



# Light Path Deployment, Guide for IT Support

## Best Practice Document

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# 1 Introduction

The purpose of this document is to support IT personnel who are implementing a light path connection in the Funet network. This document contains a step-by-step description on what should be taken into consideration in the deployment of a light path. A light path is a dedicated data transfer channel between two endpoints. Light paths are separately priced additional services provided by Funet.

## 2 Survey of the data transfer needs

- Examine the connection's purpose of use:
  - Is a light path required, or is a Funet connection (an IP connection to the Funet network) applicable/sufficient?
  - Is a duplicated connection required? Fibre cut is the primary reason for light path connection outages, and the duration of the outages ranges typically from several hours to over one day. The duplication of a light path must be designed and ordered separately.
  - Assessment of the required capacity. As a default, Funet offers 1 GE light paths, but 10 GE connections are also available.
  - What is linked by the light path?

- In which building, room and piece of equipment is the light path terminated? This information is required for both ends of the light path.
  - The terminal device can be, for example, the campus edge device towards Funet or a separate device servicing the connection in question.
  - Is routing required?
- Survey the suitability of the cabling infrastructure at both endpoints of the light path for making the connection to the end user:
  - Is there enough fibre and copper cabling, or is there a need to lay new cable?
  - Light paths are usually constructed using SM fibre (single mode, G.652). At short distances (under 300 m) MM fibre (multimode) can be used when the light path connection features active gear, usually DWDM.
  - If new fibre needs to be laid, aim to use the latest fibre types, and commonly used connectors in the fibre panels and network equipment. For example, LC connectors are in common use and take up only little space.
  - Take the required steps to bring the infrastructure to the required level.
- Funet network administration connects the light path from Funet network in one of the following ways:
  - Directly from a DWDM device (if the DWDM device is in the same space)
  - From the same fibre pair used with Funet main or backup connection utilising CWDM muxes
  - With fibre separately ordered for the light path from a Funet node
- Is there an available fibre or copper port (1 GE or 10 GE) in the terminal device into which the light path is terminated (e.g. campus edge device)?
  - Light paths are implemented using fibre connections. If the edge device does not have a suitable fibre port available, a media converter must be used. The use of media converters should be avoided if possible, as they constitute one more point of failure in the chain, and power source malfunctions are common in media converters.

### 3 Ordering/construction phase

- Order the light path from Funet.
  - Contact Funet NOC noc(at)funet.fi and describe the locations that need to be connected, including street addresses and more detailed information on the premises, if any.
  - List the local technicians who will be involved in the construction of the light path on the order.
  - Make a separate note if 10 GE capacity is required. As a default, Funet offers 1 GE light paths. Other interfaces may also be feasible, depending on the path and distance of the link.
  - Also make a note on the order if you wish to duplicate the light path or if it is meant to be a redundant link for an existing connection.
  - A Funet specialist will examine the implementation alternatives and inform you on what measures need to be taken in order for it to be possible to implement the connection. For example, whether new fibre needs to be ordered and whether there will be other costs than the annual fee for the light path.
    - Responses to fibre connection price and availability queries typically take about a month.
    - Depending on the case, CWDM technology can be used at short distances (under 50 km). Funet will inform you on the CWDM channel used and gives an estimate on the power budget.
    - You then need to place an order for a CWDM transceiver suitable for the terminal device.
    - If a media converter is required for the edge device, acquire one.
    - Funet will supply any passive CWDM multiplexers required for the light path and, if necessary, provides instructions on their installation. The multiplexer requires 1U of rack space.
- If the campus has insufficient fibre infrastructure (indoor cabling) or lacks suitable copper cabling, order them at this point at the latest, and bring the infrastructure to the required level.

- Plan the IP addressing of the networks at the ends of the light path. As a light path is a point-to-point connection, suitable IP addresses are required for the network equipment (router, switch, firewall) at the ends of the light path.
- If changes need to be made to the IP addressing at one end of the light path, prepare a separate plan for its implementation to avoid long service downtime to the end users.
- Plan what other configurations are required on the terminal devices to which the light path is terminated. For example, the VLAN configurations of the switches and any firewall rules.
- Plan the monitoring of the light path
  - Funet only monitors light paths on Funet's DWDM network sections, from which Funet NOC receives automatic alerts in case of malfunctions.
  - If the light path is implemented strictly with passive CWDM multiplexers, the user is responsible for the monitoring of the entire light path; should malfunctions occur, the user must contact Funet NOC.
- Where possible, connect the cables in advance. Always remember to clean fibre connectors when making connections. We also recommend checking the cleanliness of the connectors with a fibre optic inspection microscope. In the case of CWDM connections in particular, you must ensure that the fibres are connected the right way (RX/TX) on all sections.
- Inform the user on the progress.

## 4 Testing/deployment phase

- Funet will notify you when the light path has been connected.
  - At this point, Funet network administration has made the required fibre connections and hardware configurations.
  - Funet will inform you on the port or fibre panel from which the light path can be connected to the terminal devices.
- Schedule the deployment of the light path with Funet.
  - If necessary, Funet will coordinate the deployment, particularly in situations where the light path is connected between two different organisations.
- If necessary, inform the user of downtime.
- Connect the light path to the terminal devices (switch, router, etc.).
- Configure and enable new settings on the terminal devices (switch, router, etc.).
- Test that the light path works and no errors are displayed in the error counters of the terminal devices.
- Inform Funet of the light path's status.
  - If the light path does not work, Funet will inform you on the further measures
  - The most common reasons for a light path not working are:
    - missing connection fibre
    - incorrectly connected connection fibre
    - damaged connection fibre
- When the light path has been found to work, monitoring is implemented on the light path.
  - The Funet member monitors its own equipment at the ends of the light path
  - Funet NOC monitors the light path on the DWDM network sections. Funet NOC is alerted of any disruptions.
  - With regard to passive CWDM connections, Funet NOC is unable to monitor the status of the light path
- Light path users should document the type of the light path (CWDM/DWDM) and intermediate points in their own documentation systems as well. This information may be useful in troubleshooting and the assessment of the impact of maintenance notifications. The light path type cannot be identified from, for example, the connectors or the wavelengths used. If the connection has (a) media converter(s), the



documentation of their locations and types is particularly important, because the status of the converters is often the first thing checked during malfunctions.

- Check from the terminal devices that the optical input power of the connection is within the range reported by the manufacturer. The power level can be adjusted through the selection of transceivers and optical attenuators. For example, if the allowed power range reported by the manufacturer is 0 ... -17 dBm, the received power could be adjusted to around -15 dBm.
- Using the light path may begin.
- If necessary, put the organisation's internal invoicing in order.
  - Funet will add the annual fee for the light path to the organisation's Funet invoice.

## 5 Maintenance phase

- Monitor the status of the light path and the error counters in your own network monitoring system in order to detect disruptions
- When maintenance is performed on the light path or its terminal devices, give advance maintenance notifications to Funet NOC and the end users.
- Funet NOC will report maintenance downtimes in the Funet network on the TL-katko mailing list or directly to the technical contact address specified by the customer.
- If problems occur on the light path, for example, the connection is down or its performance does not meet expectations, contact Funet NOC.
- Keep the documentation of the connection up to date.

## Glossary

CWDM	Coarse Wavelength Division Multiplexing
DWDM	Dense Wavelength Divisio Multiplexing
MM	Multimode (fiber type)
NOC	Network Operation Centre
SM	Singlemode (fiber type)
VLAN	Virtual Local Area Network



