

The Geographies of Cyberspace and Transportation

Geo-spatial Information Systems for Transportation Symposium
Rapid City, South Dakota, 2004

Previously: Transportation Research Board
Transportation & Economic Development Conference
Portland, Oregon in 2002

Maggie Cusack
Senior Transportation Analyst
New York State Department of Transportation

Research Questions

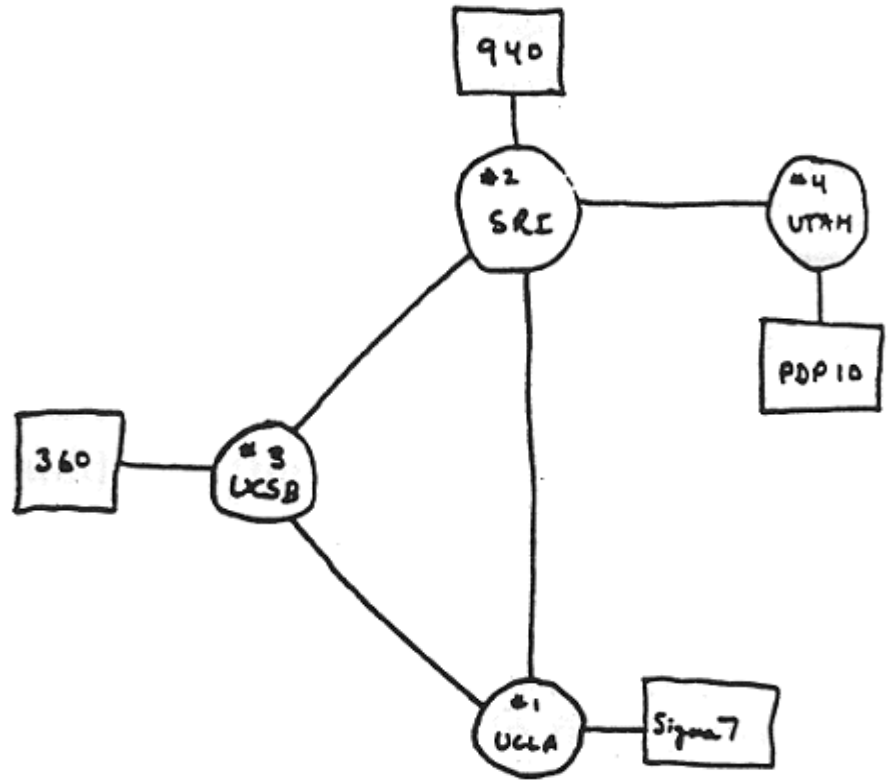
- What kind of geographic pattern, if any, does the Internet follow?
- What kind of economic geographies and interactions has the Internet spawned?
- Does the Internet follow typical population concentrations?
- What effect does the Internet and its geography have on transportation?

Cyberspace

- 'navigable space'
- from the Greek word *kyber*
- popularized by William Gibson, used in his 1984 science-fiction Neuromancer
- "Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation....A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity." (p.51)

Cyberspace exists due to the Internet infrastructure

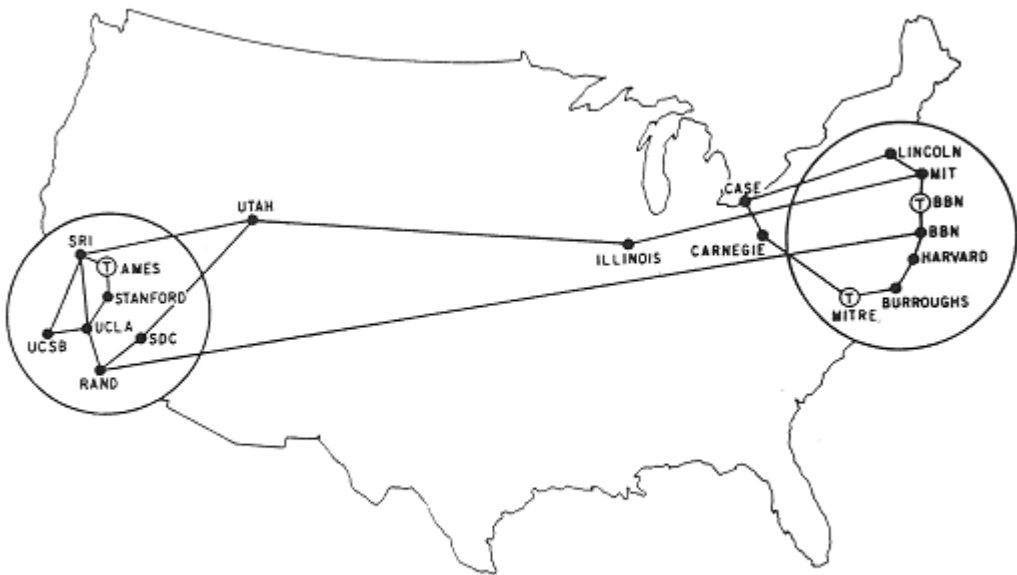
- computers
- telephone networks
- data switches
- routers
- IP backbones



THE ARPA NETWORK

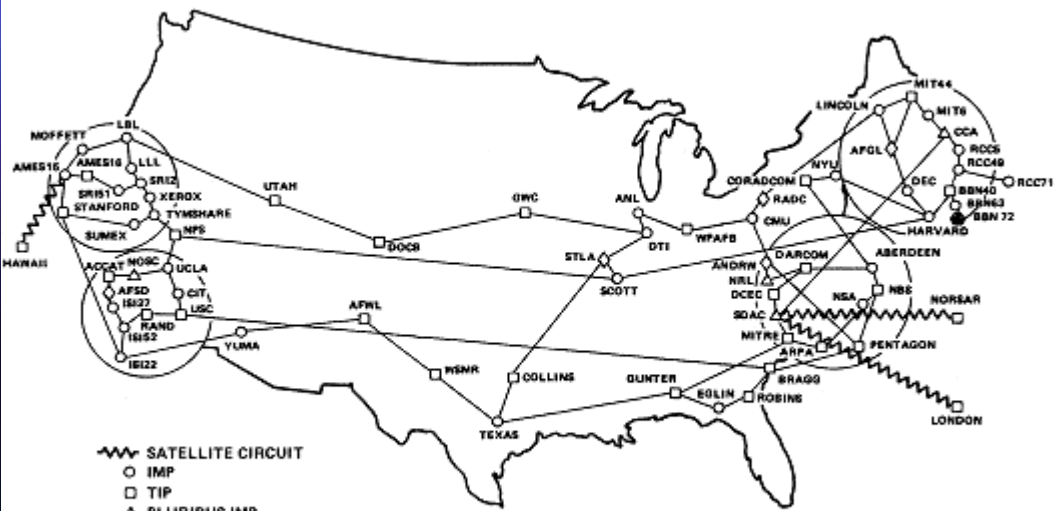
DEC 1969

4 NODES



MAP 4 September 1971

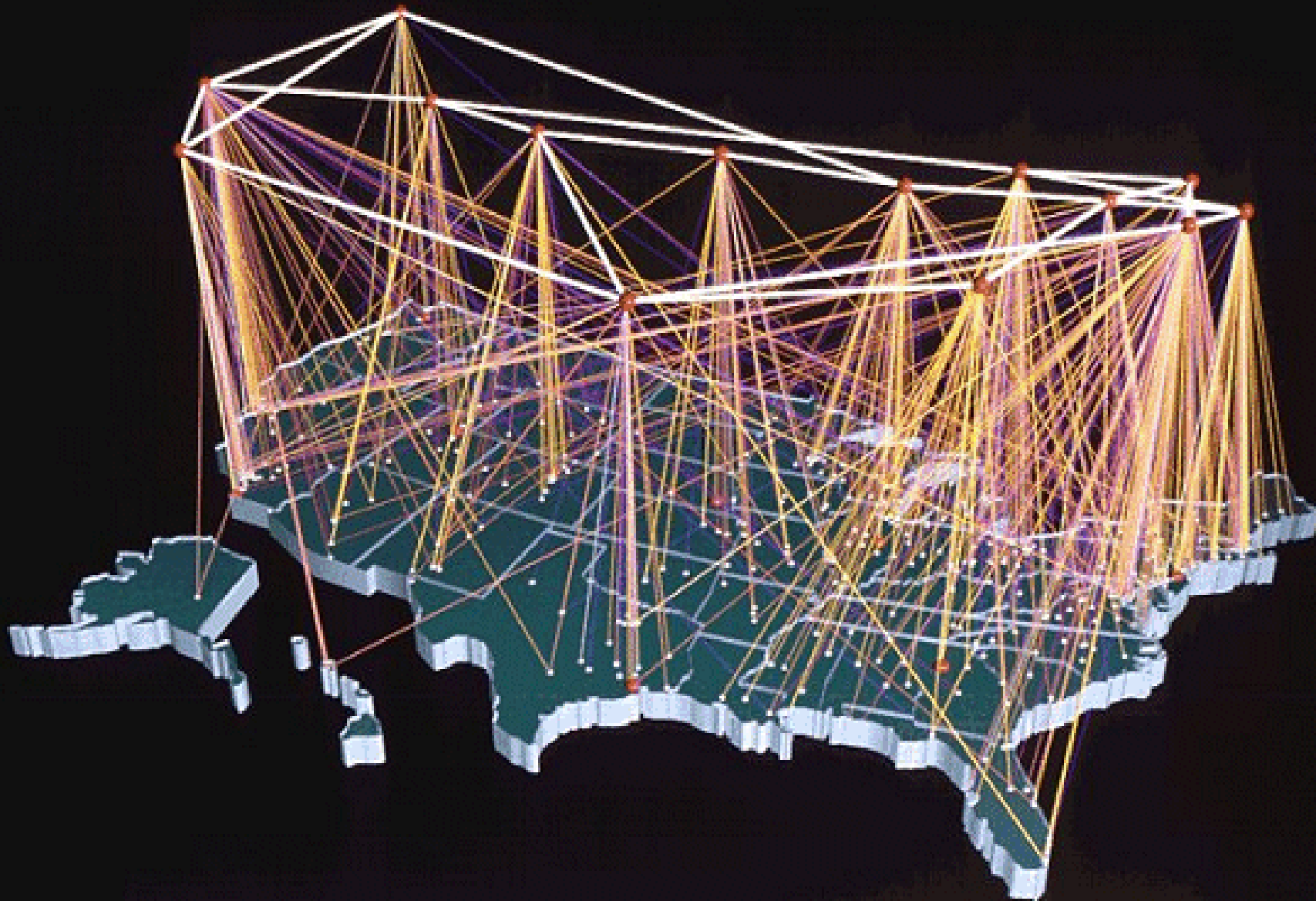
ARPANET GEOGRAPHIC MAP, OCTOBER 1980



- ⌚ SATELLITE CIRCUIT
- IMP
- TIP
- △ PLURIBUS IMP
- ◇ PLURIBUS TIP
- C30

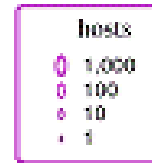
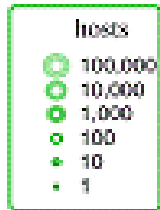
(NOTE: THIS MAP DOES NOT SHOW ARPA'S EXPERIMENTAL SATELLITE CONNECTIONS)
 NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES





Source: <http://www.mappingcyberspace.com/gallery/index.html>

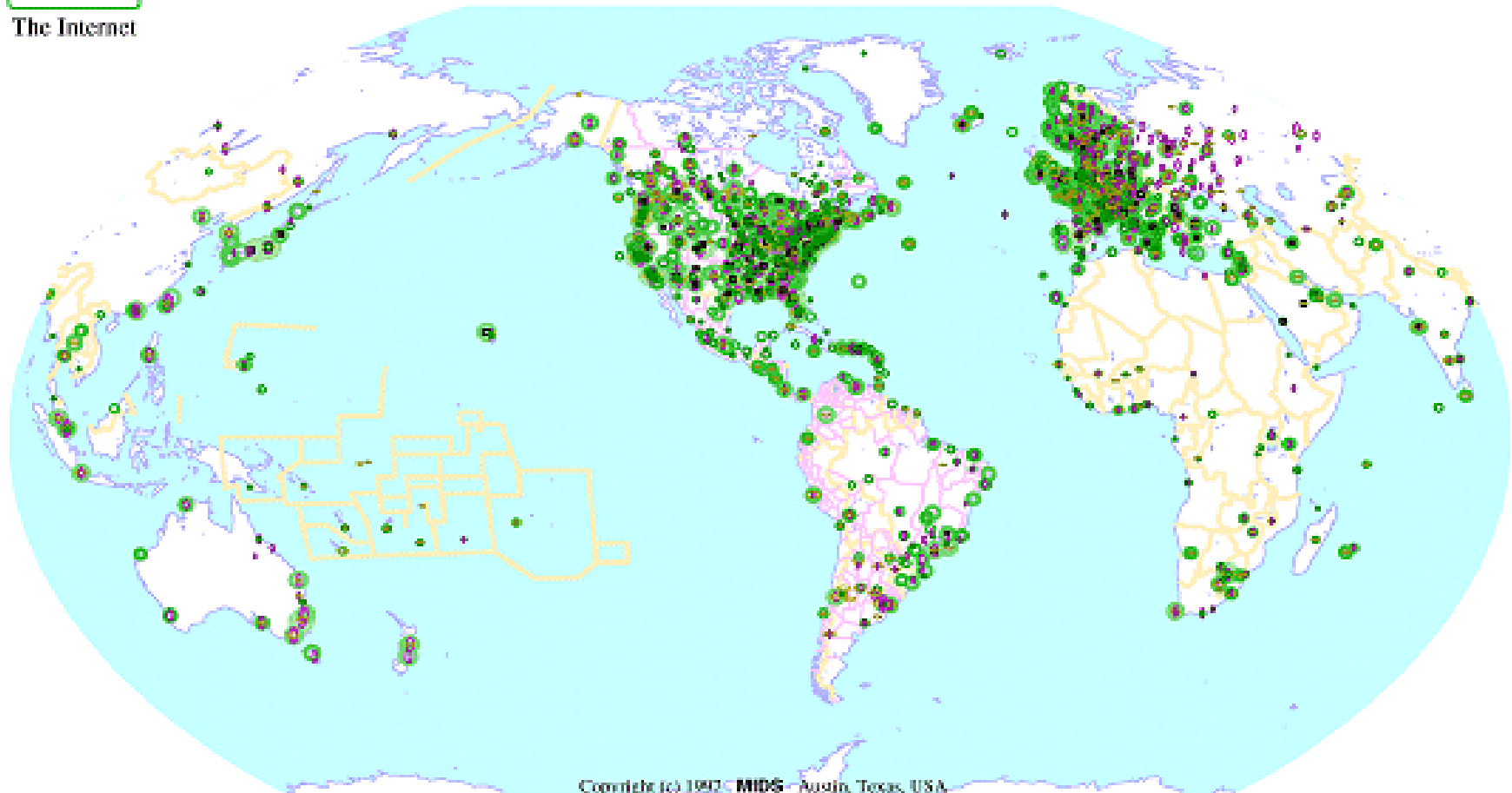
The Matrix Jan 1997



The World



The Internet



+1-512-451-7602 fax +1-512-452-0127

Copyright © 1997, MIDS - Austin, Texas, USA

<http://www.mids.org> mids@mids.org

-Ds 1:500,000,000 Winkler Tripel projection 97.03.27_09:19 (2 40 0)

Critical Development

- 1990 Information Management Proposal
- Tim Berners-Lee at CERN
- Observation: information is not organized into tree-like structure, there is a need to get from leaf to leaf
- Proposals:
 - hypertext
 - web browser
 - gateways

Cyberspace enabled technologies

- groupware
- enterprise resource planning software
- geographic information systems
- data warehousing and mining
- electronic data interchange
- portals
- 3-dimensional solid modeling
- virtual reality

Components of a virtual organization

- web-based procurement
- web-enabled order management
- business-to-business (b2b) storefronts
- collaborative planning
- web-based service and support
- product life cycle collaborations

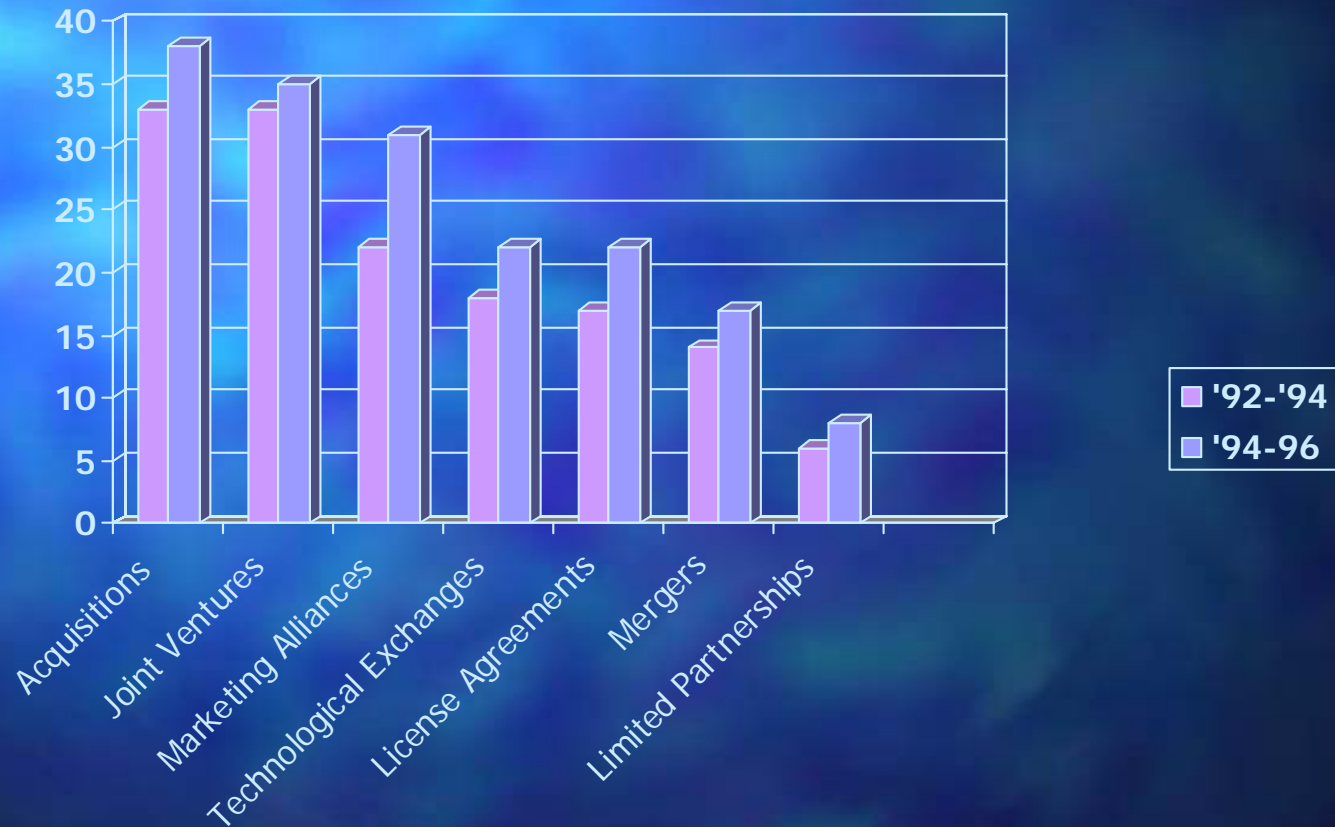
C-Commerce

- Collaborative Commerce
- based on assumptions of mutual gain
- Gartner Group: “fluid interaction of a community of personnel, business partners and customers that is joined together by the Internet, component and integration technologies, resulting in agile but highly integrated virtual multi-company enterprises”

Key pressures:

- Rapidly expanding technologies
- growing global competition
- increased demand for individual and organizational competencies and capabilities
- Higher customer expectations
- ever-decreasing cycle time changing skilled personnel requirements
- increased investor pressure on short term financial performance

Collaborative activity: on the rise



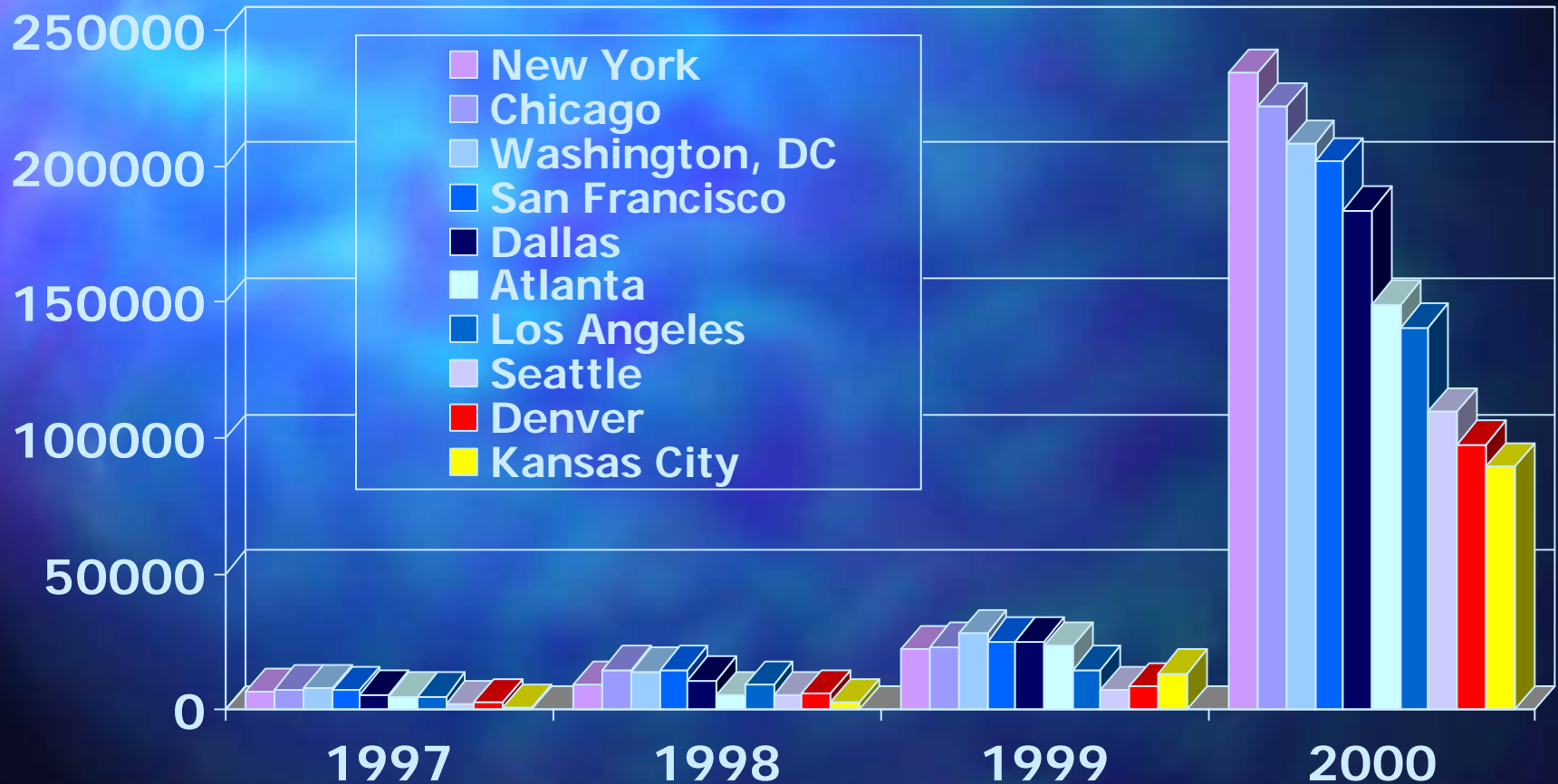
Collaboration, knowledge and community

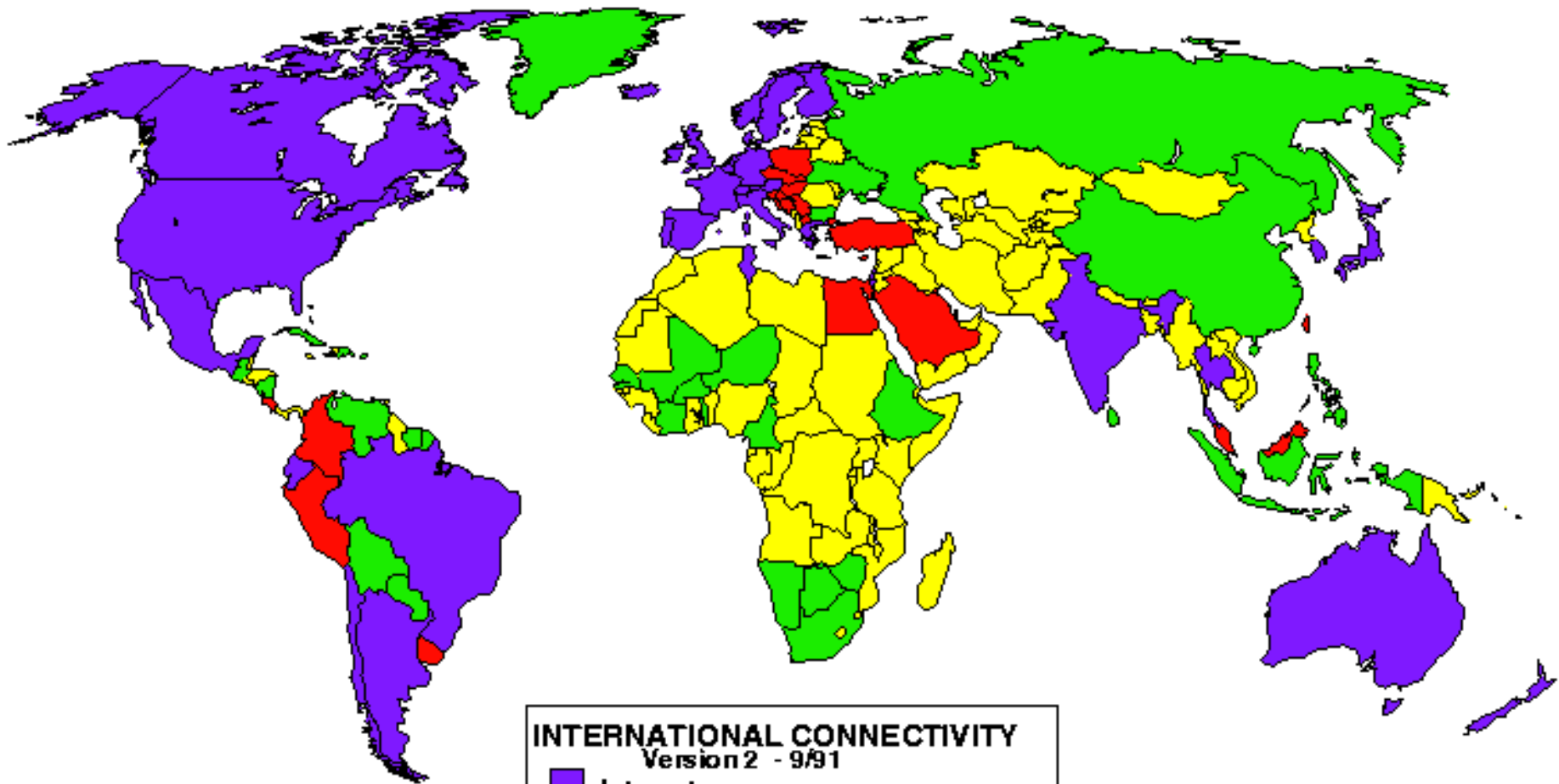
- post-industrial era, knowledge based
- global economy = constellations of firms through alliance formations
- distributed knowledge acquisition
- best practices developed by community
- virtual proximity to the community

Trends in cyberspace

- caching
- content distribution - metadata
- peer to peer
 - gunatella (not exactly true peer to peer)
 - freenet (no central server - true p2p)
- mirror sites
- web traffic - bandwidth
 - doubles each year

Bandwidth on Internet backbones in Mbps



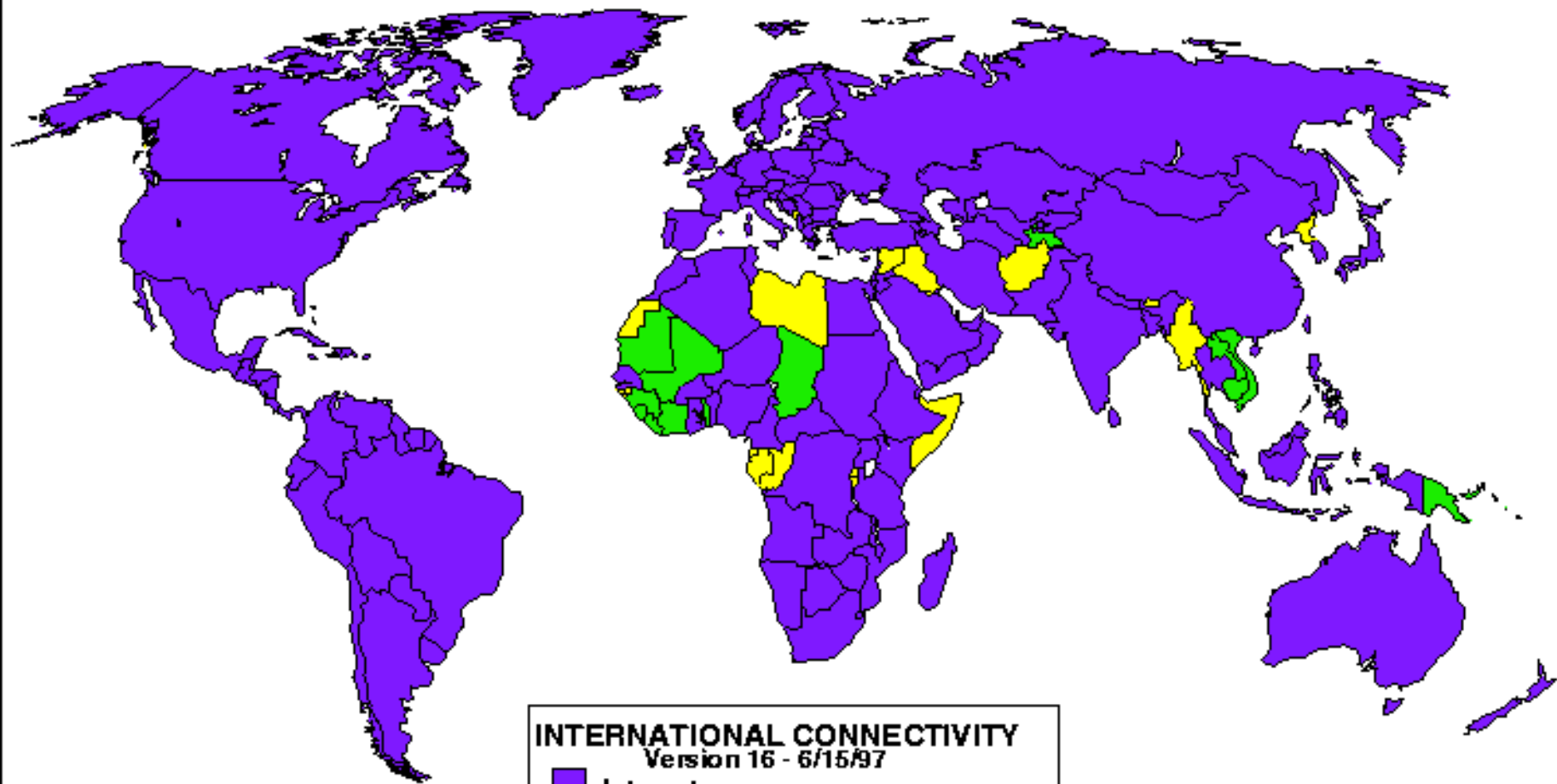


INTERNATIONAL CONNECTIVITY
Version 2 - 9/91

- Internet
- Bitnet but not Internet
- EMail Only (UUCP, FidoNet)
- No Connectivity

Copyright © 1991
Larry Landweber
and the Internet Society.
Unlimited permission to
copy or use is hereby granted
subject to inclusion of
this copyright notice.

This map may be obtained via anonymous ftp
from ftp.cs.wisc.edu, connectivity, table directory

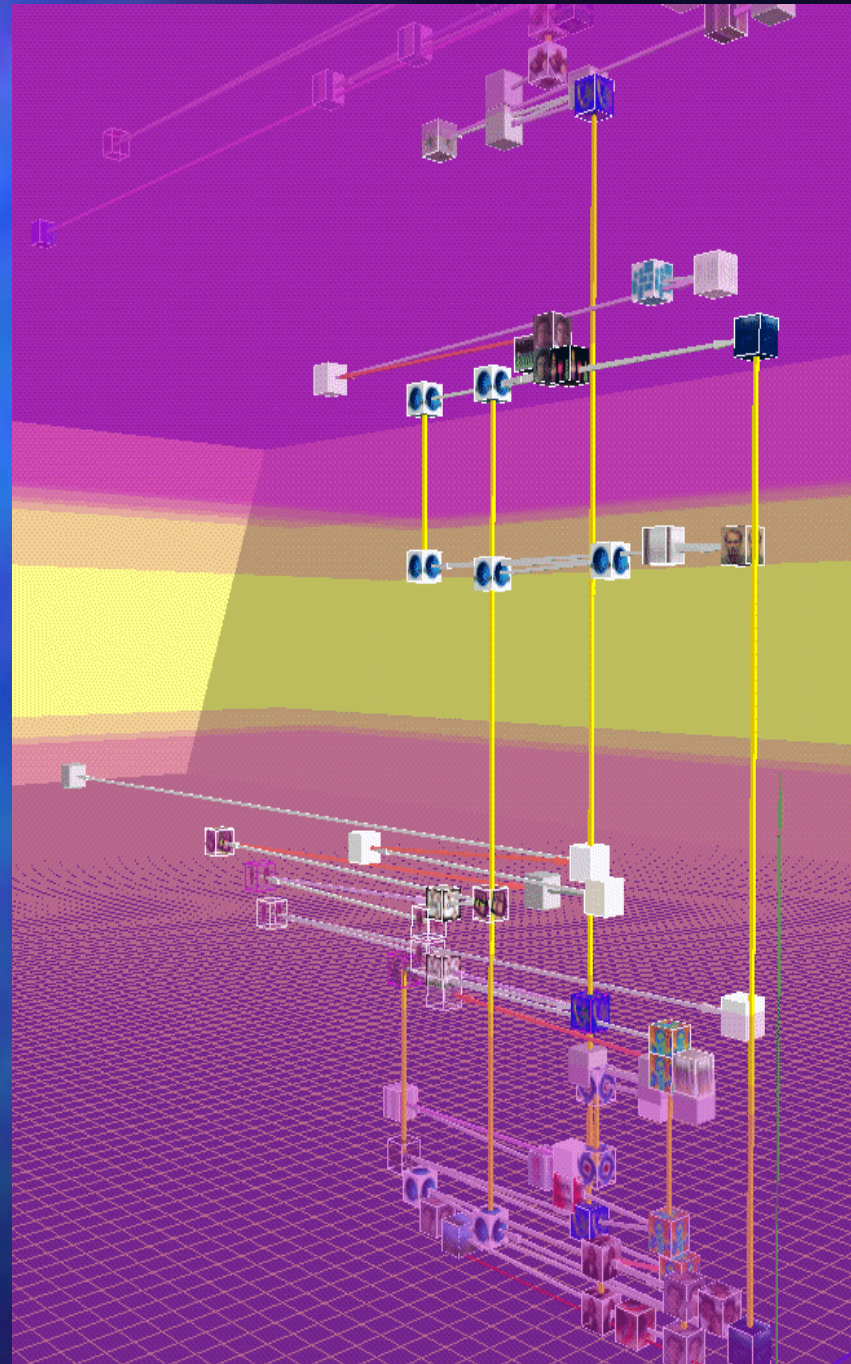
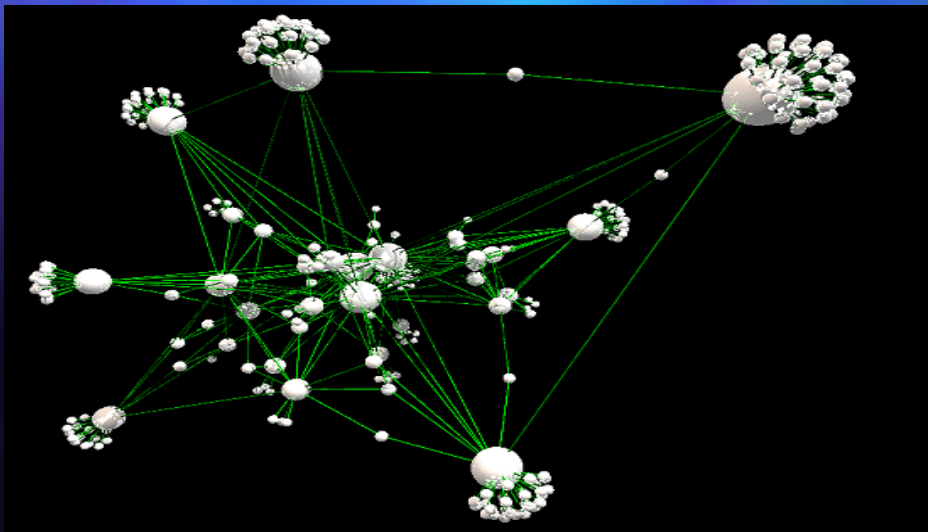
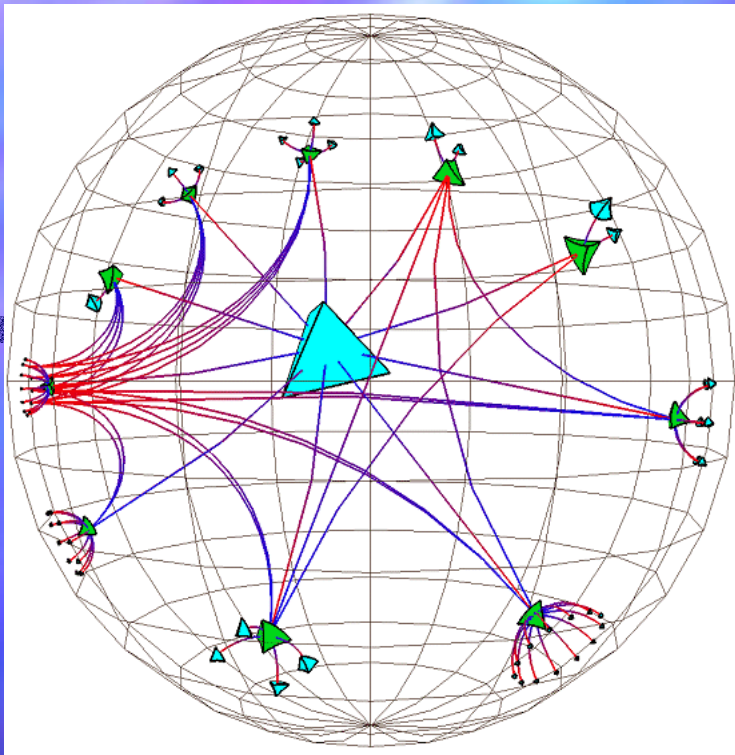


INTERNATIONAL CONNECTIVITY
Version 16 - 6/15/97

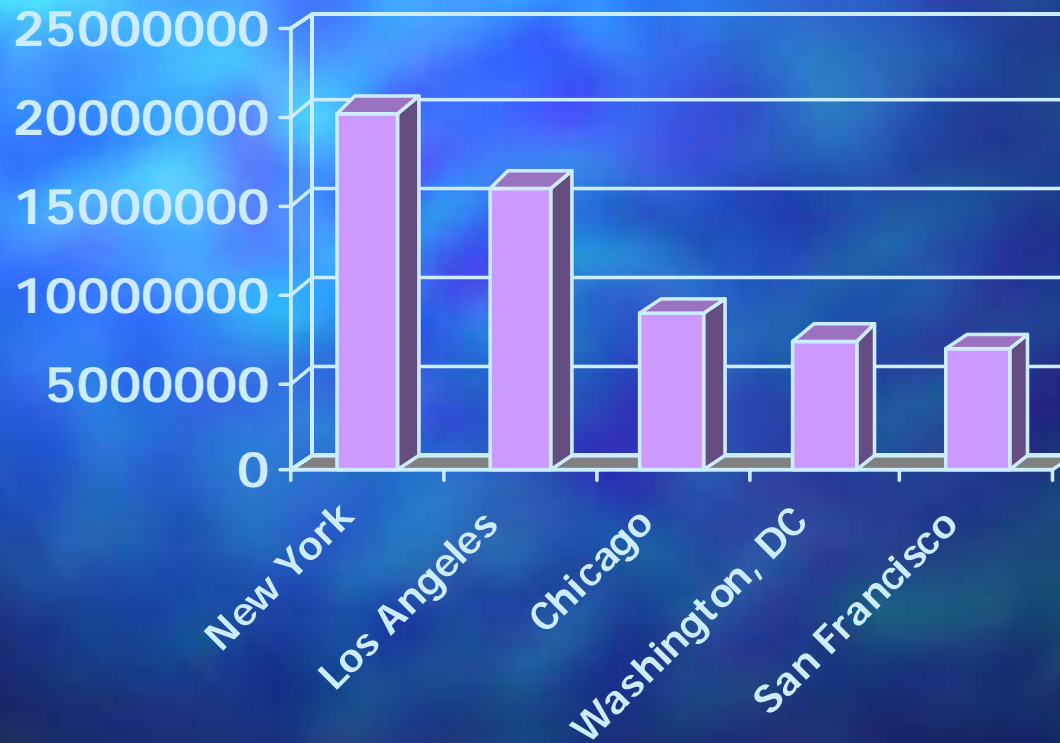
- Internet
- Bitnet but not Internet
- EMail Only (UUCP, FidoNet)
- No Connectivity

Copyright © 1997
Larry Landweber
and the Internet Society.
Unlimited permission to
copy or use is hereby granted
subject to inclusion of
this copyright notice.

This map may be obtained via anonymous ftp
from ftp.cs.wisc.edu, connectivity_table directory

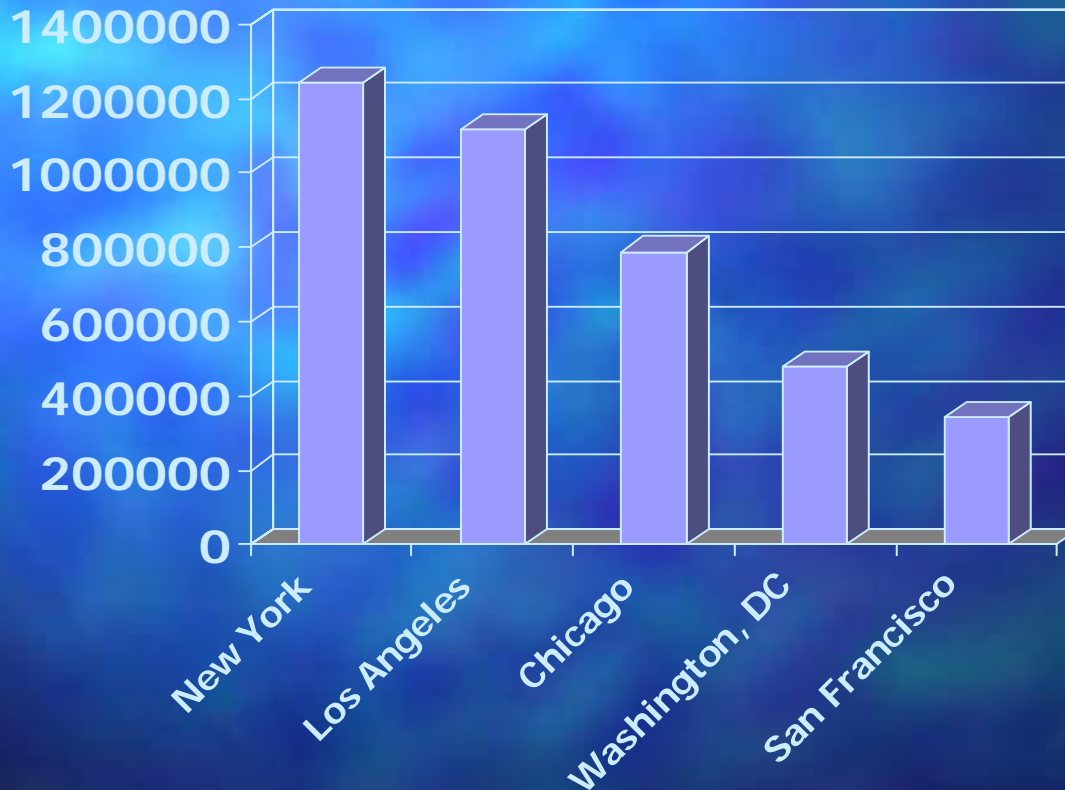


CMSA Population

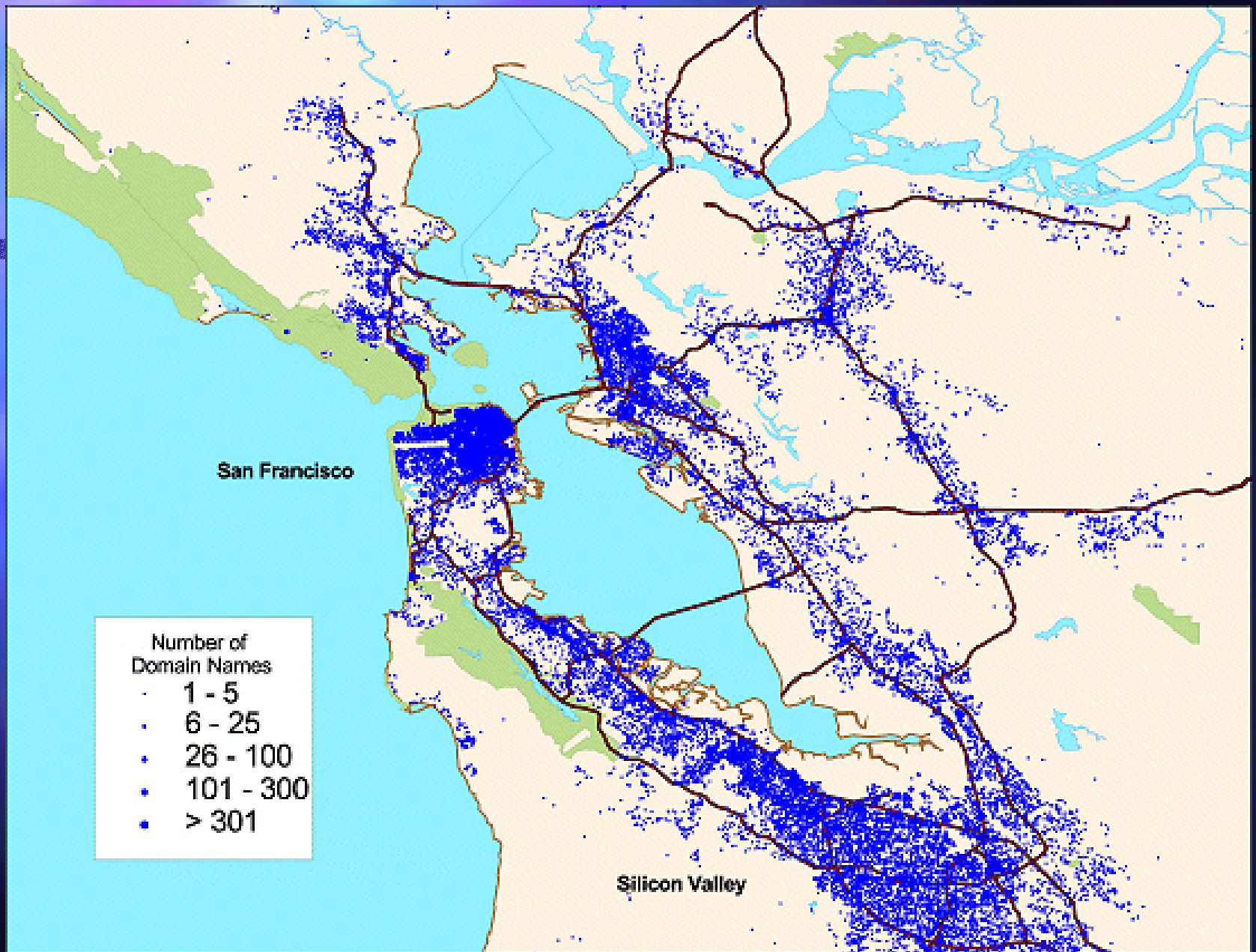


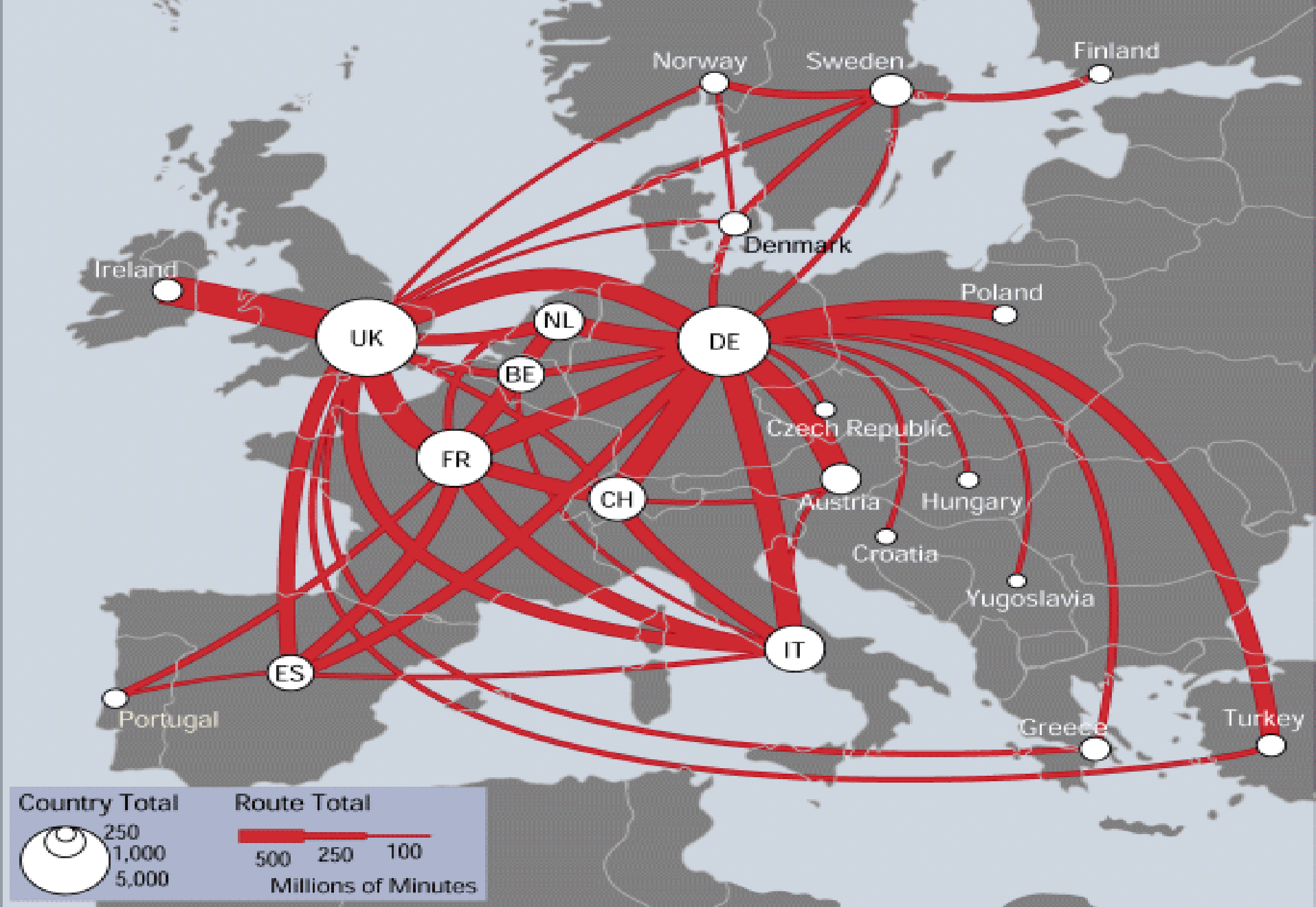
Source: Sean P. Gorman: *Where are the Web factories: The urban basis of e-business location*, 2001

Domains



Source: Sean P. Gorman: *Where are the Web factories: The urban basis of e-business location*, 2001



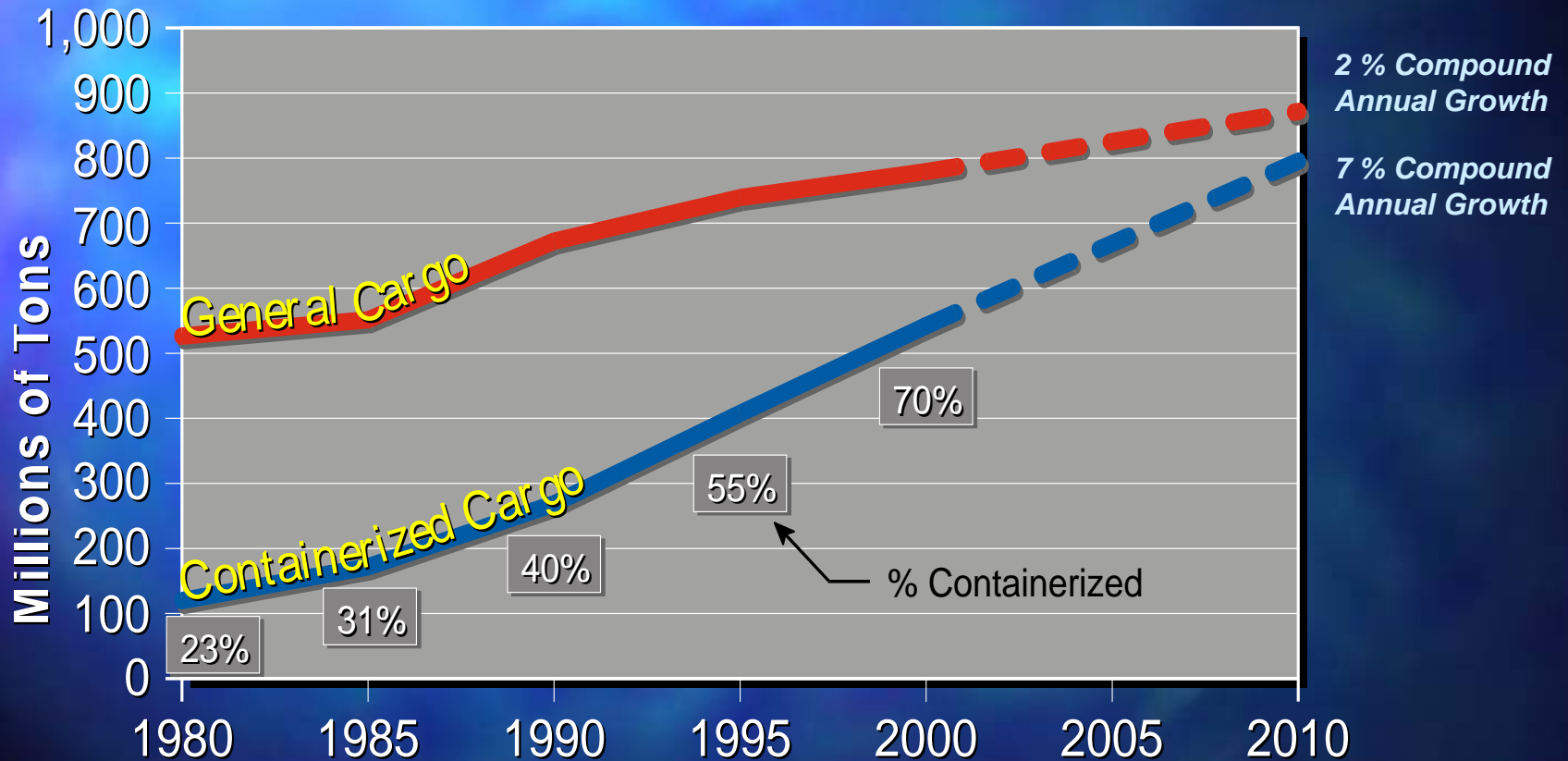


Transportation trends

- increased vehicle miles of travel
- increased ratio of trucks in traffic mix
- increase in ratio of 2-axle, 4-tire trucks
- increased port activity
- increase in air freight
- increase in passenger air travel
- increased person hours of delay

International General Cargo at PONY & NJ

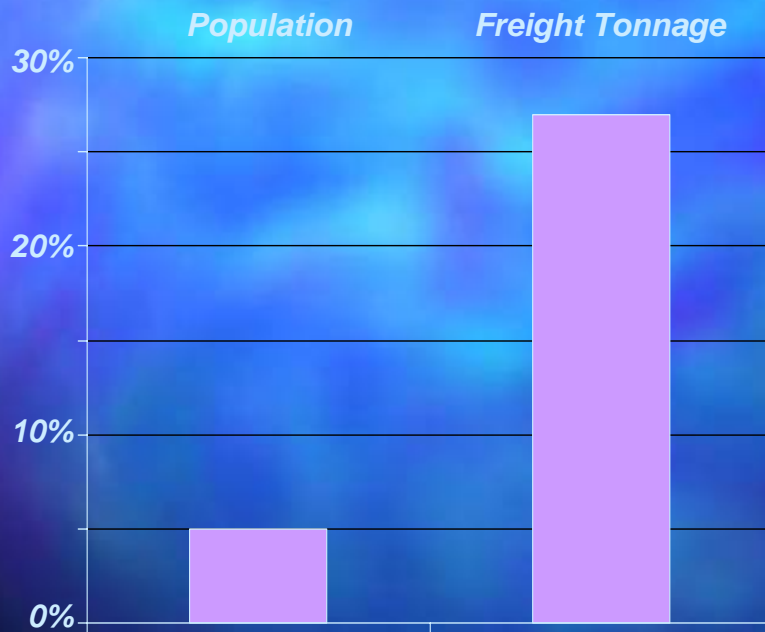
Strong growth overall, increasing share by container



Source: Maritime Reporter, November 1995

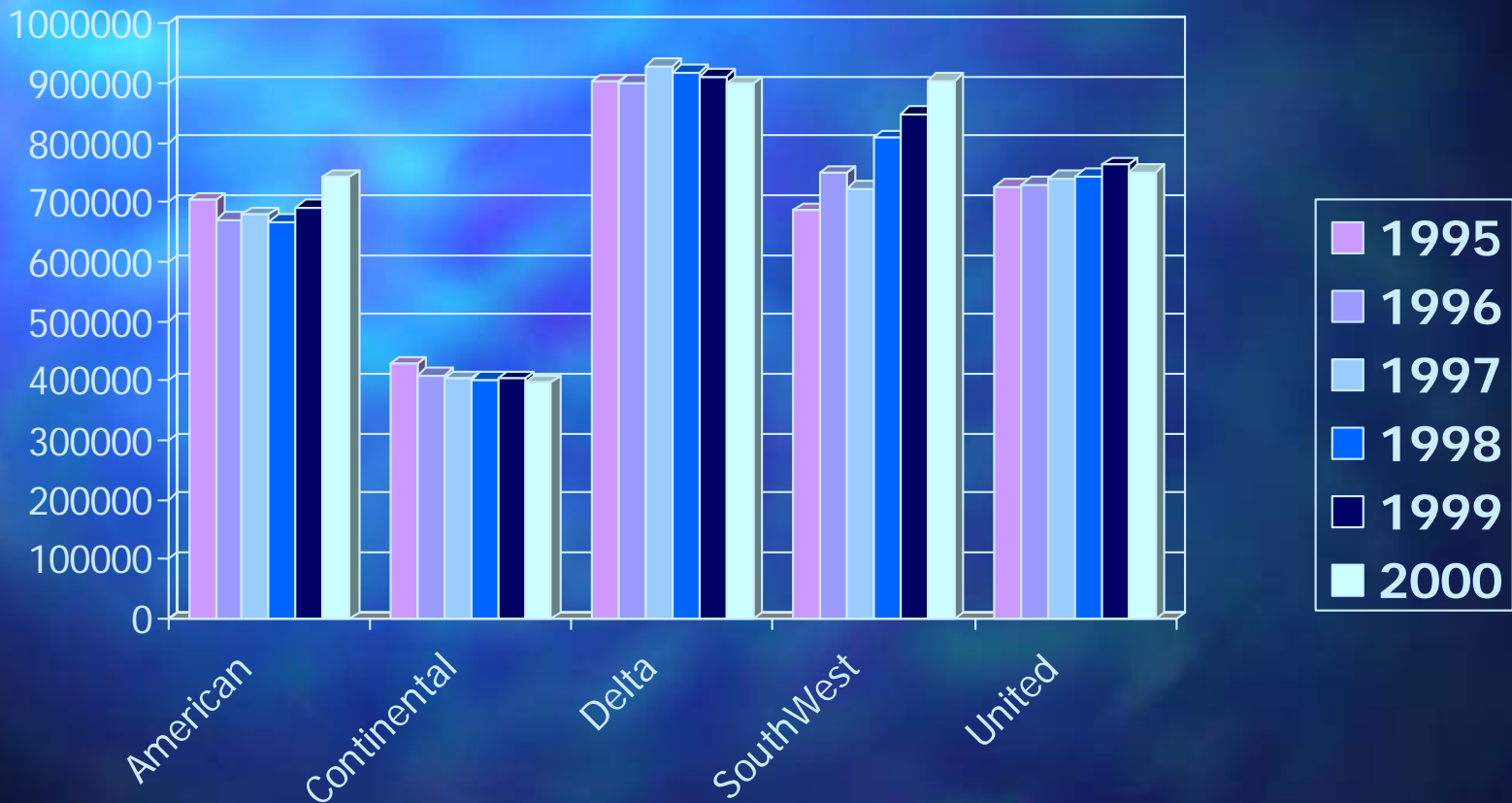
The Future of the Highway Network?

NY Metropolitan Region: 15,000 additional trucks a day in 1998



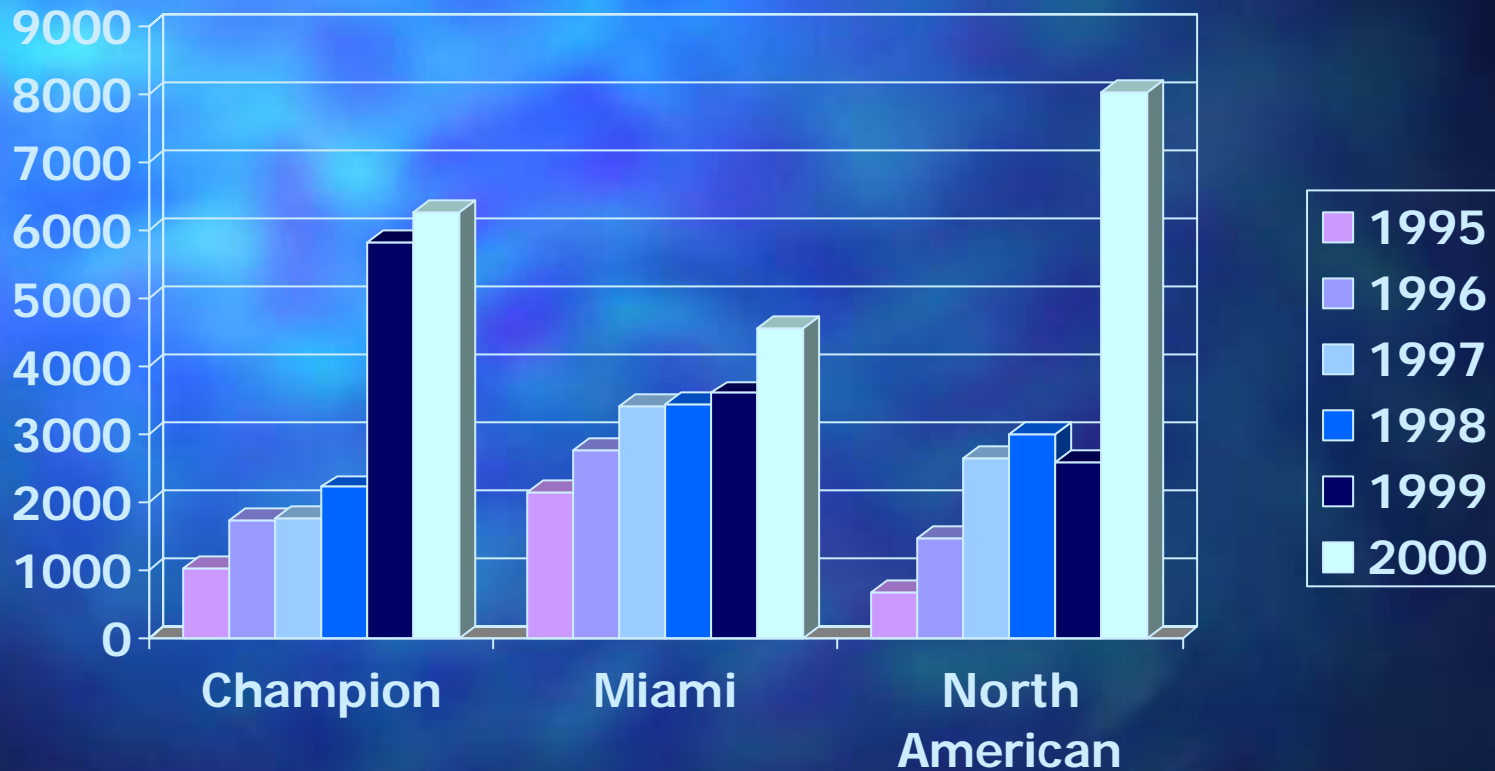
New York Metropolitan Regional Freight Tonnage, 1995-2020: 27% Growth, Most by Truck

Popular Passenger Lines Total Annual Departures

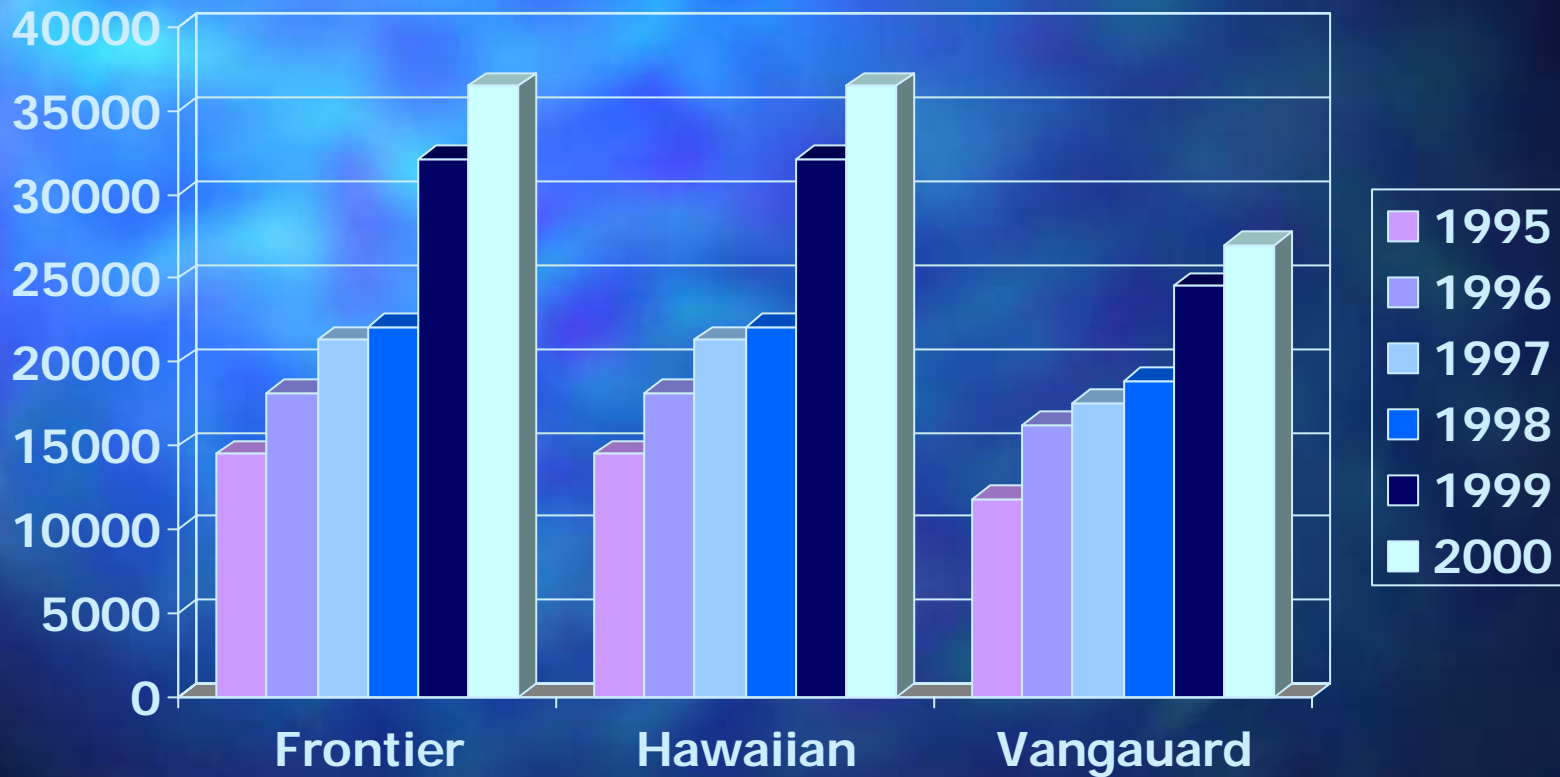


Charter Air Lines

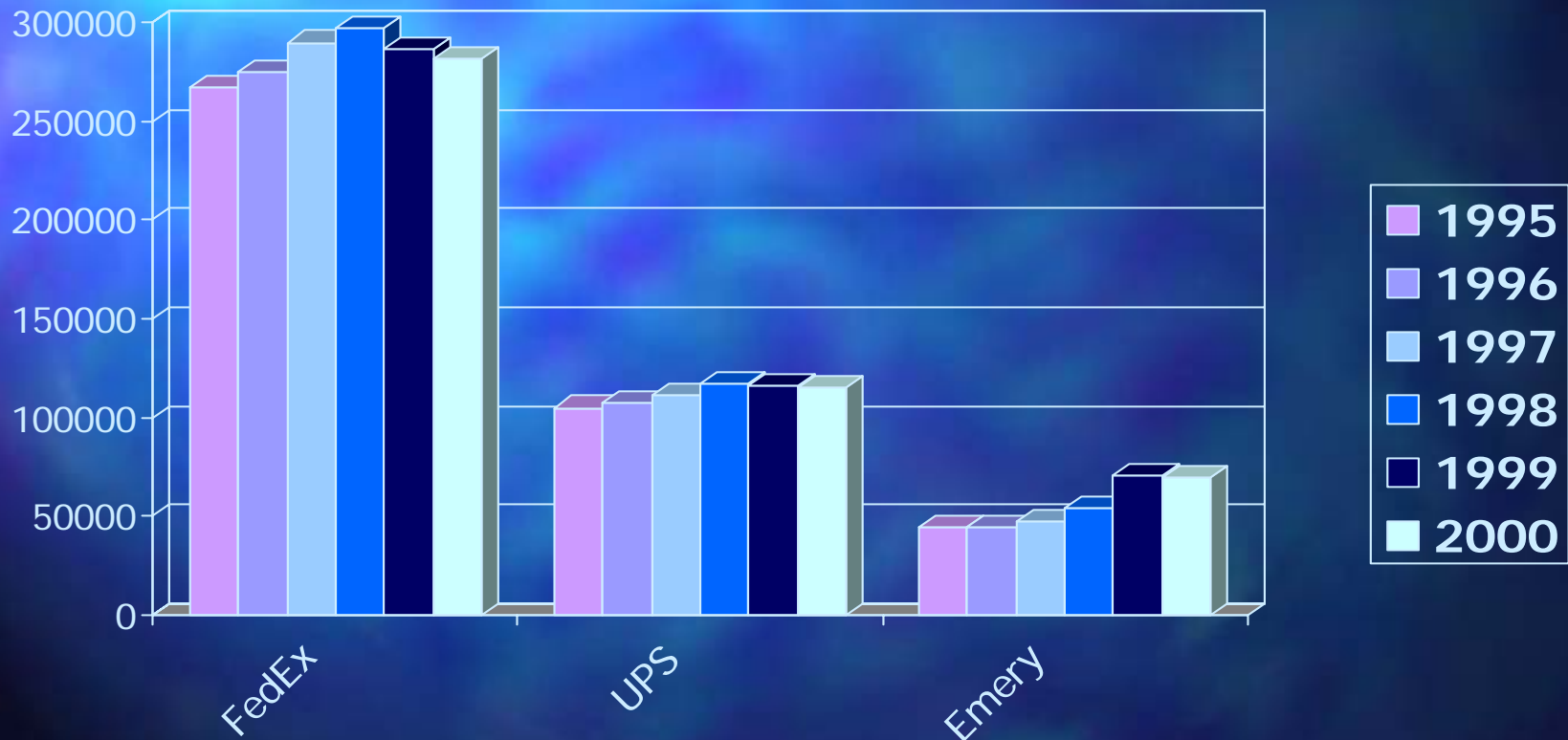
Total Annual Departures



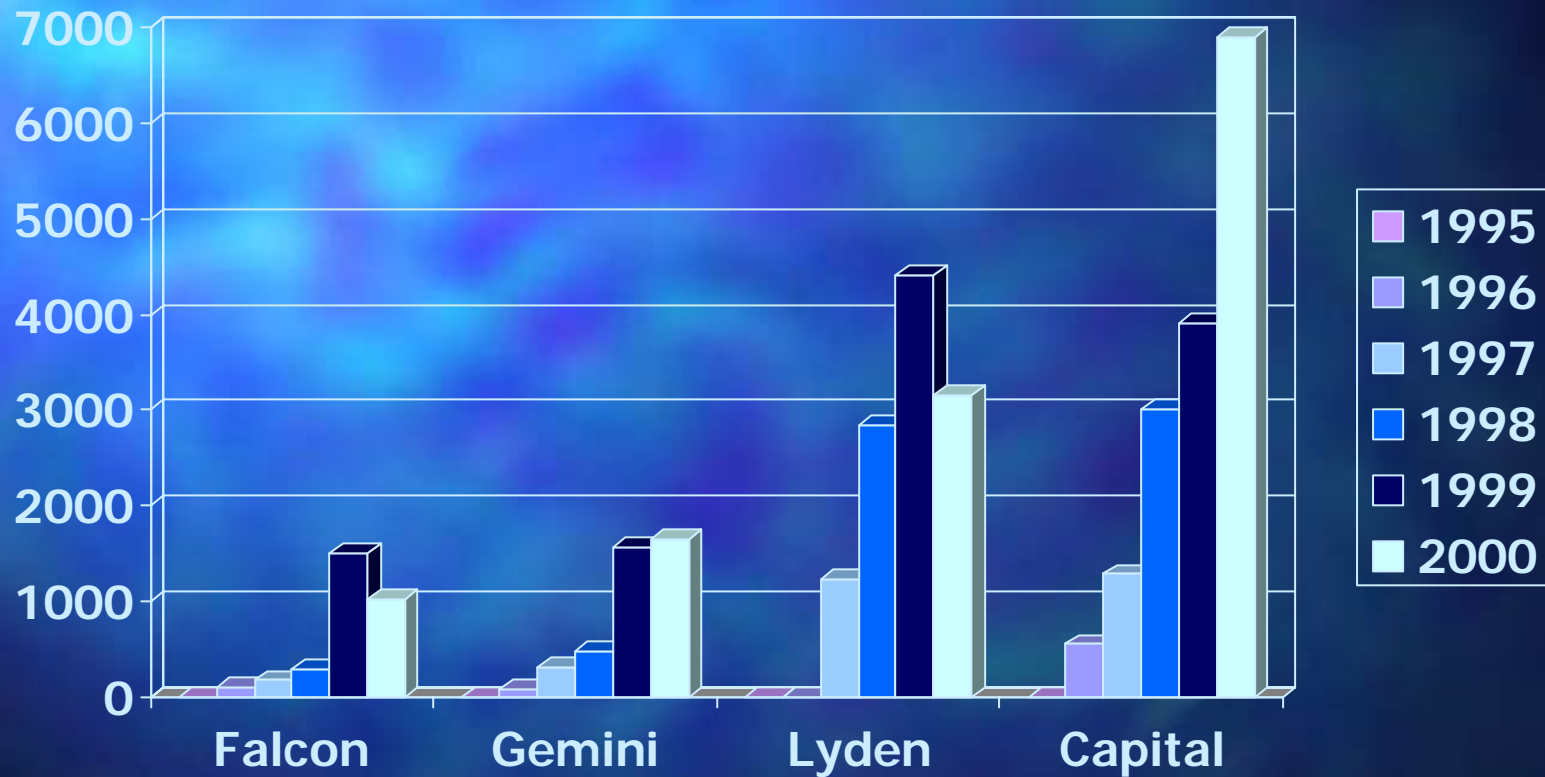
Passenger & Cargo Services Total Annual Departures



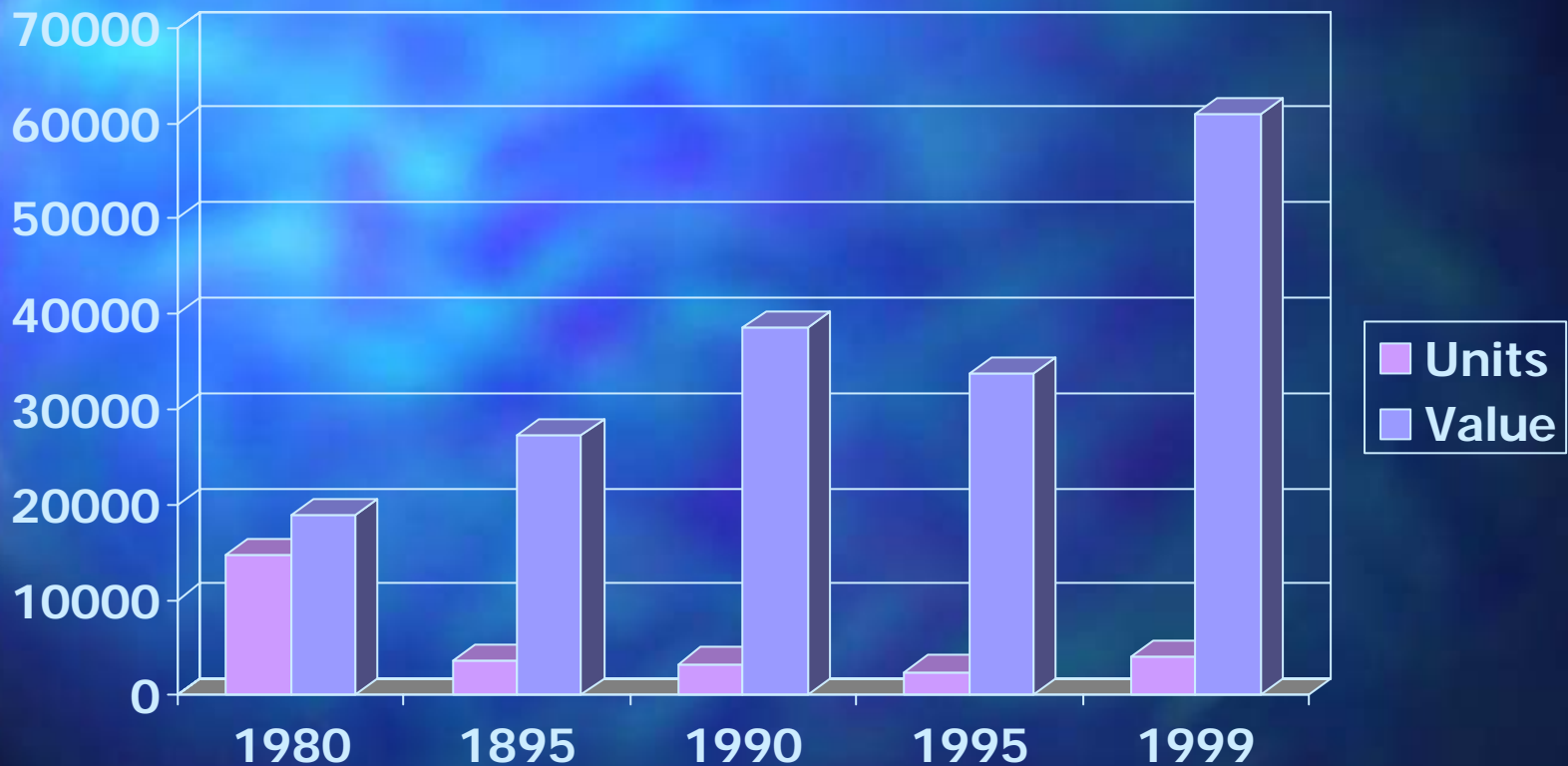
Freight Air Lines Total Annual Departures



New Freight Air Lines Total Annual Departures

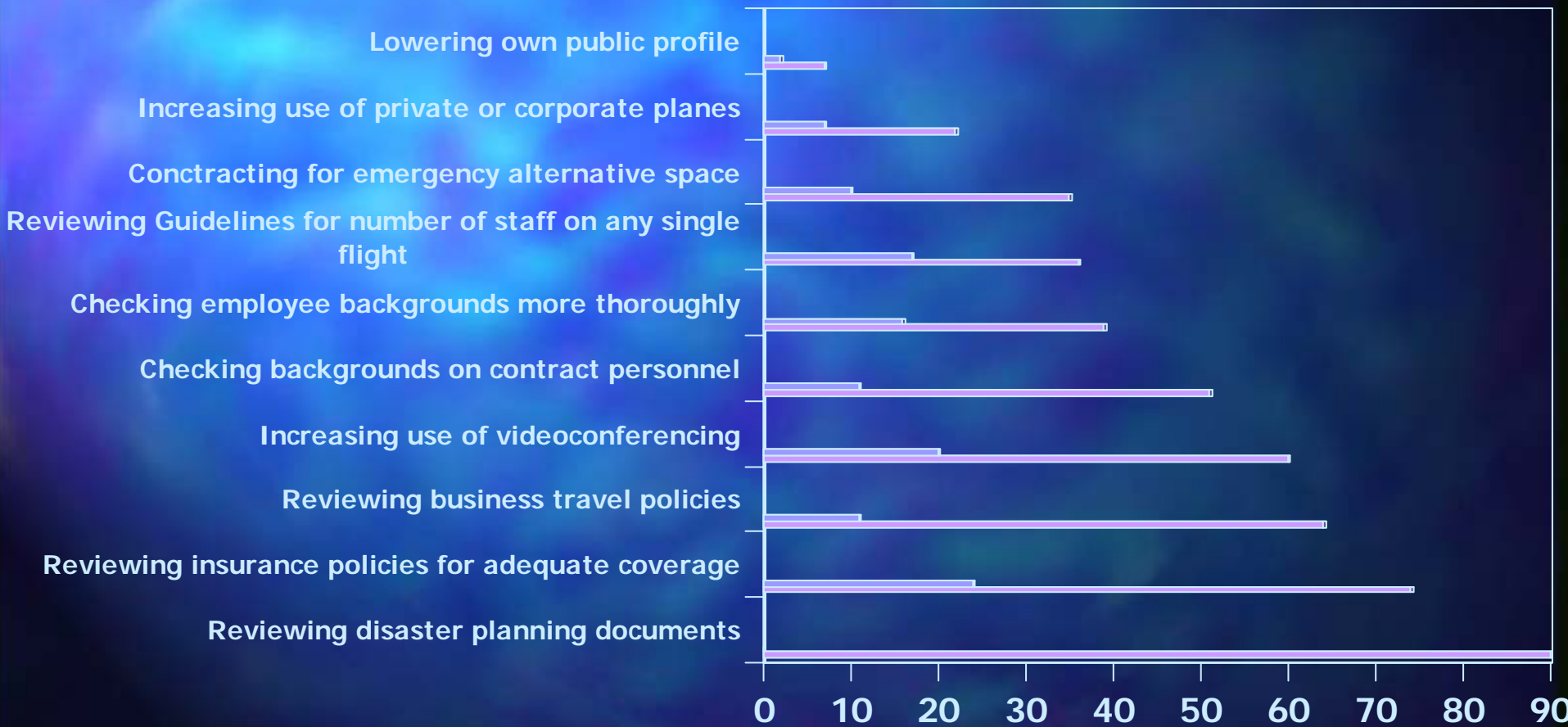


Aircraft Shipments '80 - '99

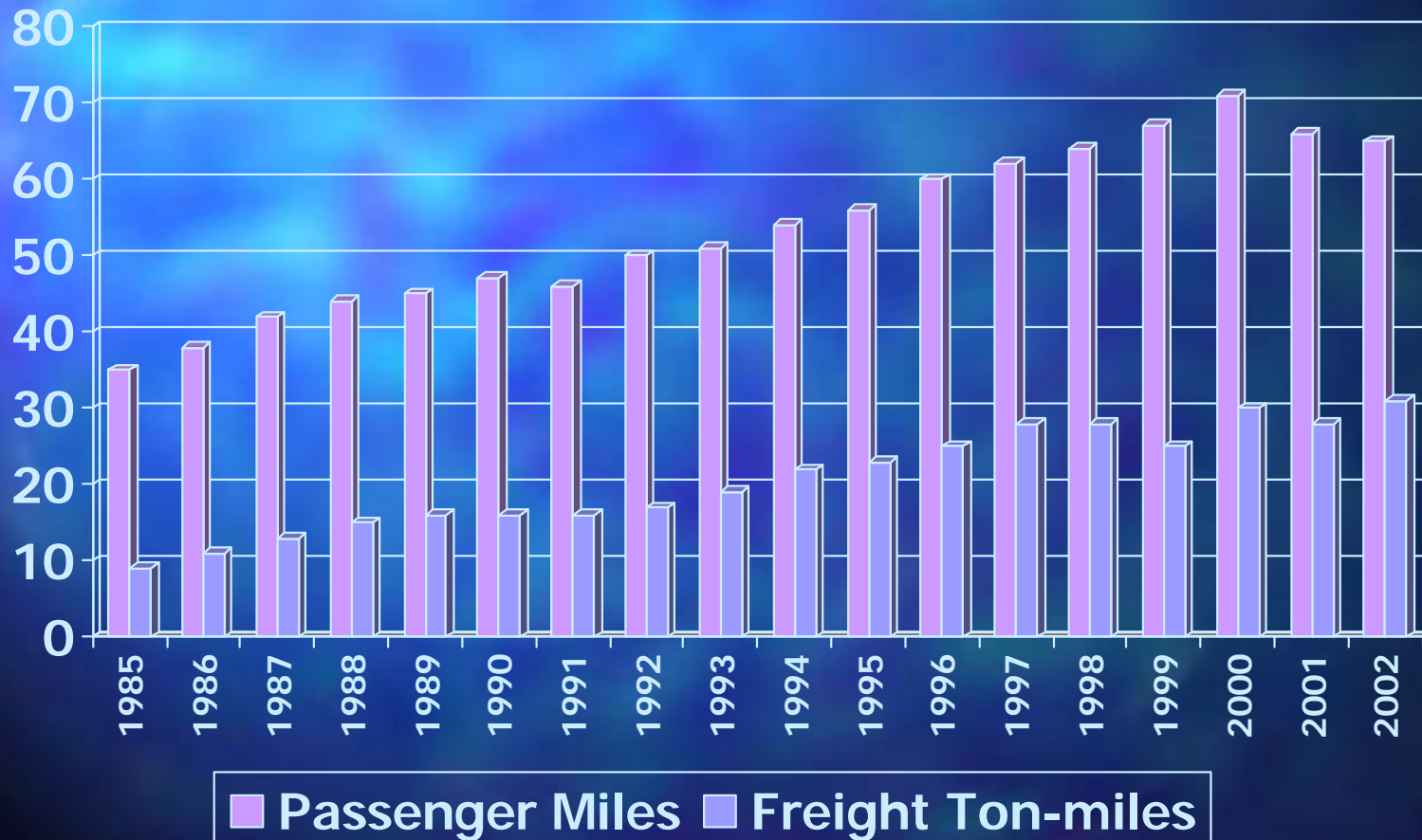


Source: Statistical Abstract of the United States, 2000

Changes Since September 11

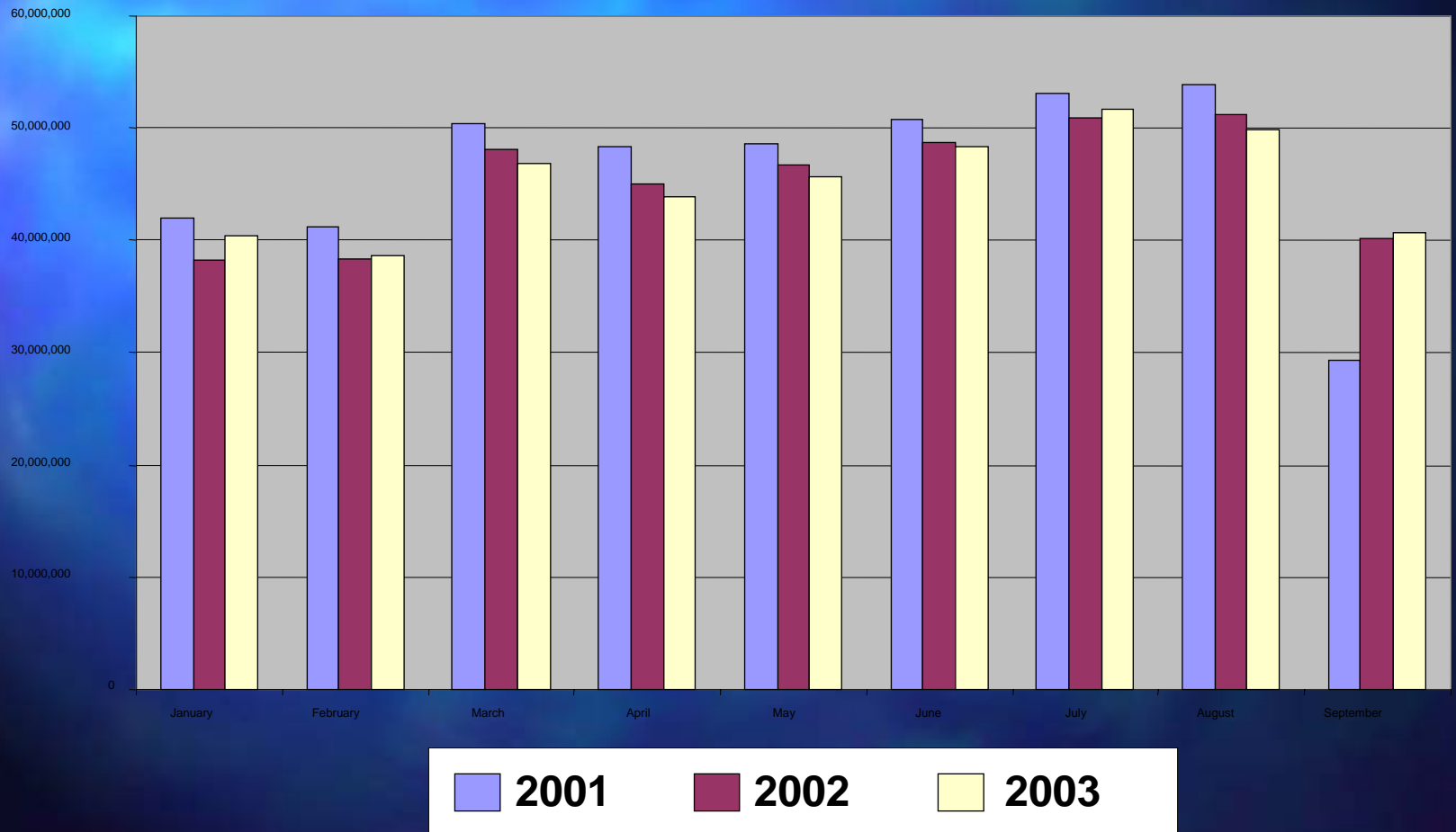


Passenger & Freight Revenue Miles (billions) by Air



Source: BTS

Domestic Enplanements for Continuously Reporting Carriers



Observed and Predicted Air Traffic Volumes into USA

ORIGIN	2001	% Change 01/00	2002	% Change 02/01	2003p	% Change 03/02	2004p	% Change 04/03	2005p	% Change 05/04	2006p	% Change 06/05	2007p	% Change 07/06	% Change 07/01	% Change 07/02
Canada	13,507	-8%	12,968	-4%	12,773	-2%	13,361	5%	13,882	4%	14,382	4%	14,857	3%	10%	15%
Mexico	9,558	-7%	9,807	3%	9,670	-1%	9,979	3%	10,418	4%	10,793	4%	11,117	3%	16%	13%
Overseas	21,833	-16%	19,117	-12%	17,698	-7%	18,818	6%	20,125	7%	21,486	7%	22,781	6%	4%	19%
Europe	9,496	-18%	8,603	-9%	8,548	-1%	9,100	6%	9,771	7%	10,391	6%	10,970	6%	16%	28%
Asia	6,316	-16%	5,689	-10%	4,845	-15%	5,187	7%	5,519	6%	5,955	8%	6,370	7%	1%	12%
South America	2,531	-14%	1,815	-28%	1,486	-18%	1,566	5%	1,706	9%	1,846	8%	1,983	7%	-22%	9%
Caribbean	1,202	-10%	1,053	-12%	977	-7%	1,030	5%	1,074	4%	1,118	4%	1,160	4%	-3%	10%
Central America	771	-6%	704	-9%	655	-7%	685	5%	722	5%	764	6%	807	6%	5%	15%
Oceania	586	-20%	529	-10%	516	-2%	545	6%	579	6%	608	5%	631	4%	8%	19%
Middle East	644	-8%	483	-25%	437	-9%	460	5%	490	7%	525	7%	564	7%	-13%	17%
Africa	287	-3%	241	-16%	233	-3%	247	6%	263	6%	279	6%	296	6%	3%	23%
Grand Total	44,898	-12%	41,892	-7%	40,142	-4%	42,158	5%	44,425	5%	46,661	5%	48,754	4%	9%	16%

Source: BTS

Conclusions

- cyberspace does reflect physical space
- community is key in the new economy
- movement of people and goods will remain challenging
- demand on transportation will increase more in urban areas that have the best communications infrastructure