Question 16/15 – Connectivity, operation and maintenance of optical physical infrastructures

(Continuation of part of Question 16/15 and Question 17/15)

1 Motivation

The rapid development of telecommunications networks around the world is based on the installation of optical fibres cables both in long-distance and access networks. Especially fifth-generation wireless networks (IMT-2020/5G) are possible only if supported by an optical fibre backbone network. Today the development stages of the networks may be different from country to country, but they have in common the need of high reliability in order to guarantee all the broadband services currently used, such as data and video communications. Moreover, the different geographical conditions must be taken into account in the network design and implementation.

The Question defines specifications needed for physical infrastructures, to enable the evolution of optical networks to support the ubiquitous availability of next-generation high-bandwidth services. It represents a natural interface to other organizations, such as IEC, that work on the same topics.

Passive optical network (PON) topology is used in many countries for FTTx applications and suitable configurations must be considered, taking into account network installation, maintenance, operation and administration, as well as the evolution towards WDM PON. Moreover, it is important to consider appropriate optical access network planning for urban areas with concentrated optical fibre demand, as well as for rural areas, which disperse the optical fibre demand across a wide region.

The progress in the miniaturization of optical cables will lead to studies on its impact on existing networks and on accessories such as splice closures, cabinets, terminal boxes, novel high-count small footprint optical connectors, etc.

Emerging topics related to the Internet of Things (IoT), IMT-2020/5G and "Smart Cities" require the analysis of their impact on existing networks and studies on new potential needs related to deployment in indoor and outside plant environments.

Large/hyper scale data centres are built to support data services and ICT technologies such as cloud computing, big data and artificial intelligence. Study on infrastructures for long-haul and city range Data Centre interconnecting are required.

Finally, telecommunication infrastructures including optical fibre cables and their supporting infrastructures such as poles, holes, tunnels and so on, continue to deteriorate from aging. In order to guarantee the continuity of the service, effective and safe management of infrastructures is essential. It is also important to improve network resilience and recovery against disasters if we are to realize sustainable telecommunication services.

With the increase of number of customers connected with FTTx techniques it becomes mandatory to develop methods of fibre testing and fibre identification in order to ease the connection of new customers, as well as to identify faults in the field without service interruption.

Regulatory scenarios should be also taken into consideration for the design of fibre access networks, for IMT-2020/5G technology deployment, smart city physical infrastructures, factories, vertical industry applications and other new scenarios.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility: L.200/L.51, L.201/L.13, L.202/L.50, L.203/L.44, L.204/L.70, L.205/L.11, L.206, L.207, L.208, L.250/L.90, L.251/L.72, L.252/L.86, L.253/L.47, L.254/L.62, L.256/L.45, L.257/L.39, L.258/L.63, L.259/L.73, L.260/L.84, L.261/L.89, L.262/L.94, L.300/L.25, L.301/L.41, L.302/L.40, L.310, L.311/L.93, L.312/L.68, L.313/L.66, L.314, L.315, L.340/L.74, L.341/L.88, L.360/L.80, L.361/L.64, L.362/L.69, L.390/L.92, L.391/L.81, L.392, L.400/L.12, L.401/L.31, L.402/L.36, L.403/L.37, and L.404.

2   Question

Study items to be considered include, but are not limited to:

–   What is the impact of different geographical conditions on optical network infrastructures?

–   What are the appropriate optical access network topologies for urban areas and rural areas taking into consideration the optical fibre demand and the size of the area?

–   What are the key considerations for indoor and outdoor network design taking into account planning and growth, including fibre needs for IMT-2020/5G deployment?

–   What are the relevant characteristics of optical access networks for supporting the evolution of PON technologies?

–   What are the optimal methods for installing network elements in common parts of the buildings?

–   What are the features needed for building distribution point (BDP)?

–   What are the key accessories and their features for the cabling in the building?

–   What are the mechanical and environmental characteristics of the optical infrastructure, including:

    •   Optical distribution frames.

    •   Outdoor closures and cabinets.

    •   Indoor and outdoor distribution terminals.

    •   Optical fibre connectivity, including splices, optical and/or optical/electrical hybrid connectors, field mountable connectors, splitters and other passive components.

    •   Customer terminals and pre-terminated drop cables.

    •   Indoor cabling solutions.

–   What methods can be envisaged for storage, protection and thermal management of active electronics in outside plant locations taking into account energy efficiency requirements?

–   Which technical issues should be taken into account when splicing different kinds of single mode fibres?

–   What are the optimal strategies for constructing new infrastructure and expansion of existing infrastructure, taking into consideration integrity of installation, maintenance and growth issues?

–   What are the key issues when the existing infrastructures of other service providers and utilities (for example, public lighting and sewers) are shared to accommodate a new fibre cable in order to minimize civil works?

–   What are the suitable techniques to investigate and/or map the existing infrastructures to avoid excavation and/or damage to the facilities?

–   What is the impact of the fibre/cable miniaturization progress on the existing networks?

–   What are the suitable techniques for urban areas and rural areas network design, taking into account the optical fibre demand and the size and future expansion of an area?

–   What are the regulatory issues to be considered for fibre deployment?

–   What is the impact of IoT on the infrastructure needs for "Smart Cities" and existing urban networks?

–   What are the suitable techniques to connect "smart city" physical infrastructures such as smart light poles, or further on, smart light poles carrying IMT-2020/5G antennas?

–   What are the suitable infrastructures for "inter-office" applications?

- What are the functional requirements for optical fibre line testing without any deterioration in optical communication signals in access networks?
- What procedures and methods can be employed for optical fibre line testing without interrupting optical services and/or during maintenance work on optical access networks?
- What test functions are needed to realize a highly reliable optical network?
- What kinds of optical devices for testing are needed to maintain an optical cable network effectively?
- What are the functional requirements for an optical fibre line testing system for access and trunk networks without any deterioration in optical communication signals?
- What kinds of parameters and/or information are needed for network operation systems for PON and optical fibre line testing systems in order to find a fault location in an optical fibre cable?
- What kinds of reliable technologies can be used to preserve and protect outside plant facilities?
- Study new solutions for monitoring critical network elements using sensor networks.
- Do the existing ITU-T Recommendations and handbooks provide an up-to-date coverage of the techniques needed to maintain the optical fibre cable infrastructure?
- Assess optical infrastructure security issues in the context of operation and maintenance.
- Study appropriate ways to improve network resilience and recovery against disasters.
- What are the functional requirements and/or suitable techniques for inspection, maintenance and repair of supporting infrastructures such as telephone poles, tunnels, ducts and manholes/handholes?

3   Tasks

Tasks include, but are not limited to, develop Recommendations and/or technical documents on:

- Aspects related to planning, installation, activation and acceptance of optical networks.
- Technical aspects concerning regulations related to optical access networks.
- Technical aspects regarding the sharing of infrastructures of other operators and utilities.
- Advanced solutions for investigating the existing buried infrastructures.
- Characteristics and installation methods for BDP (building distribution point).
- Characteristics and installation methods for cabling accessories needed inside home/buildings.
- Characteristics and installation methods of cabinets for FTTx.
- Customer end distribution boxes and terminals, taking also into account of multi operator access.
- Outdoor optical cross-connect cabinets.
- Transmission parameter values for components with respect to statistical values, such as mean and standard deviation, short-term variations with environment, long-term degradation with aging, use of these in system calculations.
- Components for construction, installation and protection of cables and other elements of outside plant (optical fibre splices, optical fibre attenuators, single mode fibre optic connectors, optical branching components as well as field mountable optical connectors).
- New families of high count, small footprint optical connectors, optical/electrical hybrid connectors.

- Impact of the new fibre types with reduced coating thickness on the outside plant components (i.e., splice closures).
- Pre-terminated fibre drop cables & hardened connectors.
- Splicing of different kinds of single-mode fibres and splice measurement method solutions in outside plant and indoor network cabling and construction.
- New network solutions to support the needs of "Smart Cities", for example, technologies for fibre to the smart city physical infrastructures such as smart light poles.
- Optical physical infrastructures for backhaul/fronthaul networks for emerging applications such as data centre interconnections, advanced mobile services, smart manufacturing, etc.
- Revising existing Recommendations as needed.

An up-to-date status of work under this Question is contained in the SG15 work programme (https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=15).

4 Relationships

Recommendations:
- ITU-T L-series and G.65x series

Questions:
- Q1/15, Q2/15, Q5/15, and Q6/15

Study Groups:
- ITU-T Study Group 5
- ITU-T Study Group 20
- ITU-R SGs
- ITU-D

Other bodies:
- IEC SC86A
- IEC SC86B
- IEC SC86C
- IEC TC86/WG4
- FTTH Council
- Broadband Forum
- CENELEC TC 86 BXA