Music Sharing Room over Named Data Network

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ABSTRACT

What is Mu-lighting?
Mu-lighting is an entertaining music player running over NDN. It has two features:
1) music sharing across multiple devices
2) using the metadata of music to control lighting.

Music Sharing allows the music player to stream music with little to no setup. If a storage device inside a network sets up the sharing function, any music player on that network can see and fetch data from it.

Additionally, the music player will control the lighting according to the frequency and onset data of a song.

What is NDN?[1]
Named data Networking (NDN) is a new Internet Architecture that emphasizes content by making it directly addressable and routable. NDN is characterized by the basic exchange of content request messages (called "Interests") and content return messages (called "Content Objects"). It is considered an Information Centric Networking architecture.
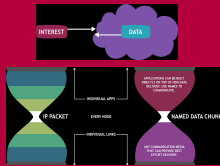
ACKNOWLEDGEMENT

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INTRODUCTION

To initialize, the storage devices will first insert all music data into the NDN repository, which is effectively long-term in-network storage.
When the user wants to play music, an updated song list is displayed and they can simply choose a song and a music player to play it.
The network will appoint the chosen music player to fetch the requested music information from the repo.
When the music player starts playing the music, it will simultaneously also send RGB command to control the lighting.

APPLICATION ARCHITECTURE

The modules inside the system includes:

Module	Amount	Function
NDN Repo	1	A place to gather music data
Controller	1	Obtain song list& order song
Storage	n	Native repository
Music player	n	Play music&send lighting command
Lighting	1	Blink according to the music

NDN Repository (repo-ng) is an external toolbox which provide permanent in-network storage to a network.
These 5 modules will interact together to realize the functions of obtaining & updating song list, ordering song(s), playing the music&controlling the lighting.
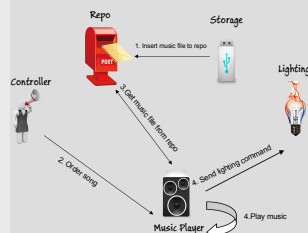
Namespace Design

Named Data Networking (NDN) emphasizes content by making it directly addressable, so we use names to replace the IP addresses.
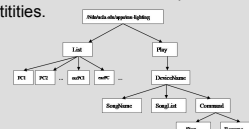Network forwards directly on hierarchical names that map to real entities.
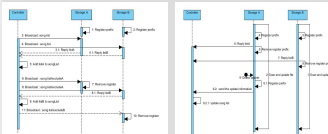
Figure1. Namespace of mu-lighting

**Figure2. Namespace of repo**

SYSTEM DESIGN

The functions of the system include: obtain&update song list, order song, play music & control lighting.
1. Obtain & update song list:

2.Request playback of song(s):
To play a song, user first types in the song name, then chooses the music player. The names will be appended to the interest name to guide the interest to the desired music player.
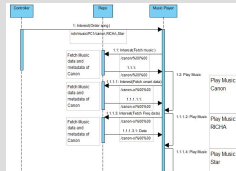
3.Lighting Control
After getting the file, a callback function is called to play the music and sending RGB command to lighting simultaneously.
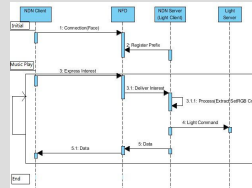
The RGB command is decided by the onset data and frequency data of a song. A software sonic visualiser is used to obtain the data.
The frequency data will decide the color of lighting. Every song will have one dominant hue.

The onset data will control the blink time of lighting. When the onset duration is relatively long, we will sent 6 interests with gradient colors. When the duration is relatively short, we only sent two command or even none command(when the duration is fairly short) in case a transient blink will make human eyes uncomfortable.

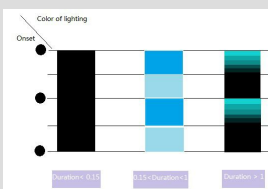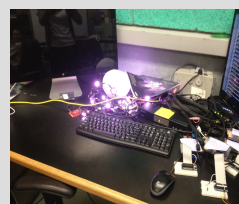An intuitive way to illustrate the 3 different conditions can be as follows:

Figure 3. Simulating effects of different durations

Photograph 1. light blinks in real time

Implementation

Mu-lighting is implemented using Python and PyNDN library (lower layer implementation written in Python).
After initialization, the user will see the latest version of song list in the music sharing room.
To play with the system, the user can choose the song and the music player to play it. Then we can enjoy the music and the magic effect of lighting.

FUTURE WORK

At present, Mu-lighting is only a basic version. To make the first version more user-friendly and to take full advantages of NDN's architecutral affordances, the next improvements are:

➤Update song list in a more secure way: by appending a version number in the end of interest name, the controller can detect any update in time and send request to obtain the new list.

➤Add command "stop" and "resume": stop the music is related to stop the processes of music playing and sending lighting command, which works in two separate thread. System needs to signal between threads.

➤Play while fetching data: at present, music player will fetch a complete file before playing the music. To realize play in the real time, we need to use a buffer to ameliorate the lag. Besides, we can calculate a proper buffering time.

CONCLUSION

Project Mu-lighting is a practical application that makes good use of affordances of NDN's architecture. With NDN, we no longer delivering the packets to a given destination address but retrieving data identified by a given name. This is what makes music sharing / distribution / remote playback applicable. My future work will focus on improving the system to better use and test NDN itself, as well as make the application more user-friendly.

REFERENCES

[1] Van Jacobson,etc. Networking named content. Commun. ACM, 55(1):117{124, January 2012.
[2] Jeff Burke, Burke-NDN-IoE, March 11, 2014 – Huawei Strategy & Technology Workshop