



TRENDS IN US MANUFACTURING AND AUTOMATION

美国制造业自动化发展的机遇与挑战

Joy Chang and Bailey Rice
CFE Media, LLC
(美国CONTROL ENGINEERING)

CFE Media, LLC (美国CONTROL ENGINEERING)

控制工程



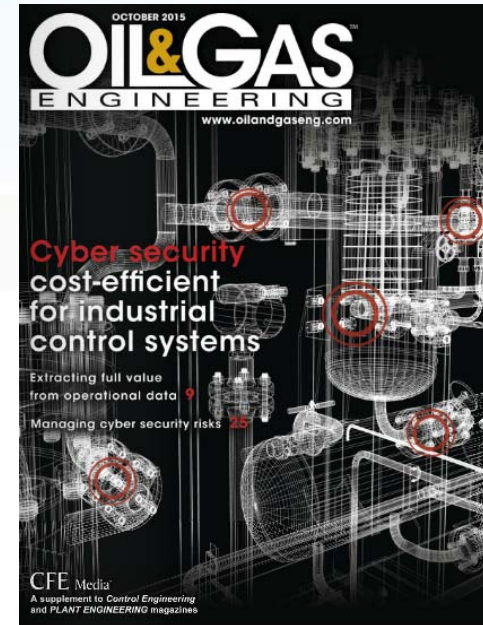
CONTROL ENGINEERING

工厂工程



PLANT ENGINEERING

石油气工程



OIL&GAS ENGINEERING

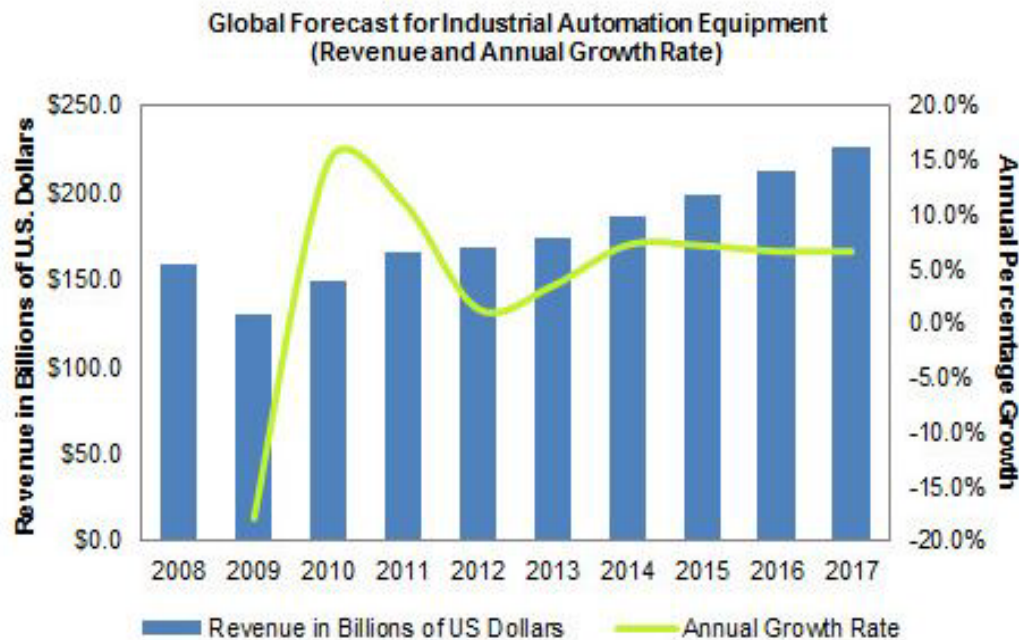
Agenda 议题

- **State of Industrial Automation** 北美工业自动化现况
- **Next Shoring** 美国制造业回归浪潮的下一步
- **Industrial Internet of Things** 美国工业物联网发展趋势
- **Skills Gap** 面临的挑战: 技术人员短缺

Global Industrial Automation

全球工业自动化现状

- Global market Industrial Automation Equipment (IAE) poised for growth. 全球市场的工业自动化设备（IAE）市场蓄势待发。
- IAE market projected \$225.0 billion by 2017. 据IHS预测，全球IAE市场预期2017年将达到2250亿美元



Source: IHS

Largest Growth Segments – IAE

工业自动化设备市场重点增长领域

1. Motors and motor controls 电机控制
 - Energy efficiency continues to be the driver 能源效率是推动力
 - Energy regulations 节能法规
2. Automation equipment 自动化设备
 - Impacted substantially by innovation 创新带来的挑战
 - Demand for more communication 更多通信的需求

Largest Growth Segments – IAE (Continued)

工业自动化设备市场重点增长领域 (续)

- Demand for more sophisticated machine control 对更复杂机器控制的需求
- Controllers at the highest need for Cyber security 控制器对于网络安全的最高需求

3. Power-transmission equipment 电力传输设备

- General shift from mechanical to electrical equipment 从机械到电力设备的转变
- Pneumatic and hydraulic actuation replaced by electromechanical solutions 气动和液压驱动被更多机电解决方案替代
- Higher efficiency motors 高效率的电机

IAE Growth Leaders

全球IAE市场快速增长地区

1. Asia-Pacific 亚太
2. The Americas and Japan 美洲和日本
3. Europe-Middle East-Africa (EMEA) 欧洲、中东和非洲



Strongest Growth/ Future Trends

强势增长行业及未来趋势

SECTORS行业:

1. Power generation 电力
2. Oil and gas 石油&天然气
3. Food, beverage and tobacco 食品、饮料和烟草

TRENDS趋势:

1. Convergence (PC-based vs. PLCs vs. DCS)
 - A. From productivity-driven 从生产驱动
 - B. Controlled by digital information 通过数字化信息控制
2. 3-D printing 3D打印
3. Combination of aging workforce with low replacement rates 劳动力老化与低替代率

Source: IHS

Next Shoring 美国制造业回归浪潮的下一步

Manufacturing bases are moving locations for strategic purposes 生产地点选择更具战略考量:

- Proximity 更接近
 - Consumer markets (demand) 市场需求
 - Innovation 创新
- Reduced energy costs 降低能源成本
- Time-to-market considerations 市场投放的考量
- Access to capabilities 可持续的发展能力
- Sensible labor costs 合理的人力成本

Industrial Internet of Things

工业物联网定义

Industrial Internet of Things (IIoT):

The transformation of industrial products, operations, value chains, and aftermarket services ...

... that is enabled through the expanded use of sensors, digitization, networking, and information systems.

-ARC's Definition

-根据ARC的定义，工业物联网是通过更多地使用传感器、数字化、网络化和信息系统，实现传统工业产品、运营、价值链以及售后服务等模式的改变。

IIoT Industrial Communications

工业物联网通讯

- Improved industrial communications can 增强的工业通讯可以带来:
- Add efficiency while delivering shorter product runs, more frequent material changes, faster deliveries, better change forecasting, supply chain management, and product traceability 提高效率，缩短产品生产周期，柔性生产，更快交货，更好的变化预测、供应链管理和产品溯源
 - Improve machine uptime, decreasing labor costs, conserving or consolidating factory floor space, augmenting throughput, and using less capital 提高机器的正常运行时间，降低劳动成本，节约工厂占地面积，增加的吞吐量，并使用更少的资本
 - Reduce scrap, waste, and energy use 减少废料、废物和能源的使用

案例一: Husky Injection Molding 注塑成型

- Plastic containers 塑料容器
- Implemented PC-based technologies to realize savings 通过基于PC的技术可以实现如下收益:
 - 10% less material used per plastic part 少使用10%的塑料部件
 - 250,000 lb of product material savings/year 每年节约承办材料250,000磅
 - \$182,000 in savings annually 每年节省费用182,000美元

Source: Beckhoff USA

案例二: Matrix Packaging Machinery

包装设备

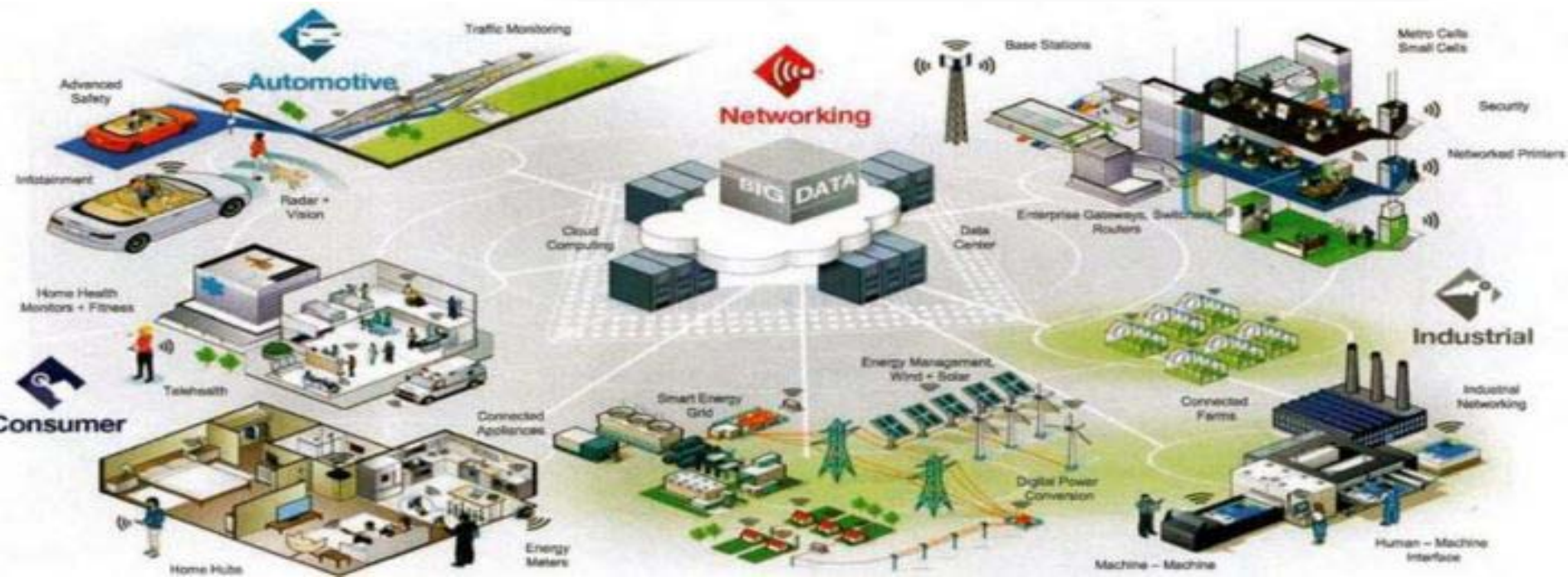
- Continuous motion, vertical form, fill, and seal machine with greater data connectivity and ability to change production variables 连续运动、垂直成型的包装和密封设备，通过更多的数据连接，灵活调整生产
- EtherCAT industrial Ethernet 使用 EtherCAT
 - Reduced cabinet size 减少柜体尺寸
 - Increased uptime 25% 提高25%的正常运行时间
 - Reduced waste by 15% 减少15%的浪费
 - Architecture costs reduced by nearly 50% 成本降低50%

Source: Beckhoff USA

Smart Factories, Smart Supply Chain

智能工厂与智能生产线

- Fourth Industrial Revolution 第四次工业革命
 - Increased efficiency, productivity, quality control 提高效率、产量和质量控制
 - Achieved by synchronizing industrial automation equipment 通过同步工业自动化设备实现



Factory Supply Chain Visibility

工厂供应链能见度

- Inbound raw materials/parts 入站的原材料/零部件
 - Protect against shortages 防止短缺
 - Speedier shop floor movement 车间运行更高效
- Outbound order-tracking schedules refined 出站订单跟踪进度细化
 - Align the assembly process 调整装配工艺
 - Manage multiple production & distribution locations 管理多个生产及分销地点
 - Meet deadlines and just-in-time delivery 按时完成任务，即时交货
 - Minimize overproduction 最大限度地减少生产过剩

IIoT For Real-Time Visibility

工业物联网提供即时生产线能见度

- Allows companies to make better-informed decisions for increased operational efficiency 积极采用能够提高公司运营效率的决策
- Minimizes out-of-stock items 最大限度地减少缺货的情况
- Enhances inventory optimization between different geographic markets 提高了不同地区市场的库存优化



Custom Approach Now Standard

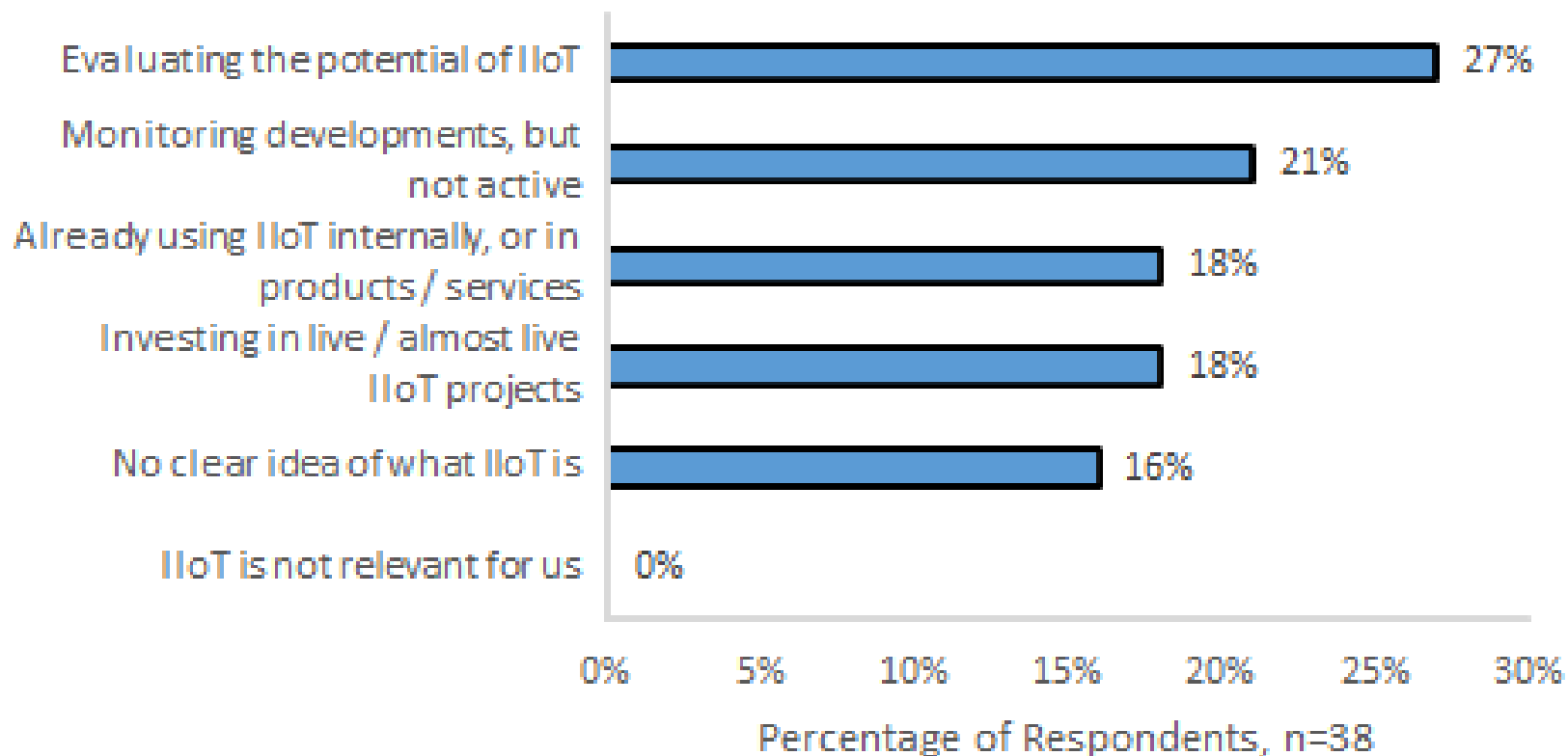
定制化的服务已成为常态

- Automating production lines will require a more complex system
 - More sensors and control software
 - Synchronize facility's machinery
- Adjoining machines detect variations
 - Production
 - Assembly performance
- Machine-to-machine (networked) communication
 - Makes fully-automated system more powerful
 - Better than individual machine

Ready for IIoT in North America?

北美产业面对工业物联网有多少准备？

Early Data: Readiness for Industrial IIoT



Control Engineering Research

工业物联网调查报告

As part of an upcoming *Control Engineering* research report on system integration, we asked subscribers what parts of the IIoT technology framework is useful? 您最关注与工业物联网相关的哪些技术?

- 72% - Interoperability and open standards connecting people processes, and data 连接人员、流程和数据的互操作性和开放标准
- 47% - Security 安全性
- 46% - Mobile 移动性
- 29% - Cloud 云计算
- 29% - Analytics 分析方法

123 responses, margin of error is +/- 8.8%.

Control Engineering Research (Continued)

工业物联网调查问卷（续）

您最关注与工业物联网相关的哪些技术？

- 55% - Real-time capabilities 实时功能
- 47% - Modularity 模块化
- 45% - Interoperability 互操作性
- 39% - Virtualization 虚拟化
- 32% - Service orientation 面向服务
- 29% - Decentralization 分散化

87 responses, margin of error is +/- 10.5%.

Promise & Risks of IIoT

工业物联网发展面临的挑战

Research conducted of plants by Ubisense 根据调查显示:

- 40% have no visibility into the real-time status of their company's manufacturing process 40%的调查者表示, 在他们的制造工艺的实时状态中, 没有任何的可视性
- 80% rely on human observation to support process improvement initiatives 80%依靠人工观察来支持过程改进措施
- 85% of quality issues caused by worker errors 85%质量问题由工人错误引起
- 10% of manufacturers spend half their day looking for equipment and products 10%的制造商花了半天的时间寻找设备和产品
- 15% of manufacturers don't prioritize product repairs 15%的生产商不优先进行产品维修

Source: Ubisense

Considerations for IIoT

工业物联网发展考量

1. Networks网络
 - A. Wireless need to be robust无线网络需要更稳定
 - B. Large expense for wired有线网络需要大量费用
2. Security安全
 - A. High-bandwidth, mission-critical reliability高带宽，关键任务可靠性
 - B. Often managed by outside sources通常由外部资源提供
3. IT
 - A. Central role in Intelligent manufacturing是智能制造的重要部分
 - B. Requires long-term view, investment需要目光长远的投资
4. Culture (willingness to change)文化
5. Skills技能

Source: Ubisense

Skilled Workers in Demand

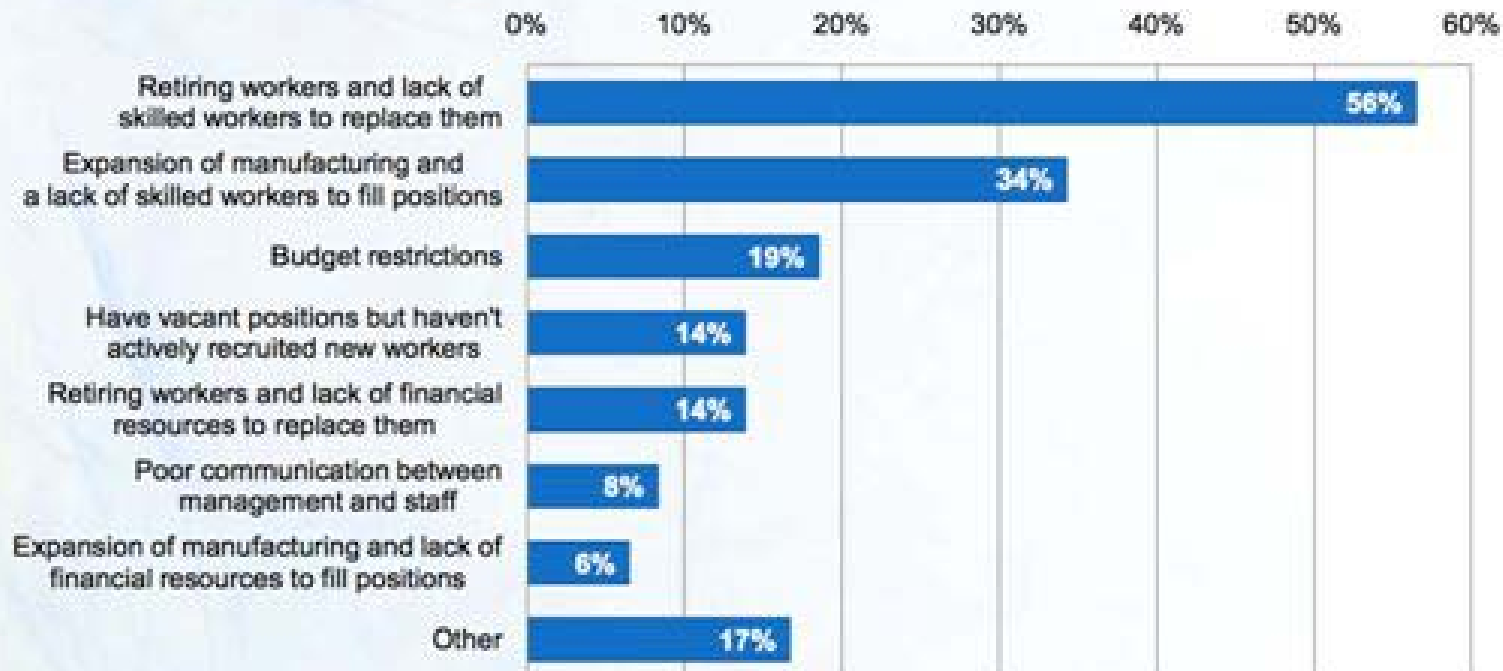
技术人员短缺困境



PLANT
ENGINEERING

Primary causes of workforce shortage

When asked about the primary causes of the workforce shortage within their facilities, the majority of respondents said they are having trouble finding qualified applicants among the new workforce.



Advanced Technology Services & Nielsen Company 技术人员短缺调查报告

- Biggest US age group of engineers retiring 美国最大的年龄组的工程师退休
- Large manufacturers to lose \$100mn next 5 yrs 未来5年大型制造商将因技术人员缺乏损失上亿美元
- 50% have 11 open positions for skilled workers 50%的公司表示对技术工人有11个职位空缺
- 45% companies encouraging workers to stay 45%家公司鼓励工人留下
- 53% likely to outsource the positions 53%可能外包的职位
- Universities can't meet growing demand 大学不能满足日益增长的需求

Document and Improve

如何应对技术人员短缺？

- New technology required for new solutions 新的解决方案所需的新技术
- Systems and tools need to be more intelligent 系统和工具需要更加智能化
- Software enabling system intelligence will ease the generational shift 软件让系统更加智能化，缓解新老交替的阵痛
- System integrators vital to filling the skills gap 系统集成商在填补技能缺口方面至关重要
- More important that software allows disparate systems to communicate 更重要的是，软件允许不同的系统通信

Proceed IIoT With Caution

面对IIoT产业界必须考量的风险

- Industry now needs to protect itself without我面对风险们应当谨慎前行，而不是：
 - Degrading its investment in automation减少自动化的投资
 - Losing, exposing information丢失、暴露信息
- With cyber security concerns, automation systems need to be smarter than ever 在网络安全方面，自动化系统需要比以往任何时候更聪明
 - Smarter systems更智慧的系统
 - Significant internet-based connectivity重要的基于互联网的连接
 - More data than ever before比以往任何时候都更多的数据

“This is where automation is coming together through integrators, who put end users and suppliers on the same technology page.” --Greg Hale, ISSSource.com



Thank you for listening!
谢谢!