Membership Information Session

APRIL 2024

SARA YUILL, MEMBERSHIP COORDINATOR

ANDREW WEST, CHAIR, TECHNICAL COMMITTEE

RONALD FARQUHARSON, DNP USERS GROUP (PRESIDENT, COO)

Outline

- Introductions
- Overview, History and Mission
- Industry Trends
- We’re Busy! 2023 Activities and Plans for 2024
- Planned DOE Cybersecurity Project
- Why Belong? The Benefits of Membership
- Discussion
- Next Steps

DNP Users Group = DNP-UG

Introductions – UG Team

Sara Yuill, Membership Coordinator

- All membership related tasks
- Chief “Duck Whisperer”

Andrew West, Chair, Technical Committee

- Serves in many key technical leadership roles
- Board of Directors
- IEEE WG Vice-Chair

Ronald (Ron) Farquharson, President, COO

- Operational leadership, strategic alliances, membership promotion
- Board of Directors
- IEEE WG Chair

Introductions – Guests

Please introduce yourself:

- Name
- Affiliation
- Title or role

Overview of the UG

- The UG actively manages DNP3:
  - **New** standard IEEE 1815.2™ (DER communications) due 2025
  - **Next** edition of IEEE 1815™ (includes SAv6) due 2025
  - **New** Authorization Management Protocol (AMP) development continues
  - Promotion and standards involvements
  - Technical Committee develops enhancements and corrections in the form Technical Bulletins
  - Technical Bulletins and other updates are merged into revisions of IEEE 1815™
  - Application Notes published to address specific applications
  - Guides provide additional information and help
- Four technical teams:
  - Technical Committee
  - Cybersecurity Task Force
  - Test Management Committee
  - Test Procedure Committee
- Board of Directors
- Funding sources:
  - Membership fees (primary)
  - Partnership Program

Image by storyset on Freepik

History of DNP3

- DNP3 = IEEE Std 1815™ – Very widely adopted in North America (94%+).
- DNP3 was developed by the Harris Corporation, passed to DNP-UG in 1994.
- Standards focused effort to define a feature-rich, robust protocol for the electric utility industry. Goal was to address the plethora of protocols (>110).
- Objective of the UG was/is to maximize multi-vendor interoperability.
- Selected by the IEEE as the recommended practice for North America - ~2000
- The DNP-UG retains all IP rights with a sharing (licensing) agreement with the IEEE.

DNP Users Group Mission Statement

- We actively develop and support measures to improve interoperability and cybersecurity in DNP systems by developing technologies and standards, implementing a conformance program, and providing education to the industry.
- Our over-arching goals:
  - Reduce utility project cost and risk.
  - Reduce vendor development cost and risk

Mission of the DNP-UG

To Actively Develop and Support Improved:

1. **Interoperability**
   - Test procedures
   - Conformance certification
   - Device profile (XML and Word formats)
   - Application specific profile (DER)
   - Technical bulletins and standard updates
   - Application notes
   - Guides
2. **Cybersecurity**
   - Secure Authentication Version 5 (SAv5)
   - Secure Authentication Version 6 (SAv6)
   - Authorization Management Protocol (AMP)
   - Technical bulletins and standard updates
   - Application notes
   - Guides
3. **Education**
   - New workshops and tutorials
   - User forum (website)
   - Expert assistance (per membership level)
   - Technical bulletins
   - Application notes
   - Guides

Key Focus Area - DER Communications

- IEEE 1815.2 – DNP3 Profile for DER Communications
- Conformance certification
- MOU with MESA

Key Publications and Dates

- Became IEEE Std 1815™ in 2010.
- Update to IEEE 1815 in 2012.
- Secure Authentication Version 5 (SAv5), released with IEEE 1815-2012:
  - EPRI Plug-fest reports – 2014, 2016
  - Test procedures – 2017
- Application notes – profiles for DER communications released in 2011, 2013 and 2018.
- IEEE 1815.1™ – Mapping between DNP3 and IEC 61850 – released in 2016.
- DNP3 Test Procedures Version 3.1 – adds Subset Level 3 – 2022.
- Device Profile Guide – 2022.
- Technical Bulletins – periodic releases.

Key Publications in Process and Pending

- Secure Authentication Version 6 (SAv6) – draft complete and will be released with IEEE 1815~2025.
- Authorization Management Protocol (AMP) – Device and Authority.
- Update to IEEE 1815 ~ 2025.
- New standard – IEEE 1815.2™ – Profile for DER Communications.
- Technical Bulletins – periodic releases.

Industry Trends

- **Pressing need for defense in depth – OT Cybersecurity**
  - The DNP-UG's next generation cybersecurity specifications are uniquely applicable to the critical OT communications link usually using DNP3
- **Interoperability is an ongoing challenge for the industry**
- **DER communications and cybersecurity is a growing imperative**
- **From devices/system to holistic solutions**
  - Holistic solutions from multiple vendors integrate well
  - Must be standards based
  - Strive to maximize interoperability, including conformance certification
  - Important to reduce the number of standards

Update on 2023 Programs and Activities (1)

Interoperability:

- Test procedures (new)
- Device profile guidance
- Update to IEEE Std 1815™
- Conformance Certification Program

Cybersecurity:

- Secure Authentication Version 5 (SAv5) – currently available.
- Secure Authentication Version 6 (SAv6) & Authorization Management Protocol (AMP) – continued development.
- Roadmap to support Zero Trust over serial and IP.
- DOE proposal

Update on 2023 Programs and Activities (2)

DER Communications:

- MOU with MESA
- Significant contributions to new standard IEEE P1815.2 (DER Communications). Chair and co-editor
- Support MESA on the MESA-DER DNP3 Profile Test and Certification Program
- Normative references to DNP3 in IEEE Std 1547-2018™
- Normative references SAv5 and SAv6 in IEEE 1547.3™

Over 4,000 hours of volunteer effort by industry leaders and top talent across our five operating committees and task forces.

New PT staff for membership engagement

Strategic and Tactical plans for 2024

Tactical Plans:

- New fee structure for 2024
- Courses at DistribuTECH
- Changes to TC Charter
- Changes to Conformance Certification Program
  - Planning for DER vendor group
  - Engage with UL in support of MESA T&C
  - Formalize offering for SAv5

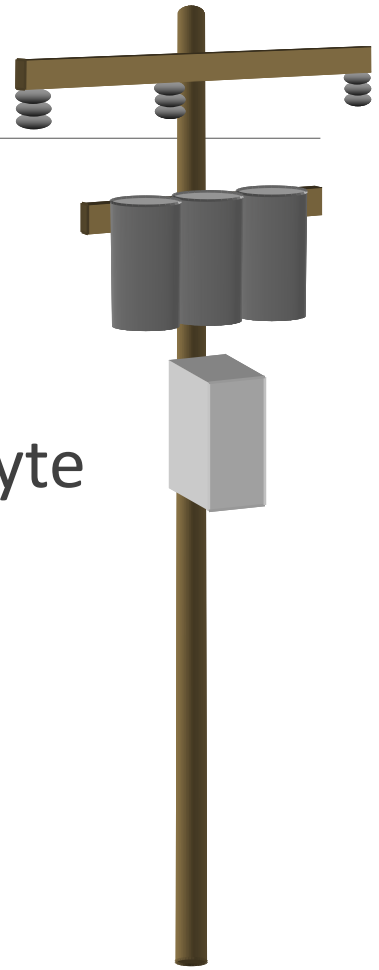
Strategic Plans:

- Continuing development of AMP
- Start test procedure development for SAv6
- Strong effort on 1815.2 to ballot
- Strong push on 1815 to ballot (includes SAv6)
- IEEE 1547.10 – Participation if funding permits
- Expand service offerings e.g., training, consulting
- Grow engagement with utilities and other entities
- Expand role of membership engagement staff
- Website improvements

DNP-UG Cybersecurity Program

SUMMARY AS OF APRIL 2024

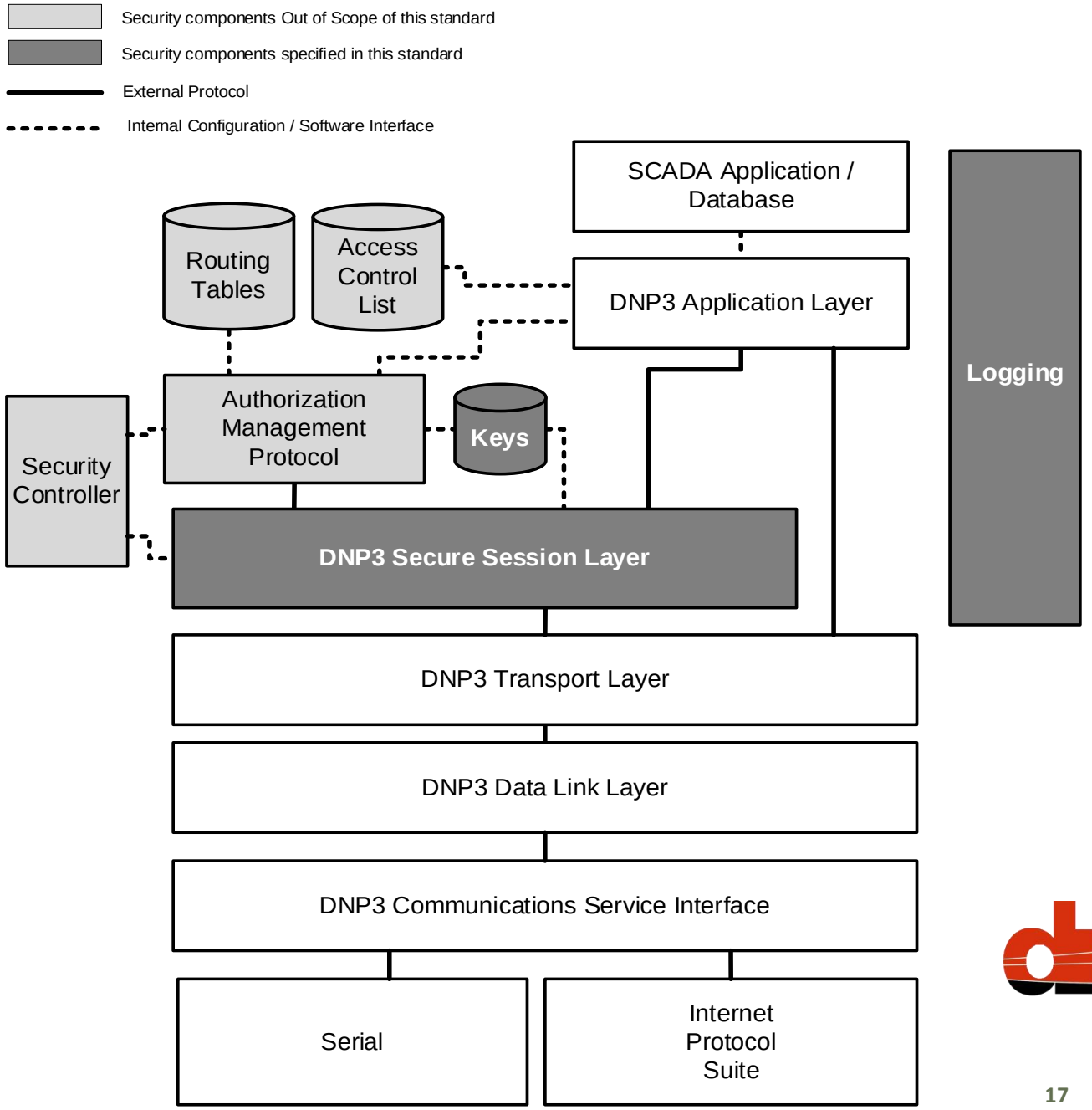
The SCADA Environment



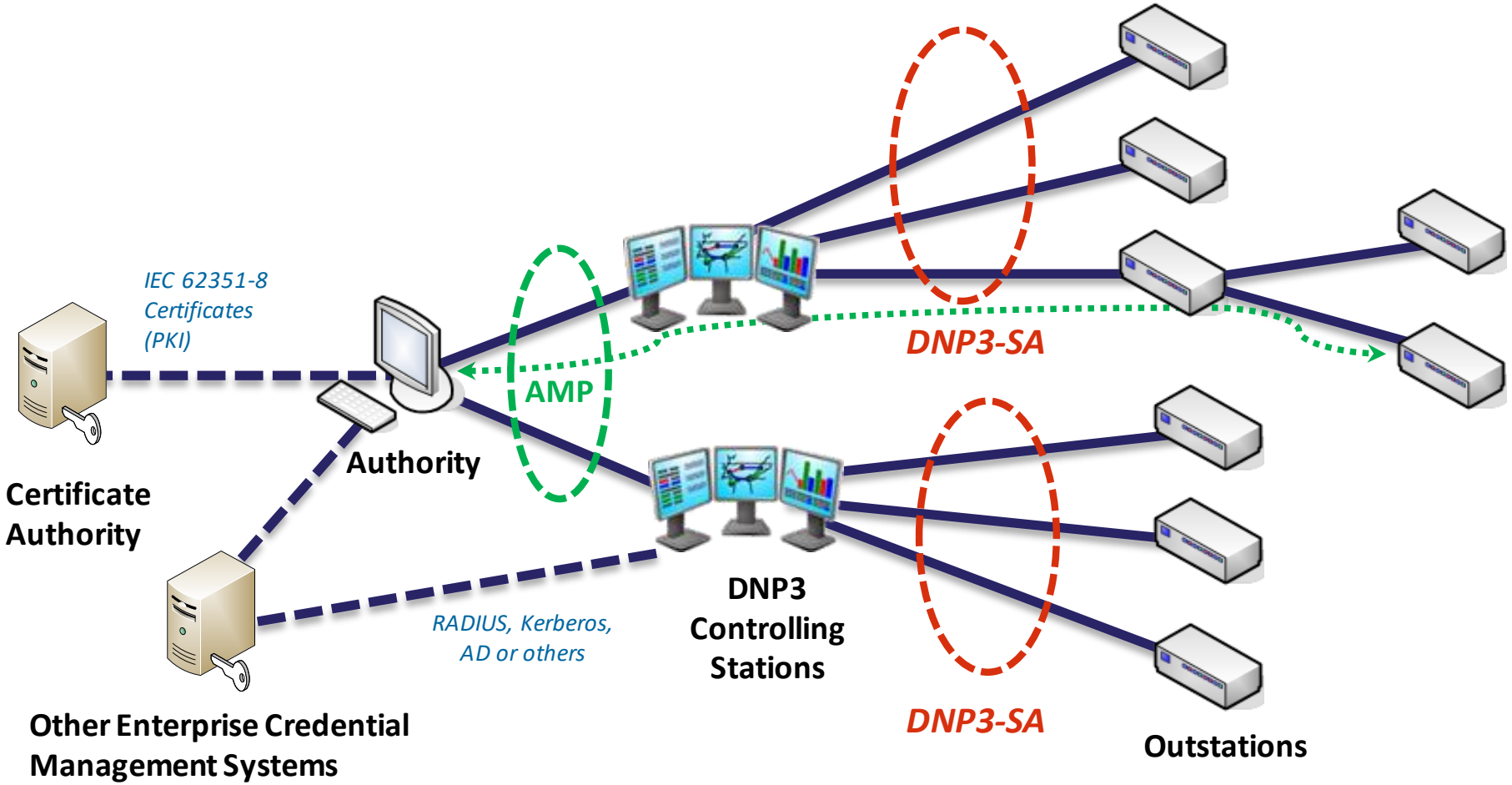
- Very challenging for implementing security
- Mixed IP-based and serial networks
- Serial is low-bandwidth, unreliable, sometimes pay-per-byte
- Devices typically have low processing power
- Use data concentrators, not routers
- Security server access available only at topmost nodes

Solution: The DNP3 Security Architecture

- To be published in IEEE Std 1815



Integration with the Enterprise



Benefits and Features

Secure Authentication v6 (SAv6)

- Authentication, integrity and RBAC between devices at ***application layer***
- Uses Hashed Message Authentication Code (HMAC)
- Now also supports ***encryption***
- Defined as ***separate layer*** that can be used for other protocols
- ***Elliptic curve*** algorithms to minimize processing power
- Simplified procedures and new algorithms in this version
- Can be used with AMP or other PKI

Authorization Management Protocol (AMP)

- Central authorization for ***both IP and hierarchical serial*** networks
- Promptly revokes authorization and/or privileges through RBAC
- Allows devices to generate their own keys, ***avoiding human interaction***
- Accommodates redundant connections, masters and authorities
- Prevents tunneling of non-DNP3 messages
- Can be used ***separately*** with other protocols

DOE Announcement – FOA 2500

The Latest From CESER

DOE Announces $45 Million to Protect Americans From Cyber Threats and Improve Cybersecurity in America's Energy Sector

On February 26, DOE awarded $45 million to 16 projects to protect the nation's energy infrastructure from future cyber-attacks. The selected projects will help develop new cutting-edge cybersecurity tools and technologies to reduce cyber risks and ensure America's energy systems remain durable and resilient to evolving cyber threats.

Topic Area 3 – Authentication Mechanisms for Energy Delivery Systems

- **EPRI (Palo Alto, CA)** will develop and/or accelerate two communications standards to perform centralized management of authentication and authorization services in a zero-trust architecture.
- **Texas A&M University-Kingsville (Kingsville, TX)** will research, develop, and demonstrate a zero-trust authentication mechanism with post-quantum cryptography to reduce the cyber-physical security risks to DER devices and networks.
- **Kansas State University (Manhattan, KS)** will address the security vulnerabilities of existing standards by integrating authentication, secret key establishment, and encryption-based secure communication mechanisms with existing standards for reliable authentication and communication between smart grid nodes, inverters' gateways, and other grid-edge devices.

Important note: NO funding flows to the DNP Users Group

DOE 2500 Project Work Plan - Preliminary

- In partnership with EPRI (prime and DER gateway)
- Completion of AMP device specification (core team development)
- Development of the AMP authority (commercial partner offering)
- Test procedures for SAv6 (core team development)
- Test procedures for AMP – Device and Authority (core team development)
- Development of the Protocol stack (commercial partner offering)
- Development of (extension to) test tool (commercial partner offering)
- Online testing – multi-vendor (core team development)
- Utility demonstration – multi-vendor (Salt River Project)
- Zero Trust Architecture – roadmap (core team development)

DOE – Cybersecurity Baselines

Office of
CYBERSECURITY, ENERGY SECURITY, AND EMERGENCY RESPONSE

ABOUT US | CYBERSECURITY | ENERGY SECURITY | EMERGENCY RESPONSE | PETROLEUM RESERVES

Office of Cybersecurity, Energy Security, and Emergency Response

New DOE-Funded Initiative Outlines Proposed Cybersecurity Baselines for Electric Distribution Systems and Distributed Energy Resources

FEBRUARY 22, 2024

Office of Cybersecurity, Energy Security, and Emergency Response »

New DOE-Funded Initiative Outlines Proposed Cybersecurity Baselines for Electric Distribution Systems and Distributed Energy Resources

Cybersecurity Baselines Released for U.S. Distribution and Clean Energy Systems

WASHINGTON D.C. – Today, the U.S. Department of Energy (DOE) applauds the release of cybersecurity baselines for electric distribution systems and distributed energy resources (DER) such as solar, wind, and storage. The initiative spearheaded by the National Association of Regulatory Utility Commissioners (NARUC), was funded by DOE's Office of Cybersecurity, Energy Security, and Emergency Response (CESER) and was guided by a steering group of industry and government subject matter experts including electricity sector owners and operators, state regulatory agencies, cybersecurity experts, and others. Today's announcement reinforces the Biden-

Rationale for Membership (1)

- **Engineering level benefits:**
  - Continued availability to our standards including updates.
  - Awareness of helps the UG provides such as the Device Profile Guide.
  - Access to other related documentation such as test procedures and tutorial information.
  - On-going enhancements with new features and updates.
  - List of Conformance Certified Products
  - The opportunity to participate in one or more of our operating committees to learn and contribute.
  - **Access to training, forum, workshops and lessons learned (future).**

Rationale for Membership (2)

- **Strategic level benefits:**
  - A holistic system approach, when using multiple vendor's products, assumes a higher degree of interoperability, reliability and security of communications provided by DNP3.
  - Lower product development (vendors) and project deployment costs and risks (utilities) are the result of the work of the DNP-UG (e.g., test procedures, guides, Conformance Certification Program).
  - Utilities gain from using the latest technology with the most functionality providing the greatest economic and operational benefits.
  - Other utilities are participating in the UG and implementing and benefiting from the most current functionality.
  - DNP3 is widely used which provides economies of scale with the lowest possible costs to all users.
  - Industry visibility and reputational benefits a partner of the DNP-UG.

Rationale for Membership (3)

- **Summary:**
  - Broad input by experts and thought leaders improves our developments!
  - Without the DNP-UG supporting DNP3, successful interoperability among different vendor's devices would be much more expensive or not possible at all.
  - Strong support of the DNP-UG will enable thousands of volunteer hours (over 4,000 hours in 2023) per year by industry experts in key programs driving improved cybersecurity and interoperability.
  - A viable DNP-UG will continue to execute on our mission of maximizing interoperability, improving cyber security, optimizing DER communications.

Utility Member Roster (April 2024)

- CPS Energy
- Evergy
- Lansing Board of Water and Light
- LG&E and KU
- ONCOR
- Pacific Gas and Electric
- Pacific Northwest National Laboratory (research category)
- Salt River Project
- Southern California Edison
- State Grid Electric Power Research Institute
- TVA
- Burlington Hydro (Ontario) – new CSTF participant, not a UG member yet

Education Initiatives (Preliminary)

Training Tutorials (on-line)

- IEEE 1815
- IEEE 1815.2 (DER communications)
- SAv5, SAv6, AMP
- Fundamentals
- Advanced topics
- 1815.1 – Mapping IEEE 1815 to IEC 61850
- Troubleshooting
- Lessons Learned

Technical Support (hosted by DNP-UG experts)

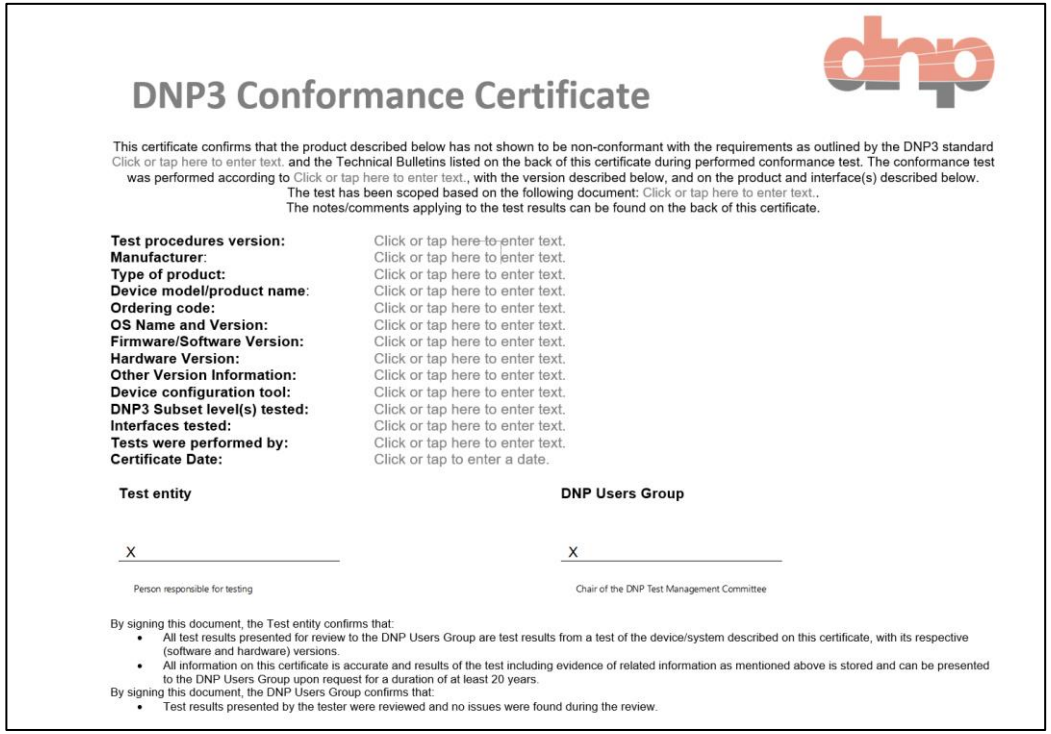
- Member forum (on-line)
- Custom training
- Periodic Q and A email support
- Included (membership) troubleshooting and consulting support (time limited)
- Troubleshooting and consulting support (optional)

Workshops (on-line)

- Industry trends
- Development update – DNP3 technical changes
- Development update – DER communications
- Development update – Cybersecurity – SAv6
- Development update – Cybersecurity – AMP
- SCADA fundamentals
- SCADA advanced topics
- DER communications Overview
- OT Cybersecurity overview
- Managing hybrid networks of IEEE 1815 and IEC 61850

Conformance Test Review (CTR) Process

- Improve product quality
- Reduced program risk
- Recommended for all new or updated products
- Expert review of Device Profile and Test Logs



DNP3 Conformance Certificate

This certificate confirms that the product described below has not shown to be non-conformant with the requirements as outlined by the DNP3 standard Click or tap here to enter text. and the Technical Bulletins listed on the back of this certificate during performed conformance test. The conformance test was performed according to Click or tap here to enter text., with the version described below, and on the product and interface(s) described below.
The test has been scoped based on the following document: Click or tap here to enter text..
The notes/comments applying to the test results can be found on the back of this certificate.

Test procedures version:	Click or tap here to enter text.
Manufacturer:	Click or tap here to enter text.
Type of product:	Click or tap here to enter text.
Device model/product name:	Click or tap here to enter text.
Ordering code:	Click or tap here to enter text.
OS Name and Version:	Click or tap here to enter text.
Firmware/Software Version:	Click or tap here to enter text.
Hardware Version:	Click or tap here to enter text.
Other Version Information:	Click or tap here to enter text.
Device configuration tool:	Click or tap here to enter text.
DNP3 Subset level(s) tested:	Click or tap here to enter text.
Interfaces tested:	Click or tap here to enter text.
Tests were performed by:	Click or tap here to enter text.
Certificate Date:	Click or tap to enter a date.

Test entity — **DNP Users Group**

X _____ X _____

Person responsible for testing — Chair of the DNP Test Management Committee

By signing this document, the Test entity confirms that:
- All test results presented for review to the DNP Users Group are test results from a test of the device/system described on this certificate, with its respective (software and hardware) versions.
- All information on this certificate is accurate and results of the test including evidence of related information as mentioned above is stored and can be presented to the DNP Users Group upon request for a duration of at least 20 years.

By signing this document, the DNP Users Group confirms that:
- Test results presented by the tester were reviewed and no issues were found during the review.

Conformance Certification Program – Getting Started

- DNP-UG employs a CTR coordinator to handle the day-to-day management of the CTR process, as overseen by the TMC
- DNP-UG strongly recommends that devices are certified periodically to ensure compliance
- Two phases in the CTR Process:
  - Device Profile review
  - Test Logs review
- Get started by contacting: conformancetesting@dnp.org or contact:
  - Deryk Yuill at deryky@ieee.org
  - Ron Farquharson at r.farquharson@ieee.org

DNP-UG Protocol Conformance Issue Tracking Summary

No.	Device Type	Issue Found	Impact
1	Outstation	No class support	Master is not able to read data from outstation
2	Outstation	Partial Event Class Polling	Outstation fails when polled by master
3	Outstation	Data Link Reset is incorrectly required	Outstation will not communicate with some masters
4	Outstation	Broadcast not supported	Outstation will not participate in a system-wide freeze commands and might not permit correct time setting via DNP3
5	Outstation	No support for UDP	Some expected functions will not work
6	Outstation	SBO command process not implemented correctly	A command may be operated in response to receiving an invalid or corrupted message
7	Outstation	Incorrect unsolicited configuration	Depending on network topology, configuration of timeouts, etc., all communications between the master and outstations stopped
8	Outstation	When replying to an integrity poll, static data is sent before event data	Operators could be shown incorrect data on their displays, which could lead to wrong actions.
9	Controlling Station	Unable to issue valid integrity poll	Operators could be shown incorrect data on their displays, which could lead to wrong actions.
10	Controlling Station	Reads frozen counter, never issues counter freeze	Unable to read frozen counter data from some devices

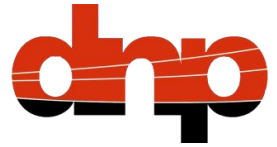
Discussion

- How to get involved and up to speed?
- Do you agree with the roles and mission of the UG?
  - Consensus was yes.
- Were you previously aware of the scope and depth of activities of the DNP-UG?
  - Consensus was no.
- What role will block-chain have in the future deployments of DNP3?
  - Response – no significant role is anticipated. Offline discussion is welcome if follow up is desired.
- How valuable to you (your company) would our proposed workshops, tutorials, courses be?
  - Not discussed
- What additional services or development would you recommend the UG provide?
  - Not discussed

Next Steps

- Follow the DNP Users Group on LinkedIn for more updates.
- Reach out to Sara at admin@dnp.org for more information and assistance with memberships.
- Please join the UG today!

Back-up Material



DNP-UG Fee Structure (2020)

DNP Users Group Member Fee Structure 2020				
Category No. (See Note 1)	Member Category (See Notes 2-4)	Annual Fees	User Accounts (See Notes 6,7)	Notes
1	Individual	$400	1	5,9
2	Water Utility	$500	5	8,12
3	Small Muni/Coop	$500	5	8,12
4	Large Muni/Coop (> $500 million)	$1,000	10	8,12
5	Small utility (< $1 billion)	$1,000	5	8,12
6	Large utility (> $1 billion)	$3,000	10	8,12
7	Micro vendor (0-$1 million)	$500	1	8,12
8	Small vendor (1-$20 million)	$1,000	3	8,12
9	Medium vendor ($20 to 100 million)	$3,000	5	8,12
10	Large Vendor (> $100 million)	$6,000	10	8,12
11	Vendor - revenue not declared	$6,000	10	8,12
12	Academic (Student/Research)	$1	1	5,9
13	Emeritus Member	$0	1	5,9
14	Research Organizations	$5,000	10	
Vendor Conformance Test Review (CTR) Program				
Member Option	Annual access fee. Additional project fees apply.	$1,000	N/A	13
Non-Member Option	Per project access fee. Additional project fees apply.	$7,000	N/A	14

All figures are in US dollars

Link to Fee Guide

Cyber Security Initiatives

Rationale:

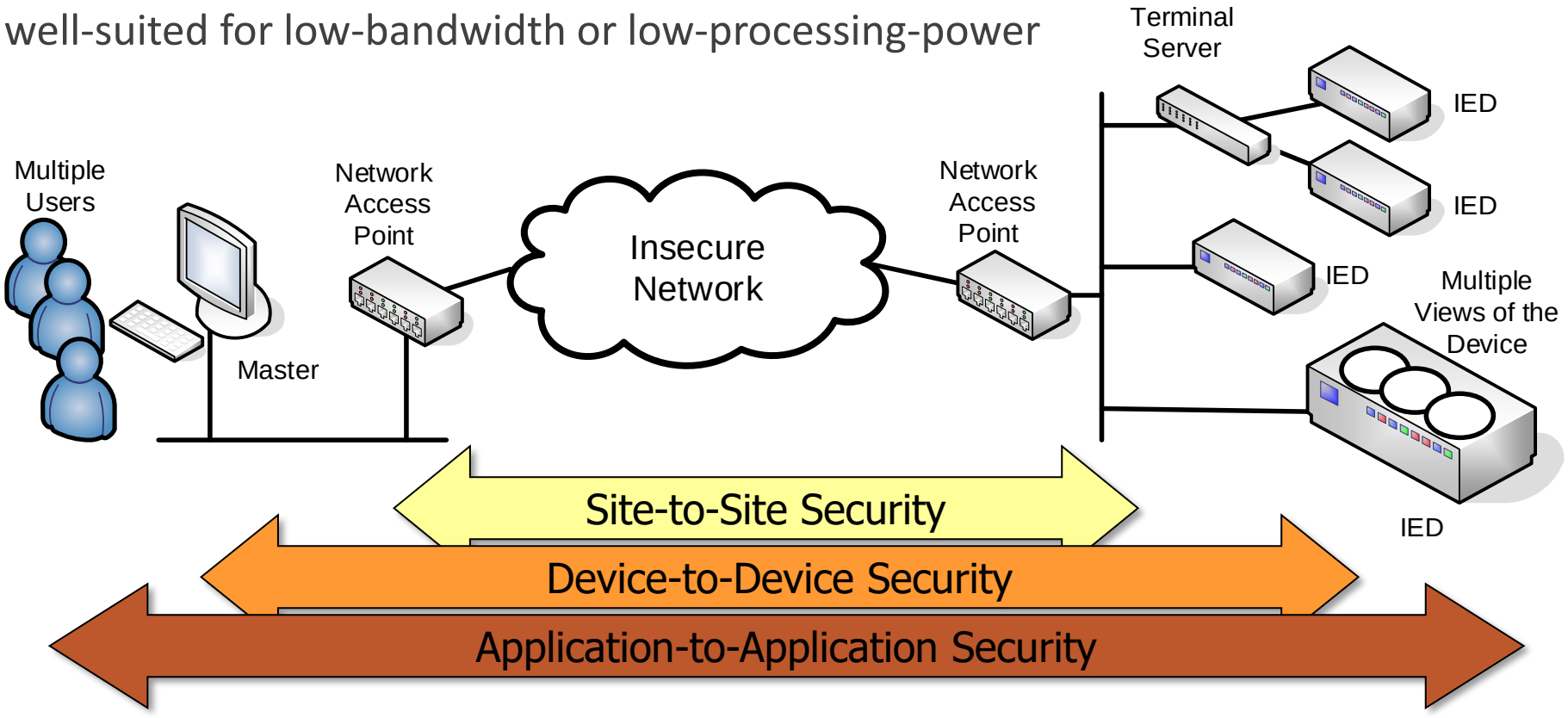
- Many DNP devices (especially on the distribution system) installed today are only minimally or not (operationally) secure as the existing NERC-CIP standards have not required this.

Activities (current and planned):

- The continued development of our next generation security provisions – Secure (separate) Session Layer and AMP
- Tight coordination with IEC TC 57 - WG15 – Part 5 team (IEC 62351-5)
- IEEE standardization – Session Layer into IEEE 1815™
- Development of new test procedures for the Session Layer and AMP
- Vendor on-line testing
- Interoperability test and demo (Interop)
- Test procedure validation and conformance testing

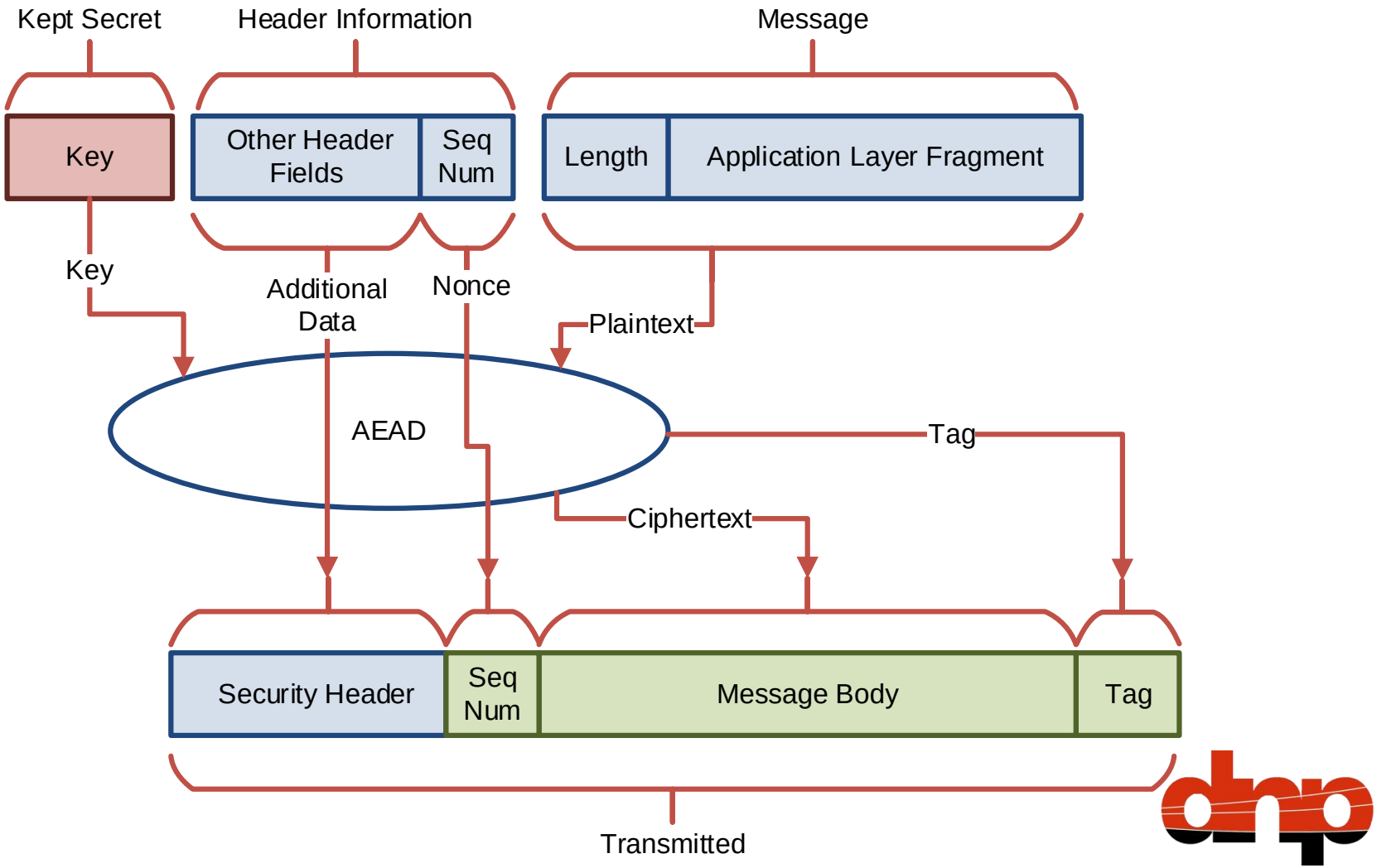
Why Not Use TLS or IPSec?

- They only reach to the borders of the IP network
- Do not reach serial devices
- Not well-suited for low-bandwidth or low-processing-power



Authentication and Encryption of Messages

- Key is never transmitted
- Tag is created by scrambling and truncating the message
- The tag sent with the message must match that calculated with local copy of the key
- Nonce prevents replay attacks
- Called a MAC if not encrypted



Interoperability Initiatives

Rationale:

- Interoperability issues are still common increasing risk and adding costs.
- Utilities and vendors expend far more system engineering effort configuring and maintaining their devices and systems than is necessary.

Projects:

- On-going test procedure developments including Master Stations and Outstations
- Profile developments and mappings for grid edge devices such as MV reclosers. Includes the development of related test procedures and guidance. Use the IEC 61850 models and mappings in IEEE Std 1815.1™ as reference
- Industry level effort to support wide adoption of the DNP3 XML Device Profile (DP) including implementation guides, test/certification processes focused on the use of the DP for tools and devices and extending to interop(s) and plug-fest(s).