

FIBRE TO THE END USER

Fibre to the End User (Fibre to the EU or FTTEU) is a subset of the well-known general term Fibre to the X. This is because both last-mile and in-building connections are optical links. The term end user means the extension of the optical fibre up to the end point of the user's choice. The focus of FTTEU is therefore the end-user workplace and as such it can be considered as the most advanced service of the Fibre to the X service set.

For R&D purposes, FTTEU can be further divided into two groups:

- **FTTDesk (Fibre to the Desk)**
Optical fibre extension directly to the (end) user's (work) desk.

Fibre to the desk

FTTDesk is the most common and preferred form of end-user connection. Because of optical fibre links along the entire path, it is possible to offer and provide advanced services based on pure photonics (e.g. remote instrument control) from which the end user can benefit.

Implementation

In the CESNET network, end users are usually connected by an optical fibre pair. The path from the CESNET node to the user is, by default, equipped and lit by GzechLight optical devices, which use technology designed for low-budget optical backbone networks. If the end user is in close proximity to the node, a

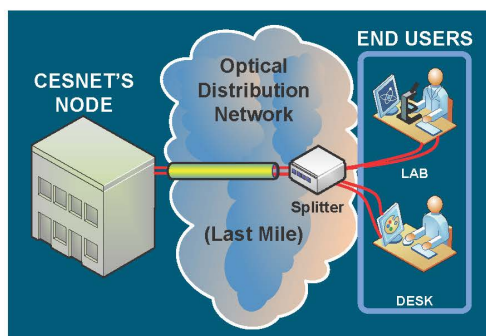


Figure 1: FTTDesk and FTTLab connections over an optical network

- **FTTLab (Fibre to the Lab)**
Optical fibre extension directly to the (end) user's laboratory devices.

Fibre to the lab

FTTLab provides a fully optical connection to an entire laboratory or its instruments. End devices might include computers or any other laboratory instrument. These devices are expected to take advantage of real-time communication over the optical network using advanced optical (lambda, photonic) services.

passive fibre solution is also possible. Over this last mile, CESNET provides standard IP services as well as advanced services based on pure fibre optics. As a result of the optical fibre last mile, interested end users may benefit from lambda and Photonic Services.

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Features

Low and guaranteed latency

The last mile to the end user is covered by all-optical fibres without any optical-electrical-optical regeneration (OEO) devices. Therefore end-to-end delay, or latency, is low and without any variation caused by OEO. The end user is not limited in the selection of network application and even advanced applications with low latency and minimal latency variation are supported.

High capacity

The end user is connected by the last mile to an optical backbone network and can benefit from terabits of optical fibre capacity. Today's communication rates for a single optical channel go up to 100 Gbps.

Examples of Applications

Remote access to distant laboratories

Low latency allows connection to and remote control of laboratory equipment. Devices can be remotely prepared for experiments and results retrieved directly for user or laboratory processing.

Hard real-time applications

For hard real-time applications, low and guaranteed latency are critical. Examples of this type of application include:

Designed for

- Research institutions and groups requiring remote access to and/or control of their devices or equipment
- Testing and development of new network protocols from Layer 2 and above
- Advanced time synchronisation
- Critical cases of remotely controlled precision device (e.g. surgical robots).
- Remote connection to distant and distributed file systems

Scalability

The number of IP optical channels and Photonic Services can be scaled according to the end user's needs as the capacity of the last mile is dedicated to the end user.

Protocol transparency

The optical last mile allows the end user to set up Photonic Services. These all-optical channels provide full protocol transparency, while standard services can only support protocols according to the network equipment available.

CONNECT

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