Digital Dependence: Cybersecurity in the 21st Century

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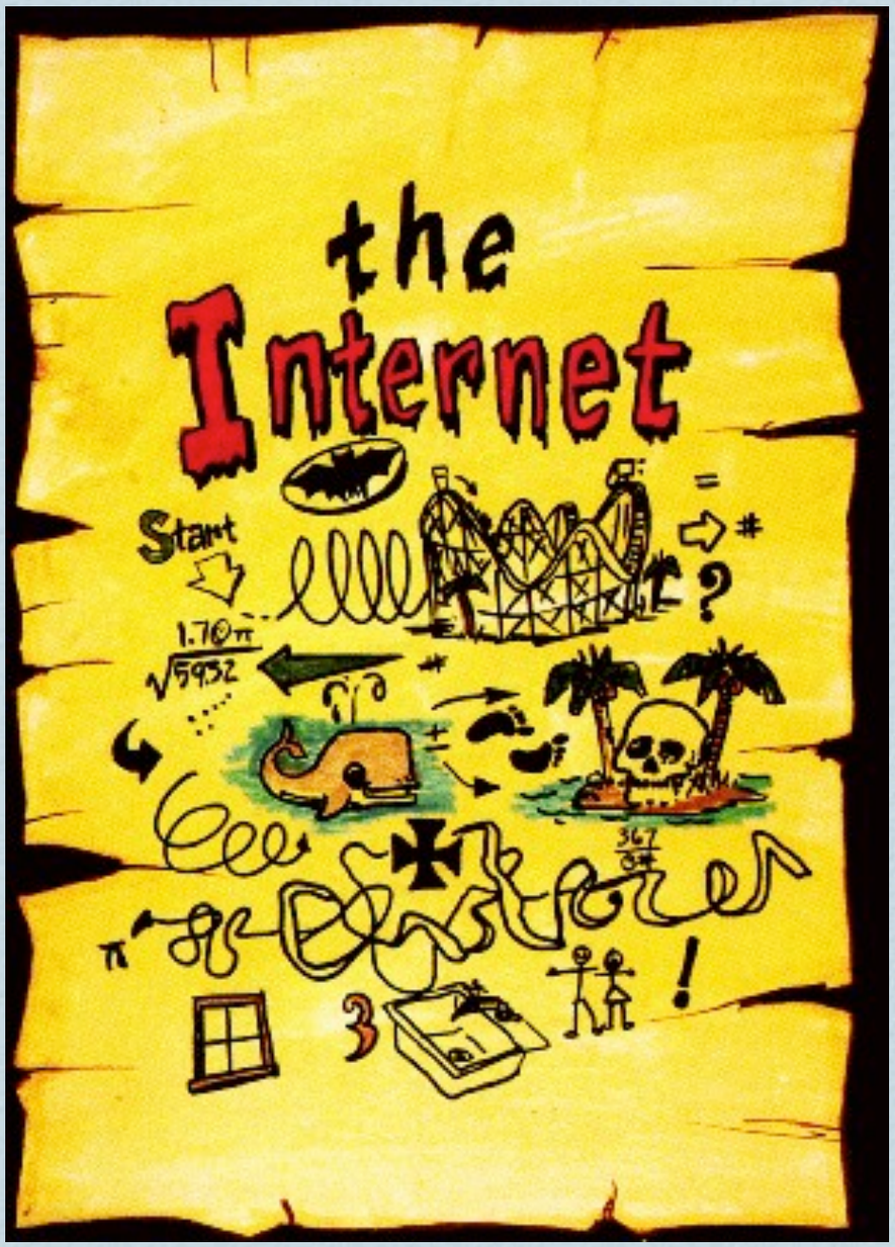
October 29, 1969: The First Transmission



- http://www.picsearch.com/info.cgi?q=1969%20Internet&id=PVUGViNVCGnNvPh-pX1_sm_AoVagXS4c9lomC0G41zY

Timeline of Digital Dependence

Commitment to anonymity and open systems

ARPANet Transmisison

1971—**Creeper Worm** demonstrates mobility and **self-replicating programs** on ARPANet

1972: File Transfer and TCP (**packet switch**)

1974—Development of the **Graphical User Interface** (GUI) at the Xerox Palo Alto Research Center (PARC)

1978: **TCP-IP** becomes **universally-accepted global standard** to supply network layer and transport layer functionality

1979—Intel introduces **8088 CPU** and ushers in the new era of the microprocessor.

1981: IBM **personal computer**

1969 1970 1972 1973 1974 1977 1978 1979 1981 1982

Collaboration of Scientists

1970—Intel introduces **first 1k DRAM chip**.

1973: ARPANet Virtual Communication with **Europe**

1973: Motorola invented the first **cellular portable telephone** to be commercialized

1977: Emergence of **Smaller Computers** (Tandy and Apple Computers)

1977: **Microsoft** Forms

1979: **First commercially automated cellular network** (the 1G generation) was launched in Japan by Nippon Telegraph Telephone

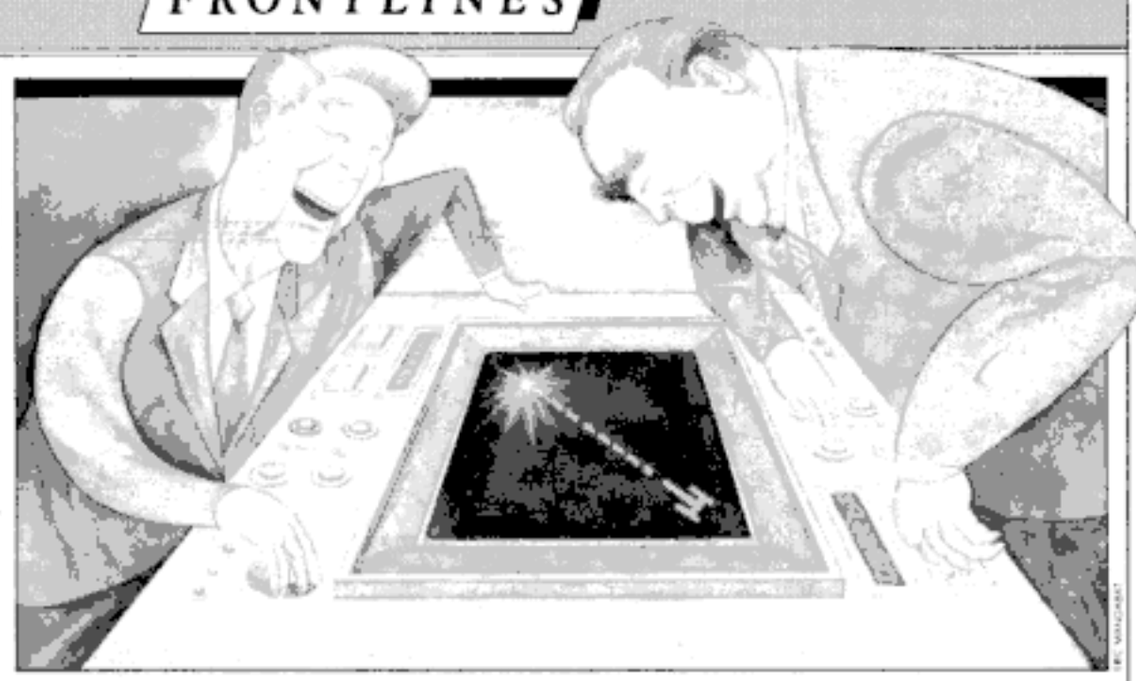
1982: AT&T divestiture in return for opportunity to go into computer business

Foreshadow the Future: 1981?

MOTHER JONES

FRONTLINES

Computerized Detente



As the chill between the Soviet Union and the United States intensifies, the Reagan administration has been busily closing down all the channels of communication that marked the era of detente. Technology trade has been limited; cultural and scientific exchanges have been curtailed, and space cooperation is nonexistent.

There is, however, still one unofficial link between the two superpowers. Sources have told *Mother Jones* that for several years there has been an electronic pathway from the ARPAnet—the experimental Pentagon computer network, which ties together major academic, corporate and military computer research centers in the U.S.—directly to Moscow.

The pathway, according to a Silicon Valley computer scientist and corporate president, "runs from an ARPAnet computer, the MIT Artificial Intelligence computer, via Telenet, a private commercial computer network, to a multinational research center, the International Institute for Applied Systems Analysis (IIASA), which is located outside of Vienna. IIASA, in turn, has a direct high-speed data link to Moscow."

The unofficial link makes it possible, hypothetically at least, for computer scientists and defense researchers on both sides to send each other messages despite the hostile international climate.

As might be expected, Department of Defense officials refused to comment on the existence of the East-West computer tunnel.

Some observers feel, however, that it just might offer a solution to the arms race. Suggests one member of the ARPAnet community, "Maybe we could just settle it all with a giant computer space-war game."

—*John Markoff*

- http://books.google.com/books?id=a-YDAAAAMBAJ&pg=PA11&lpg=PA11&dq=computerized+detente+john+markoff&source=bl&ots=w2lZQuT6ro&sig=3M268mjlqFSq-HXLTFffD-NmYdk&hl=en&ei=AHq8S5iAA4aM8gTwrOn5Bw&sa=X&oi=book_result&ct=result&resnum=3&ved=0CAsQ6AEwAg#v=onepage&q=computerized%20detente%20john%20markoff&f=false

Reflection on the First 13 Years

- Mobile platforms emerge with the birth of personal computer and cellular voice communications
- ARPANet enabled global data communications
- AT&T divestiture signaled first market force tensions -- innovation at the expense of national security and the beginning of loss of interest in State influence of core infrastructure (control)

Timeline of Digital Dependence

1983: **DNS Registry lays foundation for expansion of Internet** (ensure interoperability)

1983: DoD Begins using **MilNet--mandates TCP-IP** for all unclassified systems (ARPANet Continues for Academic Community under NSF leadership)

1985: **Microsoft Windows;** Utility of Computer Easier for Consumer

1988: Digital Equipment Corp. **White Paper on Firewalls**

1988: DoD Funds Carnegie Mellon **CERT-CC**

1990: **CERN develops HTML** code and software (world wide web is possible)

1983 — **1985** — **1988** — **1989**

IT Shifts Power; State begins to cede control to the Private Sector

1983: Wargames

1983: **First Virus** Emerges (Risk/ Vulnerabilities)

1983: Ameritech launches **first 1G Cellular Network in Chicago**

1985: Generic top-level domains were officially implemented **(.com, .gov, .mil, .edu)**

1988: **Internet Worm** (Morris) Infection affects 10% of the Internet's computers (Disrupts Internet for Days)

Rise of Internet Innovation

1989: DoD Corporate Information Management (CIM) Initiative to **identify and implement management efficiencies in DoD information systems (Foreshadow of COTs)**

Dawn of Information Sharing

- World Wide Web enables expanded and user-friendly information sharing on the Internet

Reflection at Year 20

- DoD becomes the early adopter of the technology
- Private sector driving innovation and adoption with value proposition of productivity and efficiency and consumer usability of technology
- Foreshadow the potential for e-commerce with .com domain and emergence of world wide web
- First demonstration of vulnerability and exploitation possibilities and subsequent emergence of a new market (e.g., Firewall, anti-virus software, IDS and IPS)

Timeline of Digital Dependence

Instant Messaging

Organized Electronic Crime Infrastructure Emerges

1991: National Academy of Sciences: **Computers at Risk Report**

1993: WWW with **Mosaic Browser** -- Internet adoption advances

1995: **AOL Phishing** Attacks for passwords and **Credit Card** Information

1993: MILNET becomes **NIPRNET**

1994: **$10M Stolen** from **Citibank**

1995: The Net

1991 | **1992** | **1993** | **1994** | **1995**

1991: First **GSM** network launches in Finland giving way to **2G cellular Networks**

1992: OSD Issues Policy 3600.2 **Information Warfare**

1994: VCJCS Directs IW **Joint Warfare Capability** Assessment

1995: **Evident Surprise** Wargame DEPSECDEF and IC Agree to Coordinate IW Policy

Government shifts to COTS

1992: Sneakers

1994: Nokia proof -- send **data over cell phone** (Wi-Fi possible)

Timeline of Digital Dependence

1996: ITU works on Standard (H-323) for **Voice over Internet Protocol** (voice and data over single network reduces infrastructure costs)

1996: Defense Science Board Paper: **Information Warfare -Defense**

1997: Framework for Electronic Global Commerce (policy) Encourage **International adoption of DNS**

1997: **Google Search Engine** invented

1998: Internet Corporation of Assigned Names and Numbers (**ICANN**) Established

1998: **PDD-63** Critical Infrastructure Protection Policy

1999: US Space Command Assigned military **Cyber Offense-Defense Mission** Responsibility

Net Centric Warfare Concept emerges

1999: **Melissa Virus** Sets Stage for Rapid Infections

1996 | **1997** | **1998** | **1999**

1996: OSD Issues 3600.1 Information Operations Broadening the Definition to **Engage during Peace**

1996: **US relaxes export controls on encryption** products to foster global electronic commerce

1997: **802.11 International Standard** agreed to (Wi-Fi global)

1997: ***Eligible Receiver Exercise*** Focus DOD and IC on Vulnerabilities of US Infrastructure & Foreign IO Programs

1997: President's Commission on Critical Infrastructure Protection (**Nation is Vulnerable**)

Policy Shift Begins: Trust Model breaking down

1998: DoD creates **JTF-CND** to address Threats to DoD networks

1998: ***Solar Sunrise****: DoD penetrations realized*

1999: **In-Q-Tel** established to help Government innovate

1999: DCI agrees to use same definitions Signing out **DCID 7-3**

Reflection at Year 30

- Rapid infections on Internet realized; policymakers begin to discuss and write about problem
- Organized electronic crime infrastructure emerges--anonymity provides safe have for criminals-- e-commerce trust model begins to break down
- Data over wireless emerges as next market wave and voice over Internet presents a second market disruption to "traditional voice carriers"
- Relaxation of export controls (crypto) along with promotion of international adoption of DNS encourages the world to depend upon the Internet
- Need for "controls" on interoperability and stability of the Internet is recognized with establishment of ICANN

Timeline of Digital Dependence

Global Understanding of Critical Infrastructure Vulnerability

Y2K

2000

2000: **HTML accepted as international Standard** ISO: 15445

2000: National Academy of Sciences: **Trust in Cyberspace**

2000: **DDOS Attacks** against **e-commerce**

2001

2001: Launch of **first pre-commercial trial 3G network (packet-switch)** by Nippon Telegraph Telephone

2001: DoD **Quadrennial Defense Review** Renews Focus On Information Operations

2001: **Wikipedia** created

2001: **Council of Europe, Cybercrime Convention** (Treaty)

2001: Nuclear Posture Review calls for replacement of Nuclear Weapons with **Non-kinetic Weapons**

2002

2002: Department of Homeland Security Assumes **Critical Infrastructure Protection Mission**

2002: **Social Networking Technology** takes off with *Friendster*

2002: US Strategic Command Assigned military **Cyber Offense-Defense Mission** Responsibility

2002: DOD 3600.1 policy is re-issued with **new definition for Information Operations**

2003

2003: **CA State Data Breach Law** businesses must report breach of PII

2003: **Linked-In** business application of social networking

2003: **DoD Transformation Planning Guidance** formalizes Net Centric Warfare

2003: **Beta version of Skype** released (voice over Internet revolution)

Reflection at Year 35

- World wide recognition of convergence of Internet with critical infrastructures because of Y2K computer programming error and that problem cannot be solved without a private-public partnership

- International awareness on threat of cybercrime -- but not fully embraced

- 9/11/01 refocused mission toward physical security vice electronic security and blurred mission responsibility with stand-up of Department of Homeland Security

- Recognition that the government must embrace innovation wave

- Social Networking technology emerges with fast consumer adoption rates, foreshadows next "rich" target for exploitation

Timeline of Digital Dependence

Identity Theft Regularly Occurring

2005: **Choice Point** First **Breach** of Personal Identifiable Information **(PII)**

2005: NERC announces **standards for cybersecurity for reliability of bulk-power systems**

2006: **Facebook**

2007: **USAF** Establishes a **Cyber Command**

2007: Comprehensive National Cybersecurity Initiative (**CNCI**)

2007: **TJ Maxx Breach** (exploit Wi-Fi)

2008: President announces modernization program **(Smart Grid, Next Gen FAA, Health-IT, Broadband to America)**

2008: **Georgia-Russia Conflict** demonstrate cyber in warfare

2008: RBS World Pay **$9M stolen in 30 minutes, 49 cities**

2004 **2005** **2006** **2007** **2008**

2004: DoD **IO Roadmap** programs more than **$1B in new funds** to normalize IO

2004: **EW Roadmap** to focus DOD's efforts to provide **electronic attack options**

2006: Congressional Testimony **NSA** outlines **closer coordination with DHS**

2006: Hengchun **Earthquake** (Taiwan) **affects undersea cables and Internet for 49 days**

2007: **Estonia DDOS** highlights use of force (wartime applications with **conscripted computers**)

2007: Joint Staff, **National Military Strategy for Cyberspace Operations**

2007: Live Free or Die Hard

2008: **Cable cut(s)** in Mediterranean: dramatically **slow down Internet** and Egypt affected badly (**need for resilience)**

2008: **Conficker Worm** requires unprecedented **International Cooperation** & Operational Response

Reflection at Year ~40

- Doctrine and rhetoric publicly address use of Internet for offensive means; Estonia and Georgia events demonstrate first use of Internet as a means for warfare
- Recognition that other key infrastructures (power) are now more vulnerable due to dependence on Internet infrastructure
- Conficker Worm highlights need for international cooperation and necessity of private sector information sharing
- CNCI policy illuminates need for stronger defensive posture and cooperation, cross-cueing, and leverage of mission authorities (Title: 6, 10, 18, 32, 44, 50)
- Cybercrime and cyber espionage can no longer be ignored
- Cable cut(s) in the Mediterranean demonstrates importance of undersea cables and resilience

Timeline of Digital Dependence

2009: **Heartland Payments Breach** (Payment Card Industry)

2009: **Cyberspace Policy Review**: Cyber is Economic and National Security Priority

Move to Cloud Computing: Efficiency and Cost Savings

2009: Operation Aurora coordinated attack on many high profile companies targeting their intellectual property

April 2010: **UK Data Protection Law**: 500K Sterling Fine for lost protected data

April 2010: Court Rules in Favor of **Comcast; Net Neutrality** debate heats up on Internet regulation

May 2010: **NATO Strategic Concept Review** highlights Cyber

November 2010: NATO Declares **Cyber Defense** a Priority
EU Declares **Information Security** a Priority

2009

Advanced Persistent Threat

2009: National Research Council Report: **Cyber Attack Capabilities**

2009: **4G offered via WiMAX standard** (Sprint); speed improvement of 10 fold

2010

January 2010: **Intel** Corporation **SEC Filing** (**Risk** Factor)

January 2010: **TX Bank sues Customer** over Cyber-Theft

Stuxnet

May 2010: Stand-up of **US Cyber Command**

2010: **Smokescreen** on-line virtual reality **game** guides teenagers through **dangers of social networking**

Market Shift

Proliferation of Handheld wireless devices (Mobility)

Reflection at Year 41

- Google incident -- tipping point in US policy and serves as catalyst for corporate awareness
- Cybercrime and cyber espionage are affecting bottom line and risk factors of major corporations
- Legislation and regulation are emerging as mechanisms to assert "control", manage risk and build security back into the infrastructure
- Nations realize lack of resilience is national and economic security risk
- Stuxnet targets control system (product) functionality, putting critical infrastructures at risk around the world
- Government intervention has become more pronounced and pervasive – and censorship and surveillance practices are on the rise

2011: The Tipping Point?

January: 88% of Egyptian Internet cut off from citizens.

February: The Netherlands, France, and Germany publish **Cybersecurity Strategies**

February: **IPV-4 address allocation exhausted**

February: Hackers break into **Canada's Treasury system**.

March: **Epsilon** breach **High Profile Customers exposed**

April: **G8** discusses **laws need to apply to Internet**

April: **Sony Play Station network breached**, initial clean up, $170 million

May: **Austria** declares **cyber defense national priority**

May: **U.S.A International Strategy for Cyberspace**

June: **IMF** Penetrated and **severs connection to World Bank** as precaution

January

February: NASDAQ Penetrated

February: UK states that **cyberattacks and cybercrime** among its **top** five **security issues**

February: Libya cuts off Internet and Social Networking sites from citizens.

March

March: **RSA/EMC** Corporation **SEC filing (SecureID breach)**

Two-Factor Authentication at Risk

May: 65% of Syrian Internet removed from routing tables (40/59 networks).

May: ICANN and INTERPOL begin collaboration on security of Internet.

June

June: **Citigroup** breach, **200K accounts accessed**

June: **EU increases penalties for Cybercrime**

June: **New Zealand** publishes **cybersecurity stratetgy**

It happened so fast that

we have not had time to be astonished...

Vaclav Havel

What is Needed?

- Begin an honest conversation about what is happening in your country and simple steps that can be taken to improve the situation
- Identify the seams between economic recovery and national security needs--become a *Security* advisory to both
- Retard the quick-to-adopt movement of all critical infrastructures to rely on Internet based protocols and technology
- Enlist and incentivize the private sector to understand and address the vulnerabilities and innovate our way through a solution
- Engage Congress/Parliament to clarify and legislate new authorities
- Review regulatory authorities and demand coordination across Internet jurisdictional overlap; Legislation has not kept pace with technology, making regulation difficult
- Declare policy: Identify what is tolerable (crime, espionage, and armed aggression) and impose costs if threshold is crossed

...That the further one looks back

-- the further forward one can see...

Winston Chuchill