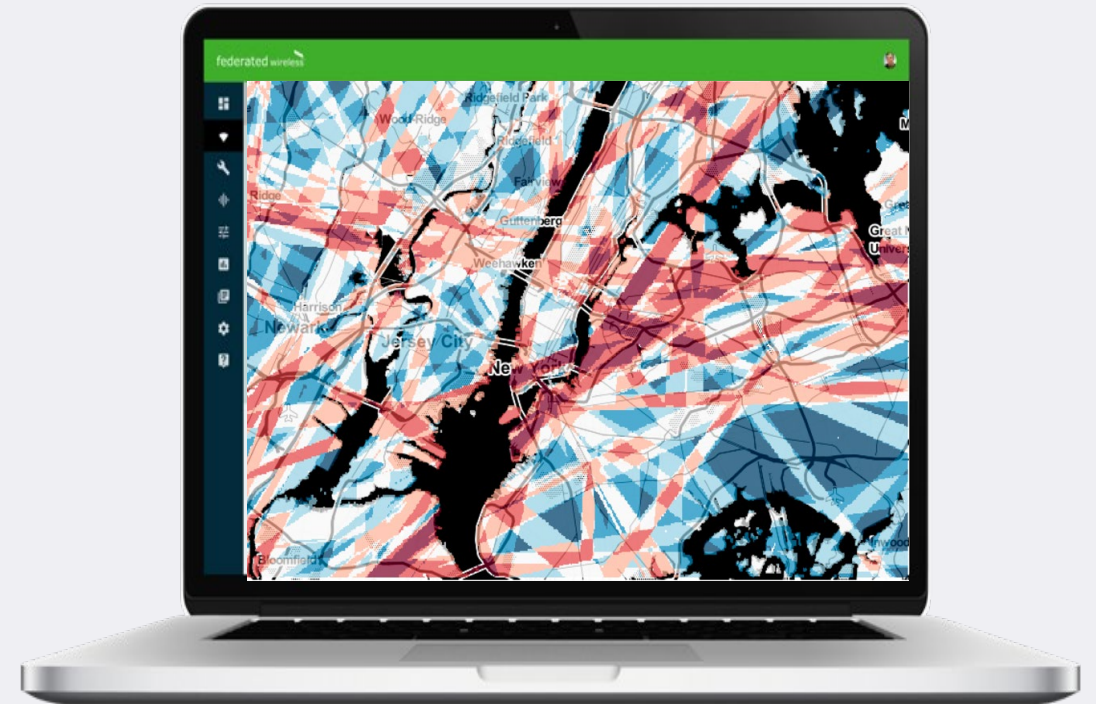
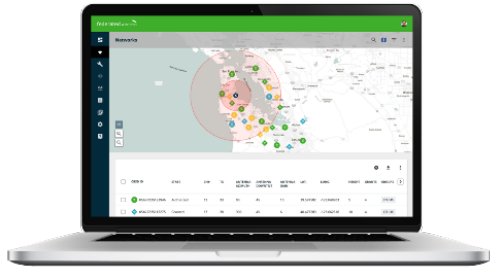


# Increasing Access through shared spectrum

November 2022



# Federated Wireless transforming wireless



## CBRS SAS

- Cloud scale and redundancy
- Unsurpassed features & functionality
- Multi-region architecture
- 99.999% reliability
- 24x7x365 NOC
- Contractual SLAs



## Private Wireless

- Private 4G/5G Wireless
- Cloud-native managed service
- Shared spectrum + wireless expertise
- Solution integration
- 24x7x365 NOC
- Enterprise SLAs
- Simplified pricing



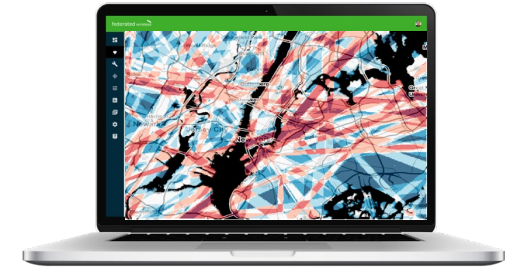
## Spectrum Exchange

- Spot Exchange
- Manage PAL inventory
- Realtime PAL leasing
- Complete lease management
- Automated enforcement



## Professional Services

- Wireless design
- CBRS spectrum assessment
- Network performance optimization
- Custom planning and support
- Online CPI Training



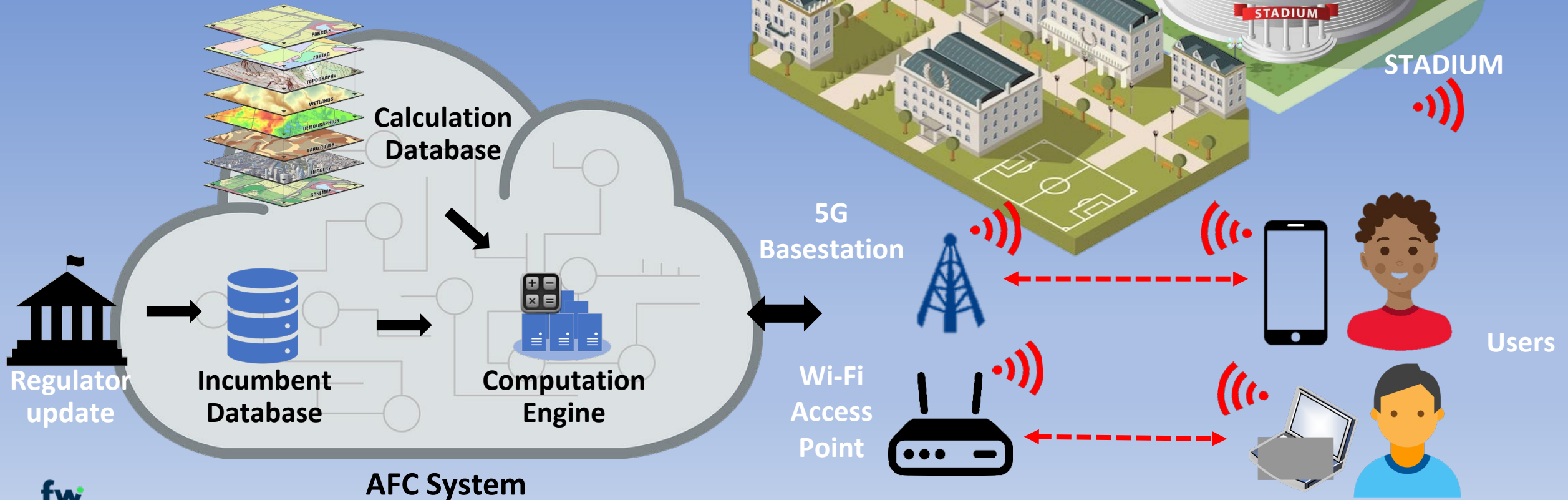
## 6 GHz AFC

- Wi-Fi 6E support
- FCC compliant
- OEM agnostic
- Cloud scale and redundancy
- 99.999% reliability
- 24x7x365 NOC
- Contractual SLAs



# AUTOMATED FREQUENCY COORDINATION

Supports multiple use cases and bands





# CBRS Market Status

## strong momentum

- ✓ **More than 280k base stations deployed across U.S. in only 3 years**
  - Wide variety of mobile broadband, fixed wireless & private use cases
- ✓ **Record number of CBRS spectrum users**
  - 228 winners of 20,625 PALs
  - Hundreds of GAA operators
    - Enterprises, smart cities, education, healthcare, rural WISPs, etc.
- ✓ **Vibrant competitive ecosystem**
  - Nine authorized SAS Administrators
  - 187 commercial CBSD models
  - 496 authorized client devices
  - >4300 certified professional installers



# Differentiated AFC Product maximizing 6 GHz spectrum



## Proprietary Cloud Architecture

Unique cloud architecture that utilizes offline computations for maximum responsiveness at scale



## Precise RF Environment Models

Massive GeoData database combined with machine learning for refined propagation modeling



## Precise Incumbent User Models

Proprietary database of Incumbent microwave antenna Radiation Pattern Envelopes (RPEs) to optimize spectrum availability



## Dashboards & Analytics

Solutions to provide unique insights into spectrum utilization, improve manageability, and troubleshoot issues



# Private Wireless for Enterprise

built for use cases at the edge



## Government

Modernize operations with private 5G connectivity



## Education

Bridge the digital divide with reliable, affordable wireless internet



## Real Estate

Differentiate with custom 5G-enabled IoT services



## Agriculture

Automate operations with reliable coverage for your entire property



## Manufacturing

Reliable connectivity with high mobility for your most challenging edge sites



## Logistics

Minimize disruption with private wireless connectivity



## Retail

Rapidly launch new experiences to any device or location, indoor or out



## Healthcare

Keep critical staff connected on all devices with private wireless



## Smart Cities

Reduce waste and improve lives with ubiquitous connectivity



## Venues/Events

Stand up private, portable wireless in days with a fraction of the hardware



# Marine Corps Logistics

## 5G smart warehouse

### → Challenge

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- Modernize US Marine Corps operations
- Meet US Military security and privacy requirements
- Improve efficiency of supply receipt, storage, issuance, inventory control, and auditability
- Goal of 40% improvement in efficiency of logistics systems

### → Solution

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- Designed and deployed secure, private wireless network for mission-critical logistics using 3.5 GHz CBRS + 37 GHz shared spectrum
- Enlisted and integrated partners: AWS, Cisco, JMA, Vectrus, Peraton Labs and Capstone Partners

### → Impact

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- Successful demo of 5G-enabled IoT applications: warehouse robotics plus holographic, augmented and virtual reality applications
- This testbed will be the reference design for future 5G smart warehouse projects across the DoD





# Remote Medic Access

## field operations connectivity

### → Challenge

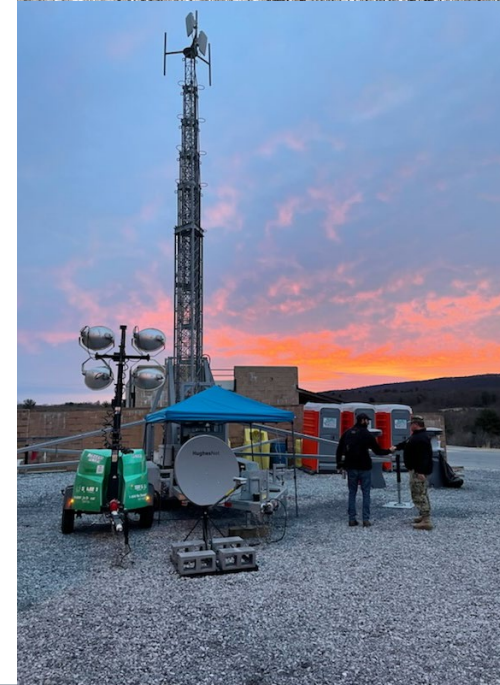
- Highly remote field exercises for 120 medics were limited by public cellular coverage gaps
- Field medics require secure, reliable connectivity to consult with specialists in real-time, performing life-saving field operations using photo and video capabilities

### → Solution

- Deploy secure, ultra-reliable private 4G/5G wireless network
- Satellite backhaul ensures telehealth applications can be connected anywhere in the globe

### → Impact

- Private network powers life-saving telehealth training exercises for 120 field medics with ultra-remote connectivity
- Secure end-to-end encrypted communications, computer vision (CV) and advanced video analytics





# Smart healthcare

## → Challenge

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- Increasing number of Wi-Fi devices on hospital's Wi-Fi network resulted in severe interference
- Patient/guest experience was poor, and mission critical staff devices were compromised
- Doctors still using pagers to stay connected

## → Solution

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- Secure high-speed Private Wireless network deployed for staff and mission-critical applications
- Freed up Wi-Fi network for patients and guests
- Ease of installation meant no disruption in hospital services during upgrade

## → Impact

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- Large Private Wireless ecosystem results in new consumer and medical devices coming to market



# Smart Agriculture automated winery robotics

## → Challenge

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- Limitations of existing connectivity solutions in deploying automated robotics and agricultural IoT (AGV tractors)
- Low latency + high throughput requirements
- Carrier coverage solution to remote farm too expensive

## → Solution

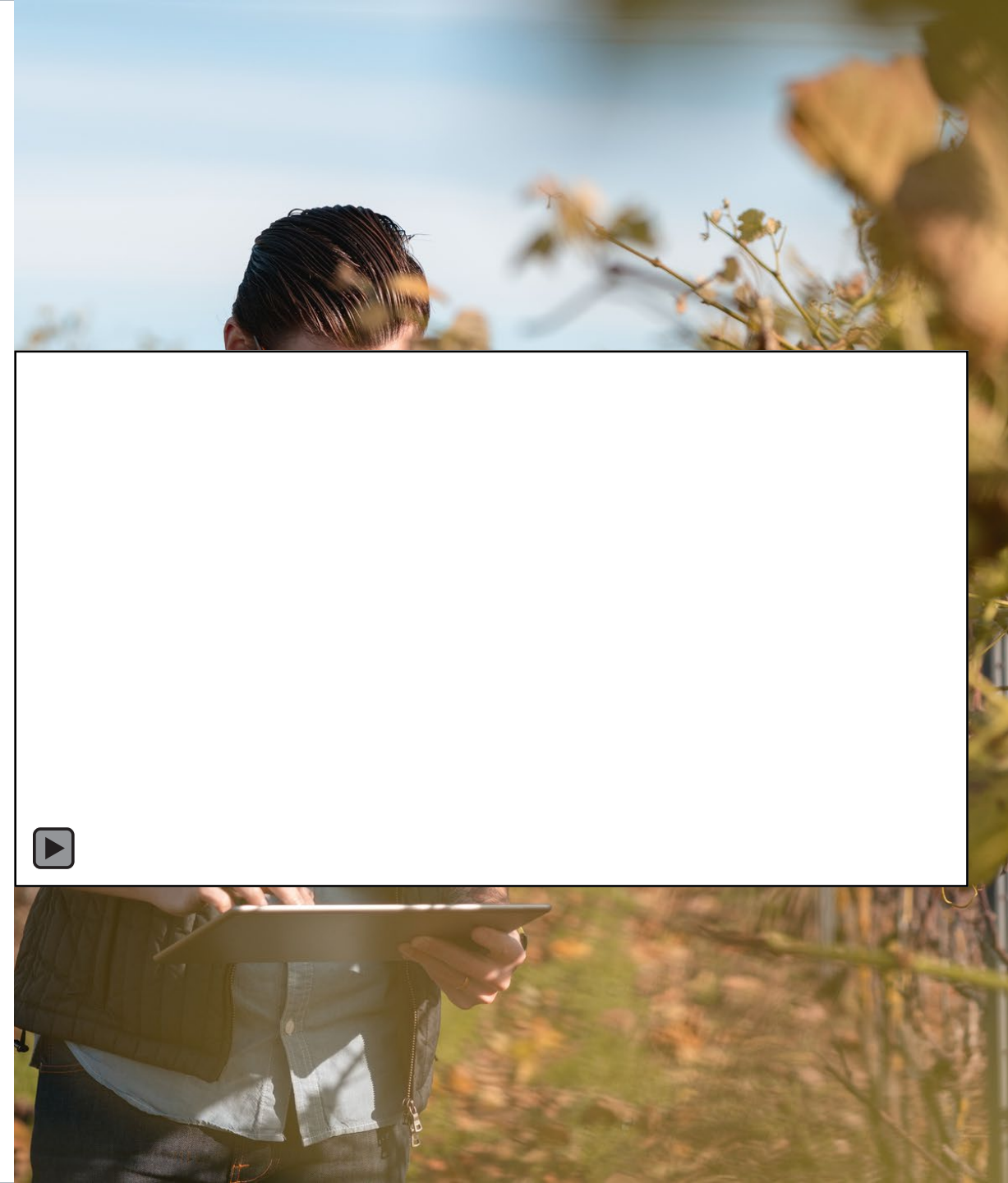
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- Private wireless for reliable outdoor coverage with mobility, low-latency and high throughput
- Edge solution tailored to Agricultural IoT Applications and Autonomous Robotics

## → Impact

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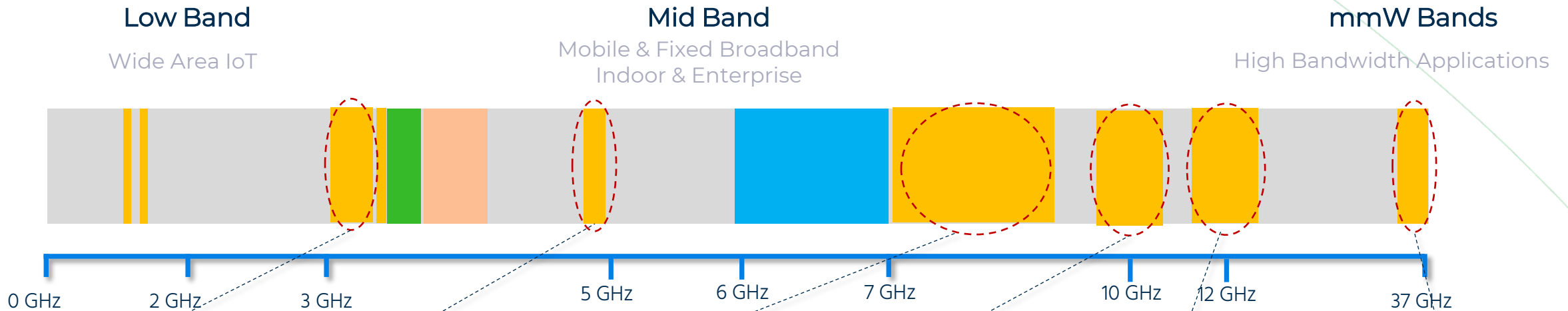
- Implementation in less than two days
- Sustained low-latency and high throughput at far edge of the coverage area (>2 miles of range covering 42 fields)
- Sufficient bandwidth to support additional agricultural use cases like soil, water monitoring, new IoT applications, and yield analytics in the future





# U.S. shared spectrum near term opportunities

- CBRS/SAS Shared Band
- AFC Shared Band
- Potential Shared Bands



**3.1-3.45 GHz**

- DoD band with diverse uses
- PATHSS group exploring DSMS approaches

**4.9 GHz**

- Public safety
- CBRS-like sharing could open band while protecting incumbents

**7 GHz**

- 1275 MHz of federal spectrum
- Point-to-point links similar to 6 GHz incumbents

**10 GHz**

- 500 MHz of federal spectrum
- WISPA petition for AFC to enable sharing

**14 GHz**

- 550 MHz of FS and FSS spectrum
- Sharing with mobile broadband being explored

**37 GHz**

- 600 MHz co-primary band
- AFC-like sharing could streamline coordination



connecting you  
to the future

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