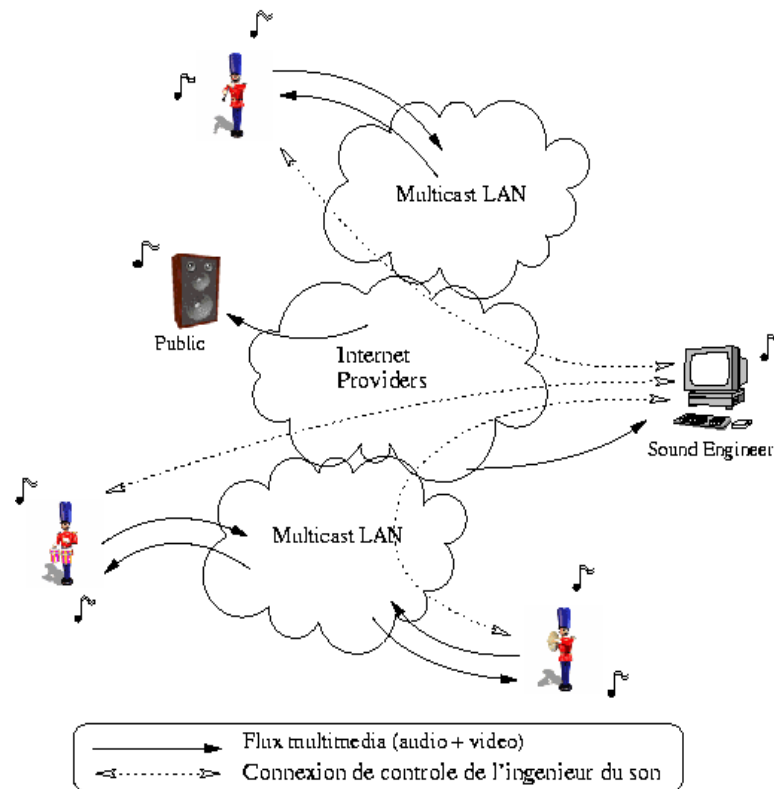


# The Distributed Virtual Concert Project

(over Internet)

Current works and Trends at CNAM-CEDRIC



Nicolas Bouillot

PhD Student

Hans-Nikolas Locher

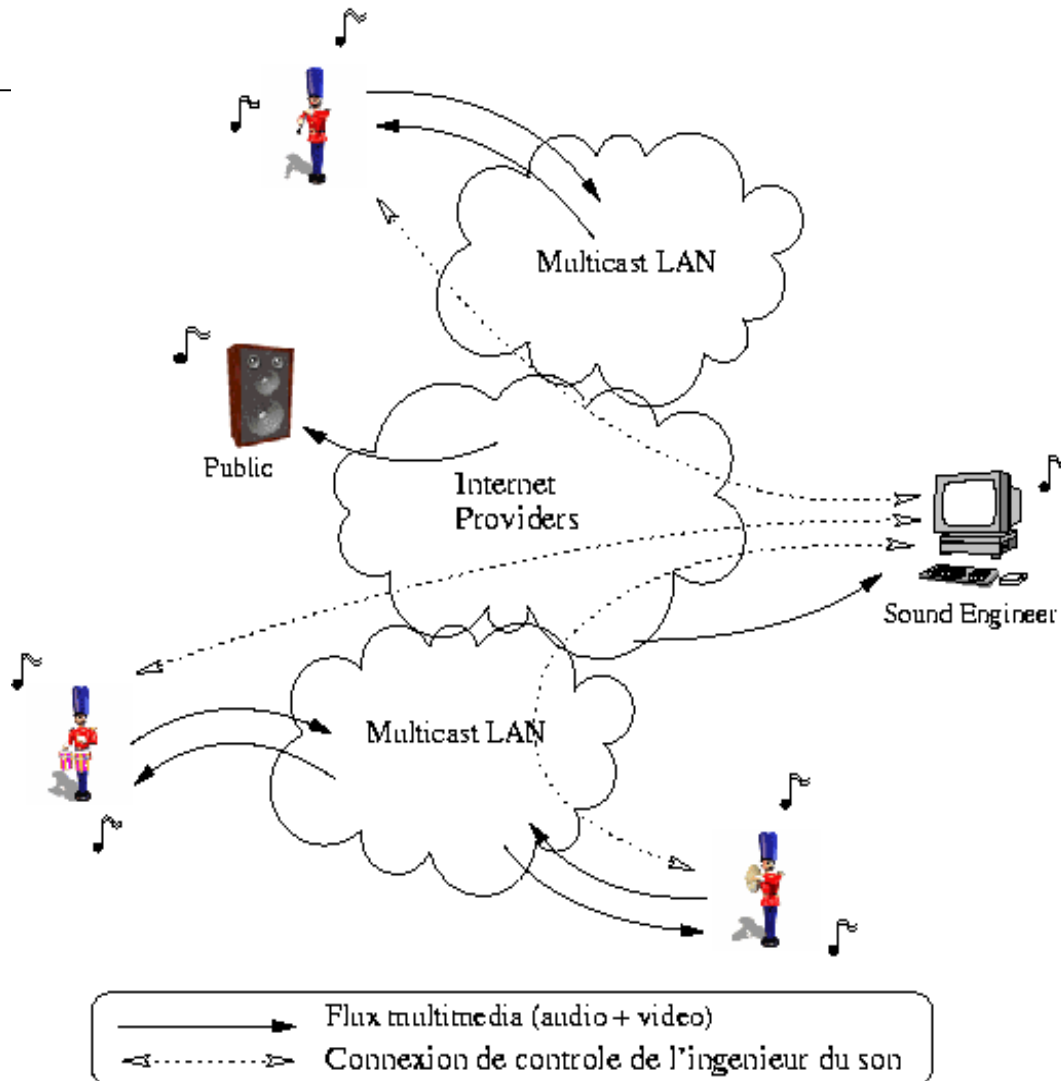
Engineering Degree Student

Eric Gressier-Soudan

Professor

A join project with the Free Software Team  
from IRCAM leaded by François Dechelle

# Goals



Musicians can hear and see each other

Musicians interact

A sound engineer controls audio devices of all the musicians

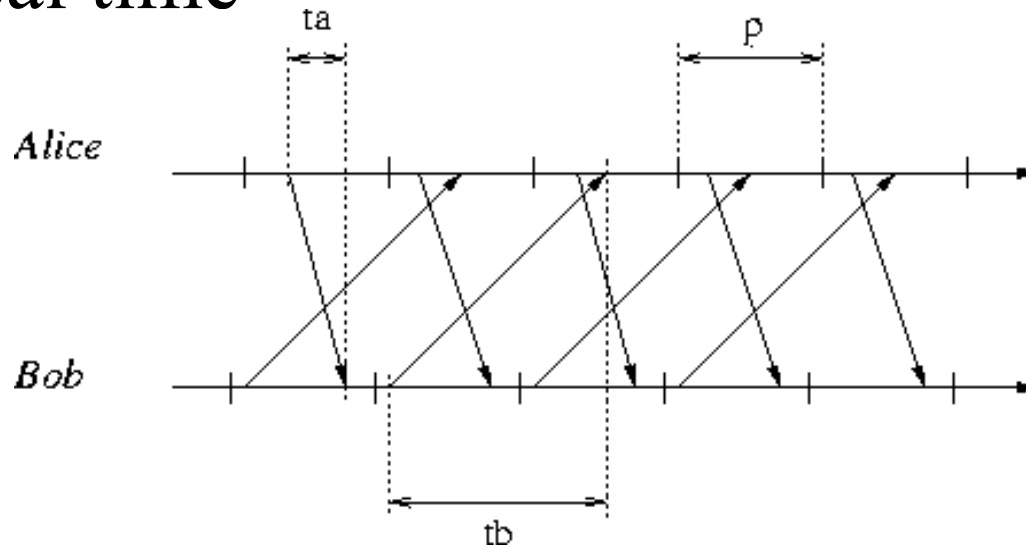
The public hear the concert in « live » at home or in an auditorium

# Direct distributed applications

- Interactive Multimedia applications
  - Multi-player Video Games
  - Virtual/augmented Reality for distributed works
  - Distributed Simulation
- Simulation of real world musical practices (close to IRCAM)
  - Musical chat
  - Audio Performance
  - Audition
  - Training with a band

# Communication with audio streaming

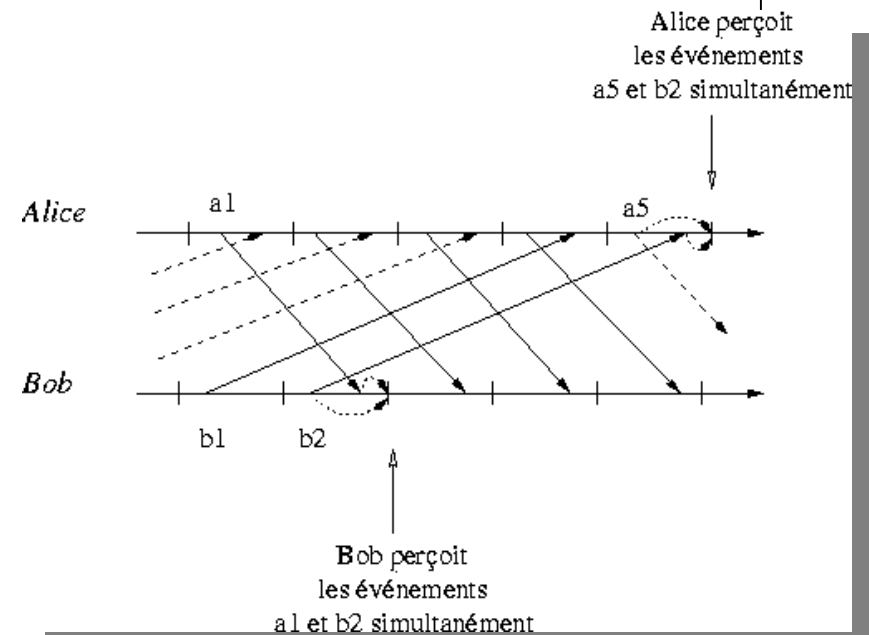
- Acquisition, playout and transport of audio data in real time



- $T_a$  ,  $T_b$  and  $p$  are constant values
  - *Insufficient for musical interactivity*

# Musical interactivity

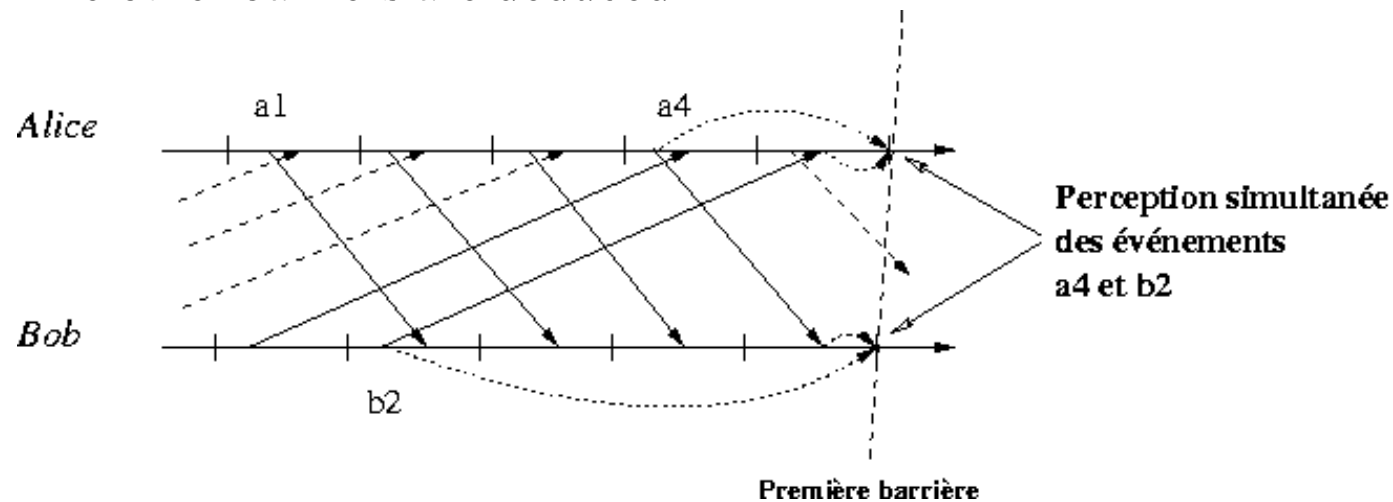
- When musicians are in the same room, they can hear each other *instantaneously* and *simultaneously*
- Across Internet, it is different !
  - The latency is unpredictable and can be heard ( $> 20\text{ms}$ )
  - Without synchronization, latency breaks simultaneity



# First proposal (NB) :

## The global perceptive synchronization (njam plugin for jMax)

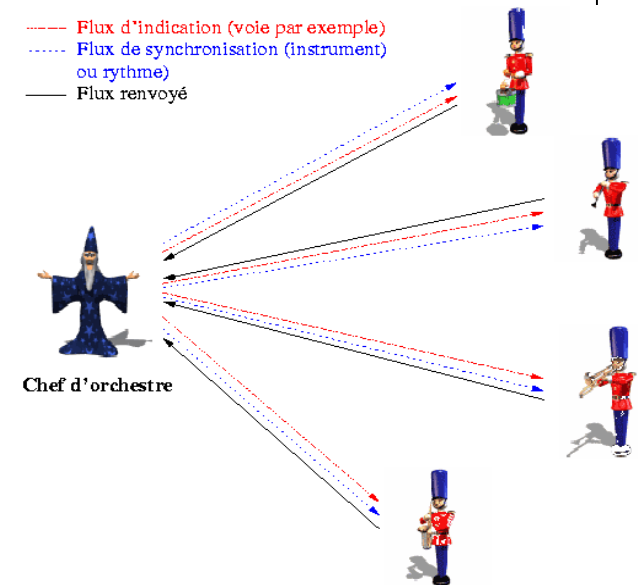
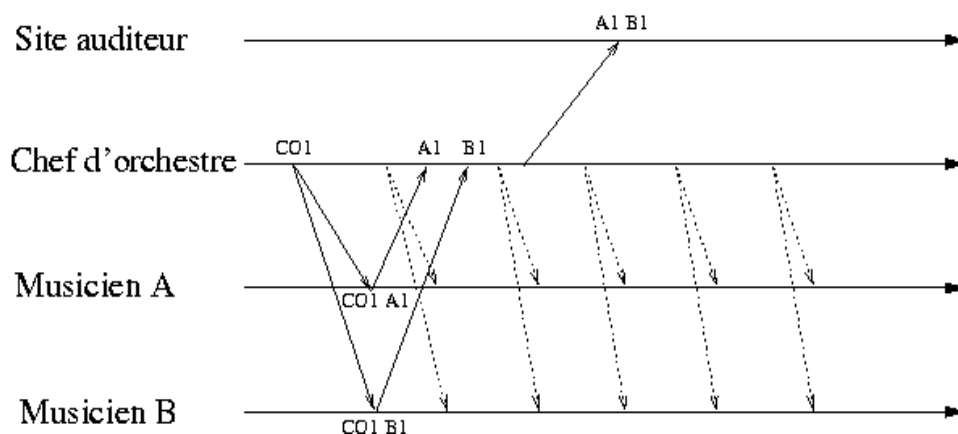
- Barrier like synchronization:
  - The first barrier is computed with a distributed coordination
  - The other barriers are deduced



- The local sound is delayed, all sounds are played simultaneously later
  - *Hypothesis : musicians can play with a delay only if this delay stays the same during a performance*

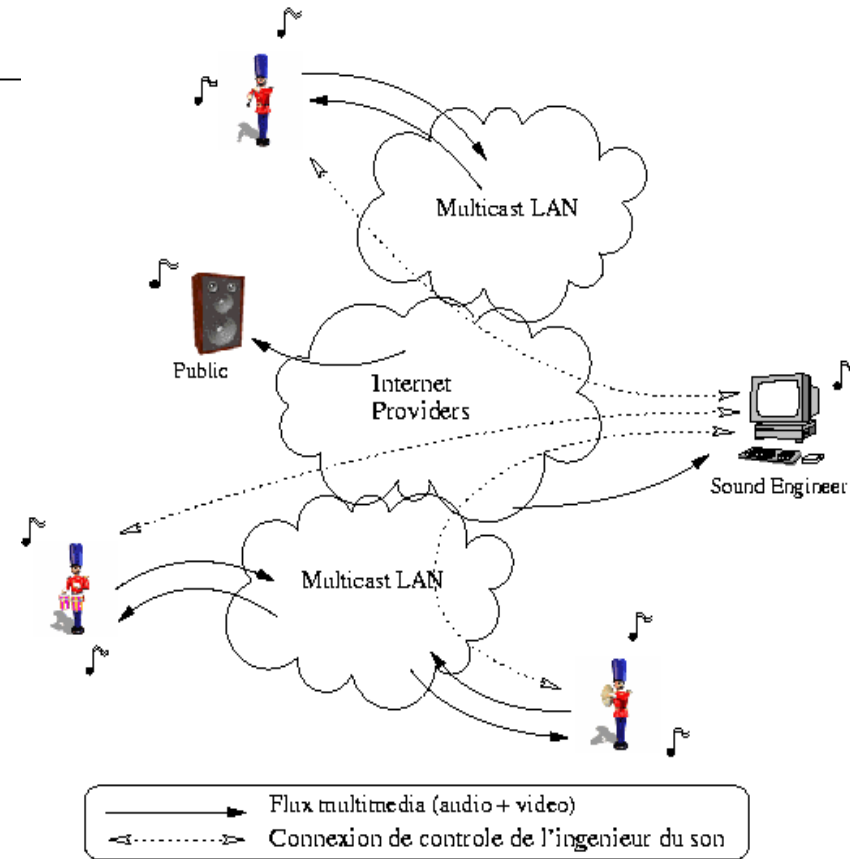
# Second proposal (NB) : The « conductor » interactivity

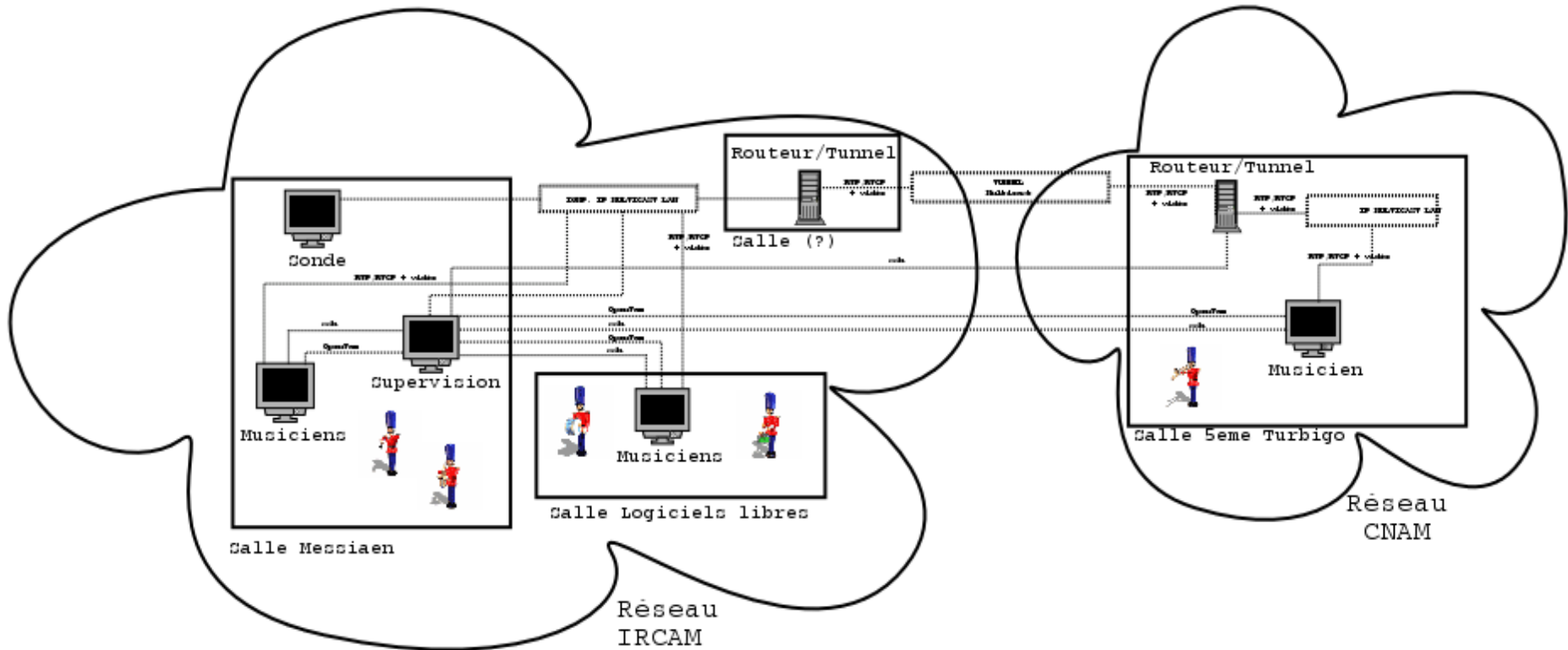
- Each musician hears only the conductor
  - The local sound is perceived instantaneously
  - This solution is adapted to situations where there is few interactions among musicians (example: Symphonic orchestra)



# Distributed mixing console (HNL)

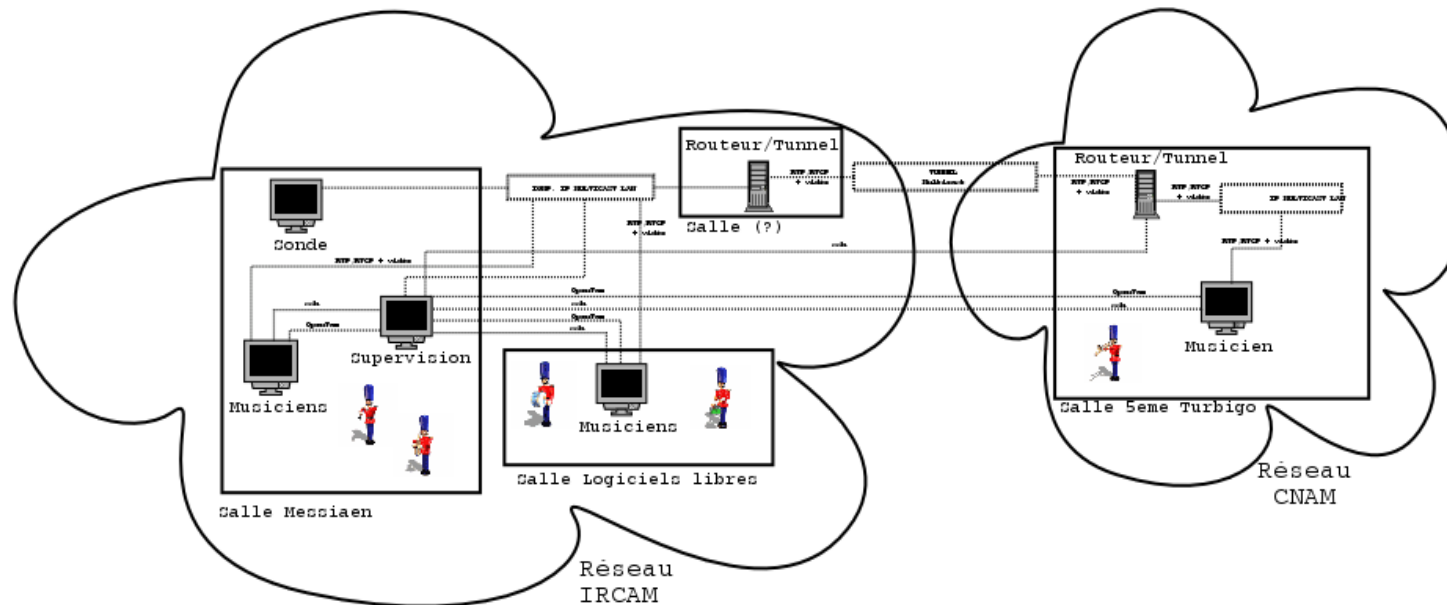
- Audio settings for each musicians:
  - Volume In/Out
  - Balance
  - Metronome
  - Digital Signal Processing
  - Environment management
- Distributed monitoring service
  - Initially defined as a mediation protocol (for power production control)
  - Corba and Corba-CCM implementations are opensource





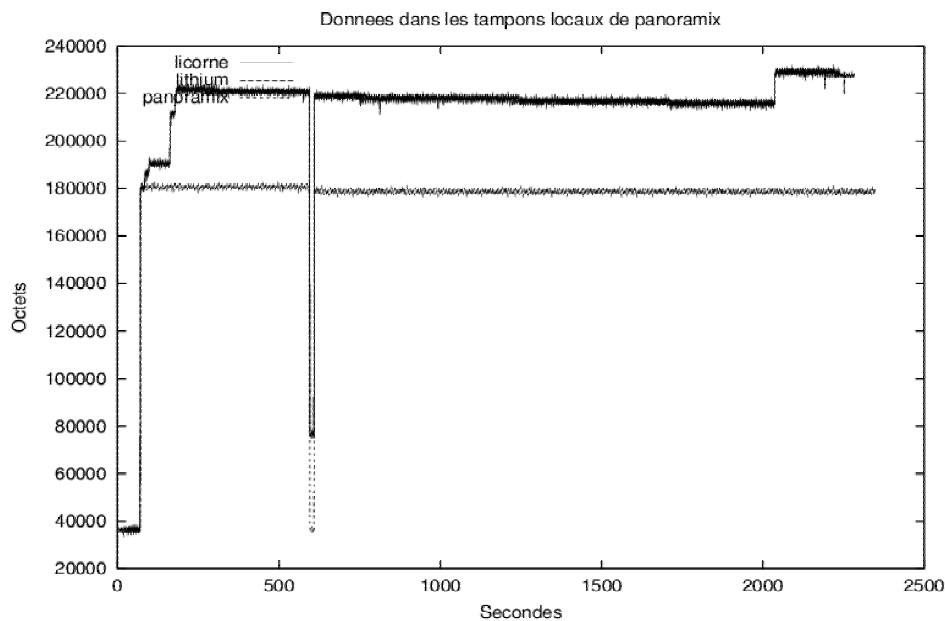
- Open house week end (18 october 2003)
- 5 musicians distributed on 3 different places
- New fonction: the distributed metronome
- Tunnel based multicasting, best effort network

# Résonances 2003 : a MAN experiment

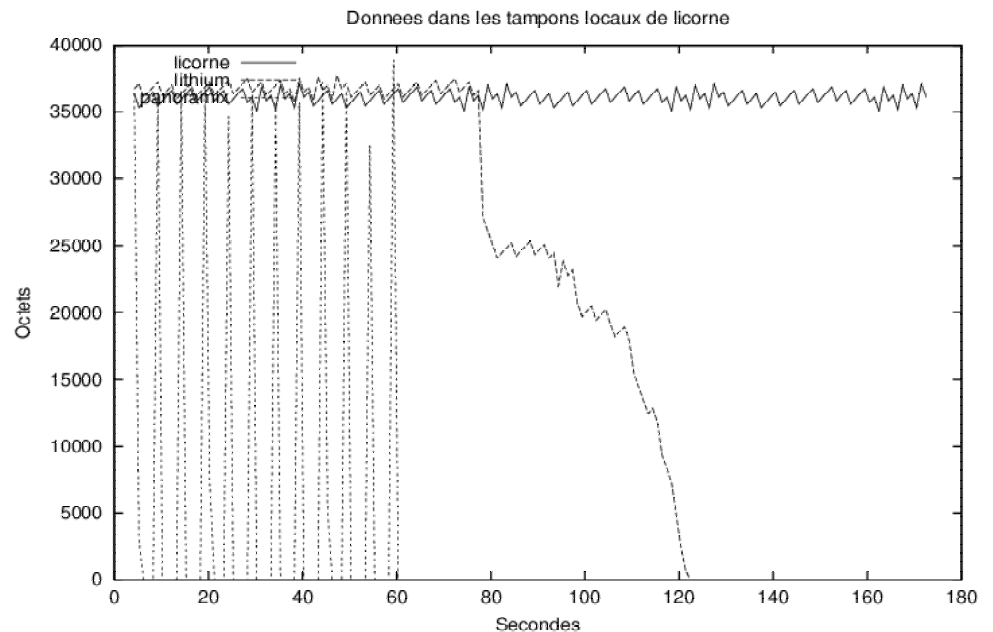


- Musicians at CNAM and IRCAM interacted with the global perceptive synchronization
- Steady state reached during the training session
- The « Live » session planned a week later was cancelled due to unpredictable and unexpected network load

# Résonances 2003



- 0,1% loss during the training session



- During the « Live » session : losses, or data arrived too late

# Conclusion and future works (1)

- From a Network point of view :

## **Musicians :**

- Native IP-multicast (need the support of net operators for the musician network)
- QoS support (same requirement)
- Try the concert accross WAN : France and then Europe

## **Need to reach the public :**

- ADSL/cable networks
- On the air networks

IP-Multicast is no longer possible : **overlay networks** or tunneling

# Conclusion and future works (2)

- From the public point of view
  - spatialize the concert :
    - Different ranges of goals : from a simple PC solutions to Grid computing, it depends on targetted effects
  - audio streaming towards our public :
    - Proxies vs P2P (discussions are under way with Inria Grenoble)
    - Mix

Terminals offer different capabilities
  - video required : a very very basic tool uses VIC

# Conclusion and future works (3)

- From a software engineering point of view :
  - Use jMax as a distributed middleware to integrate software components

**Difficult, need extensions, but the challenge is interesting !!!**

# Conclusion and future works (4)

- From a research point of view :

The distributed concert requires new solutions :

- Networks
- Distributed multimedia systems
- Performance evaluation : dimensionning and predictability

The distributed concert requires use case studies :

- How musicians play in a distributed environment
- New applications to be invented