Making the Internet Go Away

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Talk Outline

• Some humble opinions
  – About the Internet
  – About IP research
• Centre for Advanced Internet Architecture
  – ICE\(^3\)
  – GENIUS
  – Other....
What is the Internet?

• Is the Internet all whizzy and cool?
  - “Yes!” (Elec.Eng., Comp. Sci, techies... we know who we are)
  - “Yes, mostly” (eager early-adopters of technology)
  - “No!” (reactionaries – there's one in every crowd)
  - “Well, perhaps”
    • people with other things to do, real lives, that sort of thing....
    • the vast majority of the population
What is the Internet? (Take 2)

• Reliable and predictably useful?
  – “Only meant to be Best Effort!” (living in the past)
  – “Its good enough” (techies and defensive early adoptors)
  – “No!”
    • People with other things to do, real lives, that sort of thing....
    • the vast majority of the population
Technology is servant, not master

- Consider the humble motorcar
  - A “Model T” Ford from Melbourne to Sydney?
    - An exciting adventure, to say the least
    - The car becomes the experience
  - Same trip in a 2002 Falcon or Commodore
    - Significantly more complex system
    - Yet we hardly notice the car at all....

- From technology to trusted tool
  - How can we do this with the Internet?
Who is it about?

- The consumer experience is paramount
  - That's “regular” consumers, not you!
    - Regular consumers still have VCRs flashing “12:00”

- Ask the hard questions about
  - Convenience
  - Reliability
  - Predictability
Partly a network level problem

- IP networks should not be the scape-goats for poor application design
  - Up to us to (re)design IP networks better

Applications
[IEplorer, Mozilla, Groupwise, Instant Messaging, Half-Life, Everquest, etc....]

IP Transport
[packet delivery, TCP/UDP, multicast, QoS, etc....]

Services
[POP3, SMTP, IMAP, HTTP, DNS, DHCP, Routing protocols, etc....]
Talk Outline #2

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University IP Research Programs

• Should aim to be
  - Relevant (why do you get up each day?)
  - Disruptive if you can (you want to be famous don't you?)
  - Evolutionary if you must (an alternative path to recognition)

• Remember whose problem you are solving
My self-serving view....

TIRED

- Optimising TCP
- Re-inventing TCP
- Analysing TCP under obscure conditions
- IP QoS in backbone
- Faster, faster, faster X
- Pretending that business needs aren't important

WIRED

- Broadband access technologies and architectures
- Network resilience
- Seamless mobility
- Saving the Internet from archaic and narrow minded business models
Broadband Access

• Many problems now in the 'last mile' ISP
• For example, Billing models
  – Per-byte and byte-cap billing is unrelated to the consumer's online experience
    • 'The Internet' is perceived as unpredictable cost
  – Load models aligned with consumer experience?
    • Research!
  – Allow ISPs to make revenue without stupid topological constraints on our IP connectivity
    • ISPs making money is NOT a bad thing
Broadband access #2

• Or, Quality of Service
  - Last mile links asymmetric and bandwidth limited
    • Online games and file transfers don't always play nice on home access links
    • 'The Internet' is blamed
  - Need automated management tools before ISPs can offer tiered service levels
  - Need traffic characterisation/modeling before ISPs can adequately engineer for even simple tiered service levels -> Research!
Network Resilience

• We know how to make networks fast
• Now let us model and improve the failure characteristics of a running Internet
  – Impulse response modeling of BGP clouds?
  – Graceful failure modes?
  – Autodetection of e2e IP service degradation?
  – Impact of TCP on consumer perception of e2e network degradation?
  – Vulnerability and defense analysis
Internet mobility

• Can we make the Internet truly mobile?
  – IP mobility across fixed and un-wired links
  – Inter-ISP hand-off

• Need practical focus on the dynamic impact of IP mobility to the consumer experience
  – Practical: That means considering tens of thousands of nodes, not just a handful
  – Consumer: That means a systems level, multi-ISP view
  – This is hard
Talk Outline #3

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New research centre (CAIA)

- Founded early this year, 2002
- School of Biophysical Sciences and Electrical Engineering (also including...)
  - Sensory Neuroscience Laboratory (SNL)
  - Centre for Neuropsychopharmacology
  - Centre for Intelligent Systems and Complex Processes
  - Swinburne Optics and Laser Laboratory (SOLL)
    - Centre for Imaging and Applied Optics (CIAO)
    - Centre for Atom Optics and Ultrafast Laser Spectroscopy (CAOUS)
    - Centre for Micro-Photonics (CMP)
  - Centre for Astrophysics and Supercomputing
CAIA Status

• Research and Teaching
  – Another growth path for Australia's pool of research talent in IP networking
  – Currently have openings for 4 post-docs
  – Govt/industry funded growth path
  – Promoting research to evolve the Internet into something more fundamental in our lives
    • Broadband access, network resilience, mobility
Two projects begun so far....

• Inverted Capacity Extended Engineering Experiment (ICE³)
  – What would happen if most of the Internet's capacity was at the edges, and content was pushed to caches in every suburb and city?

• Game Environments Internet Utilization Study (GENIUS)
  – Characterizing the 'network load' introduced by popular online, interactive, real-time games.
ICE$^3$

- Develop plausible, alternative IP network architectures based on:
  - Inverting the existing bandwidth and service location hierarchy
  - Large scale distribution of content caches around urban areas (e.g. Library is cache)

- Evaluate the consumer's likely experience and the impact on wide- and local-area IP traffic patterns and load growth
ICE³ Research questions...

- Modeling consumer web experience
  - Estimating cachability of typical content
  - Quantifying http transaction times vs IP hop counts (...latency, jitter and packet loss)

- Architectural questions
  - Redirecting consumer web queries through local town/city caches
  - Digital rights management of cached content
  - Impact on access and backbone traffic patterns
GENIUS

• Help ISPs engineer for, and otherwise support, game playing customers
  – Develop models of interactive game traffic suitable for use in simulators
    • Short time scale per-packet traffic models
    • Long time scale session characteristics
• Develop better understanding of human requirements for IP QoS when supporting interactive immersive environments
Examples....

• We're running a Quake 3 server
  – Public, gathering usage data
• Have two X-Box units
  – playing HALO over the LAN
  – will be adding a third soon
  – will be running Ethernet over IP, adding variable loss/jitter/latency, etc..
• Will have HalfLife/Counterstrike soon...
Other Research at CAIA

- Early days just yet
- Openings for post-docs to
  - launch related research programs
  - grow their programs with outside funding
  - Particularly interested in network resilience and robustness/security research
Conclusion

• Making The Internet Go Away is about:
  – Taking a systems level view of this thing we call The Internet
  – Developing a rigorous engineering understanding of how The Internet behaves
  – Figuring out how our part (the IP network) influences the consumers experience
  – Improving the behavior of the IP network

• This topic motivates research at CAIA