From Master-Slave to Peer-to-Peer

A Paradigm Shift for the Stupid Network

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Main Points

- We are in the midst of a long economic boom.
- The Internet's engineering design is the cause of the *magnitude* of this boom.
- Why the Internet is essential to this process of wealth creation is not properly understood.
- The peer-to-peer Internet model must be allowed to prevail.
- For this to happen, governments must understand how radically it differs from the old models of communication.

Who is this man and why is he more important than you?

- This man in the checked shirt is David Reed.
- He is the co-author of the “end-to-end principle in network design”.
- He explained the fundamental features of the Internet 15 years ago. Few paid attention.

This is the telephone guy who said the same things 15 years later

- This is David Isenberg
- He wrote “the rise of the stupid network.”
- He was the first to contrast the phone network to the Internet, and found the phone network obsolete.
- More people have paid attention.

This is the guy who is building the stupid network

- This man in the white shirt is Mike O'Dell, CTO of UUNet
- He spends $4million a day to keep his networks doubling in capacity every 4 months
- "If you aren't scared, you just don't understand", he said.

From scarcity to plenty

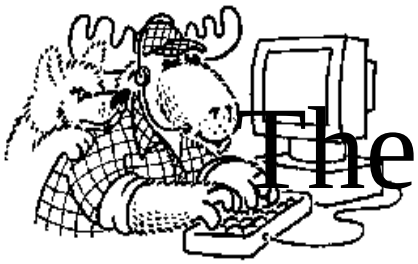
- The economic boom we are experiencing derives in a large measure from the open and unspecified nature of the Internet.
- A fundamental unleashing of creative talent has occurred because of open systems. No one has to ask permission of a central planner to create, sell, and buy across the Internet.
- Telephone companies and broadcasters are the last bastions of centralized resource allocation in the Internet economy. They own spectrum.

The design philosophy of the Internet

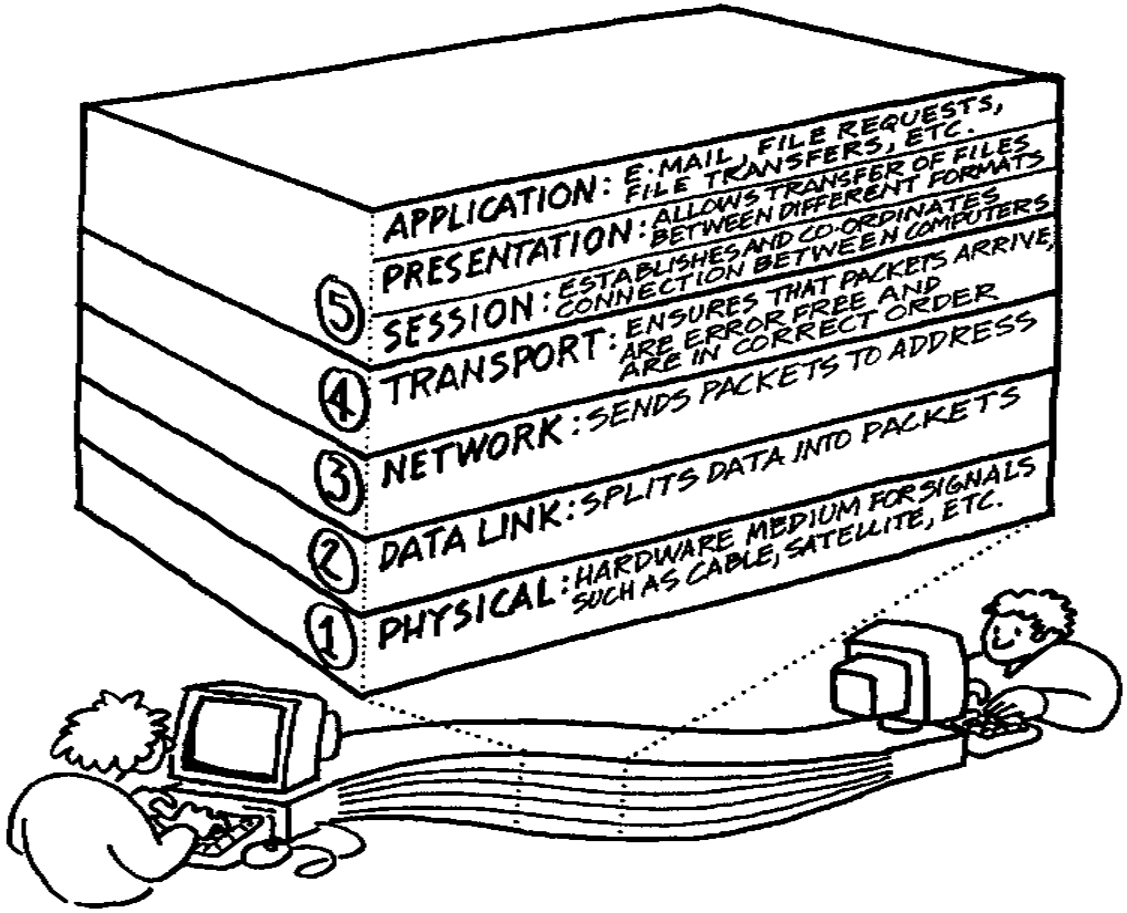
- The Internet is a set of protocols allowing computers to communicate across different platforms and operating systems (TCP/IP).
- Protocols (software instructions) are the conscious creation of human minds to achieve desired effects. TCP/IP is a peer-to-peer protocol.
- The Internet was designed to separate programs and applications from transport of signals.
- Dumb transport, smart applications.

Applications versus services

- Services are a telephony construct. Services are what the owners of transport say that you can have, at a price they determine.
- Applications are bought and sold in a free market.
- The Internet shifts power: value is added in the terminal, not the network.
- No one needs anyone’s permission to add value.
- Intelligence is placed in the terminal, not the network.



The layered architecture of the Internet



The design philosophy of the legacy networks

- While designed for different purposes, legacy networks (telephony, broadcasting and cable) share one profound feature: services are designed and delivered by the network.
- The network defines the services which may be extracted from it.
- Legacy networks follow the central planning model of socialism. You get what we plan.

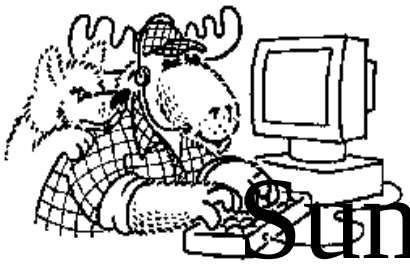
Internet vs. legacy networks

Internet

- Underspecified
- Peer-to-peer
- End-to-end
- Open
- Services are defined by anyone with an idea.
- Applications split from transport – hence the *protocol stack*

Legacy networks

- Completely specified
- Master-slave
- Service control points
- Proprietary
- Services are defined by owners of the system.
- Services vertically integrated with transport



Summary of Features: Internet

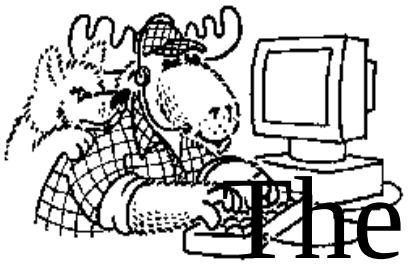
- A layered architecture that separates applications from transport by the TCP/IP layers;
- An end-to-end architecture that puts minimum functions in the network and the maximum into the terminal;
- A chaotic and adaptive routing pattern that sacrifices central control for maximum network efficiency, which results in…
- An absence of common ownership or central planning, as each network is privately owned and may pass traffic at its discretion; which results in the fact that
- States and territories have no significance for the Internet.

Summary of features: telephony

- Vertical integration of transport functions with service (telephony predates computers)
- The *service* is the product of intelligence in the network (the intelligent network) so no one can add to it from the outside;
- The routing system is designed around the characteristics of the human voice and calling patterns;
- Central planning, common ownership, carefully controlled interconnection with other carriers, leading to
- Coordination through state-based international agencies (ITU).

Services are to telephony what applications are to the Internet

- The vertical feature integration of the PSTN contrasts with the horizontal layering of the Internet.
- The telephone system supports only one “application”, telephony – switching 64kbps channels off and on (the one-trick pony).
- The internet is unaware of the applications that run on it, except that for the model to work…
- Interconnections must be free of self-preference and discrimination.



The choke-point is local access

- As always, signals must pass from the end point through legacy systems before reaching the Internet.
- These wires are owned by people whose businesses will be devalued by the Internet model.
- While their technological dominance is finished, they will use regulatory delay to preserve share value as long as possible (“one more day”)
- The regulator needs new knowledge to fulfill old tasks.

The peer-to-peer model

The Internet is designed to allow a peer-to-peer communications. This is a fundamental technical concept with vast political and economic implications.

Engineering design has not been considered sufficiently in a number of Internet policy issues:

- the absence of Internet traffic settlements,
- Censorship and content control, and
- The effect on wealth creation of the peer-to-peer model

Basic Ideas

- The economic boom unleashed by the Internet relies on lack of central planning of what the network should do.
- The previous pre-computer concept permitted only the owner of the network to design the services.
- The result was decades of technological stagnation.
- The two systems are in collision, and one must prevail.
- Software-based interconnections become the means whereby one system prevails over another, or does not.
- Accordingly, government's traditional role of constraining monopoly power in telecommunications takes on fresh and urgent relevance.