

*THE PURPOSE IS NOW TO BE
CONNECTED TO THE WORLD*

*WAS NOT THE INITIAL INTENT
OR EVEN THE DREAM*



FORMATION OF THE INTERNET AND WEB

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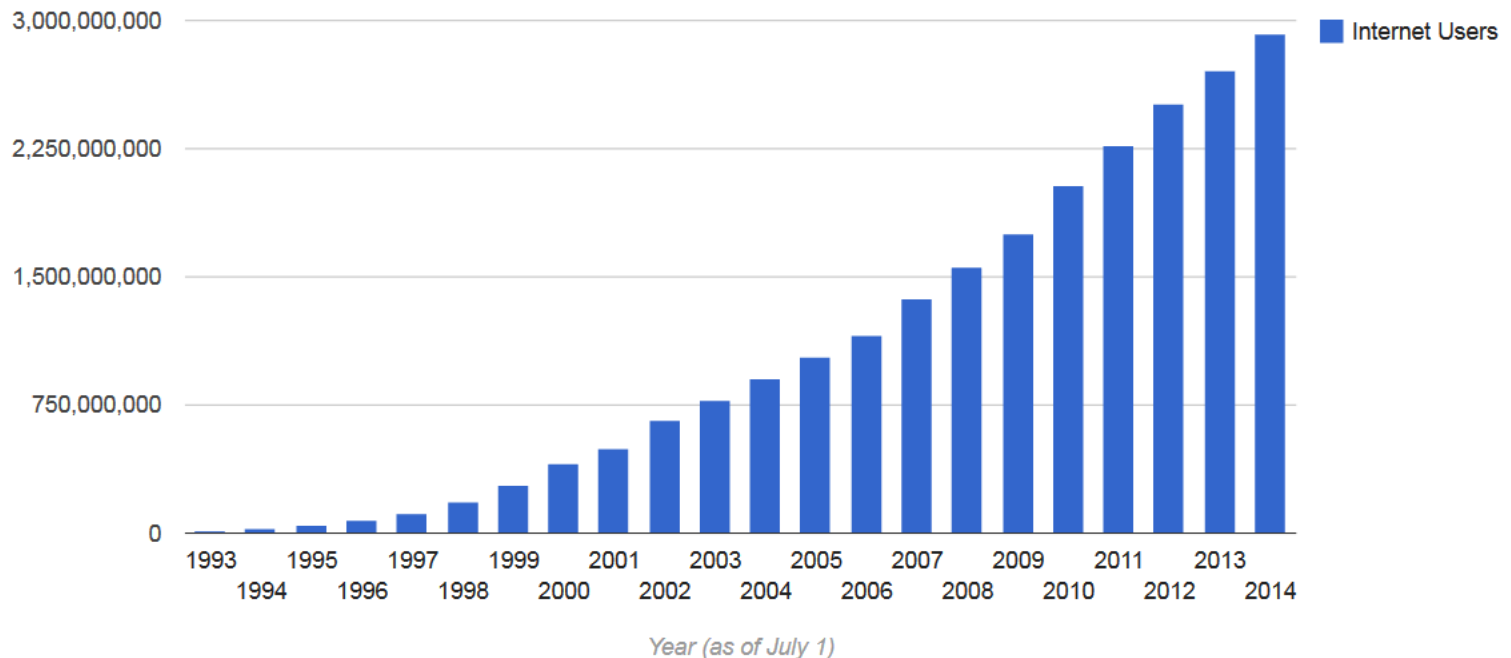
- **First Came the Technology (60s) :**
Development and mastery of digital computing and communications technology
- **Then Came the Society (Clinton/Gore 1997)**
: Intellectual property, individual privacy, and public policy
- **Then Business Jumped In:** New technologies present businesses and entrepreneurs with different ways of organizing production and transacting business

The Evolution of the Internet 1961—The Present

- Innovation Phase, 1964 – 1974
 - Creation of fundamental building blocks
- Institutionalization Phase, 1975 – 1995
 - Large institutions provide funding and legitimization
- Commercialization Phase, 1995 – present
 - Private corporations take over, expand Internet backbone and local service

World Internet Users

The first billion 2005, **Second 2010**, **Third 2014**



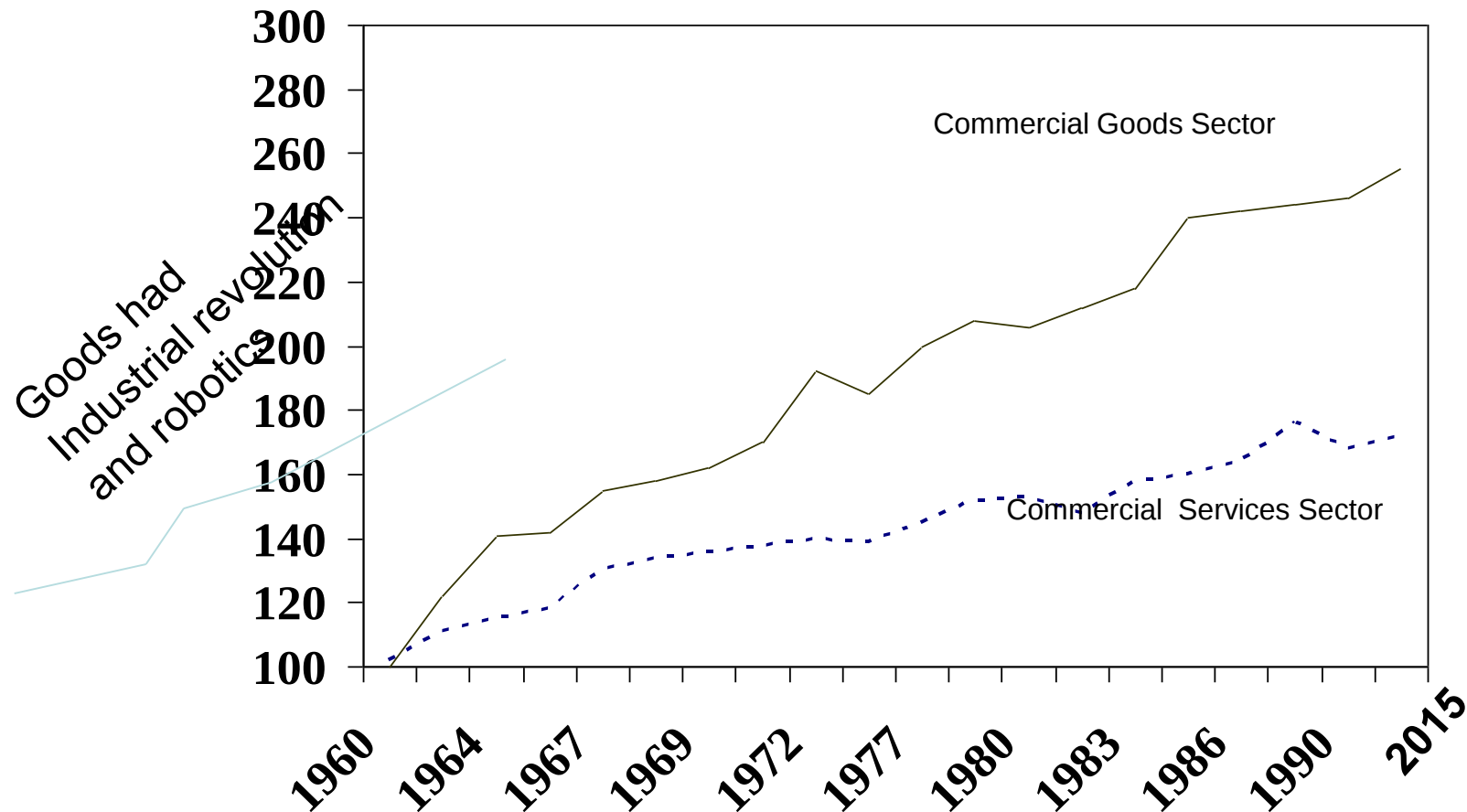
<http://www.internetlivestats.com/internet-users/#trend>

Productivity in Goods and Services 1960 - 94

Will the internet increase service productivity ?

(Annual Index of output per Person – Hour, 1960=100)

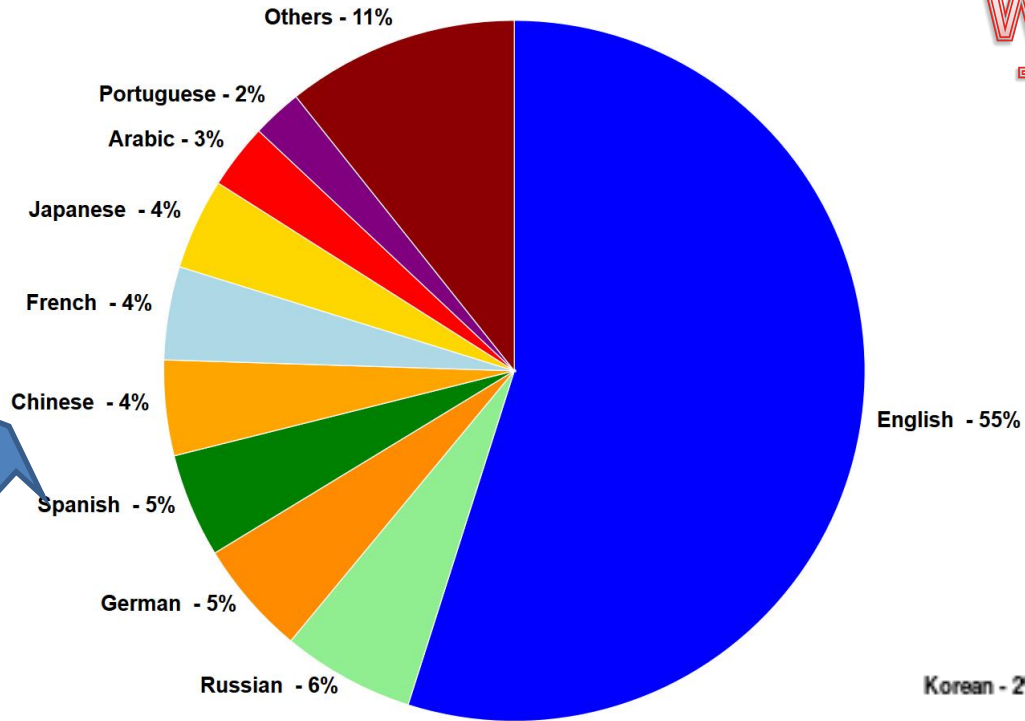
Ratio Scale



ECommerce Transaction types

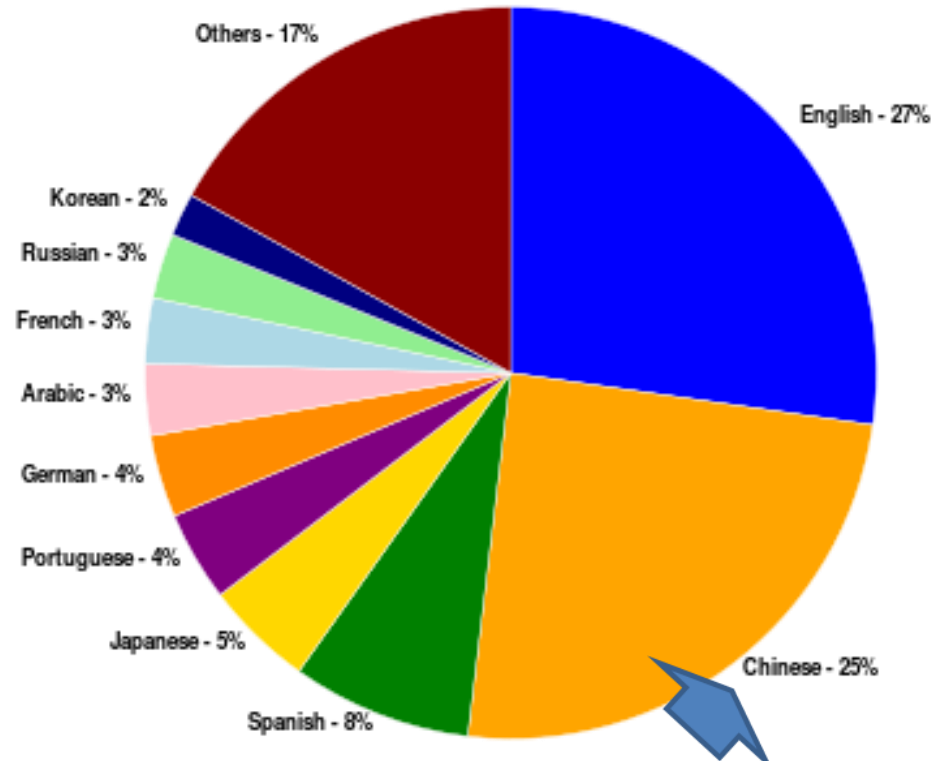
- business -to- business
- business -to- customer
- business - to - government
- Individual - to- government
- Customer -to- business
- Customer -to- customer
- Peer -to- peer

Content Languages for Websites



Websites and languages
The current English importance

Internet Users by Region



SO IT ALL STARTED AS ATTEMPT TO CONNECT COMPUTERS (GOVERNMENT, MILITARY AND UNIVERSITIES)

- Internet's beginnings traced to memos written in 1962 MIT's **Joseph Carl Robnett Licklider** outlining the galactic networking concept

Great advances made in network technology 1960s

- **Local Area Networks. A LAN**
Within organizations called : **INTRANET**

then connected to WANs

An **EXTRANET** extends intranets so that they can be accessed by partners

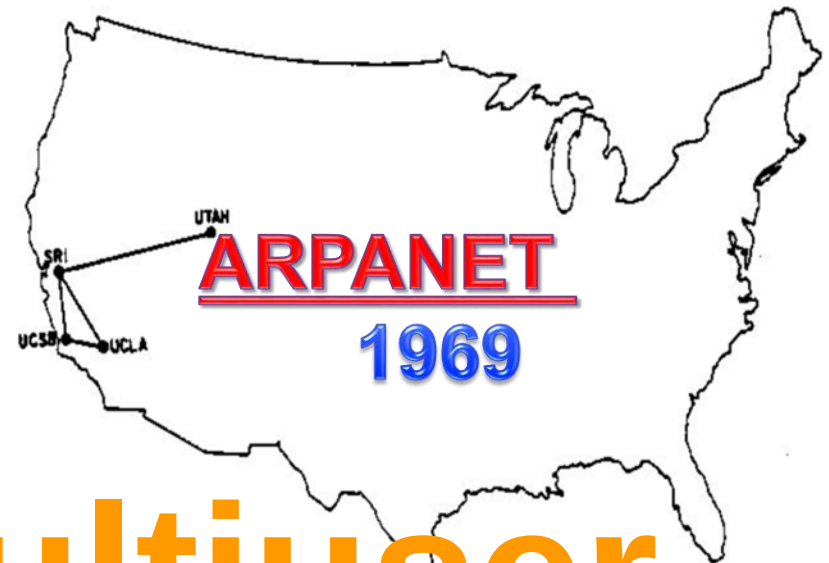




GOVERNMENT INTEREST

WHY CARE? WHY INVENT WEB ?

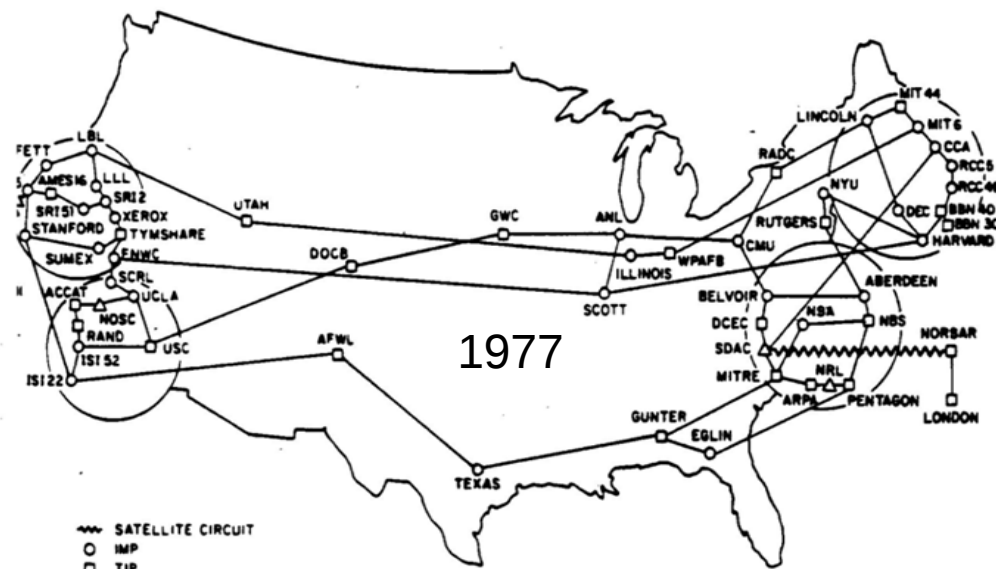
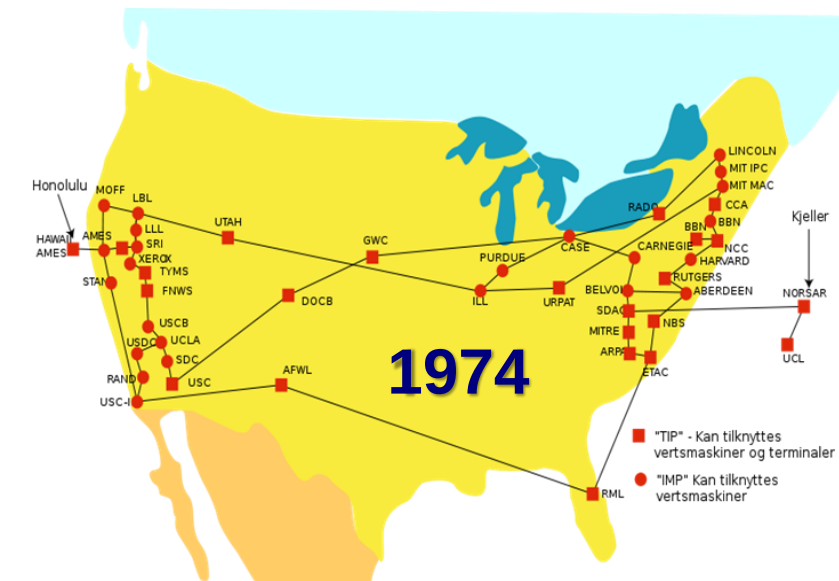
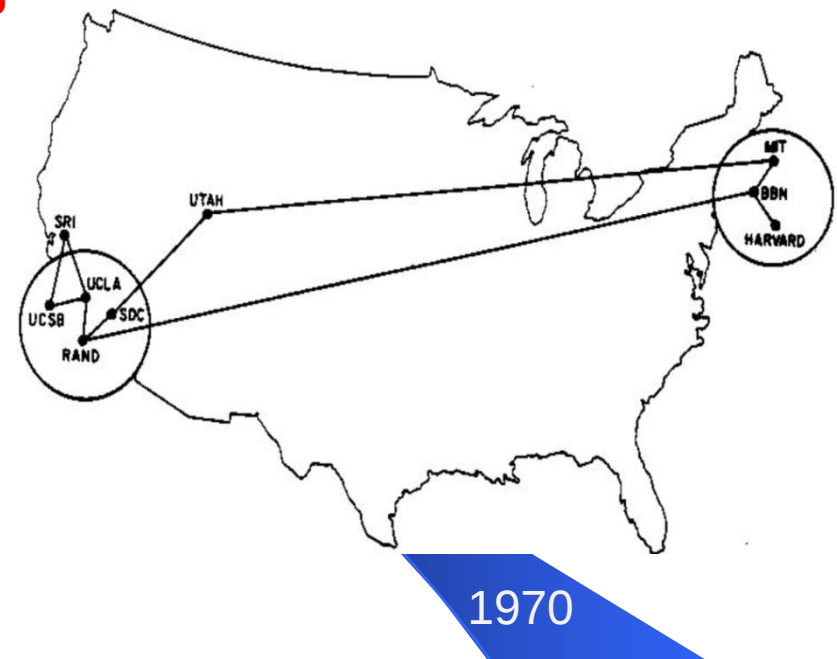
ARPA (Advanced Research Projects Agency)



TO DEVELOP **multiuser**
Wide Area Network (WAN)

First real network to run on packet switching technology

Stanford and UCLA connected first hosts on what would become the Internet.



LET'S MEET "INVENTORS"

THE WEB PROGRESSES

- 1989–1991: Web “invented” - Tim Berners-Lee at CERN
- 1993: Marc Andreessen /Others at NCSA create Mosaic, Web browser with GUI that runs on Windows, Macintosh, or Unix
- 1994: Andreessen, Jim Clark found Netscape; create first commercial Web browser, Netscape Navigator
- August 1995: Microsoft introduces Internet Explorer, its version of Web browser

Lets take a look at some of the early players

Clinton – Gore, 1997

The Initial U.S. Policy For Internet Development

- 1. Private sector should lead**
- 2. Governments should avoid undue restrictions on EC**
- 3. Where government involvement is needed, its aim should be to support and enforce a predictable minimalist, consistent and simple legal environment for commerce (intel protection, fraud etc.)**
- 4. Governments should recognize the unique qualities of the Internet**
- 5. Electronic commerce on the Internet should be facilitated on a global basis**



THAT'S A LOT TO THINK ABOUT

AND NOW YOU KNOW
HOW IT ALL STARTED

THANKS

THE INTERNET

DIGITAL INFRASTRUCTURE

The background of the slide is a photograph of the Pyramid of Kukulcan at Chichen Itza. The pyramid is a large, stepped stone structure with a central staircase leading to a small temple at the top. It is set against a blue sky with scattered white clouds. The foreground shows a grassy field and some trees in the distance.

If you were to design a system that
allows computers to interrelate

What is necessary?

Infrastructure?

Communications?

GROUP ASSIGNMENT

I would like you to design a system that will give you the SAME product/result that you would have with the current internet. What would be all the components of your SYSTEM to make the system work?

Draw out your “internet” system and list the software WWW parts

INTERNET

A NETWORK OF NETWORKS

- **ISPs**

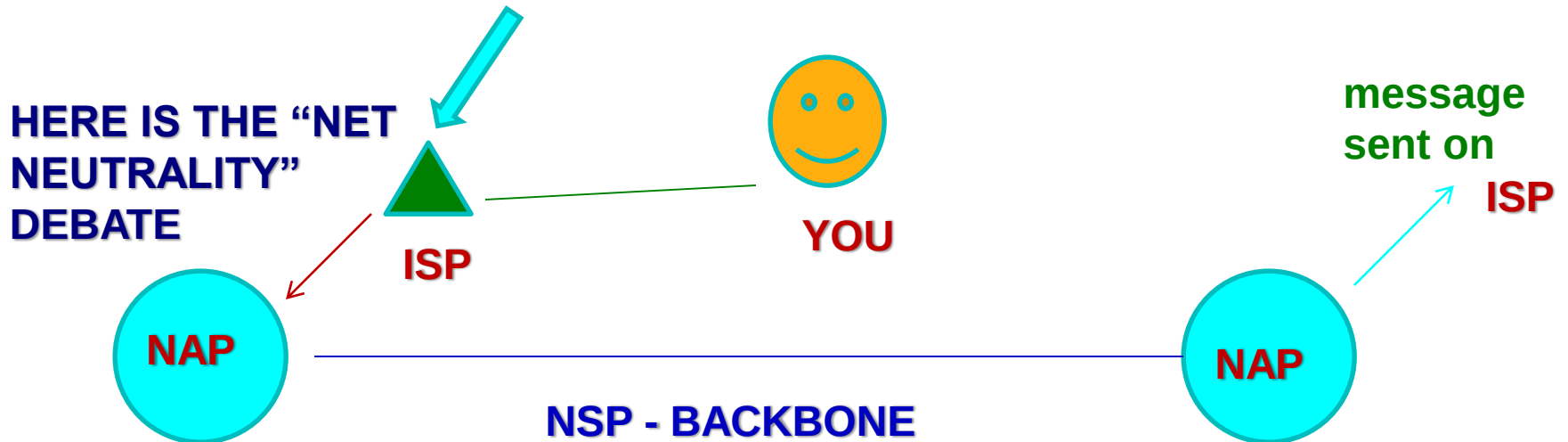
- INTERNET SERVICE PROVIDERS

- **NAPs**

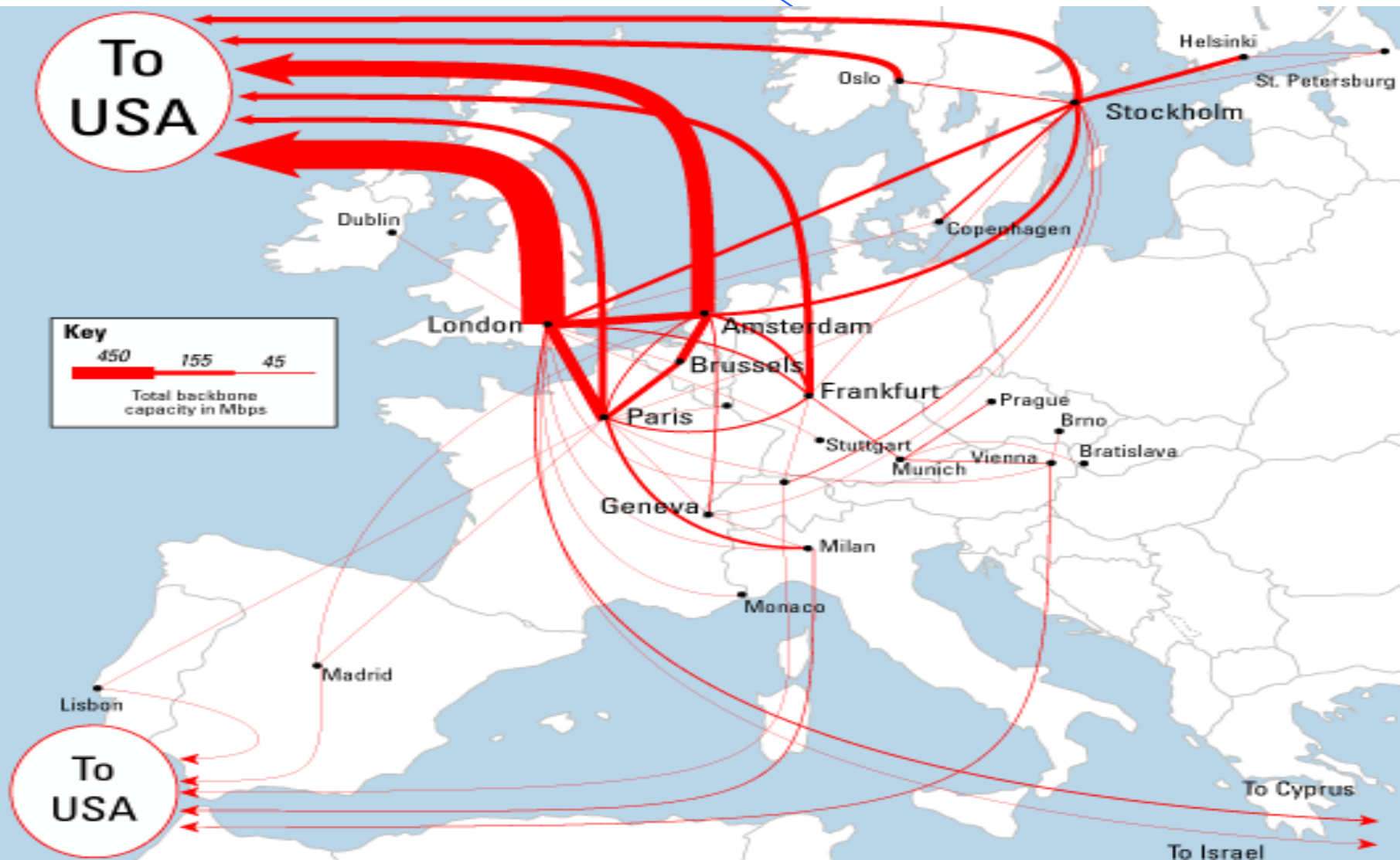
- NETWORK ACCESS POINTS/ PACIFIC BELL NAP IN SAN FRANCISCO & AMERITEC NAP CHICAGO

- **NSPs**

- “BACKBONE” NETWORK SERVICE PROVIDERS\ MCI, PSINET ETC.



COMPLICATED NETWORK OF COMMUNICATIONS NETWORKS



**2001: Jan 30 Egypt lost 70% + ½ western
India's outbound crashed downing
outsourcing industry. 75m from Algeria to
Bangladesh disrupted or cut off. 2008 Dec
Cable cut west of Dubai Middle East service
again severely disrupted. Feb '08 Iran cable
cut and looses complete internet.**



ARPANET

Remember there was no concern
about security or payments
Has led us to current problems

The beginning of the internet: 1969

"We set up a telephone connection between us and the guys at SRI ...",
Kleinrock ... said in an interview: "We typed the L and we asked on the phone,

"Do you see the L?"

"Yes, we see the L," came the response.

We typed the O, and we asked, "Do you see the O."

"Yes, we see the O."

Then we typed the G, and the system crashed ...

Yet a revolution had begun"



**First thing sold across the earliest
iteration of Internet
– Bag of marijuana. 1971 students
Stanford at Artificial Intelligence Lab to
MIT counterparts**



FROM ARPANET TO THE CLOUD

EVEN MORE PROBLEMS NEW INTERNET DATA INFRASTRUCTURE -WHO RULES THE CLOUD?

IMAGINE THE INTERNET IF:

- Europe could order Google to delete information on it's Servers in U.S.
- China could order Apple to keep icloud data created in China on Chinese Servers
- Saudi Araba could order U.S. firm to provide data on a dissident living in France

HOW TO CONSIDER CLOUD? (maybe like normal business goods transactions) or:

- Law of country stored (Data localization rule)
- Citizenship of data owner
- Citizenship of data subject
- Citizenship of data holder/custodian service provider

CONSEQUENCES

Now storing data factors: Climate, infrastructure, proximity to users

Ambiguity could result in:

- Moving servers to location of security
- Moving servers to “black holes” which provide anonymity (criminals, terrorists etc.)

Early Networking Stage technologies not compatible

ARPANET: THE ABILITY FOR COMPUTERS TO "TALK" TO EACH OTHER

ons

ow groups to have network technology best suited to them – not flexible

ve a Standard

World of : Cats versus Dogs

Individuals/Companies wanted a network technology best suited to them.

Industrial focus *"Kill off Competition"*

NOT FLEXIBILITY

RESEARCH CENTERS

Looking for solutions not pushing agenda



@ CERN: Tim Berners-Lee / Kahn

TCP Standardization

Internet Protocols

- Protocols - **A set of rules that determine how two computers communicate with one another over a network**
 - The protocols embody a series of design principles
 - **Inter-operable** — the system supports computers and software from different vendors. For e-commerce this means that the customers or businesses are not required to buy specific systems in order to conduct business.
 - **Layered** — the collection of Internet protocols work in layers with each layer building on the layers at lower levels.
 - **Simple** — each of the layers in the architecture provides only a few functions or operations. This means that application programmers are hidden from the complexities of the underlying hardware.
 - **End-to-End** — the Internet is based on “end-to-end” protocols. This means that the interpretation of the data happens at the application layer and not at the network layers. It’s much like the post office.

THE ABILITY FOR COMPUTERS TO “TALK” TO EACH OTHER



TCP/IP PROTOCOL

Solves global internetworking problem

- **Transmission Control Protocol (TCP)**

- Ensures that **2 computers can communicate** with one another in a reliable fashion

Prevents loss of data - Checks packets - Eliminates duplicate

- **Internet Protocol (IP)**

- packets are labeled with the addresses of the sending and receiving computers (think envelope)

Sends confirmation received /not Retransmitted Error-free communication

HARD/SOFTWARE To share access of data

1. Unique identification each computer

network of millions of computers - thousands networks..

Important each computer be uniquely identified

Internet Protocol (IP) address. **198.108.95.145**

2. Human-friendly addressing ↑

Domain Name System(DNS) gave address recognizable letters & words instead of IP address. <http://www.bu.edu/GoGlobal>

3. Packet Switching

Remedy delays associated unequally sized data transfers, instead of transferring files in their entirety, whole files broken into data packets before transferred over network

4. Routing

Dedicated, special-purpose computers which serve as an intermediary between networks. Route packets efficiently through networks and are building blocks of the internet. Packets used **TCP software insures safe delivery of packets**

Some Functions of TCP/IP

Prevents loss of data

Checks packets

Eliminates duplicate packets

Sends confirmation when packet is received

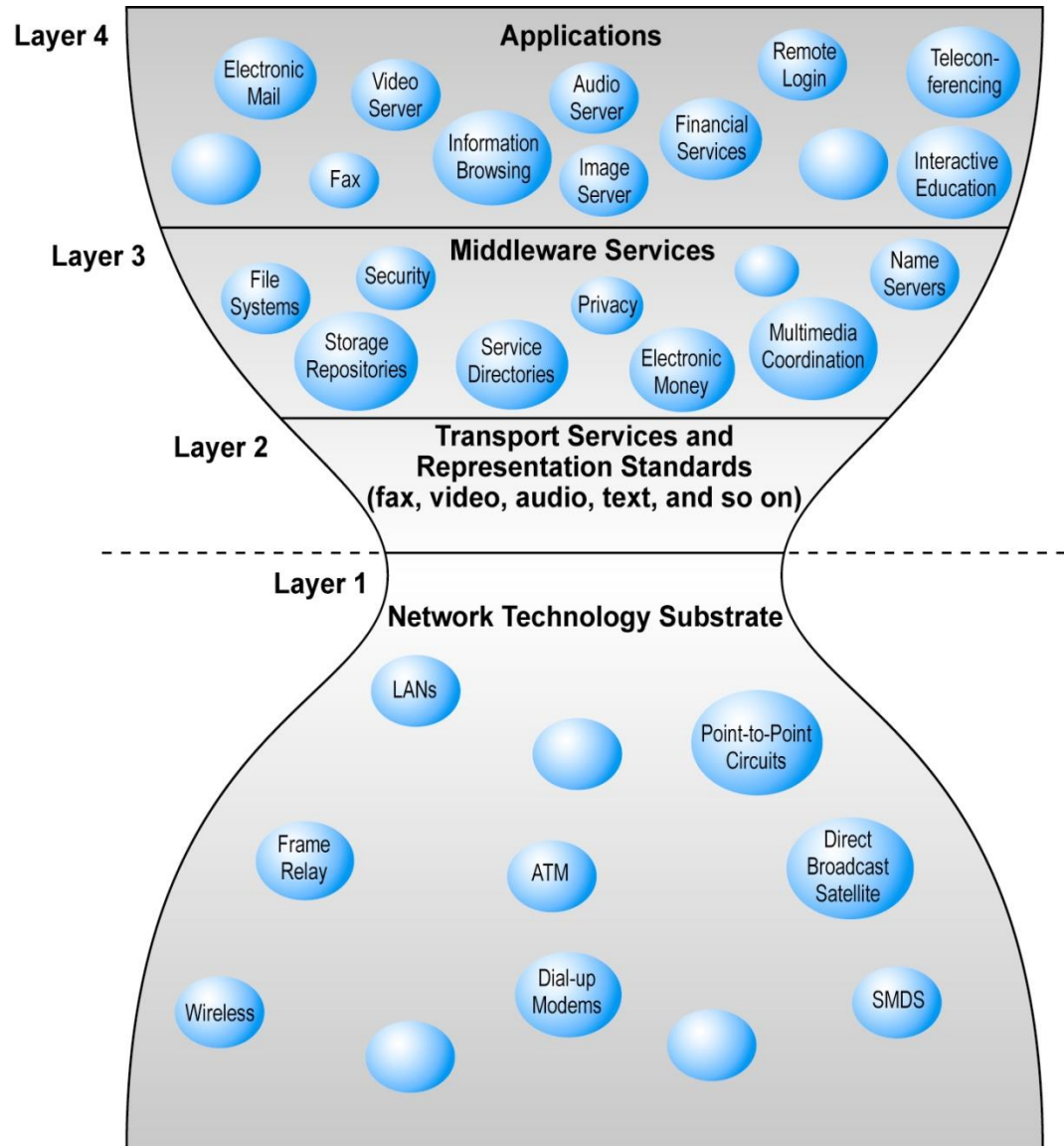
Confirmation not received - Retransmitted

Enables reliable error-free communication

■ Four TCP/IP layers

The Hourglass Model of the Internet

SOURCE: Adapted from Computer Science and Telecommunications Board (CSTB), 2000.



Packet Switching

I want to communicate with you.

0010110110001001101110001101

01100010 10101100 11000011

0011001 10101100 11000011

Original text message

Text message digitized into bits

Digital bits broken into packets



Header information added to each packet indicating destination, and other control information, such as how many bits are in the total message and how many packets

Getting on the Highway



Header information added to each packet indicating destination, and other control information, such as how many bits are in the total message and how many packets

Digital bits broken into packets

Text message digitized into bits

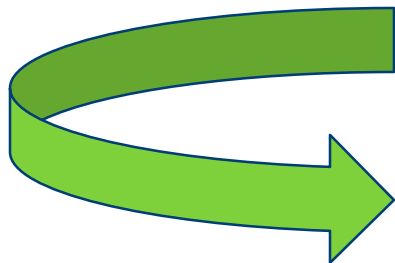
Original text message

0011001 10101100 11000011

01100010 10101100 11000011

0010110110001001101110001101

I want to communicate with you.



**Now lets see if we can put pieces
together**



Welcome to the
global community!

ICANN is a not-for-profit public-benefit corporation with participants from all over the world dedicated to keeping the Internet secure, stable and interoperable. It promotes competition and develops policy on the Internet's unique identifiers. Through its coordination role of the Internet's naming system, it does have an important impact on the expansion and evolution of the Internet.



SO WHO “OWNS” INTERNET? About ICANN

Internet Corporation for Assigned Names and Numbers

1996 to engage in internet regulation of (DNS domain name system)

on behalf of U.S. Government

Managing assignment of domain names and IP addresses.
introduction of top-level domains.

Oversees 1,100 registrars that sell Web Addresses

Does not have the authority to punish anyone for web type crimes like law enforcement

“Wrong doers” can lose their ability to register new websites

INITIAL 7 ORIGINAL DOMAINS

- IDN: support for [internationalized domain names](#) (IDN)
- DNSSEC: presence of DS records for [Domain Name System Security Extensions](#)

Name ↕	Entity ↕	Notes	IDN ↕	DNSSEC ↕
.com	commercial	This is an open TLD; any person or entity is permitted to register. Though originally intended for use by for-profit business entities, for a number of reasons it became the "main" TLD for domain names and is currently used by all types of entities including nonprofits, schools and private individuals. Domain name registrations may be successfully challenged if the holder cannot prove an outside relation justifying reservation of the name, to prevent " squatting ".	Yes	Yes
.org	organization	This is an open TLD; any person or entity is permitted to register. Originally intended for use by non-profit organizations, and still primarily used by some.	Yes	Yes
.net	network	This is an open TLD; any person or entity is permitted to register. Originally intended for use by domains pointing to a distributed network of computers, or "umbrella" sites that act as the portal to a set of smaller websites.	Yes	Yes
.int	international organizations	The .int TLD is strictly limited to organizations, offices, and programs which are endorsed by a treaty between two or more nations. However, there are a few grandfathered domain names that do not meet these criteria.	No	No
.edu	educational	The .edu TLD is limited to specific educational institutions such as, but not limited to, primary schools, middle schools, secondary schools, colleges, and universities. In the US, its usability was limited in 2001 to post-secondary institutions accredited by an agency on the list of nationally recognized accrediting agencies maintained by the United States Department of Education . This domain is therefore almost exclusively used by US colleges and universities. Some institutions that do not meet the current registration criteria have grandfathered domain names.	No	Yes
.gov	governmental	The .gov TLD is limited to governmental entities and agencies in the US.	No	Yes
.mil	US military	The .mil TLD is limited to use by the United States military.	No	Yes

RECENTLY added DOMAINS

Internationalized country code top-level domains [\[edit\]](#)

The following ccTLDs (Country code top-level domains) have been requested using a procedure known as Internationalized domain name (or IDN) ccTLD Fast Track Process.

DNS name	IDN ccTLD	Country	Transliteration	Script	ccTLD	
xn--90ae	.бг ^[4]	 Bulgaria	<i>bg</i>	Bulgarian Cyrillic	.bg	String rejected
xn--qxam	.ελ	 Greece	<i>el</i>	Greek	.gr	String rejected
xn--4dbrk0ce	ישראל ^[5]	 Israel	<i>Israel</i>	Hebrew	.il	
xn--wgv71a	日本 ^{[6][7]}	 Japan	<i>Nippon or Nihon</i>	Kanji (both Kyūjitai and Shinjitai)	.jp	
xn--vcst06ab2a	日本国 ^[6]		<i>Nippon-koku or Nihon-koku</i>	Kanji (Shinjitai)		
xn--q7ce6a	ລາວ ^[8]	 Laos	<i>Lao or Laao</i>	Lao	.la	
xn--mgb7f9yab	ليبيا	 Libya	<i>Libyā</i>	Arabic	.ly	



- ".ελ" was rejected because of its confusing similarity to .EA which is not a TLD but a reserved two letter string in the reserved ISO-3166 list. Much like the case of Bulgaria's applied-for ".бг" and subsequent denial by the DNS SP, because of similarity to .br, Greece must wait until after the IDN cctld Fast Track Process before it can enjoy its own icctld.^{[9][10]}

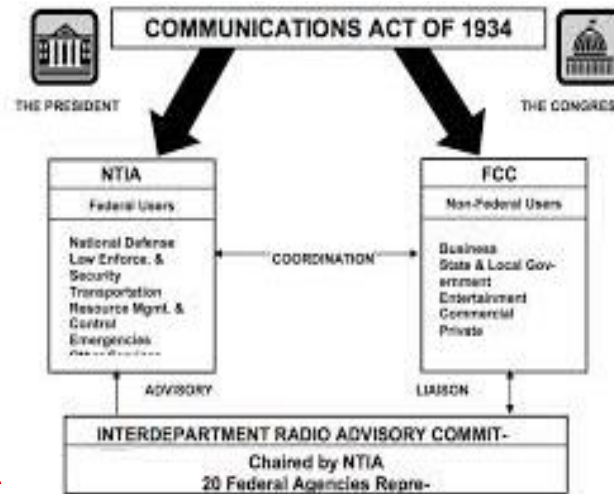
Specialized and professional topics [\[edit\]](#)

- **Donuts Inc.** has invested \$57 million in more than 300 applications.^{[24][25]} whilst **Famous Four Media** has applied for 61 applications.^[26]
- **.med** – **medical** practitioners and organizations^[27]
- **.eco** – **environmental causes**^{[28][29]}
- **.shop** – **electronic commerce** sites^[30]
- **.sport** – **sport** sites^[31]
- **.wine** – **wine** sites^[32]

Technical domain name themes [\[edit\]](#)

- **.mail** – A domain for **e-mail** networks, proposed to facilitate fighting **e-mail spam**.
- **.web** – A domain for general use on the **world wide web**.

SO WHO CONTROLS/REGULATES US INTERNET?



ENTER: THE FCC

COMMISSION CHAIRMAN KENNARD (2000)

“WE NOW KNOW THAT DECISIONS ONCE MADE BY GOVERNMENT CAN BE MADE BETTER AND FASTER BY CONSUMERS, AND WE KNOW THAT MARKETS CAN MOVE FASTER THAN LAWS”

President Obama (2014) instructs FCC to take control over: 1. Content 2. Pricing and 3. Products on the Internet

Republicans propose “the open Internet” limiting FCC authority

ENTER: NET NEUTRALITY Debate over Utility Regulations of Title II 1934 Communications Act (modeled on 1887 Interstate Commerce Act regulates Railroads) THE QUESTION? Why end the success of the “Permissionless” Internet? Many lobby Interests

BUT WAIT ! THE CONTROVERSY IS INTERNATIONAL



ENTER: THE INTERNATIONAL TELECOMMUNICATIONS UNION (founded 1865)

The ITU mission: Bringing the benefits of ICT to all the world's inhabitants

CLAIM THIS NOW INCLUDES INTERNET

INTEREST BY MANY MEMBERS TO TAKE CONTROL AWAY FROM ICANN

NOW a United Nations agency (1947) ITU based in Switzerland

Information and communication technologies.

3 core sectors: radio communication, standardization and development.

Membership: 191 Member States & more than 700 Sector Members and Associates.

THE CONCERN:



**Would the Internet be Run differently if:
RUSSIA, CHINA, BRAZIL, OR EVEN
EUROPE CONTROLLED HOW RUN
WHO COULD GET NAMES/ KEEP THEM ?**

Domain Name System(DNS)

2014 Ran out of
V4 ADDRESSES



WHY?



IPv4 32 bit or $2^{32}=4,294,967,296$

IPv6 349 undecillion or 3.4×10^{38}

Support issues: mobile/ servers



THAT'S A LOT TO THINK ABOUT

AND NOW YOU KNOW
HOW IT ALL STARTED

THANKS

THE INTERNET