Social & Economic Control of Networks

Bob Briscoe

Chief Researcher

BT Networks Research Centre

Jul 2007

Future Communications Architecture
BT's Strategic Research

- current Future Comms Arch programme started 2002
- based on earlier research (1997-2002) into
  - social & market control of comms <www.m3iproject.org>
  - pervasive computing in the environment & society
- organisational style
  - decide focus: classic problems and/or critical pinch points
  - understand the end-game (mostly economic insights)
  - design the end-game (engineering)
  - design next step (protocol engineering)
  - initiate industry collaboration & follow thru to solution over years
- technical style
  - shifting outcomes of tensions in society & economy control 'net
 - 'design for tussle'

now next   future

BT

Internet resource sharing architecture
limit freedom to limit the freedom of others?

for comparison: ~10M lines ringed in red

- no. of access lines that can congest *any* other Internet link
    - has stayed around 1,000 – 100,000
- shares of congested links:

continual conflict:
    - betw. real people (ISPs' customers)
    - between real businesses (ISPs/NGNs vs Service Providers)
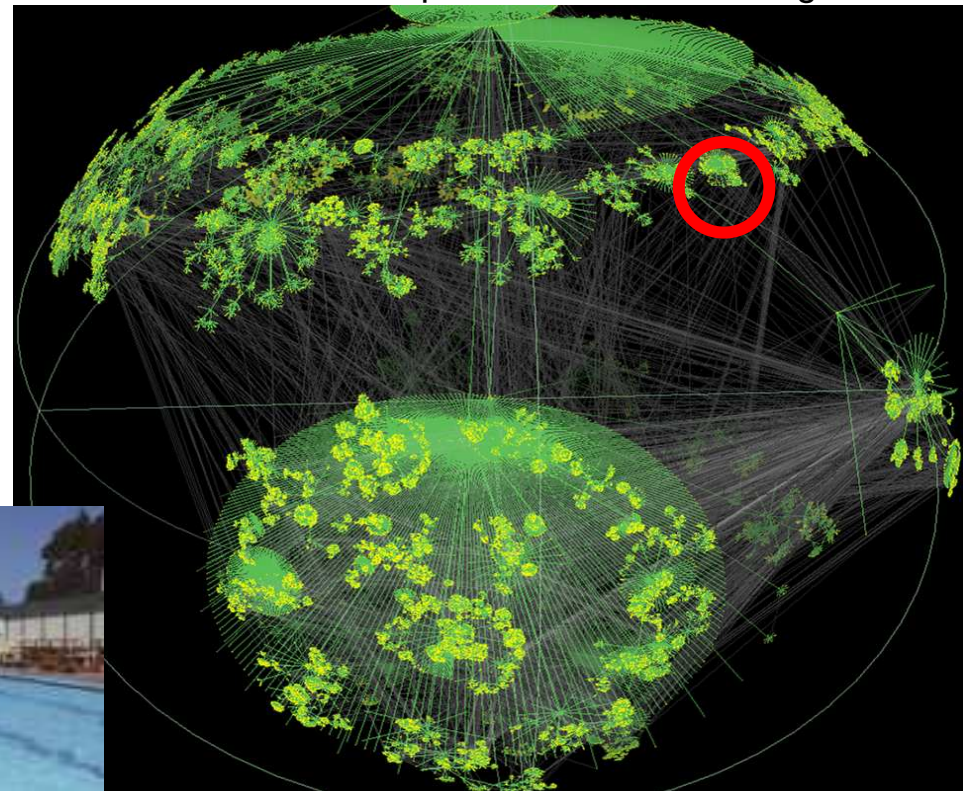
Internet topology visualization produced by Walrus (Courtesy of Young Hyun, CAIDA)

- redesign to ensure the Internet is both shaped by and shapes the outcome of tussles in the economy & society

BT

Internet resource sharing architecture
persistence in research (1997–2007) recent fruits
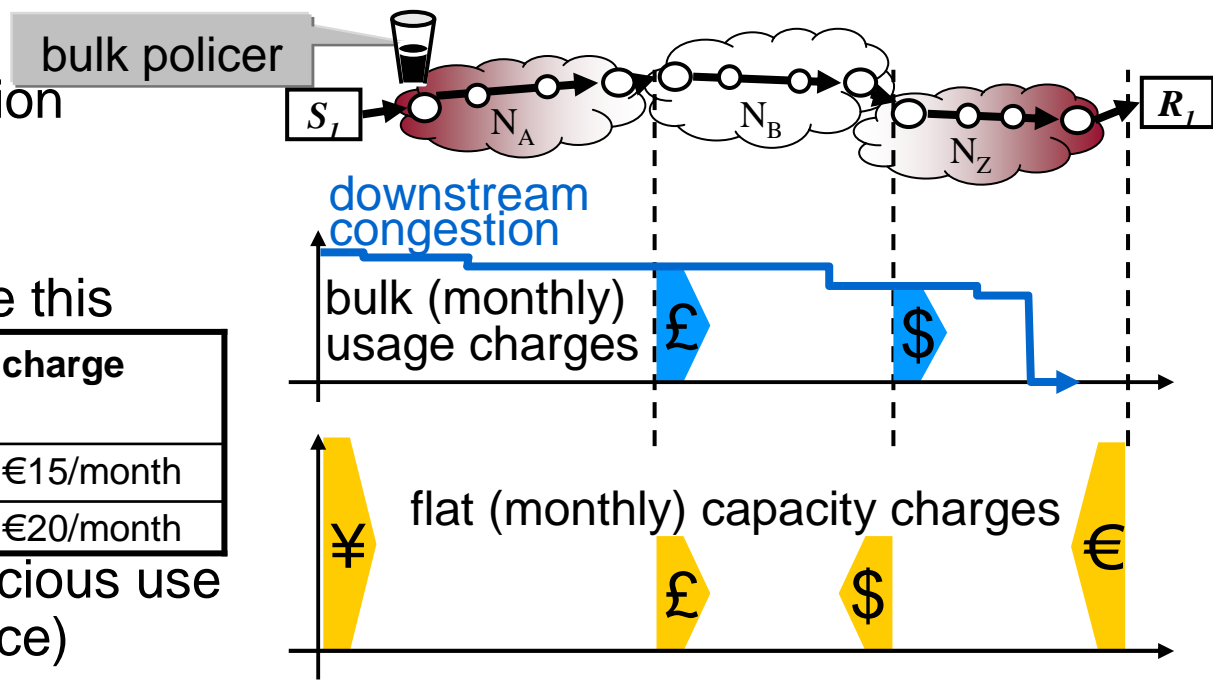
future

next

now

- initial clean-sheet economic thinking (Mackie-Mason & Varian 1995) and economic network optimisation (Kelly 1997-98)
- designed socio-economic control hook into IP (2005-...)
  - re-insertion of explicit congestion notification feedback (re-ECN)
  - using the last available bit in the header of every IP packet
  - incrementally deployable
  + added use of control hook to TCP – to weight flows up or down
  + huge simplification of Internet-wide admission control using this hook
    - based on Diffserv & pre-congestion notification (PCN)
- dismantled unsubstantiated religious dogma (TCP-'fairness') (2006-...)
- setting an aggressive agenda at the Internet standards body (the IETF) to fix Internet resource sharing (2005-...)
  - new PCN working group chartered by IETF, Feb 2007
  - new unofficial re-ECN group supported by IETF, Mar 2007
- maintaining pressure thru other industry bodies (2006-...)
  – impact on net neutrality debate
  – broadband investment incentives
  – next generation network interconnection contracts

BT

new Internet resource sharing architecture
expected effects

- network Z can make neighbouring network B accountable for congestion B allows its users to cause in Z

- recursive Z⇨B⇨A

- A can limit congestion its users cause

- all metrics are bulk

- might see tariffs like this

access link	congestion volume allow'ce	charge
100Mbps	50MB/month	€15/month
100Mbps	100MB/month	€20/month

- limits selfish & malicious use (e.g. denial of service)

- enables full interconnection
  - conservative satellite, cellular, liberal ad hoc WiFi, campus
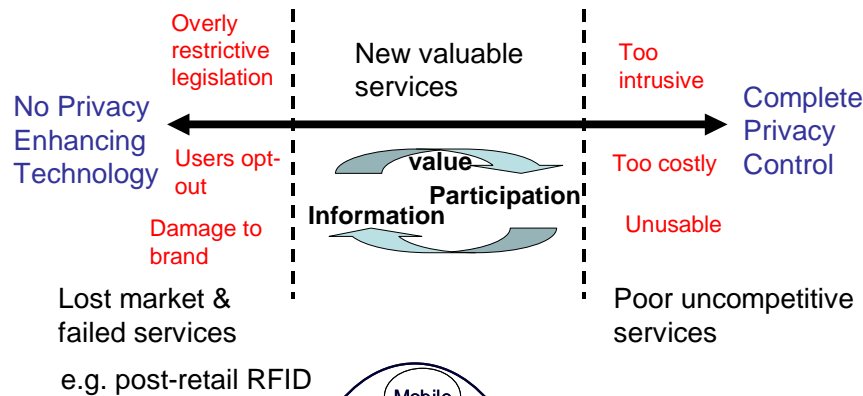 - each can simply control its resource sharing

bulk policer

S_1 N_A N_B N_Z R_1

downstream congestion

bulk (monthly) usage charges £ $

flat (monthly) capacity charges ¥ £ $ €

privacy in pervasive computing

Improving service acceptance and value
Releasing value from untapped markets
Developing Privacy Enhancing Technology

Contributing to 21C Network Vision

Privacy Control and Awareness

Targeted solutions

Innovative component technology

Overly restrictive legislation

New valuable services

Too intrusive

No Privacy Enhancing Technology

Complete Privacy Control

Users opt-out

value

Participation

Too costly

Information

Damage to brand

Unusable

Lost market & failed services

Poor uncompetitive services

e.g. post-retail RFID

Mobile

Mary

Engine mgt.

Location

Satnav

Car

EPCs

Mobile Location Provider

Seats

Preferences

Bluetooth ID

Location

Door

Pressure

RFID Tags

Open/Close

Mobile

Dave

GPS

Location

Transport
Information, ticketing, congestion, insurance

Home and office environments
Ubiquitous services, home control, whereabouts

Healthcare & Telecare
Patient records, home monitoring

21C
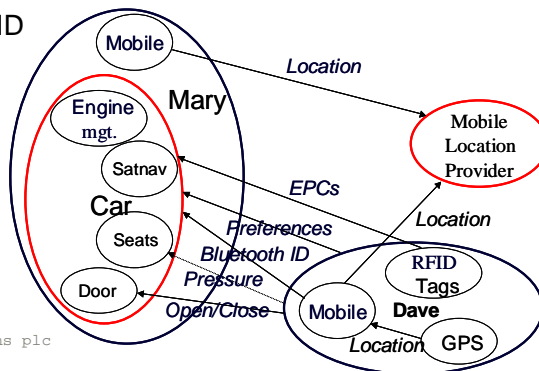Presence, Location, Directories, Address Books, Diaries

Supply Chains, Logistics & Retail
RFID Privacy & Security

Collaborations
• UC Berkeley
• Cambridge (TIME EPSRC/WINES)
• Supply chain players (BRIDGE)

BT

more info

- new Internet resource sharing architecture
  re-feedback and re-ECN project:
  <www.cs.ucl.ac.uk/staff/B.Briscoe/projects/refb/>

  pre-congestion notification (PCN) Internet admission control
  <tools.ietf.org/wg/pcn>

- privacy in pervasive computing

  { Dirk.Trossen | Andrea.2.Soppera | Trevor.Burbridge } @bt.com

- "The Implications of Pervasive Computing on Network Design"
  <http://www.cs.ucl.ac.uk/staff/B.Briscoe/pubs.html#pervimp>

- Social & Economic Control of Networks

  <www.cs.ucl.ac.uk/staff/B.Briscoe>

BT

Bringing it all together

EU Information Society Technologies proposals
"Future Internet" part of framework programme 7 call

- EIFFEL
  - proposed Strategic Support Action (1 will get funded)
  - to co-ordinate EU Future Internet programme (also with US)
  - leading role from BT Networks Research Centre
  - EU funding decision imminent

- Trilogy: proposed 3yr EU Integrated Project €10M
  - a few will get funded (plus many small single focus projects)
  - unofficially told it has come top of review scores (100%)
  - small but perfectly formed :)
    - top EU movers & shakers in Internet architecture

Trilogy Vision

- Convergence – a powerful aspiration, but how?
  - 3GPP+NGN+DVB+Internet+ad hoc+WiFi+next...
- All recognise huge value of service interconnection
- but all want to keep critical differences of culture
  - vertical integration *and* clean layer separation
  - service provision *and* self-service
  - lock-in *and* openness
- force IP to serve masters it wasn't designed to serve?
  - ⇨ complex border controls, feature interactions, bizarre failures
- key: re-think a common control architecture
  - allow assumptions on who controls what to shift
  - solve approaching dynamic limitations at the same time

BT