

LAMBDA SERVICES

The lambda service is a network service that provides a high-bandwidth end-to-end (E2E) connection between two locations and is realised as a dedicated optical wavelength channel. The lambda service across a transport network matches much stricter criteria than, for example, Ethernet E-Line services. Lambda services (such as GÉANT Lambda) may consist of number of segments representing network domains that handle the service at their edges or some segments may be traversed by the service in the form of Alien wave, as illustrated in Figure 1 below.

The figure shows that the Dense Wavelength-Division Multiplexing (DWDM) equipment is placed at the end-user premises and the optical signal is transported from end-user location CE-A through a transport network to end-user location CE-B. The topology can be more complicated when other NRENs, campus networks or local carrier networks stand between the end-user locations. The lambda service utilises network elements along its path between end points, but occupies only a small portion of network resources. As a result of its dedicated bandwidth, the lambda service offers a number of significant advantages.

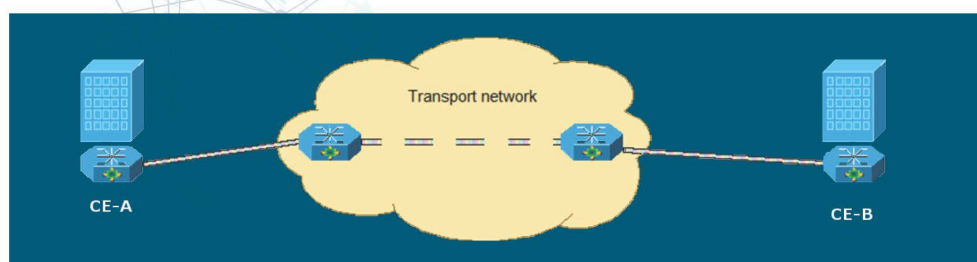


Figure 1:
End-to-end
lambda service

Advantages

Transparency

The lambda service is fully transparent and protocol independent. This allows end users to use the service with minimal limitations and without any interference to payload during transport. It allows the use of any protocol (Ethernet, SONET/SDH, InfiniBand or others) at higher layers according to the end user's needs.

High bandwidth

The lambda service occupies the bandwidth of a single ITU DWDM channel. Today's optical systems offer standardised data rates of 10 Gbps, 40 Gbps and even 100 Gbps in the single channel.

Security

End-to-end lambda services create logically separated optical channels, which provide high levels of security for the end user's application data.

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Advantages cont.

Low latency

Because the lambda service has dedicated bandwidth along its path, there are no routing decisions and forwarding actions to cause delay. As a result, latency, the end-to-end delay, is generally low and stable. The latency is primarily caused by signal propagation delay in the fibre and during optical-electrical-optical (OEO) regeneration inside the networks.

While delay in the fibre is almost constant, the time needed for OEO conversion usually

depends on network traffic, which may cause some variation in the latency – a jitter. The specific value of the jitter depends on the number of OEO regenerations along the lambda service path.

Scalability

Once a fibre infrastructure is in place, and one optical wavelength channel is being used, it is easy to add more lambda services when they are needed.

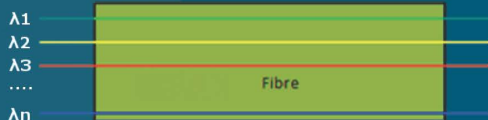


Figure 2: Lambda services in a fibre

Examples of Applications

Interconnection of data centres

Because of its high bandwidth and reliability, the lambda service could be useful for data storage solutions where moving and replicating large amounts of data are requested.

High-definition or 4k video streaming

The lambda service provides a stable connection with low latency and sufficient bandwidth for applications such as surgery broadcasting or remote access to 3D models.

Remote access to laboratories

Low latency allows the remote control of unique equipment that does not put strict requirements on latency jitter.

Real-time applications

Real-time applications allow devices at end points to communicate over lambda services in real time with given latency and low jitter. The requirement for no or negligible jitter could be met by a Photonic Service. Strict latency and jitter criteria may be required by critical cases of remotely controlled precision devices (for example, surgical robots).