

The Broadband Incentive Problem

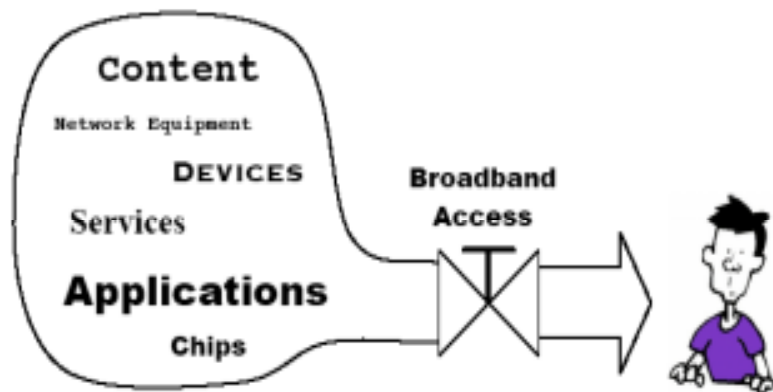
Sharon E. Gillett, MIT, for the team
May 9, 2005

Context / Process

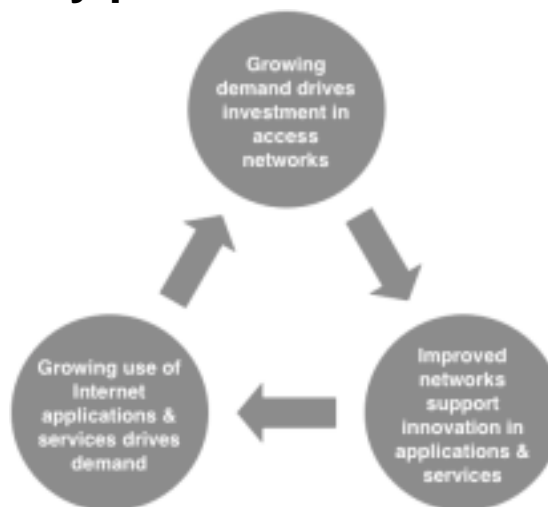
- **First issue tackled by the WG (began Nov. 04)**
 - Working team: John Watlington (FT), Sharon Gillett, William Lehr, and Steven Bauer (MIT)
- **Draft white paper, feedback at Jan 05 plenary**
- **Topic of several full-WG discussions**
- **Revised white paper today**
- **Your comments requested back today or by *May 16***
- **We expect to circulate final version to member companies for “consensus” support, late May**
 - BBWG participants as internal champions
 - Companies can opt out but the more willing to support, the more impact
- **Target: Public release at CFP Plenary meeting in UK, June 30, 2005**

Executive Summary

It's in *everyone's* interest that broadband access providers see it as in *their* interest to make the right capacity investment decisions for the value chain.



We observe incentives not currently so aligned. Harms upstream participants most immediately, but ultimately providers too.



Problem arises from misalignment of dominant broadband access pricing models (“all you can eat”) with changing nature of broadband traffic (rapid growth in volume and, potentially, variance).

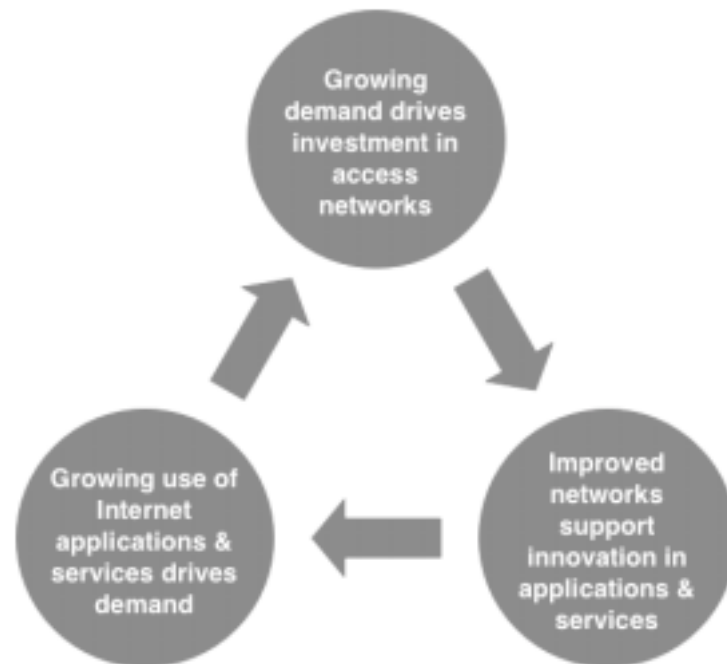
Commonly proposed solutions less than ideal. Next step for WG: explore alternatives.

Frequently Asked Questions

- 1. What is the broadband incentive problem?
- 2. How is broadband access typically priced today?
- 3. Why and how is broadband traffic likely to change?
- 4. Why is increasing broadband traffic problematic?
- 5. Why is increased variance among users also problematic?
- 6. What would characterize “good” solutions to these problems?
- 7. Why are the most commonly proposed solutions (overprovisioning, vertical integration, and throttling) problematic?

What is the Broadband (BB) Incentive Problem?

- Flat fee based pricing model misaligned with changes that bb-enabled applications induce in user traffic patterns
- These changes (detailed later) likely to impose additional costs on operators, without necessarily adding revenues
- *If* trend pronounced enough, operators will foresee negative ROI on additional network capacity, and therefore (rationally) choose not to invest in it
- **Capacity limits stall bandwidth-hungry innovations upstream...**
 - Grid computing, networked backups, file sharing, IPTV, video on demand, etc.
- **...Which in turn stalls growth for network operators.**
 - Virtuous Cycle turns Vicious.



How is BB Access Typically Priced Today?

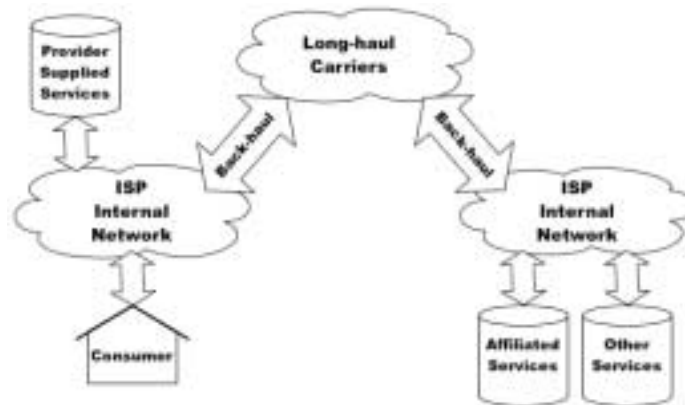
- **WG conducted informal review of primary and secondary data**
 - See Bauer (MIT) presentation from Nov 30, 2004 BBWG meeting
- **Flat rate models dominate**
 - Especially in Korea (highest BB penetration) and U.S. (largest # of BB users)
 - Flat pricing tiered by peak rate is typical
- **Some experimentation with adding usage sensitive elements to pricing**
 - E.g. volume-based caps
 - Lots of variation in form of usage sensitivity, and enforcement mechanisms
 - No data yet on sustainability (user response in competitive situations?)

Why and How is BB Traffic Likely to Change?

- **Always-on, high-peak-rate BB lifts narrowband constraints on user behavior**
- **Increasing BB penetration, wider array of applications and differential adoption by users suggests increased variance**
 - Across users, and for any given user
- **Availability of bandwidth-intensive applications suggests increased mean usage, rising aggregate traffic volumes**
- **Both effects evident in Korea**
 - Aggregate traffic nearly doubled (~100% growth rate) every year since 2001
 - Subscriber growth rates slowed to under 5% by 2004
 - 5% of users account for nearly half the traffic

Why is Increasing BB Traffic Problematic?

- **Imposes higher capacity-based costs on network operators**
 - Capex if dimensions of owned network components have to increase
 - Opex if dimensions of external network components have to increase
 - Example: backhaul transit



- **Only a problem if revenues don't also rise**
 - Which they won't, if revenues only come from flat-rate access pricing
 - Note pricing tiered by peak rate doesn't necessarily solve this problem – tiers not typically priced for high duty cycle

Why is Increased Variance Among Users Also Problematic?

- **Users like flat rates. Why not just raise them?**
- **Expect increasing dispersion among users.**
- **High mean usage likely driven by the few.**
- **Flat rates α mean impose higher “predictability premium” on light users.**
- **Some light users either priced out of the market....**
 - Limits addressable market for upstream apps, services, devices, content etc.
- **...Or defect to competitors.**
 - Obviously undesirable for access provider

What Would Characterize “Good” Solutions?

- **Benefits *both* network operators and upstream value chain participants.**
 - Ensures BB not bottleneck for demand growth, so innovation continues all along value chain.
 - Continues to promote ubiquitous BB adoption.
 - Offers access providers a reasonable expectation of earning an appropriate risk-adjusted return on invested capital.
- **Addresses consumer tastes and preferences. Convenient and not unnecessarily costly.**
- **As simple, transparent and predictable as possible.**

Can Moore's Law Save Us? Not Entirely.

- **“Overprovisioning” – shorthand for:**
 - Economies of scale – fatter pipes have lower cost per bps (static effect)
 - Moore's Law, learning effects, etc. – bandwidth costs dropping over time (dynamic effect)
- **How does rate of cost decline compare with rate of traffic growth?**
- **Both inherently uncertain, but traffic grows faster in several plausible scenarios.**
 - See Payne & Davey (BT) paper, presentation from Jan 25, 2005 CFP/BBWG meeting
 - Expected growth of IP-based video
 - Increasing personalization of BB content limits bandwidth conservation potential of solutions like multicasting and caching
- **Engineering changes that cut costs are likely to be part of the solution. But if not enough by themselves, operators will also need ways to grow revenues.**

Vertical Integration Not Complete Solution Either

- **Typical proposal for increasing carrier revenues: value-added services.**
 - Vertical integration appealing – economic efficiencies, product differentiation, etc.
- **But if only way to recover usage costs, problematic. Why?**
- **Services likely to face competition.**
 - Ex. Vonage, SkypeOut, & Skype vs. BB provider's VoIP.
 - Regulators likely to intervene if access providers act to limit competing services (ex. FCC and Madison River).
 - Leaves enough margin in service prices to offset growing bandwidth costs?
- **Not all bandwidth-intensive applications will have service revenues.**
 - “Pure” apps like P2P, BitTorrent & (basic) Skype are clearly part of BB's value for users.
 - Limiting these kinds of apps may also attract regulatory attention.
 - Better solutions would enable operators to support these kinds of innovations, *because* able to recover costs imposed by them.

Traffic Shaping – From Throttling to Pricing

- **Throttling**
 - Possibly most common solution today
 - Users blocked: can't (pay more to) use more
 - Block additional traffic either implicitly (congestion) or explicitly (traffic shaping)
 - Meets short-term needs of network operators, but clearly a problem for upstream participants in BB value chain
- **More generically, use pricing to shape traffic**
 - Blocking effectively sets infinite price, for all users if applied in aggregate
 - Finer grained mechanisms also possible; lots of work in this space
 - Need for coordinated approaches in presence of industry tussle

Conclusions

- **Growth in usage (traffic per user) combined with largely “all you can eat” pricing today creates incentives for providers to block additional traffic rather than make additional investments to support it.**
- **These incentives, while rational for providers today, are damaging for upstream value chain participants and therefore, ultimately, for providers as well.**
- **Good solutions to this problem need to align the incentives of network operators and upstream stakeholders, so that innovation and growth will continue in all parts of the broadband value chain.**
- **This alignment cannot be achieved solely through better network engineering or through vertically integrated business models.**
- **Rather, it is likely to require a revenue model for operators with additional components related to usage.**
- **The form of this revenue model, and its effects on competitive differentiation and sustainability for operators and upstream value chain participants, are topics receiving further consideration in the Working Group.**