International Internet Statistics
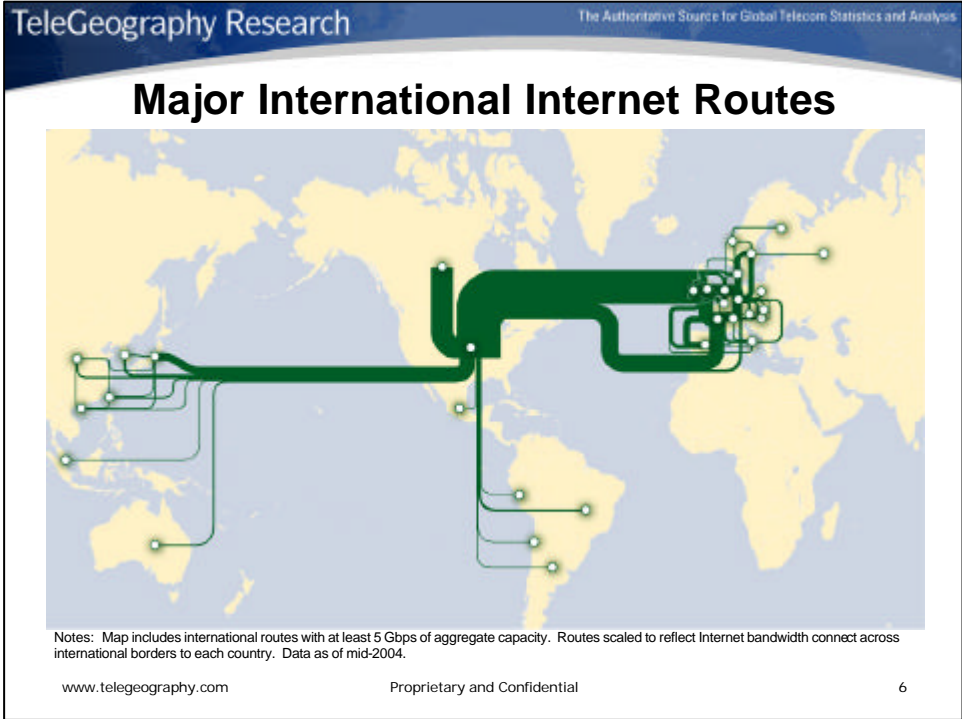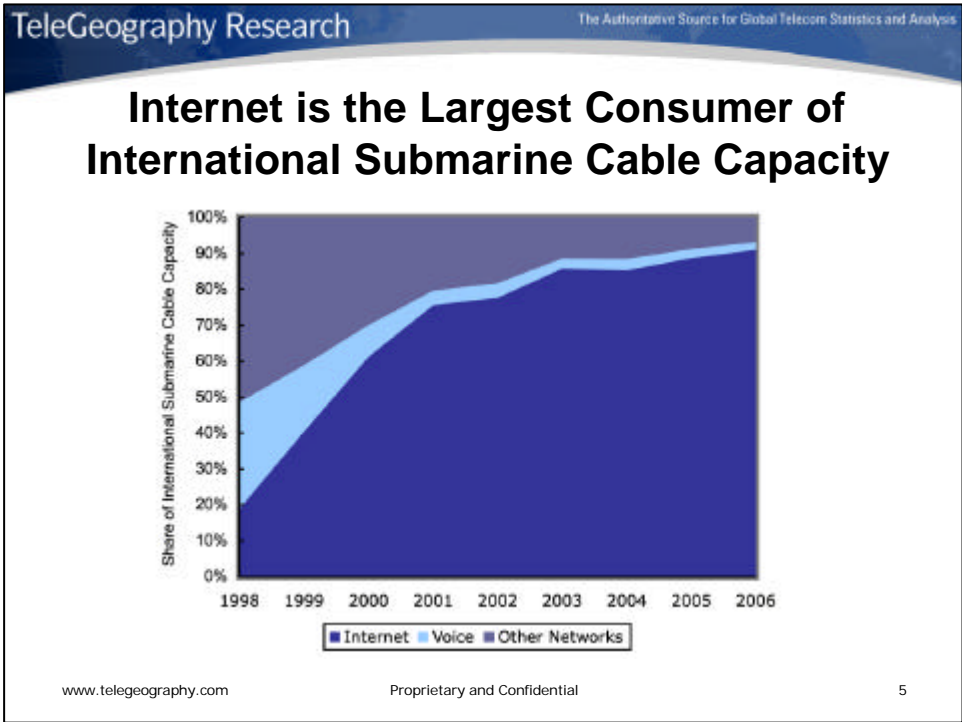
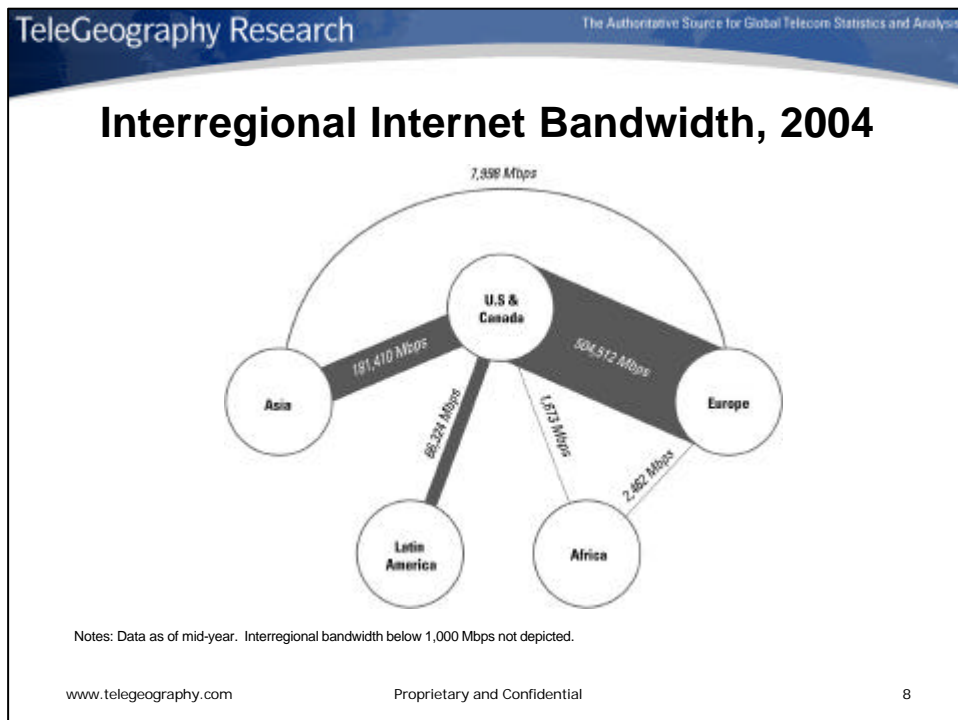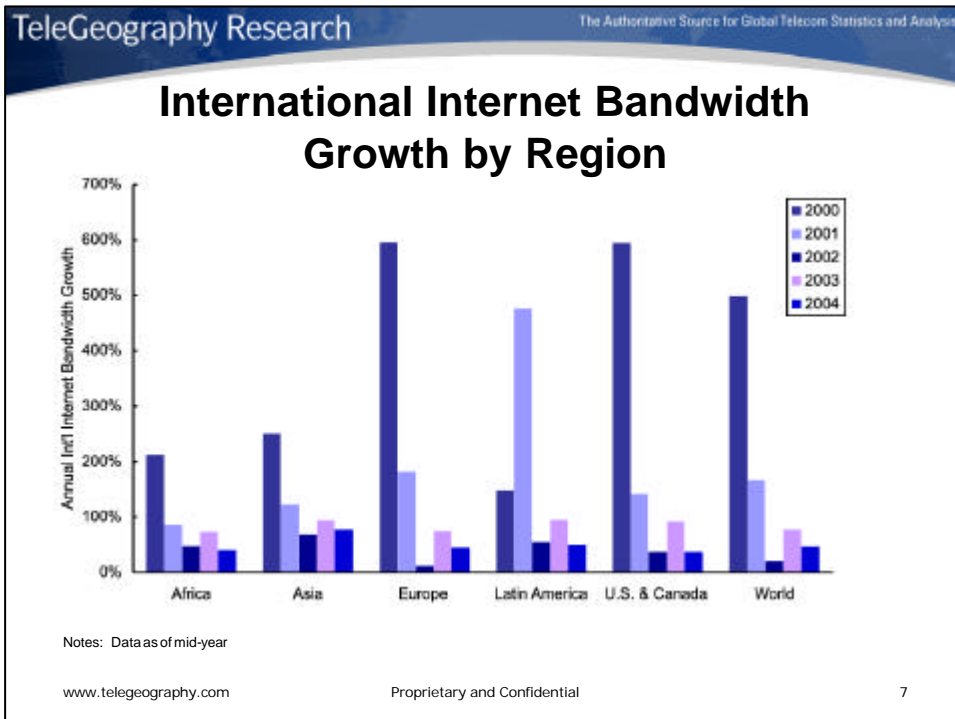ITU ICT Indicators Meeting

February 10, 2005

Overview

- International Internet Bandwidth
- International Internet Traffic
- International VoIP Traffic
- Data Sources and Research Challenges

International Internet Bandwidth

What is Internet Bandwidth?

- Internet bandwidth is capacity which backbone operators provision to carry IP traffic.

- Internet bandwidth (capacity) is not the same as Internet traffic (capacity usage).

- Internet bandwidth data do not reflect the true origin or destination of Internet traffic. Traffic may travel between any two points on the network.

Internet is the Largest Consumer of International Submarine Cable Capacity

Major International Internet Routes

Notes: Map includes international routes with at least 5 Gbps of aggregate capacity. Routes scaled to reflect Internet bandwidth connect across international borders to each country. Data as of mid-2004.

International Internet Bandwidth Growth by Region

Notes: Data as of mid-year

Interregional Internet Bandwidth, 2004

Notes: Data as of mid-year. Interregional bandwidth below 1,000 Mbps not depicted.

Highest Capacity International Internet Routes for Asia (Mbps)

Rank City, Country	2002	2003	2004
1. San Francisco, U.S.-Tokyo, Japan	9,552	24,046	44,159
2. Los Angeles, U.S.-Tokyo, Japan	4,605	8,082	17,875
3. San Francisco, U.S.-Seoul, Korea, Rep.	5,894	10,606	16,638
4. Seoul, Korea, Rep.-Tokyo, Japan	2,319	8,978	14,103
5. Hong Kong, Hong Kong-Tokyo, Japan	2,164	5,808	13,462

Notes: Figures represent Internet bandwidth connected across international borders to Consolidated Metropolitan Statistical Areas or equivalents as of mid-year. Domestic routes omitted.

Highest Capacity International Internet Hub Cities for Asia (Mbps)

Rank City	2002	2003	2004
1. Tokyo, Japan	39,605	97,351	178,605
2. San Francisco, U.S.	34,062	62,365	102,902
3. Hong Kong, Hong Kong	22,174	47,079	93,835
4. Seoul, Korea, Rep.	16,843	43,356	71,381
5. Taipei, Taiwan	16,848	28,927	65,908

Notes: Figures represent Internet bandwidth connected to Asian locations across international borders from Consolidated Metropolitan Statistical Areas or equivalents, including cities outside of Asia. Data as of mid-2004. Domestic routes are omitted.

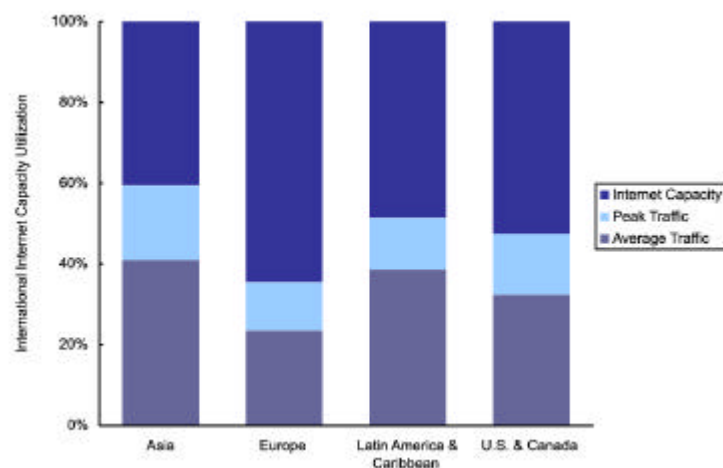# TeleGeography's International Internet Bandwidth Data Set

- Data consist of international city-to-city routes in terms of Mbps by company.

- Data set has been collected annually since 1998.

- Currently over 12,500 individual route records totaling over 10 Tbps of Internet bandwidth are stored in our internal database.

- For asymmetric Internet links, the downstream bandwidth is recorded.

International Internet Traffic

What is Internet traffic?

- To measure Internet traffic, TeleGeography uses "link utilization" - a common metric used by network engineers to measure the performance of their networks.

- Link utilization statistics show how much Internet capacity is being used between two cities during a given period of time, but does not show the true origin or destination of the traffic.

- TeleGeography collects both the average and peak utilization levels across international links.

International Internet Capacity Utilization

Legend: Internet Capacity, Peak Traffic, Average Traffic

Notes: Data reflect traffic over Internet bandwidth connected across international borders including links within the region. Data as of April 2004.

Latin American International Internet Traffic by City and by Route

City, Country	Internet Capacity	Average Traffic	Average Utilization	Peak Traffic	Peak Utilization
Buenos Aires, Argentina	12,248	3,184	26%	4,401	36%
Lima, Peru	5,644	2,285	40%	3,091	55%
Mexico City, Mexico	4,974	1,711	34%	2,313	47%
Santiago, Chile	12,704	3,656	29%	3,851	30%
S‹o Paulo, Brazil	18,433	7,098	39%	9,729	53%

Route	Internet Capacity	Average Traffic	Average Utilization	Peak Traffic	Peak Utilization
Miami, U.S.-S‹o Paulo, Brazil	11,969	4,729	40%	6,490	54%
Miami, U.S.-Santiago, Chile	7,817	3,271	42%	3,262	42%
Lima, Peru-Miami, U.S.	5,286	2,160	41%	2,916	55%
Buenos Aires, Argentina-Miami, U.S.	5,280	2,208	42%	3,009	57%

Notes: Figures represent Internet traffic and bandwidth connect across international borders as of April 2004. Domestic routes are omitted

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TeleGeography's International Internet Traffic Data Set

- Average and peak levels of international Internet traffic collected since 2003 for 45 cities, 60 routes, and 45 countries.

- Data are based on a one month sample from April of each year.

- Data are bidirectional averages - traffic flows in both directions across an Internet link.

International VoIP Traffic

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What is international VoIP traffic?

- TeleGeography tracks international phone calls that transit public or private IP networks at some point, but ultimately terminate on traditional fixed or mobile networks.

- PC-to-PC communications and intra-company private network traffic are excluded from VoIP data set.

# International VoIP and Switched Traffic
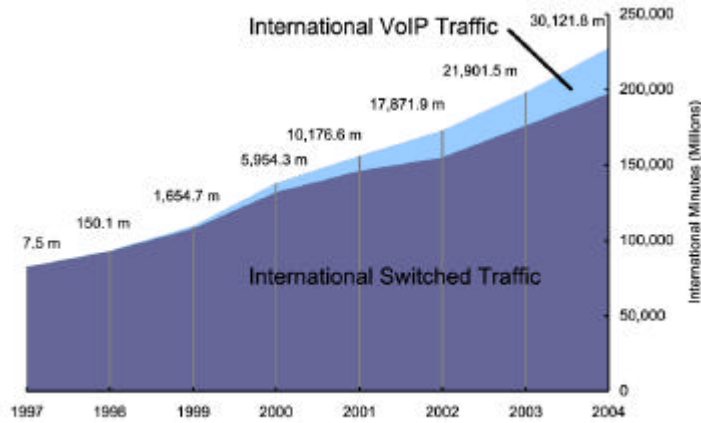
Notes: VoIP traffic includes all cross-border voice calls carried on IP networks but terminated on public switched telephone networks; PC-to-PC communications and private network traffic are excluded. Switched traffic includes circuit-switched voice and fax traffic carried on traditional international facilities as well as international simple resale (ISR) facilities. Figures for 2004 are estimated.

International Inbound VoIP Traffic Totals by Region, 2001-2003
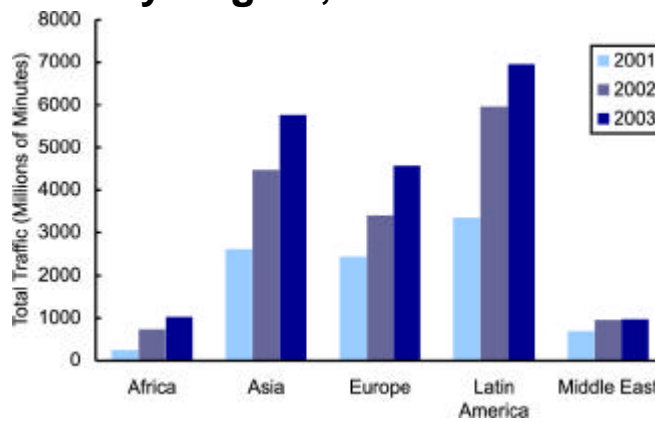
Notes: VoIP traffic includes all cross-border voice calls carried on IP networks but terminated on public switched telephone networks; PC-to-PC communications and private network traffic are excluded.

International VoIP Termination
in Africa, 2003

Total Traffic (Millions of Minutes)

| | 0 | 50 | 100 | 150 | 200 | 250 |

- Nigeria
- Senegal
- South Africa
- Egypt
- Ghana

Notes: Total inbound VoIP traffic to Africa was one billion minutes in 2003. VoIP traffic includes all cross-border voice calls carried on IP networks but terminated on public switched telephone networks; PC-to-PC communications and private network traffic are excluded.
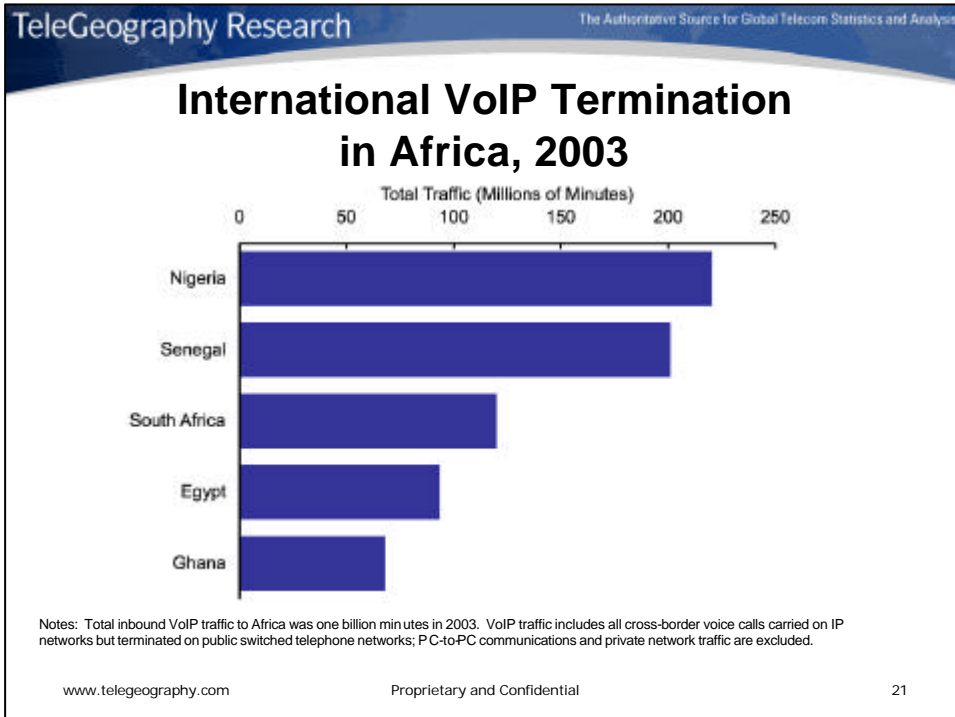
TeleGeography's International VoIP
Traffic Data Set

- Traffic data collected annually in terms of number of minutes.

- Minutes tracked by termination point.

- Data has been collected annually since 1999.

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Data Sources and Research Challenges

Internet Bandwidth & Traffic Data Sources

- Annual confidential survey of backbone providers.
- Public and private information sources used to supplement bandwidth data.
- Automated network discovery tool also used for bandwidth data. This tool collects network topology data for a large number of geographic location, which is then parsed for identifiable geographic and commercial characteristics.

International VoIP Traffic Data Sources

- Annual survey of VoIP carriers.

Research Challenges

- **Confidentiality:** Data collected from carriers is extremely sensitive, particularly Internet traffic. Convincing carriers to contribute data each year is difficult.

- **Number of Providers:** Over 400 carriers operated international Internet links in 2004. Impossible to receive data from every carrier. Estimation is required to create complete Internet bandwidth and traffic data sets.

Research Challenges

- **Internet Traffic Origin and Destination:** Traffic data do not reveal origin or destination of traffic.

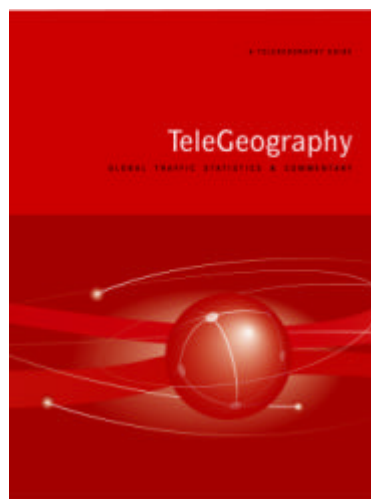- **VoIP Traffic Origin:** Not possible to track the origin of VoIP traffic due to hubbed routing.

Global Internet Geography

TeleGeography's international Internet bandwidth and traffic data are updated annually in the *Global Internet Geography* report.
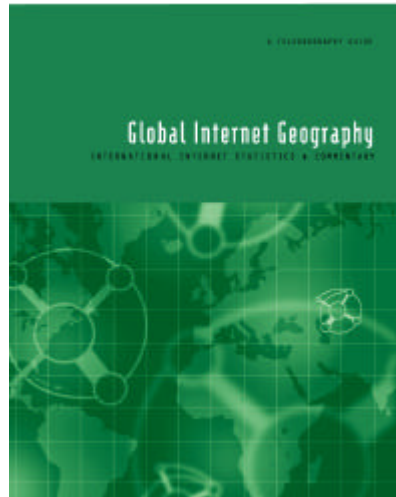
TeleGeography

TeleGeography's international VoIP data are updated annually in the *TeleGeography* report.