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Annex D: Technological developments



Technical description of IP networks

The document, and in particular, the scenarios refer to a number of supporting technologies, which are used in the provision of services. The diagram below seeks to define the relationship and dependencies of these technologies in a simple format. There are many more complexities to the UK telecoms infrastructure: this is a simple representation.

Direct Fibre	Satellite	Mobile WiFi Fixed Wireless	Low Bit Rate	Commercial MPLS	Access Fibre
IP and Packet Core					
Optical Multiplexing				Packet Based Optical	
Trunk Fibre					
Physical					

Below is a description of these technologies

Physical layer

This is the infrastructure within which telecoms capabilities are carried around the country. It refers to the ducting, aerial poles and other infrastructure required to carry the physical connections to subscribers.

Trunk Fibre

This is the fibre cable running within the physical infrastructure, sometimes known as "dark fibre" when it is not in use.

Optical Multiplexing

Optical Multiplexing generically refers to the means by which raw fibre capacity is enhanced and segmented to support multiple services and bitrates. Additional capacity can be delivered using technologies such as Wave Division Multiplexing (WDM).

Packet Based Optical

Increasingly the WDM and Packet Layer are being combined providing a more dynamic use of the raw fibre capacity. Providers favour this approach as a means to leverage greater statistical gain especially where resilient services are required. For example this allows latent capacity to be assigned on demand in the event of an underlying failure supporting efficient resilience.

IP and Packet Core

This refers to what is known as the Internet. There are two use cases today, residential and business. Residential internet is delivered through a number of

providers in the UK who provide access to their own content and others via Internet Exchange Points (IXP). Business Services follow the same model but services tend to be delivered using virtual private networks (VPN) to ensure security and privacy of content. In most cases the Internet and Business Services will share core capacity but they connect differently. Business Services connect separately from the internet although interconnects may be shared with other Business Services.

Direct Fibre

This is the delivery of high bandwidth (10Gbps +) low latency services. Whilst these can be delivered by the packet layer the service type and economics may make direct connectivity more attractive. Use cases for direct fibre connectivity include data centre connectivity which requires resilience and high bandwidth video post-production work flows.

Satellite

Satellite delivery provides one of the lowest cost points for the mass distribution of content. For pure telecoms applications it provides a means to deliver connectivity where there are geographical or commercial restrictions. Newer Ka-Band satellite communications provide capabilities similar to that provided by today's fibre services, although they are subject to additional factors, such as the weather, and are constrained on the uplink.

Mobile, WiFi and Fixed Wireless

The vast array of mobile and wireless technologies span from 2G to 5G, through to fixed wireless and WiFi. Delivering a heterogeneous access infrastructure that is distributed and connected via the IP and packet core.

Low Bit Rate

Low bit rate technologies are used for the delivery of telemetry and control protocols such as smart metering and automation of physical plant monitoring. Radio and Fixed line technologies such as Industrial, Scientific and Medical band (ISM) and power line communication (PLC) are currently in trial. Whilst the bit rates associated are small at an individual level they are aggregated and delivered to applications in the IP and Packet Layer.

Commercial MultiProtocol Layer Switching (MPLS)

These are the services that are deployed to support business to business connectivity. Increasingly the nature of these services is migrating towards business to cloud.

Access Fibre

Access Fibre services provide connectivity in the last mile. Access Fibre services are used to reach premises for FTTP or the cabinet for FTTC. Techniques such as FTTC or FTTDP use underlying connectivity such as VDSL and G-PON to establish connectivity to the access environment. With FTTP Access Fibre services are delivered point to point utilizing carrier ethernet technology direct to the premise.



Current Conceptual Physical Architecture

Example Internet Access Flow



Mobile Broadband technologies

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Cabinet

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Fibre

Mobile Broadband



Telegraph Pole OR Building

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