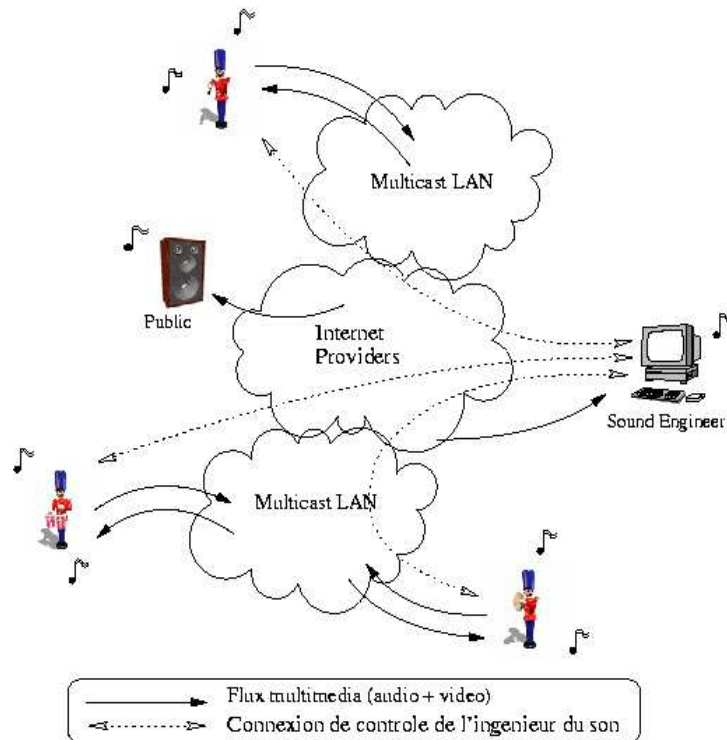


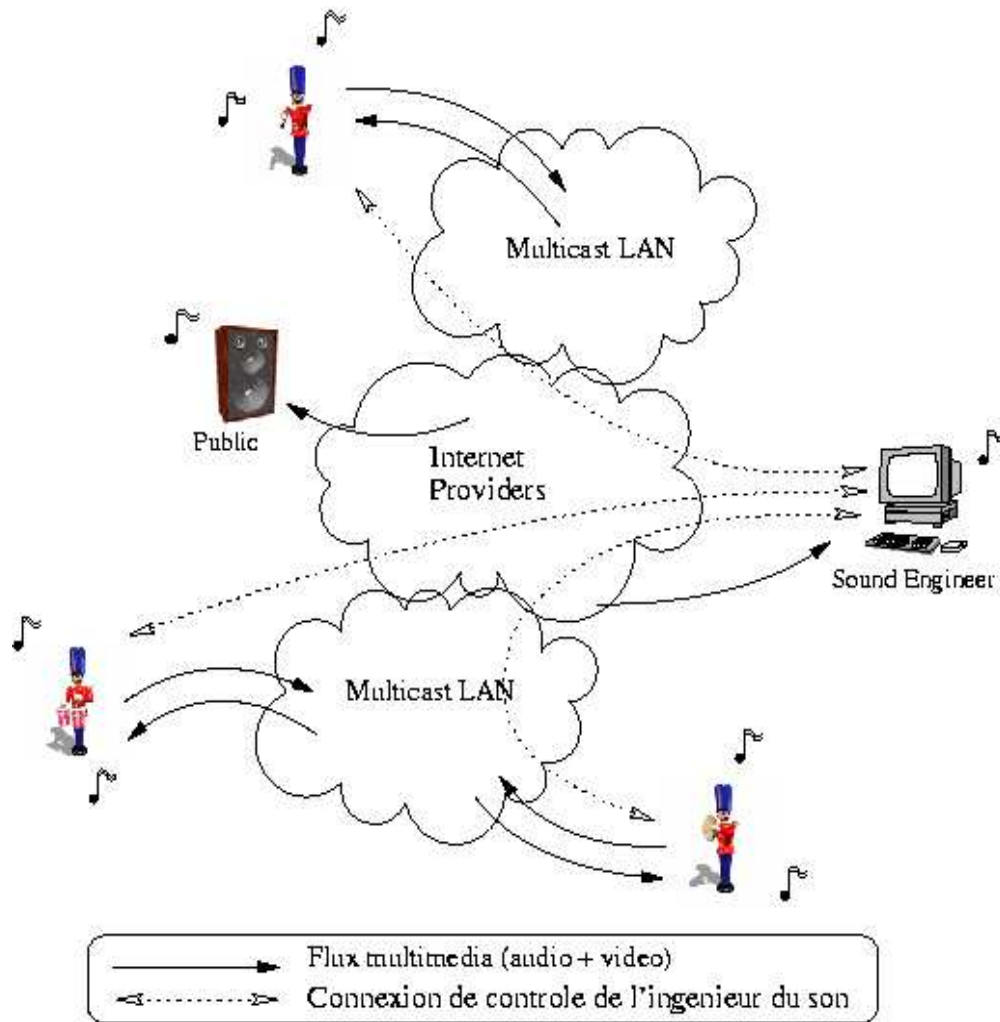
The musical interactivity in the Distributed Virtual Concert



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A joint project with the Free Software Team
from IRCAM (François Dechelle)

Objectives



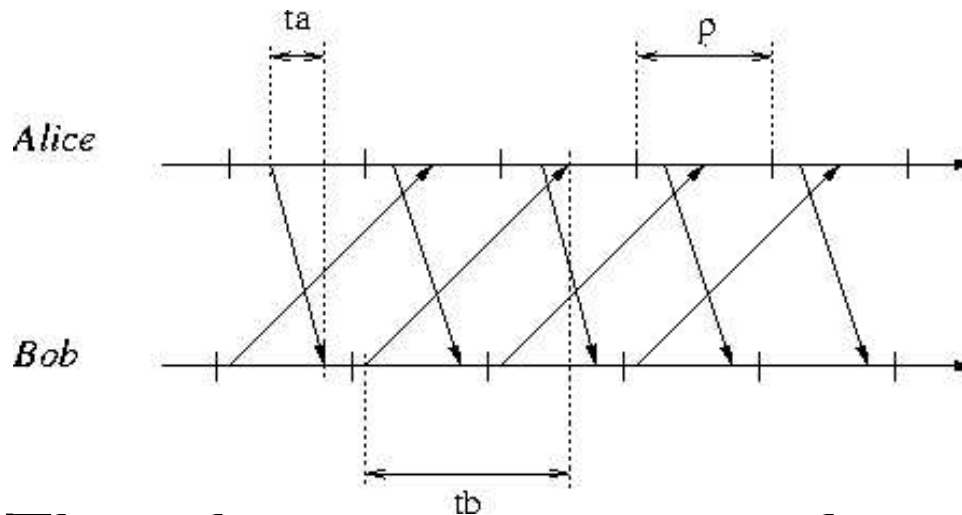
- Musicians can hear and see each other
- Musicians must interact
- A sound engineer controls audio peripherals of all the musicians
- The public must hear the concert in « live » at home or in an auditorium

Direct distributed applications

- Interactive Multimedia application
 - Distributed Video Games
 - Virtual Reality
 - Simulation
- Simulation of real world musical practices
 - Musical chat
 - Performance
 - Auditions
 - Rehearsals (musical training with a band)

Communication with audio streaming

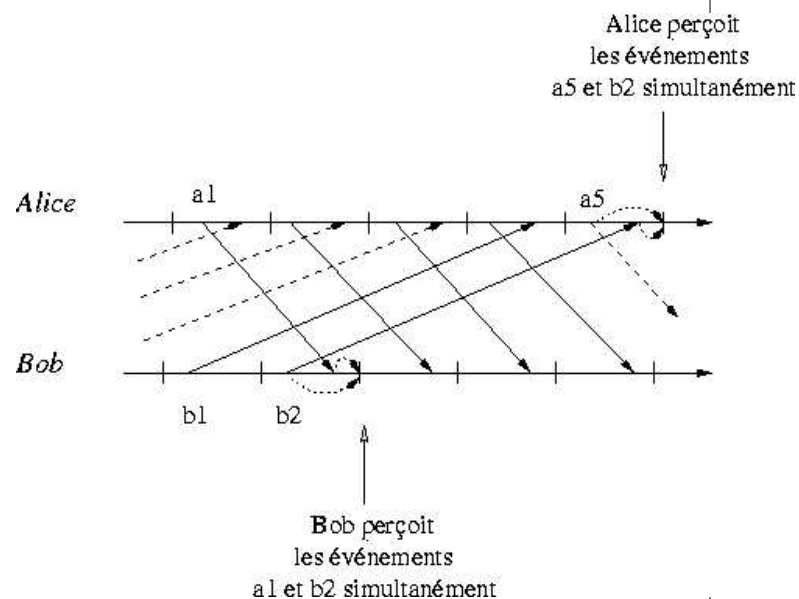
- Acquisition, playout and transport of audio data in real time



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

Musical interactivity

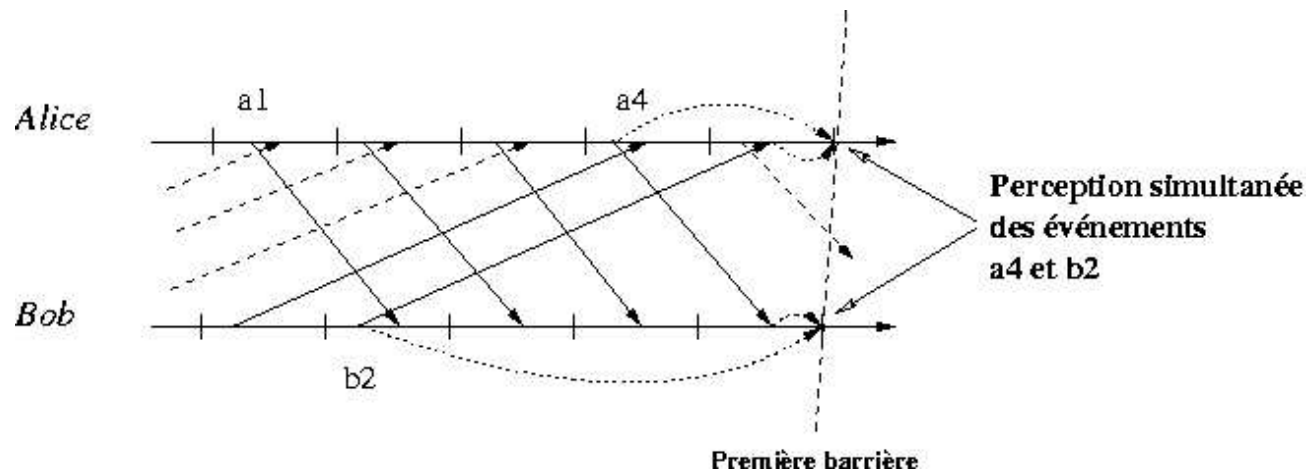
- When musicians are in the same room, they can hear each other *instantaneously* and *simultaneously*
- Across a network
 - The latency is undeterministic and perceptible ($> 20\text{ms}$)
 - Without synchronization, latency breaks simultaneity



First proposition :

The global perceptive synchronization

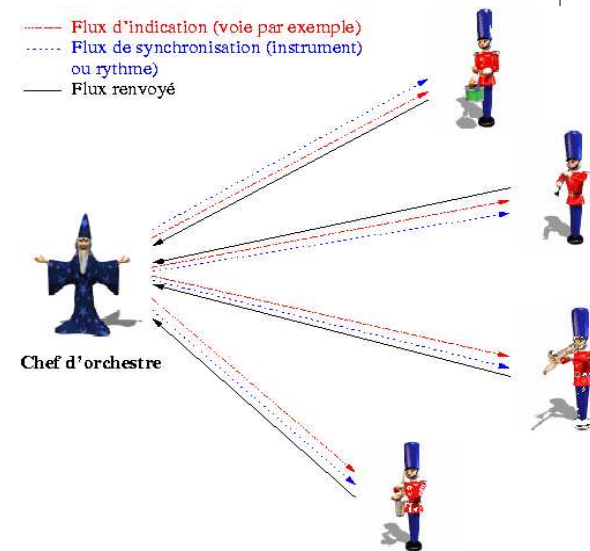
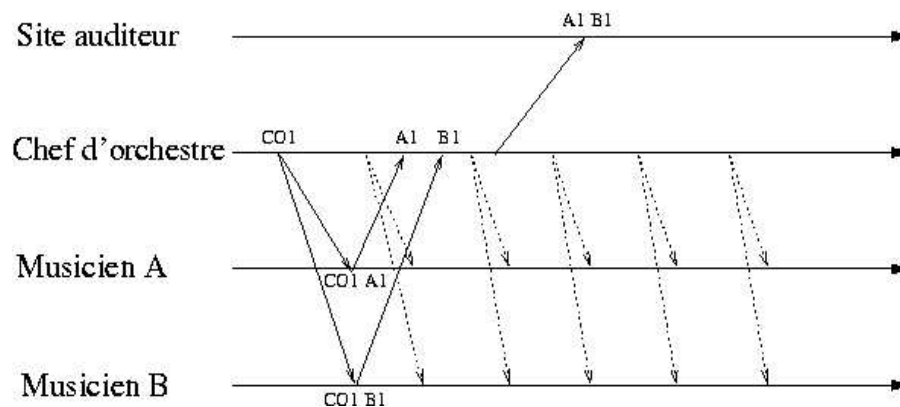
- Barrier like synchronization:
 - The first barrier is computed thanks to the distributed algorithmic
 - The other barriers are deduced



- The local sound is delayed
 - *Hypothesis : musicians can play with a constant delay only if it is constant*

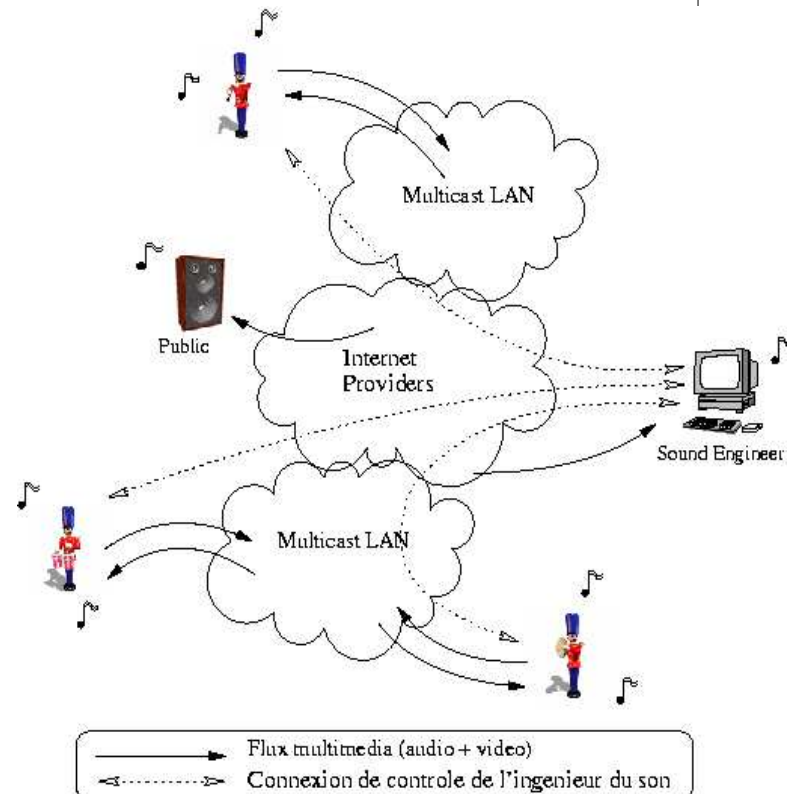
Second proposition : The « conductor » interactivity

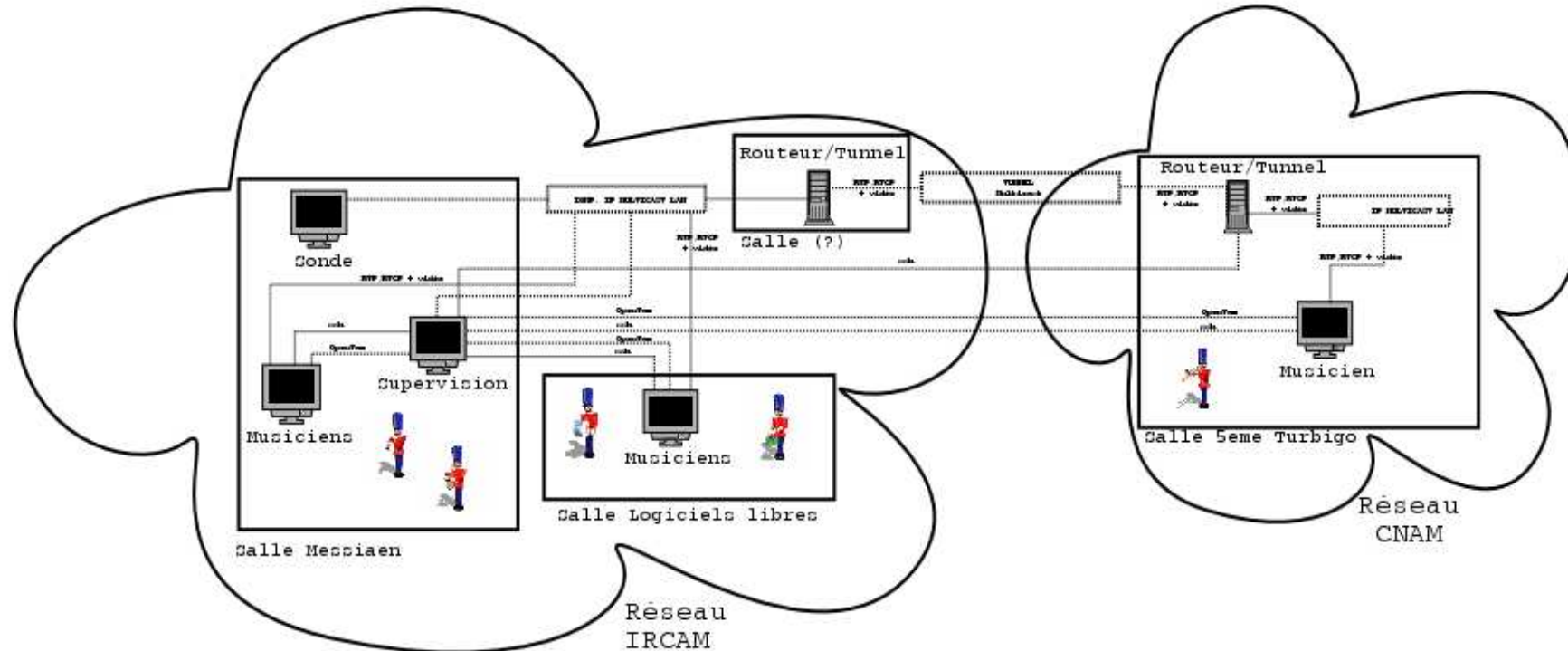
- Each musician hears only the conductor
 - The local sound is perceived instantaneously
 - This solution is adapted to situations where there is few interactions among musicians (exemple: Symphony orchestra)



Distributed mixing console

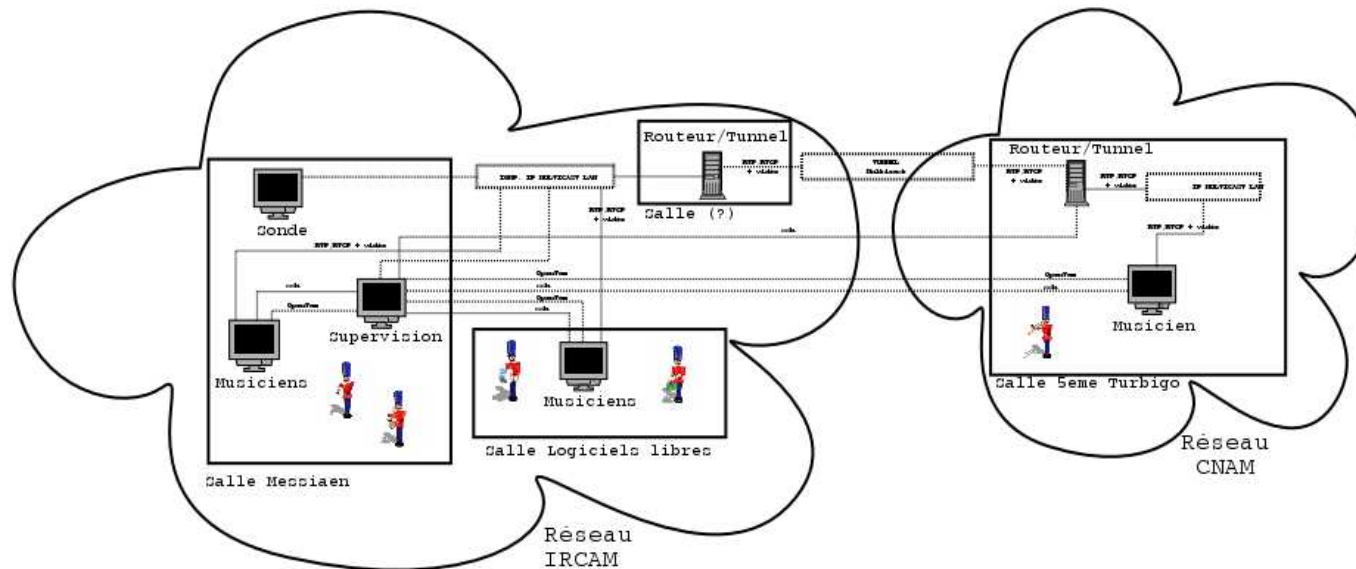
- Audio settings for each musicians:
 - Volume In/Out
 - Balance
 - Metronome
 - Digital Signal Processing
 - Environment management
- Distributed monitoring service
 - Initially defined as a mediation protocol (for power production control)
 - Corba CCM implementation





- Open house week end (18 october 2003)
- 5 musicians distributed on 3 places
- New fonction: the distributed metronome

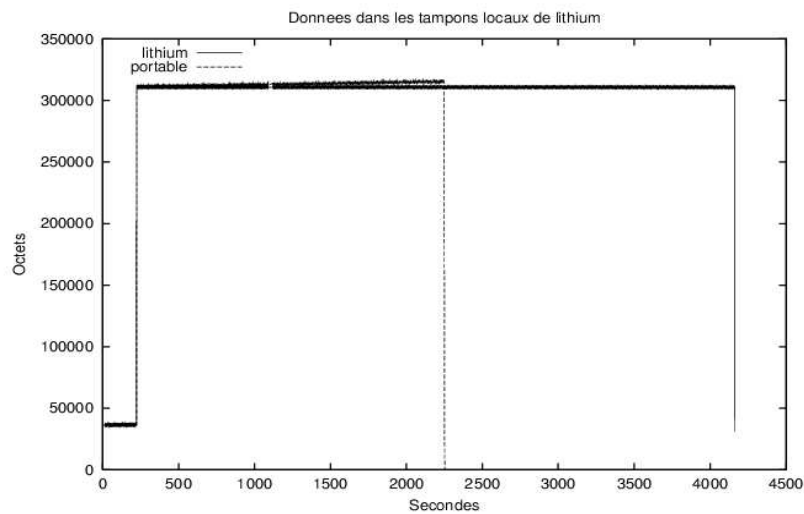
Résonances 2003 : a MAN experiment



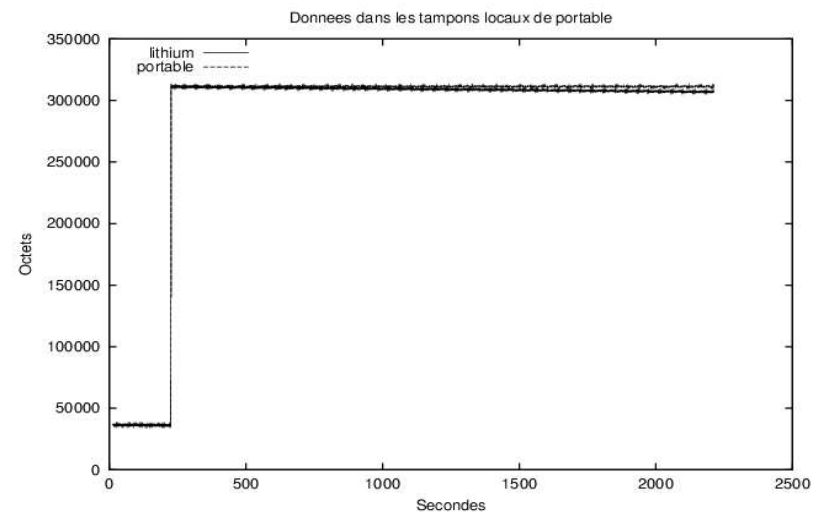
- Musicians at CNAM and IRCAM interacting with the global perceptive synchronization
- Stability noticed during the rehearsal
- The « Live » planned a week later was cancelled due to unpredictable network load

Best conditions

- LAN measurement (10/05/04)

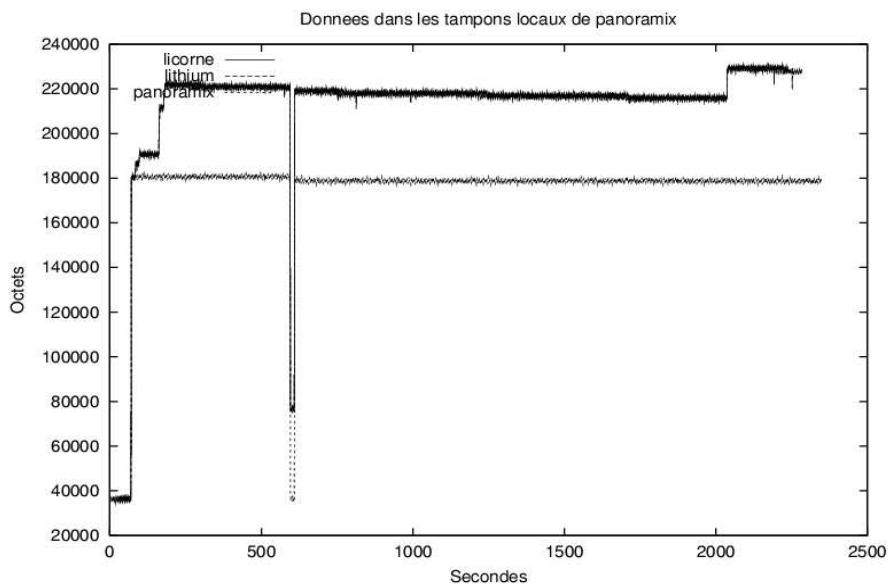


(A) *lithium*

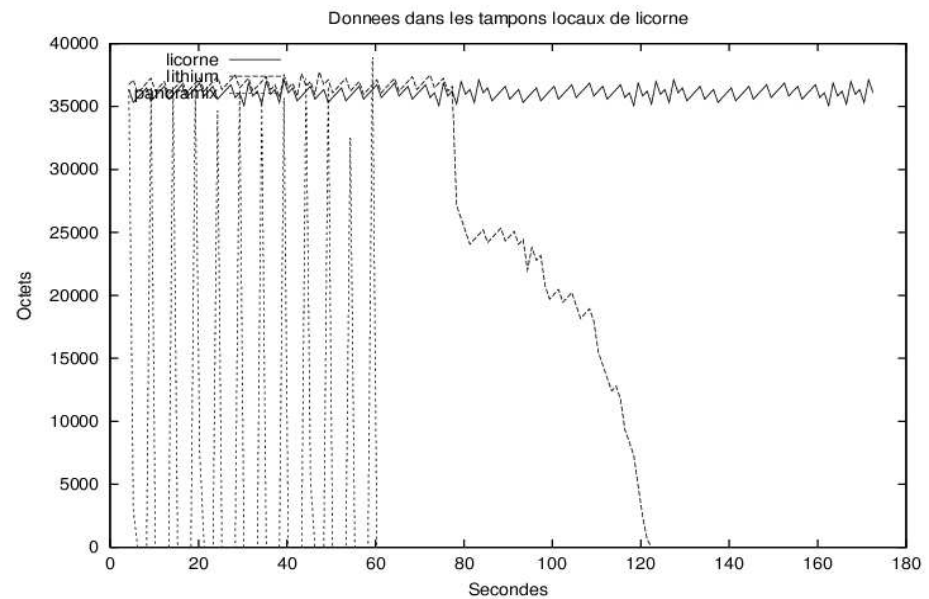


(B) *portable*

Résonances 2003



- 0,1% loss during the rehearsal session



- During the « Live » session, data were not lost but arrived too late