



Surround Demystified

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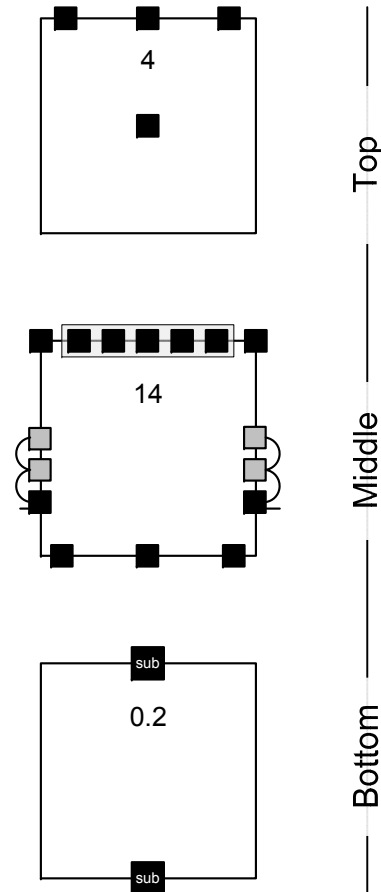
Introduction

- Existing Surround Formats
 - Cinema vs. Home
 - The Role of Upmixers/Decoders
 - Market Adoption
 - Issues
- What's Next for Surround Sound?
 - Innovation Paths
 - Authoring and Playback Environments Challenges
 - Areas of Research
- Conclusion

Existing Surround Formats

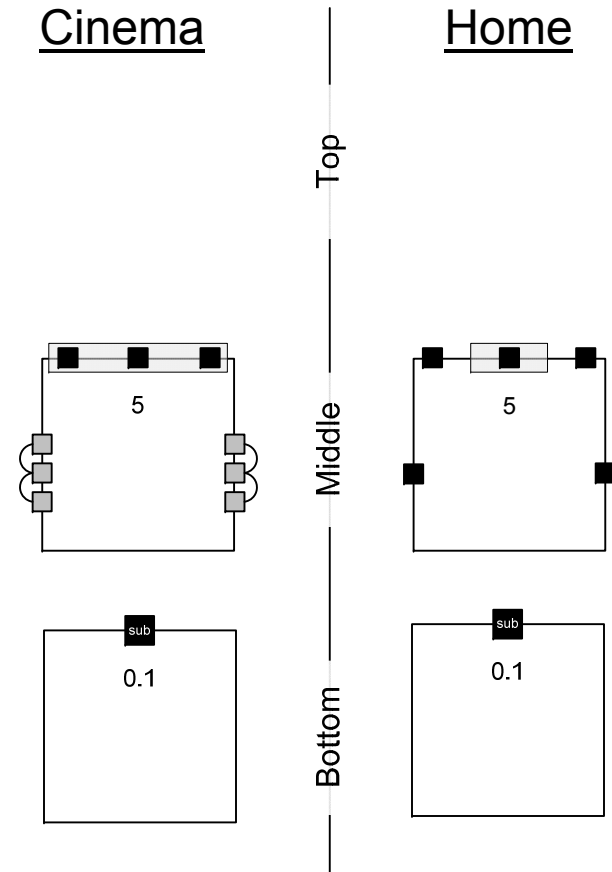
- Home or Cinema, everything is based on the SMPTE S428-3-2006 channel specifications
- 20 channels have been defined
 - Screen: L, Lc, C, Rc, R
 - Middle Surround: Lw, Ls, Lb, Cb, Rb, Rs, Rw
 - Top Surround: Lh, Ch, Rh, Ts
 - LFE: LFE1, LFE2

- Direct speaker
- Array speaker
- Direct + surround speaker
- sub Subwoofer



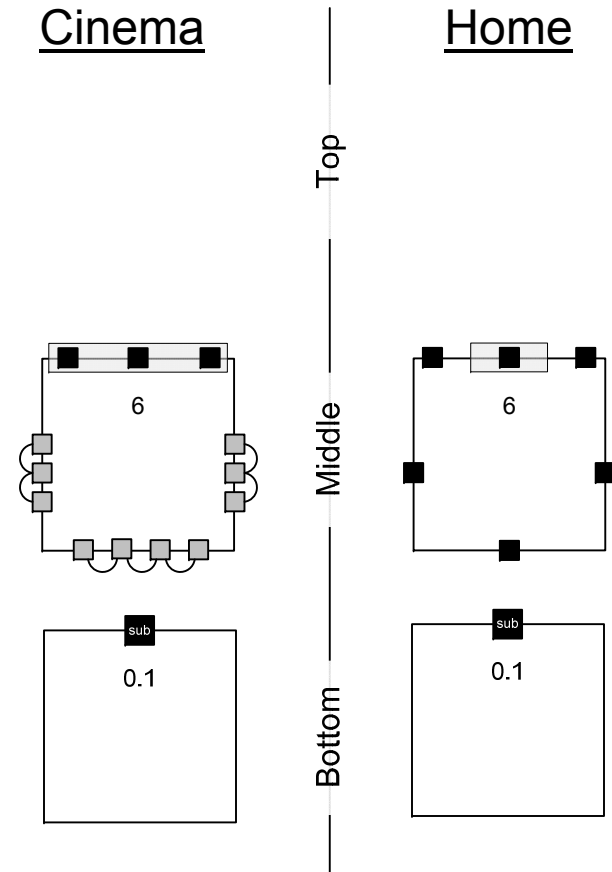
Existing Surround Formats

- Cinema vs. Home
 - **5.1**
 - Dolby Digital
 - Dolby Digital Plus
 - Dolby TrueHD
 - Dolby Pulse
 - DTS
 - DTS-HD
 - DTS-HD Master Audio
 - AAC / HE-AAC
 - PCM (*HDMI*)



Existing Surround Formats

- Cinema vs. Home
 - 5.1
 - 6.1
 - Dolby Digital EX
 - Dolby Digital Plus
 - Dolby TrueHD
 - DTS-ES
 - DTS-HD
 - DTS-HD Master Audio
 - PCM (*HDMI*)

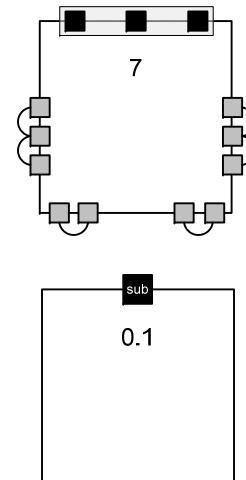


Existing Surround Formats

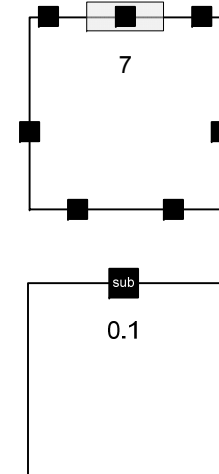
- Cinema vs. Home
 - 5.1
 - 6.1
 - 7.1 “Back”
 - Dolby Digital Plus
 - Dolby TrueHD
 - DTS-HD
 - DTS-HD Master Audio
 - PCM (HDMI)



Cinema



Home



Top
Middle
Bottom

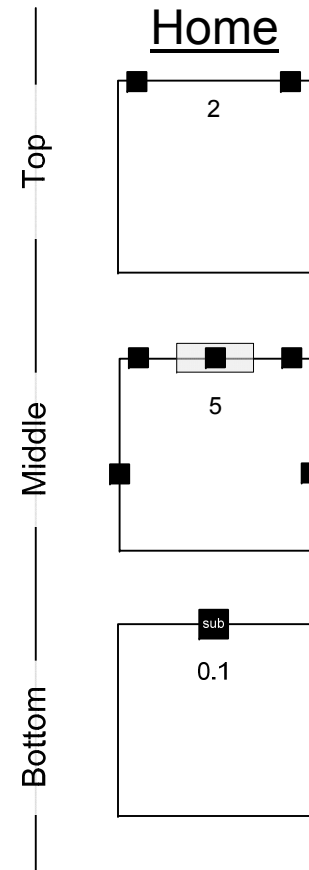
Existing Surround Formats

- Cinema vs. Home
 - 5.1
 - 6.1
 - 7.1 Back
 - **7.1 Height**
 - Dolby Digital Plus
 - Dolby TrueHD
 - DTS-HD
 - DTS-HD Master Audio
 - PCM (*HDMI**)

* CEA-861E only

Cinema

Home



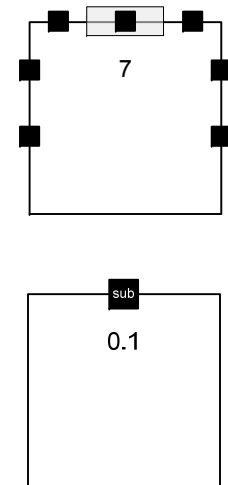
Existing Surround Formats

- Cinema vs. Home
 - 5.1
 - 6.1
 - 7.1 Back
 - 7.1 Height
 - **7.1 Wide**
 - Dolby Digital Plus
 - Dolby TrueHD
 - DTS-HD
 - DTS-HD Master Audio
 - PCM (*HDMI*)

Cinema

Home

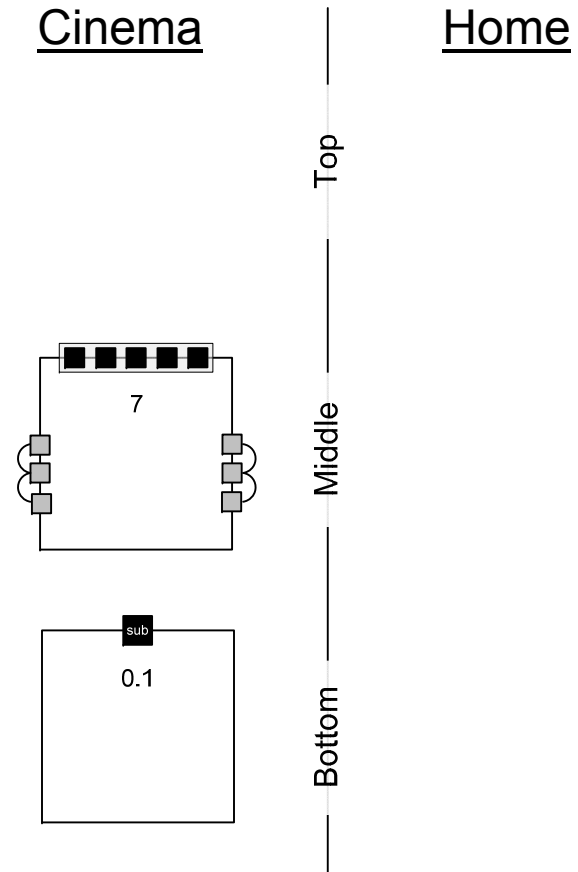
Top
Middle
Bottom



Existing Surround Formats

- Cinema vs. Home
 - 5.1
 - 6.1
 - 7.1 Back
 - 7.1 Height
 - 7.1 Wide
 - **7.1 “SDDS”**
 - Sony SDDS
 - Dolby Digital Plus
 - Dolby TrueHD
 - DTS-HD
 - DTS-HD Master Audio
 - PCM (*HDMI**)

* CEA-861E only



“Exotic” Surround Formats

- Home only
 - 9.1 (Back + Front Height)
 - 9.1 (Back + Wide)
 - 9.1 (Wide + Front Height)
 - 11.1 (Back + Front Height + Back Height)

The Role of Matrix Upmixers / Decoders

- Discrete vs. Matrixed
- Upmixers vs. Decoders
- They are critical to solve the surround sound ecosystem chicken and egg problem
 - Dolby Pro Logic (II) for 5.1
 - Dolby Pro Logic IIx for 7.1 Back
 - Dolby Pro Logic IIz for ?
- All upmixers must be decoders as well

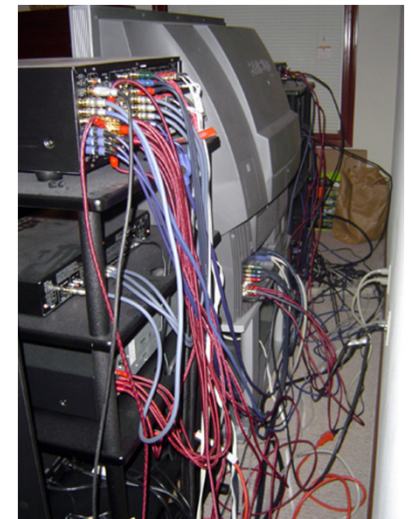
Surround Sound Household Adoption*

- 18% of households in US/Europe/Japan (saturated, Japan is now less than 5%)
 - 35% DVD HTiB
 - 30% Soundbars
 - 23% AVRs
 - 12% BD HTiB
- 0.5% of households in China/India, growing to 1% by 2014

*Source: Futuresource

Issues with Surround Sound Formats

- Cinema:
 - Multiple formats means multiple mixes: time consuming and costly
 - Complexity and cost of installation for exhibitors
- Home:
 - Complexity
 - Cost
 - Practicality
 - Form factor
 - No interest



What's next for Surround Sound?

- Innovation Paths
 - Overcoming some of the current issues (making systems simple, cheap, with small wireless speakers, etc.)
 - Create a brand-new surround sound experience
- Significant vs. Noticeable Improvement
 - Mono to Stereo
 - Stereo to 5.1
 - 5.1 to ?

What's next for Surround Sound

- 3D
 - 3D video is creating a need for a new surround sound format
 - Requests for “3D audio” come from cinema exhibitors, studios, and CE manufacturers
- What is 3D audio?
 - 3D vs. 2D vs. 1D audio
 - Simply more immersive? More realistic?

What's next for Surround Sound?

- Major challenge: distinct capture, mixing, and playback environments
- It has to work everywhere...



What's next for Surround Sound?

- Areas of Research

- Dolby experimental mixes of Avatar and The Incredible at the Skywalker studios
 - Elevation channels
 - Surround direct
- Speaker Dispersion
- Wave Field Synthesis
- Ambisonics



Conclusion

- 5.1 must be a yardstick in terms of performance, complexity, practicality, cost and form factor
- The next generation of surround sound must work in all capture, mixing and playback environments

What if the audio industry fails to find the silver bullet?...

Fundamentals might have to dramatically change (new audio coding approach, new audio transducer technologies, etc.)

Thank you