The Business Case for Internet Pricing and Benefits to Network Security

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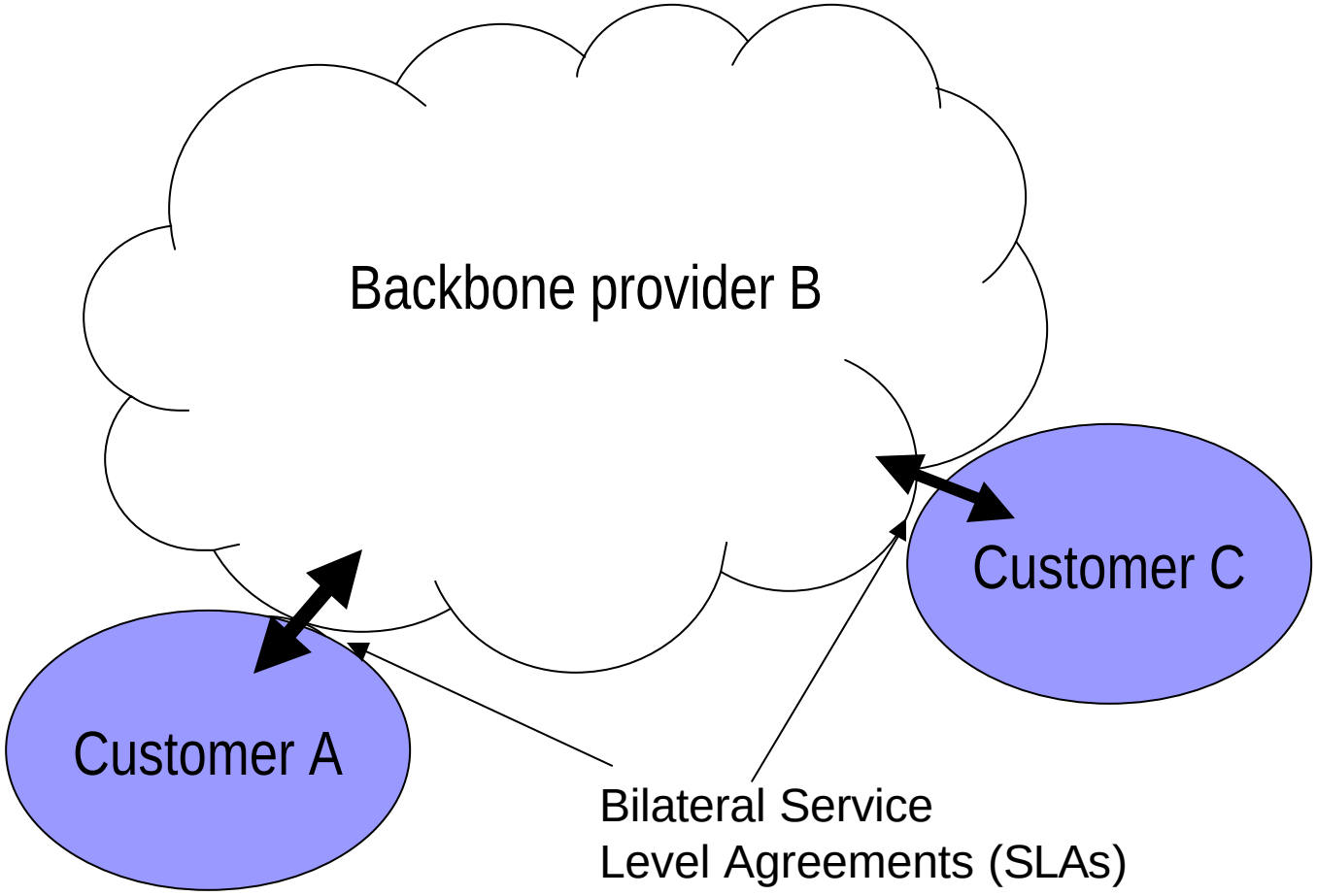
Internet Infrastructure Business Model



Business Model Problems

- Incomplete Contracts
  - SLAs are inherently incomplete
  - Transaction costs are high
  - There is room for opportunism
- Externalities
  - Agreements between A and B affect C’s value

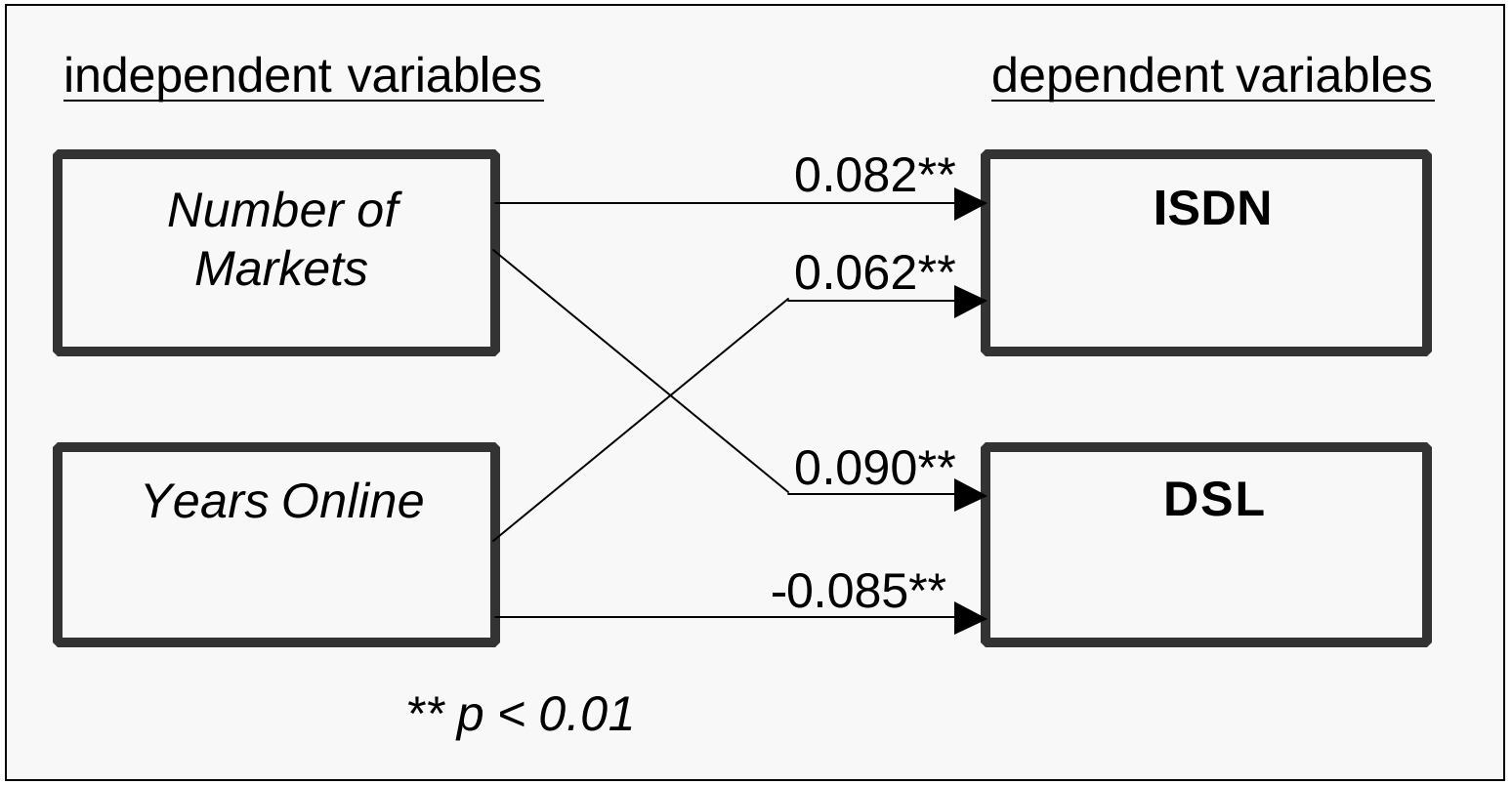
Implications for Network Security

- Incentives for SLA enforcement is often weak
- SLAs may not prevent new security problems
- Externalities include network security risks

Traditional Economic Solutions May Cause More Harm than Good

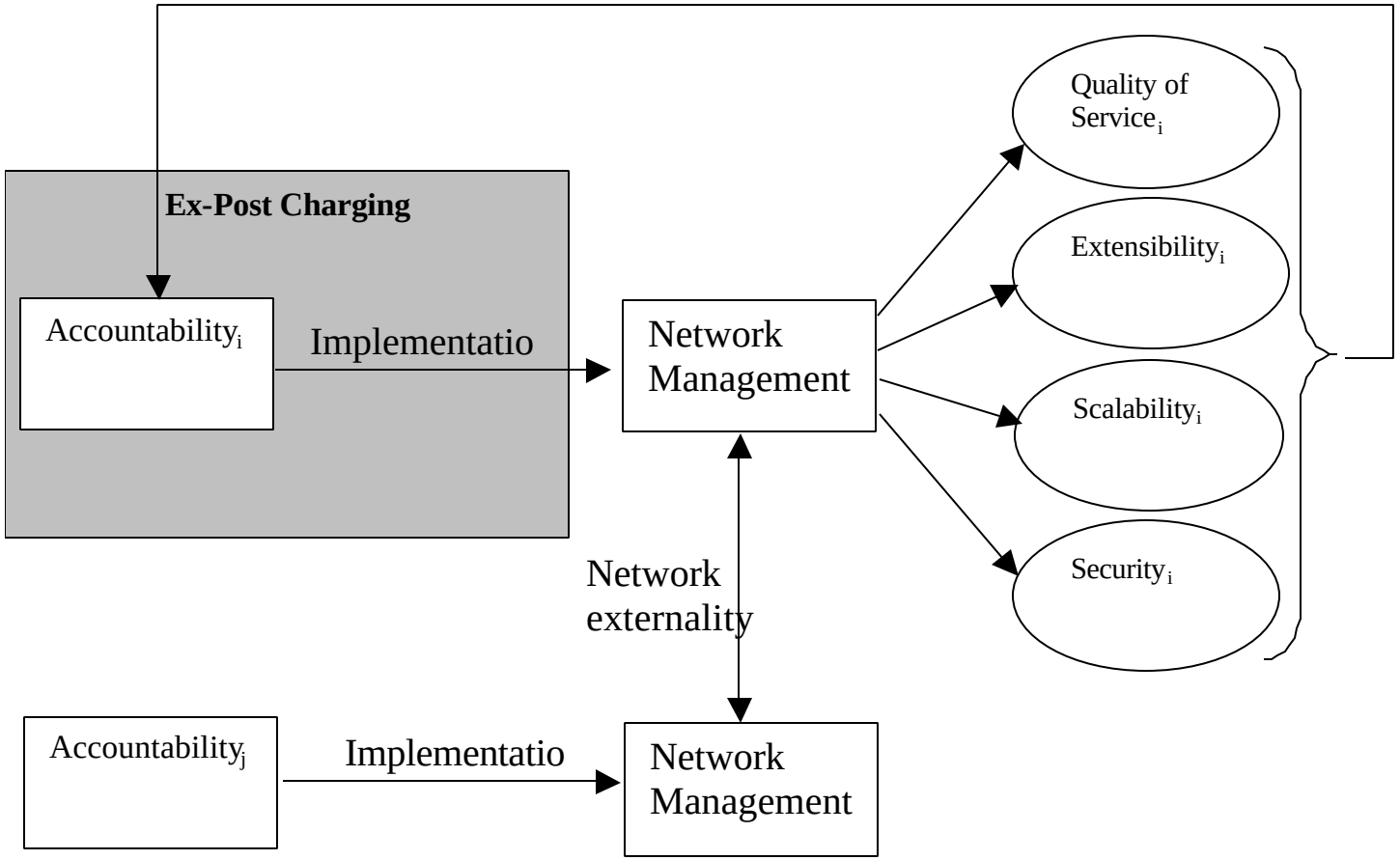
- Regulation
  - Concerns about centralized Internet governance
- Vertical Integration
  - Already a fairly concentrated market: Herfindahl-Hirshman Index (HHI) is approximately 2500
  - Monopoly -> competition -> oligopoly/duopoly (Alan Pearce)

ISP Technology Adoption



For the ISDN model: F = 26.621, adjusted r^2 = 0.008, observations = 5,996
For the DSL model: F = 54.692, adjusted r^2 = 0.018, observations = 5,996

Internet Pricing Framework



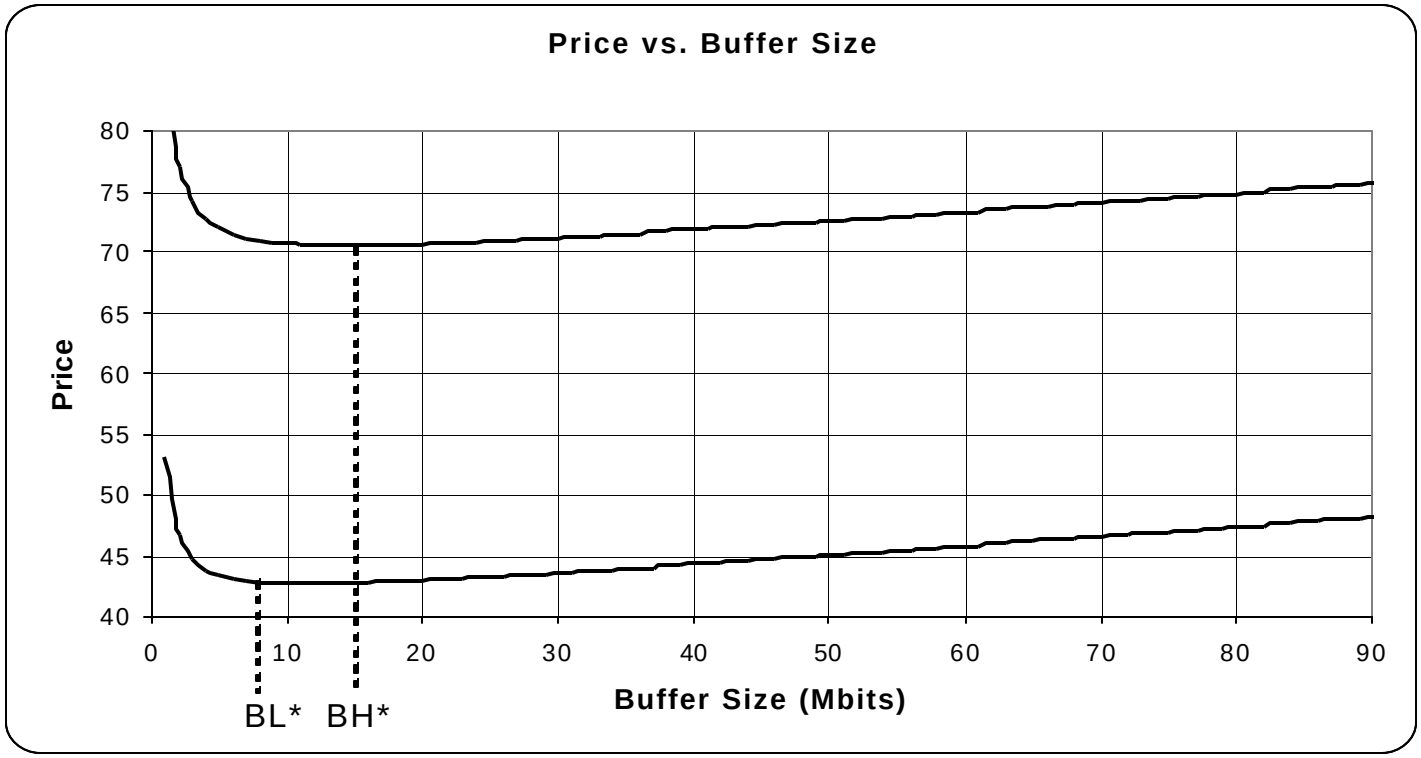
Effective Bandwidth

$$P_{expost} = a*(C + \Delta B)$$

$$C = \frac{ab(1-r)R_p - B + \sqrt{(ab(1-r)R_p - B)^2 + 4Bab\,r(1-r)R_p}}{2ab(1-r)}$$

- This is the tradeoff between bandwidth and buffer
- Provides incentive for appropriate buffer size selection

Price vs. Buffer Size

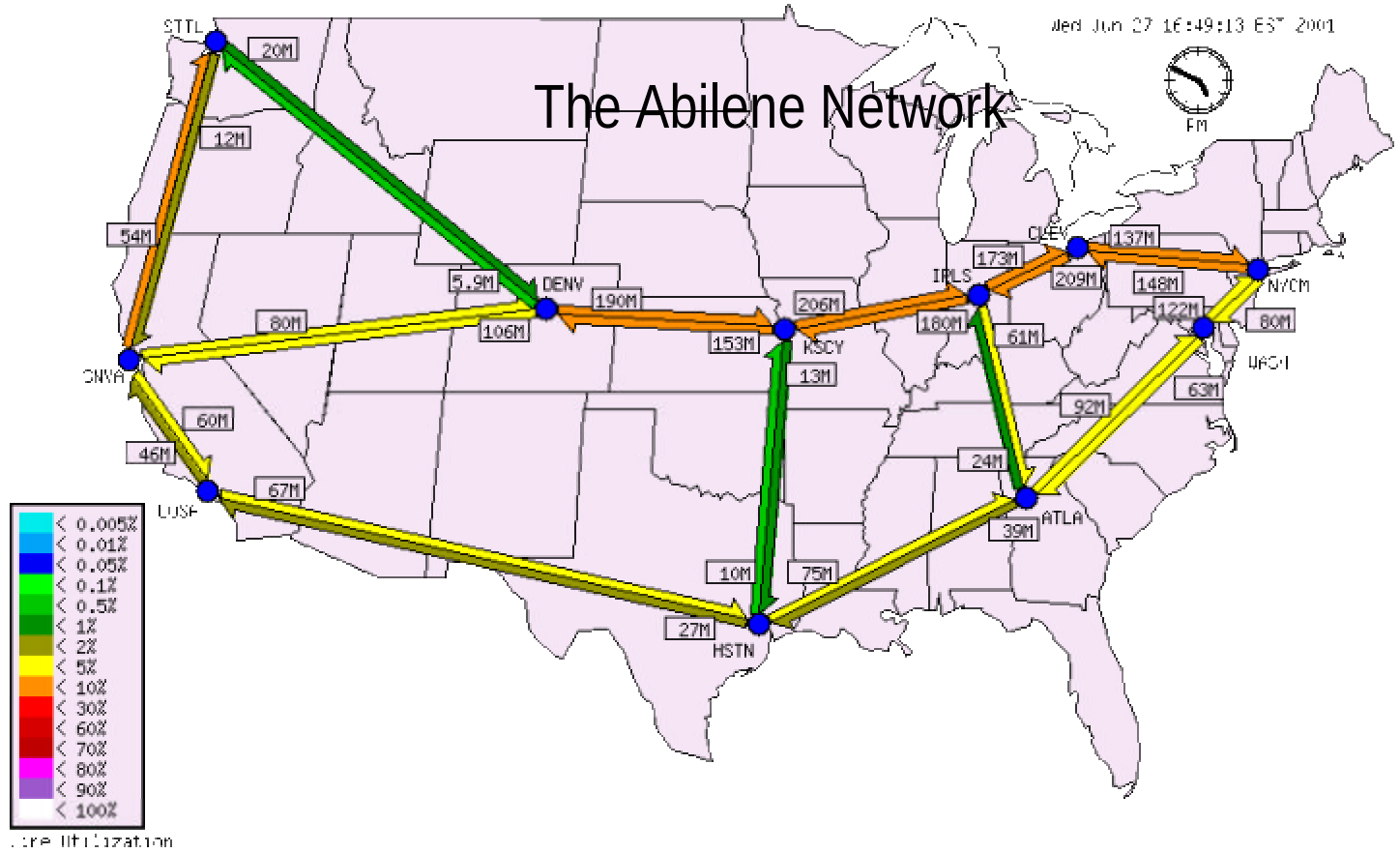


Top line: 43.9% utilization; Bottom line: 26.3% utilization

Future Business Models?

- Internet 2
  - Public goods model
  - Cooperation among government, universities, and industry
  - Overprovisioning of capacity
- Global Internet
  - Liberalization of Telecommunications Policy

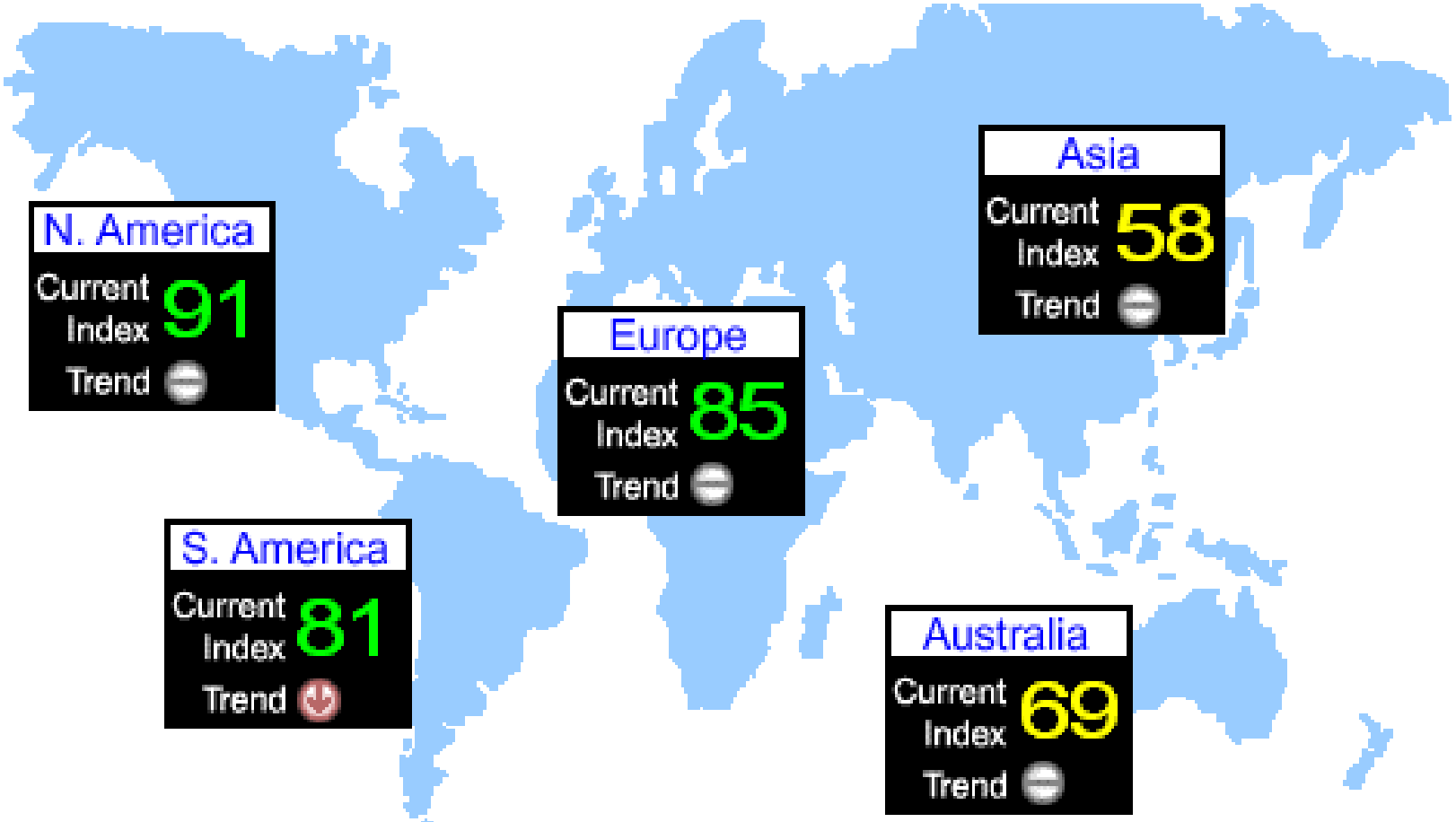
The Abilene Network



The Importance of Internet 2

- Smaller universities find Internet 2 more important
- Universities that integrate telecom and data networking find Internet 2 more important
- IMPORT = $\beta_0 + \beta_1$PRIVATE + β_2STUDENTS + β_3HOPS + β_4FUNDING + β_5URBAN + β_6TRAFFIC + β_7INTEGRATE
- β_2 (-) and β_7 (+); $p < 0.05$; N = 49

Global Traffic Flow



Source: InternetTrafficReport.com

Global Internet Penetration

Hypothesis		Expected sign	Actual sign		
			Model 1	Model 2	Model 3
H1	H1.a / Telephone	+	[+]	[+]	[+]
	H1.b / Electricity	+	[+]	+	[+]
H2	H2.a / User income	+	+	[+]	[–]
	H2.b / Internet cost	–	–	+	[+]
H3	H3.a / Literacy	+	–	+	+
	H3.b / English	+	+	+	–
H4	Young age	+	[+]	[+]	[+]
H5	H5.a / Regulation	+	[+]	–	[+]
	H5.b / Government type	+	–	–	–

Conclusions

- Incomplete Contracts and Externalities are problematic
- Integration may solve some problems including security
- More regulation is unlikely
- Ex-Post pricing may solve some potential security problems in a market context