



federated
wireless™

An AMFI company

Spectrum Access System Vertical Market Use Case

ISART 2015

mobile cloud unleashed

The Challenge for Industry

Exponential growth in data traffic

- 350 million mobile subscriptions of which more than 70% are smartphones
- Total mobile data traffic of 4.8 Exabyte annually, growing at 50% CAGR

Usage is shifting indoors and to the enterprise

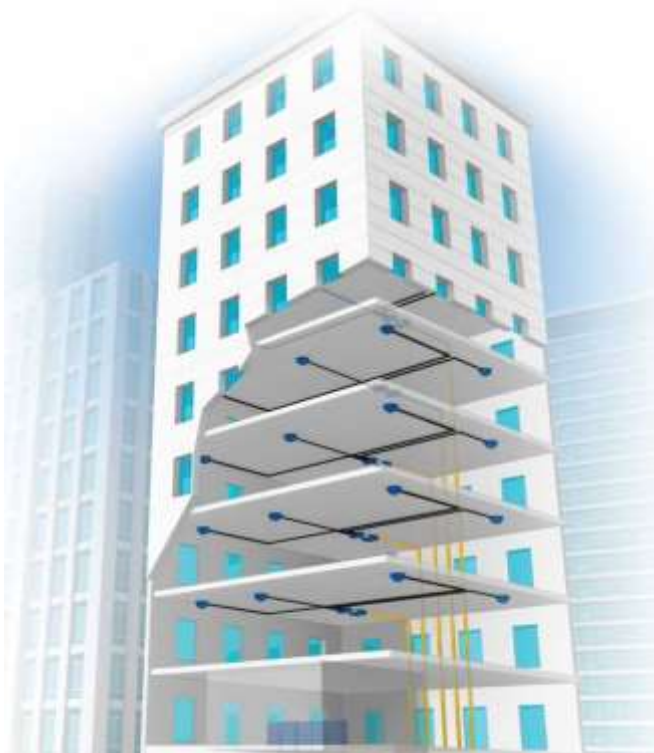
- 80% of wireless data traffic is generated within buildings
- 90% of enterprises support corporate applications on personal mobile devices

Carrier networks were designed for mobile voice

- Only 2% of buildings are served with in-building licensed spectrum systems
- Wi-Fi and offload are the predominant in-building solutions

Enterprise Mobility Market

Licensed in-building wireless (2% of buildings)



Active and Passive DAS Carrier-specific Small Cell

- Complex and customized
- Expensive as neutral host solution
- Traffic backhaul to carrier core network is expensive
- Device management can be a challenge

Enterprise Mobility Market

Unlicensed in-building wireless



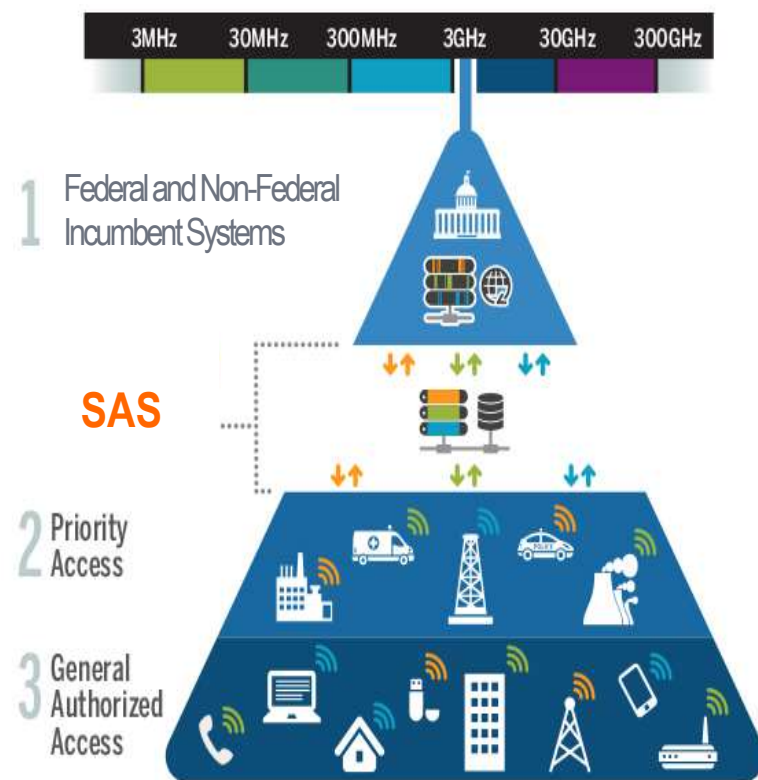
Enterprise Wi-Fi

- Unstable connections, high packet loss, low overall QoE
- Congestion degrades performance
- Data only orientation vs. integrated voice and data needs
- No seamless interoperability with 4G networks

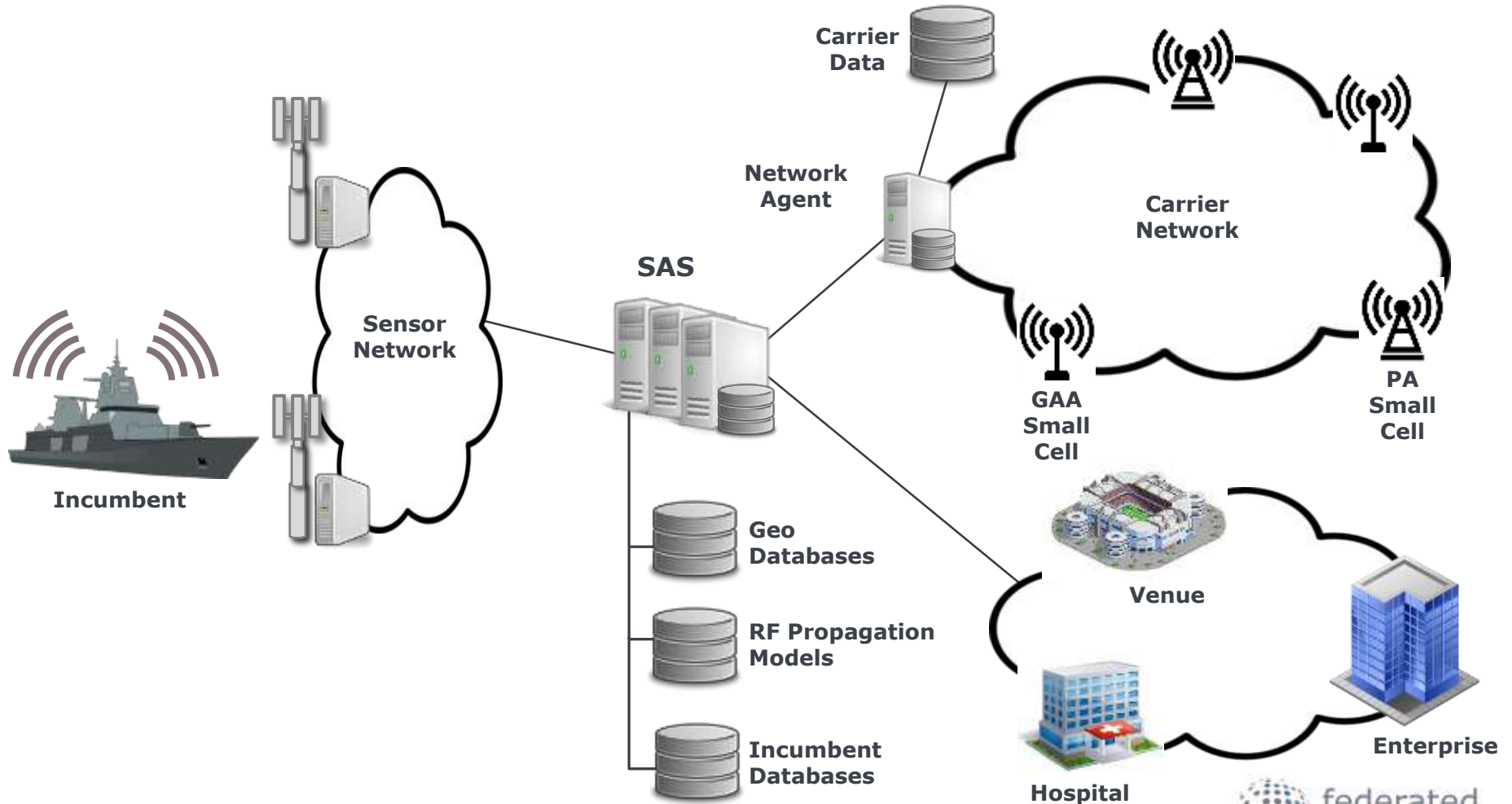
The Solution

Combine benefits of licensed and unlicensed enterprise wireless access solutions with 3.5 GHz shared spectrum

- 150 MHz of managed spectrum
- Widescale adoption in devices
- Very low cost network equipment
- Enterprise deployed and managed
- High throughput, high QoE connections
- Integrated voice, data, and mobile cloud applications
- Scalable cloud architecture



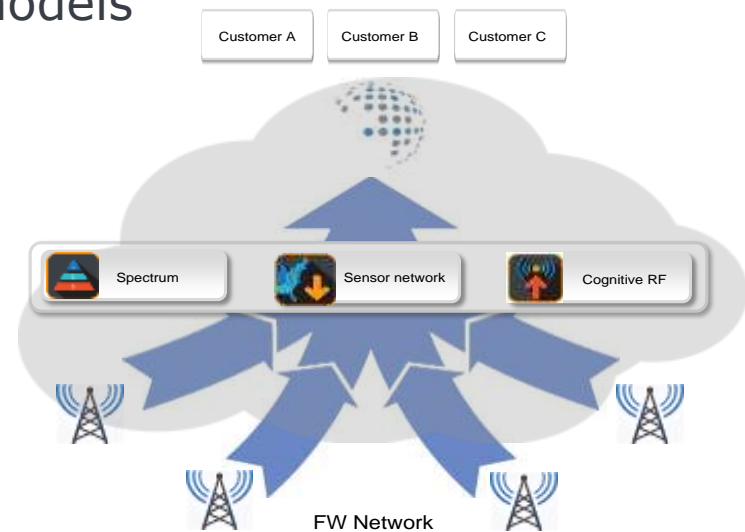
SAS Functional Architecture



Federated Wireless SAS

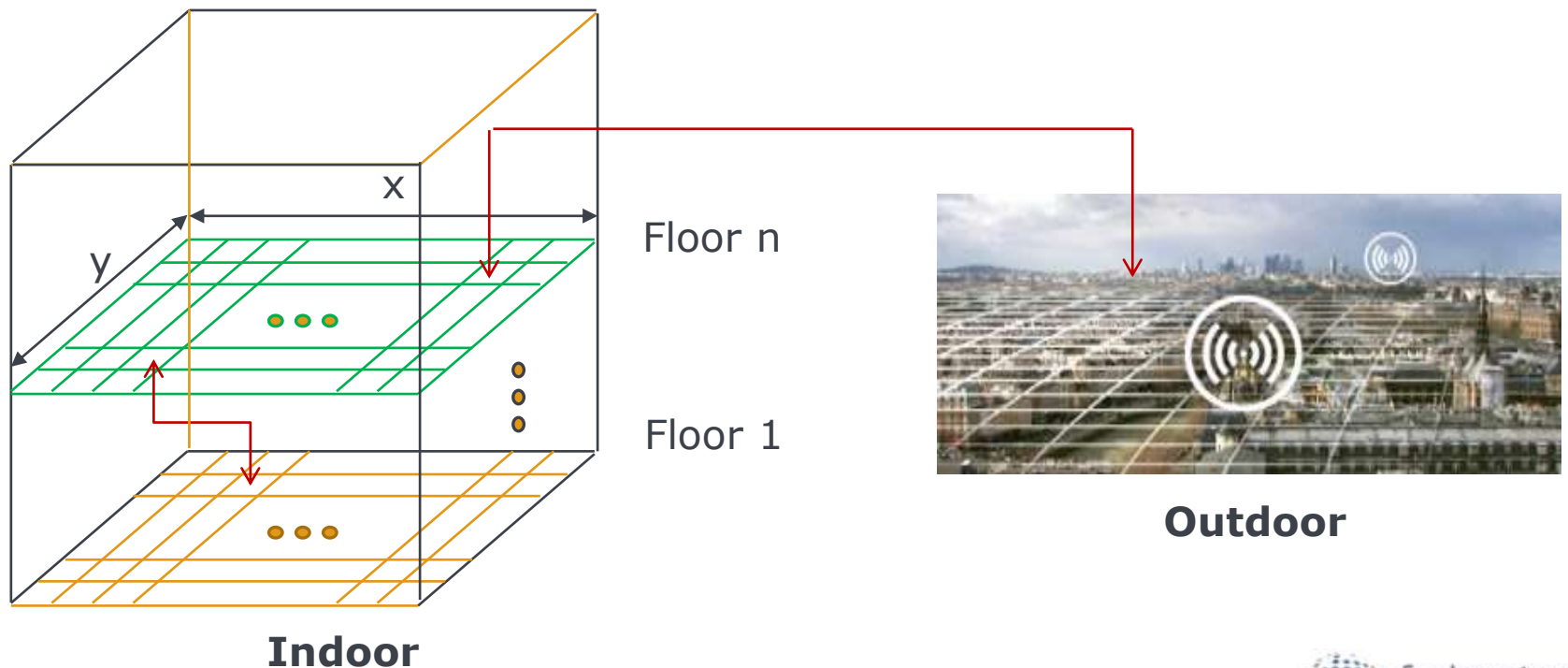
Additional SAS functions to enable QoE managed shared spectrum access

- Spectrum resource sensing
 - Incumbent usage
 - Track availability and radio environment
 - Calibration of radio propagation models
- Spectrum resource analytics
 - Predictive propagation
 - Radio Environment Mapping
 - Automated RF Optimization
- Reporting
 - Usage
 - Capacity

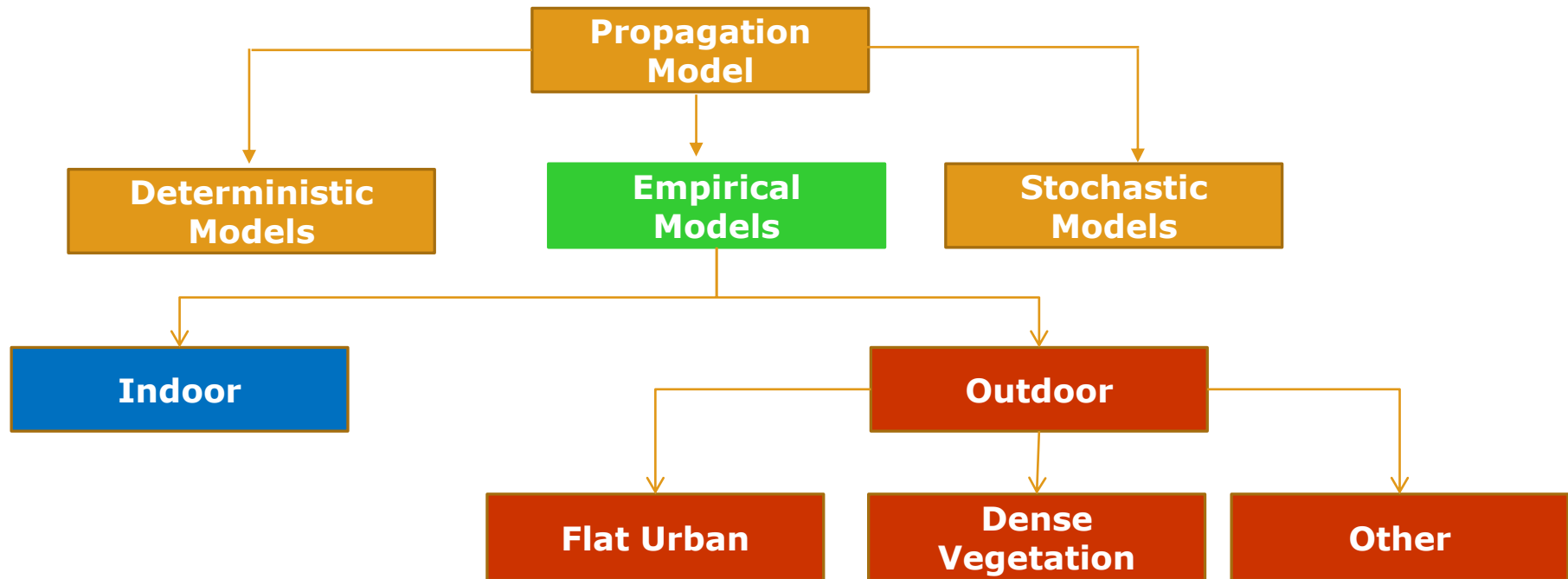


Radio Environment Map

- Estimated propagation loss between each pair of locations where an Incumbent or communications device could be located



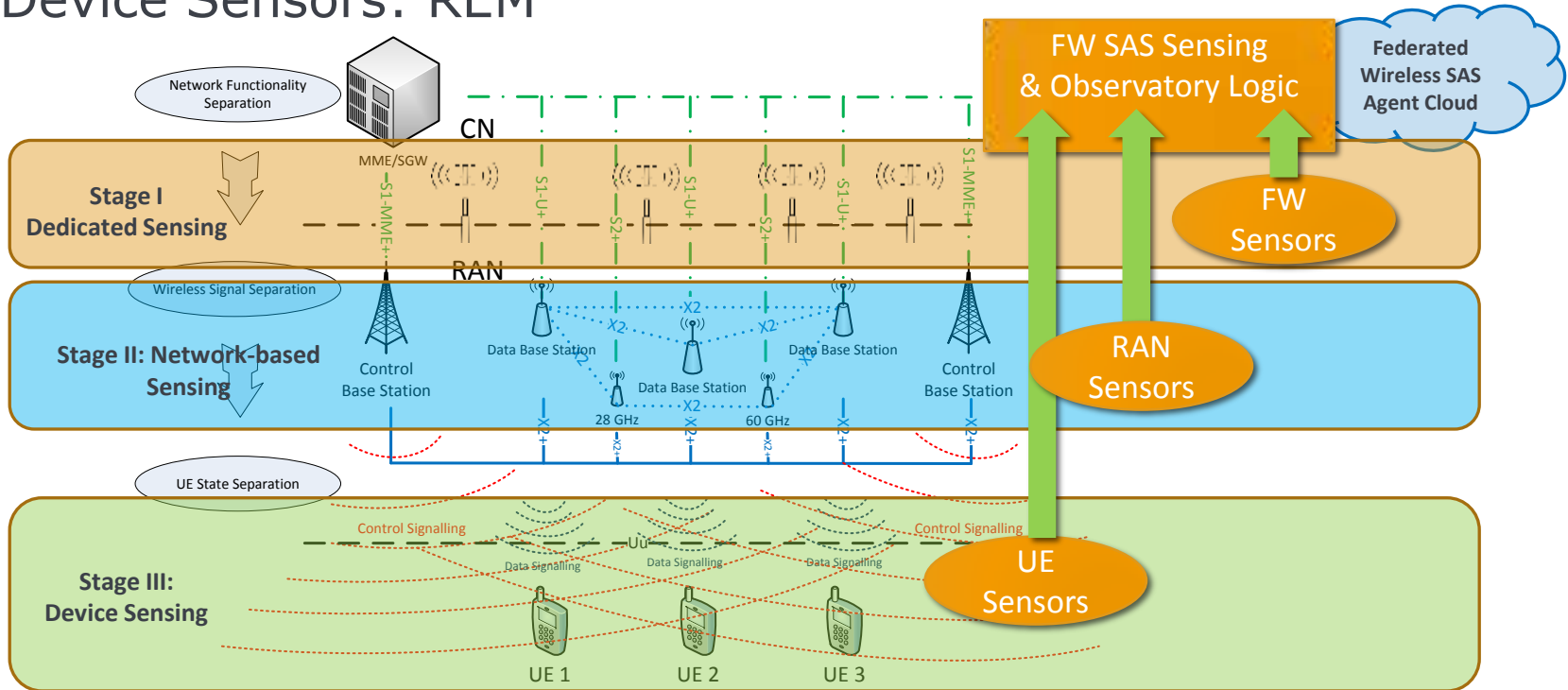
Propagation Modeling



- Empirical models offer the best tradeoff between complexity and performance
 - Use field measurements for initial model calibration

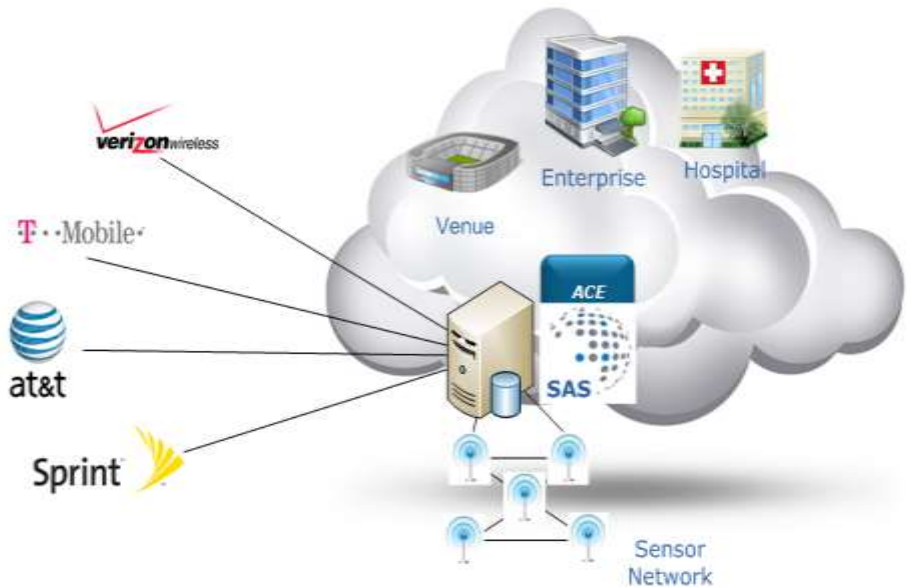
Spectrum Sensing

- Dedicated Sensors: Incumbent Detection, REM
- Network Based Sensors: REM, Incumbent Detection
- Device Sensors: REM

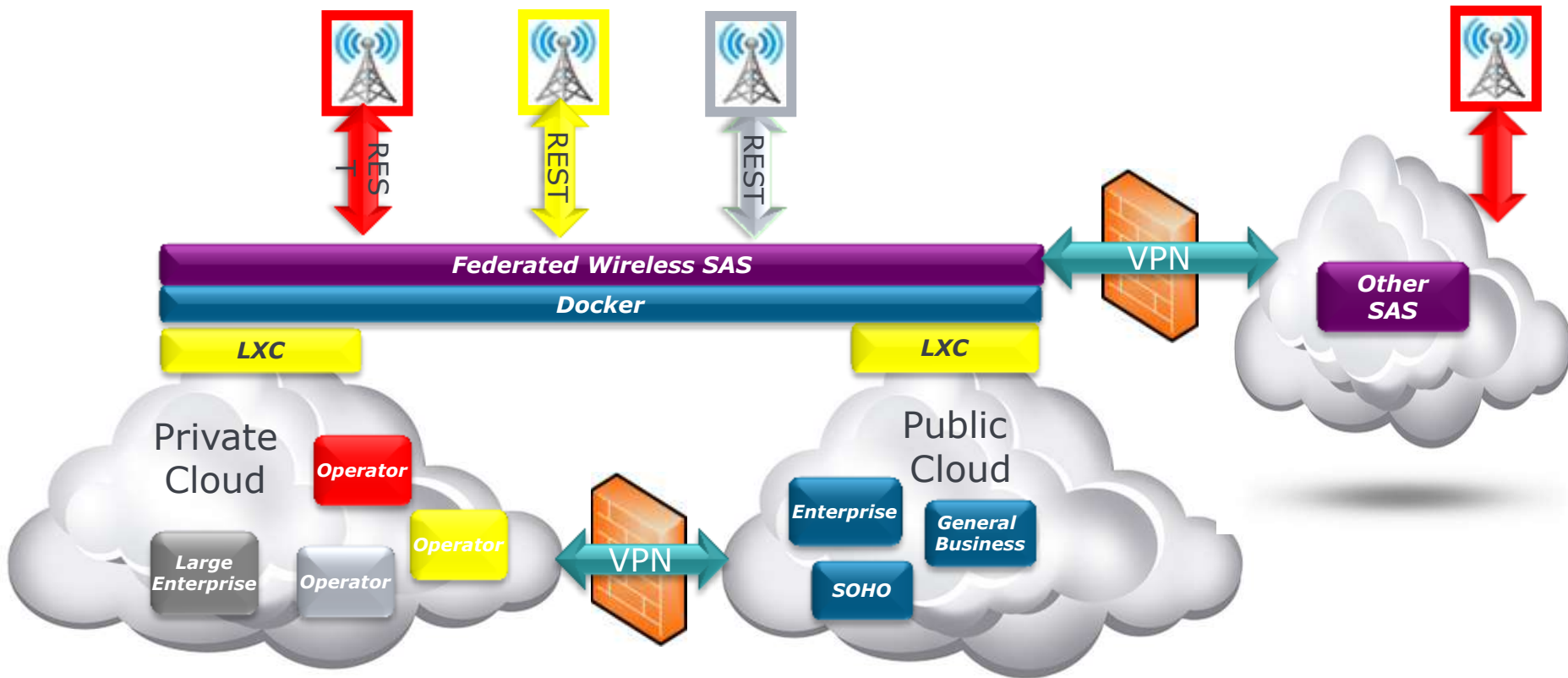


Shared Infrastructure Enablement

- Shared infrastructure architecture
 - Managed network services
 - Harmonization with 3GPP
 - Software defined
 - Scalability
- Seamless interoperability
 - Shared, licensed, and unlicensed network(s)
 - Network visibility and control
 - Ubiquitous coverage
 - Agreement management



Hybrid Cloud Security Architecture



Industry Landscape

SAS prototype &
ESC network plan

Production SAS
with integrated
limited ESC
network

Availability for
SAS and ESC

Production SAS,
fully integrated
ESC network

Today

Early
2016



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Thank You!

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