption potential
Preferred Networks	Real-time Machine Learning	Japan	+ Strong customer portfolio + Strong disruption potential
READY ROBOTICS	Robotics	USA	+ Impressive employee growth + Strong disruption potential
sparkcognition	Analytics / AI	USA	+ Impressive employee growth + Strong partnerships

... to next page

Top 10 IoT Startups 2019   ... from previous page

Source: IOT ANALYTICS

1.   Arundo Analytics - Norway (IoT Middleware & Software Infrastructure)
Arundo Analytics is a hot IoT Startup that provides analytics software for industrial and energy companies. The company has formed several strategic alliances e.g., with Dell Technologies and WorleyParsons. Arundo has also formed a joint venture with DNV GL to provide stream data analytics for maritime companies. The board of directors includes Tore Myrholt, Senior Partner at McKinsey and Thomas Malone, the founding director of the MIT Center for Collective Intelligence. Recently, Arundo launched several applications incl. machine monitoring and fuel efficiency.

2.   Bright Machines - USA (IoT Middleware & Software Infrastructure)
Bright Machines is currently the fastest growing IoT Startup, having grown from virtually zero at the beginning of 2018 to more than 400 employees a year later (April 2019). The firm focuses on "micro-factories" made up of its software and robot cells as well as new software tools that make manufacturing more efficient. The leadership team is filled with former executives from Autodesk, Flextronics, and Amazon including Amar Hanspal (CEO), Brian Mathews (CTO), Tzahi Rodrig (COO) and Nick Ciubotariu (SVP, Software Engineering). The company recently entered into a strategic partnership with BMW i Ventures.

3.   Dragos - USA (IoT Middleware & Software Infrastructure)
Dragos is a cybersecurity startup that offers a software-defined security platform for manufacturers. The company has seen a 300%+ growth in headcount the last 2 years, and collaborates with GE, Deloitte, OSIsoft, ThreatConnect, Crowdstrike, and several other companies. The company recently acquired Atlanta-based NexDefense and collaborates with Waterfall Solution for a joint solution.

4.   Element - USA (IoT Middleware & Software Infrastructure)
Element (also known as Element Analytics) is a fascinating IoT Startup that focuses on industrial analytics software such as Digital Twins, particularly in heavy industries. The company counts an impressive list of investors, including Kleiner Perkins, GE, Honeywell, and ABB. Element partners with Microsoft, Uptake, OSIsoft, and Radix (consulting).

5.   FogHorn - USA (IoT Middleware & Software Infrastructure)
In recent years, US-based startup FogHorn has gained an excellent reputation with leading manufacturers and oil and gas organizations around the world for its real-time edge computing and analytics software. The company has seen an 89% employee growth in the past 2 years and has secured partnerships with 50+ industrial solution providers, OEMs, gateway providers, and consultants/SIs, including AWS, Google Cloud, Microsoft, Cisco, HP, NTT Data, and more. FogHorn is also a member of LF Edge, an umbrella organization to drive an open, interoperable framework for edge computing to accelerate deployment among the growing number of edge devices. Investors in FogHorn include The Hive, Bosch, Dell, GE, Honeywell, Intel, Saudi Aramco, and Yokogawa.

6.   Iguazio - Israel (IoT Middleware & Software Infrastructure)
Iguazio is a hot startup that provides a state-of-the-art data science platform for various verticals, including Industrial IoT, Smart Mobility, and Telecommunications. The company recently entered into collaborations with NVIDIA, Microsoft and Google. Iguazio markets its Nuclio platform product as a "serverless" framework for multi-cloud environments and is thus well-positioned for the next wave of cloud computing.

7.   IoTium - USA (IoT Connectivity)
IoTium is a quickly upcoming IoT startup from the Silicon Valley area that focuses on software-defined network infrastructure in manufacturing and related verticals. The company has seen a 100%+ growth in headcount over the last 2 years and now counts John Chambers, former Cisco CEO, as an investor along with other well-known corporate investors incl. Juniper, Qualcomm, SafeNet and Wind River. The company is also very active in the EdgeX Foundry and recently joined the Siemens' MindSphere partner program as a gold member.

8.   Preferred Networks - Japan (IoT Middleware & Software Infrastructure)
Preferred Networks is one of Japan's IoT hot shots, focused on applying real time machine-learning technologies to new Internet of Things applications. The company has seen a 100%+ employee growth in the last 2 years and now collaborates with world leading organizations incl. Toyota Motor Corporation, Fanuc, and the National Cancer Center. The company is also very active in developing the deep-learning framework Chainer™ together with IBM, Intel, Microsoft, Nvidia.

9.   READY Robotics - USA (IoT Hardware)
READY Robotics is a rare robotics startup that is looking to benefit from the increasing automation and flexibilization of manufacturing processes around the world. The company emerged from the cutting-edge robotics research at Johns Hopkins University to develop their industrial robotic software called Forge. The company has seen a 150%+ growth in headcount in the last 2 years and is now producing roughly 15 robot systems per month.

10.   SparkCognition - USA (IoT Middleware & Software Infrastructure)
SparkCognition excels in AI-powered analytics, particularly in manufacturing and related verticals. SparkCognition has seen a 100%+ growth in headcount over the last 2 years. The company has launched Skygrid, a joint venture with Boeing and it has partnered with Siemens as part of its Mindsphere program. The company is also a Google Cloud Technology Partner and works with IBM as a trusted partner.

Request a sample of the Report « Top 10 IoT Startups 2019 from IOT ANALYTICS » Click Here

Securing the Edge Cybersecurity in the Age of IoT

On-Demand IndustryWeek-hosted webinar, sponsored by Avnet | Free [Click Here](#)

What threats do we face as critical infrastructures in the enterprise & public domains become increasingly open to IoT cybersecurity risk? Could the mainstreaming of IoT open the gate to attacks more serious than we've already seen? Current predictions estimate that the installed base of IoT devices will hit 64 to 73 billion by 2025, up from 10 billion in 2018. Yet organizations still face an uphill battle in developing comprehensive strategies, practices and technologies for end-to-end security that will sustain an ever-expanding maze of IoT endpoints.

Overview of Topics:
- New Realities of the Edge: The size and scale of the security threat
- End-to-End IoT Security: What does it really mean—and require?
- IoT Risk Management: Governance, best practices, leadership's role, resolving the knowledge and skills gap, and the third-party risk factor
- New Trends in Edge Security: What's hot, what's not
- Technologies and Services: What type of security solutions do we need in highly distributed, hyper-connected environments?

SPEAKER Dr. Larry Ponemon is the Chairman and Founder of the Ponemon Institute and is considered a pioneer in privacy auditing and the Responsible Information Management or RIM framework. Dr. Ponemon was appointed to the Advisory Committee for Online Access & Security for the United States Federal Trade Commission. He was appointed by the White House to the Data Privacy and Integrity Advisory Committee for the Department of Homeland Security. Dr. Ponemon was also appointed to two California State task forces on privacy and data security laws.

WHITE PAPER

5 Factors to Consider if You're Building a Wireless IIoT Solution

Do you belong to an enterprise looking to create revenue from your customer base through a connected solution? Do you consider your business to be "mission-critical"? Are you looking for help on selecting the right sensing and connectivity technologies for your wireless IoT architecture? If you answered yes to all the above, this white paper is for you.

This free resource examines the benefits and the complex challenges that accompany the implementation of an enterprise-grade, revenue-generating wireless IoT solution.

Download for technical insight on:

- Top Wireless IoT Challenges
- What Your Competitors are Doing – Example Applications
- Architecting Your IoT Solution
- Choosing a Connectivity Option
- Selecting a Cloud Solution
- ... and more, 13 pages

Download Now