Wi-SUN Alliance
# Field Area Network (FAN) Overview
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LPWAN@IETF97

Wi-SUN Alliance FAN
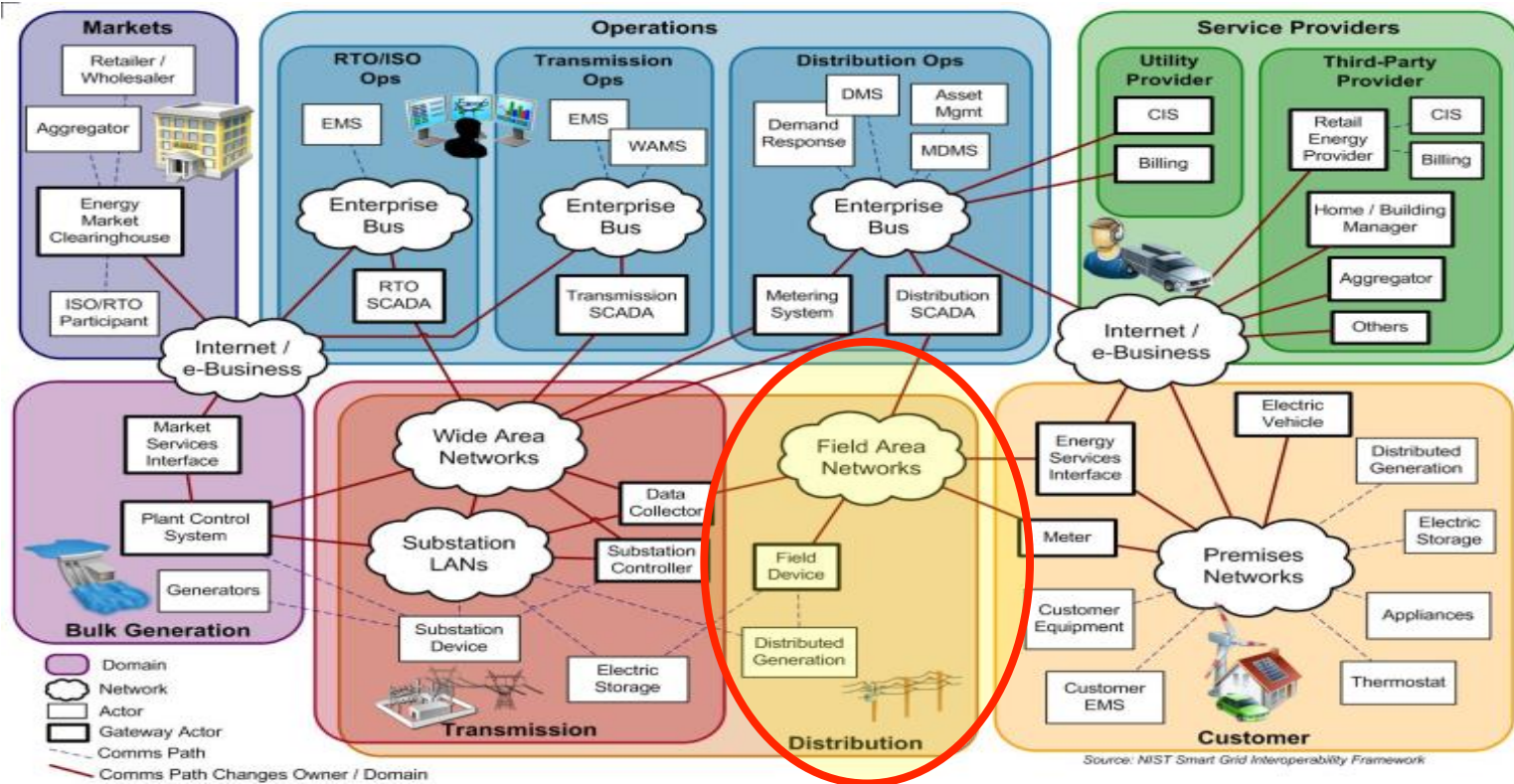

Source: NIST Smart Grid Interoperability Framework

FAN Use Cases

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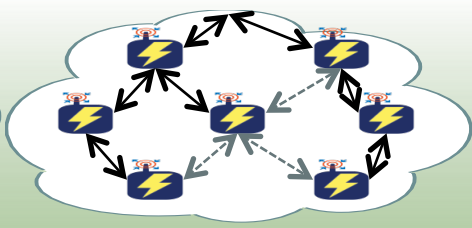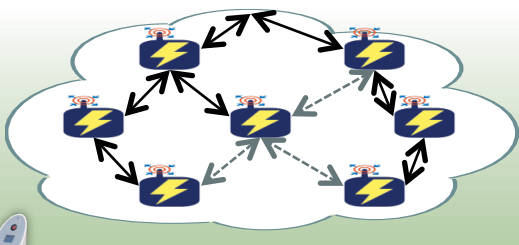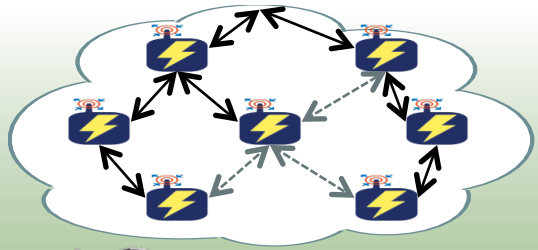
Wi-SUN FAN Communications Overview

|	
Application layer	Application · Application · Application / Service Layer / HTTP · CoAP
Transport layer	TCP · UDP
Network layer	Routing: RPL / IPv6 / 802.1x / 802.15.9 EAP-TLS
Data link layer	Adaptation Layer 6LoWPAN / IEEE 802.15.4 (g/e) · IEEE 802.11 (Wi-Fi) · IEEE 802.16 (WiMax) · Cellular · Proprietary
PHY layer	
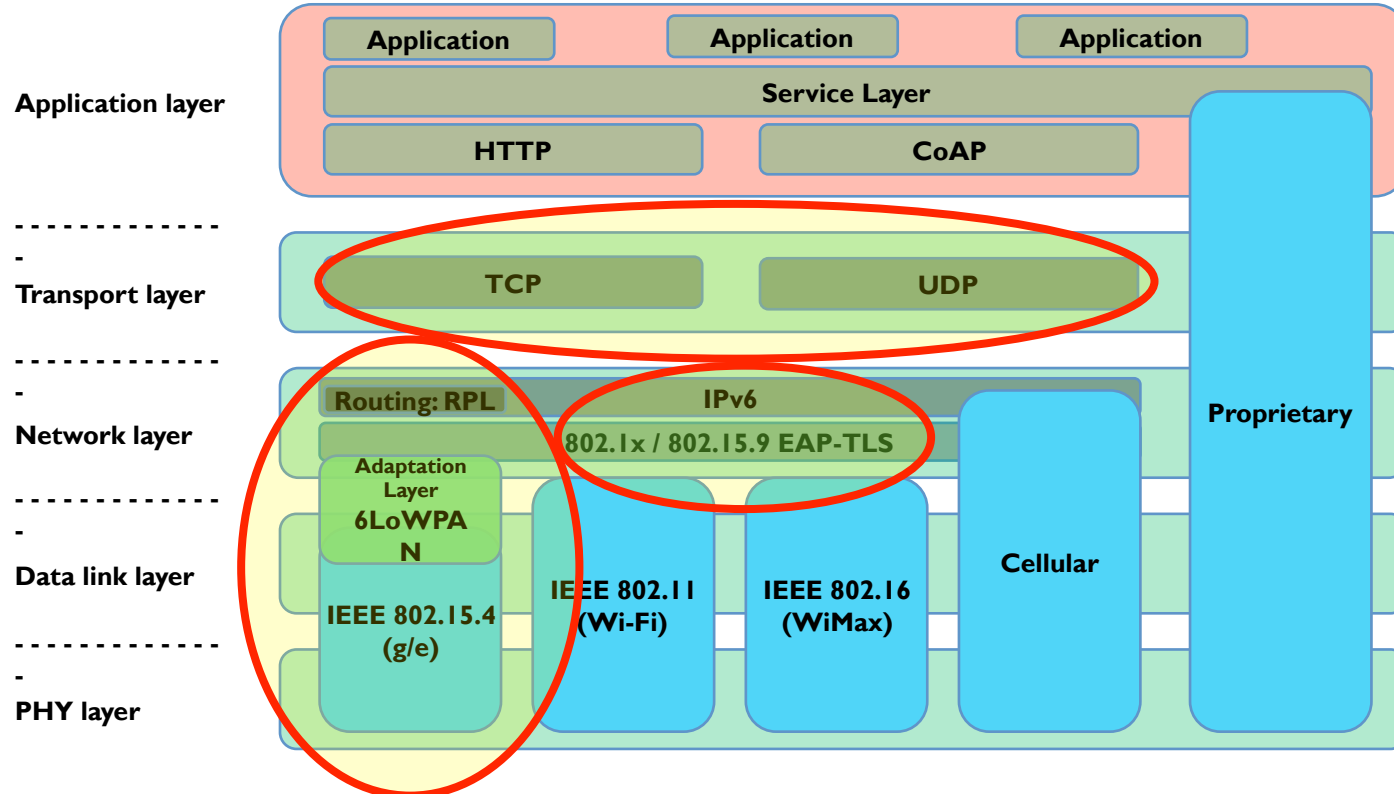
Wi-SUN FAN Summary

- Open standards based on IEEE802, IETF, TIA, ETSI
- Architecture is an IPv6 frequency hopping wireless mesh network with enterprise level security
- Simple infrastructure which is low cost, low complexity
- Superior network robustness, reliability, and resilience to interference, due to high redundancy and frequency hopping
- Excellent scalability, long range, and energy friendliness
- Supports multiple Global license-exempt sub GHz bands
- Multi-vendor interoperability
- Very low power modes in development permitting long term battery operation of network nodes.

FAN Stack Overview

(((LPWAN)))

OSI Layer	Wi-SUN FAN

Application	**Application Layer**
Presentation	**(Out of Scope)**
Session	

Security		Transport	UDP / TCP
802.1X, 802.11i, EAP-TLS		Network	**IPv6 / ICMPv6 / RPL / 6LoWPAN**

Data Link:
- LLC Sub-Layer
  - L2 MESH
- MAC Sub-Layer

Security (dashed box): ETSI-TS-102-887-2

PHY	Physical Layer

FAN Device
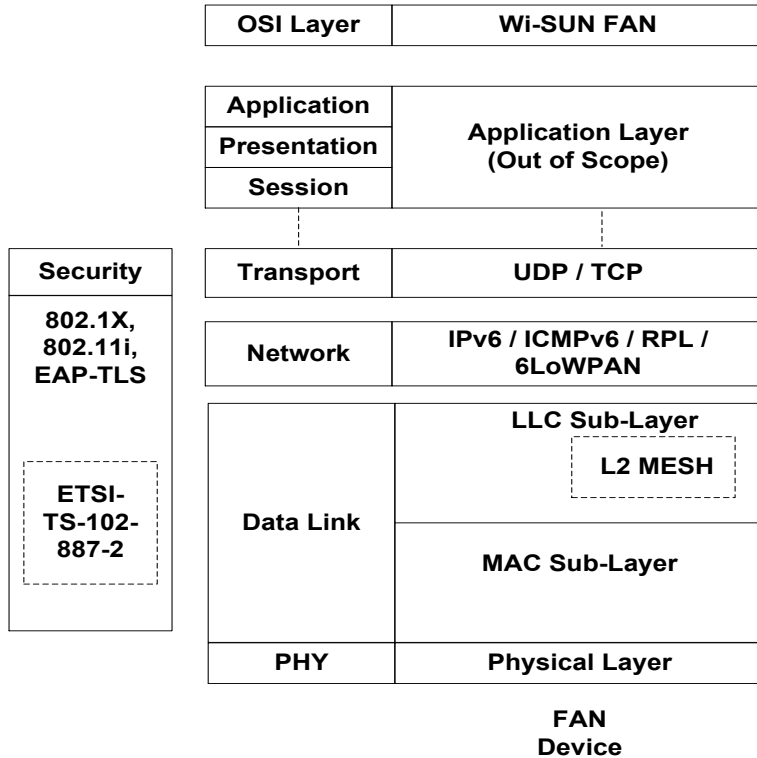
IPv6 protocol suite
- TCP/UDP
- 6LoWPAN Adaptation + Header Compression
- DHCPv6 for IP address management.
- Routing using RPL.
- ICMPv6.
- Unicast and Multicast forwarding.

MAC based on IEEE 802.15.4e + IE extensions
- Frequency hopping
- Discovery and Join
- Protocol Dispatch (IEEE 802.15.9)
- Several Frame Exchange patterns
- Optional Mesh Under routing (ANSI 4957.210).

PHY based on 802.15.4g
- Various data rates and regions

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

Supports a variety of IP based app protocols :
DLMS/COSEM, ANSI C12.22, DNP3, IEC 60870-5-104, ModBus TCP, CoAP based management protocols.

Protocol layers

- Physical layer
  - FSK modulation
  - Data rates from 50 kbps to 300 kbps
  - Node to node range up to several kilometres where regulations permit
  - Optional forward error correction for better link margin
  - Specified for Australia, Europe, India, Japan, Korea, North/South America, South East Asia

Protocol layers

- Data link layer
  - Frame supports full IP payloads
  - 4 octet FCS for good error detection
  - De-centralised frequency hopping where permitted (ANSI 4957.200)
  - Channel blacklisting for interference mitigation
  - Link layer encryption / integrity checking for privacy & message verification
  - Optional L2 multi-hop layer (ANSI 4957.210)

Protocol layers

- Adaptation Layer : 6LoWPAN
  - IPv6 header compression
  - UDP header compression
  - Fragmentation
  - Neighbour discovery
  - Routing support
- Network layer
  - IPv6
  - DHCPv6 address management

Protocol layers

- Routing
  - ROLL/RPL
- Security
  - L2 Integrity Check and Encryption
  - IEEE 802.1x over IEEE 802.15.4 (IEEE802.15.9)
  - Uses Certificates for Mutual Authentication

FAN Profile - General Comments

- The Alliance feels there is significant value to this LPWAN effort in IETF and strongly supports its objectives.

- The FAN spec was developed to serve the LPWAN space among others.

- Already included are many of the needed networking elements as a result of the longstanding working relationships between IETF and IEEE802.

FAN Profile - General Comments

- Some of the things the Alliance hopes to accomplish through its participation in the LP-WAN WG are:
  - awareness (if changes are needed in the FAN spec),
  - help ensure consistency of approach,
  - share relevant experience, and
  - address co-existence issues & potential interoperability, since these solutions will be used in the same markets in complementary ways.
- Because it is IP based, the Wi-SUN FAN already interconnects to Ethernet and WiFi through routers
- Useful if the same can be accomplished with other approaches

Things We Would Like to See

- Wi-SUN FAN and HAN profiles both use 6lowpan, primarily for header compression.

- Full IP frames supported, but header compression is useful for optimizing bandwidth.

- Very useful to include UDP and CoAP compression methods also

- Not all nodes on a Wi-SUN FAN are necessarily routing, line powered nodes

- Optimized compression for battery powered leaf nodes would help extend battery life.

Thank you for your kind attention
http://www.wi-sun.org