Unified Content Delivery on Fixed and Mobile Networks

A view of synchronous TV delivery

Steve Appleby, Tim Stevens and Rory Turnbull
British Telecommunications

5G-Xcast
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
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

<table>
<thead>
<tr>
<th>Traditional Broadcast</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Only supports TV</td>
<td>• Supports many services</td>
</tr>
<tr>
<td>• Optimised network for national coverage of popular content</td>
<td>• Non-optimised network for global coverage</td>
</tr>
<tr>
<td>• Highly efficient use of spectrum for simultaneous delivery at edge of network</td>
<td>• Unicast at edge of network inefficient for simultaneous delivery</td>
</tr>
<tr>
<td>• High barrier to provisioning a new service</td>
<td>• Very low barrier to provisioning a new service</td>
</tr>
<tr>
<td>• Only support linear delivery</td>
<td>• Supports linear and on-demand</td>
</tr>
<tr>
<td>• One-size fits all</td>
<td>• Highly customisable</td>
</tr>
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The rise of the global platforms

Live
- YouTube
- Facebook
- Amazon
- Twitch

On demand
- YouTube
- Facebook
- Netflix
- Amazon
- Twitch

Delivery
- Limelight Networks
- Akamai
- Level(3) Communications
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
Prefer Autonomous Resource Allocation

Organisation A

Organisation B

Data / Content

Resource

Internal Optimisation
Clever apps not clever networks

<table>
<thead>
<tr>
<th>Throughput Variation</th>
<th>Guaranteed Bandwidth</th>
<th>Adaptive Bitrate Streaming</th>
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<tbody>
<tr>
<td><strong>Clever Network</strong></td>
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<tr>
<th>Network Handover</th>
<th>Complex Network Handover</th>
<th>Streaming Buffer Management</th>
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NSP needs capacity for many unicast streams

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
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.
Quality control

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

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

- Significant update to Multicast operation on Demand (MooD) in Release 14
- IP Multicast Adaptive Bitrate
- Developing Multicast ABR standard
- 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 ?