Unified Content Delivery on Fixed and Mobile Networks

A view of synchronous TV delivery

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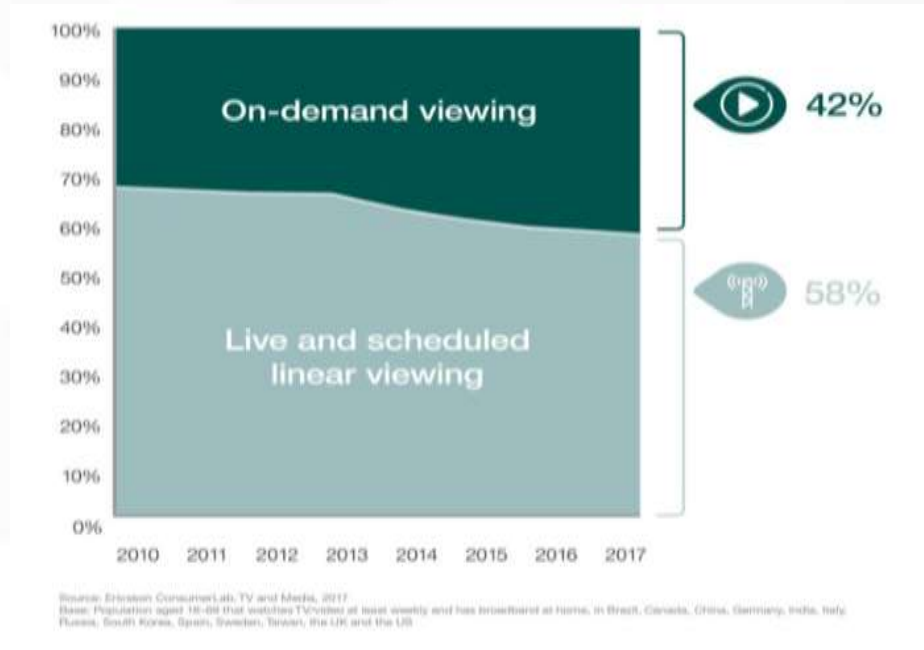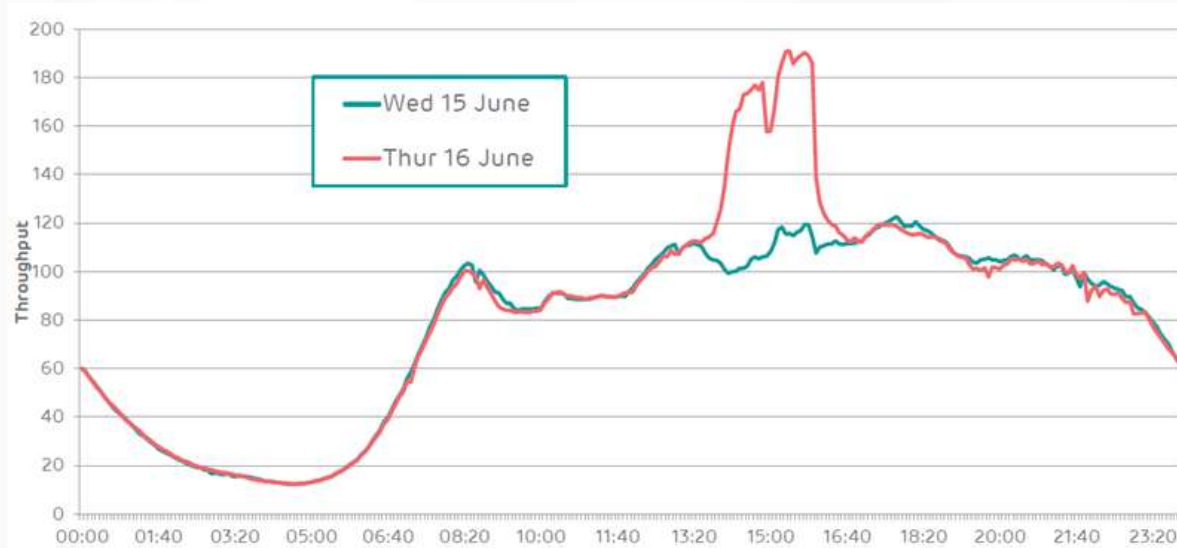
Observations on content consumption

Linear TV in decline

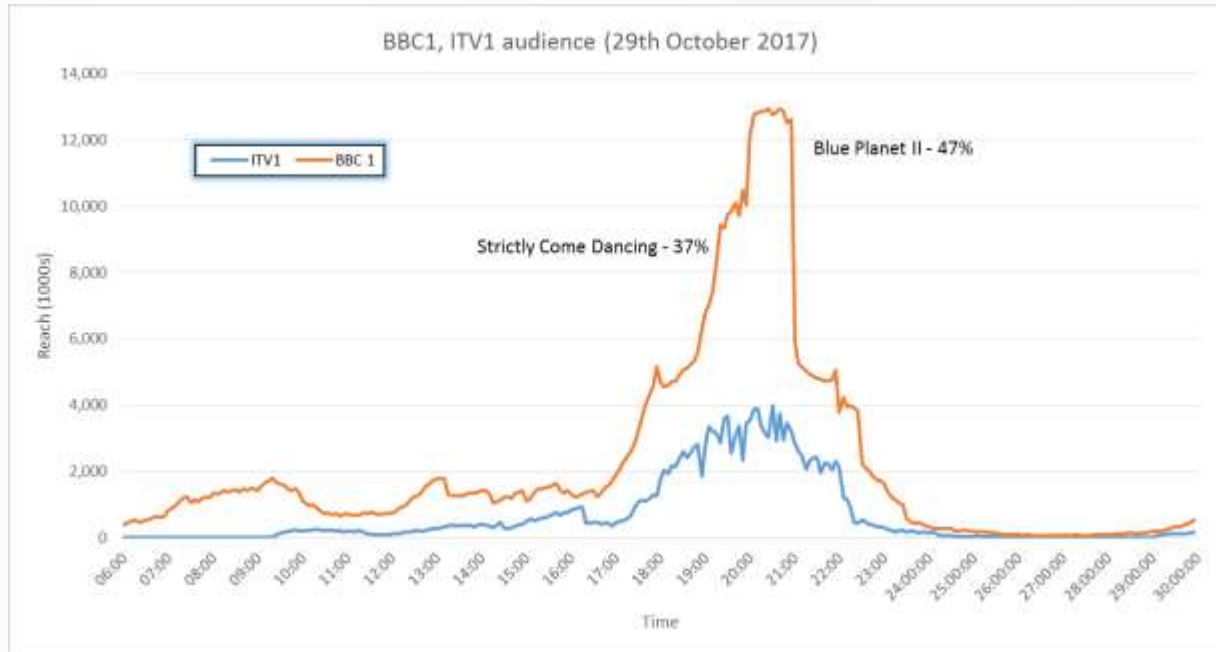Active viewing hours of on-demand vs live and scheduled linear TV

Live audiences are very dynamic

Traffic volumes over the EE network during the England vs. Wales football match during Euro16 compared with the previous day.

# "Appointment to view" broadcast audiences are very dynamic

BBC1, ITV1 audience (29th October 2017)

Blue Planet II - 47%

Strictly Come Dancing - 37%

And VOD too…

Appointment to view VoD has a similar profile to live and linear with a huge spike in demand when initially released

Consumers want to watch together and engage in social media commentary and

Traffic profile would suit carousel broadcast and/or push prepositioning
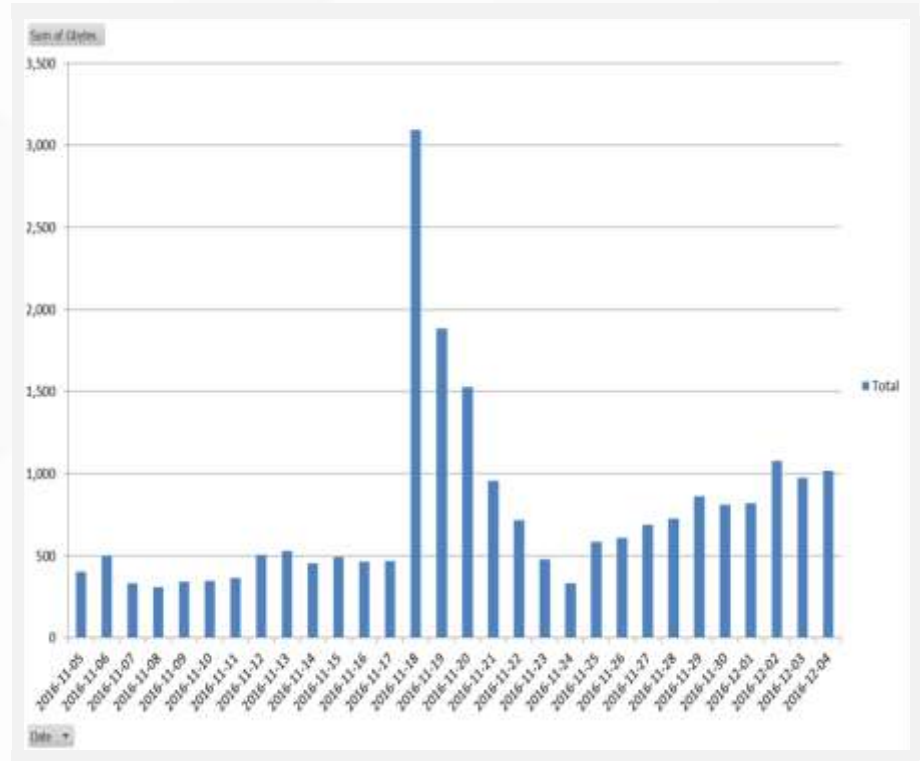
Observations

- **Concurrent viewing of popular events drives traffic volumes**
  - It doesn't just change what people are doing, it drives overall demand volumes
- **This creates a capacity planning challenge**
- **Broadcast and multicast can help manage peaks and simplify capacity management**

How to deliver event-based content?

Two worlds

Traditional Broadcast

- Only supports TV
- Optimised network for national coverage of popular content
- Highly efficient use of spectrum for simultaneous delivery at edge of network
- High barrier to provisioning a new service
- Only support linear delivery
- One-size fits all

Internet

- Supports many services
- Non-optimised network for global coverage
- Unicast at edge of network inefficient for simultaneous delivery
- Very low barrier to provisioning a new service
- Supports linear and on-demand
- Highly customisable
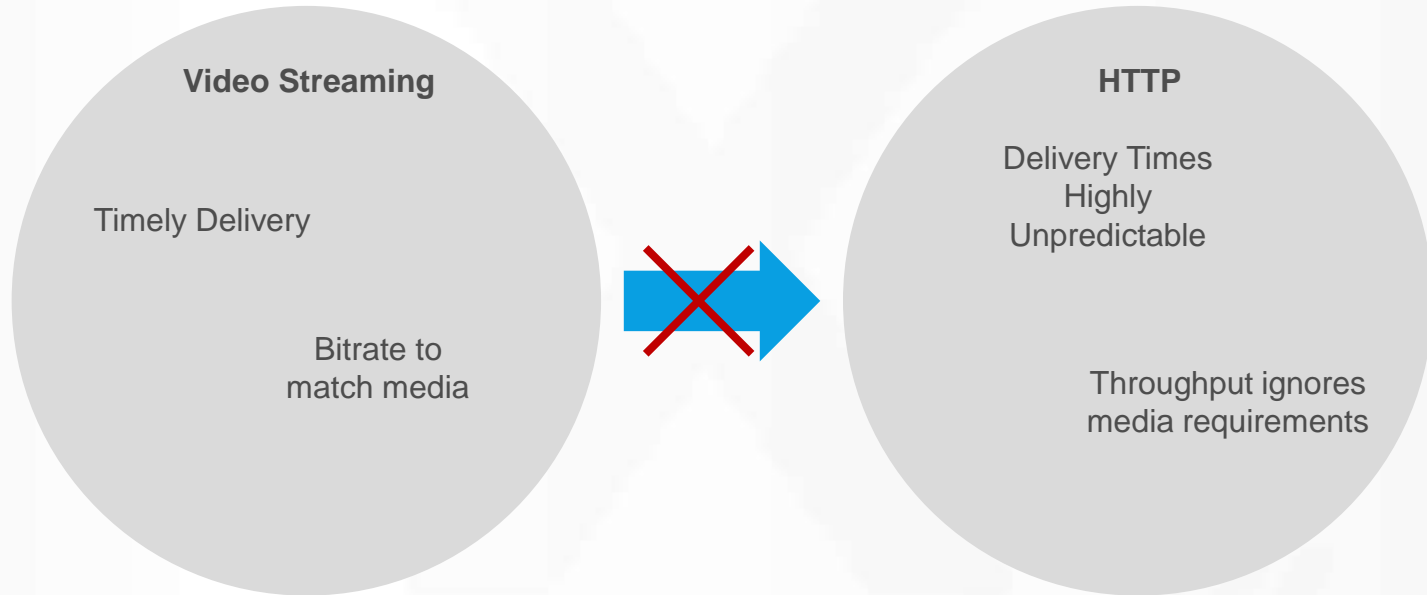
The rise of the global platforms

Content Delivery Networks
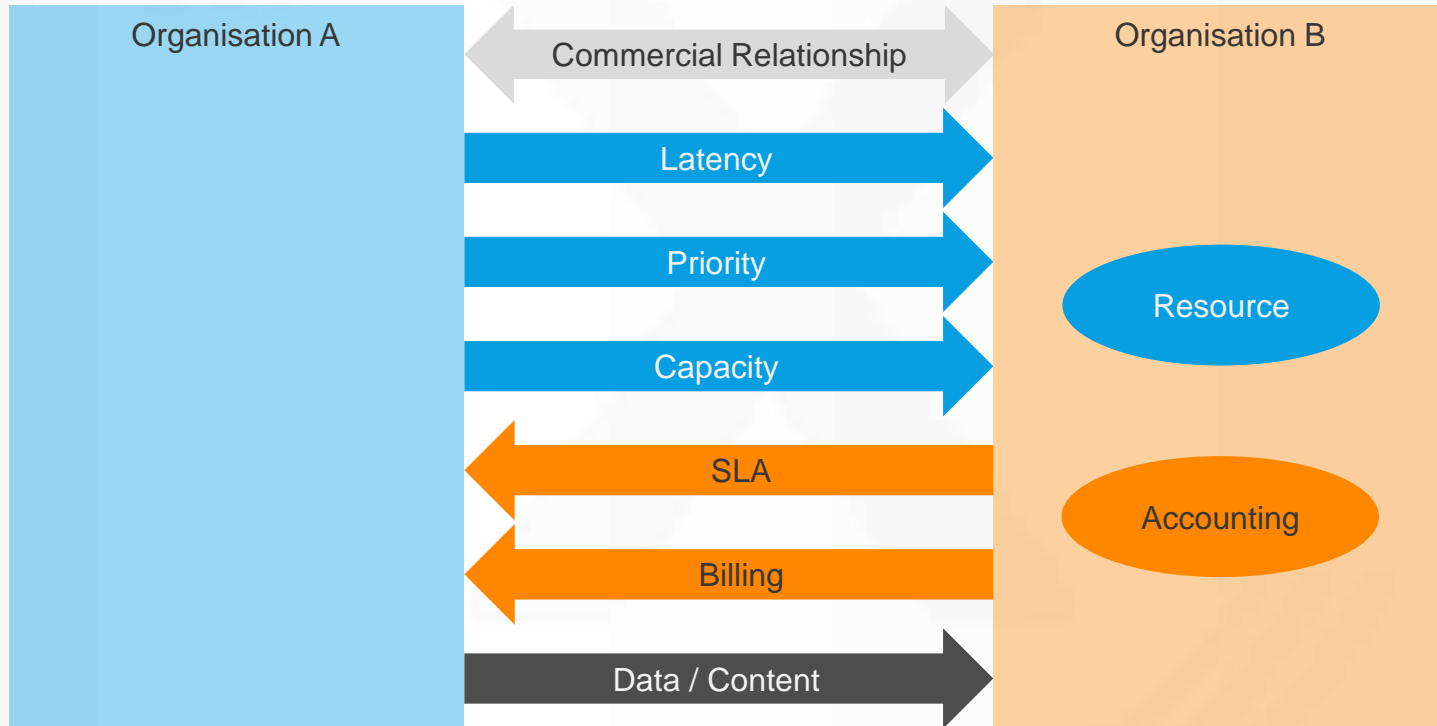
Global Platforms Use HTTP

- **Generic technology is good**
- **Non-specialist commoditised servers**
- **Readily passes through firewalls**
- **Don't require specialist software or licences**
- **It's the cheapest option!**

But… HTTP Sub-optimal

Video Streaming

Timely Delivery

Bitrate to
match media
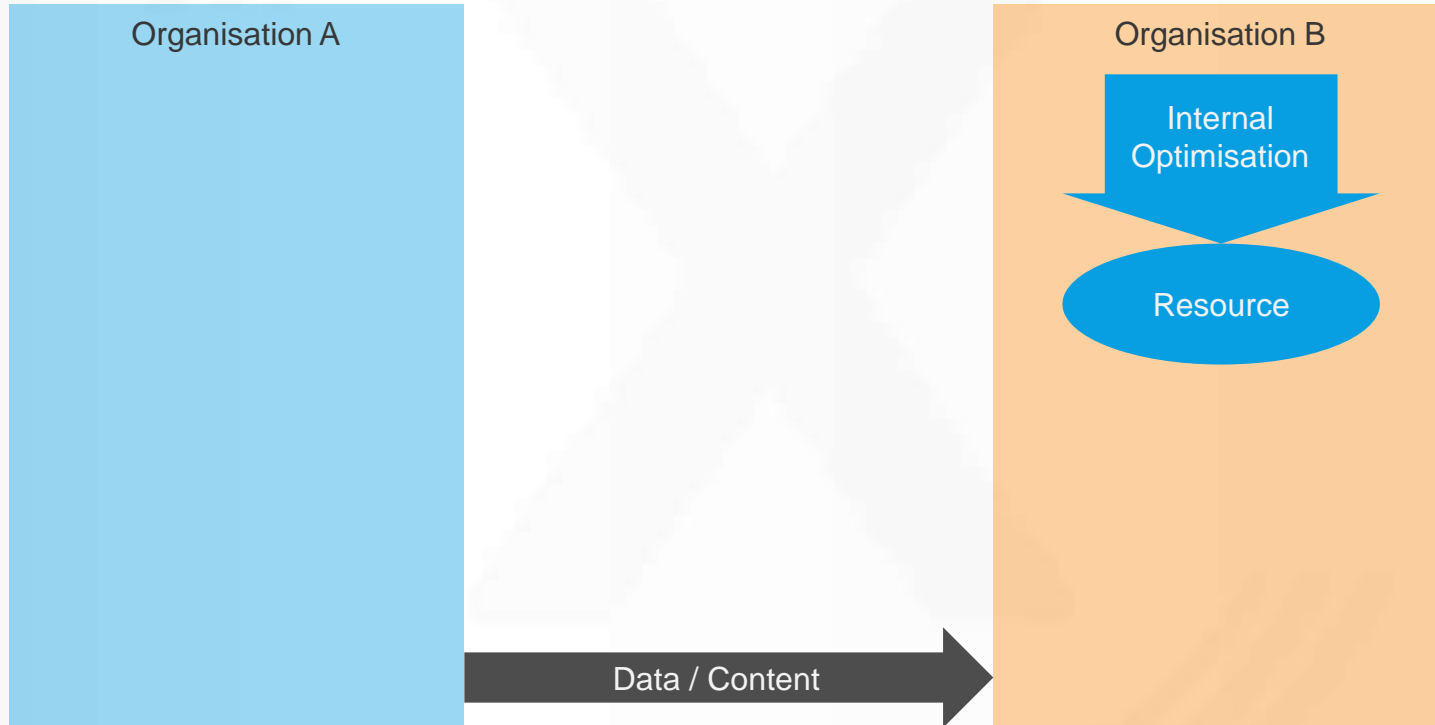
HTTP

Delivery Times
Highly
Unpredictable

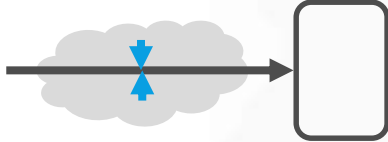Throughput ignores
media requirements

What went wrong?
Why not UDP + QoS?
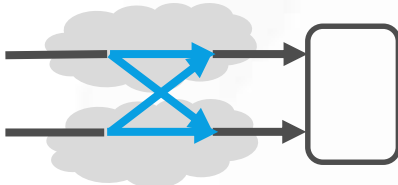
Cross-organisational resource reservation is challenging

Organisation A

Commercial Relationship

Latency

Priority

Capacity

SLA

Billing

Data / Content

Organisation B

Resource

Accounting

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Prefer Autonomous Resource Allocation

Clever apps not clever networks

	Clever Network	Clever App
Throughput Variation	Guaranteed Bandwidth	Adaptive Bitrate Streaming ABR
Network Handover	Complex Network Handover	Streaming Buffer Management Buffer

NSP needs capacity for many unicast streams

Content Service Provider

Content Delivery Network

Network Service Provider

End User

Each user served their own unicast stream causing duplications and unnecessary load
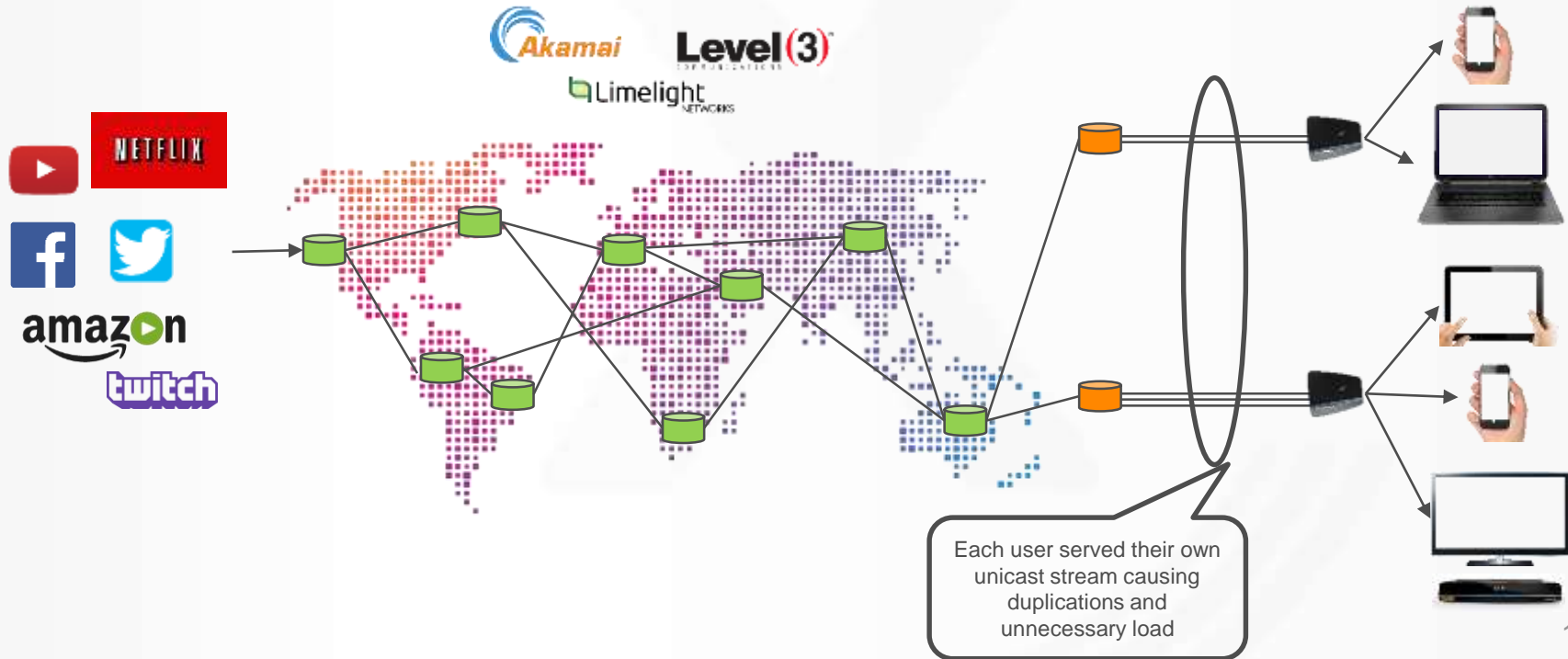
Best of both: CDN for global - dynamic selection of multicast at edge

Multicast or broadcast can be used to save capacity when streams are the same

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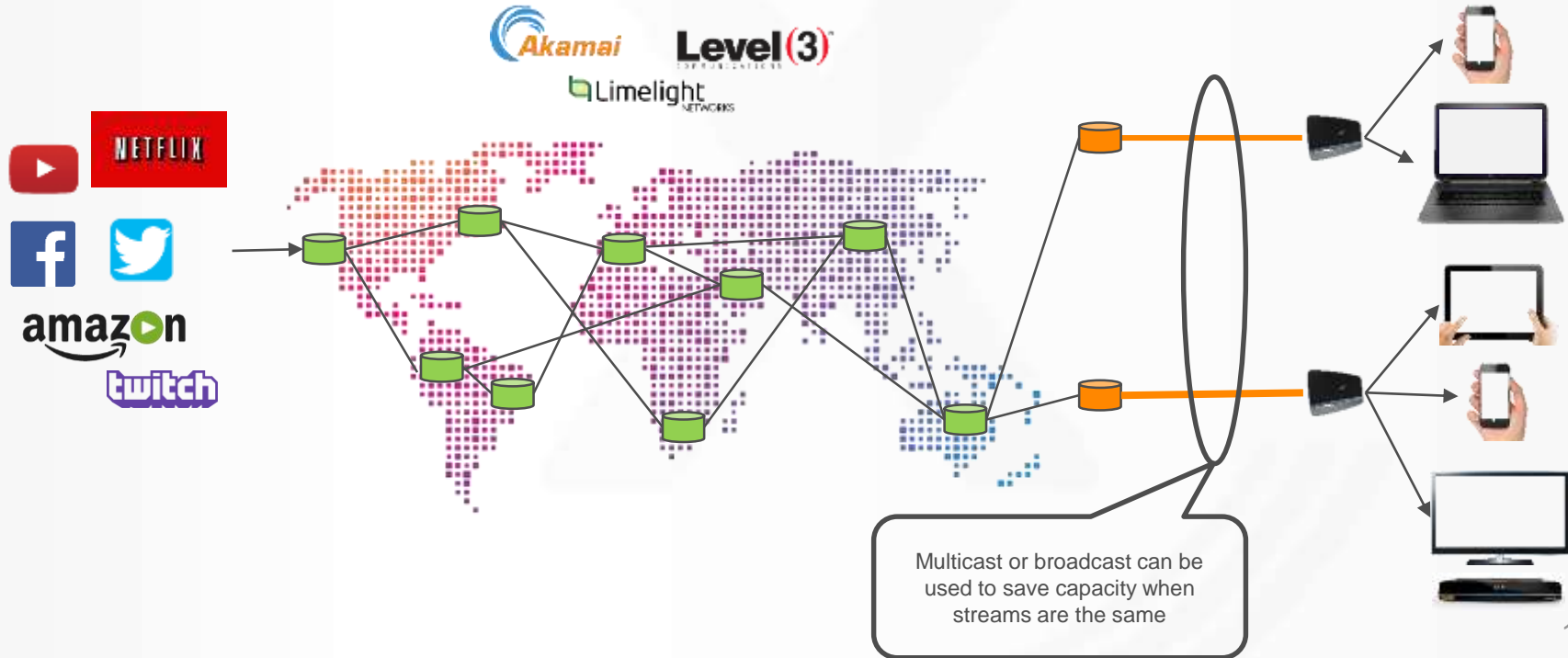
Content Delivery Framework Design Principles
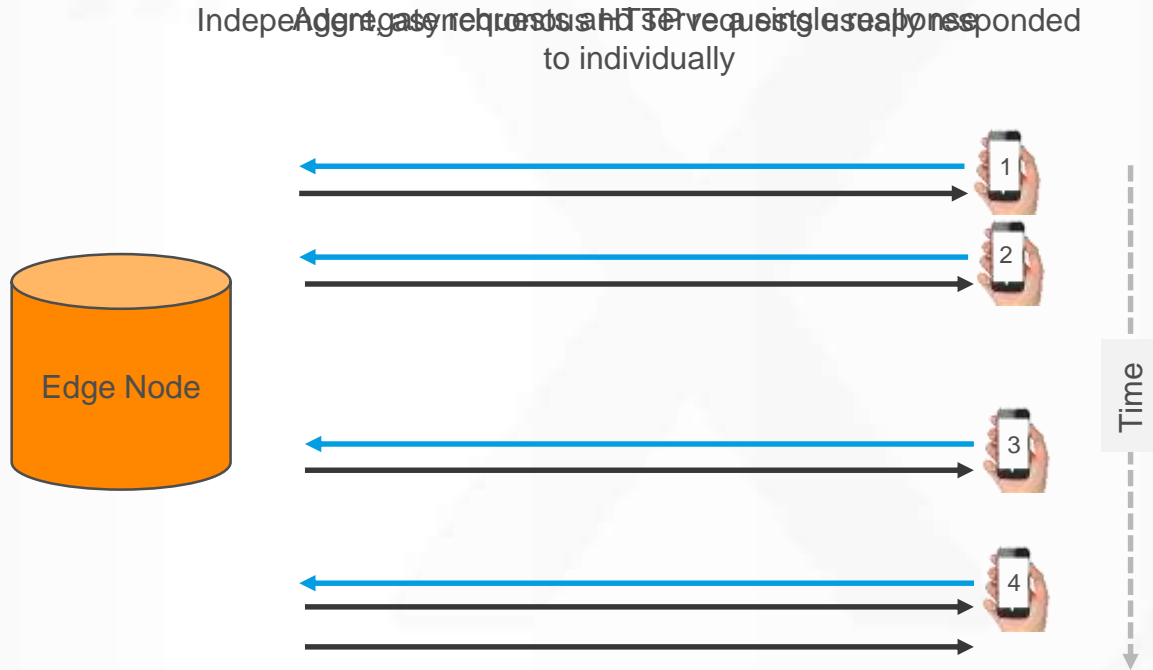
- **Combine CDN for global reach with multicast/broadcast for edge optimisation**

- **Multicast/broadcast as internal network optimisation, rather than service to be sold**

- **Servers and client applications work with unicast with standard Internet protocols (HTTP)**

- **Application layer intelligence preferred over network signalling**

Unified Content Delivery - Challenges

Synchronous Delivery of Asynchronous requests

Independent asynchronous HTTP requests usually responded to individually

Aggregate requests and serve using a single response

Edge Node

Time

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Quality control

- **How do we keep end to end delay low enough for live?**
- **How do we make it work with ABR?**

CDN delays   UC/MC conversion   MC/UC conversion   Streaming buffer
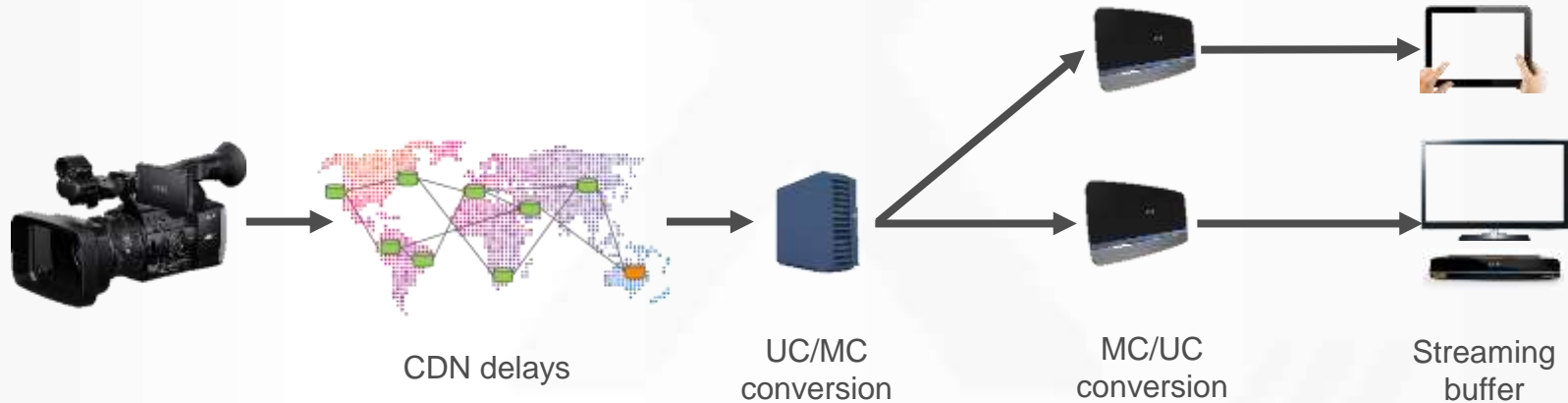
Security and Trust

- **How do will it work when the content and/or transport is encrypted?**
- **Need to avoid having visibility of content internals**

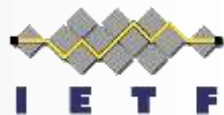CDN delays   UC/MC conversion   MC/UC conversion   Streaming buffer
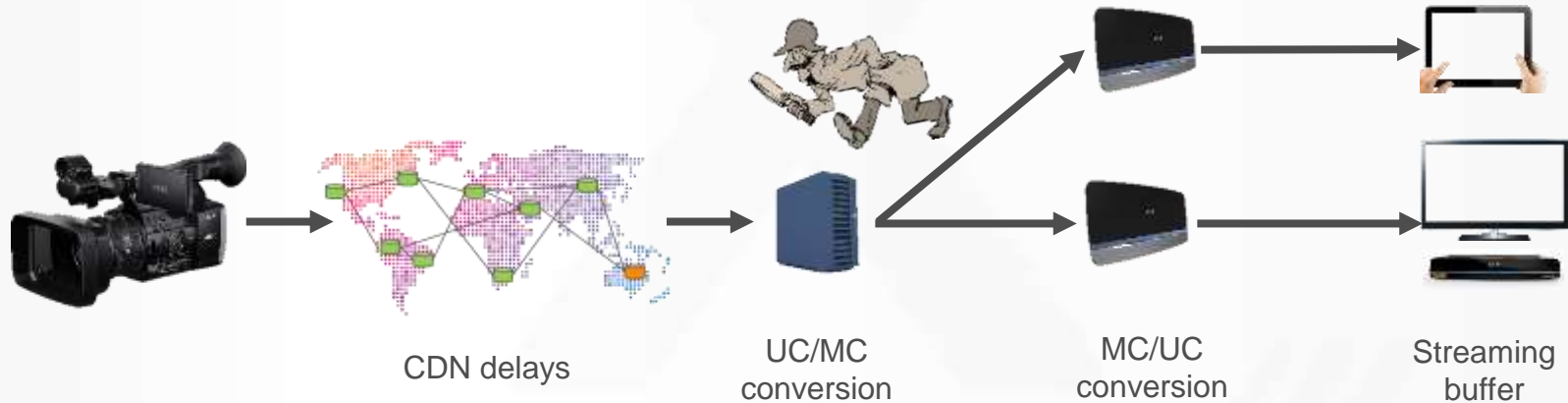
Standards activity

3GPP A GLOBAL INITIATIVE — Significant update to Multicast operation on Demand (MooD) in Release 14

CableLabs — IP Multicast Adaptive Bitrate

DVB Digital Video Broadcasting — Developing Multicast ABR standard

IETF — Relevant IP standards (e.g. media encapsulation, HTTP(S), multicast etc.)

The key takeaways

- **We can combine global CDNs with multicast and broadcast at the edge of the network to get the best of both worlds**

- **To make multicast and broadcast easy products to use, it should be possible to treat them as an internal optimisation capability, rather than a service to be sold**

- **We should beware trying to "add value" to the network by over-complicating its APIs.**

Any Questions ?