The OTT Challenge

Eric Leung
Senior Network Architect
Akamai Technologies

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:

240,000+ Servers	3,600+ Locations	1,700+ Networks	1200+ Cities	130+ Countries

Typical daily traffic:

- More than **3 trillion** requests served
- Delivering over **60 Terabits/second**

What is OTT?

What is OTT?

Over-the-top content (*OTT*) is the text, images, 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 IP packets but is not responsible for, nor able to control, the viewing abilities, copyrights, and/or other redistribution of the content.

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

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

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What is OTT?

Type	Old Way
Voice Calling	Telephony System / PSTN
Messaging	SMS over GSM
Music and Video	VHS/VCD/DVD over retail / rental stores
Television	Cable/Fiber/Terrestrial/Satellite broadcasting System

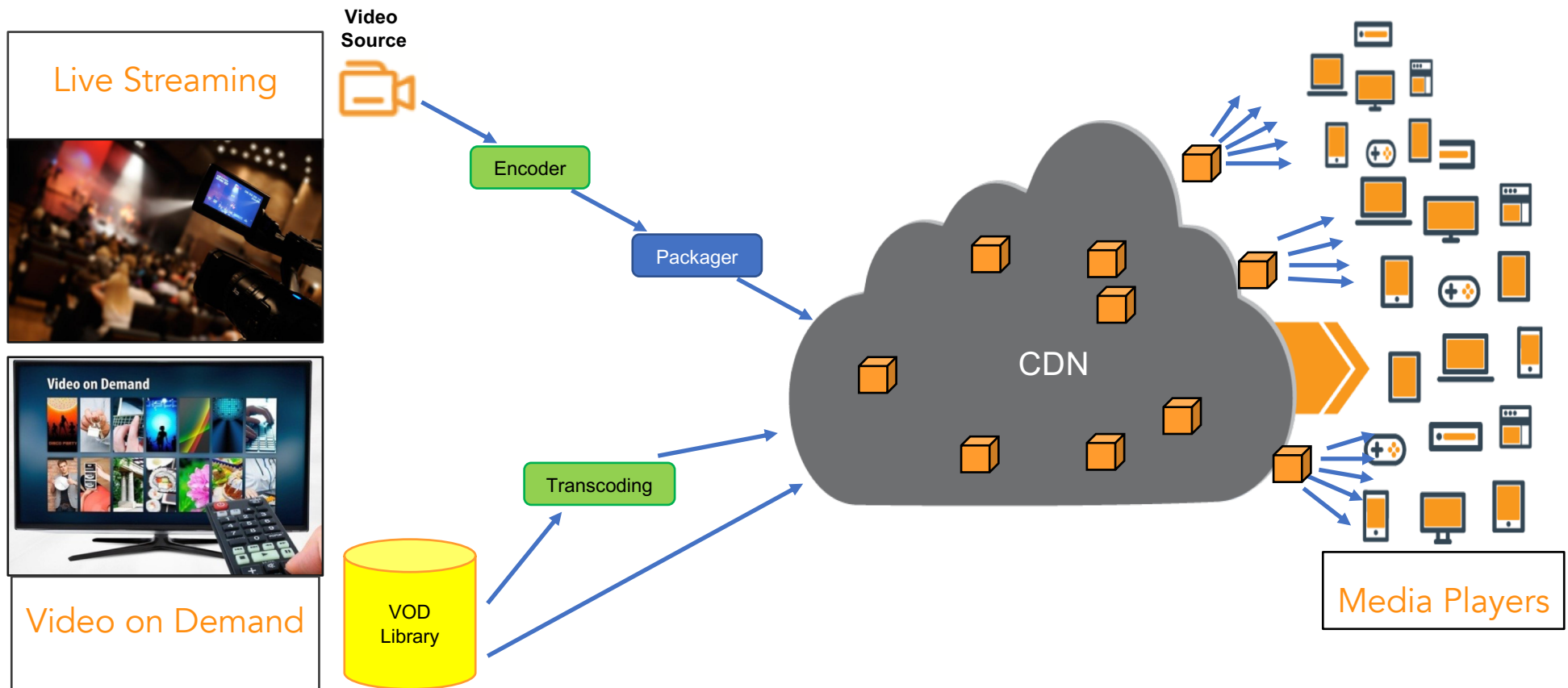# General Video Streaming Architecture

Live Streaming

Video on Demand

Live streaming refers to online streaming media simultaneously recorded and broadcast in real time to the viewer

Video on demand (VoD) allows users to select and watch video content of their choice. Users have a catalog of available videos to choose from.

General Video Streaming Architecture

Live Streaming

Video on Demand

Video Source

Encoder

Packager

Transcoding

VOD Library

CDN

Media Players

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What is the challenge?

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

For example:

- Broadcasters are responsible for Video Sources
- CDN is responsible for Ingest Servers and Delivery
- Local carrier is responsible for First Mile and Last Mile
- End User is responsible for the home wifi and Device

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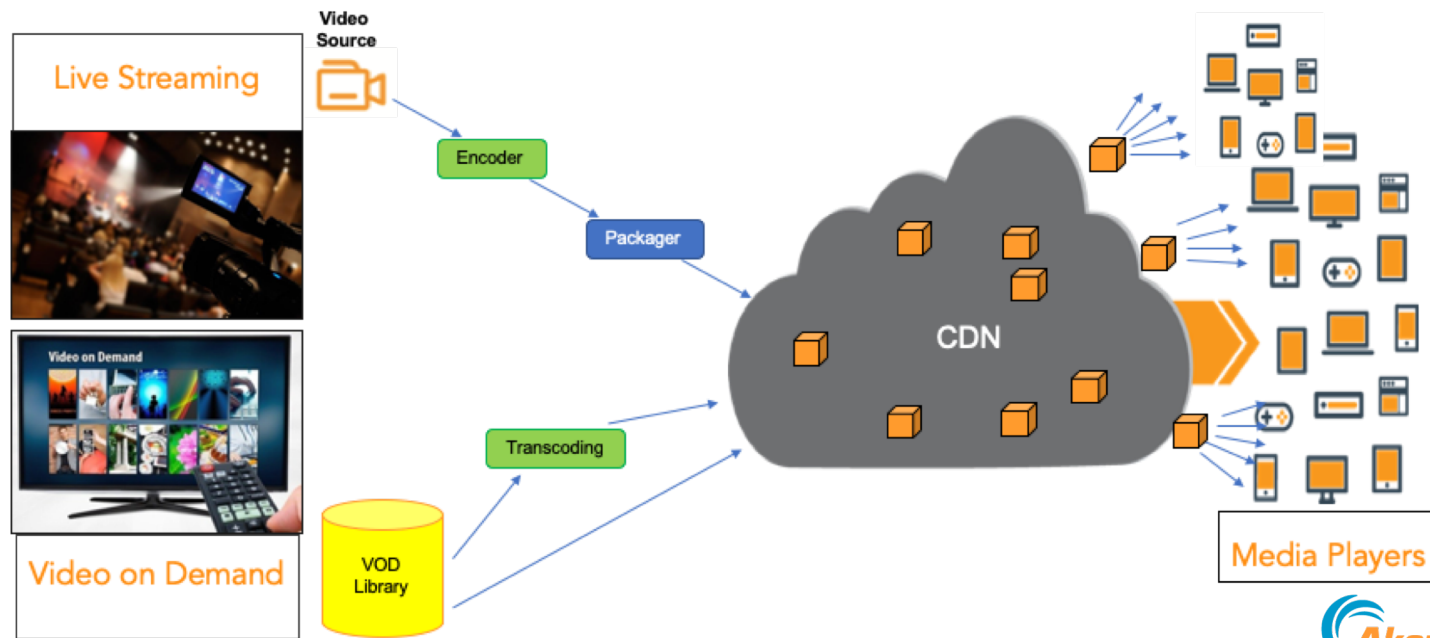
What is the challenge?

Who is responsible for the performance?

All of us are the stake holders ☺

What are the Expectations?

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 (Cont.)

Minimal/No Ads

Minimal/No subscription fee

Personalised and Interactive video
Varieties 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

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 (Cont.)

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
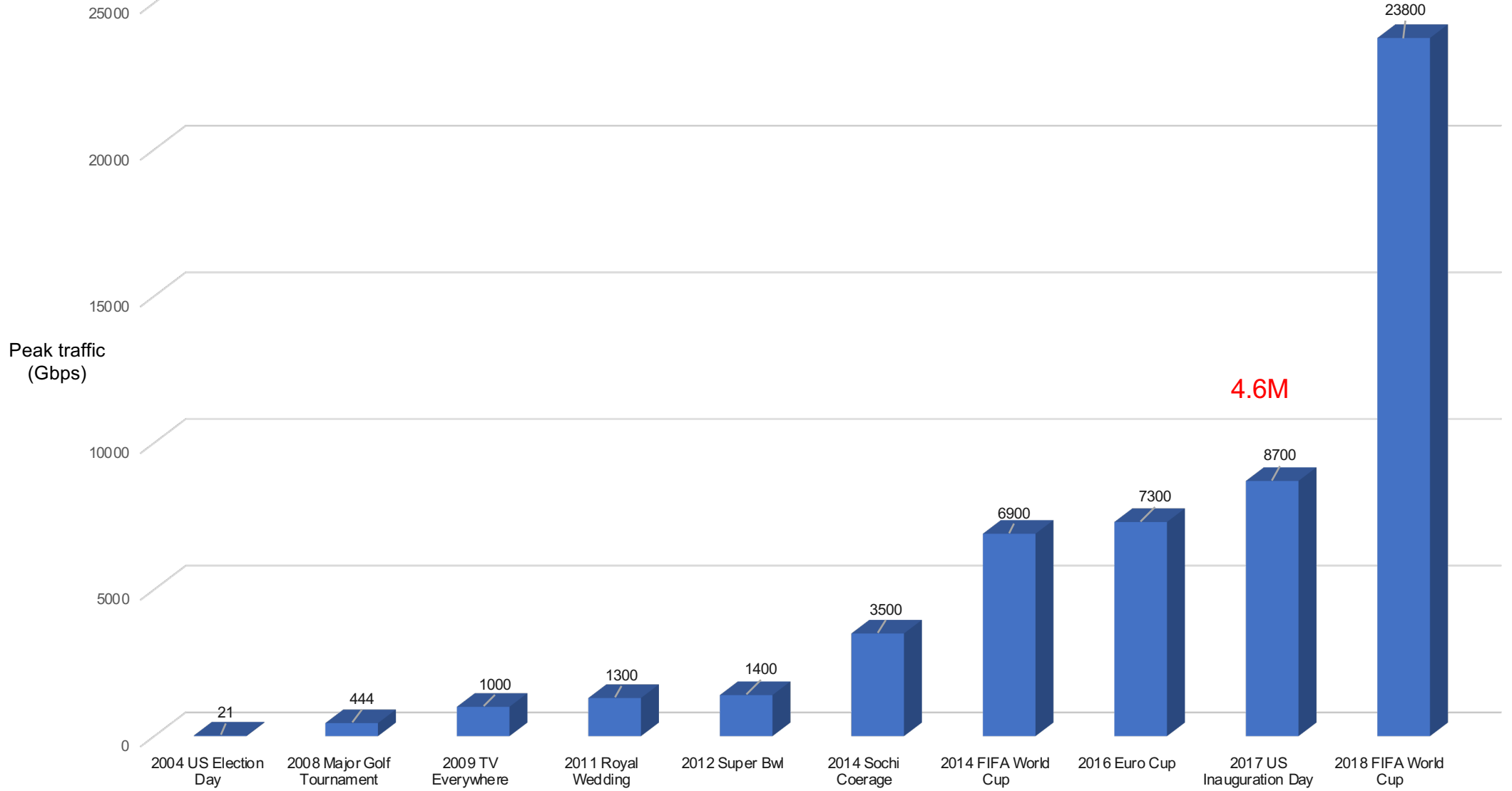Popular drama series / movies launch

Low Cost of delivery

The OTT Trend

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How big are the online events in the last decade?

Concurrent Users   9.7M

Peak traffic (Gbps)

- 25000
- 20000
- 15000
- 10000
- 5000
- 0

Event	Peak traffic (Gbps)
2004 US Election Day	21
2008 Major Golf Tournament	444
2009 TV Everywhere	1000
2011 Royal Wedding	1300
2012 Super Bwl	1400
2014 Sochi Coerage	3500
2014 FIFA World Cup	6900
2016 Euro Cup	7300
2017 US Inauguration Day	8700
2018 FIFA World Cup	23800

4.6M

9.7M

Another record breaking during IPL 2019

Hotstar records 18.6 million concurrent viewers streaming IPL final

Sindhu Hariharan | TNN | May 14, 2019, 13:36 IST

Members of Mumbai Indians celebrate their win in the VIVO IPL T20 cricket final match between Mumbai Indians a... Read More

CHENNAI: Streaming platform Hotstar said it set a new record on Sunday during the finals of IPL 2019, when it recorded its highest reach of 18.6 million concurrent viewers for the battle between Mumbai Indians and Chennai Super Kings.

The match with a nail-biting finish saw the streaming giant beat its own earlier record of 12.7 million concurrent users, achieved during an earlier game in the same tournament.

With 18.6 Million Simultaneous Viewers Streaming VIVO IPL, Hotstar Shatters Viewership Record Again
Delivered on Akamai, concurrent streaming viewers on Hotstar grew by more than 80 percent over 2018

Mumbai/Bangalore, IN | May 20, 2019

The twelfth edition of the VIVO IPL cricket tournament concluded with another high for reported online viewership. Hotstar, India's largest premium streaming platform, leveraged Akamai Technologies, Inc. (NASDAQ: AKAM), the intelligent edge platform to live stream the VIVO IPL 2019 final between the Mumbai Indians and Chennai Super Kings to 18.6 million concurrent viewers.

The VIVO IPL 2018 edition saw Hotstar and Akamai shatter multiple records for reported concurrency in quick succession. In 2019, Hotstar had already created history during the first three weeks of the VIVO IPL by exceeding its total viewership of 2018. During the course of the final match between Mumbai Indians and Chennai Super Kings, the average concurrent viewership of 11.1 million users was higher than the peak concurrency set during the VIVO IPL 2018 final with 10.3 million users. This average concurrency was bolstered by Hotstar growing its platform reach from 202 million users during the 2018 IPL tournament to over 300 million users during the course of this years' tournament.

Transformation of Traffic Pattern

….the old days….

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Classic Traffic Pattern : Residential Internet

Peak @Night
At Home

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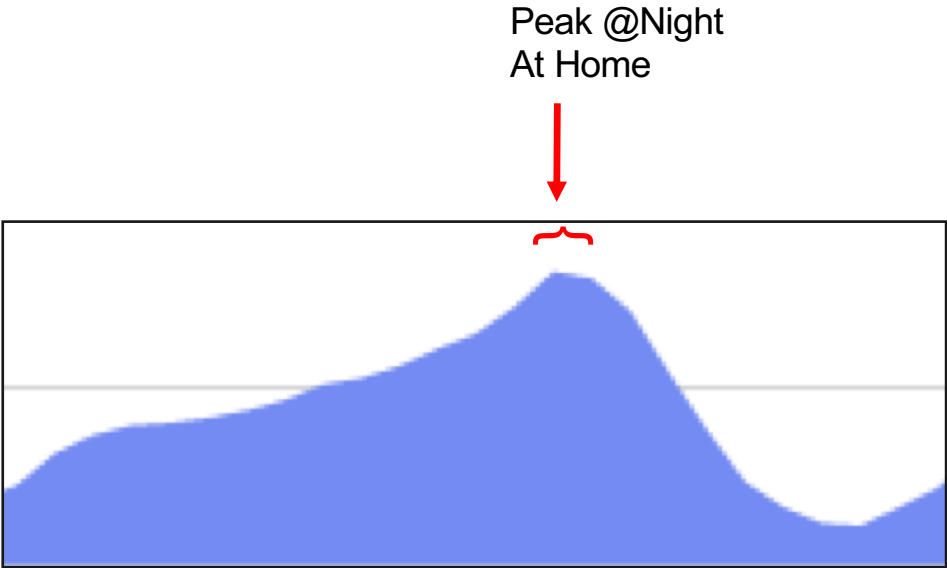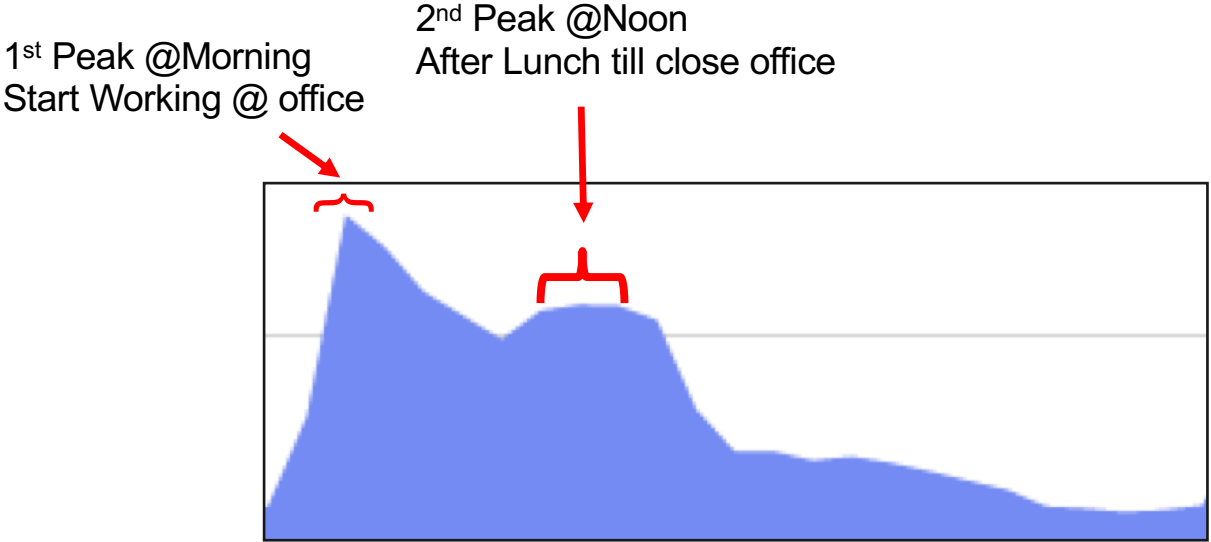
Classic Traffic Pattern : Mobile Internet

2nd Peak @Noon
Lunch Time

3rd Peak @Evening
Leave Office

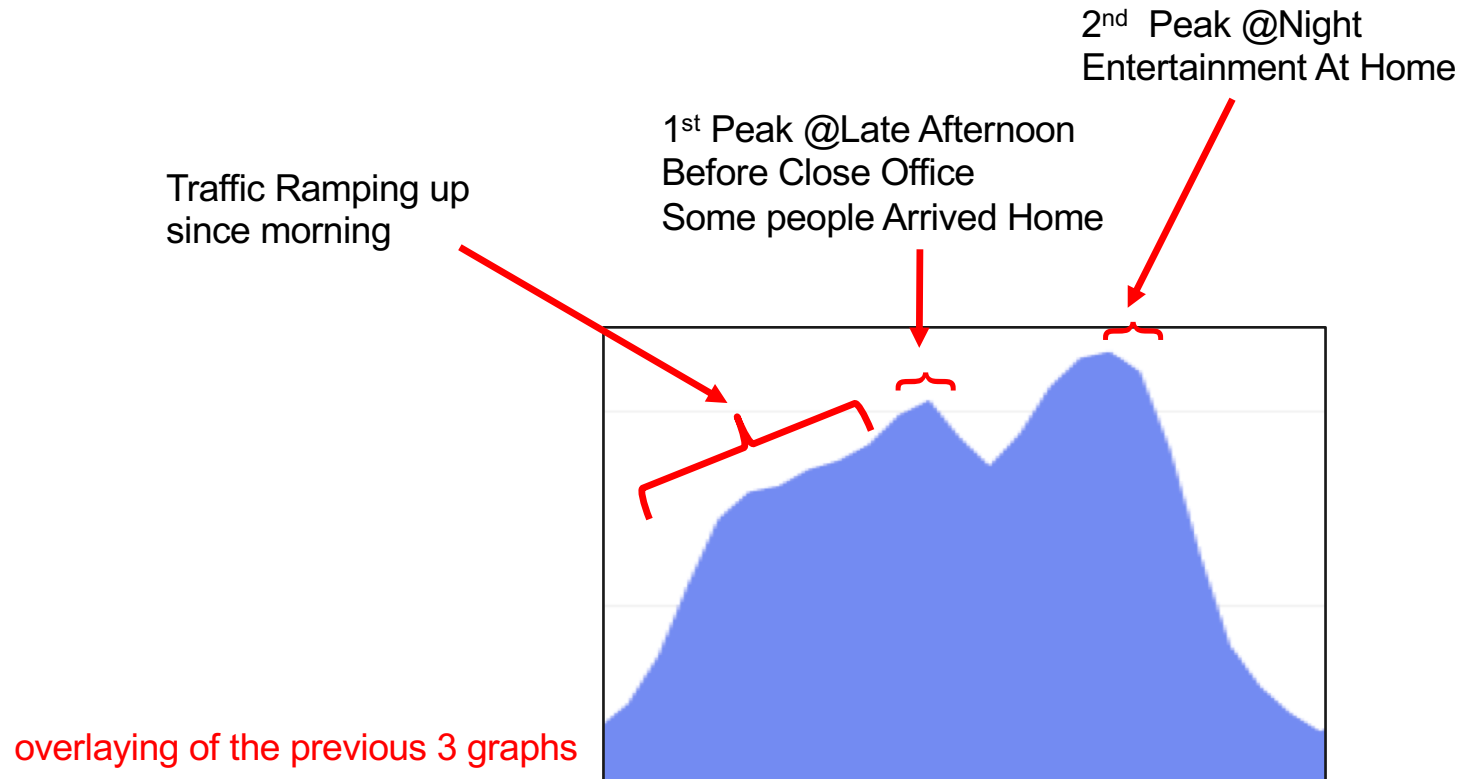1st Peak @Morning
Go to office

4th Peak @Night
Entertainment At Home

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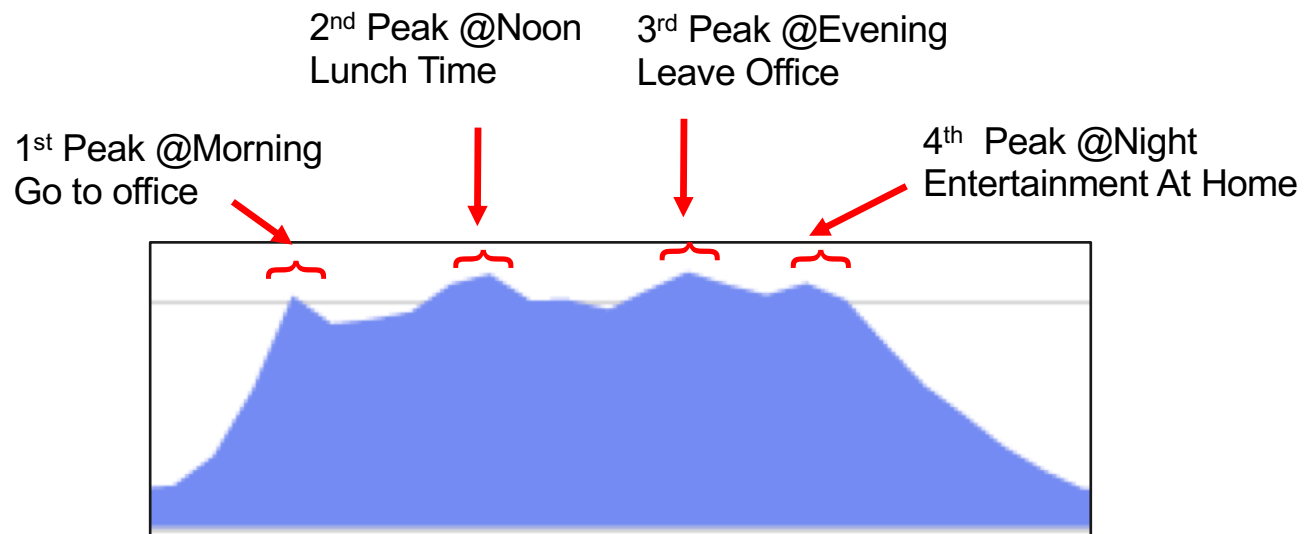
Classic Traffic Pattern : Resident, Corporate & Mobile Internet

Classic Strategy
- Let's fully utilize the network by combining Residential, Corporate and Mobile Market

2nd Peak @Night
Entertainment At Home

1st Peak @Late Afternoon
Before Close Office
Some people Arrived Home

Traffic Ramping up
since morning

overlaying of the previous 3 graphs

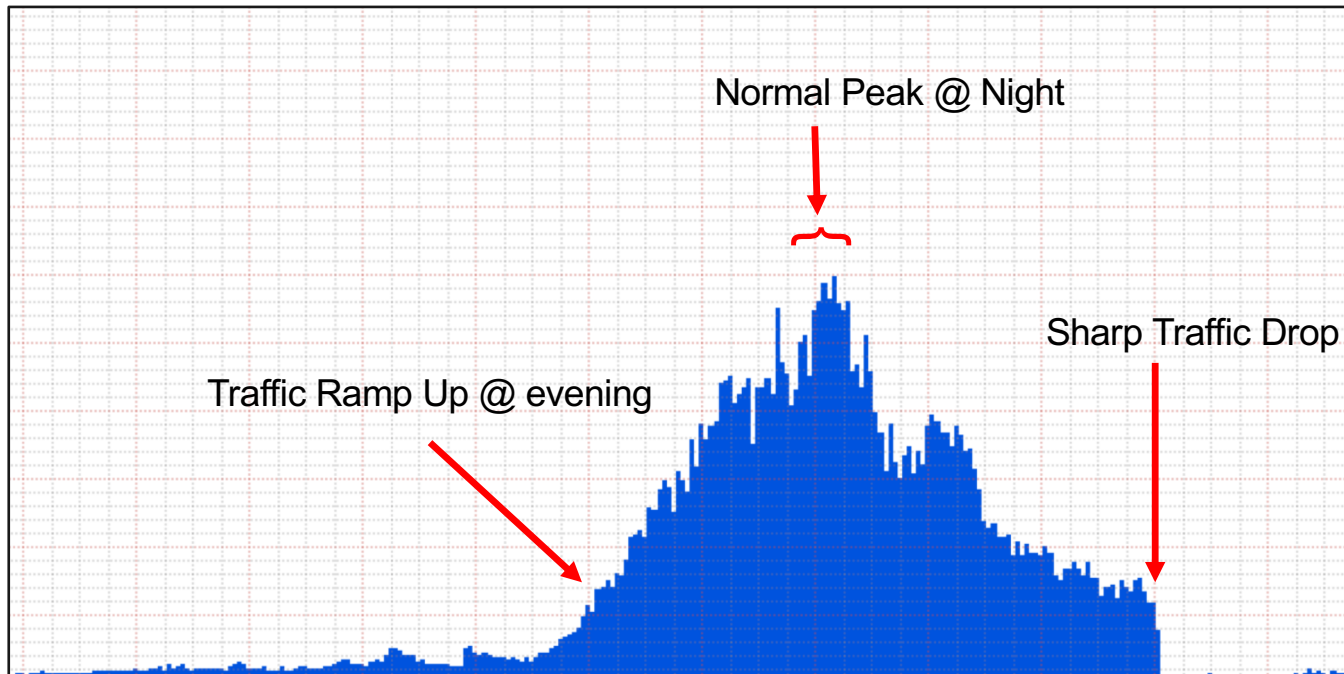# Transformation of Traffic Pattern

….with OTT traffic….

OTT Traffic Pattern: Video on Demand

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

Weekend @ Night

Mon   Tue   Wed   Thu   Fri   Sat   Sun
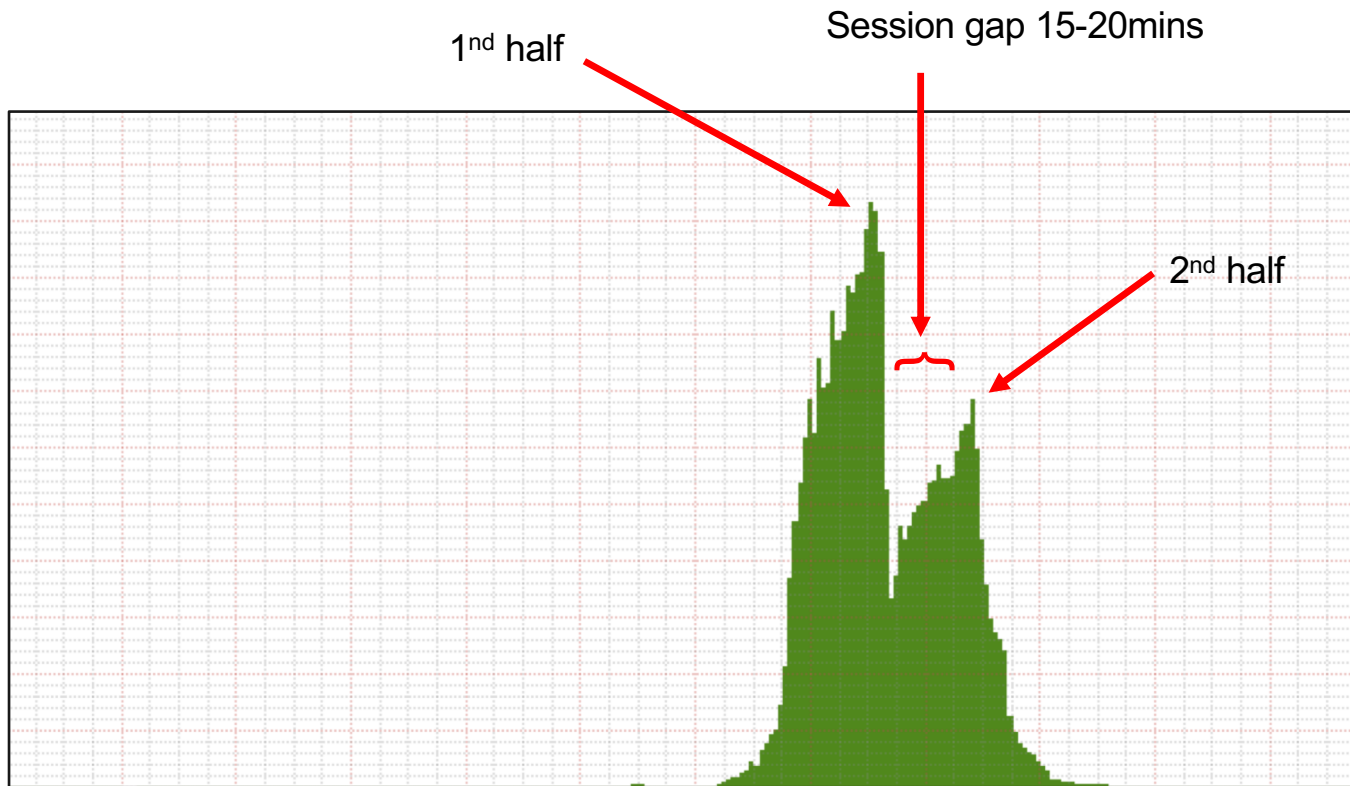
Akamai *Experience the Edge*
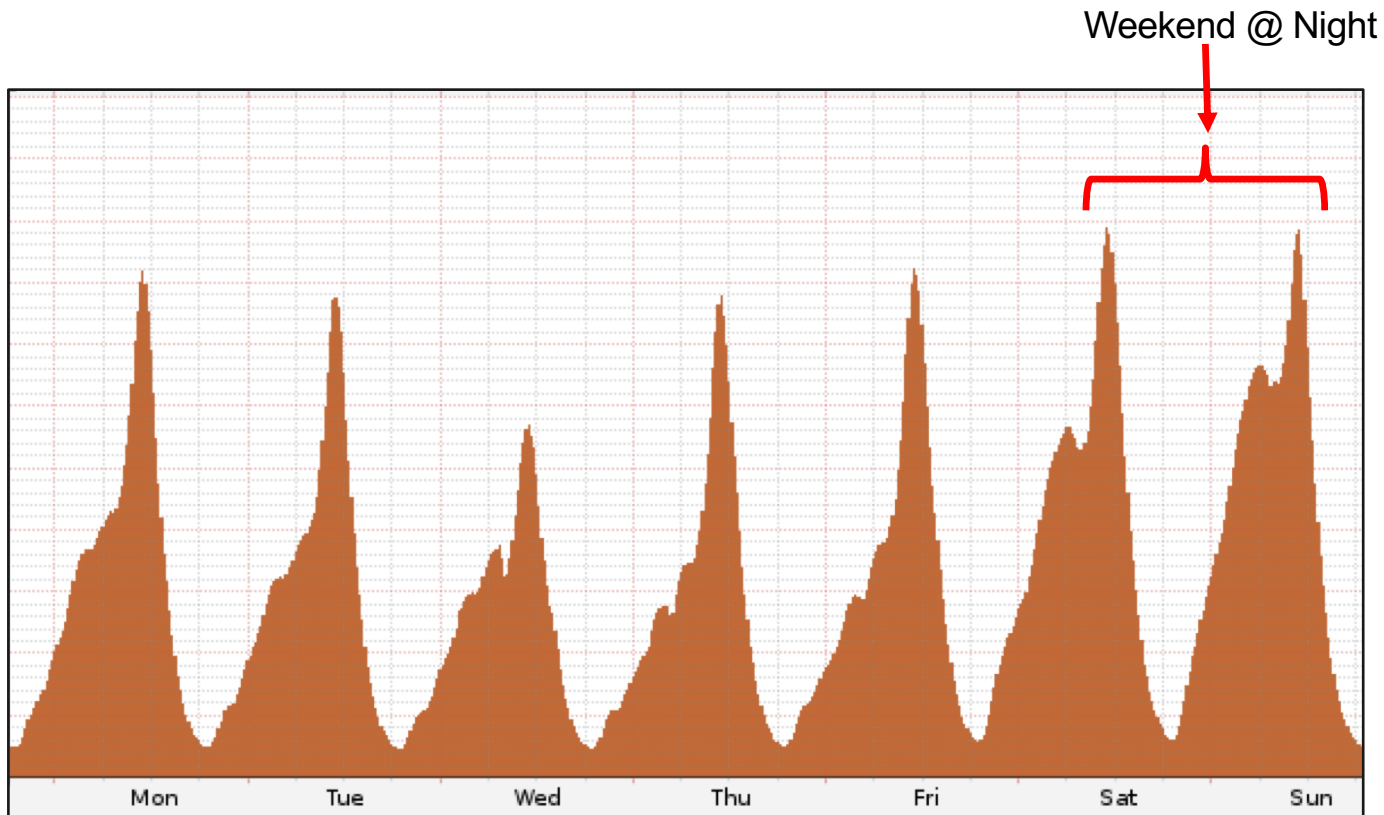
OTT Traffic Pattern: Live TV Streaming

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

OTT Traffic Pattern: Live Sport Event

- The traffic is multiple times of baseline
- V shape traffic pattern
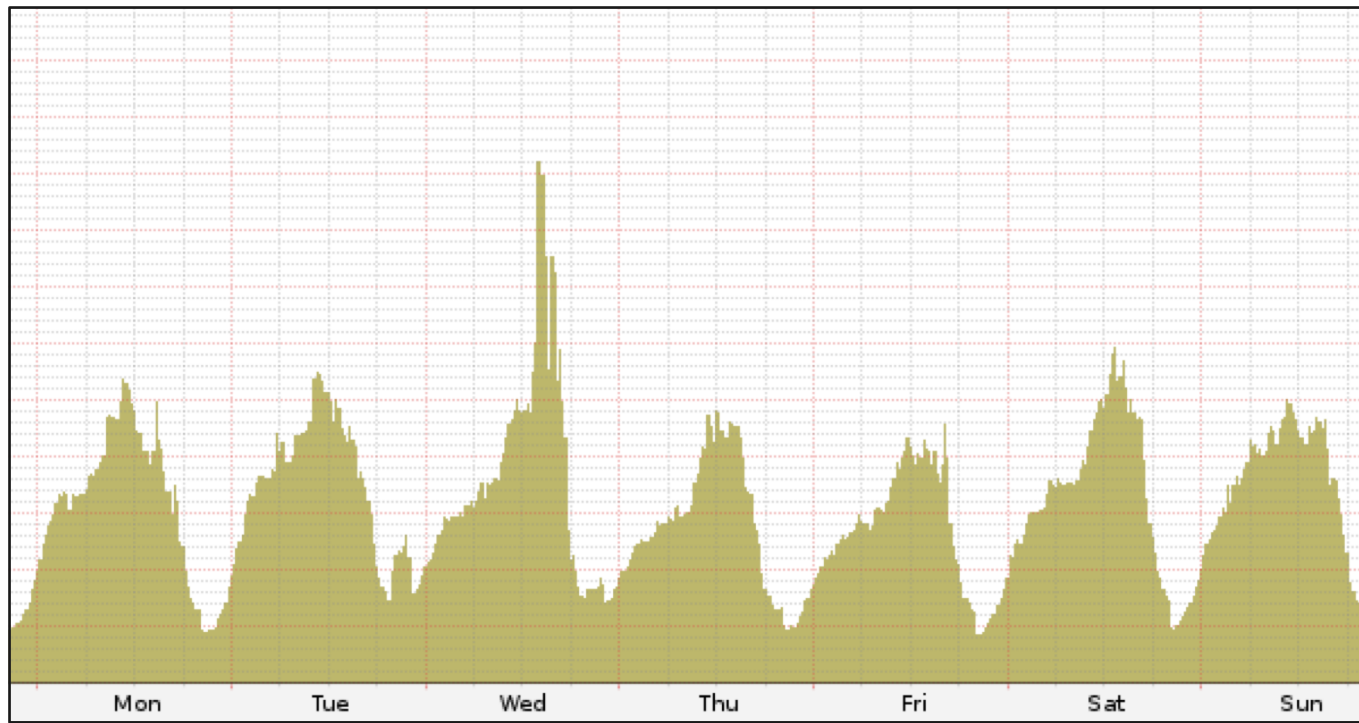
1nd half

Session gap 15-20mins

2nd half

OTT Traffic Pattern: Explain the new Norm

- Let's overlay the 3 graphs and color it
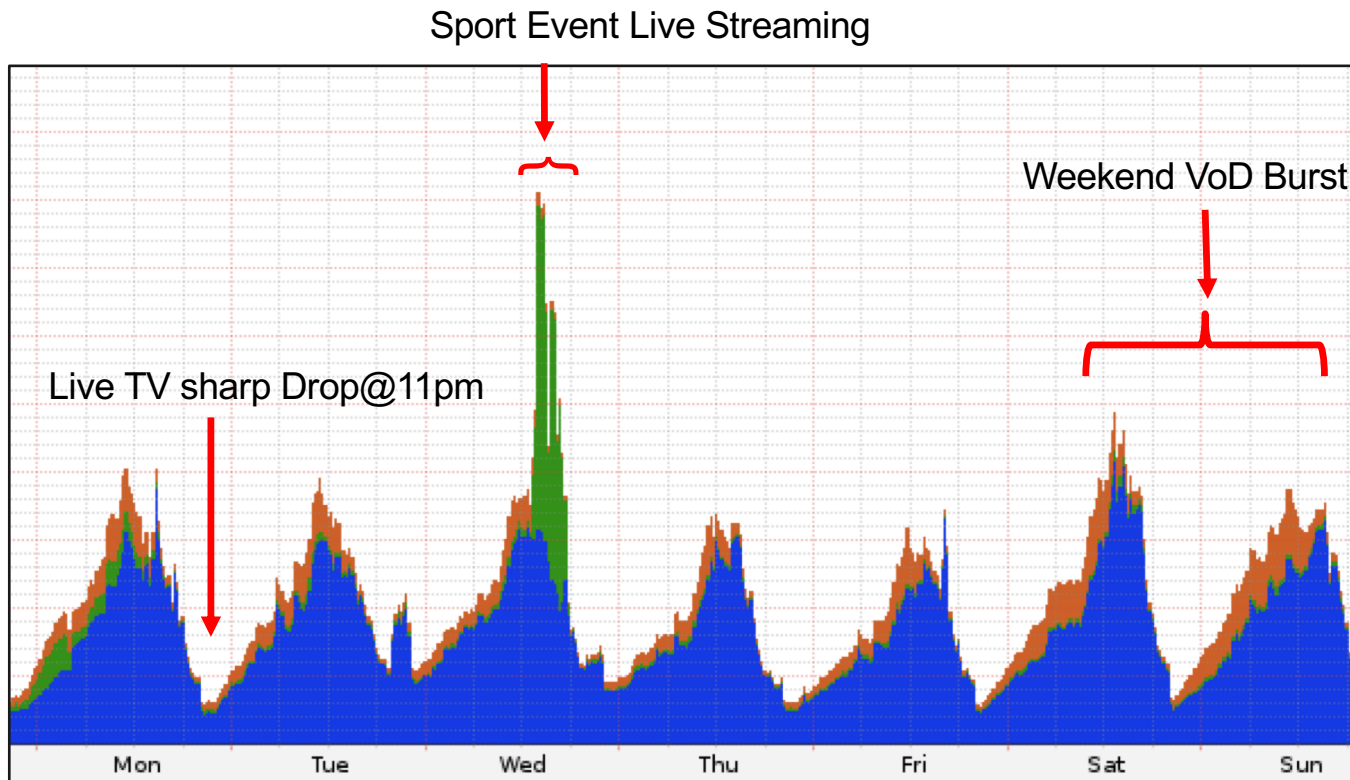
OTT Traffic Pattern: Explain the new Norm

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

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Challenges and Approaches

from Akamai point of view

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Challenges for Akamai?

- Akamai does not own or produce the content
- Different content owners are having different 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

Challenges for Akamai?

Each feature consumes different CPU cycles on the server
Similar to router ☺
E.g. Encryption uses more CPU cycles

Live Streaming does not require large disk size
Everyone basically watching the same video segment at the same time.
Only required to cache for a short period of time
Hit rate is usually good in popular Live Streaming event

Video on Demand requires large disk size
Everyone starts watching different video at irregular time
Higher cache hit rate reduce video re-buffering
Better Transit Savings for ISP

Each ISP is having different mixture of traffic types, and it varies along the time!

The same hardware delivers very different throughputs with different traffic profiles,
it is challenging to determine what and how many servers to deploy in every ISP
partners' network

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Our Approach : Hardware

Prefer to purchase new generation servers whenever possible with:
- Higher Processing Power
- Faster network interface
  - 1G → 2xGE link bundle → 10G → 2x10G link bundle
- More and Bigger SSD and Hard Disk
- Lower power consumption

Goal: Increase throughput per server in each server generation
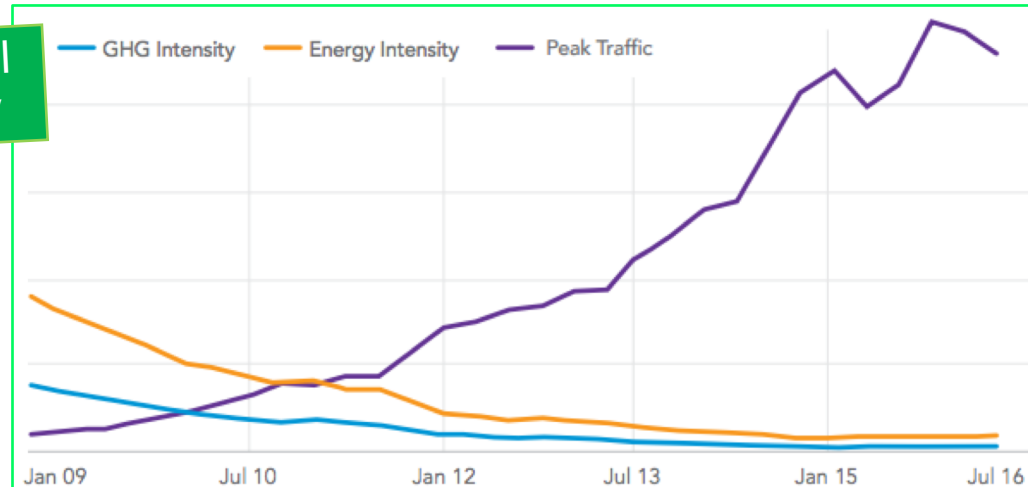
Environmental Sustainability

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

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Our Approach : Software

- TCP Optimization and FastTCP
- UDP Technology including Proprietary UDP protocol, QUIC support
- P2P Technology Algorithm to improve Live video quality
- Optimize 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

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Our Approach : Operation

24x7 Broadcast Operations Control Center (BOCC) to pro-actively monitor and support mission critical Live events

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

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Our Approach : Capacity Planning Cycle

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

What can ISPs do?

What can ISPs do?

Know your end users (traffic pattern, distribution, etc)

Monitor end user performance statistics

Understand the trend and popular festival / events

Attend conference and NOGs to understand the new trend

Subscribe the internet reports eg. Akamai SOTI report*

Understand how different CDNs deliver traffic

Closely collaborate with CDNs and Content/Broadcaster for market trend and capacity planning

Explore new technologies (e.g. P2P, Multicast, LTE-B, etc)

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 and building

Questions?

Eric Leung taleung@akamai.com

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

State of the Internet Report:
https://www.akamai.com/us/en/resources/our-thinking/state-of-the-internet-report/