



CV Technologies

Importance and applications

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Agenda

- 1 Autonomous Vehicle Technologies
- 2 Operational Network Ownership
- 3 Q&A / Discussion
- 4 Enclave Security
- 5 Q&A / Discussion

The 5.9 GHz Safety Band



WHAT IS THE SAFETY BAND?

The Safety Band is a band of wireless spectrum at 5.9GHz reserved for transportation-related communications between the devices that support connected and automated vehicles (C&AVs). Interacting via the interference-free Safety Band, these high-precision devices enable communications between vehicles and traffic lights, generate real-time alerts or warnings, or adjust signals to give emergency vehicles priority in heavy traffic—dramatically improving our transportation safety and mobility. As the U.S. continues to invest toward deployment of millions of C&AVs across our country, the Safety Band enables continued economic growth.

WHAT MAKES THE SAFETY BAND UNIQUE?

In 1999, the Federal Communications Commission (FCC) allocated the section of wireless spectrum at 5.850-5.925 GHz for “Intelligent Transportation Systems (ITS) services.” Since then, U.S. DOT has worked diligently and collaboratively with industry and the public sector to develop, evaluate and deploy new cooperative technologies, equipment, and applications known as Connected Vehicle (CV) technologies, on this dedicated band. CV technologies now reliant on the Safety Band include vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and “vehicle-to-everything” (V2X) communications, including all manner of devices or other points of connection between people, their vehicles and their transportation environments.

\$100B US public sector investment on US roadways annually, but our roadways are congested, unreliable, and present safety challenges

Connecting vehicles to infrastructure and to each other can reduce unimpaired crashes by 80%, reduce congestion

The Federal Communications Commission (FCC), since 1999, has allocated 75 MHz in the 5.9 GHz Safety Spectrum for V2X, but is moving forward with a proposal that would give away much of the spectrum to wifi and other technologies, and would allow for V2X technologies in the upper portion of the band

including all manner of devices or other points of connection between people, their vehicles and their transportation environments.

The Safety Band is uniquely configured to support safety-critical applications through continuous, high-speed, trusted and authenticable wireless data communications among and between vehicles and roadway infrastructure or mobile devices.

Currently, no other radio spectrum is configured to provide all of the critical attributes needed to support V2V and V2I safety applications. Whereas commercial wireless communications technologies continue to improve their latency and security, none match the performance capabilities or provide comparable user privacy and message authentication controls possessed by V2X technologies currently in the Safety Band.

For more information, visit:

<https://www.transportation.gov/content/safety-band>

- Road operators listen to vehicles “as sensors” to improve operations and as such are deploying Connected Roadways networks to make that happen
- States, cities, counties are actively working to develop and deploy connected vehicle (CV) applications for V2X use cases; current deployments allow vehicles to talk to infrastructure
- Despite progress, the 5.9 GHz Safety Band has not been used to the full extent possible due to largely to regulatory indifference, but also because of competing public and private sector priorities for transportation

V2I today is DSRC

Dedicated short-range communications (DSRC) provide vehicle to infrastructure (V2I) connectivity in GM, aftermarket fleets, and some Audi/VWs

Radio Service in the 5.850-5.925 GHz band (5.9 GHz band)

USDOT cites 87 DSRC public-sector deployments or projects, and nearly 7,000 RSUs deployed

OBU (on-board unit) is a transceiver that is normally mounted in or on a vehicle, or in some instances may be a portable unit. RSU (roadside unit) is a transceiver that is mounted along a road or pedestrian passageway.

Edge Intelligence makes V2I actionable

- 10 packets are transmitted per second
- Cisco is agnostic to the type of V2I communications; we focus on unpacking critical information from DSRC (or future V2I technologies) at the network edge to make decisions

The screenshot shows a Wireshark capture of DSRC traffic. The top table lists several packets, all of type 'Broadcast' and protocol 'SAE 22735 (2014) Protocol'. The selected packet (No. 1) is expanded to show details: IEEE 802.3, IEEE 802.11, and IEEE 802.15.4. The IEEE 802.15.4 section is further expanded to show a 'Wave Short Message' (WSM) with a length of 181 bytes. The WSM details include a 'BasicSafetyMessage' (BSM) with a message ID of '01001: 5460a6f14778193ab0f3ce708909023a1510000034c04...' and a heading of '15.1000° (1208)'. Other details include speed (16.88 m/s), heading, and various sensor data like acceleration and yaw rate. A small image of a blue 'Cobitis Networks' OBU device is overlaid on the bottom right of the screenshot.

V2I tomorrow will include CV2X

CV2X provides V2I connectivity in the 5.9 band

A PC5 interface is the C-V2X 5.9 GHz radio. The PC5 interface will provide the roadway operators the benefits of telemetry and alerts from vehicles, while delivering safety information to drivers in vehicle.

The PC5 interface will be used for immediate (at the edge) V2V, V2P (pedestrian) or V2I communications. The Uu interface, operating in the cellular bands or the mobile broadband license spectrum, is for communications between the car and the cloud, and is utilized for non-real-time applications to the cloud through cellular bands (not 5.9 GHz).

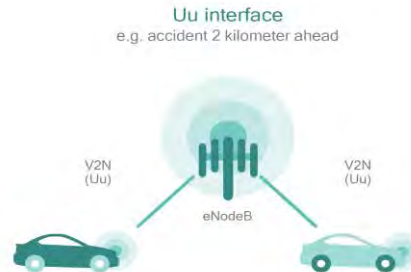
Edge Intelligence STILL makes V2I actionable

- Cisco remains agnostic to the type of V2I communications
- Ford is deploying CV2X in all new vehicles by 2022

C-V2X defines two complementary transmission modes

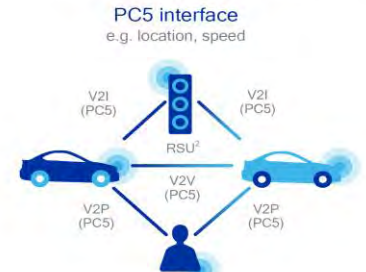
Network communications

V2N on "Uu" interface operates in traditional mobile broadband licensed spectrum



Direct communications

V2V, V2I, and V2P on "PC5" interface¹, operating in ITS bands (e.g. ITS 5.9 GHz) independent of cellular network



5G & Wi-Fi 6 add applications for non-safety applications



FCC proposal has us thinking about the future

- FCC Dec 12, 2019 proposal:
 - Introduces CV2X in the 5.9 band and explore interoperability, and reallocates much of the 5.9 spectrum to unlicensed wifi sharing, leaving only 30 MHz for transportation safety applications and the upper 20 MHz for CV2X
- FCC proposal would “share” DSRC channels with wifi and other unlicensed devices:
 - Intelligent Transportation Society of America, several members of House T&I, American Association of State Highway and Transportation Officials prepared to submit responses citing need for all 75MHz
 - 5G Automotive Association and Qualcomm: 20MHz is good enough; 75 is better
 - Cisco Connected Roadways applications will not change with CV2X, but applications could be crowded in the future



Enclave Security and why it matters

Michael Terebessy, MS Cyber & InfoSec



Why security, why now?

Laws and Regs

Comprehensive National Cyber Security Initiative:

Homeland Security Presidential Directive/HSPD-23 (January 8, 2008)

Executive Orders:

13636 *Improving Critical Infrastructure Cybersecurity*

13800 *Improving Critical Infrastructure Cybersecurity*

Homeland Security Directives:

Presidential Directive 7

Presidential Directive 12

... and more to come (H.R.3318)

New Technologies, New Threat Vectors

- Wireless Transceivers
- OBUs
- DSRC
- V2X
- CAV

Risk

- Ownership
- Litigation
- Loss of life
- Cyber terrorism

Cyberattack Disrupts Texas Department of Transportation

The attack is the second of its kind to target a state agency in less than a week. On May 8, the state's court system was targeted by a transceiver attack, which seized control of a portion of the statewide network.

BY LUCAS ROPEK / WUP 10, 2010



“The best time to plant a tree was 20 years ago. The second-best time is now.” - Chinese Proverb

Enclave Security

en·clave

/'en,klāv, 'äng,klāv/

-a place or group that is different in character from those surrounding it.

OT Enclave

- Roadside Cabinets
- WAN/Fiber Rings
- Transportation Networks
- Field Access
- Remote devices
- Field Wireless

IT Enclave

- Internet
- Email
- Database
- Data Sharing
- Remote Access

3rd Party Enclaves

- Mapping Apps
- Cities, Counties, States
- First Responders
- ESRI

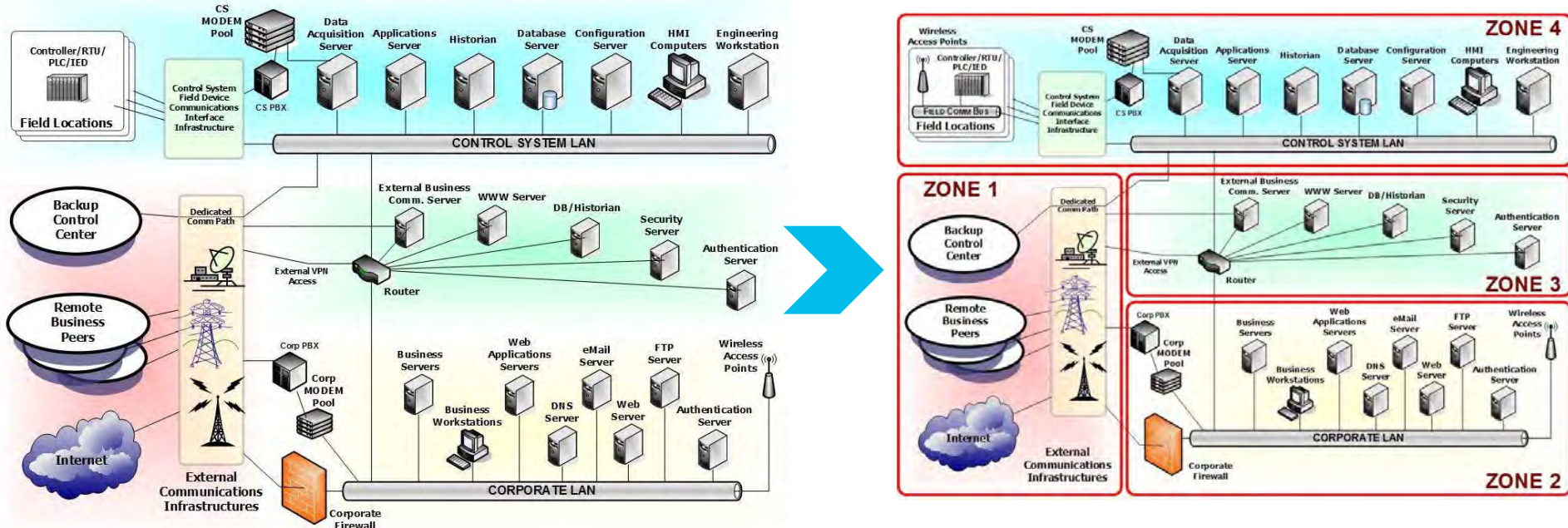
Different Networks have different requirements; and you're likely have many, many different networks.

CIA Triad

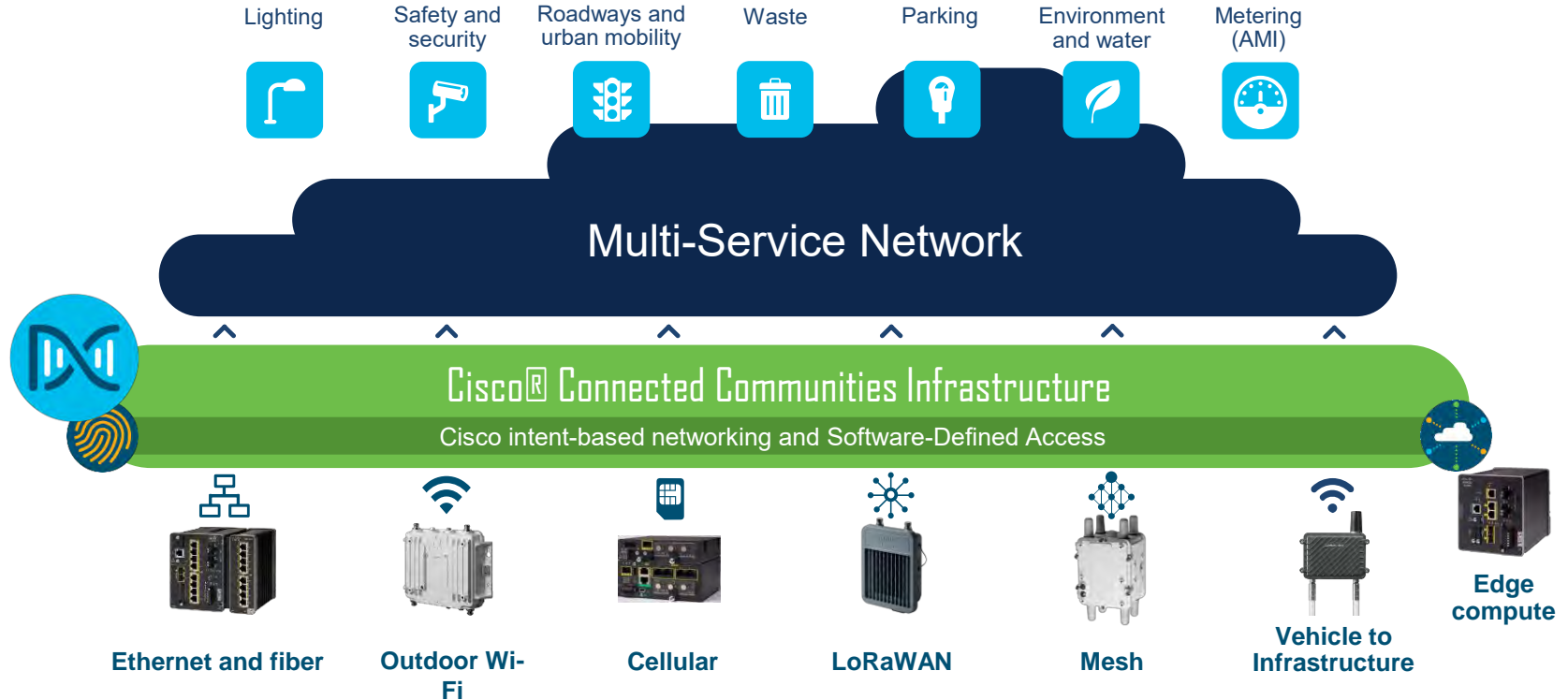


Defense in depth

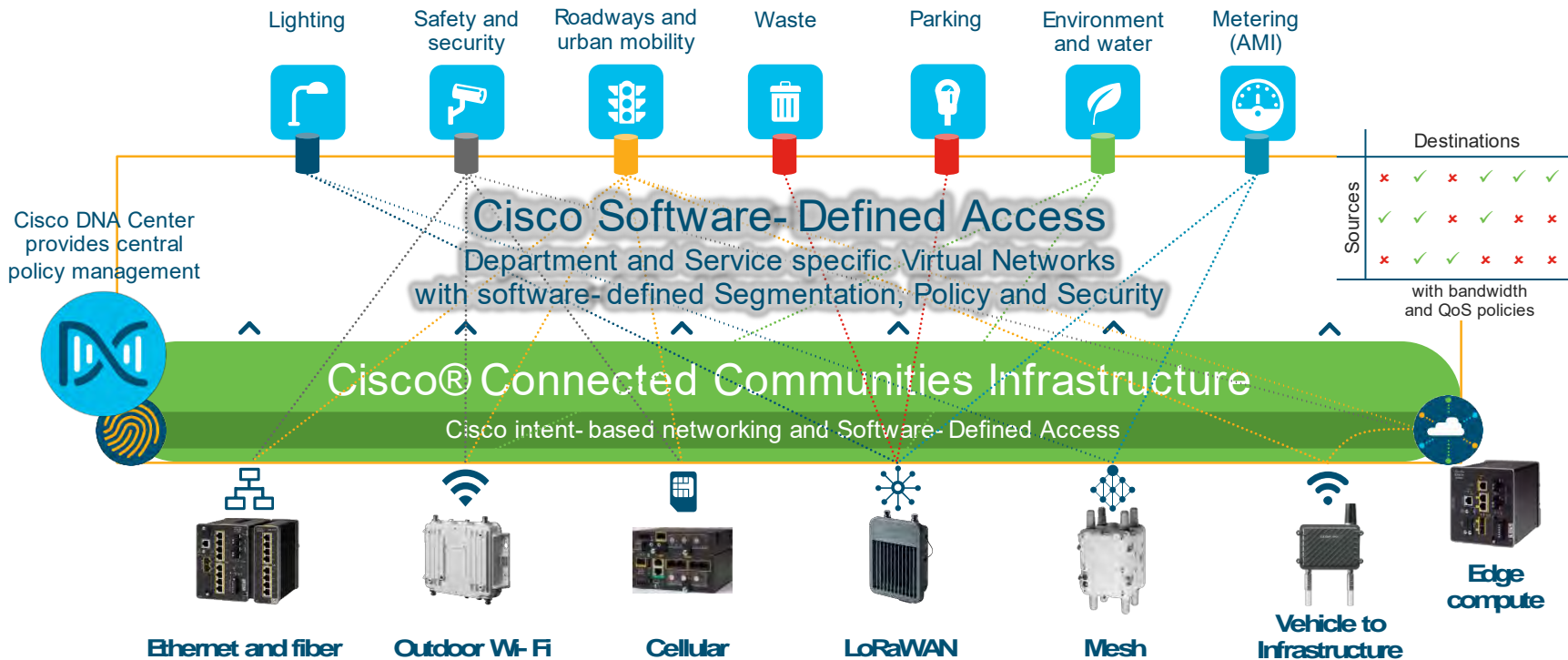
Assets, vulnerabilities, threats



Virtual Networks and Segmentation with Cisco Software-Defined Access



Virtual Networks and Segmentation with Cisco Software-Defined Access



Start with a plan, implement policies and procedures...



...but don't recreate the wheel:

1. (ISO 27001, NIST 800-53, 800-39)
2. (NIST Cybersecurity Framework, IEC 62443)
3. (NIST -137)
4. (NIST Technical Guide to Information Security Testing and Assessment 800-115)

“It is easy to make plans in this world; even a cat can do it; and when one is out in those remote oceans it is noticeable that a cat's plans and a man's are worth about the same.”

— Mark Twain, *Following the Equator: A Journey Around the World*

Do more with less (best practices for operational networks)

- Simplify deployment and management
- Secure, segmented network for each service or department as needed

Save on bandwidth, acquisition costs, operational complexities

Extract, transform, govern and deliver data to internal & external destinations.

integrate wherever possible, with whomever possible, however possible,

...as

		Destinations					
Sources		✗	✓	✗	✓	✓	✓
		✓	✓	✗	✓	✗	✗
		✗	✓	✓	✗	✗	✗

with bandwidth and QoS policies



Hidden cost of siloed services



“Subtraction is the key to design and customer delight.”

– Roger May, The Laws of Subtraction: 6 Simple Rules for Winning in the Age of Excess Everything

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