

# 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<sup>3</sup>
  - 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

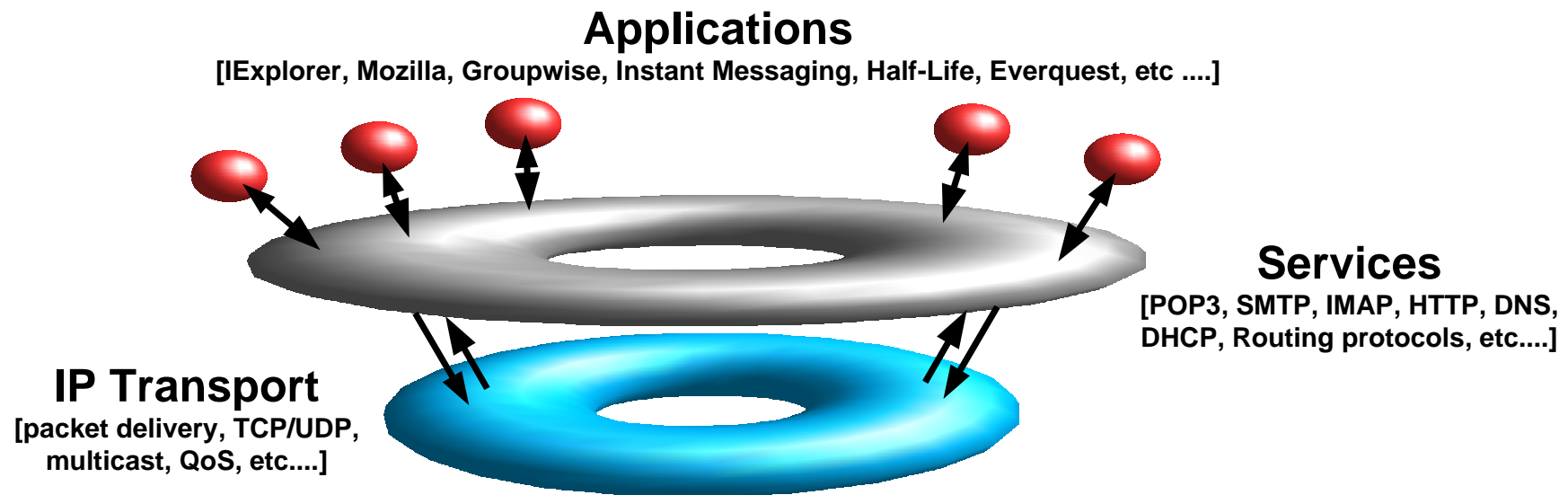
- Consider the humble motorcar
  - A “Model T” Ford from Melbourne to Sydney ?
    - An exciting adventure, to say the least
    - The car *becomes* the experience
  - Same trip in a 2002 Falcon or Commodore
    - Significantly more complex system
    - Yet we hardly notice the car at all....
- From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



# 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 (ICE<sup>3</sup>)
  - 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<sup>3</sup>

- 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

# ICE<sup>3</sup> 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