Overview of CAIDA Data Collection, Analysis, and Visualization

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outline of talk

data collection and analysis

- DNS traffic analysis
- backbone packet headers (OC48, OC12)
- security
- bandwidth estimation
- topology: macroscopic topology project

data annotation, organization, sharing

- Internet Measurement Data Catalog (IMDC)

public data

- list of publicly available data sets

DNS traffic analysis

collection

- real-time performance of roots/gTLDs
- traffic to f-root's globally announced nodes

analysis

- studies of DNS pollution at root servers
- modeling of DNS resolver behavior

related work

- dsc (open source) software for root traffic monitoring/analysis

backbone traffic

collection

- two collection points at major IXes
- OC48 speeds with full headers
- only OC48 trace available to researchers

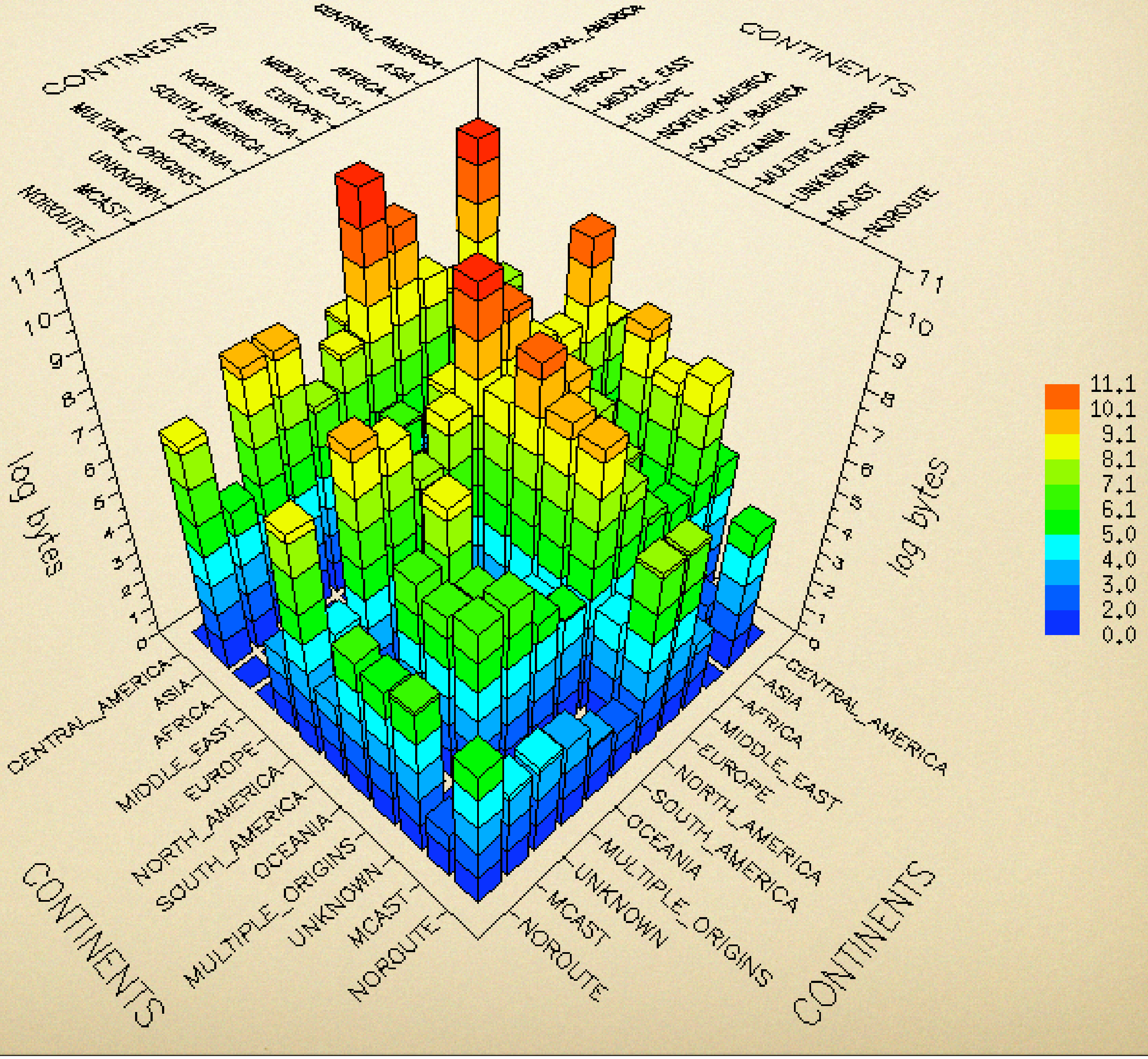
analysis

- track growth of p2p and other emerging trends
- burstiness of TCP flows
- detection of long running streams

related work

- algorithms for high speed traffic sampling/ aggregation
- co-chairing IETF WG developing standards for flow measurements

backbone: visualization



security

collection

- UCSD network telescope
- honeynet

analysis

- denial-of-service detection
  - analysis of backscatter traffic
- Internet worms - detect and tracking
  - code-red, witty worm, slammer, etc
- simulation of worm spread/quarantine

security: collection

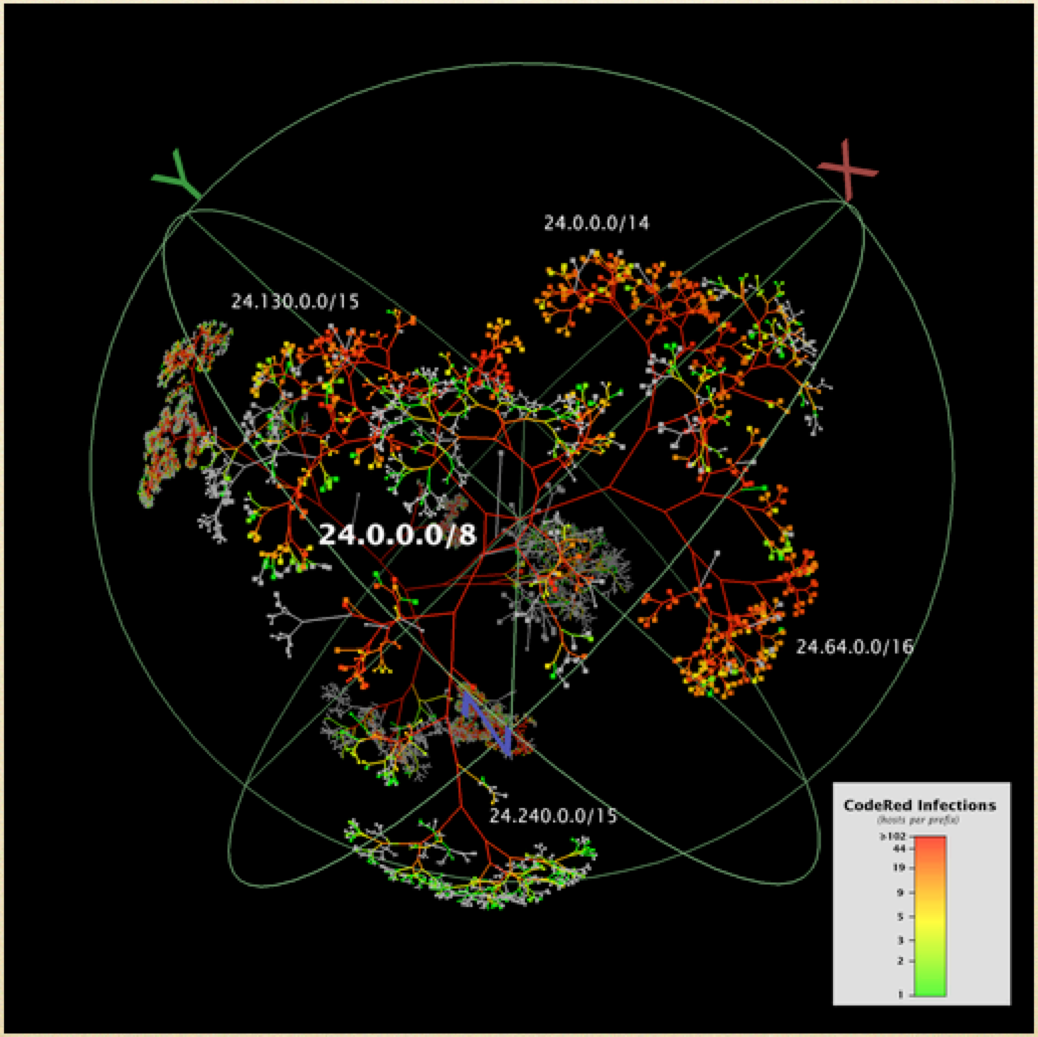
network telescope

- globally routed /8 address
  - globally announced by BGP
  - little or no legitimate traffic
- continuous raw data for 18 months

honeynet

- specialized gateway and virtual hosts
- complete copy of OS and applications to transparently react to malicious software
- configuration diversity better approximates real world

security: visualization



prefix colored by number of infected hosts

bandwidth estimation

(project ended 2004)

collection

- measurements along Abilene (Internet2)
- testbed for control comparisons

analysis

- comparing and calibrating available tools
  - pathload, pathrate pathchirp, ABw, igi, nettest, iperf

related work

- convenient user interface to these tools

topology

collection

- macroscopic topology project

analysis

- geographic
- AS hierarchy
- AS routing

data sets

- IPv4 global topology
- AS adjacencies

visualization

- AS core
- geopolitical ownership
    - breakdown by country
    - Lorenz curve

topology: collection

macroscopic topology project

- IPv4 (skitter)
- 25 monitors
  - global deployment
- 971,000 destinations
  - 75% routable prefix coverage
- running since 1998

topology: analysis

geographic

- dual-stack IPv4/IPv6 comparison
- geography of transit traffic

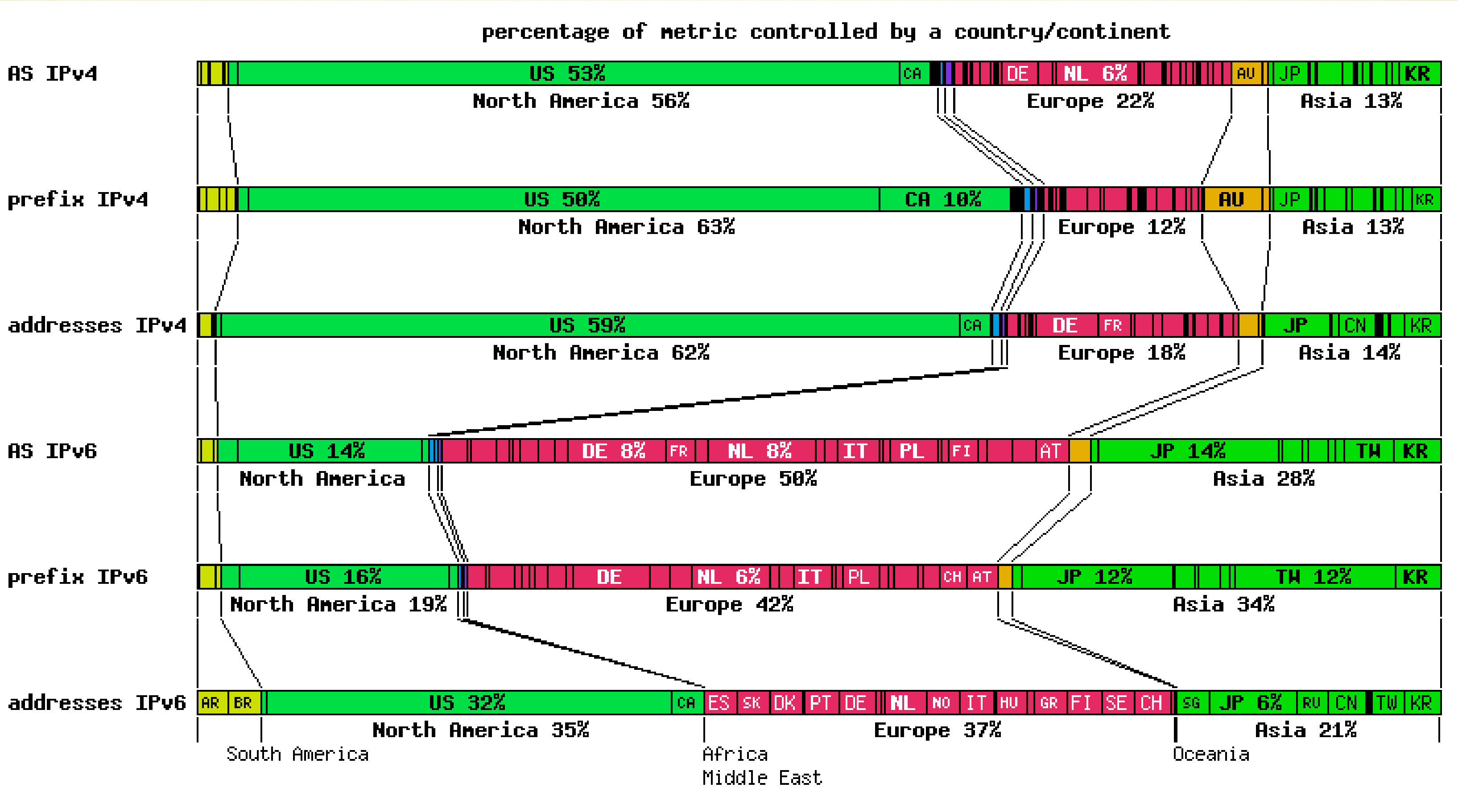
AS hierarchy

- geopolitical ownership of AS and IP address
- AS ranking
  - number of peers
  - number of customers/customer's customers

AS routing

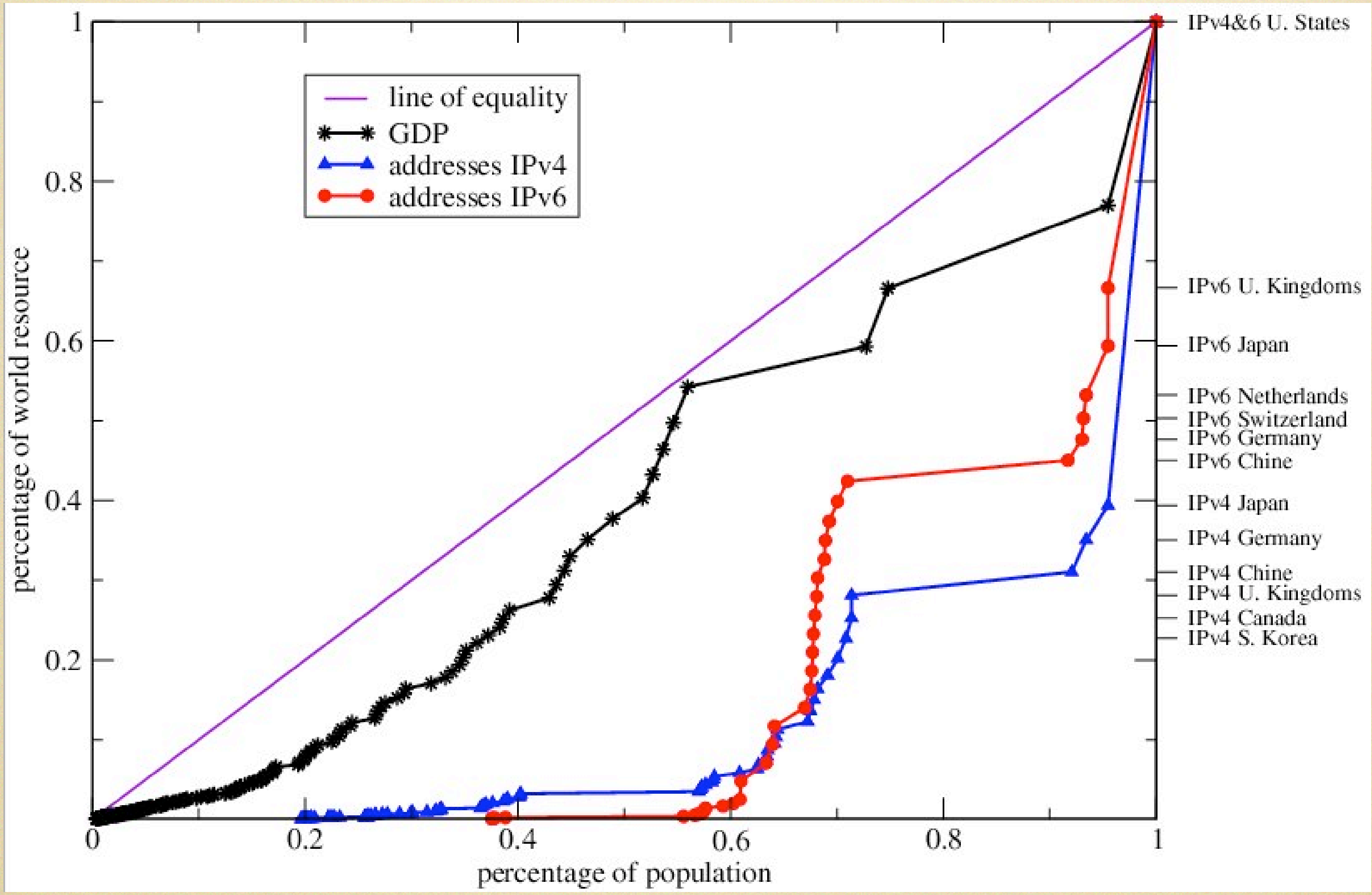
- AS atom-based routing
- compact routing

topology: visualization



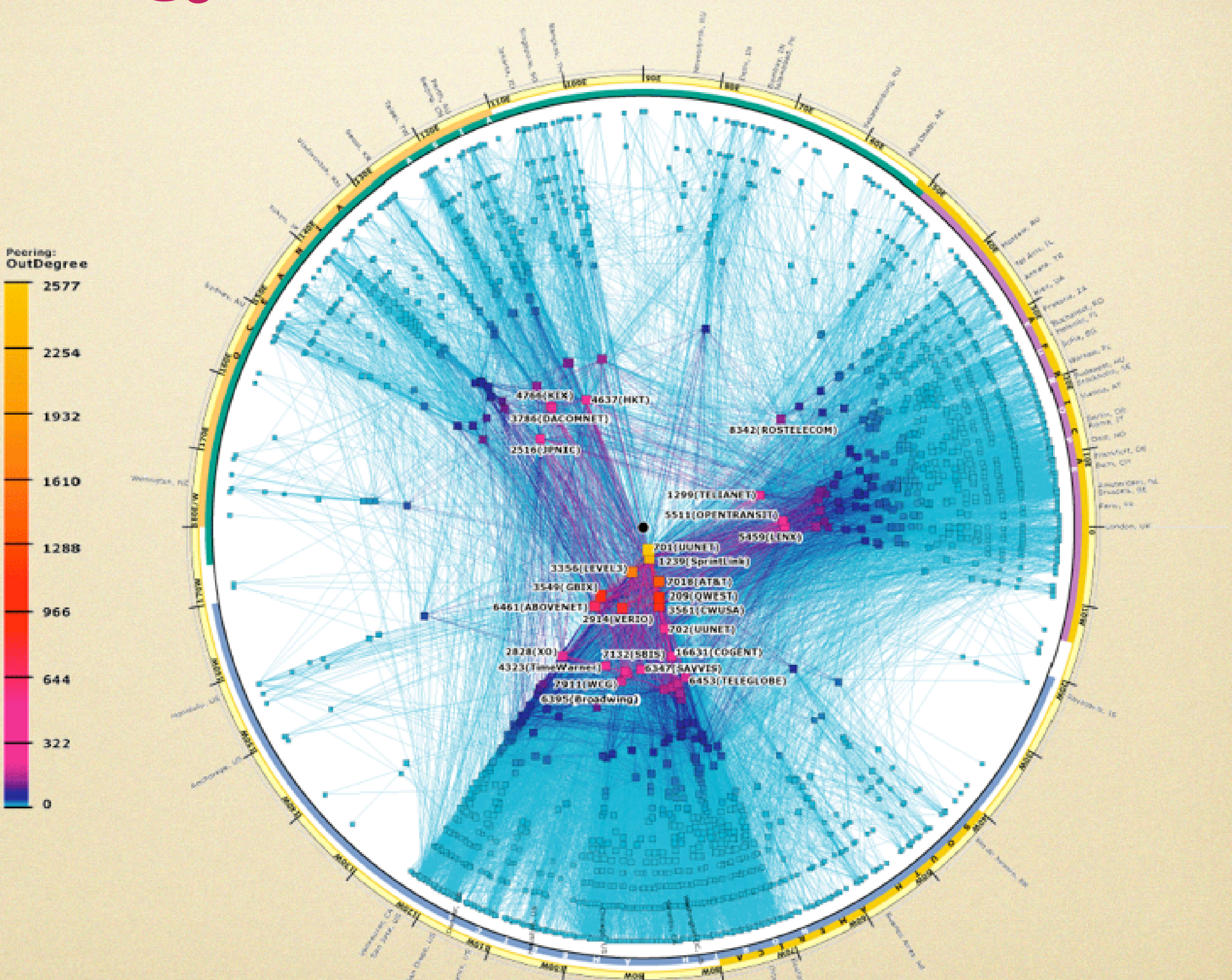
allocated AS and IP address space
by country and continent.

topology: visualization



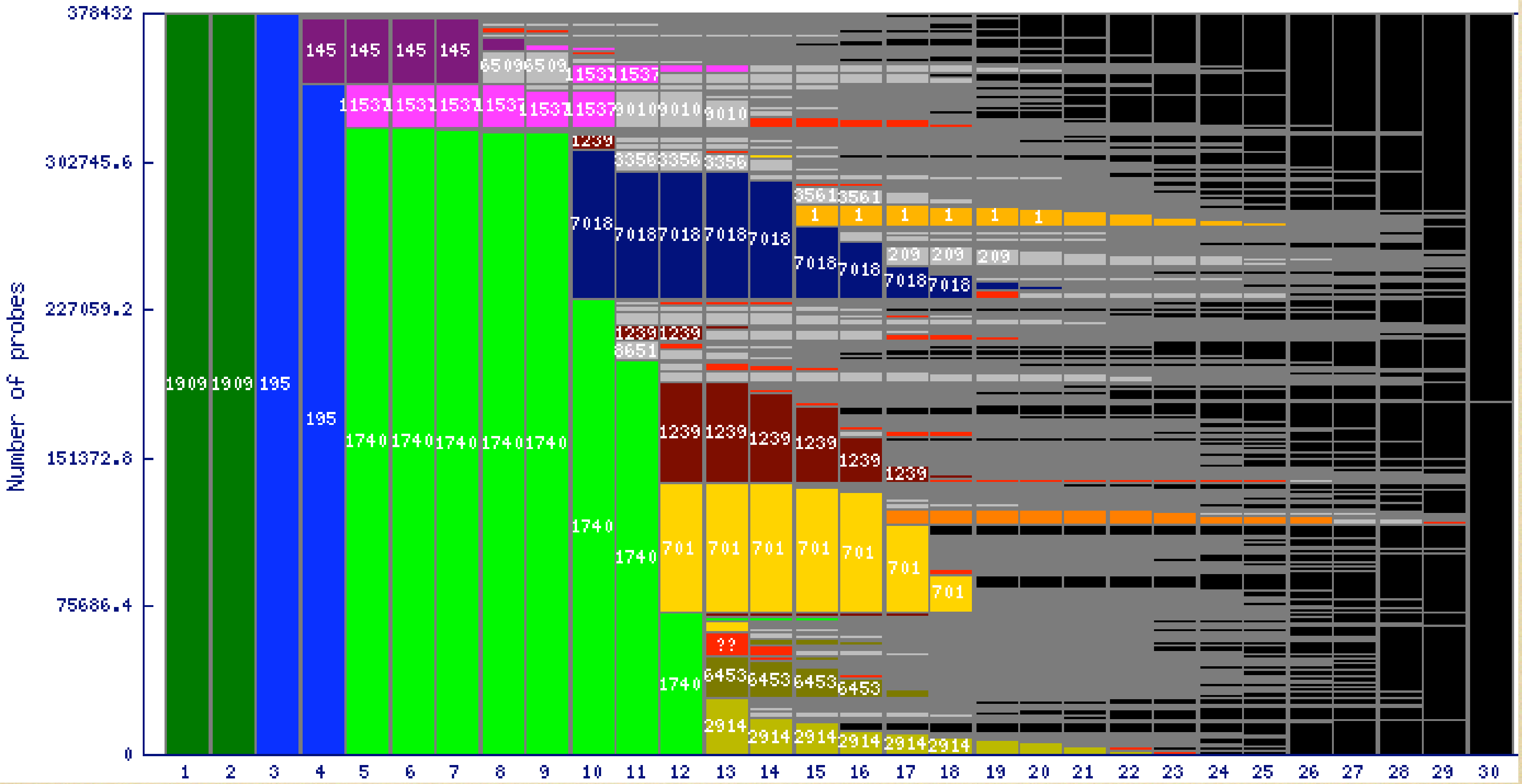
Lorenz curve of inequality

topology: visualization



AS Core graph

topology: visualization



AS dispersion from single source/many IP

IMDC

“trends” project

- design a universal annotation system
  - how to describe heterogeneous Internet data sets
- build meta-data repository to store “data about data”
- start building community memory
  - recommendations for long-term archiving of measurement data
- collaboration with IRTF’s IMRG
- working prototype

public data sets

http://www.caida.org/data

topology (raw topology traces)

- http://www.caida.org/tools/measurement/skitter/research.xml

topology (AS graph links)

- http://www.caida.org/tools/measurement/skitter/as_adjacencies.xml

backbone (anonymized OC 48 passive traces)

- http://www.caida.org/analysis/measurement/oc48_data_request.xml

security (DOS backscatter traces)

conclusion

Thank you for listening

questions?