Internet Connectivity in LDCs

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I. Connectivity

Definition: what is it?

Measurement: how is it distributed?

Diagnosis: is that a problem?

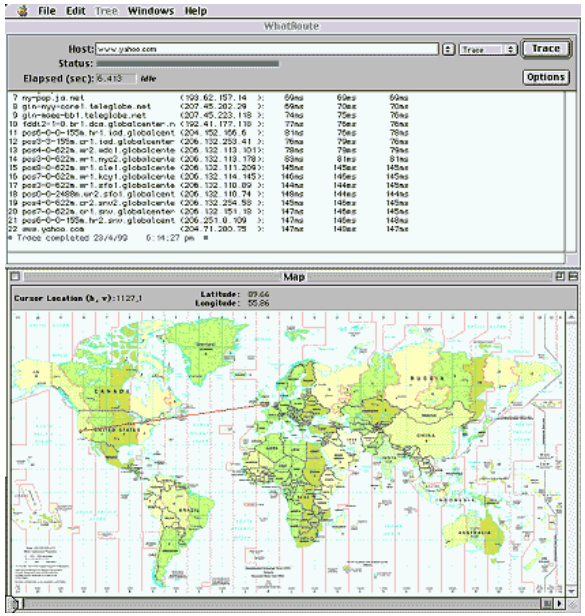
Analysis: is there a big picture?

II. Transit

Connectivity: Definition

- capacity, connectivity, applications
- Internet connectivity:
  - unique *ICANN-overseen* IP number for duration of connection;
  - ability to exchange *general Internet traffic* (POP, http) with other ICANN-overseen IP addresses
- excludes:
  - private networks
  - closed networks
- implies:
  - end-to-end interoperability

Connectivity: Measurement



- building blocks: for each provider, every international route (City A, City B, Capacity)
- methodology: network tools, public data, private data
- automatable: much can be routinized; some private-sector firms are building this capability (Quova, IXIA)

- mid-2001: LDCs had 0.1X percent of Internet users, 0.02 percent of international Internet bandwidth.
- Africa connected 0.15 percent of international Internet bandwidth, down from 0.22 percent—but South Africa's growth was slowest.
- toolkits and international benchmarking: do connectivity market regulators {need|want} year-on-year results?
- is this a useable metric?

Connectivity: Diagnosis

To diagnose market failure:

- supply must be insufficient to meet demand; and
- market distortions must prevent the additional supply from being provisioned.

Traditional approaches to demand-supply matching:

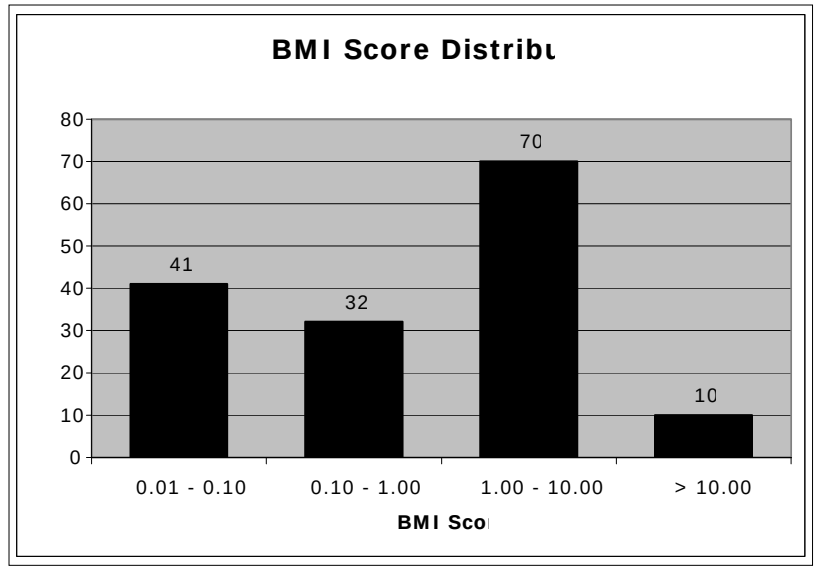
- top-down: start with historical bandwidth usage data; extrapolate future usage; compare to forecasted supply. *But we know little about bandwidth usage.*
- bottom-up: start with assumptions about applications usage and bandwidth used per application; multiply out. *But we know little about applications usage, and nothing about how available bandwidth affects it.*

Connectivity: Diagnosis
Alternative Approaches

- bandwidth per person, but:
  - non-users unlikely to produce bandwidth demand, so can't claim market failure
- bandwidth per user, but:
  - demand for international traffic varies by language, etc.
  - some countries produce more non-user (hosting) traffic than others
- bandwidth per host, but:
  - does not address international traffic mix
  - hosts are hard to count; for LDCs, impossible.

Connectivity: Diagnosis
Bit-Minute Index

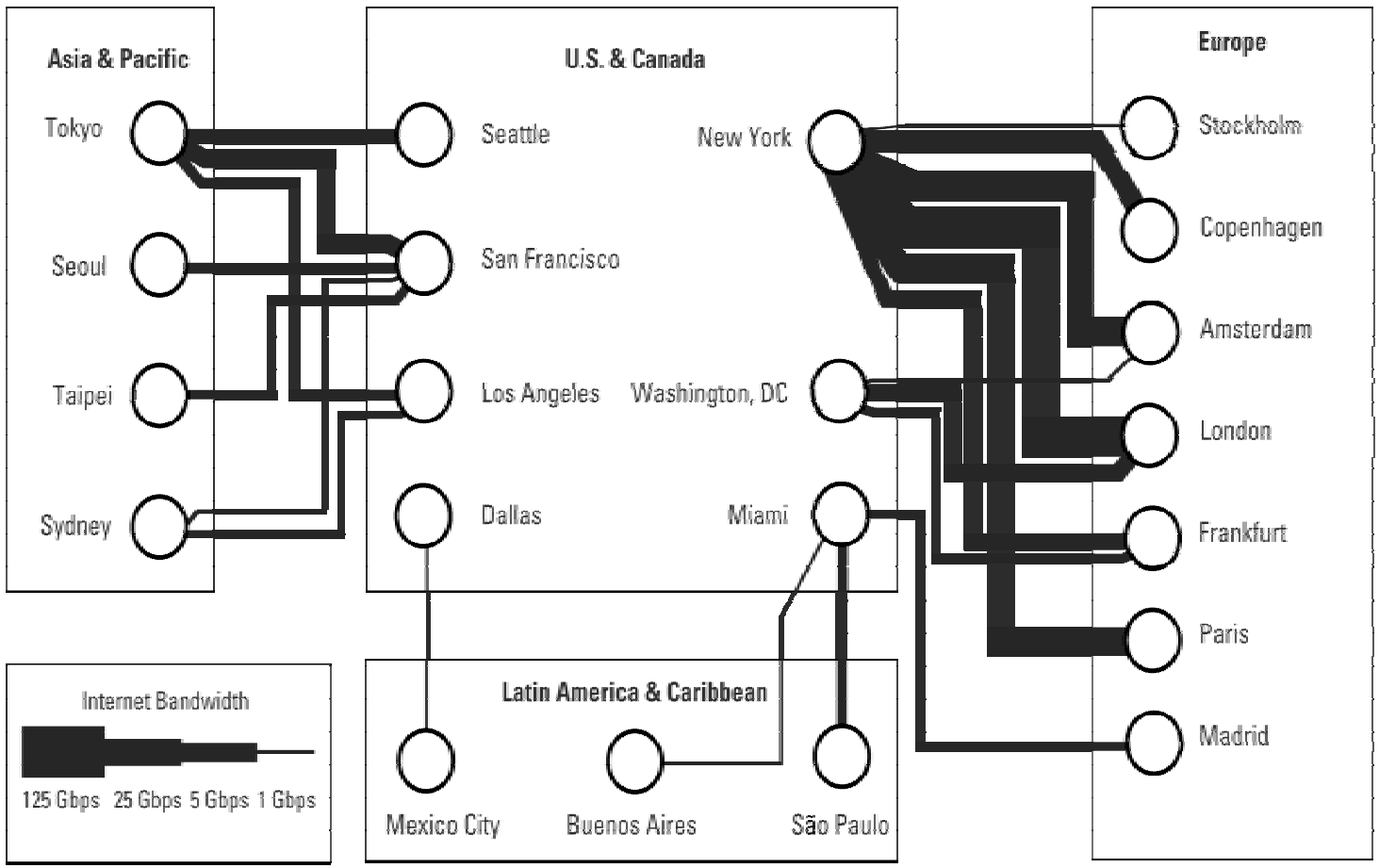
OECD: 10.79
U.S. & Canada: 6.10
Europe: 6.09
LatAm & Caribbean: 0.87
Asia: 0.79
LDCs: 0.18
Africa: 0.17



- calculated as (inbound and outbound international minutes) / (international Internet bandwidth)
- assumes international telephone traffic is relevant to demand for international communications, including users, hubbing, hosting
- further work needed: international audiovisual traffic?

Connectivity: Analysis
U.S.-centric Internet (1/3)

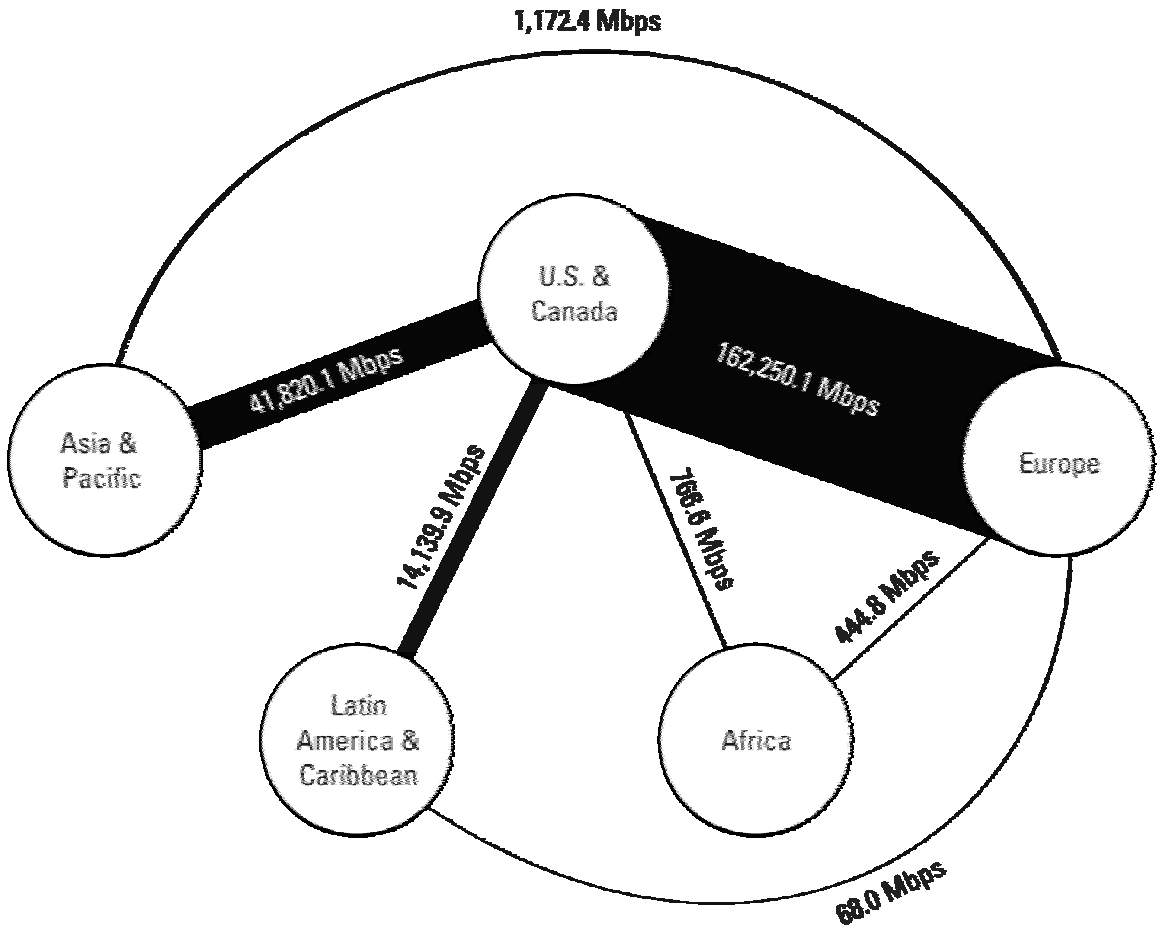
Largest Interregional Routes, mid-2001



Source: TeleGeography, Inc., *Packet Geography 2002*

Connectivity: Analysis Hub-and-Spoke (2/3)

Interregional Internet Capacity, mid-2001



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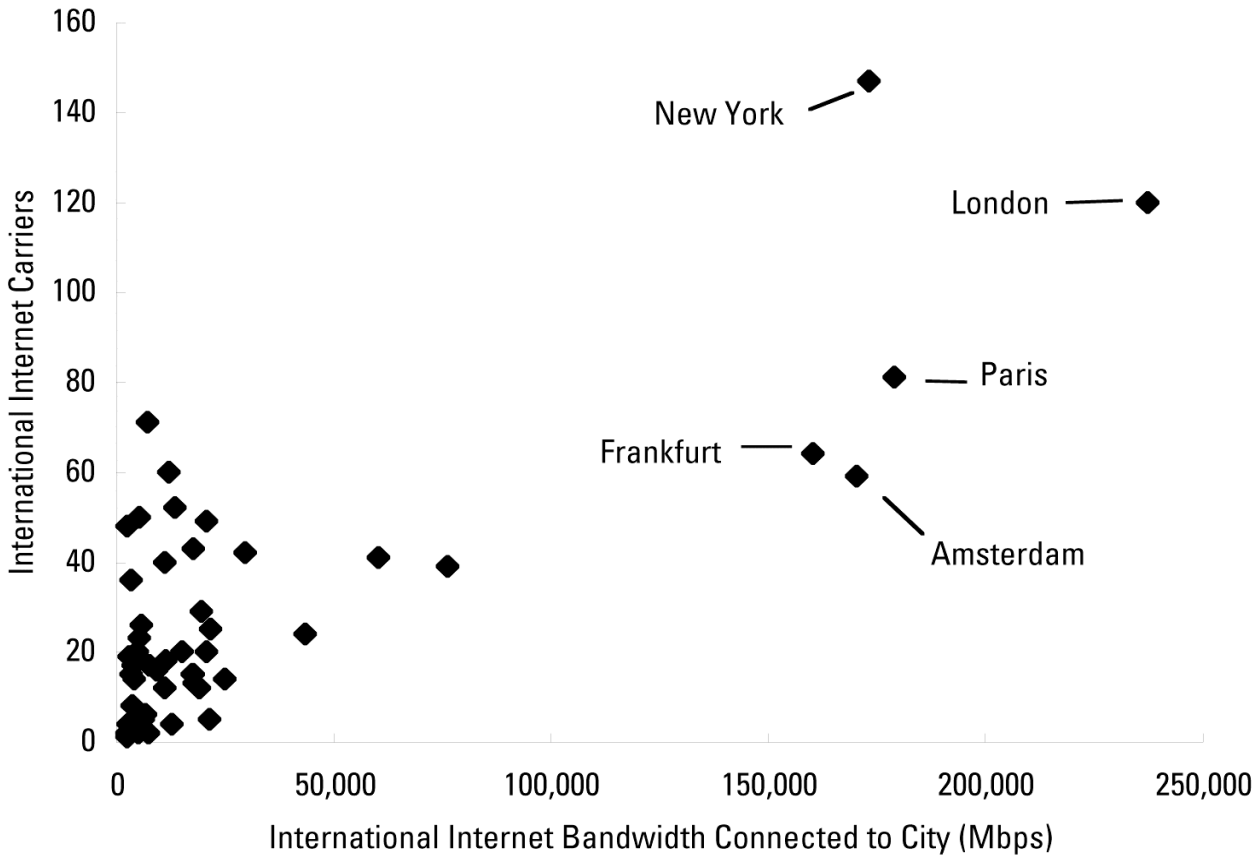
Connectivity: Analysis
Hub-and-Spoke (2/3)

International Internet Providers vs International Internet Capacity, by City



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Connectivity: Analysis
Regionalisation (3/3)

- "regionalisation" as new narrative
  - in every region except Africa, intraregional growth has been the fastest-growing set of connectivity routes
- two extremes in intraregional connectivity
  - Europe: 75 percent of international Internet bandwidth
  - Africa: < 1 percent of international Internet bandwidth
- is higher intraregional connectivity desirable?
  - Latin America: 3%, mid-2000; 12%, 2001
  - Asia: 7%, mid-1999; 13%, mid-2000; 18%, 2001

I. Connectivity

II. Transit

Definition

Competitive Markets

Developing Markets

Internet Transit: Definition

- buying transit is similar to buying Internet access, but requires bundling of inter-AS BGP routing with connectivity
  - engaged in only by ISPs with >1 connection to the Internet
- related to peering
  - peering is settlement-free, unlike transit;
  - peering allows access only to on-net destinations, not the whole Internet

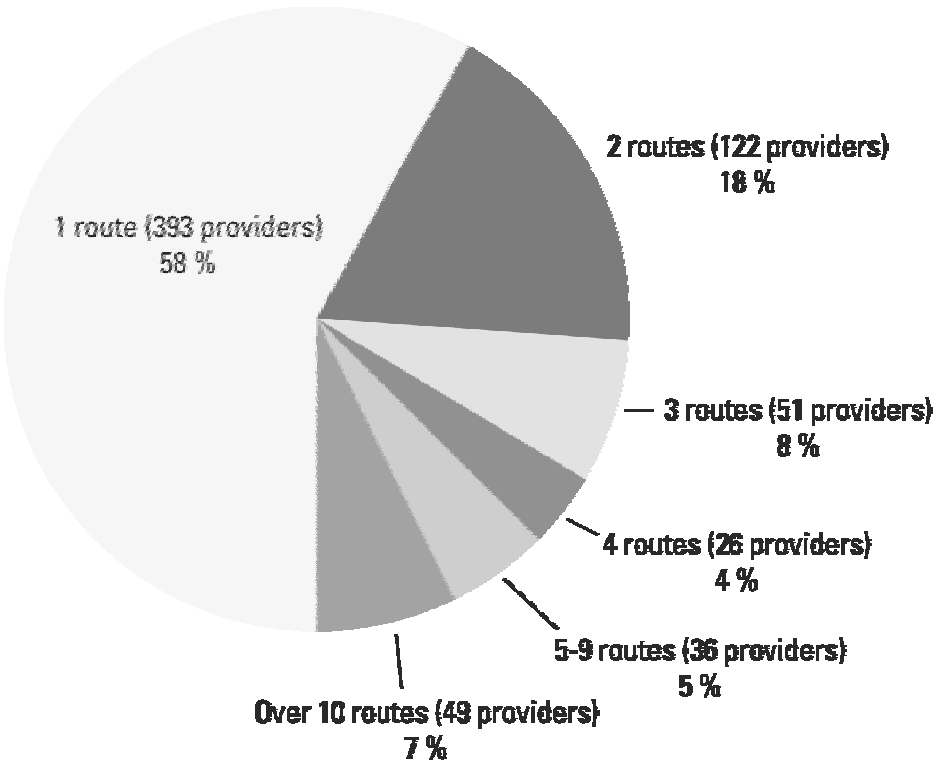
Internet Transit: Competitive Markets

Commodity (n.): tangible good or service resulting from the process of production. Differences between commodities, real or imagined, will determine whether or not they are close substitutes for one another.

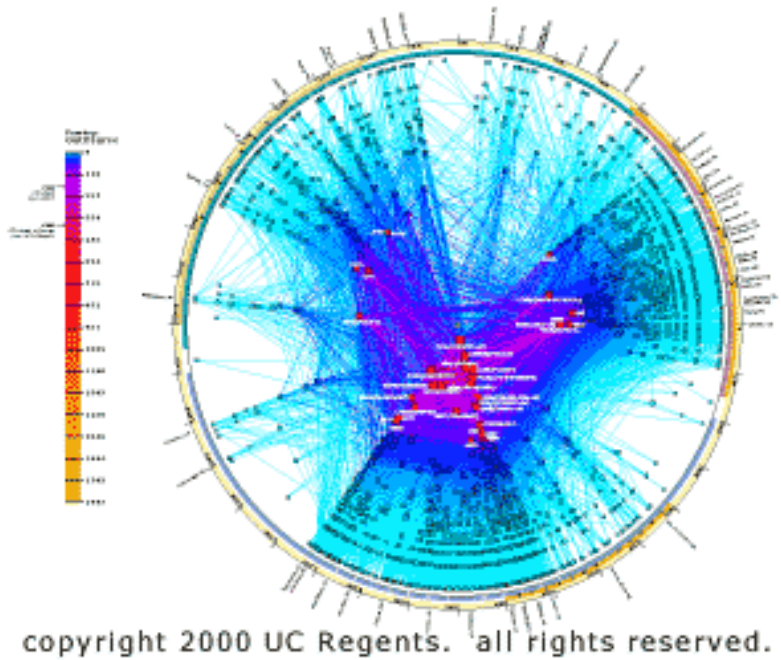
- for purchasers, commodity competition leads to lower prices
- for vendors, commoditisation is to be staved off: product differentiation strategies (bundling, features, etc.) take on greater importance

Internet Transit: Competitive Markets

Who has the most routes?



Who is the best connected?



Internet Transit: Developing Markets

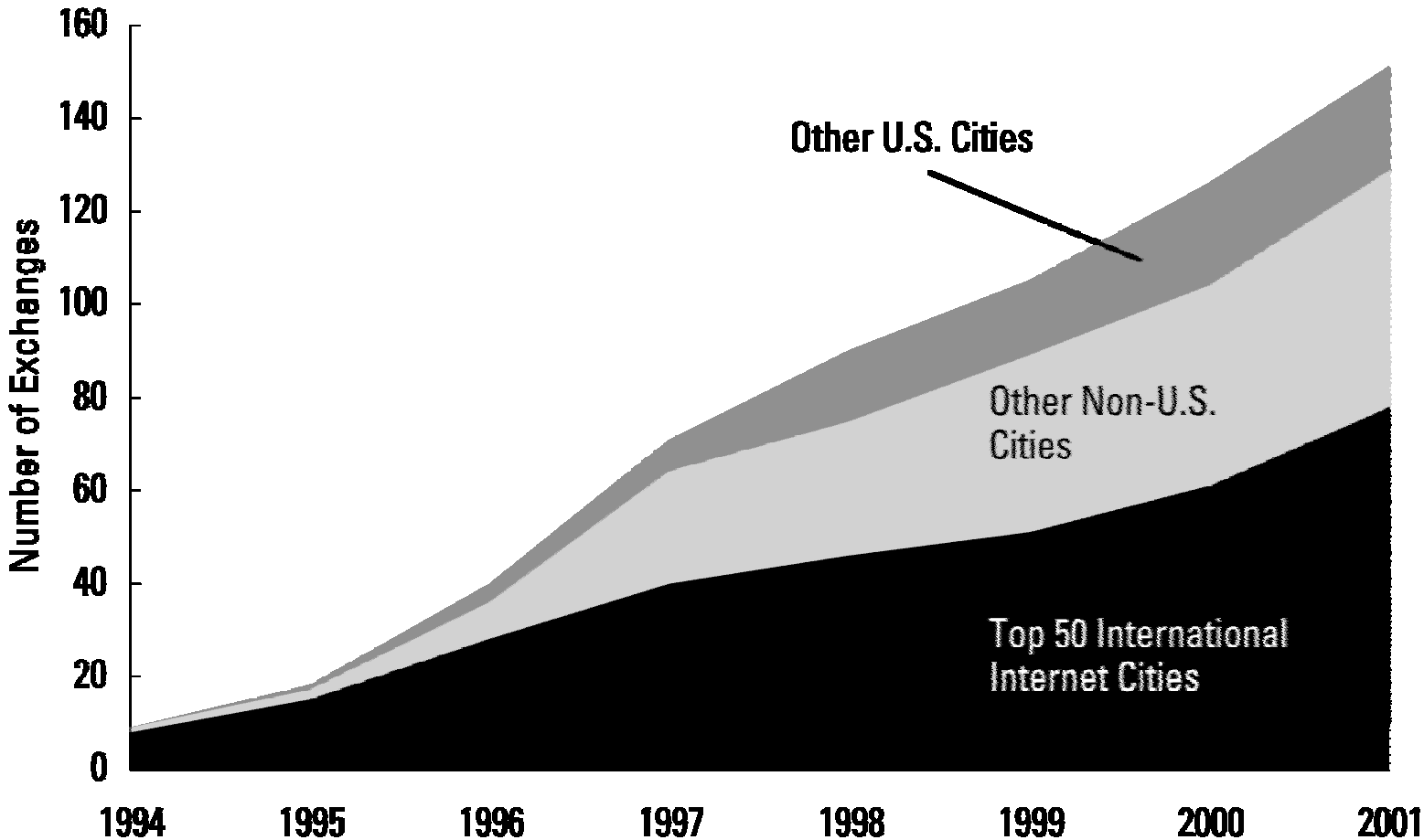
Lessons from competitive markets:

- information transparency drives down prices
- price or product unbundling helps build commodity-like markets
- innovation should be encouraged at each layer

Ways to implement:

- separate pricing for capacity (terrestrial/satellite leased-line equivalents), connectivity (Internet transit)
- information-gathering and analysis: price-performance

Internet Transit: Developing Markets Internet Exchange Growth



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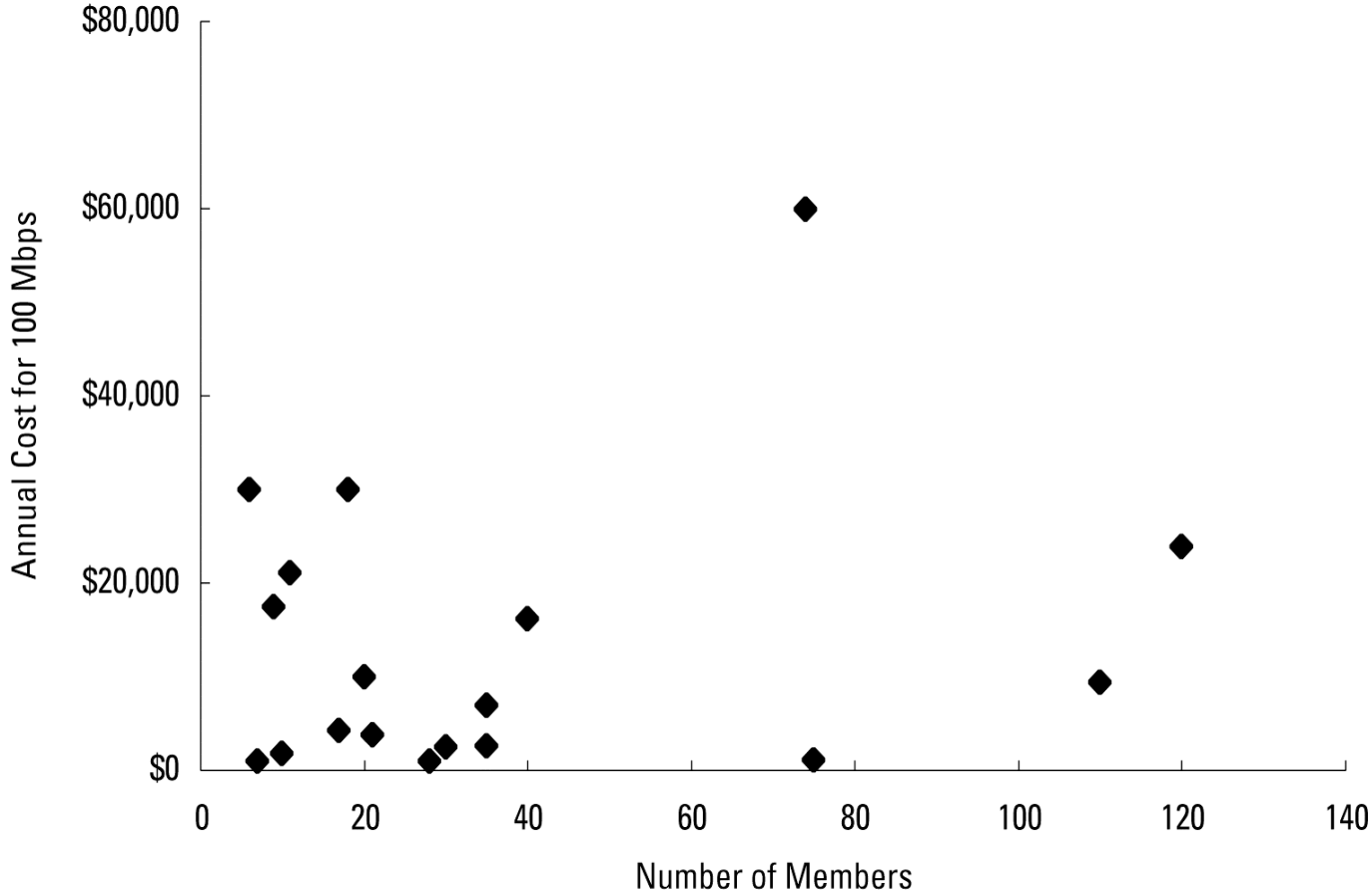
Internet Transit: Developing Markets

Scattered Pricing for Internet Exchanges



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Internet Transit: Developing Markets
Transit Aggregation

- A model exists for discounted transit pricing for research markets.
  - Backbone providers find it advantageous to participate, partly as a way of developing new markets.
- "ITU Transit POP": several transit vendors colocate at a single location and provide very competitive transit pricing restricted to a well-defined set of providers ("all LDC-based transit ISPs", etc.).
  - subsidise the Transit POP's maintenance, engineering staff, etc.
  - should competitive or subsidised leased-line pricing to get to POP be provided?
  - should several POPs of this type be located in developing regions? would subsidy be necessary to establish them?

Internet Transit: Developing Markets

Content Peering

Content peering:

- began as non-market innovation (Squid)
- content peering initiative lived briefly; died when swallowed up by Digital Island (now Cable & Wireless)
- what model could be designed for high cost-of-bandwidth areas, bundled with measurement tools, standardised, and made available as an Internet exchange enhancement?

Internet Transit: Developing Markets
Beyond Connectivity

Why did the Internet grow?

- active transmission of authoring and design know-how...
  - the Web was once thought of as a two-way medium!
- ... and focus on end-to-end connectivity as efficient two-way distribution plant

What will stimulate bandwidth demand in LDCs?

- active transmission of authoring and design know-how...
  - enable LDC citizenries to design their own applications, content
  - move beyond point-to-mass paradigm
- ... and focus on end-to-end connectivity as efficient two-way distribution plant

Thanks!

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