

Optical Networks in 4 Dimensions

A NewSpace Twist to the Future of the Internet

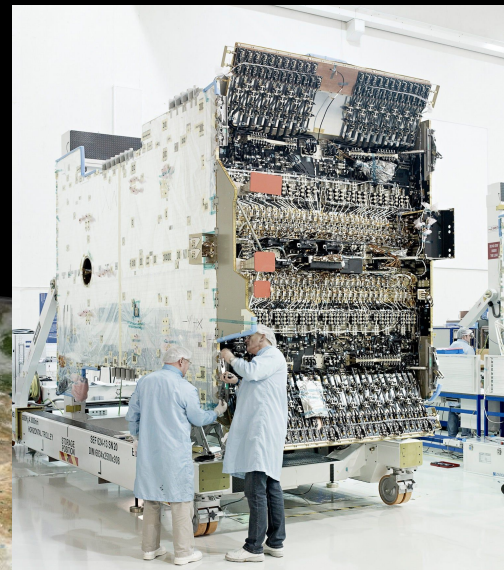
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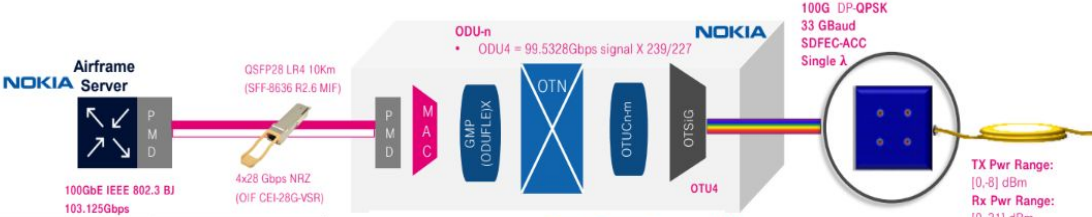




Closing the gap between terrestrial and non-terrestrial networks

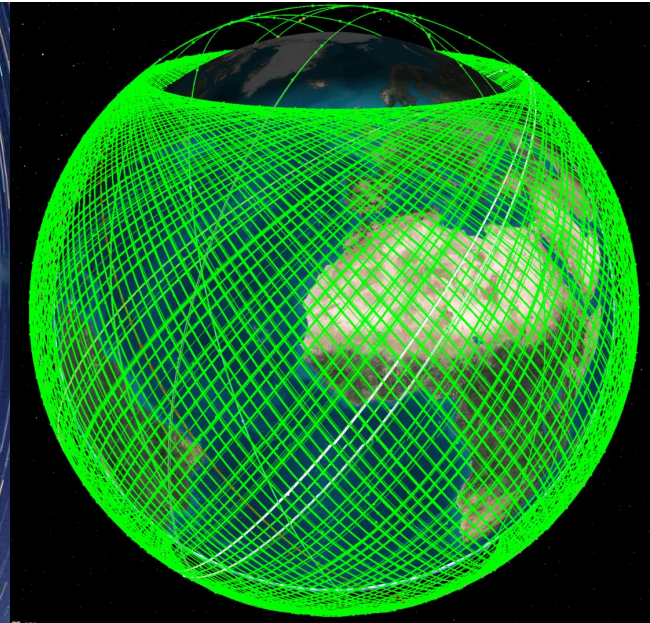


100GE CONVERGED TRANSPARENT TRANSPORT OVER OTN ITU-T G.709 Optical Transport Network (OTN) standard



NewSpace rekindles interest in networks in space

AIRBUS



Recent announcements in space optical networking

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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(Credit: SpaceX's Starlink)

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OCTOBER 2, 2023 IAN COPITHORNE

SDA Funds Demonstration of Satellite Laser Links

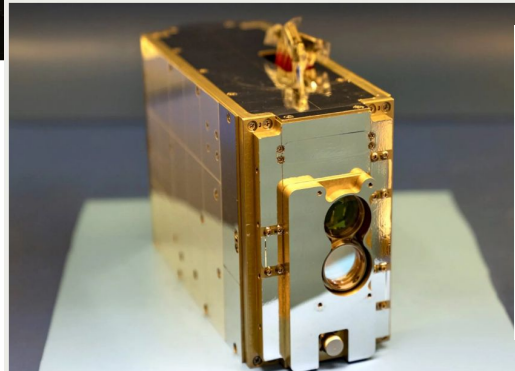
IEEE Spectrum NASA's Laser Link Boasts Record-Breaking

NEWS TELECOMMUNICATIONS

NASA's Laser Link Boasts Record-Breaking 200-Gb/s Speed

Researchers doubled the downlink record they set just last year

BY CHARLES S. COO | 20 MAY 2023 | 4 MIN READ



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Optical communications, i.e. lasers, are the network pipes for the Internet of Space

A new constellation with laser comms and compatibility with the Space Development Agency's Proliferated Warfighter Space Architecture is now talking shop.

By BREAKING DEFENSE on January 08, 2024 at 10:06 AM

Amazon Bedrock adds Mistral AI models, giving customers more choice.

Here's how much a Prime membership costs, and how to make the most of its benefits.

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Avanti to integrate Telesat Lightspeed LEO broadband services

Jason Rainbow February 22, 2024



Reading:

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

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.

Since the successful launch and deployment of two prototype satellites in October 2023, Project Kuiper has been conducting extensive testing of its end-to-end communications payload and network. In November, we confirmed we had validated all priority systems and subsystems within 30 days of launch, and we shared a first look at demos over the Kuiper network. One critical system that was part of that testing—but has remained confidential until now—was our optical inter-satellite link (OISL) capabilities.



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Extendable Internet for large scale 4D network

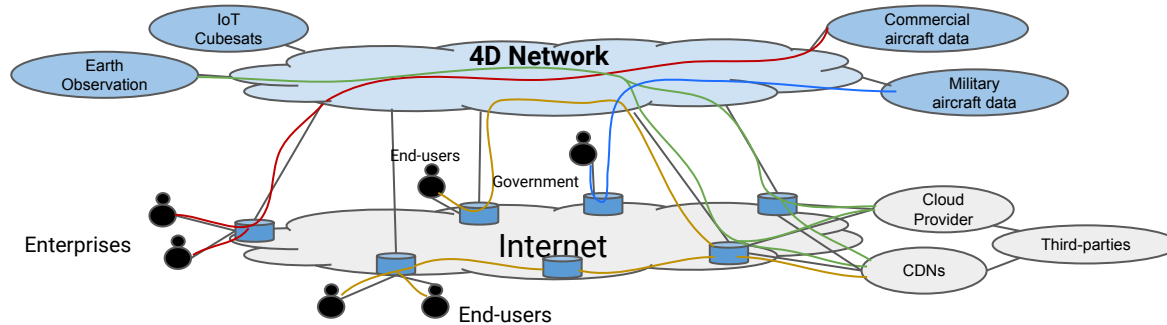


Design and implementation a flexible networking architecture for **time-varying large scale spaceborne networks (4D networks)**, such as:

- LEO constellations
- Multi-orbit satellites
- Peering data between operators of different satellite constellations

Space Content Distribution Network Scenario

Space Content Distribution Network → High-performance 4D network extending the Internet and maintaining its own network of highly-distributed servers, dispersed over different locations.



- **Data center synchronization, Enterprise Data Management and Content Distribution Networks**
 - Data center market valued at \$187.35 billion in 2020, and projected to reach **\$517.17 billion by 2030**.
 - Enterprise data market size valued at \$82.25 billion in 2021 and expected to expand to **\$265.68 billion by 2030**.
 - The CDN market value is expected to reach over **\$67.12 Billion by the year 2030**
- **Connected Vehicles including aircraft**
 - Totally the connected vehicle market is projected to reach **\$217.26 billion by 2029**.
- **Broadband mobile internet services**
 - Global satellite internet market size was valued at \$2.93 billion in 2020, and is projected to reach **\$19.7 billion by 2030**.
- **Earth observation and Space IoT**
 - Global Satellite Earth Observation market size is expected to grow to **\$14,2 Billion by 2030**.
 - Satellite IoT Market is estimated to grow to **\$6 Billion in 2031**.

Extendable Internet for large scale 4D network



How does Internet service model fit the challenge?

Internet Exchange Points in Space?

- Essential technical infrastructure where networks connect and exchange Internet traffic
- Typical customers of IXPs are Internet service providers, mobile operators, and content delivery networks
- IXPs create shorter, more direct routes for Internet traffic
- Main components of an IXP
 - A switch
 - Routers
 - Servers
 - A neutral location
 - Appropriate power sources
 - Cooling systems
 - Security
 - Technical experts to run and manage it







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Thank you!

