The OTT Challenge

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The Akamai Intelligent Platform

The world's largest on-demand, distributed computing platform delivers all forms of web content and applications

The Akamai Intelligent Platform:

233,000+ Servers	3,600+ Locations	1,600+ Networks	1200+ Cities	131 Countries

Typical daily traffic:

- More than **3 trillion** requests served
- Delivering over **46 Terabits/second**

What is OTT?

What is OTT?

In broadcasting, *over-the-top content* (*OTT*) is the audio, video, and other media content delivered over the Internet without the involvement of a multiple-system operator (MSO) in the control or distribution of the content.

The Internet provider may be aware of the contents of the Internet Protocol (IP) packets but is not responsible for, nor able to control, the viewing abilities, copyrights, and/or other redistribution of the content. This model contrasts with the purchasing or rental of video or audio content from an Internet service provider (ISP), such as pay television,video on demand,and from internet protocol television (IPTV).

OTT refers to content from a third party that is delivered to an end-user, with the ISP simply transporting IP packets.

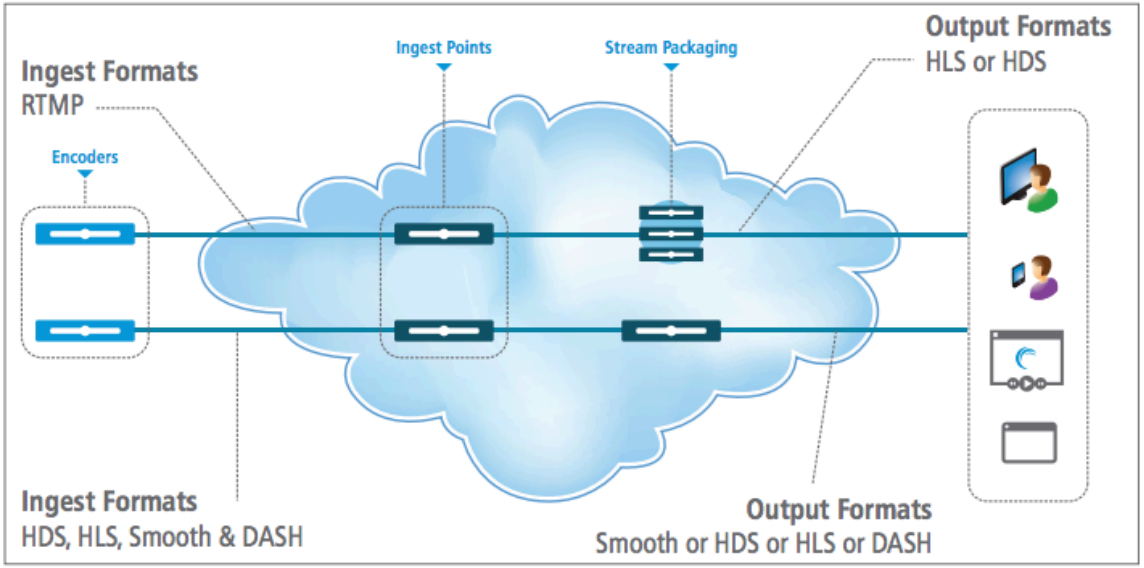
Quote from: https://en.wikipedia.org/wiki/Over-the-top_content

What is the challenge?

By definition, no single entity is responsible for the end to end quality.

For example:

- Broadcasters are responsible for Encoders
- CDN is responsible for Ingest Servers and Delivery
- Local carrier is responsible for First Mile and Last Mile
- End User is responsible for Device



What is the challenge?

Who is responsible for the performance?

All of us are the stake holders ☺

What are the Expectations?

End Users and Content Owner

End Users Expectations

- Access the video content from anywhere, any devices, anytime
  - Mobile network / Wifi / home broadband from subway, bus, café, home; etc
  - Multi-device such as Tablet, Phone, Set Top Box, Game Console, Laptop; etc
- Fast startup times and minimal delay
  - Video plays instantly
  - Minimal buffering time and delay
- Video quality comparable to Traditional / Linear TV
  - Higher bit rate e.g. HD / 4K / 8K
  - Minimal re-buffering or freezing

End Users Expectations

- Minimal/No Ads

- Personalised and Interactive video
  - Variety of content such as K-PoP, Japan Animation, Hollywood, Bollywood
  - Localised content such as language and culture
  - End user can consume or broadcast Live Streaming on gaming and daily life

- Minimal/No subscription fee

Content/Broadcaster Expectations

- Audience Engagement
  - Concurrent viewers, visits, plays, play duration, low abandonment rate
  - Personalize and Interactive Content

- Quality Video
  - Availability, startup time, re-buffering, bit rate

- Monetise Content / Traffic
  - Premium Content / Subscription Base
  - Target advertising

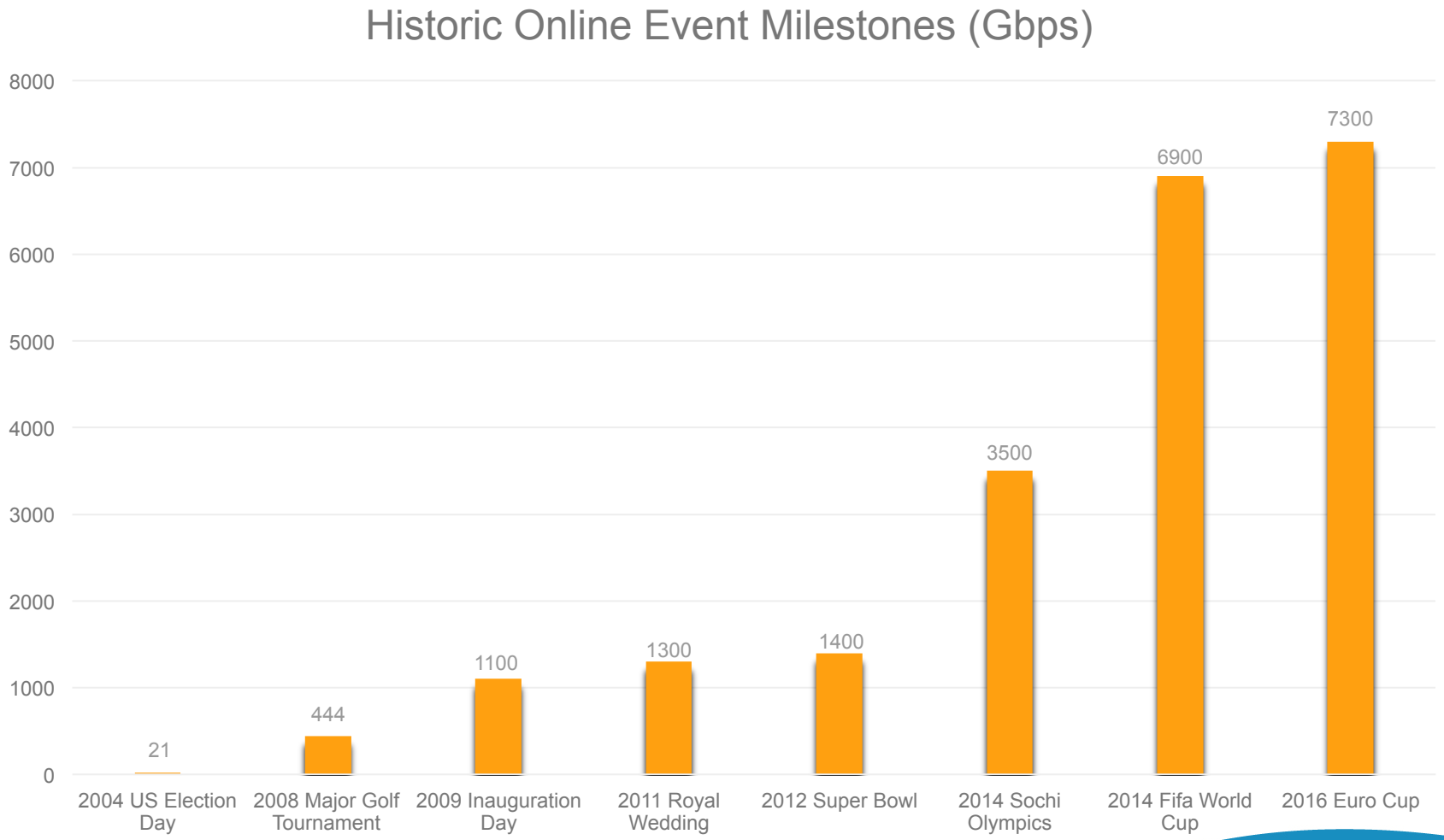
Content/Broadcaster Expectations

- Copyright Protection
  - DRM / Media Encryption / End to end SSL
- Support all devices, platforms and formats
  - Flash, Silverlight, iOS apps, Android and HTML5
- Scalable capacity for Traffic Spikes
  - Popular concert / sporting event / user generated live content
  - Popular drama series / movies launch
- Low Cost of delivery

The OTT Trend

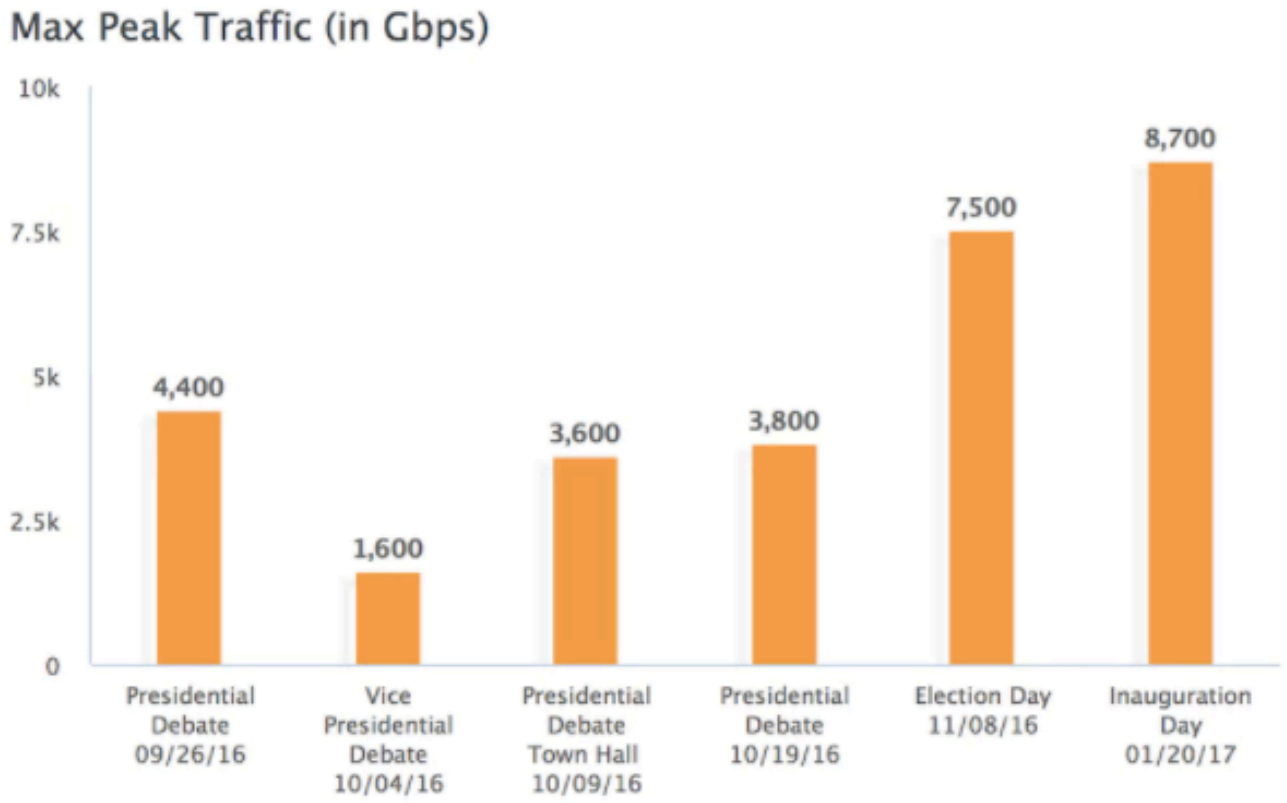
From Akamai Point of View

How big are the online events in the last decade?



How big are the online events recently?

JANUARY 20, 2017: INAUGURATING A NEW RECORD FOR LIVE VIDEO STREAMING
https://www.akamai.com/uk/en/media-and-delivery/us-election-debate-video-streaming.jsp



Peak Live Video Streaming Traffic (Gbps)

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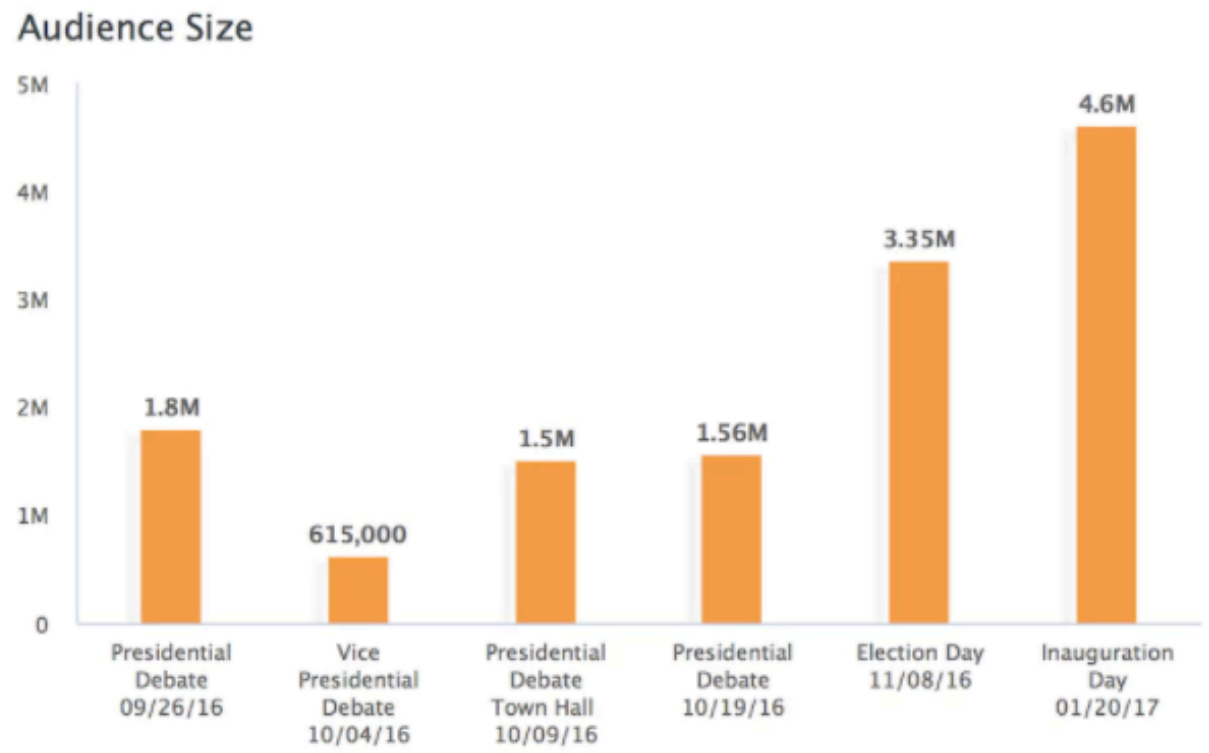


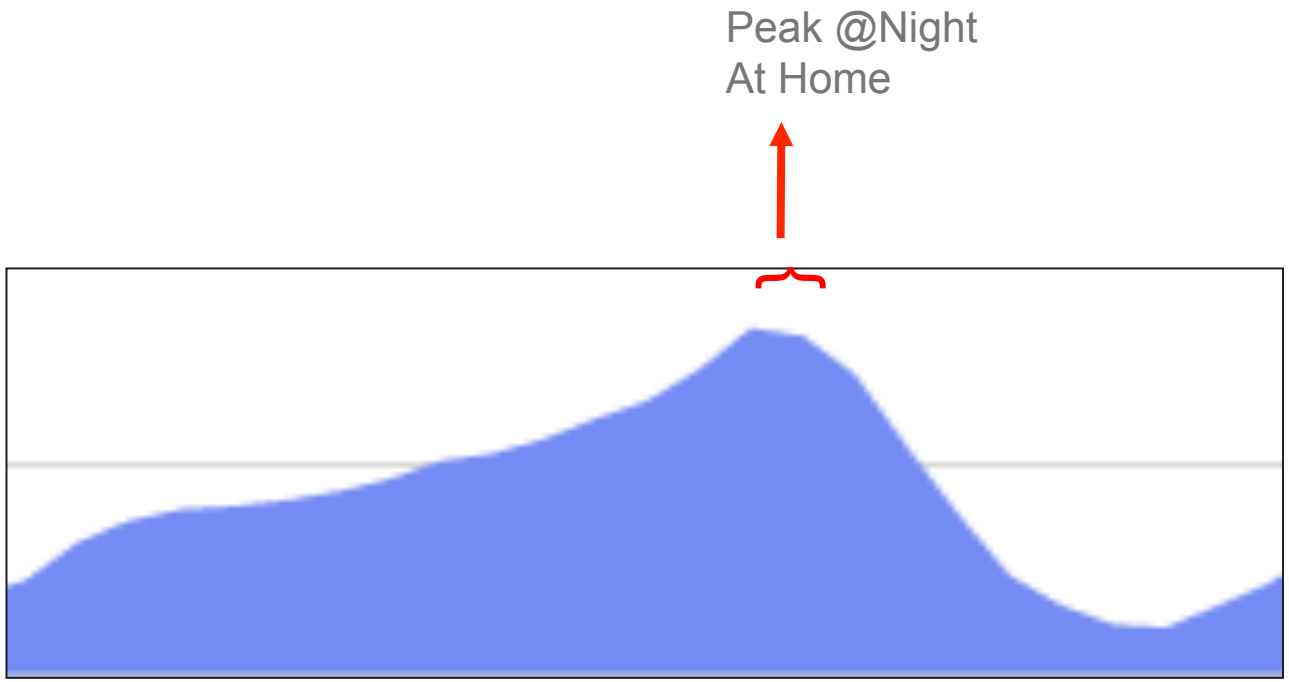
**estimated audience size at the time of publication*

Peak Concurrent Streams

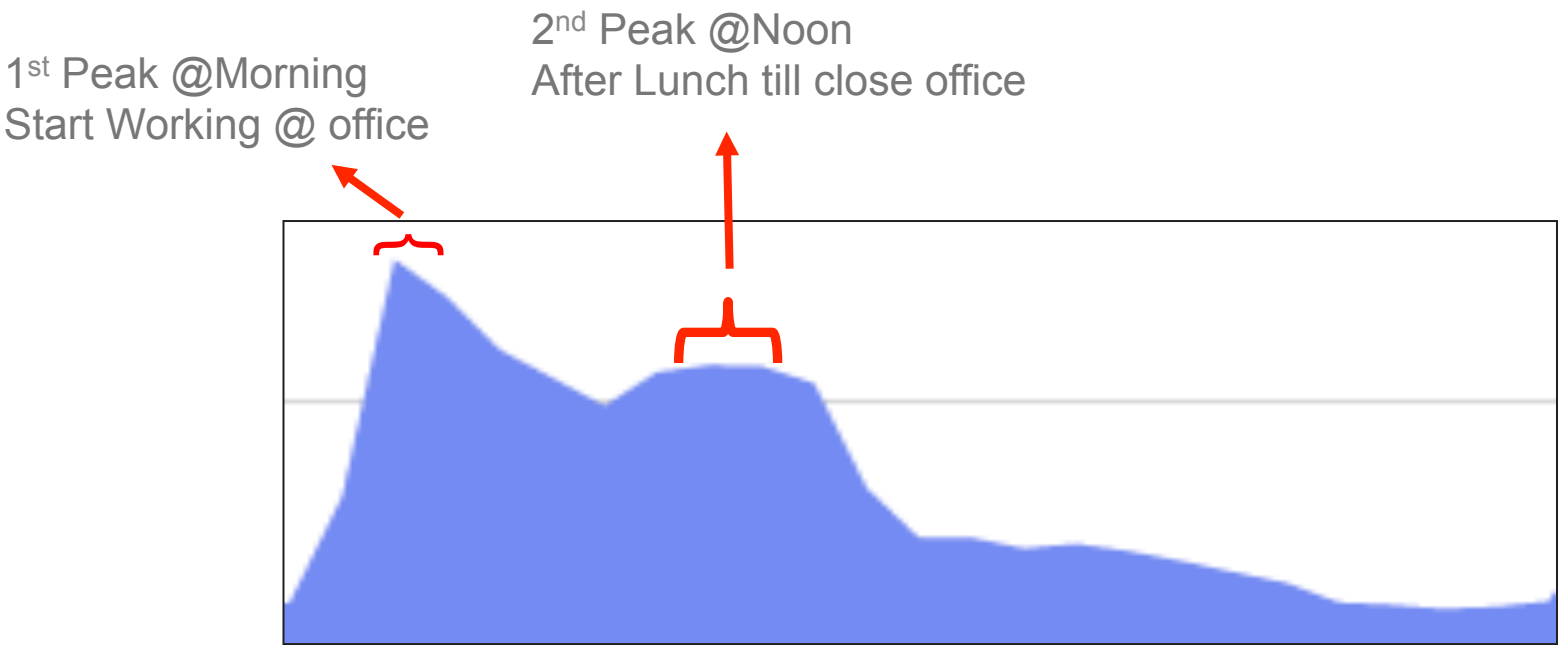
Transformation of Traffic Patterns

Classic Traffic Pattern

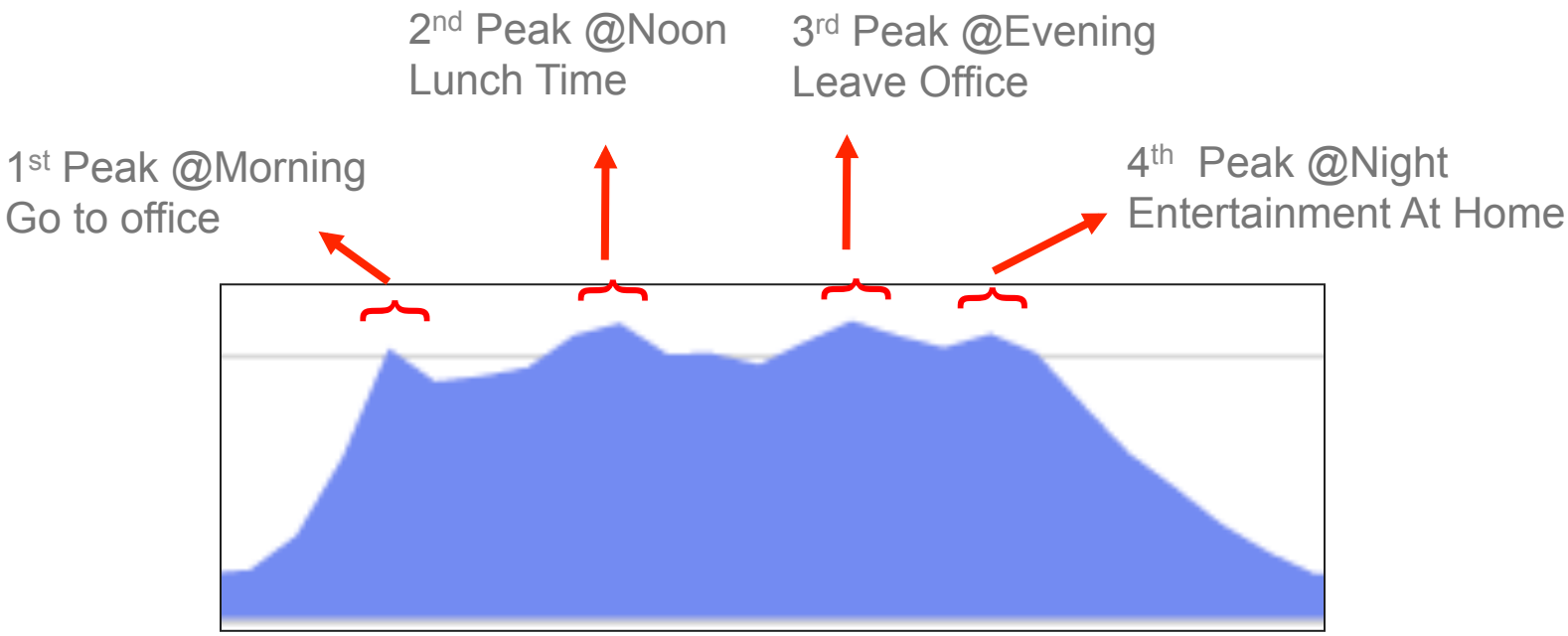
Classic Traffic Pattern : Residential Internet



Classic Traffic Pattern : Corporate Internet



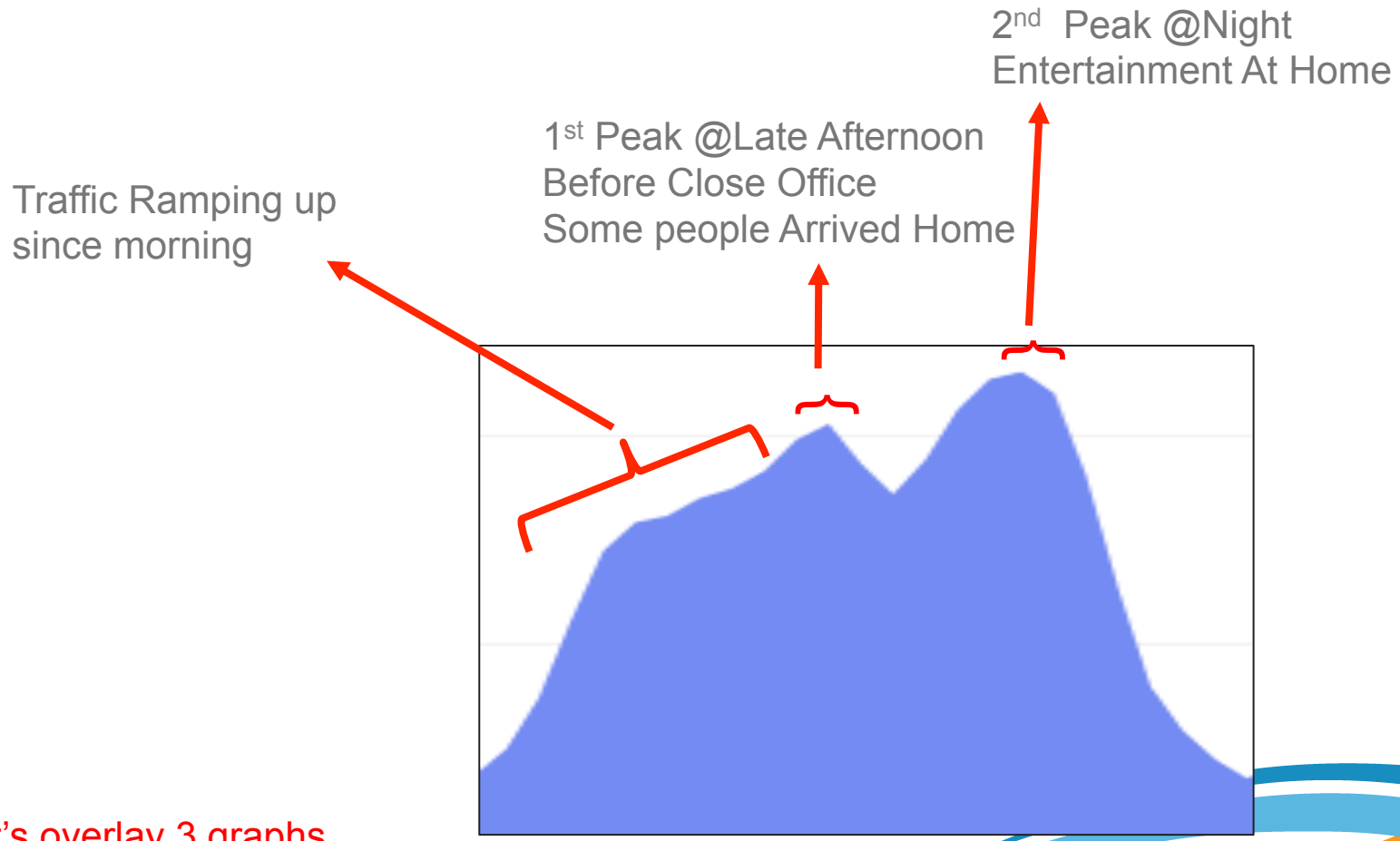
Classic Traffic Pattern : Mobile Internet



Classic Traffic Pattern : Residential + Corporate + Mobile

Classic Strategy

- Let's fully utilise the network by combining Residential, Corporate and Mobile Market



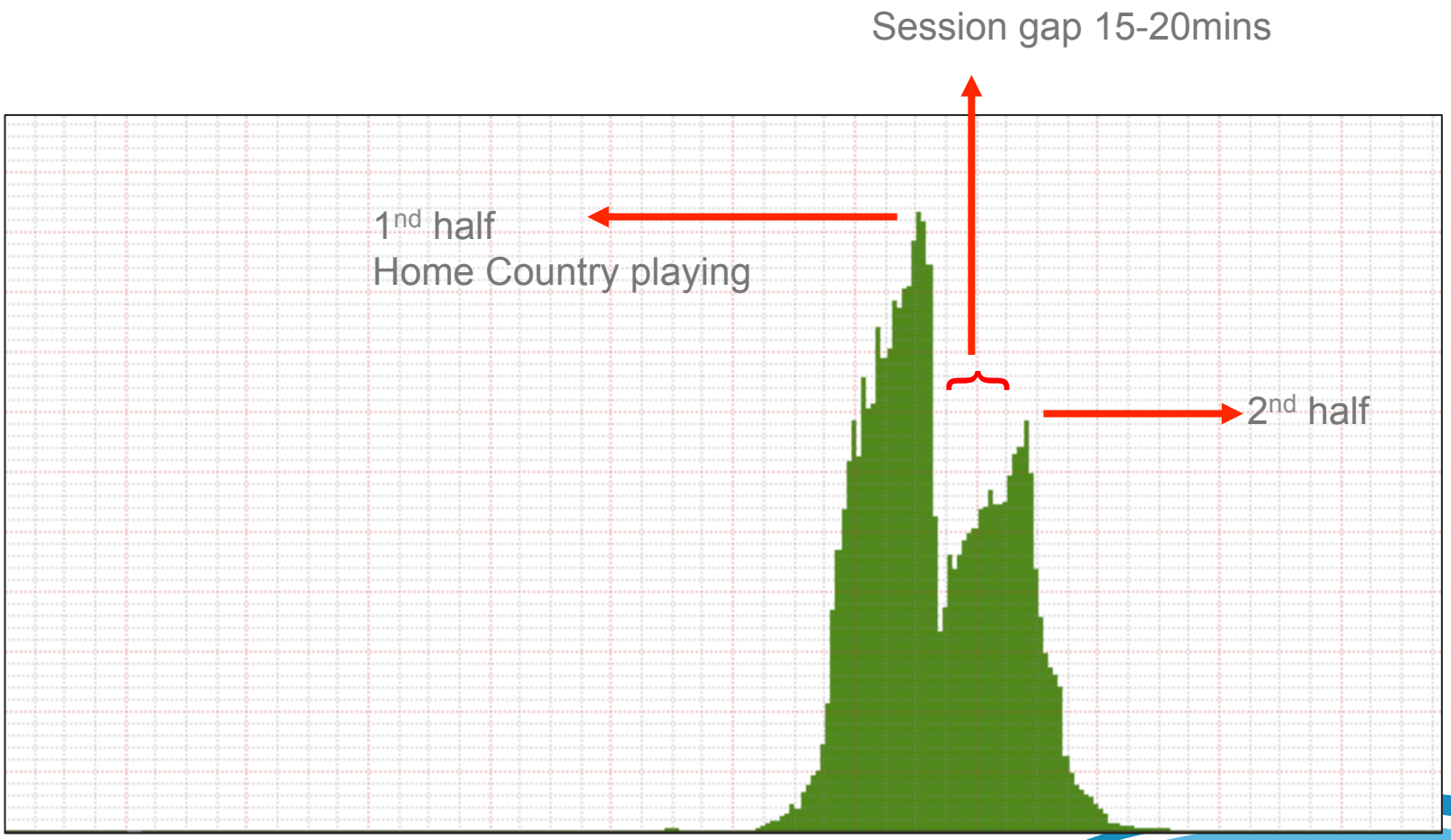
Let's overlay 3 graphs

Transformation of Traffic Patterns

New OTT Traffic Pattern

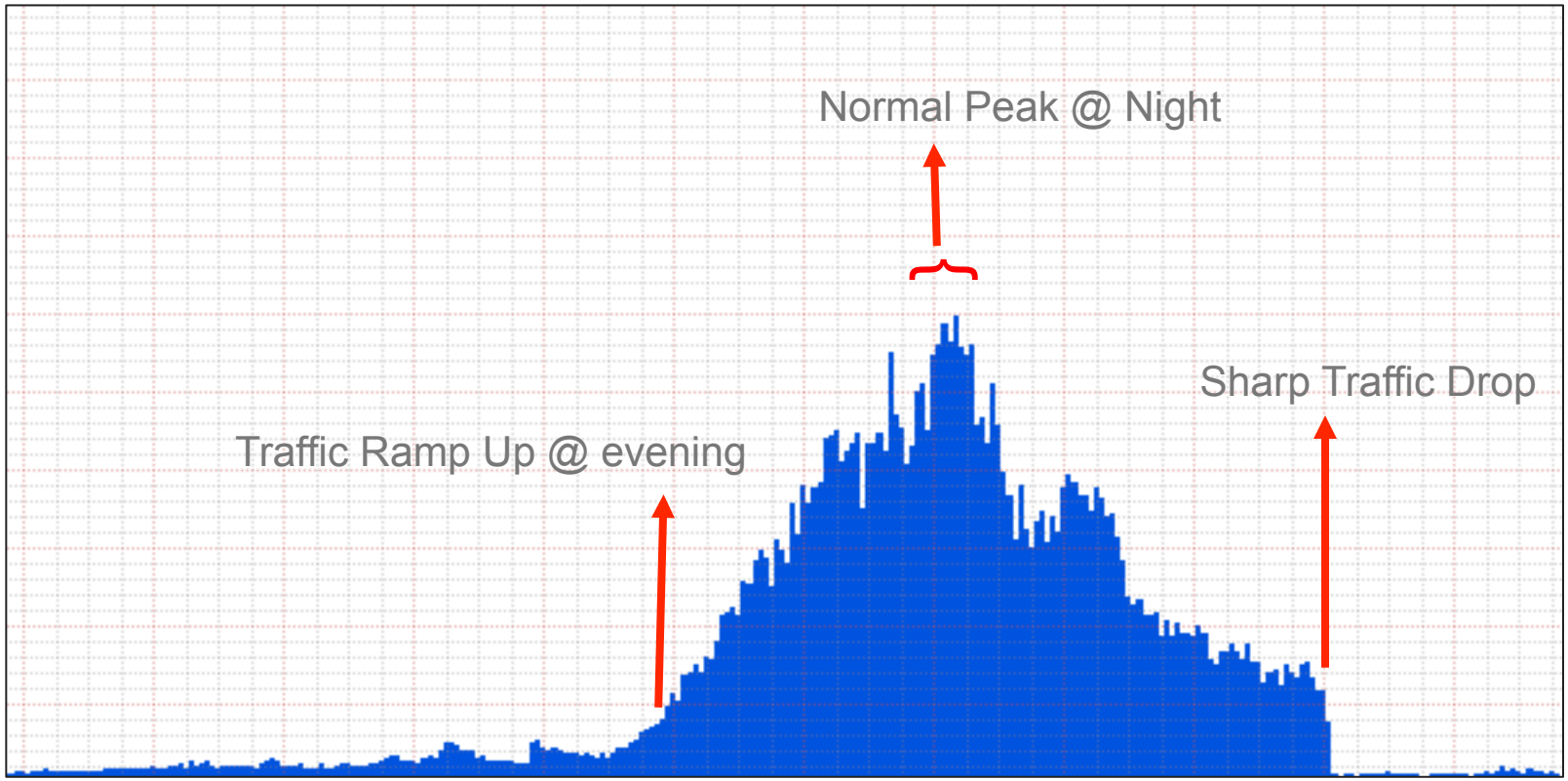
OTT Traffic Pattern : Sport Event - Cricket Live Streaming

- V shape traffic pattern before daily peak time



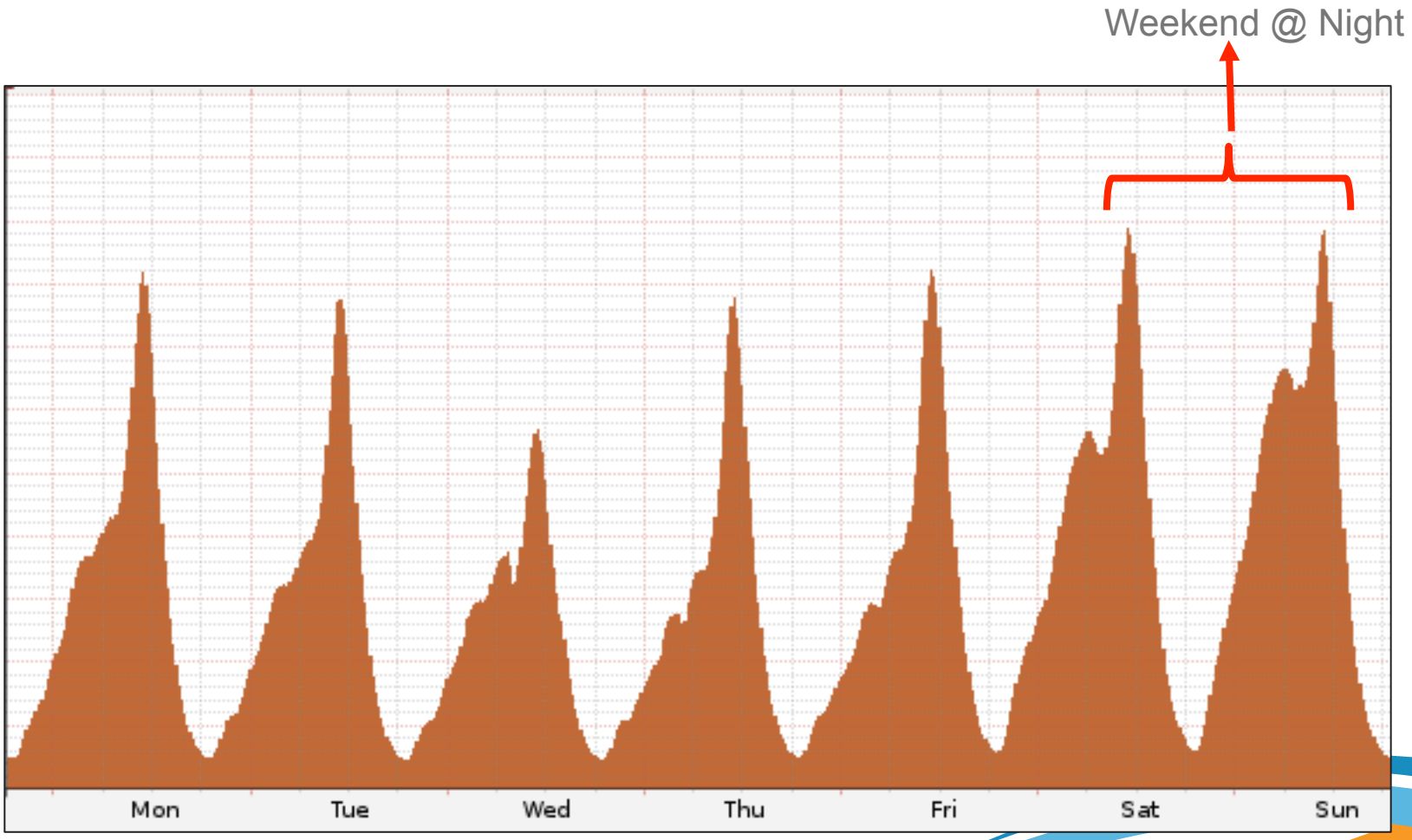
OTT Traffic Pattern : Live TV Streaming

- Most users offline and go to bed on 11pm every night



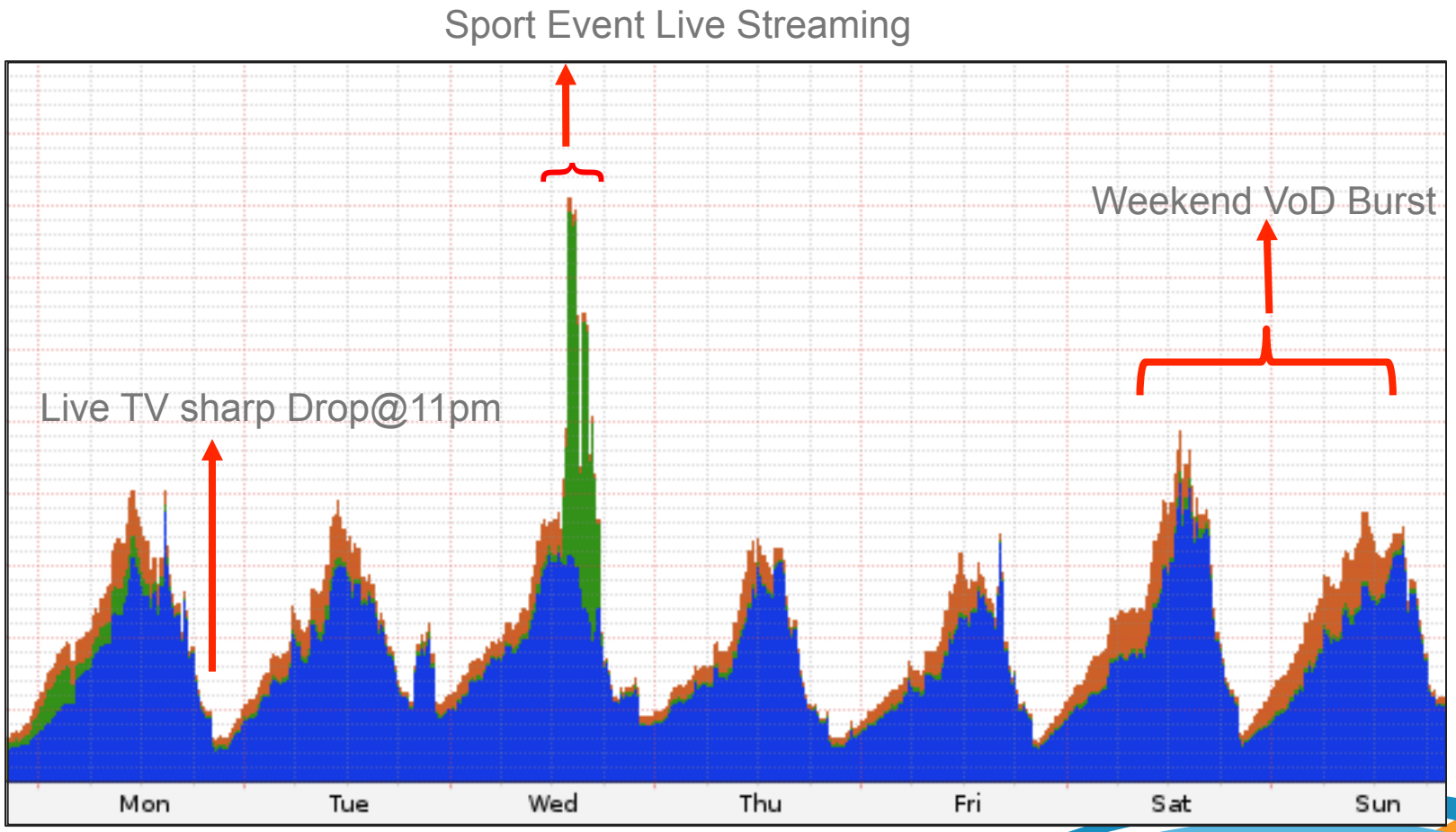
OTT Traffic Pattern : Video On Demand

- Weekday total traffic is higher than weekend, but users consume more video in the weekend and holidays



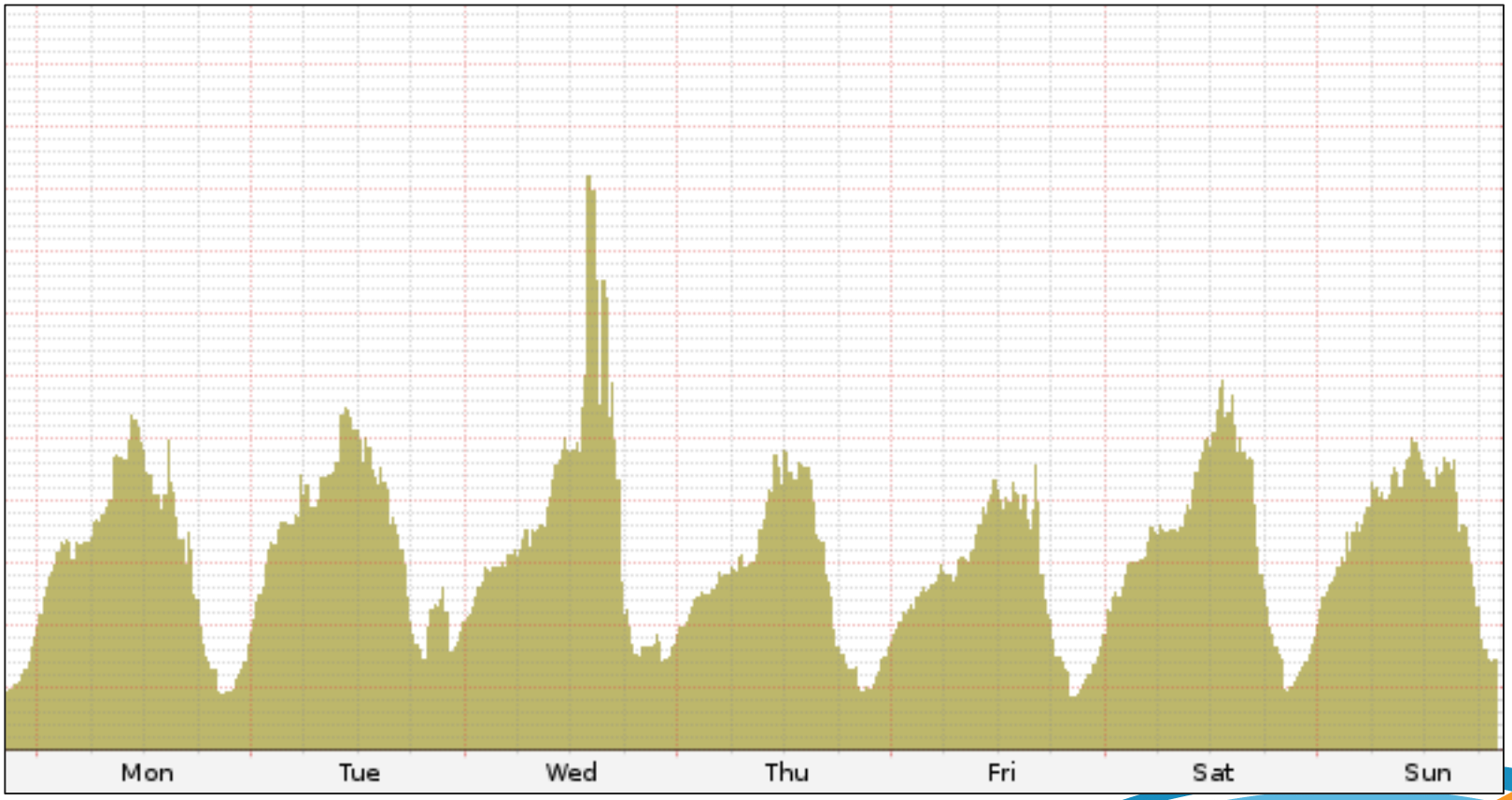
OTT Traffic Pattern : The New Norm

- Let's overlay the 3 graphs and color it



New Traffic Pattern : From Provider Point of View

- There is also e-commerce, software update and all kinds of traffic
- How can ISPs interpret it?



What can ISPs do?

The OTT Challenge

What can ISPs do?

- Know your end users
- Monitor end user performance statistics
- Understand the trends and popular festival / events
- Attend conference and NOGs to understand the new trends
- Subscribe the internet reports eg. Akamai SOTI report
- Closely collaborate with CDNs and Content Providers/Broadcasters for market trends and capacity planning

The OTT Challenge

Akamai

What other challenges for Akamai?

- Akamai does not own or produce the content
- Flexibility and rich features to cope with different content owner requirement and delivery workflow

Features:

- Broad Protocol support for ingest live
  - Eg. RTMP,HLS, HDS, Microsoft Smooth, MPEG-DASH
- Support Pre-packaged or pre-encrypted video
- Support Stream Packaging for original video
  - On-the-fly packaging and off-line on the cloud pre-packaging
- Support Media Encryption for clear video
  - Encrypt video with HTTP or SSL delivery option
- Broad Protocol Support for delivery
  - HTTP based live and on demand streaming media
  - Eg. HLS, HDS, Microsoft Smooth, MPEG-DASH
- Token Authentication to prevent link sharing
- Content Targeting to manage content availability by IP address /Geo Association

What other challenges for Akamai?

- Each feature consumes different CPU cycles on the server
  - Similar to router ☺
  - E.g. Encryption uses more CPU cycles
- Therefore, the same hardware delivers very different throughputs with different traffic profiles

For example:

- Provider A
  - 50% traffic on Live streaming on pre-encrypted video
  - 50% traffic on Software Download
- Provider B
  - 100% traffic are Live streaming with media encryption enabled
- The same hardware at Provider A might have higher throughput than Provider B

What other challenges of Akamai?

- Live Streaming does not require large disk size
  - Only required to cache for a short period of time
  - You don’t want to watch outdated content
  - Hit rate is usually good in popular Live Streaming event

- Video on Demand requires large disk size
  - Higher cache hit rate reduce video re-buffering
  - Better Transit Savings for ISP

- Spinning Hard disk have bigger disk size, but consume more power
- SSD is higher IO and lower power consumption, but the disk size is smaller

- **The requirement is big disk size, low power consumption and high IO throughput**

Our Approach

- Hardware
- Software
- Operation
- Capacity Planning Cycle

Our Approach : Hardware

- Prefer to purchase new generation servers whenever possible
- Server interface
  - 1G → 2xGE link bundle → 10G → 2x10G link bundle
- Increase server density per rack every year
  - 2U → 1.5U / 1U / 0.5U server
  - 1.5U can install more disks
- Lower power consumption in each server generation
- Use bigger SSD and Hard Disk in each server generation
- Goal: Increase throughput per server in each server generation

Environmental Sustainability

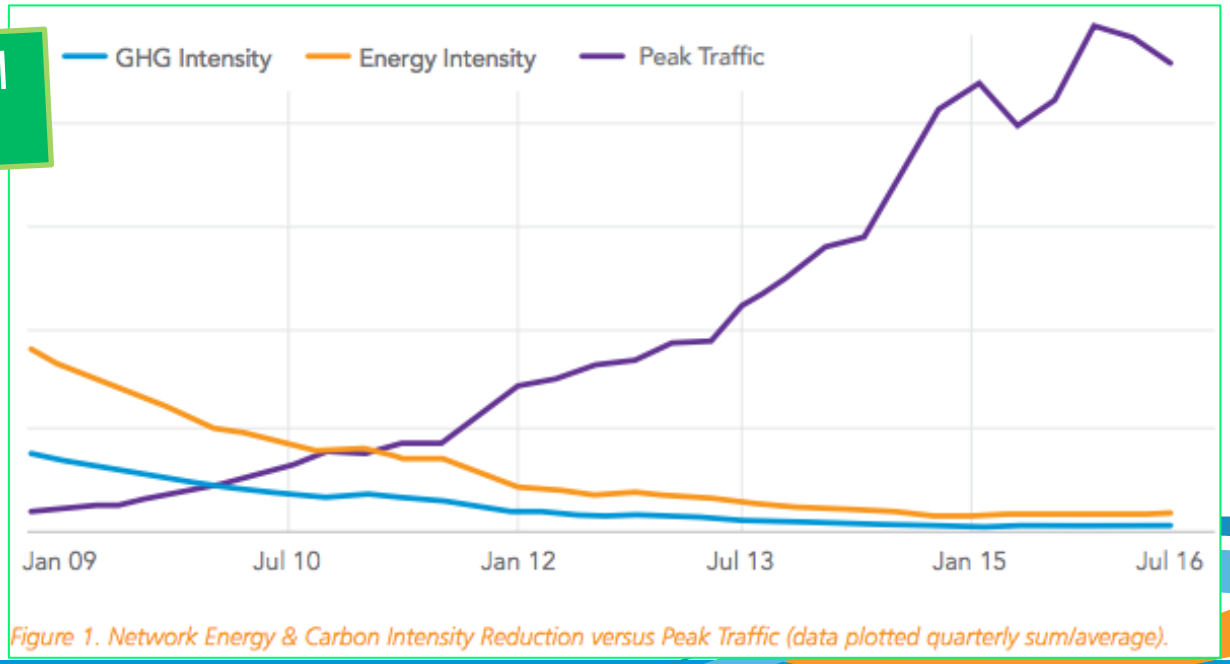


Figure 1. Network Energy & Carbon Intensity Reduction versus Peak Traffic (data plotted quarterly sum/average).

Our Approach : Software

- TCP Optimisation and FastTCP
- P2P Technology Algorithm to improve Live video quality
- UDP Technology including Proprietary UDP protocol, QUIC support
- Optimise kernel to improve server throughput
- Adaptive Bitrate Streaming according the connection type (e.g.. Mobile / Broadband)
- Enhance Media Architecture over time

FastTCP@FastSoft

UDP@QUIC

P2P@Octoshape

Our Approach : Operations

- Established 24x7 Broadcast Operations Control Center (BOCC) in April 2016
- To pro-actively monitor and support mission critical Live events

Our Approach : Capacity Planning Cycle

- Closely collaborate with ISP
- Review the traffic profiles
- Localise traffic in each metro
  - Lower distance to end users
  - Maximise burst capability
  - Reduce ISP backbone usage
- Peer with ISP on all commonly present IX
- Encourage IPv6 deployment to both ISPs and Content Owners, which usually improves throughput and removes CGNAT in many scenarios

Conclusions

Summary

Summary

- End users expect OTT to be comparable or better than Linear TV
- By OTT definition, no single entity is responsible for the end to end quality, we all are the stakeholders
- The best solution is collaboration among all stake holders to ensure the end user experience
- ISP can collaborate with CDN closely for understanding the trend and capacity planning
- Akamai ensures the quality delivery by improving hardware, software and operation
- Akamai collaborates with ISP closely on capacity planning

Questions?

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Peering: http://as20940.peeringdb.com
http://as32787.peeringdb.com

SOTI Quarterly Report
https://www.stateoftheinternet.com

Akamai Opens Broadcast Operations Control Center To Support OTT Video Providers
https://www.akamai.com/us/en/about/news/press/2016-press/akamai-opens-broadcast-operations-control-center.jsp