Conclusions

Future Technologies

Semantic Web

http://www.semanticweb.org/
Current Internet has lots of info in text form
Readable by humans
Use google to find info by text search
Semantic Web
    Structure and tag info formally so that the info is usable by software
Theme: handled by hand, vs handled by software agent
e.g. Let's make a reservation at Hobees
e.g. Is there a copy of the book "Touching the Void" for sale within a mile of here?
    Can be answered by hand, looking at each vendor web site
    With semantic web, the data is structured so that a software agent can tour all the sites for me
e.g. Can we meet Thu afternoon?
    Our scheduling apps can exchange info for when we are free

RDF

Resource Description Framework
http://www.w3.org/RDF/
A framework that describes content -- a necessary step for the Semantic Web

Web Services

Currently, we have human consumable "web apps", expressed via HTML
Web services is, simply, expressing a service, computation, etc. in a way that can be used by a software agent
Allows a network of entities, interacting with each other to solve an overall problem
Both Microsoft (.net) and Sun (Java) are
XML -- format for data exchange
SOAP
    http://www.w3.org/TR/SOAP/
    Simple Object Access Protocol
    A protocol for sending a sort of object message send over the internet. Uses an HTTP like protocol, so works with firewalls etc.

Thicker Clients

Building a richer client
Contenders:
- JavaScript
- Java
- MS .net (Windows only)

Inertia
- These will have a tough time getting popular vs. the high inertia of the current HTTP / HTML system. It has problems, but it works and it's portable and fairly reliable.

Identity

When using a computer, it's useful to have a reliable, formal notion of "identity"
One login for... email, web sites, leland, ...
Trust problem for ebay: both parties would like a way to show the other that they are who they say they are

Identity Gadget

You have an account with an "identity server" (maybe run by the government, or maybe there will be many competing identity services)
No more passwords
You will carry around a card, ring, etc. with your private key in it -- you put your thumbprint on it or type in a PIN when it needs to prove your identity to some other entity
Might work wirelessly
Could double as door lock, car lock, train ticket, etc.... they just know its you

Privacy

There is a tendency to think of privacy as an absolute good, but it's more complex than that
Obviously, there are times when a person wants to keep their privacy -- "Right to privacy" -- but t

Transparent Association

There are times when two or more people would like to interact, but need to build a network of accountability / trust.
Each person reveals information about themselves, creating accountability (which leads to trust)
The right to transparent association -- a community may require a degree of transparency
Voluntary -- people can decide if they would like to join the community or not

e.g. ebay Transparent Identity

(hypothetical) Suppose ebay offers an "transparent identity" service, where they fingerprint, photograph, etc. you, and then you can list your identity as an ebay seller

A seller can decide if they want to participate -- voluntary transparent association
Buyers will prefer transparent sellers, since (transparency -> accountability) such sellers are far less likely to cheat the buyer
When someone tries to hide their identity, they are usually doing something bad to you (mugger, spammer)

Internet Lesson

What is the lesson of the history of the Internet so far?

Network Effect

Lots of value -- N^2 (N square, for N participants)
- Fax machine
- SMTP
- VHS video format (vs. Beta) -- i.e. why, in the end, was VHS equipment more valuable than Beta equipment? -- network effect
- MP3 -- lots of books, tools, players, collective expertise, MP3's made by others
- The more participants = more overall value

Aka "Metcalfe's law" -- n squared effect
- "the usefulness, or utility, of a network equals the square of the number of users."
- Bob Metcalfe -- the inventor of Ethernet

Hard to Dislodge - "Inertia"

Once the Network Effect as achieved critical mass, it's hard for a competing standard to become popular. Once the N^2 value has kicked in, it's hard for the small-N competitor to appear at all desirable. A new standard will need to be drastically superior to the old standard to have a chance.
- e.g. No tape format can compete with VHS once network effect has kicked in
- e.g. DVD can displace VHS

Public Standard -- e.g. RFC

Standard -- e.g. RFC
- Freely available, well defined standard.
- Something controlled by one company, kept secret, and changed without notification does not count.
- It's possible for a company owned technology to act as a standard, so long as the information is public and well-defined.

Compatible

It's about being compatible. By being compatible with the standard (which may have some costs) your system now interoperates with everyone else who has volunteered to be compatible with the standard.

Replaceable / Commodity --> Competition

If the standard is working well, then the consumer should be able to replace vendor A's solution with vendor B. This keeps the quality up and prices down. Vendors dislike this somewhat, but it makes the domain more attractive to consumers.

Car example: GM car that only takes GM gas. GM car that works with gas from any company.

n^2 Value

The standards allow separately authored components to interoperate with each other thing -- n^2 connections. We may not know the exact mechanism, but recent history shows that standards based n^2 networks create a lot of value.

Not proprietary

If anyone is free to implement the standard, no one vendor gets to monopolize the value. It's not like there's some "owner" of TCP / IP that gets all the value out of it. The TCP / IP **participants** collectively receive the value of TCP / IP.

vs. Markets

It's hard for vendors driven by market forces to make good standards (even though in reality, the vendors come out ahead once the standard exists).

The TCP / IP, HTTP, email, .. standards ... these were all produced by non-profit groups, often with government funding. I think markets are great for some things, but standards are an interesting and important area they get very wrong.

How The Internet Came About

Short history of the Internet...

N^2 Value available -- there was obviously enormous potential value in connecting all the computers.

Proprietary Failure

IBM, Microsoft, Novell -- they each came up with ways of connecting **their** computers. Trying to create a network effect that included only their brand -- trying to re-create the Win32 money-making franchise. Microsoft in particular has always succeeded by making Microsoft tech work well with other Microsoft tech. The standards based internet goes against the things that have made Microsoft so successful. Nonetheless. Nonetheless, Microsoft has proved it can learn to play under the new rules too (possibly with some monopoly cheating).

Attractive Standards

Homely, ordinary, publicly funded standard like TCP / IP, HTTP, HTML were defined as real standards.

As real public standards, they were attractive to **participants**.

As the number of participants grew, the network effect for TCP / IP, HTTP, etc. etc. grew at the N^2 rate -- at some point they became unstoppable.

Vendors love / hate Standards

Vendors: bad: you are replaceable, you only get your share of the pie, and no monopoly rents. There will be competition.

Vendors: good -- the pie will be very large, and even if you are small, you can break in since your standards-compliant technology will interoperate just as well as the big vendors.

Study Question

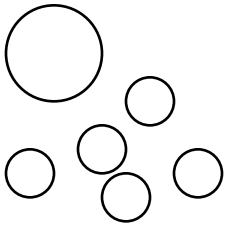
Microsoft writes the OS that runs 90% of the computers on the Internet. Microsoft word has 95% of the word processing market share on those computers. How is it that we are not using some Microsoft networking tech to connect those computers? How it is that we are using the (relatively low-tech) HTML format instead of the .doc? There must be some other force that helps standards like TCP / IP and HTML succeed.

Network Effect Marketing

Suppose we are in a domain with powerful network effects.

1. Proprietary / non-compatible

Vendors could all be not-compatible with each other. This follows the vendor's natural instinct (just like the prisoners dilemma)...



Balkanized -- value is being lost

Consumers don't know which to pick, and network effect is squandered.

e.g. mem cards: Compact flash, vs. SD, vs Smart Media, vs. Memory Stick

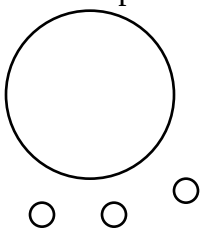
2. Monopoly

A vendor would love the outcome where the one vendor gets a large enough market share that network effect kicks in for them -- they get big, everyone else gets small.

e.g. Win32

Every vendor would love to do this if possible.

The market size is a little limited -- the vendor extracts extra profits, produces a lamer product, etc. etc. since the network effect prevents competition.



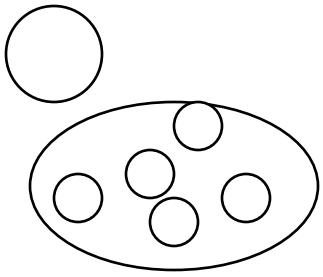
Cooperative Standard

Many vendors could agree to be compatible with each other. This is not an easy step for the vendors (e.g. Compact Flash above)

This magnifies the network effect -- vendor A does not just work with vendor A. Now A works with A, B, C, ... -- so the network effect is a function of the sum of their sizes.

The small guys think this is a big improvement.

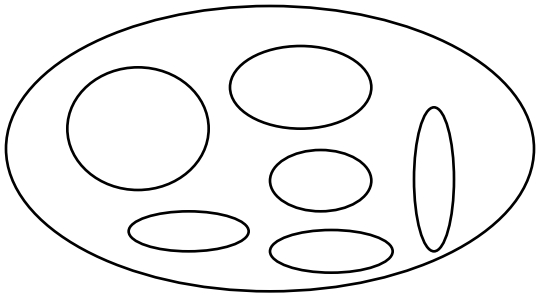
If a vendor was near to getting a monopoly, they will hate this idea.



e.g. instant messaging: AOL (the largest) does not cooperate with messaging standards, but the smaller players (Jabber, etc.) do

Cooperative Standard Outcome

The cooperative standard gets big enough for the network effect to kick in. The overall market gets bigger, since competition keeps quality high and prices low, and customers are not afraid of vendor lock-in.



Cooperative Result

The vendors have to share the market with the other vendors
But the market is very healthy -- it's attractive to the customers, so it gets bigger.
To the vendors, this is not as good as getting a monopoly, but it's still a good "2nd best" outcome.
For the users of the technology, this is a great outcome. It makes the market large (lots of network effect) while still forcing the vendors to compete (high quality, low prices).

How TCP/IP, HTTP, etc. won...

Theory 1 - Enlightened Vendors

Enlightened vendors. They knew about prisoners dilemma, and chose to cooperate -- create the large market and compete with in. The "unenlightened" strategy was to just all remain incompatible.

Theory 2 - Demanding Customers

Demanding customers. The customers also know about network effects. Therefore, they are demanding to their vendors.
e.g. would you buy a GM car that only ran on GM gasoline?
Customers demand standards-compliant solutions, since that keeps the vendors replaceable -- i.e. keeps competition going.
Customers avoid "vendor lock in"

Theory 3 - Network Effect Snowball

Public standards are attractive to participants, even little ones.
Participation is what drives the network effect
Perhaps this leads to a "snowball" effect where the market sum of all the little participants tends to pull in more participants and so make better use of network effect than any one vendor. Eventually, the standard is so big, the vendors must comply (theory 2). This theory does not depend on the vendors being enlightened. The participants are naturally drawn to the standard, and network effect drives the outcome from there. A vendor can resist this is they have a monopoly already (e.g. Win32).

Theory 4 - Engineers

Maybe anonymous engineers implement to the standard, even if it is not in their company's self-interest, because the engineers realize that it's globally the "right" thing. A "standards" ethos.