

8K live streaming using IP Live in 100G SDN network on distance over 1.000 km

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Purpose of the demo

During the TNC17 conference taken place in Linz (Austria) on 29 May – 02 June 2017, Poznan Supercomputing and Networking Center (PSNC) in cooperation with ADVA and Juniper prepared a demonstration presenting benefits of the packet-optical integrated network infrastructure managed by SDN controller in broadcast IP live video transmissions systems.

The purpose of the demo was to present the multilayer cooperation between network equipment and video transmission systems. Around 1.000 km long connection specially established for the demonstration purposes between Poznan (Poland) and Linz (Austria) was supported by the ADVA DWDM equipment on the optical layer, Juniper MX switching platform in the packet domain and the Juniper NorthStar system as a SDN controller.

As a service running on top of the network transport layer the Sony IP Live system was used for real-time streaming of 8K video. Two 8K IP Live streams were transmitted from Poznan over 100G network to Linz where the media IP traffic was routed in SDN domain and finally displayed on 8K wall.

The motivation of using IP Live system was not only the capability of transportation 8K video with very low latency, but also quite restrictive requirements of the network environment. Huge data streams (around 30Gbps) generated by the streaming system and sensitive synchronization mechanisms were a great indicator of the transmission quality of the network layer. Each configuration change of the underlying system or any unexpected network failure had an immediate impact on the synchronization and quality of the displayed 8K picture. Juniper NorthStar SDN controlled integrated network environment made it possible to simulate network topology changes and reconfigure both single optical links or even whole fiber cuts without any impact on the 8K IP Live stream transmission.

8K IP Live video system

The 8K Sony IP Live video system used during the demonstration was provided by the New Media Department of PSNC and consisted of two upgraded Sony F65 8K cameras featured with the CA4000 Camera System Adaptor, two BPU 8000 Baseband Processor Unit, three NXL-FR318 SDI-IP signal processing units equipped with 24 x NXLK-IP40F SDI to IP Processing boards and the IP Live System Manager application software.

The 8K live signals from two Sony F65 cameras installed in PSNC offices in Poznan were transmitted through two BPU 8000 units directly to the Sony IP live system over 32 SDI

interfaces. The IP Live system (NXL-FR318, NXLK-IP40F) was responsible for signal compression with visually lossless LLVC codec and for providing IP stream for the Juniper router installed as a gateways to the IP packet-optical network infrastructure.

In the conference venue in Linz, the compressed IP video stream provided by the Juniper edge router was received by the Sony IP Live system, decoded and finally delivered to the 8K wall composed with four 4K TVs. During the demonstration two independent 8K live streams were transmitted utilizing around 30 Gbps of the network bandwidth what was shown on network statistics chart on Figure 1. Using Sony IP Live System Manager software, installed locally in Linz on PWS-100 server, it was possible to smoothly switch 8K streams and change the content displayed on the 8K video wall.

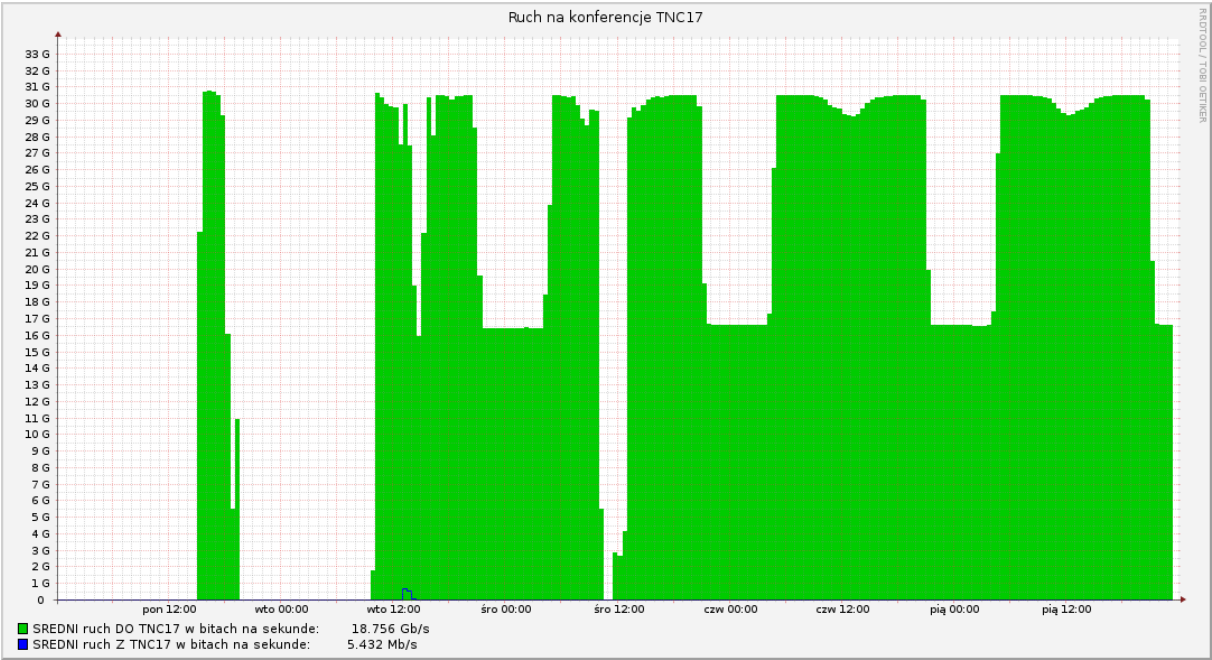


Fig. 1 – Chart depicting the bandwidth occupied during 8K live transmission

The whole installation was able to transmit two independent compressed 8K video streams in real time over IP SDN network infrastructure on large distance without any influence on the quality and therefore provide high quality content for the 8K wall installed in Linz.

Both 8K camera live system and IP Live streaming system were designed and constructed by SONY for ultra-high resolution content streaming research performed by New Media Department of PSNC as well as production broadcast system for live transmissions and demonstrations during events such as sports games, scientific research conferences or cultural events.

SDN network architecture

The 8K IP traffic was transmitted over the 100G link from Poznan via the PIONIER and GEANT networks directly to the experimental SDN network environment setup in Linz. The optical route in GEANT network led through Hamburg, Prague and Vienna. The local infrastructure prepared for the TNC17 demonstration was consisted of an optical layer, in ring topology,

composed of three ADVA FSP3000 R7 DWDM devices and an IP layer supported by two physical Juniper MX routers and four logical routers working in the packet domain. On top of the network infrastructure the Juniper NorthStar SDN Controller (SDN orchestrator) was installed and it was responsible for management of the whole multilayer network system. The architecture and topology of the demo was depicted on Figure 2.

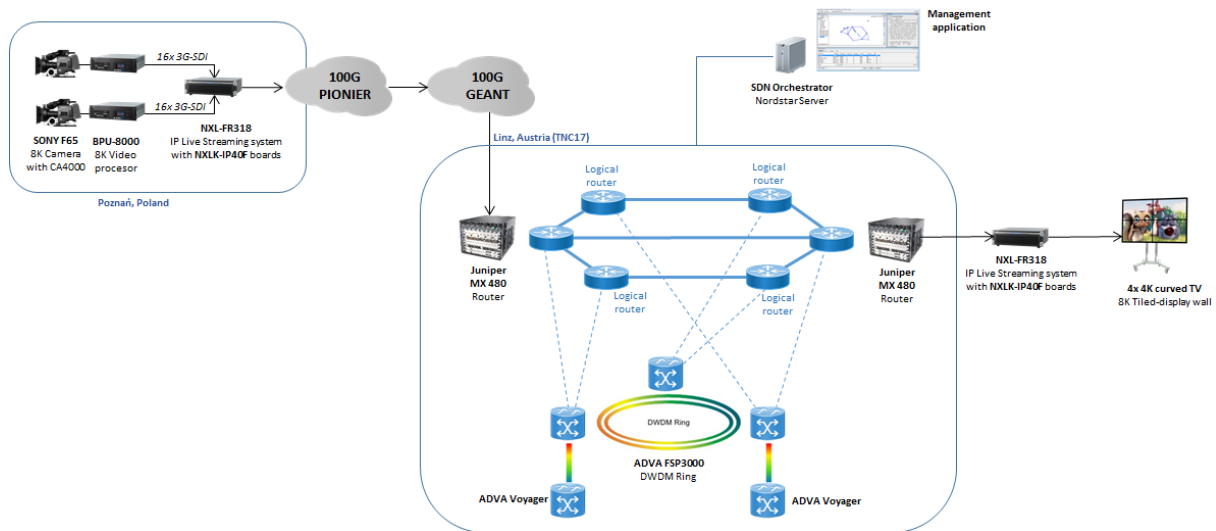


Fig. 2 – 8K Live demo architecture

The main goal of the demonstration from the network perspective was to show interaction of the SDN Controller with Adva Optical DWDM system. The NorthStar controller discovered automatically the topology information and status for the optical and networking layers. Through the RESTCONF API interface the optical network structure was imported to the system including SRLG information. The only area where the manual interference was required was mapping of the connecting interfaces between the optical and networking layers. The whole set of information was then used for building an optimal and redundant LSP for the 8K video stream transmission. One of the key constraints for such LSP is path diversity avoiding the redundant path to use optical channels established over the same optical line. In case of fiber optic failure, this guarantees fast and reliable failover to working backup path. Furthermore, the NorthStar SDN Controller was presenting real-time statistics for both layers – performance, topology and alarms.

The NorthStar SDN Controller provides visibility of the large service provider IP/MPLS networks and allows optimization their network infrastructure by using more complex path selection algorithms. The NorthStar system is a powerful tool for monitoring, planning, and provisioning LSPs using a global network view perspective. It uses PCEP protocol in order to communicate with networking devices and BGP-LS to discover current state of traffic engineering database. Moreover NorthStar Controller provides ability to collect some information about underlying transport system.