



## **BEREC Draft Common Positions on WLA, WBA and WLL**

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## Access

According to the Access Directive – Art. 2a) –, “access” means the making available of facilities and/or services to another undertaking, under defined conditions, on either an exclusive or non-exclusive basis, for the purpose of providing electronic communications services, including when they are used for the delivery of information society services or broadcast content services. It covers *inter alia*: access to network elements and associated facilities, which may involve the connection of equipment, by fixed or non-fixed means (in particular this includes access to the local loop and to facilities and services necessary to provide services over the local loop); access to physical infrastructure including buildings, ducts and masts; access to relevant software systems including operational support systems; access to information systems or databases for pre-ordering, provisioning, ordering, maintaining and repair requests, and billing; access to number translation or systems offering equivalent functionality; access to fixed and mobile networks, in particular for roaming; access to conditional access systems for digital television services and access to virtual network services”.

## Access point

Point in the SMP operator’s network where wholesale access is granted to the operators. This point can be located in the building, in a duct (manhole or pole), street cabinet, CO or MPoP. In the case of bitstream access this point can be local (such as DSLAM, OLT or equivalent) regional (Ethernet switch, IP Switch) or national (IP-Switch, BRAS).

## Access/Interconnection level

Geographical/hierarchical level of the access and/or interconnections points to the SMP operators’ network. Normally, there are 3 levels: i) National (or Distant) – a “single” access/interconnection point for all products/services, ii) Regional (or Parent) – a relatively small set of points distributed along “regional areas”, and iii) Local (or MPoP in case of FTTH) – access/interconnection at the CO level (MDF/ODF).

## Backhaul (network)

The intermediate link between the core/backbone network and the access network, i.e., the connection between typically distributed aggregation/access points and more centralised points of presence (PoP) – e.g. connecting wireless base stations to the corresponding base station controllers, connecting DSLAMs to the nearest ATM or Ethernet aggregation node or connecting a submarine communications cable system landing point with the main terrestrial telecommunications network. Backhaul technologies include: microwave transmission and access technologies (e.g. WiMAX), dark fibre, xDSL, SDH or Ethernet.

## Bitstream Access

Bitstream Access is a wholesale product which consists of an access link to the customer premises (over copper, coax or fibre) and a transmission service (e.g. Ethernet) to a defined set of handover points (the access point). It enables alternative operators to differentiate

their services by altering a number of technical parameters and/or the use of their own network. (BoR (10) 08, Ch. C.5.II)

#### Civil engineering infrastructure

"Civil engineering infrastructure" means physical local loop facilities deployed by an electronic communications operator to host local loop cables such as copper wires, optical fibre and co-axial cables. It typically refers, but is not limited to, subterranean or above-ground assets such as sub-ducts, ducts, manholes and poles. (NGA-Recommendation, Art. 11)

#### CO Central Office

A CO, part of the legacy "telephone network", is a dedicated building in which the access lines (from home or office) terminate in a MDF and, normally, access/switching (PSTN) equipment. In large metropolitan areas, COs are more appropriately known as Local (switching) exchanges, because they serve a local area. The term "CO" is from the early days of the telephone system when the telephone company did have only one central office in each area. Currently, with FTTH, the CO can also hold ODFs, where fibre local loops are connected, and/or OLTs and could serve as a MPoP.

#### Colocation

Colocation (also spelled co-location), is an ancillary service of the SMP operator, providing equipment space and facilities for rental to alternative operators in the access/interconnection points (e.g. MPoP, street cabinets). Colocation facilities provide space, power, cooling, and physical security for the networking equipment of the operators.

#### Contention ratio

Contention ratio is the ratio of the potential maximum demand to the actual bandwidth. In practice, they are planning rules which are used to design a network offering (typically) an Internet access service: the higher the contention ratio, the greater the number of users that may be trying to use the actual bandwidth at any one time and, therefore, the lower the effective bandwidth offered, especially at peak times. A contended service is a service which offers (or attempts to offer) the users of the network a minimum statistically guaranteed contention ratio, while typically offering peaks of usage of up to the maximum bandwidth supplied to the user. For example, a connection marketed with a contention ratio between 20:1 and 50:1 within the network, means that 20 to 50 subscribers, each assigned or sold a bandwidth of "up to" 8 Mbit/s for instance, may be sharing 8 Mbit/s of downlink bandwidth.

Contended services are usually much cheaper to provide than uncontended services, although they only reduce the backbone traffic costs for the users, and do not reduce the costs of providing and maintaining equipment for connecting to the network.

### Customer Premises Equipment (CPE)

Communications equipment, such as modems, set-top boxes, PABX (Private Automatic Branch Exchanges), etc., that resides on the business/residential customer's premises (e.g., company building, home office).

### Dark Fibre

Optical fibre already deployed (e.g. in ducts), but not active (unlit), i.e. without any electronics/optoelectronics operating at both ends.

### Distribution Point

The "distribution point" means an intermediary node in an NGA network from where one or several fibre cables coming from the MPoP (the feeder segment) are split and distributed to connect to end-users' premises (the terminating or drop segment). A distribution point generally serves several buildings or houses. It can be located either at the base of a building (in case of multi-dwelling units), or in the street. A distribution point hosts a distribution frame mutualising the drop cables, and possibly un-powered equipment such as optical splitters. (*NGA-Recommendation, Art. 11*)

### DSLAM Digital Subscriber Line Access Multiplexer

Equipment which allows copper lines to support broadband access. It is network equipment, normally located in the local exchange (but may also be installed in a street cabinet) whose function is to aggregate the traffic of several access lines which have modems that are compatible with xDSL technology and re-lay it through the data network (core). Depending on the product, DSLAM multiplexers connect DSL lines with some combination of ATM, Ethernet, or IP networks. (*BoR (10) 08, p. 65*)

### xDSL xDigital Subscriber Line

Collective description for a range of Digital Subscriber Line technologies designed to provide high speed data links over ordinary copper telephone lines. Asymmetric DSL (ADSL), for example, is called asymmetric because the downstream (to the customer/end-user) speed is faster than the upstream (to the telco) speed. ADSL speeds are typically below 20 Mbps downstream and 1 Mbps upstream. Very high data rate DSL (VDSL) is similar to ADSL, but operates at higher (up to 50) Mbps downstream. Symmetric Digital Subscriber Line (SDSL) operates at symmetrical speeds of up to 2 Mbps at distances up to 4 km.

### Duct

"Duct" means an underground pipe or conduit used to house (fibre, copper or coax) cables of either core or access networks. (*NGA-Recommendation, Art. 11*)

### Equivalence of Input (EOI)

The downstream access product retailed by the incumbent consumes exactly the same physical upstream inputs as the downstream product supplied by competitors, e.g. same tie-cables, same electronic equipment, same space exchange etc. The product development process is therefore exactly equivalent as their provision in terms of functionality and price. (*BoR (10) 44 Rev1, page 7*)

### Equivalence of Output (EEO)

The access products offered by the incumbent operator to alternative operators are comparable to the products it provides to its retail division in terms of functionality and price, but they may be provided by different systems and processes. (*BoR (10) 44 Rev1, page 8*)

### Ethernet

The most widely-installed LAN technology. Standardised as IEEE 802.3, runs over a coaxial cable or twisted pair wires in case of 10BASE-T, with transmission speeds up to 10 Mbps. Fast Ethernet, 100BASE-T10, provides transmission speeds of up to 100 Mbps and is typically used for LAN backbone systems and Gigabit Ethernet (1 Gbps) provides an even higher level of backbone support, both supported by fibre infrastructure.

### FTTx

Broadband telecommunications system/network based on fibre-optic cables and associated optical electronics for delivery of multiple advanced services such as telephony, broadband Internet and television across one link (triple play) all the way to the home or business:

- FTTH - Fibre to the home network, reaches the end-user premises with fibre from the MPoP, an access network consisting of optical fibres lines in both the distribution/feeder and the drop/terminal segments of the access network (including in-house wiring).
- FTTB - Fibre to the building, reaches the end-user premises with fibre, but copper, coax or LAN is used within the building.
- FTTN - Fibre to the Nodes, reaches a street cabinet (up to several kilometers away from the customer premises) with fibre, but the final connection is copper (e.g. VDSL) or coax (with DOCSIS3.0).

### In-house wiring

In the context of NGA, in-house wiring relates to the cabling (e.g. fibre) between the basement of a building and each flat, normally inside dedicated cable trays.

### IP

The Internet Protocol (IP) is a data-oriented protocol used for communicating data across a packet-switched network. IP is a network layer protocol in the internet protocol suite and is encapsulated in a data link layer protocol (e.g. Ethernet). As a lower layer protocol, IP provides the service of communicable unique global addressing amongst computers.

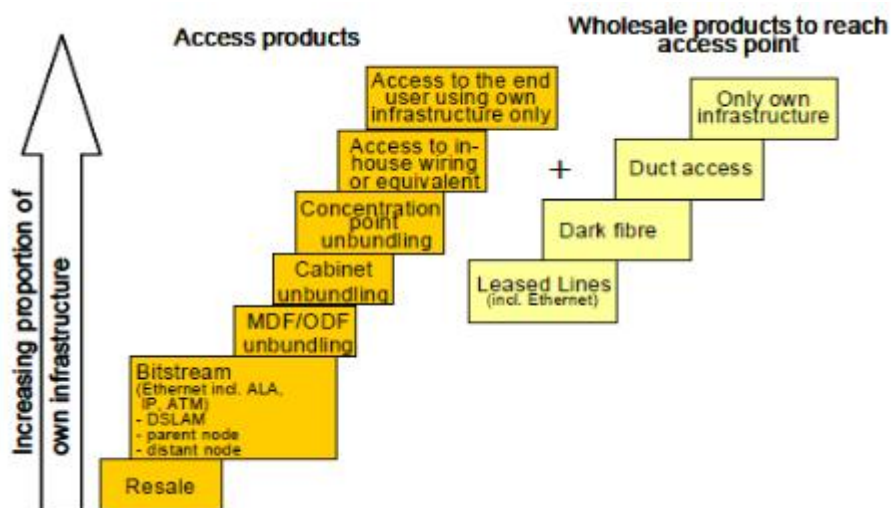
## Jitter

Jitter is the packet delay variation. It is defined in ITU-T Rec. Y.1540: “End-to-end 2-point IP packet delay variation (PDV) is defined based on the observations of corresponding IP packet arrivals at ingress and egress MP (e.g., MPDST, MPSRC). These observations characterize the variability in the pattern of IP packet arrival events at the egress MP and the pattern of corresponding events at the ingress MP with respect to a reference delay.” Jitter may be caused by electromagnetic interference and crosstalk with carriers of other signals and can introduce clicks or other undesired effects in audio signals and loss of transmitted data between networks.

KPI = Key Performance Indicator

Statistics used to measure performance, such as the time to provide services and repair faults.

## Ladder of investment



Source: BoR (11) 43, p. 10

As concluded in the ERG NGA CP and further developed in the ERG NGA Report the principle of the ladder of investment remains valid in a NGA environment, but is expected to be a more sophisticated ladder, with changes in the relative importance of their rungs and, in general, different dynamics, as a consequence of a shift in the economic bottlenecks.

The left hand side of the ladder displays the different access products (linked to access points). The right hand side depicts the different wholesale products in the access/concentration network that an alternative operator may use to reach the access points from its own PoP. Various combinations of access products (left hand side) and “backhaul” products (right hand side) are possible depending on the scenario and network architecture, implying different degrees of own infrastructure.

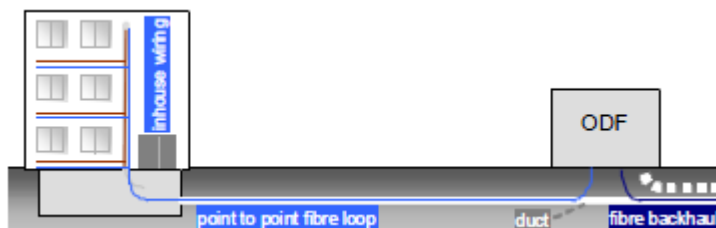
Different rungs of the ladder involve different access points along the value chain. Generally, a higher rung of the ladder implies that the access point is located closer to the end-user associated with an increased proportion of own infrastructure used.

## Local Loop

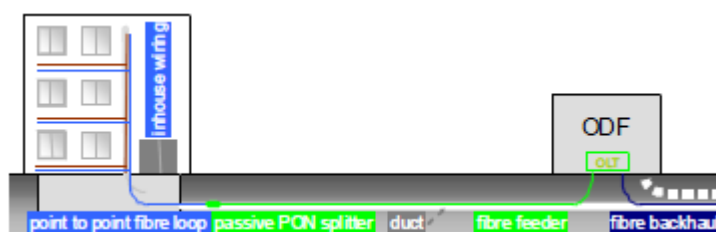
According to the Access Directive (Art. 2e)), “local loop” means the physical circuit connecting the network termination point to a distribution frame or equivalent facility in the fixed public electronic communications network”.

Network upgrades in the context of NGA comprise some deployment of optical fibre. The broad options available may be generically distinguished as to how far fibre is rolled out towards the end-user, enabling increasing reach and bandwidth to the end-user.

- Fibre to the home (FtTH) which is a fully optical solution going to the end-user premises. However, different topologies have to be distinguished:
  - point-to-point
  - point-to-multipoint
- Fibre to the building is included in the Fibre to the home scenario even though, technically, it has to be considered a hybrid solution.
- Fibre to the cabinet (FtCab), which consists of a hybrid solution with DSL technology and fibre going to the street cabinet and copper between the street cabinet and the end-user.



Point-to-point FttH design (BoR (10) 08, Ch. B.2.1.1)

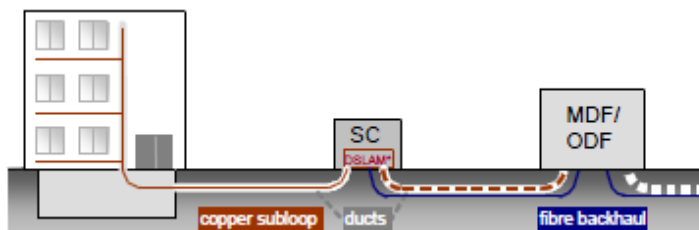


Generic Point-to-Multipoint / PON design (BoR (10) 08, Ch. B.2.1.1)



Generic FttB design (BoR (10) 08, Ch. B.2.1.1)





FttC Generic design (*BoR (10) 08, Ch. B.2.1.1*)

### LLU Local Loop Unbundling

LLU (or ULL) refers to the process in which SMP operators lease, wholly or in part, the local segment of their access/distribution copper or fibre network to competitors. With full unbundling the alternative operators take total control of the local loop and can provide subscribers with all services or technologies. Full physical unbundling grants access to the end-consumer access line and allows the competitor's own transmission systems to directly transmit over it.

### MDF Main Distribution Frame

A MDF is often found at the CO/local exchange and is used to terminate the copper cables running from the customers' premises. The frame allows these cables to be cross connected to other equipment such as a concentrator or switch.

### Mid Span Handover (ISH)

An interconnection between the SMP operator and an alternative operator where the SMP operator's handover circuit terminates at a point between its premises and the alternative operator's premises.

### MPoP Metropolitan Point of Presence

The "Metropolitan Point of Presence" (MPoP) means the point of inter-connection between the access and core networks of an NGA operator. It is equivalent to the Main Distribution Frame (MDF) in the case of the copper access network. All NGA subscribers' connections in a given area (usually a town or part of a town) are centralised to the MPoP on an Optical Distribution Frame (ODF). From the ODF, NGA loops are connected to the core network equipment of the NGA operator or of other operators, possibly via intermediate backhaul links where equipment is not collocated in the MPoP. (*NGA-Recommendation, Art. 11*)

### Multicast functionality

IP multicast is a method of sending Internet Protocol (IP) datagrams to a group of interested receivers upon their demand in a single transmission. It is often employed for streaming media applications on the Internet and private networks. The method is the IP-specific

version of the general concept of multicast networking. It uses specially reserved multicast address blocks. IP multicast is described in IETF RFC 1112.

#### NGA Next Generation Access

"Next generation access (NGA) networks" (NGAs) means wired access networks which consist wholly or in part of optical elements and which are capable of delivering broadband access services with enhanced characteristics (such as higher throughput) as compared to those provided over already existing copper networks. In most cases NGAs are the result of an upgrade of an already existing copper or coaxial access network. (*NGA-Recommendation, Art. 11*)

#### NGN Next Generation Network

A packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users. (*ITU-T Recommendation Y.2001*).

#### ODF Optical Distribution Frame

The ODF is a passive device which terminates optical fibre cables. It is used for interconnection and patching between the optical transmission network/equipment and also optical access networks, in case of a P2P FTTH.

#### OLT Optical Line Termination

OLT is an access concentrator and termination point (for ONUs) on a FttX (e.g. PON) solution, normally located at the CO. A single fibre runs from the OLT towards the customers (ONUs) and, typically, a single OLT serves up to 32 ONUs for distances up to dozens of km. Normally uses separate optical wavelengths for voice/data (and/or video) downstream and upstream.

#### ONU/ONT Optical Network Unit/Terminal

Within FttX networks the user nodes are called ONUs or optical network terminals (ONTs). An ONT is a single integrated electronics unit, while an ONU is a shelf with plug-in circuit packs, in practice, either term is used generically to refer to both classes of equipment.

#### Passive wholesale access

Wholesale access to a SMP operator's (transmission) medium without any active/electronic component (e.g. access to ducts, dark fibre or fibre local loop).

### Passive network

Broadband network without any active component. Typically comprises ducts, fibre cabling and ODFs (e.g. at the MPoP) or splitters (e.g. in street cabinets).

### Plesiochronous Digital Hierarchy (PDH)

An older digital transmission technology that uses Time Division Multiplexing. Although PDH systems are still in widespread use, they are being replaced by SDH and increasingly Ethernet services.

### PON Passive Optical Network

A PON is P2MP (Point to Multipoint) passive network that brings optical fibre cabling and signals to multiple end-users, normally in a FTTH scenario. A PON consists of an Optical Line Termination (OLT) at the CO/MPoP, splitters and a number of Optical Network Units (ONUs) near/at end-users premises. Typically, up to 32/64 end-users can be connected to a PON. The passive simply describes the fact that optical transmission has no power requirements or active electronic parts once the signal is going through the network. A PON reduces the amount of fibre and (CO/MPoP) equipment required compared with P2P architectures.

### P2MP Point-to-multipoint

A network topology that has dedicated individual customer lines to an intermediate concentration/distribution passive node (e.g. street cabinet) where these lines are aggregated onto a shared line. Aggregation could be either passive (with splitters such as in a PON architecture) or active (such as FTTN).

### P2P Point-to-Point

Network topology whereby the customer lines remain dedicated all the way from the customer to the concentration point (MPoP in the case of FTTH).

### (x)PON

APON (ATM PON) was the first PON standard. BPON (Broadband PON) appeared in a later phase, largely replacing APON in PON deployments because of its superior characteristics. Currently, EPON (Ethernet PON), a 2004 standard by IEEE, and, mainly, GPON are used. The GPON (Gigabit PON) standard differs from other PON standards in that it achieves higher bandwidth and higher efficiency using larger, variable-length packets. GPON offers efficient packaging of user traffic, with frame segmentation allowing higher quality of service (QoS) for delay-sensitive voice and video communications traffic. Current GPON deployments have a downstream capacity of 2.488 Gb/s and an upstream capacity of 1.244 Gbp/s that is shared among users.

### QoS Quality of Service

QoS is the “*Totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service*” in which “service” is a set of functions offered to a user by an organization. QoS is always end-to-end, i.e. user-to-user or user-to-content. QoS measurements are also carried out end-to-end and are made using objective (quantitative) or subjective (qualitative) parameters. A QoS measurement is an indication of the performance of a set of functions observable at the user-interface of the service. (*BOR (11) 53, Ch. 4.2*)

### Service Level Agreement (SLA)

A contract between a network service provider and a customer that specifies, usually in measurable terms, what services the network service provider will furnish.

### Service Level Guarantee (SLG)

A contractual agreement specifying the compensation payable if the service provider fails to deliver the agreed service performance.

### SLU Sub-Loop Unbundling

Sub-loop unbundling allows for the possibility to alternative operators to have access to the SMP operator’s access network on an unbundled basis closer to the customer than at the MDF/ODF, normally in a street cabinet, at a point between the customer’s location and the MDF/ODF. The copper sub-loop stretches from the end-user to the DSLAM. The fibre sub-loop reaches from the end-user to the splitter.

### Splitter

A passive fibre optic device that divides light from a single fibre into two or more fibre (channels). Most splitters are designed bi-directionally, enabling the same product to be used as a coupler or a splitter.

### Street cabinet

A cabinet holding network and transmission equipment (copper sub-frame or fibre ODF/splitters) located in the “street” (or e.g. underground in a manhole) between the CO/MPoP and the customer premises. It is a concentration/aggregation node, where the (copper, coax or fibre) local loop cables coming from the end-users are connected.

### Synchronous Digital Hierarchy (SDH)

The SDH is a hierarchical set of digital transport structures, standardized for the transport of suitably adapted payloads over physical transmission networks (*from ITU, G.780: Terms and definitions for synchronous digital hierarchy (SDH) networks*). SDH is a digital transmission

standard that is widely used in communications networks and for leased lines. ing replaced by SDH and increasingly Ethernet services.

#### Terminating segment

The "terminating segment" means the segment of an NGA access network which connects an end-user's premises to the first distribution point. The terminating segment thus includes vertical in-building wiring and possibly horizontal wiring up to an optical splitter located in a building's basement or a nearby manhole. (*NGA-Recommendation, Art. 11*)

#### Time division multiplexing (TDM)

A method of combining multiple data streams for transmission over a shared channel by means of time-sharing. The multiplexor shares the channel by repeatedly allowing each data stream in turn to transmit data for a short period. PDH and SDH are examples of systems that employ TDM.

#### VLAN Virtual LAN

VLANs are layer 2 constructs (compared with IP subnets, which are layer 3 constructs), created to provide the segmentation services traditionally provided by routers in LAN configurations, addressing also issues such as scalability, security and network and traffic flow management. They are also useful to create multiple layer 3 networks on the same layer 2 switch (e.g. Ethernet). By using VLANs, operators can control traffic patterns and react quickly to relocations, with more flexibility to adapt to changes in network requirements and simplified administration.

#### WDM Wavelength Multiplexing

In fibre-optic communications, wavelength-division multiplexing (WDM) is a technology which multiplexes multiple optical carrier signals on a single optical fibre by using different wavelengths (colours) of laser light to carry different signals. This allows for a multiplication in capacity, in addition to making it possible to perform bidirectional communications over one strand of fibre. Two options are available: Coarse WDM (CWDM uses passive add-drop filters) or Dense WDM (DWDM uses active filters).

#### Wholesale access products

Access enabling an operator to utilize the facilities/networks/services of the SMP operator. For the wholesale access products that can be provided, see the "Ladder of investment".

#### Wholesale products to reach access point

Wholesale products from the SMP operator used by access seekers to connect their networks (their PoPs) to the access point. Those products can be passive (e.g. ducts or dark fibre) or active (e.g. Ethernet leased line). See also the "Ladder of investment".