Setting the Standard for Automation™

Leveraging A Secure Wireless Network for Automation and Control

Thurston Brooks & Keith Byerly
VP Product Marketing
Ultra Electronics, 3eTI

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Introduction

- The US DoD/DHS are leading the way in defining, validating and deploying highly secure, industrial control systems
- Information Assurance and Defense in Depth security concepts are being adopted by ISA for industrial automation and control applications
- ISA100 incorporates “basic” security by design
- Additional layers of security based on proven DoD solutions will address security concerns that are inhibiting adoption of industrial wireless sensor networks in Federal networks

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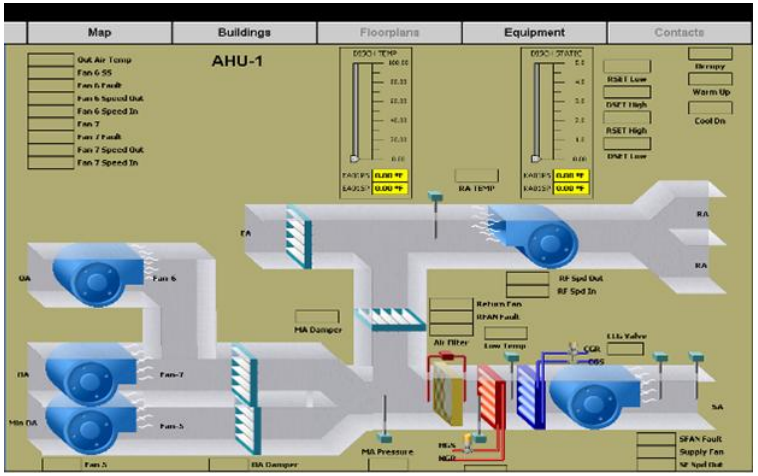
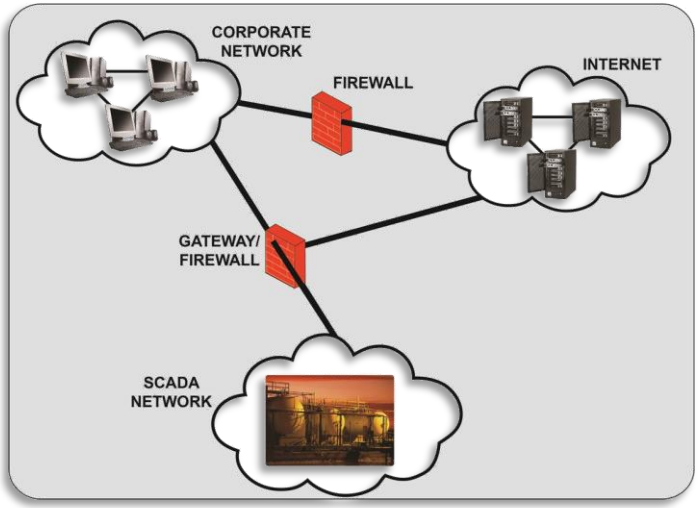
Industrial Automation and Control Systems Evolving Security Threats

- 1970 to 1990s: Security by Obscurity
  - Legacy proprietary protocols
  - Isolated systems
- Today
  - Open standards-based protocols
  - Enterprise and control networks, applications and systems interconnected by IP
  - Expanded network security perimeter

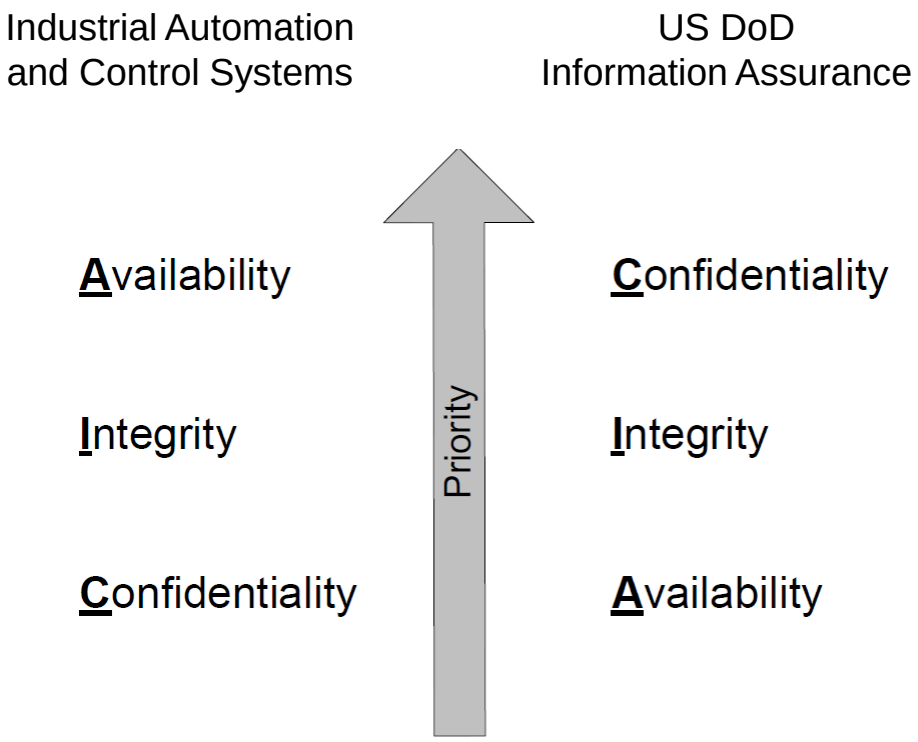
- Threat Vectors
  - Backdoors, holes in network perimeter
  - Vulnerabilities in common protocols
  - Database attacks
  - Communications hijacking and ‘man-in-the-middle’ attacks
  - Insecure devices
  - Wireless networks





Industrial Automation and Control Systems
ISA99 Security Standards

- Security Context
  - Threats, risks, and countermeasures
  - Relationships between them
- Security Objectives
  - CIA/AIC
- Security Concepts
  - Defense in Depth
  - Threat-Risk Assessment
  - Security Program Maturity
  - Security Policies
  - Role Based Access Control

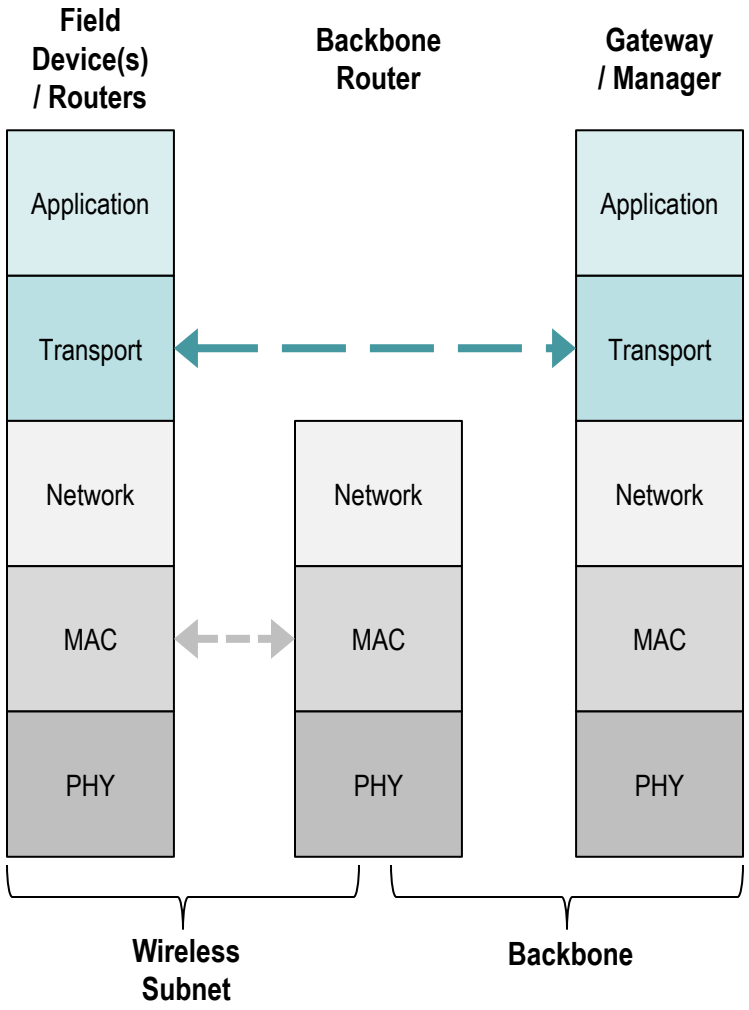


Industrial Automation and Control Systems
ISA100 Security by Design

- Authentication and Encryption
  - Guarantee messages received truly originated by an authorized device and have not been modified
  - Data confidentiality provided via advanced AES encryption
  - Symmetric keys used for data encryption and authentication
- Security Policies
  - Based on authentication and authorization
- Time-Based Security
  - Time stamps provide protection against replay and delay attacks

ISA100 Security by Design
Authentication and Encryption

- Link Layer
  - Hop-to-hop authentication and encryption of packets at Layer 2
  - Provides protection within the 802.15.4 mesh
- Transport Layer
  - End-to-end authentication and encryption of Protocol Data Units (PDUs) at Layer 5
  - Secure sessions established between IP ports at originating device and destination device



ISA100 Security by Design
Symmetric Keys

- Global Key
  - Well known key (not secure)
- Join Key
  - Created at the conclusion of symmetric key provisioning
  - Used to join the network, receive the Master Key
- Master Key
  - Created at the conclusion of the key agreement scheme
  - Used for communication between Security Manager and devices
  - Expires and needs to be periodically updated
- DL Key
  - Used to compute the Message Integrity Code (MIC) at the link layer
  - Expires and needs to be periodically updated
- Session Key (Optional)
  - Used to encrypt and/or authenticate PDUs at the transport layer
  - Expires and needs to be periodically updated

ISA100 Security by Design
Security Policies

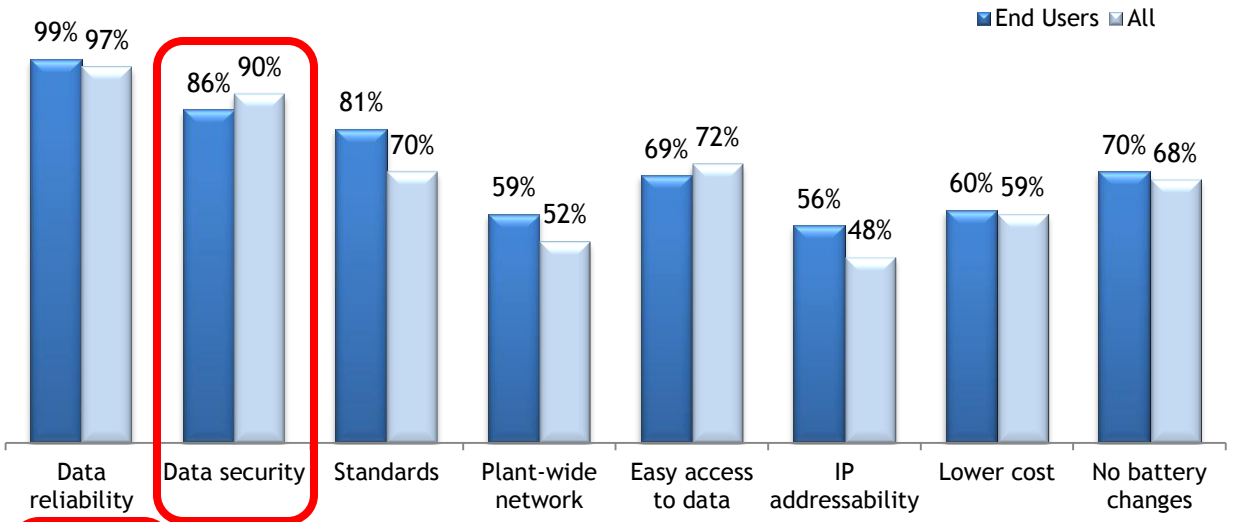
- Authentication and encryption are controlled by flexible security policy
  - Can be varied at both Link and Transport layers
  - Authentication and encryption independently defined
- Security policies distributed with cryptographic material
  - Allows application-specific security levels
- Security Manager
  - Controls policies for cryptographic materials it generates
  - Manages and distributes keys
    - Asymmetric keys
    - Master keys for session key distribution

ISA100 Security by Design
Time-Based Security

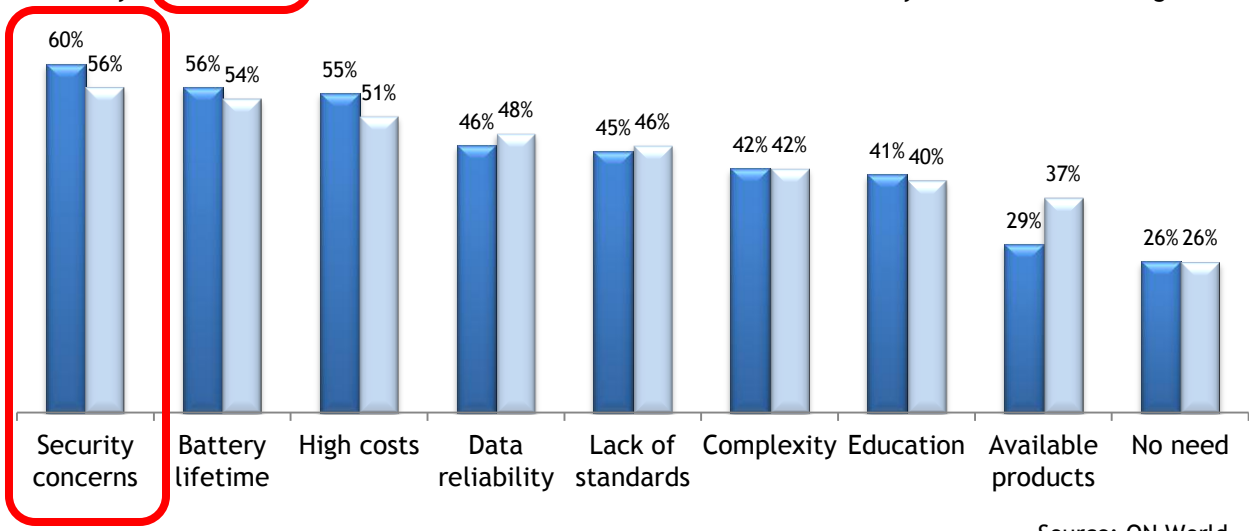
- Transport layer security utilizes a time stamp for protection against replay attacks (esp. important for industrial applications)
  - Devices are continuously synchronized using TAI (atomic international time)
  - Time stamp in the nonce needed for AES-128 indicates when each data packet was created
  - Packets older than N seconds (configurable) will be discarded by recipient

Industrial Automation and Control Systems
The WSN Security Challenge

Most Important WSN Features



Inhibitors to WSN Adoption



Source: ON World

Secure Wireless Sensor Networks in the DoD Defense in Depth Example

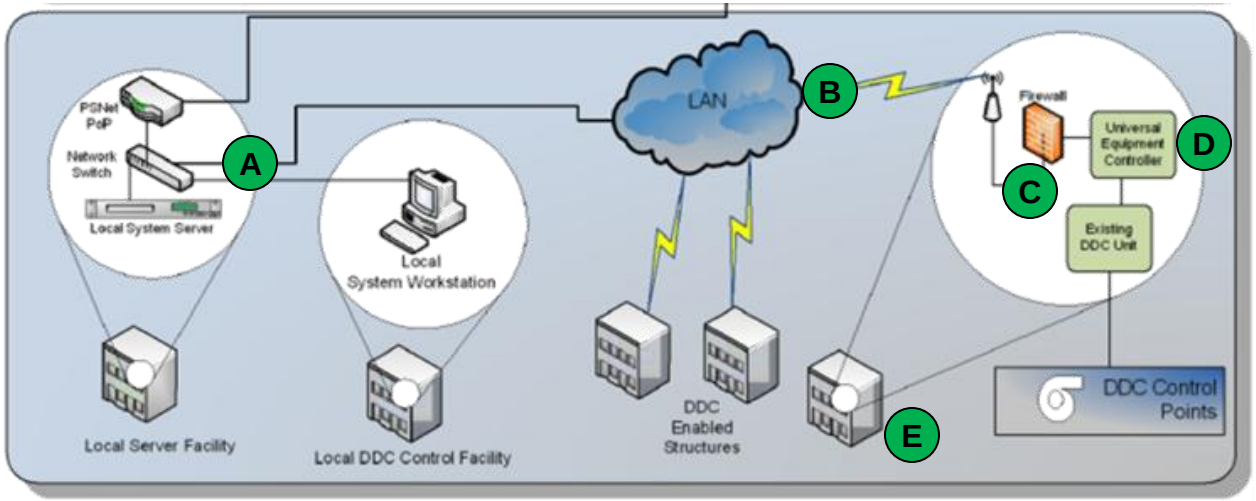
A. Secure IP network connection to server
   - End users connect to server via SSL / HTTPS - no path to field devices
   - Access to the network is restricted to the system server's specific IP and port
   - 802.1x port security ensures all physical connections are authenticated prior to network access

B. Secure wireless network connection
   - Wireless Intrusion Detection System (WIDS)
   - FIPS 140-2 & Common Criteria EAL4 Certified encryption and security

C. Embedded firewall w/Deep Packet Inspection
   - Stateful validation of protocol payload
   - Access Control Lists, port scanning

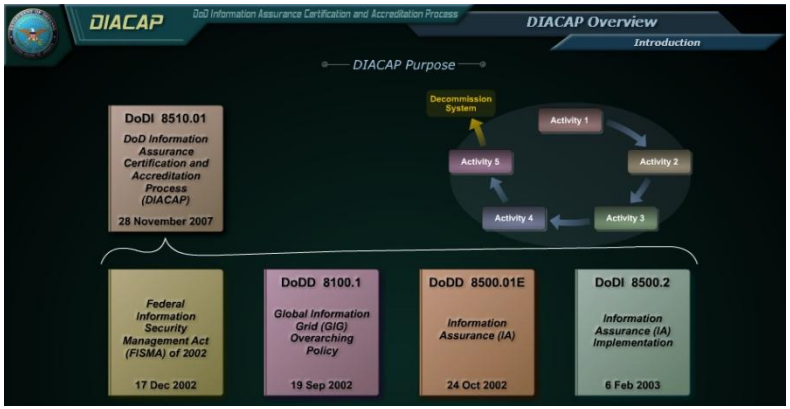
D. Enhanced SCADA controller
   - Secure, validated configuration
   - 802.1x port security

E. Locked, monitored enclosure
   - Physical security w/intrusion prevention and detection
   - Physical access automatically generates alarm at operator console



DoD – Cyber Security Initiative - DIACAP
Defense Information Assurance, Certification & Accreditation Process

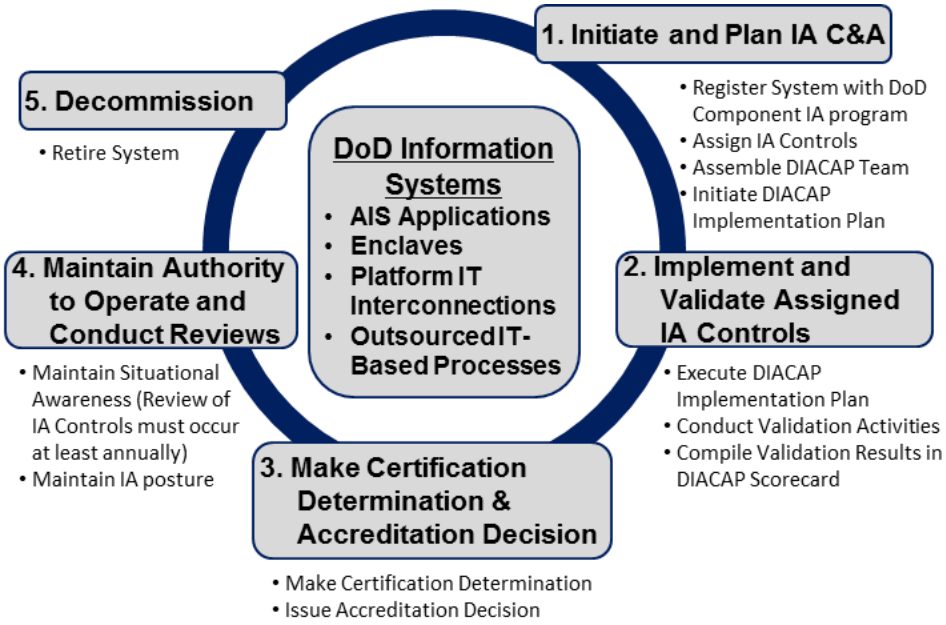
- DoDI 8510.01 DoD Information Assurance Certification and Accreditation Process (DIACAP)
  - Federal Information Security Management Act (FISMA) of 2002
  - DoDD 8100.1 Global Information Grid (GIG) Overarching Policy
  - DoDD 8500.01 Information Assurance (IA)
  - DoDI 8500.2 Information Assurance (IA) Implementation
- IA Controls are determined based on the system's mission assurance category (MAC) and confidentiality level (CL).



U.S. Government – Cyber Security Initiatives
DIACAP vs. NIST IA

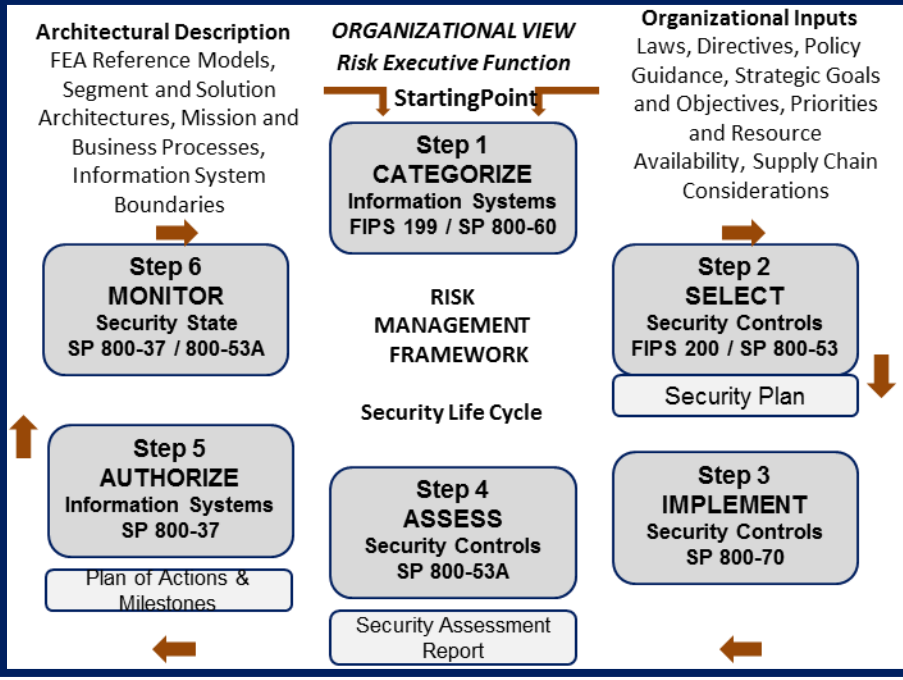
DIACAP/Platform IT

Defense IA Certification & Accreditation Program



NIST Process

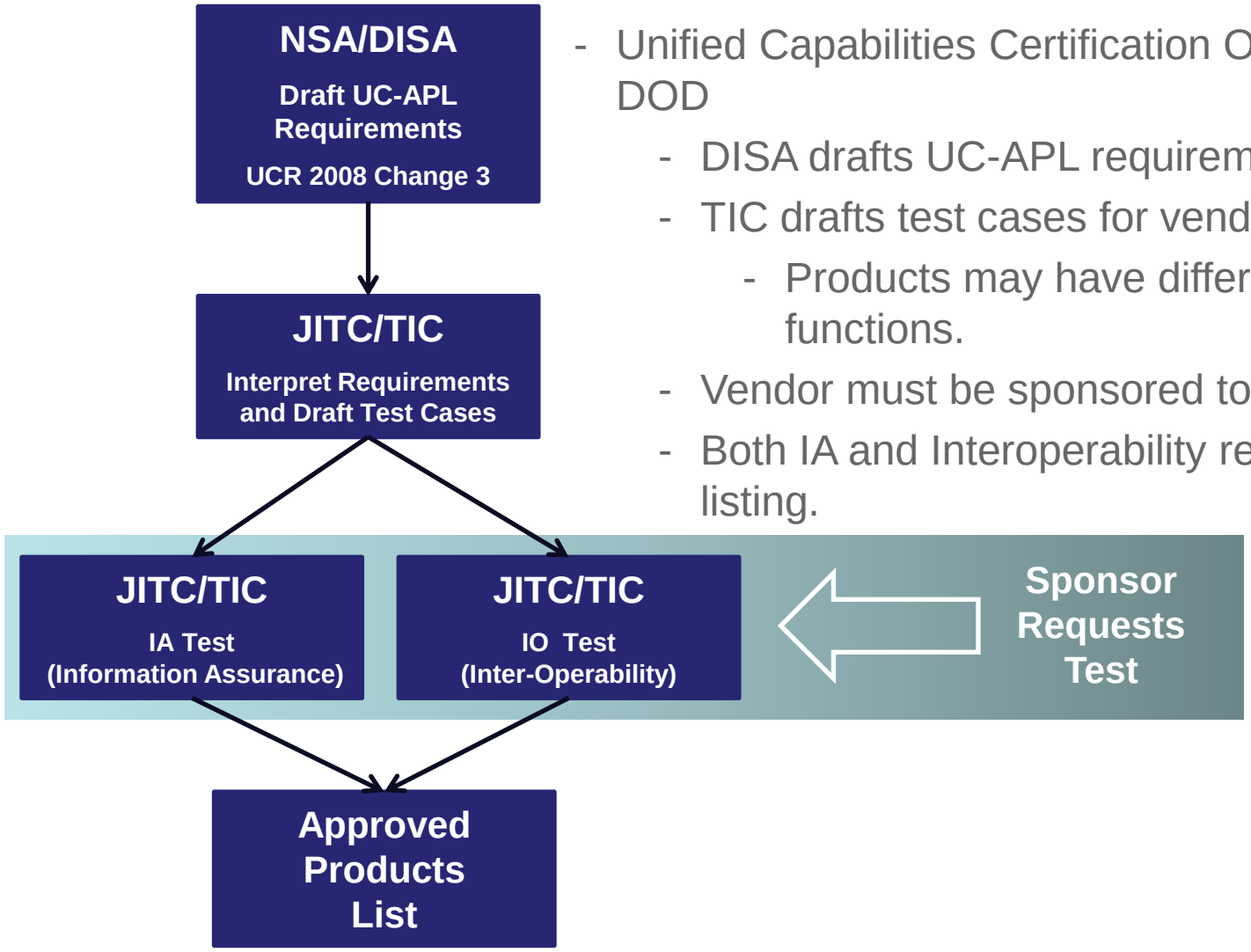
IA Process for Civilian Government Agencies



Integrated DIACAP / NIST Accreditation Strategy

- Reduce vulnerabilities through integrated IA approach
- Combine DIACAP and NIST IA controls into accreditation package for interoperable protection against cyberthreats
- Validate IA packages independently such as via DIACAP / NIST Validators and / or National SCADA Testbed (INL)

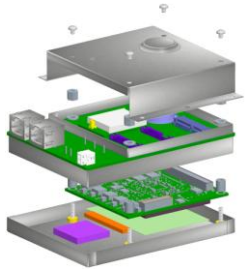
Unified Capabilities Approved Products List



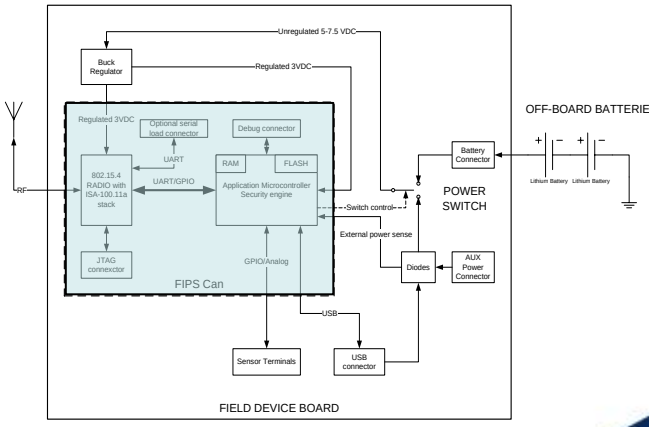
- Unified Capabilities Certification Office (UCCO) for all DOD
  - DISA drafts UC-APL requirements.
  - TIC drafts test cases for vendor equipment
    - Products may have different mix of functions.
  - Vendor must be sponsored to be tested.
  - Both IA and Interoperability required for APL listing.

The WSN Security Challenge
Enhanced Confidentiality: FIPS 140-2

- Local Requirements
  - Correctness of implementation or deployment
    - cryptographic boundaries, random bit generators
- Algorithmic Requirements
  - Known-answer tests for algorithms
  - Assure interoperability
  - Symmetric key encryption w/AES, hashing using SHA-1
  - AES-CCM used to protect the data exchanged
  - Defined approved key establishment techniques
    - Diffie-Hellman, EAP-TLS



FIPS VALIDATED 140-2 ™

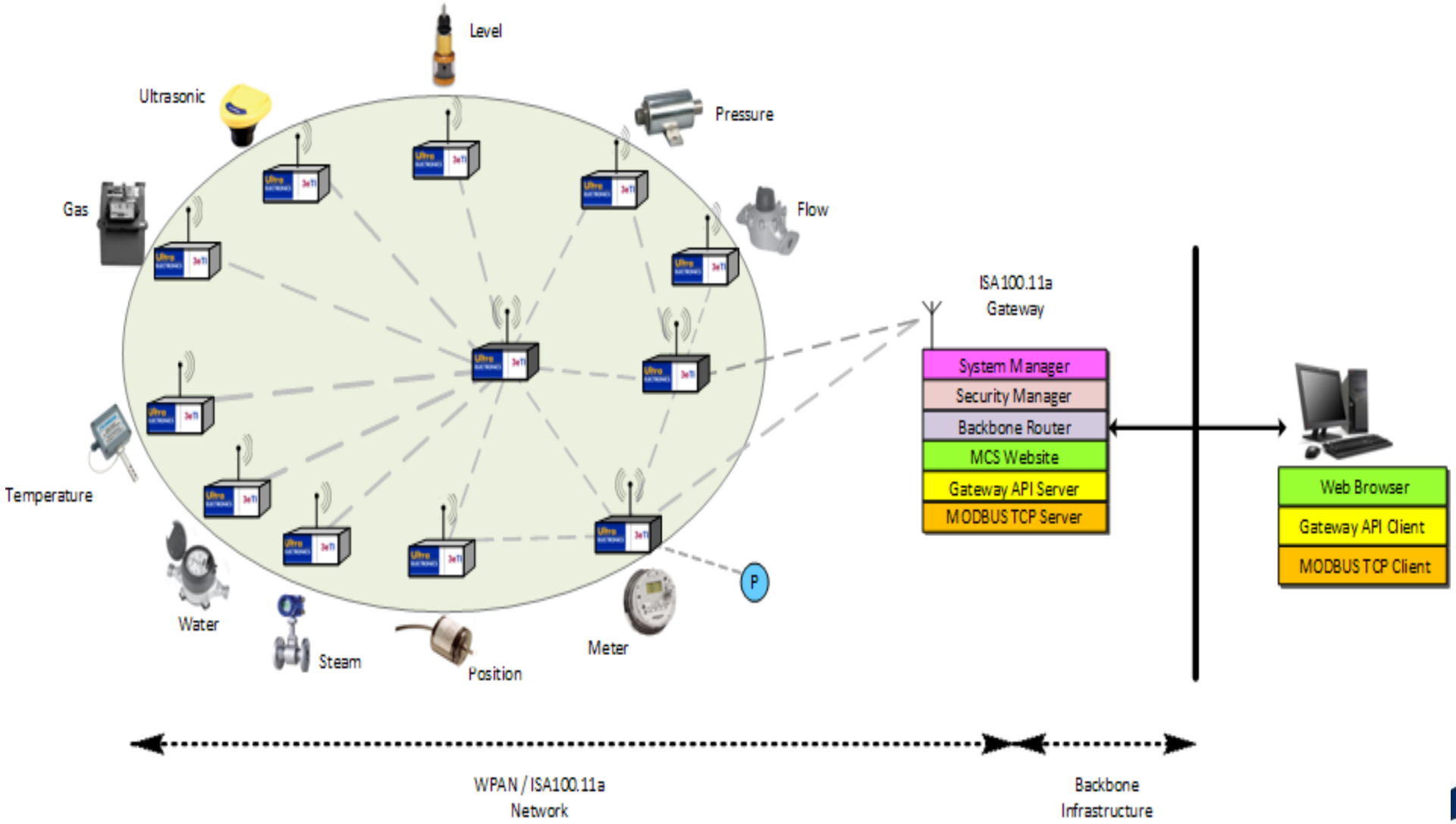


The WSN Security Challenge
Enhanced Integrity: Common Criteria

- Unlike FIPS 140, CC does not provide a list of product security requirements or features that they must contain

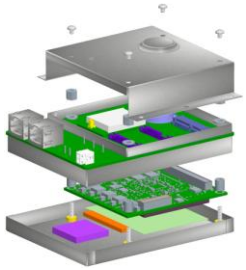
- ISO/IEC 15408 describes a framework in which:
  - system users can specify their security requirements
  - vendors can then implement and/or make claims about the security attributes of their products
  - testing laboratories evaluate the products to determine that they actually meet the claims

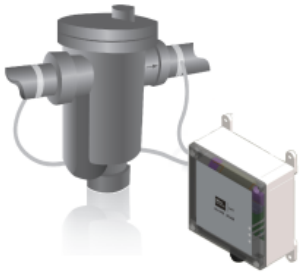
The WSN Security Solution Overview



The WSN Security Solution
Federal/DoD Implementation Options

- Low-Power Sensor Crypto Library
  - Optimized for battery-powered applications
  - Incorporates FIPS security into wireless sensor software
- Sensor, Gateway Crypto Modules
  - All-in-one ISA100 wireless modules with FIPS security and CC Evaluated
  - Integrates secure wireless technology into wired sensors
- Sensor Node and Gateway Devices
  - ISA100-compliant nodes provide secure, universal network connectivity to sensors and meters
  - Gateway seamlessly and securely bridges 802.15.4/ISA100, 802.11/Wi-Fi and 802.3/Ethernet networks using accepted certifications (FIPS 140, CC, IA, UC-APL)





Conclusion

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- Information Assurance (CIA-AIC) and Defense in Depth security concepts have been adopted by ISA for industrial automation and control applications
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Q & A

Thurston Brooks
Vice President, Product Marketing
3eTI
thurston.brooks@ultra-3eti.com
+1 301.944.1343

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Thurston Brooks, VP of Product Marketing

- Developed new technologies and solutions for industrial and commercial applications for the protection of critical infrastructure.
- More than 30 years of professional experience in developing and managing a wide variety of solutions for military and industrial applications.
- Engineering Degrees from the University of Florida (BS) and the Massachusetts Institute of Technology (MS) with a thesis in Human-Machine Systems and Controls and an MBA from the University of Chicago.
- 45+ publications in referred Journals, Symposiums and Conferences
- Two patents. One patented product won 1993 Star Tech Award for Best New Product in Washington Technology magazine.

Agenda

- Secure Wireless Sensor Networks in the DoD
  - Information Assurance / CIA
  - Defense in Depth
- Industrial Automation and Control Systems
  - Evolving Security Threats
  - ISA99 Security Standards
  - ISA100 Security by Design
  - The Wireless Sensor Networks Security Challenge
    - Enhanced Confidentiality: FIPS 140-2
    - Enhanced Integrity: Common Criteria

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About 3eTI

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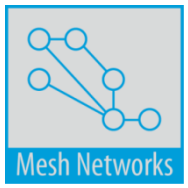
About 3eTI

- Founded in 1995
- Headquartered in Rockville, MD
- Technology company with ~16 patents
- ~90 employees
- Fully owned subsidiary of Ultra Electronics
  - $1.1B+ Public company (London Stock Exchange)
  - 26 business units

Products & Solutions

3eTI provides highly secure wireless networks that enable critical systems security, infrastructure security and industrial automation for the military, government, industry and utility markets.



Wireless Mesh Networks
Robust and scalable networks that assure delivery and security of your integrated video, data

Wireless Sensor Networks
Scalable networks that monitor environmental conditions and enable control activity

CyberFence™
Military-grade protection of IP networks that cannot be pinged, hacked or compromised

VirtualFence™
Out-of-the box wireless video surveillance and auto-detection systems

What We Do

Onboard Ship Communications

Secure wireless access to shipboard networks

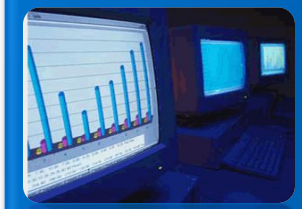
Virtual Perimeter Monitoring

Virtual perimeter monitoring with remote video and sensors

Advanced Metering Infrastructure (AMI)

DoD

Real-time, advanced monitoring and collection of building-by-building energy usage



Energy Management and Resource Management

Integrated, adaptive, intelligent energy management on a building, base and region level

Vessel Boarding Communications

Wireless reach back system for video, data, and voice connectivity with boarding teams

Military Base Security

Remote 24-hour monitoring and intrusion detection systems