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People, Process and Technology for **Industrial Internet of Thing (IIOT)**

129 POSTS

19 PARTICIPANTS

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Background

While the **Industrial Internet of Things (IIoT)** has the power to significantly improve reliability, production and customer satisfaction, taking full advantage of its capabilities requires that companies re-think the people, processes and technologies involved in all aspects of operations.

We assembled a high-caliber panel of industrial manufacturing leaders and respected experts in the field of IIoT to discuss the necessary requirements for this transformation, and the best practice approaches for realizing maximum value.

Objectives

The objectives of this engagement were to:

1. Better understand how IIot currently fits into the industrial landscape - is it a game changer or is it just a buzz-word? And can IIoT deliver real value to companies today?

2. Understand the primary gaps in knowledge and capabilities teams in industry must address in order to adopt IIoT effectively.

3. Discuss existing or new processes that are needed to manage both the IIoT transition and take full advantage of IIoT capabilities.

4. Identify the technological challenges currently facing IIoT projects (such as security and interoperability) and explore solutions and standards available to help address these issues.

5. Outline an implementation plan for IIoT projects and suggest five steps teams should take to obtain the best results from their IIoT efforts.

Participants

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IoT Technologist

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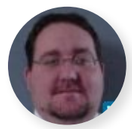

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Steven C. Venema
Security Through Extreme Containerization

Executive Summary

Setting the Stage for IIoT

- IIoT isn't so much a game changer as it is a recognition that the game is changing.
- IIoT has immediate benefits for maintenance and operations today, but it will have much bigger benefits tomorrow.
- IIoOT is not without its risks and these must be factored into any IIoT project.

Skills and Expertise for IIoT

- It's not just the CIO's project - the deployment of and the benefits from IIoT should involve the whole company.
- Top Down or Bottom Up? - A Middle Way!
- Successful IIoT deployments require staff with skills in analytics and combined IT/OT operations.
- Lean and Six-Sigma methodologies can both benefit from and bring better results to IIoT deployments.

Best Practice Processes for IIoT

- Drive Business Value.
- Focus on the WHY, not the HOW.
- Create a corporate IIoT framework supported by senior management and finance.
- Pilot, Then Scale: Start small and get some clear wins.
- IIoT may force reevaluation of established company processes.

Technology Challenges in IIoT

- "Ecosystem" or IIoT Mix-and Match?
- All that data is nice, but it is good analytics that ultimately drives the real benefit.
- Security is a key issue and potential roadblock to IIoT.
- New security models are needed to allow IIoT to reach its full potential.
- Interoperability can be a major challenge.

A Roadmap for Successful IIoT Deployments

- IIoT Data Can't Replace the Human Touch.
- Recommendations Forward: Engaging Product and Process Understandings.
- Recommendations Forward: Strong Business Case and Stakeholders.

Setting the Stage for IIOT

IIoT isn't so much a game changer as it is a recognition that the game is changing

- Industry has a long history of interconnecting smart devices such as PLCs and sensors.
- What is changing is the rate of integration, its complexity and the range of interconnectivity.
- Massive amounts of industrial data can now flow either up into the corporation and "The Cloud" or down into increasingly "Smart" field devices.
- Requires new ways of looking at how we integrate and use all the data available in our industrial processes, from the field sensor to real-time customer feedback.

> "IIoT seems like new label for something which has actually been developing for decades: the growing interconnectivity of 'cyber' devices which control physical systems."

Steven C. Venema
Security Through Extreme Containerization

IIoT has immediate benefits for maintenance and operations today, but it will have much bigger benefits tomorrow

Today most of IIoT applications are focused around improving reliability and reducing downtime. These applications have immediate benefits to manufacturing.

Properly done, IIoT can offer a platform for continuous improvement of all facets of manufacturing from optimizing inputs to gauging customer satisfaction and their use of product features in real-time.

> "Right now... most uses relate to traditional ideas of maintenance, support and operations (e.g. tell me how a system is operating and whether it's operating within normal parameters)."

Frank Coppersmith
CEO at Possum Interactive

> "IIoT's potential, from the manufacturing perspective, is in quality oversight in an ongoing fashion and continuous improvement."

Steve Zebovitz
Life Sciences MFG, Engineering & Tech Services Leader | Lean Six Sigma Black Belt

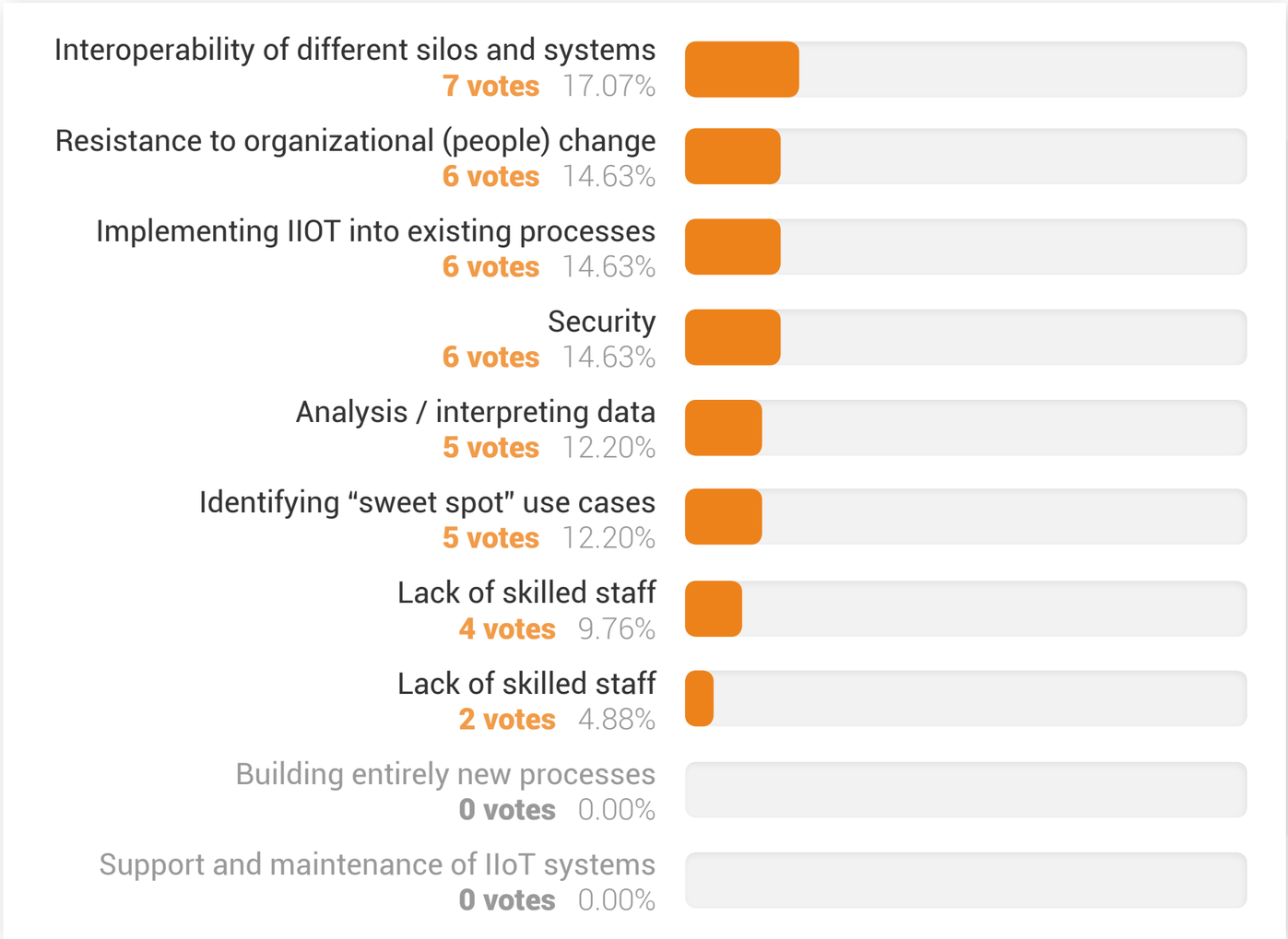
CASE STUDY

How IIoT reaches all the way to the customer

"I am currently implementing a sensor on… hydraulic crimping machines to detect the force supplied when assembling tubular automotive components. Operators, engineers, and customers will have line-of-sight to throughput and quality of the assembly. Major automotive customers are requesting this technology… to quickly diagnose and repair quality defects."

Cory Nation
Senior Product Engineer at Bridgestone Americas

What are the greatest challenges companies must overcome today in order to adopt IIoT capabilities?



> “Software is... a huge impediment to the rapid adoption of IIoT in industry as an IIoT conversation... is quite often like walking into the United Nations general assembly and trying to have a conversation without any translators."

Barry Caldwell
IoT Technologist

IIoT has immediate benefits for maintenance and operations today, but it will have much bigger benefits tomorrow

IIoT has the potential to create valuable linkages between areas of the business that were only loosely connected. Over time these may become mission critical to the company.

"IIoT brings with it the potential for new failure modes due to unanticipated interactions between components."

Steven C. Venema
Security Through Extreme Containerization

Security is one of the major concerns in IIoT and it needs to be at the forefront of any design and development program.

"Organizations need new security frameworks that span the entire physical stack, from device-level authentication and application security, to system-wide assurance, resiliency and incidence response models"

Kishor Akshinthala
Passion for enabling Businesses to realize full potential

Interoperability fuels IIoT adoption. Unfortunately interoperability between different vendors and systems is currently a significant challenge.

"The majority of OT systems work in silos, and will need to transform into a fully functional digital ecosystem."

Kishor Akshinthala
Passion for enabling Businesses to realize full potential

Skills and Expertise for IIoT

It's not just the CIO's project - the deployment of and the benefits from IIoT should involve the whole company

- IIoT involves the whole company and is not just an IT concern.
- It can and should provide useful and actionable data for all aspects of the business.
- It is critical that all management have a say in how IIoT will be deployed and what the business objectives are.

"Resist the urge to dump IoT on the CTO/CIO without close coordination with rest of C-suite."

Frank Coppersmith
CEO at Possum Interactive

Top Down or Bottom Up? - A Middle Way!

"Many large companies will attempt to use large top-down deployment initiatives that focus on consistency and conformity in order to achieve large-scale functional and business objectives. However, IIoT is often not a one-size-fits-all proposition and I have seen multiple top-down deployment initiatives run aground on the rocks of necessary variation and technology limitations."

- Steven C. Venema | Security Through Extreme Containerization

- IIoT is not a one-size-fits all technology and top-down initiatives that focus on conformity are often too inflexible to get real value
- Bottom-up initiatives often include expensive technical debt that isn't revealed until enterprise-wide integration is attempted.
- The solution is to create a cross-disciplinary team who understand both the large-scale needs of the enterprise and the operational needs of the local business units.
- The team's job is to create standardized infrastructure and processes that encourage local business units to experiment without reinventing the technology wheel and/or impacting overall corporate policy and strategy.

"The key is to create a culture at both the enterprise and the local levels which embraces the need to continuously improve. This requires a small core of cross-disciplinary practitioners who truly understand both the large-scale needs of the Enterprise and the business and operational needs of the local business units."

Steven C. Venema
Security Through Extreme Containerization

Successful IIoT deployments require staff with skills in analytics and combined IT/OT operations

- A massive amount of data can be generated from an IIoT project.
- Unfortunately data on its own is of little use. It can even be a distraction.
- Clear and intelligent actions must be driven from the data collected to give it value to the company.
- Staff need capabilities in analytics and combined IT/OT management, ideally focused on the company's vertical.
- Unfortunately these skills are currently in short supply and typically must be nurtured within the company.

> "The convergence of physical industries and digital technologies will aggravate the talent gap, especially among workers with both OT and IT skills. The Industrial Internet requires analytical talent, including data scientists, yet the current education and training approaches are not up to the challenge."

Kishor Akshinthala
Passion for enabling Businesses to realize full potential

Lean and Six-Sigma methodologies can both benefit from and bring better results to IIoT deployments

Well proven frameworks like Six Sigma and Lean can gain from IIoT deployments. Six Sigma in particular is data driven and IIoT supplies lots of data.

"Six-Sigma and other quality systems can easily have IIoT integrated... IIoT will also allow a more cost effective adoption of design-for-experiment methodologies... These systems use the enhanced data granularity supplied by a well thought out IIoT implementation."

Barry Caldwell
IoT Technologist

Six Sigma's project-based, continuous-improvement focus provides an ideal process for successful outcomes for IIoT projects.

"Pitching the IIoT as a methodology, similar to Lean or Six Sigma, instead of a product can possibly reduce the software challenges."

Cory Nation
Senior Product Engineer at Bridgestone Americas

Best Practice Processes for IIoT

Driving business value

- One of the most common causes of failure in IIoT deployments is focusing on the connectivity technologies and not the business case.
- IIoT is not about just connecting everything together - it is about using data to clearly add value to the business.
- IIoT project teams need to focus on aligning with the objectives of the company.
- Realize the key business use cases for data first.

"To realize IIoT's potential, leadership must understand the value drivers and align IIoT objectives to the business model"

"Train your workforce to be able to map the words "customer" and "value" into their goals and objectives for the day, the month, the year."

Steven C. Venema
Security Through Extreme Containerization

CASE STUDY

Driving business value through removal of error

"To offer an opposing view to convince those companies who are resistant to change and have the "way we always done it" mentality, a successful adaptation of the IIoT to compliment an existing process can replace obsolete resources (which can include people).

As a continuous improvement engineer and six sigma black belt, I am always looking to create faster, easier, and potentially automated activities that are repeatable tasks (e.g. calculations, measurements). Additionally, the removal of variation associated with human error can be avoided in certain repeatable tasks.

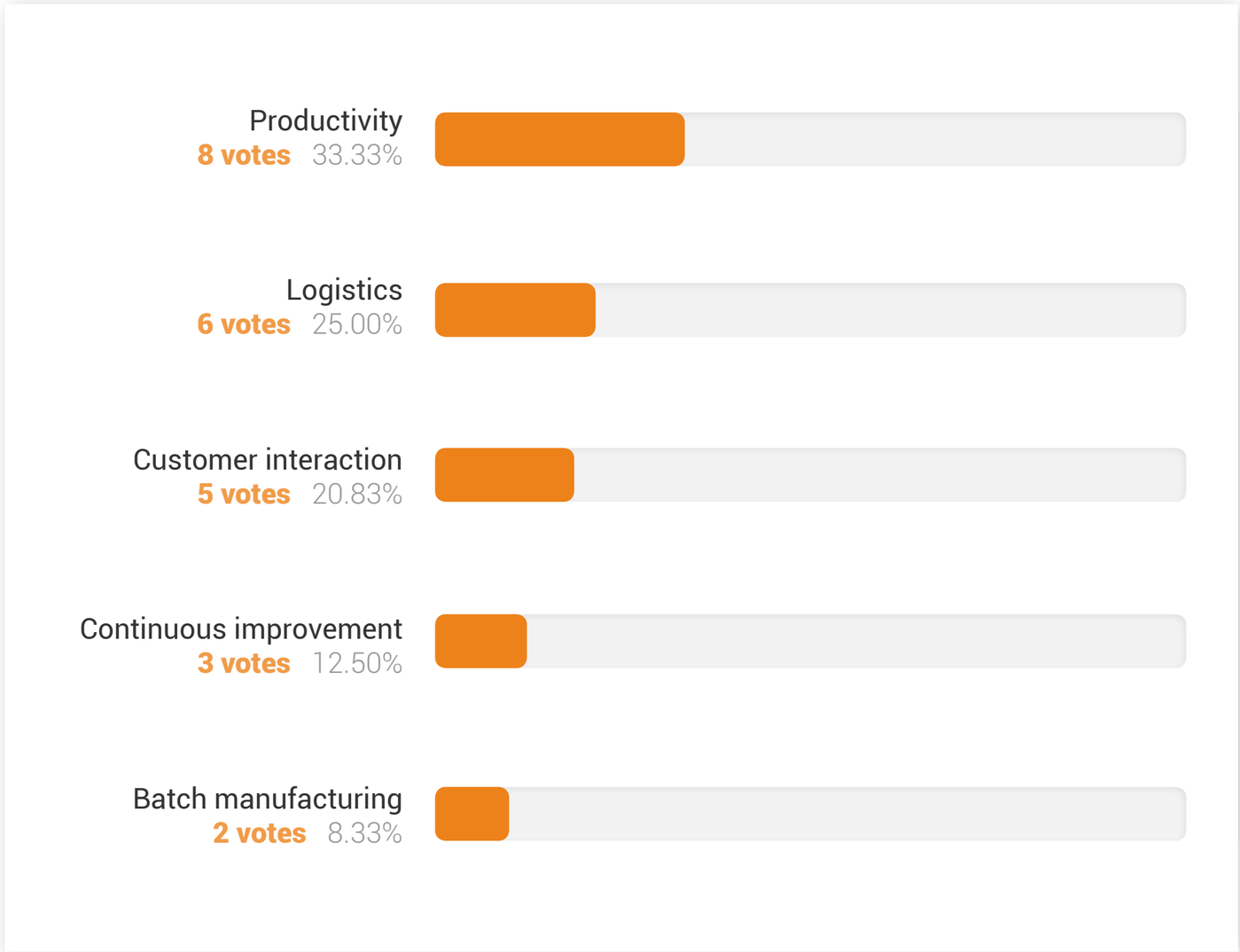
Combined with creativity, the IIoT offers a unique opportunity to further "poka-yoke" industrial processes.

A current process for a centrifugal impeller blade frequency test requires the blade frequency to be measured for each of the 17-23 blades on the impeller. These measurements, conducted by a person, are inputted by that person into a spreadsheet and a hard-copy is delivered to an engineer for review where approval/rejection is communicated. In the case of a rejected blade, an amount of material is removed, calculated based on the standard blade geometry and operational speed.

This process may take days to weeks to complete, which can hold up a $200,000+ part in inventory (waste). By adding intelligence into the blade ring test machine through the IIoT, the three potential areas for transpose errors, wasted man hours, and many hours of held up inventory can be eliminated. All of the tasks are repeatable, and therefore can be completed autonomously; the operator can know pass/fail within seconds and alerts can sent (remotely) to the engineer if approval is required. Notice the process of measuring, tuning, and dispositioning of the impeller was never changed, but was replaced by intelligence."

Cory Nation
Senior Product Engineer at Bridgestone Americas

Where in the manufacturing chain can IIoT unlock most value?



"Software is... a huge impediment to the rapid adoption of IIoT in industry as an IIoT conversation... is quite often like walking into the United Nations general assembly and trying to have a conversation without any translators."

Barry Caldwell
IoT Technologist

Focus on the WHY, not the HOW

- **IIoT projects must be driven by a clear business need and not by technology.**
- **Ask the fundamental question:** *"if I could have data automatically presented to my business systems and/or if I could trigger changes in my physical world, what would that mean?"*

"Technology that does not suit a first order business purpose is doomed to mediocrity or failure."

Chad Jones
Chief Strategy Officer at Deep Information Sciences, Inc.

"Management and users alike must determine what data will bring value to the company... Otherwise the investment will be underutilized and possibly impede further implementation."

Cory Nation
Senior Product Engineer at Bridgestone Americas

"The mindset of simply connecting a system for remote control and not looking at the larger business implications of true interconnection between ALL systems related to the business is a severe limiter."

Chad Jones
Chief Strategy Officer at Deep Information Sciences, Inc.

CASE STUDY

Driving business value through performance insights

"In the regulated industries of pharmaceuticals and defense, product quality metrics are critical. So, to stay in the game, analytics of Conformance to Specifications are scrutinized. IIoT can form the yardstick by which we appraise our own performance.

The best in class practices I'm aware of are products and processes designed from the start with the up front Six Sigma work done. My personal experience is with an (unnamed) product whose value approaches $1B/year. The formulators did an excellent job of process design and reduced all process controls to easily-measured physical parameters, like air flow, time, temperature, and weight. In other words, no fancy in-process digital analytical equipment that required skilled upkeep [was needed]. Each tablet weighed 750 milligrams (a large tablet). The powder blend was compressed in parallel tablet presses at a rate of 190,000 / hour, a very, very fast speed. The company built an automated, vertical plant manned by 5 equipment operators and easily kept pace with the sales demand.

IIoT can be used to capture these operating parameters and connect with the analytical data for statistical reviews of raw material, product and equipment performance."

Steve Zebovitz
Life Sciences MFG, Engineering & Tech Services Leader | Lean Six Sigma Black Belt

Create a corporate IIoT framework supported by senior management and finance

- Create and empower a core support group that provides an IIoT framework to local business units.
- The entire organization needs to be on board, but especially senior management and finance.
- IIoT projects are often disruptive to an enterprise, so the Finance Dept's CAPEX processes are critical to get any IIoT project off the ground.

> “All of the key groups within the organisation need to be involved... the board, senior executives, quality assurance and process improvement, operation leaders, finance and legal; workplace health and safety in designing and developing the IIoT framework."

Brett Skyring
Director, Panther Consultant Planners Pty Ltd

> "Partnering with finance and legal organizations during the concept or design of the solution can help the organization identify the needs, [and perform] more realistic cost and risk analyses".

Norma H. Antuñano
Transformational Leader | Technical Leader

Pilot, Then Scale: Start small and get some clear wins

- For organizations starting out, it is often better to get some clear early wins to support further IIoT efforts.
- A small project that complements rather than changes existing processes (but makes them more efficient) can be a great way to motivate those resistant to change.

"Transition and implementation should be in small steps such that mistakes and refinements don't damage corporations or motivations."

Steve Zebovitz
Life Sciences MFG, Engineering & Tech Services Leader | Lean Six Sigma Black Belt

IIoT may force reevaluation of established company processes

- **Because of IIoT's ability to interconnect previously disconnected data sources in real time, existing decision-making processes and models in the company often need to change.**
- **If they do not, then many of the benefits that IIoT brings may be lost.**

IIoT will/should replace both manual processes and sub-optimal automation with real-time inputs. Management will have to adopt new processes to take advantage of the immediacy of this information. For example, daily status meetings will miss huge opportunities to change operations in real time as new information comes in. How will this information get routed to the decision-makers? What systems will they use to evaluate it? If something dramatic changes, who gets told? “

Frank Coppersmith
CEO at Possum Interactive

Technology Challenges in IIoT

1 IIoT "Ecosystem" or IIoT Mix-and Match?

Advantages of an Ecosystem:

- An inherent guarantee that all components will interoperate.
- Built-in advanced features such as patch management security, etc.
- Fewer requirements for user to develop technical skill sets in staff.

Disadvantages of an Ecosystem:

- Risk of vendor tie-in.
- Ability to select best-in-class components is limited.
- Issues regarding change control.

"Being a part of an ecosystem is an inherent guarantee that everything purchased will work well with each other. Ecosystems are thoughtfully constructed and definitely not easy to produce, which is why they are so valuable."

Chris Woods
Strategic Leader I Change Agent I Problem Solver

"Choosing an integrated package from a vertical supplier generally ties the company... into a captive vendor house with a large cost threshold to cross if things do not go well at the start... Not a happy place to be."

Barry Caldwell
IoT Technologist

2 IIoT "Ecosystem" or IIoT Mix-and Match?

Of course the single vendor/multi-vendor question is not a new one for industrial companies. Most companies in the manufacturing, energy or utilities sectors have had to address this question for decades as they assembled their industrial control systems. Thus there is a good chance that there will be sufficient company precedent to help make that decision.

"Ultimately, whether a company chooses a platform or a combination solution depends on the requirements and technical capabilities of the company."

Michael Wang
Co-Founder and Chief Engineer at FutureAir

"Companies have to evaluate carefully their current level of maturity to choose between a commercial IIoT platform vis-à-vis indigenously building or augmenting the platform leveraging multiple providers."

Kishor Akshinthala
Passion for enabling Businesses to realize full potential

All that data is nice, but it is good analytics that ultimately drives the real benefit to the company

- A massive amount of data can be generated from an IIoT project.
- Unfortunately data on its own is of little use. It can even be a distraction.
- Clear and intelligent actions must be driven from the data collected to give it value to the company.
- Making intelligent use of IIoT data in a timely manner is a key challenge for companies.

"Analytics is also incredibly important because it is filter on the vast information from which users, managers, and leaders will depend to make decisions."

Chris Woods
Strategic Leader I Change Agent I Problem Solver

"The risk of improperly processing data... We can see in the social world, as people are more readily introduced to data and further removed from the problem, the true "story" can become muddied."

Cory Nation
Senior Product Engineer at Bridgestone Americas

Security is a key issue and potential roadblock to IIoT

- Security is considered by many experts to be one of the most serious impediments to IIoT realizing its full potential.
- Not only does the inherently interconnected nature and complexity of IIoT expose the company's assets to new external attacks, but the lack of security can also reduce the trustworthiness of the data that IIoT depends on.
- All the analytic tools in the world are of little use if the data being fed to them can't be trusted.
- In other words, poor security limits opportunities, while robust security enhances them.

"Adoption of IIoT is threatened by, not merely a lack of focus on security for our industrial systems, but by an inability to match risk to response."

Frank Coppersmith
CEO at Possum Interactive

"One of the biggest issues that faces the IIoT domain is security updates and monitoring."

Steven C. Venema
Security Through Extreme Containerization

New security models are needed to allow IIoT to reach its full potential

- The current IT security models and frameworks are not sufficient to meet the demands of IIoT.
- Nor is the concept of isolating the control system from the Internet - after all, the whole premise of IIoT is interconnectivity.
- **Fortunately there are a number of available security standards and guidelines including NIST SP8-82 R2, ISA/IEC 62443 and the NIST Cybersecurity Framework (CSF).**
- **These stress a strategy of using zones to allow enhanced security for mission critical equipment and provide a defence-in-depth strategy to limit attackers.**

"Partition your equipment and system designs to allow security components to be updated on a faster cycle than other operational components."

"I recommend reviewing the ISA99 standards (also known as IEC 62443) for a good introduction to partitioned architectures for the ICS/SCADA domain."

Steven C. Venema
Security Through Extreme Containerization

Security key insights

"One of the biggest issues that faces the IIoT domain is security updates and monitoring. Security is a fast-moving problem space and new vulnerability are discovered in ICS/SCADA equipment on an almost daily basis. Getting patches out to your field equipment in a timely manner and monitoring for potential security events are very important. However, reliability and certification considerations often limit the rate at which equipment can be updated. Potential solutions include:

- Partition your equipment and system designs to allow security components to be updated on a faster cycle than other operational components. Also design in automated failback features to quickly recover from failed updates, etc.
- Include in your design an increased tolerance for short term failures in components.
- Include security monitoring in your system operations plan. Create and regularly test scenarios where security compromise occurs."

Steven C. Venema
Security Through Extreme Containerization

Interoperability can be a major challenge

Interoperability can be an issue on multiple levels including:

- **Obtaining the data from a wide variety of controllers and sensors supplied by different vendors over decades.**
- **Allowing different tools/services to access collected data.**
- **Having a coherent management platform for the system.**

At the sensor/controller level there has been significant progress with protocols like OPC to allow plant floor sharing of data.

On the other hand, collection and aggregation of data (the IIoT part) and the deployment of sensors in non-traditional applications is still evolving. Fortunately public standards like IIRA are being developed to address this.

> "The key to interoperability is public standards. Collaborative efforts in the International Society for Automation (ISA), the Internet Engineering Task Force (IETF), the Trusted Computing Group (TCG) and others have already created standards that are applicable to the IIoT domain. However, gaps still remain and investing some limited time and travel for participation in these collaborative efforts is a powerful (though not fast!) way to move the ball forward on interoperability."
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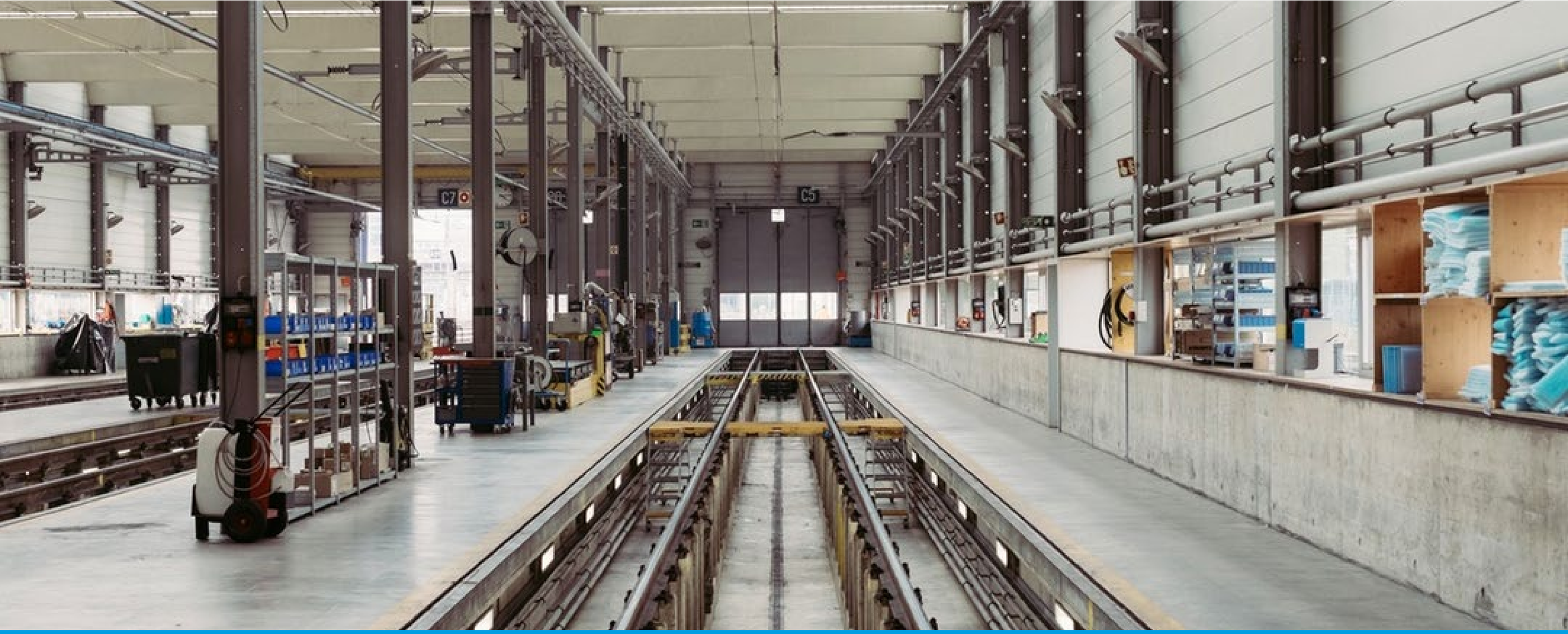
> 
> **Steven C. Venema**
> Security Through Extreme Containerization



A Roadmap for Successful IIoT Deployments

IIoT data can't replace the human touch

- While the data and analytics obtained from IIoT are extremely useful to improve company efficiency and quality, they are not the whole story.
- Ultimately human beings need to be in place to validate IIoT-based decisions.

"The value of manufacturing operators cannot be overstated. And the value of having operator involvement can augment a control system (and hence the reliability of IIoT data)."

"The process 'feel' that operators develop is difficult to quantify and thereby difficult to control. This 'feel' occurs outside objective measurements and poses a weakness to control schemes."

Steve Zebovitz
Life Sciences MFG, Engineering & Tech Services Leader | Lean Six Sigma Black Belt

ROADMAP SUGGESTION

1 Engaging Product and Process Understandings

- Steve Zebovitz

Have a solid foundation for onboarding IIoT: understand the process to eliminate common cause variation, and determine measurement and control points as follows:

a. Engage **product and process understandings,** cradle to grave.

b. **Product Development:** Design quality into the process from the beginning and reduce dependence on measurements and their resulting rejects.

c. **Materials:** Correlate raw material attributes with in-process & final product specifications.

d. **Machines:** Ensure that process and laboratory equipment is maintained and calibrated.

e. **Methods:** Ensure that processing steps, analytical testing protocols, and testing methods are understood and free of variation. Ensure that materials of construction (equipment & sensors) are appropriate for conditions.

f. **Measurements:** Ensure that equipment is calibrated, noise is eliminated, sensors are appropriate and properly placed, units of measure agree, precision & tolerances are in place.

g. **Manpower:** Communicate constancy of purpose, institute a rigorous program of education and self-improvement, eliminate barriers, eliminate managerial trends, enable open communication between ranks, eliminate slogans, incentivize accomplishments.

h. **Environmental factors:** Ensure that conditions affecting product are tightly controlled (e.g. light frequencies, humidity, vibration, temperature, pressure, etc.)

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ROADMAP SUGGESTION

Engaging Product and Process Understandings

- Steve Zebovitz

II **Establish ongoing metrics and systematize the analytics:**

a. Train operators, managers, and senior management how to interpret the data.

b. Make the data widely available. Everyone in manufacturing should understand the data and the outcomes of their contributions.

c. Incentivize continuous improvement activities.

d. Agree on endpoints for continuous improvement activities. Then move to the next process to be improved lest we paralyze ourselves and our goals.

III **Automate locally:**

a. Start small, debug, optimize, tune, and then go live on a larger scale.

b. Hire the right automation firm with process engineers to convert manual measurements & reactions into sensor selection and local controllers. Work alongside an internal, cross-functional team with dedicated stakeholders, champions, and management, and ensure deep understandings and conformance to standards.

c. Take knowledge gained Product Development and ongoing process monitoring to establish control points and operating ranges.

d. Go through the RFP process, CAPEX, and bow to the finance groups.

e. Select a single product on a single line as a test case, and go through the installation.

f. **Validate, validate, validate.**

g. Once complete, **celebrate, celebrate, celebrate.** Keep everyone enrolled (especially equipment operators & mechanics). Ensure that all management levels attend, and encourage the next steps.

h. Roll out to other products and manufacturing cells/lines.

1

ROADMAP SUGGESTION

Engaging Product and Process Understandings

- Steve Zebovitz

IV **Decide on an IIoT protocol and system, install, validate, and launch.**

V **Look backward and look forward.**

a. Retrospectively

- Does the vertical apparatus really make for a better product?
- Is it sustainable?
- Is it economical?
- Is it flexible?
- Is it faster, cheaper and better?
- Is it encompassing of customers, people, products, suppliers, vendors, planners, sales/marketing?

b. Prospectively

- Is it sufficiently flexible for new products & processes?
- Will it allow for corporate diversification?
- Does it make our employers an enviable place to work for current and new employees?

Most importantly, have fun along the way, make the lives of your employees and customers better, and celebrate your contributions!

ROADMAP SUGGESTION

2 Strong Business Case & Stakeholders

- Cory Nation

This process follows Einstein's logic: If I had 1 hour to save the world, I would spend the first 55 minutes defining the problem, and the last 5 finding a solution.

Like any big project , especially those involving culture changes, the development of a clearly defined scope and vision are the most important steps. Without a solid foundation and goal communicated to the entire team, the project implementation will not reach its full potential or fail entirely.

I Define why the company needs to invest in IIOT.

a. Develop a business case that is in line with the company's values and beliefs, (e.g. innovation, quality, etc.).

b. A well developed business case will not only address the why, but also answer "Who cares?"

c. A measurable goal, (including financial benefit, quality reduction, tact-time reduction) must be set with a number that directly transfers, in format and content, to the company's goals/metrics.

II Define stakeholders and project champion.

a. The project champion must be an individual that shares a common vision and will drive the project, especially when show-stopping roadblocks are encountered.

b. The best stakeholders are [often] the people most opposed to the implementation of IIoT. Once they've been influenced towards the benefits of IIoT and project goals, they will become the project's biggest advocates.

c. The define step and project goals may need to change to "win over" the tough stakeholders.

ROADMAP SUGGESTION

2 Strong Business Case & Stakeholders

- Cory Nation

III. **Using a variety of tools (e.g. Lean, Six-Sigma, Shainin, VA/VE) drill down within the target process to determine the top areas that may benefit from IIoT. The Pareto principle states that 80% of defects/ variation lies in the top 20% of the population. Once the top target areas are defined, resources and solutions can be properly aligned for best "bang-for-buck".**

IV. **Develop best practices and determine "BOB / WOW" comparisons ("Best-of-the-Best" / "Worst-of-the-Worst").**

a. Identify the basic functions that comprise the top areas of interest. A basic function is best used in a two word, verb-noun format; For example: conduct current, position part, transfer fluid.

b. Identify the top processes utilizing IIoT in these basic functional areas. This step has two purposes, 1) develop ideas for solutions and implement into the target process, and 2) check feasibility of goals set in step 1 and adjust up or down, if necessary with the support of project champion and stakeholders. This is a reality check to ensure the target project isn't "boiling the ocean".

V. **Develop and implement solutions.**

a. In step 4, the top performing IIoT installations (most likely early adopters) were identified and should provide insight to solving the problem areas discovered in step 3.

b. Brainstorm solutions and improvement ideas. Some favorite idea generation tools are: functional analysis, 5-why, 7-ways, spaghetti diagram, and multi-variate chart.

c. Identify suppliers and discuss with IIoT providers or brokers on cost for a turnkey solution for scope of project.

d. Begin implementation, control of solutions and maintenance plan.

Conclusions

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While deploying IIoT can bring significant benefits to a company today, the focus must be on aligning the objectives to the company's business model rather than just connecting things together and seeing what the data reveals.

IIoT has the power to involve and impact the whole organization. As such, it requires a framework and technical resources supported by corporate senior management and finance.

Management must also be aware that IIoT is not without its risk (including security risks and unanticipated interaction risks) and these must be factored into any IIoT project.