Changing the Internet

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Proposal

- No papers to review on December 7th (last lecture)
- Have project presentations on December 8th
  - 15 minute presentation followed by 5 Q&A
  - 3 hour slot

- Take-home final: Saturday December 9th, 9am
  - Due Tuesday December 12th, 9am
- Project writeup due December 15th at 11:59pm
Idea behind Active Networks

• Code running in the middle of the network

• Motivation:
  – Easy to deploy and test new protocols
  – Could better handle network heterogeneity
    • Discontinuities is where action in the networks occurs
    • Today’s ability to manage heterogeneity limited by end-to-end

• Is this a good idea?
Mechanism for Active Networks

- Restricted by the API
- Trade-off between “too restricted” and performance
- Problems:
  - Unclear how to do network measurements
    - Measure the network or measure code performance?
  - Computation on payload
    - Code must be very well hardened
  - Reliable communication is still unavailable
    - Code must handle it
ANTS

• Code handles each packet individually
• Alternative: code can handle streams of data

• Capsule has a type registered when first entering the network
  – Type determines how to handle the capsule and what packets the capsule can access
  – Type restricts capsules from unlimited access
    • How are firewalls done then?
Pros and Cons of Active Nets?

• Pros:

• Cons:
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• Pros:
  – ISPs can prototype/deploy new apps very quickly

• Cons:
  – Security
  – Performance
  – No service guarantees
  – No killer app.
What Other Options Instead of Active Nets?
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• Overlays
  – I3 can be thought of a “simple overlay”
GENI

- New NSF planned large-scale networking project
  - Many ideas inspired from Active Networks (+ PlanetLab?)

- Programmable nodes deployed on top of network
- Horizontal virtualization
- Users can opt-in into each horizontal slice

- Huge effort by the research community
Overlays

• No need to change Internet infrastructure
  – Ease of deployment

• Build virtual links from Internet paths

• Route packets through virtual links

• Sometimes could find better path than what the Internet would offer
• An overlay providing a level of indirection only is sufficient to build many services
• You can provide level of indirection through proxy only
  – V. simple version of an overlay

• Abstraction supported by I3
  – A sends packets to B’s mailbox in the proxy
  – B requests the packets when it wants them
Mobility

- How can I3 support mobility?
Multicast

- How can I3 support multicast?