

MOMENTOUS DECISIONS

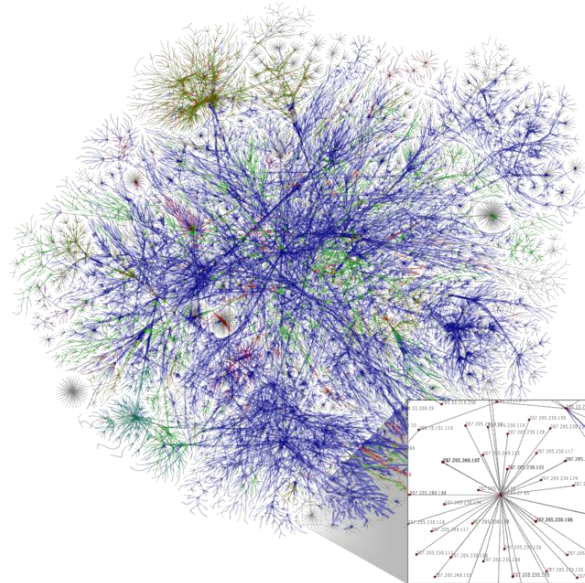
The internet

A multiplicity of decisions

Creating the Internet and the World Wide  
Web **that uses the internet.**

# What is the Internet?

- It is not to be confused with the **World Wide Web** which actually is only **one of the users** of the Internet.
- The Internet is also used for e-mail, file transfer, remote computer control, newsgroups, and online games.



# Computer protocols

- A protocol is a **computer language** and its 'grammar' i.e. **the rules for using it**.
- Before the Internet, a group of computers from the same maker could use any protocol developed by their makers to form a **network of computers within an organisation** such as a school, university, research group, bank, motor manufacturer etc.
- This was called **Intra-networking**.
- These school students, before the internet existed, could communicate with each other, using computers connected together, in the room i.e. were using an intranet.



# Agreement was necessary to enable intranets to communicate with each other

- To create the Internet there had to be an agreed upon protocol (a computer language and its rules) for exchanging information between these **separate, different, intra-networks** in a process then called **Inter-networking** (giving rise to 'Internet').
- **AppleTalk** was a proprietary group of networking protocols developed by Apple Inc. for their Macintosh computers.
- Useless for IBM intranetworks.



# TCP/IP

- The most common Internetworking protocols in public use belong to the Internet Protocol (IP) family.
- **IP works well** for moving individual messages from one network to another but cannot cope with a stream of messages in both directions.

It is like a narrow (local) road.



# TCP is like a freeway and IP like the local road network

- The Transmission Control Protocol (TCP) extends IP with a higher layer capability, and because point-to-point connections are so essential on the Internet, the two protocols are almost always paired together and known as TCP/IP.





# The Internet is the highway plus local roads, and road rules, that links all user computers together

- Thus CPT/IP allows several billion Intranets and individual computers to talk to each other for the purposes of emails, file sharing, telephony etc.
- **Before the WWW was created there were no generally available information sources i.e. documents that could be called up on any computer.**



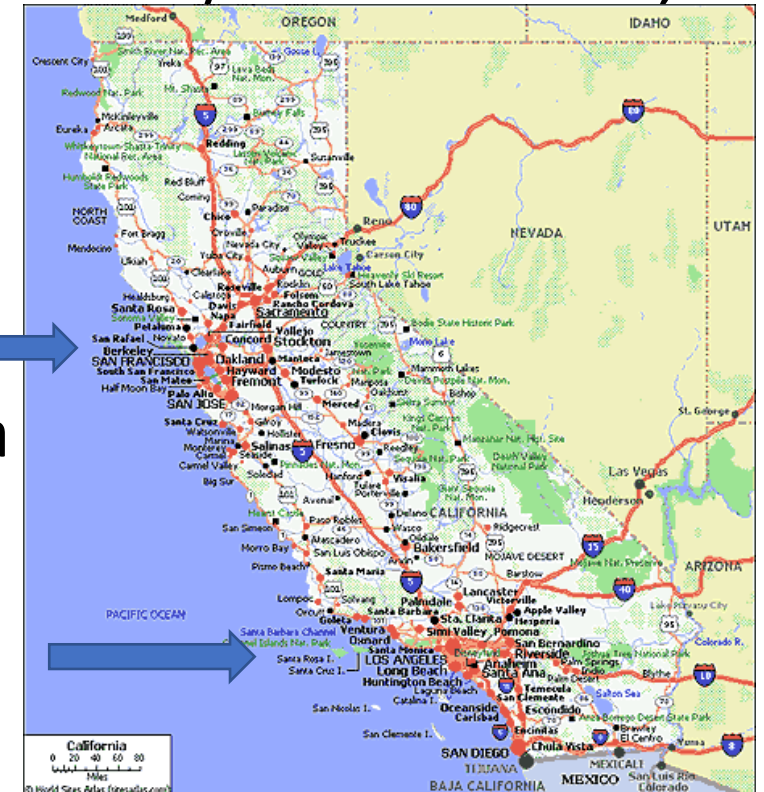


# It was initially called the ARPANET (Advanced Research Projects Agency Network)

The first hook-up was between the Network Measurement Centre at the UCLA's School of Engineering/Applied Science and the NLS (oN-Line System) at SRI(Stanford Research Institute) in Menlo Park, California, on 29<sup>th</sup> October 1969.

SRI formally separated from Stanford University in 1970 and became known as SRI International in 1977.

Menlo Park is a city in the San Francisco Bay Area of California, in the United States.



# The first of many decisions that led to the life-changing Internet

It was the brain-child of UCLA's Leonard Kleinrock and SRI's Douglas Engelbart.

Leonard Kleinrock and the IMP1.  
(Interface Message Processor).



# The first attempted Log-on

- "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" ...

# Logged-on safely

- They each had internal networks of computers so what they were doing when they hooked up was **inter networking**.
- This term was later abbreviated to describe what they were using, rather than what they were doing thus: The Internet was born.



# The Internet spreads

- The third site on the ARPANET was the Culler-Fried Interactive Mathematics centre at the University of California at Santa Barbara, and the fourth was the University of Utah Graphics Department.
- In an early sign of future growth, there were already fifteen sites connected to the young ARPANET by the end of 1971.
- This was like a party line in telephones i.e. each computer in the internal networks (intranets) could contact any computer in any of the other 14 intranets.
- When they were communicating they used a **mixture of computer languages (protocols)**.

# International lack of cooperation at first

- Early international collaborations on ARPANET were sparse. For various political reasons, European developers were concerned with developing the X.25 networks
- Access to the ARPANET was expanded in 1981 when the National Science Foundation (NSF) developed the Computer Science Network (CSNET).
- Team members (in white lab coats) included Douglas Comer, Chris Kent, Paul McNabb, and Tim Korb.
- Larry Peterson looks on.



# Co-operation between countries

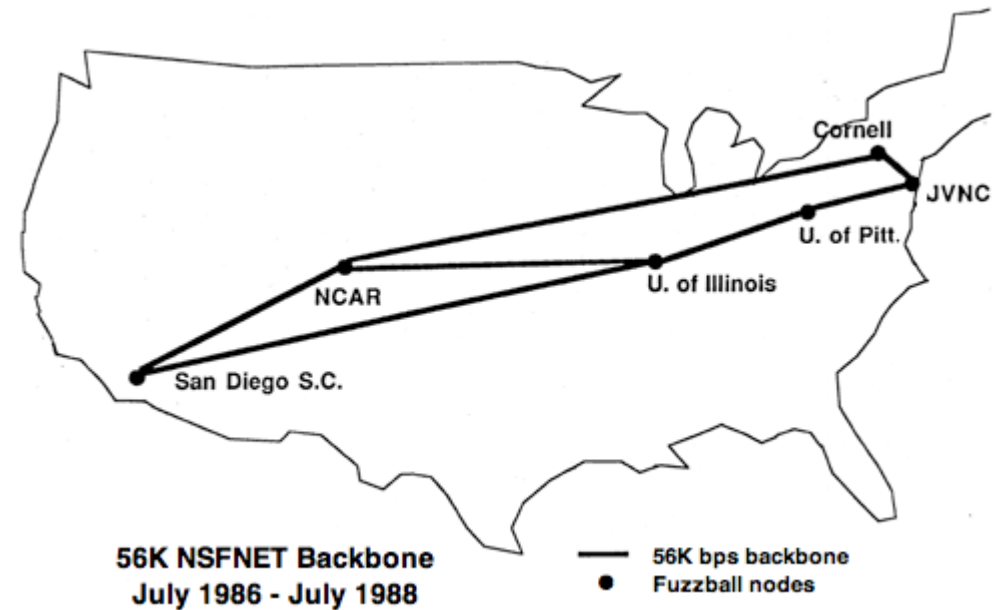
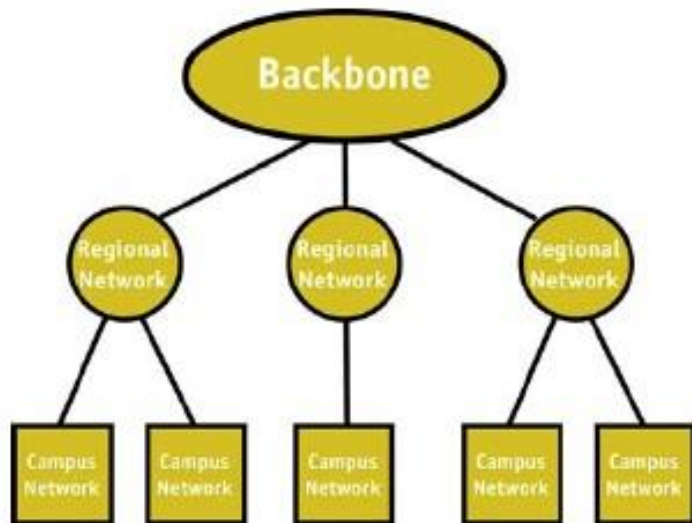
- In 1982, the Internet Protocol Suite (TCP/IP) was standardised and the concept of a world-wide **network** of fully interconnected TCP/IP networks **called the Internet** was introduced.
- This did not include **information (or documents)** that could be accessed i.e. the World Wide Web.





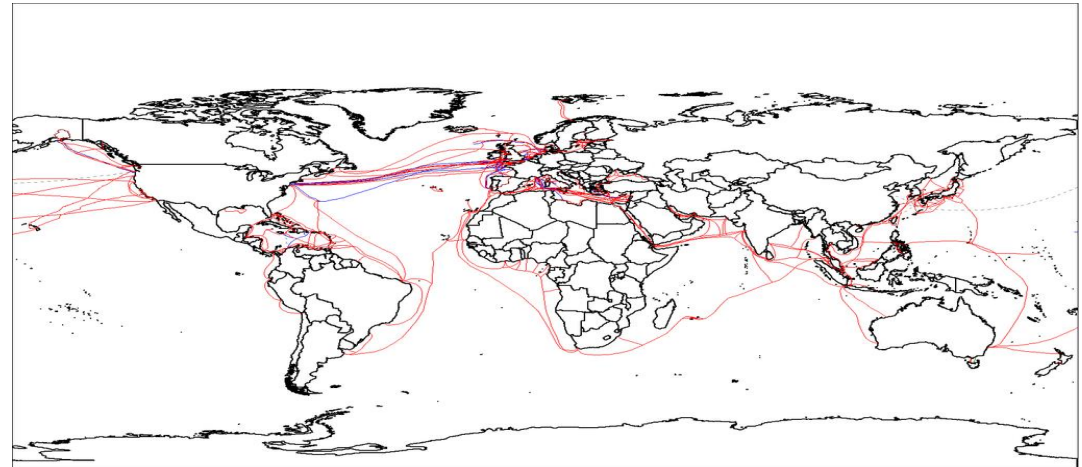
# Out with the old and in with the new!

- The TCP/IP network access expanded again in 1986 when the National Science Foundation Network (NSFNET) provided access to supercomputer sites in the United States for research and education organizations.



# Decommissioning of early net

- The ARPANET was decommissioned in 1990.
- The Internet was fully commercialized in the U.S. by 1995 when NSFNET was decommissioned, removing the last restrictions on the use of the Internet to carry commercial traffic.
- The Internet started a rapid expansion to Europe and Australia in the mid to late 1980s—and to Asia in the late 1980s and early 1990s.
- 2007 map showing submarine optical fibre telecommunication cables around the world.



# World Wide Web, WWW or W3, or even, W<sup>3</sup>

- Tim Berners-Lee, a British computer scientist is considered the inventor of the Web.
- On March 12, 1989,-he wrote a proposal for what would eventually become the World Wide Web.
- The 1989 proposal was meant for a more effective CERN (European Organization for Nuclear Research) **internal information sharing system** but Berners-Lee eventually realised the concept could be implemented throughout the world.



# Essential ingredient of WWW

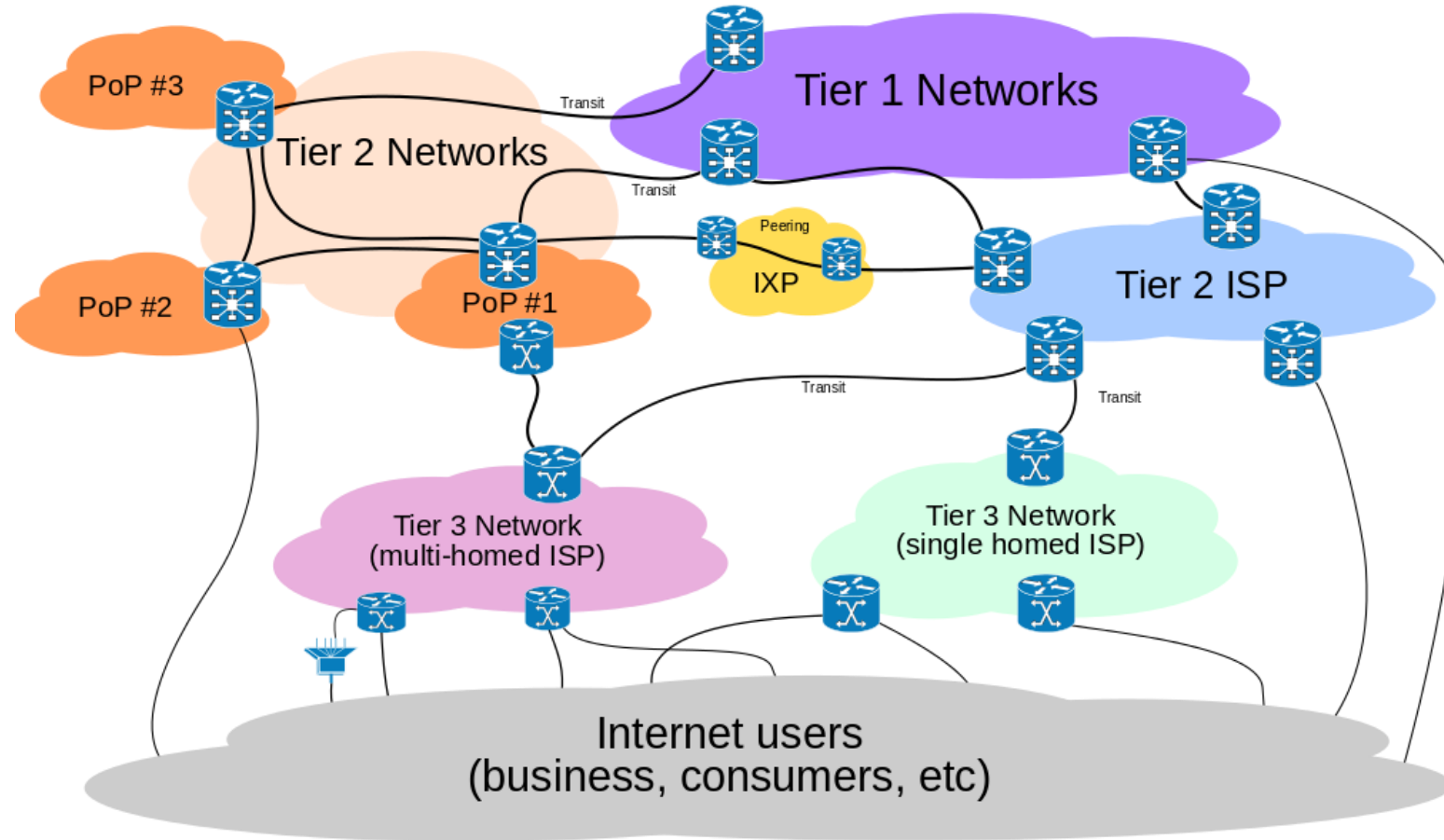
- The core of the proposal was the setting up of a **store of information** that could be accessed by people **on the CERN internal network**.
- That store was on a neXT computer.
- The neXT Computer used by Tim Berners-Lee at CERN.



# ISPs

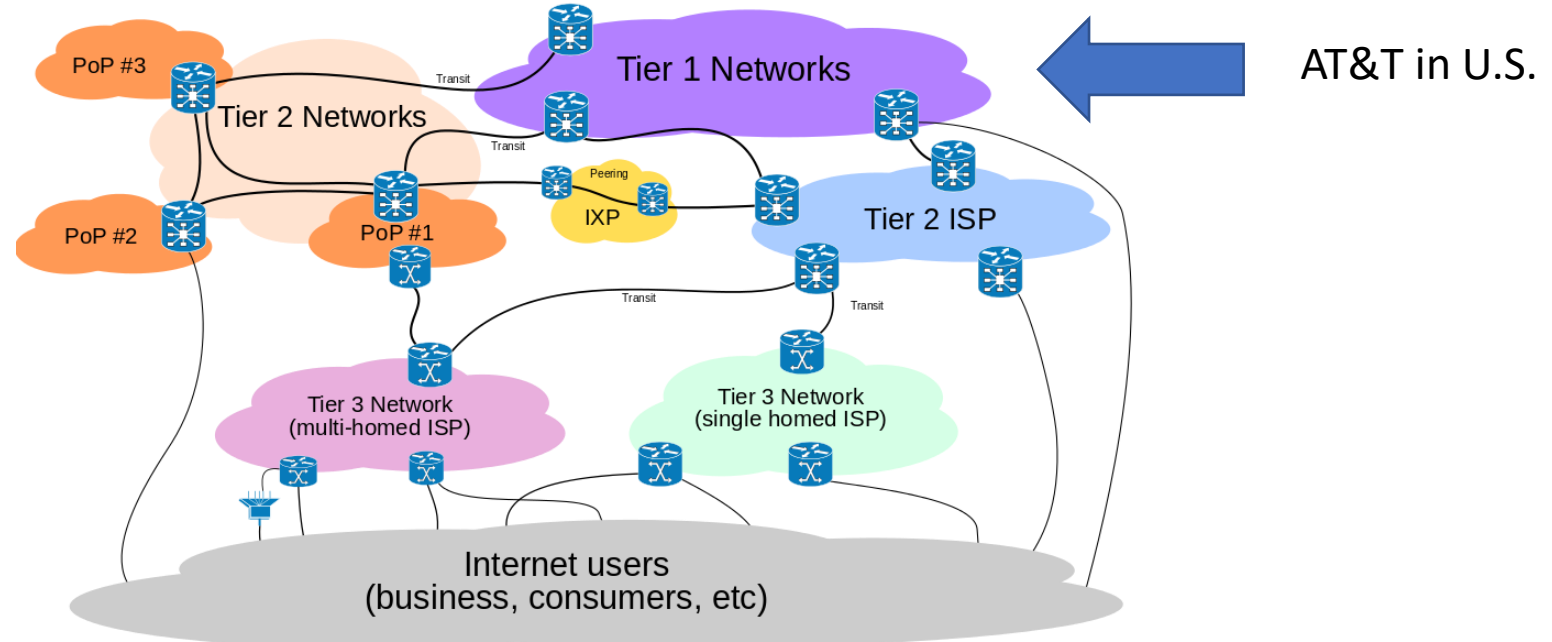
- In/on the **WWW now, the neXT** computer has been replaced by computers with huge, huge, huge, storage capacities **owned by tier 1 companies** that use HTTP language i.e. protocol.
- Hypertext Transfer Protocol, or HTTP, is the language used by the WWW on the Internet **for information transfer**, yet it **is just one** of many languages or protocols that can be used for communication on the Internet.

What the **WWW** looks like now. We will look at it in digestible bits.



# Top of the totem pole

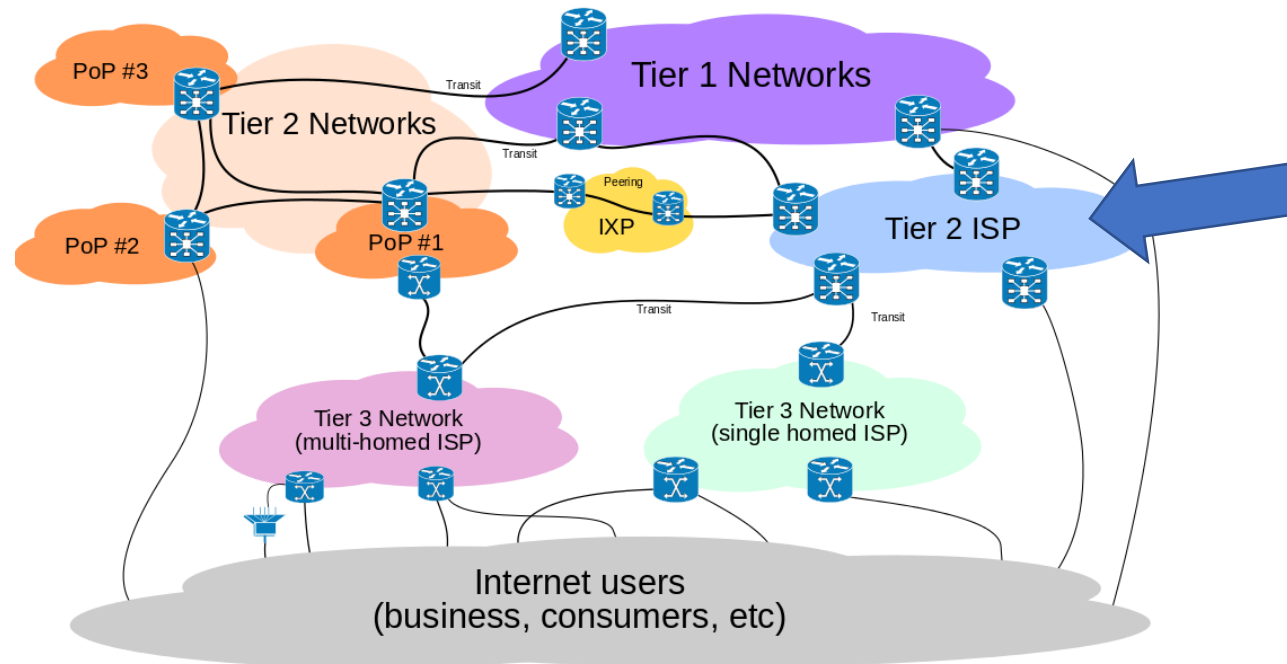
- At the top of the routing hierarchy are the tier 1 networks, large telecommunication companies, that exchange traffic directly with each other via peering agreements. Telstra and Optus are, by some, regarded (internationally) as Tier 2 networks.





# Other Tiers

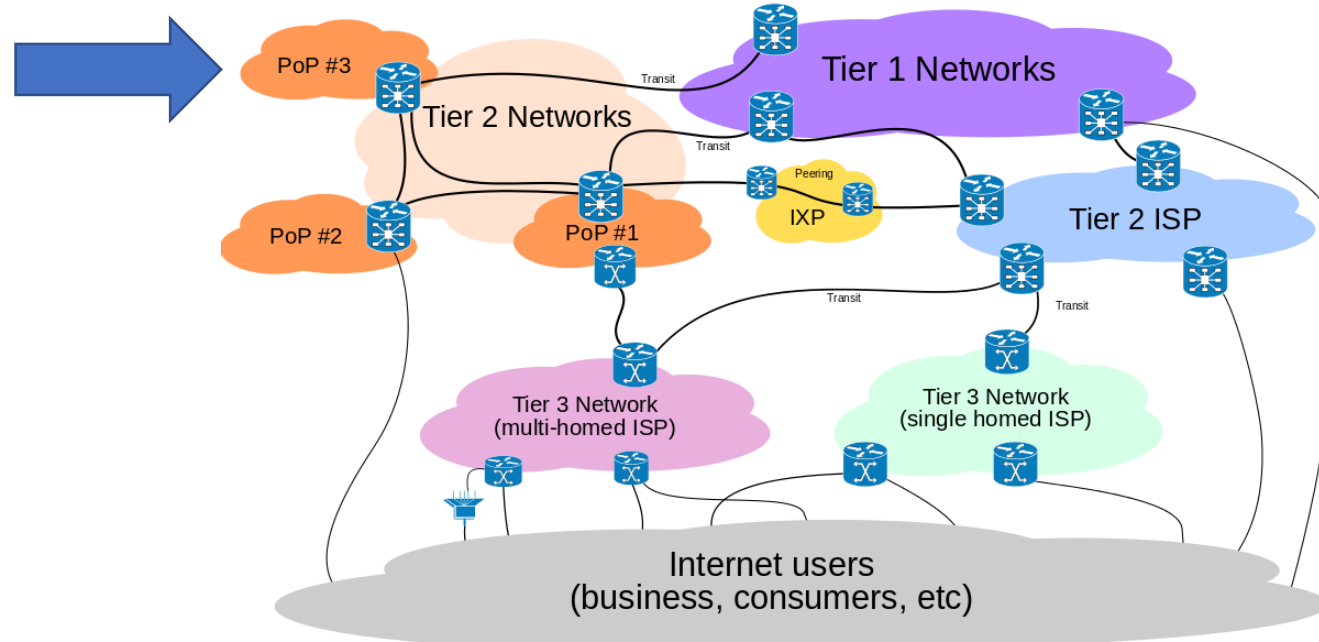
- Tier 2 and lower level networks buy Internet transit from other providers to reach at least some parties on the global Internet, though they may also engage in peering.



Telstra and Optus.

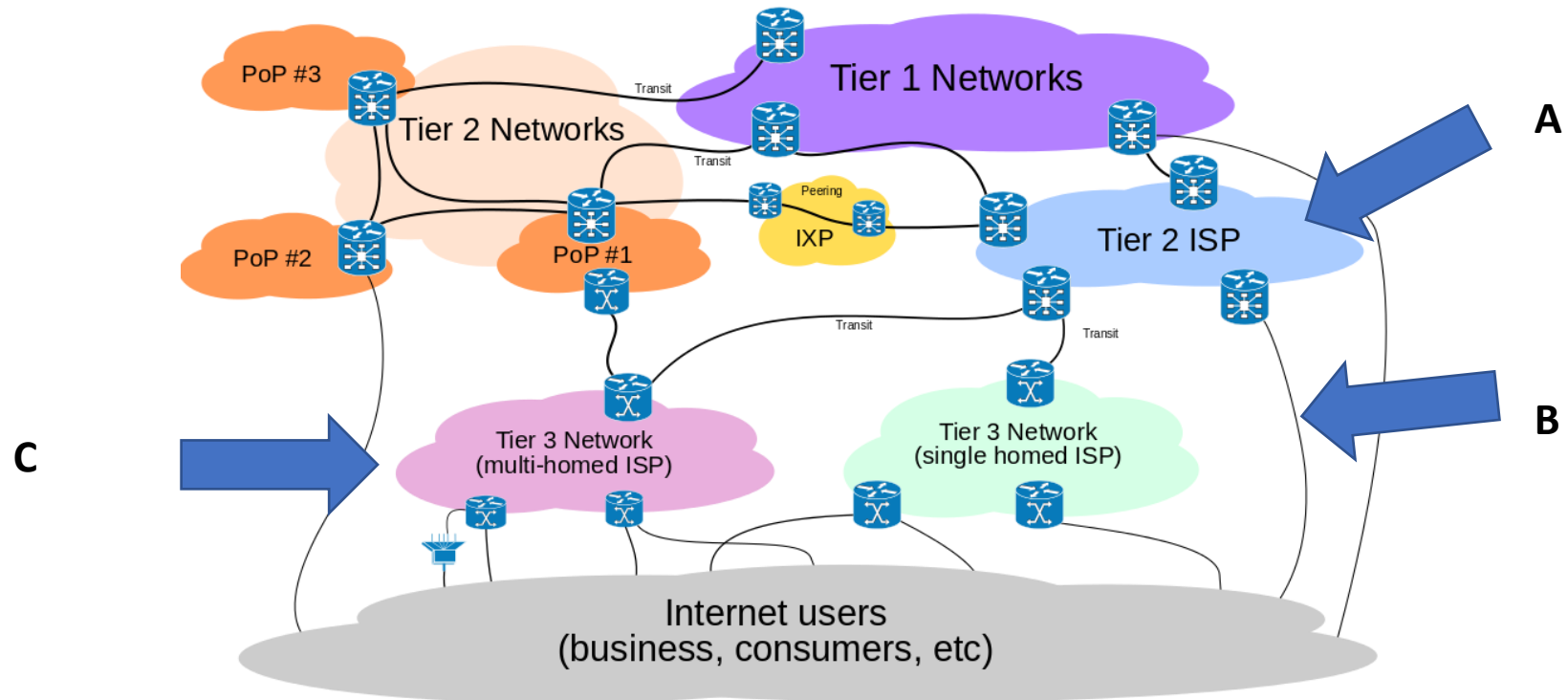
# More terminology

- A **point of presence (PoP)** is an artificial demarcation point or interface point between communicating entities



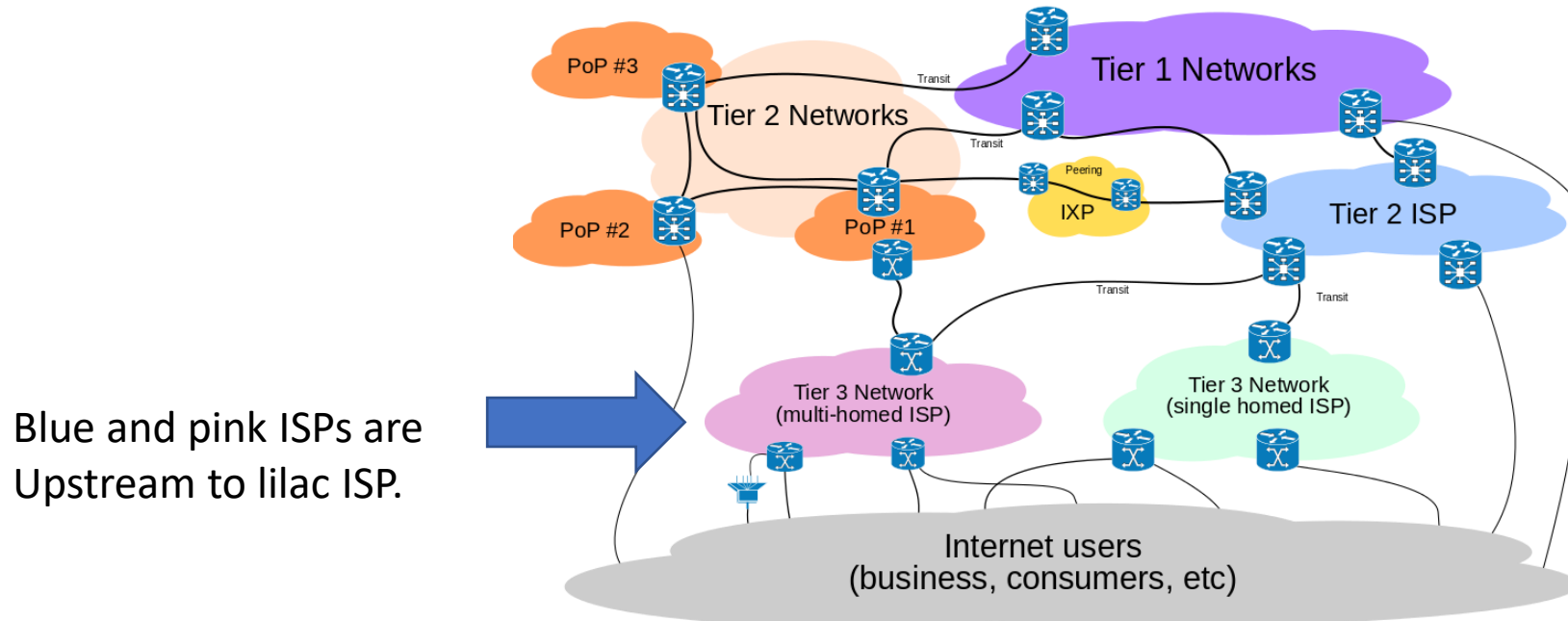
# Information highway

- **Internet service providers(A)** connect **customers (B)**, which represent the bottom of the routing hierarchy, to customers **of other ISPs (C)** via other or same-tier networks.



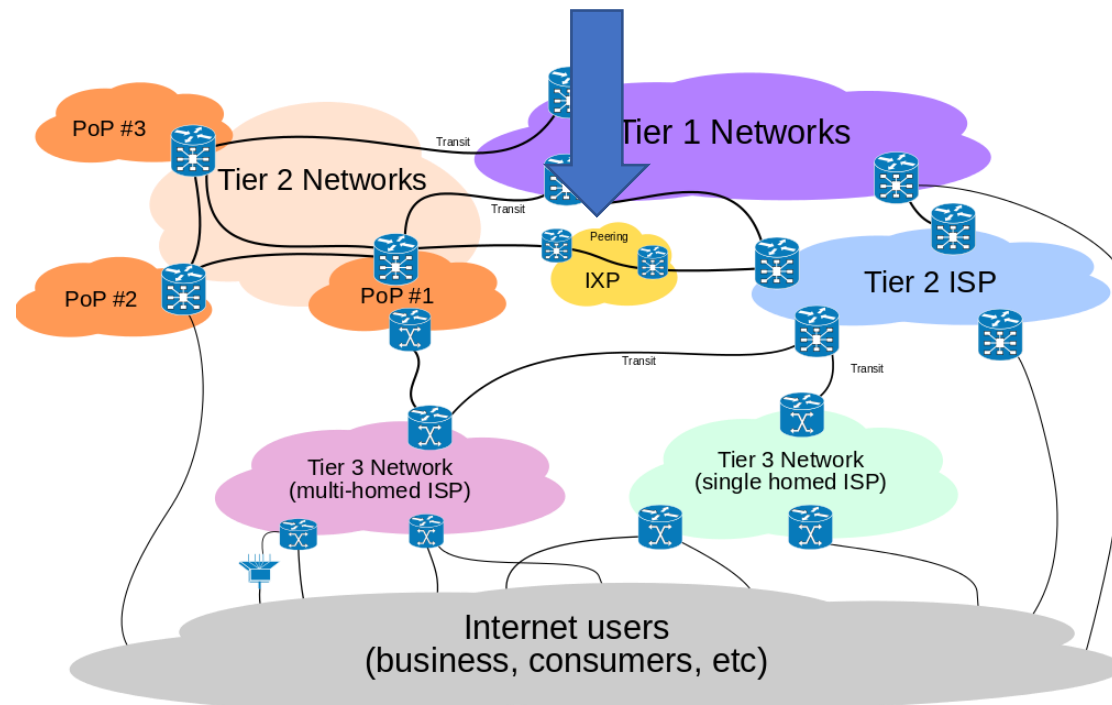
# Practices

- An ISP may use a single upstream provider for connectivity, or implement multi-homing to avoid redundancy and achieve load balancing.



# IXPs

- Internet exchange points are major traffic exchanges with physical connections to multiple ISPs



# Summary

- Internet Service Providers work at several levels.
- Big Telecommunications companies link together with peer agreements and exchange information.
- Secondary providers rent from these big companies and deal with users.
- Until the invention of the World Wide Web the Internet was used chiefly for emails, file transfers etc. by universities, research institutions, business companies and the like.
- With WWW anyone with a device such as a computer or phone can access the Internet.

# Some abbreviations

- The **uniform resource locator**, abbreviated as **URL** (also known as **web address**, particularly when used with HTTP), is a specific character string that constitutes a reference to a resource.
- In most web browsers, the URL of a web page is displayed on top inside an address bar.
- An example of a typical URL:  
`"http://en.example.org/wiki/Main_Page"`.
- A URL is technically a type of uniform resource identifier (URI), but in many technical documents and verbal discussions, URL is often used as a synonym for URI, and this is not considered a problem.



# More abbreviations

- USB = universal serial bus (USB2.0 is 40 times faster than USB1.0).
- RAM = random access memory (any address can be located as quickly as any other address)
- ROM = read only memory ( memory where data and programs cannot be altered i.e. they can only be read).
- 419 scam violates section 419 of the criminal code.
- HTML= Hypertext Mark up Language.