



The Next Phase of IT: Expanding Opportunities for Openness

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Elliot E. Maxwell

The Perils of Prediction

“I think there is a world market for maybe five computers.”

-Thomas Watson, Chairman of IBM, 1943

“Computers in the future may weigh no more than 1.5 tons.”

-Popular Mechanics Magazine, 1949

“There is no reason anyone would want a computer in their home.”

-Ken Olson, Founder of DEC, 1977

“640K should be enough for anybody.”

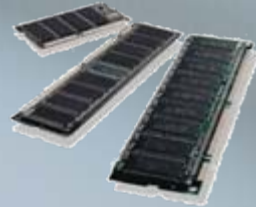
-Bill Gates, Founder of Microsoft, 1981

Past IT Trends Continue

- Computing power continues to increase, with declining costs per cycle



- Memory is becoming cheaper, with faster access

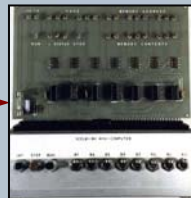


- Transmission capacity (bandwidth) is increasing and communication costs are falling



Another Wave of IT Progress

- First wave – Mainframes
- Second wave – Mini-computers
- Third wave – Personal computers
- Fourth wave – Networked computers
- Fifth wave – Networked mobile devices



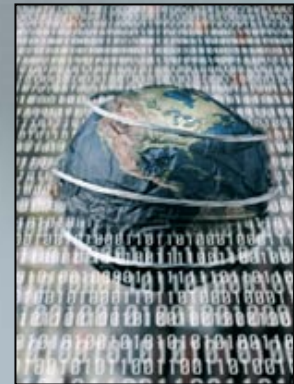
Devices are Becoming Cheaper, Smaller, More Capable, Customizable

- Cell phones are mobile telephony devices, but also personal digital assistants, cameras, music players, TV's, RFID readers, credit cards, etc.
- Sensors are linking the physical and cyber worlds – 1 trillion sensors by 2015 – “Smart dust”
- Radio Frequency Identification Devices (RFID) allow “all objects to communicate”
- An Internet of things – more machine to machine communication than person to person

We will be surrounded by IT enabled objects. We may contain such objects.

Separate Networks, Separately Regulated, Are Converging

- Single purpose networks for broadcasting, fixed telephony, mobile telephony are being supplanted by IP networks
- Information is being digitized
- The Internet provides end-to-end communications capability for all types of information and all kinds of IT devices
 - ✓ One to one
 - ✓ One to many
 - ✓ Many to one
 - ✓ Many to many

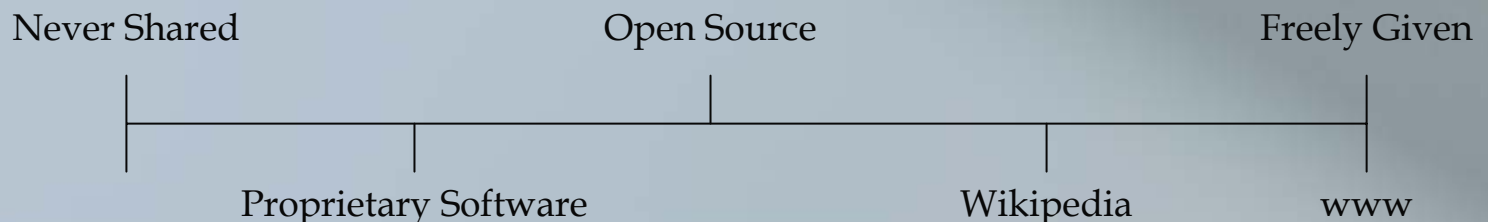


So what?



Pervasive Computing and Communications Facilitate Openness

- Openness is a characteristic based on accessibility and responsiveness
- Most products, services, or processes are neither open nor closed, but exist on a continuum of openness
- Moving towards openness means increasing accessibility and responsiveness
- The degree of openness depends on the purpose of the activity



Some Examples of Openness – Sharing, Peer Production, Reputation, and Receptivity

- Linux
- Wikipedia
- SETI – world's fastest supercomputer
- Human Genome Project
- Napster
- Flickr
- Podcasting, blogs
- Second Life
- Public Library of Science
- E-Bay listings, ratings; Amazon reviews
- InnoCentive

Access to Information

- Old view: Internet allows access to the world's knowledge
- New view: Pervasive computing and communications allow access to the world's knowledge **and enable collaboration to expand it**

Encyclopedia Britannica vs. Wikipedia

Walled Garden vs. Internet

Intellectual Property

- Old view: IP rights holders obtain value by controlling access to their works and charging for it
- New view: IP rights holders obtain value by controlling access to their works and charging for it, or by freely sharing and encouraging others to contribute. Neither should be mandated.

Propriety software vs. Open source software

Open source software relies on IP licensing system

Intellectual Property II

- Old view: Intellectual property protection is necessary, given the capital investments in creation, production, and distribution
- New view: Intellectual property protection may be necessary as an incentive. Perfect copies of digital goods and their distribution are free. Digital rights management and licensing restrictions can temporarily control access.

Extending IP rights and strengthening DRM

vs.

Finding new means to compensate creators

How can we recognize fair use?

Intellectual Property III: Open Standards and Interoperability

- Old view: Make your technology the de facto standard and obtain monopoly rents through licensing. Interoperability is a by-product. Build patent war-chests
- New view: Make your technology part of an open standard to speed up market development and validate the technology you know best. Give away your patents; innovation takes place higher in the stack. Interoperability crucial for market growth

Word processing vs. Grid computing

Open standards openly arrived at

Non-interoperable emergency communications systems

Interoperability for other critical governmental functions

Innovation

- Old view: Innovation comes from “lone genius”. R&D is done in-house and tightly held
- New view: Anyone anywhere – customer, supplier, shop floor worker – is a potential creator and collaborator. Open innovation emerges with an “architecture of participation” (O’Reilly)

Not invented here

vs.

“Proudly discovered elsewhere” (P&G)

InnoCentive, Nine Sigma, Yet2com – distributed innovation

Roomba vs. Sony vs. Apple

Maxwell’s Law – Choose the side with the most smart people

Spectrum Policy

- Old view: Spectrum scarcity and interference requires exclusive licensing arrangements. Additional users create congestion. Unlicensed spectrum is for non-critical services
- New view: Multiple users can share frequencies using “smart radios”. Each user in a mesh network adds communicative capacity. Disruptive technologies – Wi-Fi, Wi-Max, RFID – are operating in unlicensed bands.

Licensed frequency as Railroad track

vs.

Spectrum as Ocean

Convergence in a World of Pervasive Computing and Communications

- Old View: Regulation as appropriate for each distinct service
- New View: Convergence of networks requires a new converged regulatory structure. Regulation should facilitate competition and preserve openness

Level playing field

vs.

Pro-competitive, openness-enhancing level playing field

Net neutrality requirements

vs.

Premature government interference

Increasing access for those without it

Privacy and Security in a Pervasive Computing World

- Old view: Data collectors and data subjects reach agreement under Fair Information Practices. “I know who knows what about me.”
- New view: Data collection is decentralized and always on; data is easily repurposed and responsibility elusive. Location information from cell phones, GPS, etc. “Somebody can know almost everything about anyone.”
Phishing, spam, identity theft undercut trust and make reliable authentication essential.

Fair Information Practices vs. New privacy paradigm

Is anonymity possible? Desirable?
The issue of liability

The Nature of the Firm

- Old view: Firms extend vertically because of the high costs of coordination and control of outside parties
- New view: Firms extend horizontally with loosely coupled partners as costs of coordination and control plummet

Conglomerates vs. Creation networks

Measuring the impact of non-market oriented production

Contact Information

For further information, please contact

emaxwell@emaxwell.net

or visit

www.emaxwell.net

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