

InteNtion – Interactive Network Sonification

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ABSTRACT

This paper presents an innovative approach in monitoring network traffic by adding a new dimension: the sound. InteNtion (Interactive Network Sonification) is a project aimed at mapping network activity to musical aesthetic. The network traffic analysis is made with the SharpPCap library (a port of WinPCap to C# environment). From this analysis, the collected data are converted into MIDI (Musical Instrument Digital Interface) messages and sent to dedicated synthesizers, which generate sounds dynamically mixed together. The whole process results in an interactive soundscape. This novel approach will initiate two opportunities for technological development. It allows users to actively take part in an interactive exhibition system through simple actions involving network access, including streaming radio over the Internet, sharing music on Twitter, downloading mp3 files and others. This project initiates also a new dimension in monitoring the network by helping the administrator in detecting efficiently the hacking and abuse of the infrastructure.

1. INTRODUCTION

Networked systems are more and more ubiquitous at home, at work, in bars, shops ... even in streets. We are facing a growing number of hotspots and services, allowing us to stay connected any time of the day.

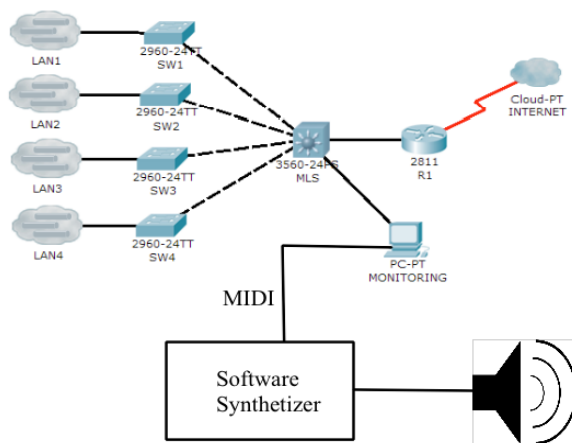


Figure 1: Traffic analysis and sonification

The problem is that, because of the number of users (who are anonymous most of the time), the networks remain more and more vulnerable to hacking or usage abuse. To avoid that, professionals use a lot of different softwares to monitor all the aspects of their network, providing some text alerts, statistical graphics and so on. Thus, the traffic control is essentially based on visual reports.

We propose to add to this existing dimension a new one which is based on sound. The initial idea of this project is to analyze the network flow via a software program, called NAC [8] (Network Access Control) and map these data into a network sonification.

Several projects propose to sonify Internet sites [3] or to focus on specific parameters such as the network performance [4]. Our approach is different. The solution we propose is to divert the standard applications' libraries to analyze the traffic at a very low level (layer 3 of the ISO model [2]) which brings us to a new way of interacting with the network. Based on other studies [5] and [6], we have imagined mapping the data into MIDI events, which are sent to software music synthesizers. The output is a soundscape literally composed by the network activity. It means that users can act interactively with the sounds just by surfing on the Internet, sharing data on Facebook or synchronizing their Dropbox. You will definitely hear your network in another way.

2. THE CONCEPT

Applications such as WireShark [1] are useful to monitor a network, to detect intrusion, hacking or bugs. Those programs are mainly based on the PCap library that can be integrated in other projects for different, original and artistic purposes. We propose a software solution that analyzes live streams of an entire network flow (this software is running on the PC-PT-Monitoring; Figure 1) and generates usage statistics of the network. The Internet Protocol (IP) parameters (including TCP/UDP segment and the data) are manifold: the Time-To-Live (TTL), the packet size, the fragmentation information, the source and destination addresses, the type of service and all the port usage statistics included in the TCP/UDP segments.

These collected data are then converted into MIDI messages to be sent on a MIDI interface as "Note On" or "Control Change" events on different channels (Figure 2).

At this stage of our work, the mapping is still experimental. However, using the method described in the following paragraph, the first musical aesthetic results are very promising.

We use four different sound synthesizer softwares from Native Instruments [9]. Taking the protocol into account, an analysis of the datagram is effected. We send the MIDI message to the associated synthesizer depending on the protocol (HTTP, FTP, DNS and for the fourth synthesizer all the other existing protocols). The amount of useless datagrams (e.g., ACK packet) considered as “noise” for the communication will be mapped in relation to the amount of “noise” in another particular granular synthesizer.

The other parameters are mapped as follows :

- The packet size is mapped to the frequency. A small packet gives a high frequency and the large one will result in a bass sound.
- The TTL of the datagram is used as duration of the note.
- The bandpass of the network, measured in real time, will modify by a Midi Control Change the bandpass of a resonant filter in the appropriate synthesizer.
- We can estimate by the IP addresses, the distance between the origin and the destination. That parameter will change the reverb size of the sound with a Midi Control Change.

A second result of this project is the initiation of a software program allowing a network administrator to monitor the infrastructure in differentiating regular, normal data flow from an unusual behavior (abuse or hacking) just by hearing sounds.

4. REFERENCES

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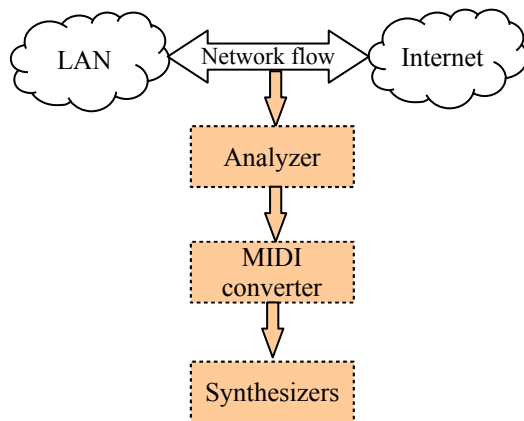


Figure 2: The different layers of the project

Thus, the synthesizers produce sounds mixed together which result in a soundscape. The soundscape will react on what is going on the network [7]. People using the network will, due to their own actions, modify the activity and consequently the soundscape.

3. CONCLUSION

At this stage of our work, InteNtion provides an unusual and innovative way to monitor networks by using their entire data flow to create musical aesthetic. Therefore we can consider this project as an artistic project that might be used, for instance, in a concert where the audience participates as main composer in the music performance.