IMPORTANCE OF SDN & NFV TO 5G STRATEGIES

Transport Network Perspective

July, 2019

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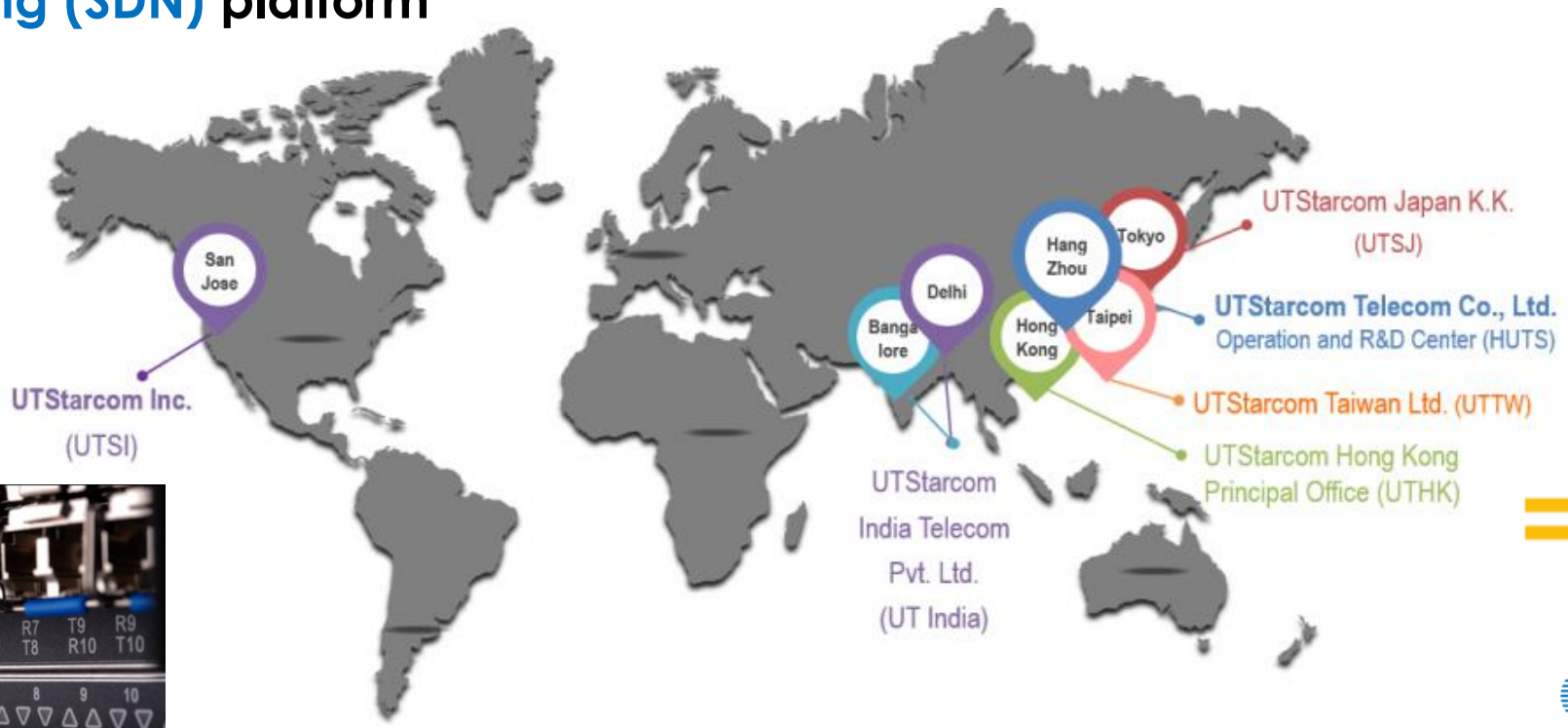
UTSTARCOM – A GLOBAL TELECOM INFRASTRUCTURE PROVIDER

- Founded in 1991, started trading on NASDAQ in 2000 (UTSI)
- Strong customer bases worldwide
- **Focus on delivering innovative cutting-edge packet optical transport, synchronization, wireless and fixed broadband access products and solutions coupled with carrier grade Software Defined Networking (SDN) platform**



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OUR BIG IDEA

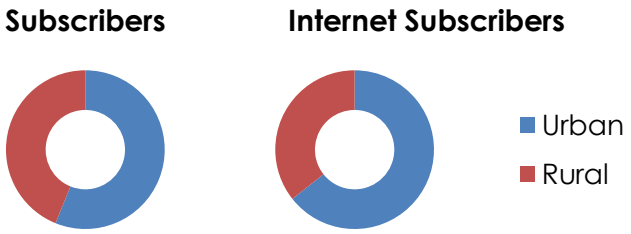
Our mission is to provide faster and reliable network with ultra low latency to enable internet Proliferation with latest technologies in India.

India , Image by NASA Observatory – Creating a Digitally Connected India

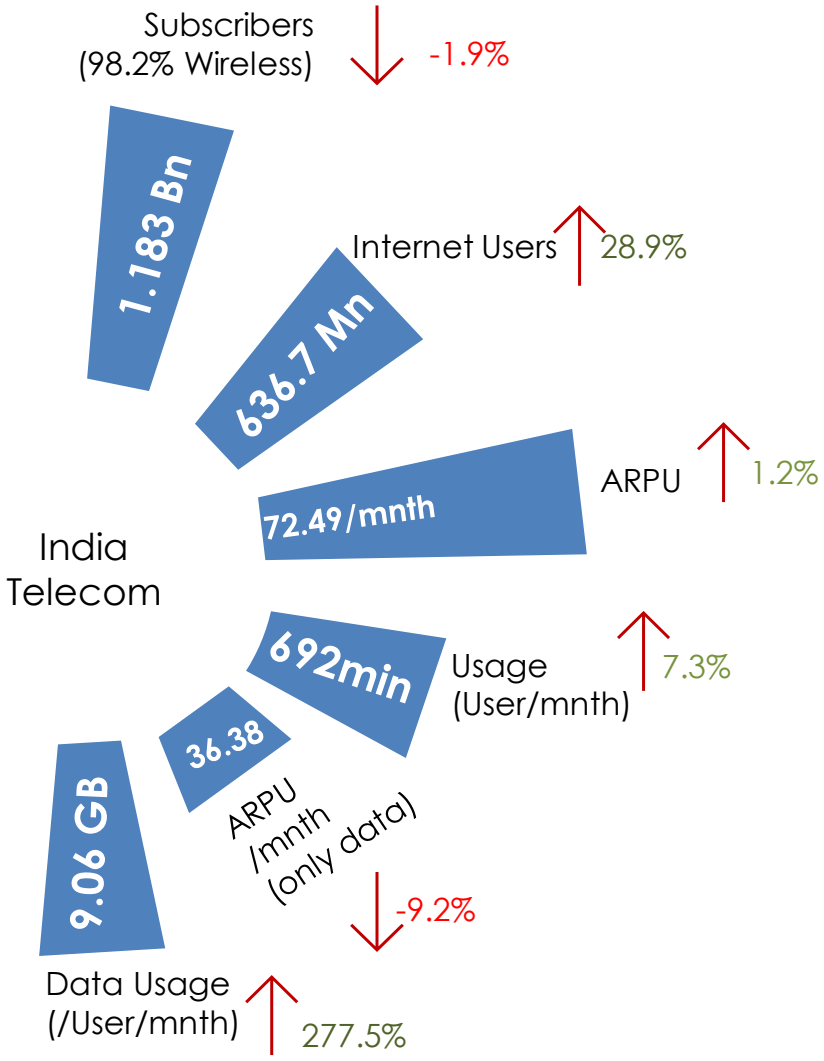
INDIAN TELECOM SECTOR

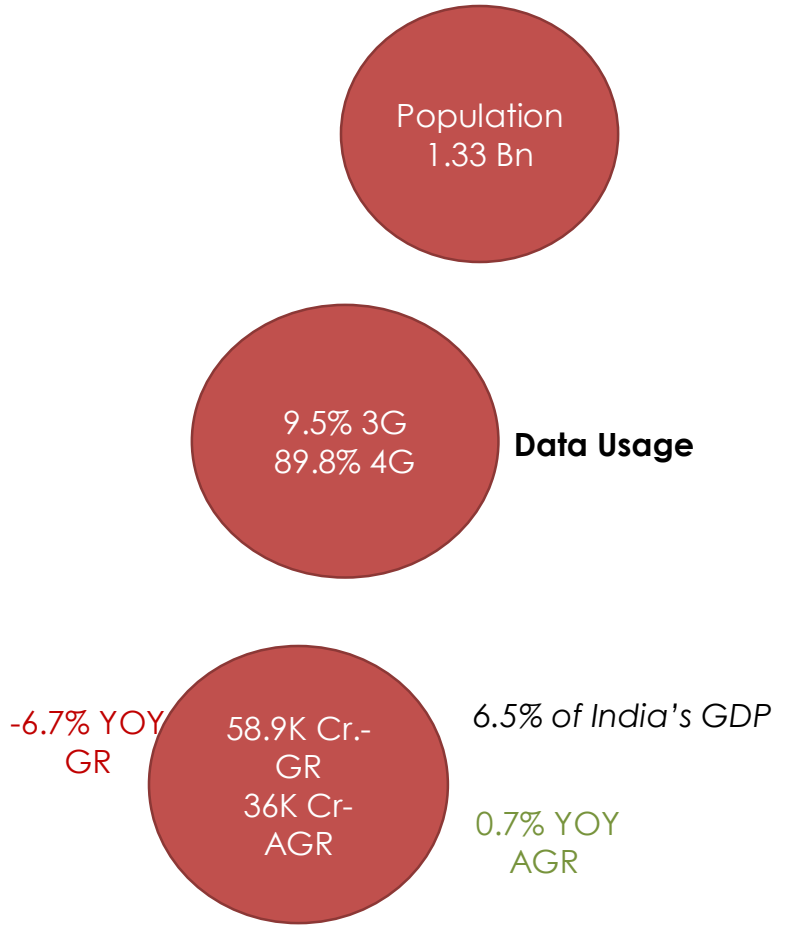
CURRENT SCENARIO

INDIA STORY # TELECOM SECTOR



- Second-largest subscriber base
- Rising penetration rate (74.6% in 10 yrs)
- 2nd highest no. of internet users
- Affordability and lower rates



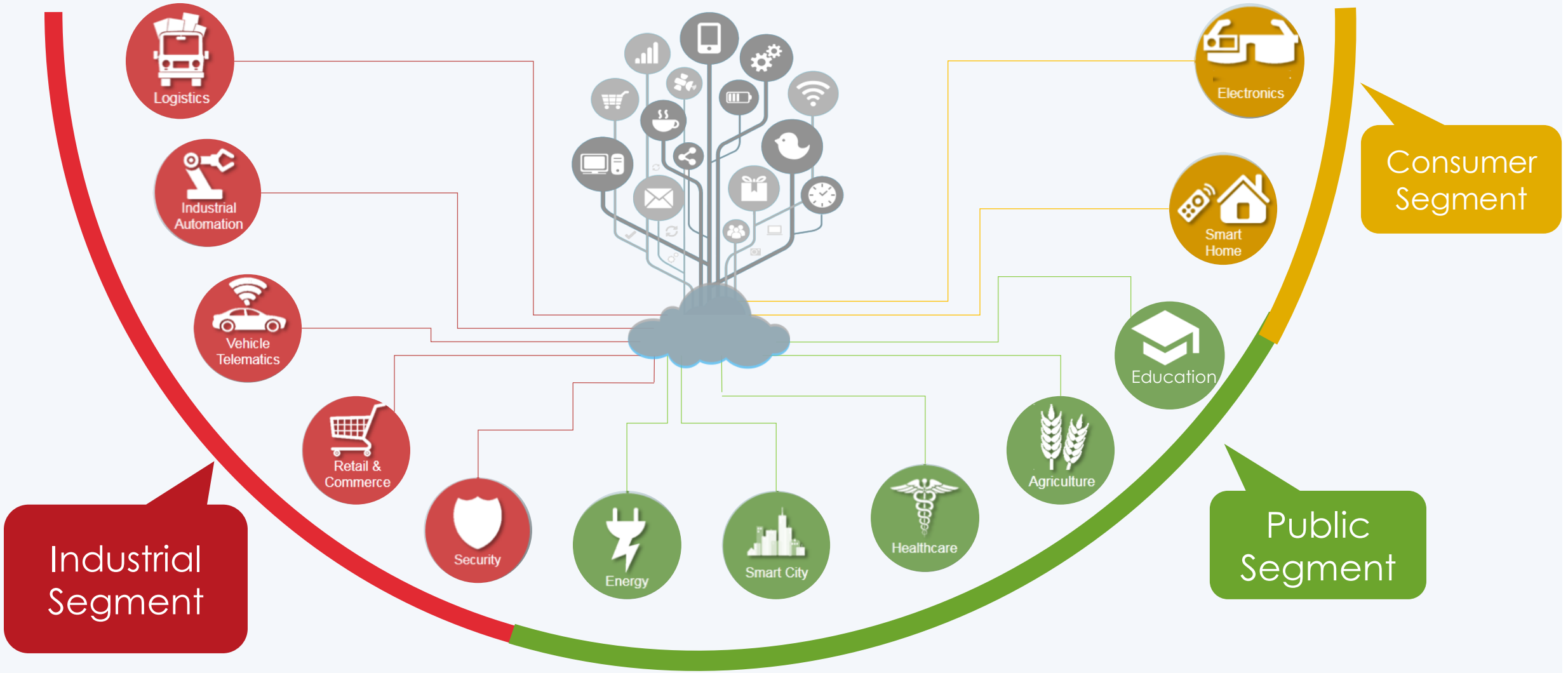


TRAI Report: June '19

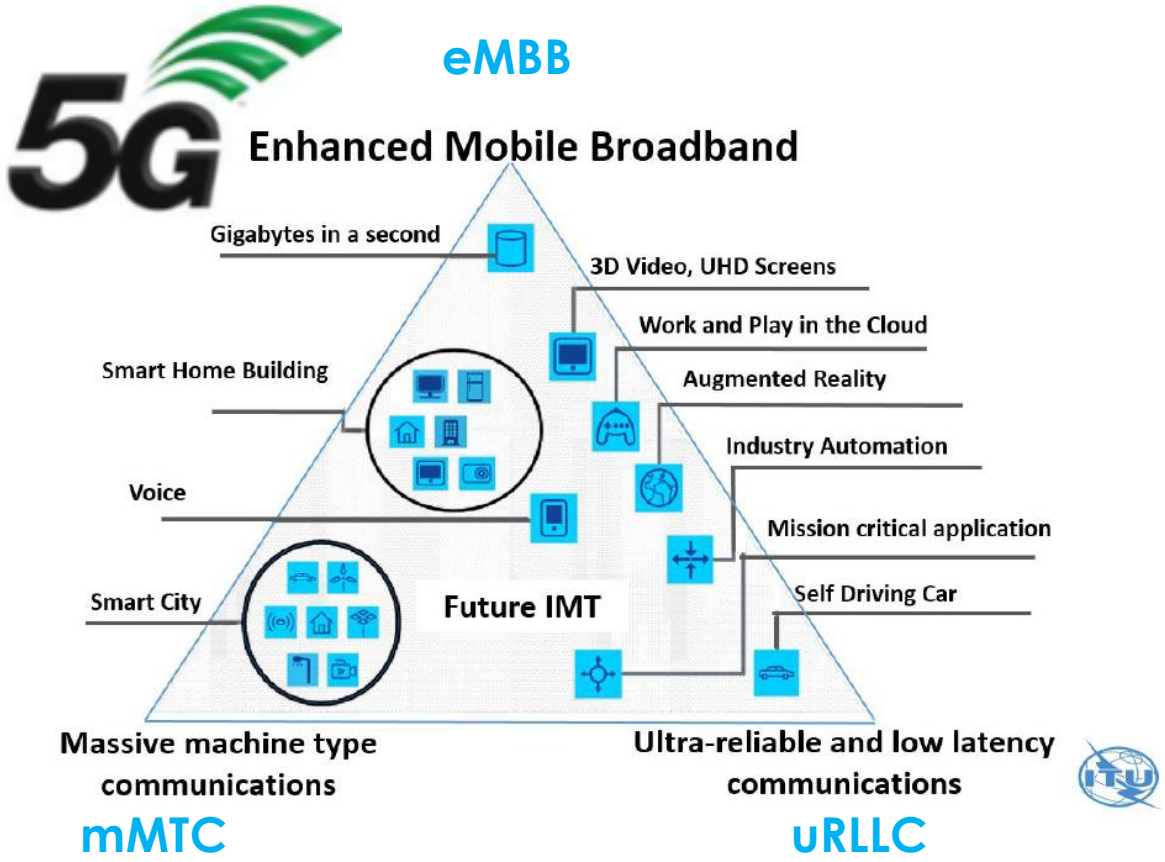
Yearly Comparison and Trend

INDIAN TELECOM SECTOR
POTENTIAL & OPPORTUNITY

5G OPPORTUNITIES

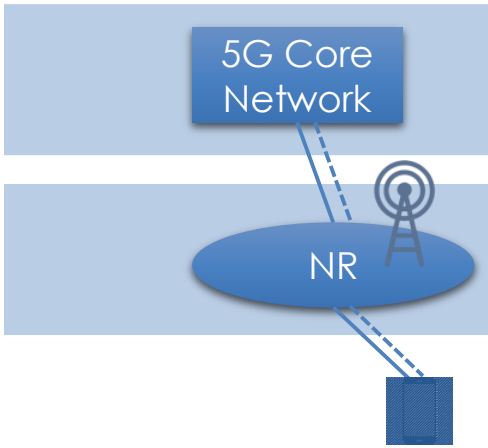


5G MOBILE TECHNOLOGY



- ✓ **High bandwidth**: 10Gbit/s per user
- ✓ **Low latency**: 4ms for eMBB, 1ms for URLLC
- ✓ **Density**: 1 000 000 devices per km^2
- ✓ **Flexible connection**: >10K nodes Full-Mesh data connection
- ✓ **High spectral efficiency**: up to 30bit/s/Hz (downlink)
- ✓ **Mobility**: stationary to <500km/h
- ✓ **Energy efficiency**

5G TRANSPORT NETWORK REQUIREMENTS



✓**New Core** – Service-based architecture, C/U separation, Network slicing

✓**New Radio** – new frequencies, new waveforms, massive MIMO, CA, CoMP

✓**New Transport** – 5G needs a new network infrastructure

Bandwidth	**Flexibility**	**Latency**	**Sync**	**Availability**	**Net Slicing**
50/100G Access, n*100/200G Aggregation and n*200/400G Core	Flexible traffic/flow scheduling and direction, e.g. eX2 traffic, URLLC etc.	Low latency, e2e < 1ms latency requirement	Stringent time sync requirement (65ns to ±1.5μs)	Transport network availability + uRLLC targets	Independent e2e logical networks over shared physical infrastructure

Cost & Efficiency To support network densification, huge traffic volume etc.

5G REQUIRES NEW TRANSPORT NETWORK

Mobile network densification leads also to **densification of the transport network**

Variety of services, wide range of requirements, network slicing, etc.

Drives to overall **growing transport network complexity**

?

Fewer subscribers per base station, low ARPU – requires **low cost of transport** per port (per base station)

New Transport Network

Needs more efficient, more flexible and more scalable **new networking technology**

+

Requires **wide use of SDN** for automation, orchestration, dynamic network

Technology to Adopt 5G # SDN and NFV

NFV pulls network functions out of boxes and turns them into pieces of software that operate as needed within the cloud.

NFV & SDN are key enablers of the coming 5G infrastructure. NFV will help to virtualize various appliances in the network.

While SDN will decouple network control & forwarding functions

In 5G, NFV will enable network slicing—a virtual network architecture aspect that allows multiple virtual networks to be created atop a shared physical infrastructure.

In 5G, SDN & NFV will also enable distributed cloud, quickly respond to network changes.

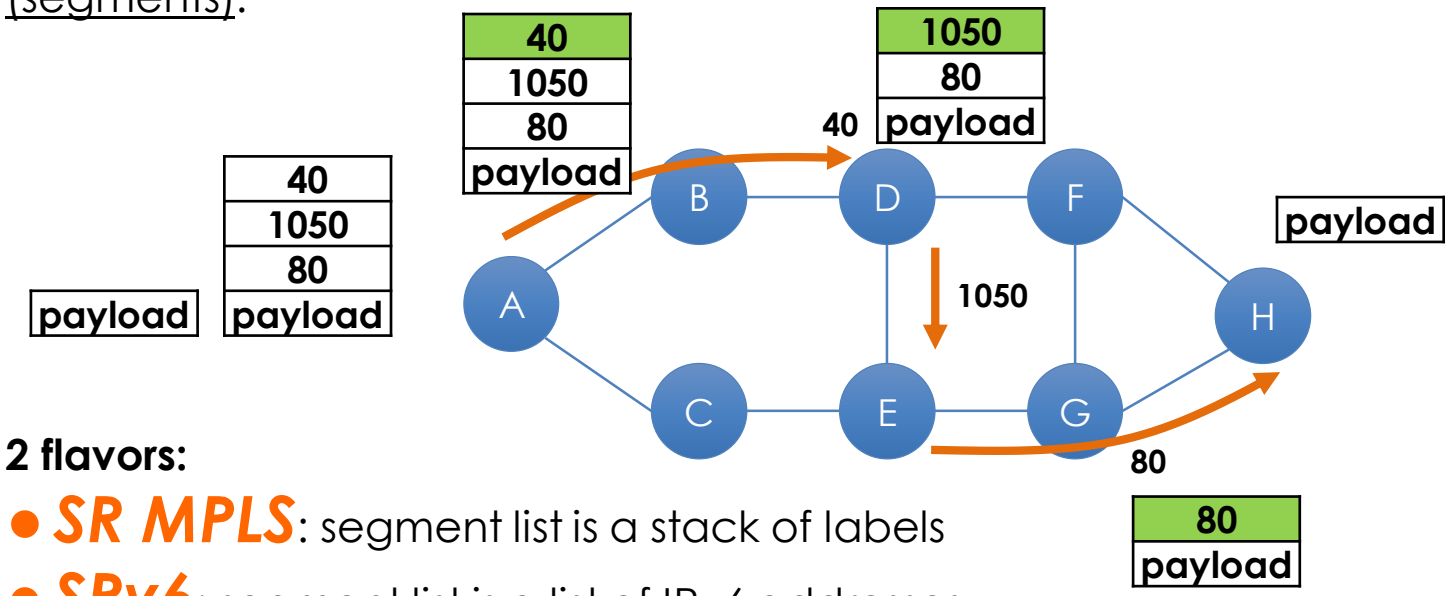
Create flexible and programmable networks for the needs of tomorrow.

Network Infrastructure leveraging Network Functions Virtualization (NFV) and Software Defined Networking (SDN) at the core, transport and edge of the network

NEW NETWORKING TECHNOLOGY: SEGMENT ROUTING

Segment Routing – a tunneling mechanism based on source routing paradigm

a route is defined at a source node as an ordered list of instructions (segments):



2 flavors:

- ***SR MPLS***: segment list is a stack of labels
- ***SRv6***: segment list is a list of IPv6 addresses in SRH of IPv6 header

Simple

- Stateless network, state only at network edge
- Removes protocol stack complexity
- Easy e2e path control

Scalable

- Does not require path signaling
- The network fabric is stateless
- Removes LDP, RSVP-TE limitations

Great match to SDN

- The controller needs to instruct only a source node
- Segment list – a network program
- Benefits of global network view are easily applied to SR (PCE)

IETF®

Standardization in IETF: Segment Routing, SPRING (Source Packet Routing In NetworkinG)

NEW NETWORKING TECHNOLOGY: SEGMENT ROUTING

Segment Routing – is a key networking technology to facilitate SDN implementation in transport networks

The controller needs to instruct only a source node (not all nodes in the path)

Segment list – a network program, a match to software nature of SDN

40
1050
80
payload

Great network scalability

Fast convergence

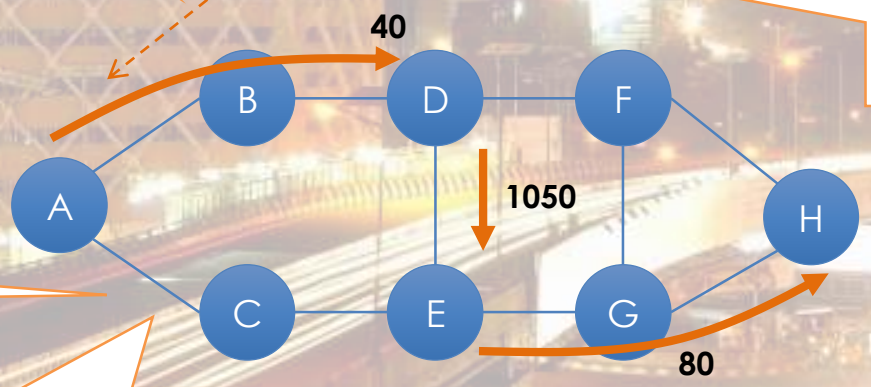
SDN Controller PCE

- Global network view
- Centralized service-aware PCE
- Open APIs

Automation of network operation and service provisioning

Multi-domain operation with e2e service orchestration

Immediate service setup (no signaling in between nodes)



SDN-BASED TRANSPORT FOR 5G

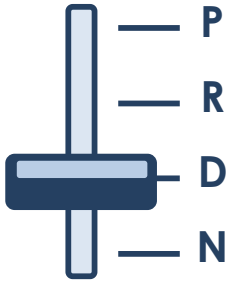
Service orchestration

Network on Demand

- BoD:
  - Schedule/Time-based
  - Dynamic (APP/API-driven)
- Dynamic QoS
- Policy*
- SLA*

Automation:

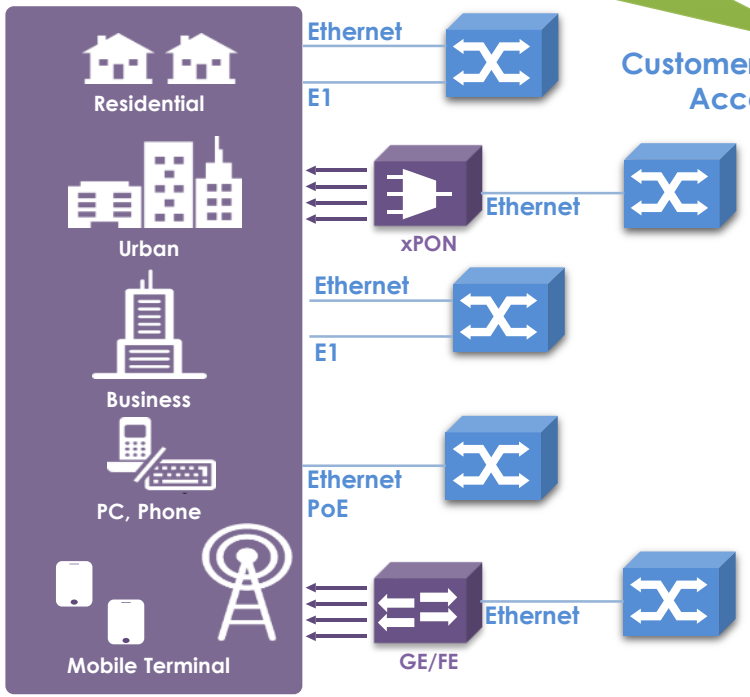
- PCE
- Auto E2E service ordering and provisioning
- Zero-touch installation
- Auto restoration protection
- Network data analytics



Automation

L2/L3 VPN/SR

E2E service provisioning across multiple network segments



Based on Open source software platform

API

- Towards user: for service self-ordering and self-management. Portal and app-based.
- Towards network: for network resources and services orchestration

SPN (SLICING PACKET NETWORK)

Key Technologies for NEXT GEN Network

Segment Routing (SR):
- Source routing technology
- SR-TP and SR-BE

01

Flex Ethernet (FlexE):
- TDM tunnel and SE-XC
- Various MAC rates

02

Synchronization:
- Sync over packet network
- PTP & SyncE

04

SDN Controller
- Global network view
- Service agility
- Automation

03

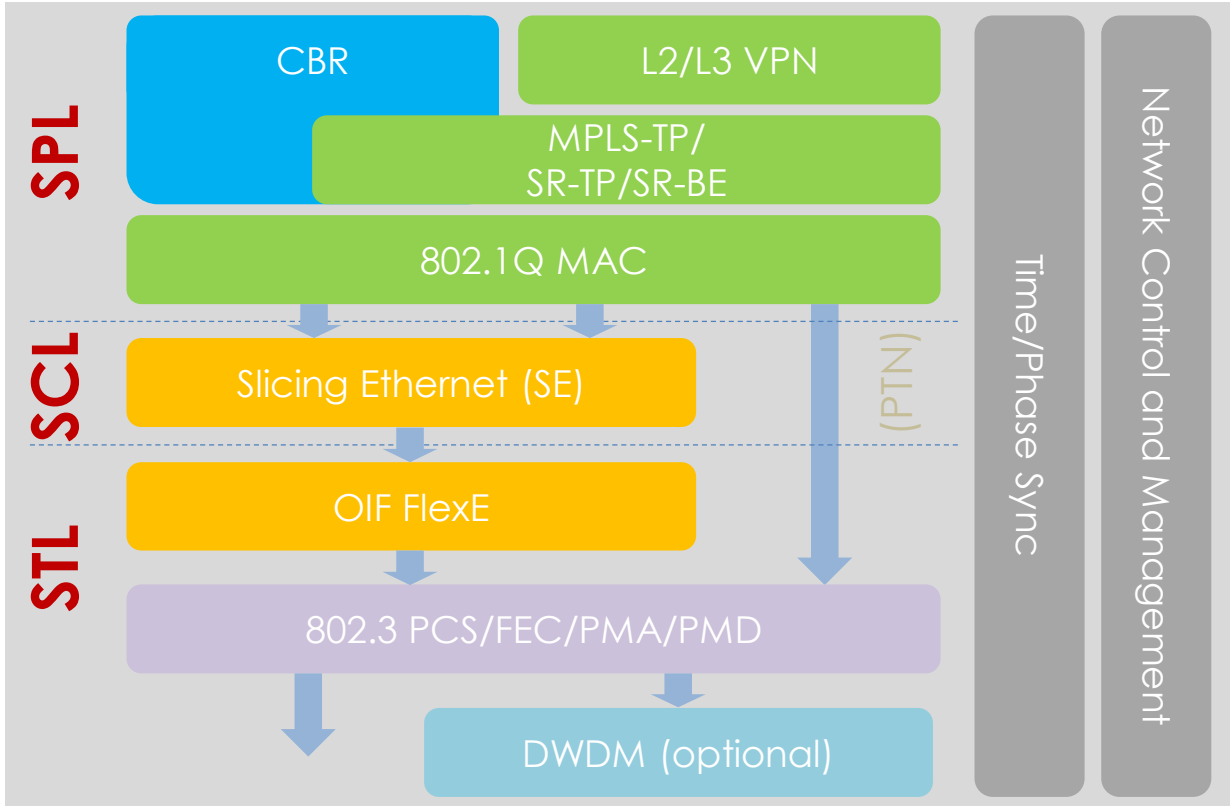
SDN

SPN
Slicing Packet Network

- SDN, Segment Routing SR-TP, FlexE and WDM to build a new transport network for 5G
- Evolve to 50/100GE access, 100/200G aggregation and 200/400G core

SPN ARCHITECTURE

- **SPL (Slicing Packet Layer)**: Packet forwarding and routing, support Segment Routing and MPLS-TP
- **SCL (Slicing Channel Layer)**: Slicing Ethernet supports 66B-block cross-connection & e2e channel layer OAM
- **STL (Slicing Transport Layer)**: compatible with Ethernet Phy and optionally support DWDM.



- ✓ SPN architecture and mechanisms: G.ctn5g, G.mtn
- ✓ Segment Routing standards
- ✓ SR-TP: spring-mpls-path-segment, pce-sr-path-segment
- ✓ Ethernet standards
- ✓ FlexE standards: Flex Ethernet 2.0 Implementation Agreement

SPN ARCHITECTURE

Variety of Services

- L2 VPN (E-LINE/VPWS, E-LAN/VPLS, E-TREE/VPLS
- L3VPN (IPv4/IPv6)
- CBR (Constant Bit Rate)

Slicing Ethernet

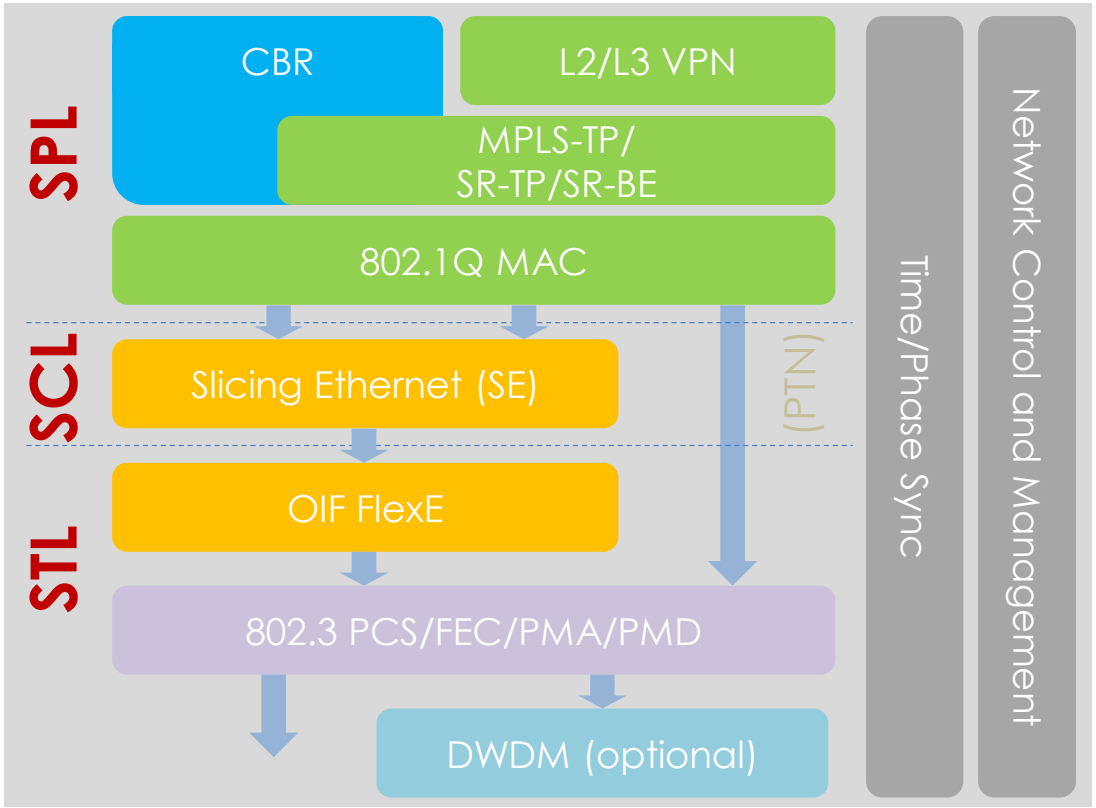
- Extra-low latency cross connect
- Network slicing

FlexE

- Great flexibility and performance
- Variety of MAC rates with 5GE granularity

Ethernet

- Standards compliant Ethernet incl. 100/200/400GE
- Interoperability



DWDM Integration

- Cost effective transport
- Large bandwidth & distance

Strong Tunneling Mechanisms

- SR-TP
- SR-BE
- MPLS-TP

SDN Integration

- Unified control and management
- Centralized PCE
- Automation

Excellent Sync

- Extra-high accuracy up to 5ns per node!

OAM & Protection

- Multi-layer OAM
- Sub 50ms protection

SKYFLUX PLATFORM

01 Segment Routing (SR)

02 Flex Ethernet (FlexE)

PERFORMANCE AND FLEXIBILITY READY TO MEET 5G CHALLENGES

04 Synchronization

03 NETWORK SDN Controller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Thank you !