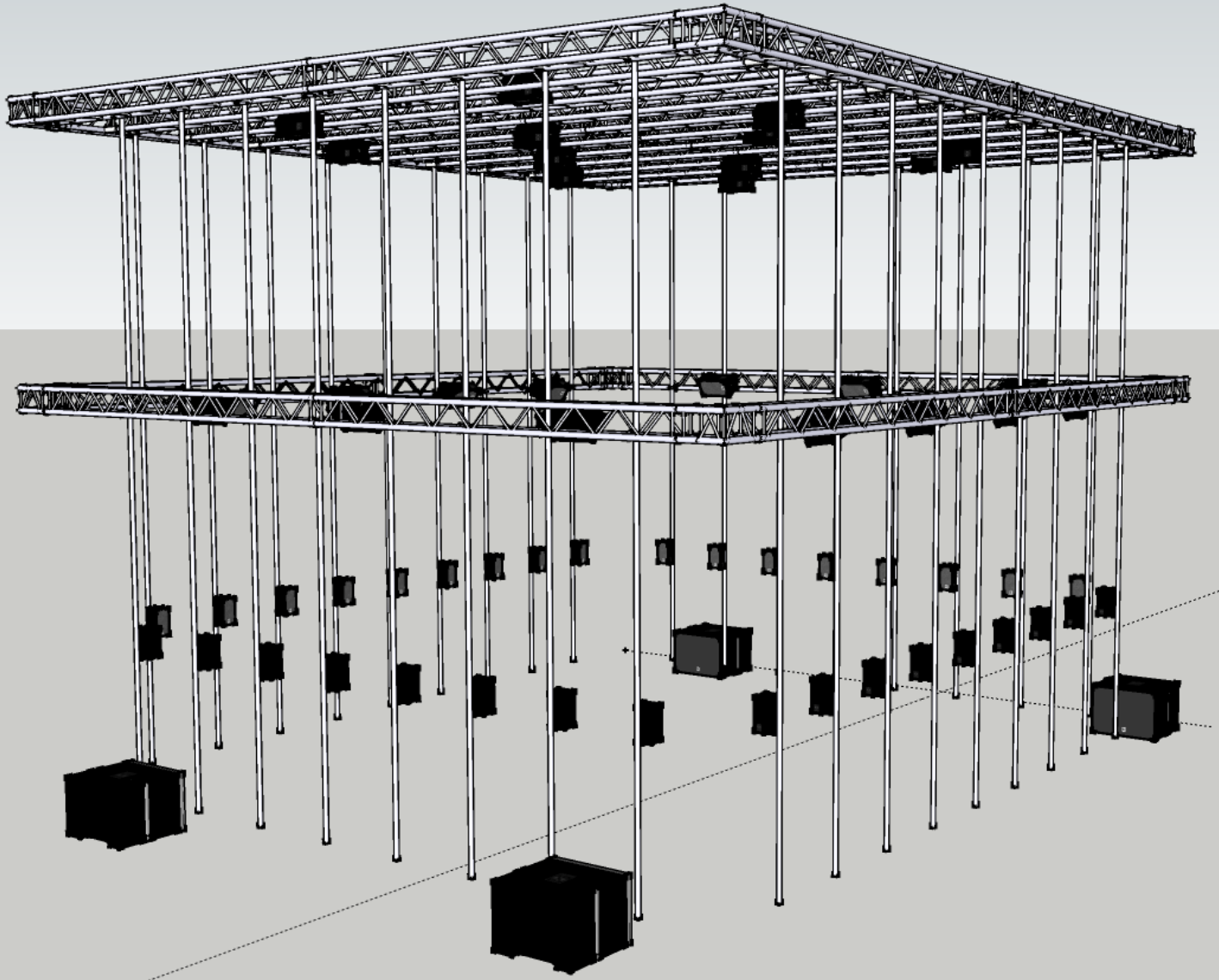
UNIVERSITEIT GENT

Art & Science Lab: Audio Over IP workshop

Bart Moens – Bart.moens@ugent.be – 01/03/2017



Dante™

BARCO Visibly yours

IOSONO))) the future of spatial audio

DE KROOK

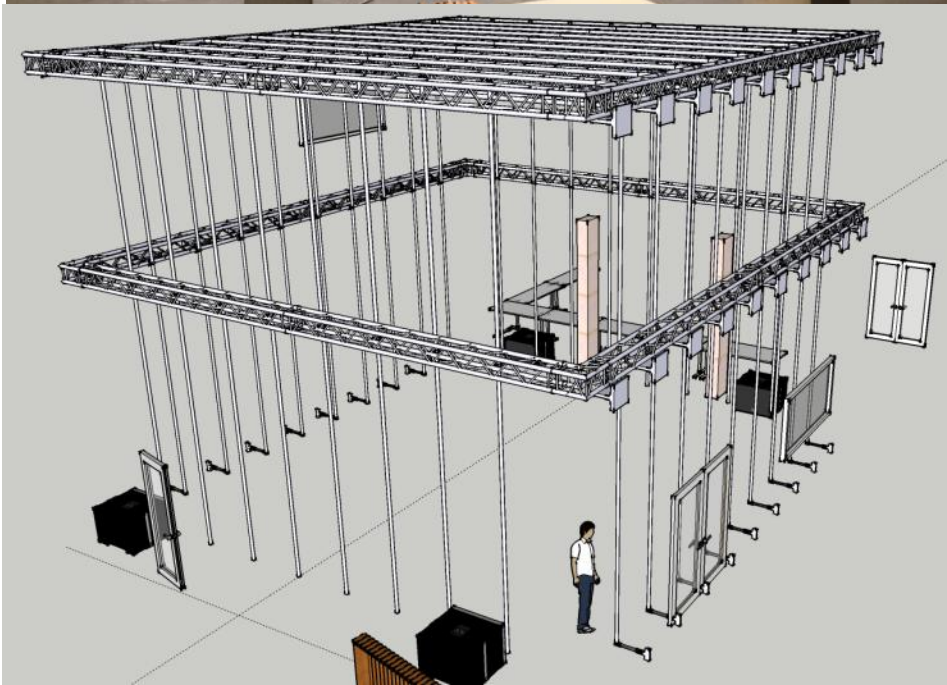
Contents

- Introduction & Infrastructure
- Audio-over-IP: the Dante protocol
- Audio-over-IP: software tools & Demo
- Documentation & Hands-on session

Art & Science lab

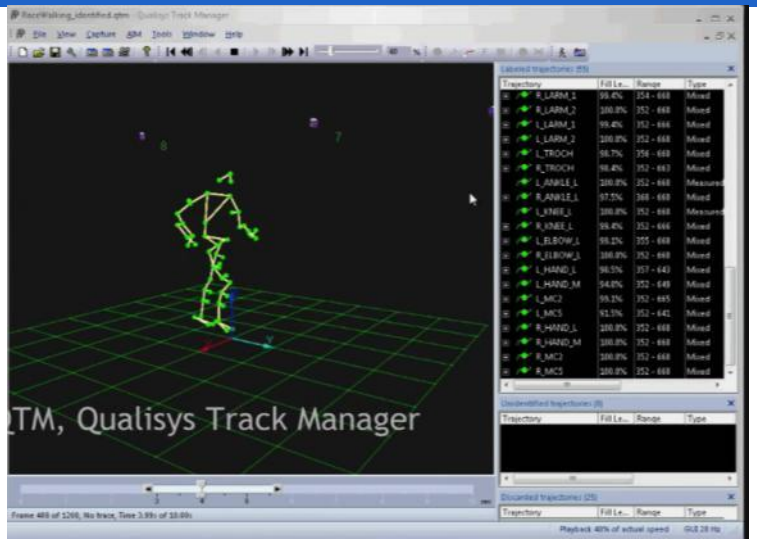
Infrastructure:

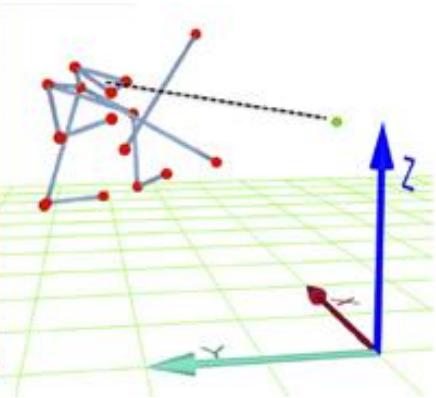
- Flexible trussing system
- Immersive 3D sound
- Motion Capture (IDLab)
- 360° projection / AR (IDLab)
- Studio-level acoustics



MOCAP

- **Motion Sensing**
  - Marker-Based IR camera system
  - Obtain position in 3D space of these IR reflectors
  - Attachable to humans (skeleton tracking, face detection, finger movement….)
  - Also attachable to musical instruments (get position of bow, etc)

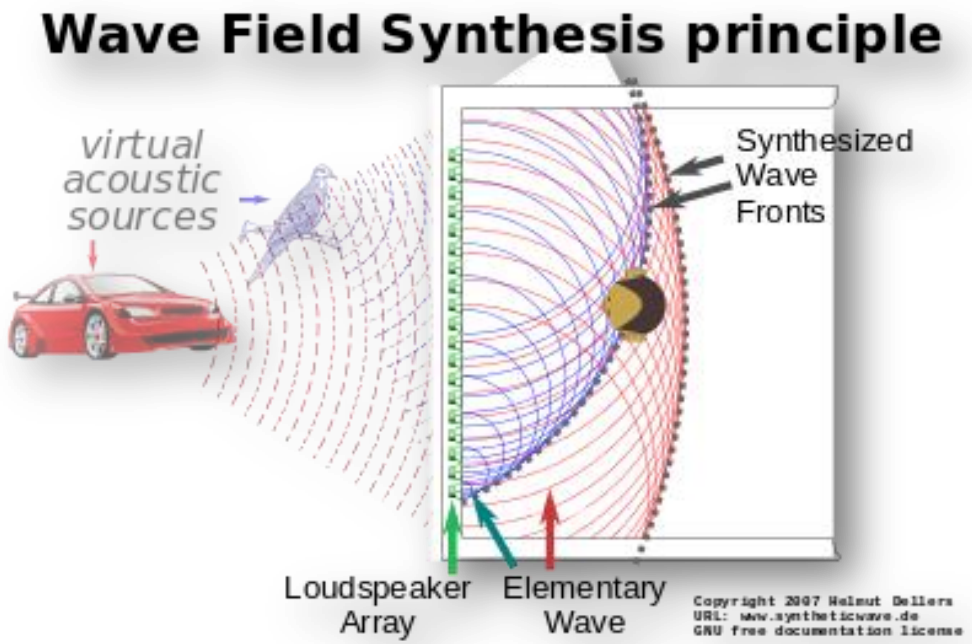




QUALISYS

3D sound

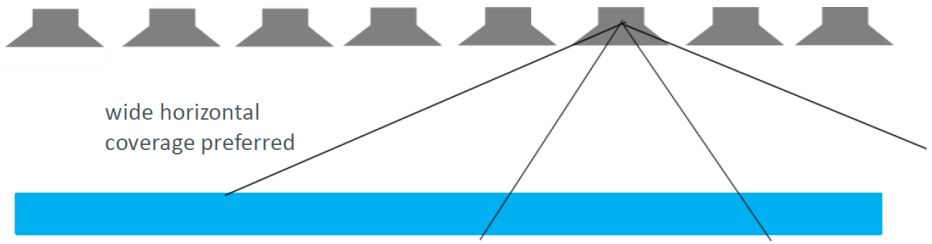
- **Immersive 3D sound**
  - Using wavefield synthesis
  - Play audio or samples at specific coordinates
  - Sound appears to originate from that location
  - Accessible for large audience (inside trussing)

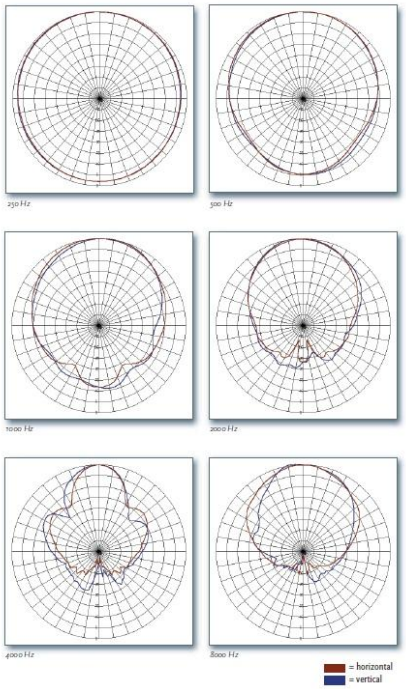


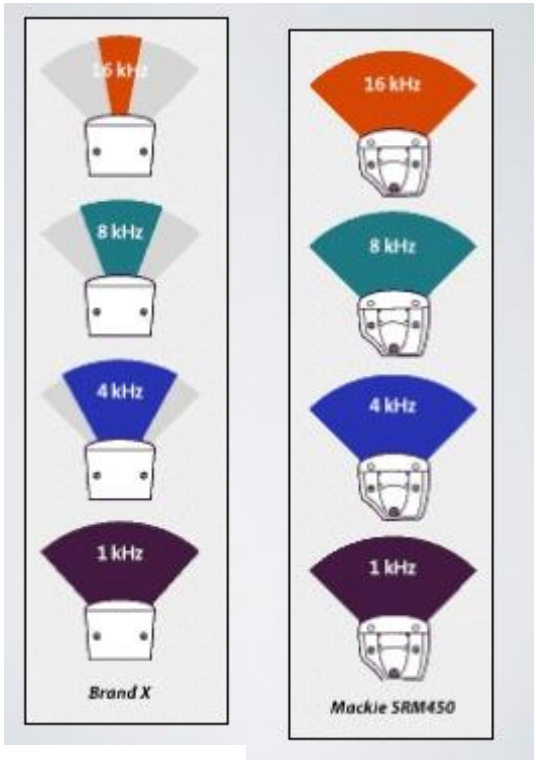
Speaker setup

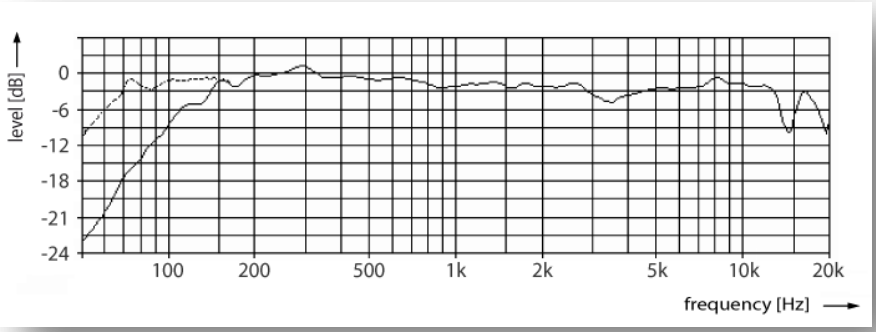
- Speaker locations and amounts based on Barco's recommendation:
  - Floor: 4 subwoofers
  - Ring 0 (ear height): 34 speakers (distance ca 92 cm)
  - Ring 1 (halfway): 14 speakers (distance ca 184 cm)
  - Planar array ceiling: 12 speakers (distance ca 240 cm)
- Discrete feeds for every speaker (64 channel)

Speaker Considerations

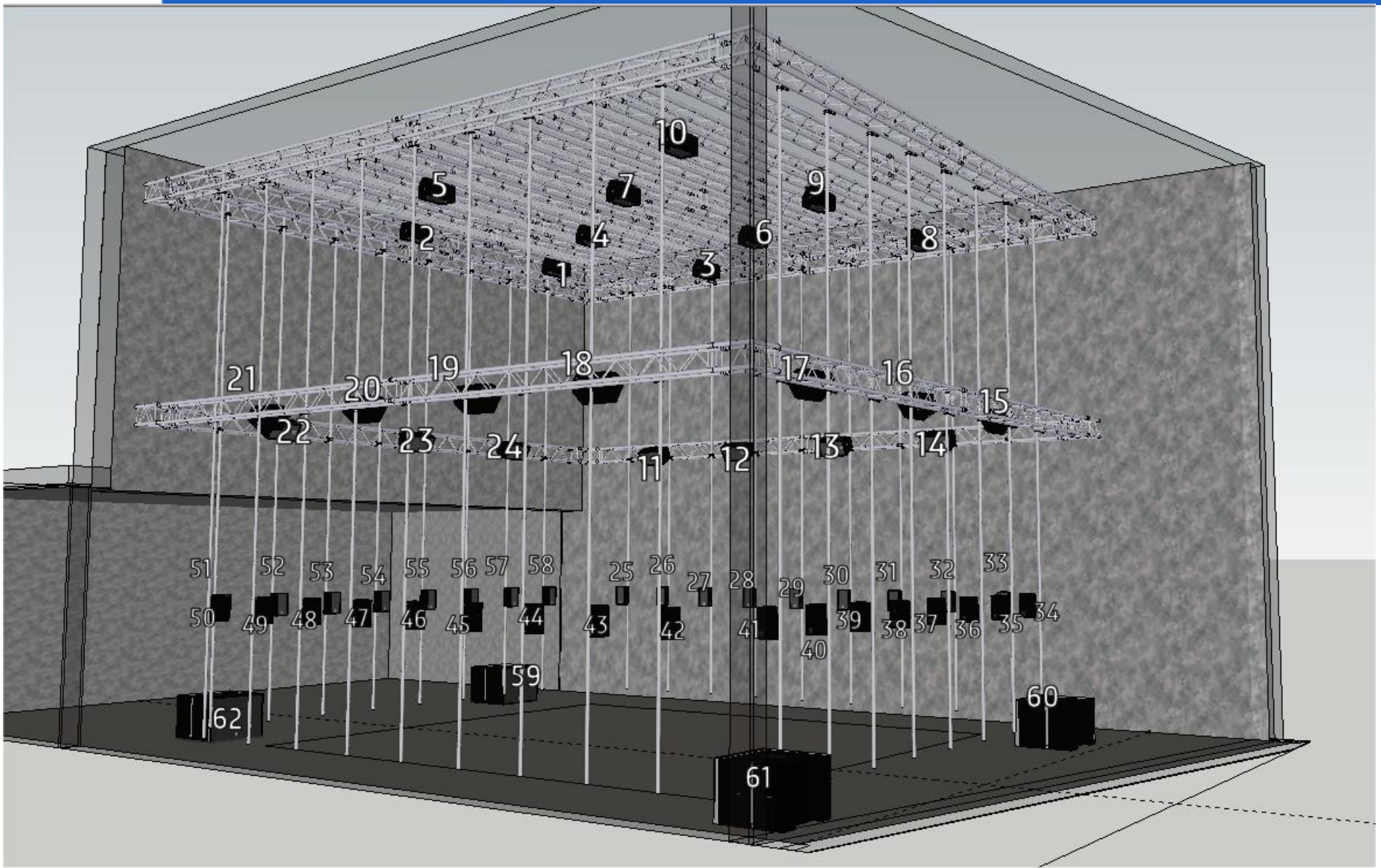






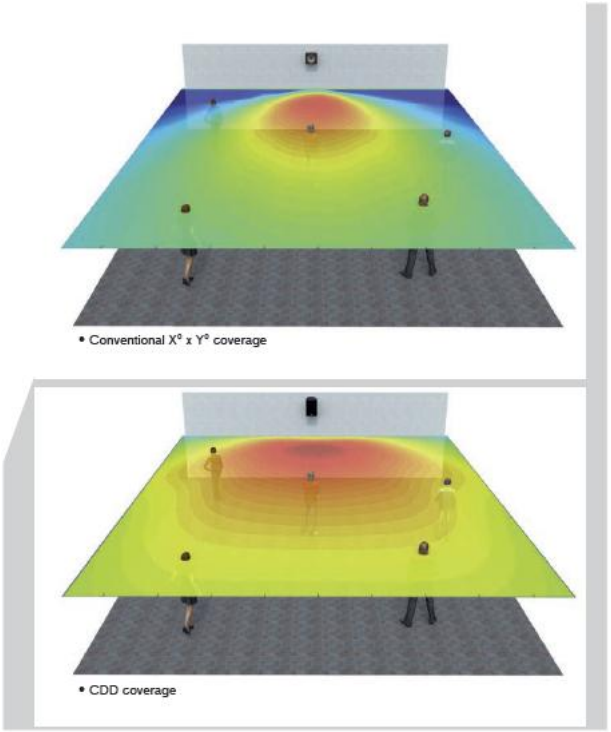


Speakers


10
5
7
9
2
4
6
8
1
3
21
19
18
17
16
20
15
22
23
24
11
12
13
14
51
52
53
54
55
56
57
58
25
26
27
28
29
30
31
32
33
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
59
60
62
61

Type of speakers

- Martin Audio CDD 6
  - Compact, lightweight, high-powerd, coaxial

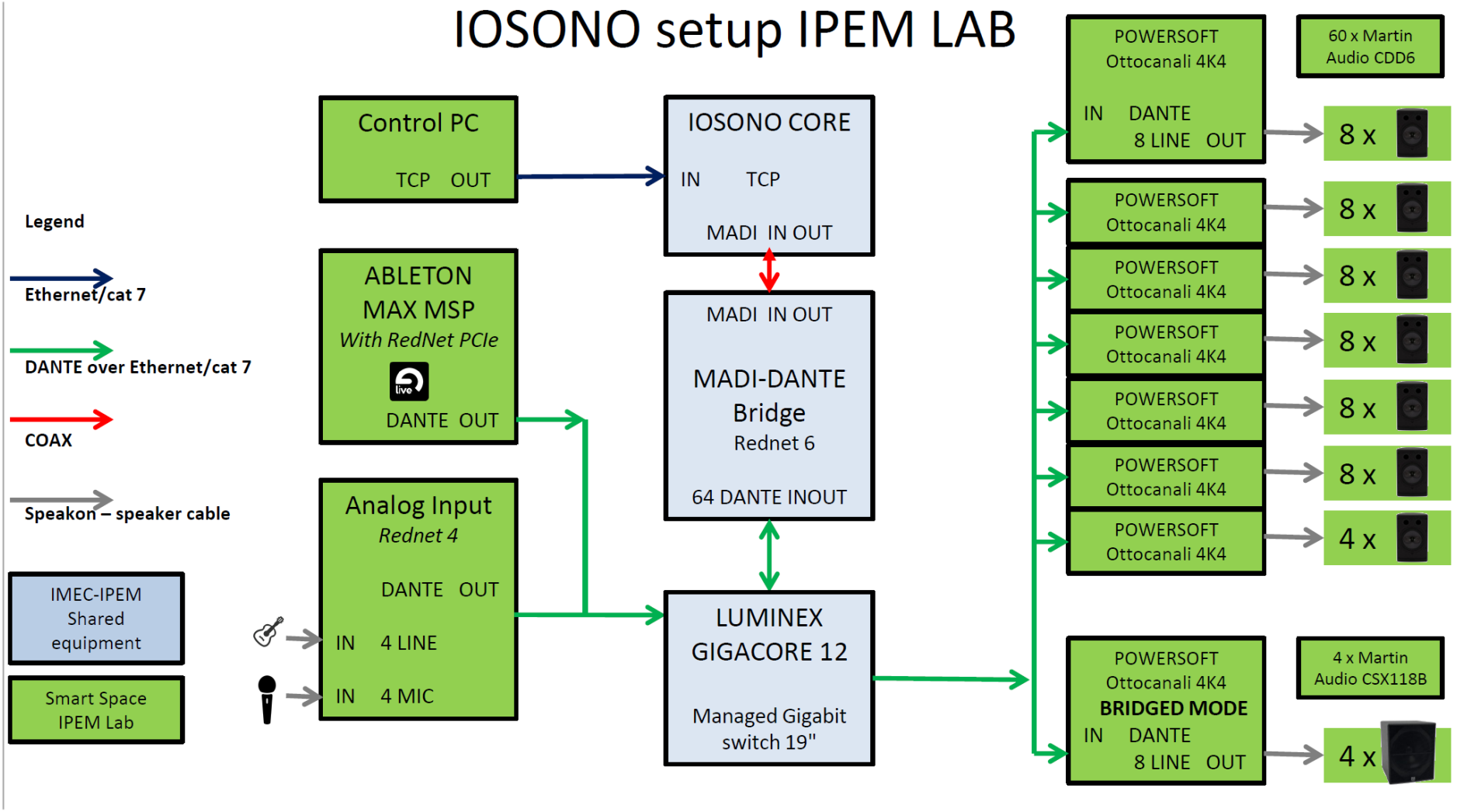


Amplifiers

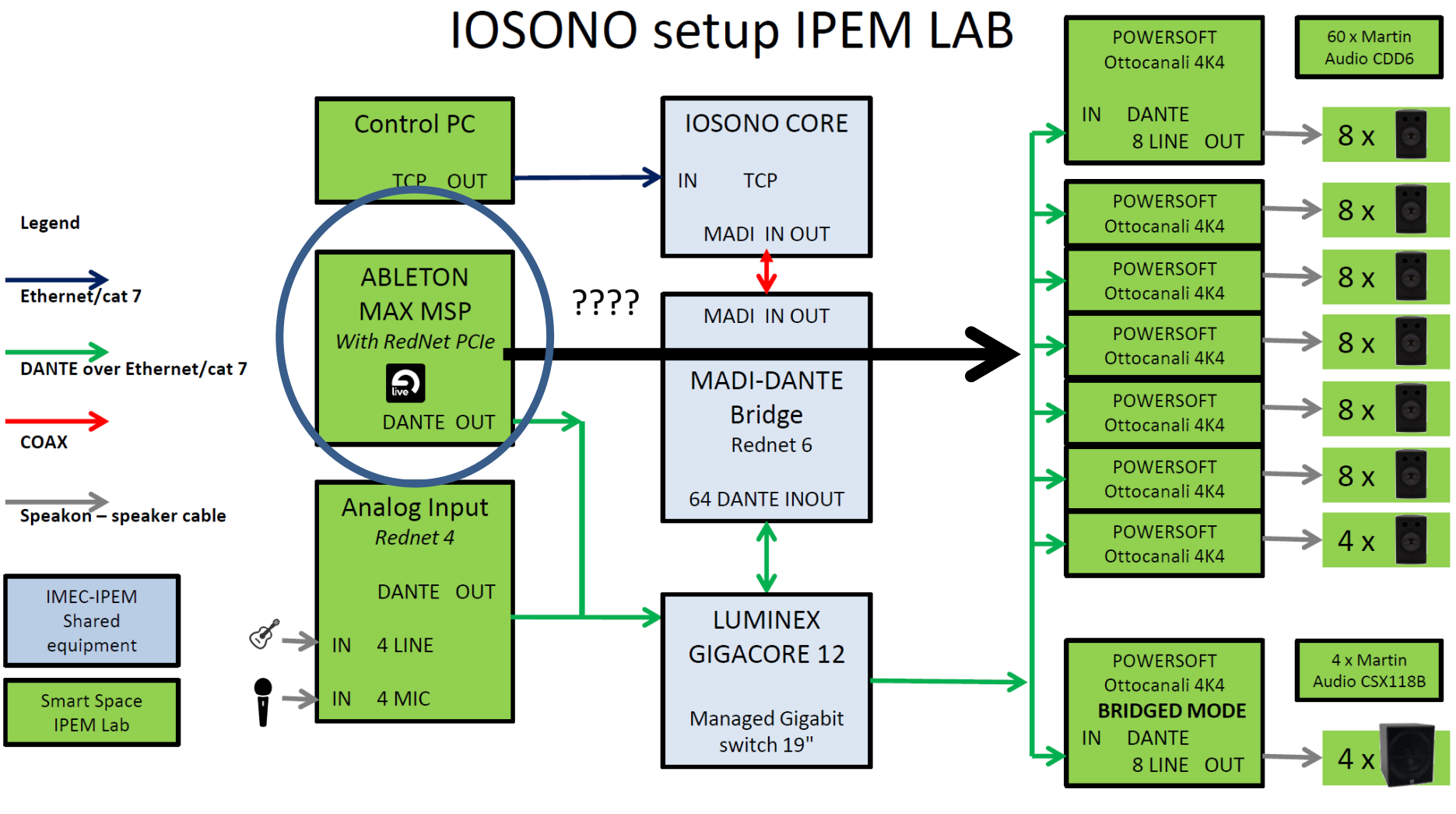
- Powersoft ottocanali 4K4 DSP
- 8 channel amps
- Audio over ip built-in
- Internal low-latency DSP
- Software-configurable
- 9 amps, 2 switches

Infrastructure

IOSONO setup IPEM LAB



Infrastructure



Part 2: audio over IP

Introduction to Dante

DANTE CERTIFICATION PROGRAM

LEVEL 1

Images from dante training programme pdfs (https://www.audinate.com)

Part 2: audio over IP

- "Dante is a hardware and software solution that transports precisely timed digital audio between devices using standard IP networking"
  - Dante = multichannel audio **protocol** over ethernet
  - Dante is not "a device"! *Its a way to bring audio from device A to B as fast & flexible as possible.*
- Created by Australian company Audinate

Dante™

What is DANTE?

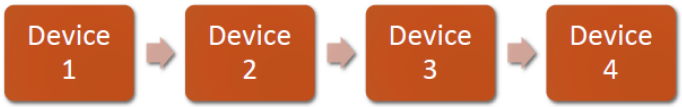
- Dante features and benefits
  - All devices use human-readable names
  - Precise time alignment of all audio
  - Automatic device discovery
  - One-click routing
  - Low, deterministic latency
  - Virtually jitter-free
  - Automatic re-connection after power cycles

Dante™

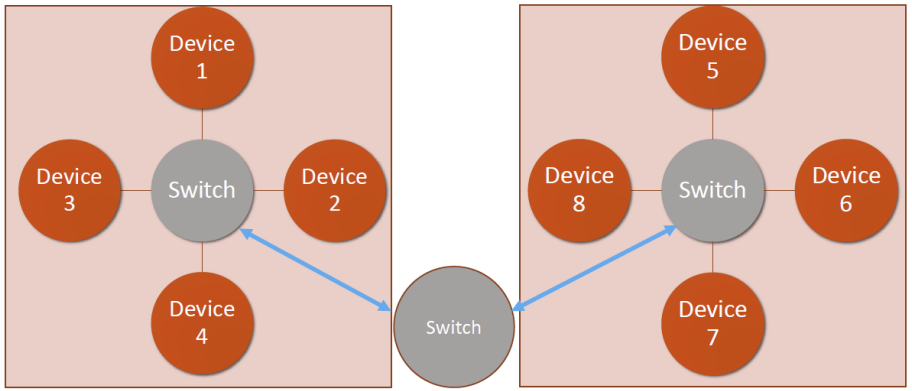
What is DANTE?

- Dante tech stuff
  - Requires CAT6; *no wifi*
  - Network star topology, no daisy chaning

Daisy chain



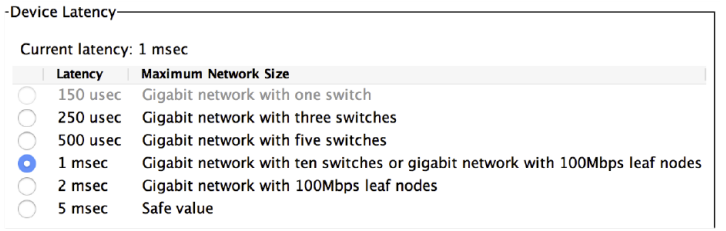
Multiple stars



Dante™

What is DANTE?

- Dante tech stuff
  - 1024 channels max over 1 gbit ethernet
    - 64 channels of audio at 48kHz/24-bit = 48,000 x 24 x 64 = 74 mbits/sec
    - Thus: 32x32 setup possible with normal computers!
  - Requires same samplerate over complete network **(Krook = 48 kHz)**
  - Latency calculated in “hops”
    - Our setup:
      - ipem internal: **1 hop = 250 usec**
      - Iosono: **4 hops => < 500 usec** (excl processing)
  - Clocking automatically (1 master device)



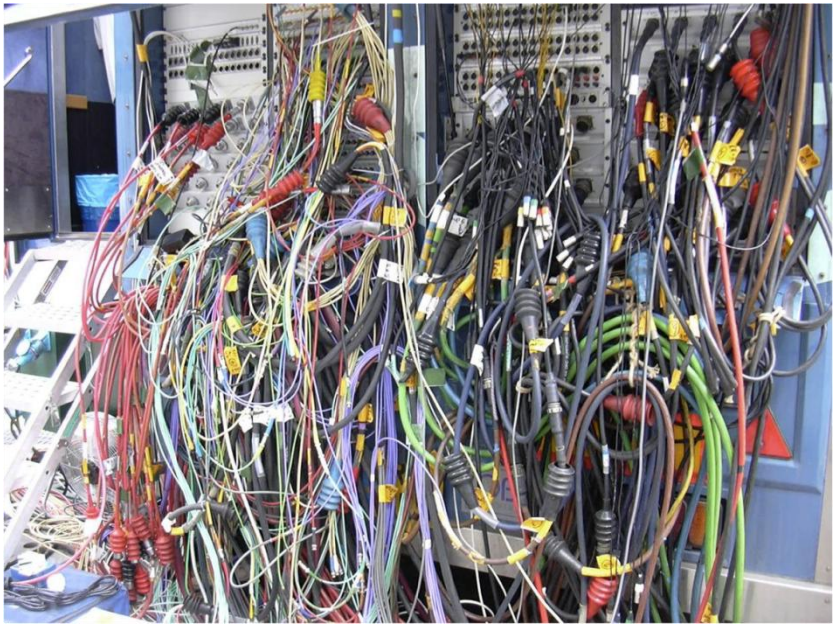
Dante™

What is DANTE?

- What does Dante NOT do?
  - Sample rate conversion
  - Level control **(mind the volume)**
  - MIDI
  - SMPTE time code

Why DANTE?

- 64 channels is not ‘easy’
- Flexible, patchable, extensable
- 1-cable installation



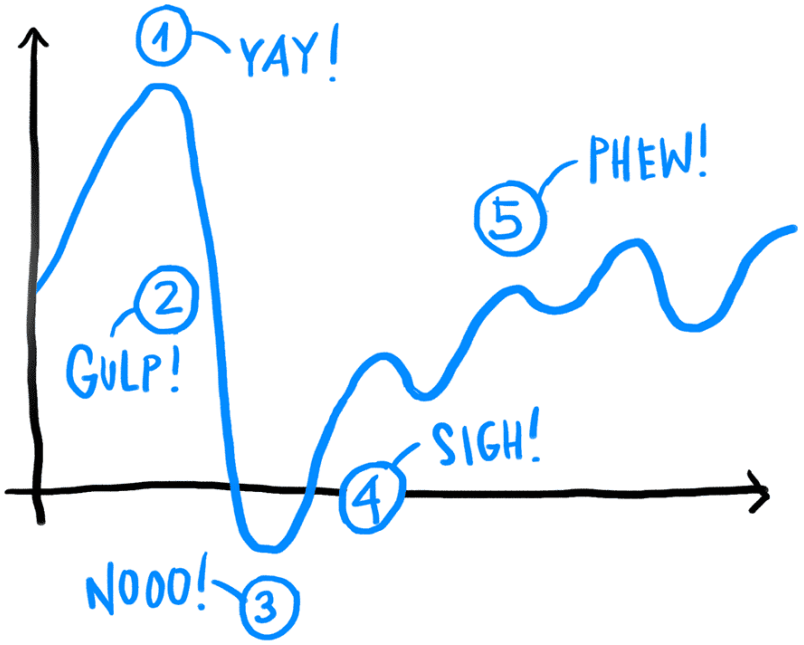
=

Why DANTE?

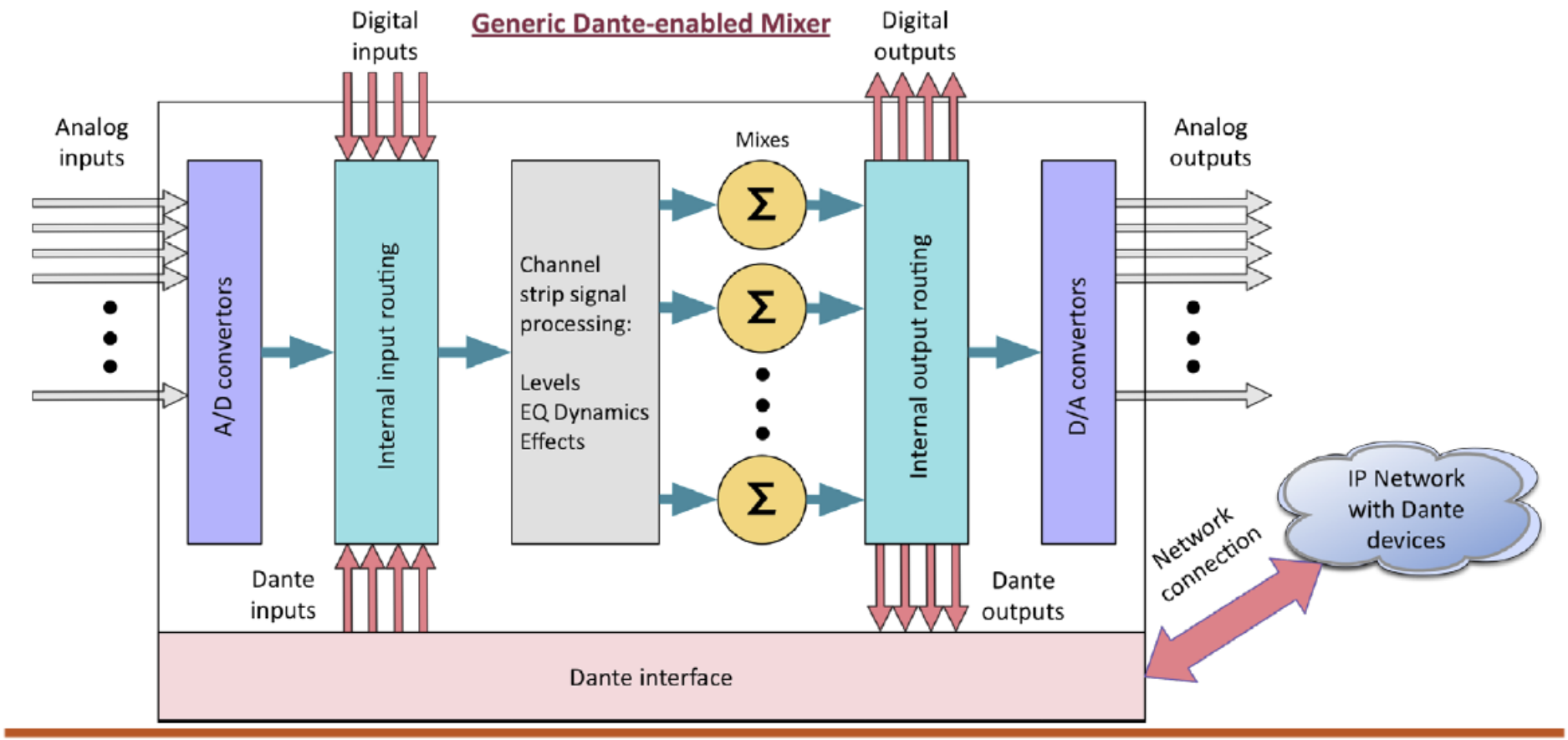
- Agreed protocol in the Krook
  - Direct audio connections & shared infrastrcutre (eg iosono)
  - Partners: IMEC – IPEM – URGENT
- Future extensions over fiber to Vooruit, Wintercircus, Minard, ..
- Krook = multimedia hub for cultural Ghent!

Dante: downsides

- “New” technology
- Not open source: propriatary licences
- We can accidently mess up connected labs
- Learning curve!
- Do not expect Plug & Play



Dante-enabled devices



Dante-enabled devices

- Speakers: built in receiver
  - (DAC -> Amp -> speaker)

- Classical DAC / ADC
  - Ethernet in (no usb!!) – multichannel analog in/out

Dante-enabled devices

- AMPS with Dante-in: no XLR or ADC!
  - (DAC -> Amp -> speaker)

- Mixers: dante in-out +

dsp + level control

Dante-enabled devices

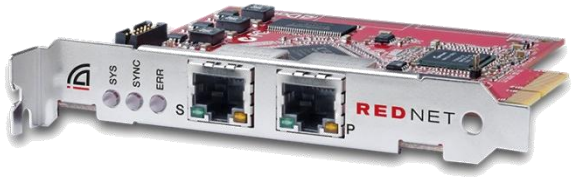
- ADC & DAC:
  - 16-channel ADC's (16 xlr -> dante)

  - 8 channel mic preamps (8 xlr –> dante)

  - 16-channel outputs (Dante -> 16 x xlr)

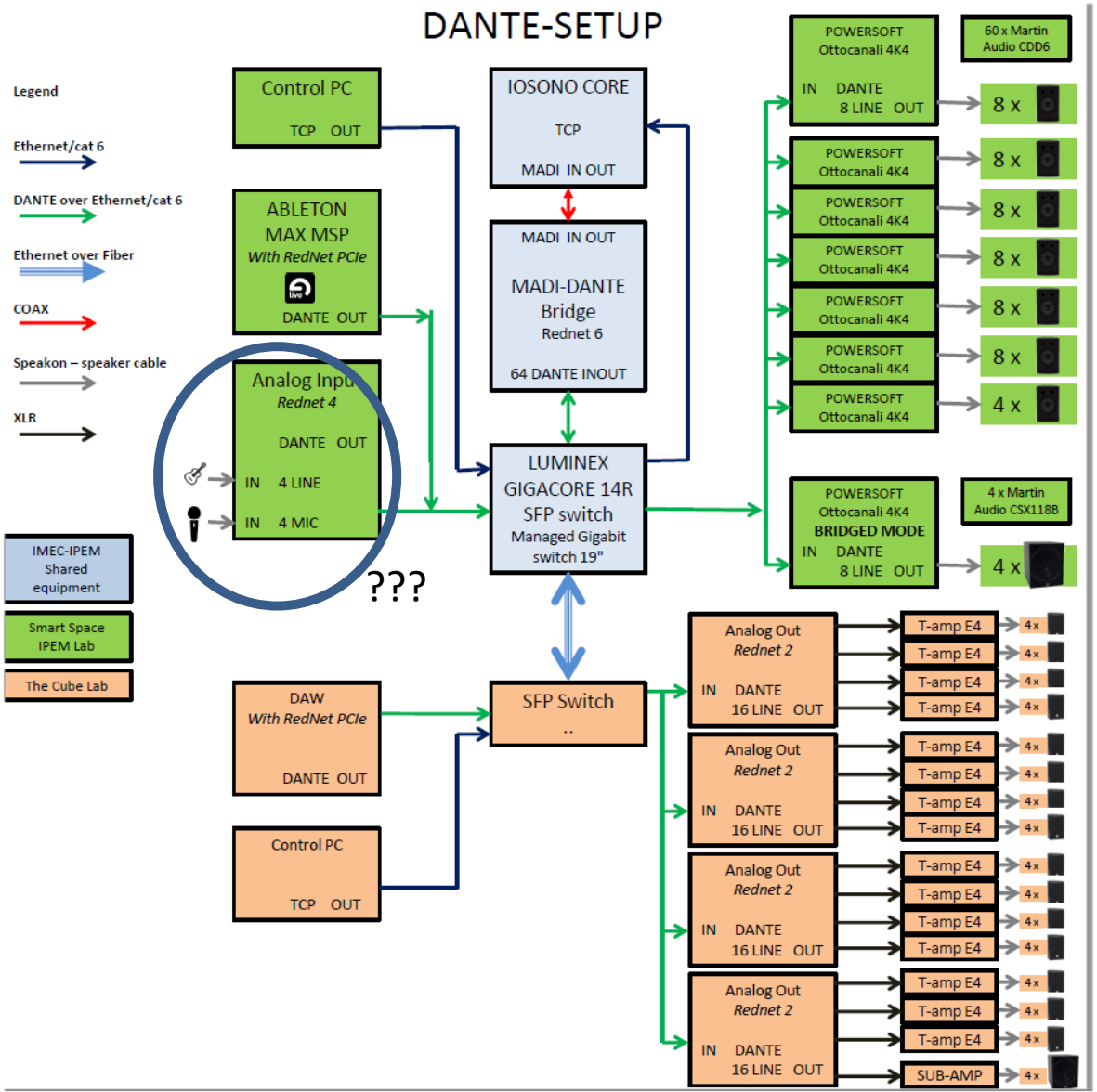
Dante: computer interface

- How to use your computer?
  - Dante **hardware** 'soundcard': High perforamnce: dante-input card
    - Latencies < 1ms
    - Studio setup
    - >1024 channels
    - Enables connection to and from complete dante network!



  - Dante **virtual** 'soundcard'
    - Downloadable software
    - *Enable dante on normal PC hardware*
    - Latencies > 4ms, < 10ms
    - Max 64 channel
    - Enables connection to and from complete dante network!

Current Krook Infrastructure



Future outlook

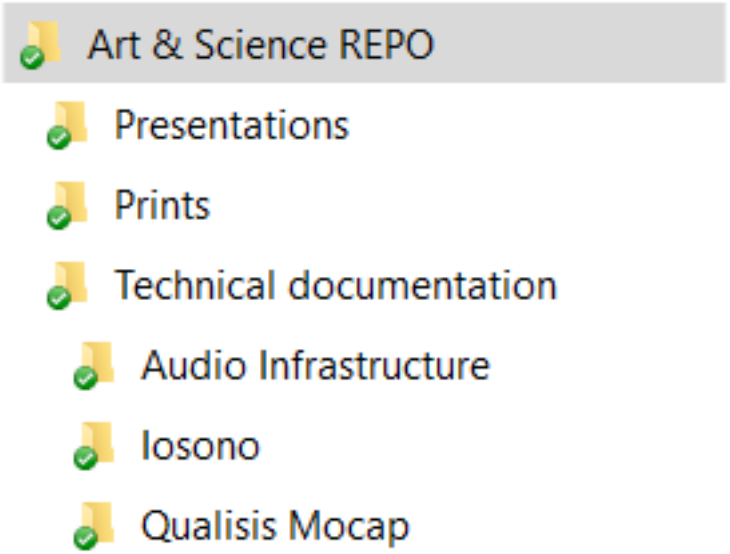
- Extend audio infrastructure to allow for usecases of the A & S lab
  - IPEM Experiments
  - 3D sound (iosono, projections)
  - Live radio sessions
  - Artists in residence / band rehersal
  - Studio recordings
  - Future links to other venues
  - …
- Study over several months

Part 3: Audio-over-IP: software tools & Demo

- Dante virtual soundcard
- Dante routing & controllers
- Demo

Repository

- Presentations, schematics, tech docs can be found at the **ipem repository**



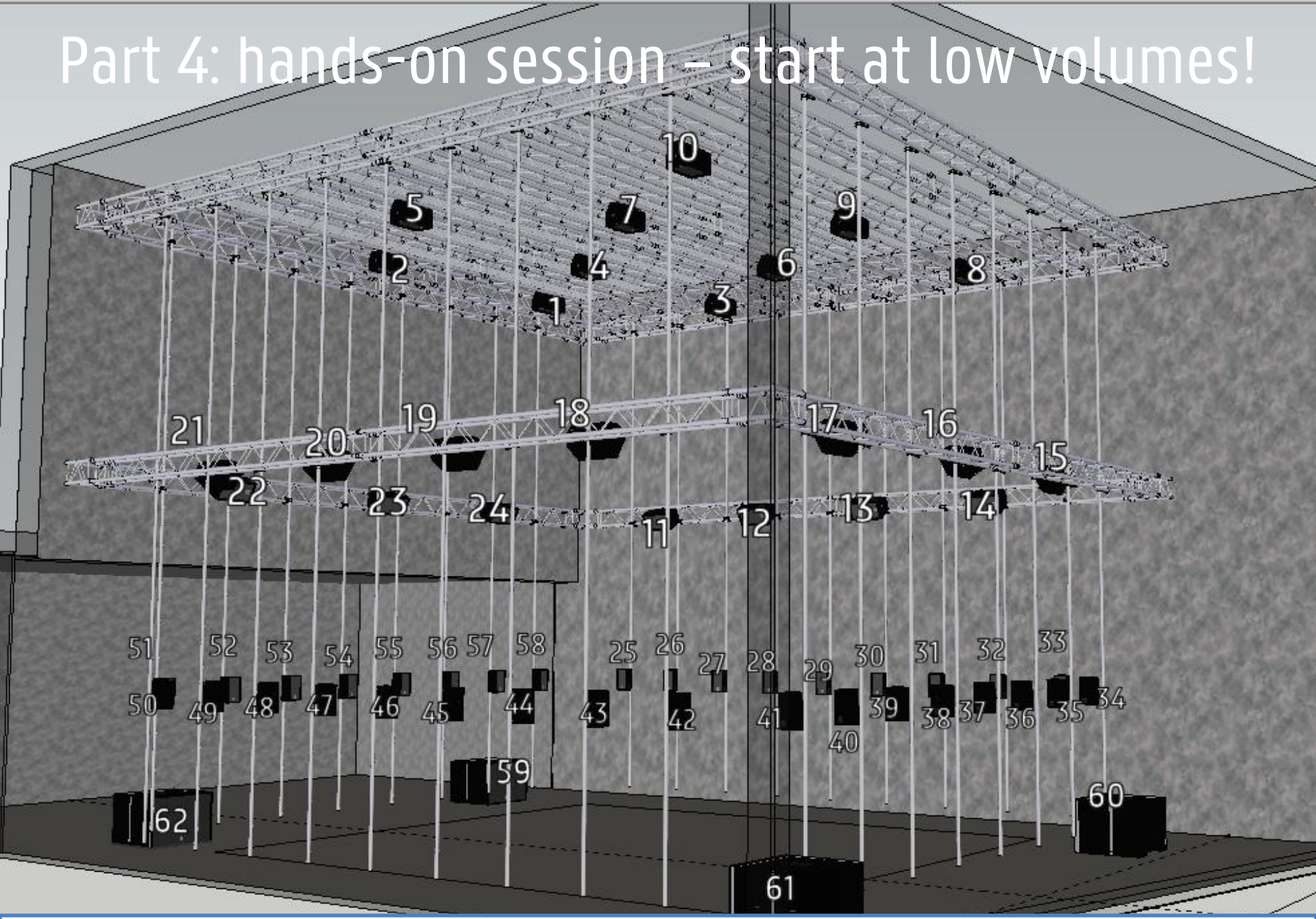
- https://www.audinate.com/ for Dante virtual soundcard & Dante controller (free trials after registering)

Thank you for your attention!

- Questions?

- Next up: practical hands-on session

Part 4: hands-on session – start at low volumes!



https://www.audinate.com/ for Dante virtual soundcard & Dante controller

IPEM repo for docs