"The Once and Future Web"

Scientific American Bright Horizons

Jan-Feb 2008

Bebo White

bebo@slac.stanford.edu

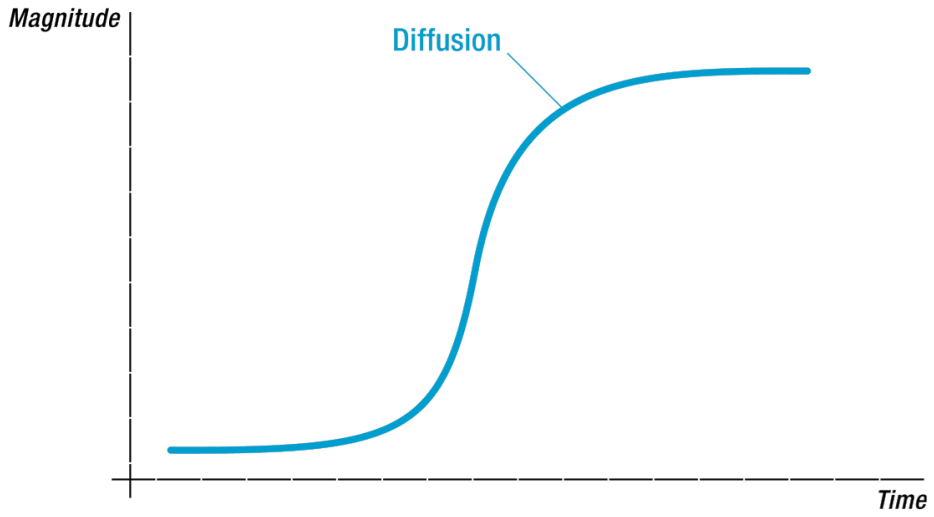
Caveats

- I am not a historian
  - But happened to be around during early Web history
- I am not a technology futurist
  - But happen to be involved with organizations shaping the Web's future

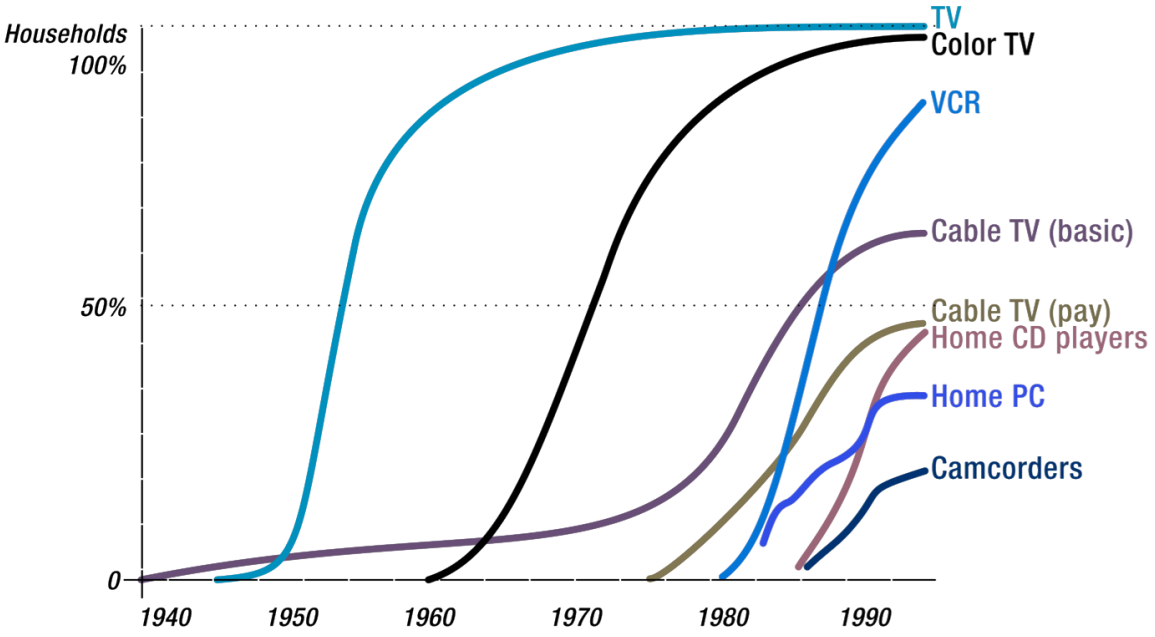
Diffusion Models – Tools for Forecasting

- Models can be
  - Quantitative – based on mathematics/statistics – Rogers' S-Curve
  - Quasi-qualitative – conceptually founded – Gartner Group Hype cycle

The Rogers' S-Curve of Technology Adoption



S-Curve Examples



Ref: Paul Saffo

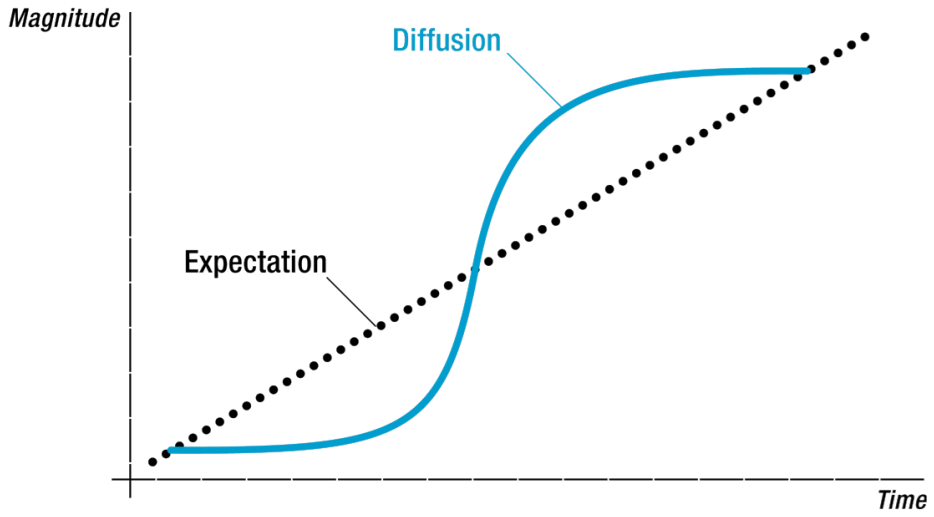
Another Example is the Cell Phone

- Basic concept introduced in 1947!
- Problems with technology and FCC restrictions
- Star Trek (1966-69) - communicator
- First call in April 1973 by Cooper and Engel
- First commercial cell system in Tokyo in 1979
- 1982 – FCC finally authorized commercial cell service in the US
- Growth exploded; now ubiquitous (diffuse); "the device formerly known as the cell phone"

What Can the S-Curve Tell Us About the Future of the Web?

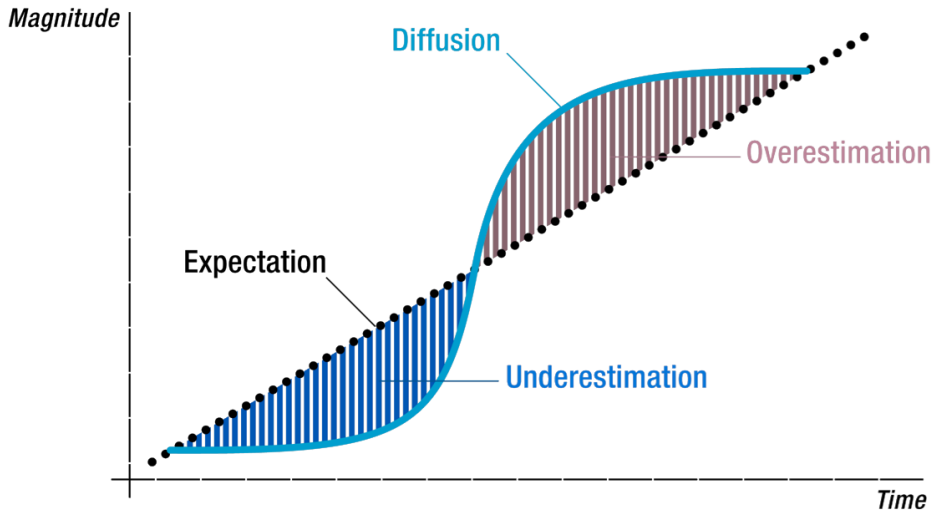
- It depends upon where we are on the curve – are we at the plateau?
- What is our perception of diffusion? Acceptance? Ubiquity? How are people using the Web? How do they want/expect to use the Web?
- Is the Web successful?
- What are the intra-technology relationships/dependencies? –Web and PC, Web and TV, Web and mobile phone; how do the diffusions correlate?
- If the S-curve is fractal, have we only reached one step of the Web's future?

We Tend to Predict Linearly



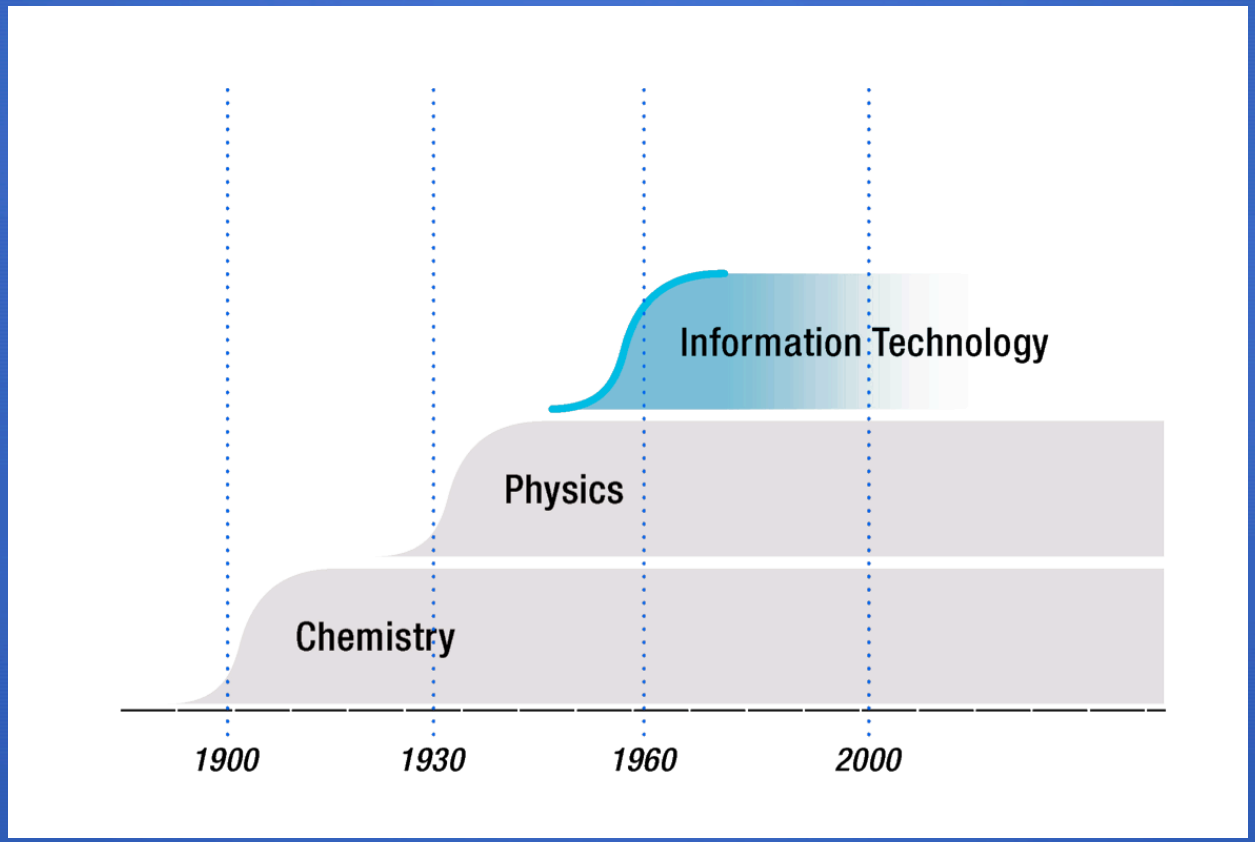
Ref: Paul Saffo

Underestimation and Overestimation



Ref: Paul Saffo

S-Curves and New Eras of Technology

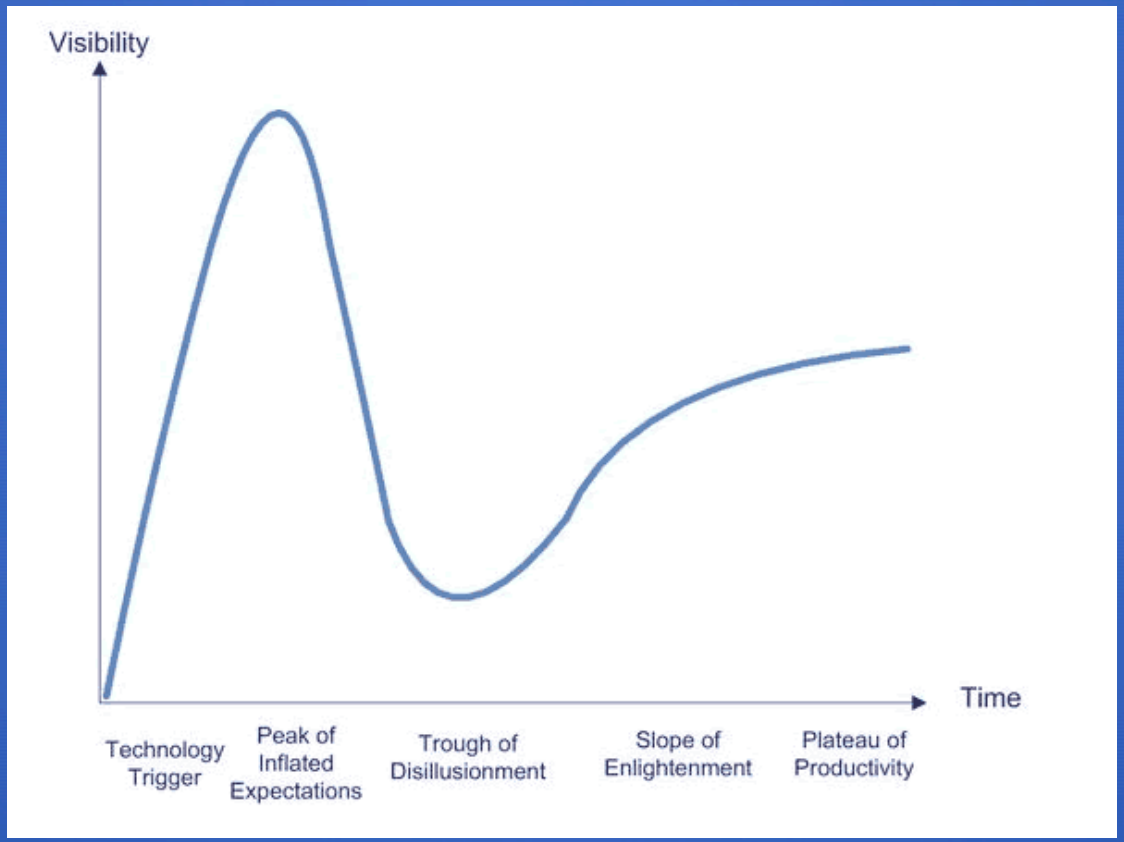


Ref: Paul Saffo

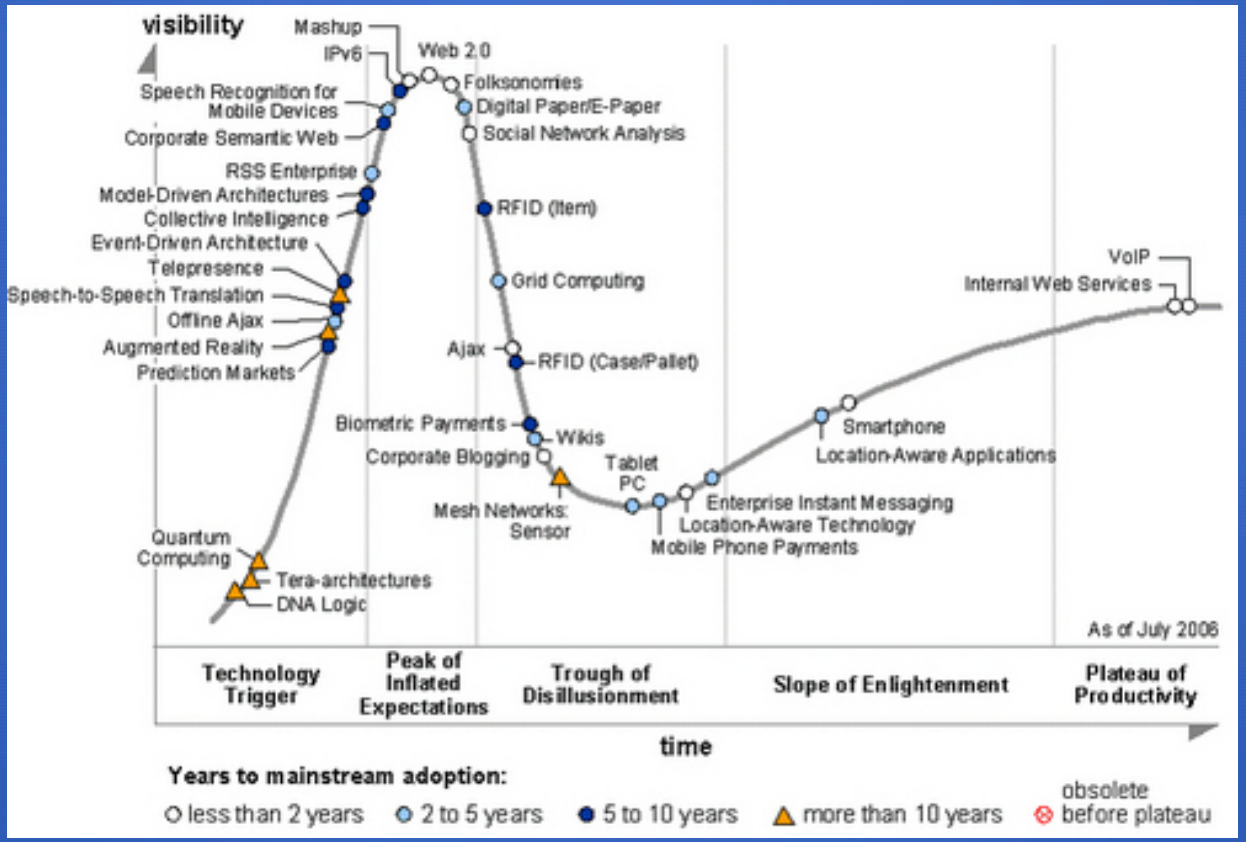
The Information Revolution is Over!

- We won!
- The Web was our secret weapon
- Information is no longer scarce but ubiquitous
- It has become media
- But it can't (IMHO) be explained merely by the S-curve
- Where is the Web on the S-curve? It has not become invisible

Gartner Group "Hype Cycle"

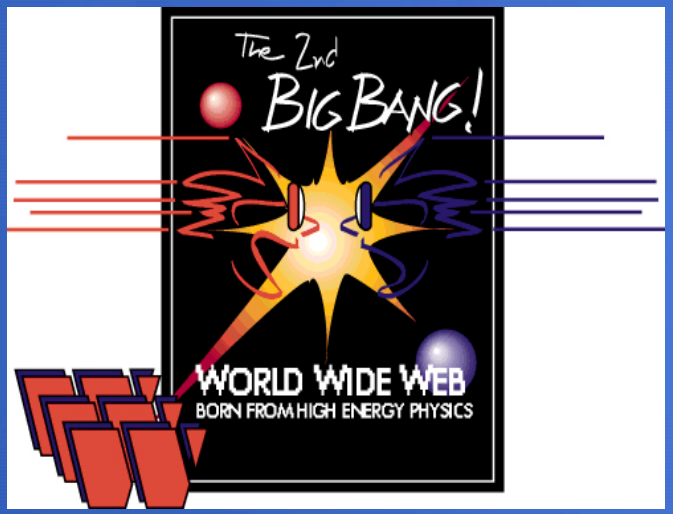


How Much of the Web is Hype? (1/2)



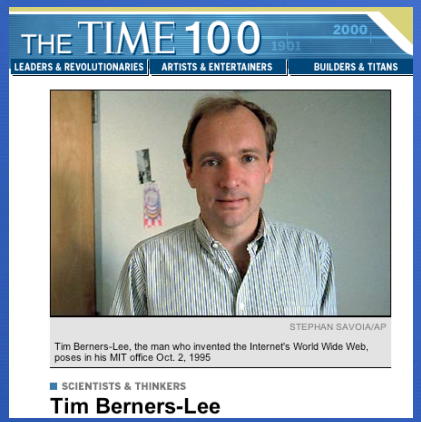
How Much of the Web is Hype? (2/2)

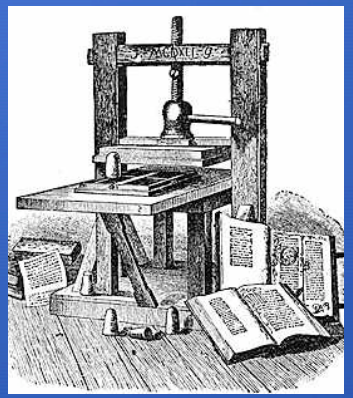
The Web has Seen Hype and Disillusionment



"The first generation of the Web was largely about throwing silly ideas against the wall and seeing what stuck (or at least what attracted enough venture capital to keep Web entrepreneurs in Herman Miller chairs and chai lattes).

---Dan Tynan





San Antonio Hypertext Conference - 1991

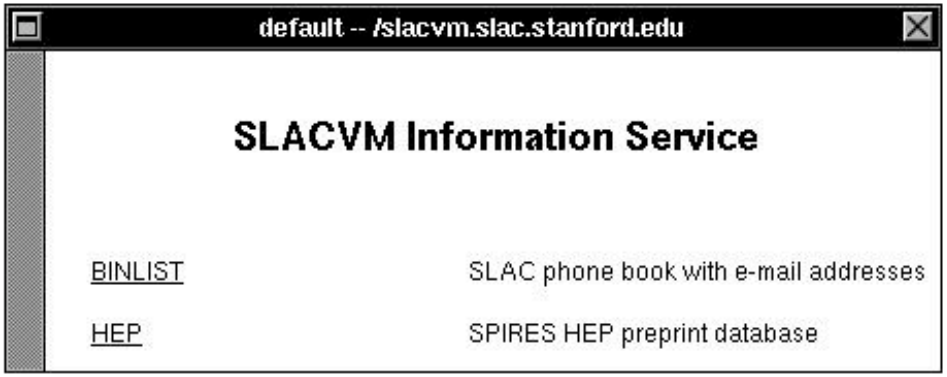
Four days before this photo (12/12/91) the first US Web server was installed at SLAC

The First SLAC Page

DEFAULT.HTML page

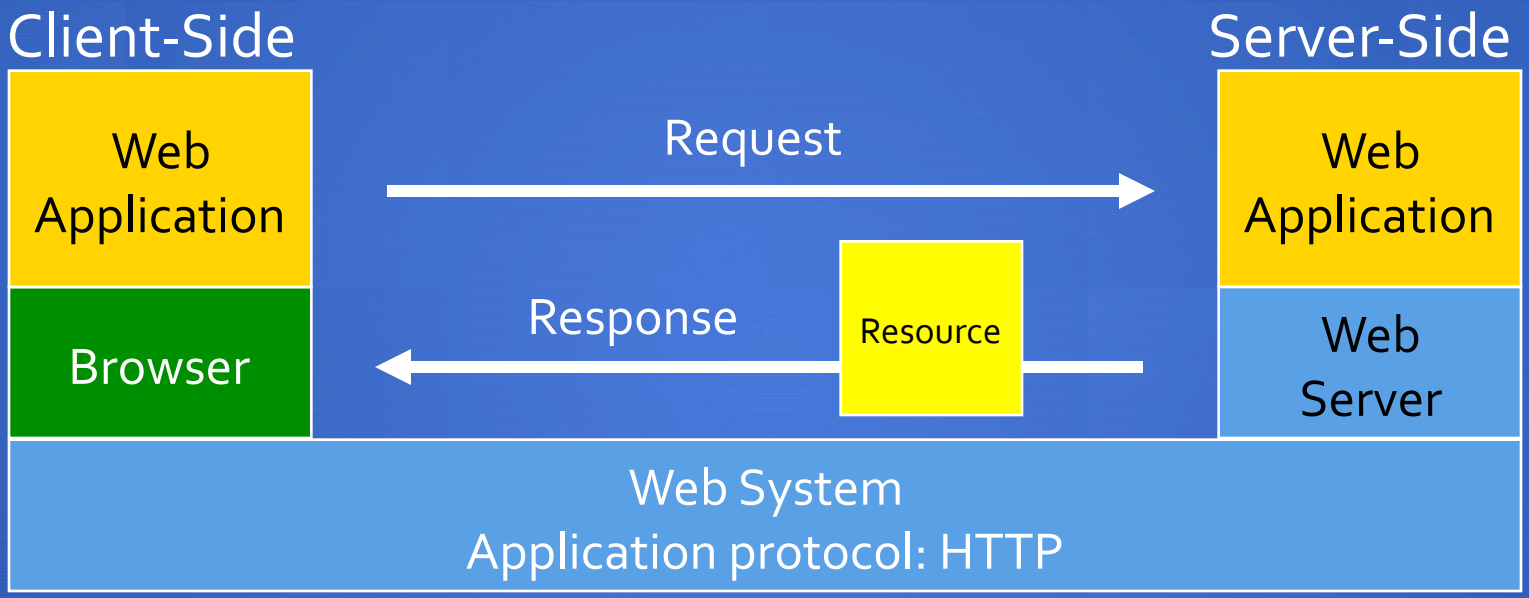
SLAC VM was the mainframe computing system at SLAC in 1991.

BINLIST was the online directory of staff, faculty, and high-energy physics correspondents' names and contact information.



This was incredible, but no one realized it!

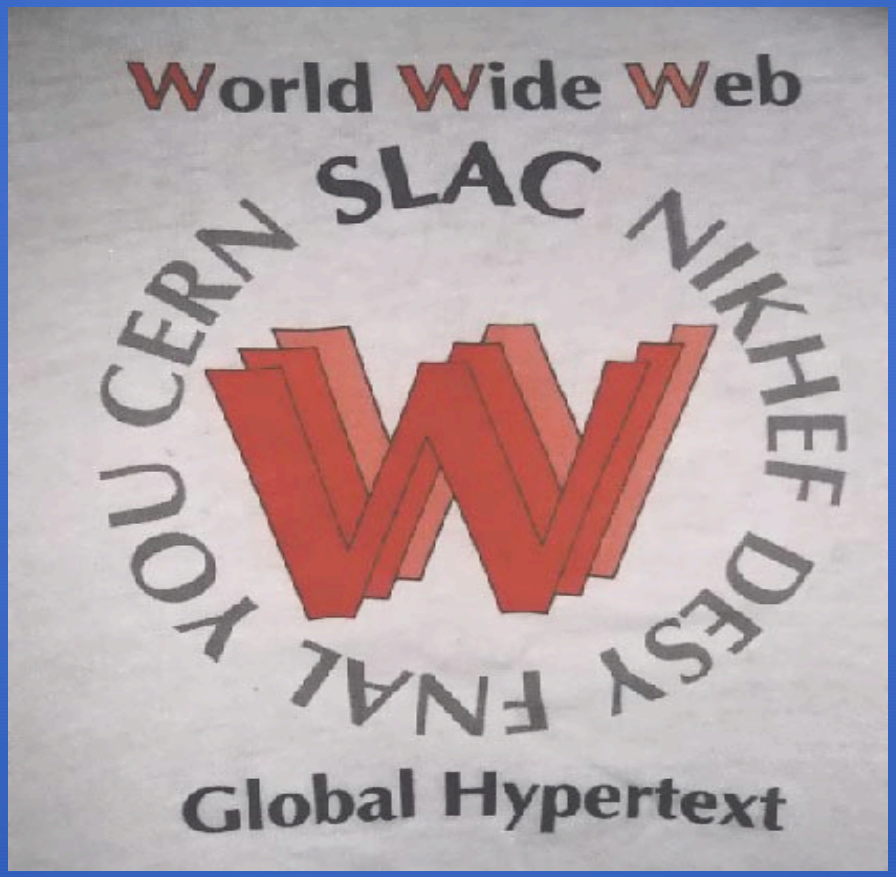
1st Generation Web System



- Browser
  - CERN, Midas, etc.
  - HTML
  - Helper applications
- Web System
  - HTTP
- Web Server
  - HTTP
  - Filesystem
  - Database
  - Information system

FREE! Server and browser code could be downloaded by anyone

The First Web T-Shirt



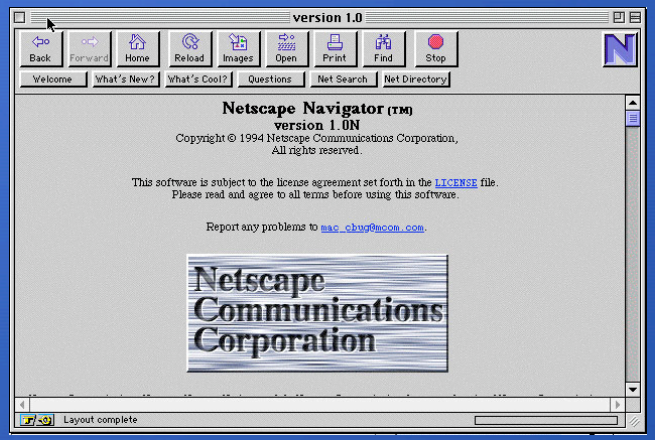
Today's Web T-Shirt

Today's Web T-Shirt

- 155,230,051 Web sites (news.netcraft.com – 12/07
- 45,045.045 sites/square inch
- 212.23 sites/inch

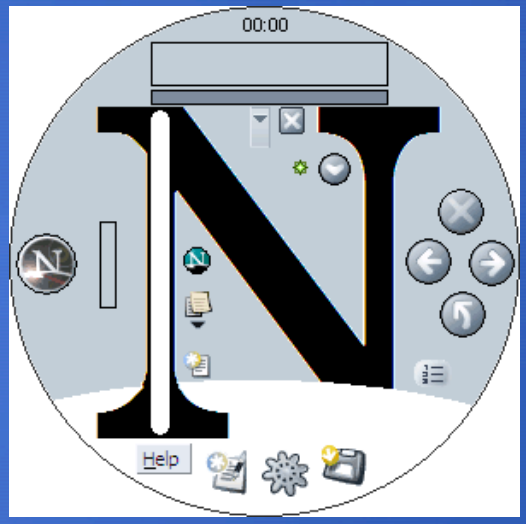
The Web Takes Off (1/3)

- February, 1993 – the Mosaic browser
- April, 1993 – the NCSA Httpd server
- Netscape



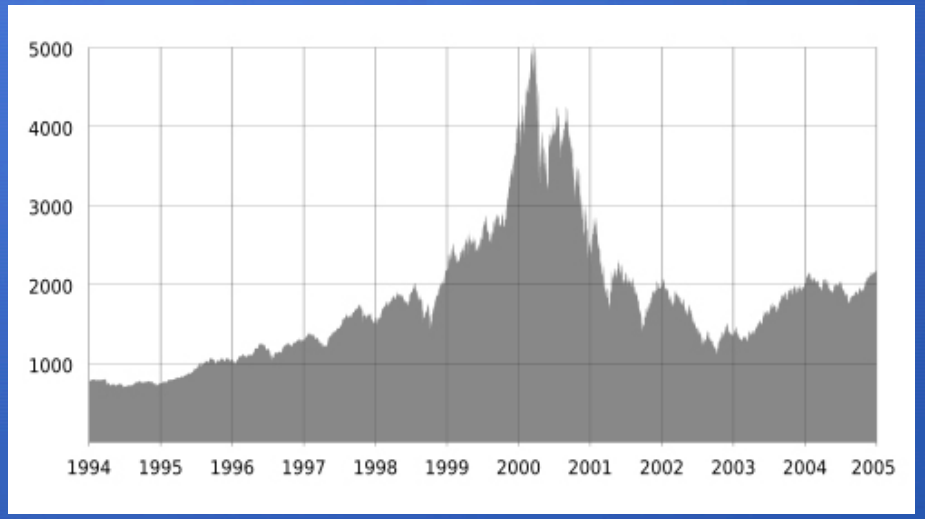
The Web Takes Off (2/3)

- February, 1993 – the Mosaic browser
- April, 1993 – the NCSA Httpd server
- Netscape
  - IPO announced 11/95
  - No profitable quarter
  - Priced at $28 (typical tech was $15)
  - Opened at $71, peaked at $75, closed at $58
- The Internet "big bang" had begun!

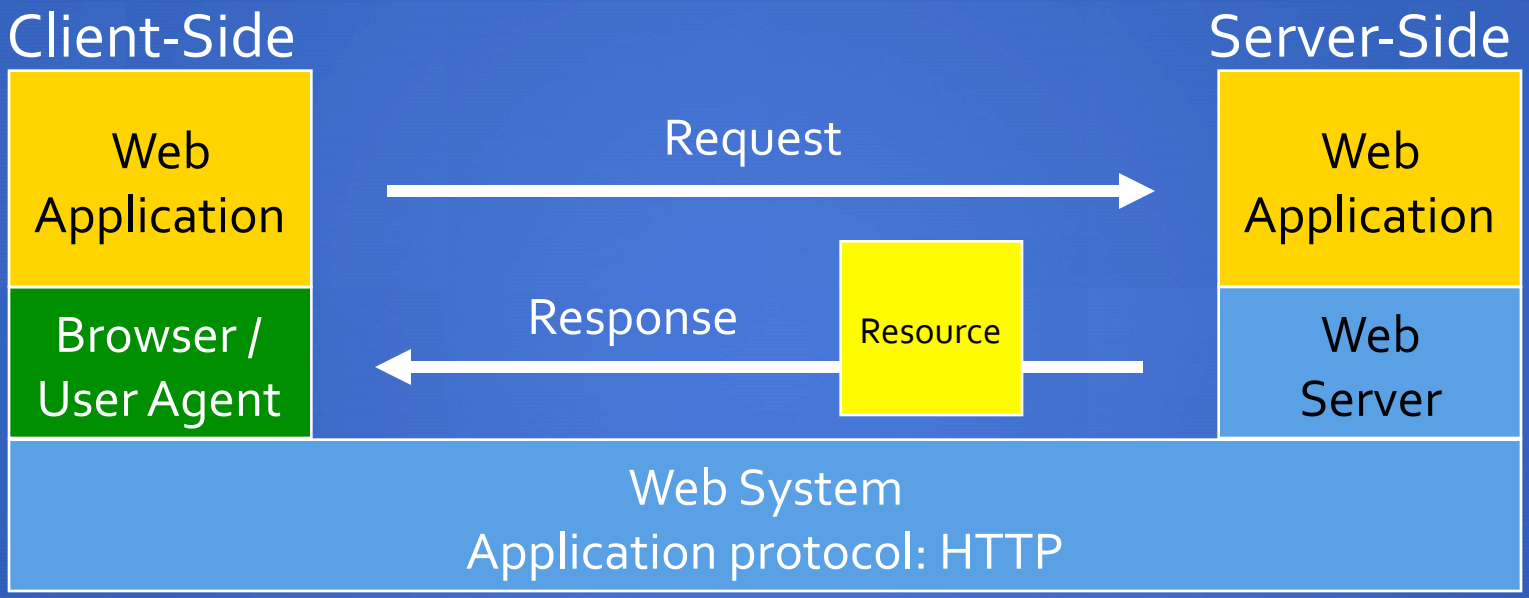


The Web Takes Off (3/3)

- March, 2000 – Yahoo! Hits a market value of $104 billion – greater than the entire US auto industry, parts suppliers included
- The browser wars



2nd Generation Web System

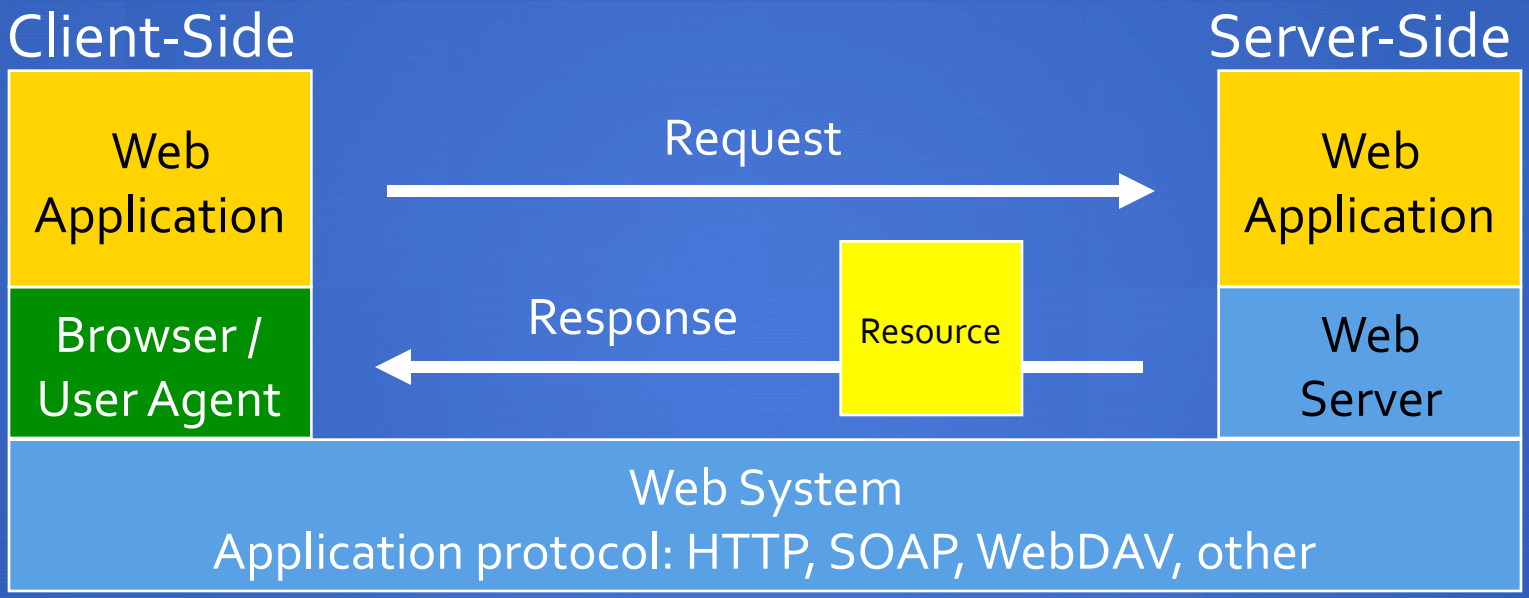


- Browser
  - Mosaic, Netscape
  - HTML, Frames
  - Images
  - HTML-Forms
  - Helper
    - Audio, Video etc.
- Web System
  - HTTP
  - Cookies
- Web Server
  - HTTP
  - Server-API & CGI
    - Database
    - Information Systems
    - Media Server

The Web Has Been Struggling to Define Its Future

- The "dot.com bust" – what is the Web good for?
- User reaction/involvement – e.g., Web 2.0
- Standards vs. Growth (W3C vs. Designers)
- The "Media Revolution" has succeeded the "Information Revolution"
- Portable devices with rich interfaces must be a part of the Web's future
- Where is the Web on the S-curve or the Hype Cycle?
- Are we headed for another bust?

3rd Generation Web System



- User Agent
  - IE, Firefox, and PDA-Browser etc.
  - Other Types of User Agents (indexers)
  - Plug-Ins, Applets, ActiveX
  - Script-Code
  - Ajax, More...
- Web System
  - HTTP, WebDAV, SOAP, other
  - Cookies
  - UDDI
  - Other relevant protocols FTP, SMTP
  - More...
- Web Server
  - HTTP, more
  - Server-API & CGI
  - XML-Support
  - Component-Support
    - Servlets
    - Web-Services

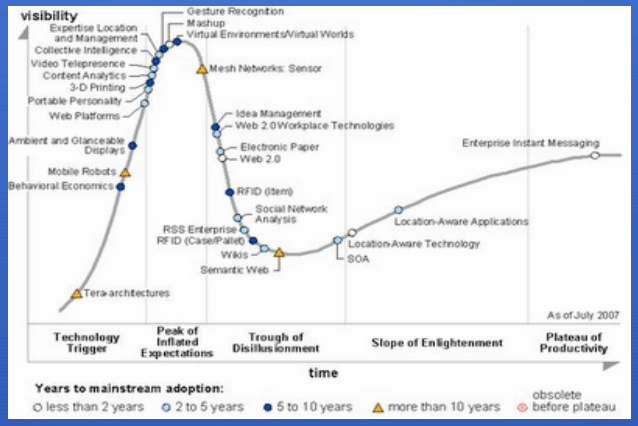
What is the Future Web?

"If I were to guess what Web 3.0 is, I would tell you that it's a different way of building applications… My prediction would be that Web 3.0 will ultimately be seen as applications which are pieced together. There are a number of characteristics: the applications are relatively small, the data is in the cloud, the applications can run on any device, PC or mobile phone, the applications are very fast and they're very customizable. Furthermore, the applications are distributed virally: literally by social networks, by email. You won't go to the store and purchase them… That's a very different application model than we've ever seen in computing."

---Eric Schmidt, CEO, Google

Major Drivers of the Future Web

- Web 2.0 – user and community driven, rich interfaces and applications, mobile, and all that means
- The Semantic Web – knowledge and agent driven and all that means
- Web Services – Service-oriented architectures (SOA) and all that means



What is Web 2.0?

"Putting The 'We' in Web"

'…the Living Web'

---Newsweek, 4/3/2006

(Andy Budd)

What Web 2.0 is Not

- The Semantic Web (though there are some crossovers)
- A new collection of technologies (though there are new applications of existing technologies)
- Just blogging, wikis, AJAX, mashups, and RSS

Web 2.0 is Happening

Logos of start-ups "claiming" to be Web 2.0

Web 2.0 By Example

Web 1.0	Web 2.0
Personal Web Sites	Blogs
Britannica Online	Wikipedia
Content Management Systems	Wikis
Directories (Taxonomy)	Tagging ("Folksonomy")
Screen Scraping	Web Services
Etc.	Etc.

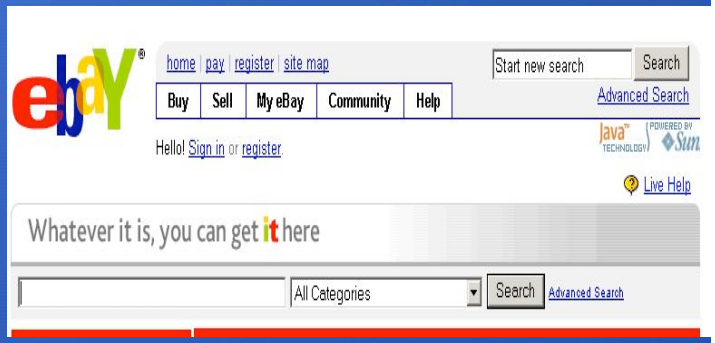
(from Tim O'Reilly)

Web 2.0 Drivers - Technology

- Computing power
  - Still doubling every 18 months
  - PC-based data centers
- Connectivity
  - Low cost, broad reach Internet
  - Wireless, broadband access
- Device proliferation
  - PDAs, cell phones, etc.
  - Towards a digital devices decade
- Internet standards
  - XML-based integration
- User Interface
  - Many possibilities

Web 2.0 Drivers - Environmental

- The "dot-com" collapse forced a Web re-examination
- The "long tail" – the collective power of small sites that make up the bulk of the Web's content
- The Web reached a critical mass of
  - (Good) information content sources
  - Use (and desire for reuse)
  - Trust
- Web users developed an expectation of fulfillment



So, What is Web 2.0? (1/2)

- Definition is still evolving…
- A marketing term, a buzzword, but moreover an *ATTITUDE*
- Shifts the focus to the user of the information, not the creator of the information
- Information moves "beyond" Web sites
- Information has properties and these properties follow each other and find relationships
- Information comes to users as they move around

So, What is Web 2.0? (2/2)

- Information is broken up into "microcontent" units that can be distributed over many domains
- Interaction is no longer limited to (X)HTML
- Users are able to control how information is categorized and manipulated
- User agent becomes a "fat" rather than "thin" client
- Requires a new set of tools to aggregate and remix microcontent in new and useful ways

The Big Ideas of Web 2.0

- Fresh, useful data is the core
- The ability for other parties to manipulate that data
- "Living" applications that can be easily adapted
- Harnessing the collective experience
- "The Web as a platform," independent of user platform
- Primary focus of participation, rather than publishing
- Trusting of users to provide reliable content

What is Web 2.0 Again? (1/2)

"Web 2.0 is a set of economic, social, and technology trends that collectively form the basis for the next generation of the Internet – a more mature, distinctive medium characterized by user participation, openness, and network effects"

----"Web 2.0, Principles and Practices," O'Reilly Media

What is Web 2.0 Again? (2/2)

"The tool that makes this possible is the World Wide Web. Not the Web that Tim Berners-Lee hacked together (15 years ago, according to Wikipedia) as a way for scientists to share research. It's not even the overhyped dotcom Web of the late 1990s. The new Web is a very different thing. It's a tool for bringing together the small contributions of millions of people and making them matter. Silicon Valley consultants call it Web 2.0, as if it were a new version of some old software. But it's really a revolution."

---TIME magazine, 12/27/06

What is the Semantic Web?

- The Semantic Web is an evolving extension of the Web in which Web content can be expressed not only in natural language, but also in a format that can be read and used by software agents, thus permitting them to find, share and integrate information more easily
- At its core, the Semantic Web is comprised of a philosophy, a set of design principles, collaborative working groups, and a variety of enabling technologies. Some elements of the Semantic Web are expressed as prospective future possibilities that have yet to be implemented or realized. Other elements of the Semantic Web are expressed in formal specifications
- "The Semantic Web," Scientific American, September 2001, is one of the most often cited references

Semantic Web Drivers

Static

Serious Problems in

- Information retrieval
- information extraction
- information representation
- information interpretation
- information maintenance

microformats

Web IR & IE

W3C Semantic Web

WWW
URI, HTML, HTTP

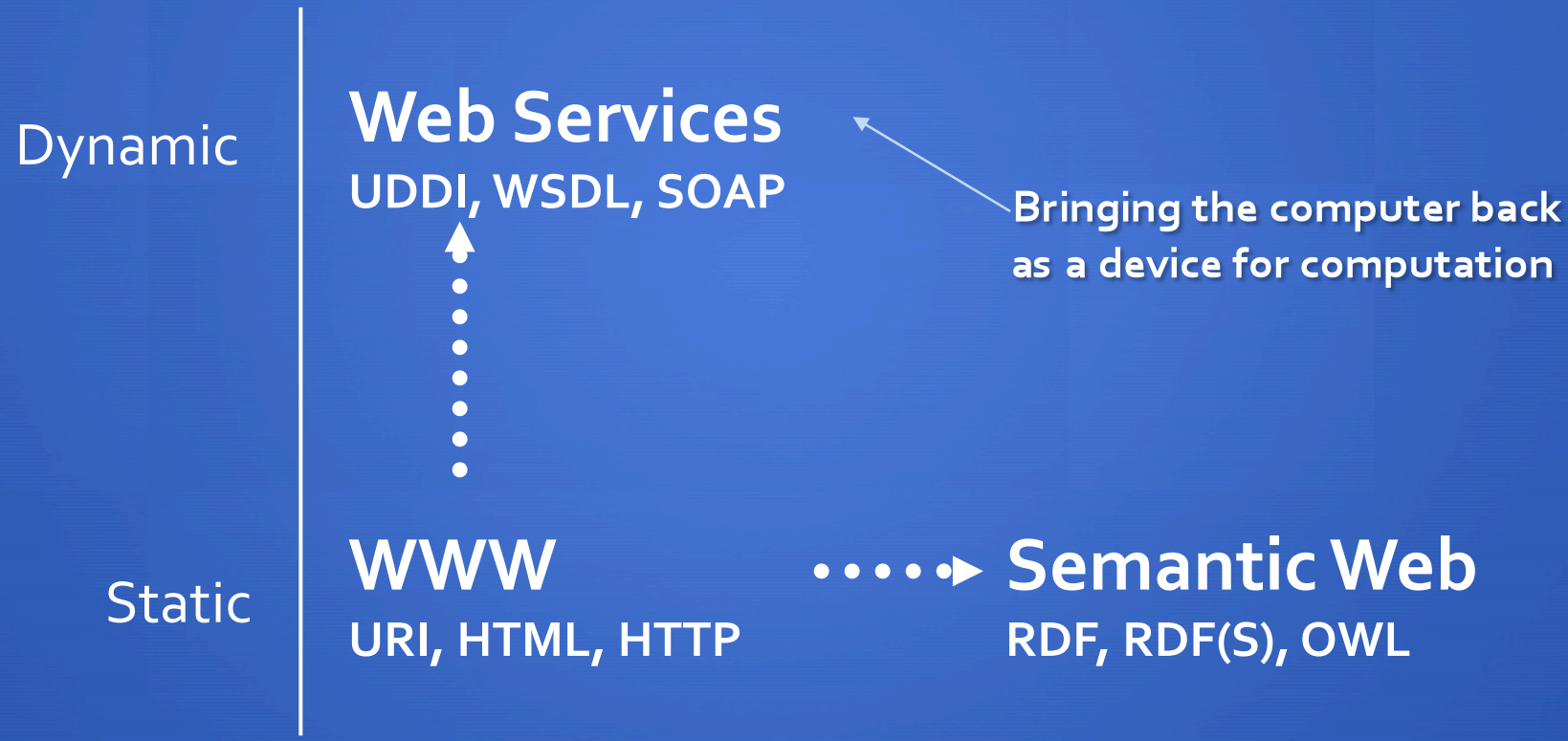
Semantic Web
RDF, RDF(S), OWL

Strong commitment to standards

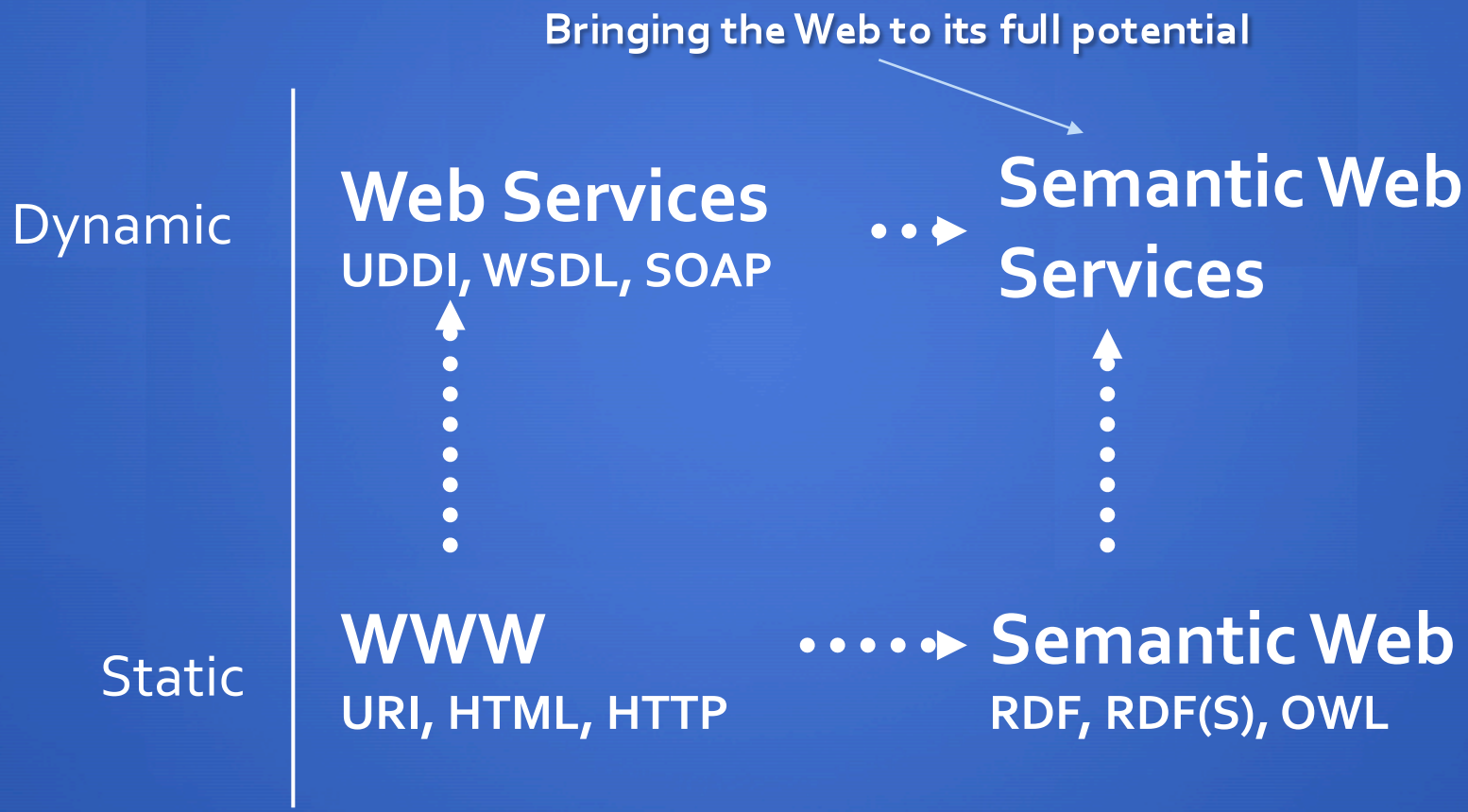
The Big Ideas of the Semantic Web (1/3)

- Information has "machine processable" and "machine-understandable" semantics
- Can be built upon the framework of the existing Web technology
- Ontologies are the basic building block of a semantic Web

The Big Ideas of the Semantic Web (2/3)



The Big Ideas of the Semantic Web (3/3)



Ontologies and Taxonomies (1/2)

- Much confusion with usage of terms *ontology* and *taxonomy*
- Ontology
  - What exists in a domain and how they relate with each other; commonly available set of definitions and concepts
  - (Formal ontology) - Formal treatment of the concepts and relationships in a domain
- Taxonomy
  - Classification in a hierarchical structure
  - Classifies according to properties internal to the data

Ontologies and Taxonomies (2/2)

- Taxonomy = simple ontology
- *"Ontologies are machine-readable sets of definitions that create a taxonomy of classes and subclasses and relationships between them."* – W3C WebOntology Working Group

Purposes of Ontologies

- Basis for communication
  - Between people (may be informal)
  - Between agents (formal ontologies)
- Applications
  - Representing and storing data (e.g., DB schema)
  - Knowledge sharing within and between domains
  - Search and retrieval
  - Software development
  - Classification and organization of data resources
  - Establishing contracts
  - Policy enforcement

Criteria for Introducing Ontologies

- Large amounts of data
  - Data available on the Web
  - Data acquired or generated by new techniques
- Complex data structures
  - Inheritance, containment and other hierarchies
  - Many relationships
- Diverse sources
  - Many legacy systems
  - Sources on the Web using different formats
- Requirement for formal proofs
  - Contracts and policy enforcement

Ontology Example

Concept

conceptual entity of the domain

Property

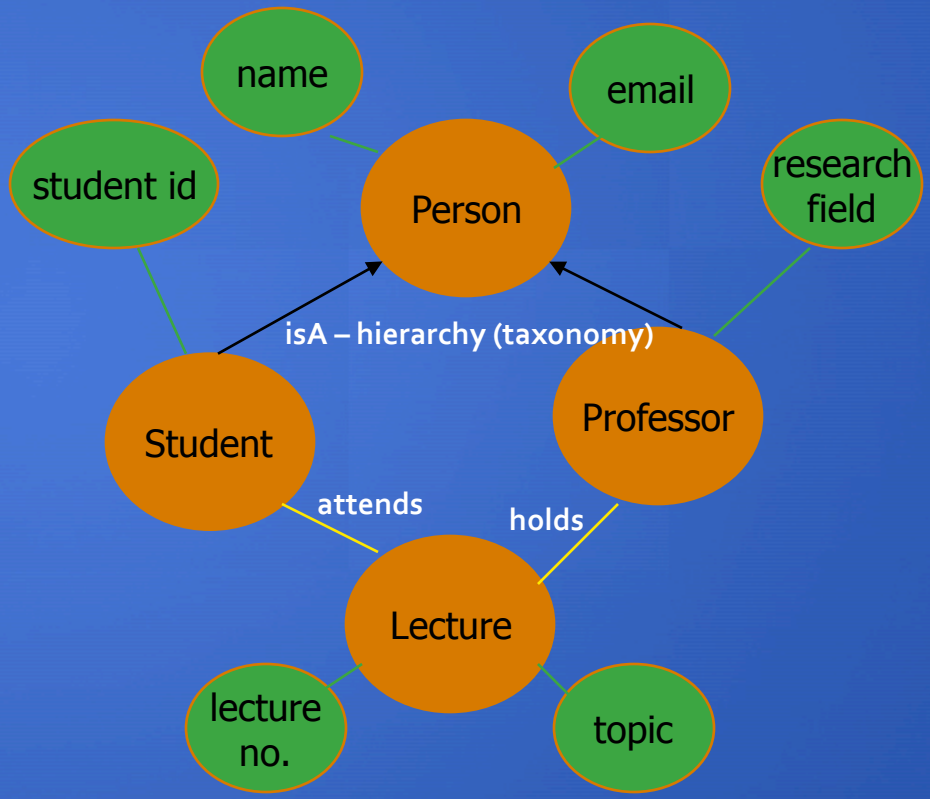
attribute describing a concept

Relation

relationship between concepts or properties

Axiom

coherency description between Concepts / Properties / Relations via logical expressions



holds(Professor, Lecture) =>
Lecture.topic = Professor.researchField

Ontology Technology (1/2)

- Ontology languages
  - Expressivity
  - Reasoning support
  - Web compliance
- Ontology reasoning
  - Large scale knowledge handling
  - Fault-tolerance
  - Stable and scalable inference machines

Ontology Technology (2/2)

- Ontology management techniques
  - Editing and browsing
  - Storage and retrieval
  - Versioning and evolution support
- Ontology integration techniques
  - Ontology mapping, alignment, merging
  - Semantic interoperability determination

Ontologies and Folksonomies

- "A folksonomy is an Internet-based information retrieval methodology consisting of collaboratively generated, open-ended labels that categorize content such as Web pages, online photographs, and Web links".
  - *Thomas Vander Wal*
- The main difference from formal knowledge models like ontology:
  - Subjective view (community-based)
  - Uncontrolled vocabulary
  - Poor structure

Myths About the Semantic Web

- *"The Semantic Web is metadata for classifying documents"*
- *"The Semantic Web is about hand-annotated Web pages"* – Such pages are interesting, but not the mainstay of Semantic Web; too much trouble!
- *"The Semantic Web is mainly about content extracted from text"* – No, it is primarily an interlingua for relational data and logic. Bridges will always be important
- *"The Semantic Web is about making one big ontology"* – The Semantic Web is about a fractal mess of interconnected ontologies….
- *"The Semantic Web ontologies must all be consistent"* – Only the parts that are being used together

(From Tim Berners-Lee)

AI in the Future Web (1/2)

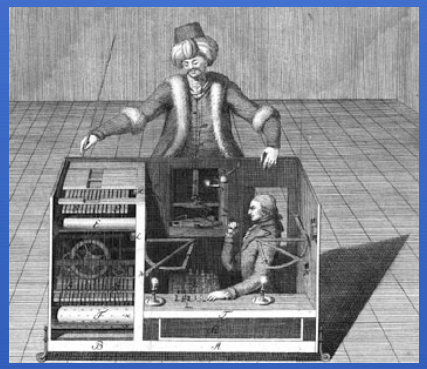
- It is easy to speculate about the role of AI in the future Web
- The Semantic Web can be an AI "playground" with large, structured knowledge bases available to AI agents

askville BETA by amazon

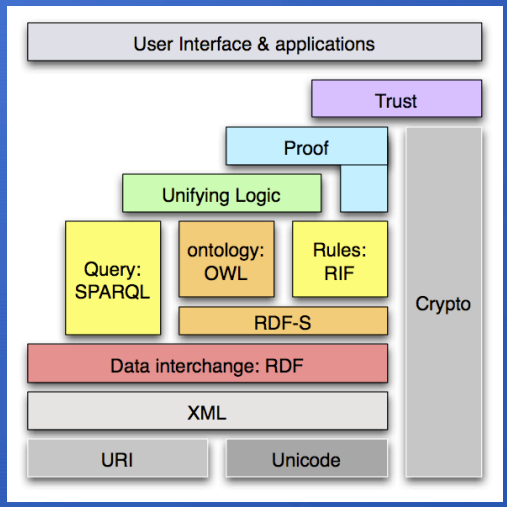
ask ... answer ... meet ... play

amazon mechanical turk beta

Artificial Artificial Intelligence



Google Book Search BETA



AI in the Future Web (2/2)

- Natural Language Processing (NLP) has been a goal for many years – e.g., "Ask Jeeves"
- AI and Search
  - "When I'm typing, I want the computer to show me what I should be typing"
  - "When you search if you get more than one answer, that's a bug. We should give you one answer, what you meant, and in your language. This will happen, but maybe not in my lifetime…"

3D, Real and Virtual Worlds and the Future Web?

- A natural result of rich interfaces, community participation, and AI
- Consider the popularity of Google Earth, WoW, and Second Life
- Existing problems with latency and bandwidth should go away

web|3D CONSORTIUM

SECOND LIFE

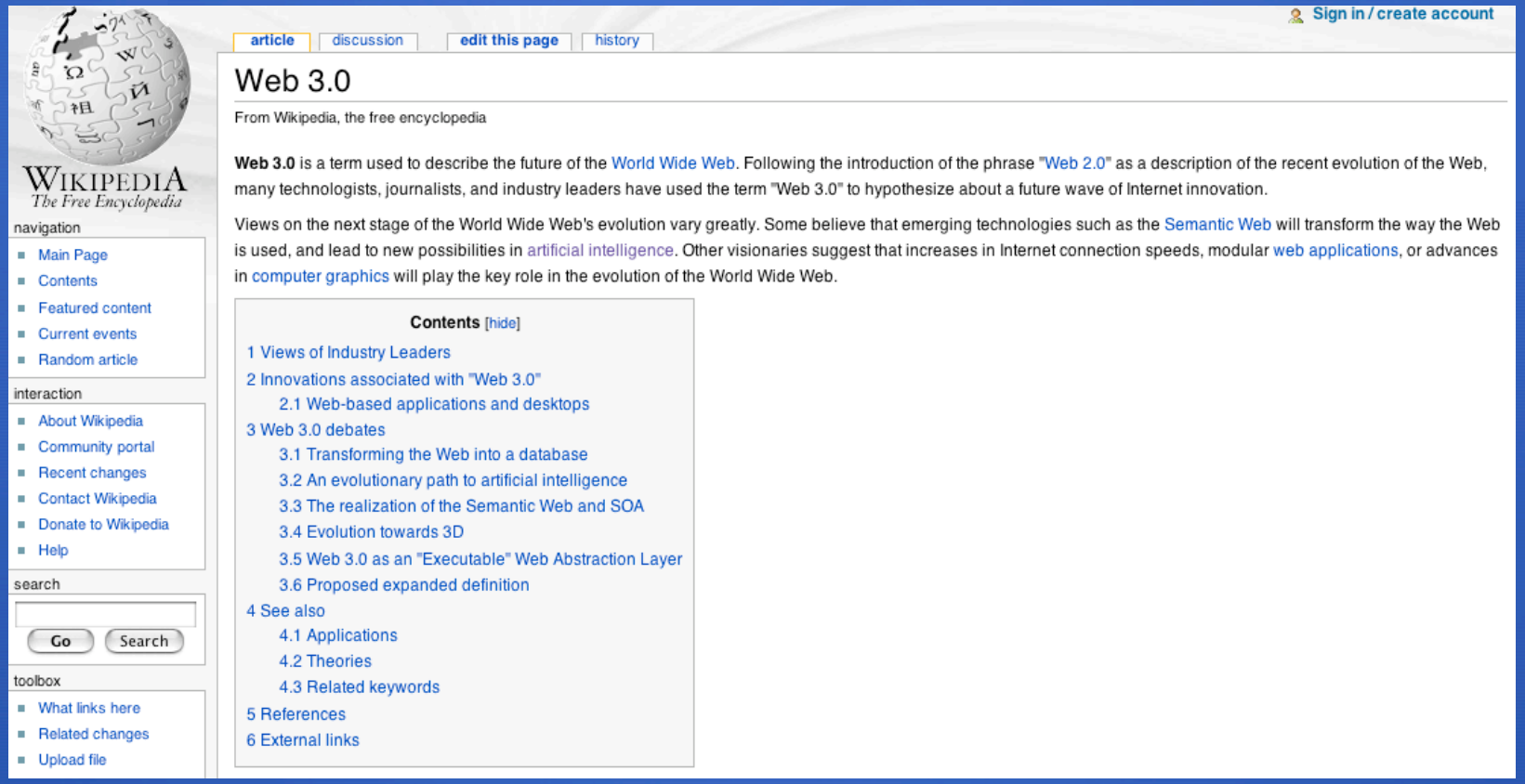
Google Earth

Real Companies in Second Life

"By the end of 2011, 80% of active Internet users (and Fortune 500 enterprises) will have a 'second life', but not necessarily in Second Life."

---April 2007, Gartner Inc.

These are Only a Few Things That *Might* Appear in the Future Web



WIKIPEDIA
The Free Encyclopedia

navigation
- Main Page
- Contents
- Featured content
- Current events
- Random article

interaction
- About Wikipedia
- Community portal
- Recent changes
- Contact Wikipedia
- Donate to Wikipedia
- Help

search
Go Search

toolbox
- What links here
- Related changes
- Upload file

Sign in / create account

article | discussion | edit this page | history

Web 3.0

From Wikipedia, the free encyclopedia

Web 3.0 is a term used to describe the future of the World Wide Web. Following the introduction of the phrase "Web 2.0" as a description of the recent evolution of the Web, many technologists, journalists, and industry leaders have used the term "Web 3.0" to hypothesize about a future wave of Internet innovation.

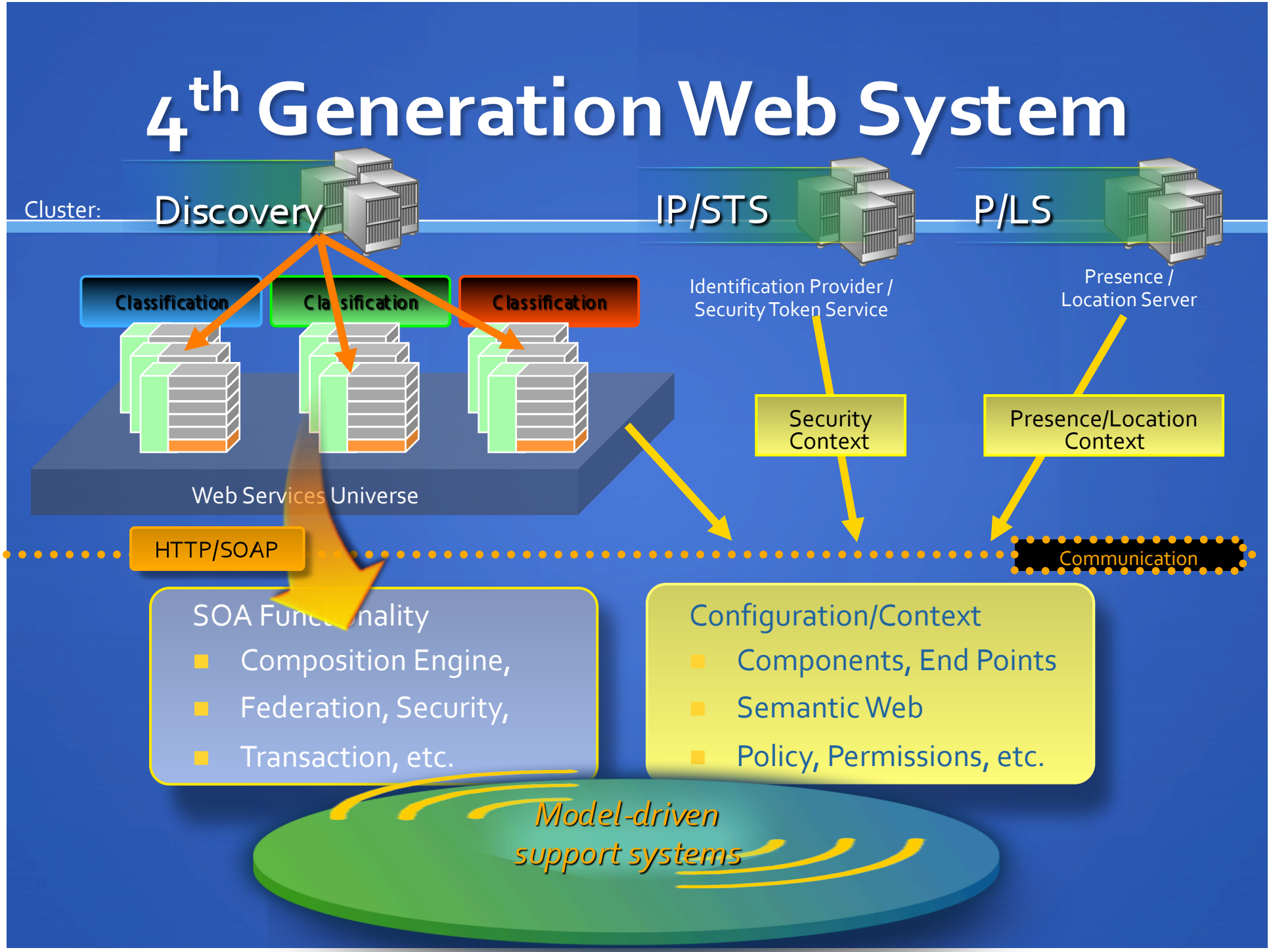
Views on the next stage of the World Wide Web's evolution vary greatly. Some believe that emerging technologies such as the Semantic Web will transform the way the Web is used, and lead to new possibilities in artificial intelligence. Other visionaries suggest that increases in Internet connection speeds, modular web applications, or advances in computer graphics will play the key role in the evolution of the World Wide Web.

Contents [hide]

1 Views of Industry Leaders
2 Innovations associated with "Web 3.0"
  2.1 Web-based applications and desktops
3 Web 3.0 debates
  3.1 Transforming the Web into a database
  3.2 An evolutionary path to artificial intelligence
  3.3 The realization of the Semantic Web and SOA
  3.4 Evolution towards 3D
  3.5 Web 3.0 as an "Executable" Web Abstraction Layer
  3.6 Proposed expanded definition
4 See also
  4.1 Applications
  4.2 Theories
  4.3 Related keywords
5 References
6 External links

So How Might the Future Web Work?

4th Generation Web System



But That's Just the Technology the Future Web Might be Built Upon…

Applications

- It's the applications that make the Web
- It's the killer applications that make the Web diffuse
- It's also the killer applications that generate the hype
- What was the killer app of Web 1.0?

Killer Apps

- It's the killer applications that make the Web diffuse
- It's also the killer applications that generate the hype
- What was the killer app of Web 1.0?
  - I think forms, CGI, and SSL
  - They drove e-commerce
  - Browsers were certainly killer apps

What's the Killer App of the Future Web?

- Maybe there won't be one
  - The technology will "stand on it's on"
  - "The death of the browser"

What's the Killer App of the Future Web?

- Maybe there won't be one
  - The technology will "stand on it's on"
  - "The death of the browser"
- My guess is that semantics + mobility + personalization will lead to numerous killer apps
  - Think searching, education, entertainment, science

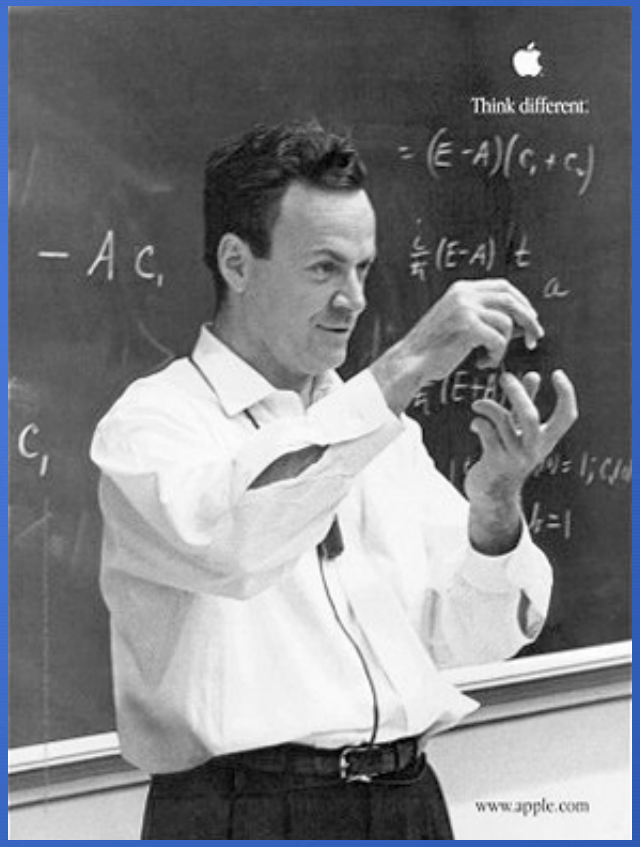
What's the Killer App of the Future Web?

- **Maybe there won't be one**
  - The technology will "stand on it's on"
  - "The death of the browser"
- **My guess is that semantics + mobility + personalization will lead to numerous killer apps**
  - Think searching, education, entertainment, science
- **Tim B-L once said that the days of the Web are numbered**
  - It will disappear into the background
  - The Web becomes as OS; the network is the computer; the world's largest database
  - This would be the "ultimate diffusion"

Just Remember

- No one predicted the Web
  - Not even Ted Nelson or Vannevar Bush
  - It wasn't in Star Trek or 2001
  - It has always been "people driven" with technology 2nd
- Don't get "caught up in the hype"

What I Want My Future Web to Look Like



Thank You!

Questions? Comments?

bebo@slac.stanford.edu