Telecom Infrastructure Sharing Best Practices.

ITU Regional Workshop on Cost Models for Data Services and International Internet Connectivity

Dr Rajkumar Upadhyay,
Chief Executive officer
Centre for Development of Telematics (C-DOT)

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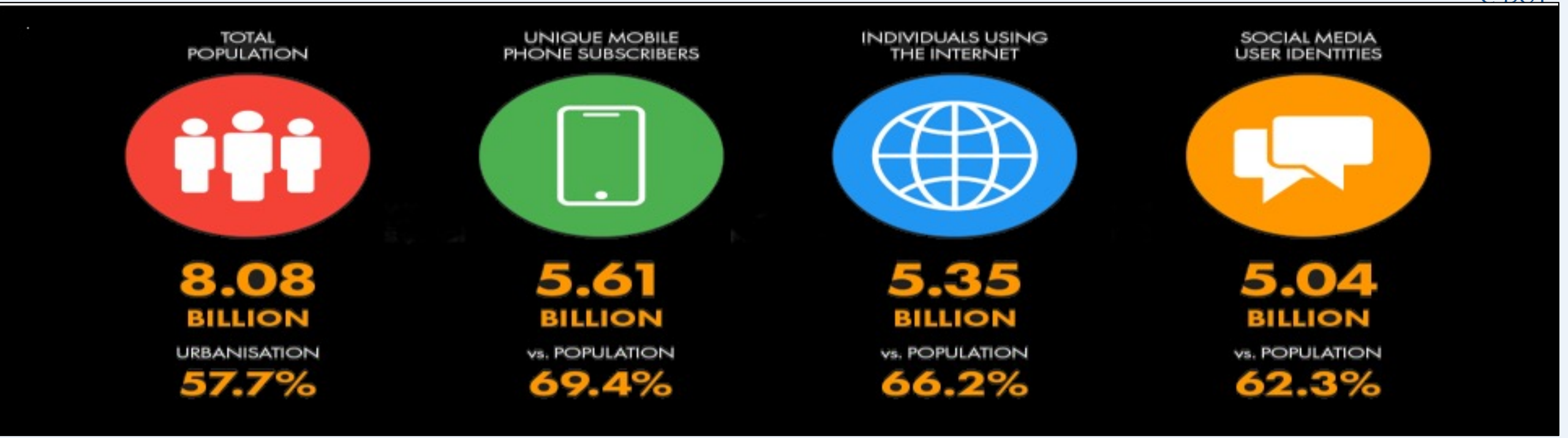
The World is Going Digital



* *As of January 2024 - Source : DataReportal*

- Digital Economy makes up 15% of the global GDP and Will grow tremendously and contribute 30% to the global GDP and 30 million jobs by 2030. (*source*: *Digital Cooperation organization, World Bank)*
- The global digital payment market is expected to grow manifold by 2025. In India alone During the month of March 2023, UPI accounted for 12.2 billion financial digital transactions with a total value of 18410.83 billion Rupees (220.7 Bn US$) (*source*: *NPCI)*

Factors Aiding Digital Growth

- High speed mobile networks like 4G, 5G and WiFi-6
- Growing Penetration of Smartphones among Masses
- Secured Telecom infrastructure

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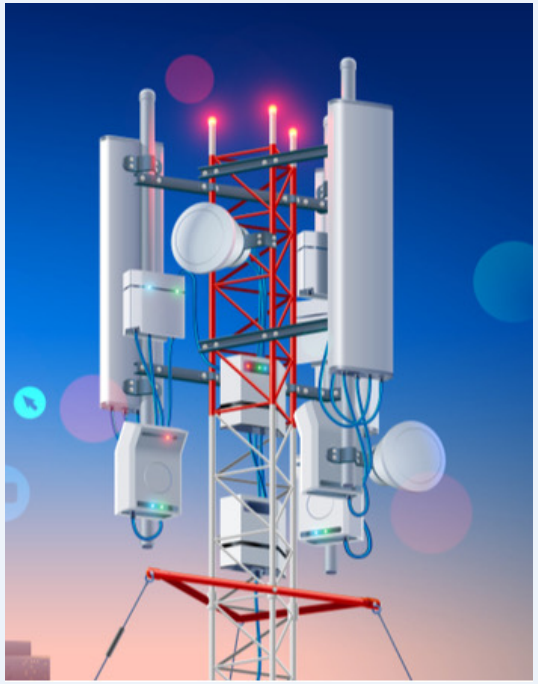
Major Enabling Factor

- Robust Infrastructure
- High Speed Internet
- 24*7 Data Availability

Infrastructure Sharing

Strategic arrangement where multiple operators share and utilize physical network components, such as towers, antennas, base stations, network components etc. to provide wireless/Data services.

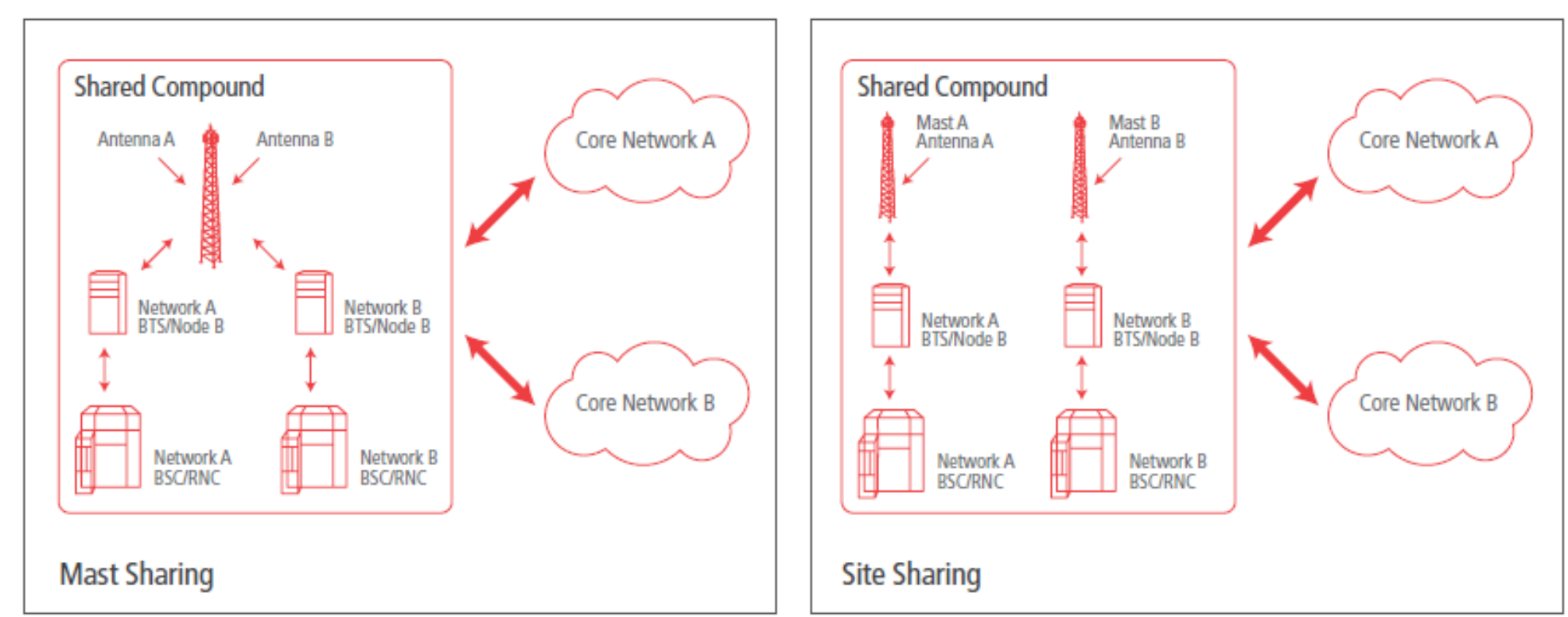


Key Benefits

- ✓ Expand network coverage
- ✓ Reduction in Costs (CAPEX and OPEX)
- ✓ Reduction in the environmental impact of otherwise redundant infrastructure
- ✓ Improvement in Quality of Service (QoS)
- ✓ Services provided to more Consumers and underserved areas
- ✓ Faster collaborative rollout of new technologies like 5G.

Example: *In areas with low population density, individual operators may find it financially unfeasible to deploy their own network infrastructure. Sharing resources, will help in collectively expand coverage and provide services*

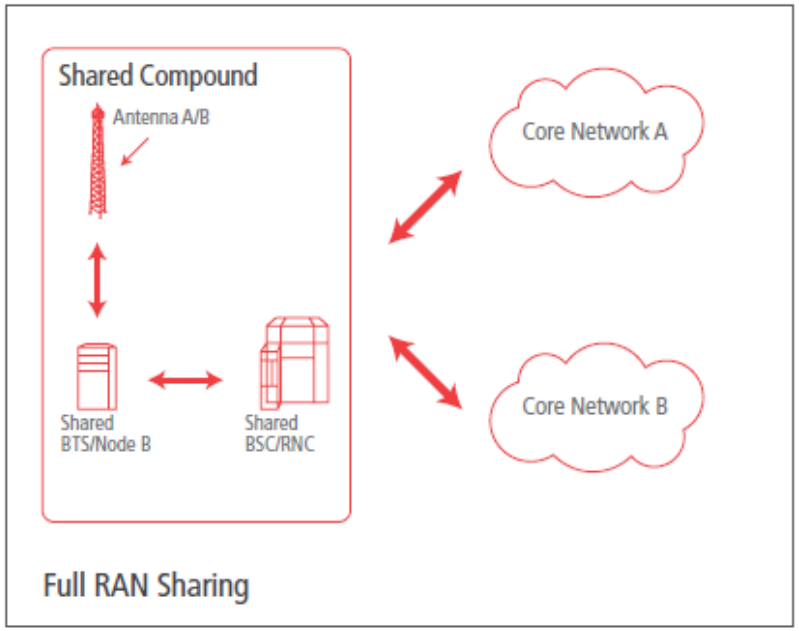
Passive Mobile Infrastructure Sharing

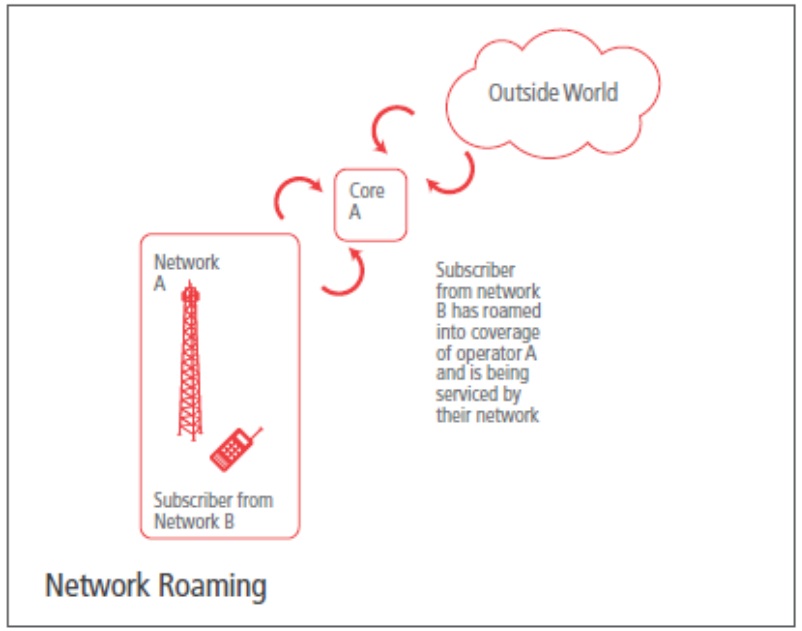


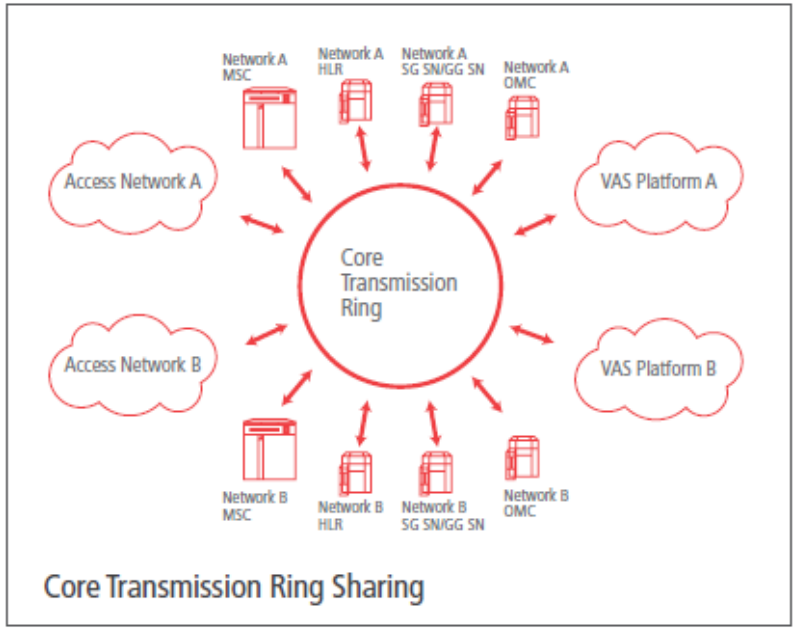
- Passive Infrastructure Sharing: Sharing physical elements of the network that don't actively process or transmit signals. Examples include towers, poles, ducts, and shelters.
- Operators can avoid redundant construction efforts, reduce site acquisition and maintenance costs, and minimize environmental impact.

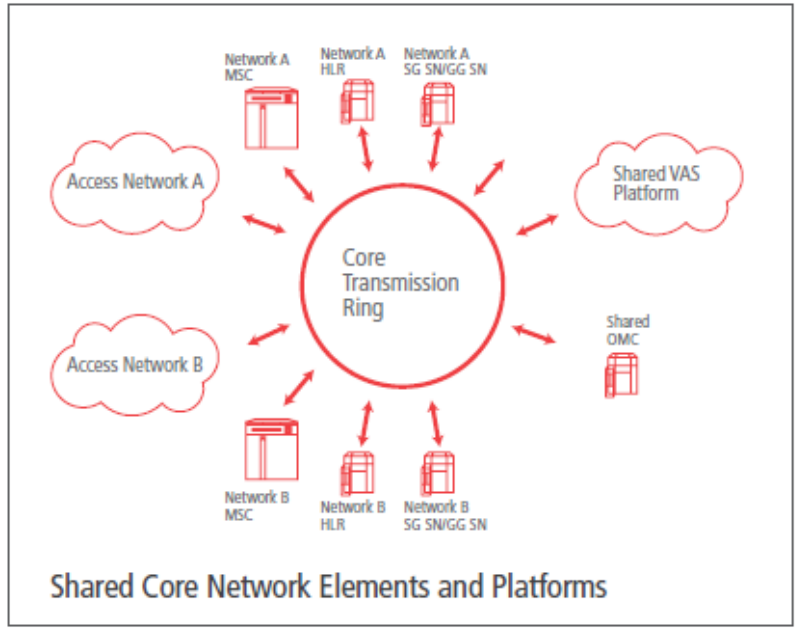
Source : GSMA Telecom Infrastructure Sharing

Active Mobile Infrastructure Sharing









- **Active Infrastructure Sharing:** sharing network equipment and components that actively transmit and process signals.

- This includes sharing of base stations, Radios-BTS/eNodeB, gNodeB etc), transmission equipment, and backhaul networks.

Figure : GSMA Telecom Infrastructure Sharing

Multi Operator RAN, Core

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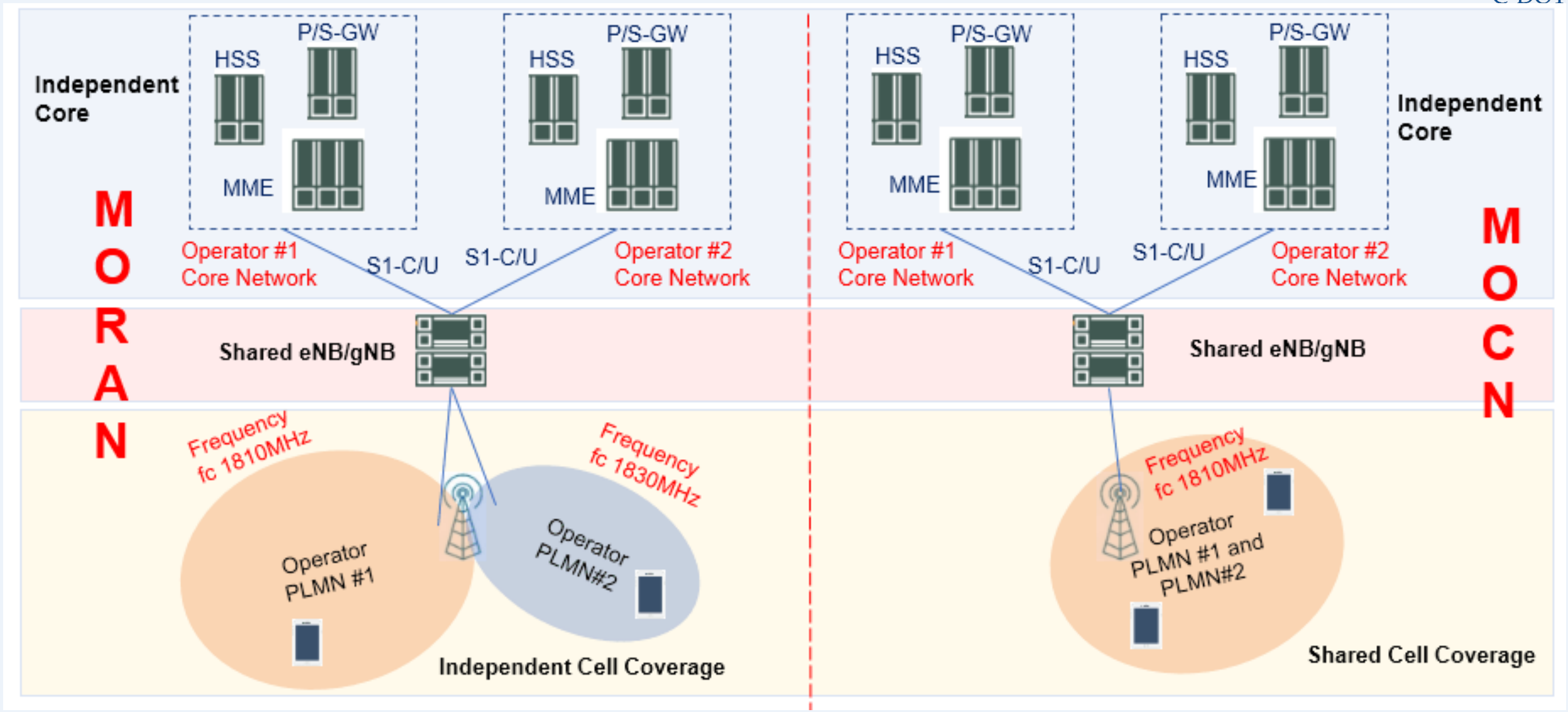
❖ MORAN (Multi-operator RAN):

- ✓ Infrastructure sharing by enabling multiple operators to share RAN elements.
- ✓ Standard architecture where the eNBs/gNBs etc. are shared, while the core network is proprietary to each network provider.
- ✓ With MORAN everything in the RAN (antenna, tower, site, power) except the radio carriers (frequency) is shared between two or more operators.
- ✓ Dedicated radio frequencies assigned to each Provider. Each carrier is independently configured and managed.

❖ MOCN (Multi-operator core network):

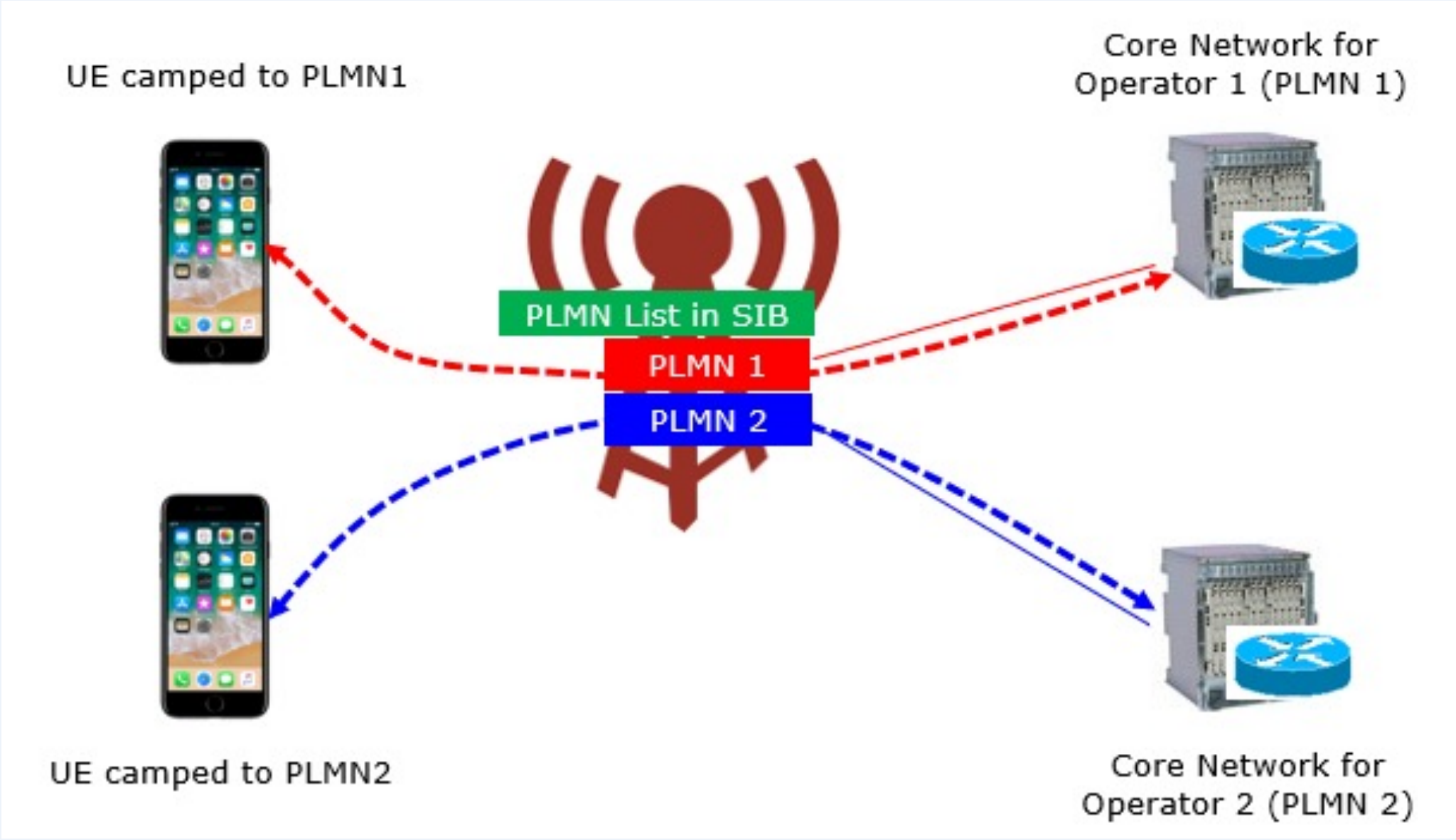
- ✓ A form of RAN sharing where two or more core networks share same Radio Access network and a carrier (Also frequency sharing in addition to RAN sharing).
- ✓ One or more carriers are configured for frequency sharing. Operators share their cells - physically and logically; in each cell, multiple Public Land Mobile Networks (PLMNs) are broadcasted
- ✓ MOCN is used when an operator A has a spectrum license, and the other operator does not have a spectrum license but would like to use the spectrum of operator A.

Understanding MORAN, MOCN



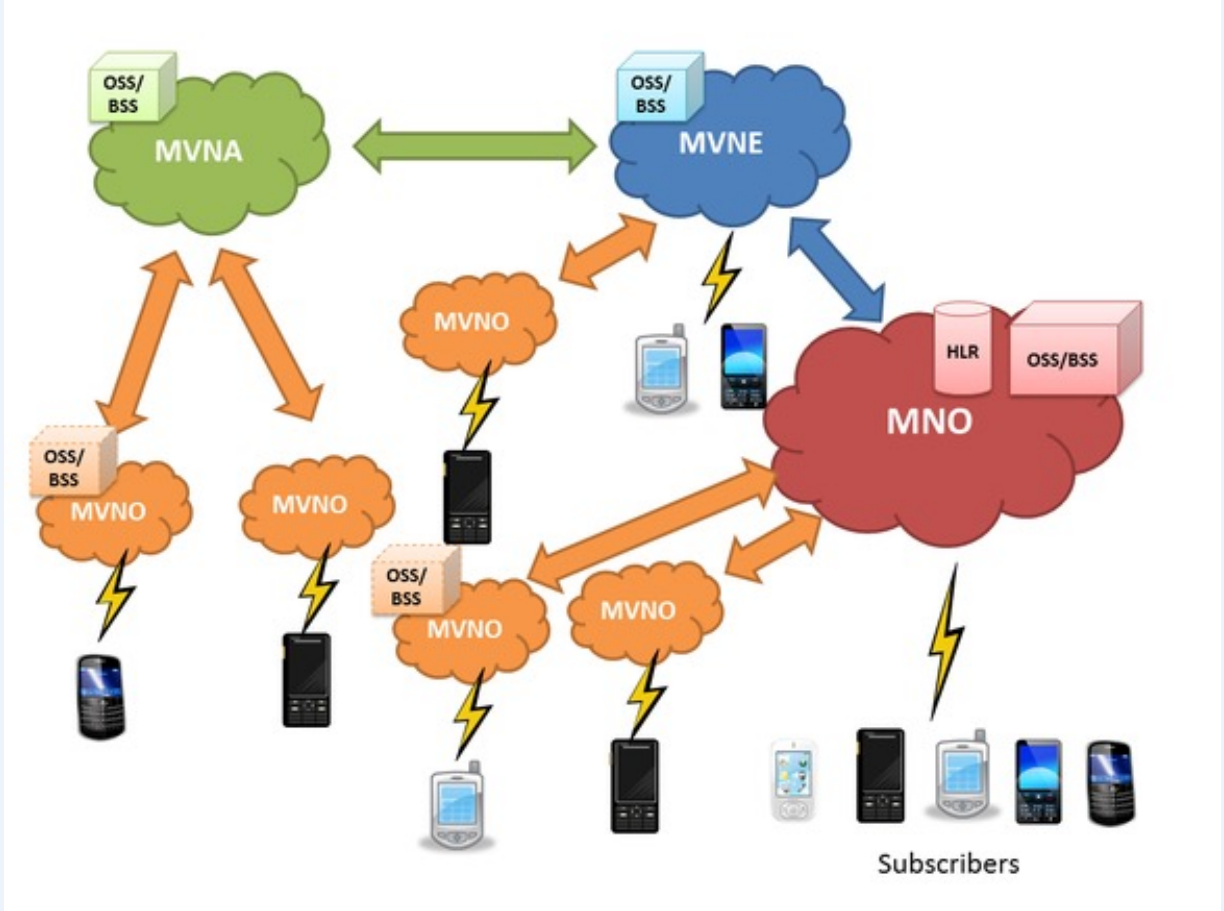
Source : GSMA

MOCN


UE camped to PLMN1
Core Network for Operator 1 (PLMN 1)
PLMN List in SIB
PLMN 1
PLMN 2
UE camped to PLMN2
Core Network for Operator 2 (PLMN 2)

Mobile Virtual Network Operator

- The MVNO model allows virtual operators to offer mobile services without owning network infrastructure.
- MVNOs lease network capacity from traditional MNOs.
- Utilizes existing network infrastructure, avoiding substantial capital investment.
- MVNOs don't have to deal with the significant infrastructure and operational costs associated with running a wireless network, whether it's fourth-generation (4G) or fifth generation (5G). Eg: they don't need to pay for radio frequency spectrum licenses and construct and maintain cell towers and other network hardware.
- Promotes competition, expands consumer choice, and potentially lowers service costs.



Spectrum Sharing

❖ **Spectrum Sharing** : Multiple users or services to share the same frequency band within the radio frequency spectrum.

- ✓ Traditionally, spectrum allocation has been based on exclusive licensing.
- ✓ With increasing demand and limited availability, there's need of spectrum resource through sharing.
- ✓ **Dynamic Spectrum Sharing (DSS)** optimizes the use of available spectrum. Enables opportunistic access to spectrum bands that are not being used by their primary license holders at a particular time and location.
- ✓ Cognitive radio technology is often used in DSS systems to detect and exploit available spectrum opportunities while minimizing interference to licensed users.
- ✓ **Licensed Shared Access (LSA)**: LSA allows licensed spectrum holders to share their allocated spectrum with other users or services under specific conditions.
- ✓ **Reduced Costs and Efficient Resource Utilization**
- ✓ **Usage of legacy networks (e.g., 2G, 3G) alongside 4G/5G**. As revenues decline for legacy networks, sharing infrastructure helps operators maintain service quality while minimizing costs. (New Service Operators can share legacy networks with existing players.)

Dynamic Spectrum Sharing (DSS)

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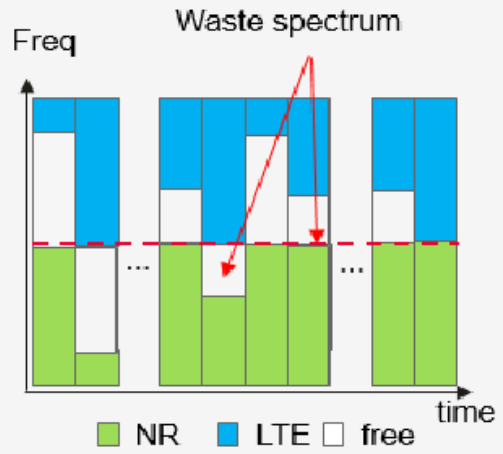
Static Refarming, Waste Spectrum

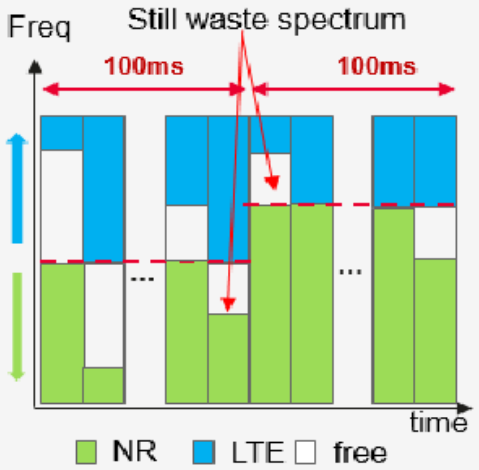


Spectrum Allocation
NR: 50%
LTE: 50%

VS

100ms DSS, Still Waste Spectrum

Dynamic allocate spectrum in 100ms unit



Spectrum Allocation

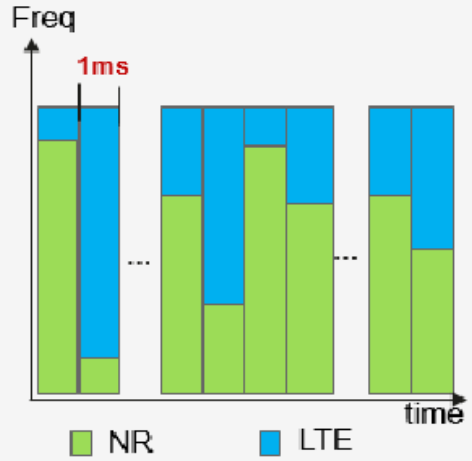
1st 100ms
NR: 50%
LTE: 50%

2nd 100ms
NR: 75%
LTE: 25%

VS

1ms DSS, Maximize Spectrum Utilization

Dynamic allocate spectrum resource based on LTE/NR real time traffic

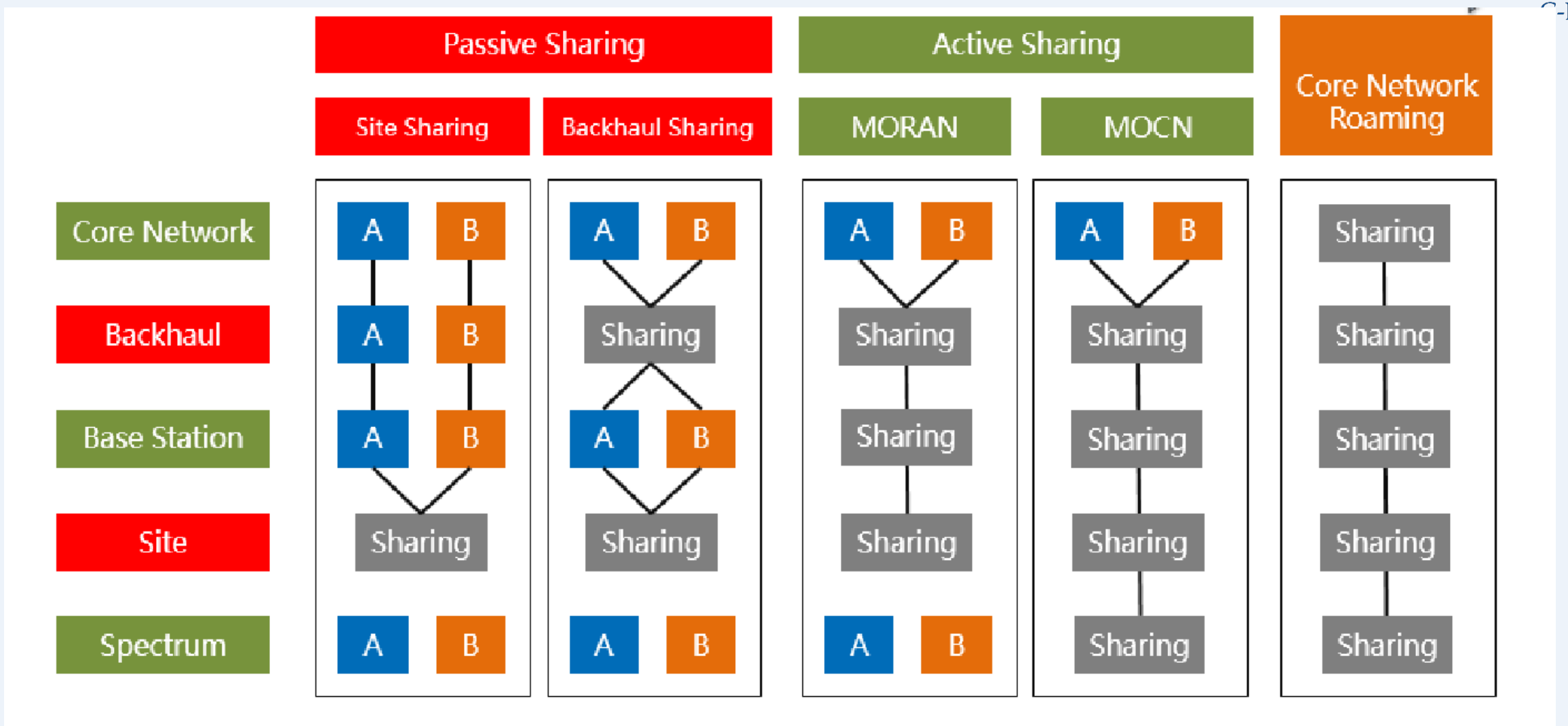


DSS: Dynamic Spectrum Sharing

- With the DSS technology, 5G networks can be rapidly deployed without affecting 4G user experience, effectively improving spectrum efficiency and meeting different service requirements of both 4G and 5G users

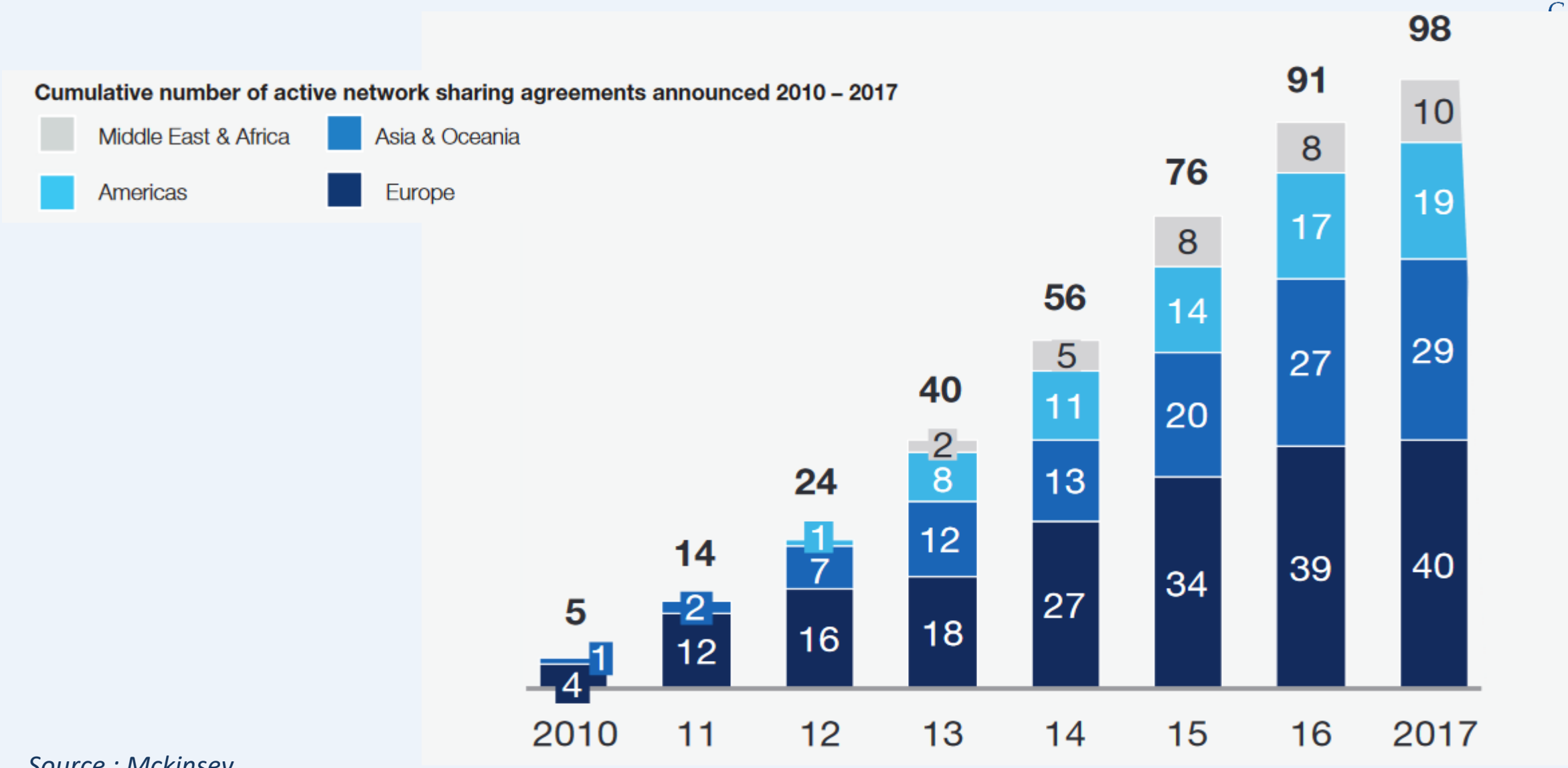
Source : GSMA

Network Resource Sharing Model



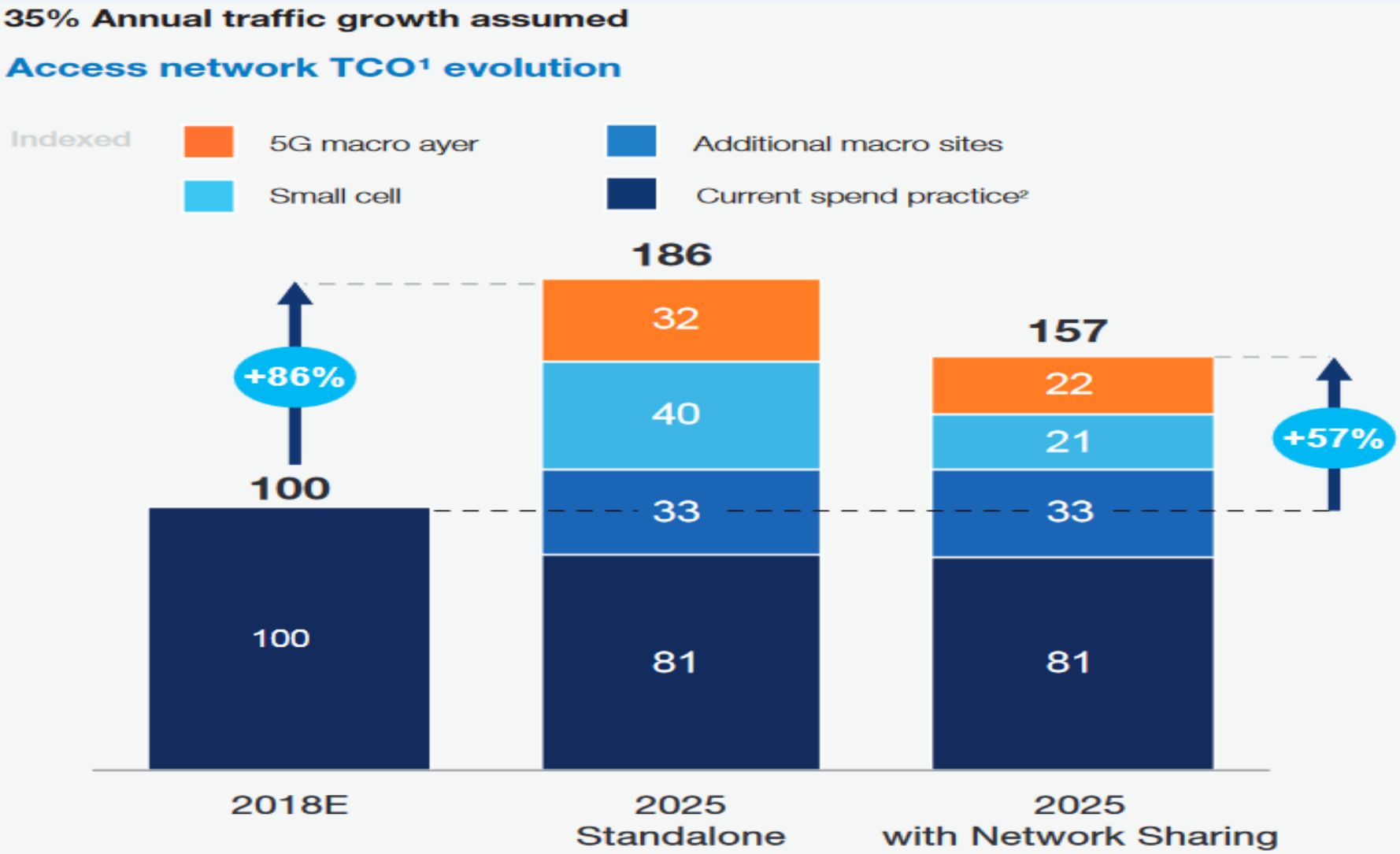
Source : GSMA

Global Trend : Sharing becoming more common



Source : Mckinsey

Expected Cost Reduction by 40% in 5G networks



Network sharing is a lever that can reduce ~40% the cost of 5G related access network domains (small cells and 5G macro layer)

Source : Mckinsey

Infrastructure Sharing : Best Practices

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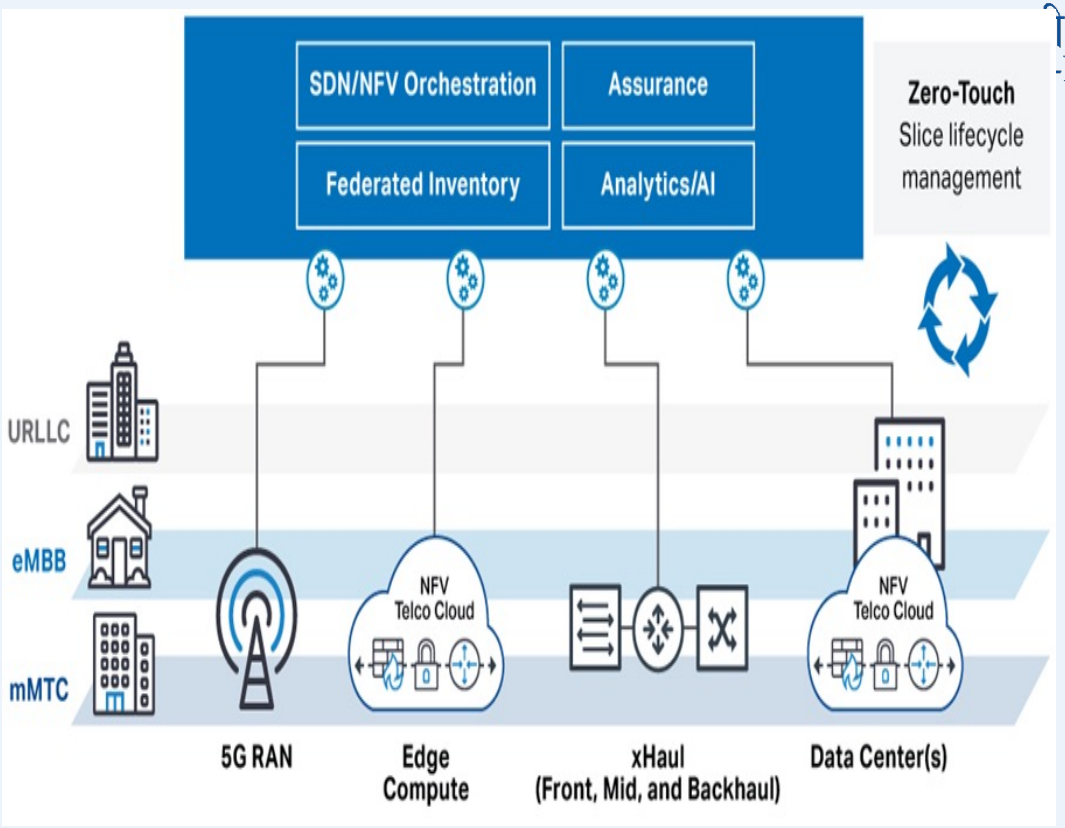
❖ Some Best Practices for Efficient Network Infrastructure Sharing:

- ✓ Adoption of Cloud Native Architecture
- ✓ Radio Access Network Slicing (RAN-Slicing)
- ✓ Usage of Radio Access Network Analytics (RAN-Analytics)
- ✓ Radio Access Network Optimization
- ✓ Cloud Radio Access Network (RAN) Sharing
- ✓ Usage of Self Optimizing Networks for optimum Resources Utilization

Cloud RAN and RAN-Slicing

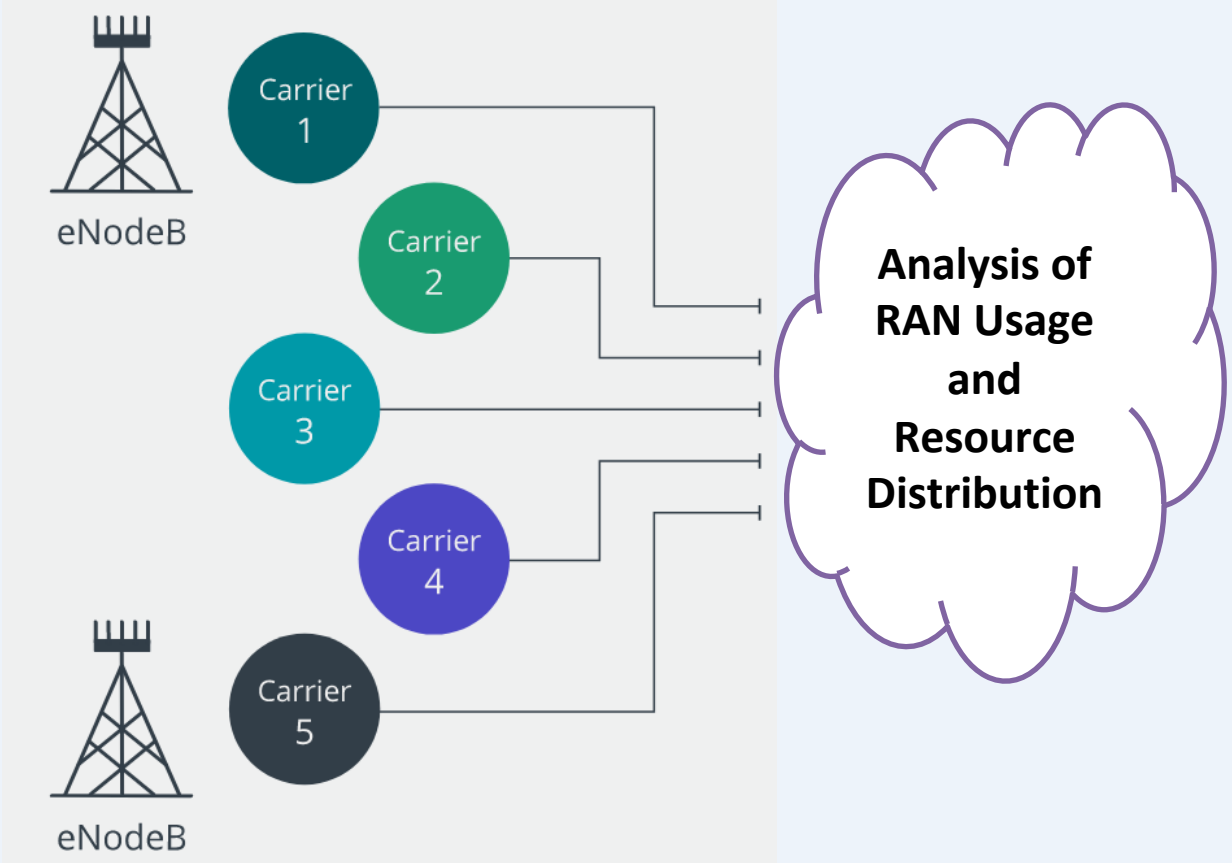
- Adoption of a **Cloud-native RAN Architecture**, that leverages the advantages of cloud computing, such as scalability, flexibility, automation, and resilience.
- Cloud RAN reduce capital and operational expenditures, as well as simplify network management
- Cloud-native RAN also enables open and interoperable interfaces and components, which can reduce vendor lock-in and increase innovation.



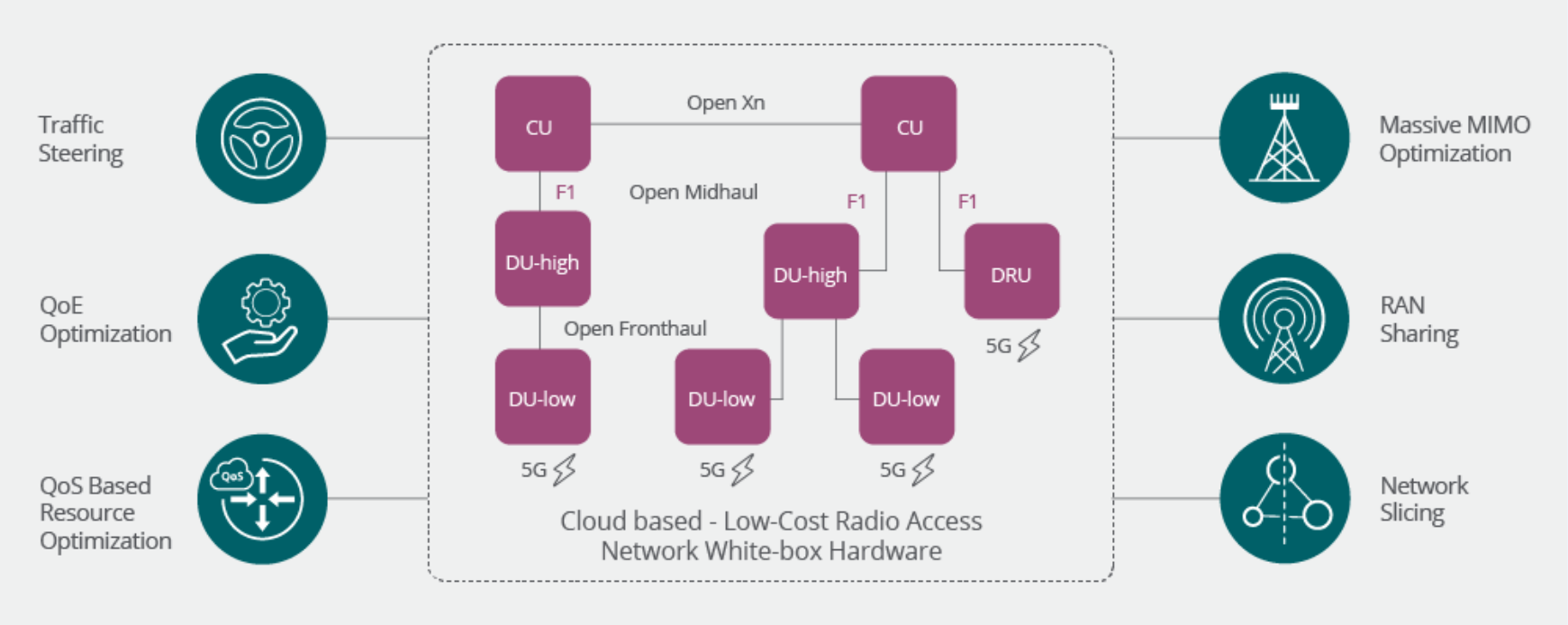
- **RAN Slicing**: Ability to create and manage multiple logical networks on the same physical infrastructure, each with different service levels and characteristics.
- RAN slicing can help optimize network utilization and performance, as well as offer customized and differentiated services to different customers and applications.
- Reduce network complexity and overhead.

Best Practices: Implement RAN Analytics

- **Analytics**: Analytics tools collect and analyse data from the RAN to optimize network performance, predict failures, and identify opportunities for improvement.
- Use of RAN data and artificial intelligence to monitor, analyze, and improve network behavior.
- RAN analytics can help gain insights into network status, trends, and issues, as well as identify and solve problems before they affect customers.
- RAN analytics can also help automate network operations and maintenance, as well as optimize network planning and design.
- Sharing anonymized analytics data between operators and vendors facilitates collaborative optimization efforts, enhances network efficiency,



Best Practices : RAN Optimization and Sharing



- **RAN optimization:** Improving the quality and efficiency of the network by using techniques, such as load balancing, interference management, traffic shaping, and power control.

✓ enhance network capacity and coverage,

✓ reduce network congestion and latency.

- **Adopt Cloud RAN sharing** which is the collaboration between operators to share resources, such as spectrum, sites, equipment, and backhaul typically hosted on a cloud infrastructure

✓ reduce network deployment and operation costs, increase network quality.

Self-Optimizing Networks

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Dynamically adjusting and enhancing network performance without human intervention

Self-Optimizing Networks contributes to efficient infrastructure sharing using predictive AI for optimum resources allocation between multiple operators. This results in :

- **Improved Efficiency**: SON algorithms continuously monitor network conditions and traffic patterns, optimizing parameters like signal strength, bandwidth allocation, and routing configurations in real-time, leading to more efficient resource utilization

- **Enhanced Quality of Service (QoS)**: Automatically minimizes issues such as dropped calls, slow data speeds, and network congestion, leading to a better user experience for all stakeholders.

- **Cost Optimization**: Reduce CAPEX by efficiently utilizing existing infrastructure and resources, infrastructure sharing for all parties involved

- **Dynamic Adaptation to Changes**: Dynamic allocation of resources with fluctuating demands and network conditions. Adapt in real-time ensures that the network remains resilient and responsive to changes, maintaining optimal performance under varying circumstances.

Conclusion

- Telecom infrastructure sharing helps operators to improve efficiency, reduce costs, and accelerate network deployment by sharing network infrastructure between multiple operators.
- It also helps in expanding network coverage, Improvement in Quality of Service (QoS) and reduction in the environmental impact of otherwise redundant infrastructure
- Sharing Infrastructure between operators is **increasing globally at a good rate** and helps achieve overall **cost reduction of up to 40% in tech like 5G.**
- In 5G Era and beyond with adoption of technologies like cloud Infra and usage of AI, **it will become less complex** for operators to share infrastructure and maintain Healthy SLAs
- **Adopting cloud-native technologies will** enable network programmability, automation, and efficient orchestration of services
- Using Self optimizing networks would result in Dynamic allocation of resources with fluctuating demands and network conditions in real-time.
- Using **Dynamic Spectrum Sharing, RAN Slicing , RAN Optimization** would result in in even more efficient Infra Sharing between operators.

Thank You

Centre for Development of Telematics (C-DOT),
Ministry of Communications, Govt of India,
C-DOT Campus, Mandi Road, Mehrauli Delhi -110030
Website: www.cdot.in