Large-Scale Measurement of P2P-TV Systems

Insights on Fairness and Locality of Peers

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Background

- Television over the Internet
  - (Live ≠ VoD)
- Peer-to-Peer applications (e.g. BitTorrent)
  - Large-scale delivery (≠ client/server)
  - Low costs (≠ CDN, Multicast)
- Video streaming (e.g. Youtube)
- New kind of applications on Internet
  - Peer-to-peer video live streaming (P2P-TV)

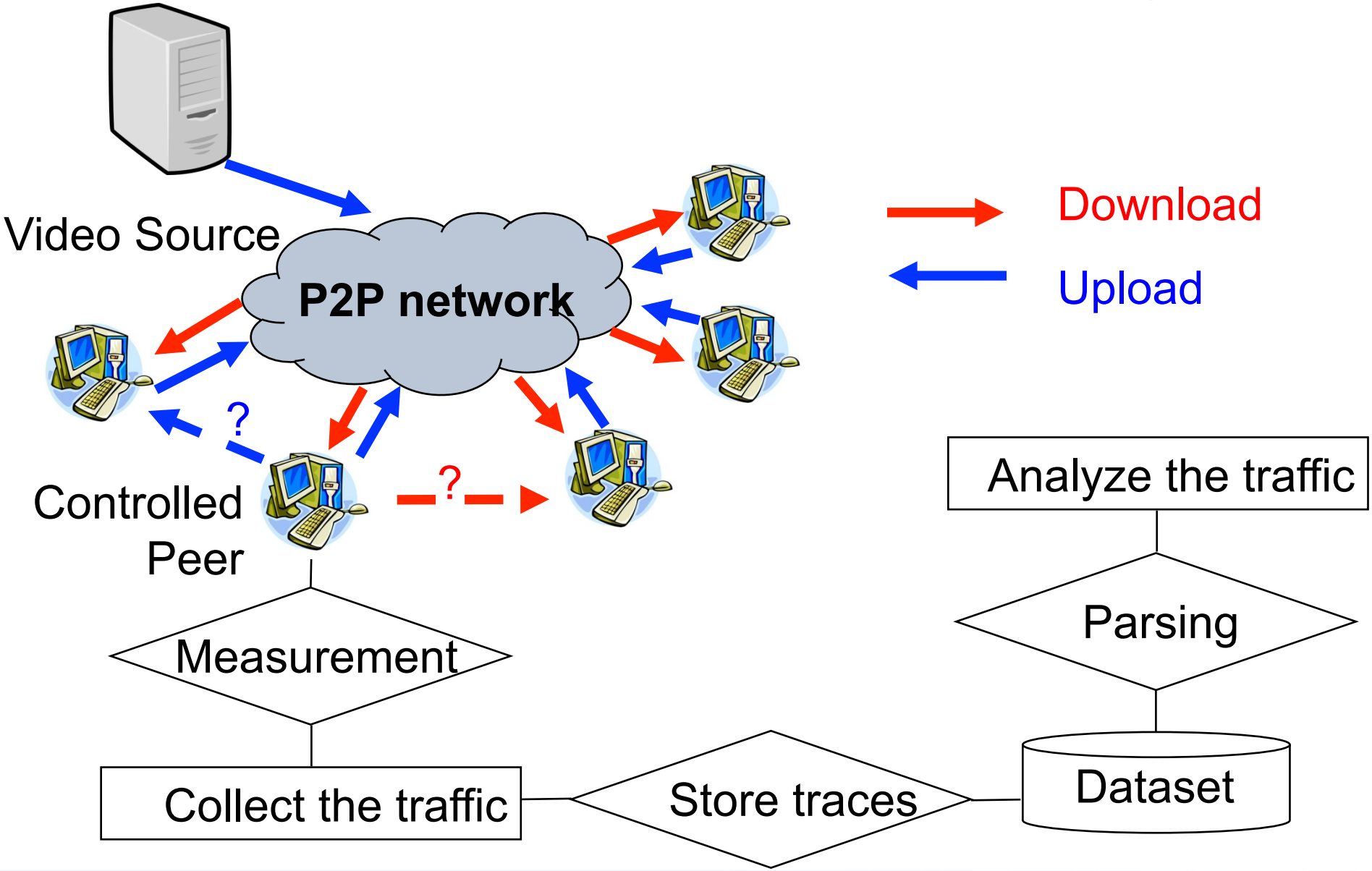
Measuring P2P-TV Systems

- Internet traffic
  - P2P (e.g. BitTorrent, eDonkey)
  - Video (Youtube)
    - Issue for the Internet Service Providers (ISPs)
- P2P-TV: large part of the traffic in the future
  - Resources consumption
  - Proprietary applications (unknown architecture)
- Measurement and monitoring of P2P-TV

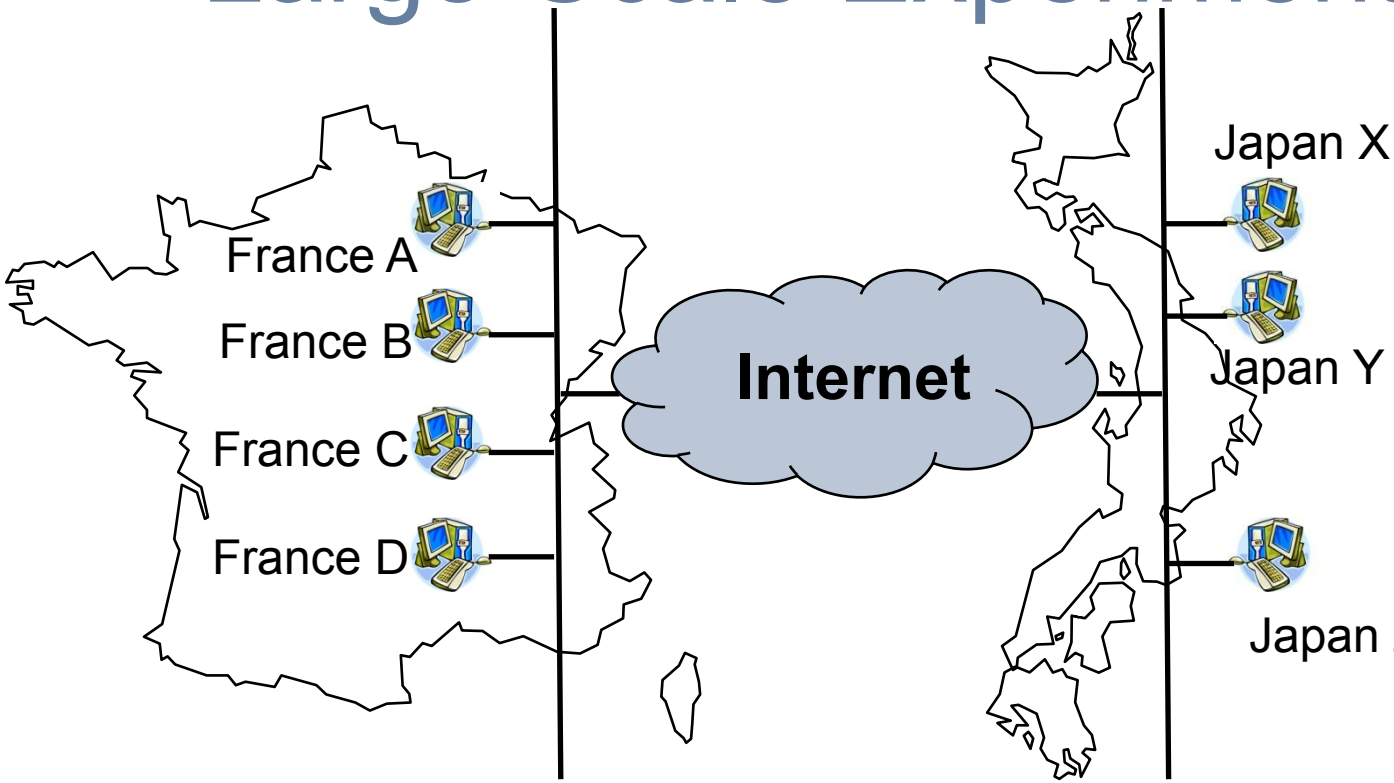
Large-Scale Experiment

- Previous measurement experiments
  - Reverse engineering of P2P-TV
    - [Hei 2006], [ACM Nossdav 2007], [Alessandria 2009]
  - Local-view of the networks
- Characterize P2P-TV traffic at large scale
  - Global-view of the networks
  - Impact for ISPs, usage, scalability

Measurement Methodology



Large-Scale Experiment Testbed



- Soccer games
- 5 to 7 nodes
- 24 traces (>100GB)

- Multiple measurement points
- Diversity betweens probes

Traces Summary

TVAnts	Size (GB)	#Pkt	#IP	Simi-larity (%)	Up. (%)	Down. (%)
FRA A	2.7	3.3	1,854	97	79	21
FRA B	2.0	2.4	1,864	97	79	21
FRA C	2.6	3.1	1,768	97	78	22
FRA D	2.7	3.3	1,887	97	79	21
JPN X	2.4	2.9	1,855	97	77	23
JPN Y	2.3	2.8	1,862	97	75	25
JPN Z	2.5	3.0	1,877	97	78	22

The same event measured by all the nodes

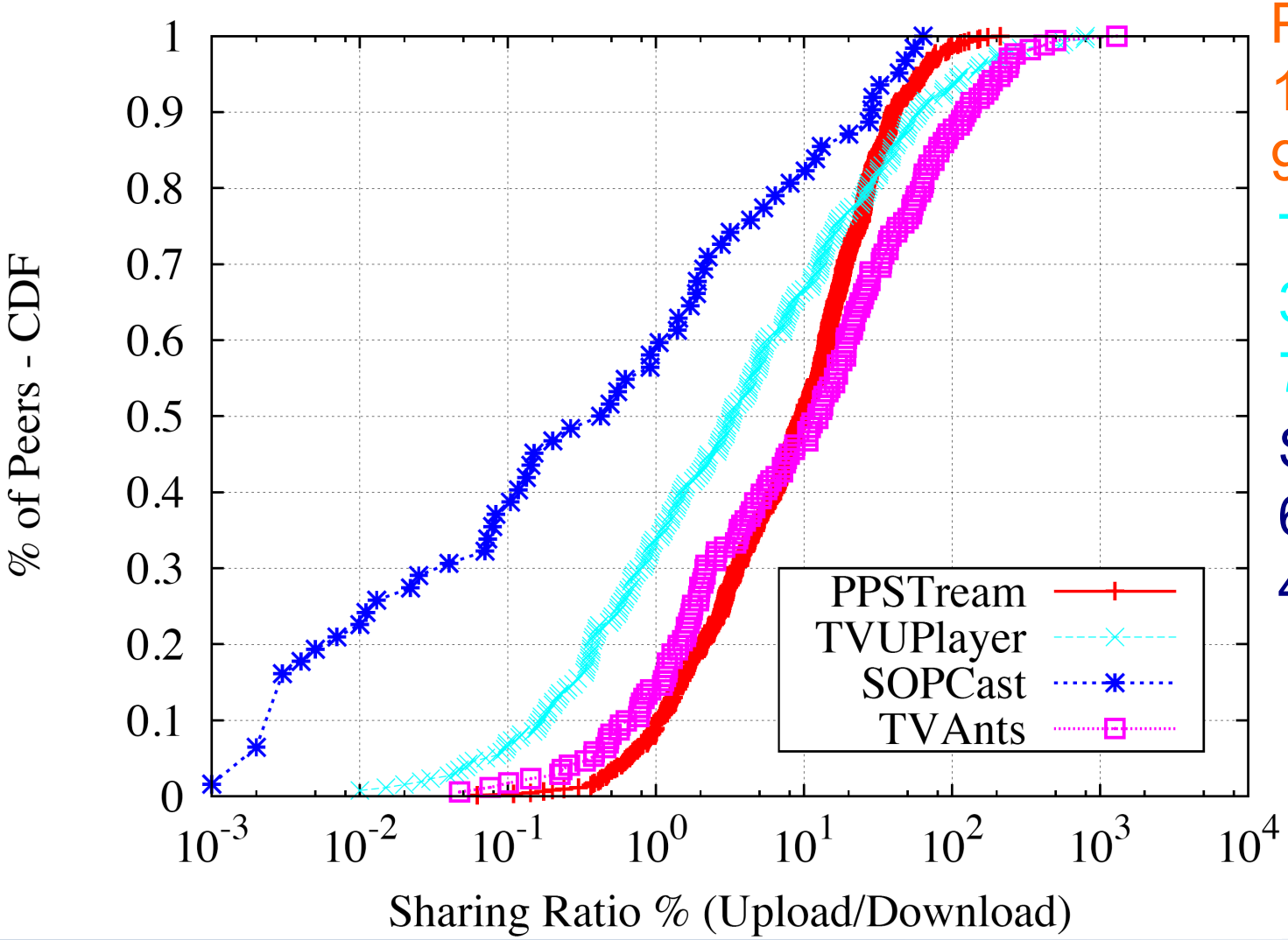
Similarity: ratio of IPs present in the other traces

#Pts of measure is adequate

Collaboration Between Peers

- Peers are responsible to transmit data
  - Collaboration for scalability
- Exchange of data between peers
- *Sharing Ratio*: Upload/Download
  - >1: our peers are altruist
  - =1: exchange is fair
  - <1: our peers benefit from remote peers

Collaboration Between Peers



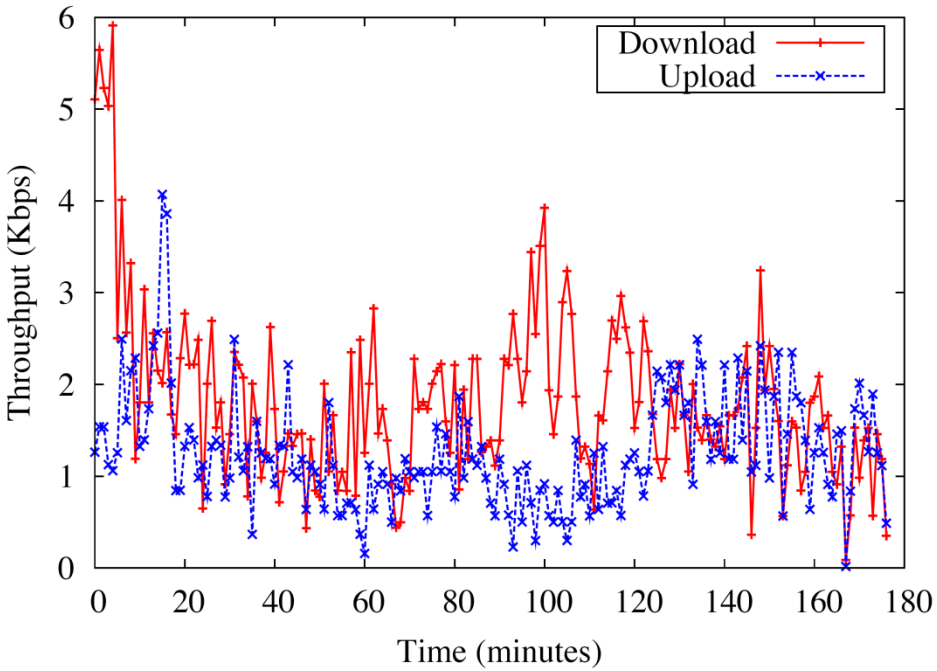
PPSTream, TVAnts:
10% are altruist
90% benefit

TVUPlayer:
30% are altruist
70% benefit

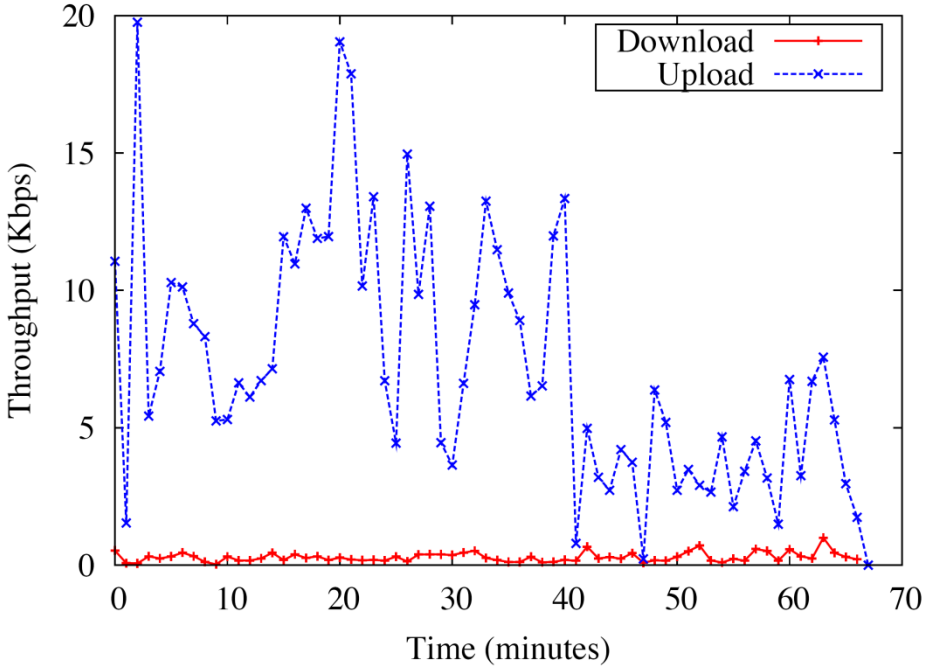
SOPCast
60% are altruist
40% benefit

No Fairness between Peers

Collaboration Between Peers



Fair Exchange

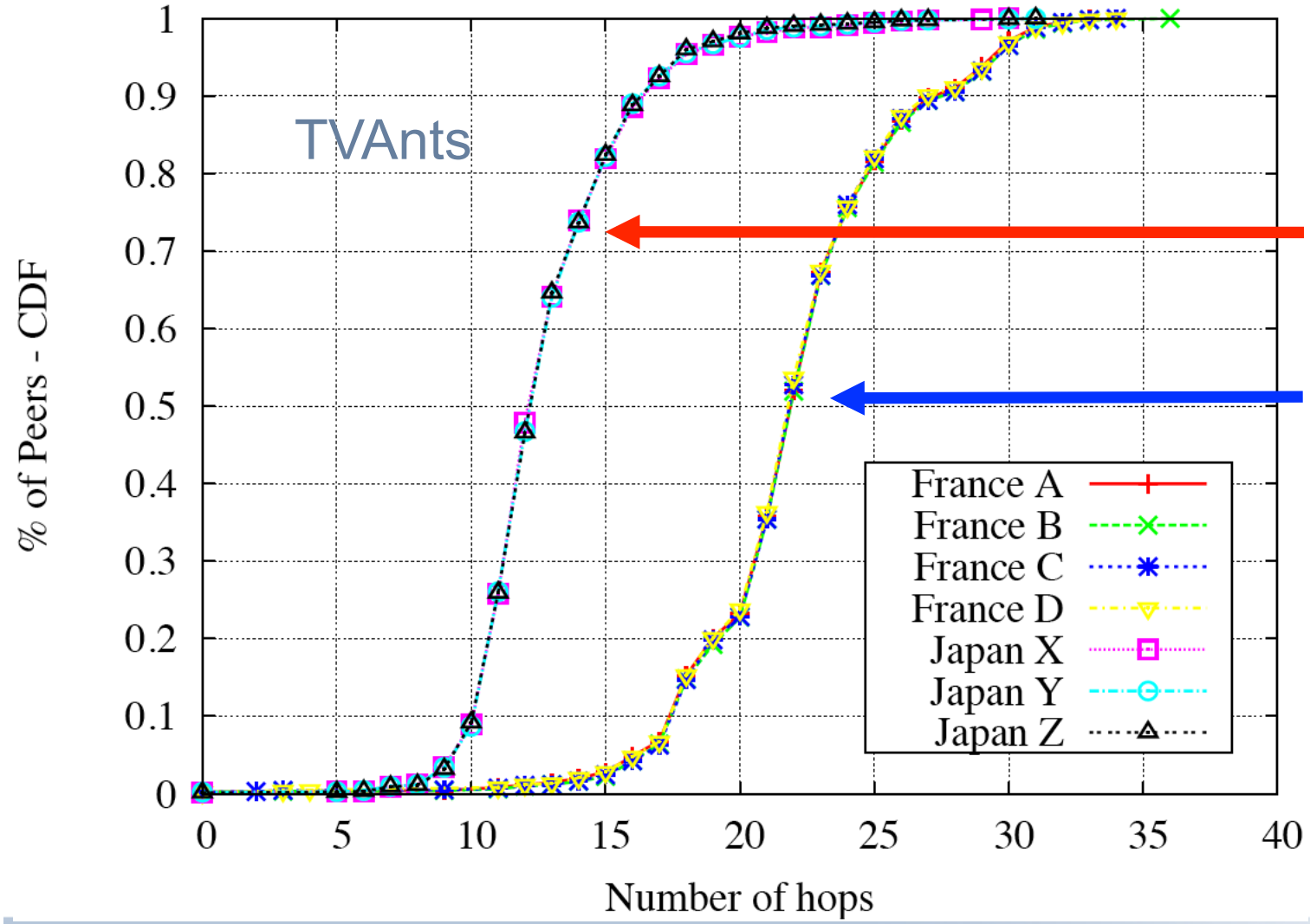


UnFair Exchange

Distance Between Peers

- Distance where peers download the video
- TTL field of received IP datagrams
- Windows XP set TTL to 128
- Distance = TTL_default - TTL_received
  - Ex: if TTL_received = 120
  - Distance = 128-120 = 8 hops

Distance Between Peers



Japanese peers: 70% of peers are situated from 10 to 15 hops

French peers: 70% of peers are situated from 20 to 27 hops

- French peers download at longer distance than Japanese Peers

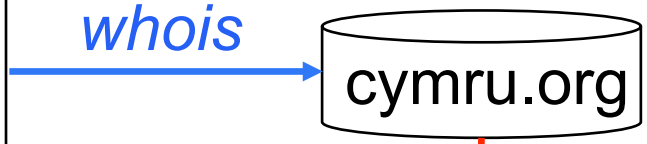
Asian Peers

Locality-aware

Locality of Peers

- Traceroute from French peers
  - Download at longer distance than Japanese

```
traceroute 132.227.74.100 -> 74.125.127.100
1  132.227.74.253  10 ms   9 ms   9 ms
2  193.68.109.158  20 ms   18 ms   19 ms
3  193.51.181.102  88 ms   90 ms   86 ms
4  74.125.127.100  94 ms   93 ms    94 ms
```

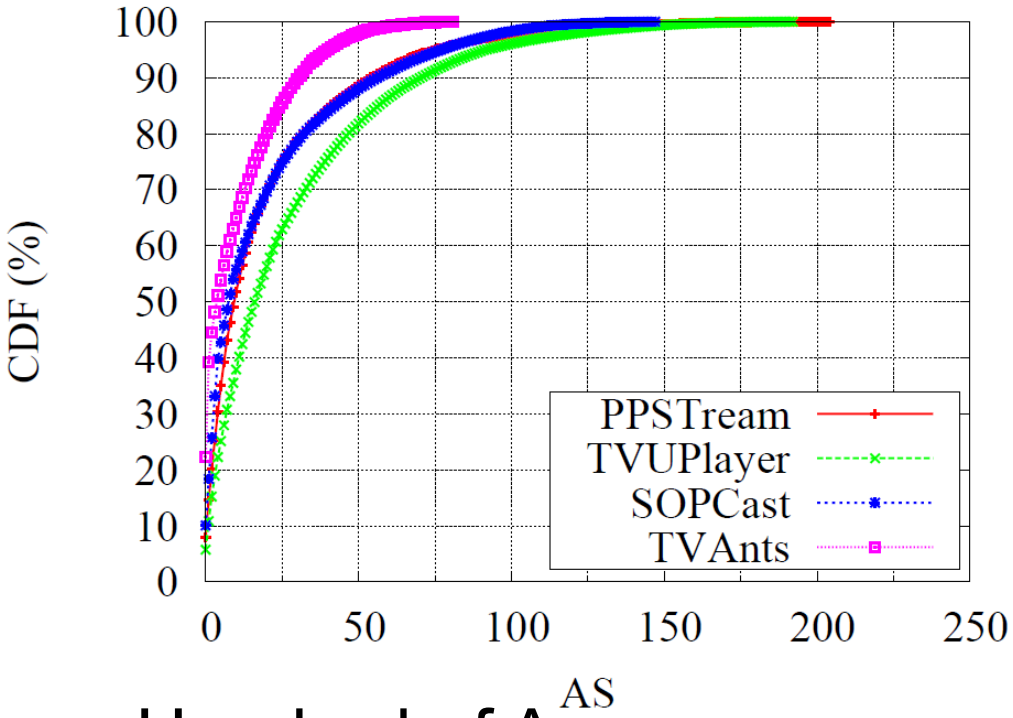


1 AS37
2 AS528
3 AS528
4 AS1217

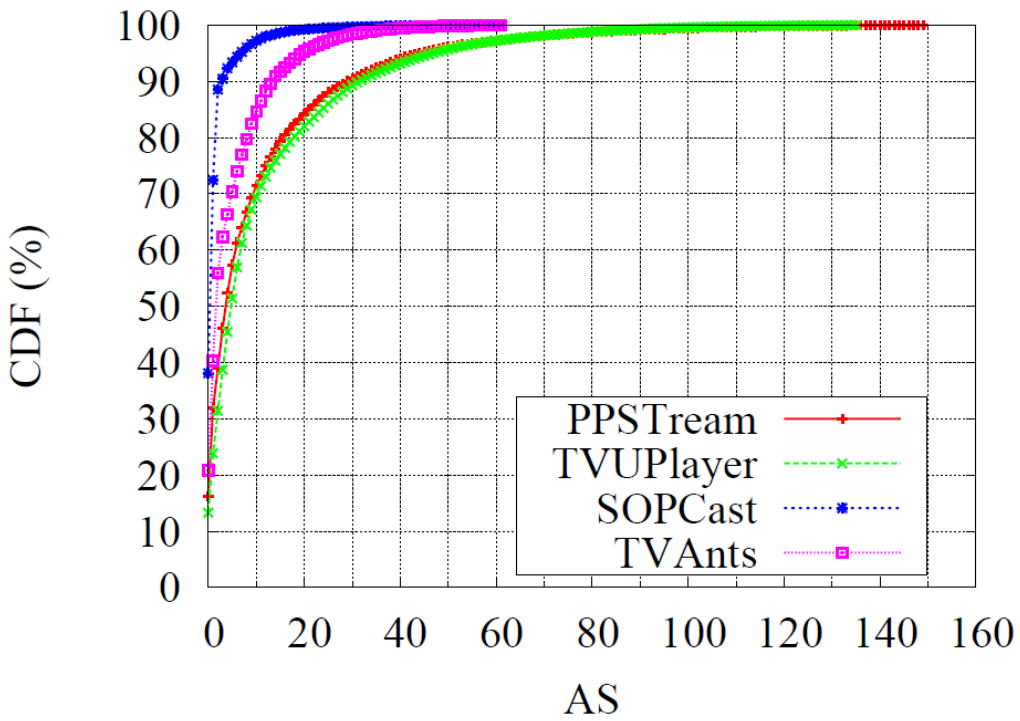
2 AS hops

Locality of Peers

Upload



Download

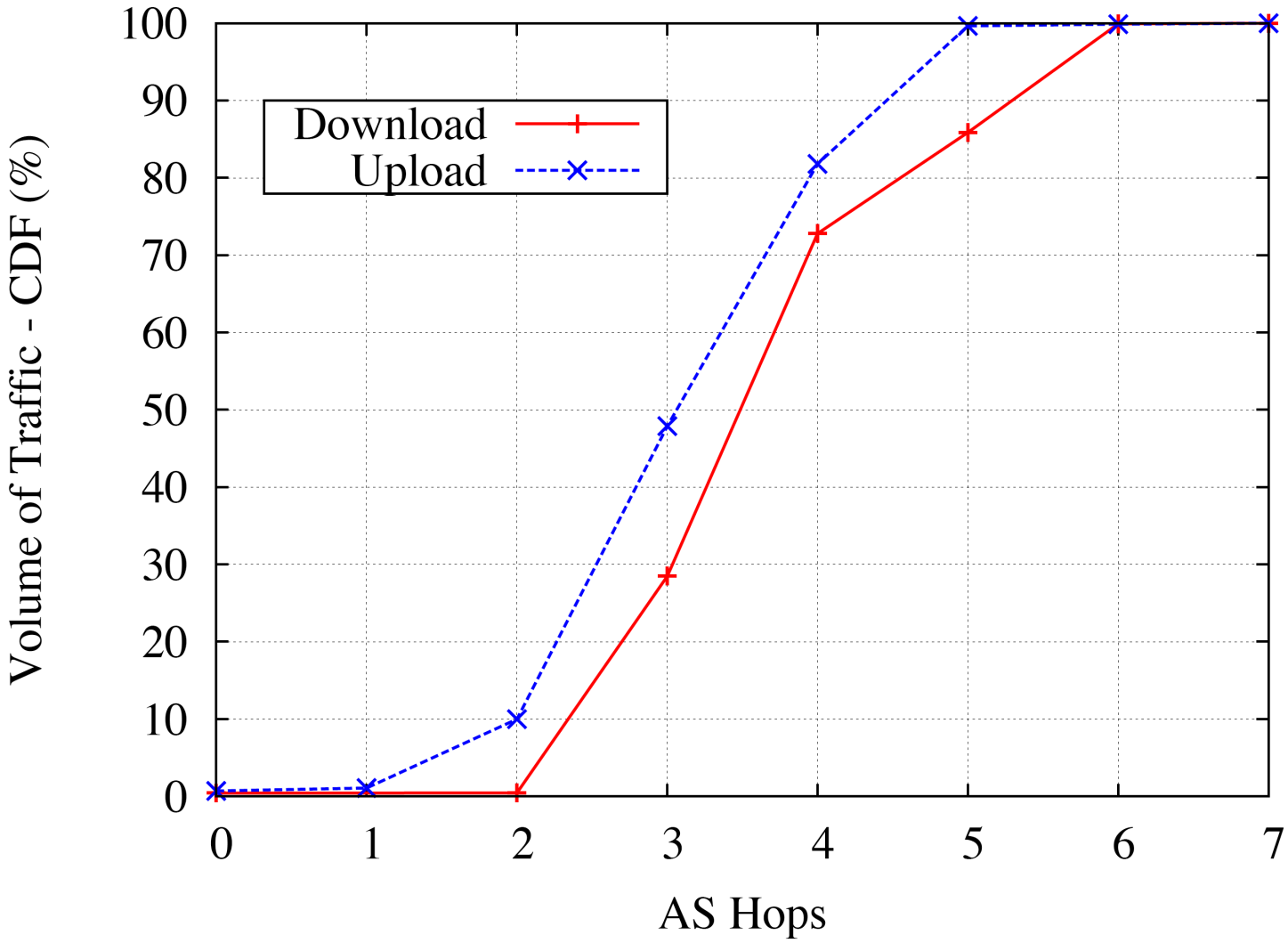


- Hundred of Ases

  -Dispersion of peers

  -Ex: 90% of PPSTream Up to 60 Ases

Locality of Peers

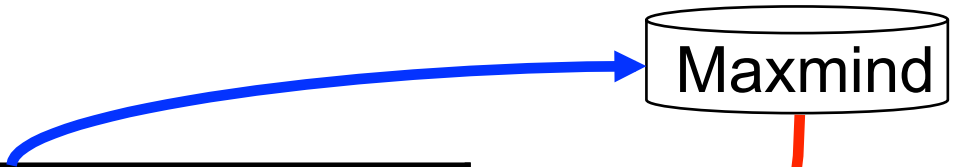


- Upload:
  50% < 3 AS hops
- Download:
  30% < 3 AS hops
  15% > 5 AS hops

- Download traffic crosses more AS links
- Impact for ISP

Geographic Location of Traffic

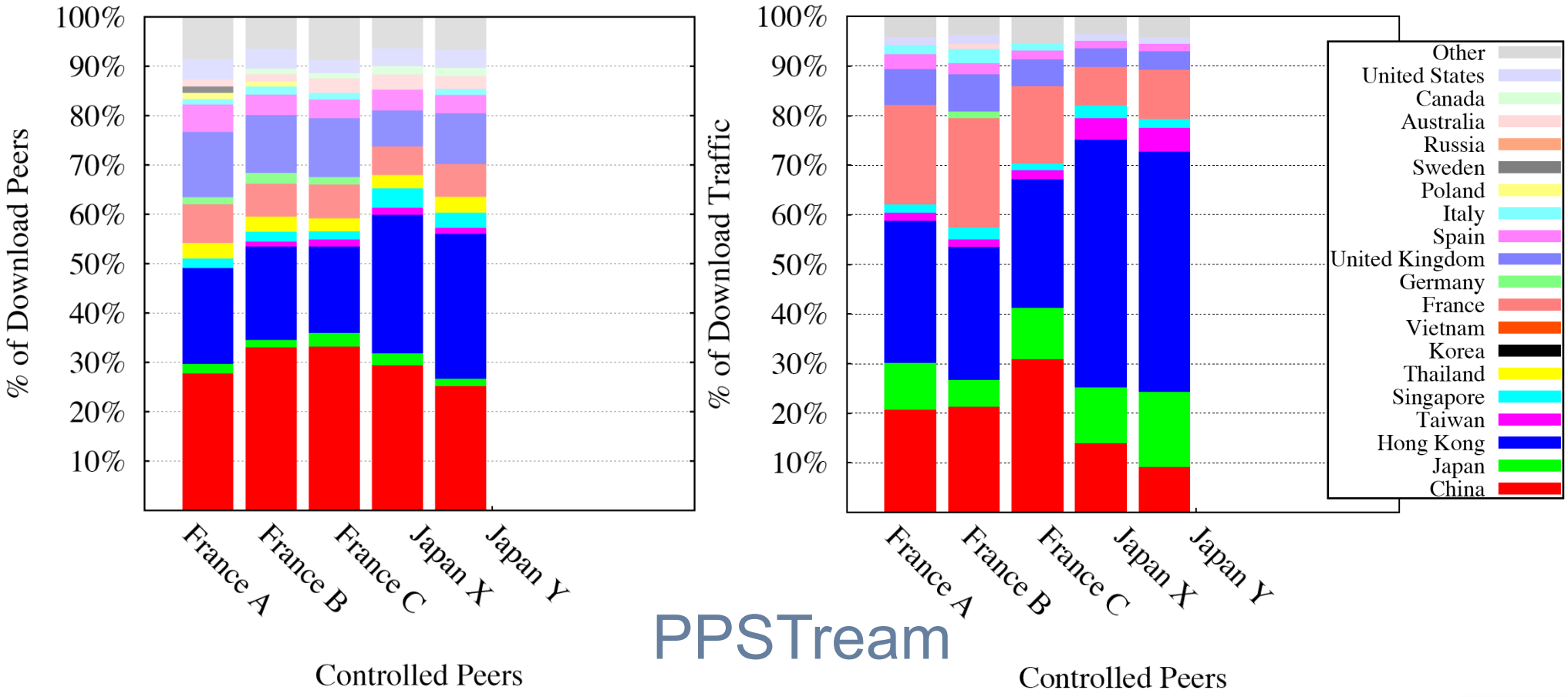
- Where are the peers in P2P-TV
- Usage of P2P-TV



IP Address	Up. (MB)	Down. (MB)	
132.227.62.23	50	10	FRA
84.68.18.30	20	100	GBR
203.178.135.14	200	10	JPN

Location of Download Traffic

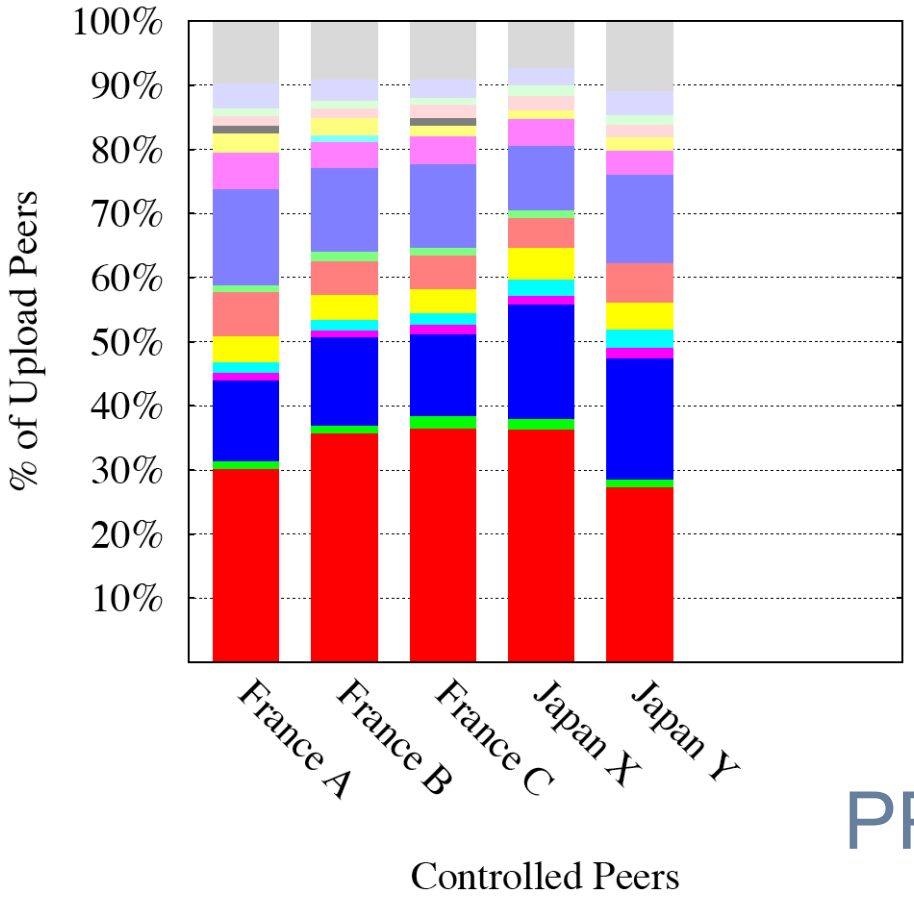
Soccer game: GBR vs. FRA

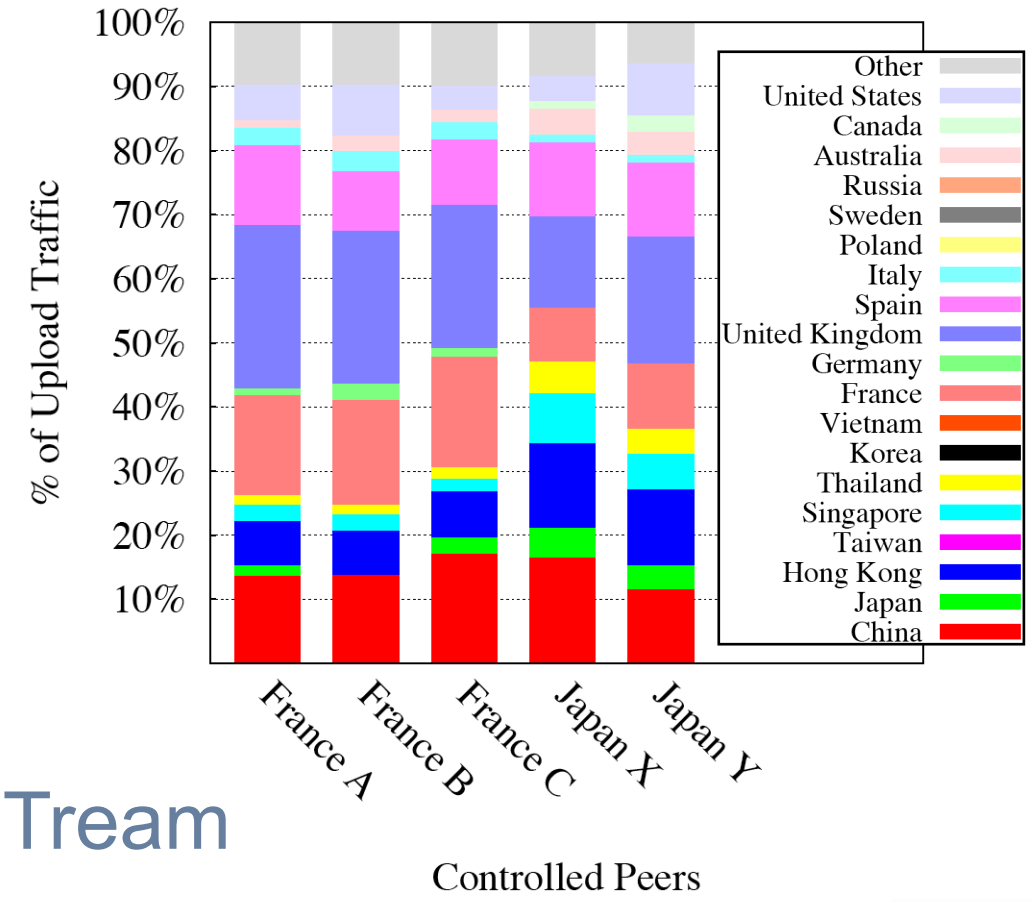


PPSTream

Location of Upload Traffic

Soccer game: GBR vs. FRA

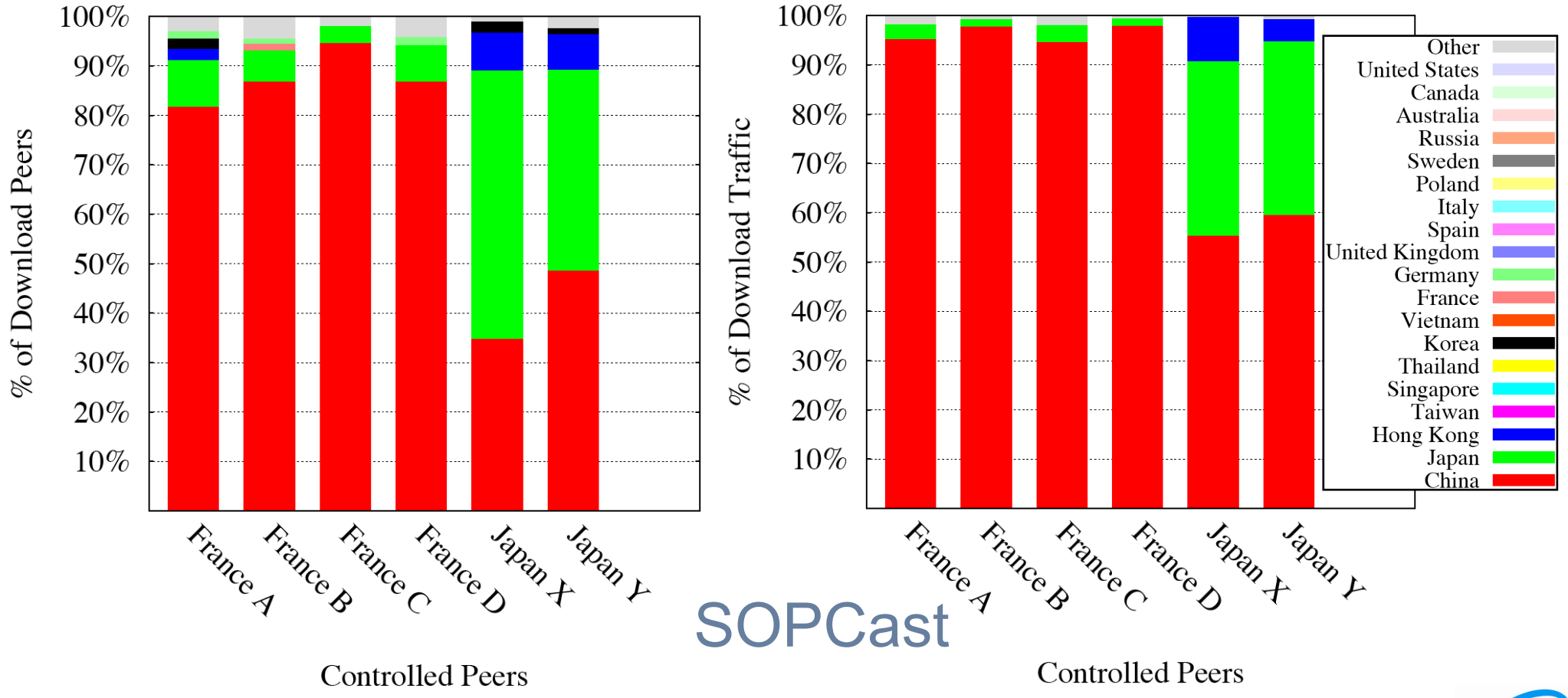




PPSTream

Location of Download Traffic

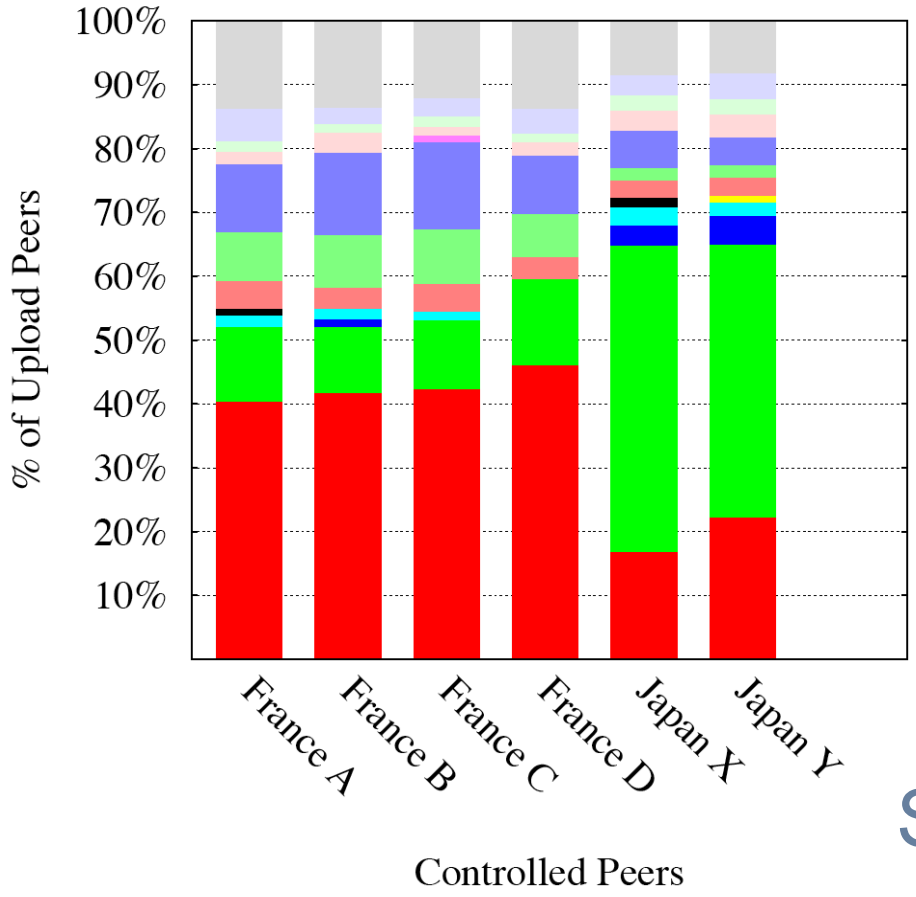
Soccer game: CHN vs. JPN

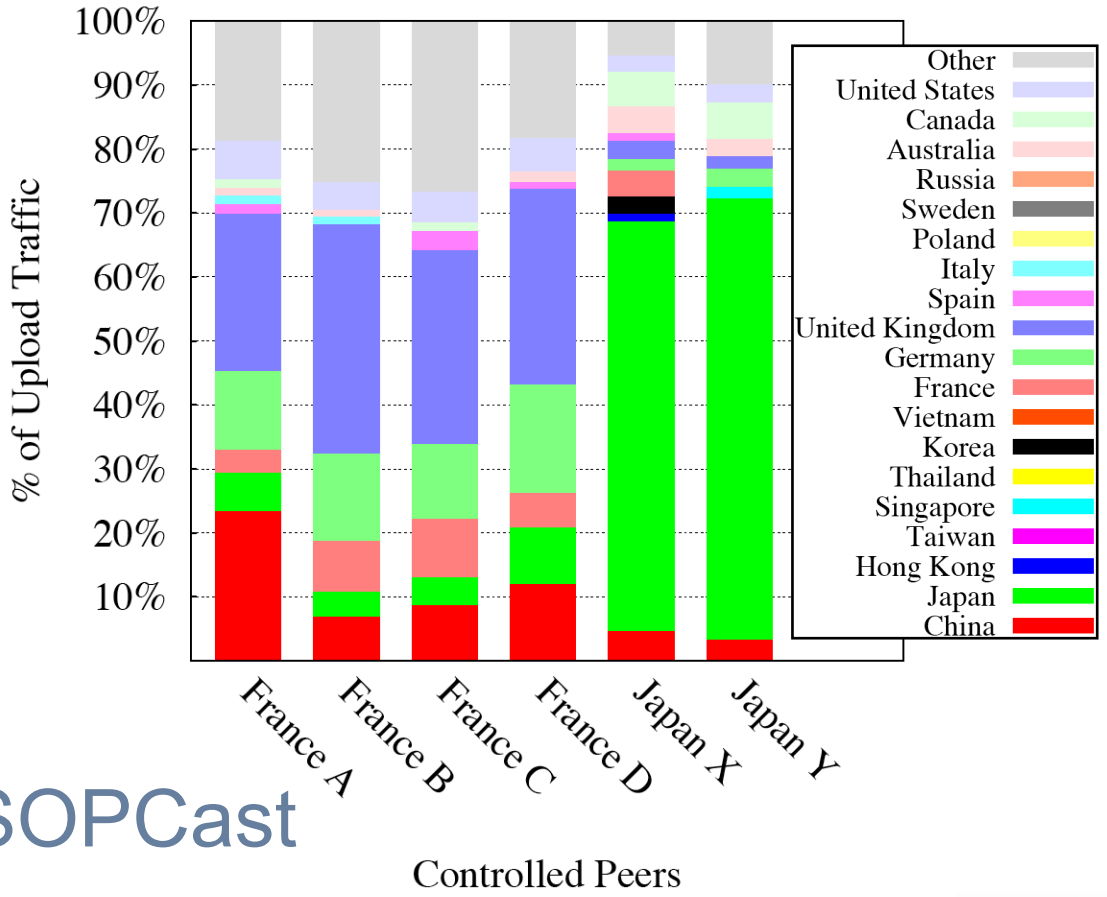


SOPCast

Location of Upload Traffic

Soccer game: CHN vs. JPN



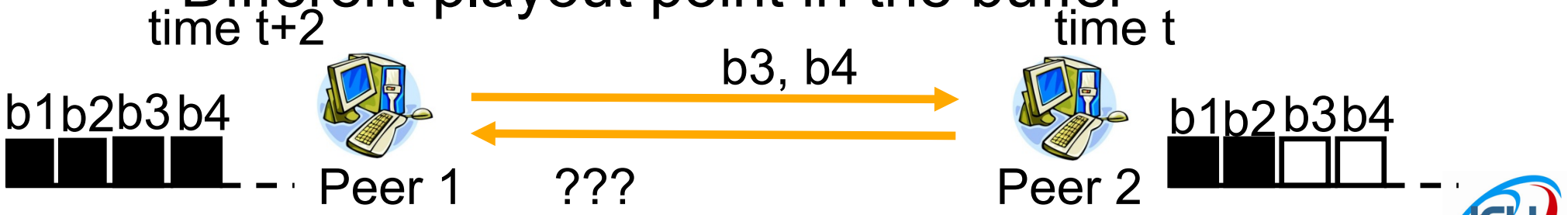


SOPCast

Geographic Location of Traffic

- Influence of the content
- Dominance of traffic and peers from Asia
  - Download from Asia
  - Upload to Europe

  } No reciprocity
- Continuous nature of the media
  - Different playout point in the buffer



Conclusion

- Large-scale P2P-TV measurement experiment
- Locality of traffic
  - Peers situated in Asia
  - Locality-aware mechanisms
- Impact for ISP
  - Traffic crosses many AS
  - Inter-ISP traffic
- Unfair exchange between peers
  - Time-constraints of the content
  - Improve the collaboration: incentive mechanisms

Thank You

ありがとうございます

Merci