Wi-SUN Alliance: Technology, Certification and Status

Phil Beecher, President and CEO

August 2019

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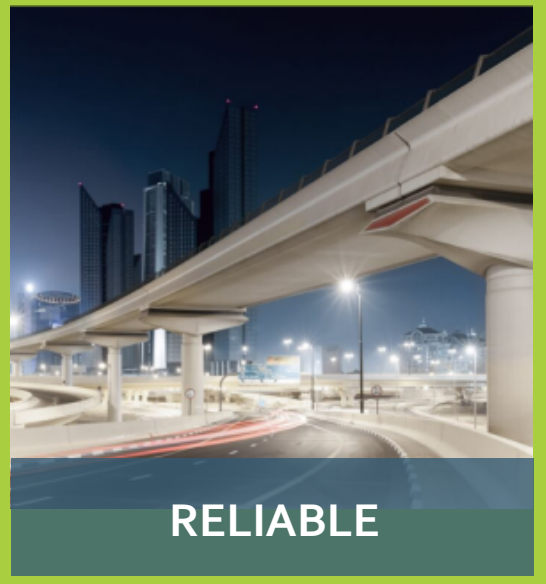
What is Wi-SUN Alliance?



A global ecosystem of member companies seeking to accelerate the implementation of open standards-based Field Area Networks (FAN) and Internet of Things (IoT).

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Over 240 members representing 26 countries

With 60% growth in global membership in 12 months

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>90 Million Wi-SUN Capable Endpoints Deployed Worldwide

– Navigant Research

>90 M

NAVIGANT RESEARCH

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An Established Leader Enabling Innovation in Smart Solutions

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An Established Leader Enabling Innovation in Smart Solutions

- Promotes multi-vendor interoperability, vendor competition, and customer choice

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An Established Leader Enabling Innovation in Smart Solutions

- Promotes multi-vendor interoperability, vendor competition, and customer choice
- **Robust certification program to ensure interoperability, for wireless devices for outdoor Field Area Networks (FAN), Home Area Networks (HAN) and other IoT networks**

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An Established Leader Enabling Innovation in Smart Solutions

- Promotes multi-vendor interoperability, vendor competition, and customer choice
- Robust certification program to ensure interoperability, for wireless devices for outdoor Field Area Networks (FAN), Home Area Networks (HAN) and other IoT networks
- **Enables diverse ecosystem of solution providers including, cities, utilities, government institutions, and academia to collaborate on smart solutions**

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An Established Leader Enabling Innovation in Smart Solutions

- Promotes multi-vendor interoperability, vendor competition, and customer choice
- Robust certification program to ensure interoperability, for wireless devices for outdoor Field Area Networks (FAN), Home Area Networks (HAN) and other IoT networks
- Enables diverse ecosystem of solution providers including, cities, utilities, government institutions, and academia to collaborate on smart solutions
- **Delivers global reach with over 240 members in over 26 countries**

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A complete ecosystem

From Silicon to Solutions

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Wi-SUN Members

Promoter Members (8)

Cisco, Itron, Landis+Gyr, NICT, OMRON, Renesas, Toshiba Leading Innovation, Trilliant

Contributor Members (82)

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Wi-SUN Members

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Test Lab Members

Test Lab Members (8)

Allion Engineering Services

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TELEC Empower the wave!

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Standards Development - the need for IEEE 802.15.4g

- In 2008 there were no wireless communications standards for Peer to Peer Field Area Networks
- There were various Field Area Network solutions, including Arch Rock (Cisco), Elster, Itron, Landis+Gyr, Silver Spring Networks (Itron),
- They used similar technology, but not interoperable

A standard was needed - IEEE802.15.4g

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Standards Development IEEE 802.15.4g - Scope

- Initial Focus was on Smart Utility Network Communication
- Standard was optimised for Large Scale outdoor Wireless Mesh Networks – i.e. Field Area Networks
- Goal was to take proven technology and create a standard to meet FAN needs and allow interoperable products globally
- First published in March 2012 and included in 802.15.4 revision in 2015

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IEEE 802.15.4g feature summary

Features and Outcomes

- Takes advantage of proven technology
- Backward compatibility with installed base of 10's of millions of meters
- Great flexibility
  - Multiple data rates
  - Robust error detection
  - Optional forward error correction
  - Supports direct use of an IP network layer without 6LoWPAN
- Support for Global and Regional frequency bands
  - 902-907.5 & 915-928 MHz in Brazil
  - 902-928 MHz in US and many other regions
  - 920MHz Japan
  - 868.3 MHz Europe

Further extended with 802.15.4u and 802.15.4v

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Target Applications

Wi-SUN supports applications that enhance efficiency, quality of service and resilience including:

- ***Smart utilities***: Advanced Metering Infrastructure (AMI), Peak Load Management, distribution automation and smart metering
- ***Smart cities***: Infrastructure management, street lighting, parking, traffic and transport systems
- ***Smart home***: Smart thermostats, air cond, heating, energy usage displays and health and well-being applications
- ***M2M***: Agriculture, structural health monitoring (e.g. bridges, buildings, etc.), monitoring and asset management

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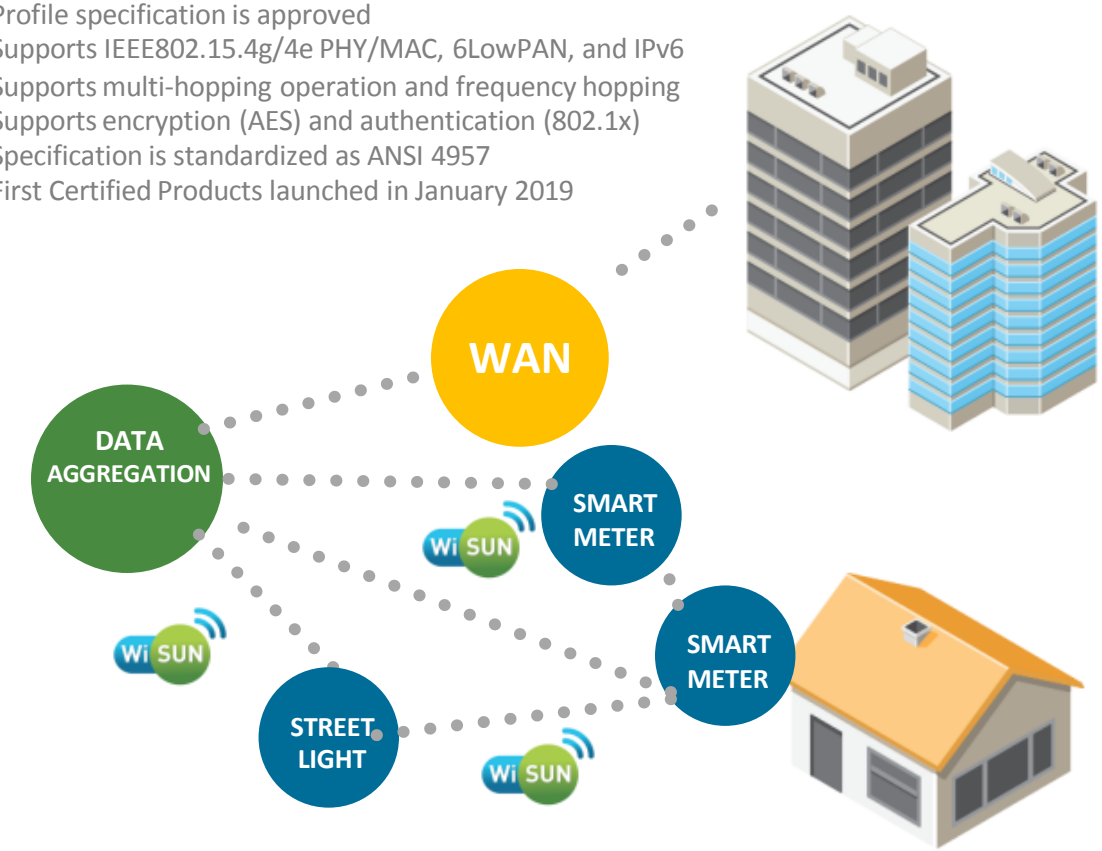
Profile Specifications for Smart Utility/City Applications

FIELD AREA NETWORK (FAN) Profile

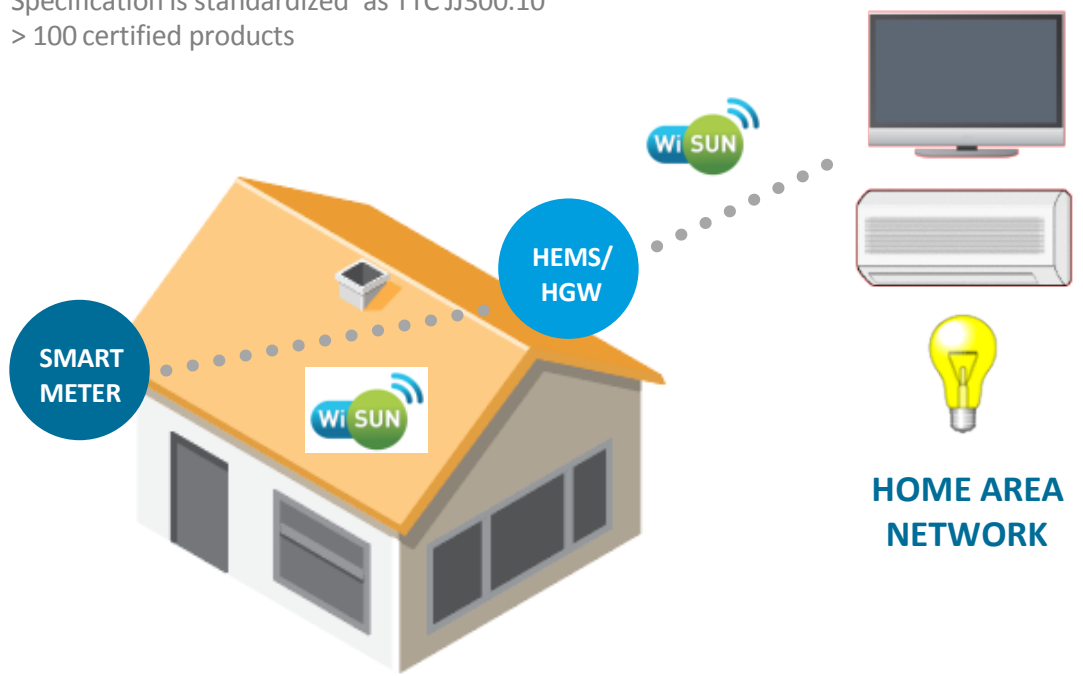
- Profile specification is approved
- Supports IEEE802.15.4g/4e PHY/MAC, 6LowPAN, and IPv6
- Supports multi-hopping operation and frequency hopping
- Supports encryption (AES) and authentication (802.1x)
- Specification is standardized as ANSI 4957
- First Certified Products launched in January 2019



FAN: Communication Between Smart Meters and Distribution Automation

HOME AREA NETWORK (HAN) Profile

- Profile Specification is approved (Wi-SUN profile for ECHONET Lite)
- Support IEEE802.15.4g/4e PHY/MAC, 6LowPAN, and IPv6
- Support encryption (AES) and authentication(PANA)
- Specification is standardized as TTC JJ300.10
- > 100 certified products



TEPCO B-ROUTE: Communication between Smart Meters and HEMS

HAN: Communication between HEMS controller and HAN device

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What is the Wi-SUN FAN specification ?

- Technical specification and certification program for interoperable, multi-service, secure IPv6 over IEEE 802.15.4g* wireless mesh network.
- Use Cases:
  - Advanced Metering Infrastructure (AMI)
  - Distribution Automation (DA)
  - Smart Cities
- Global standard: North America, Japan, Korea, India, Brazil, Australia, Asia Pacific, EU, etc.

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What are the Key Use Cases for Wi-SUN FAN?

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What are the benefits of FAN Certification?

For utilities, smart cities, FAN Certification ensures interoperability, which results in accelerated time to market.

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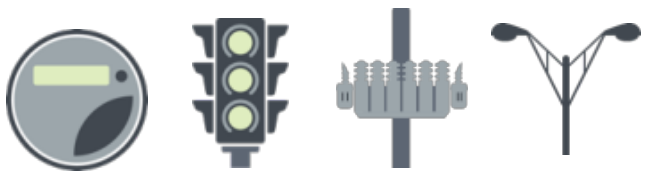
Certification delivers Interoperability

Standardization Body	Industry Alliance	Interoperable Products
IEEE802.11 Wireless LAN	Wi-Fi™	
IEEE802.15.4g Wireless SUN	Wi SUN Alliance	



Wi-SUN Alliance is the certification organization for large scale IoT Networks

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Certification Program Elements

Test method and specification	• Wi-SUN Alliance members develop test methodology and test specification
Test equipment	• Wi-SUN Test and Certification Committee (TCC) works with test equipment vendors to provide test harness for conformance testing
Test laboratory	• TCC works with Wi-SUN approved test laboratories (ATLs) to deliver third party testing
Test bed units	• TCC works with product vendor to develop test bed units (TBU) to facilitate the third party interoperability testing • TBU is a customized implementation for constructing the test bed

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Testing Methodology

- Two Part Testing:
  - Conformance component – assessing Device Under Test for conformance to the specification using specialized test environment
  - Interoperability component – assessing Device Under Test for interoperability with reference implementations
- Device Under Test must pass all relevant tests to be eligible for certification
- All testing is conducted by a Wi-SUN appointed Independent Test Laboratory – Third Party Testing
- Test Laboratory prepares Test Report

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FAN Certification Testing Overview

- FAN Conformance Test Bed
  - Test Bed Controller
    - Script driven TBC to automate FAN device certification.
      - TBC controls test bed as certification test plan is executed upon a Device Under Test.
  - Test Bed Units
    - 14 TBUs constitute the test bed.
      - Test Bed Units from multiple vendors
      - TBUs implement the API used by the Test Bed Controller.
  - Wireshark protocol decoder
    - Wireshark protocol decoder is integrated into the TBC and test bed.

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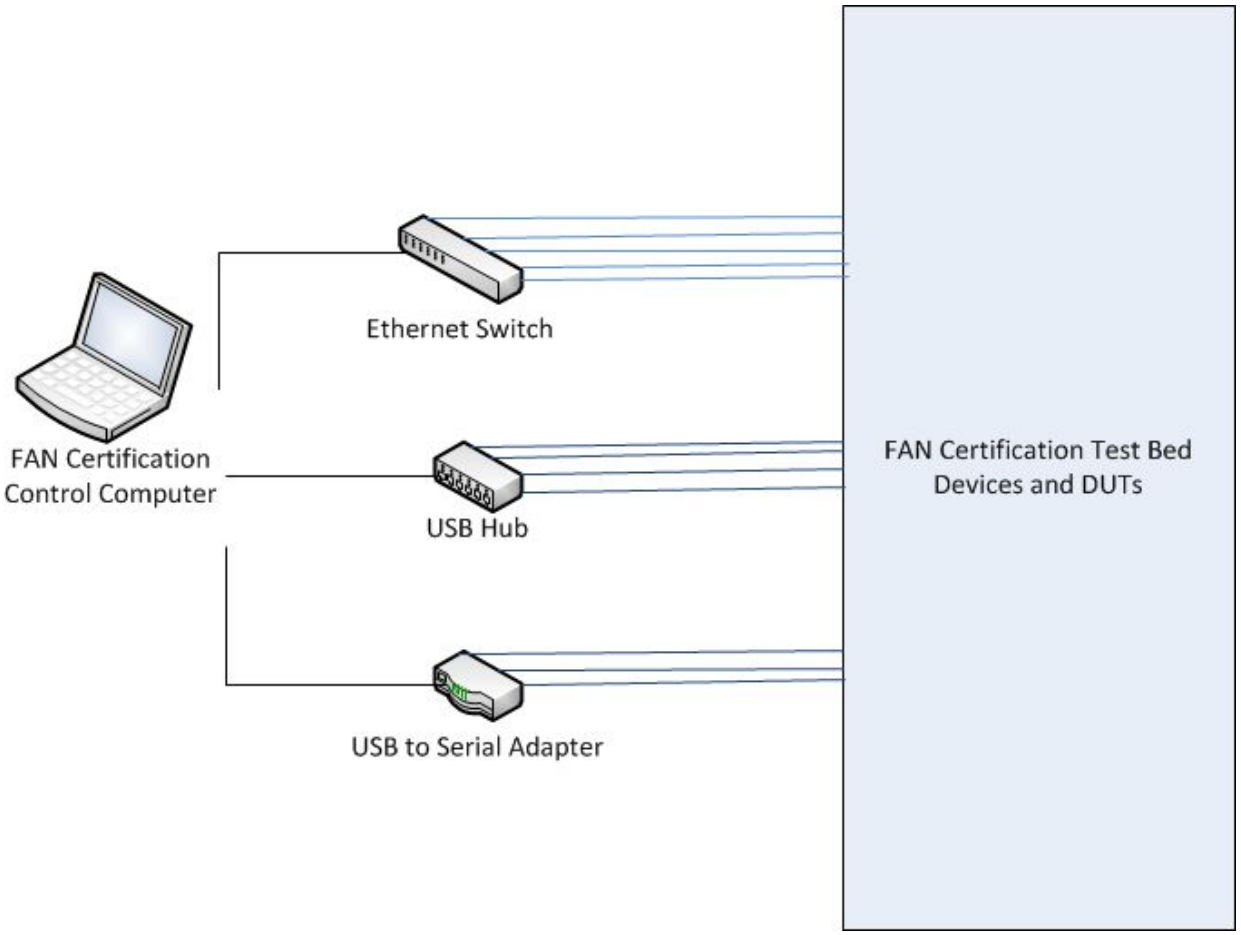
FAN Certification Test Bed Overview



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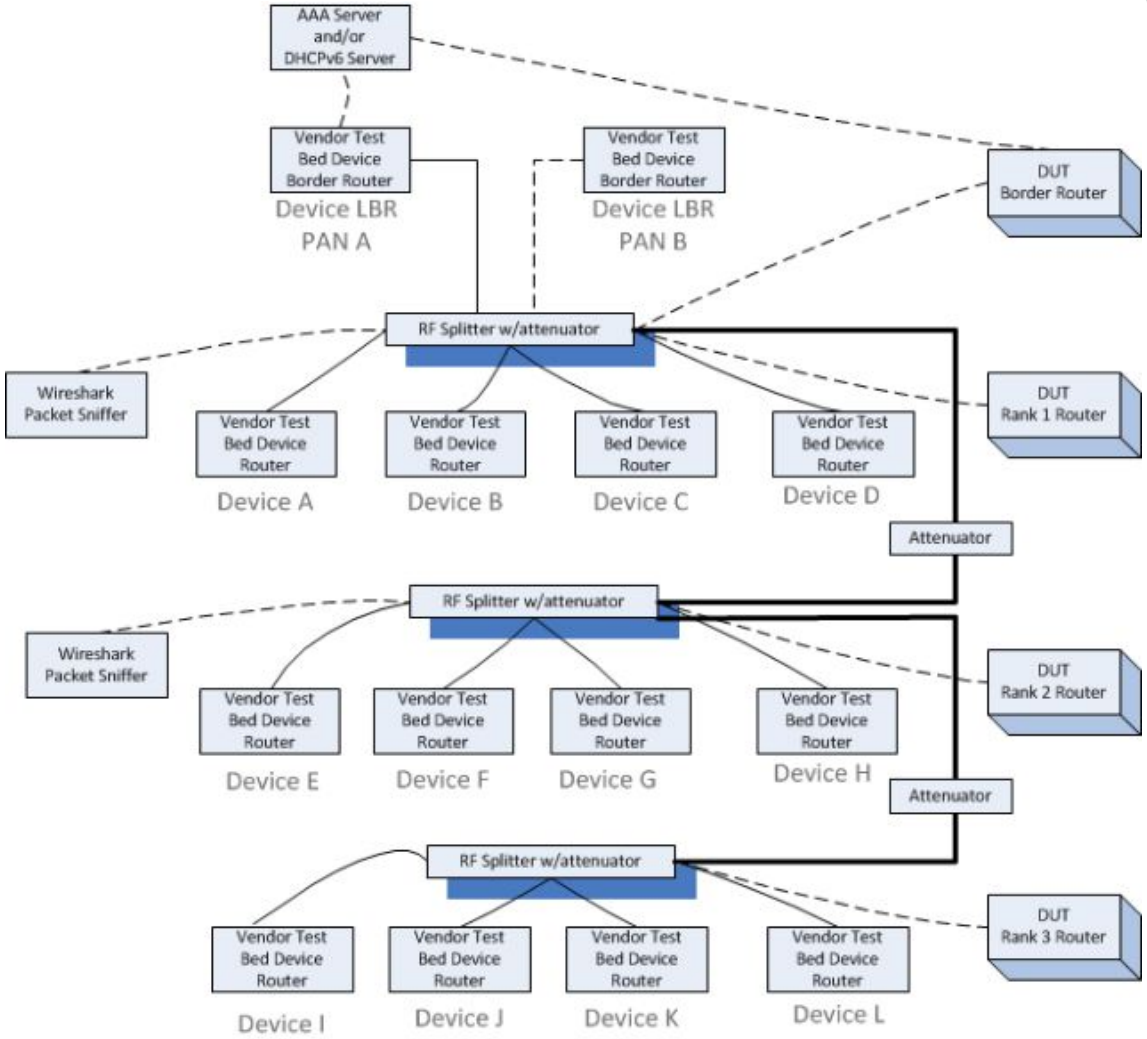
FAN Certification Test Bed Internal Detail



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Wi SUN Certified FAN

IR509, IR 529
WPAN Industrial Router
CGR 1120, CGR 1240
Connected Grid Router
+ 8 more products

Bridge 5 –WS
Network
Platform

The N550 Network Node
an integral part of
Gridstream® Connect

Collaborated on the
development of the
EW-WSN BP35C4

RF (RAA604S00)+
MCU(RX651)
wireless solution

Test services
provider

Test tool
provider

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Benefits of Mesh Networks

Please view the animation on the Wi-SUN website:

https://www.youtube.com/watch?v=oPuOqdHYcTk

Comparing IoT Networks at a Glance

Download the whitepaper from here:

https://www.wi-sun.org/tcwp-en/file

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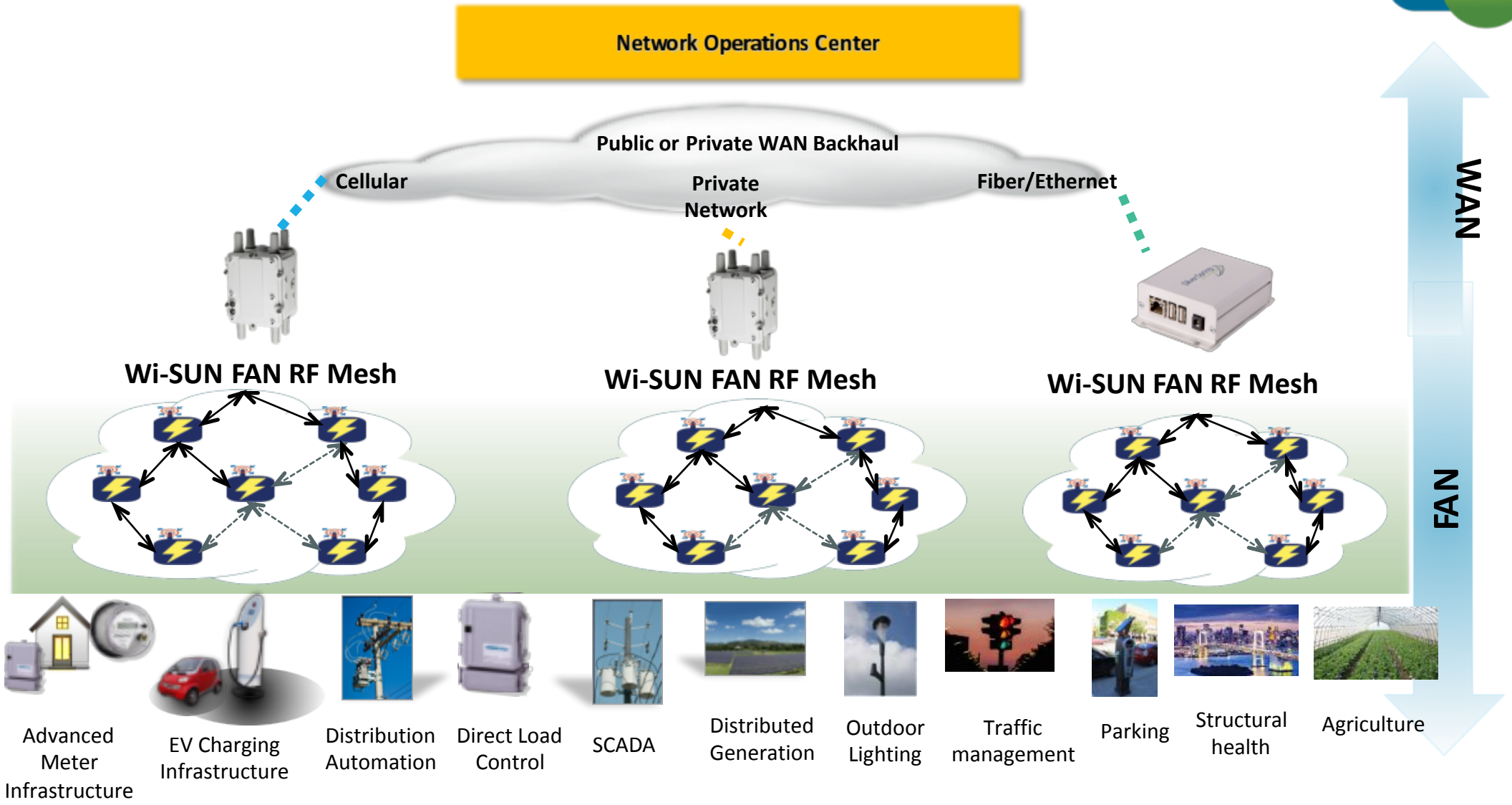
Wi-SUN FAN Architecture



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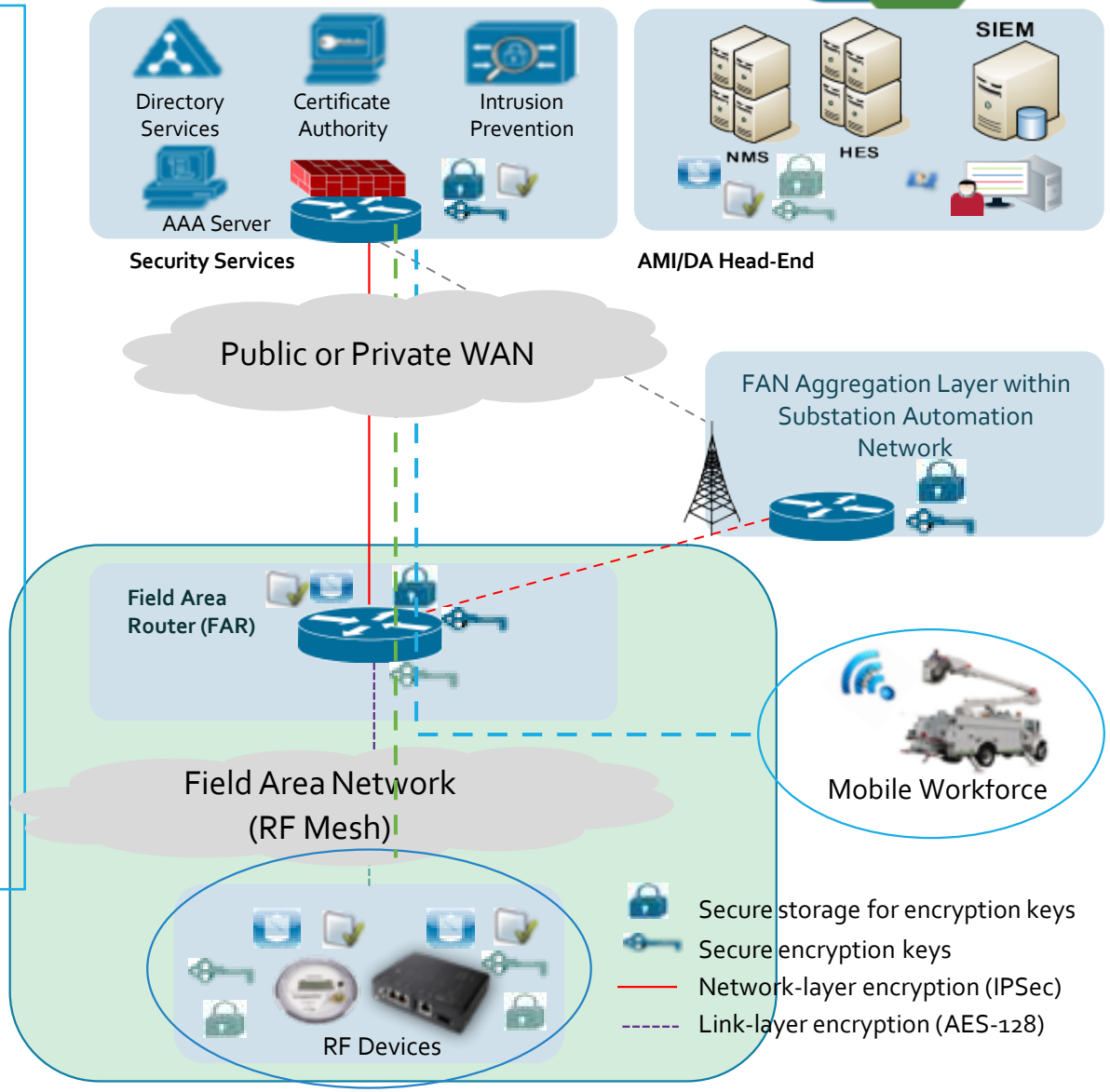
Wi-SUN FAN Security Architecture

- Device hardening with 802.1AR and hardware security chip or PUF
- Network hardening tools
- Certificate-based identities
- Role based Access Control
- 802.1x-based access control for meters, routers, grid devices
- Frequency hopping RF
- Link-layer encryption in RF Mesh
- Group-based key generation and management (mesh)
- Network-layer encryption for WAN Backhaul (IPSec)
- Over the air upgradable devices



Secure Device Identity via Digital Certificates

Strong user identities with Role-Based Access

Time-stamped logs, correlation at SIEM

Separation of AMI vs. non-AMI traffic, segmentation

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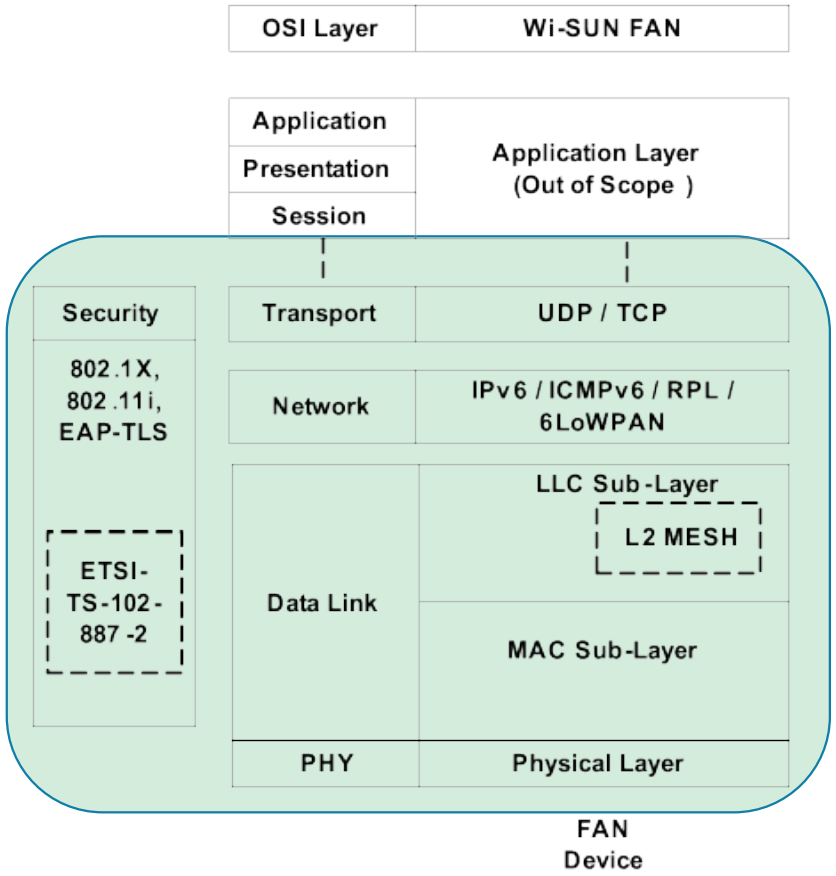
Wi-SUN FAN Stack Overview



IPv6 protocol suite

- TCP/UDP
- 6LoWPAN Adaptation + Header Compression
- DHCPv6 for IP address management.
- Routing using RPL.
- ICMPv6.
- Unicast and Multicast forwarding.

Security

- 802.1X/EAP-TLS/PKI Authentication.
- 802.11i Group Key Management
- Optional ETSI-TS-102-887-2 Node 2 Node Key Management

MAC based on IEEE 802.15.4e + IE extensions

- Frequency hopping
- Discovery/Join
- Protocol Dispatch (IEEE 802.15.9)

PHY based on 802.15.4g, 802.15.4u, 802.15.4v

- Various data rates and regions

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For More Information

For more information or questions contact:

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