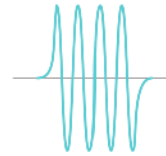




Optical free-space links

Current challenge

Any single technology
unable to **meet**
business needs



RF/Microwave spectrum congested

High speeds require substantial spectrum with limited capacity to scale in future

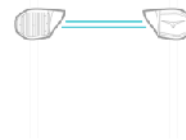


Fiber is too expensive to deploy and maintain

\$100k per km, \$0.5b-1b per subsea cable



Spectrum costs



Availability requirements vs distance



Satellite communications have very high cost/bit

\$1B satellites max capacity of a few Gbps

Solution with optical free-space links (LaserLink)

WIRELESS LASER COMMUNICATIONS



INDUSTRIES AND USE CASES



TELCO

Enhance and expand services, supporting 4G/5G backhaul and fronthaul, and last-mile connectivity to new and underserved communities.



ISP

Accelerate capacity expansion, enable new market entry, and reduce the time it takes to move from "signup" to "revenue" from new subscribers.



LARGE CAMPUS

Fast and easy deployment for campus-wide connectivity. Expand network capacity to support high-volume data flows and support mission-critical applications in record time.



DEFENCE

Deploy 10Gbps line-of-sight links in a matter of hours. Inherently secure and jam-proof communications in a lightweight, low-power design for mobile deployments.

Advantages



SPEED TO MARKET

No Right of Way Needed.
Rapid Deployment Time.
No Trenching and Digging.



HIGHEST BANDWIDTH

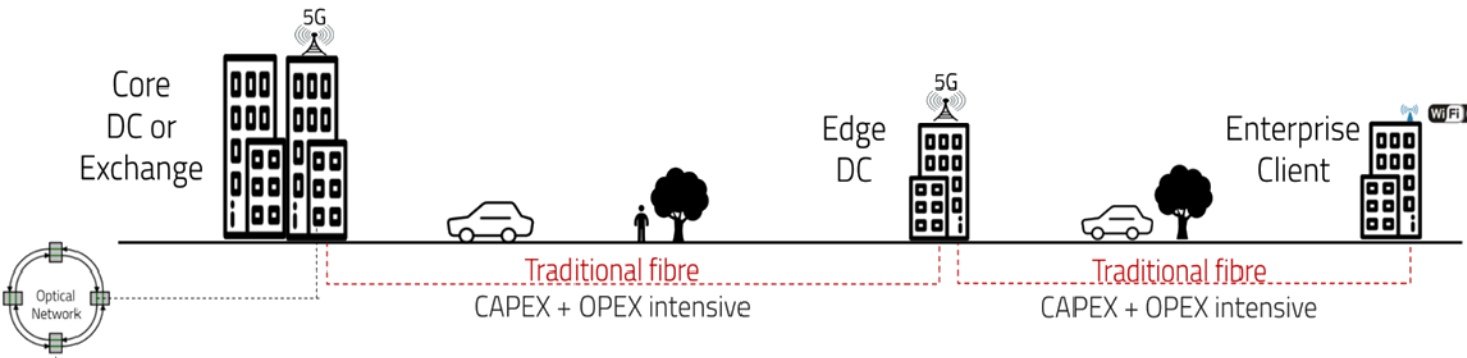
Fibre Alternative or
Microwave Replacement.
Line Rate Throughput Scaling Up
To 100Gbps In Future



LOWEST TCO

ZERO Spectrum Costs.
ZERO Fibre Laying Costs.
Opex Pricing Options.

Solve your problems



Industry Challenges

using Fiber:

1. Long time to deploy
2. High costs
3. Right of way, terrain

Using Radio:

1. Spectrum congestion
2. Regulatory approvals
3. Low security
4. Limited future capacity
5. Throughput throttling
6. Affected by water bodies
7. Pole sway

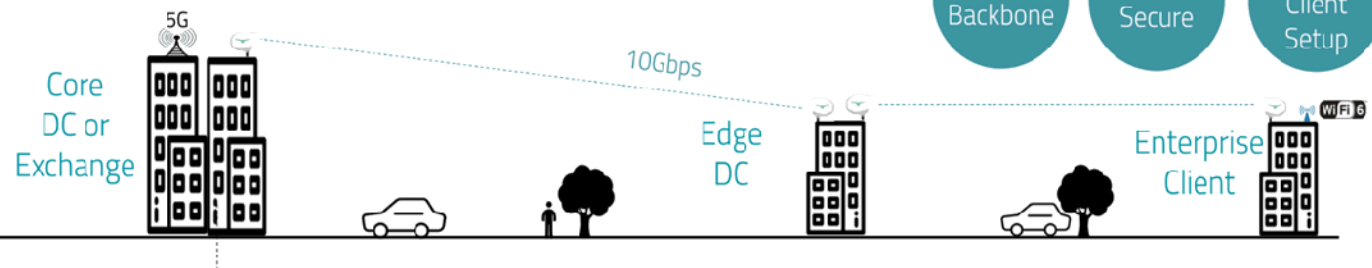
Our Solution

With DELTA:

1. Quick half day to deploy
2. Cost effective
3. No right of way required

With DELTA:

1. No spectrum congestion
2. No spectrum approvals
3. Highly secure
4. Extensive future capacity
5. Line rate throughput
6. Not affected by water
7. Active tracking



Benefits of wireless laser communication



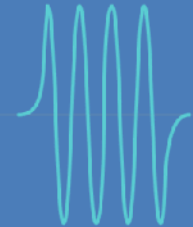
**Half day to
deploy**



**Cost
effective**



**No right of
way required**



**Not impacted
by spectrum
congestion**



**No regulatory
approvals**



Highly secure



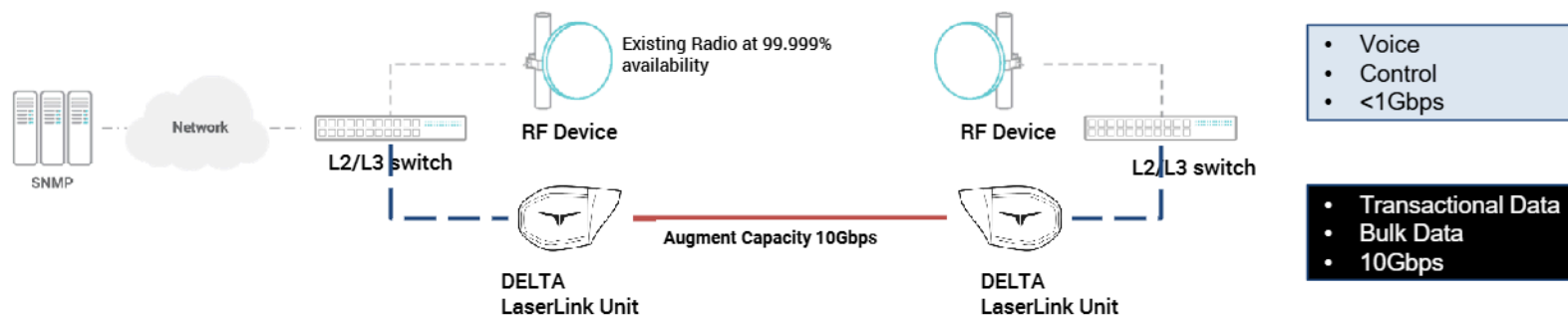
**Extensive
future capacity**



**Performance in
adverse weather**

DELTA's Hybrid solution

Hybrid solution with 99.999% availability



BYOD

Radio	Provided by operator
L2/L3 switch	Provided by operator
DELTA LaserLink Unit	✓
SNMP monitoring	✓
Transcendental tested configurations	✓

- Delta provides best practice configuration guidelines
- We can recommend L2/L3 tested switches

Deployment and SiteSurveyTool

INSTALLING THE SST



Figure 13: The Site Survey Tool installation orientation (right) relative to the empty mounting pole (left) and the positioning of the LaserLink device (centre).

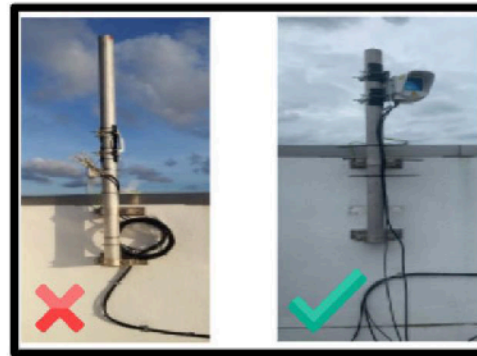


Figure 5: "Bad" pole (Left) vs. "Good" pole

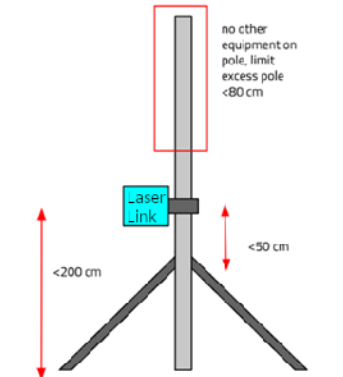
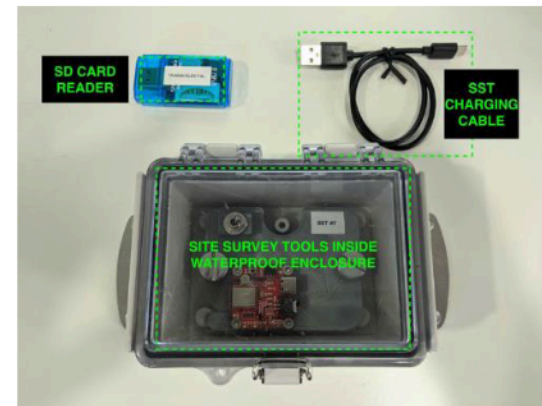


Figure 10: Telecommunications Freestanding Pole Installation



SST records any vibrations with a mems-sensor for a few days
→ Quality of the mounting location is analyzed

Site Survey Tool for checking
robustness of location

Application benefits

Delta Product Details



- Throughput - 10Gbps full duplex
- Range - 200m to 3Kms
- Availability - 99% to 99.999% depending on rain zone
- RTD <25us. (round-trip delay)

Class-leading performance

AI-powered Alignment & Tracking

Software Guided Deployment

Intelligent Window Heating

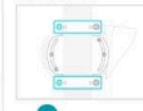
Easy to Monitor at Scale

Streaming Telemetry

PERFORM COARSE ALIGNMENT

Adjust device horizontally

Ensure back ends of the mount clamp are tighter than front nuts

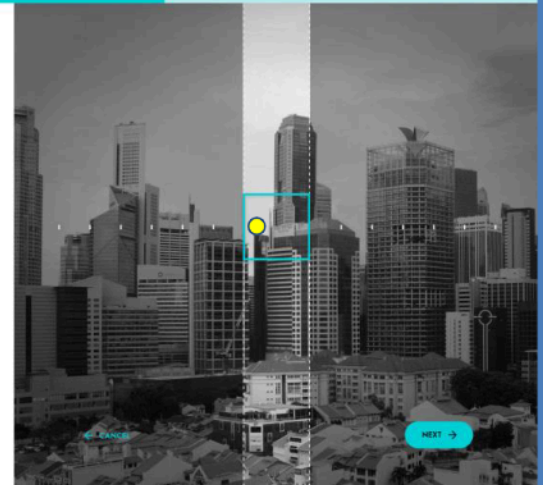


1 2 3 4

Adjust device vertically

Alignment complete!

[VIEW TUTORIAL](#)



Overall Benefits



Ultra High Capacity

Low latency 10 / 25Gbps Full Duplex

Long Distance - up to 1.5km

currently suitable for line-of-sight distances of up to 3km and can be daisy chain relayed for longer distance requirements

Lowest Size, Weight, and Power (SWaP)

Delta's lightweight, compact design is a fraction of the size and weight of traditional RF wireless devices and easily installed in the most space-constrained locations. The unit is the size of a shoebox, weighs <3kg and requires only 25 - 32W of power to operate, conducive to remote solar cell operation.

Weather Resilient Wavelength

Device employs invisible 1550nm directional light wavelength for data transmission. This spectrum is unregulated requiring zero spectrum licensing costs to deploy, is optimal for reduced absorption and diffraction in the atmosphere, and impervious to spectrum congestion and density challenges. The device includes additional optical filtering which improves solar spectra performance during sunrise/sunset and reduces stray light from entering the device enabling east/west facing deployments

Diffraction Limited Beams

Units laser beam width is diffraction limited resulting in minimum spillover at the receiver (high security) and maximizing transmission distance due to limited beam spread

Automated Pointing & Tracking Control (APT)

Device employs patented high-speed active Pointing and Tracking AI technologies which adjust in real-time to compensate for pole vibrations, thermal expansion and other environmental impacts ensuring highly reliable transmission between two device points.

Adaptive Power Control (APC)

The Adaptive Power Control ensures device transmission autonomously adjusts in real-time to changes in weather conditions through sensor fusion enhancing the link budget by adjusting power output during such events to compensate for increased dB/km transmission losses.

Guaranteed throughput in adverse conditions

Unlike RF Microwave/e-band solutions, the units point-to-point laser connections ensure users always receive the throughput advertised even in the most congested and climatic challenged environments.

Mobile & Rapid Deployment

The units can be deployed single handedly in as little as an hour utilising Transcelestial's user friendly proprietary DMD installation and alignment platform. All that is required is confirmation of line-of-sight and distance measurements and appropriate on-site cabling for connectivity.

Network Management System (NMS)

DELTA supports Transcelestial's own NMS platform and SNMP v3 platform integration including real time network performance monitoring, alerts, and alarms.

Highly Secure

DELTA provides the highest level of security of any wireless solution. Data transmissions are not scannable or jammable and it can pass through fully encrypted data. Interruption to the line-of-sight beam path severs the data link, eliminating intercepts, eavesdropping and MITM attacks due to use of an extremely narrow invisible beam that ceases packet transmission in the event of an attempted link diversion.

Compliance

DELTA complies with applicable international IEC/EN/ISO regulatory and quality standards for safety as a Class 3B laser product.

Future Proof

DELTA uses lasers in the 200 THz spectrum, supporting nearly unrestricted headroom for future upgrades and the ability to scale up to higher transmission rates in the future - Our technology can scale as your bandwidth needs grow.

Environment conditions

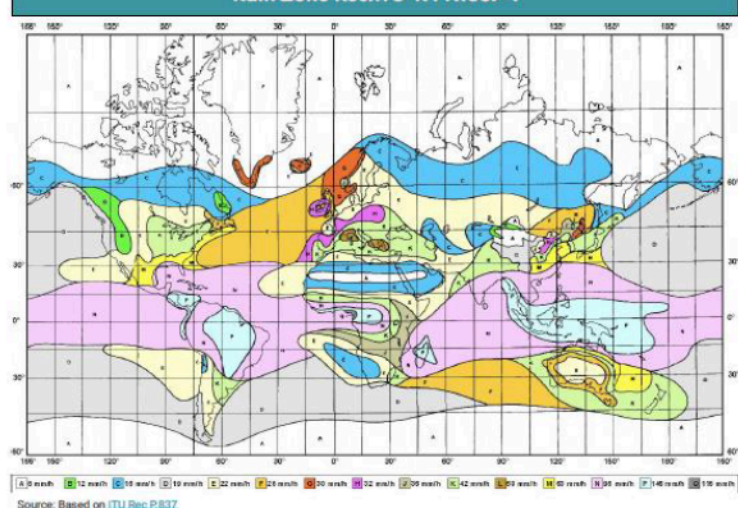
IG Availability vs Distance(km) for each Rain Zone Rec.ITU-R PN.837-1

Availability	99.0%	99.7%	99.9%	99.97%	99.99%	99.997%	99.999%
Annual Downtime	3d 15h	1d 2h	8h 45m	2h 37m	52m 35s	15m 46s	5m 15s
Rain Zone	km	km	km	km	km	km	km
A	3.00	3.00	3.00	3.00	3.00	3.00	2.90
B	3.00	3.00	3.00	3.00	3.00	2.95	2.40
C	3.00	3.00	3.00	3.00	3.00	2.70	2.10
D	3.00	3.00	3.00	3.00	3.00	2.55	2.10
E	3.00	3.00	3.00	3.00	2.90	2.15	1.65
F	3.00	3.00	3.00	3.00	2.60	1.85	1.55
G	3.00	3.00	3.00	3.00	2.50	2.05	1.70
H	3.00	3.00	3.00	3.00	2.40	1.85	1.50
J	3.00	3.00	3.00	2.60	2.30	2.05	1.85
K	3.00	3.00	3.00	2.85	2.10	1.65	1.35
L	3.00	3.00	3.00	2.40	1.75	1.30	1.10
M	3.00	3.00	2.90	2.15	1.70	1.40	1.25
N	3.00	3.00	2.30	1.70	1.40	1.15	1.00
P	3.00	2.35	1.70	1.30	1.10	0.95	0.85
Q	2.00	1.95	1.60	1.40	1.25	1.10	1.00

10G Availability vs Distance(km) for each Rain Zone Rec.ITU-R PN.837-1

Availability	99.0%	99.7%	99.9%	99.97%	99.99%	99.997%	99.999%
Annual Downtime	3d 15h	1d 2h	8h 45m	2h 37m	52m 35s	15m 46s	5m 15s
Rain Zone	km	km	km	km	km	km	km
A	3.00	3.00	3.00	3.00	2.85	2.35	1.95
B	3.00	3.00	3.00	3.00	2.45	2.00	1.55
C	3.00	3.00	3.00	2.75	2.25	1.80	1.45
D	3.00	3.00	2.85	2.40	2.05	1.75	1.45
E	3.00	3.00	3.00	2.45	1.95	1.50	1.15
F	3.00	3.00	2.85	2.25	1.75	1.30	1.10
G	3.00	3.00	2.45	2.00	1.70	1.40	1.20
H	3.00	3.00	2.65	2.10	1.95	1.30	1.05
J	2.85	2.40	2.00	1.75	1.60	1.40	1.30
K	3.00	3.00	2.45	1.90	1.45	1.15	1.00
L	3.00	3.00	2.25	1.65	1.25	0.95	0.80
M	3.00	2.55	1.95	1.50	1.20	1.00	0.90
N	3.00	2.25	1.60	1.20	1.00	0.85	0.75
P	2.45	1.60	1.20	0.95	0.85	0.70	0.55
Q	1.85	1.35	1.15	1.00	0.90	0.85	0.75

Rain Zone Rec.ITU-R PN.837-1



Rainfall Intensity Exceeded (mm/hr)

% Time Rain Zone	1.0%	0.3%	0.1%	0.03%	0.01%	0.003%	0.001%
A	< 0.1	0.8	2	5	8	14	22
B	0.5	2	3	6	12	21	32
C	0.7	2.8	5	9	15	26	42
D	2.1	4.5	8	13	19	29	42
E	0.6	2.4	6	12	22	41	70
F	1.7	4.5	8	15	28	54	78
G	3	7	12	20	30	45	65
H	2	4	10	18	32	55	83
J	8	13	20	28	35	45	55
K	1.5	4.2	12	23	42	70	100
L	2	7	15	33	60	105	150
M	4	11	22	40	63	95	120
N	5	15	35	65	95	140	180
P	12	34	65	105	145	200	250
Q	24	49	72	96	115	142	170

Source: Based on ITU Rec P.837

DELTA's LaserLink

Technical specifications

Main Specifications

Dimensions	32 (L) x 18 (W) x 20 (H) cm
Weight - Device / Mount	2.7 kg / 1.1 kg
Power Supply	25W PoE or 48V DC
Mounting	Pole Mount (3-4 inches diameter, 35°vertical adjustment)
Operating Temperature	-40 to 50°C (-13 to 122°F)
Weatherproofing	IP65 Rated
Wavelength	1550nm
MAX conducted Tx power	<200mW (dynamic)
Tx power control	Automatic upto 23dBm
Interface	SFP+ (Data), 100 BASE-T (Management)
Automated Pointing and Tracking	Realtime Ultra-Fine Beam Stabilization Range: Horizontal: $\pm 2^\circ$, Vertical: $\pm 2^\circ$

Network Management

Monitoring & Configuration	<ul style="list-style-type: none"> - Outband - NMS - SNMP v3
Management Interface	- 100 Base-T, RJ45

System

Models	1 / 10 /25 Gbps (full duplex)
Reliability & Range ("E" Rain Zone, 10 Gbps)	1.2 km: 99.999% 1.5 km: 99.997% 2.0 km: 99.99% 2.5 km: 99.97% 3.0 km: 99.9%
RTD at 3km	< 25 μ s

Certification & Compliance

General Safety	IEC 62368-1:2014+A11:2017
EMI/EMC interference	FCC 15B EN55011 EN 55032/35/24
Laser Safety	Class 3B Laser product IEC/EN 60825-1
Quality Standards	ISO 9001 ISO 14001