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Gigabit ++

With Wired and Wireless Convergence

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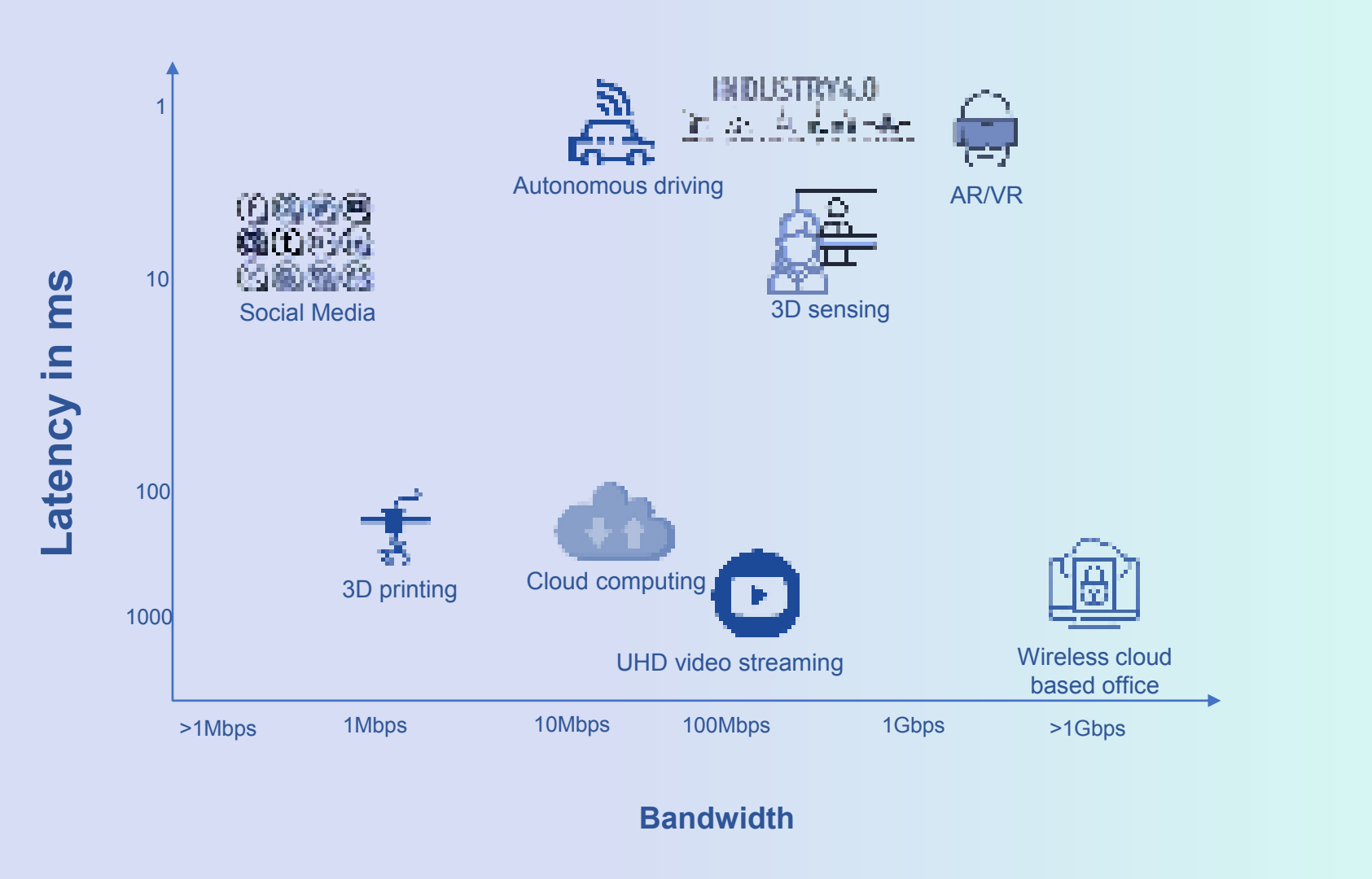
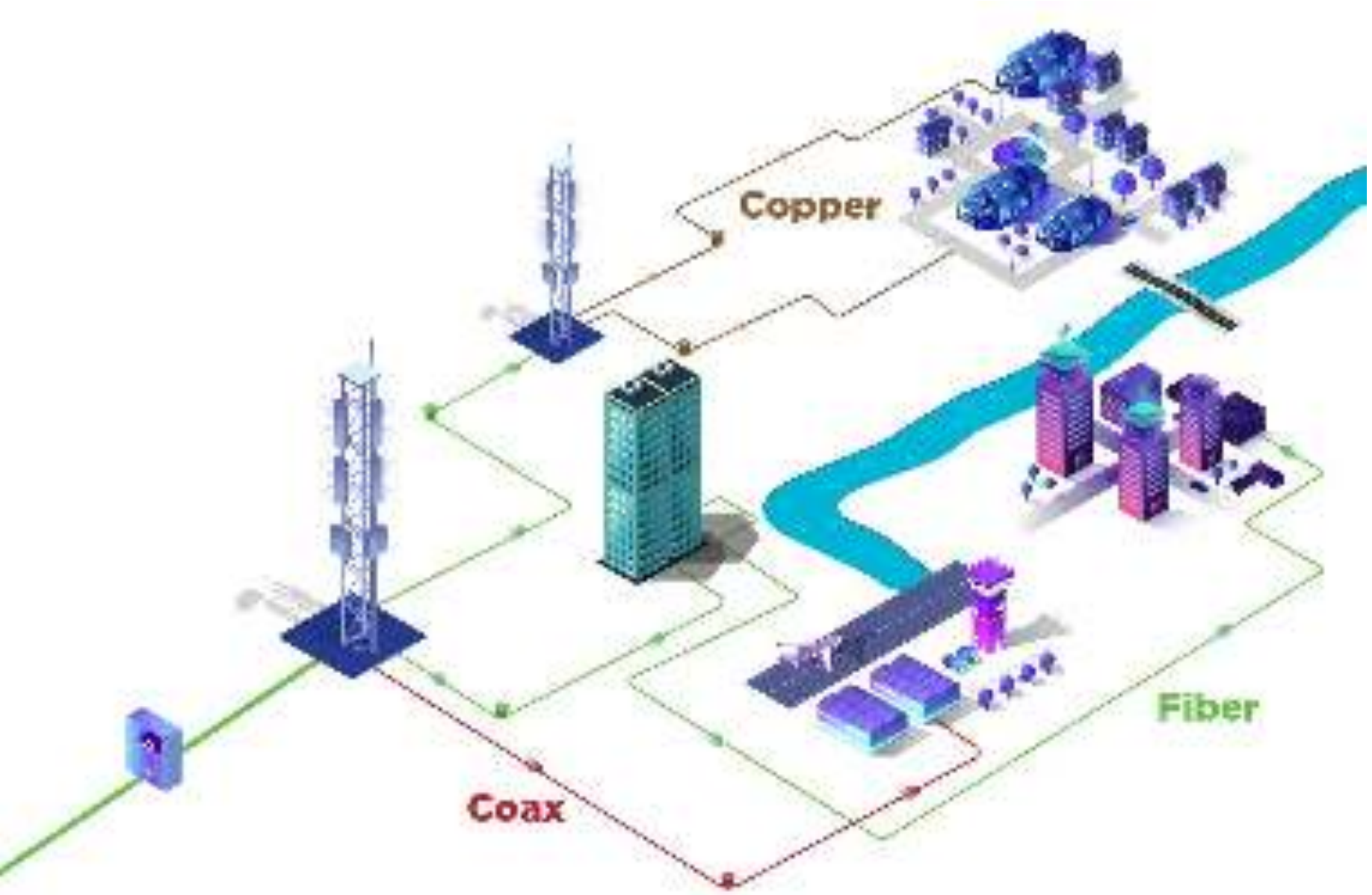
Head of Wireless Broadband Converged Platforms

5G is coming with great Gigabit applications



Endpoints today have Megabit network



Network infrastructure is mixed

- Copper cable
- Coaxial cable
- Fiber
- Wireless

As demand grows

GIGABIT Network

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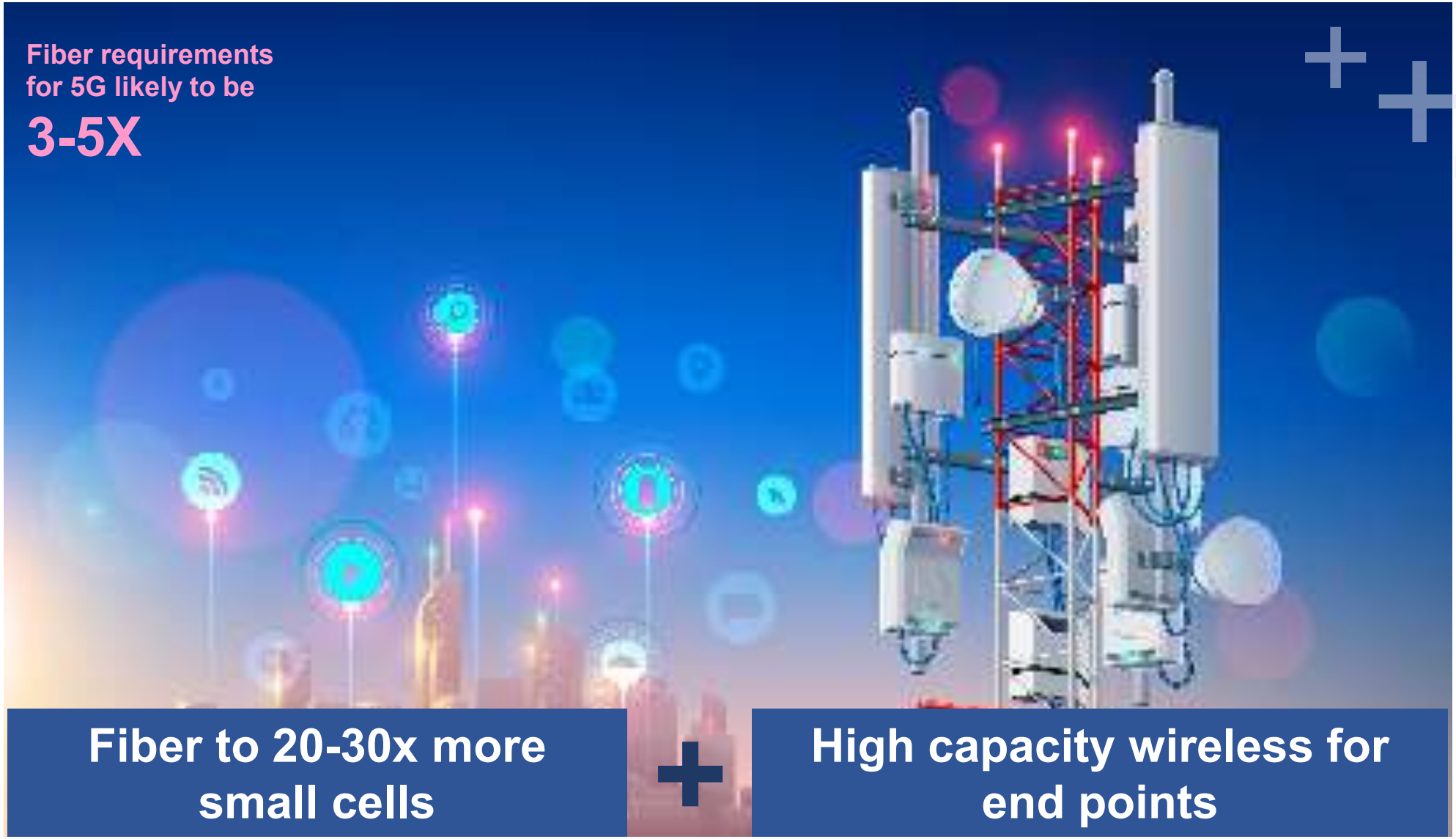
Gigabit network needed at each end point

5G is the solution to enable Gigabit connectivity at end points



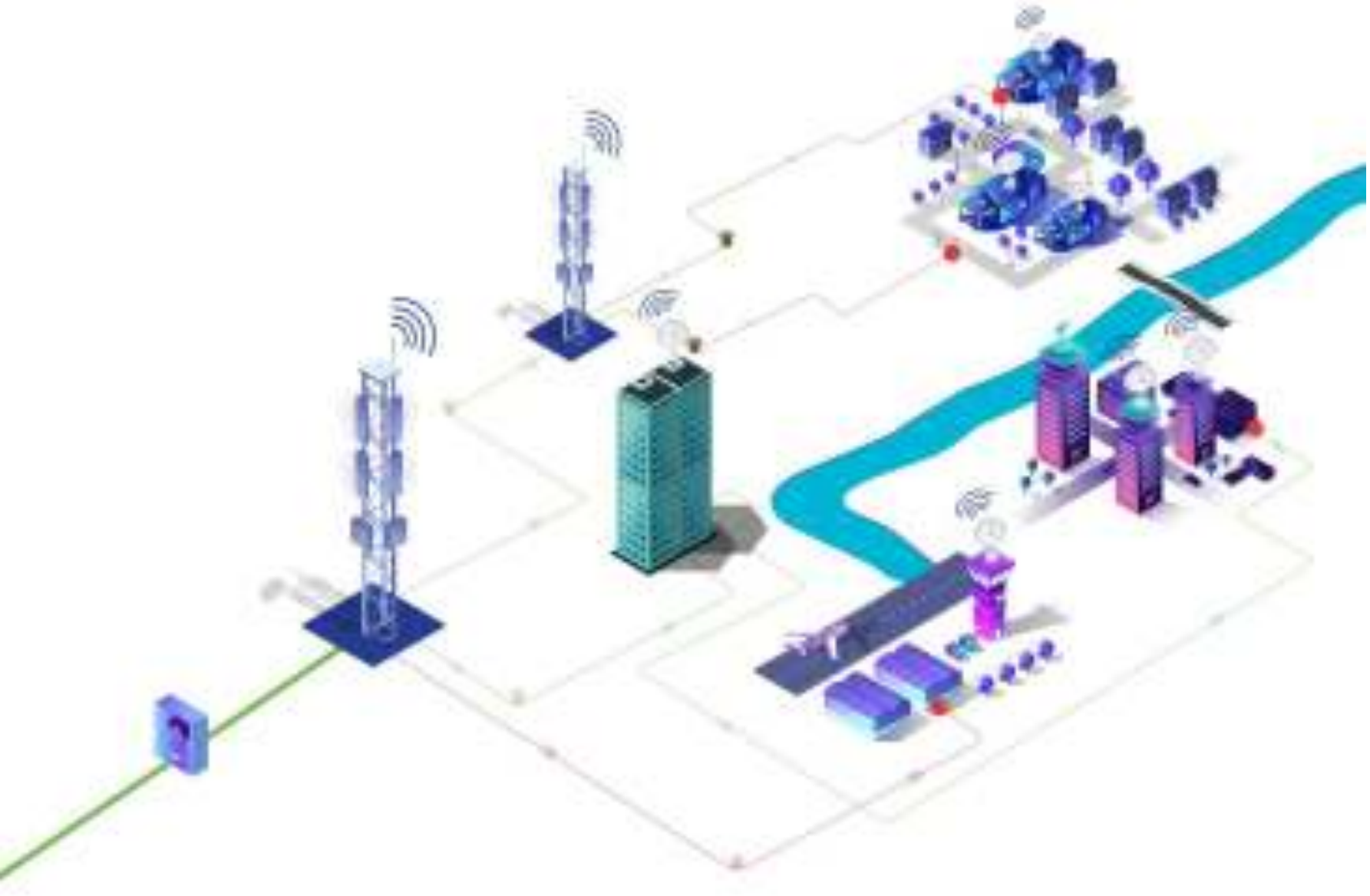
However, wired connection have their challenges

Tough Terrain

ROW Permits for Trenching

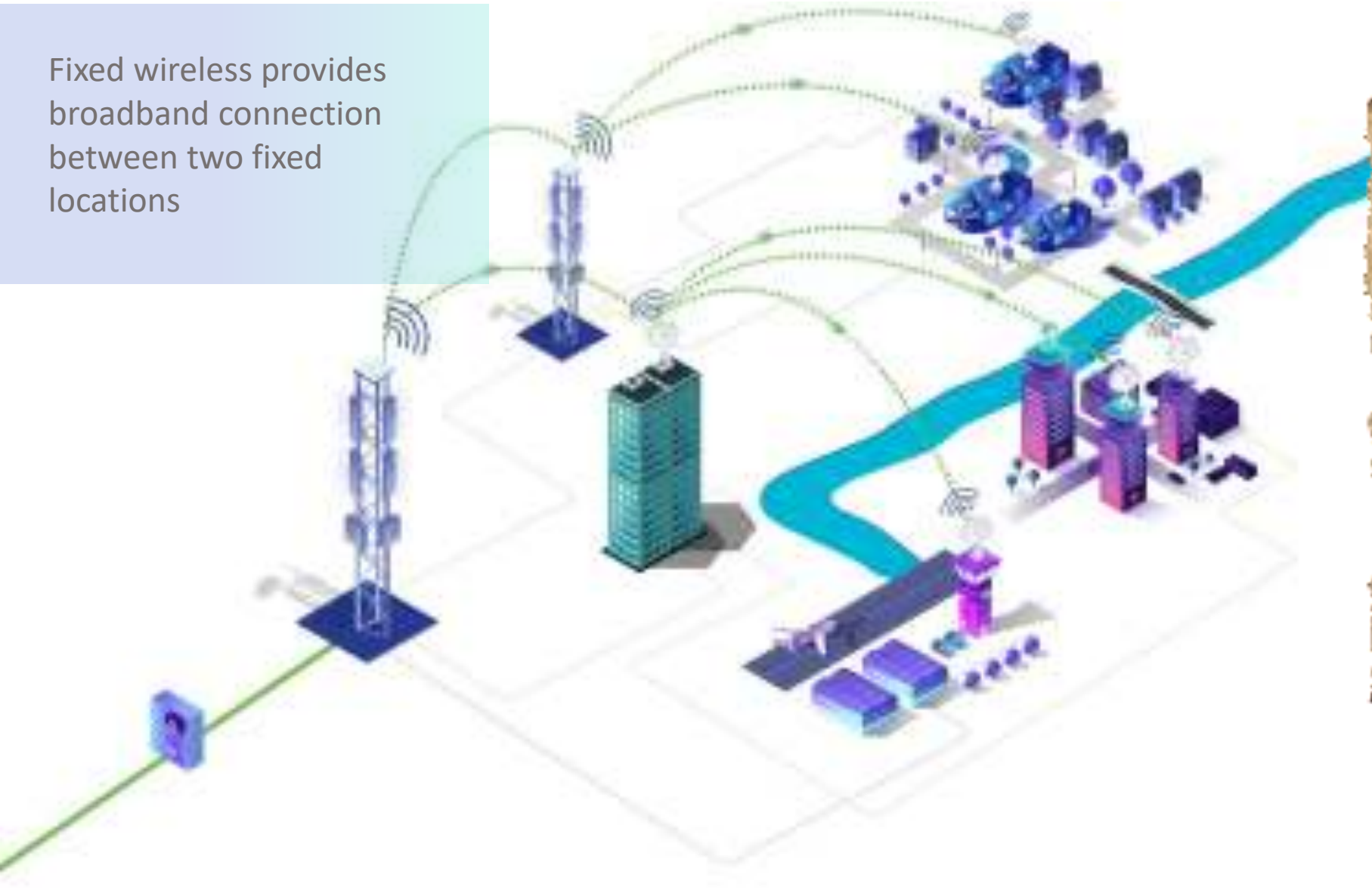
Slower Time to Market

Gigabit network needed at each end point



Enter Fixed Wireless: a must have tool in your network toolbox

Fixed wireless provides broadband connection between two fixed locations



ONE CONVERGED NETWORK

Diverse use cases for Fixed Wireless

Between Cell Towers

Enterprises

Rural Areas

High Density Venues

Hospitals

High Footfall Areas

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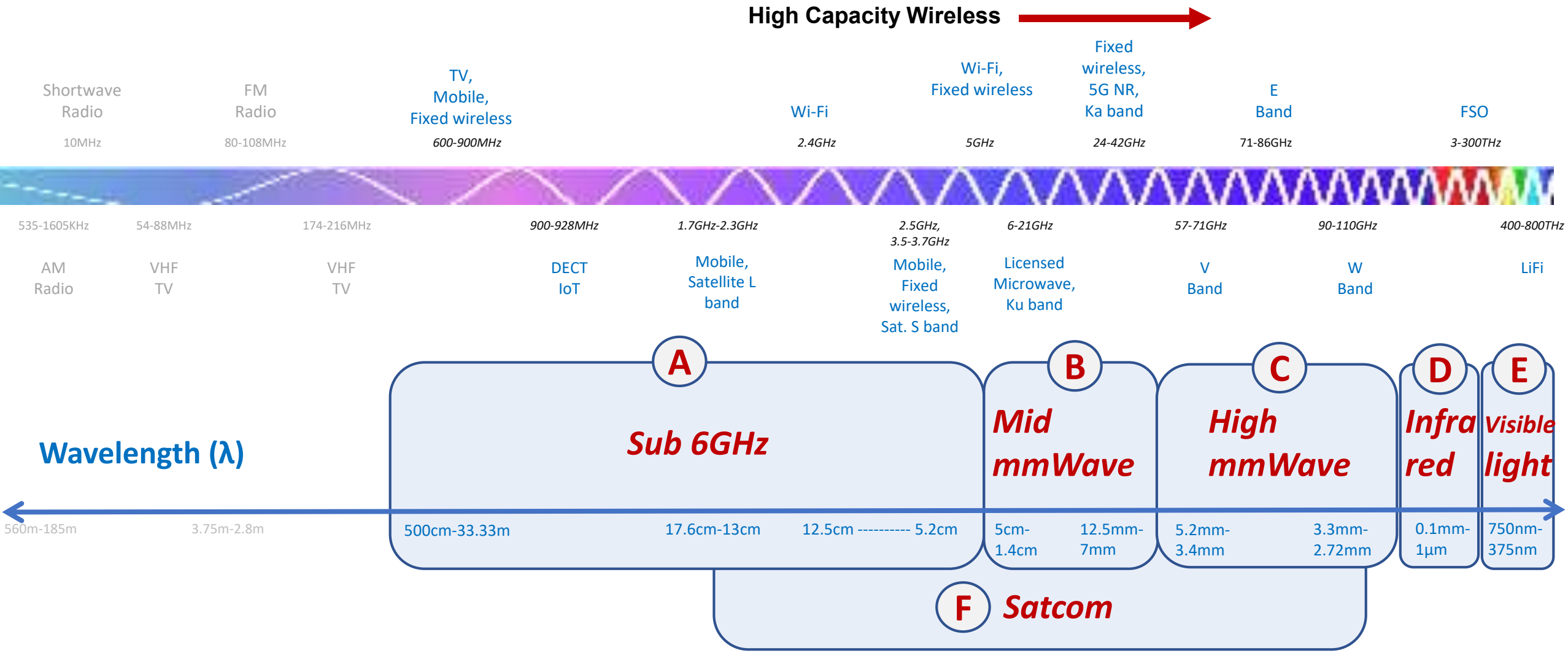
So, how should an operator implement a converged network?

1. **Choose the right wireless tech***
2. Design a great “ One Converged Network”

** In addition to the best wired technology - fiber*

Fixed wireless has many spectrum choices



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We suggest, you ask the right questions

CLARITY

Whether the maximum throughput or data capacity carried over the fixed wireless link – yield of the wireless link meets the requirements for that deployment use case

Whether the total cost of ownership that includes any spectrum acquisition cost (as applicable), equipment cost, utilities, maintenance, OA&M justifies the expected ROI vis. a vis., fiber roll out

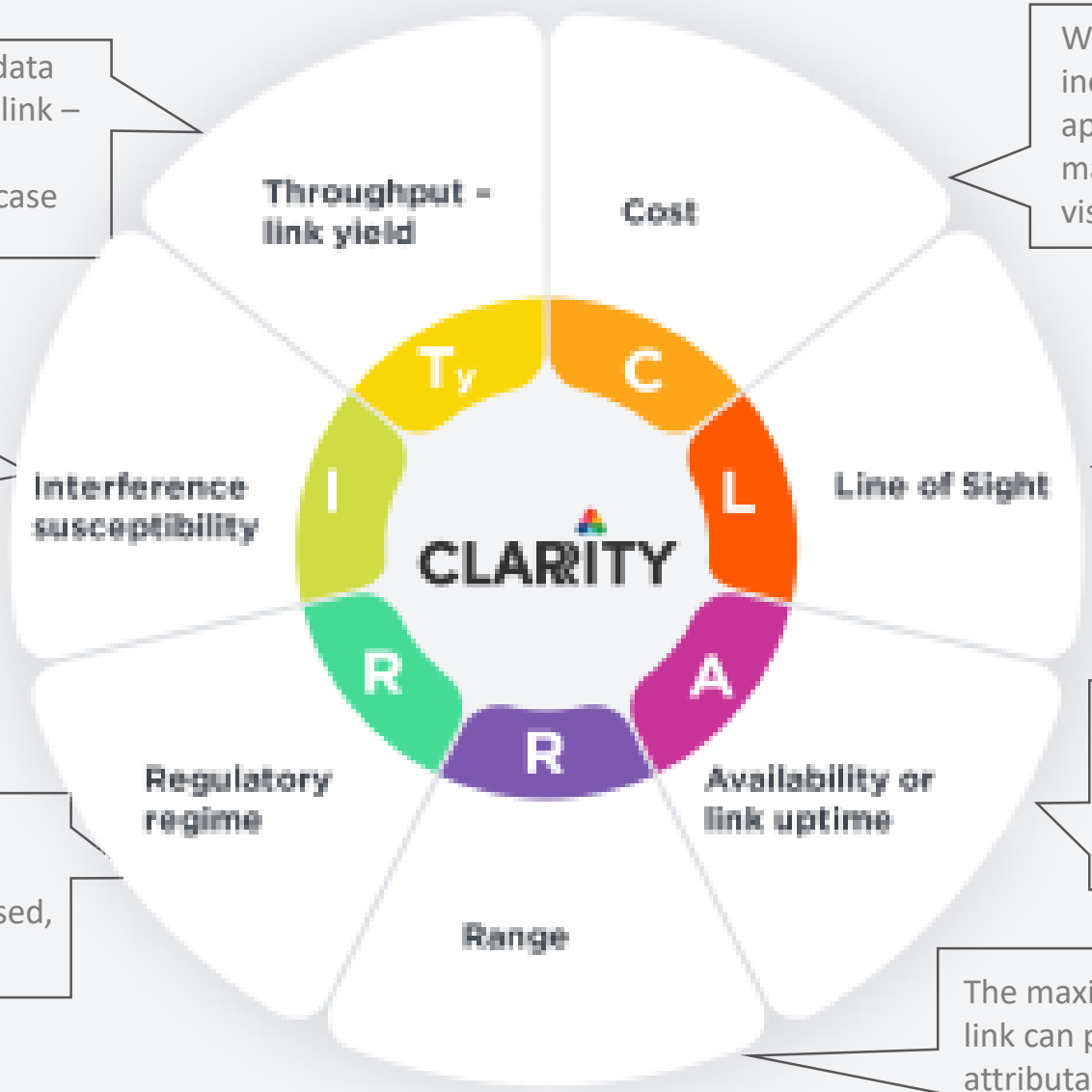
Whether the fixed wireless technology is susceptible to interference

Whether a clear unobstructed straight line view between the transmit and receive nodes is possible

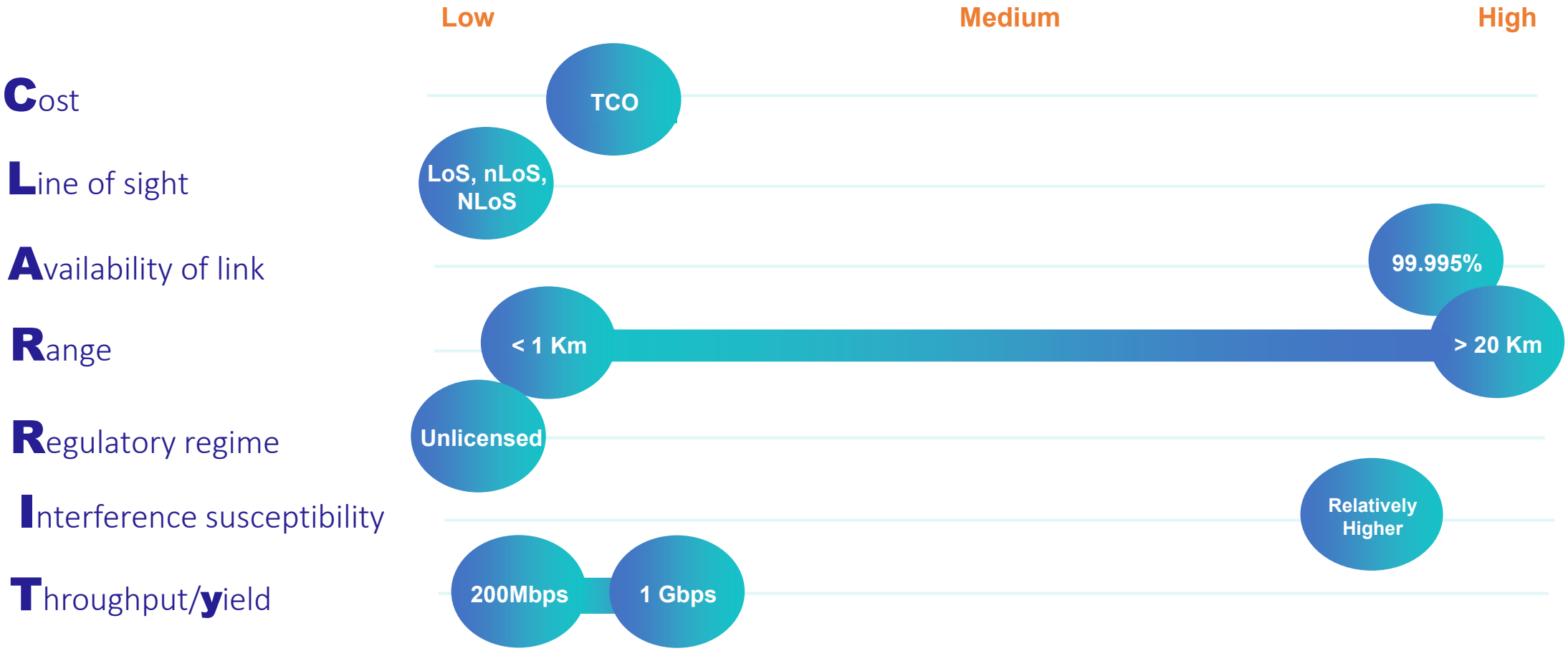
Whether the measured as a percentage of uptime of the fixed wireless link meets the minimum requirement for the specific deployment use case

Spectrum regulation local to the region/country specifying right of use of RF spectrum. Typically, licensed, unlicensed, lightly licensed or shared

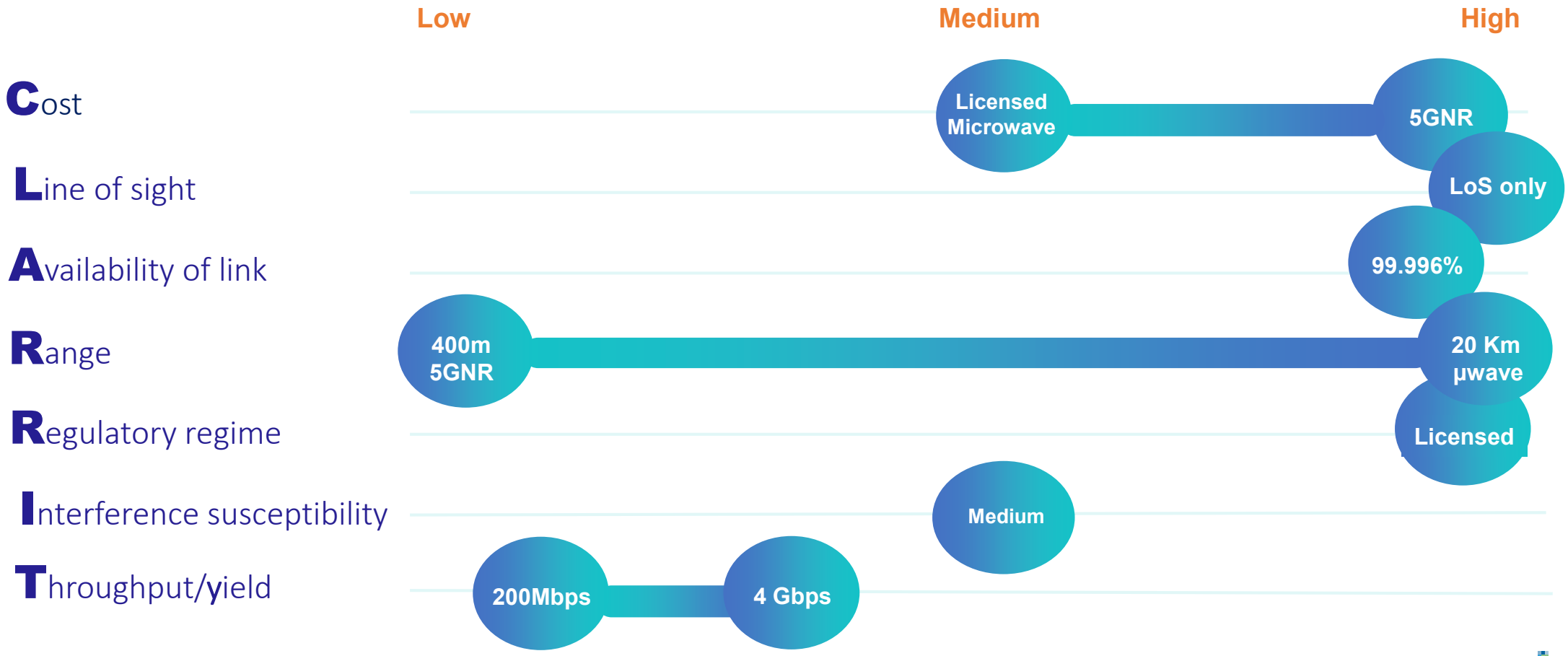
The maximum link distance at which a fixed wireless link can provide required sustained throughput attributable to the technology/bandwidth



Sub 6GHz: Predominant use of unlicensed spectra



Mid mmWave: Predominantly licensed spectra

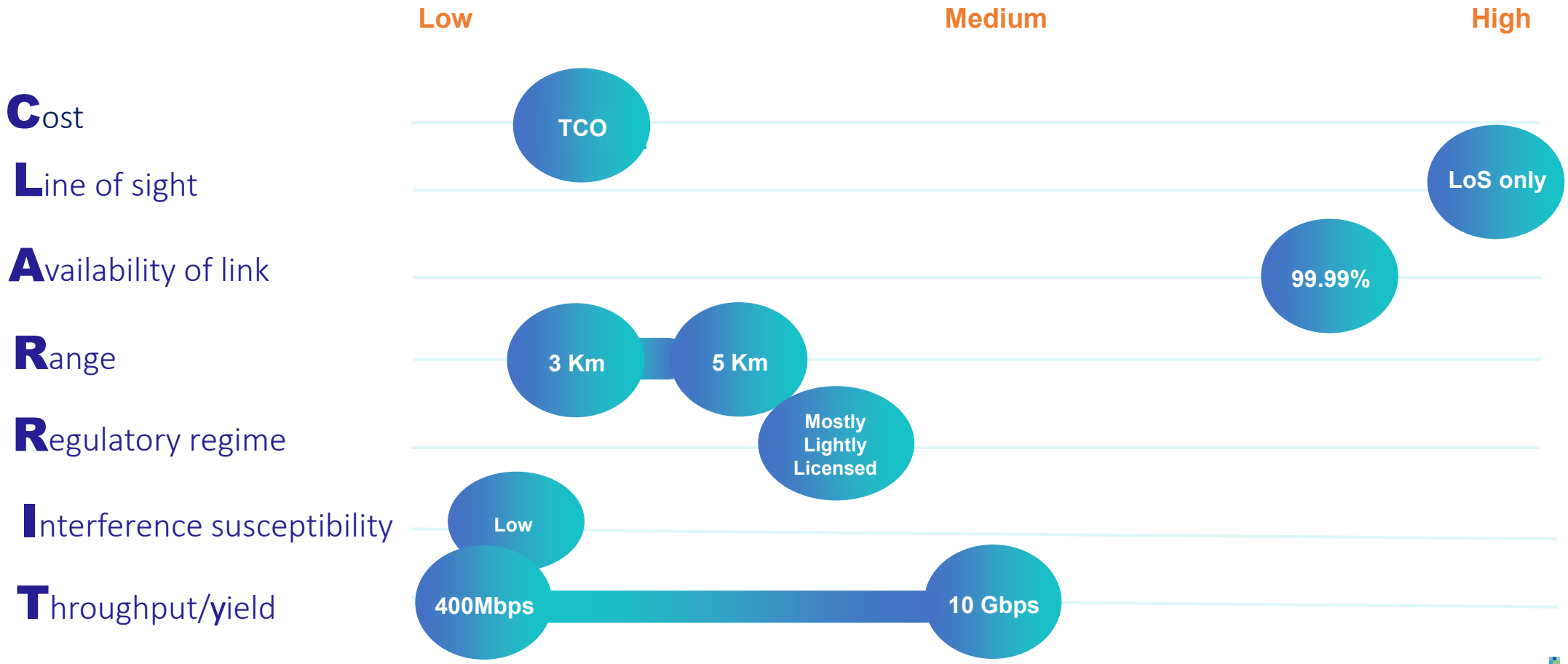


High mmWave: V Band (60 GHz)

57GHz –71GHz

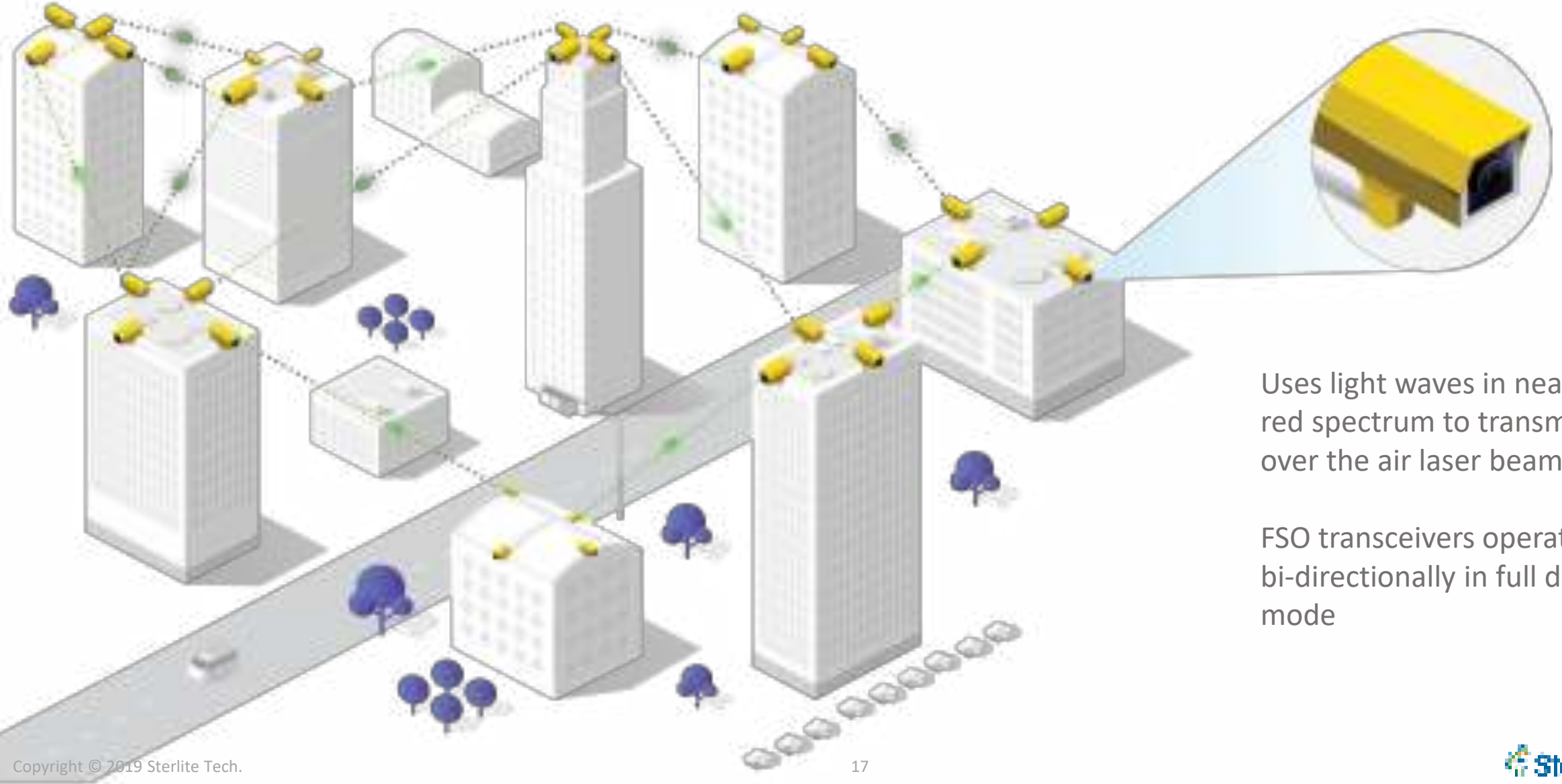
High mmWave E Band (80 GHz)

71 GHz – 86 GHz



Near Infrared: Free space optics (FSO)

D



Uses light waves in near infra red spectrum to transmit data over the air laser beams

FSO transceivers operate bi-directionally in full duplex mode

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Near Infrared: FSO

Cost

Line of sight

Availability of link

Range

Regulatory regime

Interference susceptibility

Throughput/yield

Visible Light: Light Fidelity (LiFi)

E

Uses visible light waves instead of radio waves to transmit high speed data over the air

- LED bulbs become high speed data source
- Light intensity is modulated at extremely high speeds (imperceptible to naked eye) to deliver gigabit connectivity

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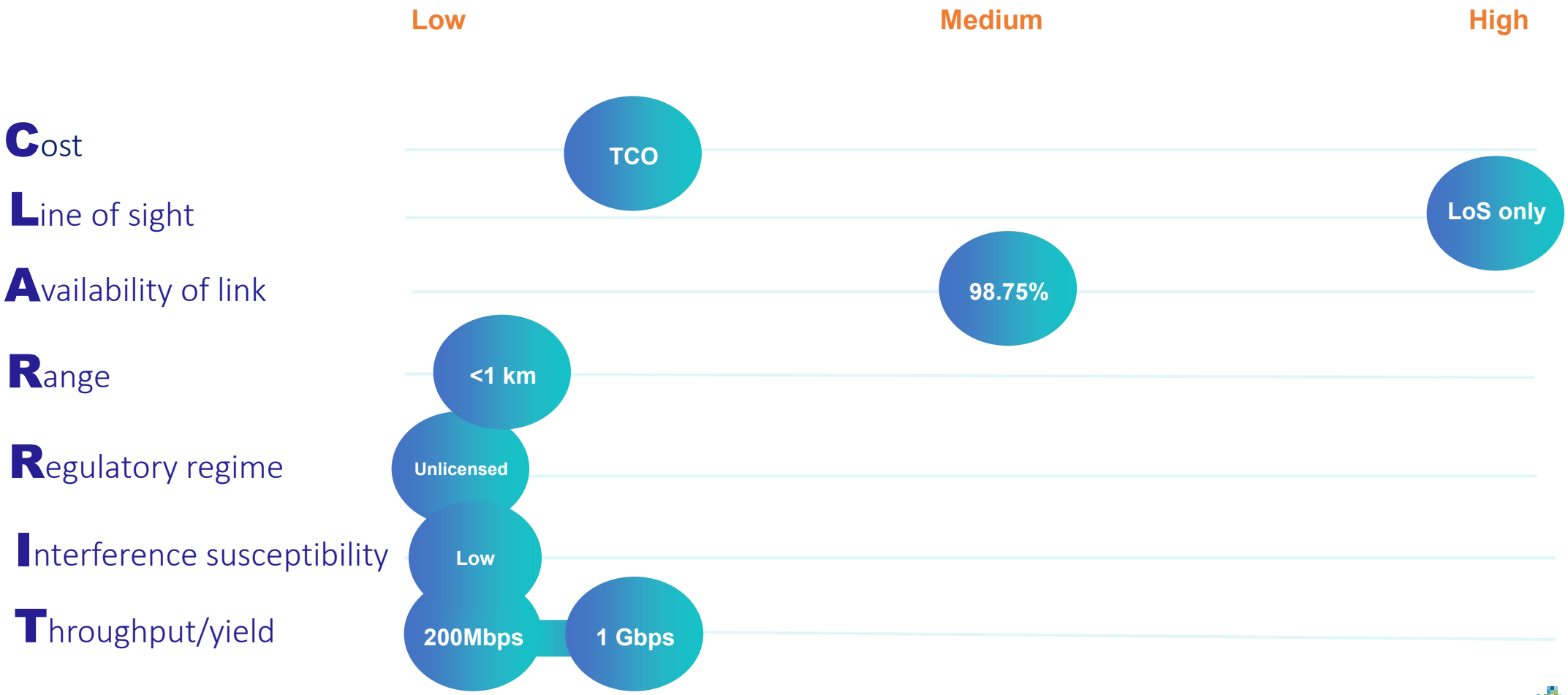
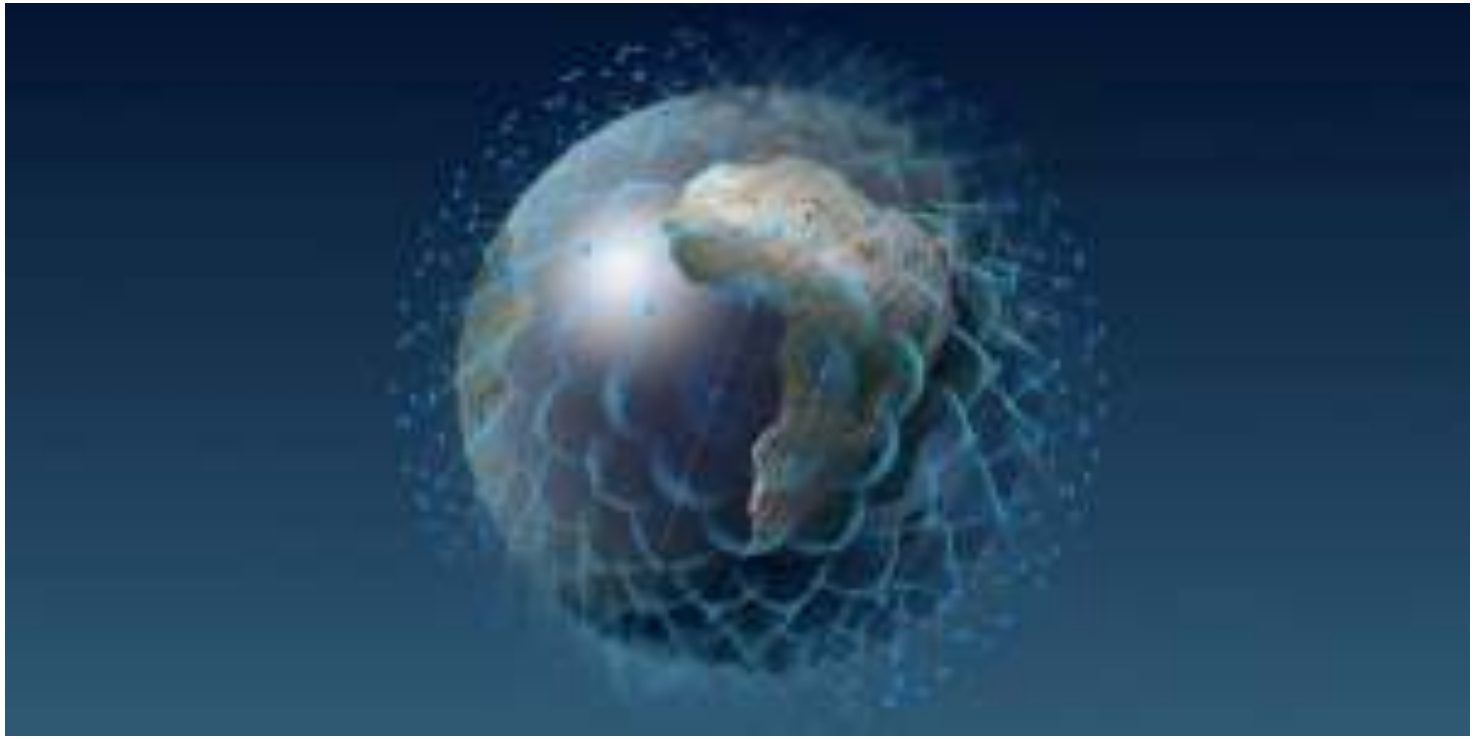
Visible Light: LiFi



LEO satellite constellation: Mostly licensed

F



Source: Forecast International

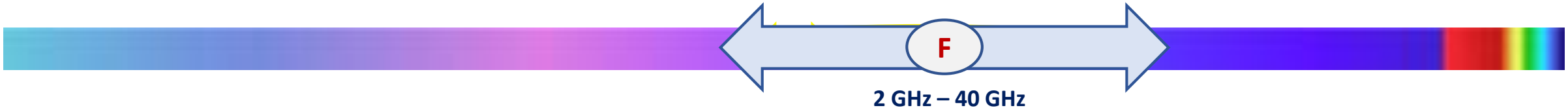
Constellation of low earth orbit (LEO) satellites blanketing the entire earth to provide high speed data connectivity

High capacity transponders offer high bandwidth communication between satellites and ground terminals

Inter satellite communication through technologies such as FSO allows seamless connectivity

Ground terminals communicate with the satellite transponder in their field of vision using radio waves (in L, Ku, Ka & W bands and possibly FSO in the future)

LEO satellite constellation



	Low	Medium	High
Cost			TCO
Line of sight			LoS only
Availability of link		99.9%	
Range			> 20km
Regulatory regime			Licensed
Interference susceptibility	Low		
Throughput/yield	1 Gbps/link		

So, how should an operator implement a converged network?

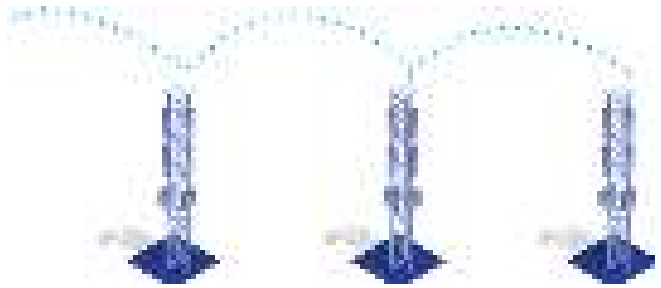
** Choose the best wired / fiber tech*

1. Choose the right wireless tech

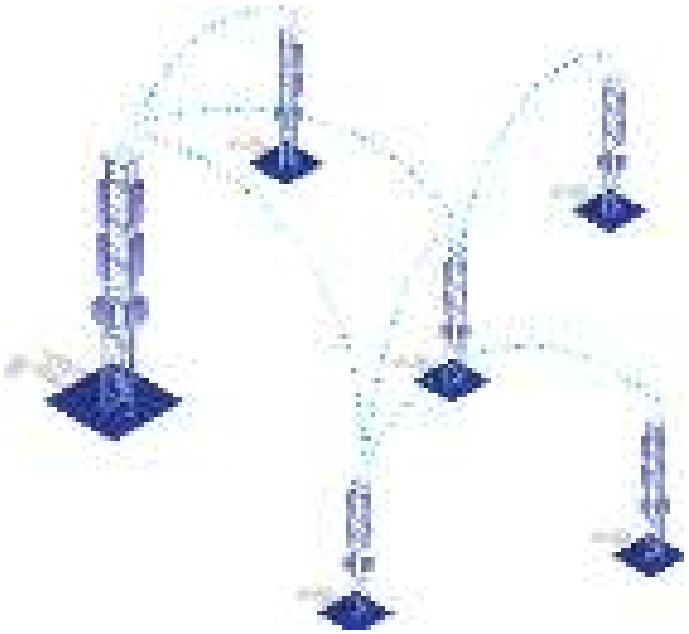
2. **Design a great " One Converged Network"**

Fixed wireless can be designed in many network topologies

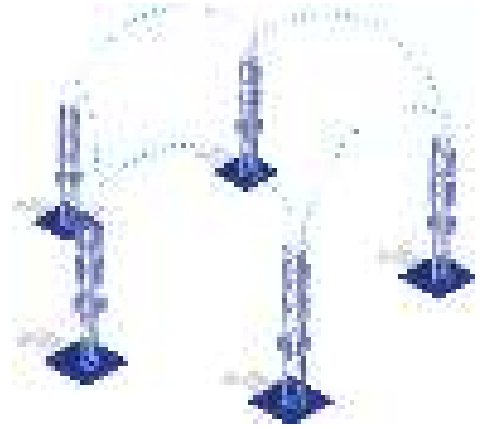
Point to point relay



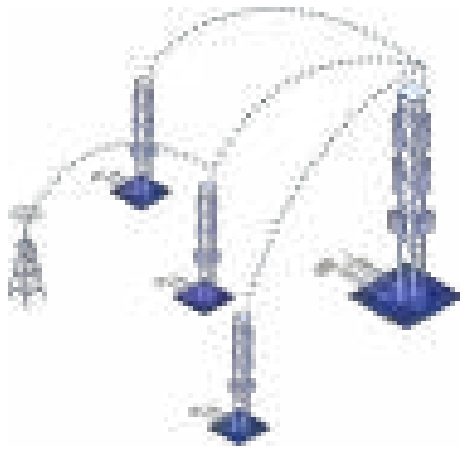
Linear



Mesh

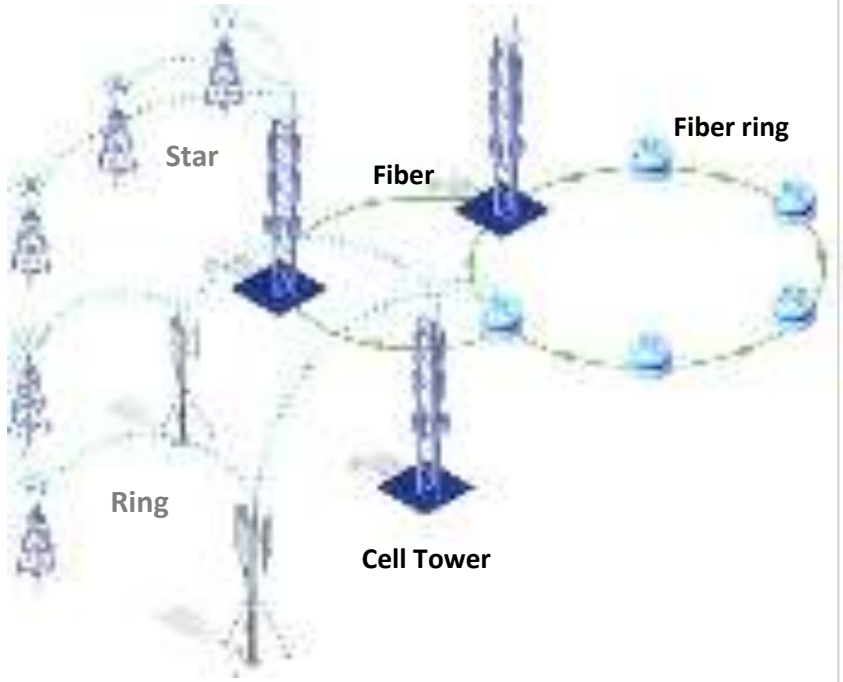


Ring

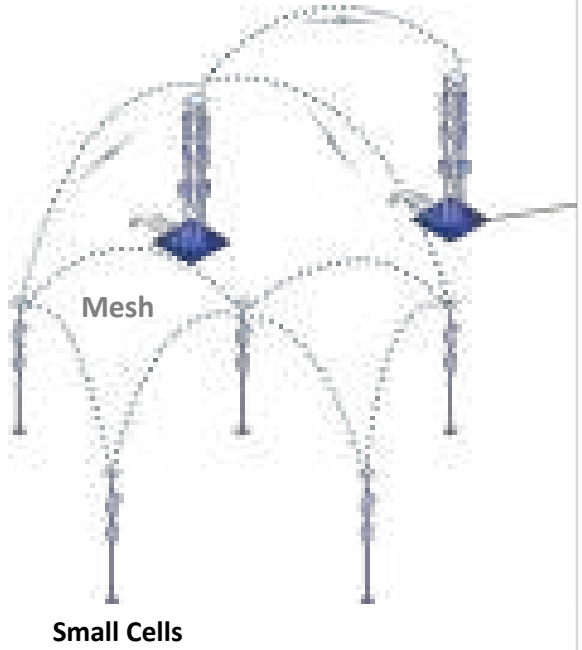


Star

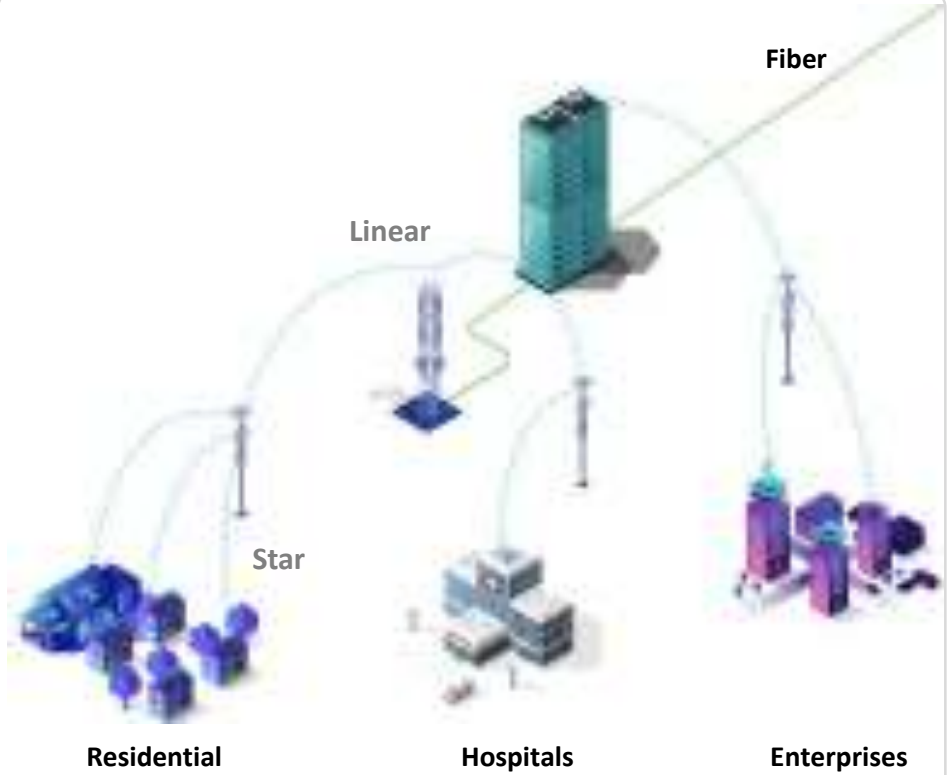
Converged topologies are applicable to most use cases



Cell Tower backhaul



Small cell backhaul



Fixed wireless to Premise

Design a good “converged network” in 5 steps

I-CORE approach of designing a network

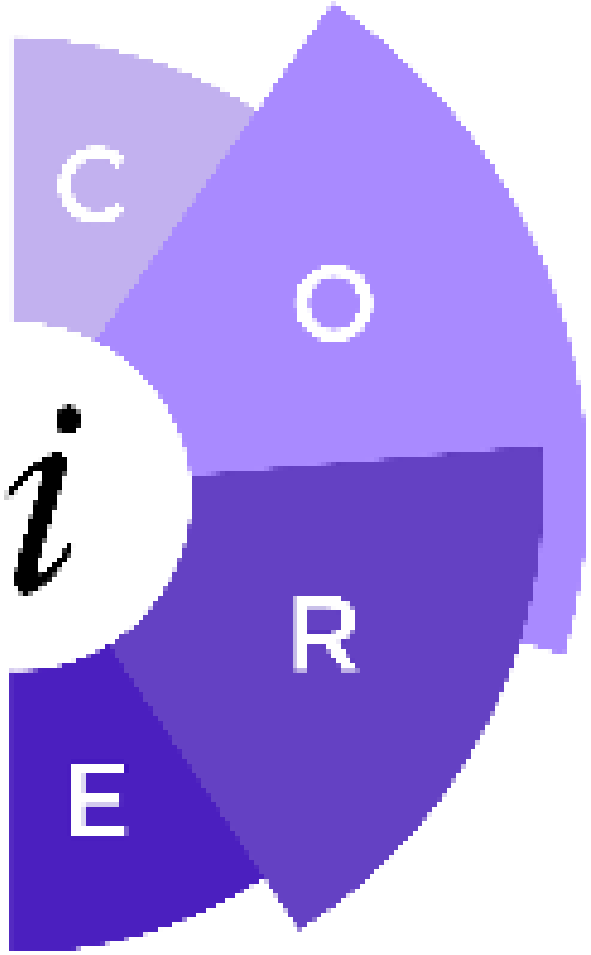
I Integrated Design across layers

C Centralized Planning

O One Converged Network

R Re-Use Existing Infra

E Everything Survey



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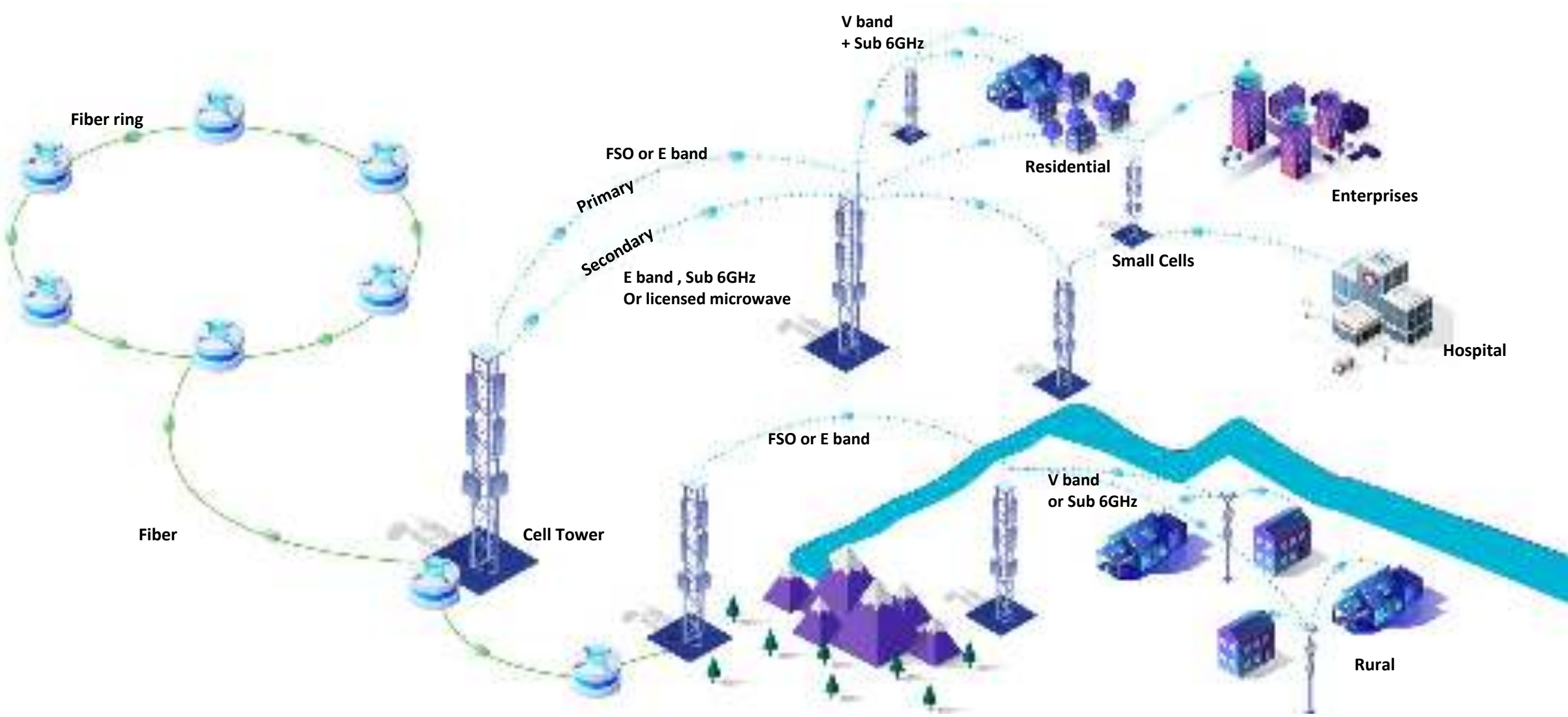
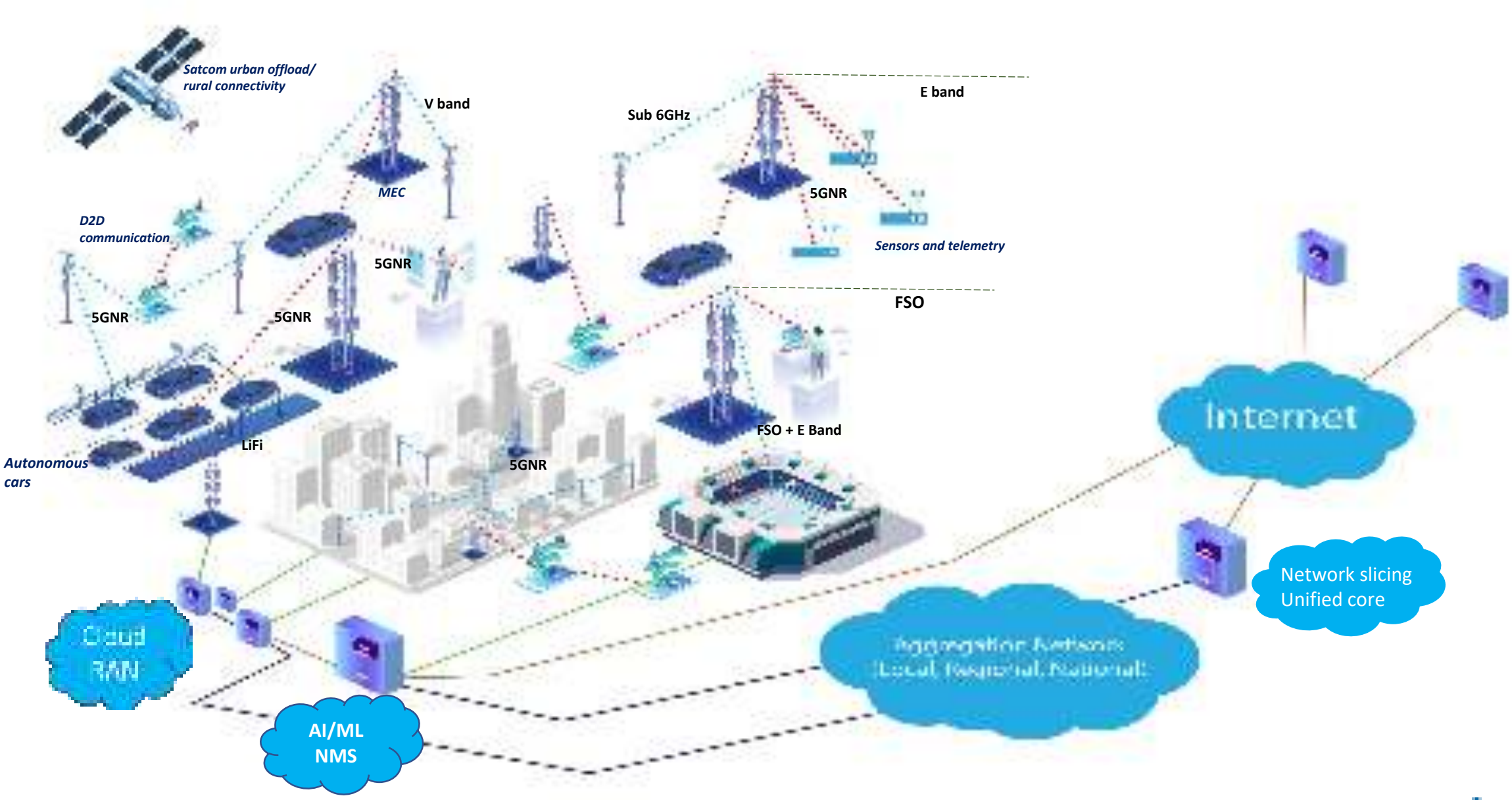
How would the “converged network” design look like?



Convergence driving the “Networks of Tomorrow”



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OUR CAPABILITIES ACROSS THE VALUE CHAIN

Optical Fibre & Cable

Fibre roll out

Converged Network Integration

Software & Intelligence

Programmable Network

Presence in over **100** countries

Partnering with **8** of top 10 Global Telcos

3 Research Labs

8 Production Facilities

Designing, Building and Managing Smarter Networks

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