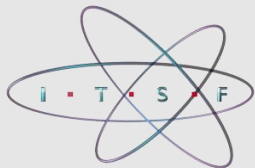


Why do Broadcasters Care about Timing?

Mike Ellis

B B C Design & Engineering

mike.ellis@bbc.co.uk



Why do broadcasters care about timing?

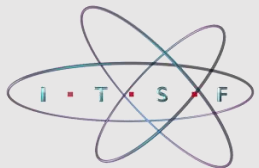
History of timing in broadcast

Maintaining the illusion

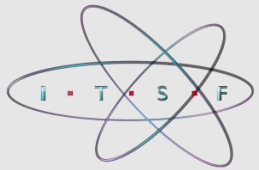
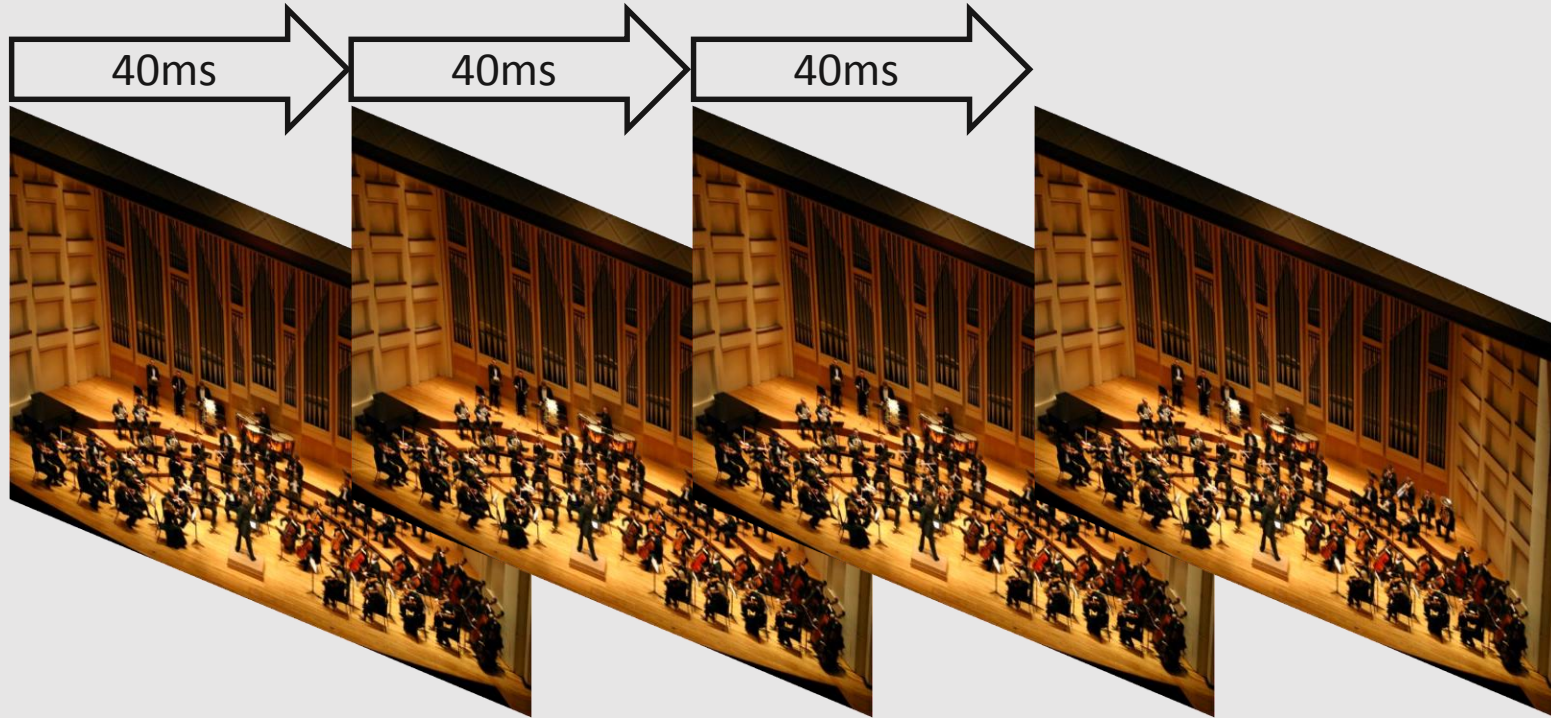
Behind the scenes

Making the programme

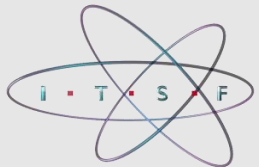
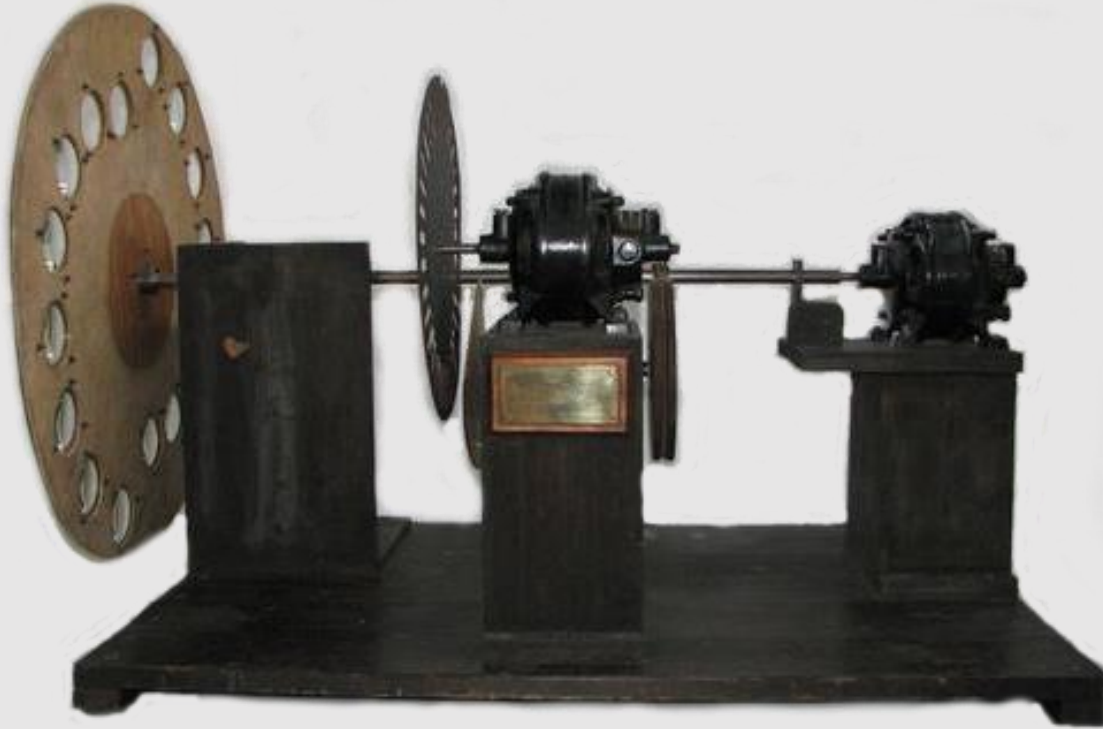
Delivery to the audience



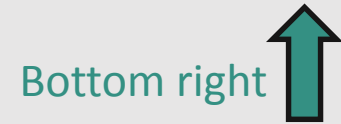
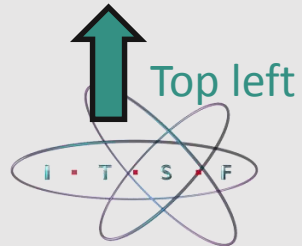
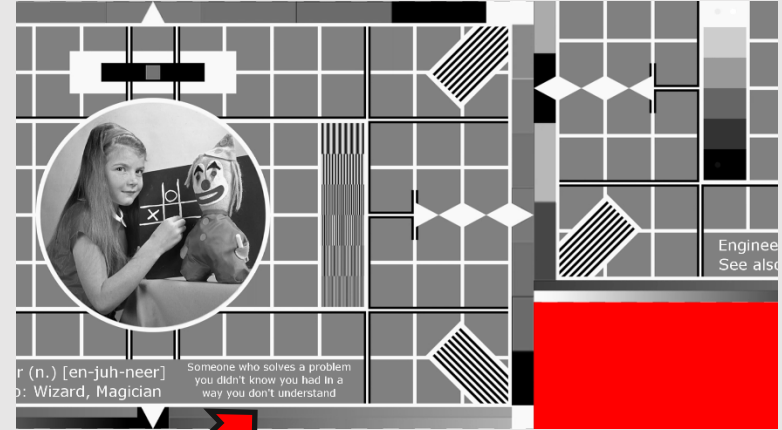
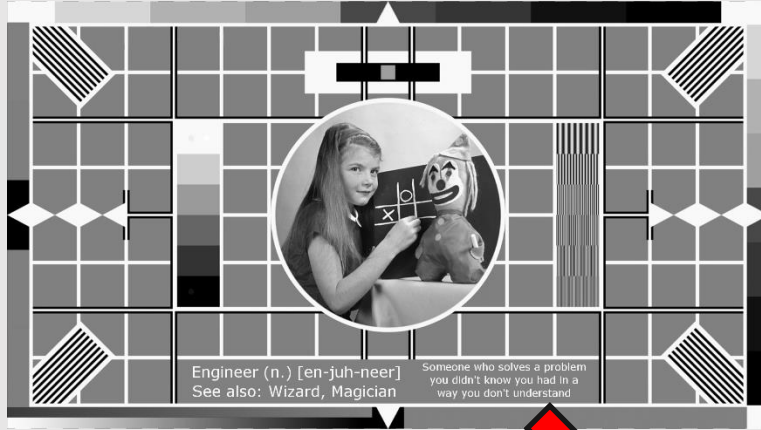
What is Television?



Creating the still image



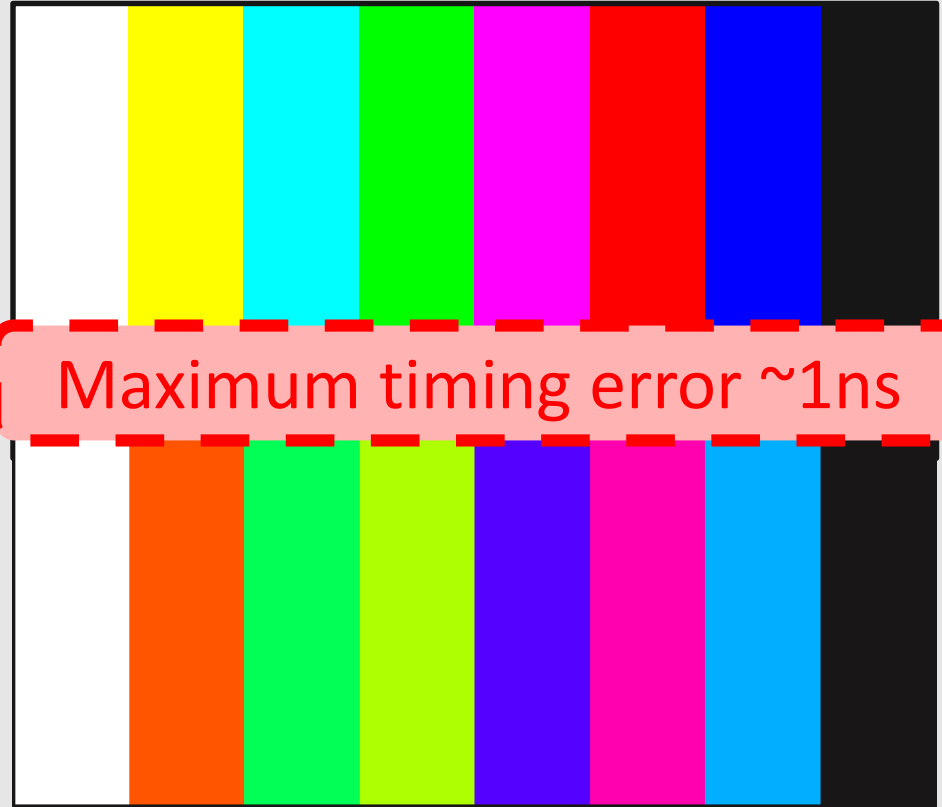
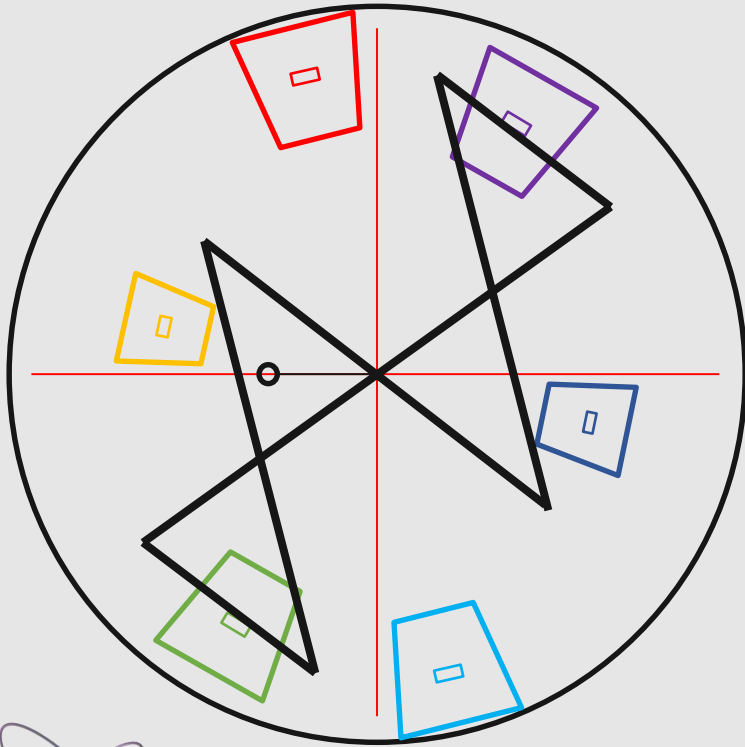
Time as a proxy for position



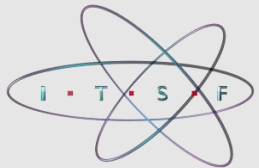
Maximum timing error $\sim 1\mu\text{s}$

B B C

Timing as a proxy for Colour (NTSC)

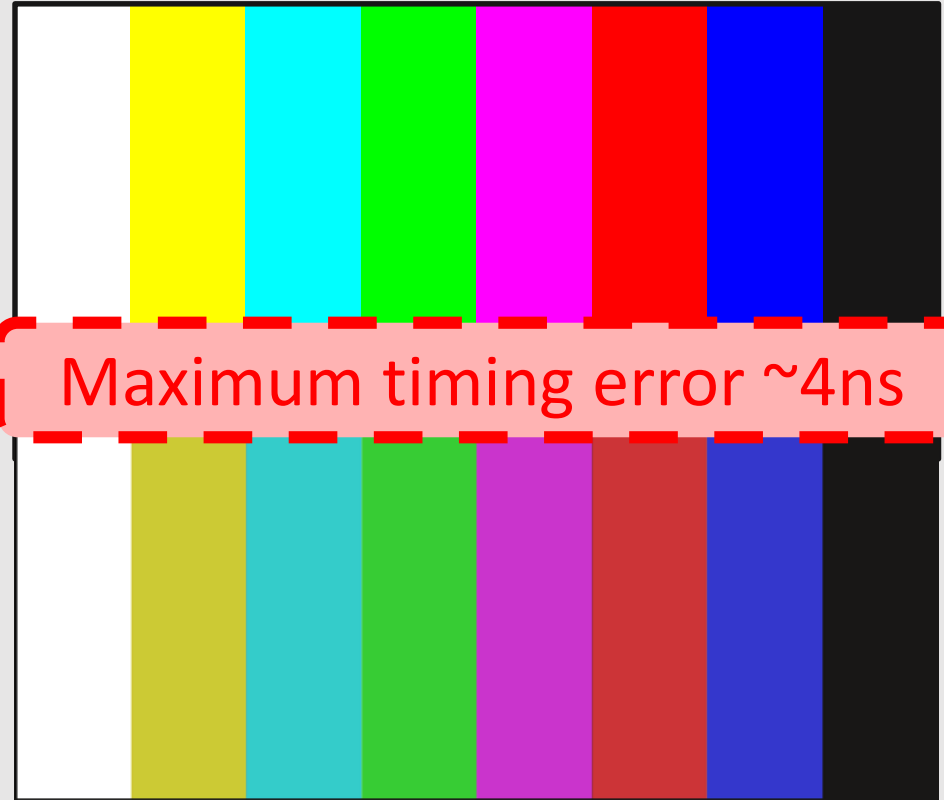
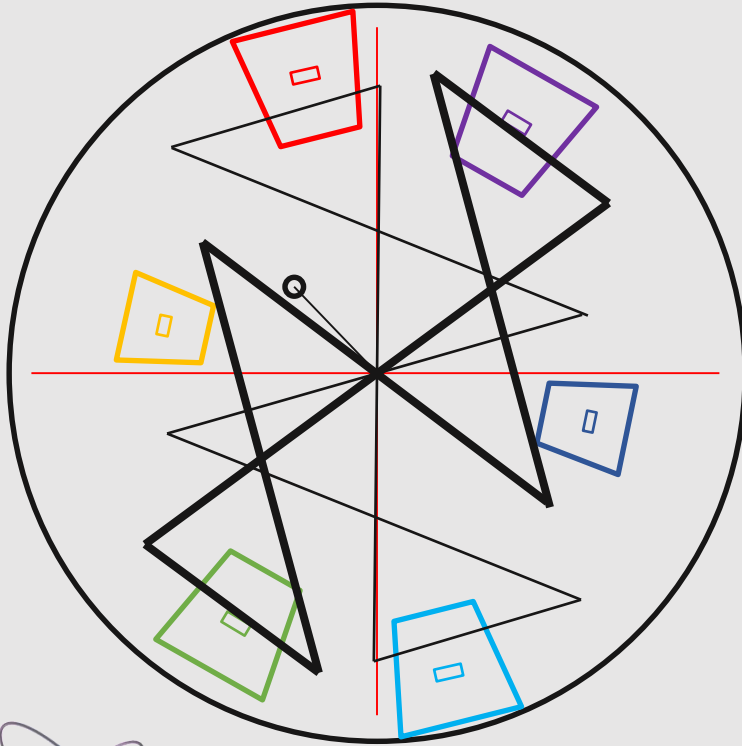


Maximum timing error ~1ns

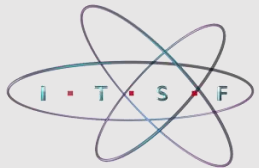


B B C

Timing as a proxy for Colour (PAL)



Maximum timing error ~4ns



Why do we care about timing?

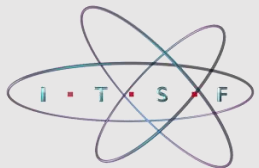
History of timing in broadcast

Maintaining the illusion

Behind the scenes

Making the programme

Delivery to the audience



Maintaining the illusion



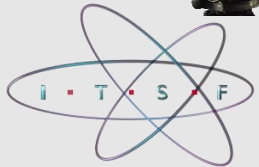
Maximum timing error $10\mu\text{s}$



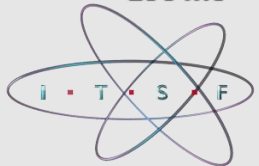
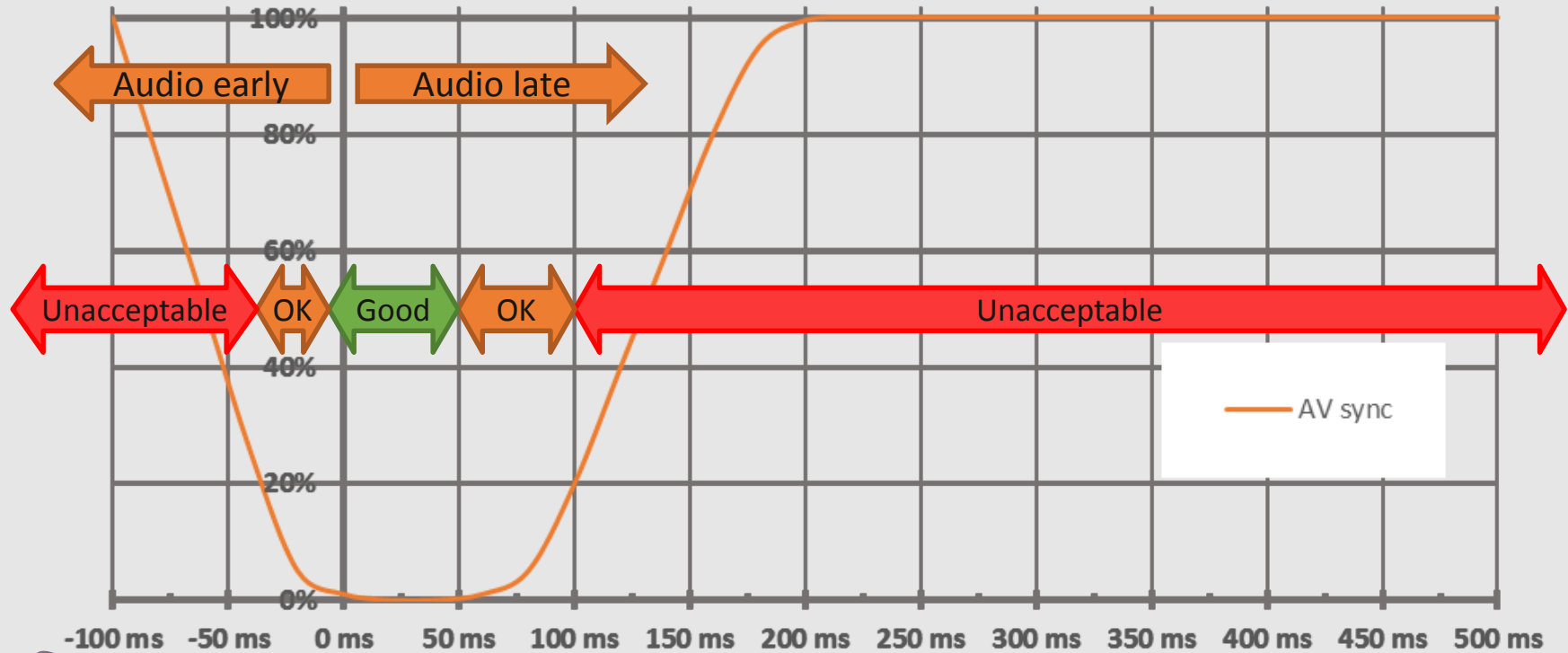
Max 10ms



Maximum timing error 10ms



Human perception



Why do we care about timing?

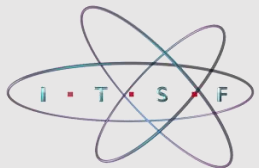
History of timing in broadcast

Maintaining the illusion

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Making the programme

Delivery to the audience

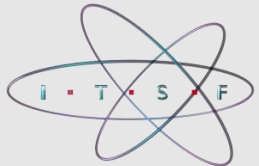
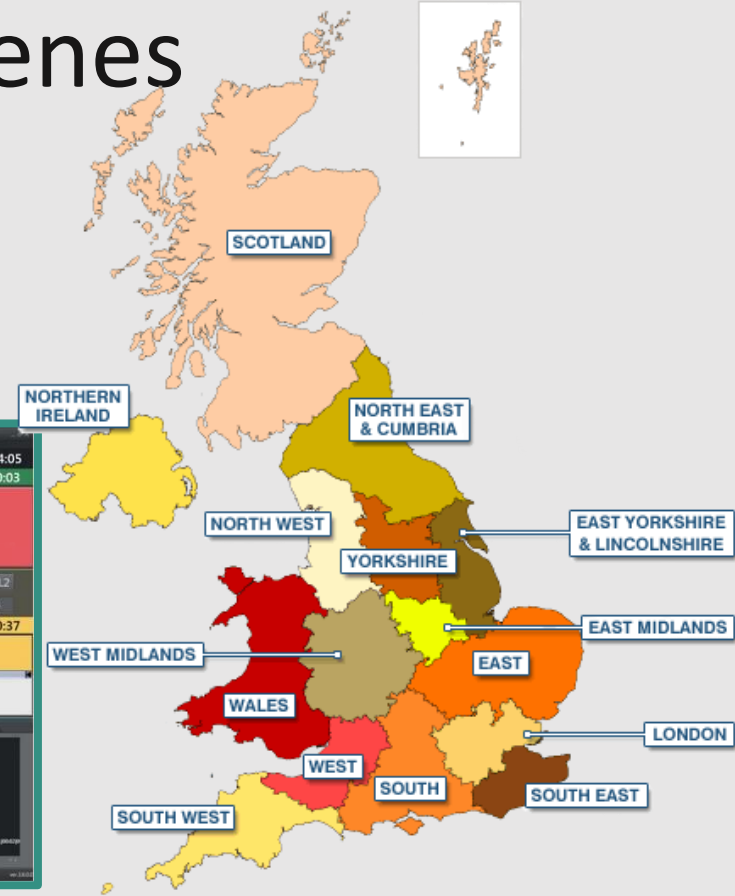


Behind the scenes

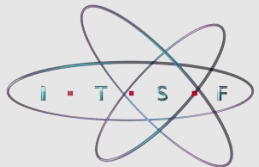
Linear schedule

Playout automation

Gallery automation



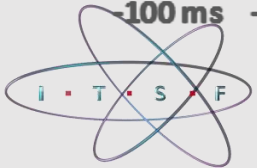
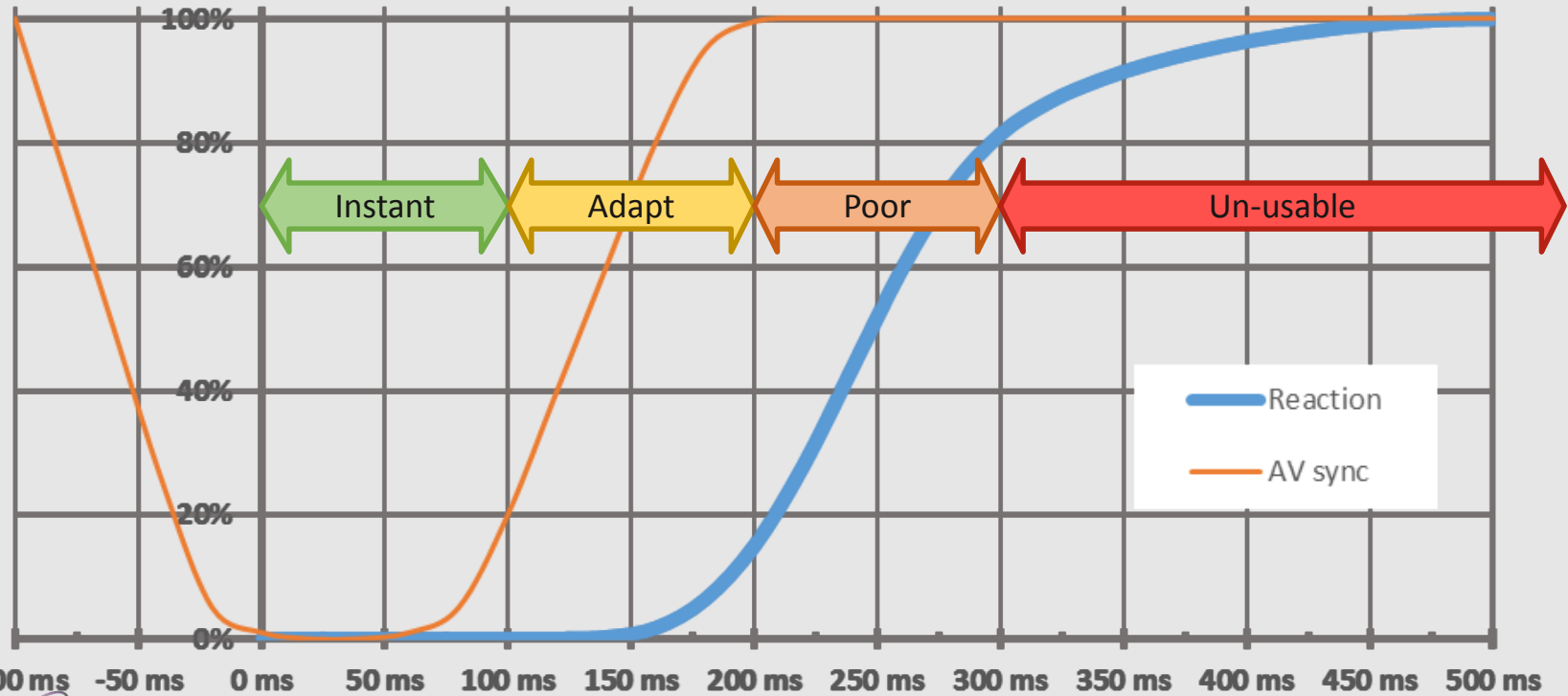
Making the programme



by Martin Deutsch



Operators



Why do we care about timing?

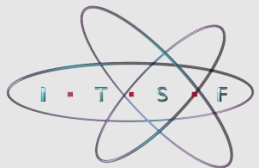
History of timing in broadcast

Maintaining the illusion

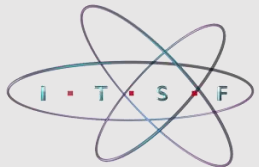
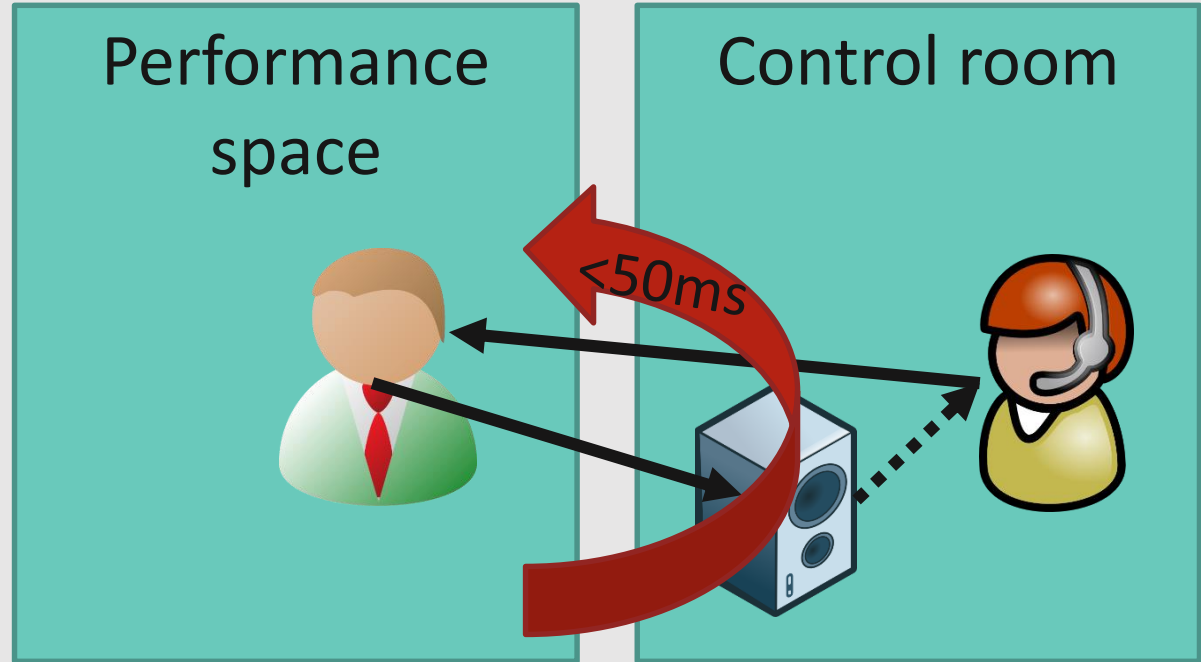
Behind the scenes

Making the programme

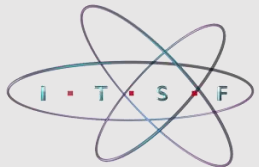
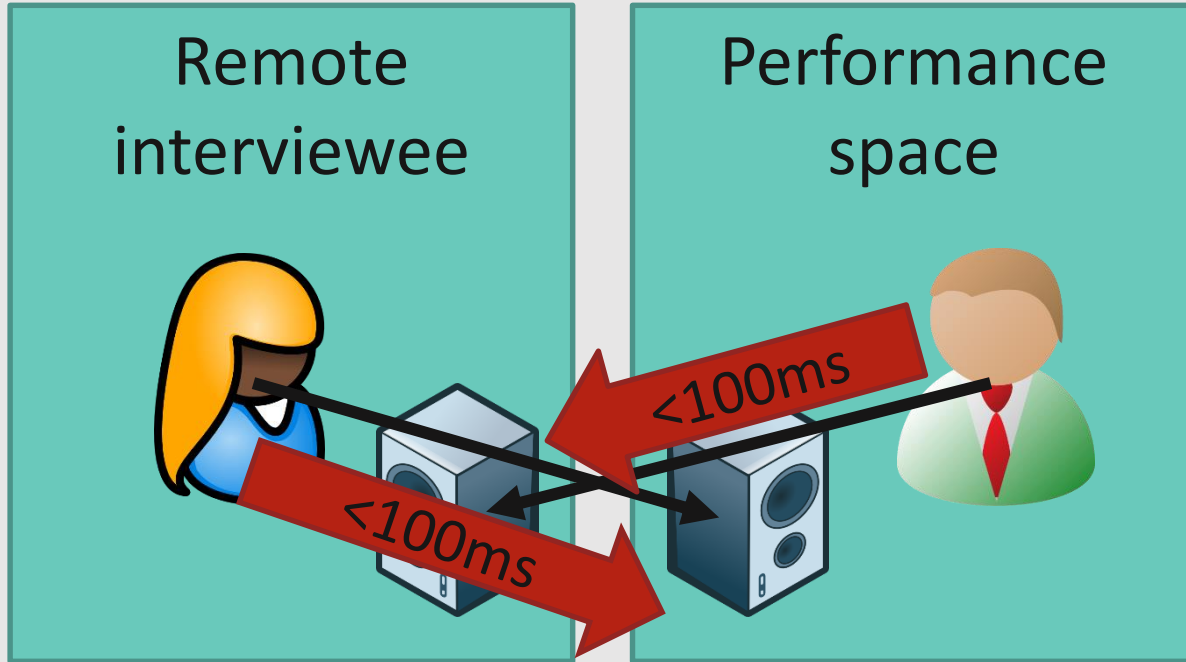
Delivery to the audience



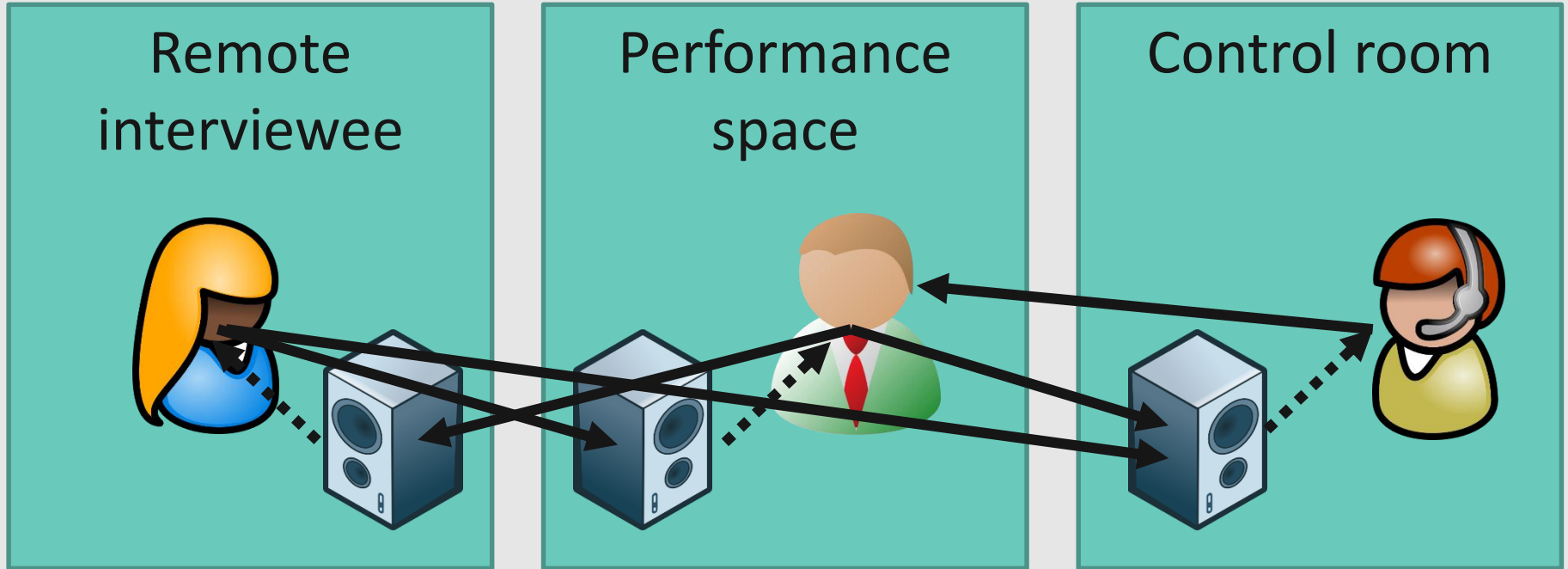
The Presenter and the Director



The Two-way Interview



The Production Team



Why do we care about timing?

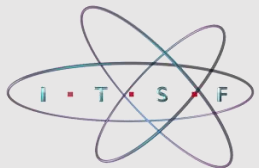
History of timing in broadcast

Maintaining the illusion

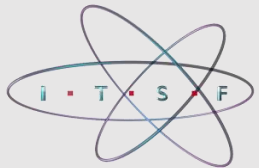
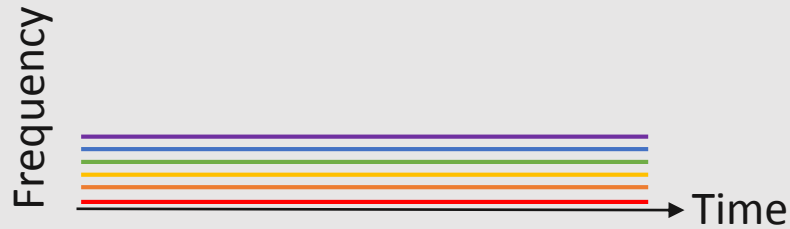
Behind the scenes

Making the programme

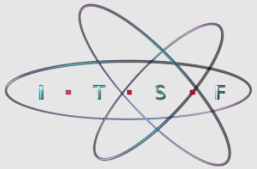
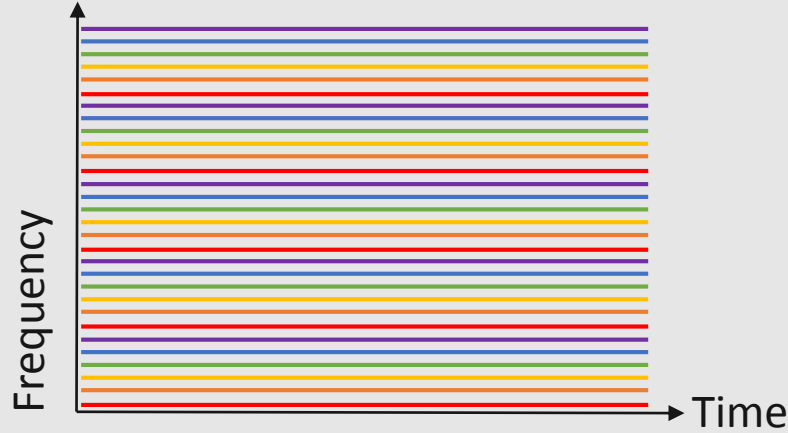
Delivery to the audience



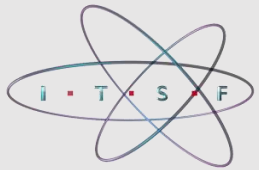
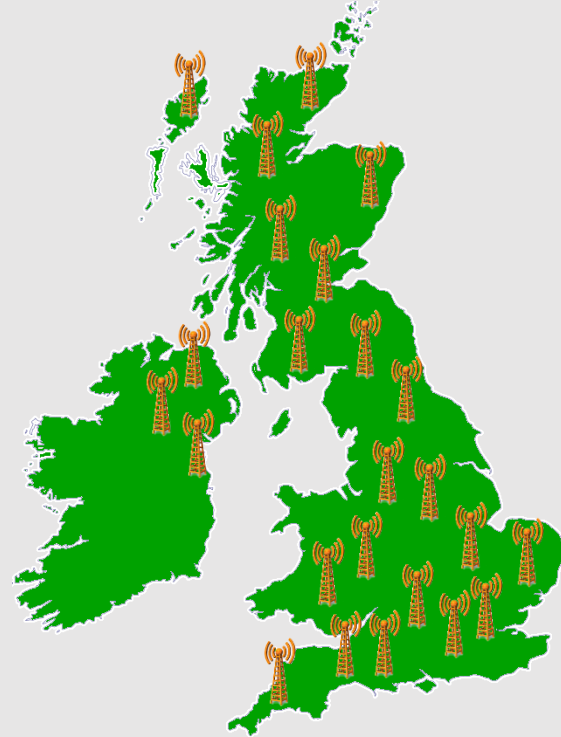
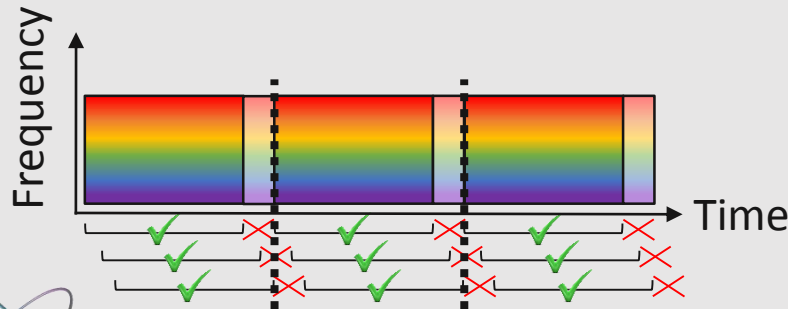
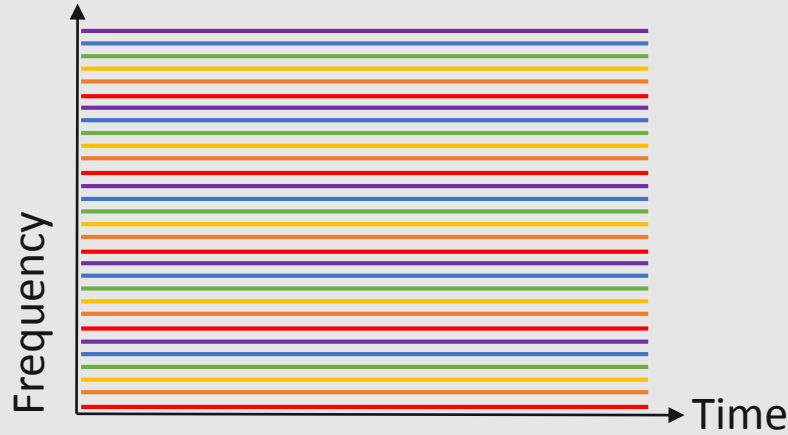
Delivery to the Audience



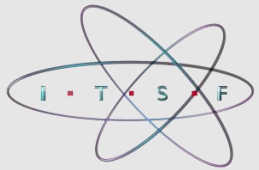
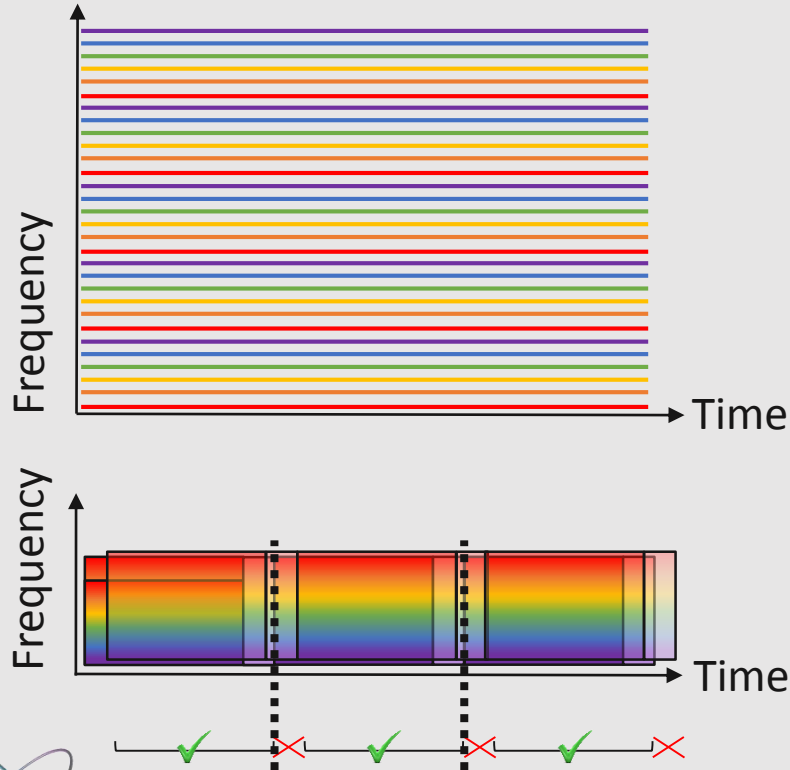
Delivery to the Audience



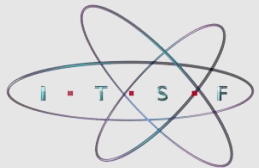
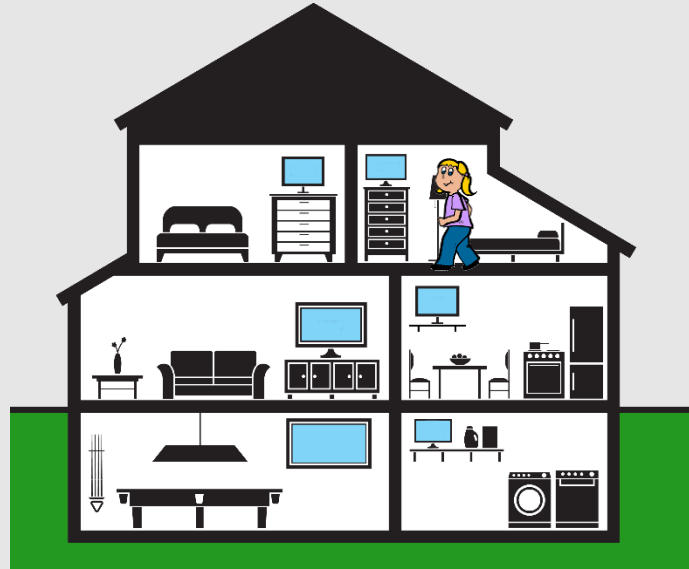
Delivery to the Audience



Delivery to the Audience



Live and Multi-receiver Coverage



Why do broadcasters care about timing?

Maintaining the illusion

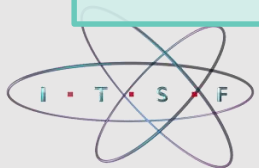
- Historically time was a proxy for position and colour and needed nanosecond precision
- Un-related content only needs millisecond – roughly a million times easier
- Related content – e.g. stereo mics – will need to be tighter, maybe microsecond accuracy

Behind the scenes

- Operators can only tolerate delays of 50-100ms
- Presenters need delays <50ms when hearing their own voice, <200ms total for a conversation
- Single Frequency Network transmitters must be co-timed to ~100ns over large areas
- Audiences want “live” content to be live – not delayed by several tens of seconds

Solutions!

- Design systems to be loosely coupled (non-hard real-time) but as low delay as possible
- Don't slavishly follow a single external reference such as GPS – you know how long a second is
- Use a common time reference (e.g. UTC or, better, something without leap-seconds!)



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mike.ellis@bbc.co.uk

