



Measurement Lab



*Open broadband data for consumer empowerment
measurementlab.net*

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EUHackathon Closing Ceremony November, 2011*

MLAB

measurementlab.net

*M-Lab is an open, distributed platform for Internet measurement tools.
By enhancing transparency, M-Lab helps sustain a healthy, innovative Internet.*

- **Researchers:**
Server resources to do good, scientific broadband measurement
- **Consumers:**
Open source **tools** giving real-time information on broadband performance
- **Key decision makers:**
Scientifically vetted **data** to found good Internet policy



Enabling scientific conclusions

Complex, real, raw data. **400 terabytes** in the public domain.
Far beyond the average “speed test”

```
WEB100 Kernel Variables:
Client: localhost/127.0.0.1
CurMSS: 1374
X_Rcvbuf: 87380
X_Sndbuf: 176596
AckPktsIn: 1337
AckPktsOut: 0
BytesRetrans: 6870
CongAvoid: 549
CongestionOverCount: 0
CongestionSignals: 5
CountRTT: 1200
CurCwnd: 10992
CurRTO: 312
CurRwinRcvd: 65952
```

```
CurRwinSent: 5888
CurSsthresh: 6870
DSACKDups: 0
DataBytesIn: 0
DataBytesOut: 3463864
DataPktsIn: 0
DataPktsOut: 2464
DupAcksIn: 138
ECNEnabled: 0
FastRetran: 5
MaxCwnd: 67326
MaxMSS: 1374
MaxRTO: 474
MaxRTT: 194
MaxRwinRcvd: 65952
```

```
MaxRwinSent: 5888
MaxSsthresh: 32976
MinMSS: 1374
MinRTO: 309
MinRTT: 106
MinRwinRcvd: 0
MinRwinSent: 5792
NagleEnabled: 1
OtherReductions: 0
PktsIn: 1337
PktsOut: 2464
PktsRetrans: 5
RcvWinScale: 7
SACKEnabled: 3
SACKsRcvd: 137
SendStall: 0
```

```
SlowStart: 73
SampleRTT: 106
SmoothedRTT: 109
SndWinScale: 1
SndLimTimeRwin: 2775674
SndLimTimeCwnd: 7284333
SndLimTimeSender: 174120
SndLimTransRwin: 2
SndLimTransCwnd: 10
SndLimTransSender: 9
SndLimBytesRwin: 1637990
SndLimBytesCwnd: 1803898
SndLimBytesSender: 21976
SubsequentTimeouts: 0
SumRTT: 130594
Timeouts: 0
```

```
TimestampsEnabled: 1
WinScaleRcvd: 1
WinScaleSent: 7
DupAcksOut: 0
StartTimeUsec: 988290
Duration: 10235350
c2sData: 6
c2sAck: 6
s2cData: 8
s2cAck: 4
half_duplex: 0
link: 0
congestion: 0
bad_cable: 0
mismatch: 0
```

```
spd: 2.71
bw: 2.14
loss: 0.002029221
avgrtt: 108.83
waitsec: 0.00
timesec: 10.00
order: 0.1032
rwin: 0.5032
swin: 1.3473
cwin: 0.5137
rttsec: 0.108828
Sndbuf: 176596
```

```
aspd: 0.00000
CWND-Limited: 88.98
minCWNDpeak: 2748
maxCWNDpeak: 67326
CWNDpeaks: 5
```

The theoretical network limit is 2.14 Mbps
The NDT server has a 86.0 KByte buffer which limits the throughput to 12.38 Mbps
Your PC/Workstation has a 64.0 KByte buffer which limits the throughput to 4.62 Mbps
The network based flow control limits the throughput to 4.72 Mbps

Client Data reports link is 'OC-12', Client Acks report link is 'OC-12'
Server Data reports link is 'OC-48', Server Acks report link is 'T3'

Why are we hacking?

```
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CountRTT: 1200
CurCwnd: 10992
CurRTO: 312
CurRwinRcvd: 65952
CurRwinSent: 5888
CurSsthresh: 6870
DSACKDups: 0
DataBytesIn: 0
DataBytesOut: 0
DataPktsIn: 0
DataPktsOut: 0
DupAcksIn: 13
ECNEnabled: 0
FastRetran: 5
MaxCwnd: 673
MaxMSS: 1374
MaxRTO: 474
MaxRTT: 194
MaxRwinRcvd: 65952
MaxRwinSent: 5888
TimestampsEnabled: 1
WinScaleRcvd: 1
WinScaleSent: 7
DupAcksOut: 0
StartTimeUsec: 988290
Duration: 10235350
c2sData: 6
c2sAck: 6
s2cData: 8
s2cAck: 4
half_duplex: 0
link: 0
congestion: 0
bad_cable: 0
mismatch: 0
spd: 2.71
bw: 2.14
loss: 0.00202
avgrrt: 108.8
waitsec: 0.00
timesec: 10.0
order: 0.1032
rwin: 0.5032
swin: 1.3473
cwin: 0.5137
rttsec: 0.108828
Sndbuf: 176596
```



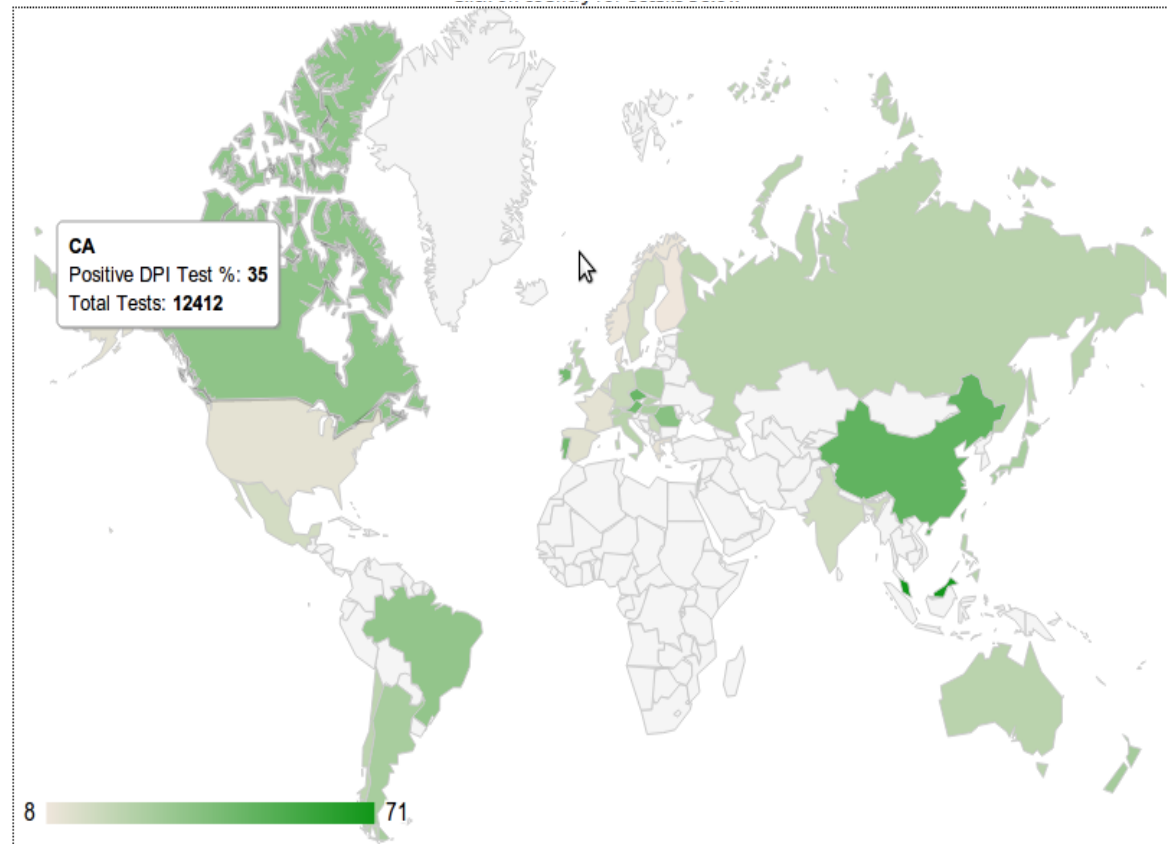
We're here to make this... meaningful to them
(and to everyone else!)

Turning data into meaning



- Team: TU Delft
- Netherlands

Using M-Lab's Glasnost data, creating a heat map showing where deep packet inspection by ISPs is most common



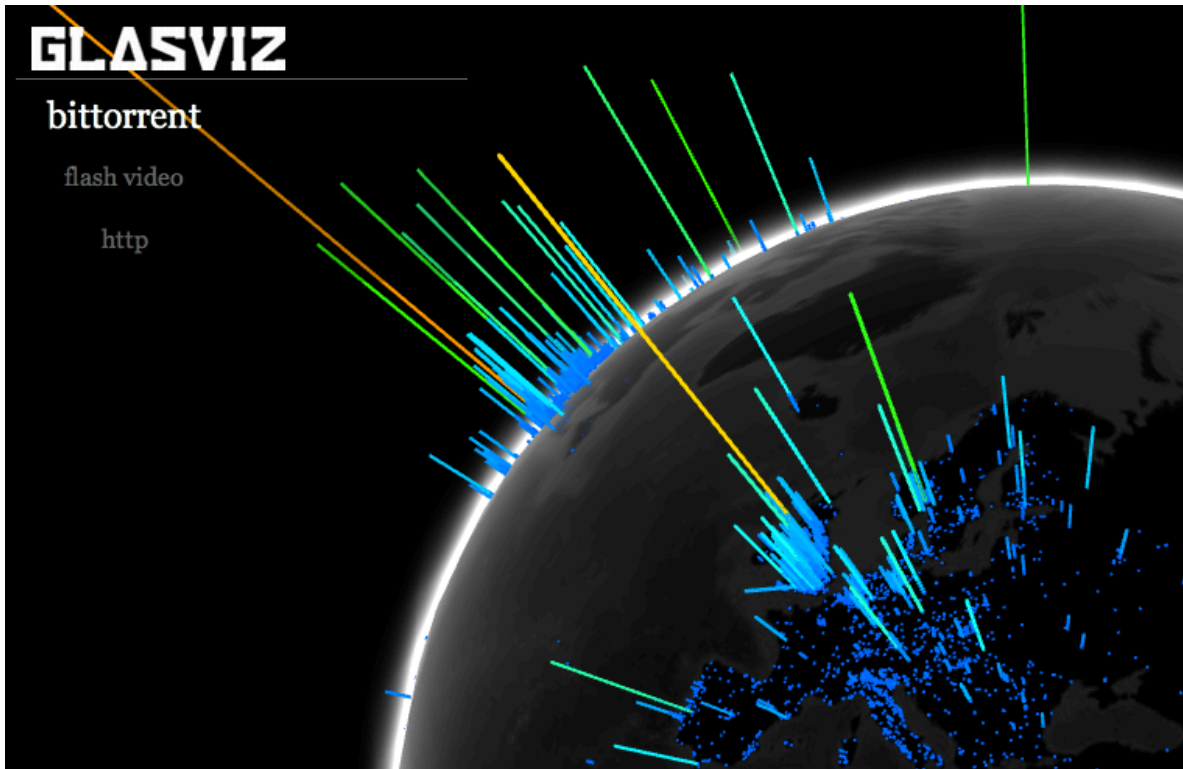
Turning data into meaning



- Team: Malik
- Origin: Sweden, Denmark

NDT test interface that compares a consumer's results with others', and summarizes expected performance of applications.

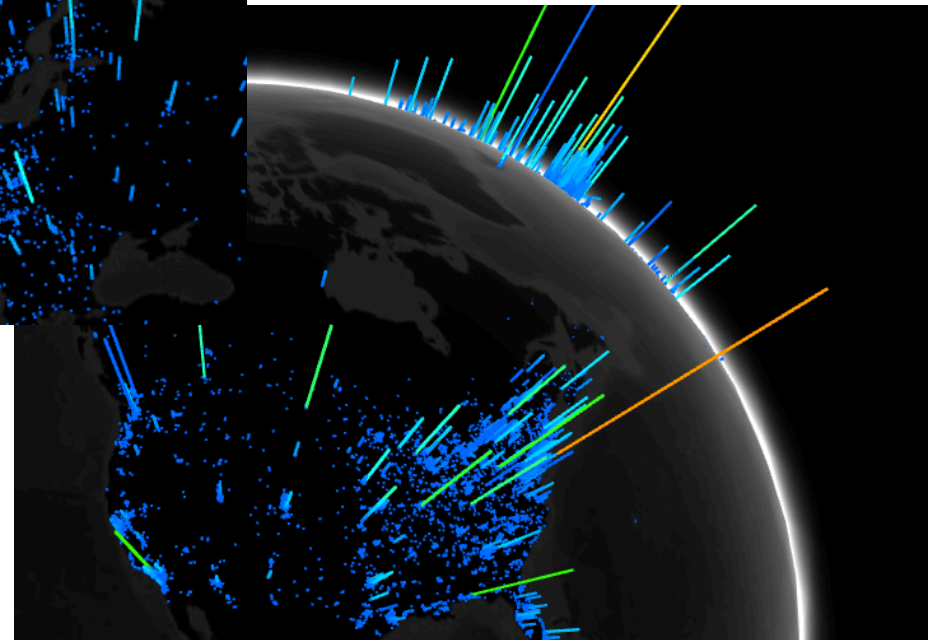
Turning data into meaning



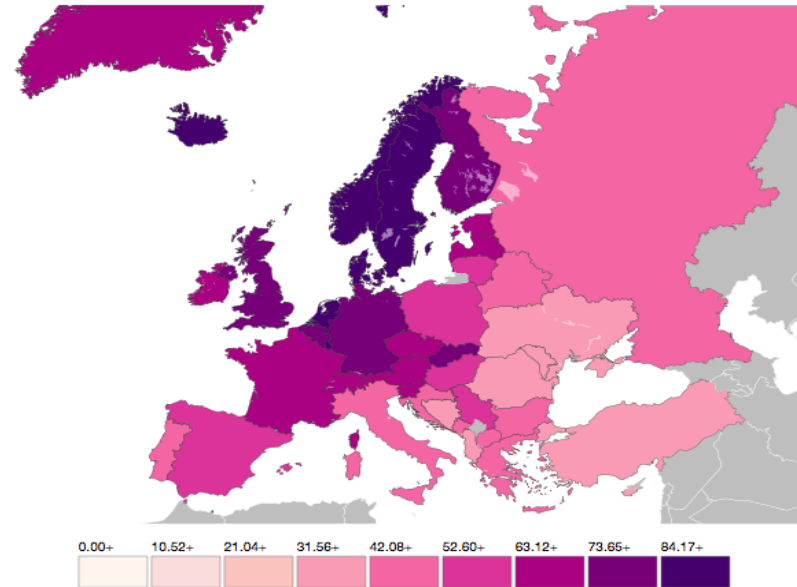
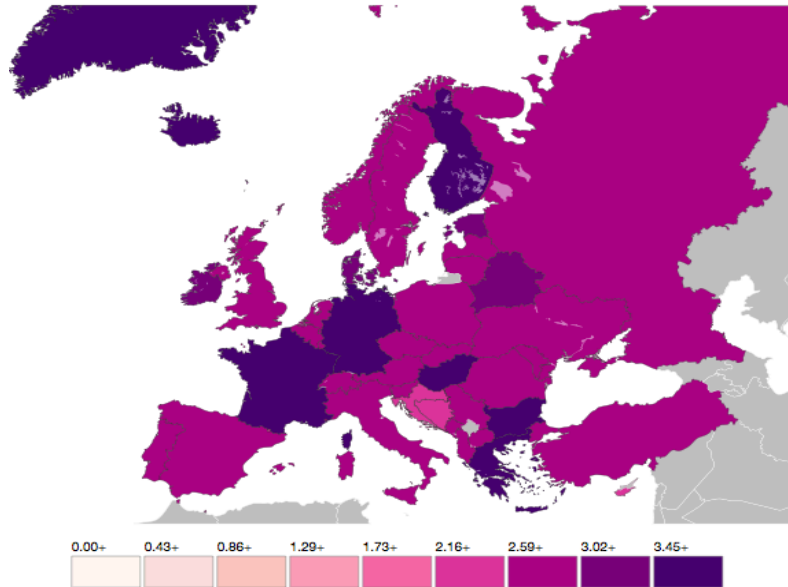
- Team: Tony Blank
- USA

Application throttling around the globe

EUhACKATHon



Turning data into meaning



- Team: Eduardo Graells
- Spain
- Global map showing network conditions across multiple parameters