A Group-Centric Internet Architecture

Stephen Strowes
1st Year Viva
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Introduction

The Internet Architecture
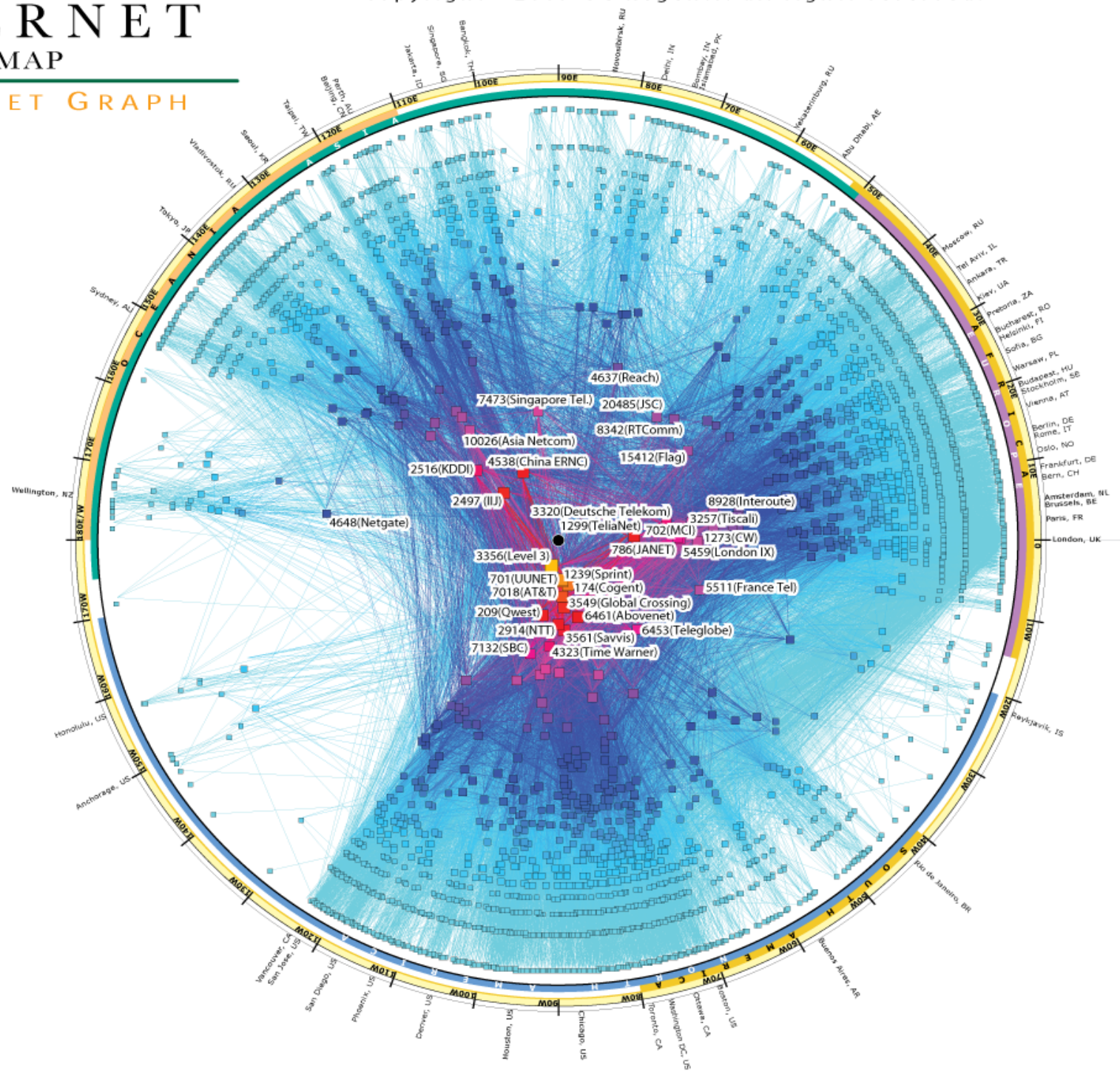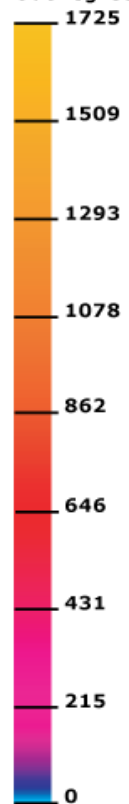
The Internet Architecture

- Current Internet Architecture

  - IP Multicast deployment

- Usage models

  - Network overlays

- Imminent problems

  - IPv4 address shortage

  - DFZ scalability

IPv4 INTERNET
TOPOLOGY MAP
AS-level INTERNET GRAPH

Peering: OutDegree

1725
1509
1293
1078
862
646
431
215
0

4637(Reach)
7473(Singapore Tel.)   20485(JSC)
8342(RTComm)
10026(Asia Netcom)
15412(Flag)
2516(KDDI)   4538(China ERNC)
2497 (IIJ)
8928(Interoute)
3320(Deutsche Telekom)   3257(Tiscali)
4648(Netgate)   1299(TeliaNet)   702(MCI)
1273(CW)
786(JANET)   5459(London IX)
3356(Level 3)
701(UUNET)   1239(Sprint)
7018(AT&T)   174(Cogent)   5511(France Tel)
209(Qwest)   3549(Global Crossing)
6461(Abovenet)
2914(NTT)   6453(Teleglobe)
7132(SBC)   3561(Savvis)
4323(Time Warner)

Related Works

Related Works

- Transport identifiers vs. Network locators

    - (ID/loc)

  – Host-based solutions

  – Network-based solutions

Related Works

- Routing schemes
  - Compact Routing
  - DHTs

Related Works

- Roads to multicast deployment

  - Tunnelling across "legacy" zones in network

  - Reduce on-path state burden

  - Overlay multicast

A Group-Centric Architecture?

A Group-Centric Architecture?

- If I am asserting that a group-centric architecture is viable for the Internet, why has IP Multicast not taken off?

  - Deering multicast model

  - Accountability; who pays for what?

  - "All-or-nothing" approach to deployment

  - Distinction between uni & multicast address space

A Group-Centric Architecture?

- The 1st year report presents initial ideas for a group-centric architecture

- Key goals:

  1. Step away from Deering model, aligned with UDP
  2. Step away from flat address space for multicast
  3. Step away from signalling state

A Group-Centric Architecture?

1. Step away from Deering model

   – The ability to send packets into any group, without having to be a member, seems trusting

     • Enforce a "connect" phase ("subscribe"/"register"...)

     • Implies some form of group admittance/security...

       – ... which I'm not going to touch just yet.

A Group-Centric Architecture?

2. Step away from flat address space for multicast

  – Convey a clear sense of group ownership

  – Allow a clear "target" for connection requests

    • Either routed directly toward the source, or intercepted within an AS by a rendezvous point

A Group-Centric Architecture?

3. Step away from signalling state...

- A HBH scheme suggests that:
  - State expands with size of group
  - No additional *forwarding* state for a group of 2 when compared to unicast
  - No necessity for any additional state in the core of the network

A Group-Centric Architecture...
Key concerns?

A Group-Centric Architecture?

- State explosion is still a possible concern
  - How much of a concern is it really?
- The introduction of the word "security"
  - Who secures what, where, and why?
  - I'm avoiding this question for now, though identifying it as one which must be looked at.

A Group-Centric Architecture?

- Forwarding tables may still exhibit expansion rates currently observed without an overhaul to the routing algorithms

    - There is interesting work in the realm of compact routing which may produce a solution here...

The Road Ahead

Focus

- These are obviously initial ideas...

- By considering a "network architecture":

  - I'm assuming existing layer 2 (link layer) transports

  - Focus on layer 3 (network layer), routing and addressing

  - Utilise existing multicast transport protocols for layer 4 (transport layer)

Evaluation

- How to evaluate an Internet architecture?
    - Small testbed
    - Xen cluster
    - PlanetLab
    - Network simulation

Timeline

- **Internship: Nokia**
    - 30/June/2008 – 31/October/2008
    - Therefore, year 2 of the PhD should commence November 2008.

- **A paper covering high-level initial ideas, would be ideal...**

- **Initial work on implementation of these ideas, and investigative work on simulation and evaluation**

Potential Contributions

- The main contribution will hopefully be to add to the discussion of what the future Internet looks like...
  - Group support seems natural, and lots of work looking at multicast supports this assertion
  - The distinction between unicast and multicast communications is a technical artificiality
- Up for discussion is scalability, addressability, gains/losses, etc.

… questions?