Controlling Internet Quality with Price

*Market Managed Multi-service Internet*

Bob Briscoe
BTexact Research, Edge Lab, University College London & M3I Technical Director

M3I

- **self-managing Internet resources**
  - through market forces

- **show validity of approach through:**
  - economic and network modelling
  - software and network engineering design & prototyping
  - customer experiments
pricing principles

- edge pricing & bilateral contracts - strict
- (be able to) price approaching congestion
- (be able to) price at service granularity - no flows, no SLAs
- (be able to) introduce new tariffs & mechs - policy ctrl
- (be able to) be commercially open - bundling, re-sale

- minimise then synthesise
  - design end to end
  - then synthesise services at edge - technical & commercial

end to end QoS means...

✔ *QoS synthesised by the ends*
  ✔ scalability and evolvability

✘ *not just QoS everywhere along the path*

✘ integrated services arch (Intserv),
✘ differentiated services SLAs (Diffserv)
✔ ECN + diffserv field...

• computing industry vs. networking industry
Dynamic Price Handler agent

Customer

Video Player

QoS Buying Policy

DPH agent

Policy Editor

non-linear demand function

in elastic

elastic

congestion price

max

target rate, x

Charge = \#mk \cdot price/mk

Network

Data Server

Content Provider

Policy Editor

Video Server

Network Service

Marking

Requested Rate

Meter

Video

Meter

Data

probability

mark

drop

ave queue

length

Apr 2002

Apr 2002

Controlling Internet Quality with Price

6

e2e = tussle of industries

• network operators & vendors think:
  • QoS = added value
  • e2e = beyond the horizon (scalability & evolvability)

• solve dilemma:
  – design for e2e QoS
  – then pull back control into edge
    • under policy control
    • tariff = policy [M3I architecture]
  – when network-centric QoS commoditises (5-7yrs)...
    ...expose raw e2e QoS interfaces
    • as option e.g. for computer-computer traffic
synthesised admission control

\[
\text{dynamic congestion pricing} \rightarrow \text{session admission control}
\]
\[
\text{packet QoS} \rightarrow \text{session QoS}
\]

- **guaranteed QoS**
  - indistinguishable from Intserv
  - no per flow processing, no SLAs within ECN cloud

**no time for...**

- **e2e QoS stability**
  - second order dynamics of e2e QoS
  - user experiments on utility of stability

- **ECN with wireless access (no buffers)**

- **enabling business model innovation**
  - active tariff objects for policy control
    - of QoS control architecture
    - of charging system, rate controllers, etc.
  - wholesale market structure
    - inter-domain pricing, price-based routing
    - avoiding global business models (carrier selection)
  - retail market structure
    - multi-homing, provider selection by quality-value
    - avoiding global business models (roaming, termination charges)
    - SLAs irrelevant for retail market
pricing principles

- edge pricing & bilateral contracts - strict
- (be able to) price approaching congestion
- (be able to) price at service granularity - no flows, no SLAs
- (be able to) introduce new tariffs & mechs - policy ctrl
- (be able to) be commercially open - bundling, re-sale

- minimise then synthesise
  - design end to end
  - then synthesise services at edge - technical & commercial

more info

- M3I project
  - Jan 2000 - Mar 2002
  - first papers and deliverables
  - http://www.m3i.org/

- Bob Briscoe:
  - http://www.btexact.com/people/briscorj/