Wholesale services

• Wholesale services can be classified as:
  - Bitstream access
  - Wholesale Line Rental
  - Individual Line Rental
Wholesale services: bitstream

• From a technical standpoint bitstream services do not place issues: the NGAN can offer customizable high speed access, usually to business users (see the Openreach GEA (Generic Ethernet Access) offer in Great Britain, over FTTC/FTTH)

• Quality of service (QoS), can be differentiated, at least two priority levels can be provided, for example with IEEE 802.1p

• Offering different classes of service through the NGAN allows an effective sharing of the infrastructure among different applications
Wholesale services: Line rental

• The standard line rental service could be substituted with a packet-base service through the NGAN

• The problem of the distribution of line synchronism applies also in this case
Unbundling and colocation

- Only large operators can sustain the investment costs for the deployment of a NGAN infrastructure.
- Allowing small operators into competition is thus a significant issue.
- For the incumbent operator, the migration to the NGAN leads to the removal of local exchange offices.
- The issue is that in local exchange offices usually other operators locate equipment (colocation) to implement Unbundling of the Local Loop (ULL).
- In Holland and Spain (for example) the devised solution is to allow enough time to colocated operator to implement alternative solutions.
- Five years of time is generally agreed as a reasonable time span.
Unbundling and colocation

• A colocated operator could:
  - Transfer unbundling to alternative locations
  - Sub-Loop Unbundle in street cabinets only in FTTC case
Access, metropolitan and backbone networks

- NGAN is the peripheral system component of the NGN network, which in turn is constituted by Access, Metro and Backbone networks.

- A possible (not the unique) architectural solution is to operate at the IP layer in the Access and Backbone network, and at the Ethernet layer in the Metro network, as shown in the Figure.
Access, metropolitan and backbone networks

- The differentiation of Quality of Service is a critical issue.
- In the Metro network, it can be done thorough virtual LANS, by means of IEEE 802.1Q or IEEE 802.1ad.
- IEEE 802.1Q differentiates VLANs by means of a priority indication in the Ethernet frame (IEEE 802.1p).
- In this way, 4.096 VLAN can be identified and managed.
- IEEE 802.1ad with VLAN stacking enables 16.777.216 VLANs.
- The VLAN space usually is not flat: Service VLANs (S-VLAN) and Customer VLANs (C-VLAN) can be distinguished.
- S-VLANs can be associated to operators and/or services, while C-VLANs are associated to individual users.
Access, metropolitan and backbone networks

- In the metro network also MPLS can be employed
- MPLS partially overlaps with Ethernet VLANs
- An interesting feature of MPLS is the efficient multicasting it can provide which, in turn, is useful for the distribution of audio/video content in a push model of distribution