

Audio networking

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IRCAM

- Distributed virtual concert
 - project and issues
 - network protocols and libraries
 - nJam
- Experimentations in grid computing
 - what is it
 - middlewares for grids
 - tests and benchmarks

Distributed virtual concert

- Goal: to distribute a concert (musicians, sound engineers and public) on the Internet
- Performance is geographically distributed
- Real time audio streaming over Internet
- Developed technologies can be applied to other domains (virtual or augmented reality distributed applications)
- A joint project between Ircam and CNAM

Similar projects

- SoundWIRE (CCRMA): using networks with high QoS for musical collaborations
- GRAME: distributed rehearsal, network protocol for events streaming, clock skew compensation
- Many others, using ISDN or MIDI over internet or OGG or ...

Issues

- Network adds a latency that varies a lot
- Latency is difficult to manage for a musician
- Real time and transfer reliability cannot be obtained together
- n sources and m destinations means high traffic and requires native multicast
- Clock skew between sources and destinations

Network protocols for audio

- RTP/RTCP
 - real-time protocol for audio and video applications
 - RTP uses UDP as underlying layer
 - provides packets typing and timestamping
 - RTCP provides control and reporting
- Other protocols of interest:
 - SIP/SDP: Session Initiation/Description Protocol
 - RTSP: Real Time Streaming Protocol

Libraries and applications

- Some libraries that implement RTP:
 - liveMedia (www.live.com/liveMedia)
 - ccRTP (www.gnu.org/software/ccrtp/ccrtp.html)
 - Vovida (www.vovida.org)
 - UCL Common (www-mice.cs.ucl.ac.uk/multimedia/software)
- Some applications that support RTP:
 - VideoLan
 - mplayer

nJam

- An implementation of the distributed virtual concert inside jMax with the UCL library
- Multicast support
- Each participant sends local sound and receives all participants streams
- A distributed algorithm compensates network latency and resynchronizes locally all streams
- Musicians hear themselves with a fixed delay

nJam experimentation

- Experimentation of a distributed concert during Résonances 2003 at Ircam
- 4 musicians on 2 sites
- Soft multicast using a tunnel
- Musicians trained fast during rehearsal
- Public presentation failed:
 - port scanning attack just before concert
 - no QoS network giving priority to audio packets

Jack RTP client

- Goals:
 - implement distributed virtual concert outside jMax
 - provide a networking Jack client using standard protocols
- First development using LiveMedia library
- Multicast support
- Under development...

Distributed virtual concert: future

- Finish the reimplementing using Jack
- Add control to the Jack client (with which protocol?)
- Implement clock skew compensation (difficult issue: breaks the synchronization algorithm)
- Make large scale tests
- Consider xDSL (compression, no multicast)

Grid computing

- Virtualization of computing and data resources over high speed networks
- Unlike clusters, grids can be geographically distributed and heterogeneous
- Used mainly in high performance computing
- Based on open standards and protocols, the Open Grid Services Architecture (OGSA)

Grid computing for audio

- Audio is less demanding than particle physics, but grid computing can help to
- ... get more CPU than your single desktop
- ... process large sound databases
- ... use applications remotely
- ... explore large parameters spaces

Ircam grid testbed

- Small deployment for tests and benchmarks
- « cycle stealing » on standard workstations
- Linux only for now, Mac OS X soon
- 2 middlewares tested:
 - Globus toolkit (<http://www.globus.org/>)
 - XtremWeb (<http://www.xtremweb.org/>)
- Future deployment : ~ 60 machines

The Globus toolkit

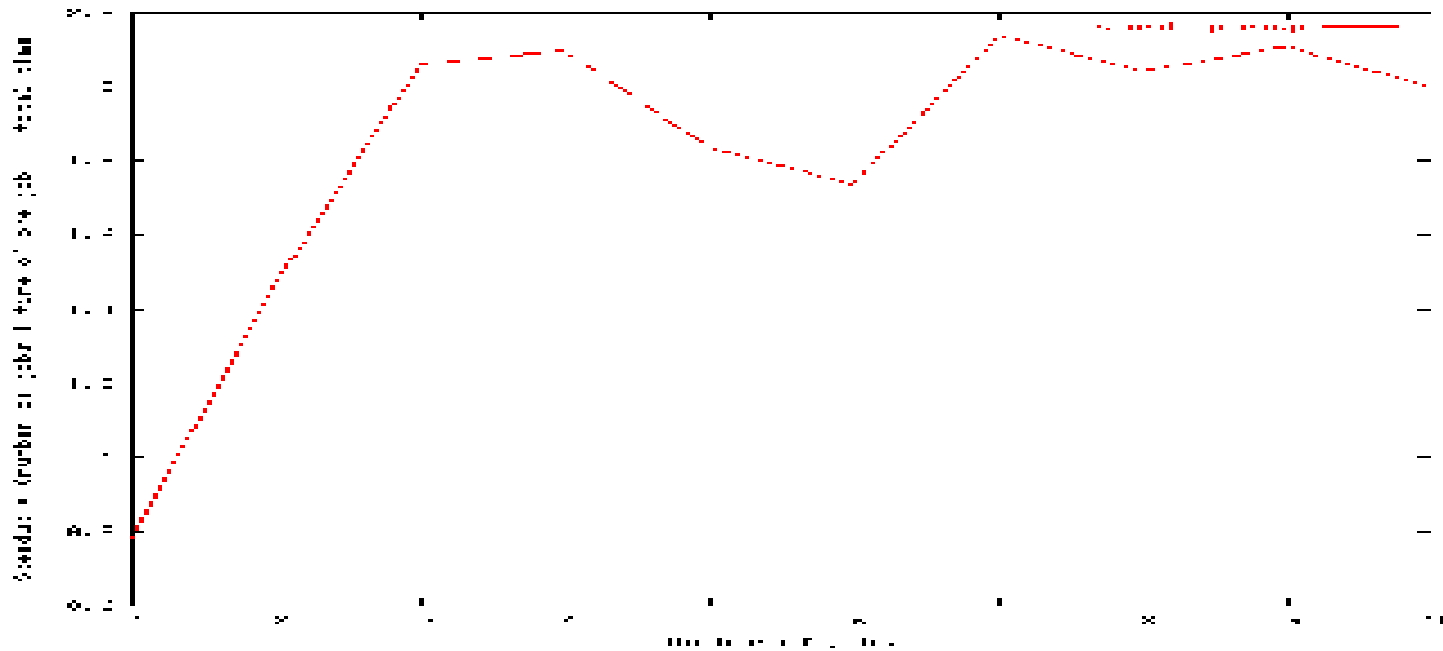
- A free software toolkit for building grids
- The base of many grid deployments
- Features:
 - grid security
 - remote job submission and control
 - high-performance secure data transfer
 - system and service information
- Heavy, but efficient, standard and portable

XtremWeb

- A free software platform for global computing
- Architecture:
 - servers dispatch jobs
 - workers execute jobs dispatched by servers
 - clients submit and control jobs
- Much lighter than Globus, portable, but less efficient than Globus
- Still under development

Globus vs. XtremWeb

- Example using Csound:



- On a 4 machines grid, speedup is about 2
- Disappointing, but can be explained...

Issues

- Globus is too heavy for a large deployment on a grid of desktop machines
- XtremWeb is not enough stable and efficient
- Our testbed is too small
- Heterogeneity is difficult to manage
- But it offers interesting possibilities

Grid computing: future

- Distributed computation by exploding each computation into a set of jobs communicating via MPI:
 - MPI speed can be an issue
 - not all applications can be parallelized this way
- Merging of grid services and web services (Globus toolkit 4)
- Integration with streaming architecture