Why Accurate Timing is Important for Broadcasters and Audiences

Mike Ellis

BBC Design + Engineering

mike.ellis@bbc.co.uk

BBC

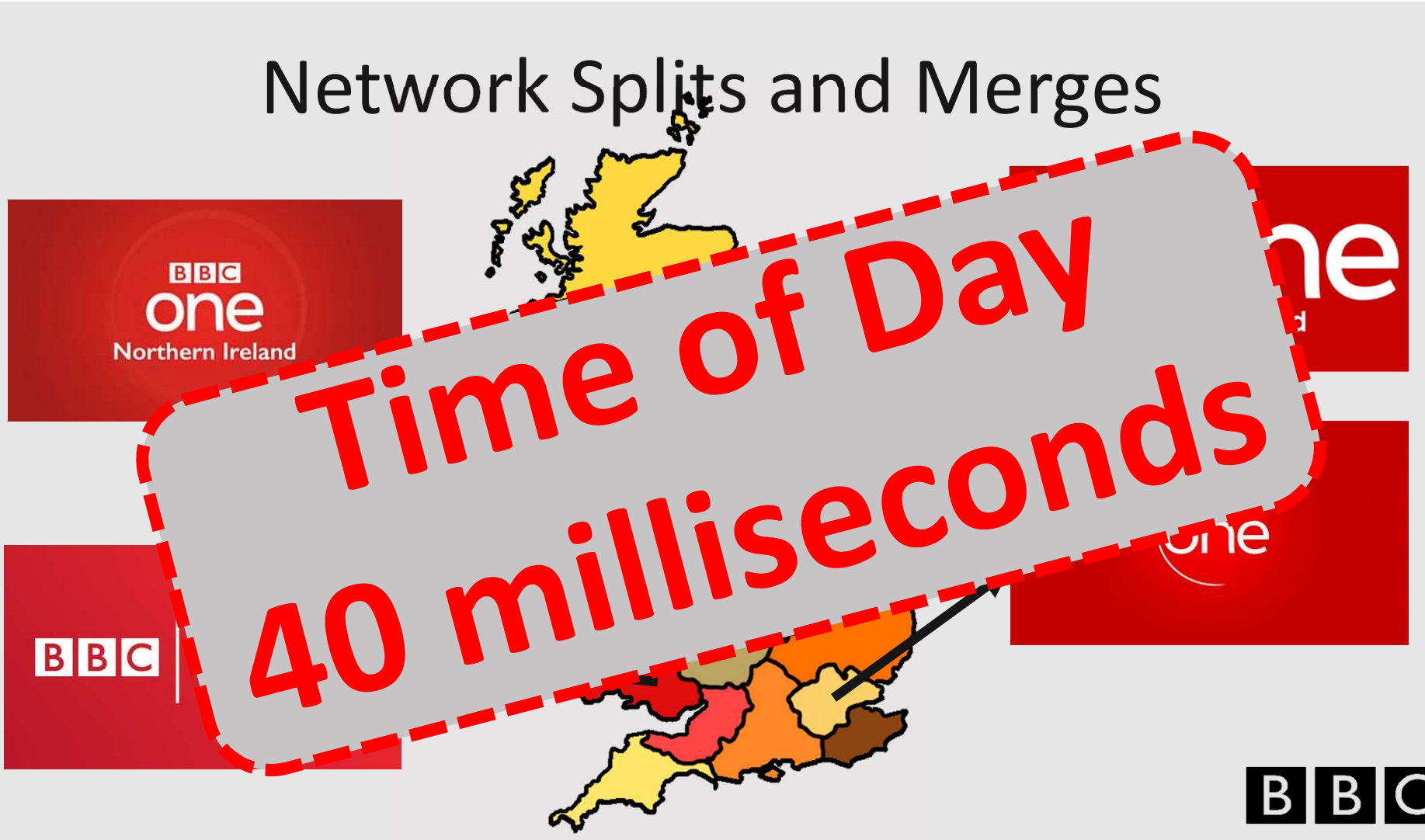
Why accurate timing is important

- The audience perspective
- Maintaining the illusion
- Making the programme
- Technical considerations
- How do we solve the problem(s)?

BBC

Appointment to View

Network Splits and Merges



Live and Multi-receiver Coverage

Constant, low delay

by Ed Webster

BBC

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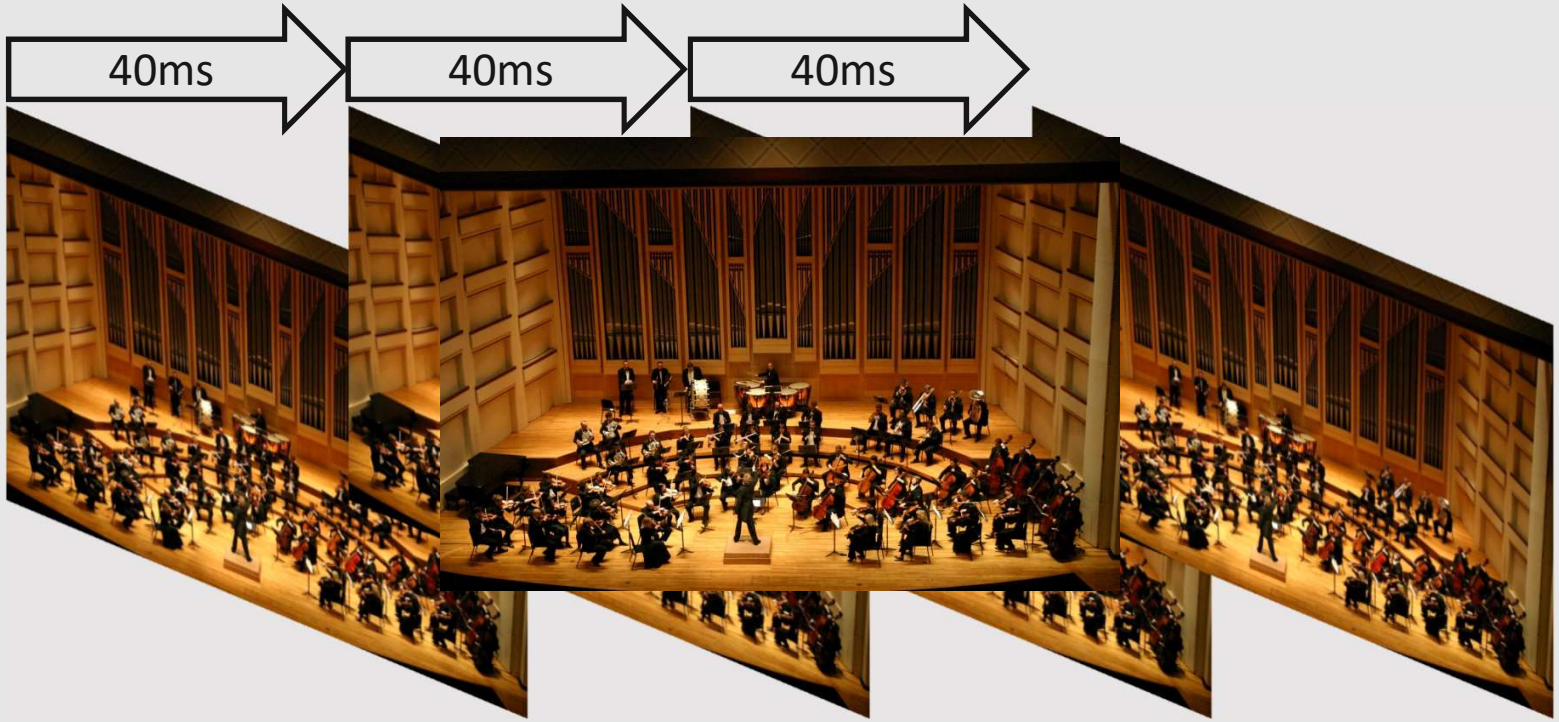
What is Television?



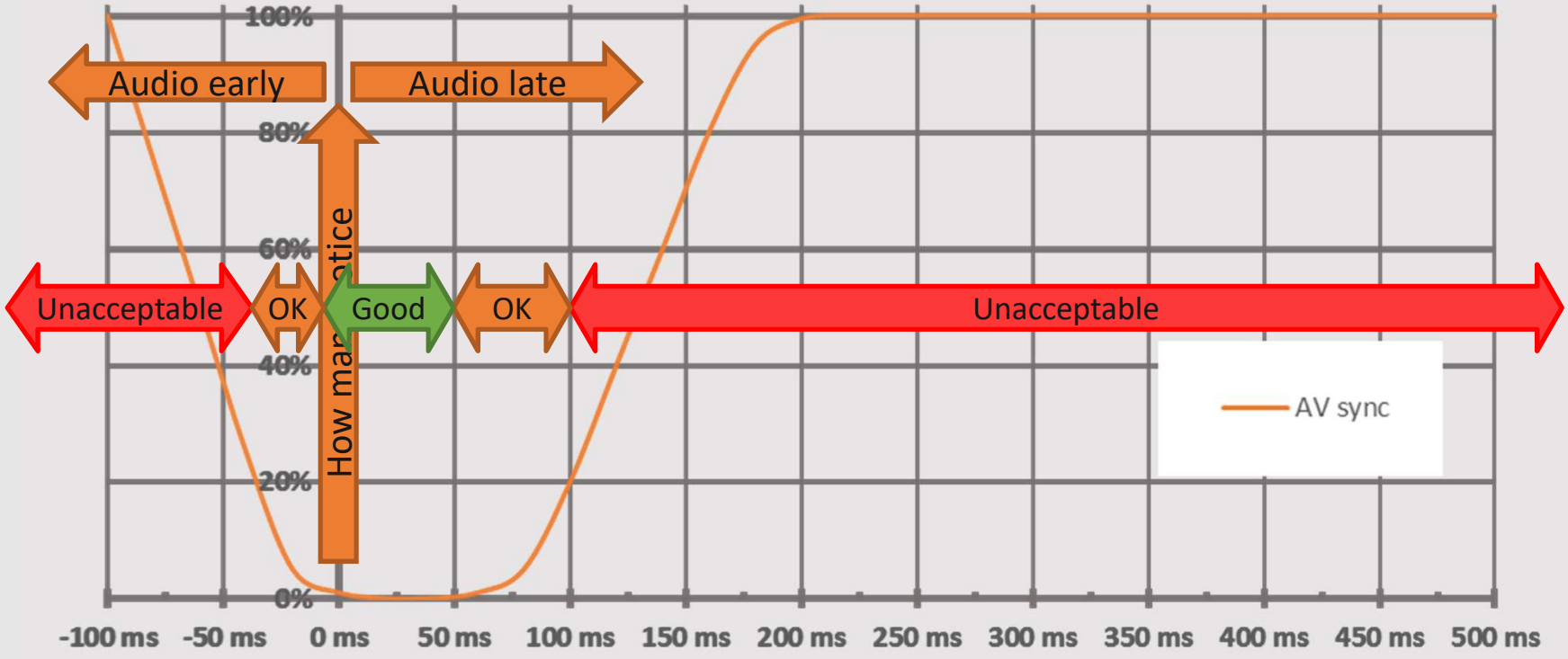
Maintaining the illusion

Maximum timing error 10µs

Maximum timing error 10ms

BBC

Human perception



BBC

Virtual Reality

Synchronised ~1ms

BBC

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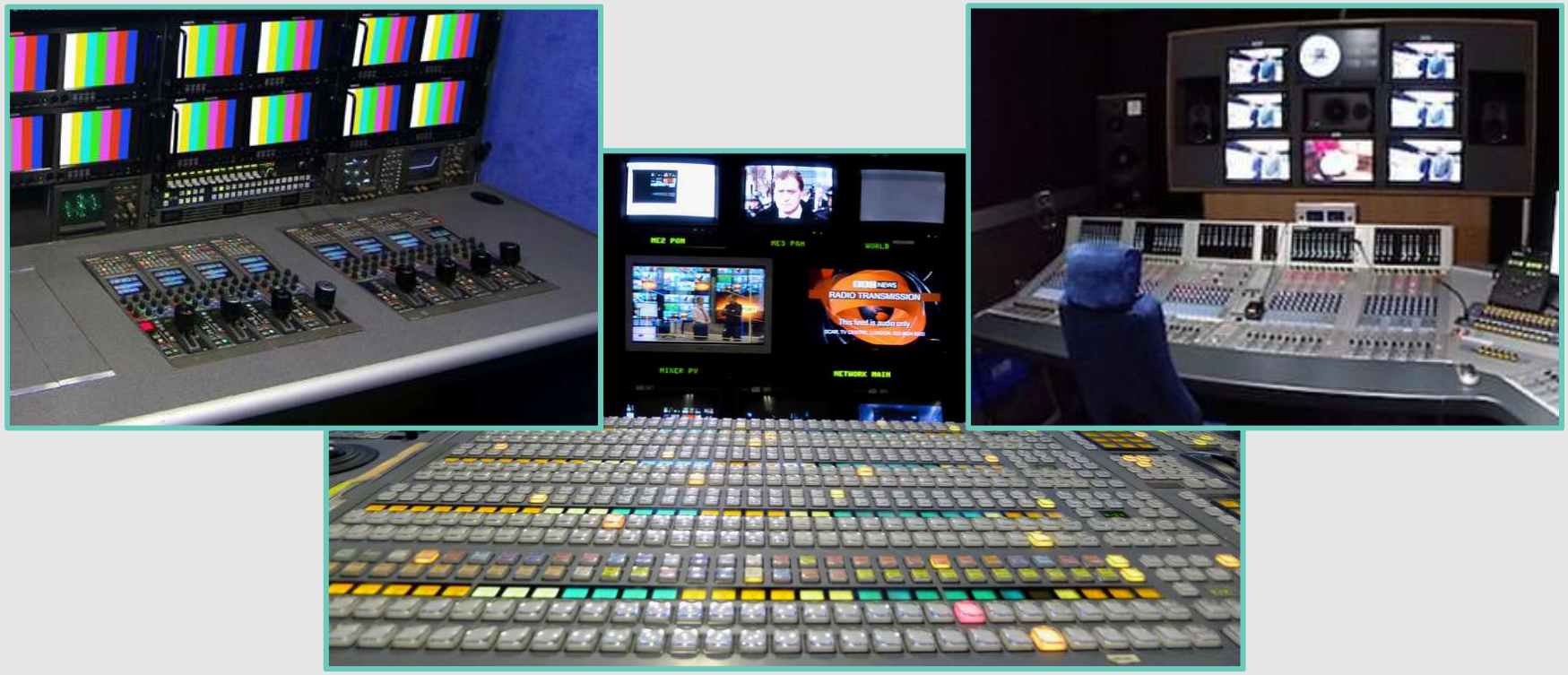
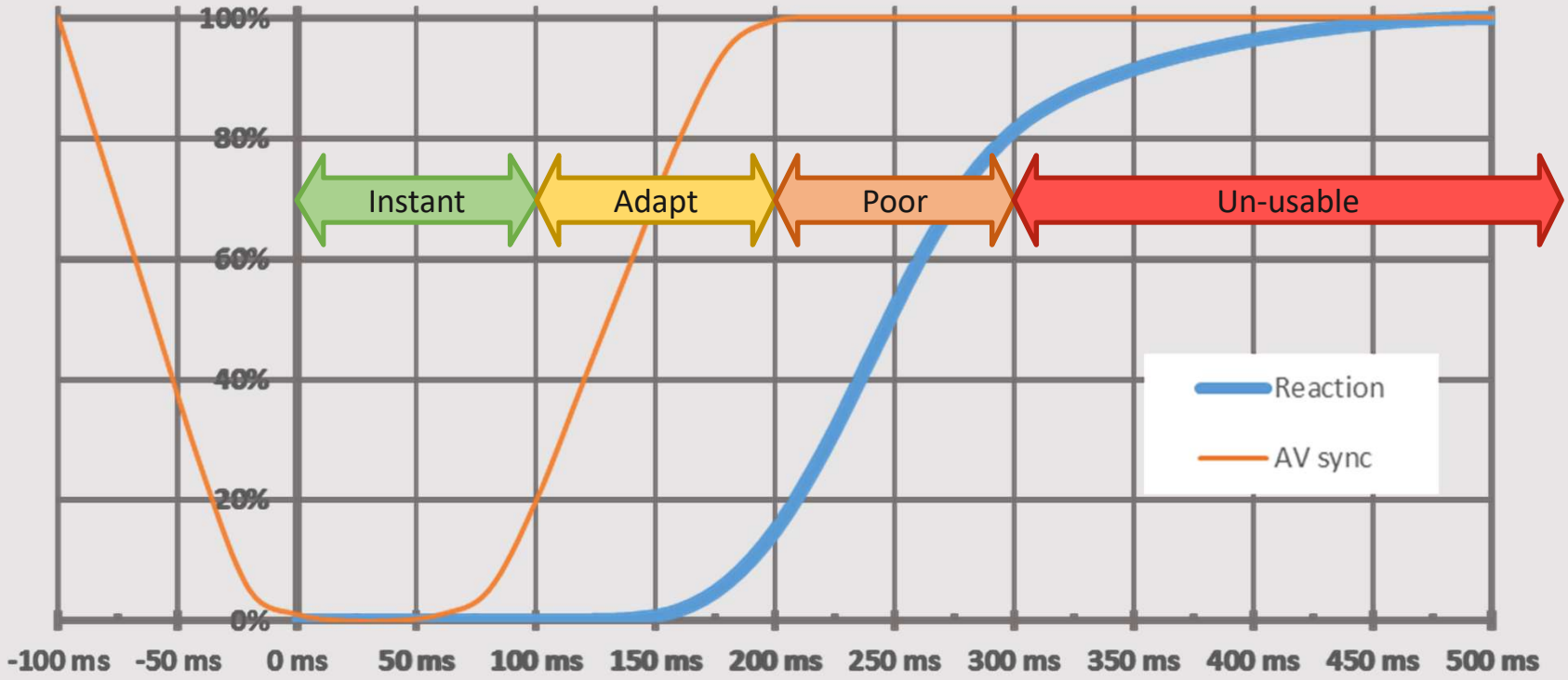
Making the programme



by Martin Deutsch

BBC

Operators



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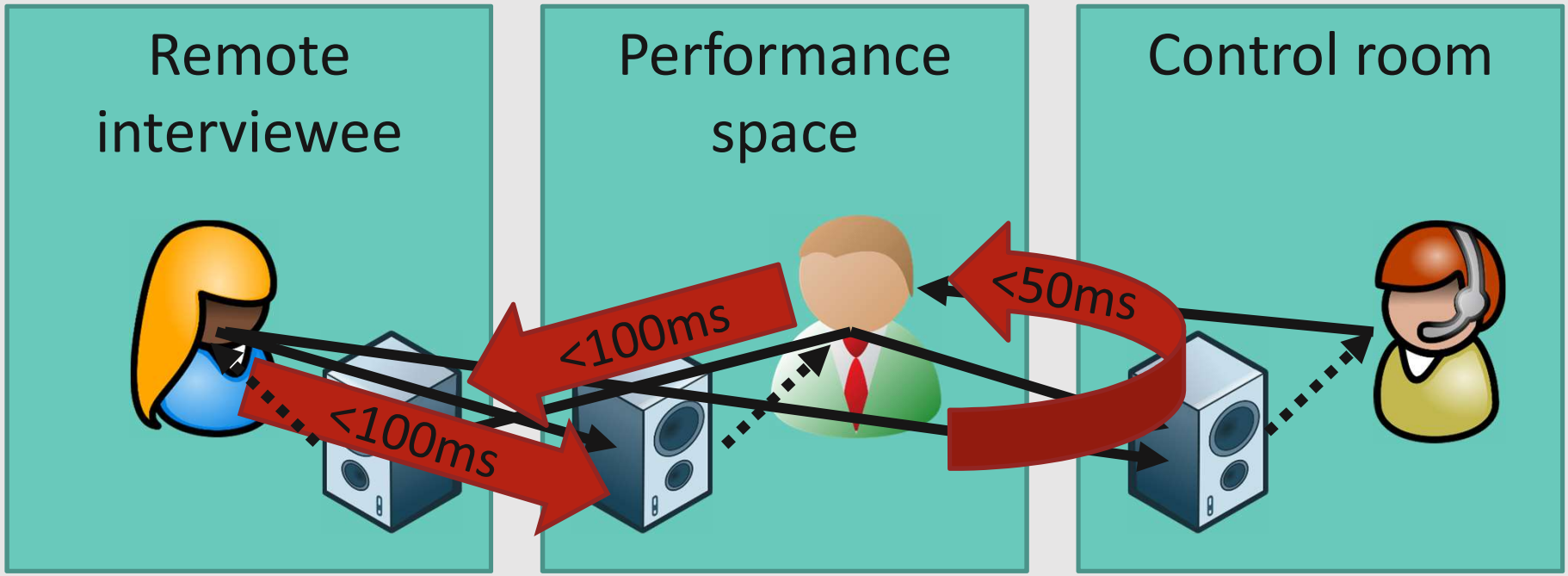
The Production Team



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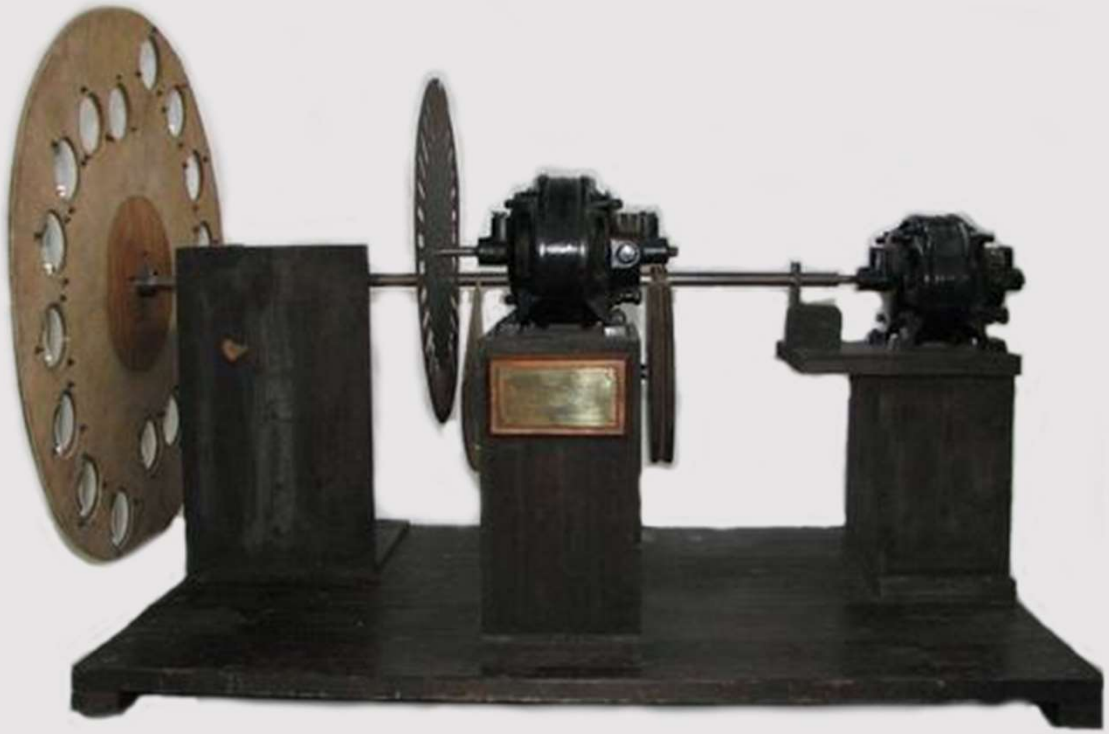
Fundamentals of television



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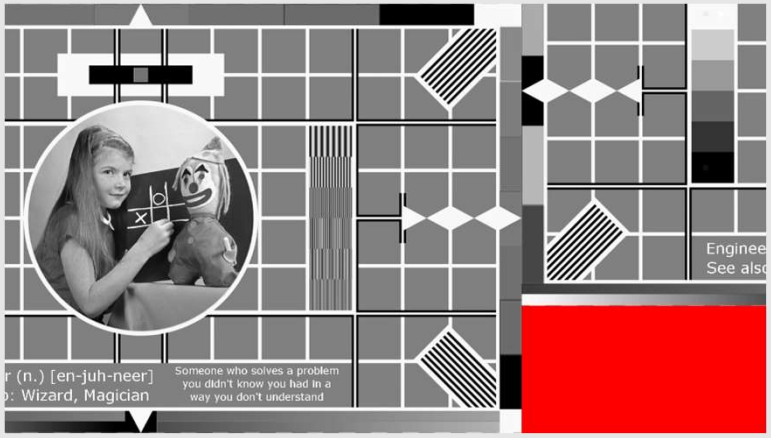
Time as a proxy for position



Maximum timing error ~1µs

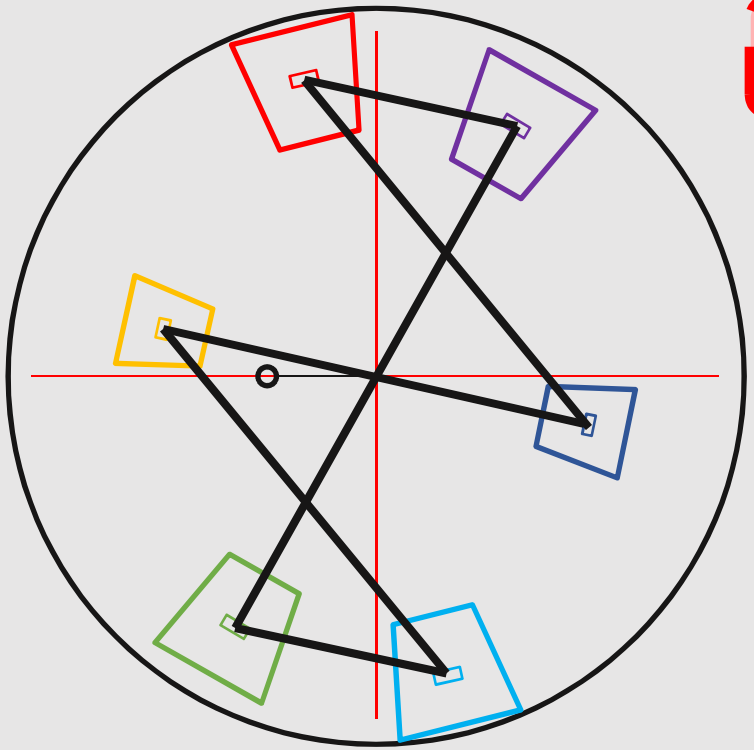
Top left

Middle

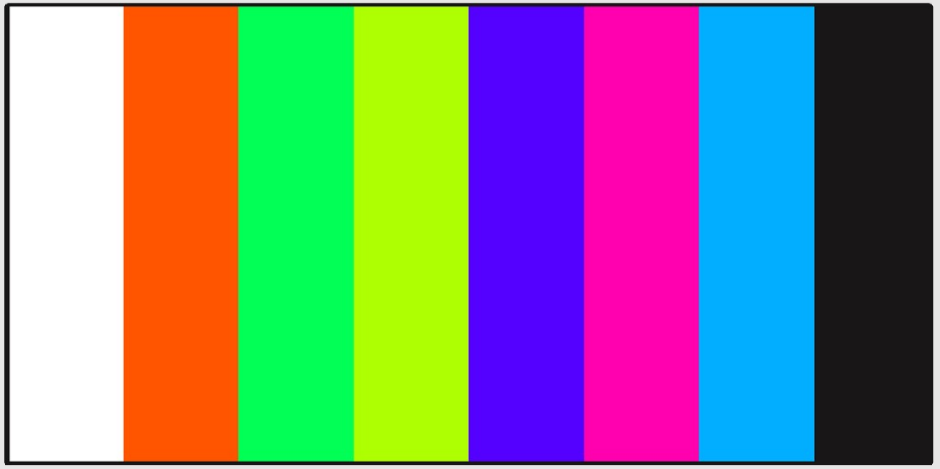
Bottom right

BBC

Timing as a proxy for Colour (NTSC)

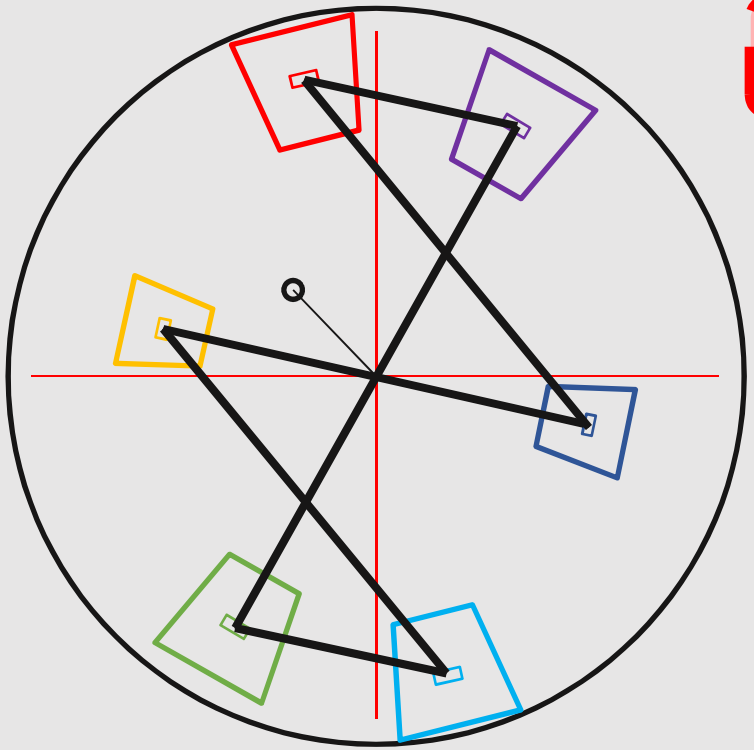


Maximum timing error ~1ns

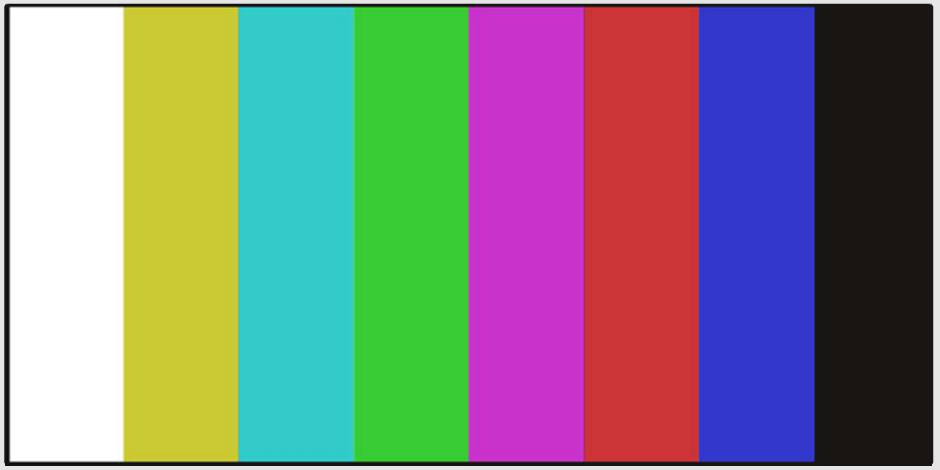


BBC

Timing as a proxy for Colour (PAL)



Maximum timing error ~4ns



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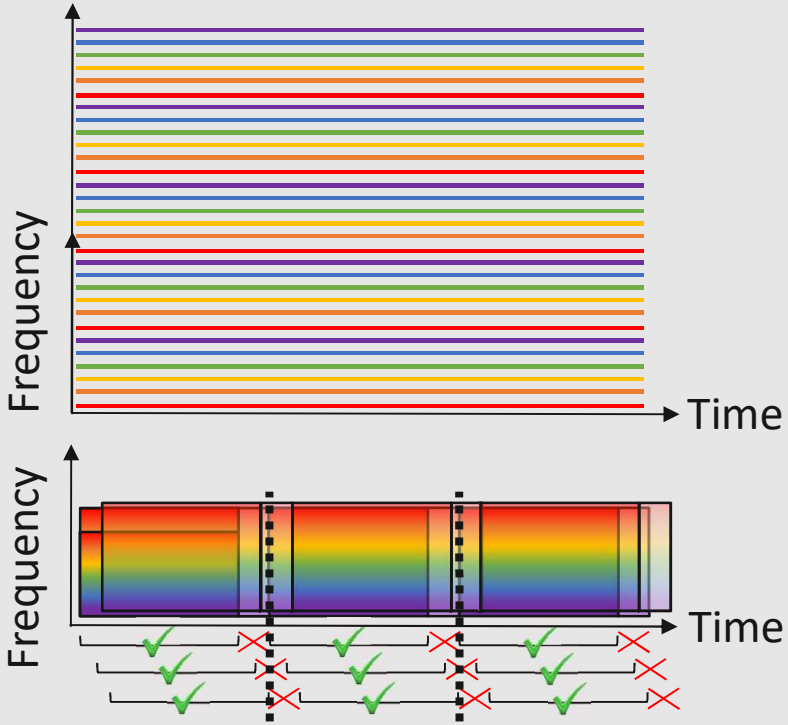
Delivery to the Audience



Transmitter synchronisation error of 10-300µs

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What if it all goes wrong?

26th January 2016

- GPS SVN23 anomaly

26th January 2017

- GPS Tx power increased

Security of external time sources

- Does the time make sense?
- Three-way comparison
- Malicious actors – jammers and spoofers

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How do broadcasters keep time?

Local clocks synced using GNSS	Local clocks synced to terrestrial transmitters	Carefully calibrated, equal length cables
Manually adjustable delay lines	Automatically adjustable delays *(FrameSyncs)*	Design systems to tolerate timing errors

BBC

Why accurate timing is important

The audience perspective	• The schedule, especially live events • Splits and joins
Maintaining the illusion	• Cutting between cameras • Audio “image”
Making the programme	• Operators • Presenters
Technical considerations	• Time is not position/colour • Transmitter synchronisation
How do broadcasters solve the problem(s)?	• Local clocks adjusted by external references • Loose coupling

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