IP Network Evolution

Scalable, simplified and open networks

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Network evolution

Agenda

1	Changing Drivers
2	IP Networks Challenge
3	New IP Architecture
4	Virtualization
5	5G
6	Takeaways

Changing Drivers

New Technologies are changing the way business and people interact

Blockchain

Artificial Intelligence

Edge Computing

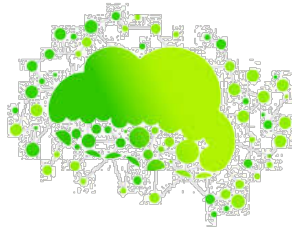
Internet of Things

Adaptable Connectivity, Compute & Storage

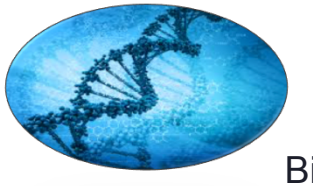
Fusing the physical, digital and biological worlds

Big Data

Public Cloud



Robotics



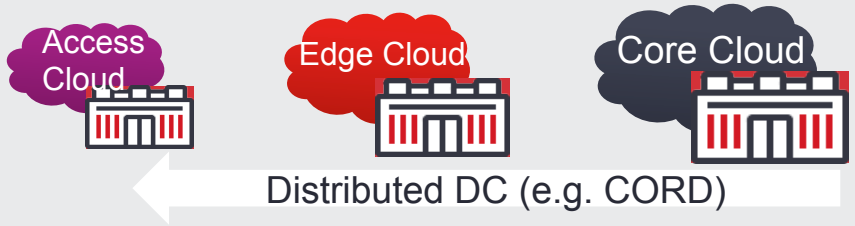
Biotechnology

Communications solution are evolving to support the new applications

Cloud-Enabled Services

Mobile Edge Computing
On-Demand Video
Content caching
Immersive (AR/VR)
Internet of Things

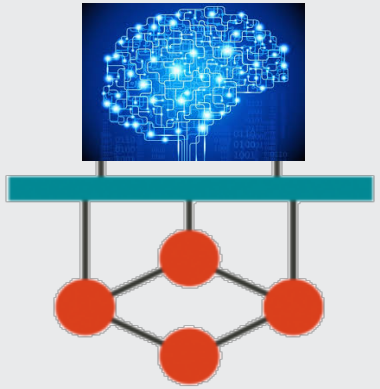
Distribution of Content & Applications



Evolving traffic patterns, low latency, high BW
Adaptive network, IP-enabled, network slicing
Operators adopting webscale approaches

5G

Disaggregation and SDN Control

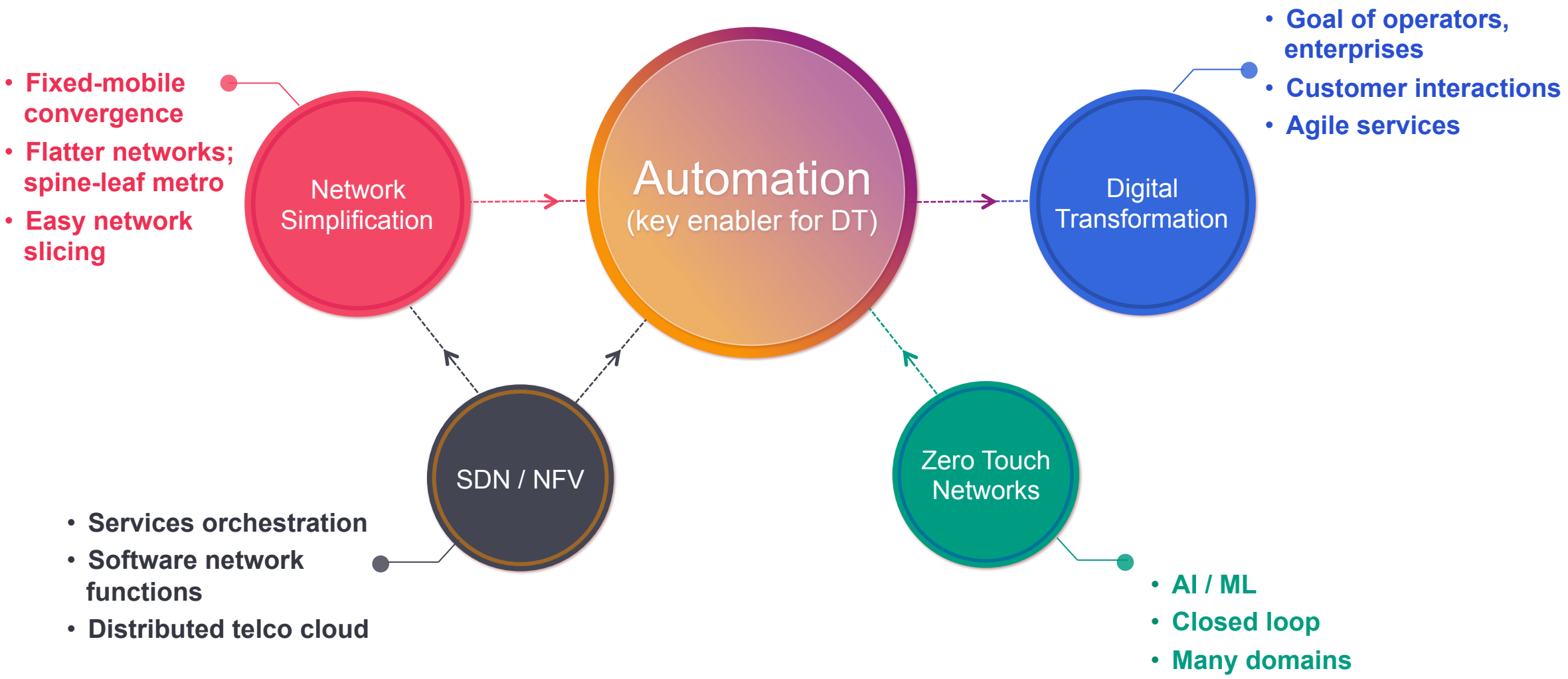


Adaptive networking
Orchestration & automation
Analytics
Centralized intelligence
(e.g. Segment Routing)

Modular Architecture & Distributed Fabric

Merchant silicon has reached multi-terabit density
Modularly scalable, pay-as-you-grow
Programmable infrastructure

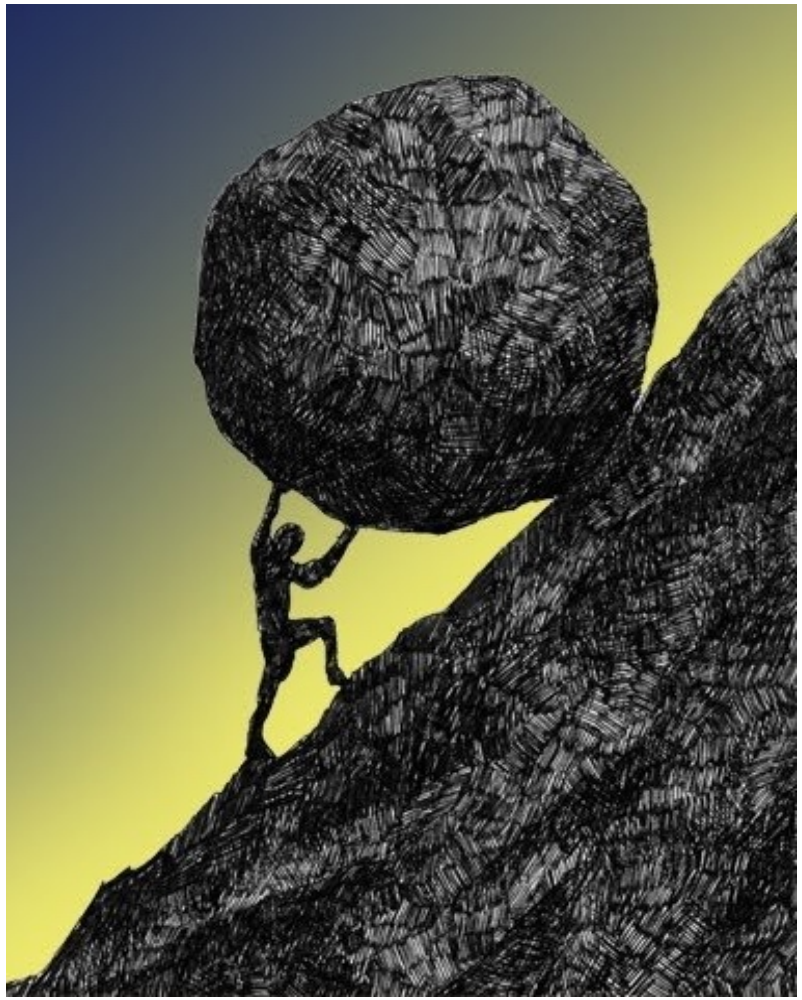
And Network Operators also need to embrace Digital transformation



Source: *IHS Markit SDN & NFV Intelligence Service; 2H 2017*

IP Networks Challenges

Network Operators challenges with IP Networks



1

New and emerging applications require increased Layer 3 IP flexibility closer to the network edge, resulting in a significant increase in the number of IP nodes and related complexity

2

320% traffic growth (2017 – 2022), flat to declining revenues and margins results in declining CAPEX/OPEX that hinders traditional wide-scale and cost-effective transformations

Visual Networking Index, February 2019 (Cisco)

3

Legacy IP approach of adding more IP protocols, and more and bigger routers is rapidly increasing operational complexity with a direct, negative impact on CAPEX, OPEX, TTM, TTR

IP networks need to evolve to become Adaptive

Traditional IP	New IP
Designed to scale clients (devices/nodes)	Capable of scaling clients and resources on-demand (cloud-like)
Rigid topology and architecture	Fluid in topology and architecture
Hardware-centric	Software-centric
Integrated control and data planes	Disaggregated control and data planes
Proprietary but standards-driven innovation	Open hardware platform, open-sourced software innovation
Success metrics → speeds, feeds, protocols	Success metrics → agility, simplicity, and usability

Leverage a decade of new and emerging technologies supporting openness, programmability, and centralized control with distributed processing

New IP Architecture

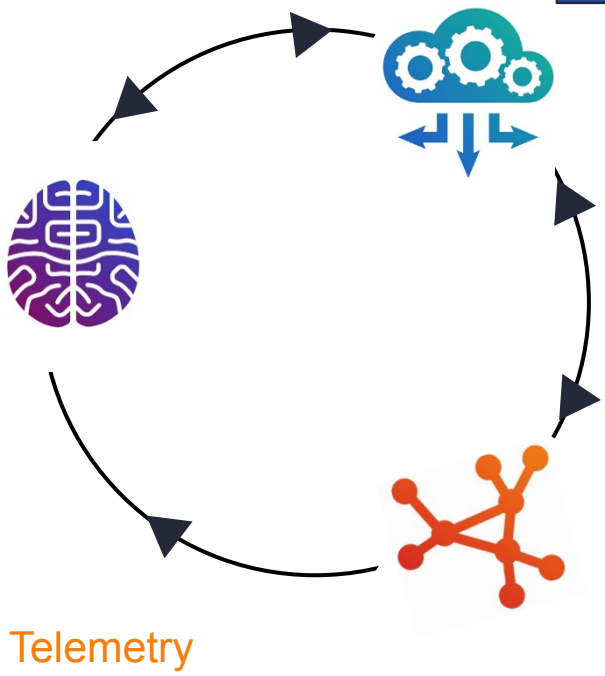
How IP Networks should evolve to support new applications

Act

Software Control & Automation

- Multi-Domain Service Orchestration software platforms

Intent-based Policies



Automation

Sense

Analytics & Intelligence

- Route Optimization & Assurance using open standards like gRPC, IGP, BGP and IP-SLA to capture information about topology, latency, and routing to create a virtual map

Telemetry

Connect

Programmable Infrastructure

- Provides streamlined IP capabilities to evolve and expand IP networks, access to metro
- Real-time monitoring of the network control plane and overlay services

Virtualization

Adaptive IP Application Considerations

Focusing on characteristics

Industry Trends

- Virtualization
- Open
- Disaggregation
- Programmability
- Routing
- Automation
- Reliability

+

4G and 5G Mobile Networks

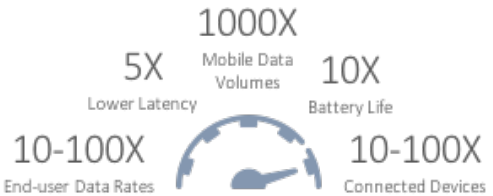
VNF, L3 and L2 Business Services

Cable MSO Next Generation Access (Fiber Deep)

5G

The 5G Promise

Connectivity Anywhere and Anytime, to Anyone and Anything



Enhanced Mobile Broadband (eMBB)

Extremely high data rates, low latency, extreme coverage

Massive Machine Type Communications (mMTC)

Extremely large volumes, ultra dense coverage, small payloads

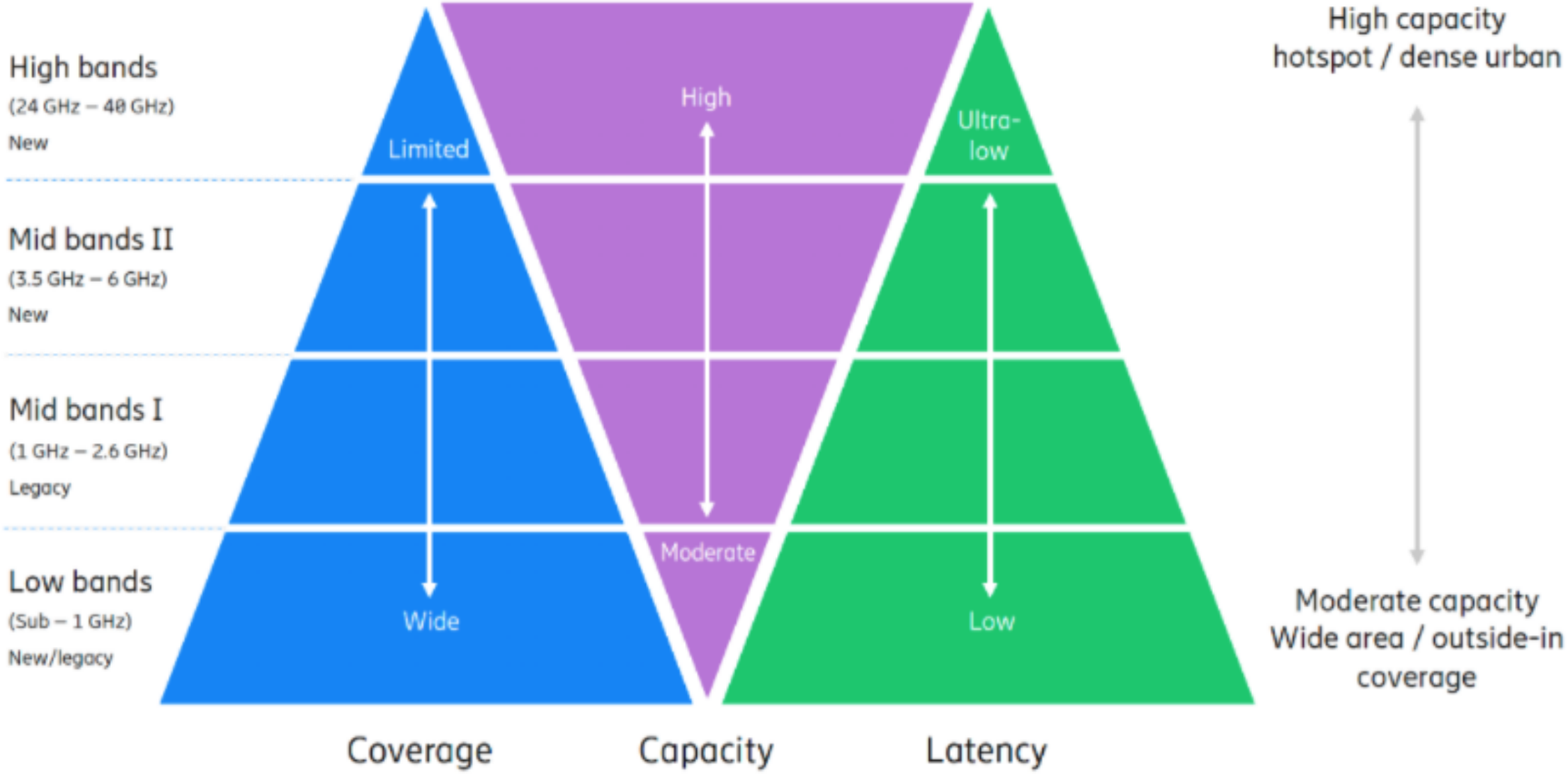
Ultra-reliable Low Latency Communications (urLLC)

Extremely high reliability and availability, ultra low latency

Order of magnitude increase in ***Complexity*** due to dynamic service variance,

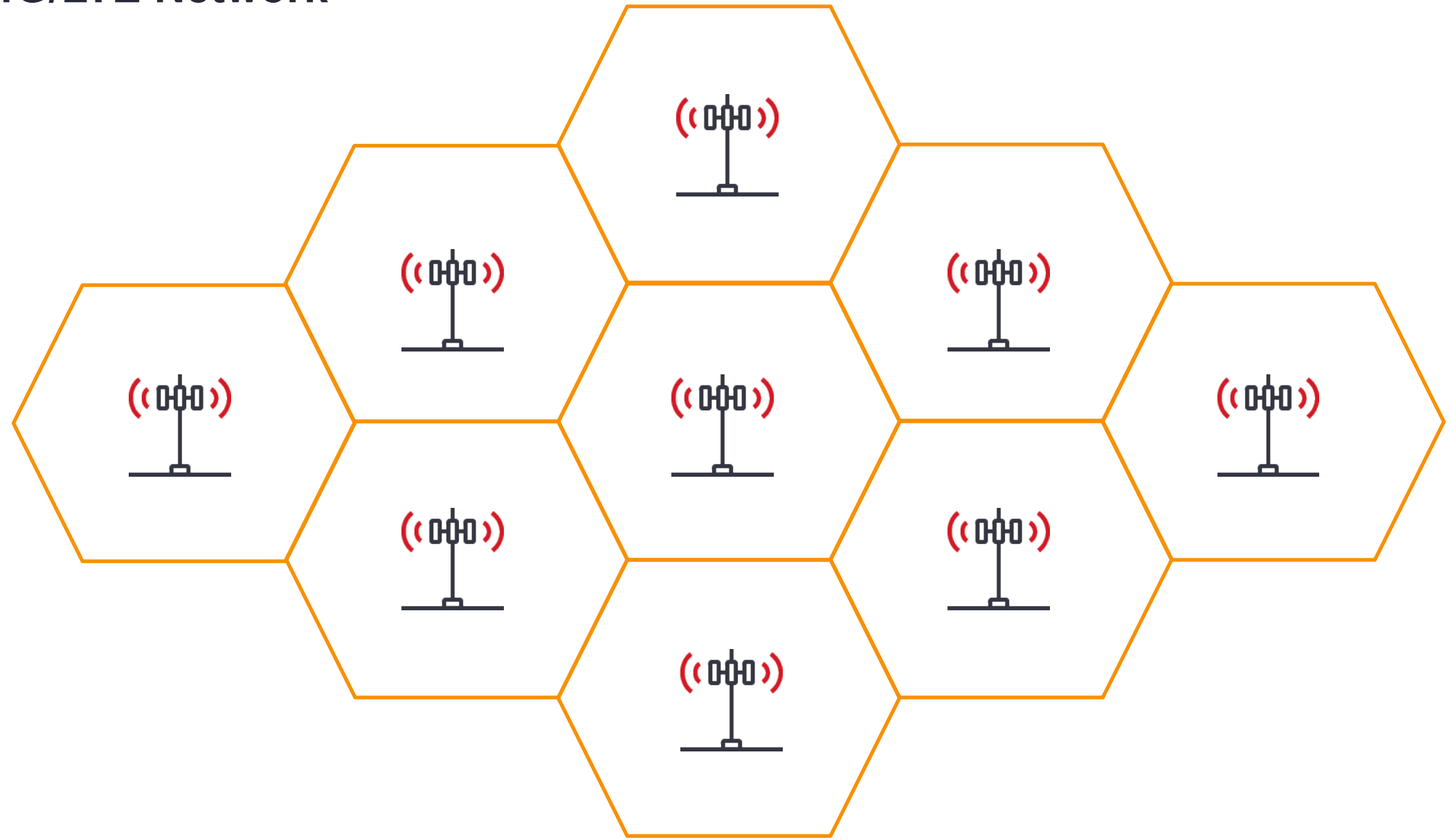
seeking a new design paradigm that preserves ***Simplicity*** while enabling extreme flexibility …

The Impact of Spectrum on 5G Network Requirements is Huge

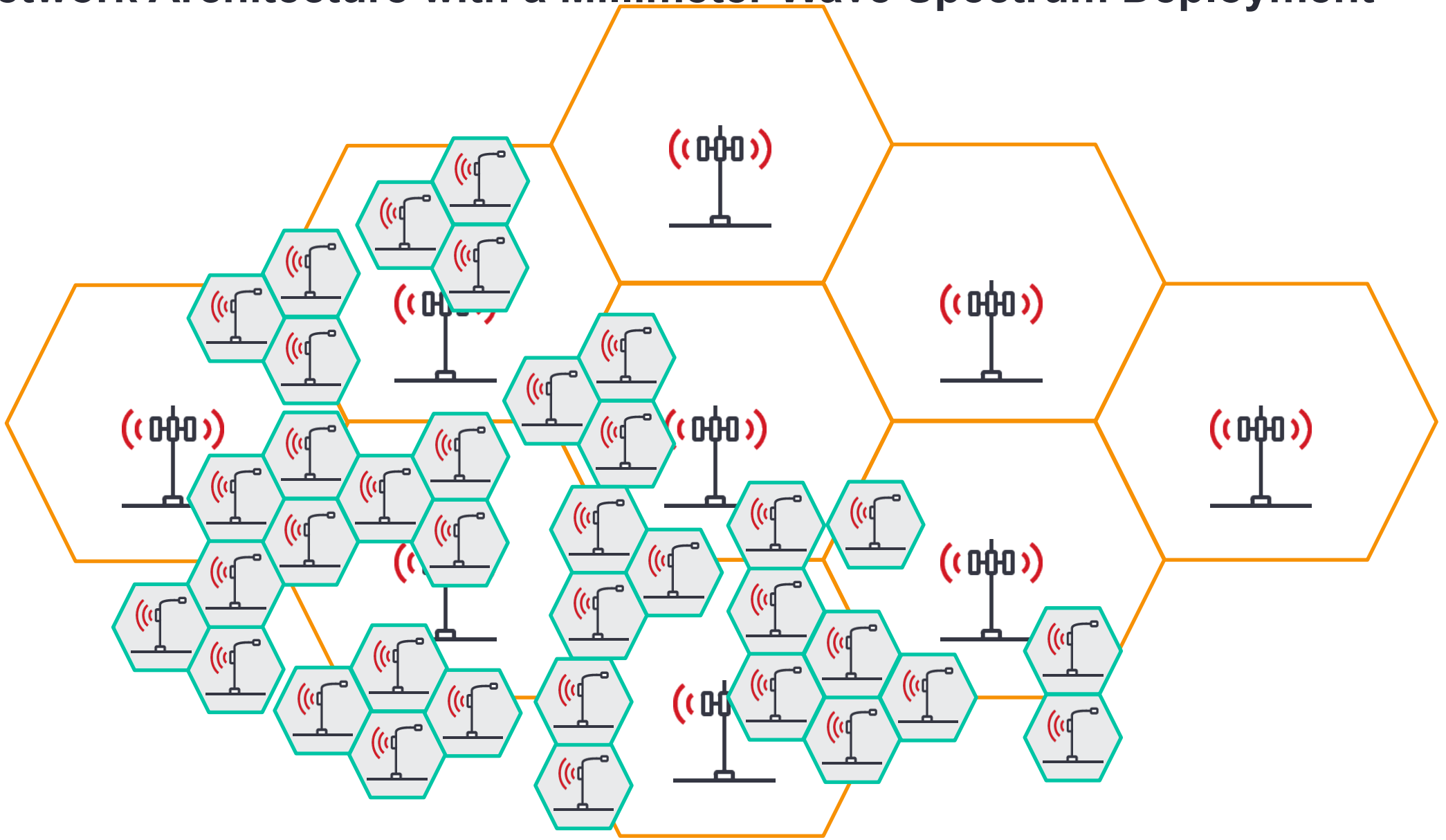


Source: IEEE – Survey on Low Latency towards 5G RAN

The 4G/LTE Network



5G Network Architecture with a Millimeter Wave Spectrum Deployment



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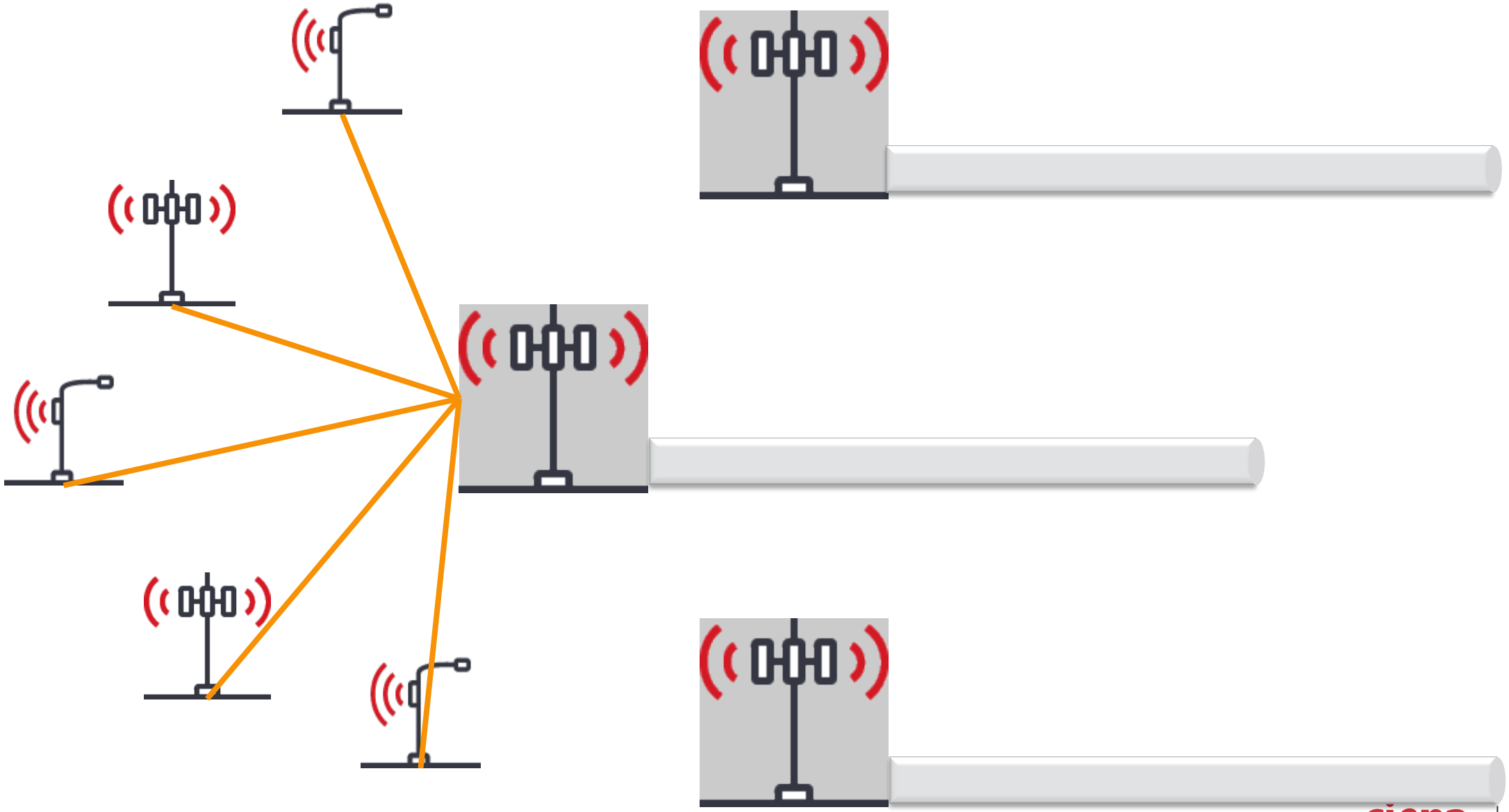
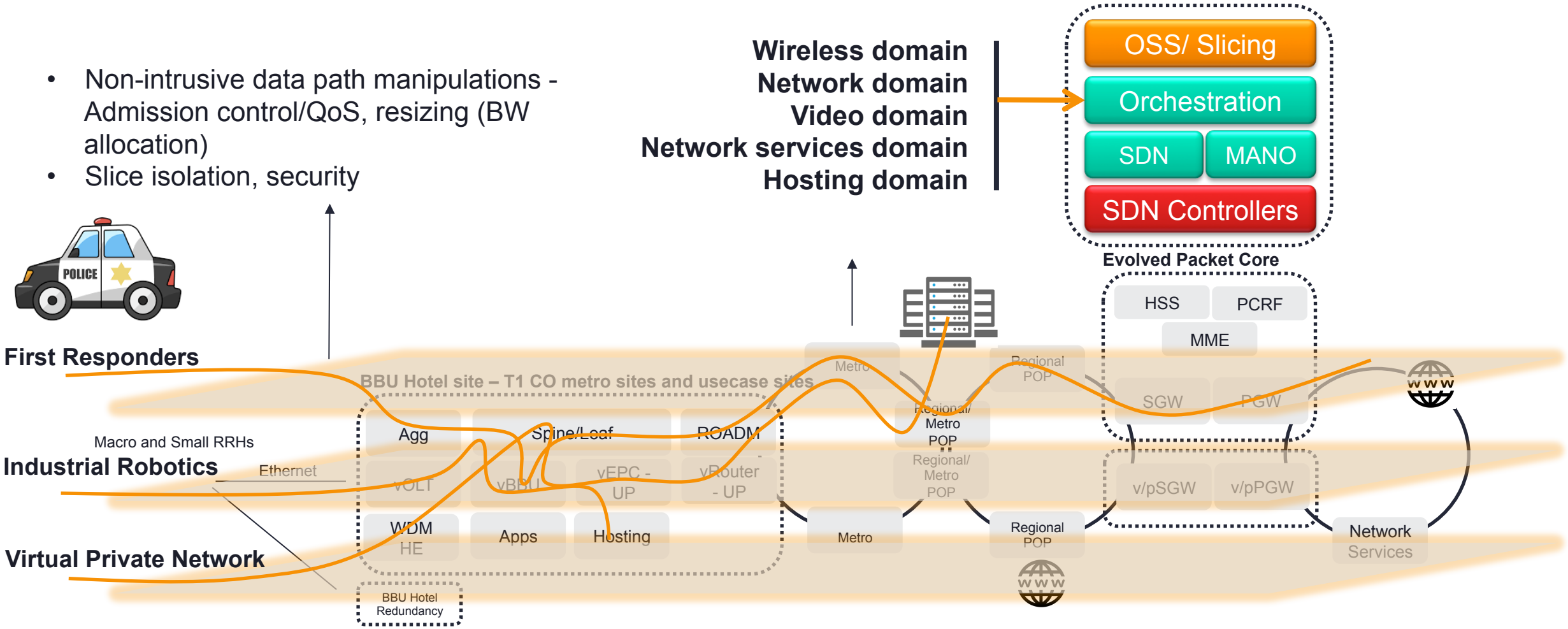


5G Brings Concept of Network Slicing

- Non-intrusive data path manipulations - Admission control/QoS, resizing (BW allocation)
- Slice isolation, security

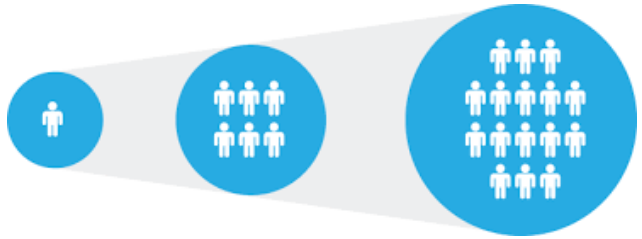


Per slice – QoS, resources allocation, performance metrics
Packet and optical slicing support

Takeaways

Takeaways

With the new IP architecture, network providers benefit from:

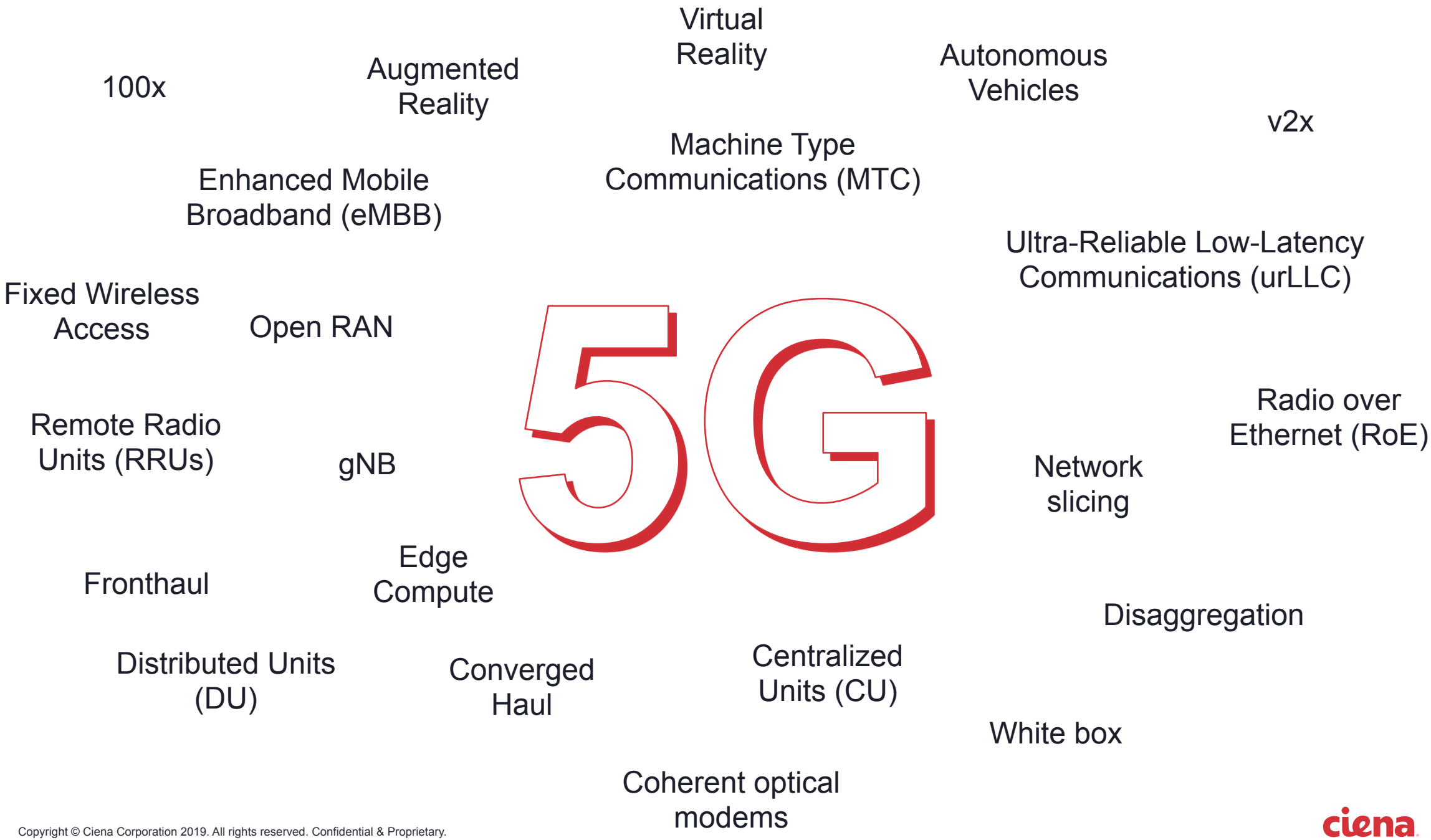


- Highly scalable and cost-efficient platform
  - Supporting greater network capacity, while expanding IP capabilities to the network edge

- Simplified operation by abstracting complexity to an SDN software layer
  - Enable network optimization and real-time visibility to simplify management and troubleshooting
  - Highly flexible Path Computation Engine (PCE) for optimized traffic engineering

- Create a future-proof network infrastructure with an open and disaggregated approach
  - Separation of data plane and control plane for cloud-like innovation
  - Multi-vendor environment to take advantage of the most innovative solutions
  - Virtualization for service agility and avoid vendor lock in

Future Packet (Ethernet/IP/MPLS) networks simplify network operations, making them less costly to operate, and also results in a faster time-to-market while providing more flexibility to successfully address changing customer demands.



Thank You

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