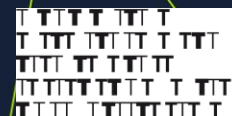


# ***LoLa means Low Latency (and high quality!)***

CLAUDIO ALLOCCHIO - GARR

New Time Music Conference– 04 June 2020

... somewhere on the net!



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# How and when LoLa was born...

June 2005: a networked Masterclass between Pisa and Miami: high quality sound and video, but... more than 0.5 second of delay!

**“To achieve an effective music teaching, listening to students’ performances in minimal details is not enough: you must be able to play along with them. Can we do this at distance on the network?”:**





**Massimo Parovel, Conservatorio Tartini Trieste**



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# What do you need to play together?

- latency (delay) less than  $\sim 30$  milliseconds: **10 meters!**
- eyes contact to synchronize
- sound spatial immersion to tune expression and timbre
- to feel the ambience sound response
- to feel the “presence” of the other musicians
- a non distracting environment
- ... and art!



# LoLa means

# Low Latency

*Less than 5 ms*

*Plus all other needed  
features*



# LoLa is NOT:

- a software/App that you download and install
- an online platform where you get an account
- a service you run into a browser
- a service which allows you to connect many sites
- an audio only system

# LoLa is:

- a **multi-component system** that you install in **all** locations
- state of the art technology to **optimize low latency** in A/V
- a system which delivers **studio quality multichannel audio**
- **tailored for music/art teaching and rehearsing**, but you can also use it for performances and other scenarios

T T T T T T T T  
T T T T T T T T  
T T T T T T T T  
T T T T T T T T  
T T T T T T T T  
T T T T T T T T

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# LoLa is made of 3 components

*An highly optimized Software*



**Specialized  
Hardware  
(computer  
& A/V)**



**A very hi-end Network**



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THE ITALIAN  
EDUCATION  
& RESEARCH  
NETWORK

# LoLa is: good hardware



**Hi-end gaming PCs**  
**Multicore (8, 10, 12,...) i7, i9 CPUs**  
**Good Server class NICs**  
**Good GPUs**  
**Fast monitors**

**Machine vision cameras (no webcam)**

**Professional audio setups (microphones, mixers, audio monitors, ...)**





# LoLa is: a excellent network

LoLa needs:

**1 Gigabit (upload and download) clean, stable service (minimal 100 Megabit)**

**Research and Education networks are ok, but not everywhere and not for everyone**

**commercial providers are way back from the required service level**

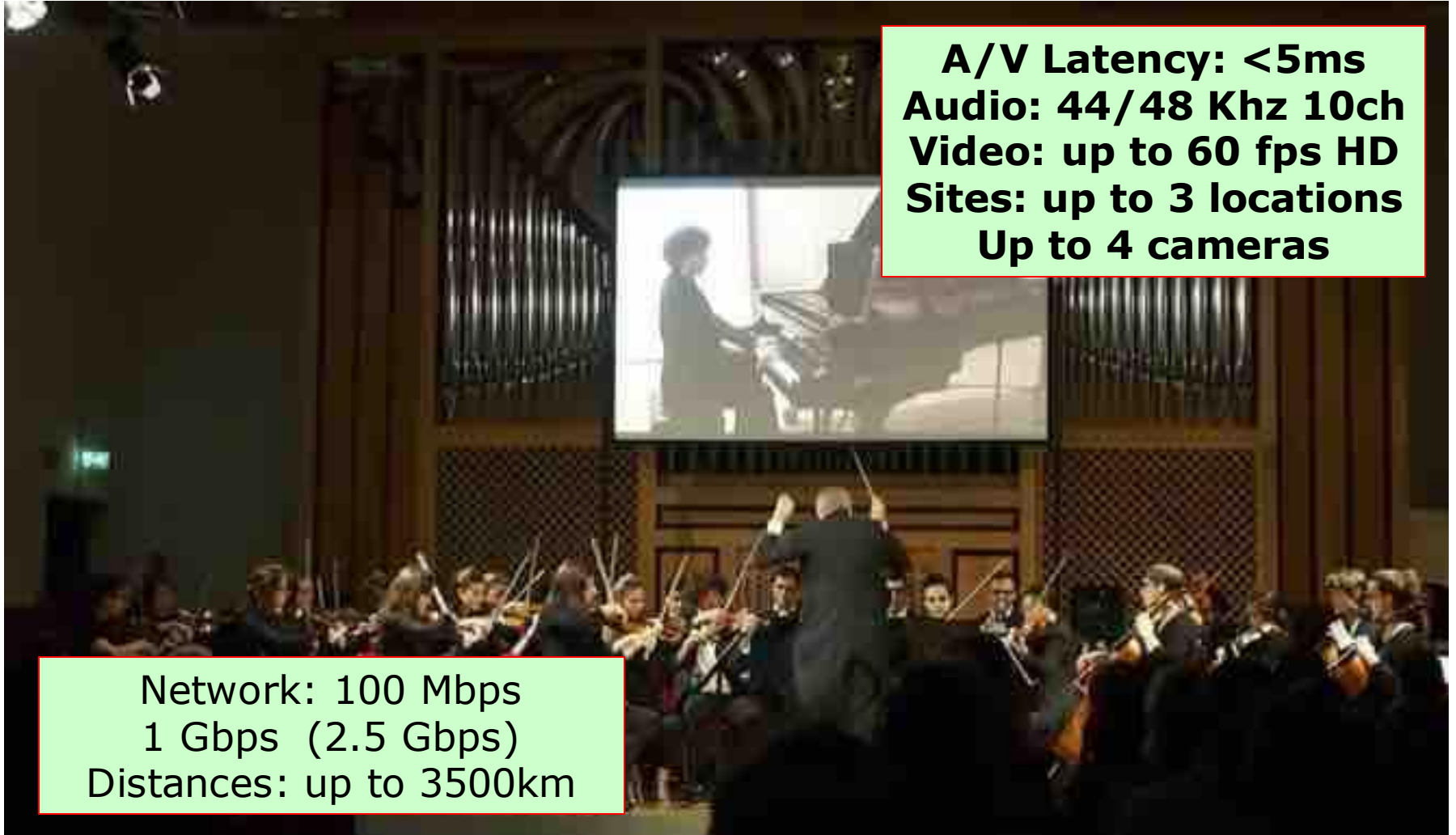
**A few Smart "symmetric" GIG-City services are appearing!**



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# Some features of LoLa



**A/V Latency: <5ms**  
**Audio: 44/48 Khz 10ch**  
**Video: up to 60 fps HD**  
**Sites: up to 3 locations**  
**Up to 4 cameras**

**Network: 100 Mbps**  
**1 Gbps (2.5 Gbps)**  
**Distances: up to 3500km**



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# ... so to use LoLa I need:

*The software (free academic license):*

```
fcomplex sqrt(fcomplex z)
{
    fcomplex c;
    float w;
    if ((z.r == 0.0) && (z.i == 0.0)) {
        c.r=0.0;
        c.i=0.0;
    } else {
        w = sqrt((sqrt(z.r*z.r + z.i*z.i)));
        if (z.r >= 0.0) {
            c.r=w;
            c.i=z.i/(2.0*w);
        } else {
            c.r=-w;
            c.i=z.i/(2.0*w);
        }
    }
    return c;
}

fcomplex RCmul(float x, fcomplex a)
{
    fcomplex c;
    c.r=x*a.r;
    c.i=x*a.i;
    return c;
}

fcomplex Cinv(fcomplex z)
{
    fcomplex c;
    float s = 1.0 / (z.r*z.r + z.i*z.i);
    c.r = z.r*s;
    c.i = -z.i*s;
    return c;
}
```

*To get the specialized Hardware (computer & A/V)*



*To connect to an hi-end Network*



# What do I get from LoLa?

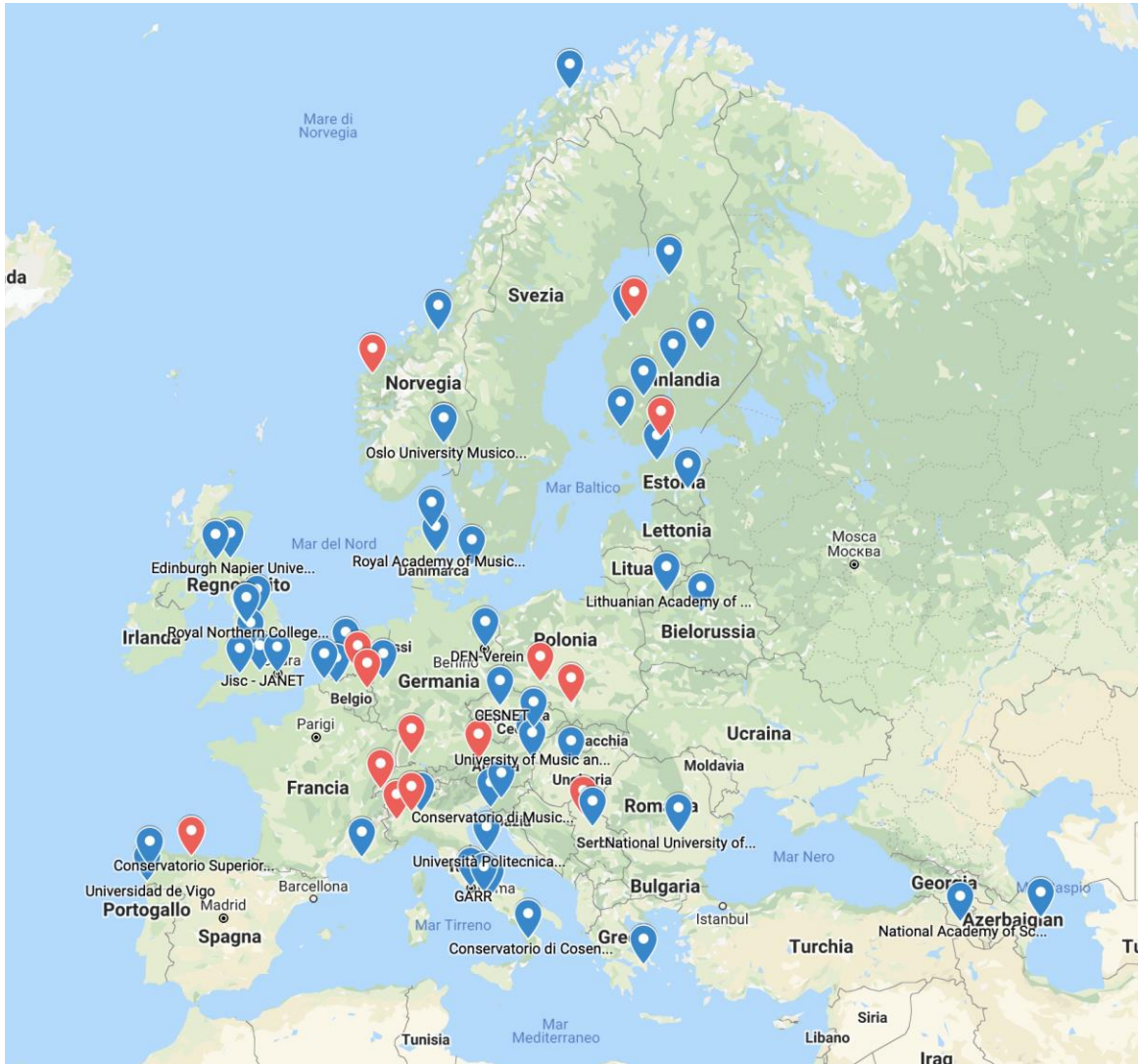
- the sound quality is fully preserved, no manipulations
- the video is fluid (high speed frame rate)
- the system is non invasive, it adapts to the musicians and their instruments (not viceversa)
- musicians (even newcomers) forget about LoLa presence in very few minutes and focus on music
- you may get more details than in physical presence
- you can ask for new features, instead of adapting to what the vendor decides



# What can I do with LoLa?

- to play at distance as if we are a few meters away
- to record and reply the performance/piece
- to see the performer/student from 4 viewpoints
- to exchange masterclasses and courses
- to create shared curricula courses
- to easily enable the “collective teaching” model
- to experiment new teaching methods
- to create the future of musica teaching

# LoLa partners?



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# SWING – teaching with LoLa

<https://www.garr.tv/stream/5e2ea346879ba9001be40133>

<https://www.garr.tv/stream/5e2b1b70879ba9001be400c8>

<https://www.garr.tv/stream/5e4153195d81c9001b718695>

*(use subtitles if you do not understand German and Slovenian)*



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# More info:

<https://lola.conts.it>

<https://www.swing-project.eu>

[lola-project@garr.it](mailto:lola-project@garr.it)



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