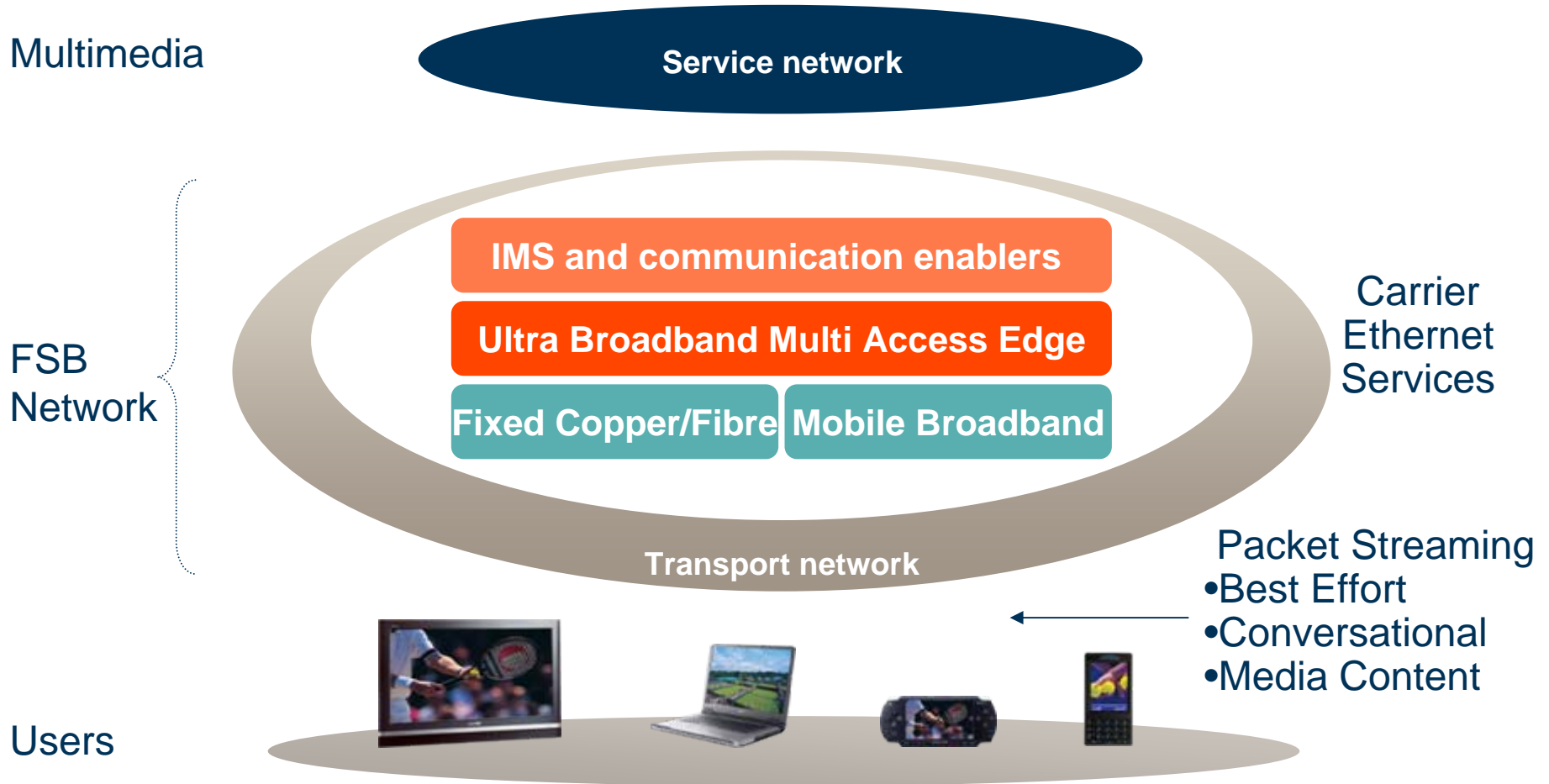


“Fotonica, larga banda, NGN”

**21 Maggio 2008
Ezio Zerbini**

Ericsson Full Service Broadband



Key messages

- Technology is almost ready
- Mobile Broadband Wireless coverage is a must for fast service delivery
- Indoor wiring requires regulations and funding
- Fibre is the ultimate solution but economics are not very good.
- Copper will last for many years as an alternative. OPEX shall be improved eliminating the flexibility.

Key strategies

- GPON fits very well into the future broadband scenario, maybe not as the main drop technology, but rather as the main IP-DSLAM (VDSL2) backhauling technology.
- Evolution to FTTH is uncertain today in countries where there is not a government commitment.
- DWDM-PON is the ultimate technology to serve multiple kind of access terminations.
- The best network strategy is a mix of Mobile Broadband (eUTRAN), copper and fibre access complementing each other. (i.e. backhauling).
- Investments, in Europe, are today the main barrier for NGN

Agenda

- Optical Transport
- Mobile Broadband
- Fibre Access
- Conclusions

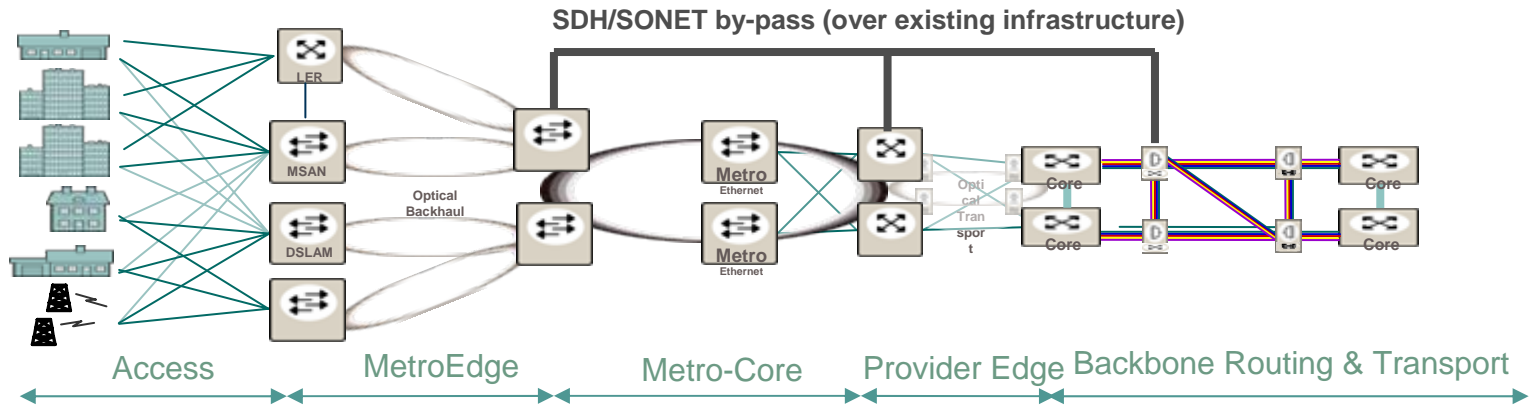
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Strategic Directions in Optical Transport

- Ethernet will become the preferred network technology – aggregated rates handed off at 10GigE, rising to 40/100G
- QoS and SLA drivers will be based on carrier class Ethernet
- ATM and SDH/SONET will become ring-fenced - displaced for new build; replacement will depend on obsolescence and economics
- As service bandwidth grows, higher aggregated bandwidths drive the economics of WDM closer to the edge
- WDM and OTN will play a key role in the metro-core and core.
- Core connectivity will be 10G granularity, with packets carried in service agnostic ODU payloads
- Core economics favour optical switching for some applications
- Hierarchical network is returning to favour, based on reducing network complexity and facility provisioning

Network evolution & product positioning



Rationale per segment:

Mixed SDH/SONET & Ethernet transport retreats to the Metro Edge.

SDH/SONET ring closure for TDM and GFP/VCAT mapped Ethernet & other data services

1st aggregation nodes aggregate and groom separate TDM & data traffic

Ethernet aggregation grows to fill 10G uplink pipes

10G+ aggregated traffic carried in C/DWDM pipes for efficiency

1st & 2nd aggregation provides service grooming and hand-off

Option to combine aggregation and WDM in common equipment/node

Flexible wavelength assignments to match traffic patterns & topology

Limited or no requirement for TDM structured switch

Packet aggregation and switching in head-end packet nodes

Possible EoSDH/SONET for transport over existing infrastructure

Part of transport layer – includes MPLS, TMPLS, PBT + integrated WDM

Long haul, high density, flexible bandwidth layer

Optical + electrical switching and restoration

SDH/SONET interfaces provide for residual transport over backbone network

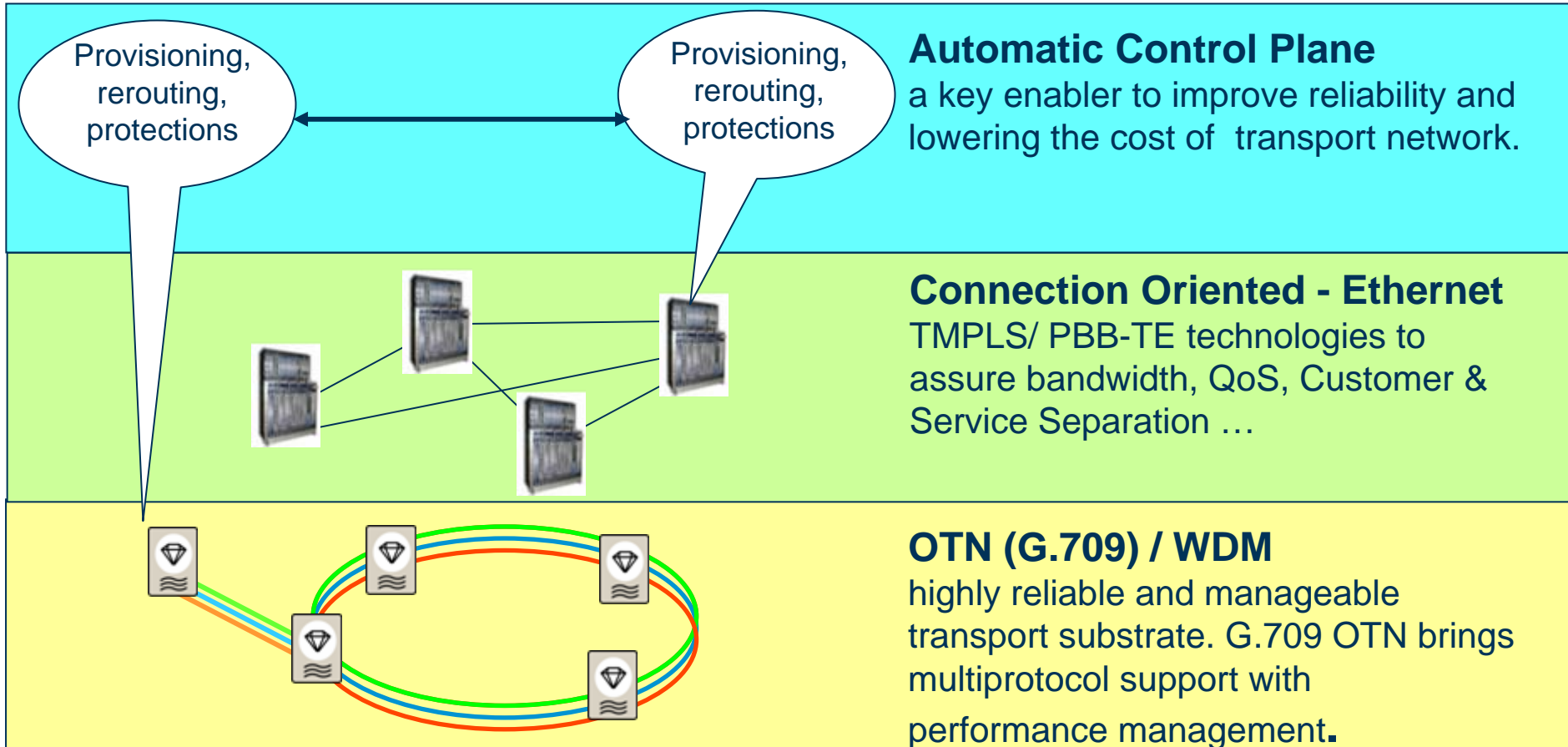
Router by-pass and L1/L2 transport

New SDH/SONET deployment declines

SDH/SONET will remain a required technology for interworking (MSP) for the foreseeable future

Packet Transport and WDM deployment will be the key grow segments

Target Core Transport Network



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Strategic Directions in Mobile

- Drivers towards mobile broadband technologies:
 - Voice continues to grow, but the biggest growth will be in data.
 - A lot of the operators introducing HSPA are showing increased interest in mobile data services like mobile emails, internet surfing, TV.
 - Standards are currently concentrating on conversational and media content services definition.
 - Radio based broadband access will be increasingly used as a fixed access alternative.

Mobile traffic to grow tenfold by 2012

Data traffic tripled in 2006



Sources: Internal Ericsson 2007

Plan for allocating spectrum important

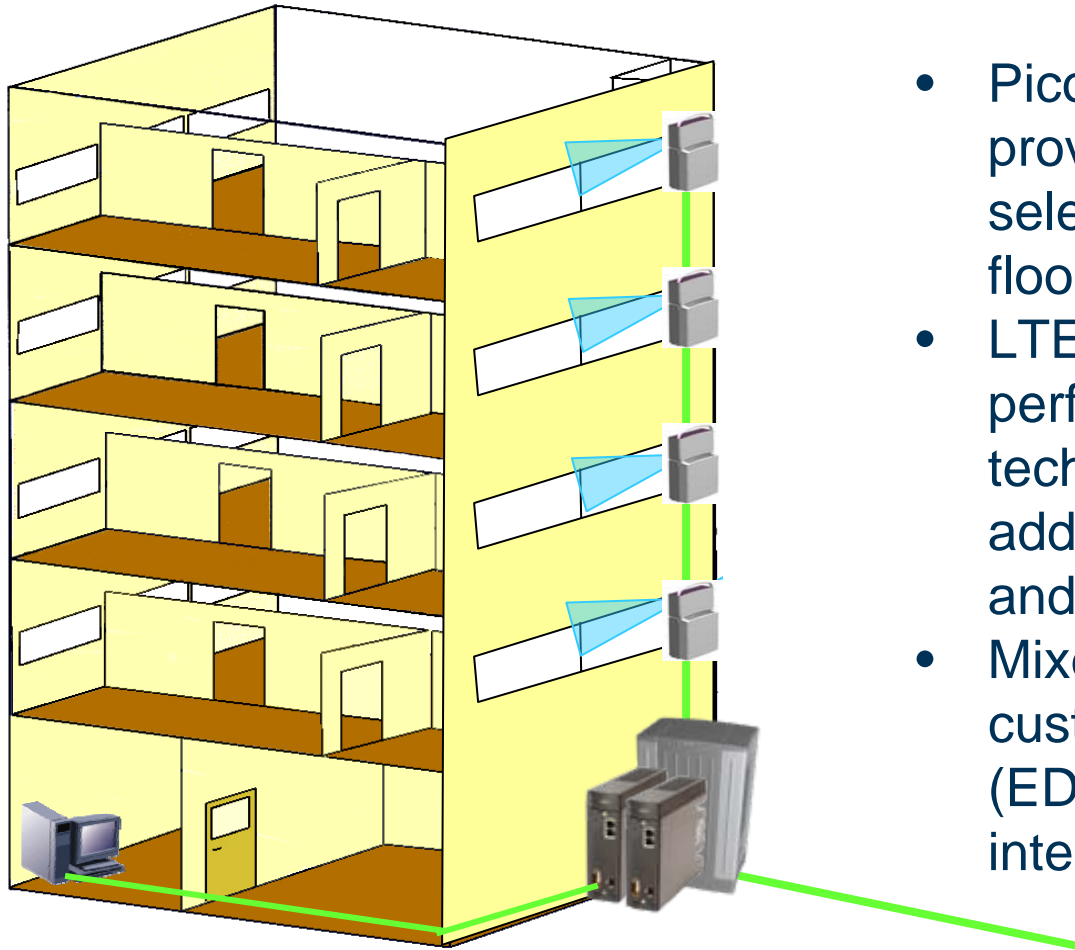
HSPA offers true broadband today

Part of 3GSM technology family



Almost 40 operators in 25 countries offer 7 Mbps user speeds today

LTE Solution for Vertical Cabling



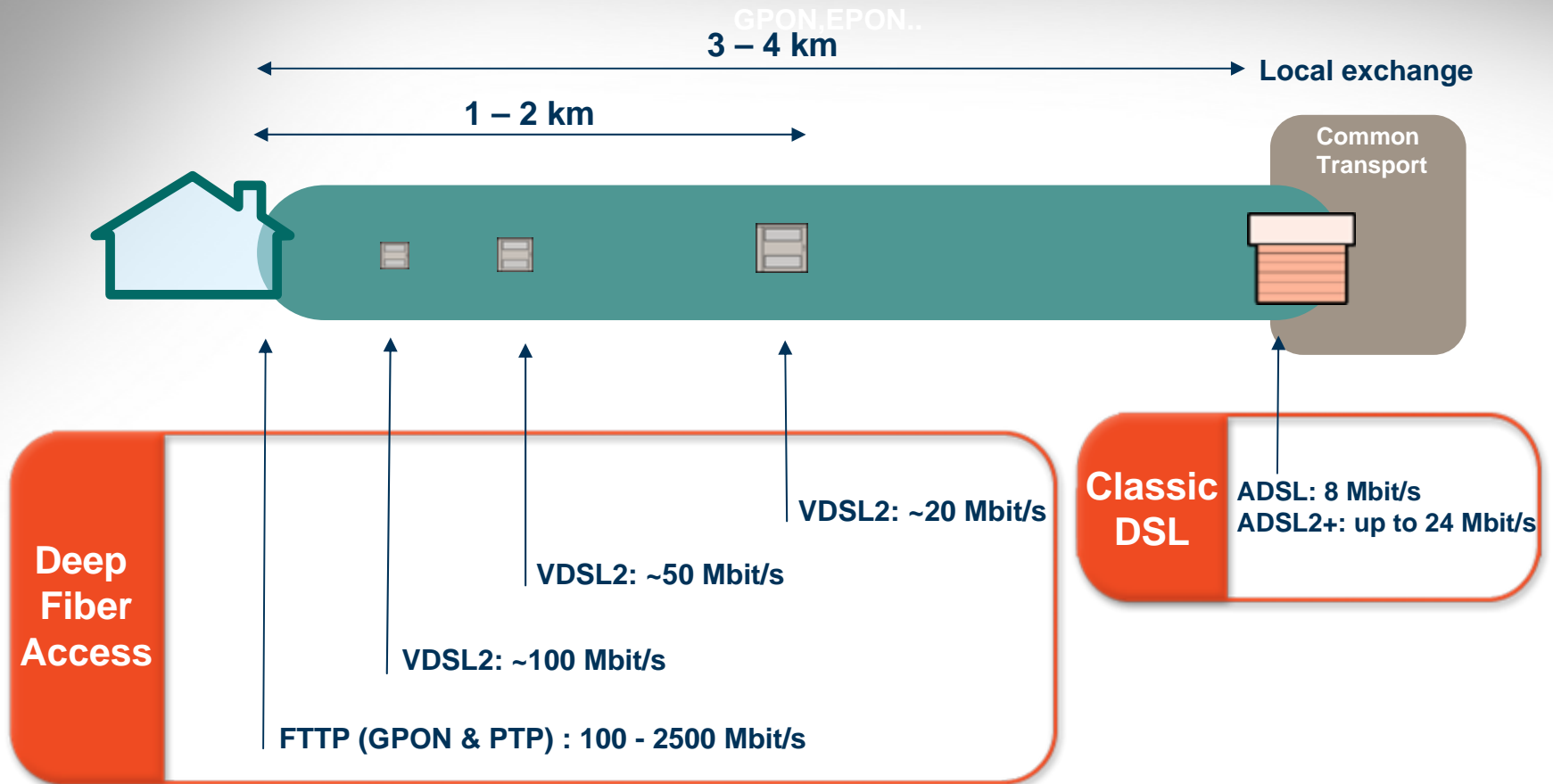
- Pico-cell LTE coverage can provide high peak rates in selected areas (e.g. different floors of a building)
- LTE will have a data rate performance exceeding current technologies (e.g WiFi), and in addition will support Mobility and QoS
- Mixed approach with VDSL for customers reached by copper (EDA 1200 provide 12 interfaces modularity)

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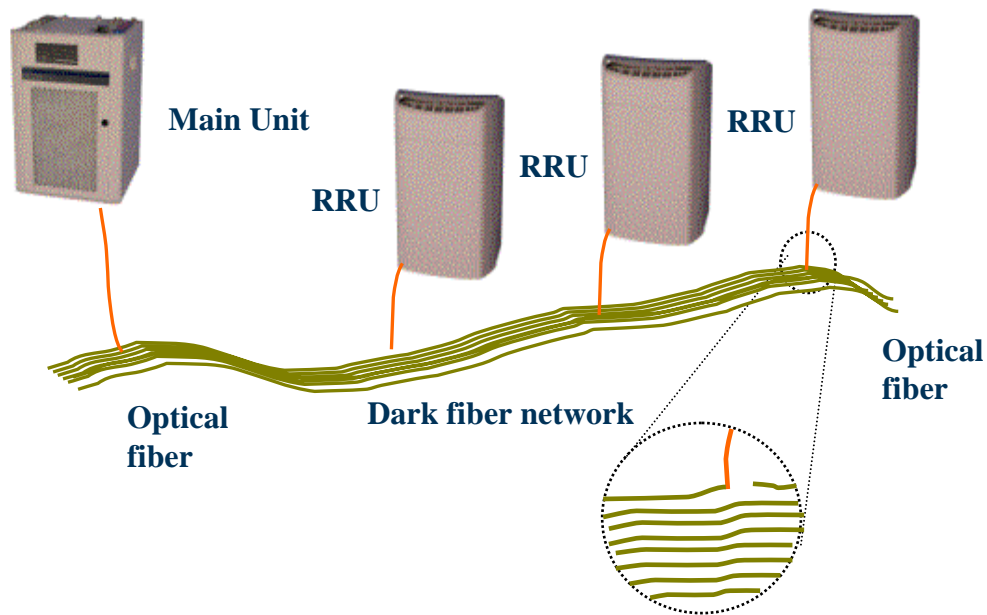
Transformation to Deep Fiber Access

Multiple Deep Fiber alternatives – VDSL2/GPON/PTP Fiber



Closer to customer to increase speed and mitigate interference

Main-Remote architecture over fiber infrastructure



DWDM PON Evolution

- Massive Video Services introduction in the residential segment, combined with Mobile Broadband Services growth, could lead to saturation of the fiber access infrastructure in a few years.
- DWDM PON technology has the capacity to overcome fiber infrastructure limitations, in case of unexpected traffic growth.
- DWDM can offer cost advantages compared to new fiber installation or leasing of fibers for point to point links.
- The evolutionary path can initially foreseen a grey GPON deployment, adding DWDM into a second step, when the aggregate interfaces are going to saturate and when the mobile can be carried onto a Main-remote architecture.

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Ericsson Full Service Broadband

- The main reason for that is to reach a shortest payback investment time in line with present market conditions.
- Players in the market are changing and there is a pressure from adjacent ICT segments.
- Converged is already happened and need to be network supported.
- We have many projects in place also with CNR, that is hosting us, under the TERIT umbrella.

ERICSSON 

TAKING YOU FORWARD

Appoggio

Key messages

- DSL is not an initial short-term broadband technology, but rather here to coexist and stay for a very long time.
- New copper technologies being standardized (i.e. DSM) will affirm this strongly. Components vendors are integrating these technologies into their chipsets.
- Ericsson is able to take the lead in DSL technology, also on the basis of strong synergies with radio.
- An important driver for products is to help to mitigate copper OPEX increasing.

Strategic Directions in DSL

- Technologies to decrease OPEX (stability and QoS)
 - **Copper Plant Management (CPM)** – Performance monitoring and trend analysis; automated line configuration and parameter optimization; fault detection and analysis, including possibilities for automatic guidance.
 - **Noise** – Interference and noise detection, classification and mitigation
 - **Low Power solutions** – DSM level 1&2 - noise adaptation; low power mode; fast retrain
 - **SELT/DELT/MELT** – Built-in measurement techniques for channel estimation, topology estimation, capacity prediction, cross talk estimation, problem identification and “golden box” concept
 - **Site Solutions** – Co-existence with radio base stations; power feeding and environmental aspects

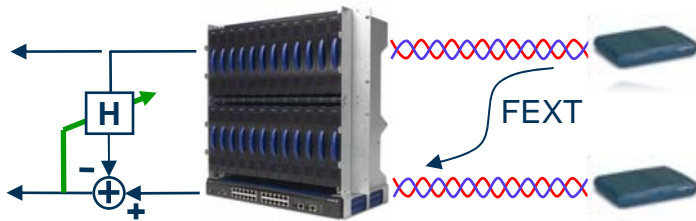
- Technologies to increase performance (speed and reach)
 - **Dynamic Spectrum Management (DSM) level 1 & 2** – Efficient spectrum usage for VDSL2
 - **Vectoring (DSM level 3)** – for x-talk cancellation and 2-3 times capacity increase of VDSL2
 - **Bonded DSL** – Bonded systems including vectoring for very high capacity business and radio backhauling applications (E1/T1 replacement for HSPA and LTE backhauling)
 - **New bandwidth** – Up to 150 MHz or more for very short haul applications (20-200m)
 - Drive the new standards – (G.vector standardization has just started in ITU-T)

CPM - Key features

- **DSL Auto Optimizer – (new functionality from “layer1 support for 3Play” Research)**
 - Providing *auto line configuration* using the concept of Dynamic Link Management (DLM)
 - Profile creator for accurate DSL line configuration
 - Profile selector, achieving self-managed DSL links
- **Troubleshooting - (“Fault Localization Tool” from CPM prototype)**
 - 1:st and 2:nd line support user interfaces
 - Monitor DSL-link stability and performance (non-disruptive)
 - Powerful real-time tools
 - Scheduled measurements and storage of historical data
 - Trend analysis
- **Network and service planning - (Extending “Site Survey” from CPM prototype)**
 - Maximize usage of network capacity
 - Visualize available resources
 - Pre-qualification and upgrade
 - Site level statistics
 - Grant SLA for Open Access Operations
- **Service Provisioning - (new functionality for service qualification)**
 - Analyze (similar to DAO) for supporting service provisioning
 - User interface providing service provisioning
 - Service Upgrade Provisioning based on:
 - EDA Line Test data + DSL link stability measure (monitored over time)

Dynamic Spectrum Management – DSM

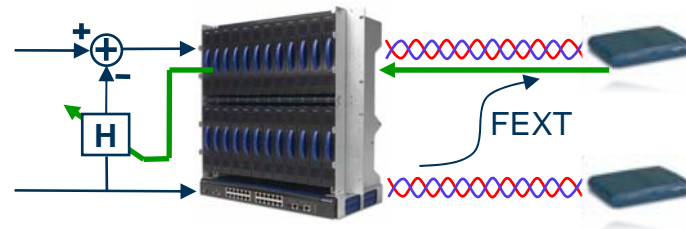
- DSM at Level 1 & 2
 - Different techniques of “Dynamic” Spectral Management for crosstalk *reduction*
- DSM at Level 3 – Vectoring
 - Techniques for crosstalk *cancellation*
 - Simple channel inversion achieves almost channel capacity
 - Complexity kept in CO by performing Pre-coding in DS
 - Eventually Multi-User-Detection (MUD) schemes in US
 - Only minor CPE changes necessary to allow for Vectoring (firmware upgrade)



Upstream: Cancellation, MUD

Crosstalk is cancelled, AFTER it is coupled into the line

No feedback (→No change of standard)



Downstream: Pre-coding

Crosstalk is pre-compensated, BEFORE it is coupled into the line

CPE feedback needed

SAE architecture other accesses

Detailed view, non-roaming case

