

# 5G Connected Edge Cloud for Industry 4.0 Transformation: The Private Cellular Opportunity

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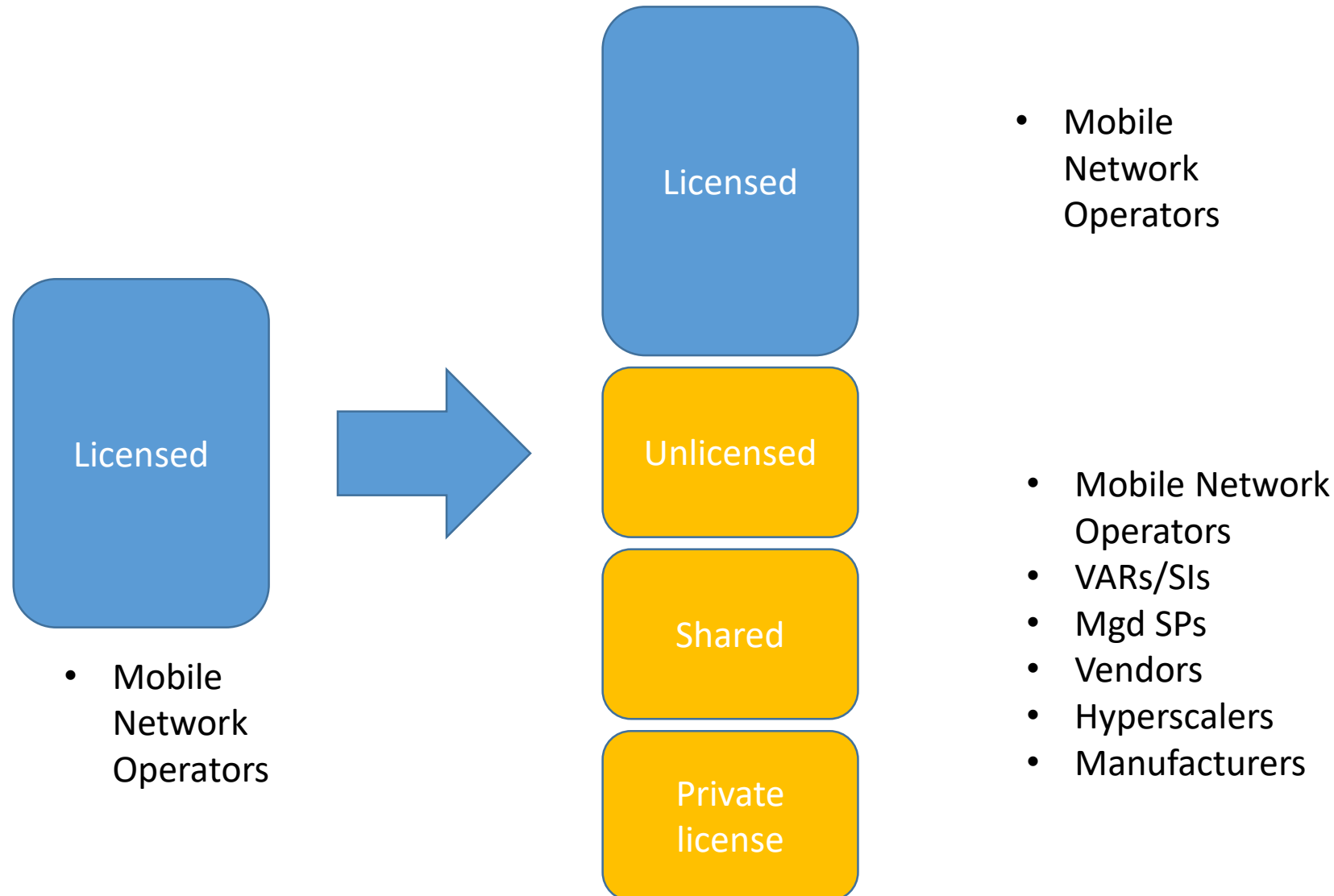
# The Private Cellular Opportunity: The Transition from Consumer Licensed

- 3G: Smartphone era
- 4G: Uber, Lyft, Grubhub, Doordash, Pokemon Go
- 5G: New era of communications and computing where 5G and Industry 4.0 come together
  - New spectrum creates new avenues to market
  - New uses for wireless demands new devices and services
  - New distribution channels and use cases demand new technology and business models

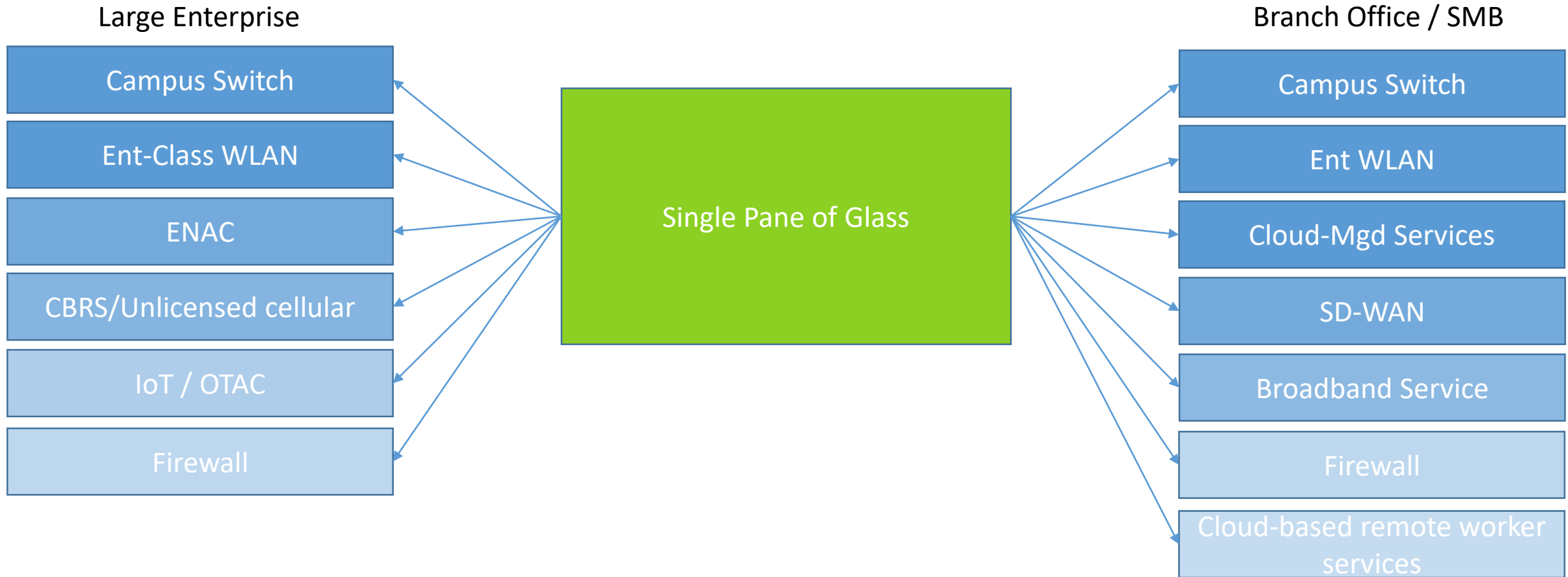
# Private Cellular New Spectrum

Spectrum	Comments	Age
CBRS/3.5 GHz	5G Spectrum throughout the world	New
6 GHz	Initially for Wi-Fi	New
Private mid-band	LTE/5G	New
60 GHz	802.11ay; mmWave	Recent
5 GHz	Wi-Fi and cellular co-exist (802.11, LAA, Multe-Fire)	Mature
900 MHz	LoRa, Hallow (.11ah)	Mature
2.4 GHz	Wi-Fi	Mature

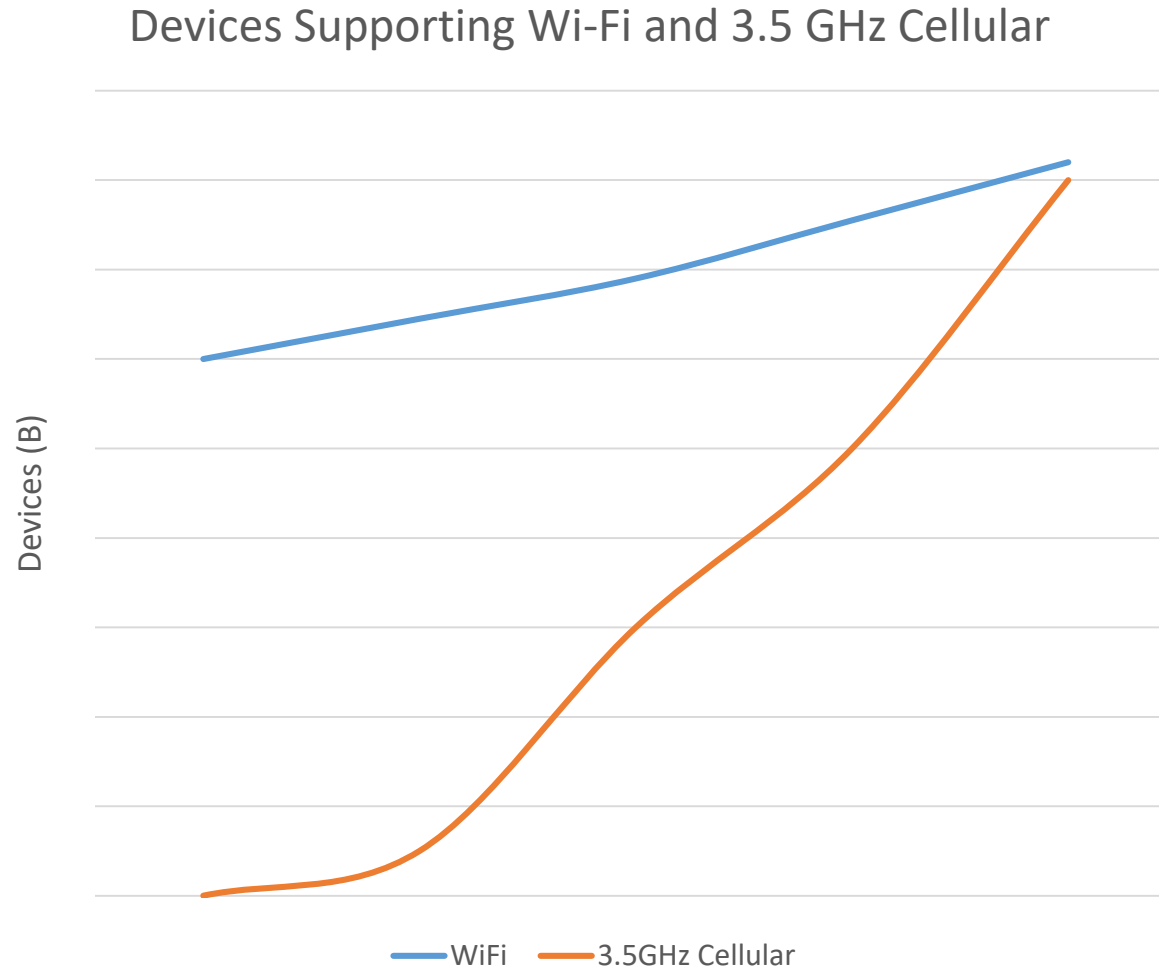
# Private Cellular New Spectrum – New Avenues To Market



# Private Cellular Cellular Emerging as an IT Product/Service



# Private Cellular Enterprise Wi-Fi vs Enterprise Cellular

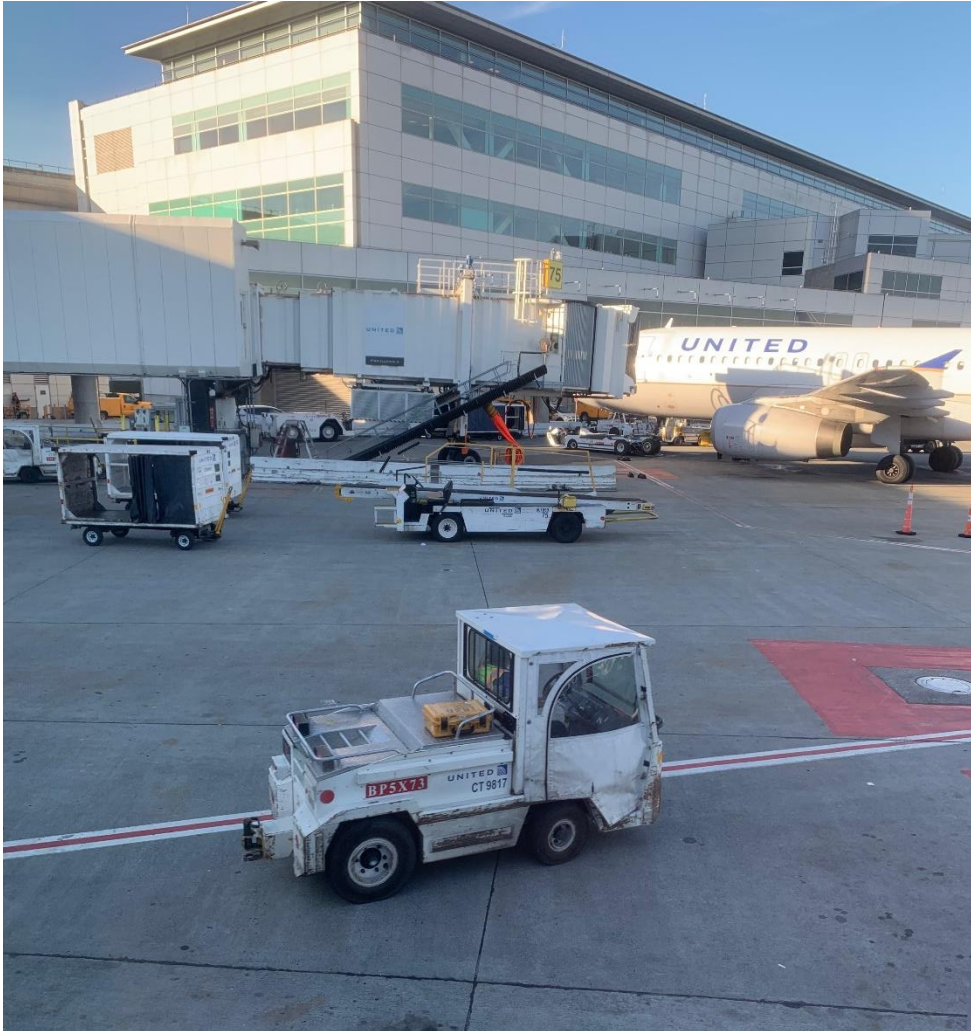


3.5 GHz is where most  
of the world is  
deploying 5G

# Private Cellular Channels: Hyperscalers, Mgd SP, VARs, Vendors...

- Hyperscalers
  - Amazon and Azure storefronts for CBRS
  - Azure acquired two telco-core companies in 2020
- CBRS SAS
  - Federated Wireless
  - Google, Commscope, others
- Managed SPs
  - Federated
  - Geoverse
  - Many others
- MNOs
- Non-profit organizations / associations
- Equipment Vendors (long list)
  - Main Vendors:
    - Nokia
    - Commscope
    - JMA Wireless
    - ADRF
  - Challengers
    - Cisco
    - Ericsson
    - Motorola Solutions
    - Celona
    - Huawei (?)
    - [Others:](https://www.650group.com/blog/cbrs-alliance-event-marks-the-launch-of-ongo-and-initial-commercial-deployment)  
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# Private Cellular: Customer Targets



## Enterprise cellular opportunities:

- Mobility: Wings, wheels or rails; airport, transportation, logistics
  - Outdoor enterprise: utilities, mining, exploration
  - Ultra customer service: venues, hotels
  - Ultra-security: government
  - Ultra-performance: hospitals
- 
- Summary: a subset of Enterprise WiFi market
- 
- Most of the most earnest private LTE/5G/CBRS deployments will be anchored in outdoor or potentially open-air indoor (mfg) use cases.



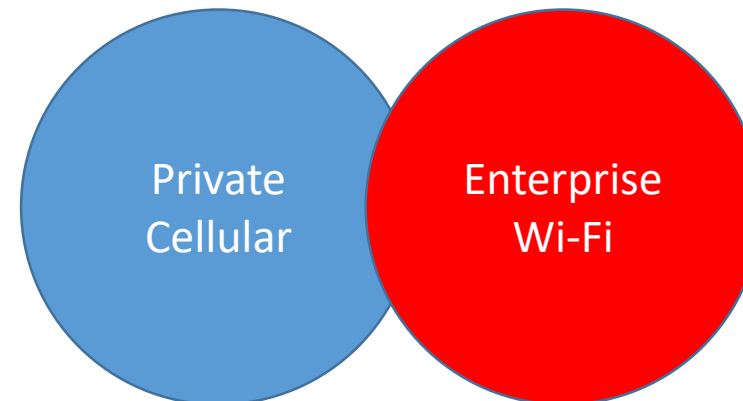
# Private Cellular: Cellular Vertical Markets

## Cellular: Range, Coverage, Mobility, Outdoor, Security

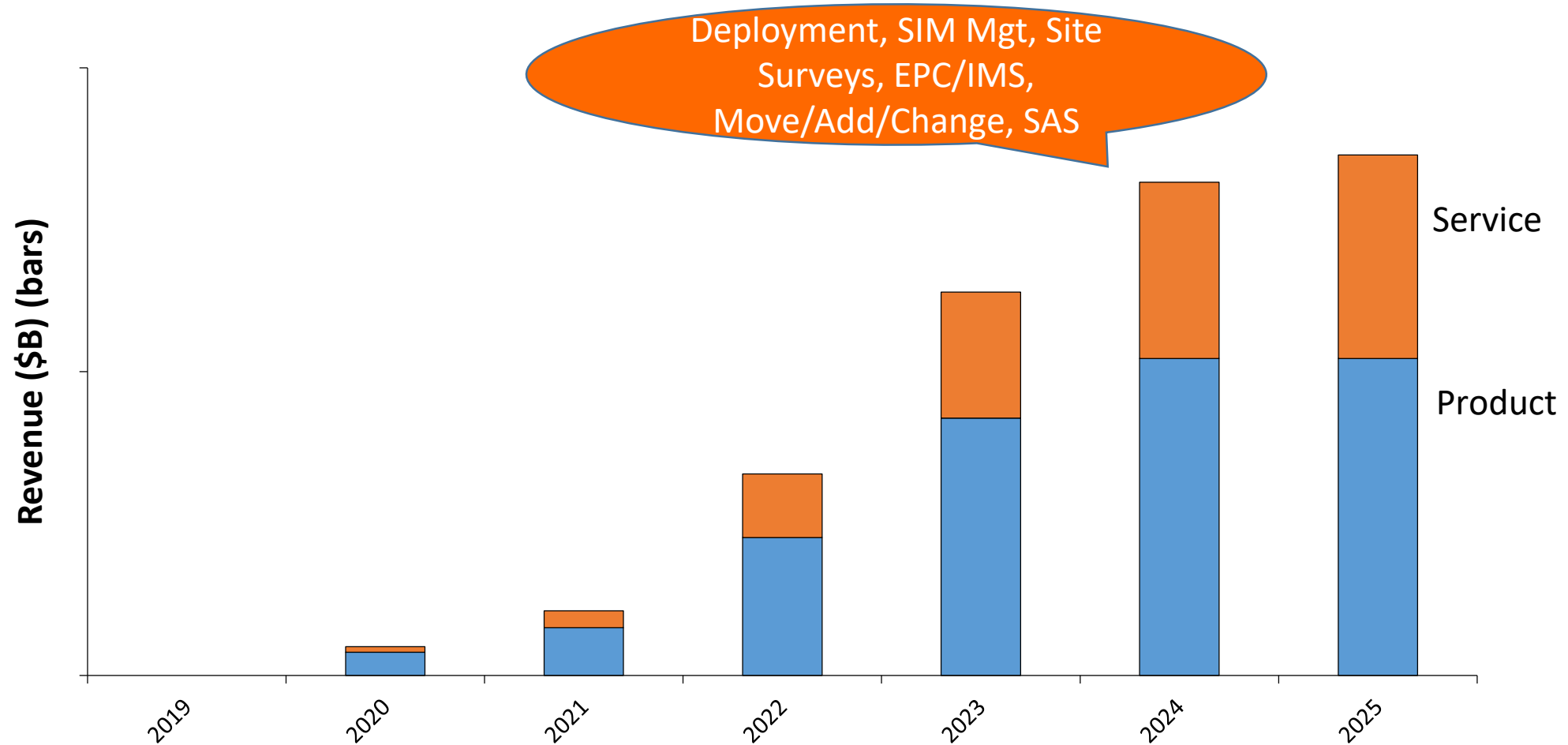
- Oilfield / mining / exploration
- K-12 / Higher Ed
- Energy / Utilities
- Retail (backhaul)
- Transportation hubs / airports / logistics
- Warehouse / Logistics
- Neutral host
- Venues / Sports / Casinos / Racetracks / Amusement Parks
- MSO territory expansion
- Manufacturing
- Government
- Hospitals
- Hospitality / Hotel
- Smart City
- Outdoor robots / delivery / drones
- Digital signage

## WiFi: Compatibility, Ease-Of-Use, Maturity

- 802.11ax / Wi-Fi 6 improves on mobility, security, determinism
- Information Technology orientation
- Significant installed base advantage
- Ease of Use advantage
- Noisy spectrum

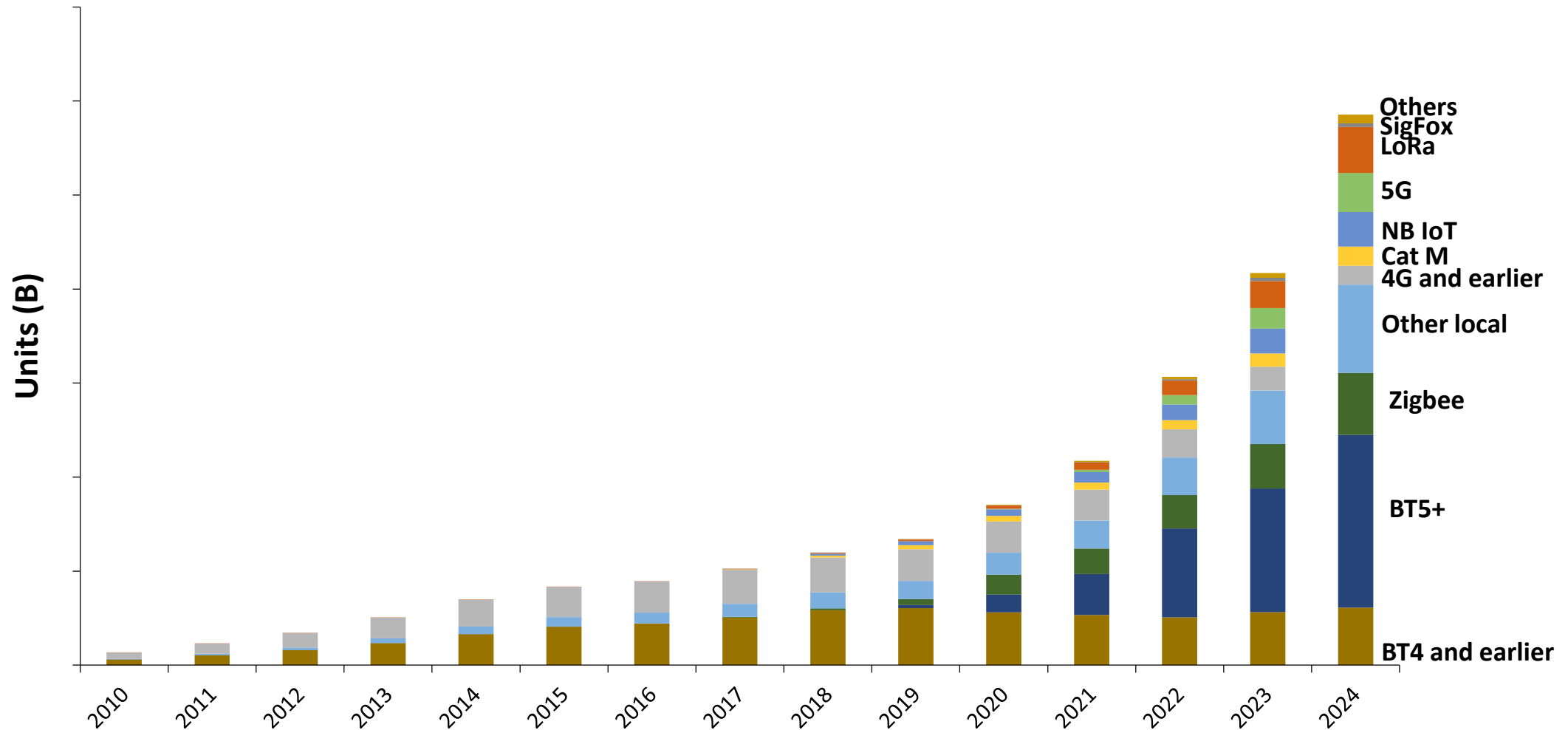


# Private Cellular CBRS/USA + Rest of World Forecast



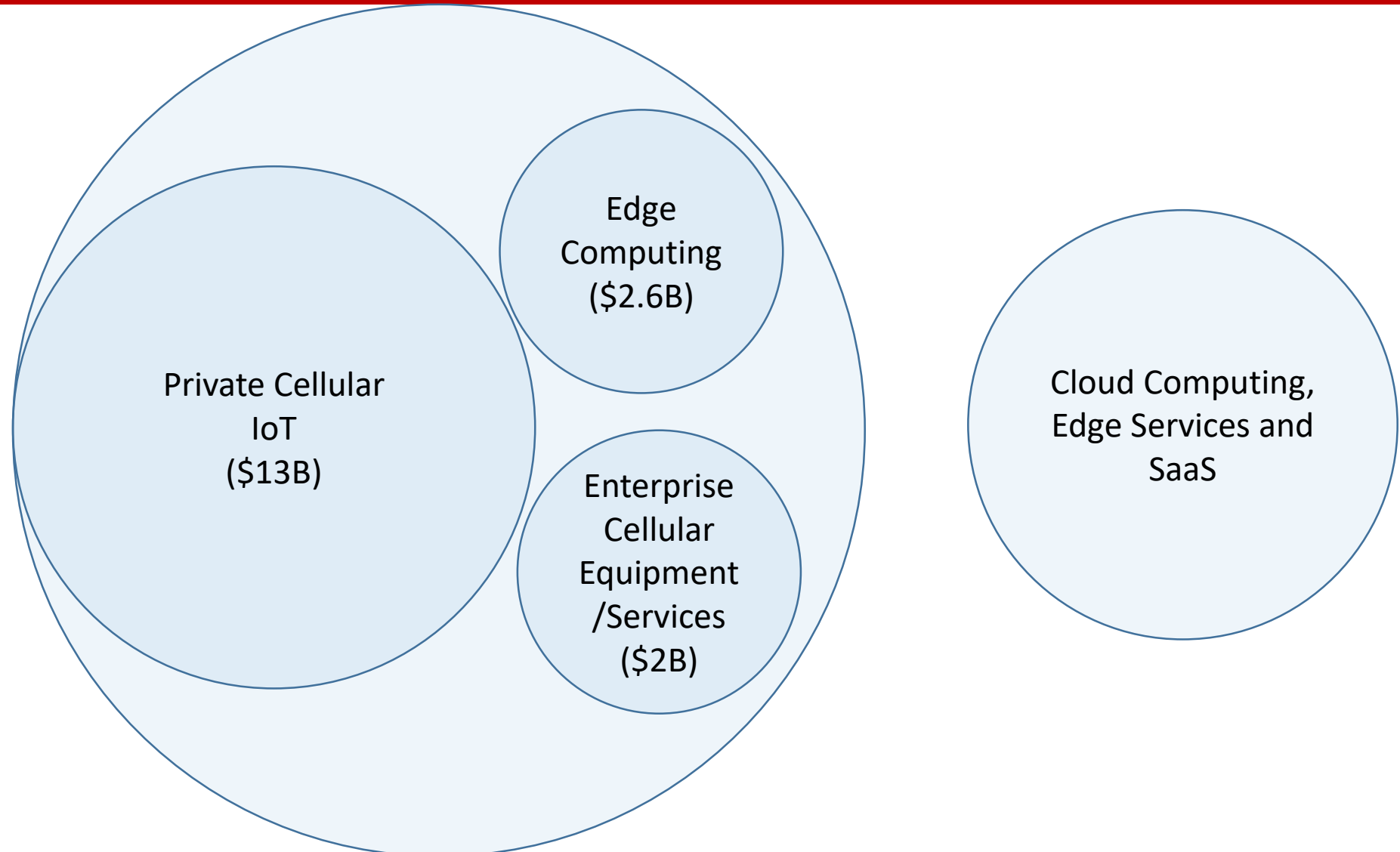
# IoT Opportunity

## Non-WLAN by Speed



\*examples: appliances, healthcare, security, speakers, lights, pets, clothing, other.

# Private Cellular: Enterprise Cellular Opportunity



# About 650 Group

We started 650 Group to provide our subscribers and customers with a unique perspective on the industries we research. Our team has decades of experience researching our focus industries and in roles at companies similar to the ones we cover. We research the data center, communications and Information Technology markets.

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- Founded in Silicon Valley
- Trusted source of research for system vendors, component manufacturers, service providers, sell-side, buy-side, and standards bodies
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