"Service Delivery over Broadband Advanced Networks"

Oscar González de Dios, 12th September, Paris

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Motivation

- Customers are asking for **new advanced services**, like collaborative working and remote control.
- BANITS 2 finds ways for Network Operators to **leverage the existing infrastructure**, also studying the evolution towards new technologies.
- BANITS 2: Broadband Advanced Networks Integrated Telecommunication System

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Which services are considered and demonstrated?

- **Medical Robot:**
  - Remote diagnosis of heart insufficiency
  - Technical achievements:
    - Remote-controlled examination using ultrasound
    - Specification of communication demands for accurate diagnosis and steering of robot

- **H.264 Video Distribution:**
  - H.264 HD encoder & transmitter for broadcasters.
  - Technical achievements:
    - Evaluation of the available codecs in the market.
    - Specifications for networking adaptation of the compressed stream over the access networks.
    - Development of a traffic shaping mechanism for the access network interface.

Which services are considered and demonstrated?

- **Enhanced Collaborative Service ECS**
  - Advanced tool for collaborative environments with new and useful features
  - Technical characteristics:
    - High quality application
    - High bandwidth required per partner
    - Low latency and skew for high fluency
    - Standard PC based, no hardware dependency
    - Multicast based, for optimizing the network resources
    - Advanced features to be included (CLIR/CLIP, Chat, file sharing, …)
- **Other services:** NVoD, IPTV, etc.
- **Service requirements:** bandwidth, mode, QoS classes according to ITU specs (delay, jitter, packet loss) → following tables

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Service Requirements

Service	Type	Quality	Requirements		
			Bandwidth	QoS Class	Mode
Near Video On Demand NVoD	Real-time on demand, based on distribution (unidirectional)	High (MPEG2) Low (MPEG-4)	1 – 8 Mbps	1/2/3	Unicast/Multicast
Video-Distribution HD264	Real-time distribution (unidirectional)	High (H.264-HD)	6-15 Mbps	1/2/3	Multicast
IPTV Distribution	Real-time distribution (unidirectional)	High (MPEG2) Low (MPEG-4)	1 – 8 Mbps	1/2/3	Unicast/Multicast
Enhanced Collaborative Service ECS	Real-time interactive (bidirectional)	Very High (No compress)	2 - 13 Mbps per partner	0	Multicast
Remote Control Robot	Real-time interactive (bidirectional)	High	Up to 12 Mbps	0	Unicast
TDM-based services	Real-time (bidirectional)	Very high	2,5 to 10Mbit/s	1	Unicast
Remote Monitoring Video-surveillance (for residential and business)	Real-time distribution (unidirectional)	Low / Medium	0.5 – 1,1 Mbps	2	Unicast
Web and Data Distribution, [downloads, e-commerce,...] (for residential and business)	Information and data (bidirectional)	Medium	Kbps – Mbps variable (depending on service)	5	Unicast

ITU classification of QoS

Network performance parameter	Nature of network performance objective	QoS Classes					
		Class 0	Class 1	Class 2	Class 3	Class 4	Class 5
IPTD IP packet transfer delay	Upper bound on the mean IPTD	100 ms	400 ms	100 ms	400 ms	1 s	U
IPDV IP packet delay variation	Upper bound on the 10^{-3} quantile of IPTD minus the minimum IPTD	50 ms	50 ms	U	U	U	U
IPLR IP packet loss ratio	Upper bound on the packet loss probability	10^{-3}	10^{-3}	10^{-3}	10^{-3}	10^{-3}	U
IPER IP packet error ratio	Upper bound	10^{-4}					U

Which Broadband access technologies are considered?

- **xDSL Advanced Solutions**
  - Enabling multimedia service delivery by xDSL
  - Decreasing operators' OPEX & CAPEX
  - Technical achievements:
    - Enhanced line testing LT functionalities
    - Active copper resource management ACRM, including DLCM and DSM techniques, among other
- **TDM over Packet**
  - Optimizing the transport of TDM services over Ethernet
  - Technical achievements:
    - Development of gateway “TDM over Ethernet”
    - Improvement in clock-recovering technique

Which Broadband metro/aggregation technologies are considered?

- We need a technologies that..
  - Makes the services coexist together on a converged and single platform
- How can we make the coexistance?
  - by means of circuit emulation and efficient statistical multiplexing
- Which benefits do we get from the coexistance?
  - reducing capital expenses and operating costs

Which Broadband metro/aggregation technologies are considered?

- **RPR Based Network Solutions:**
  - Convergent solution to capable to accommodate legacy TDM services and new packetised Ethernet and data aware service
  - "Carrier-class" Ethernet Technology for MAN networks.
  - Standardized by IEEE as 802.17.
  - Extra features, besides those of a "carrier-class" infrastructure,
    - Robustness and recovery fail capabilities (in less than 50 ms)
    - OAM capabilities
    - QoS control mechanisms for jitter and delay
    - Connection and admission control mechanisms
    - Unicast, broadcast and multicast types of transmission
    - Optimal BW utilization mechanisms and sharing unused BW mechanisms among the nodes of the ring
  - Manufactures add, in a propietary way, features required by operators:
  - Creation of P2P, P2MP and MP2MP services.
  - Port/Slot redundancy for connections
  - VPLS services availability

Which Broadband metro/aggregation technologies are considered?

- Distributed monitoring and management systems
  - Easiness to manage end-to-end Ethernet services
  - Support of point to point and point to multipoint services
  - Measurements: jitter, delay, throughput, packet loss, etc. Specific VoIP quality measures.
  - Test traffic and analysis of results.
  - Developed monitors currently used in Telefonica network

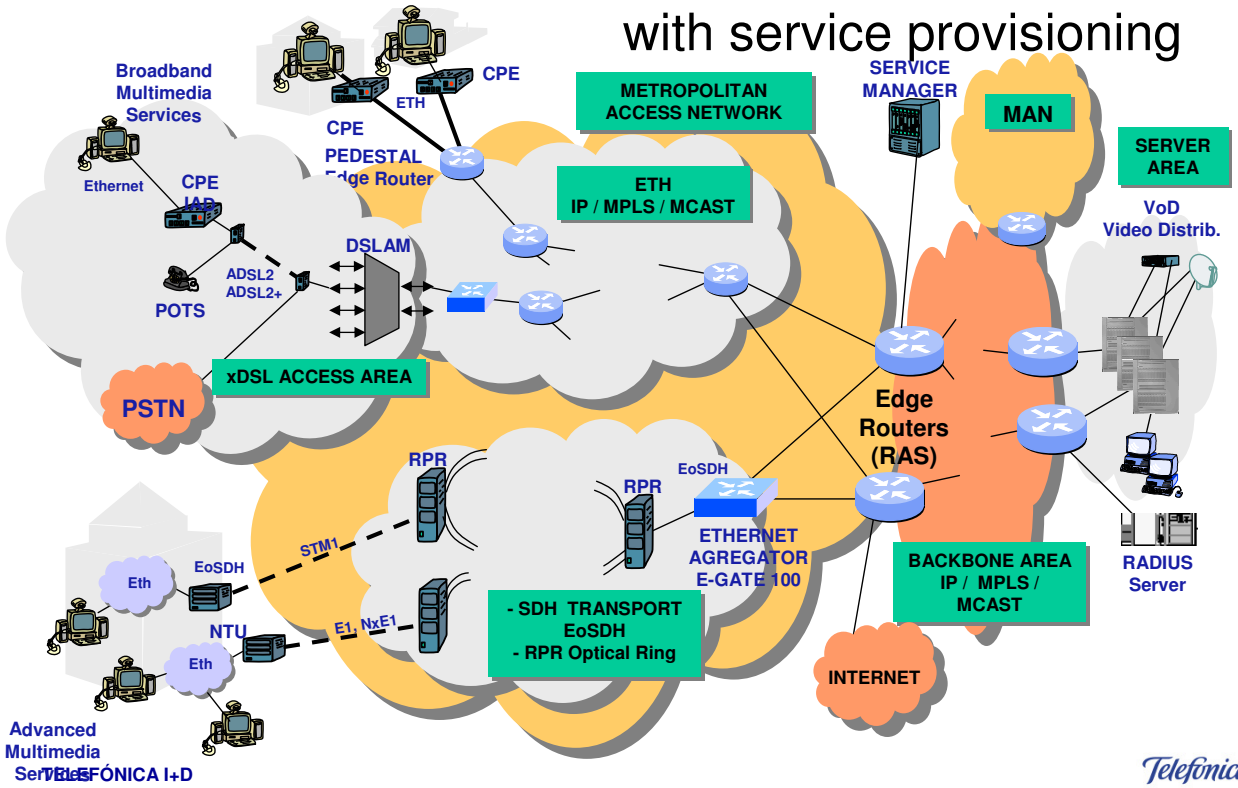
BANITS 2 Test bed

- **BANITS 2** has set up a fully interconnected test bed providing an integrated platform to validate the solutions as a pre-commercial deployment
- **Technical achievements has been focused on:**
  - Test bed design as a faithful sample of the defined system archit.
  - Seamless integration between different technologies and partners' contributions in a pan-european scenario
  - Service deployment to show/highlight the technical achievements in the different areas of the project: Provisioning in remote scenarios and using real environments

BANITS 2 Test bed (II)

- **External connection infrastructure for intra-testbed connections, fulfilling the specified service-requirements**
  - Provide bandwidth, mode (unicast and multicast support), QoS classes according to ITU specs (delay, jitter, packet loss)
  - Interconnection is available for tests, service integration and demonstration activities to be carried out until the end of the project

BANITS test bed platform with service provisioning



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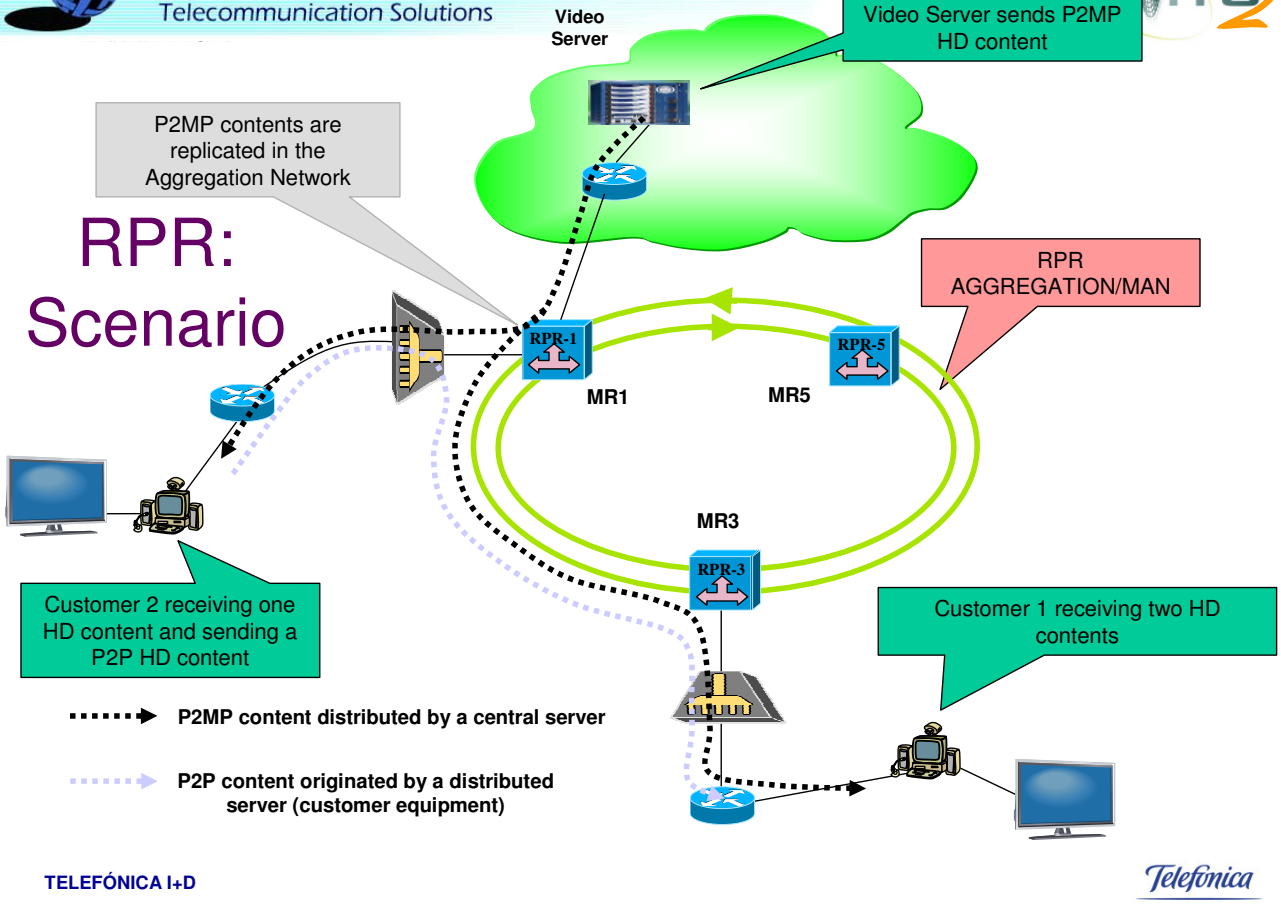
RPR: Scenario



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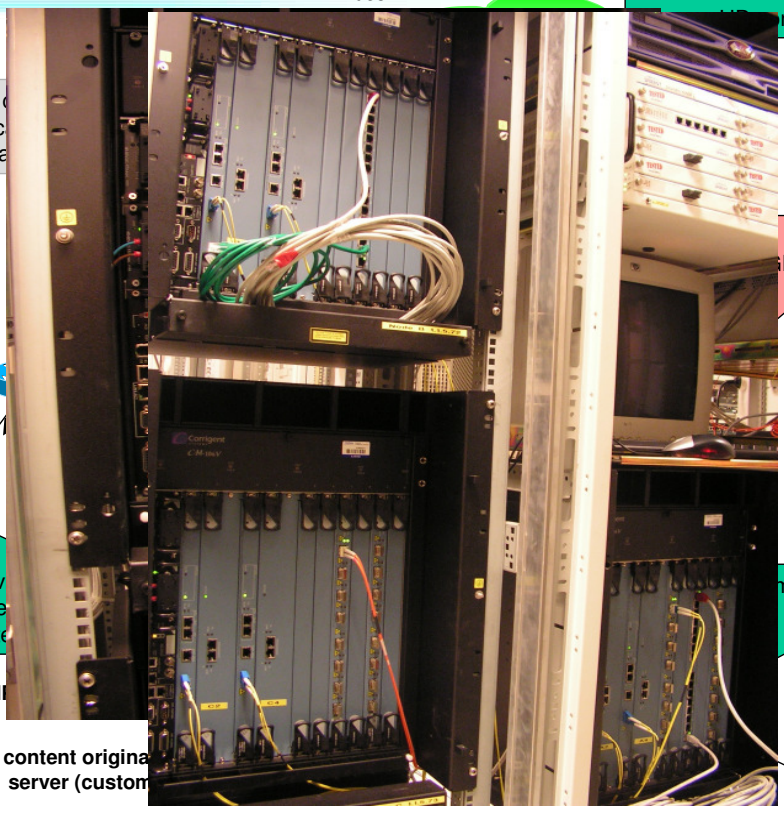

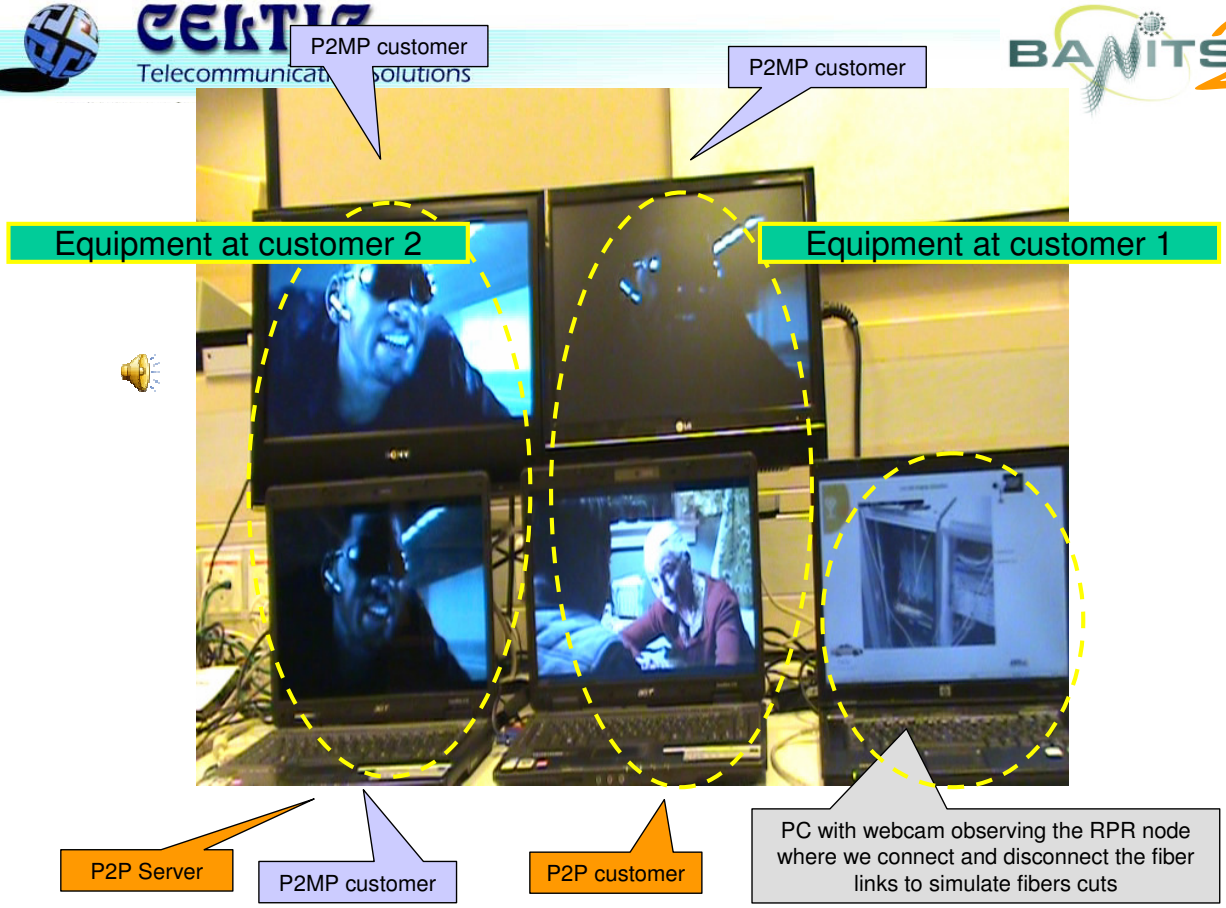

Conclusions

- Advanced services can be provisioned over current infrastructure with enhancements.
- xDSL technologies can still be improved (ACRM)
- RPR is a convergent technology which provides highly resilient transport
- Experimental validation in testbeds is essential.