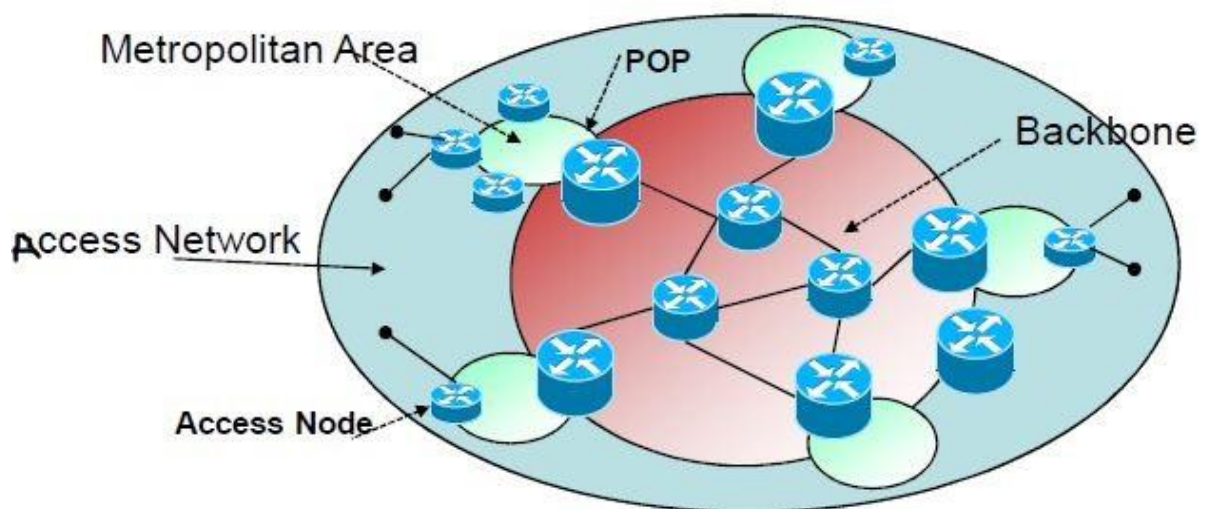# 3. Network functional areas

3.1 Access Network

Is the part that connects subscribers directly to the Service Provider

It may be further divided in plant or distribution network and drop plant or edge network.

While communications carriers have historically used "copper lines" to offer phone service to individual subscribers, today the same line carries high-speed broadband services such as DSL in addition.

3.2 Edge of the Network and the Core

The edge can perform functions not performed in the inside: if the core is using MPLS, the edge can examine packet and select the path based on the analysis

Then, the core switches the packets. (in this case the router is dumb, while the edge is smart)

A core network is a backbone network:

– usually with a mesh topology

– provides any-to-any connections among devices on the network

- that may perform intelligent functions that are not performed inside the core network

- then switches the packets (as opposed to doing hop-by-hop routing of the packets), which significantly improves performance
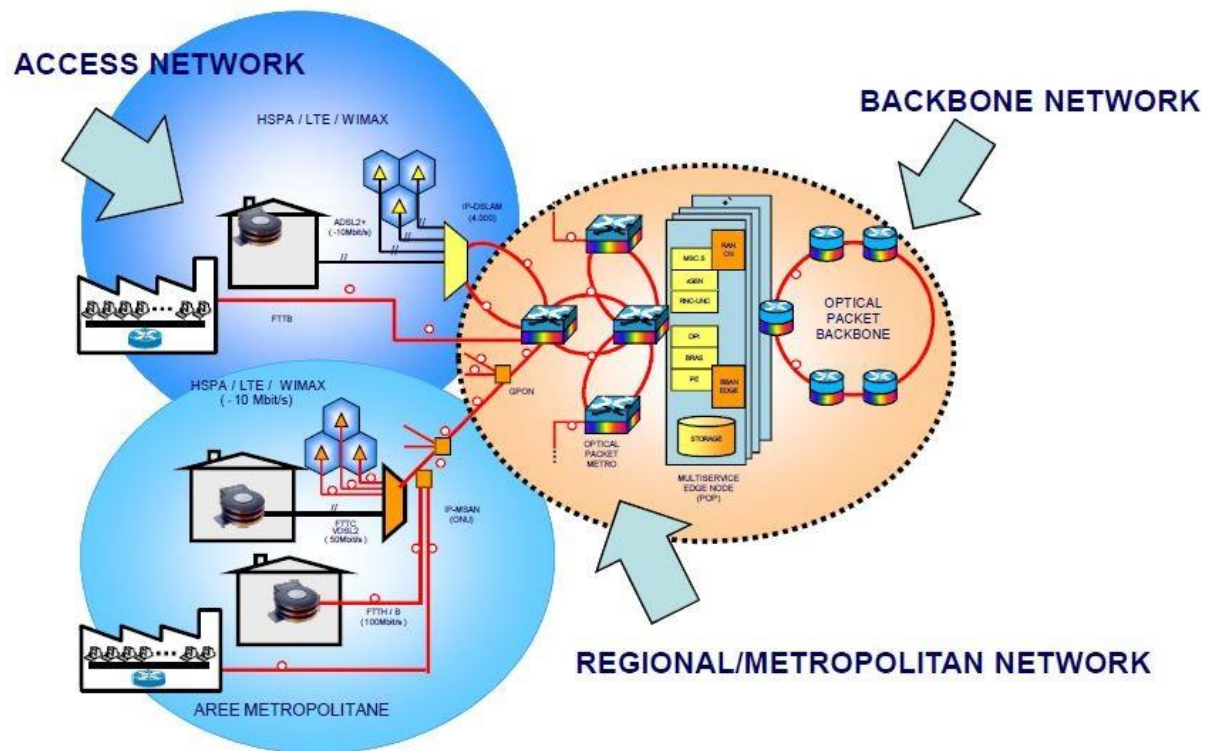
Example of Telecom

3.3 Fixed Line Access Network

An access network refers to the series of wires, cables and equipments.

This makes the access network one of the most complex networks in the world to maintain and keep track of; is also the most valuable asset an operator owns.

The local exchange contains banks of switches to calls or connections.

Optical fiber already makes up the majority of core networks, and is now closer and closer to the customer.

3.4 Local loop

Local loop is the physical link or circuit, that connects from the demarcation point of the customer premises to the edge of the carrier.

At the edge of the carrier network in a traditional PSTN (Public Switched Telephone Network) scenario, the local loop terminates in a circuit switch housed in an ILEC Central Office.

Traditionally, the local loop was wireline in nature from customer to CO; Modern implementations may include a digital loop or fiber optic transmission

system known
as fiber-in-the-loop.

The local loop may terminate at a circuit switch owned by a CLEC and housed in a POP.

Can be used for many services:
– analog voice and signaling used in traditional POTS
– Integrated Services Digital Network (ISDN)
– variants of Digital Subscriber Line (DSL)

The term "local loop" is sometimes used for any "last mile" connection to the customer.

Local loop connections include:
– Electric local loop: PLC (power line communications)
– Optical local loop: Fiber Optics services
– Satellite local loop: (DVB-S- Digital Video Broadcasting-Satellite)
– Cable local loop: Cable modem
– Wireless local loop (WLL): WiMAX, GPRS, HSDPA

3.5 Type of access

3.5.1 Copper access

Provides both high-speed broadband and existing phone service

- **Copper based access network**

adv.: widely available, in industrialized countries is almost universal

They are established in markets with monopoly, so designed to cover the entire market.

One problem is that networks are designed mainly for carrying POTS, while a growing share of the traffic is based on IP or other data communication protocols.

- **Cost analysis**

Access costs are 35-50% of the total; the major cost is for the cables and to laying them underground. It also can cost 5 times more to connect rural areas than metropolitan ones.
Instead, the cos of copper-based networks are affected by:

▼ advance of fiber

▼ digitalization of switching facilities

▼ implementation of new gen.

Alternative access networks offer lower costs; to upgrade copper-based can be used xDSL technologies.

Bandwidth from 128 kbps to 10 Mbps.

xDSL is the most widespread access technology for broadband access.

Capacity is much lower than optical, but a investments to upgrade are a fraction of the cost to establish optical.
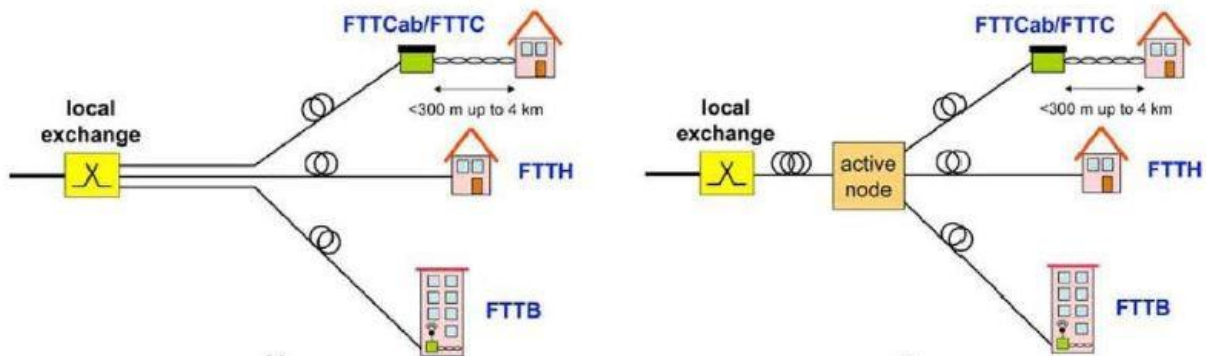
## 3.5.2 Optical access

Standard for the coming years

- **FTTx: reference architectures**

– OLT: Optical Line Terminal
– ONU: Optical Network Unit
– ONT: Optical Network Termination (NT: Network termination)
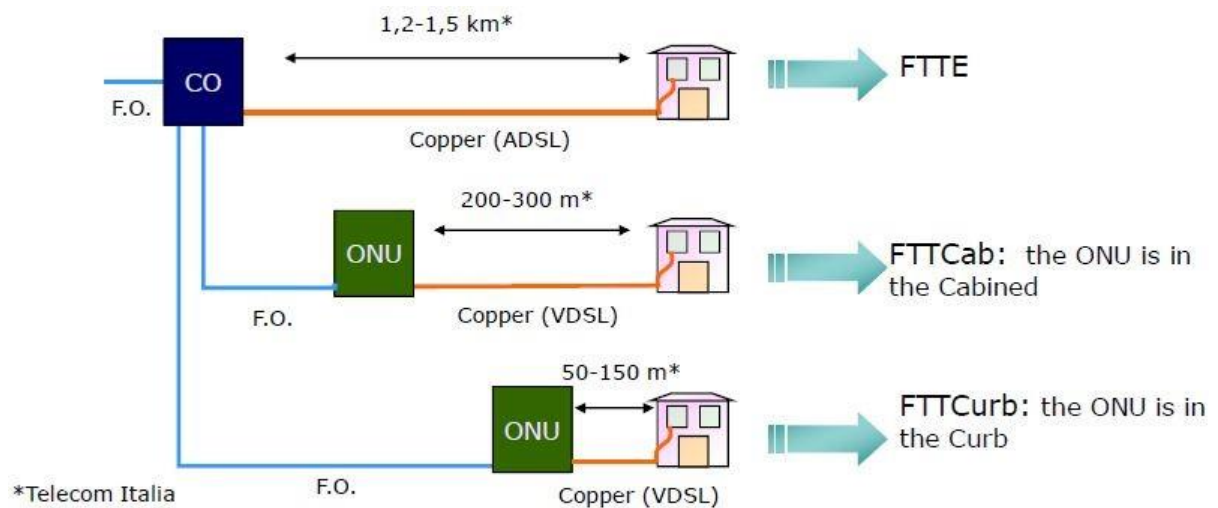– ODN: Optical Distribution Network
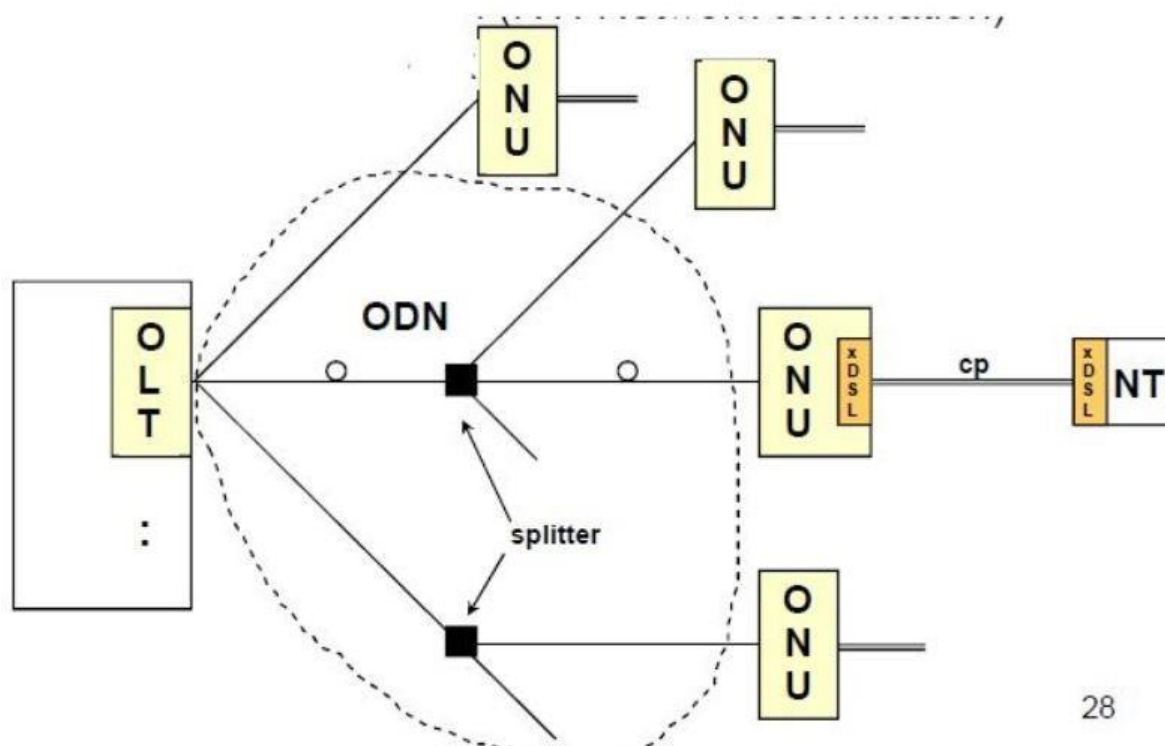
▼ **AON (Active Optical Network),**also called Point-to-Point (P2P)

▼ **PON (Passive Optical Network):** passive branching of fiber via optical spiltters and tree-based topologies
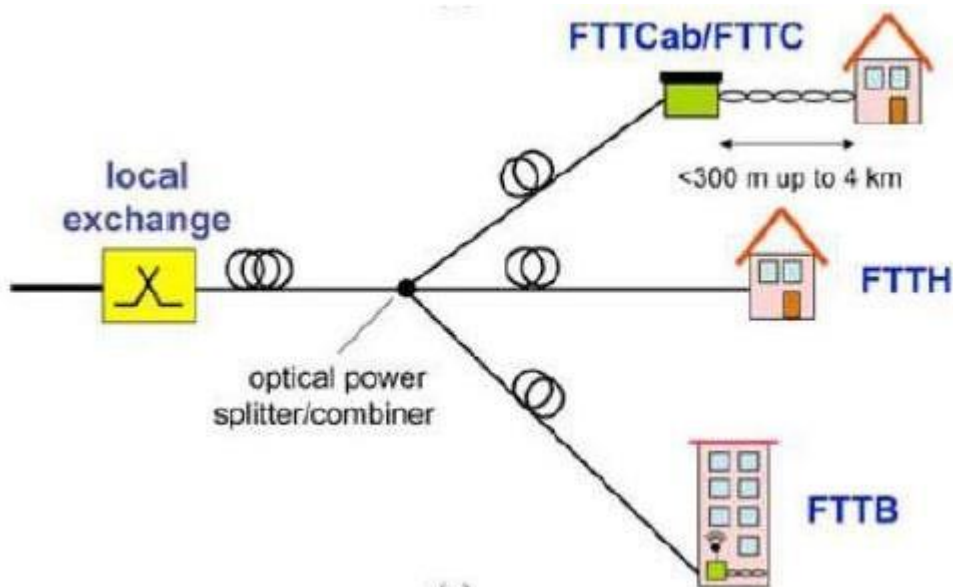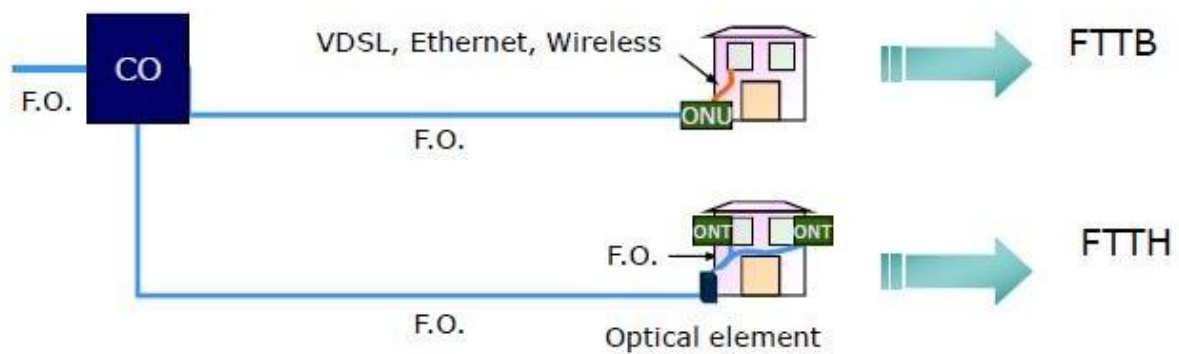

▼ **Fiber to the Exchange:** the optical fiber terminates to the Central Office (CO) and the CO is connected with the user via a copper based line (e.g., ADSL)
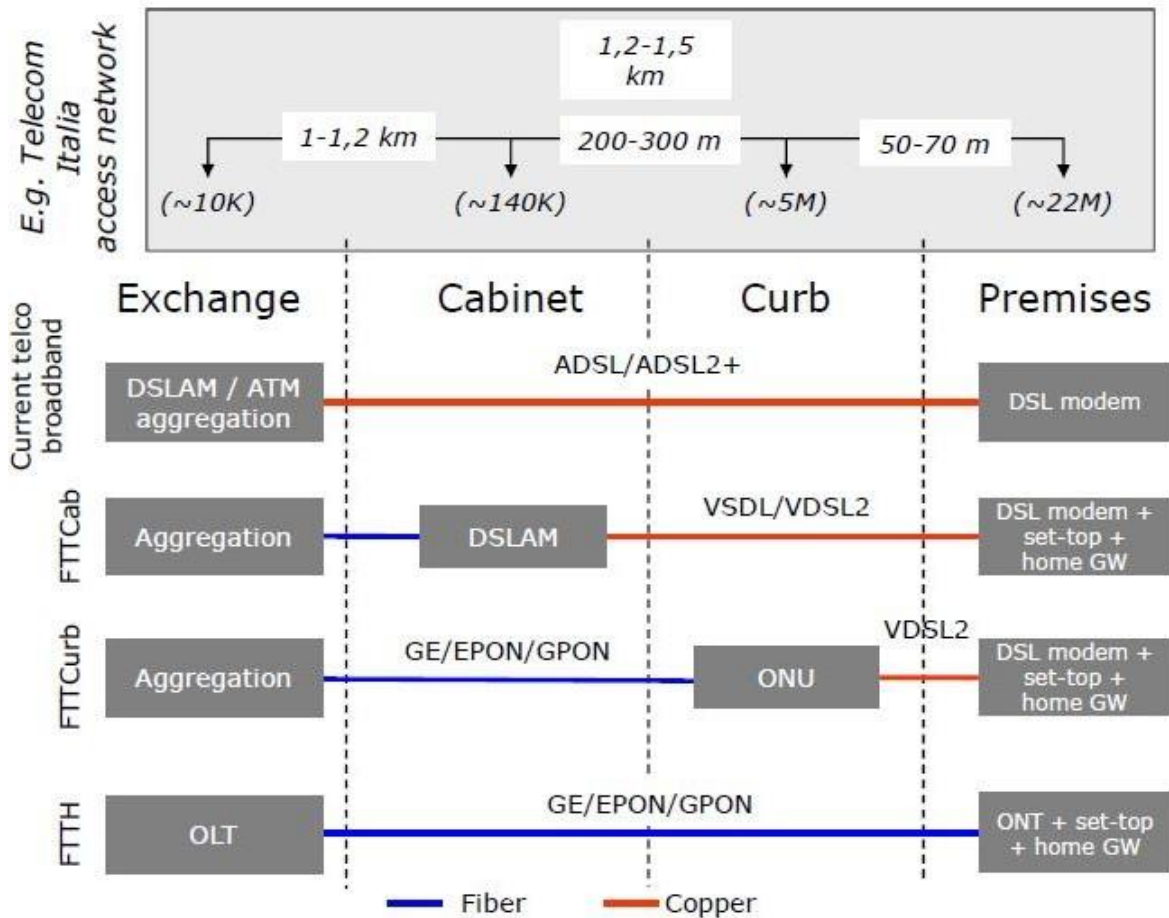
*Telecom Italia

▼ **Fiber to the Premises:** the fiber cables arrive to the users' premises
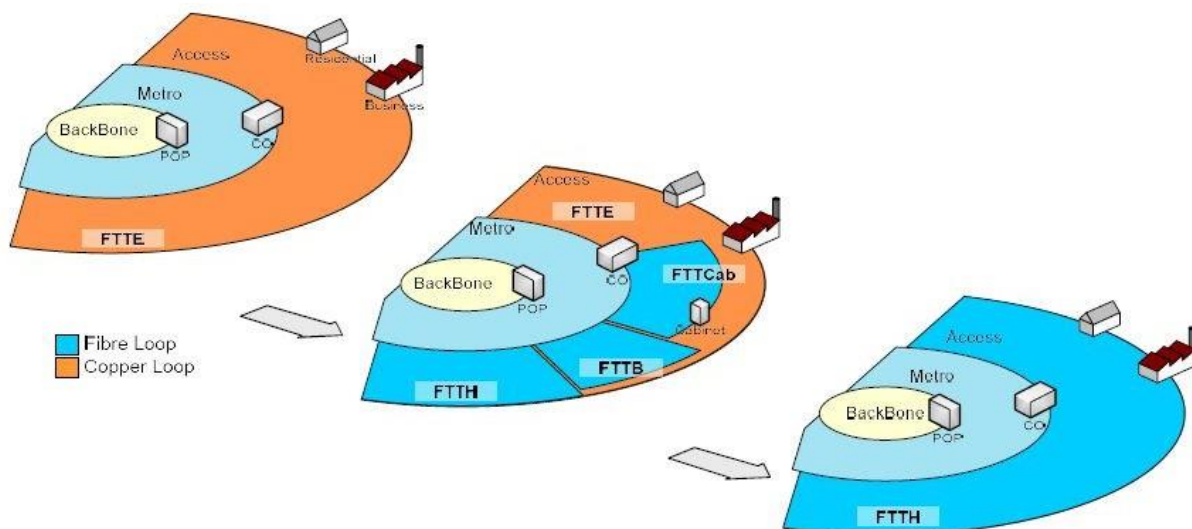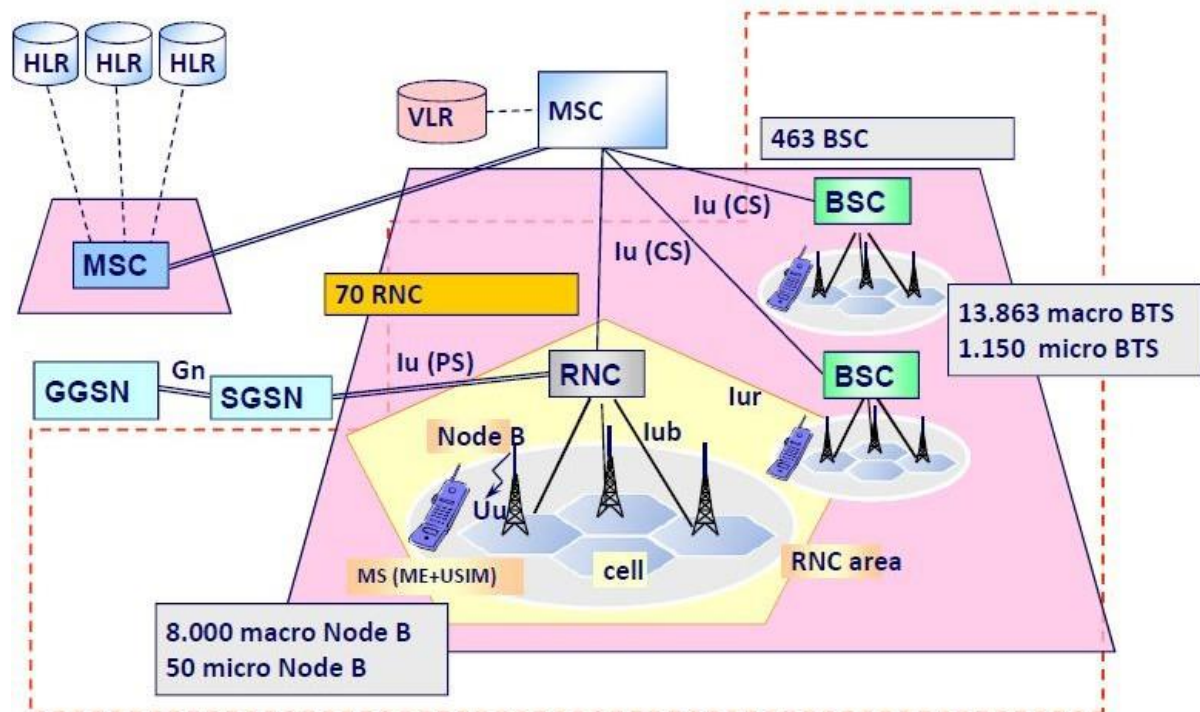- **Fiber to the Building**
- **Fiber to the Home**

Wireline access

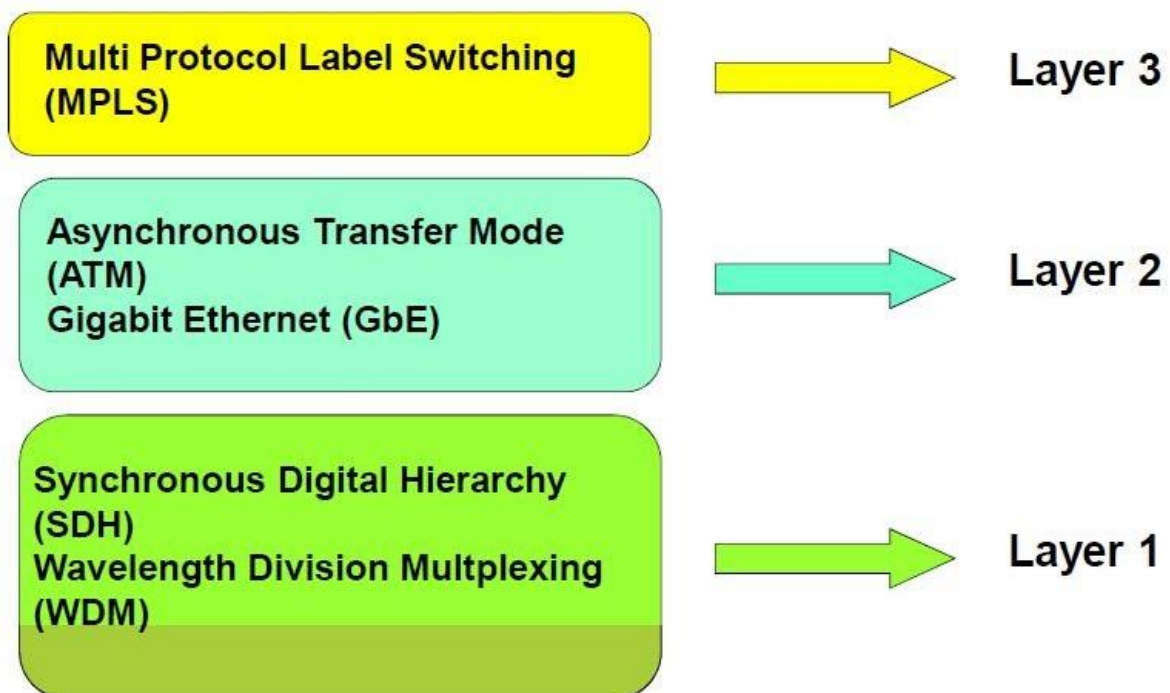**Fiber based access network**

3.5.3 Wireless access

ubiquitous networking

Technologies and protocols

Gartner hype cycle