TNC2010 Abstract: Investigation of Emerging Carrier Class Transport Network Technologies

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Abstract

1. Introduction

Carriers and transport network providers are facing new challenges in network transport, because of:

- A steady growth of Internet traffic (e.g. 18 exabytes per year today in US, and 72 exabytes per year in 2011 according to Cisco Networking Index projections).
• The strict Quality of Service (QoS) and bandwidth requirements for providing controlled data flows for new media-rich applications such as video calls and Internet Protocol television (IPTV).

• The demand for multi-provider and multi-domain support of new transport services such as Layer 2 VPN or multicast (previously mostly single-domain solutions).

• New requirements in terms of control protocols and management applications in order to provide dynamic provisioning of services.

• New targets for service levels, survivability, and scalability.

These new challenges mean new requirements such as the provision of very high-speed data transfer with fine granularity for QoS, and low cost and simplicity – but provided by feature-rich equipment to offer a range of service options. These requirements are difficult to satisfy with existing technological solutions. This has led to the demand for ‘Carrier Class’ transport technologies, to offer telecommunications standards in previously data-centric technologies. For this reason, providers and standardisation authorities have been working in recent years on developing new standards and technologies capable of satisfying the demands outlined above. Examples of these technologies are Provider Backbone Bridge with Traffic Engineering (PBB-TE) and Multi-Protocol Label Switching Transport Profile (MPLS-TP).

NRENs, service providers and carriers are asking themselves which of these technologies is the one to choose for their future networks and which strategy hardware manufacturers will follow.

2. Investigation Approach

The pan-European research networking community has been conducting an investigation under the title ‘Carrier Class Transport Network Technologies’, or CCTNT, as part of the GN3 project. Joint Research Activity 1 Task 1 (JRA1 T1) has been investigating both worlds, packet and transmission, paying attention to such emerging packet-based transport technologies as PBB/PBB-TE and MPLS-TP, new features of Ethernet, and new packet-friendly features of Synchronous Digital Hierarchy/Optical Transport Network (SDH/OTN). We have found that meeting these tough new requirements means we need to make some changes in both converging worlds, packet and transmission. For example, in the packet world we must have a packet-based transport technology with SDH-like Operation, Administration and Maintenance (OAM), resilience, QoS, and reporting functionalities whilst retaining some of the best features of packet technologies such as fine granularity in bandwidth provisioning, low cost, flexible connectivity (not only point-to-point), etc. In the telecoms transmission (optical/electrical) world, we must have smoother grooming of data traffic; flexible and dynamic provisioning. The major challenge will be the full integration of control plane, equipment, operations, administration, management, provisioning and troubleshooting functionalities – so far, defining this integration has been largely theoretical.

The research has been carried out in close cooperation with equipment providers in order to understand their perspective and strategy with regard to future networks. Several workshops have been arranged to gather information and to present our views and concerns about new technologies. JRA1 Task 1 has also been following standardisation progress very closely, especially for those technologies that are under definition, like MPLS-TP.

All this information will be part of a report that will be available by first quarter 2010 and can therefore be referenced in the full paper.

3. Second Phase: Testing

The next stage of research will involve a cutting-edge multi-domain trial and test environment – a pan-European cascaded lab interconnecting national research network testbeds. The intention with this environment is to test new technologies, new hardware and new features with particular focus on
those issues that worry most of the NREN community, like end-to-end OAM, multi-domain and multi-vendor interoperability, protection and restoration, control plane protocols, etc.

To facilitate the work of JRA1 Task 1, the testing phase will demand a major contribution from equipment providers in terms of documentation, knowledge and equipment.

4. Results and Contribution

JRA1 Task 1 results will be presented in two separate reports. A first report will provide an introduction to and general overview of the status of CCTNT, and describe the features of key technologies and architectures under such focus area sub-headings as QoS; protection and restoration; OAM; multicasting; control plane protocols; multi-domain services; scalability and manageability; applications; benefits; implications for the network architecture; motivation for using the technology; and standards. The report will also compare the different technologies based on their functionality. The second report will be based mainly on the results of the tests outlined above. It will cover functionality testing and research so far, including updates from the standards body discussions and practical implications of these standards.

JRA1 Task 1 will disseminate the knowledge resulting from the investigation and testing to help NRENs specify and build their next-generation networks, and contribute to other Activities/Tasks within GN3 with relevant and qualified documentation and information.

5. Conclusions

Transport networks are evolving rapidly due to new requirements. The possibilities for building these new networks are various, providing different functionality but also presenting new challenges in terms of interoperability. By the time of TNC2010, GN3 JRA1 Task 1 will have a full report with relevant information for the NREN community regarding these matters, which can therefore be drawn upon in the full paper.

Biographies

Alberto Colmenero joined NORDUnet on September 2007 as an Optical Network Architect. Since then he has been working on the design and specification of Ethernet Network Services. His area of responsibility covers the Alcatel TSS network where he is responsible for defining new services, customer solutions, network documentation and planning for network evolution. Alberto holds a B.Sc. in Telecommunications Engineering and during his 10 years’ experience in the telecommunications business he has been involved with the design and implementation of IP, ATM, SDH, ADSL access networks and transport networks for UMTS.

Rebecca Corn joined DANTE in September 2008, where she is a Network Engineer within the Network Engineering and Planning team. Rebecca has 10 years’ experience in High Capacity Optical Networking; designing, implementing and supporting long haul and metro area optical networks and networking technologies in data, telecoms and broadcast environments. During this time Rebecca has been employed to provide engineering training and consultancy across Europe for companies such as Nortel Networks, Metromedia Fibre Networks, Siemens Network Systems, Bloomberg and CityGroup. Within the GN3 ‘Future Network’ Joint Research Activity (JRA1), Rebecca’s research area is Next Generation Optical Transport Networks.

Marcin Garstka joined PSNC in 1995 and since then has held different positions in the Network Department, being responsible for the planning and operations of the PSNC national networks PIONIER and POL-34 and the metropolitan area network POZMAN. Marcin has an M.Sc. in Computer Sciences and during his 14 years’ experience in PSNC he has been working on the design, implementation and maintenance of FDDI, ATM, Gigabit Ethernet, IP, MPLS and VPNS.

Victor Olifer joined JANET(UK) Strategic Technologies as Network Development Project Manager in November 2003. Victor had been managing the JANET QoS Development Project for four years.
He now works as a technical specialist and his main area is investigating emerging Carrier Ethernet technologies. Victor has two first degrees (in Computer Science and Applied Mathematics) and a Ph.D. in Computer Science.

**Jan Radil** received M.Sc. and Ph.D. degrees in Electrical Engineering from the Czech Technical University, Praha, in 1996 and 2004, respectively. His Ph.D. research interests were the diagnostics and quality improvements of solar cells. Jan joined the Research and Development Department, CESNET, Praha, in 1999, where he is responsible for optical networking and the development of the next generation of the Czech research and education network. Since 2002, Jan has been working on network planning and designing, especially on experimental L0/L1/L2 facilities like GLIF and the CESNET Experimental Facility.

**Krzysztof Stanecki** joined PSNC in 1996 and since then has held different positions in the Network Department, being responsible for the planning and operations of the PSNC national networks PIONIER and POL-34 and the metropolitan area network. Krzysztof has an M.Sc. in Electronic and Telecommunications Engineering and during 13 years’ experience in PSNC he has been working on the design, implementation and maintenance of optical transmission, DWDM, ATM, SDH, Ethernet, MPLS and IP.