Core Networks Beyond the Earth's Core

DEFENCE AND SPACE

Kevin Shortt, Research Project Leader, 1XRC
11 December, 2025

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The Internet World We Live In...

on

Earth's Surface!

Access to exabytes of data...

Livestreaming/Real-time data at the touch of a button...

Connected to billions of people...

But all this exists...

1XRC - Communication Technologies

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But what about **BEYOND**
Earth's surface?

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Key Trends in Global Optical Networks

- Proliferation of AI is driving future optical network architectures
  - Data-centric infrastructure, resource sharing (e.g. GPUs)
  - Data pools geographically dispersed from AI compute
  - Connectivity upgrade (AI data centers): **800Gbps** today, **1.6Tbps** in 2026, **3.2Tbps** in ~2028
  - Economic impact of AI to Global GDP: **+$7-10 trillion**
- Energy efficiency and sustainability
  - Total data center electricity consumption in 2022 ~150TWh
- **IOWN Global Forum Vision 2030:**

Increase transmission capacity by	Decrease power consumption at device component level by	Lower end-to-end latency by
125x	**100x**	**200x**

These trends will have knock-on effects on
satellite networks!

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Industry Concept: All-photonics Network

- Enabler for:
  - Light-speed remote direct memory access (RDMA) to remote GPU for predictive AI
  - RDMA capable edge with 5G RAN
  - Distributed data hub
  - GenAI training data transfer to remote GPU
  - Data center disaster recovery

- **Achieving low power and low latency goals!**

Credit: NTT

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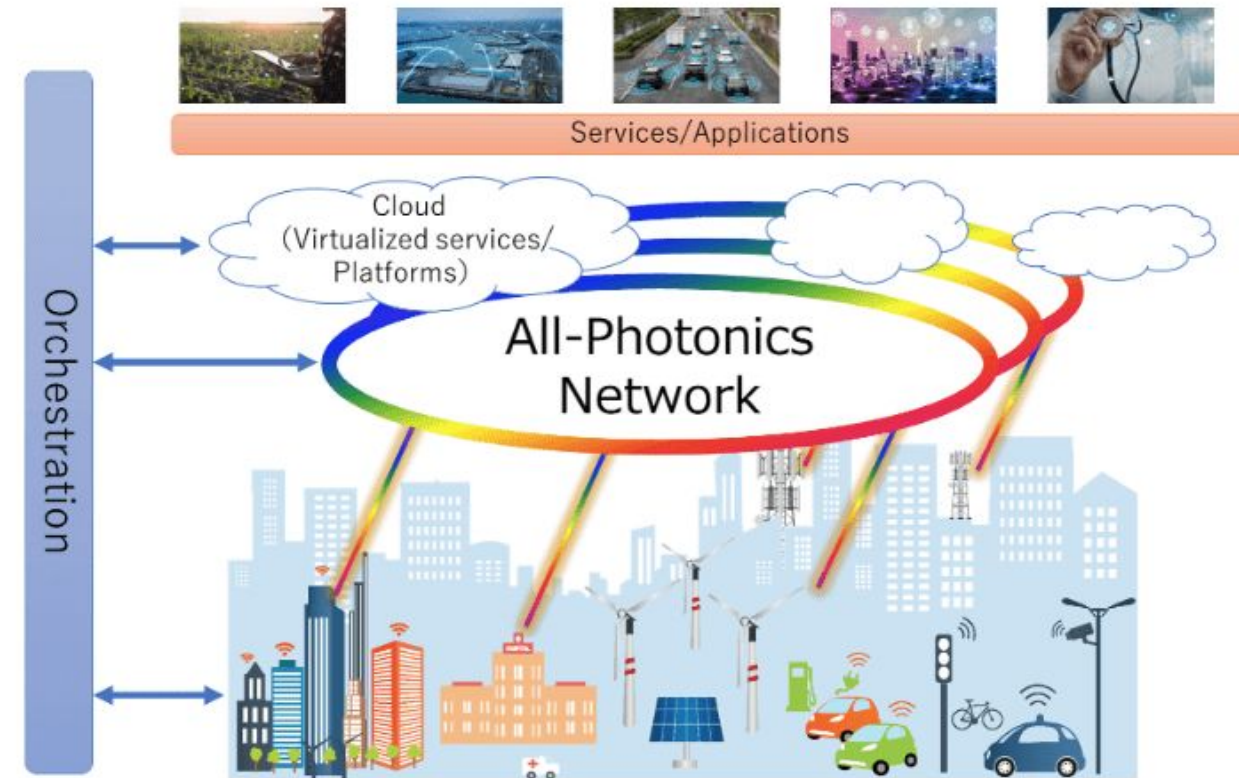
4 min

December 14, 2023

Amazon's Project Kuiper completes successful tests of optical mesh network in low Earth orbit

Written by Amazon Staff

After demonstrating 100 Gbps optical links between its prototype satellites, Project Kuiper will include laser links on every satellite in its constellation to form a mesh network in space.

Space startup Aalyria demonstrates satellite mesh network

The company is working with the Defense Innovation Unit to create a "hybrid space architecture"

Sandra Erwin   February 12, 2024

Starlink's Laser System Is Beaming 42 Million GB of Data Per Day

A SpaceX engineer details how the company is using a fleet of 9,000 lasers over the Starlink constellation to deliver high-speed internet across the globe.
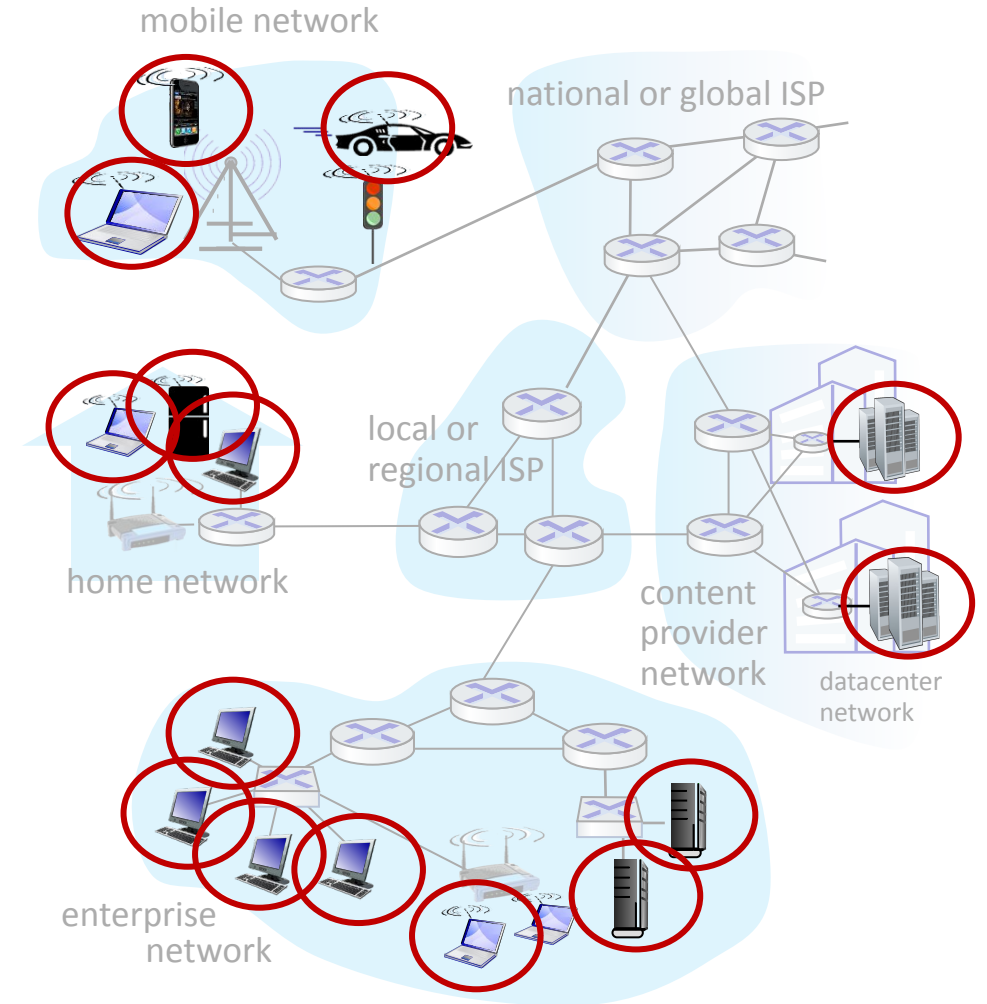
by Michael Kan   Jan 30, 2024
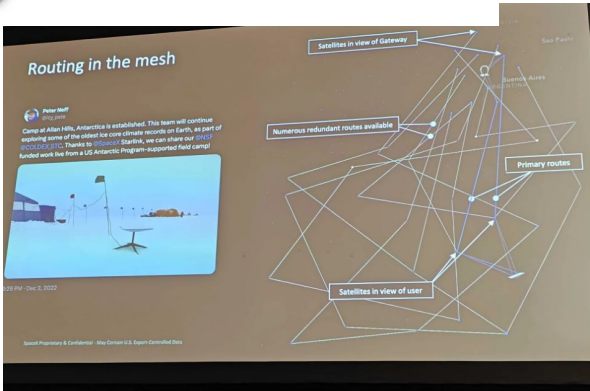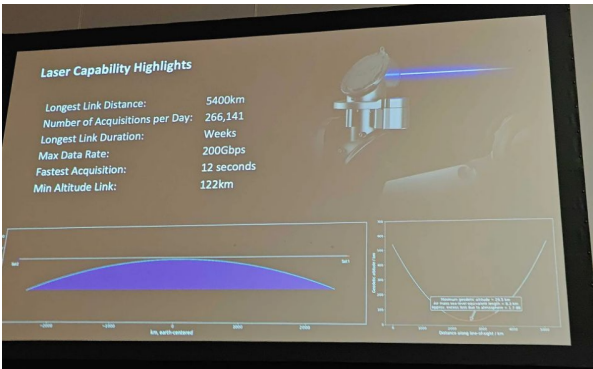
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A Closer Look at Internet Structure

Network edge:

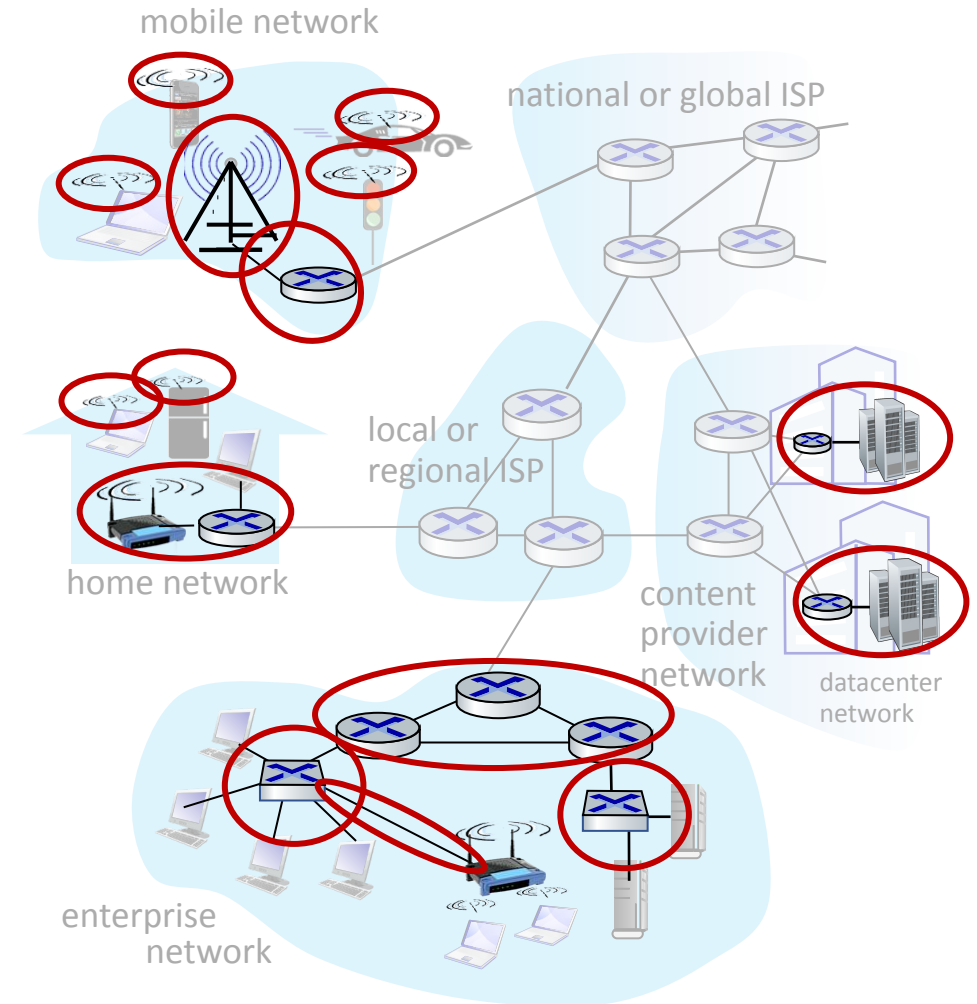- Hosts: clients and servers
- Servers often in data centers

A Closer Look at Internet Structure

Network edge:

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- Servers often in data centers

Access networks, physical media:

- Wired, wireless communication links
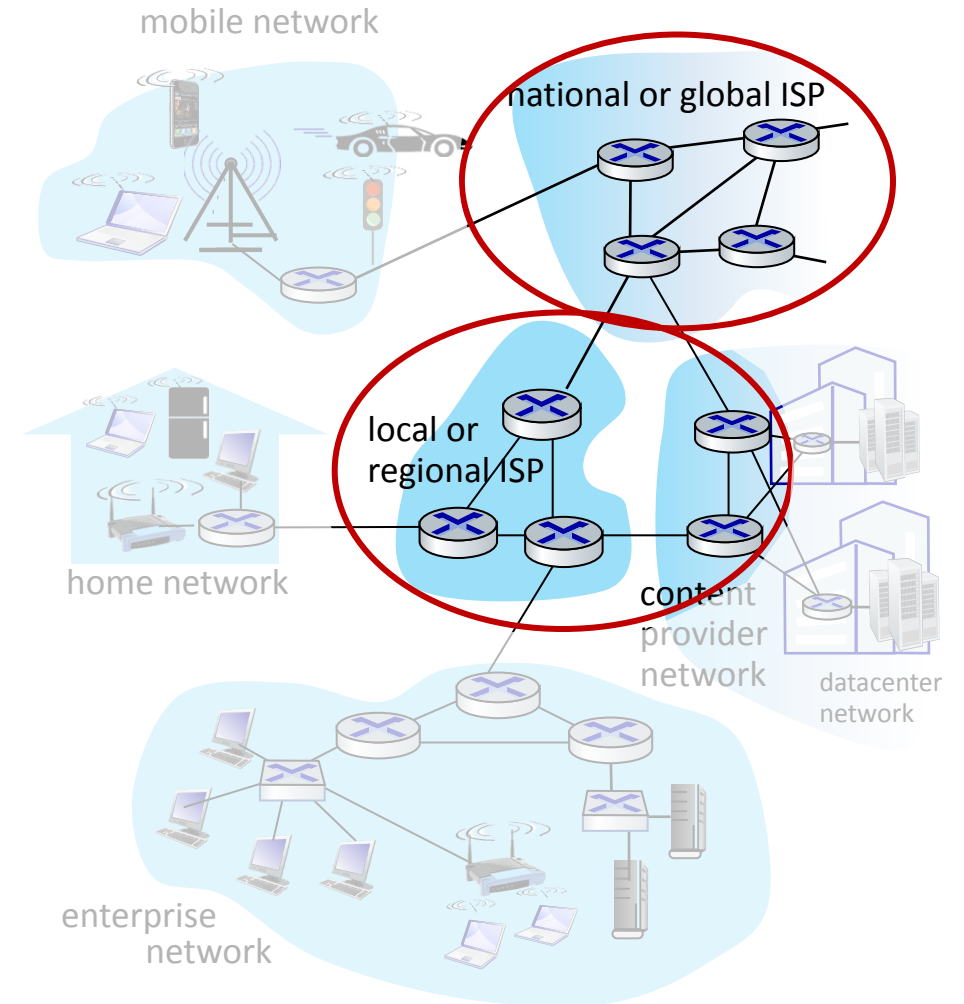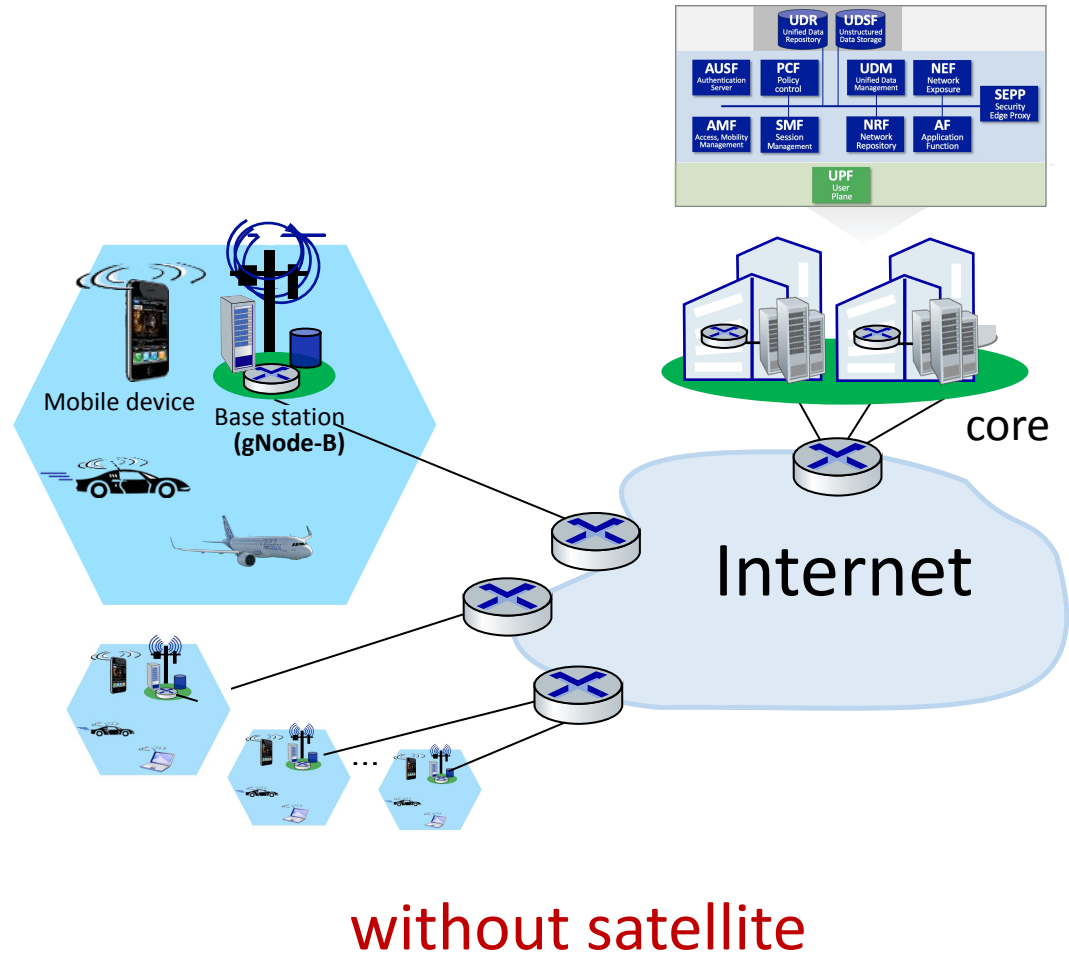
A Closer Look at Internet Structure

Network edge:

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Access networks, physical media:

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Network core:
- Interconnected routers
- Network of networks

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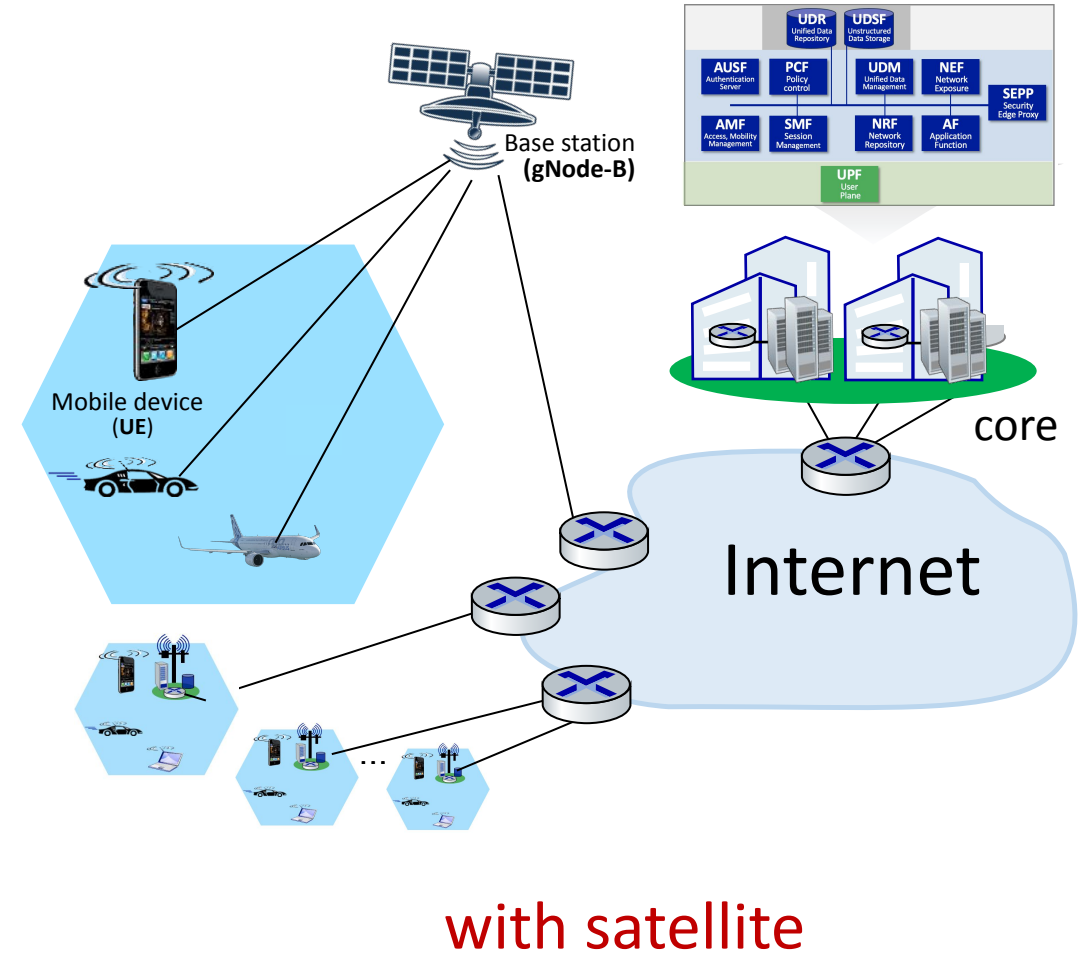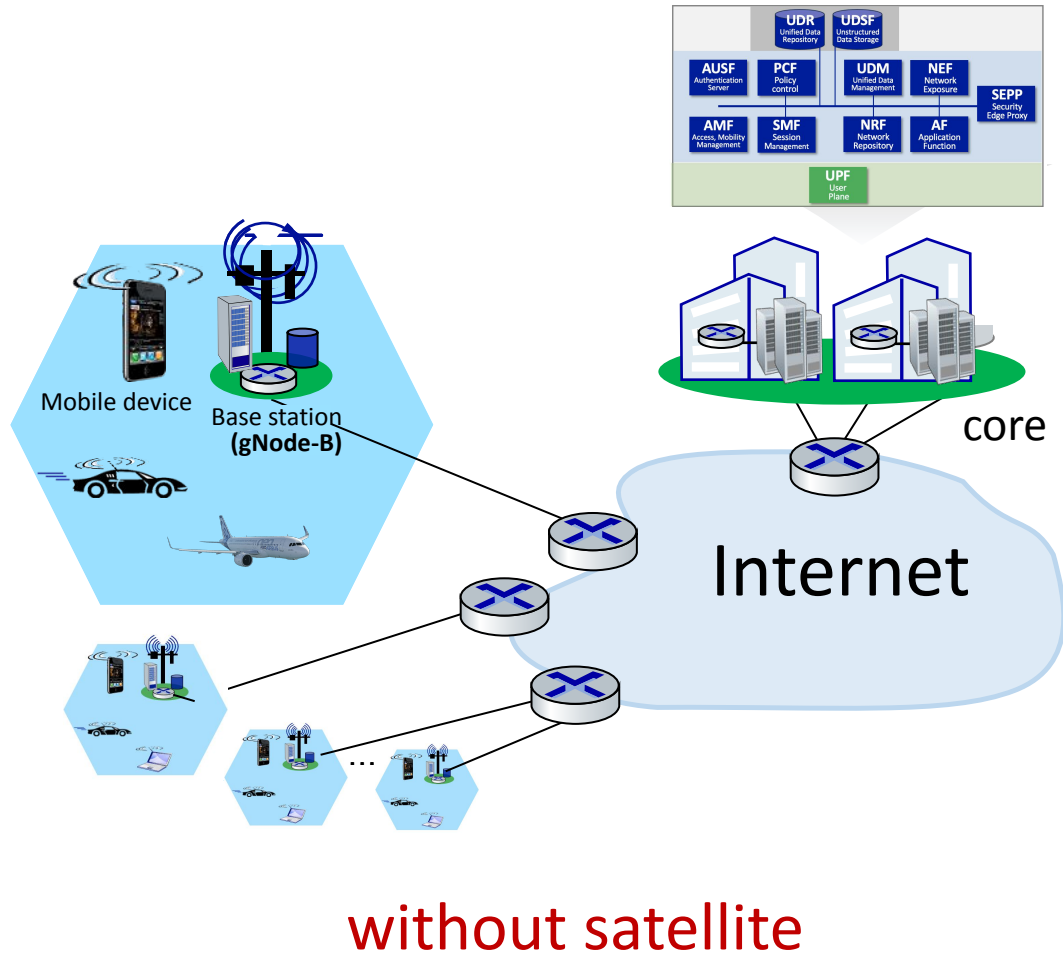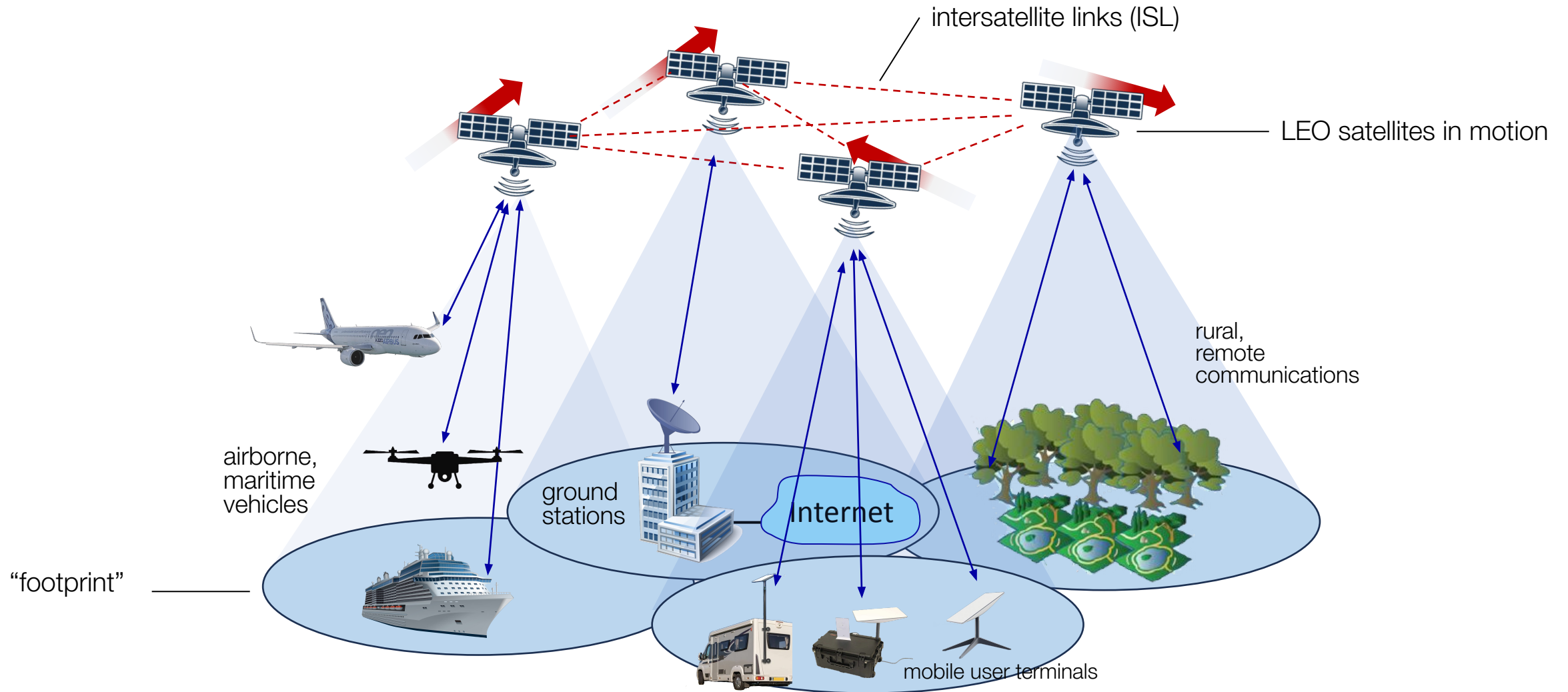# Radio Access Networks - Outdoors (e.g. 5G)

Option #1

without satellite

with satellite

Radio Access Networks - Outdoors (e.g. 5G)
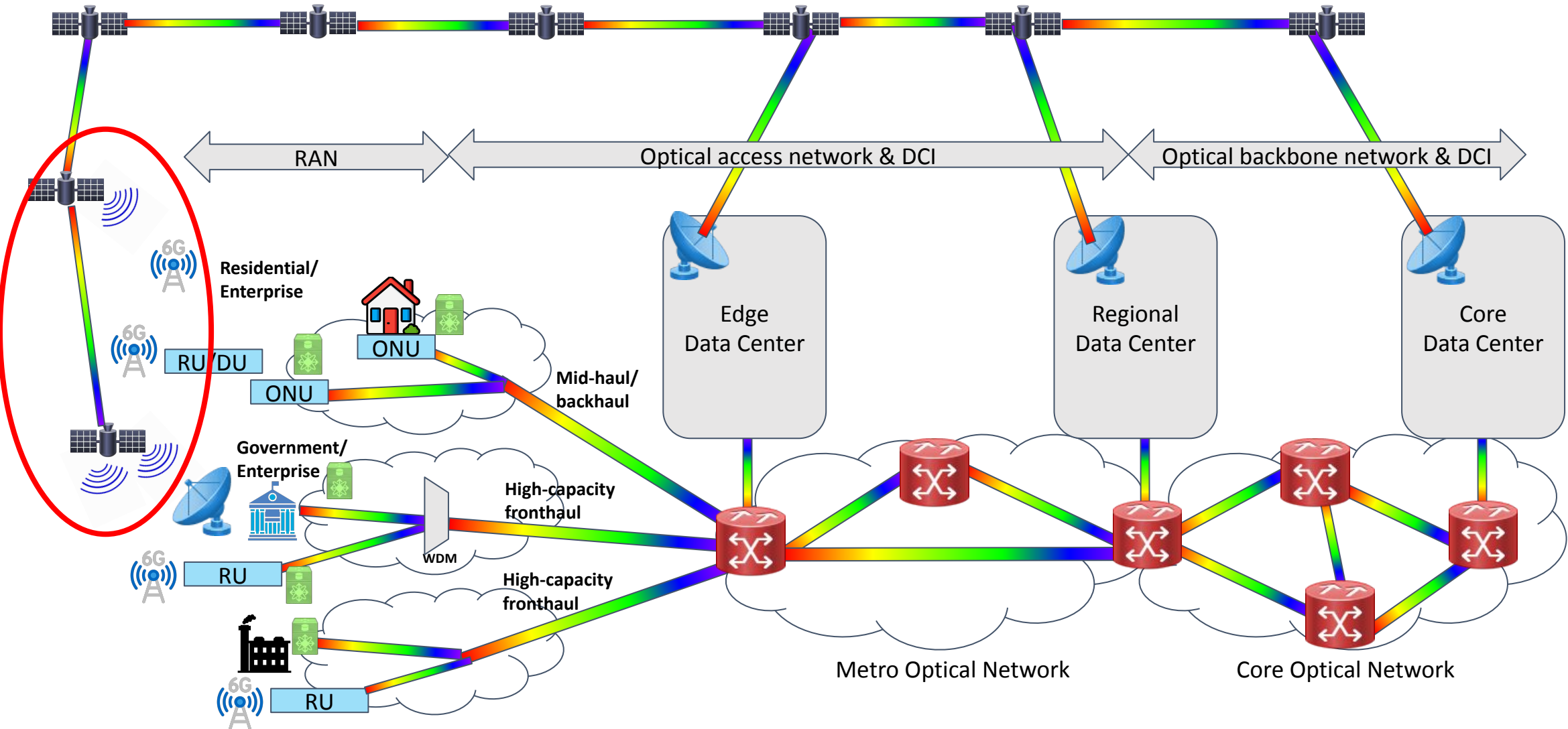

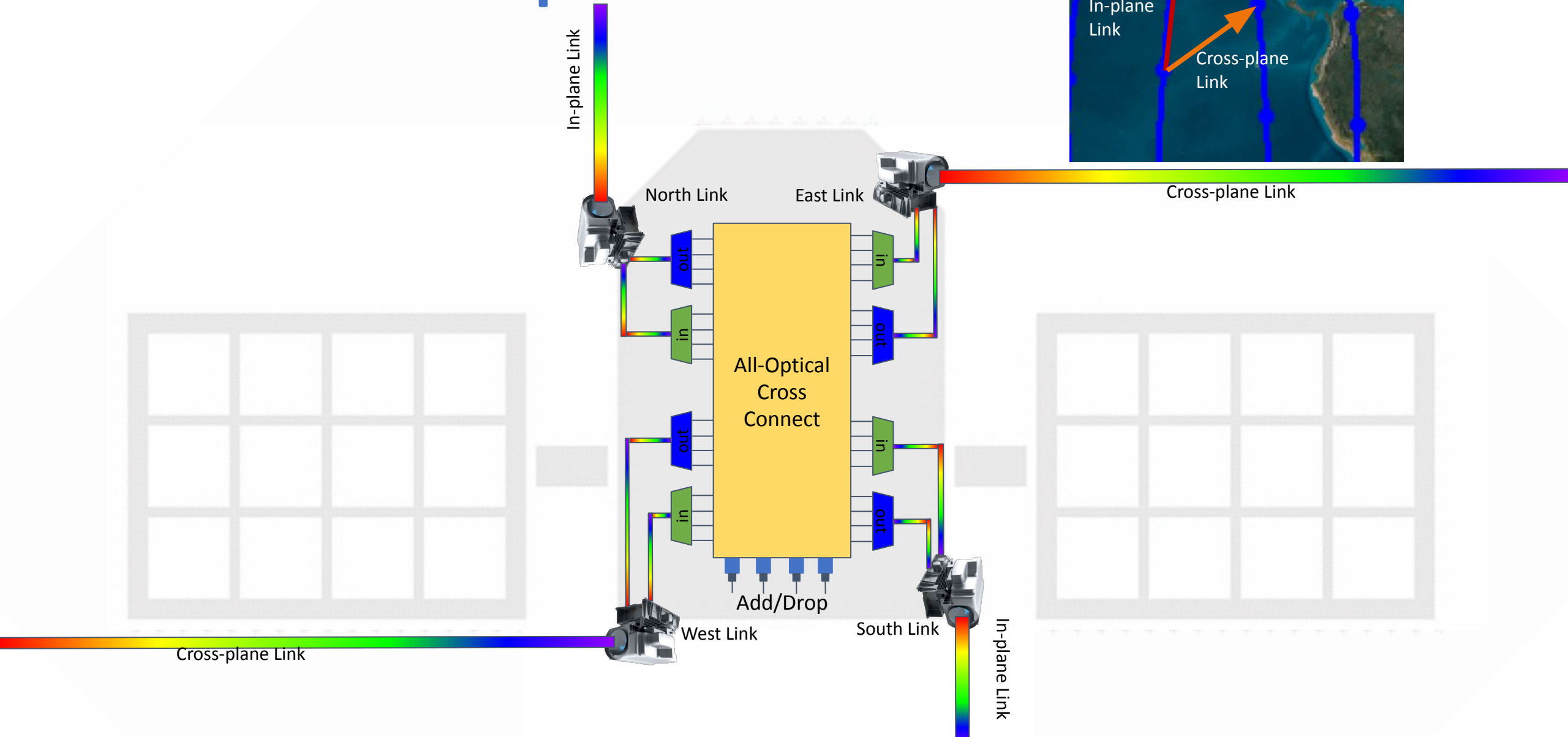
Option #2

without satellite
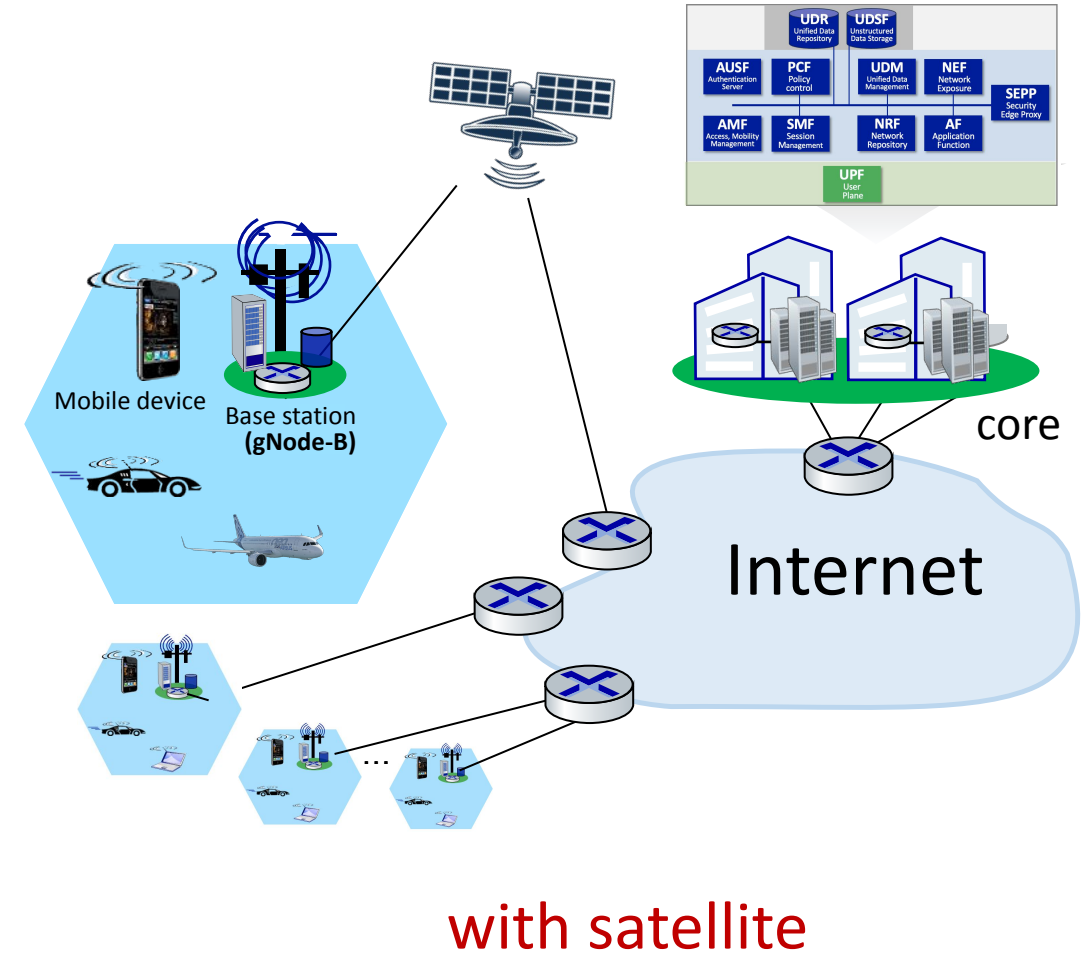
with satellite

Satellite Constellations: A network by itself

So what about the core?

Satellites as Optical Nodes

Conclusion

- Today's global optical networks are being stressed
  - AI deployment
  - Data center interconnects for resource sharing
- Step-change in optical network architecture evolution
- Drive to integrate satellites into these new architectures
- FSO technologies key to this integration
- Optical core networks in space exploit full potential of FSO

Thank you

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