www.garr.it

LoLa

Low Latency Audio Visual Streaming System

Conservatorio G. Tartini, Trieste
Consortium GARR

lola.conts.it

Conservatorio
di musica
Giuseppe
Tartini
Trieste

An impossible dream in 2005

"To perform together, from distant locations,
as if distance has vanished
in a click of a computer mouse"

… a viola Masterclass with New World Symphony (Miami)
at the GARR Conference 2005, in Pisa (Italy).
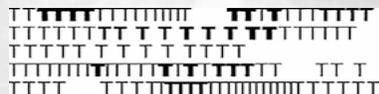
and real life ...

H.323/SIP

DVTS

Conference XP

Skype

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The LOLA team
LOLA v1.5.0 and v2.0.0

and real life …

Latency: 200ms
Audio for voice
Auto echo cancellation

H.323/SIP

Latency: 400ms
Echo

DVTS

Latency: 350ms
Echo

Conference XP
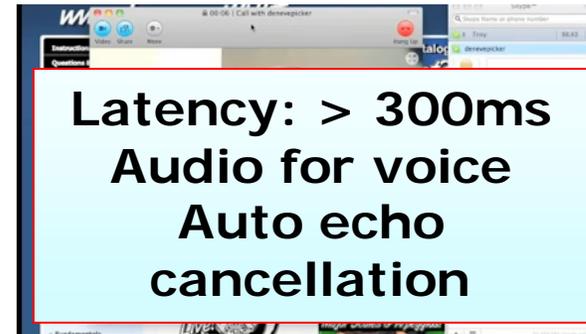
Latency: > 300ms
Audio for voice
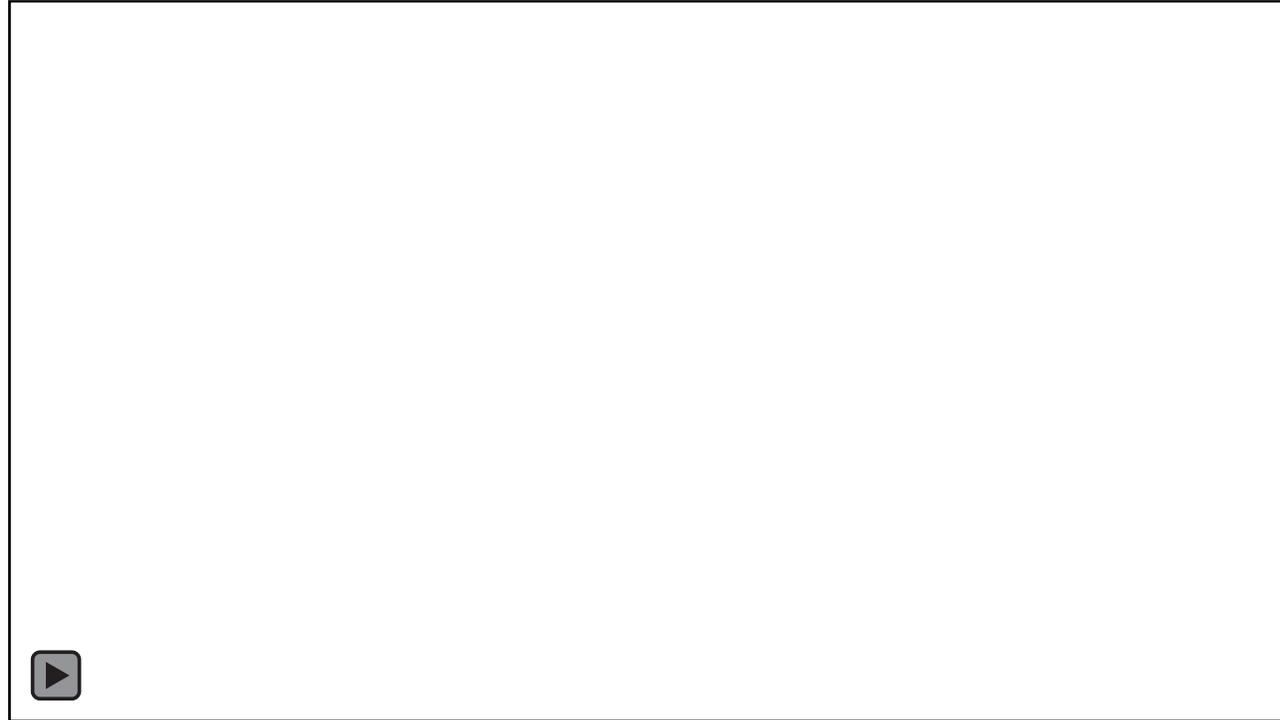**Auto echo cancellation**

Skype

Just to understand …

Audio only… (JackTrip a long time ago)

CCRMA Stanford University, 2003

Acoustic echo cancellers (AEC)…
it is for voice, not for music!

DVTS - Rome/Miami (2006)
Viola Master Class by Maestro Luigi Alberto Bianchi

The LOLA team
LOLA v1.5.0 and v2.0.0

What did musicians want?

- Extremely low audio/video latency: at least lower than 30ms

- A "recording studio quality" with multichannel audio

- Smooth, natural, high quality video

- A simple to use system (no engineers!)

- A non invasive system, which disappears in their environment

- ... and something tailored upon their suggestions

So what?

The users' requirements clearly told us that existing ideas on A/V systems were inadequate to achieve the goal.

→ GLOBAL RE-ENGINEERING ! → Innovation.

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New Approach: back to basics

- **Latency:**
  - remove all unnecessary buffering/processing
  - directly talk to network interfaces (low level access)
  - use top bandwidth/quality networks
  - multi-core parallel processing
- Use hardware acceleration (CPU/GPU)

- **Audio:**
  - use professional audio cards (RME)

- **Video:**
  - use fast machine vision HD cameras at high frame rates (60fps) and ultra low latency;
  - line-by-line progressive scan (no "frames")

- **User friendly:**
  - Just some simple buttons: Call/hang;

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LOLA v1.5.0 and v2.0.0

So, we came to LoLa ...

- SW/HW Latency: 3ms **!!!**
- Uncompressed Audio 48KHz
- 2 until   10 audio channels
- No echo
- High speed camera
- Good PC (i7/i9)
- Very fast and reliable networks

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LoLa system (what is LoLa?)

Software

Hardware

Network

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LoLa is a good piece of s/w

- **Parallel computing**

- **Code optimization**

- **Low level programming**

- **CPU/GPU acceleration**

- **New Audio and Video processing techniques**

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LoLa is a good piece of h/w

You still need to put together a few pieces of technology:

- A good gaming PC
- Audio and video cards
- Tune a bit the system

We have at least a few "out of the box" suppliers for a ready "LoLa Box"

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LoLa has a good network

Research and Education networks are not everywhere and not for everyone.

(Many) commercial providers are way back from the required service level

Many LANs are obsolete or misconfigured

… but we enabled features to make less hi-level demand on network

… and Smart "symmetric" GIG-City services are appearing!

30Mbps →   1Gbps →   10Gbps

LoLa is also made by its users!

- "I need and easy backstage channel to talk to my remote technical partner!"

- "I'm not a network expert, I need a quick real time snapshot of what is going on..."

- "What the musicians need to see is different from what the audience likes!"

- "I really need LoLa to teach in places were we will never have 1Gbps..."

- "I need HD to see details and feel closer"

- "I want to hear the ambience where we are in"

- "I need to calibrate my video gear easily!"

... some further steps:
LoLa 2.0 and SWING

We can play in more than 2 sites! (3 sites)

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... some further steps:
LoLa 2.0 and SWING

We can choose what to see! (Multiple cameras support)

… some further steps:
LoLa 2.0 and SWING

We can walk around closing our eyes! (Surround sound)

THE DUET.
www.alamy.com - B7PWY2

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… some further steps:
LoLa 2.0 and SWING

"Can I teach my way?" (robotic aided tools)

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LoLa website: lola.conts.it

https://lola.conts.it
email: lola-project@garr.it
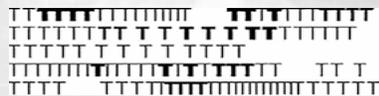
Ljubljana - Trieste

"A tribute to W. A. Mozart"

project SWING

CONTEXT:

Programme: **Erasmus+**

Cooperation for innovation and the exchange of good practices

Strategic Partnerships for higher education

PROJECT:

Synergic Work Incoming New Goals for Higher Education Music Institutions (SWING)

duration: **36 months**

PRIORITIES:

Open education and innovative practices in a digital era

Developing skills - supporting the use of digital technologies to improve pedagogies and assessment methods

PARTICIPATING ORGANISATIONS:

CONSORTIUM GARR
Consortium GARR (GARR) is a non-profit association founded under the auspices of the Ministry of Education, University and Research. The founding members are CNR, ENEA, INFN e CRUI Foundation, representing all Italian universities

http://www.garr.it

CONSERVATORIO DI MUSICA GIUSEPPE TARTINI
Higher education institution (tertiary level)

www.conservatorio.trieste.it

UNIVERSITAT FUR MUSIK UND DARSTELLENDE KUNST WIEN
Higher education institution (tertiary level)

www.mdw.ac.at

UNIVERZA V LJUBLJANI, AKADEMIJA ZA GLASBO
Higher education institution (tertiary level)

http://www.uni-lj.si
https://www.ag.uni-lj.si

ASSOCIATION EUROPEENNE DES CONSERVATOIRES, ACADEMIES DE MUSIQUE ET MUSIKHOCHSCHULEN
The Association Européenne des Conservatoires, Académies de Musique et Musikhochschulen (AEC) is a European cultural and educational network (a "members organization:") that represents institutions concerned with high-level training for the music profession.

www.aec-music.eu

List of partners we already know we will work with (but others may join, too) during the project activities:

- **Conservatorio di Musica Giuseppe Verdi, Milano Italy (CONSMI)**
- **Politecnico di Milano, Italy (POLIMI)**
- **The Royal Danish Academy of Music, Copenhagen, Denmark (RDAM)**
- **Academic and Research Network of Slovenia, ARNES, Ljubljana, Slovenia**

THE PROJECT FORESEES 3 DIFFERENT TYPES OF
ACTIVITY:

1 distance and on site learning modules

**2 platform development both as LoLa technology
development and as creation of a new educational
enhanced environment;**

3 multiplier dissemination events.

About **100 students of UL AG, MDW and CONTS** will be involved in distance learning modules, trained by about **15 teachers**.

At least 200 delegates of European Music Higher Education Institutions will be involved in multiplier events.

The **learning modules** are addressed to **Master level students** of participating HME (Higher Music Education) and will be **handled by the institutions music teachers**.

These modules will fit into the **normal curricula in place at the various institutions**, and as such they must adapt to existing schedules.

The project is scheduled along a **3 years period**, to cover different aspects, from **solo instruments to medium and then large groups** in details, giving each situation the time to develop its needs and result in a satisfactory achievement.

The learning platform development and enhancement will be done by the internal teams of **GARR, UL AG, MDW and CONTS;**

These teams are made by **teachers, researchers and technicians** and will be engaged during the overall duration of the project, acting in close contact with the distance learning modules participants.

The multiplier events, organized by AEC during the 2nd and 3rd year of the project, will be addressed to **a wide group of delegates from European and worldwide HME**

Delegates will be involved in **demonstrations and discussions about the methodologies, results and more relevant technological platform (LoLa) features**, in the perspective of a future wide adoption of this platform,

VIDEO EXAMPLES:

https://video.arnes.si/portal/search.zul?q=lola