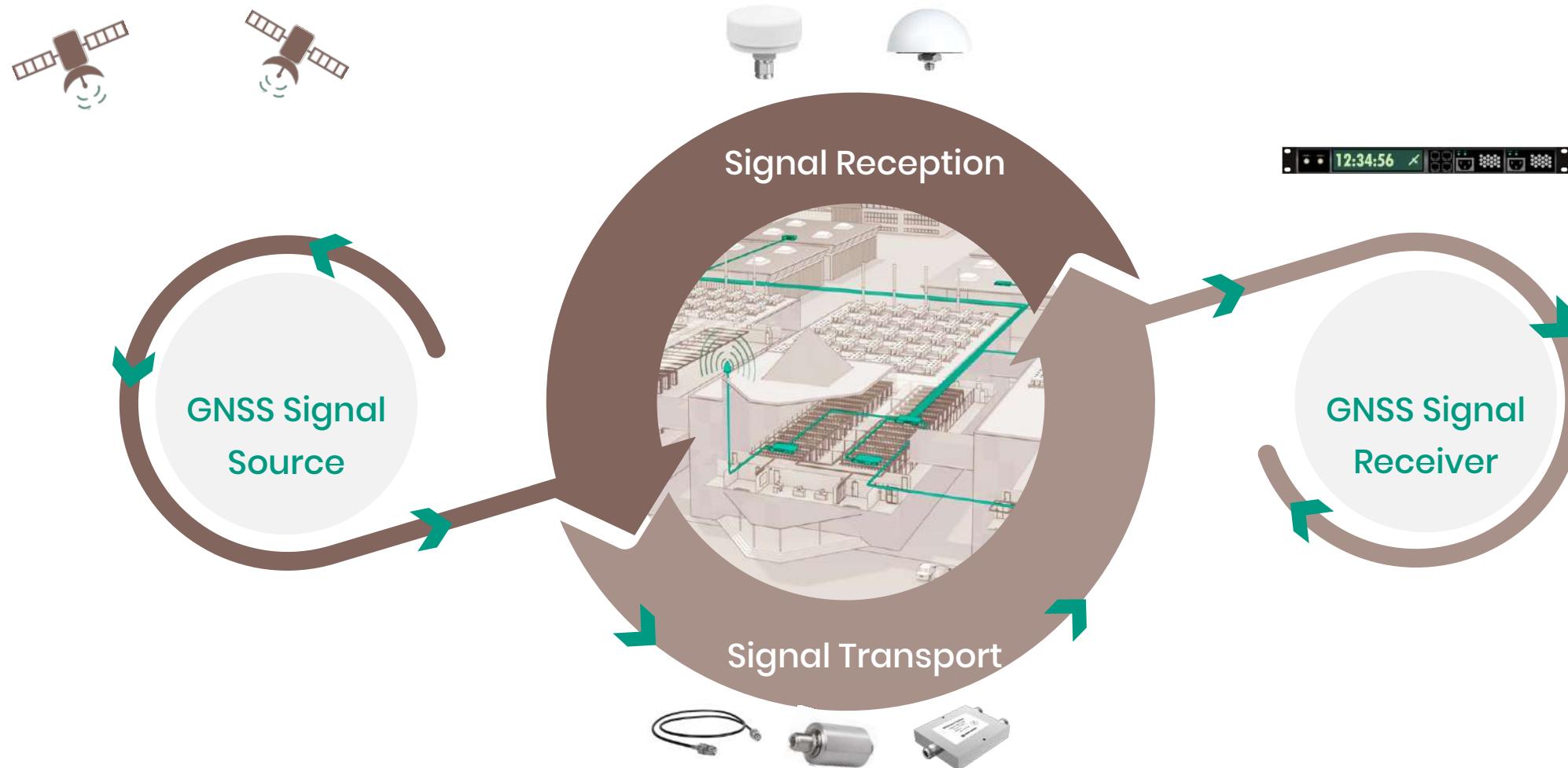


**HUBER+SUHNER**

# **Fiber-Enhanced GNSS Distribution**

# GNSS Signal Journey

## Satellite to Synchronised Packet



# GNSS deployment – today...

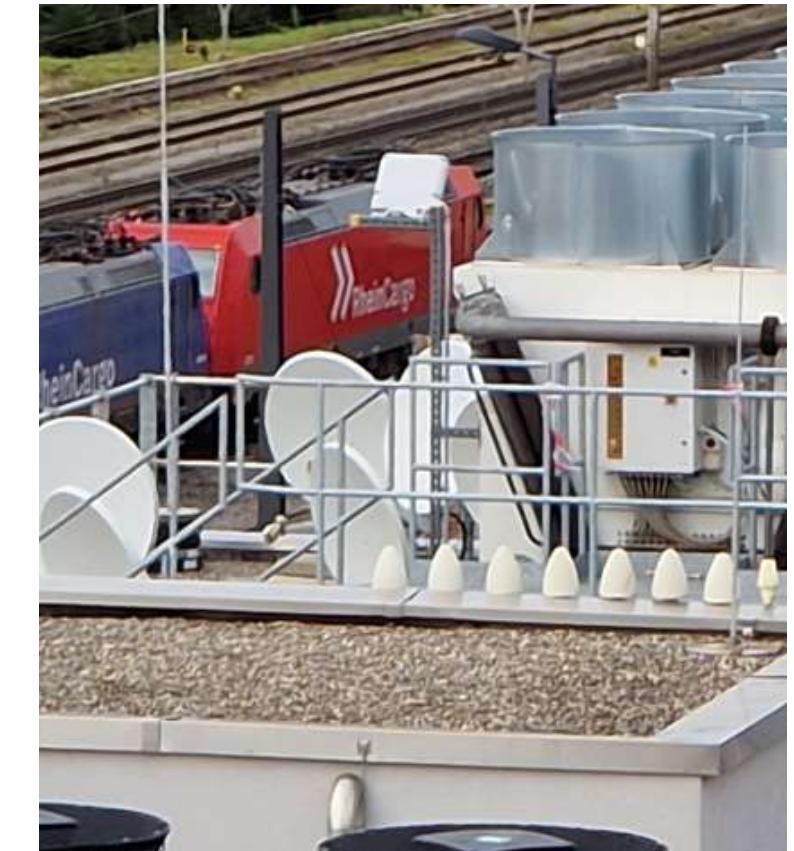
**Hyperscale**



**Colocation**



**Enterprise**



# Current solution

## Today's challenges and limitations

### Solution

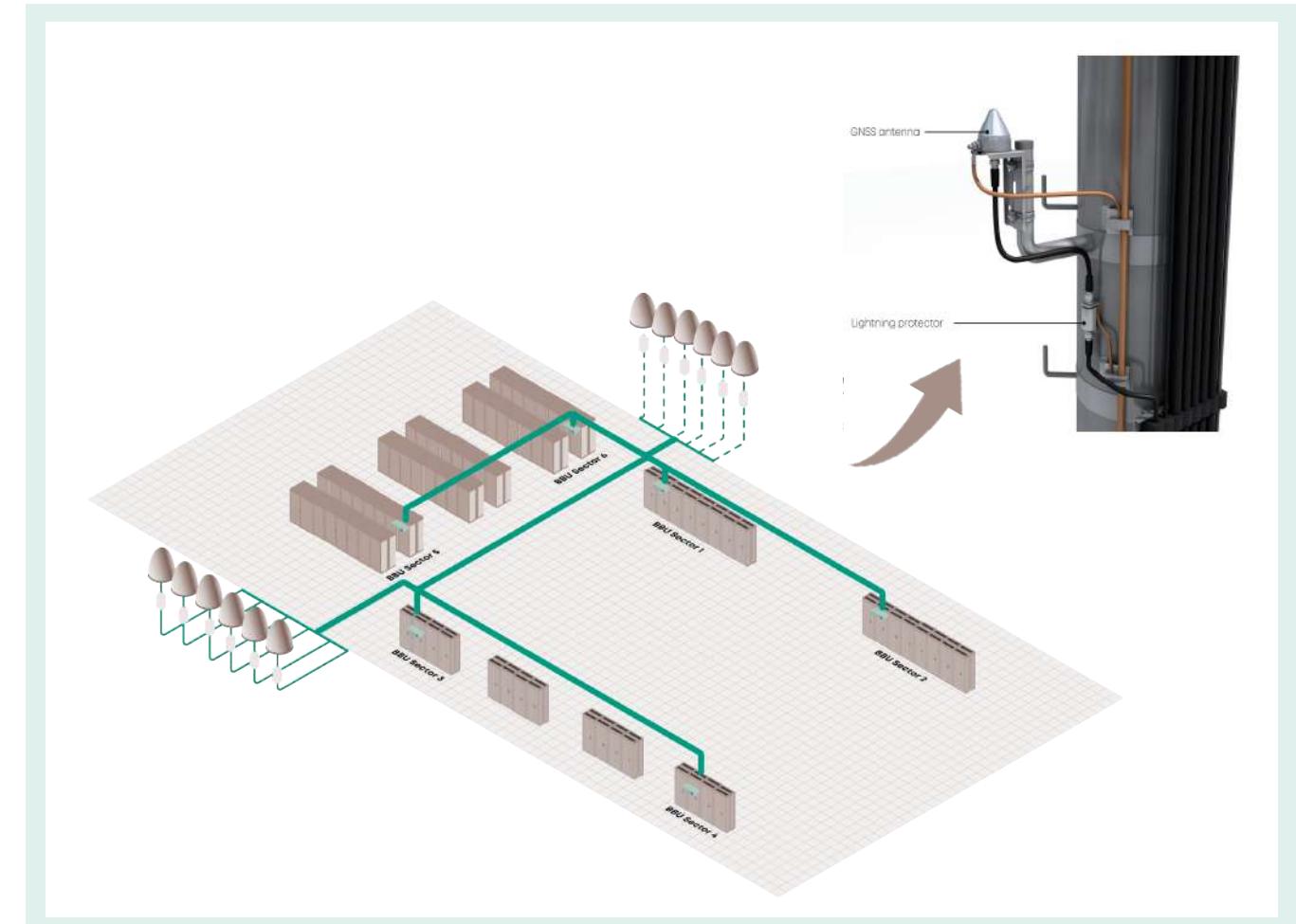
- Passive antenna, Coax and Lightning arrestor setup

### Infrastructure

- Single shaft (cable riser) to run all the cables
- No powering needed at rooftop
- challenge to find RF trained installers

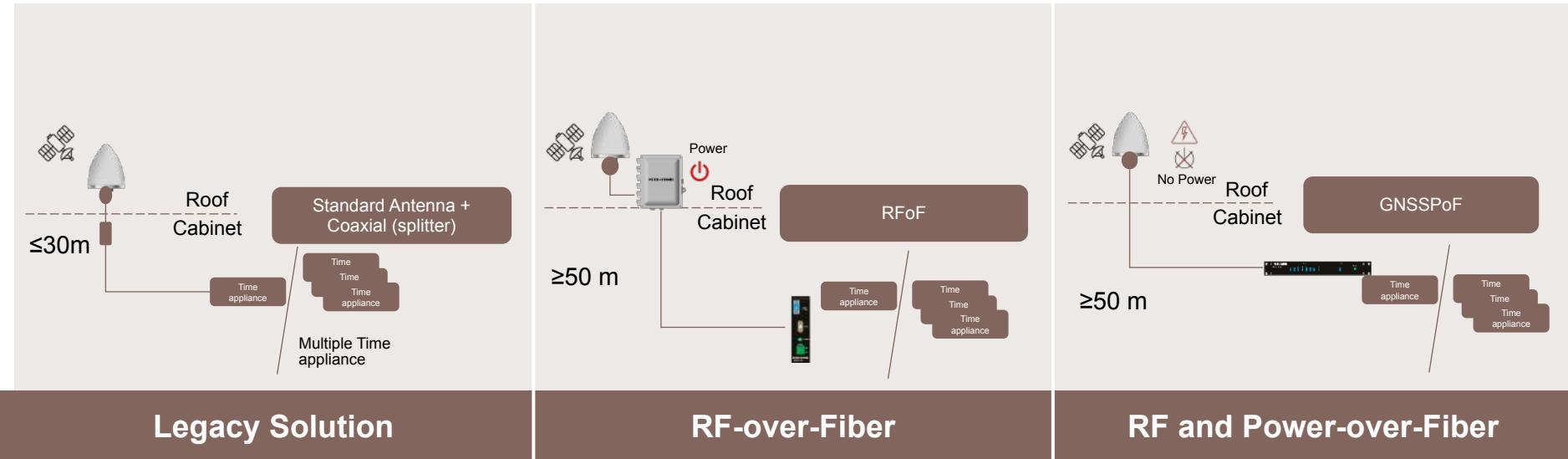
### Technical challenges

- Coaxial limitations: high attenuation leads to shorter range and reduced scalability.
- Susceptibility to electromagnetic interference
- Mandatory additional lightning protection
- Reduced service life due to environmental and electrical stresses



# Fiber-Enhanced GNSS Distribution

## Solution Comparison

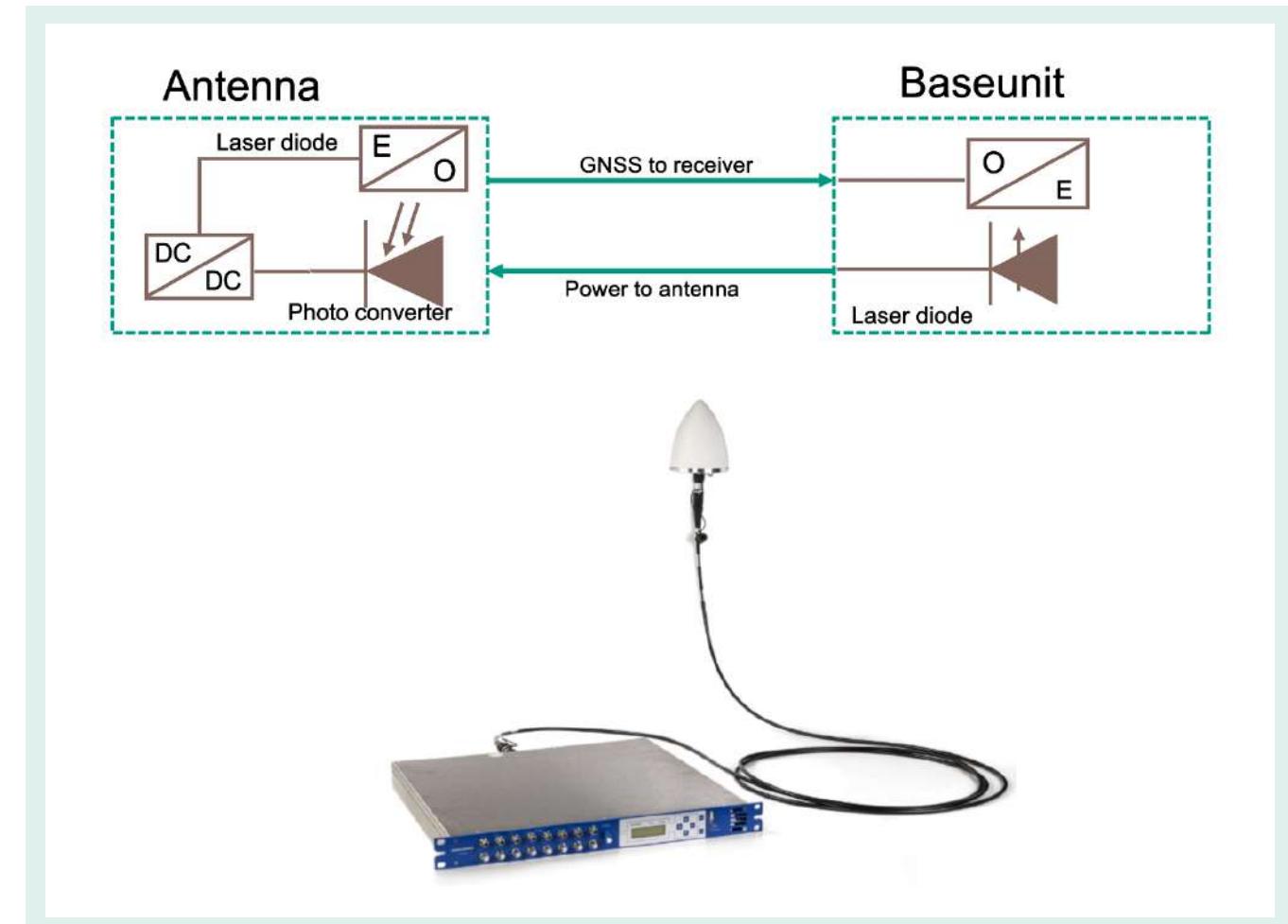


Solution type	Legacy Solution	RF-over-Fiber	RF and Power-over-Fiber
Long distance ( $\geq 50\text{ m}$ )	✗	✓	✓
Lightning / Grounding	✗	✗✓	✓
Scalability	✗	✓	✓
Remote powering (External)	✓	✗	✓
Ease of installation	✗	✗	✓
Antenna positioning	✗	✗✓	✓

# Infrastructure Challenges

## Antenna Power Supply via Power-over-Fiber (PoF)

- Power and GNSS signal utilises the **same fiber**
- A **high-power laser** converts electrical power to optical.
- The antenna converts **optical power back to electrical** to feed active components.
- **Multiple fibers** in one cable reduce optical hazard level.
- GNSS power needs result in **Laser Class 1M** – safe for standard use.
- **No special safety measures** needed, except switching off laser during connector inspection.
- Compatible with **standard building fiber infrastructure**.



# GNSS Signal Transmission for Timing Application

## Management of Fiber Link Parameters

### Monitoring parameters

- Laser current, Received optical power
- Antenna status
- Receiver power consumption

### Integrated GNSS receiver

- supports install and diagnostics/ troubleshooting
- detects jamming and spoofing threats.
- Possible integration of hold over time

### Critical timing indicators:

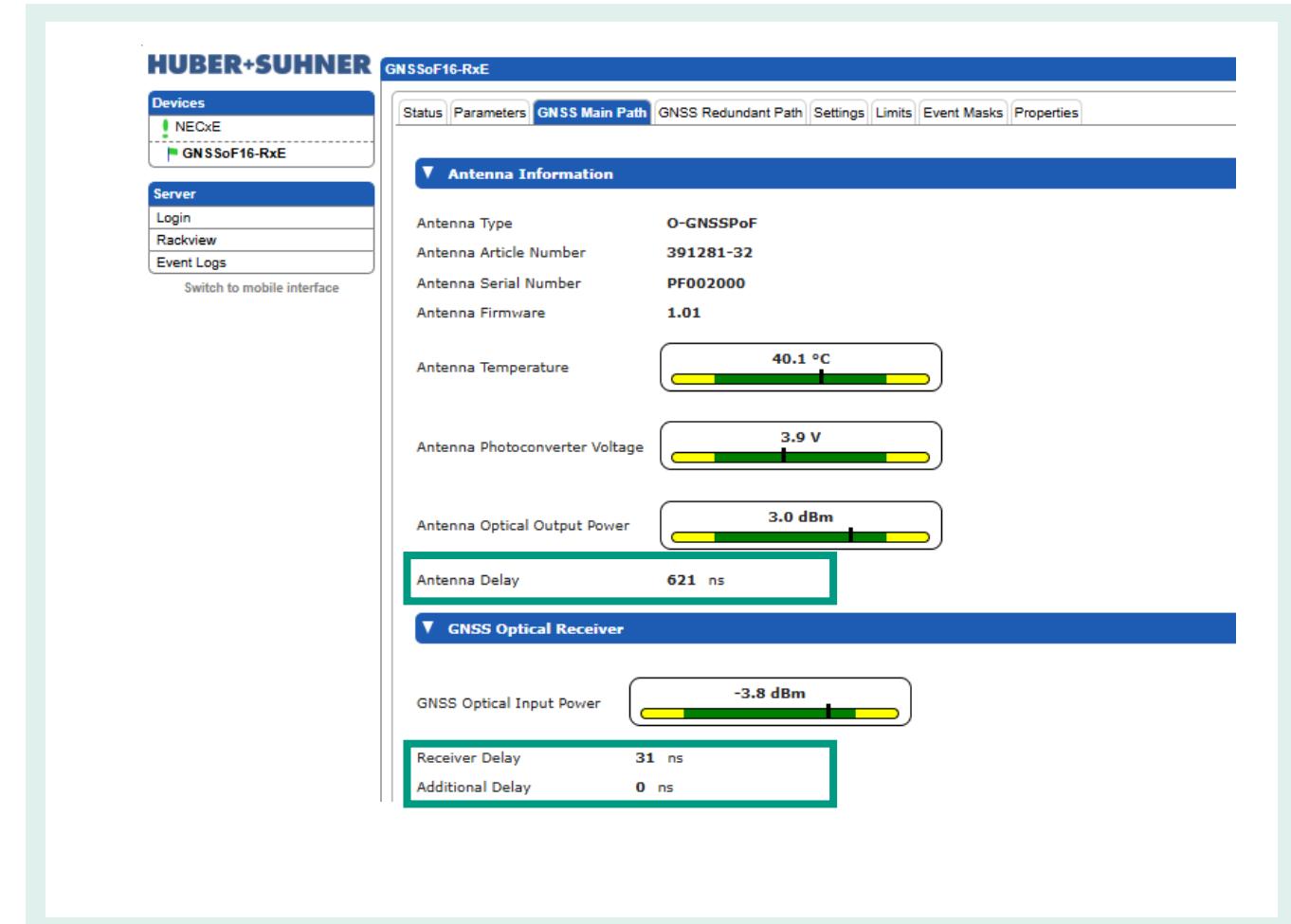
- Number of received satellites
- Signal-to-noise ratio (SNR)
- 3D accuracy & dilution of precision
- GNSSoF link delay

### Access options:

- Local: WebGUI, CLI
- Remote: SNMP, Restconf/YANG, Netconf/YANG

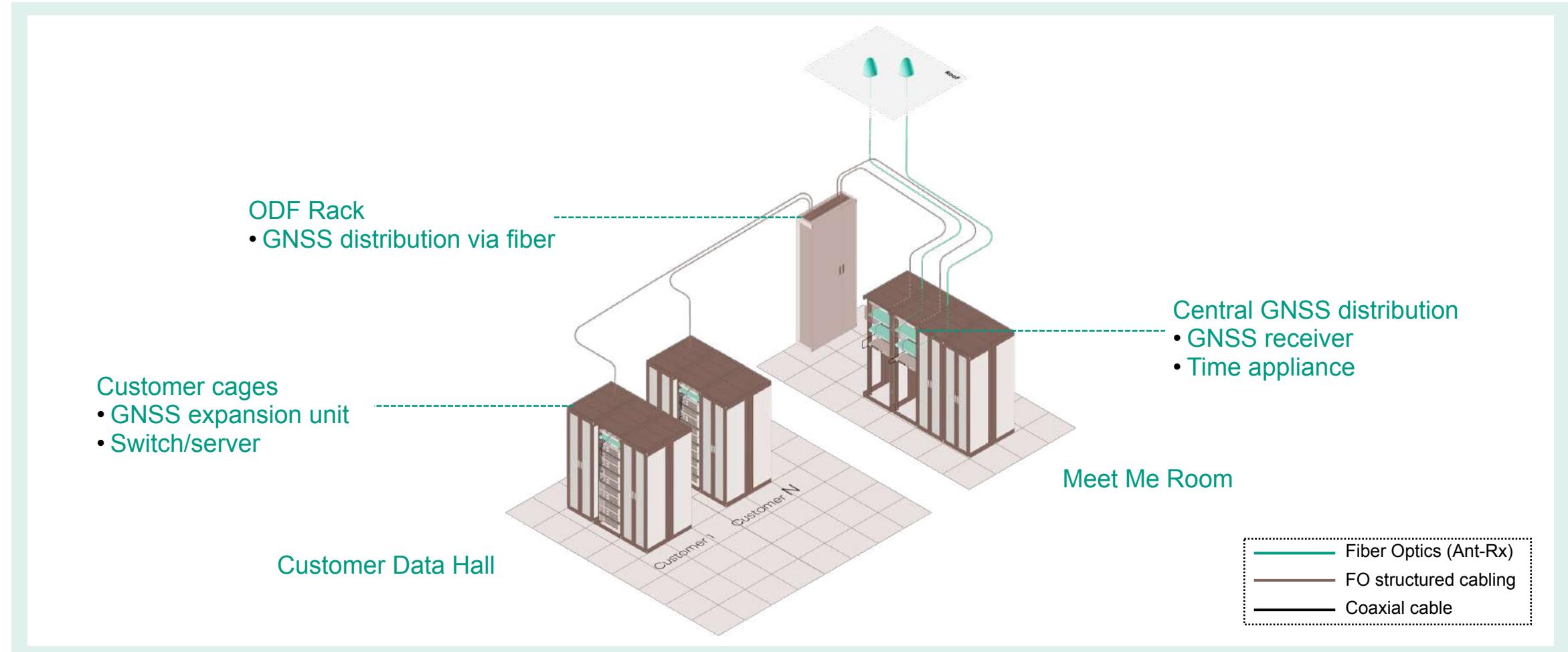
### Future development

- Automatic detection and mitigation of impairments.

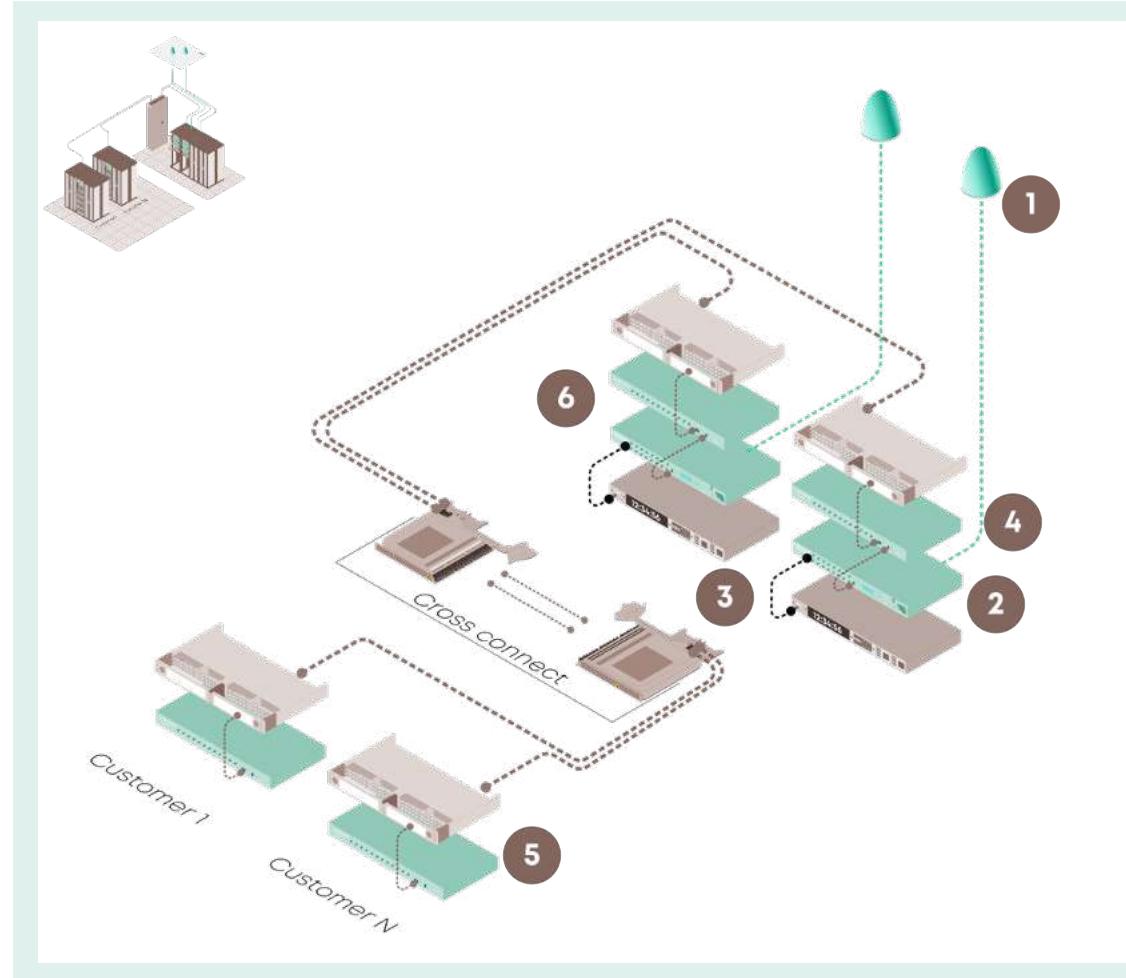


# Use Case

## Colocation (Multi-tenant )



# Use Case Colocation (Multi-tenant )



## Typical deployment setup

- 1 shared GNSS PoF system (1,2)
- Coaxial connection to host time server (3)
- GNSS distribution via Fiber (patch panel or optical splitter) to tenant's cage (4)
- Expansion module at the tenant cage (5)
- **Optional:** Additional GNSS PoF module for redundancy (6)

## Practical advantages

**Shared infrastructure:** One rooftop antenna and PoF transmitter can serve multiple tenants

**Tenant isolation:** Fiber can be easily routed to tenant cages without exposing the raw coax or complicated signal splitters

**Scalable growth:** Adding new tenants only requires running additional fiber drops.

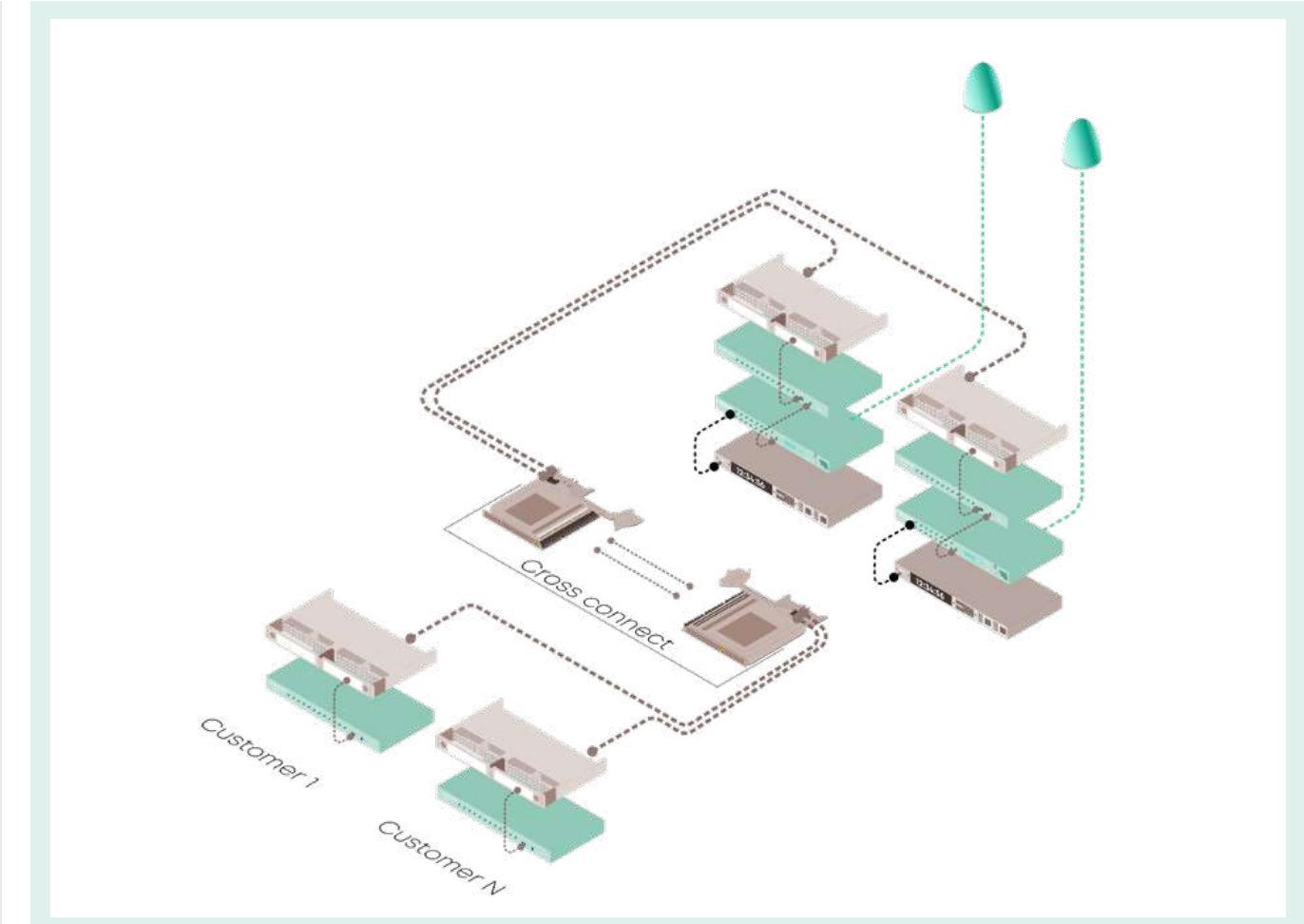
## Implementation tip

**“GNSS timing service”** as part of the colocation package – tenants simply plug into their fiber patch for immediate, accurate timing

# GNSS Signal Transmission for Timing Application

## Link Redundancy and Security

- **Different antenna positions** help detect and mitigate jamming/spoofing.
- **RF filters** in the antenna reduce out-of-band interference, enable Multi band reception for improved accuracy
- **Two separate fiber cables**, each with its own antenna to two separate receivers
- A **redundancy switch** selects the best-performing signal at the receiver.
- If both main and backup signals degrade, the system enters **holdover mode** to maintain timing quality.



# Summary

- **Fiber-enhanced GNSS** distribution delivers precision, scalability, and reliability for demanding timing applications.  
Overcomes **legacy limitations**: longer range, simplified infrastructure, safer installation, and minimal maintenance requirements.
  - 40× longer reach - no repeaters needed
  - $\geq 10$  dB improvement in GNSS SNR
  - 80% reduction in installation time
  - No infrastructure upgrade required
  - Instant scalability and plug-and-play integration for future growth
- **Power-over-Fiber (PoF)** enables resilient, location-agnostic antenna deployment to ensure true operational redundancy.  
100% fiber optic based - Zero electrical hazards at the antenna
- **Modular design** supports diverse infrastructure needs - from hyperscaler data centers to colocation facilities and Enterprise datacenters, from RAN hub to DAS and many more—enabling future-proof growth and cost-effective expansion.
- **Integrated diagnostics / threat detection features and redundancy** add another level of safety, guarantee continuity and security for mission-critical timing services.



Connecting – today and beyond