QoE & Usage Analytics
WIE 2016

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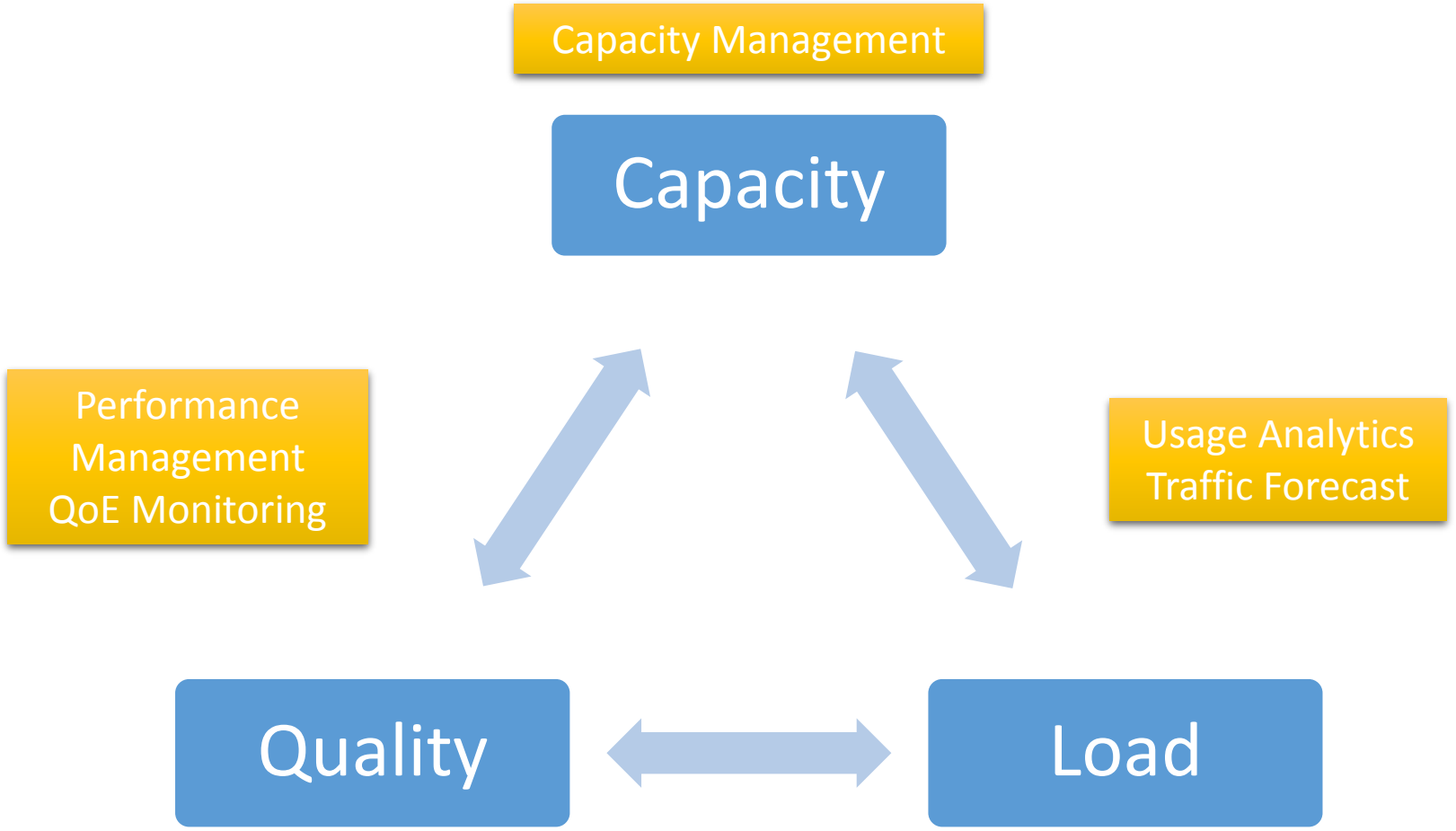
The scope of QoE and Usage Analytics

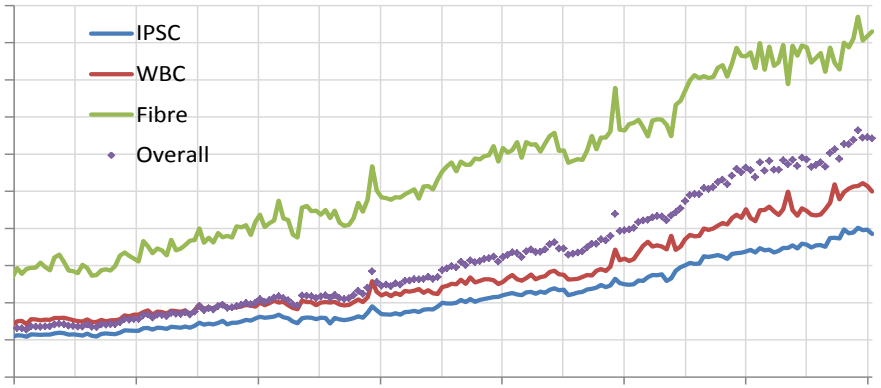


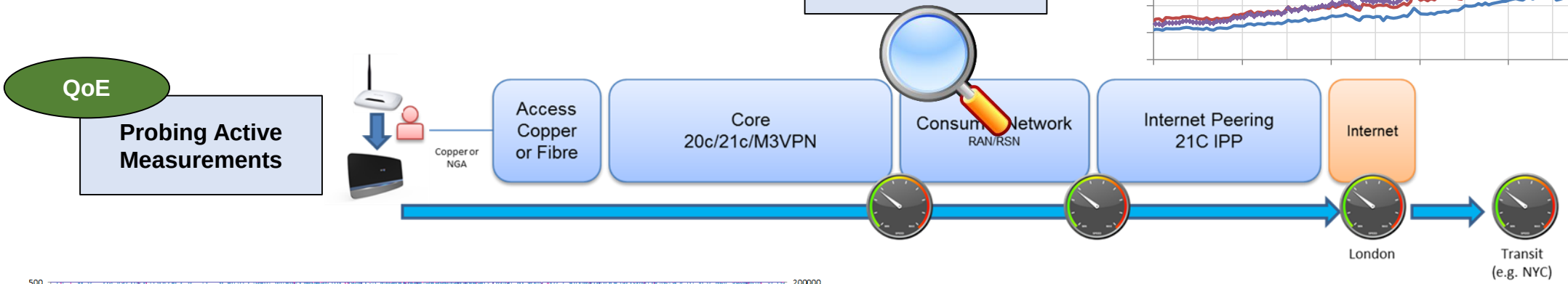
Measuring Quality of Experience & Demand/Usage

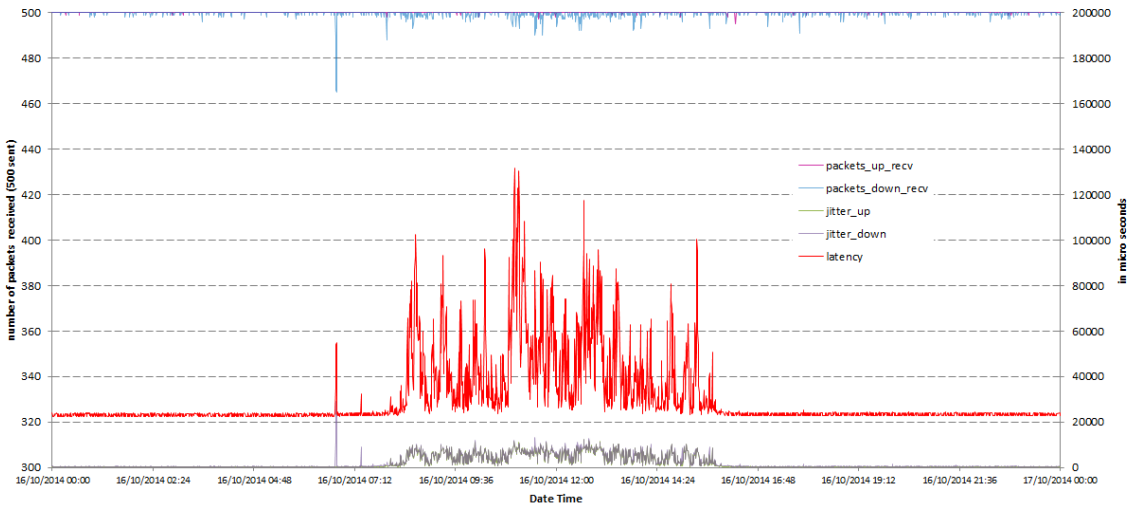
Monitor and study broadband demand behaviour and performance

Soft probes embedded in HomeHubs

Average demand per user at peaktime







Benefits:

- IP transport & Video, VoIP, Web performance
- SLA validation
- Claims against competition
- Troubleshooting and root cause analysis
- Effective traffic forecasting and capacity planning
- New technology assessment
- Research on robust and large scale measurements

QoE Monitoring

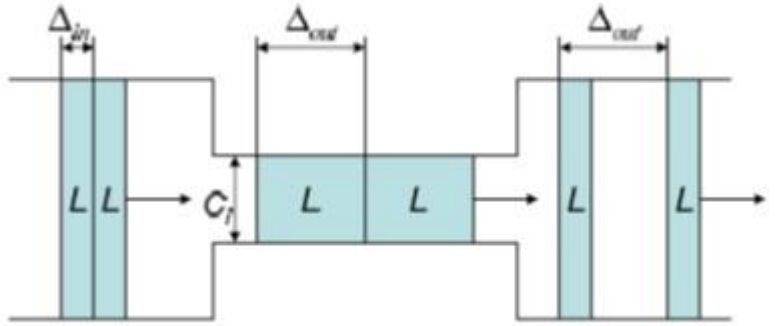
Submissions for IET Innovation and BBWF Innovation awards

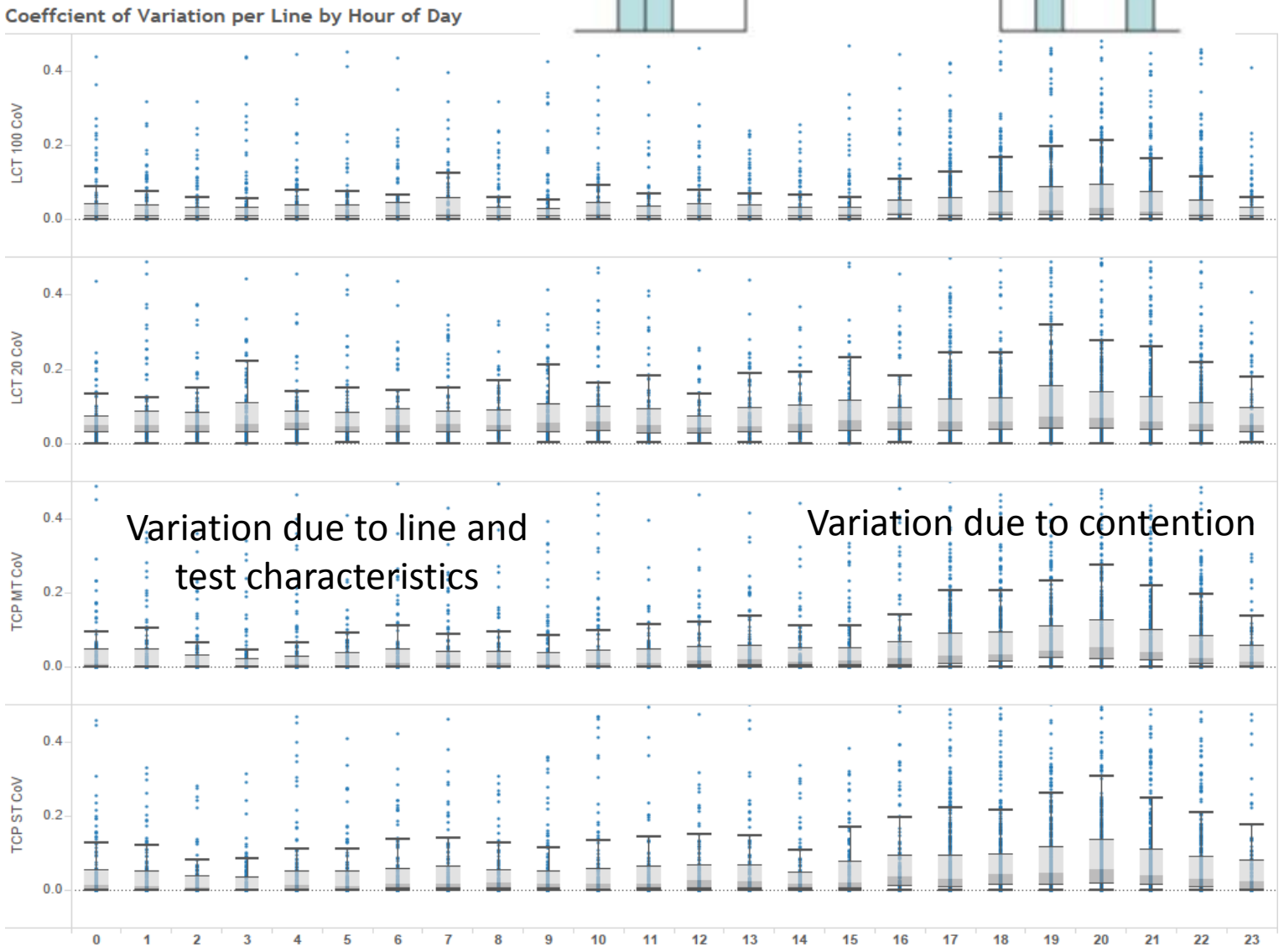
- Large-scale managed broadband monitoring of end-to-end user experience from home gateways

Highly Commended in the Customer Experience Innovation category

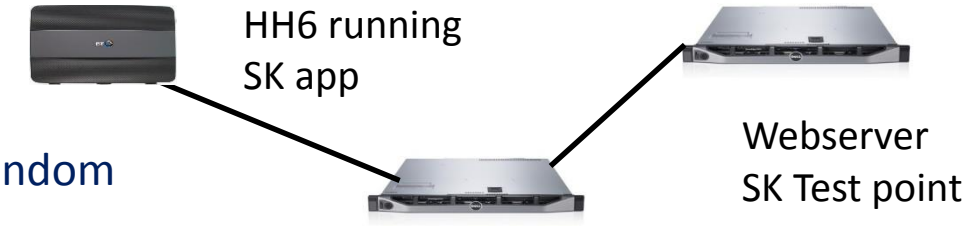
Lightweight Capacity Test

- Light test to run on every line to improve QoE coverage
  - Test CVLAN capacity and detect network problems
- Experiment with full (10Gbps) and line-rate trains
  - detect CVLAN capacity and available bandwidth (includes contention in CVLAN & core)
- Want good correlation to backhaul utilisation



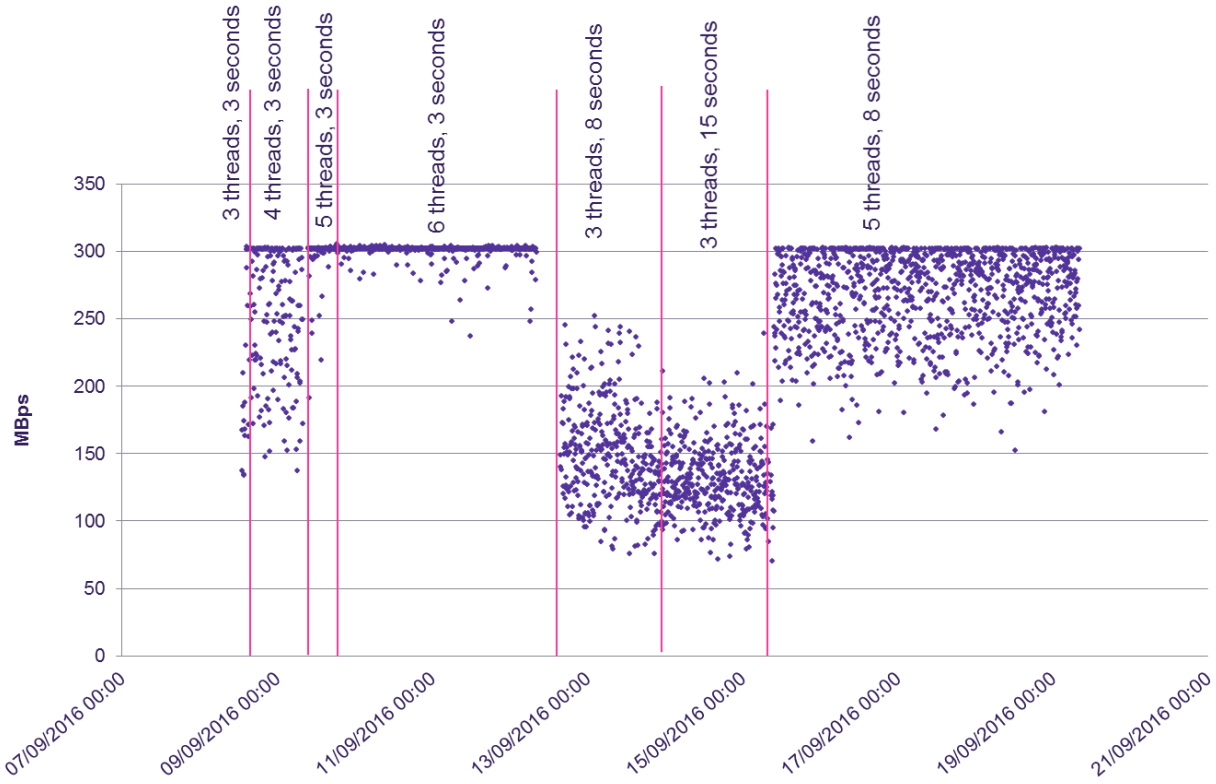


G.Fast Performance Testing

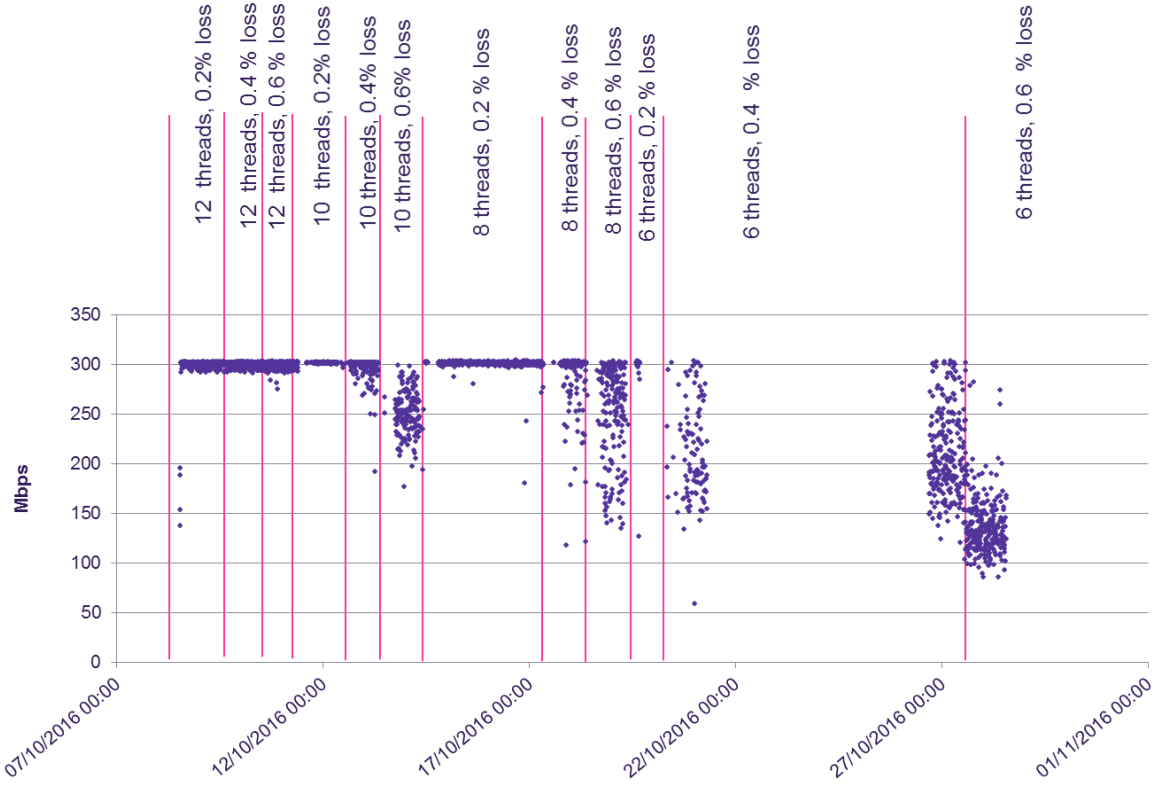


- Increasing threads better enables line speed to be assessed in face of random loss than increasing duration of threads
- Increasing duration, increases probability of more loss during test (drops are random in netem as used)
- Increasing loss requires increasing thread-count to compensate in order to keep measuring “line speed”

delay 20ms, loss 0.2%, varying threads and duration

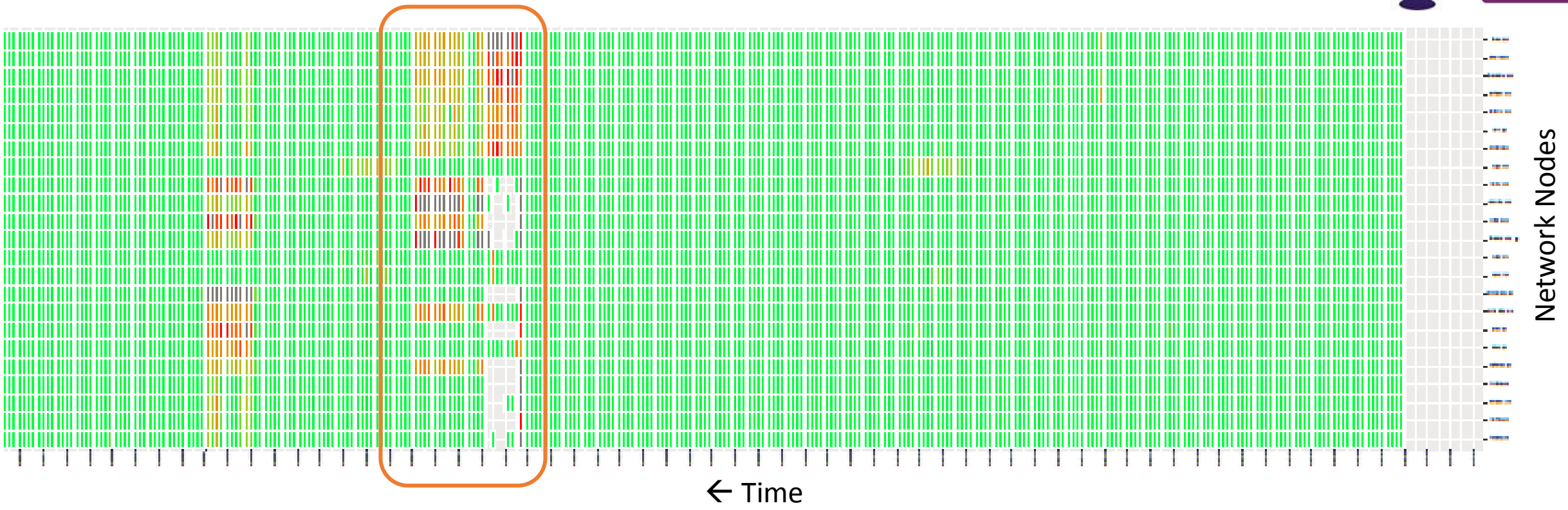


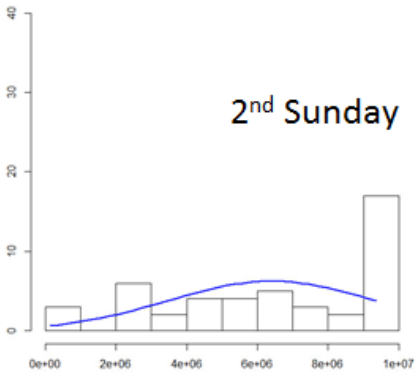
Changing thread count and increasing loss

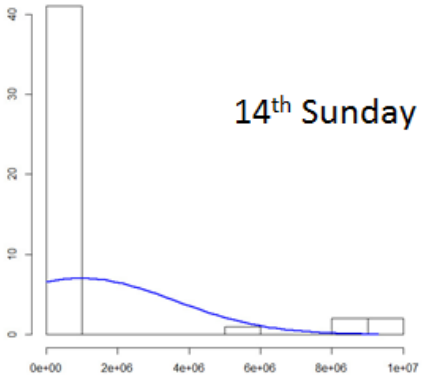


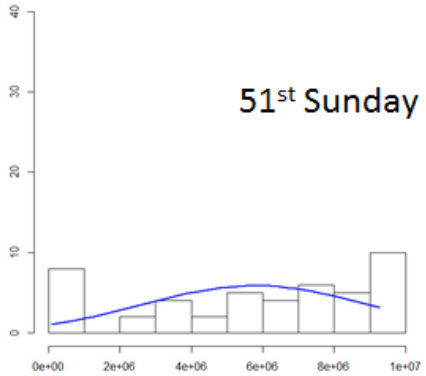
Anomaly Detection

Challenge Cup 2016







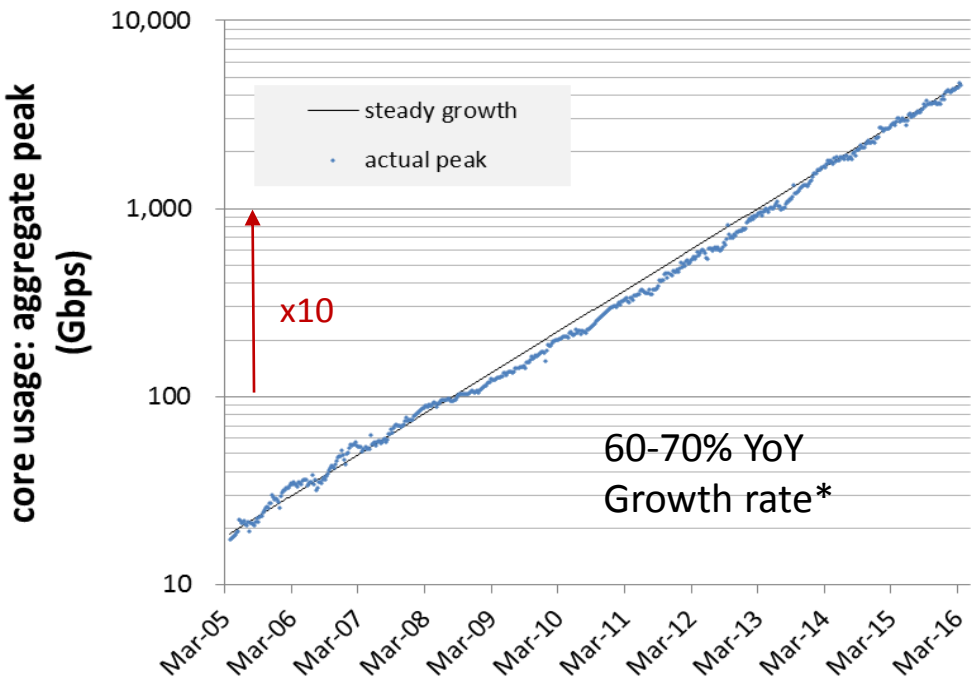


- Earth Mover's Distance: the amount of effort in shape-shifting distributions
- Used for 2D image recognition
- Works over multiple dimensions (QoE metrics)

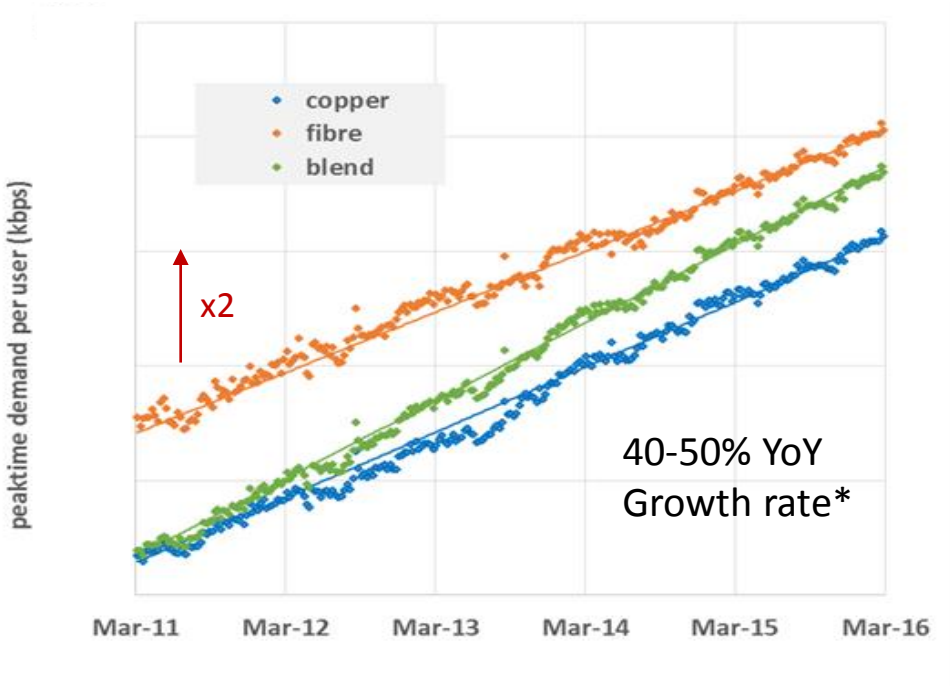
Usage Analytics

What difference a few years make to core usage

Weekly aggregate peak (Gbps)

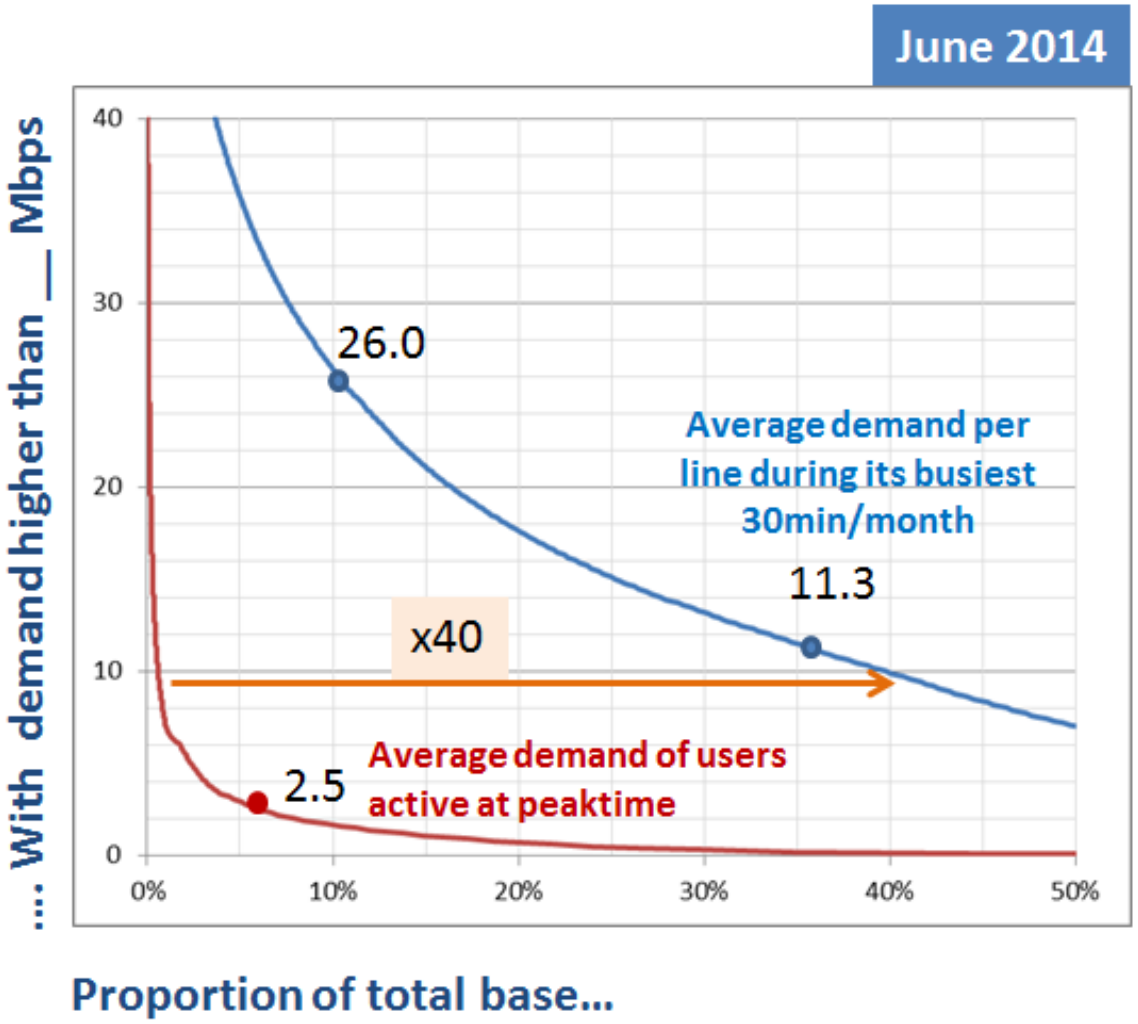


Peaktime demand (kbps/user)



* The growth rate is higher on the aggregate traffic compared to the normalised Kbps per EU due to the combined effect of increasing demand per EU, number of EUs and migration of EUs to faster and unlimited products

Link between core and access usage



Distribution for users on least constrained lines: FTTC80/20 unlimited

Measurement resolution = 30min.

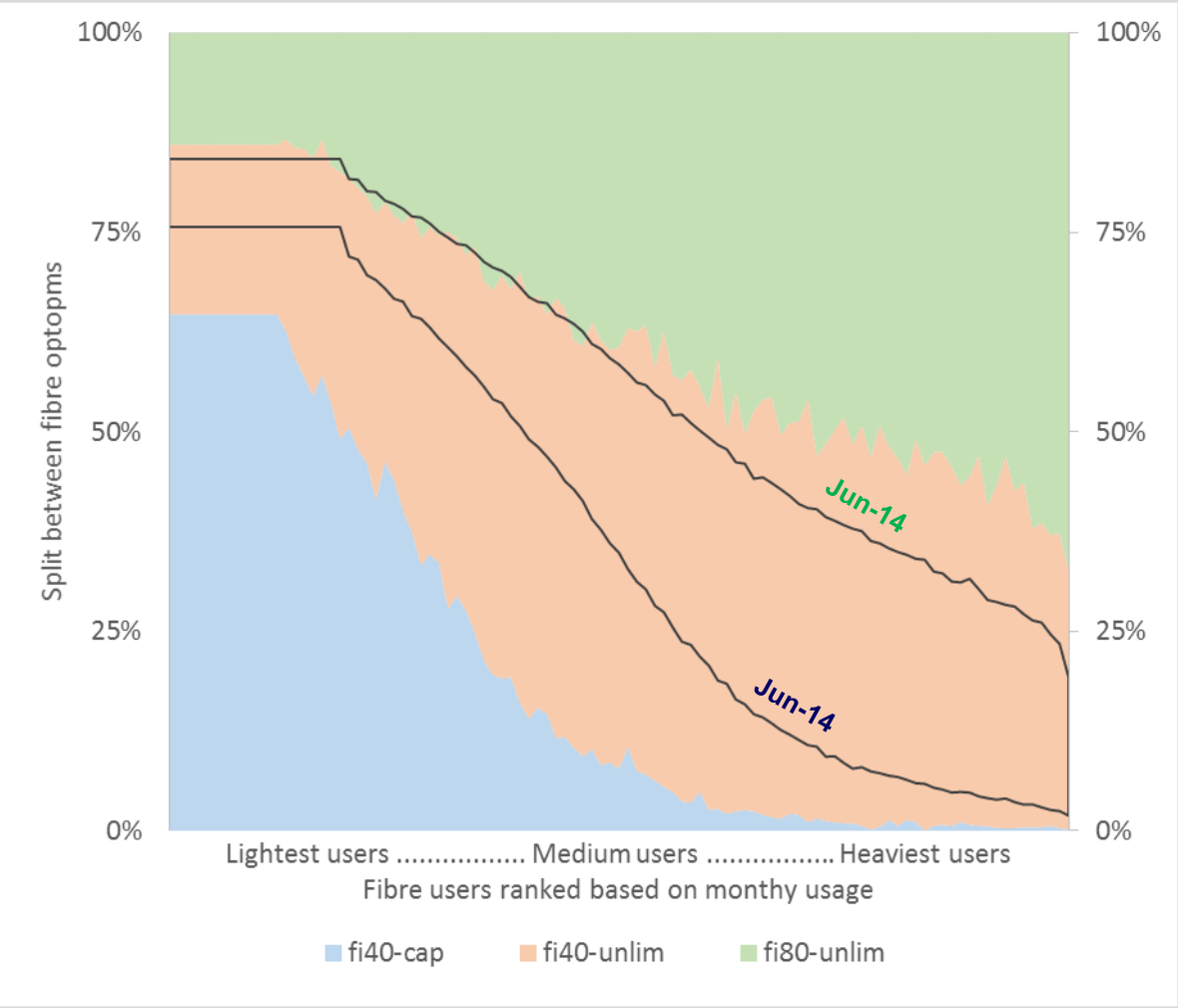
At peak time on a Sunday evening (red):

- Active users are using on average 2.5Mbps
- Only about 20% of users are concurrently active (with usage >0.5Mbps).

Busiest 30-min in a month (blue):

- Heaviest 10% of "Fibre-80" lines sustain >26Mbps for 30min at least once a month
- Heaviest 5% of "Fibre-80" lines sustain >35Mbps

Self-selection effect over time

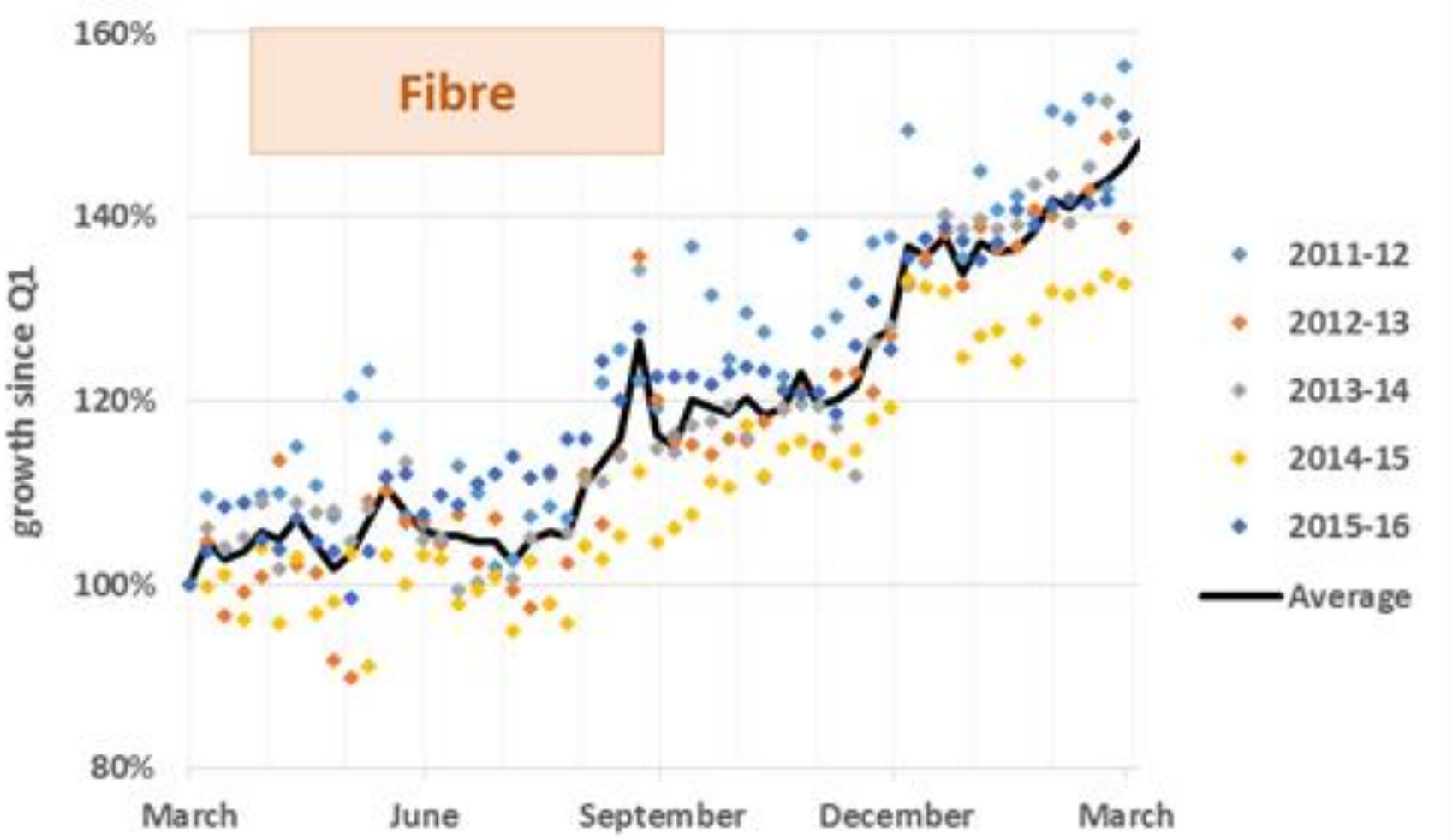


Absolute self-selection effect

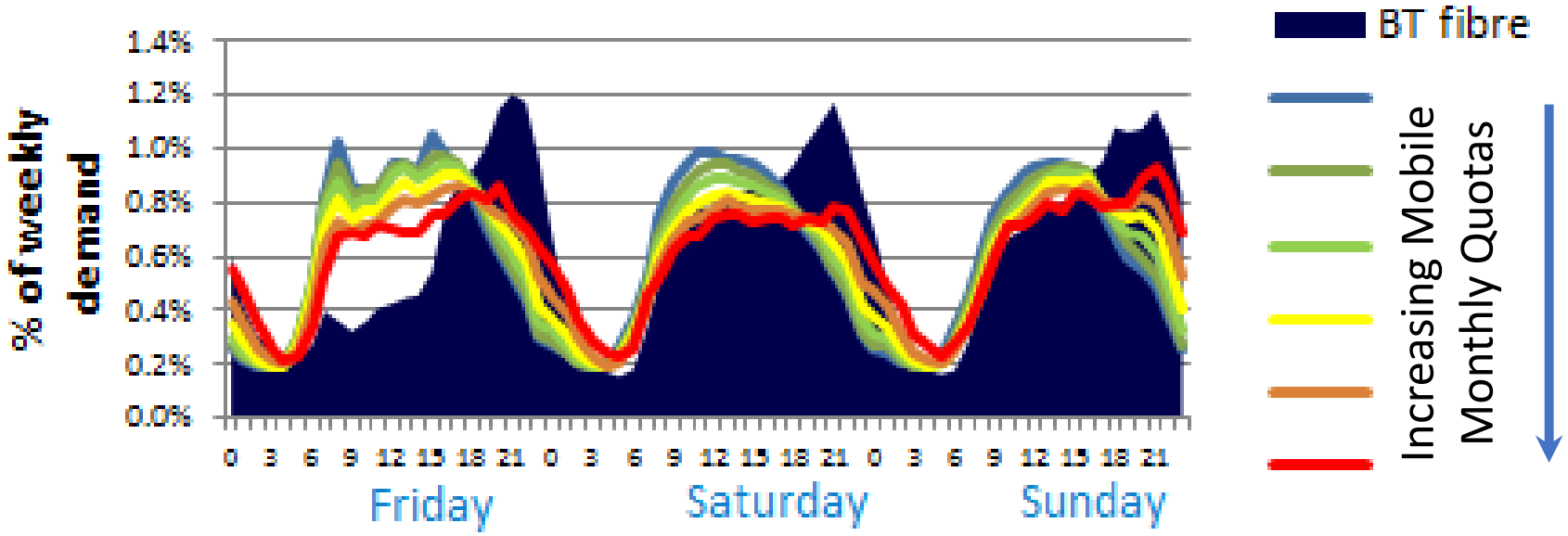
Inexistent self-selection effect

- The graph captures how broadband users' choice of broadband option has changed since Jun-14
- The FTTC40 unlimited option has significantly increased in popularity
- FTTC 40 unlimited has also been more popular than FTTC80 unlimited and only so amongst heavy users
  ➔ This suggests early fibre adopters valued the higher linespeed more than more recent fibre adopters. This is also rational if users assess FTTC80's main benefit over FTTC40 to be quicker data transfers for large files.

Seasonal expectations



Fixed and Mobile Traffic



Moving Forward

- Being part of the Convergence Research Directorate, would mean exploring QoE and Usage analytics inside home, across different wireless and wireline access technologies as well as potential converged core networks

- QoE is the highest-rated competitive differentiator for ISPs driving access network transformation