Transforming Telecommunications

Cord Summit, July 2019

Alan Blackburn
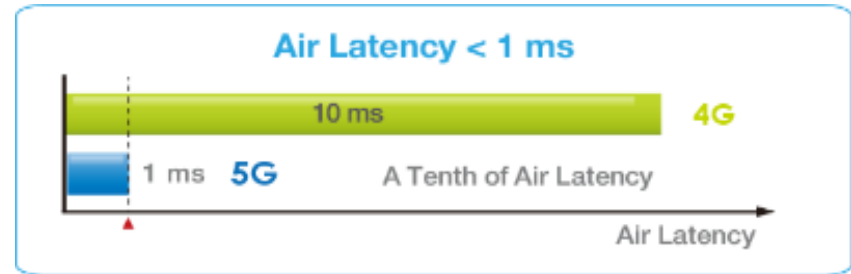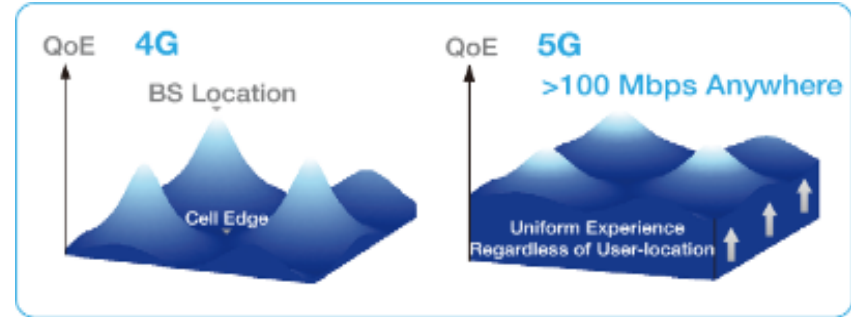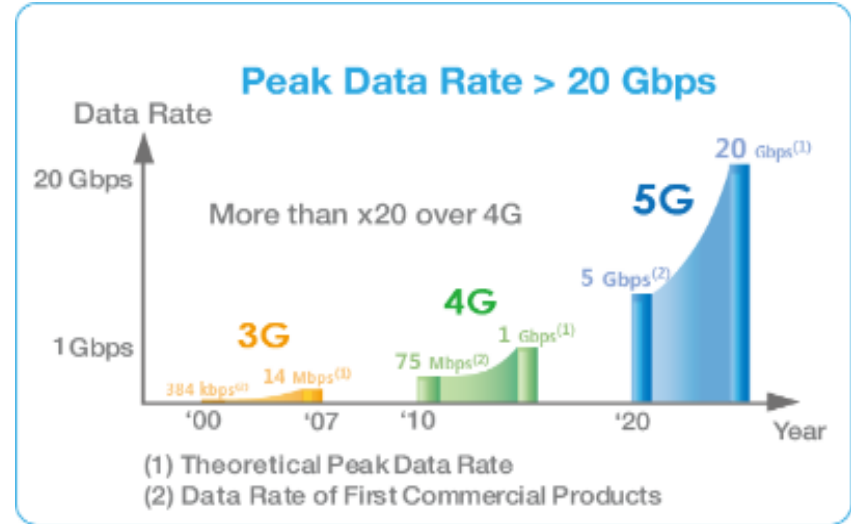
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Drivers For Change

1. Network Traffic Continues to Grow and Change

2. Services Decouple from Infrastructure

3. Operational Paradigm Shifts

4. Existing Networks Must Evolve to Meet Demand Variances (Fixed and Mobile)

5. Big Data & Analytics Become Increasingly Important in Network Control Planes

6. Security, Identity and Authentication paradigms emerge that become more robust and intelligent

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WIDENING DYNAMIC RANGE-
Emerging 5G Requirements

Peak Data Rate (20 Gbps)

Edge Throughput (100 Mbps)

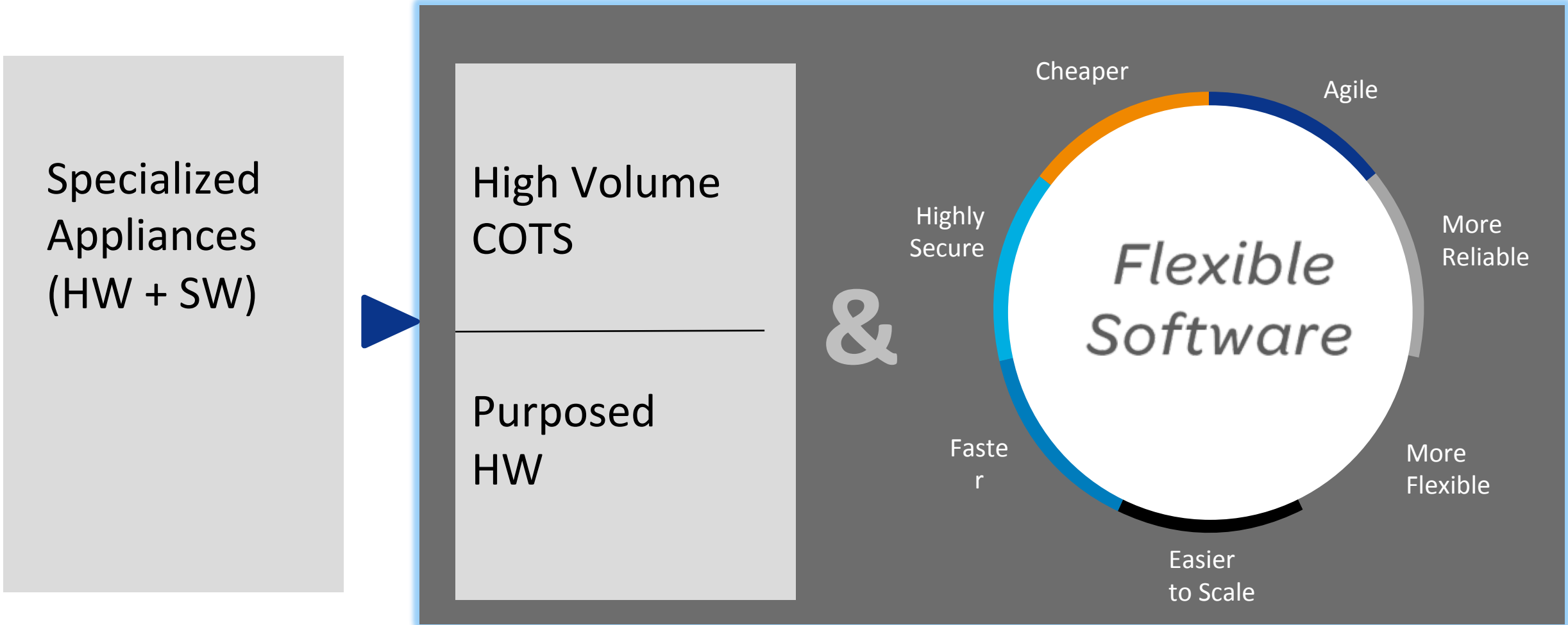**Latency (1 ms)**

IMT-2020

IMT-Advanced

Area Traffic Capacity (Mbit/s/m²)

Spectrum Efficiency

Network Energy Efficiency

Mobility (km/h)

Connection Density (devices/km²)

Peak Data Rate > 20 Gbps

Data Rate

More than x20 over 4G

20 Gbps — 20 Gbps[1]

5G

5 Gbps[2]

4G

1 Gbps — 1 Gbps[1]

3G

384 kbps[2]   14 Mbps[1]   75 Mbps[2]

'00   '07   '10   '20   Year

(1) Theoretical Peak Data Rate
(2) Data Rate of First Commercial Products

QoE **4G**   BS Location   Cell Edge

QoE **5G** **>100 Mbps Anywhere**   Uniform Experience Regardless of User-location

Air Latency < 1 ms

10 ms **4G**

1 ms **5G**   A Tenth of Air Latency

Air Latency

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RETHINKING THE NETWORK

Specialized Appliances (HW + SW)

▶

High Volume COTS

——————

Purposed HW

&

Flexible Software

- Cheaper
- Agile
- More Reliable
- More Flexible
- Easier to Scale
- Faster
- Highly Secure

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VIRTUALIZE AND CONTROL

75% of our network using cloud infrastructure and SDN By 2020

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AT&T DOMAIN 2.0 TRANSFORMATION IMPERATIVES

Open our Network

Modular

Programmable via robust Network API's, service creation and execution

Simplify and Scale

Common NFV Infrastructure

New operational paradigms

Emergent significant stressors include Video and Internet of Everything

Increase Value

Agile, Elastic, Dynamic

Cost-Performance leadership

Enable new growth services & apps

World class, industry-leading security, performance, reliability

Facilitate new business models and associated monetization paradigms

Architecture and Technology Directions

Decouple HW from SW – <u>NFV</u>

Separate Control from Forwarding – <u>SDN</u>

Combining NFV and SDN, enables a <u>real time</u> network cloud, <u>distributed</u> and <u>integrated</u> through the WAN, <u>optimized for packet</u>

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AT&T INTEGRATED CLOUD (AIC) DISTRIBUTION

National

Big Deployments / Low Distribution (<50 sites)

- Centralized Functions
- Large scale facilities, e.g., compute centric

Regional/Metro

Medium Deployments / Distribution (300-600 sites)

- Regional/metro functions
- Hub locations, proximity centric

End Office

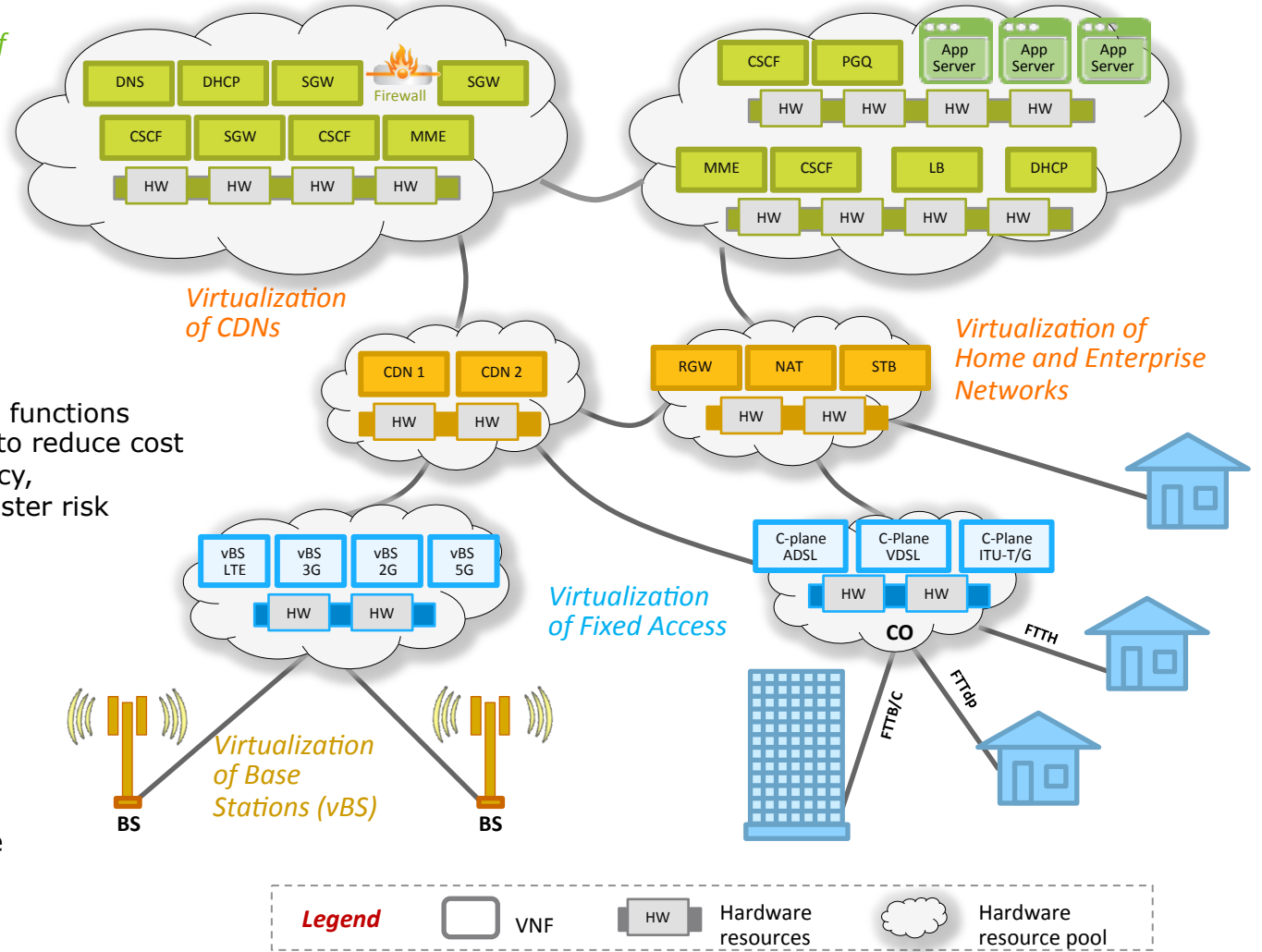**Small/Medium Deployments / Large Distribution (5000+ Sites)**

- End Office, LATA, and MOW functions
- Access hand-off points, highly proximity centric

Remote

Small / Very Small Deployments, Extreme Distribution (100K to 100M)

- Remote terminal, campus/venue
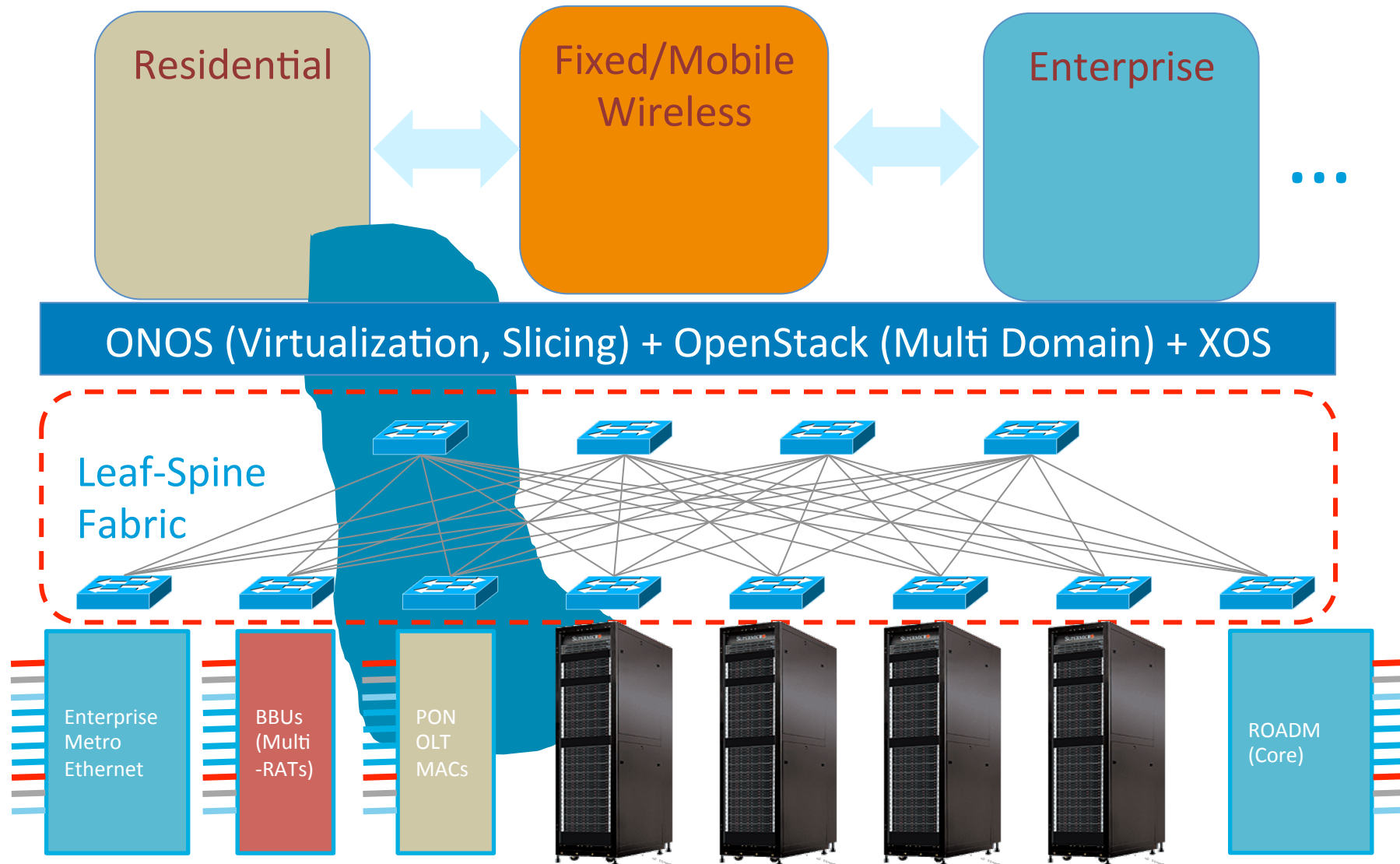- Customer premises CPE, Customer devices

Trend to distribute functions towards the edge to reduce cost of transport, latency, concentration/disaster risk

Trend to centralize functions into the network to reduce Access & CPE TCO

Virtualization of Mobile Core/ IMS

Virtualization of CDNs

Virtualization of Home and Enterprise Networks

Virtualization of Fixed Access

Virtualization of Base Stations (vBS)

DNS | DHCP | SGW | Firewall | SGW
HW | HW | HW | HW
CSCF | SGW | CSCF | MME

CSCF | PGQ | App Server | App Server | App Server
HW | HW | HW | HW
MME | CSCF | LB | DHCP
HW | HW | HW | HW

CDN 1 | CDN 2
HW | HW

RGW | NAT | STB
HW | HW

vBS LTE | vBS 3G | vBS 2G | vBS 5G
HW | HW

C-plane ADSL | C-Plane VDSL | C-Plane ITU-T/G
HW | HW

CO

FTTH

FTTdp

FTTB/C

BS

BS

Legend

| VNF | HW — Hardware resources | ☁ Hardware resource pool |

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CORD- CENTRAL OFFICE REARCHITECTED AS A DATACENTER

KEY OBERSVATIONS & OPPORTUNITIES

1. <u>Scaling Down</u>/Lighter Weight – Hard, but *necessary*

2. <u>ECOMP worked</u> – the framework held up well in deployments

3. <u>Consistency</u> of on-boarding standards and <u>best practices</u> lacking

4. Performance & flexibility can be found <u>without</u> violating key principles

5. Working in an <u>open community</u>, sharing a purpose <u>is FUN</u>!...and drives value.

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