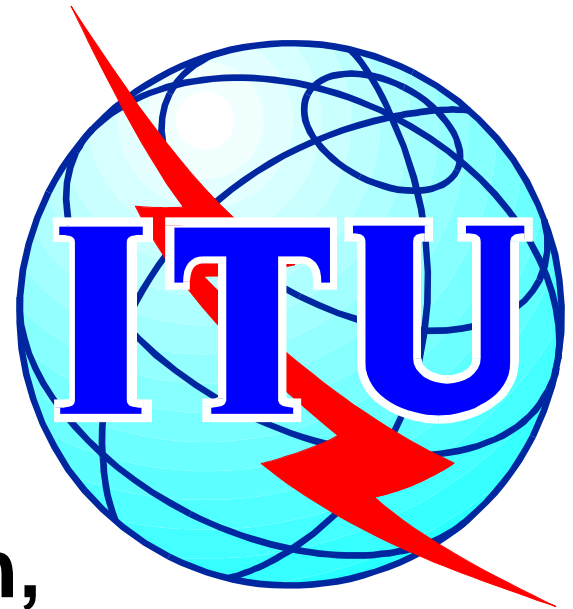
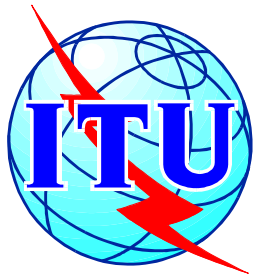


When and where will IP overtake voice?

**Dr Tim Kelly,
Co-ordinator, Strategies and
Policy Unit, International
Telecommunication Union,
TeleNor Carrier Event, Lofoten,
Norway, 29 Aug – 1 Sept 2000**



The views expressed in this presentation are those of the author and do not necessarily reflect the opinions of the ITU or its membership. The author can be contacted at tim.kelly@itu.int.



When and where will IP overtake voice?

- **Why is the question important?**

- ⇒ **Investment in networks**
- ⇒ **Investment in companies**

- **Different dimensions of the question**

- ⇒ **IP overtaking voice, by volume**
- ⇒ **IP overtaking voice, by value**

- **The Geography of IP**

- ⇒ **Accelerating returns to scale**
- ⇒ **Cross-overs at global, regional and national levels**

- **Implications**

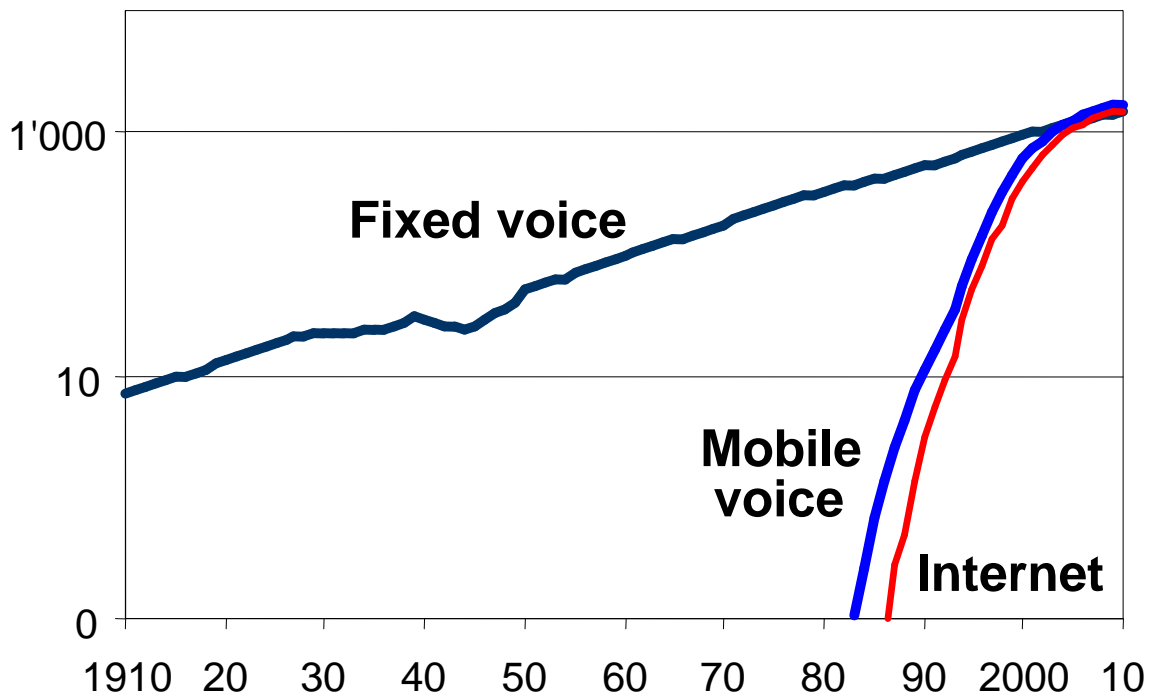
- ⇒ **... for network provisioning**
- ⇒ **... for bandwidth pricing**



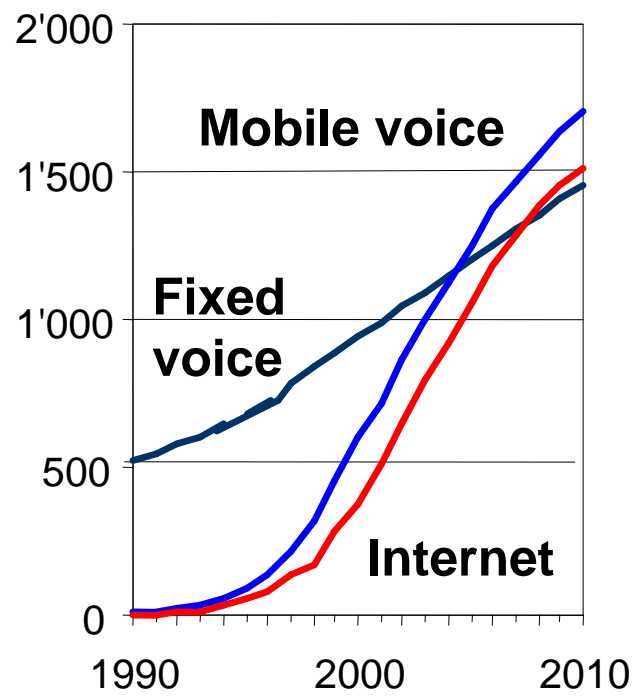
Taking the long-term view

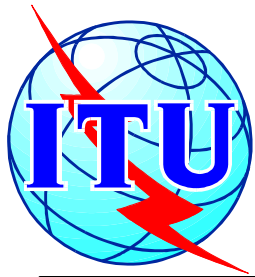
Fixed voice, Mobile voice and Internet users worldwide (millions)

1910-2010, Logarithmic scale



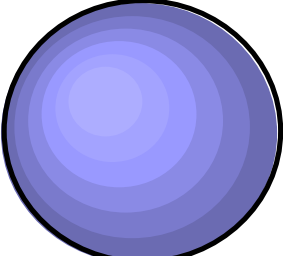


Normal scale



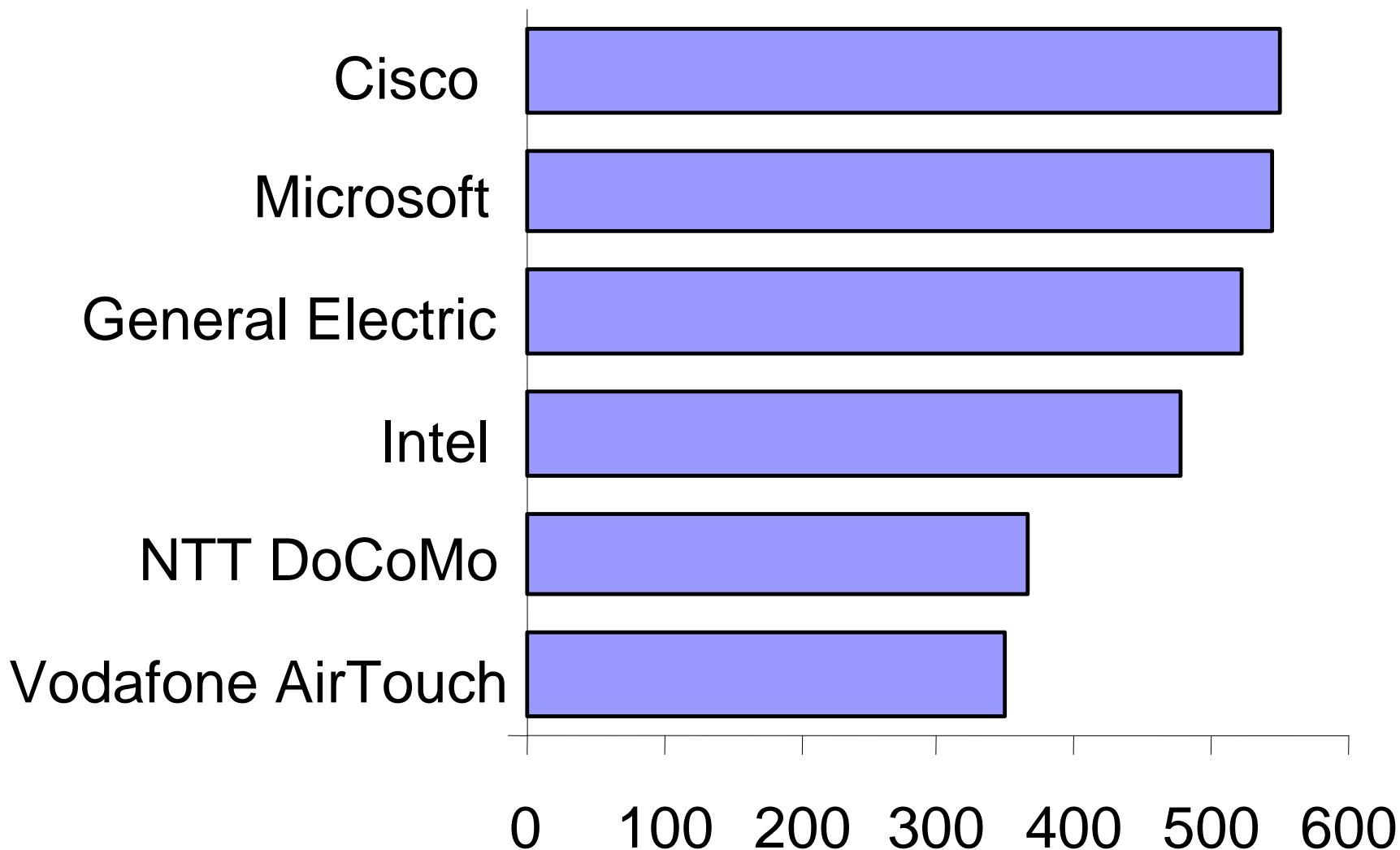


Relative bandwidth requirements *(highly approximate!)*

<i>Typical usage</i>	<i>Duration and volume</i>	<i>Bandwidth per month</i>	<i>Relative size</i>
Voice telephone user	6 hours per month: 8 kbit/s duplex	350 Mb	
Current Internet user	30 hours per month: 56 kbit/s downstream, 4 kbit/s upstream	6.5 Gb	
Future Internet user (streaming media)	50 hours per month: 1 Mbit/s downstream, 56 kbit/s upstream	190 Gb	



*Market capitalization driven by market expectations: **Top 6 firms in US\$bn***



Source: Primark Datastream, valid at 27 March 2000.



When will IP overtake voice (1): By volume?

● **Measured by traffic:**

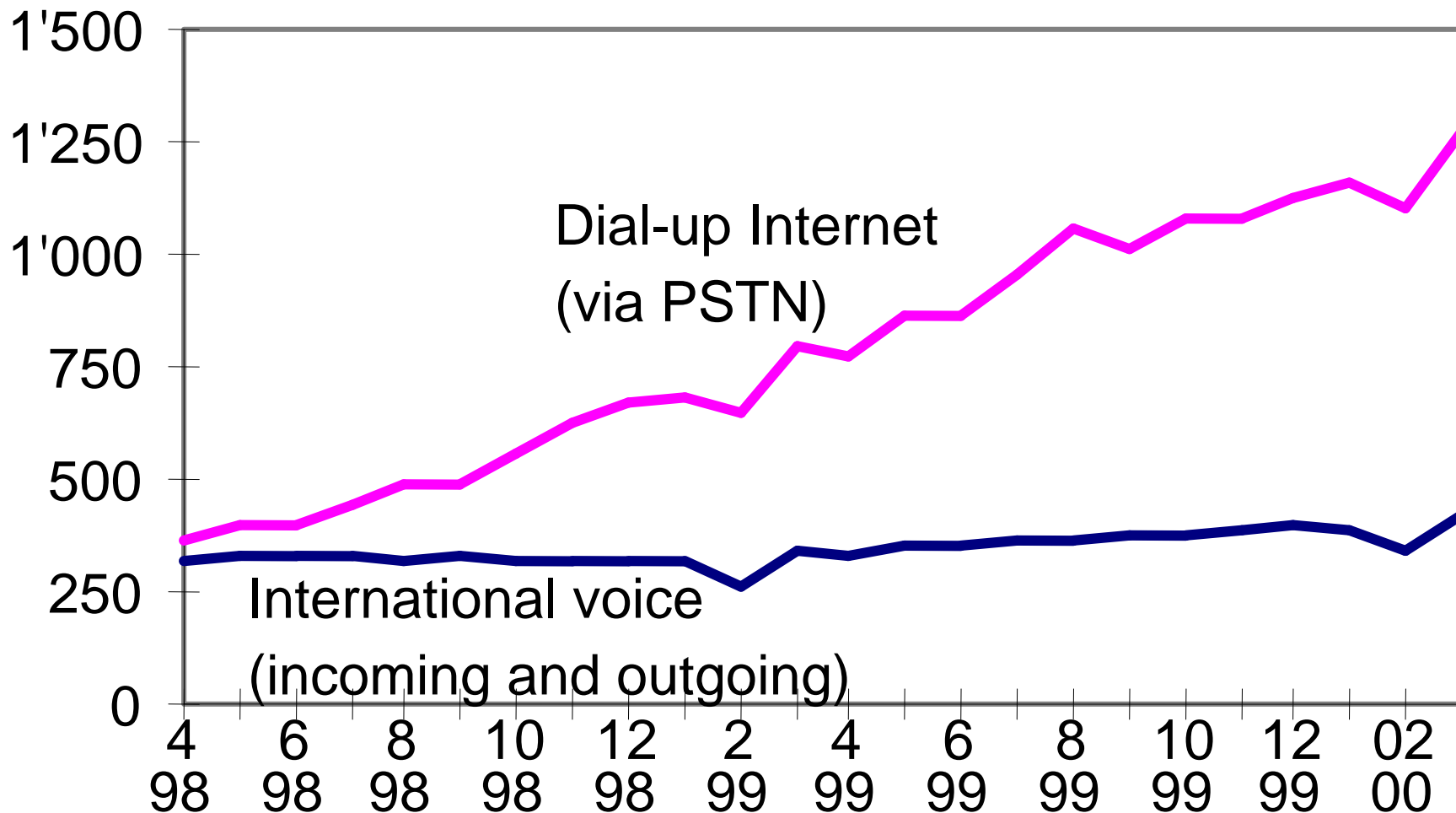
- ⇒ **Around 105 billion minutes of international PSTN traffic in 1999 (mainly voice and fax)**
- ⇒ **Around 5 trillion minutes of total PSTN traffic**
- ⇒ **Global quantity of data traffic not known, but growing exponentially (doubling every 100 days?)**
- ⇒ **Comparable data available for individual countries (e.g. Hongkong SAR, Germany, Portugal, Sweden)**

● **Measured by circuits:**

- ⇒ **Data available for US carriers, broken down by PSTN, IPL and other**
- ⇒ **Crossover between PSTN and IPL in 1998**



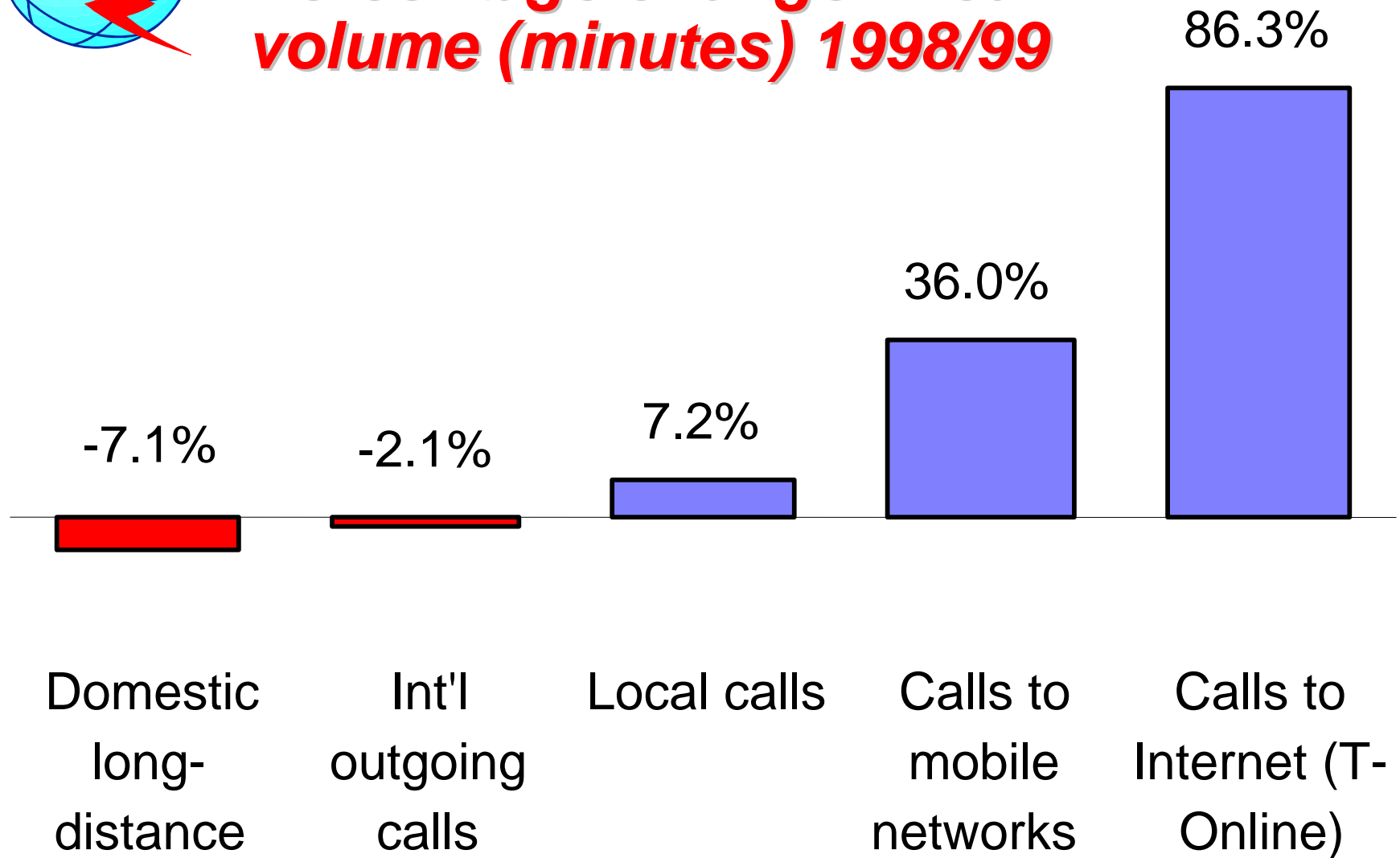
Minutes of use by month, Hongkong SAR ('000s)



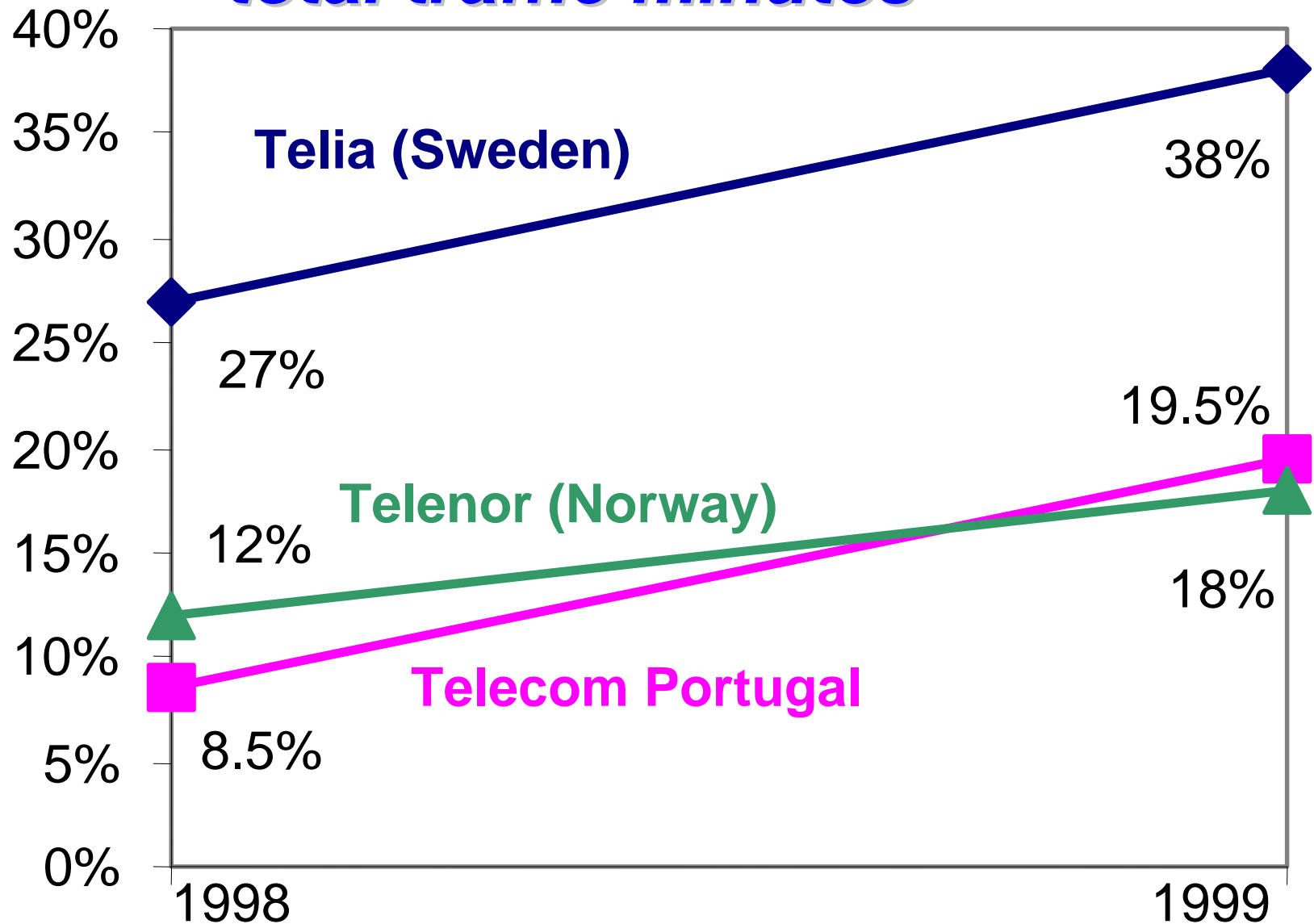


Deutsche Telekom

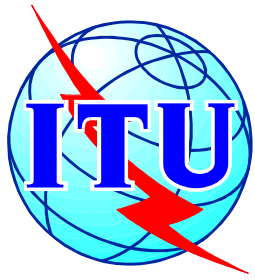
Percentage change in call volume (minutes) 1998/99



Dial-up Internet traffic as % of total traffic minutes



Source: PTO annual reports. Note: For Telia, Internet traffic as % of local minutes. For others, as % of total



When will IP overtake voice (2): By value?

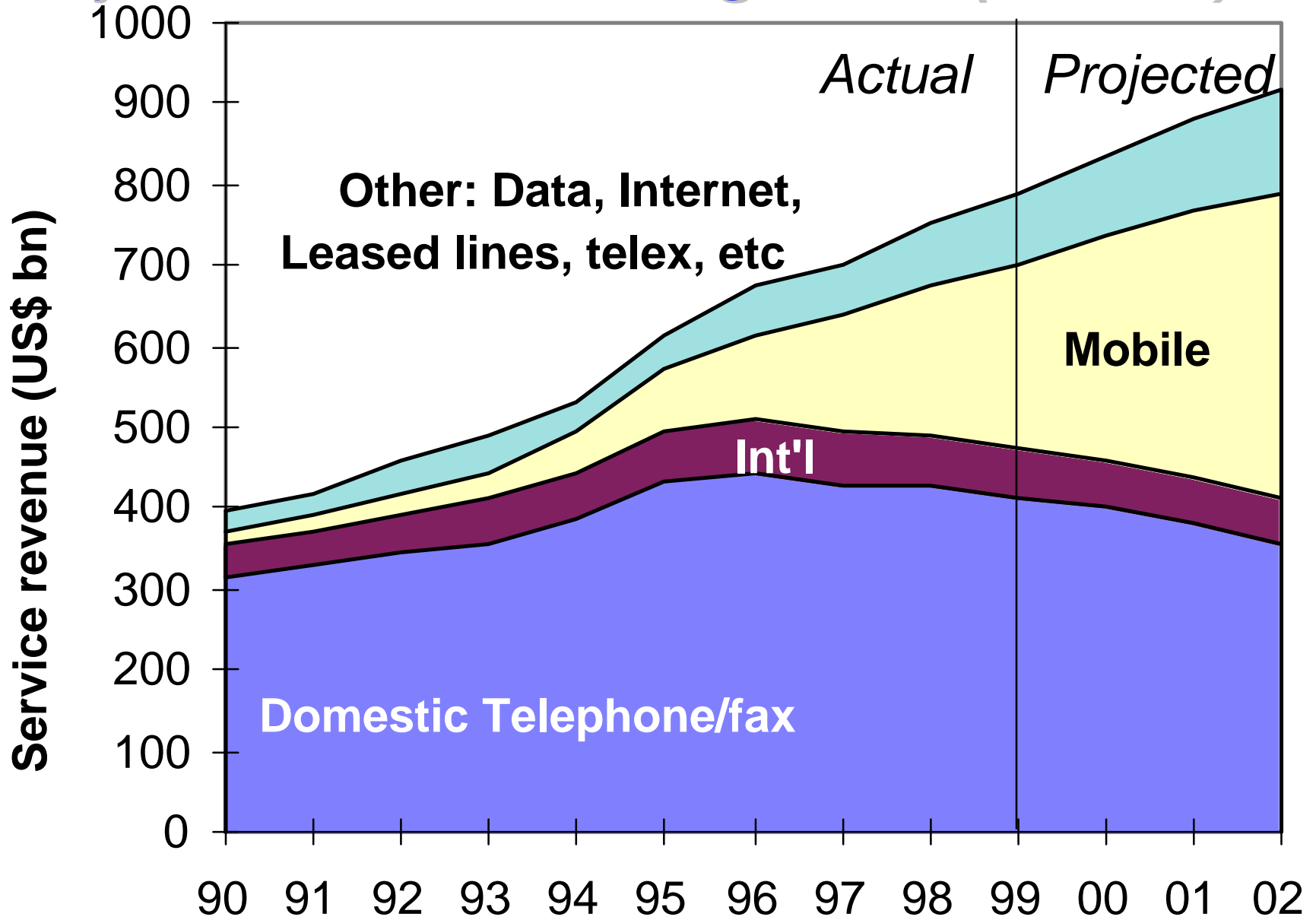
- **Paradigm shift postponed**

- ⇒ **Most Public Telecommunication Operators still heavily dependent on voice revenues**
- ⇒ **Mobile revenues (largely voice) represent main current area of growth**
- ⇒ **Price erosion of Internet revenues is offsetting volume gains (e.g., falling leased line prices)**

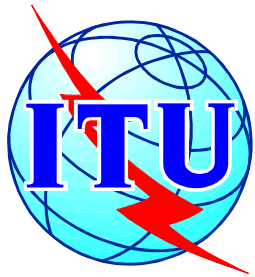
- **Paradigm shift regained**

- ⇒ **Mobile Internet is likely to be a major area of future revenue growth**
- ⇒ **Possible future shift of broadcast entertainment (TV, music, pay-per-view) onto telecom-type networks (broadband Internet)**
- ⇒ **PSTN voice traffic shifting to IP-based networks**

Projection of revenue growth (US\$bn)



Source: ITU "World Telecommunication Development Report 1999: Mobile cellular"

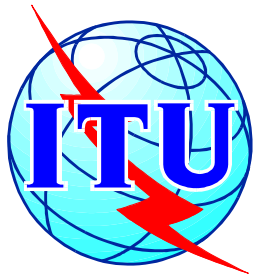


The influence of Voice over IP

- **IDC** forecasts that “Web Talk” revenues will reach US\$16.5 bn by 2004 with 135 billion mins of traffic
- **Gartner Group** forecast that voice over IP and competition in Europe will reduce prices by 75% by 2002
- IP Telephony as % of all int’l calls in 2004
 - ⇒ **Tarifica** forecast 40%
 - ⇒ **Analysys** forecast 25%
- In **developing countries**, the majority of IP Telephony calls are incoming



Source: IDC.

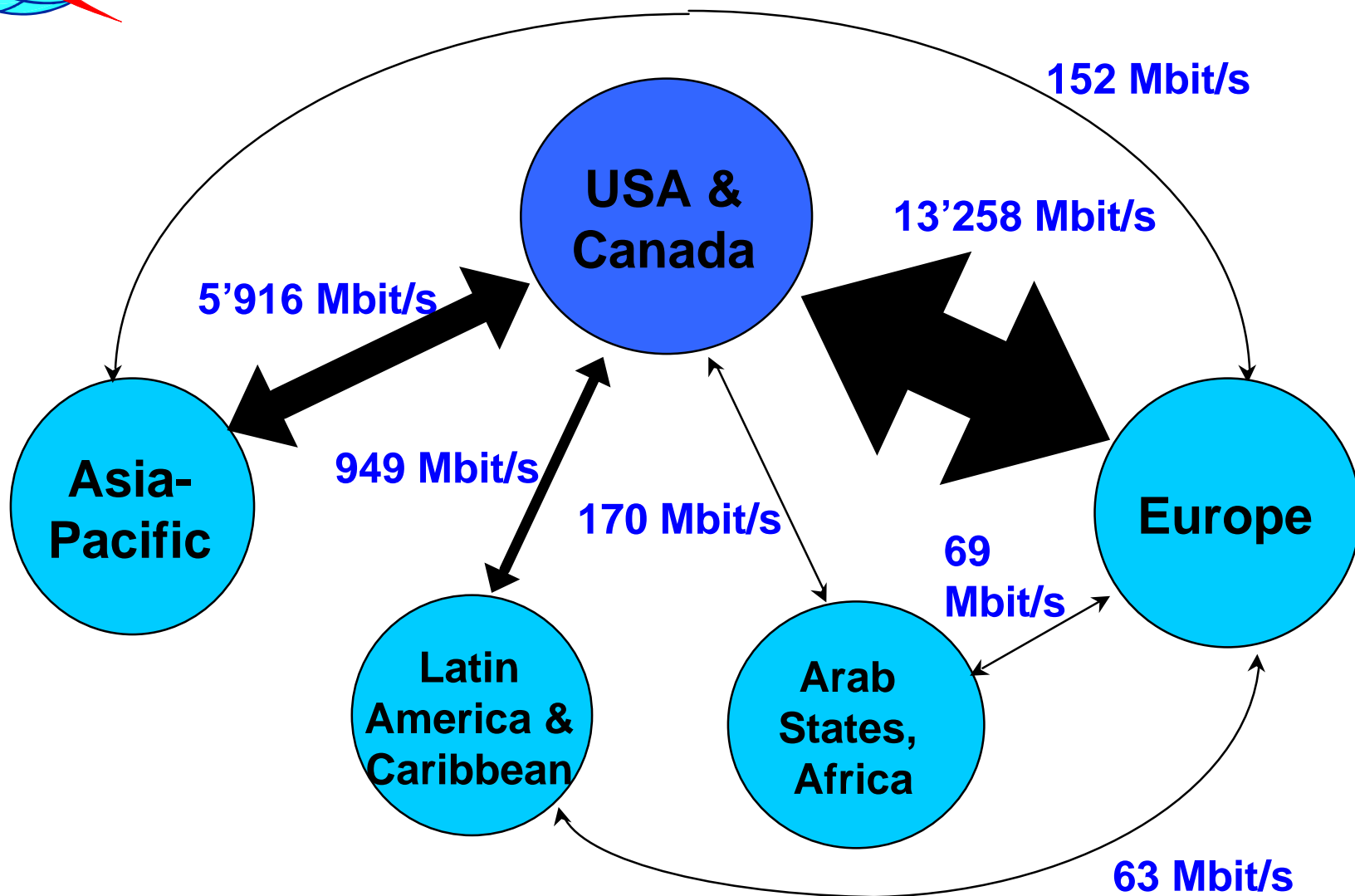


The Geography of IP

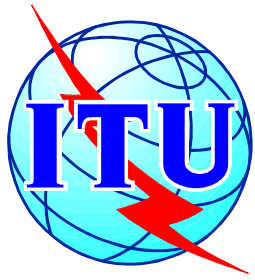
- **Investment in IP networks is still highly US-centric**
 - ⇒ **More than 95 per cent of inter-regional IP bandwidth connectivity is to/from North America**
 - ⇒ **Accelerating returns to scale means that big get bigger**
- **Europe catching up fast**
 - ⇒ **Major investment in fibre-based networks since opening up of EU markets in late 1990s**
- **Asia-Pacific lagging behind**
 - ⇒ **Top European city (Geneva) has 50 times more connectivity per inhabitant than top Asian city (Japan)**
- **Latecomers disadvantaged by high prices**
 - ⇒ **Non-liberalised telecom markets and obligation to pay both cost of both half-circuits of Int'l Private Line**
 - ⇒ **Insufficient demand to force down prices**



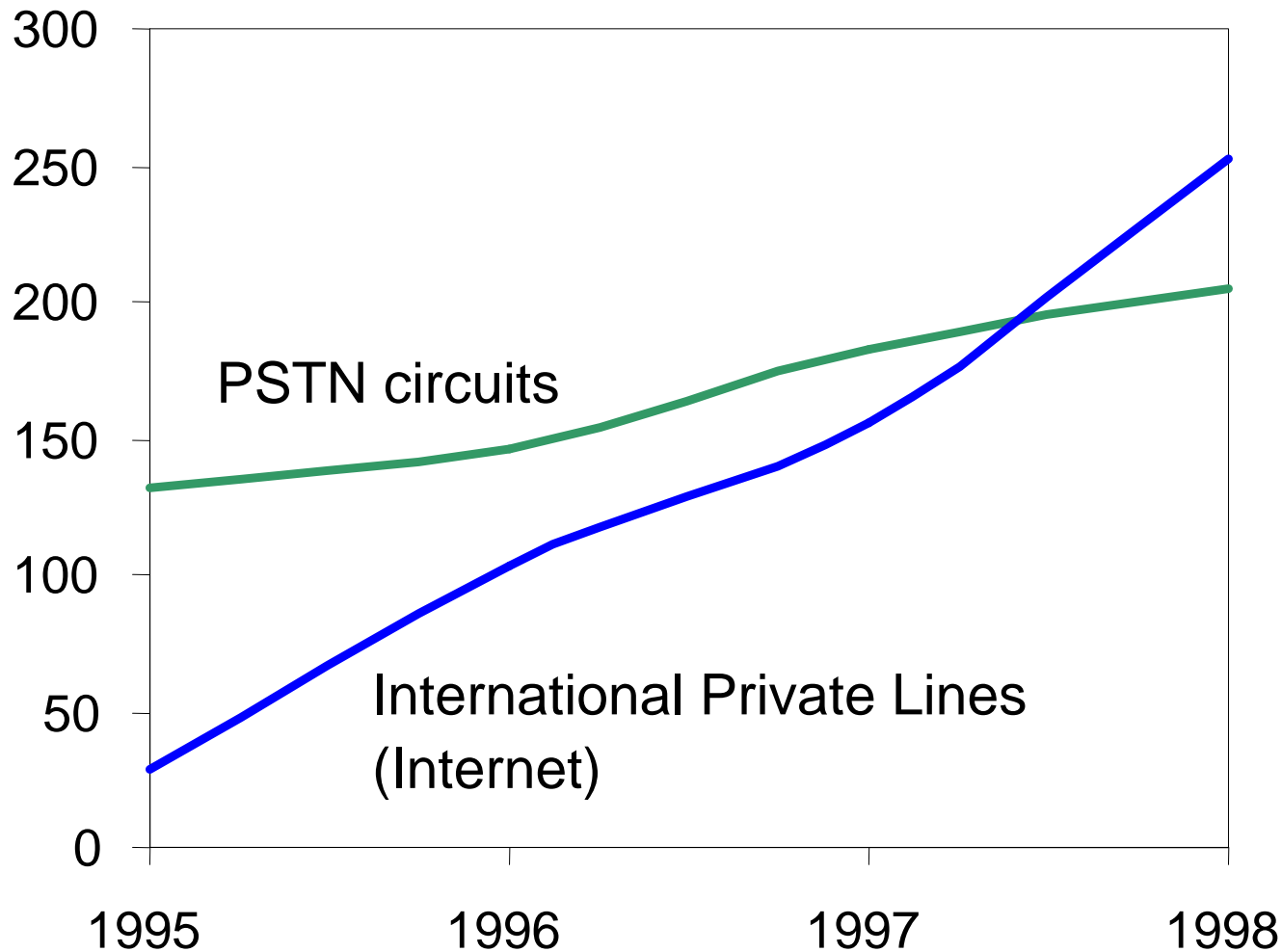
Inter-regional Internet backbone



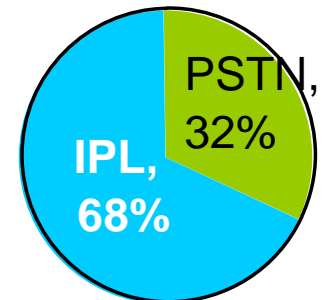
Source: TeleGeography Inc., Global Backbone Database. Data valid for Sept. 1999.



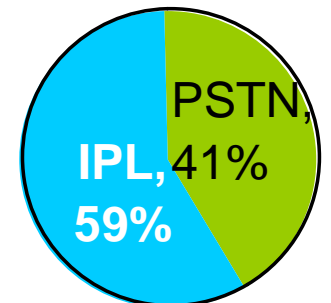
Number of int'l circuits in use, worldwide, and by region 1998 (in thousands)



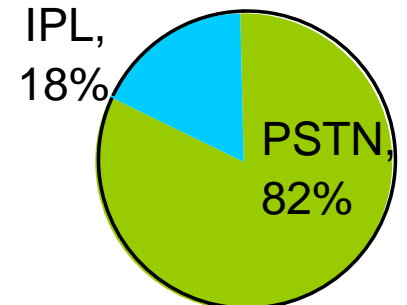
Western Europe



Asia



Caribbean



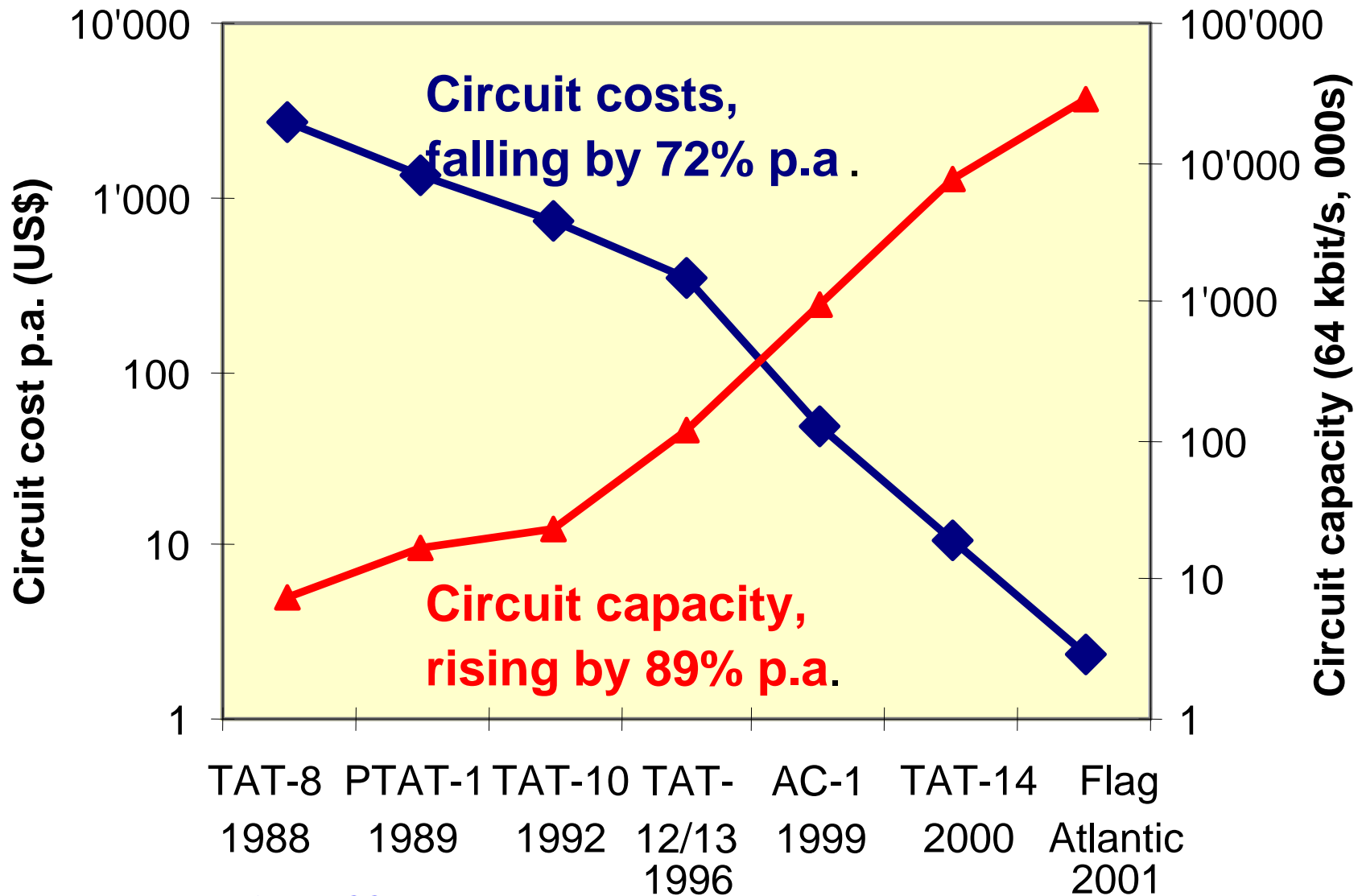
Source: FCC. Applies to US carriers only.



Implications for network provisioning

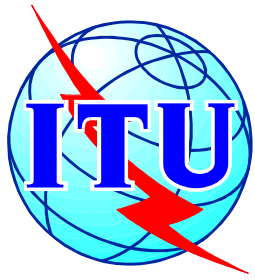
- **Internet is likely to be the main demand driver**
 - ⇒ **World Wide Web**
 - ⇒ **Company Intranets**
 - ⇒ **Managed IP-based networks**
 - ⇒ **Streaming media**
- **Voice growth may nevertheless be significant**
 - ⇒ **International voice growing by around 15% p.a.**
 - ⇒ **Demand for digitized voice in unified messaging applications**
 - ⇒ **Voice demand will be more geographically dispersed than data demand**

Infrastructure capacity and costs, TransAtlantic cables, 1988-2001



Source: ITU, adapted from FCC.

Note: Circuit costs assume a usage level of 18%, a compression level of 5:1 and a life-time of 20 years.



Implications for bandwidth pricing

- **“Cost-oriented” pricing may be unsustainable**
 - ⇒ **Customer perception is that voice has more “value” than data**
 - ⇒ **Narrow-bandwidth services, such as voice, might otherwise be “too cheap to meter”**
- **Pricing for access more significant than pricing for usage**
 - ⇒ **Price of link to fat pipe would cost more than share of fat pipe**
 - ⇒ **Internet-style flat-rate, distance-insensitive tariffing of capacity likely to be dominant mode**
- **Key to success will be managing transition to lower prices**