Making Disruptive Technologies Work for You

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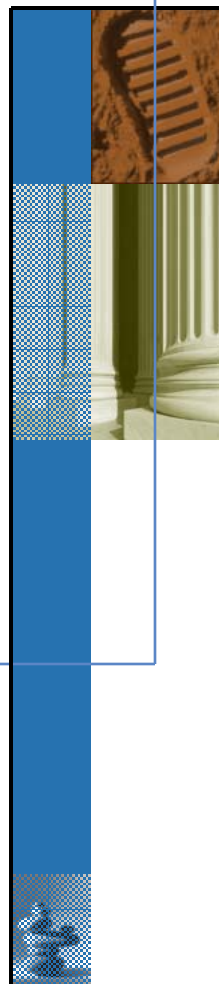

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Thesis

- There's a bunch of technologies that may disrupt the enterprise (as some disrupted telcom)
- If we plan ahead, we can minimize the bad and maximize the good
- "The best way to predict the future is to invent it"
  -Alan Kay

Goal

- Identify technologies that satisfy profound needs with acceptable “insertion force”.
  - Examples:
  - Public Key Infrastructure – huge need, moderate use due to overhead
  - iPod
- Identify tectonic shifts in the Internet that will increase the importance of existing technologies.

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Candidate Disruptive Technologies

- QOS & Delay Sensitive Applications
- Optical Networking
- Gigabit Ethernet and Beyond
- Network Troubleshooting
- Ethernet as the New Power Jack
- P2P

- Open Source Network Technology

- Digital Identifiers

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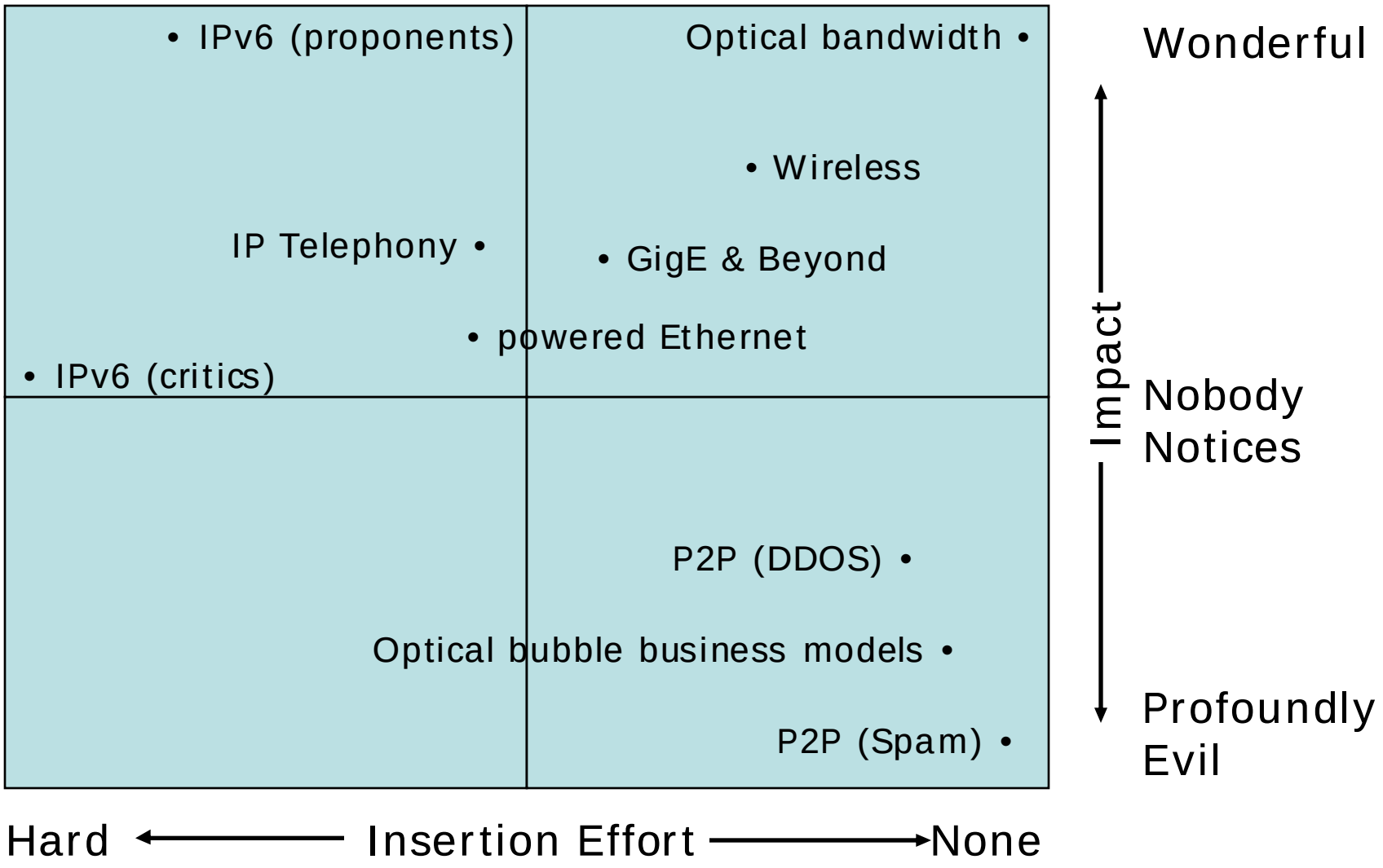
Disruptive Technologies Quadrants



QOS & Delay Sensitive Applications

- IP telephony is the elephant in the tent now
  - The bulk telephone industry is about reinvent (& refinance) itself
  - Compatibility with 100 feature PBXes takes time but will happen (e.g. IETF considers music on hold)
  - In many ways, control is more complicated than media (which will improve)
  - Do I really need multiple identifiers for IM, email, IP telephony, mobile, etc?
- Reconciling DRM and the future
- Editing the news by demographic

Optical Networking

- Optical bandwidth has done wonders for the backbones.
- Why is optical networking like a tulip?

- Integration technologies on the front burner now

- Sidewalk costs:
  - A lot: Fiber, twisted pair, coax
  - Nothing: wireless

Gigabit Ethernet and Beyond & Powered Ethernet

- Ethernet is the classical example of what's important in a standard:
  - 1973 – coax for passive reliability, privacy, multitaps
  - 2004 – wireless & twisted pair, point-to-point switched
  - Frame structure is the standard
- How do we power wireless Ethernet?
- When will security and QOS/priority become ubiquitous?

Network Troubleshooting (Enterprise)

- Several interesting phenomena
  - > Is there a security perimeter?
    - Wireless access & virus-bearing laptops say no
    - DNS application attack & bots covert channel say yes
  - > Attacks move up the stack
  - > Understand & Measure “real objects”
    - NOT bits/sec or traffic by port, less synthetic
    - Sarbanes-Oxeley, compliance, and privacy vs. measurement

Network Troubleshooting (Internet)

- What are the risks?
  - Routers, fiber links, radio noise?
- NO - The internet architecture is designed to use multiple systems & algorithms to route around component failures.
- The major risks are all related to the failures of the control *algorithms* or *systems*
  - Failures often caused by bad design (algorithms), bad implementation (systems) or changing needs.
  - The more pervasive the system, the more important For example, DNS & BGP in Clarke report *"The National Strategy to Secure Cyberspace"*

How do the control systems fail?

- Systemic failures brought on by:
  - Scalability & Crises of complexity
  - Attacks
  - Mismanagement
- Failure to meet business goals
  - No agility to complete mergers, reorganizations, etc.
  - No ability to bring tailored services to market

Causes of scalability and complexity risks

- Simple size growth
  - Machines
  - Users
  - Applications
- New types of use
  - Mail routing in DNS
  - Access control in DHCP for WIFI networks
- Both can trigger non-linear consequences

Open Source Network Technology

- Very important to technology introduction
  - Router
    - 1971 University of Edinburgh DCN OS
    - 1977 Fuzzball routers, later NSF backbone
    - 1981 MIT C gateway RFC898
  - TCP
    - BBN for DEC timesharing
    - BSD for UNIX
  - DNS
    - 1983 PDP10 root server code at ISI
    - 1984 BSD Unix implementation

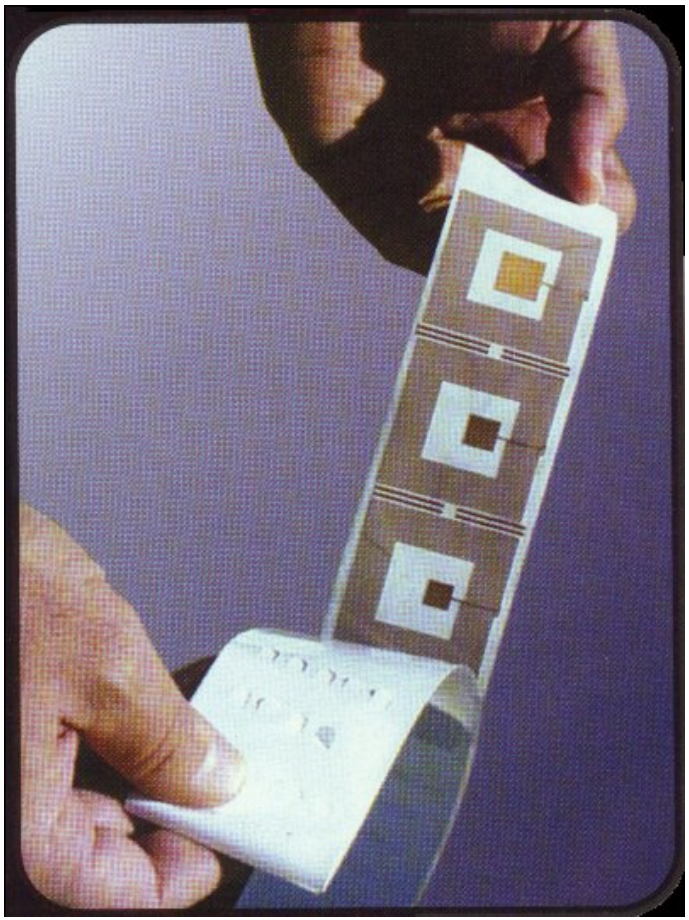
"Linux of routing"

- Extensible Open Router Platform (XORP)
  - International Computer Science Institute (independent and closely affiliated UCB EECS)
  - Version 1.0 in June
  - Using PC components, 10 X $ improvement
  - Processes & modularity key
- Reminds one of Gated
  - UMich licensed early 80s
  - NextHop licenses and supports
  - Very popular with silicon startups
    - Fiberlane, Siara, CoSine, Riverstone, Juniper, Avici, Atoga

Open Source Network Technology - Future

- Server technology has a large role in Internet
  - ISC's Bind & DHCP have huge market share
  - Except
    - Infrastructure - Move, add, change on fly, performance
    - Nice user interface(s)
- Router technology has been limited
  - Low-end routers are a consumer product
    - Easier to use than a VCR
  - High-end use ASICs, etc and are a combination of
    - Wine – the software base
    - Milk – the hardware
  - Where does open source hardware come from?

Digital Identifiers



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Digital Identifiers

- Explosion in use of digital identifiers on network
  - It is easier to move bits than physical objects.
  - Example (Business Week)
    - Banks spend $.50 to process a paper check
    - Banks spend $.10 to process electronic equivalent
  - VOIP & ENUM & URIs
  - RFID – it's the standard, stupid
    - Unify 6+ numbering schemes
  - **モッカペトリス.jp**
  - **모카페트리스.kr**
  - **莫卡派乔斯.cn**

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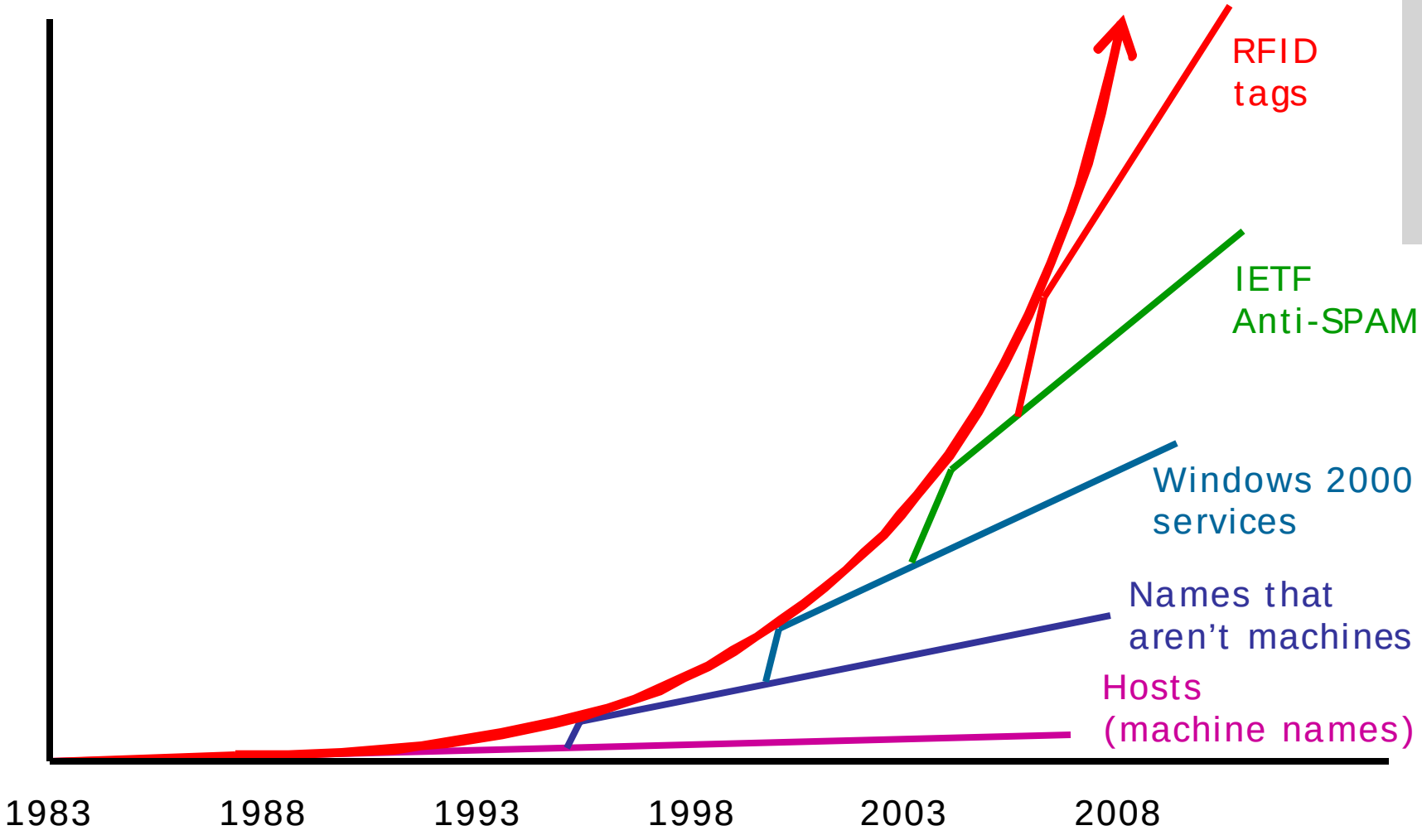
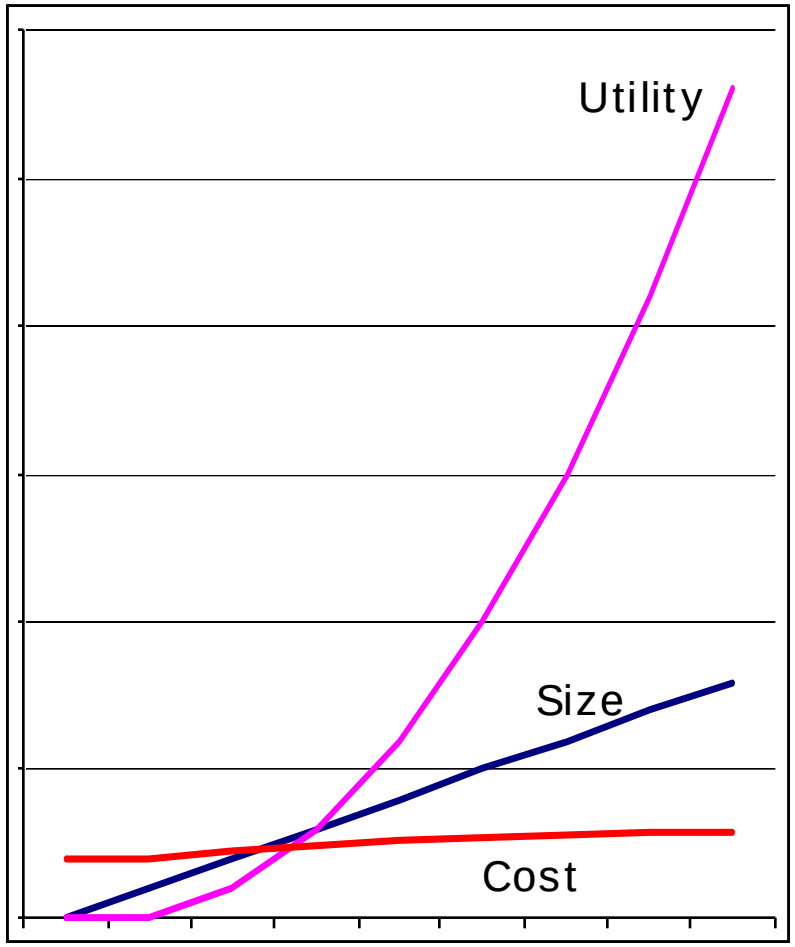
DNS use is growing exponentially



In the beginning… $U = m^2$



- Metcalfe's law says utility of network is proportional to square of number of members.
- Or utility proportional to number of potential connections.
- Challenge has been to make sure cost grows (much) less than utility and less than size if possible
- With the commercialization of the Internet, law breaks down (e.g. spam, $)

Today... $u = mc^2$ $U = u_1 + u_2 + \ldots$

- Utility of a single community
  - $u = mc^2$
    - Where m is merit of community's activity
    - c is number of useful members in community
- U of Internet is sum of u for every community
  - Communities are:
    - VPNs
    - Intranets
    - Email groups
    - ...

Implications

- What counts is number of useful members in community
  - Every mailbox is multiple communities (Spam)
  - I can only do so much communication
    - Replace m with log(m)
  - Maybe toasters can coordinate
- Enormous leverage in adding whole populations
  - E.g. E.164 with phones
  - >$1B in DNS infrastructure
- But legacy owners still care
  - New technology old owners?
  - Pick your regulator if you can

Found in my inbox...

To: pvm@a21.com
Subject: Paypal account limited
From: security@paypal.com
Reply-To: security@paypal.com
Date: Thu, 25 Mar 2004 17:25:42 -0500

Dear PayPal user,

We recently reviewed your account, and suspect that your PayPal account may have been accessed by an unauthorized third party. Protecting the security of your account and of the PayPal network is our primary concern. Therefore, as a prevention measure, we have temporarely limited access to sensitive PayPal account features.
Please click on the link below to confirm your information:

https://www.paypal.com/fraudcheck/secure/bill.html?sl=070304

I'm suspicious, let's view the source…

https://www.paypal.com/fraudcheck/secure/bill.html?sl=070304

Is really

```
<a
   href="http://140.115.135.13/.secure/hide/index2.
   htm">https://www.paypal.com/fraudcheck/secure
   /bill.html?sl=070304</a><br><br><p>
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- And then, I don't have a paypal account.

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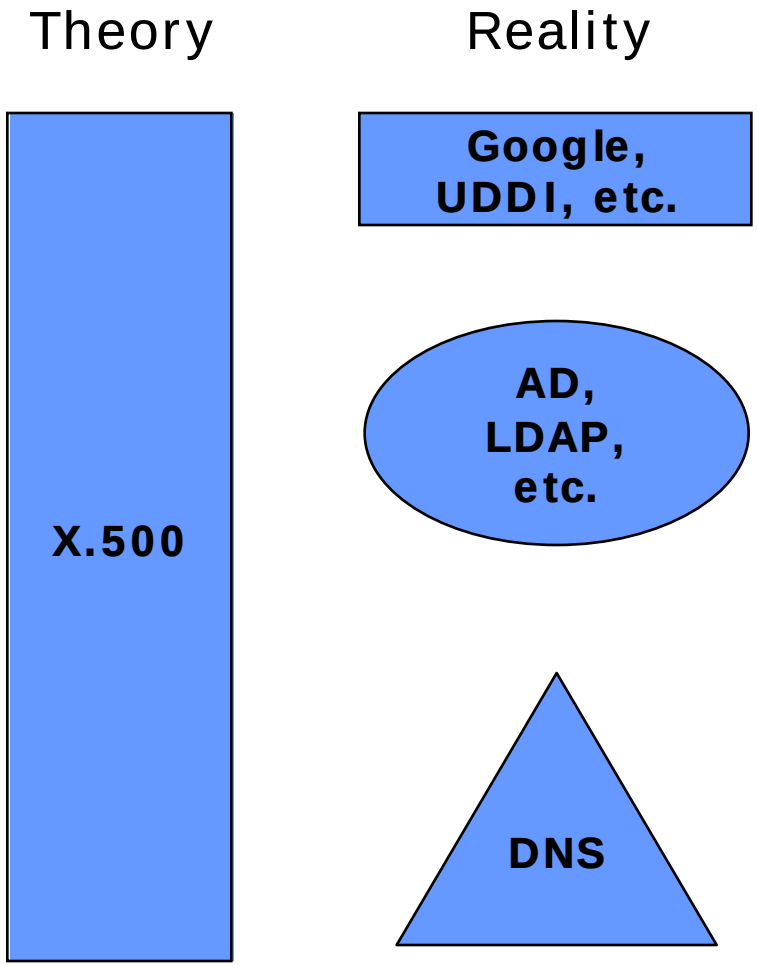
Integration of Platforms that Create Digital Identifiers in general



- In the beginning, theory said there would be one monolithic service – X.500
  - Searches
  - Lookups
  - Schema
  - Access Control
- In practice, there are many services, with different properties, at 3 levels:
  - Web
  - Directory
  - DNS

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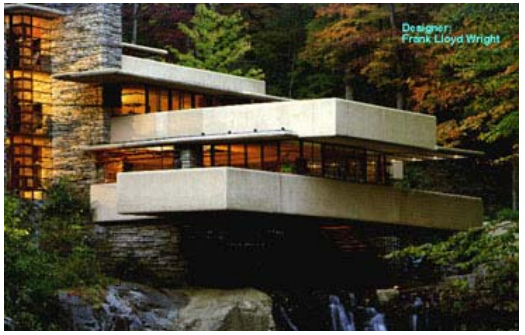
Architectures that Create Digital Identifiers

DNS

AD, LDAP, etc.

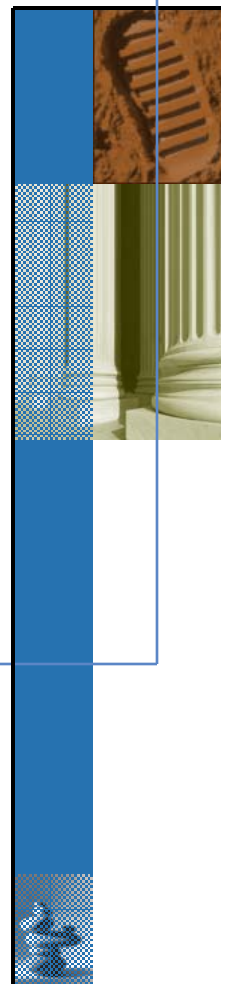
Google, UDDI, etc.



Conclusions

- Complexity is issue #1
  - Seek solutions that help
  - Troubleshooting moves up the stack
- Digital IDs
  - You will be managing more of these
  - Need “science” for Ids
  - Need new politics
  - Security starts with identity

Thank you



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