Presentation:	SamKnows
Presenter:	SAM CRAWFORD
Event:	IETF 85
Location:	Atlanta, GA
Date:	Nov 7, 2012

- Large scale active measurement of broadband networks

- Hardware probes

- Began in 2008...

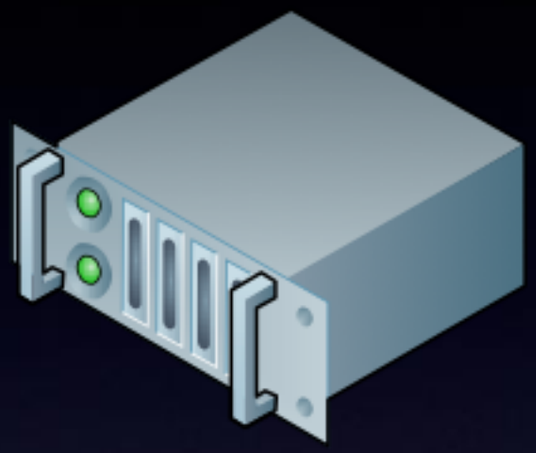
- Six regulator and twelve ISP deployments
- Thirty-four countries on four continents
- Eight languages directly supported
- Over 40,000 measurement probes deployed

Challenges

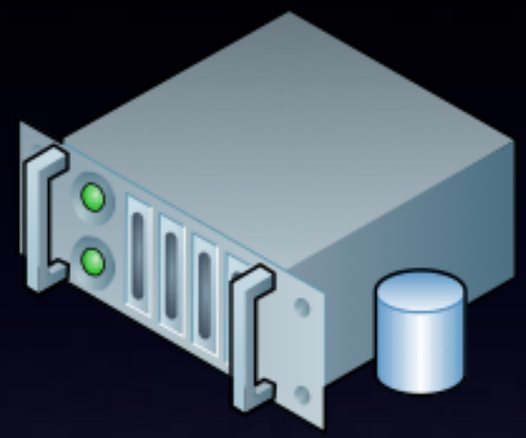
- Technical Challenges
  - Probe hardware and software
  - Measurement servers
  - Data collection and analysis
- Operational Challenges
- Data Challenges

Technical Challenges

Measurement Servers (>300)

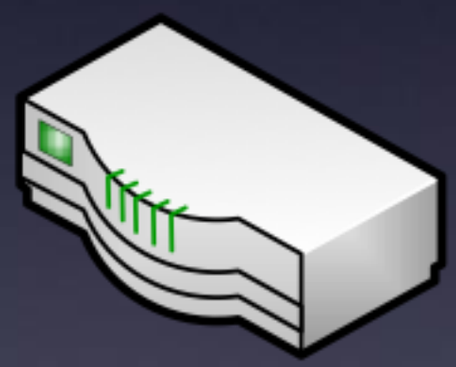


Data Collection Infrastructure (3)



MANAGEMENT TRAFFIC

MEASUREMENT TRAFFIC

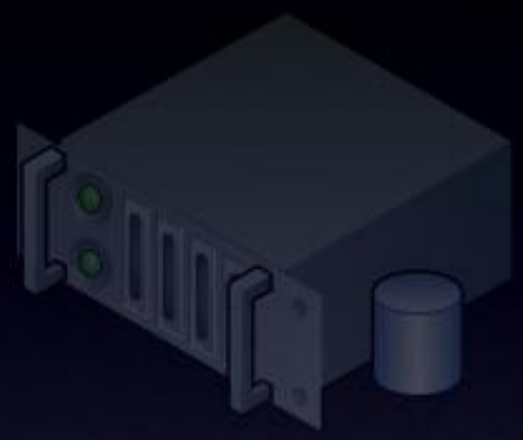


MEASUREMENT RESULTS

Measurement Probes (>40,000)

Measurement Servers (>300)

Data Collection Infrastructure (3)



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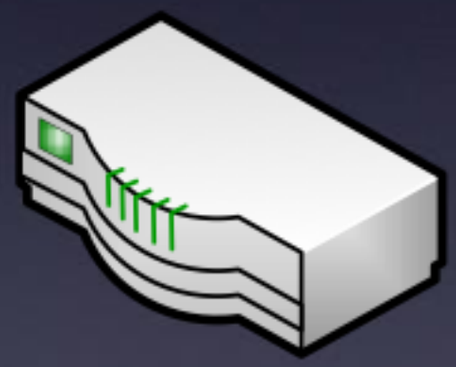


Measurement Probes (>40,000)

TP-LINK
PWR
SYS
WLAN
4
3
2
1
WAN
USB
QSS
Wireless N Gigabit Router
TL-WR1043ND
QSS

Probe Software

- We required:

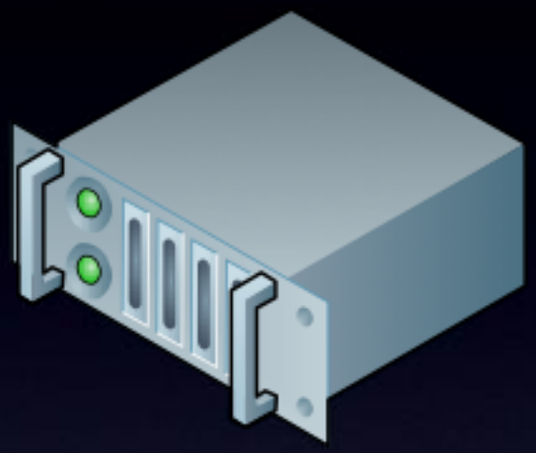
- Small footprint

- Resilient to infrastructure failure

- Remotely upgradeable

- Ability to run 24x7 and support scheduled testing

Measurement Servers (>300)



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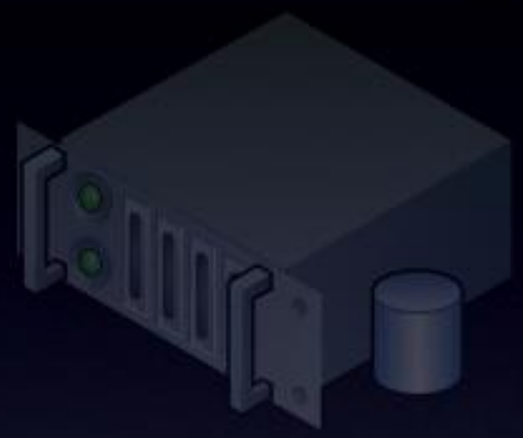

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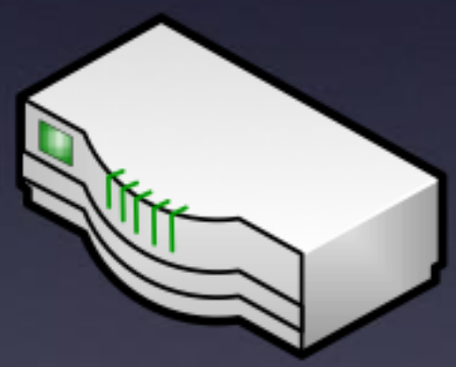


MEASUREMENT RESULTS

Measurement Probes (>40,000)

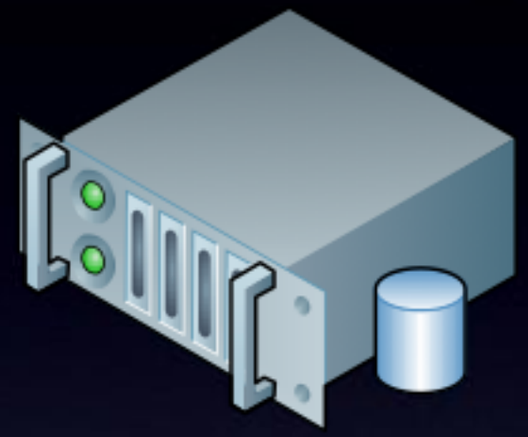
Measurement Servers

- We required:
  - Simple, ‘dumb’ software with minimal barriers
  - No data storage
  - Minimum technical specification

Data Collection

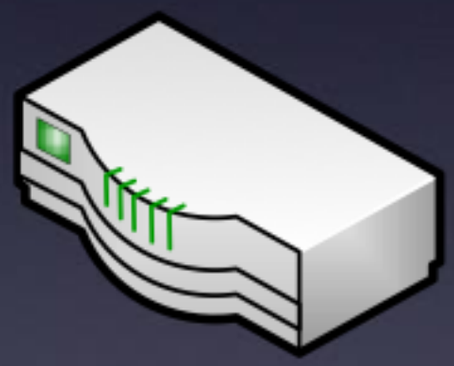
Measurement Servers (>300)

Data Collection Infrastructure (3)



MANAGEMENT TRAFFIC

MEASUREMENT TRAFFIC



MEASUREMENT RESULTS

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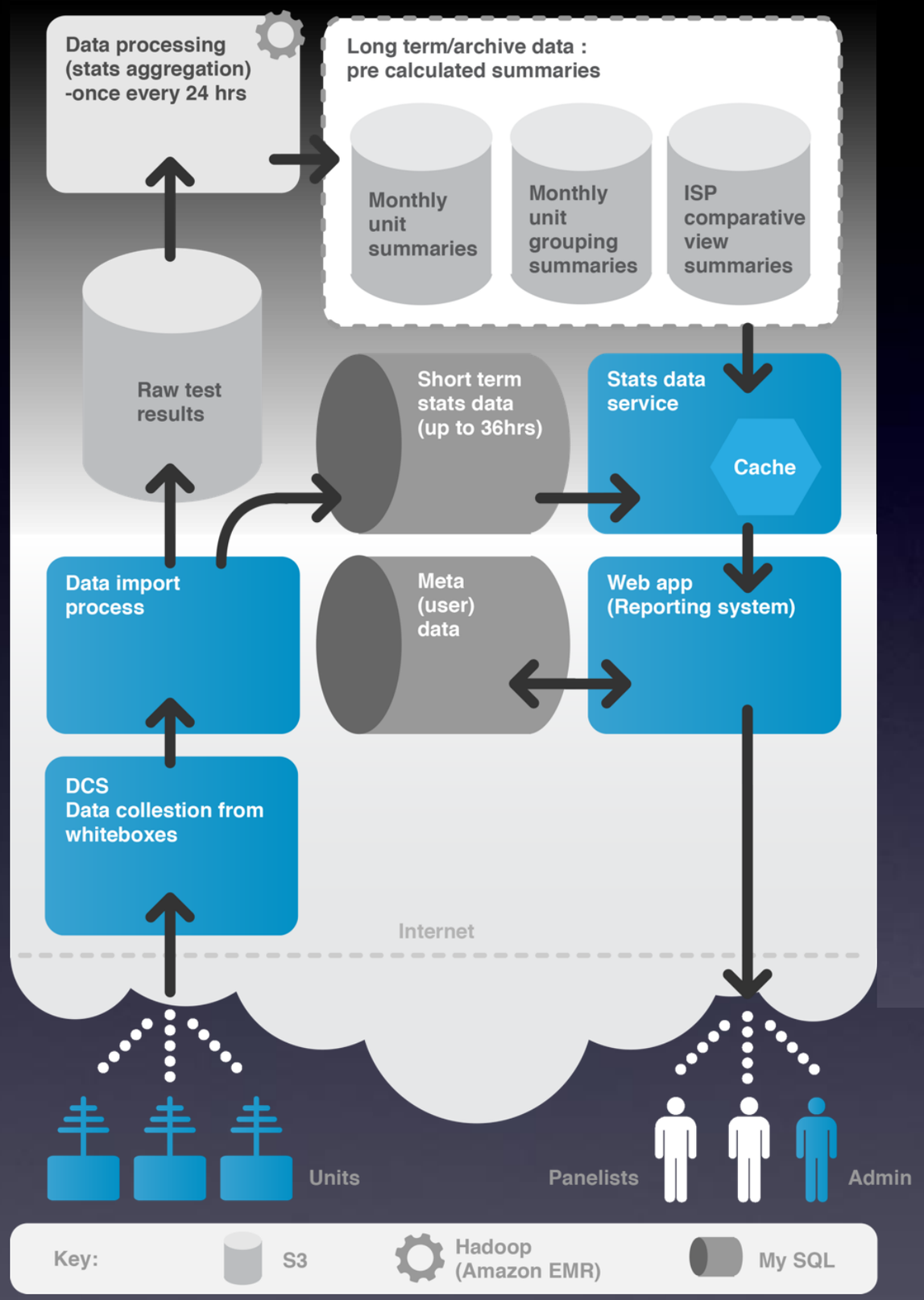

Data processing
(stats aggregation)
-once every 24 hrs
Long term/archive data :
pre calculated summaries
Monthly unit summaries
Monthly unit grouping summaries
ISP comparative view summaries
Raw test results
Short term stats data (up to 36hrs)
Stats data service
Cache
Data import process
Meta (user) data
Web app (Reporting system)
DCS
Data collestion from whiteboxes
Internet
Units
Panelists
Admin
Key:
S3
Hadoop (Amazon EMR)
My SQL

Data Challenges

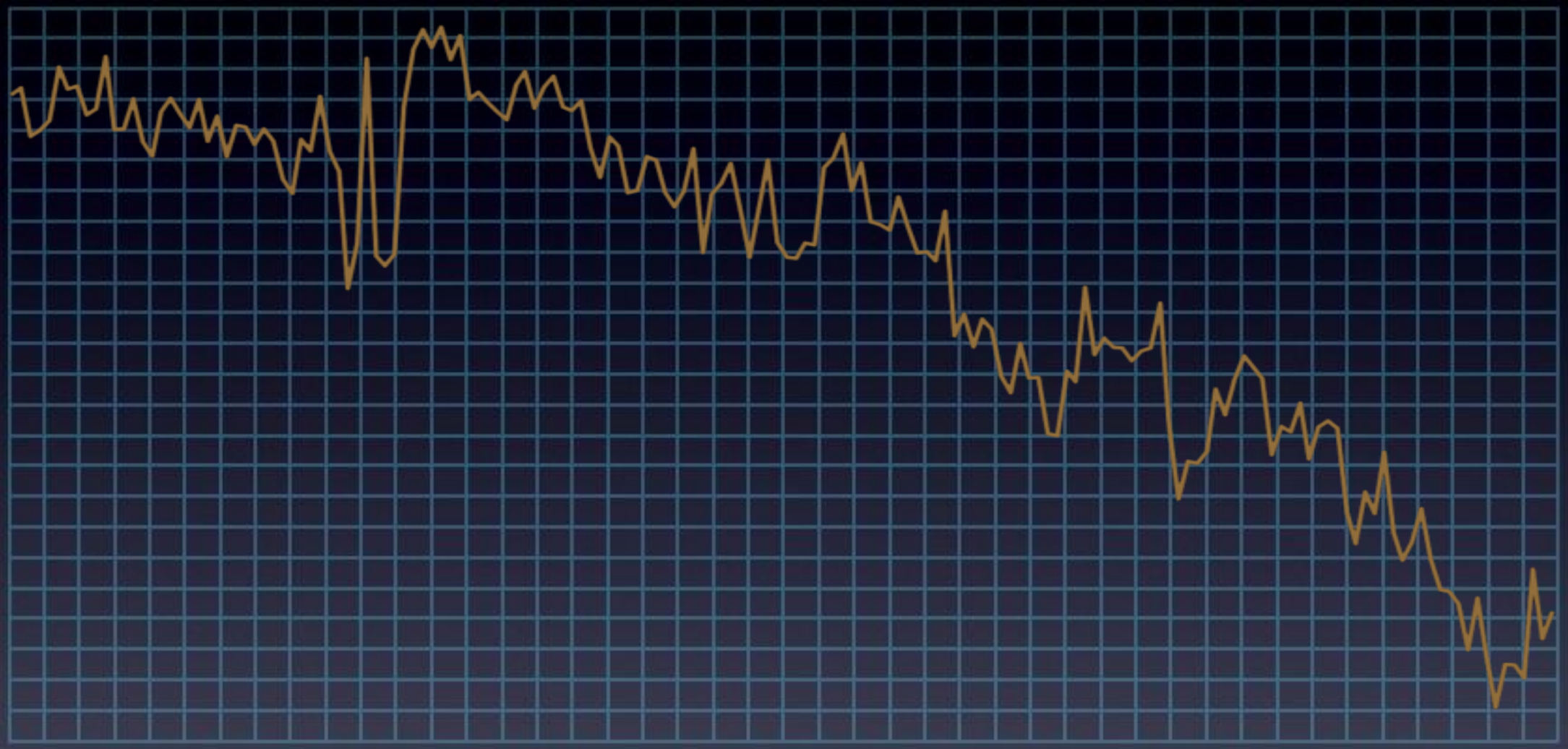
- More than 1 billion data points captured, processed and archived every month
- Service tier validation – critical!
- ISP collaboration
- Panelist privacy issues (including local legislation)

Operational Challenges

- Shipping challenges:
  - Local logistics for tens of thousands of devices
  - Technical integration and further challenges
- Localisation challenges:
  - Language support
  - Regulatory issues
- Infrastructure outages

Example

End-to-end downstream throughput for a single broadband product (200 probes)



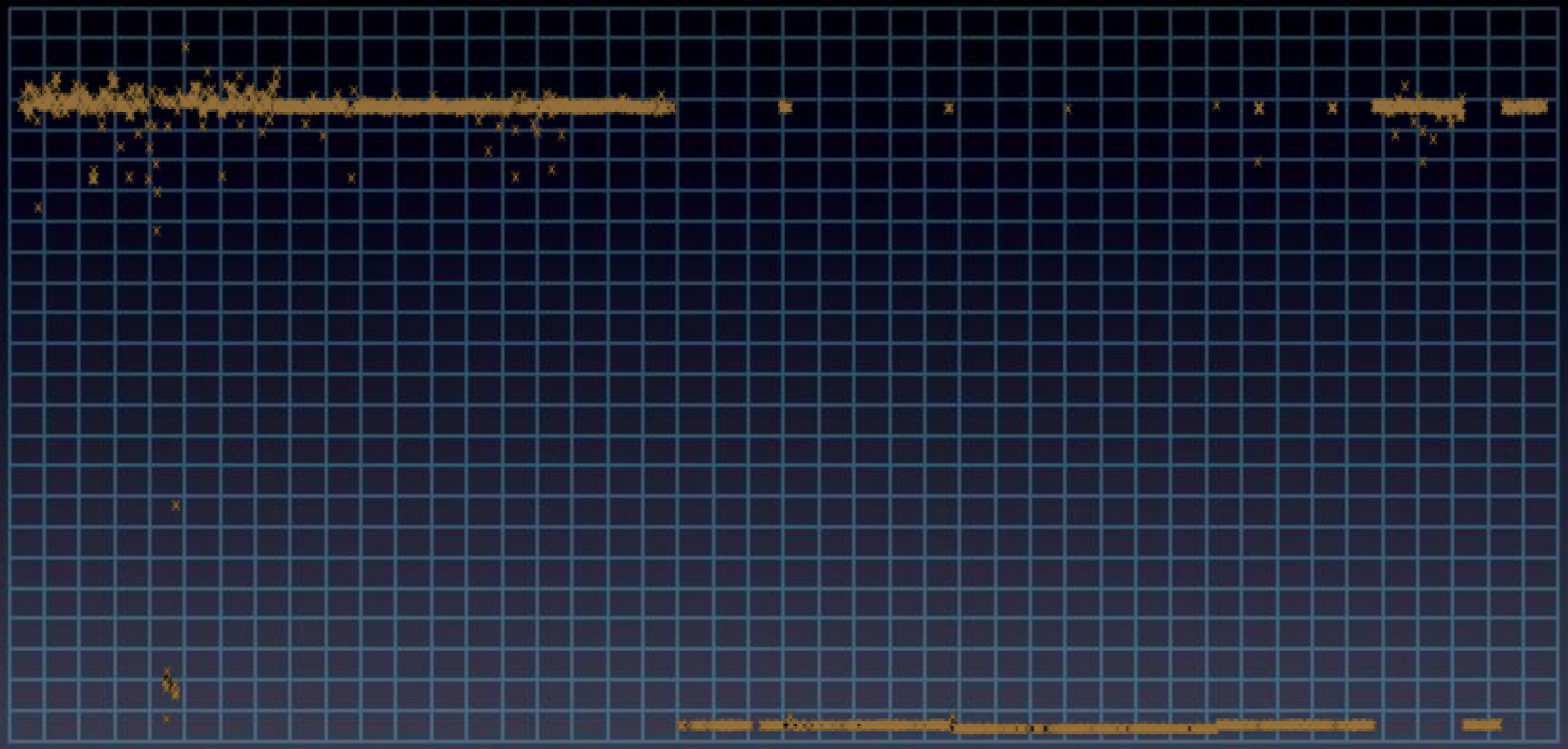
Jan 2012 Apr 2012 Jul 2012

Source: SamKnows

End-to-end downstream throughput for a single broadband product (200 probes)

Source: SamKnows

End-to-end downstream throughput for a single probe



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End-to-end downstream throughput for a single probe

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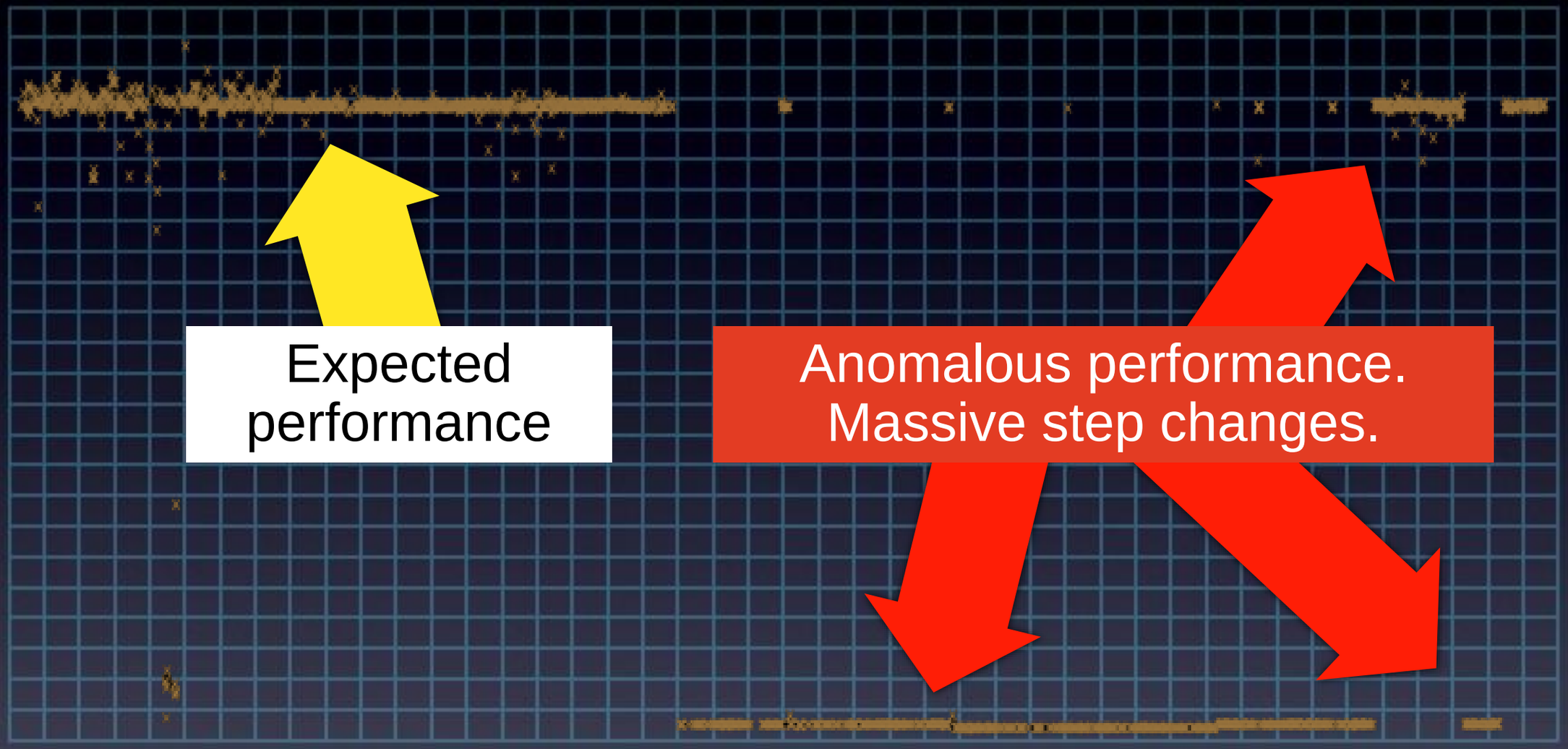
End-to-end downstream throughput for a single probe



Source: SamKnows

Diagnosis

- ISP found no capacity issues
- Investigation with users revealed:

  - Wired throughput intermittently dropped <1M

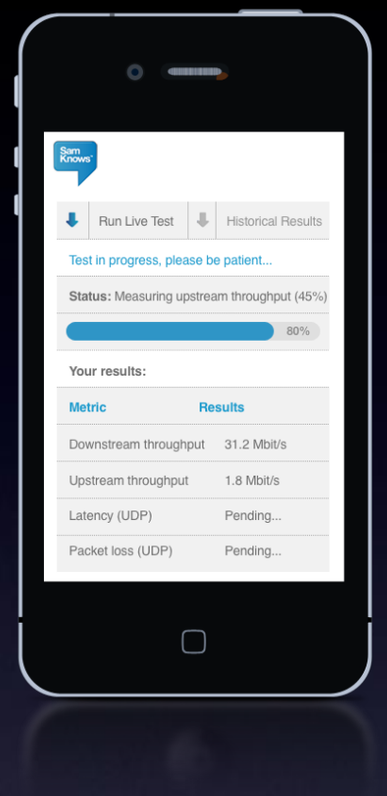
  - Wireless unaffected

- Ultimate cause: bug in ISP’s latest CPE
- Only visible through end-to-end measurements

What’s Next?

- Mobile measurement:

  - Smartphone apps



  - Mobile hardware probes

- IPv4 vs IPv6 measurements

- Standards contributions

samknows.com