Exploring interactive music production over public and private networks.

This presentation describes experiences, findings and challenges with technical set ups, communication and workflows when collaborating interactively in a “virtual” sound studio with several partners in different locations at the same time. "Virtual" in this context refers to an interconnected and interdomain studio environment consisting of several local production systems located in public and private networks.

Background and framework:

Since 2005 telecommunication and music departments at the Norwegian University of Science and Technology (NTNU) have been investigating high quality multimedia over IP networks through the project "Nettmusikk". Early technical work has now emerged into musical applications including several music performances and concerts, teaching, and “real time” music productions. To enable the described situations, we have established a local network (10Gb + VLAN) around the city of Trondheim to different key buildings optimized for music performance and production, as illustrated in Fig. 1. The network connects these buildings into a large "virtual" collaborative studio and performance space. We have built and equipped a recording studio at NTNU that are tailor made around the use of network technology. The framework includes and combines both analogue and digital sound equipment, and also serves both commercially and opens source software and hardware to maintain flexibility between a variety of different production systems and musical situations.

Premises for use and flexibility:

Important premises have been to guarantee for a low latency audio connection between the different localisations to enable for real time musical interaction between different musicians and music producers. Real time sharing of acoustical spaces and musical equipment is also made possible. Emphasis has been put on ensuring the infrastructure to be both inclusive and independent of specific music software and production systems. Inclusive in the way that involved producers are given the opportunity to work on their own “instrument” to maintain their expertise and workflow during performance, and independent in the way that system components can exchange audio and control data even when they rely on music software and production systems from different vendors.

Our proposed presentation at the conference will mainly concentrate on experience drawn from 3 specific session carried out in 2017.

1. Connection between two professional sound studios located 3 km apart, with musicians at both locations in a live recording. Both music producers having the possibility to remote control preamps and individual fold back through their local interfaces.

2. Musical performance and remote recording between a professional studio and a home studio, located 4 km apart and connected via a public network.
3. Musical performance and production in three locations interconnected via the academic Internet; Trondheim, Irvine and San Diego.

To enable these three sessions a "toolbox" for interconnecting production systems was required.

For case 1) a dedicated virtual local area network (VLAN) was "stretched" to reach both location, enabling audio processing and control signal protocols designed to operate within a LAN to work properly.

For case 2), tools designed to operate beyond LANs was applied, Jacktrip for audio transport and "Remote desktop" for control.

For case 3), a "star topology" was applied to interconnect the three sites with Irvine as the hub.

Figure 2 illustrates the configuration for the three different sessions.

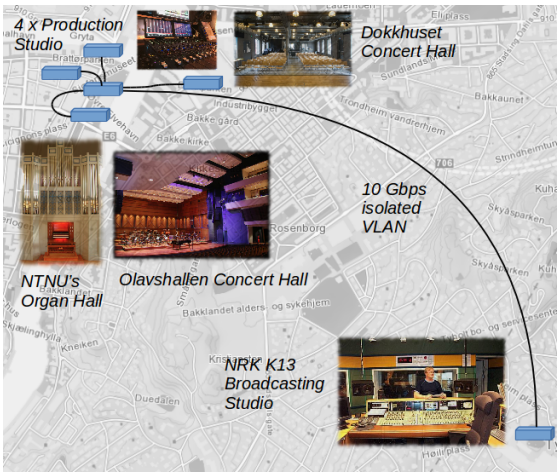

Fig.1: The "Nettmusikk" high capacity VLAN interconnecting studios [1,2] and concert halls [3,4,5].

[1] *Studios at Department of Music*, NTNU, Trondheim, Norway. https://www.ntnu.edu/music

[2] *The S13 studio at Tyholt*, NRK, Trondheim, Norway. https://www.nrk.no/about/

[3] *Olavshallen concert hall*, Trondheim, Norway. https://www.olavshallen.no/english

[4] *Dokkhuset scene*, Trondheim, Norway. http://www.dokkhuset.no/teknisk/

[5] *The Organ Hall*, NTNU, Trondheim, Norway. https://www.ntnu.no/c/document_library/get_file?uuid=215a6777-95e5-48b2-aabc-f07af5e6d7eb&groupId=10256

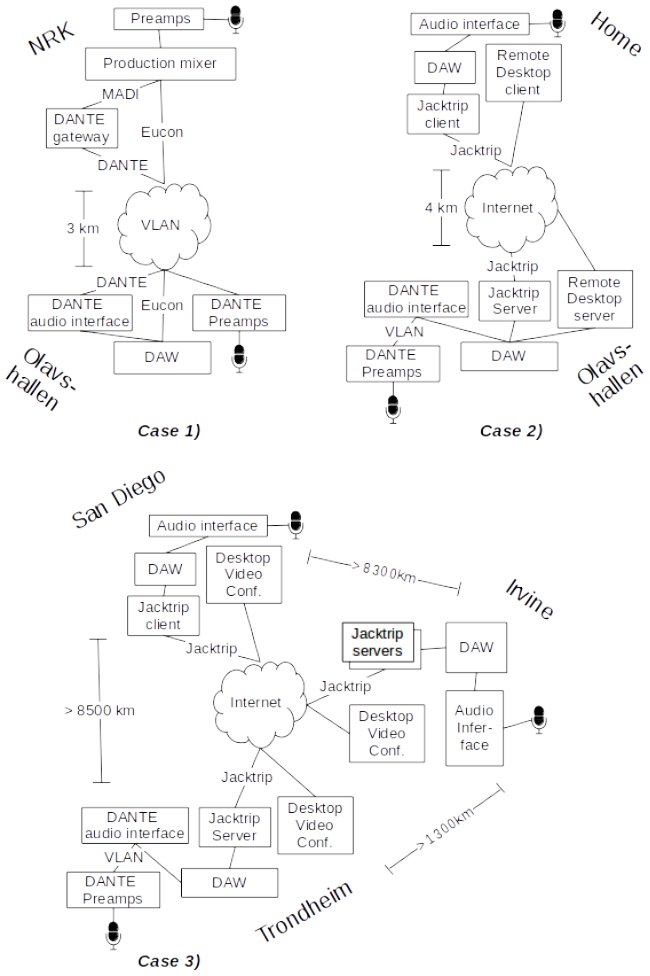

Fig. 2: Three sample cases of interactive music production.

Short Bio presenters:

Trond Engum is a professor of music technology at NTNU, Norway. He also works as a composer and performer within the field of music technology. His main instrument is guitar and electronics. Engum has a background from bands like The 3rd and The Mortal and The Soundbyte, and have released numerous international recognized albums, played concerts and festivals since the mid 90`s. He has composed music for several theatrical performances and television programs. Engum is also a part of the ensemble Trondheim Electroacoustic Performance (T-EMP).

Otto J Wittner, PhD, works part time with innovation projects at UNINETT, the Norwegian national research IP network provider, and part time as adjunct associate professor at department of InfoSec and ComTech at NTNU, Norway. Since 2009 he has been project manager of innovation activities within multimedia and contributed to research activities at many Norwegian universities (e.g. NTNU, UiO, UiT, NMH). He is also actively working with innovation and research within networking with Software Defined Networks and Named Data Networks as current areas.