



ixi software

# Latency as Musical Property: Networked Performances

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ixi software

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## ixi software

- Started in 2000 as research of interactive modes in musical software
- Free and open source software on our website
- ixi workshops all over Europe - from Madrid to Helsinki.
- Propagating open source software and the sharing of knowledge
  
- Dual semiotic stance of the user of creative software.
- The designer of creative software has to be aware of this fact.
  
- Lectured and taught in various universities
- Residencies in DRUH (Huddersfield), Buchsenhausen (Innsbruck), KHM (Colgne), STEIM (Amsterdam).



## Networked Music: new paradigms

- Multi-user instruments
- Distributed performances
  - Spatially distributed
  - Temporally distributed
- Audience participation
- Blurring of instrument and composition
- Wireless networks
- Heterogeneous control devices (computer, PDA, mobile)
- Different interfaces to the same instrument
- It affords different compositional ideas



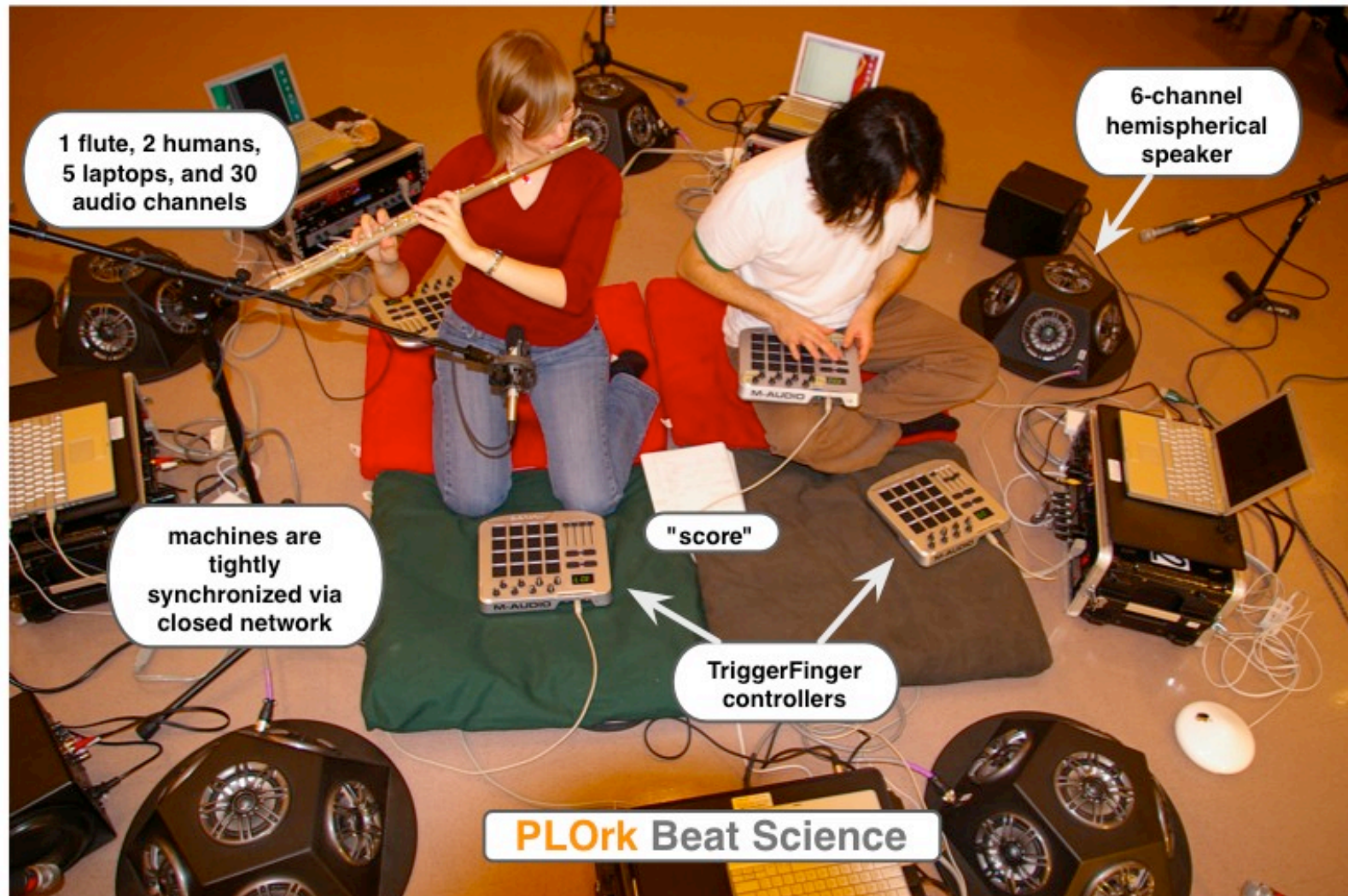
## Short History of Networked Performances

- The League of Automatic Music Composers (1980)
- The Hub (1986)
- .... Endless experimentations
- Open Sound Control (ca. 1997)
- Tudor's Rainforest performed on a SuperCollider system written by Ron Kuivila at the ICMC year 2000.
- ... Endless experimentations
- TOPLAP (live-coding)

# Short History of Networked Performances



# Short History of Networked Performances





## Two modes of networked communication

- Stream compressed audio/video through the network
- Exchange control messages with Open Sound Control
- But what is OSC?



## Open Sound Control

- Open Sound Control ("OSC") is a **protocol** for communication among computers, sound synthesizers, and other multimedia devices that is optimized for modern networking technology.
- OSC can send **integers** (1, 2, 0, -2, etc), **floats** (1.1, -0.222, etc.), **strings** ("this is a string"), symbols (\symbol), and **binary files** (0101010101110) through a network.
- OSC is an open protocol and there are now OSC libraries in almost all programming languages.





## OSC and MIDI

- OSC is the 21st century version of MIDI
- MIDI only supports 7 bit integer control values (0-127).
- OSC is 32 bit
- MIDI can send around 4000 bytes per second whereas OSC can send around 1.250.000 bytes per second.
- The good thing about MIDI is its generality and use in all hardware and software.
- However, OSC is now being introduced into hardware as well.



## How does it work?

- It uses either the UDP or TCP internet protocol.
- You need an **IP address** (like “209.197.102.193” or “127.0.0.1”)
- You choose a **port number** (any port above say 8000 will do).
- And you need to be connected to a LAN or Internet.



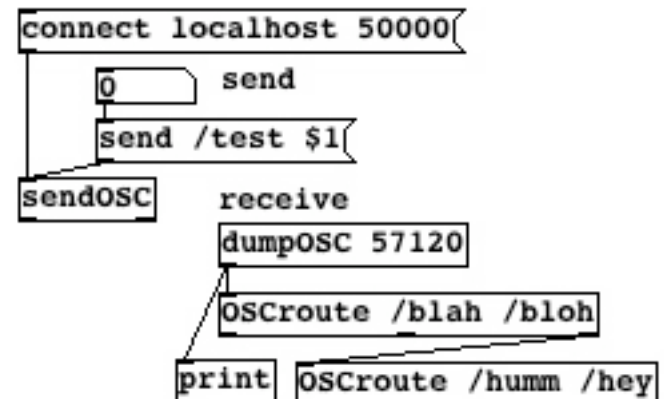
Some examples of OSC

# Simple example 1

Using two different platforms on the same computer



```
int receiveAtPort = 50000;  
int sendToPort = 57120;  
String host = "127.0.0.1";
```

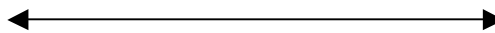


# Simple example 1

Using two different platforms on the same computer



Processing



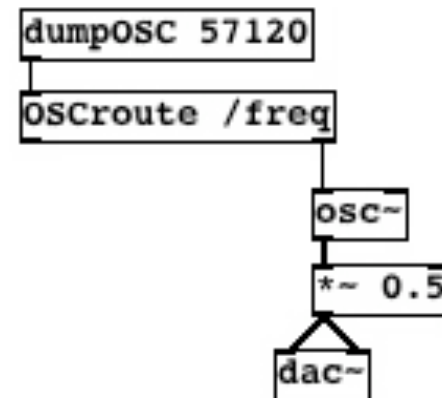
Pure Data

```
int freq =myBox.getLoc().y;
```

```
msg = SendOSC.newMsg("/freq");
```

```
msg.add(freq);
```

```
SendOSC.sendMsg(msg);
```



## Simple example 2

Communicating two applications on two computers

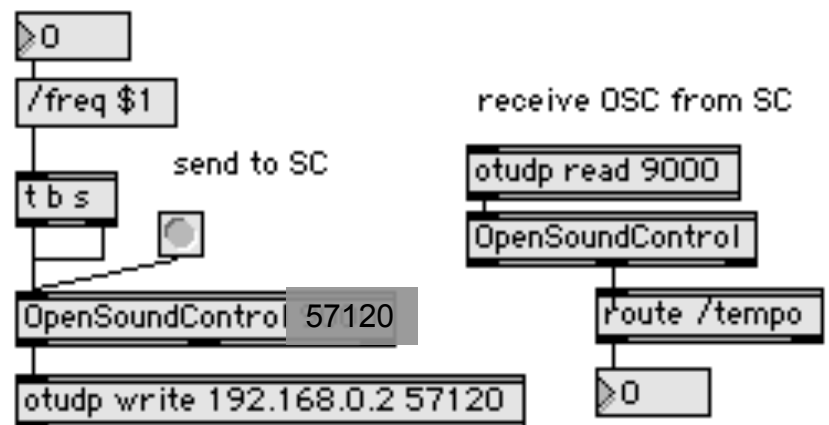


```
var receiveAddr, sendAddr;
// connecting two computers on local network

receiveAddr = NetAddr("192.168.0.2", 57120);
sendAddr = NetAddr("192.168.0.7", 9000);

r = OSCresponder(receiveAddr, '/freq',
{ arg time, resp, msg; [time, msg].postln });.add;

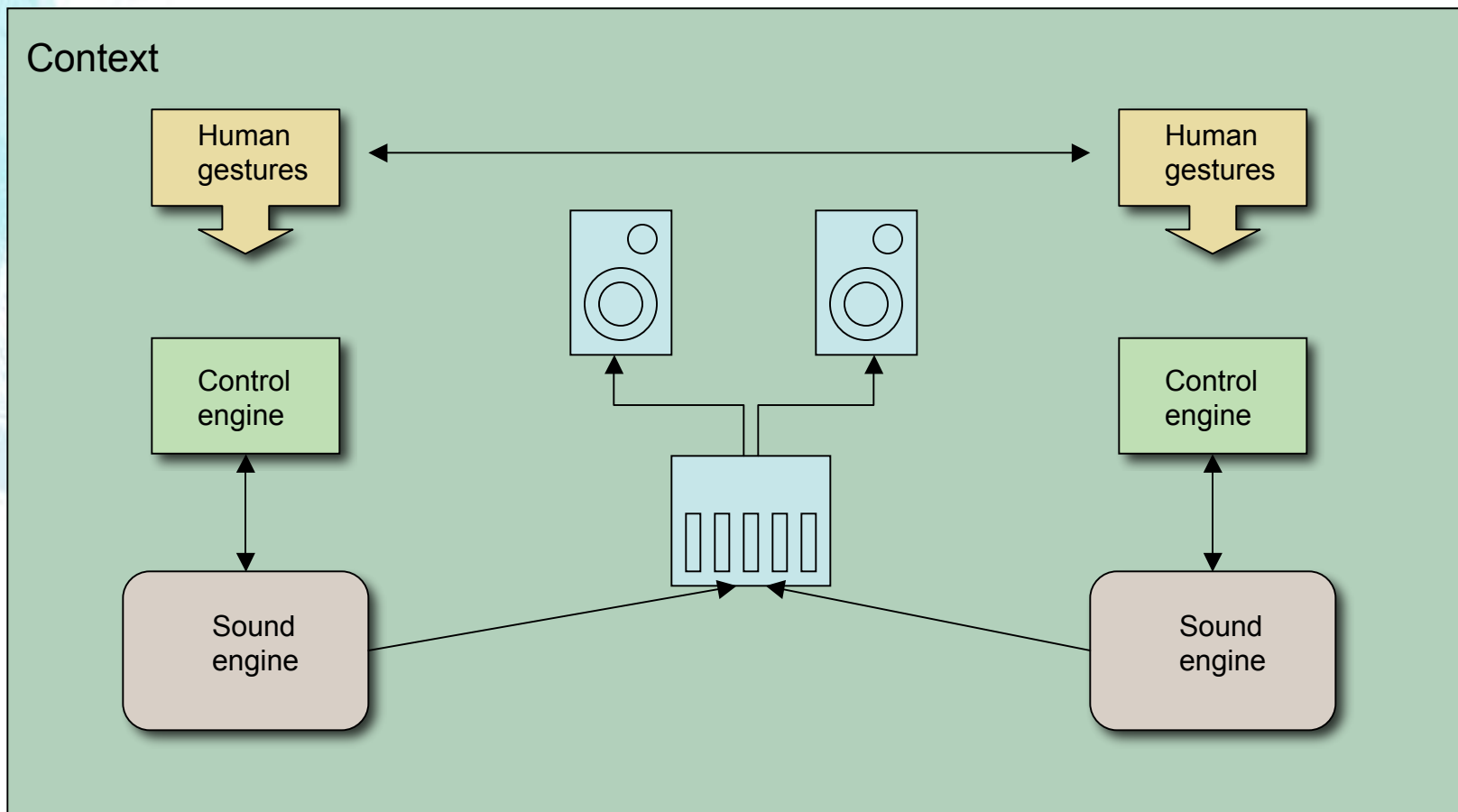
sendAddr.sendMessage("/tempo", 114);
```





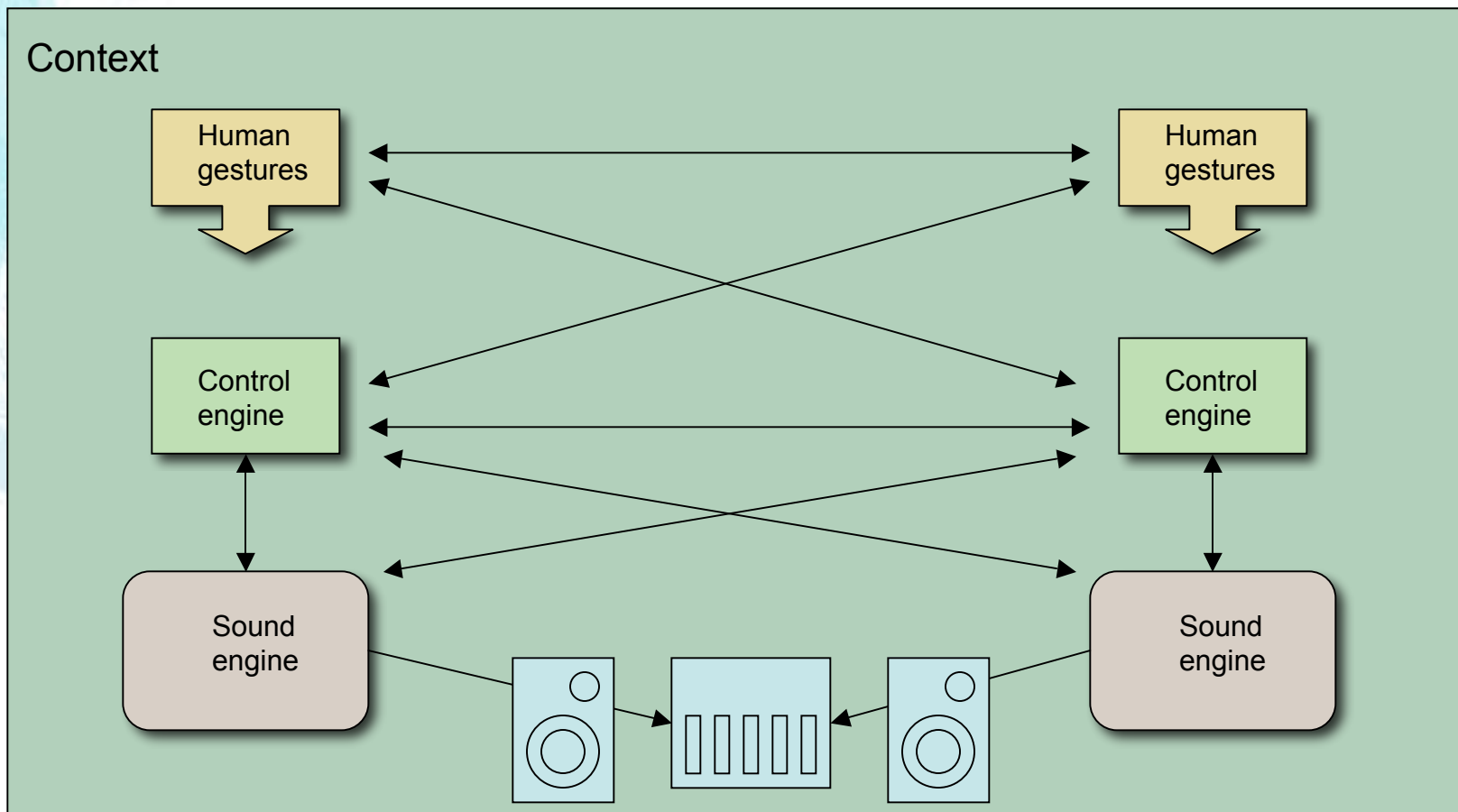
## Some examples of technical setups in Networked Musical Performances

# Co-located networked performance

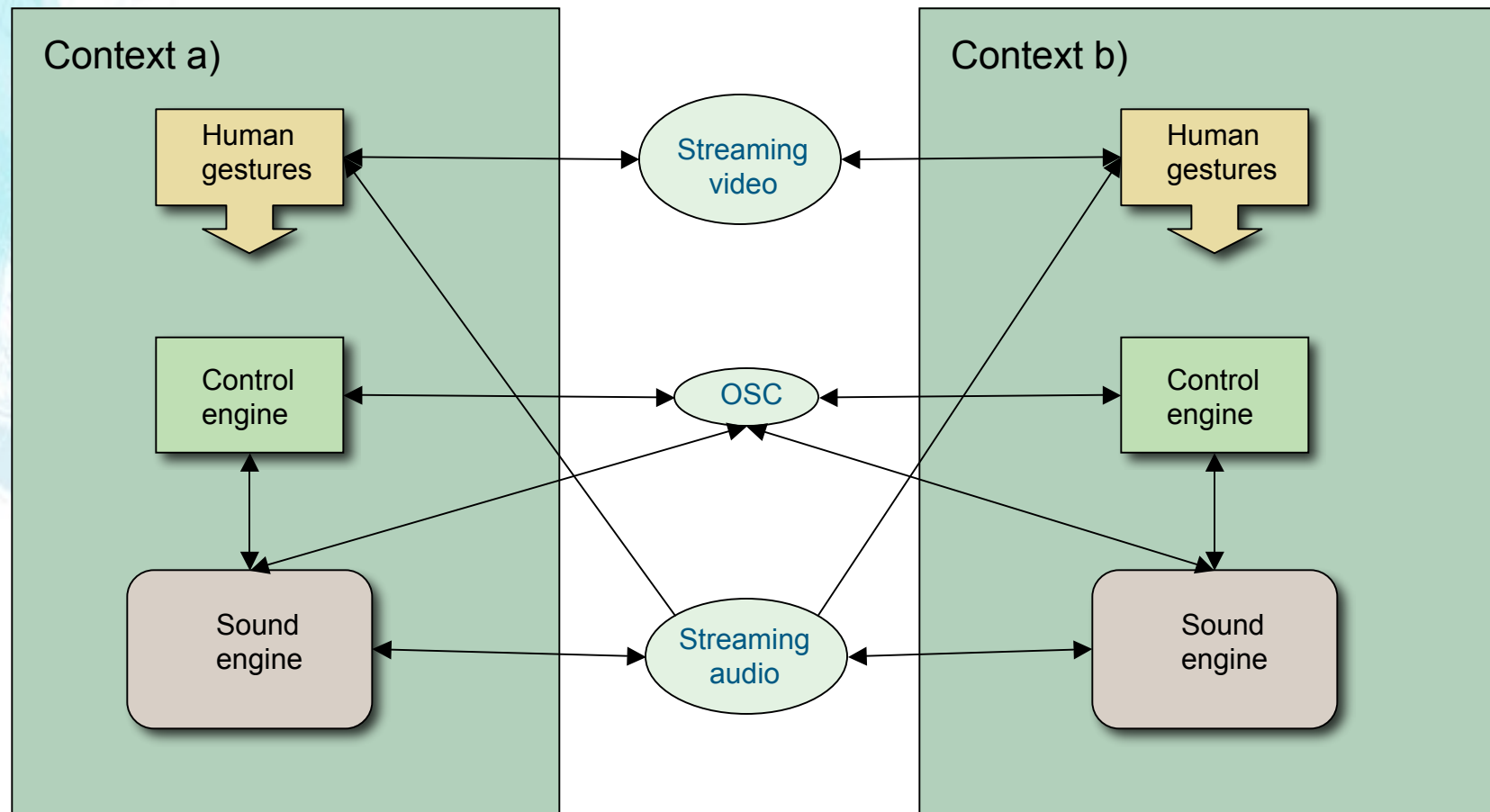




# Co-located networked performance



# Dis-located networked performance

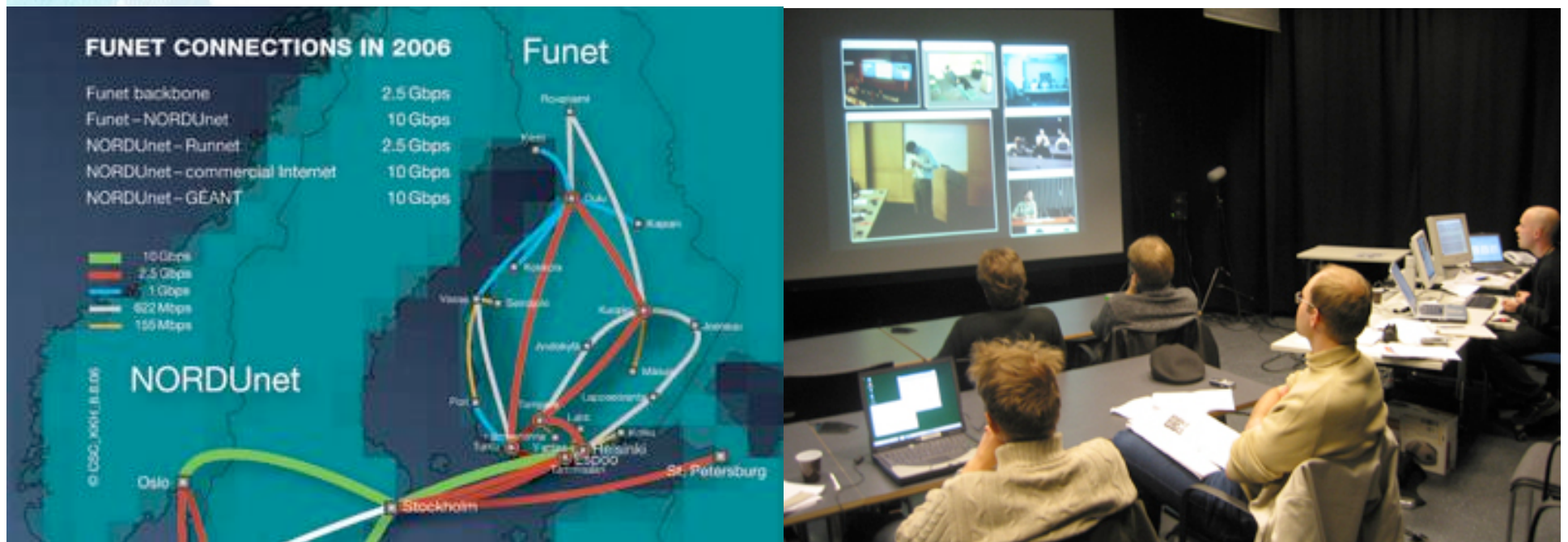


# Example: Helsinki-Fairbanks networked gig

10 Gbps - Internet 2 : US University network

Funet - 2.5 Gbps : backbone

Latency : The use of AccessGrid & DVTS (video conf systems)



# Helsinki-Fairbanks

- March 23, 2006. - ImproMasters + ixi (Helsinki) vs. The Percussion Ensemble of University of Alaska (Fairbanks)
- 9 o'clock in the morning in Helsinki - 9 in the evening in Fairbanks
- Super fast video and sound connection (video slightly slower ~150 ms).
- View [stream](#)





## Latency as condition of music

- Latency (usually more than 20 ms.) is a necessary property of networked communication.
- One can struggle against it and be frustrated
- Or adapt the compositional ideas to this new “acoustics”, I.e. the network acoustics.
- As always in computer music the focus is usually on the synthesis and the score level of the music and not the note (or gestural) level.



## Further information

- [www.opensoundcontrol.org/](http://www.opensoundcontrol.org/)
- [www.ixi-software.net](http://www.ixi-software.net)
- <http://silakka.fi/netcon/fairbanks.html>
- <http://silakka.fi/ImproMasters/>

Questions/comments?