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Issues in Managing Persistent Identifiers

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In the digital world…

- Unambiguous identification of assets in digital systems is key:
  - Physical
  - Digital
  - Conceptual

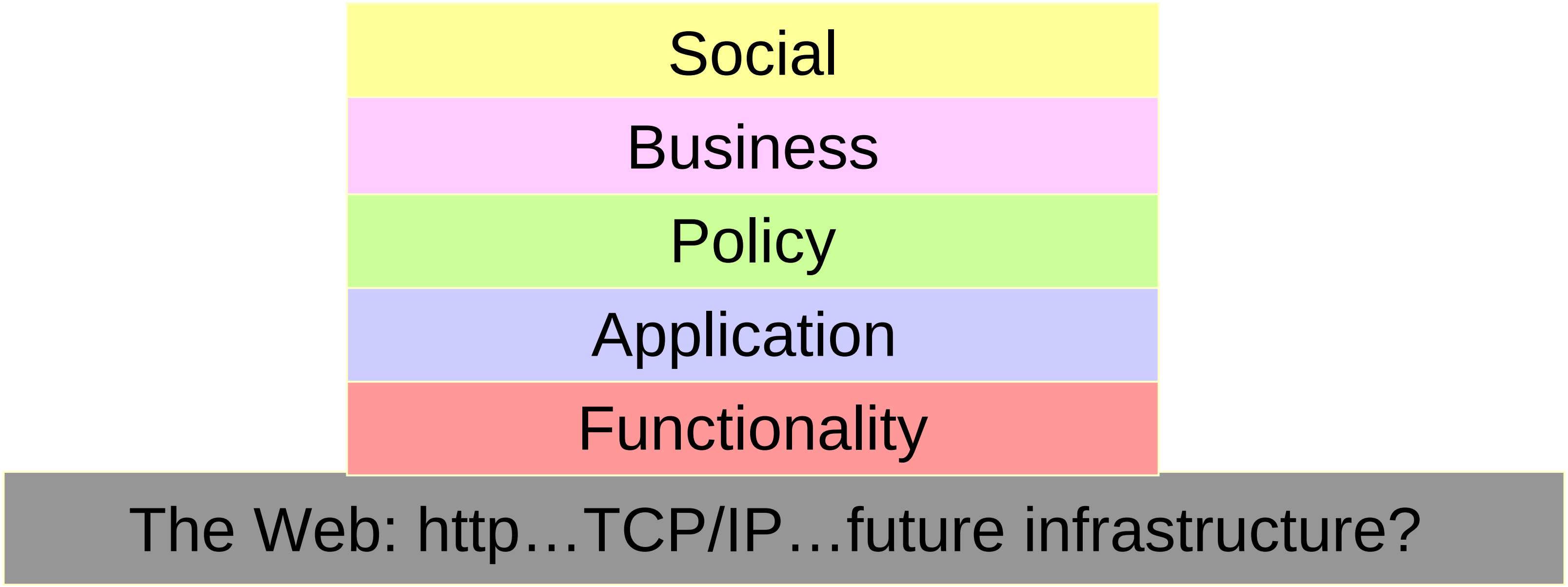
  - Knowing you have what you think you have
  - Comparing identity (referring to the same thing)
  - Reference linking
  - Managing intellectual property

What do we want from Identifiers?

- Global uniqueness
- Authority
- Reliability
- Appropriate Functionality (resolution and sometimes other services)
- Persistence – throughout the life cycle of the information object

The Identifier Layer Cake

- Identifiers come in many sizes, flavours, and colours… what questions do we ask?



Social

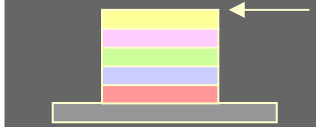
Business

Policy

Application

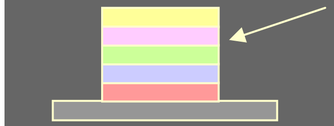
Functionality

The Web: http…TCP/IP…future infrastructure?



Social Layer

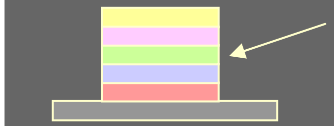
- The only guarantee of the usefulness and persistence of identifier systems is the commitment of the organizations which assign, manage, and resolve identifiers
- Who do you trust?
  - Governments?
  - Cultural heritage institutions?
  - Commercial entities?
  - Non-profit consortia?
- We trust different agencies for different purposes at different times



Business layer

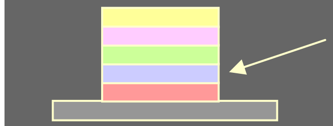
- Who pays the cost?
- How, and how much?
- Who decides (see governance model)?

- The problem with identifier business models…
  - Those who accrue the value are often not the same as those who bear the costs
  - You probably can’t collect revenue for resolution
  - Identifier management generally needs to be subsidiary to other business processes



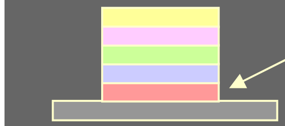
Policy Layer

- Who has the ‘right’ to assign or distribute Identifiers?
- Who has the ‘right’ to resolve them or offer serves against them?
- What are appropriate assets for which identifiers can be assigned, and at what granularity?
- Can identifiers be recycled?
- Can ID-Asset bindings be changed?
- Is there supporting metadata, and if so, is it public, private, or indeterminate?
- Is there a governance model?



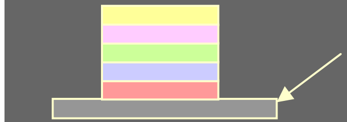
Application Layer

- What underlying dependencies are assumed?
  - http… tcp/ip…(bar code|RFID) scanners…
- What is the nature of the systems that support assignment, maintenance, resolution of identifiers?
- Are servers centralized? federated? peer to peer?
- How is uniqueness assured?



Functional Layer: Operational characteristics of Identifiers

- Is it globally unique? (easy)
- What is the means for matching persistence with the need?
- Can a given identifier be reassigned?
- Is it resolvable? To what?
- How does it ‘behave’? What applications recognize it and act on it appropriately?
- Is the ‘name’ portion of the identifier opaque, or can it carry ‘semantics’?
- Do humans need to read and transcribe them?
- Do identifiers need to be matched to the characteristics of the assets they identify?



Technology layer: The Web

Some fundamental questions:

- Must our identifiers be URIs (URLs, really)?
- Must they be universally actionable?
- If so, what is the desired action?
- Is there ever a reason to use a URI other than an http-URI as an identifier?

Pure Identifiers versus pure Locators

- But *locators* and *identifiers* are not the same…or are they?
- In Web-space, they are close:
  - Not every *identifier* is a *locator*, but every *locator* is an *identifier*
  - Google-like search makes non-locator *identifiers* pretty good *locators* as well

Debates about purity of *identifiers* and *locators* are ideological and unhelpful.

How we got here

- In the beginning, there was DNS
- TimBL begat URLs (within meters of where we stand)
- Uniform Resource Identifiers
  - URLs (Locators)
  - A variety of schemes, mostly grandfathered from the pre-Web Internet
  - URNs (Names, or identifiers)
  - IRIs (a URI that knows the world has more than one character set… but talk is cheap)

URI = SCHEME, HOST, and PATH

(the global file system)

URI Schemes (as of 2005 06 03) http://www.iana.org/assignments/uri-schemes

ftp	File Transfer Protocol
http	Hypertext Transfer Protocol
gopher	The Gopher Protocol
mailto	Electronic mail address
news	USENET news
nntp	USENET news using NNTP access
telnet	Reference to interactive sessions
wais	Wide Area Information
prospero	Prospero Directory
z39.50s	Z39.50
z39.50r	Z39.50 Retrieval
cid	content identifier
mid	message identifier
vemmi	versatile multimedia
Interfaceservice	service location
imap	internet message access protocol
nfs	network file system protocol
acap	application configuration access
protocolrtsp	real time streaming protocol
tip	Transaction Internet Protocol
pop	Post Office Protocol v3
data	data
dav	dav
opaquelocktoken	opaquelocktoken
sip	session initiation protocol
sips	secure session intitiaion protocol
tel	telephone
fax	fax

modem	modem
ldap	Lightweight Directory Access Protocol
https	Hypertext Transfer Protocol Secure
soap.beep	soap.beep
soap.beeps	soap.beeps
xmlrpc.beep	xmlrpc.beeps
xmlrpc.beeps	xmlrpc.beeps
urn	Uniform Resource Names
go	go
h323	H.323
ipp	Internet Printing Protocol
tftp	Trivial File Transfer Protocol
mupdate	Mailbox Update (MUPDATE) Protocol
pres	Presence
im	Instant Messaging
mtqp	Message Tracking Query Protocol
iris.beep	iris.beep
dict	dictionary service protocol
snmp	Simple Network Management Protocol
crid	TV-Anytime Content Reference Identifier
tag	tag

Reserved URI Scheme Names:

afs	Andrew File System global file names
tn3270	Interactive 3270 emulation sessions
mailserver	Access to data available from mail servers

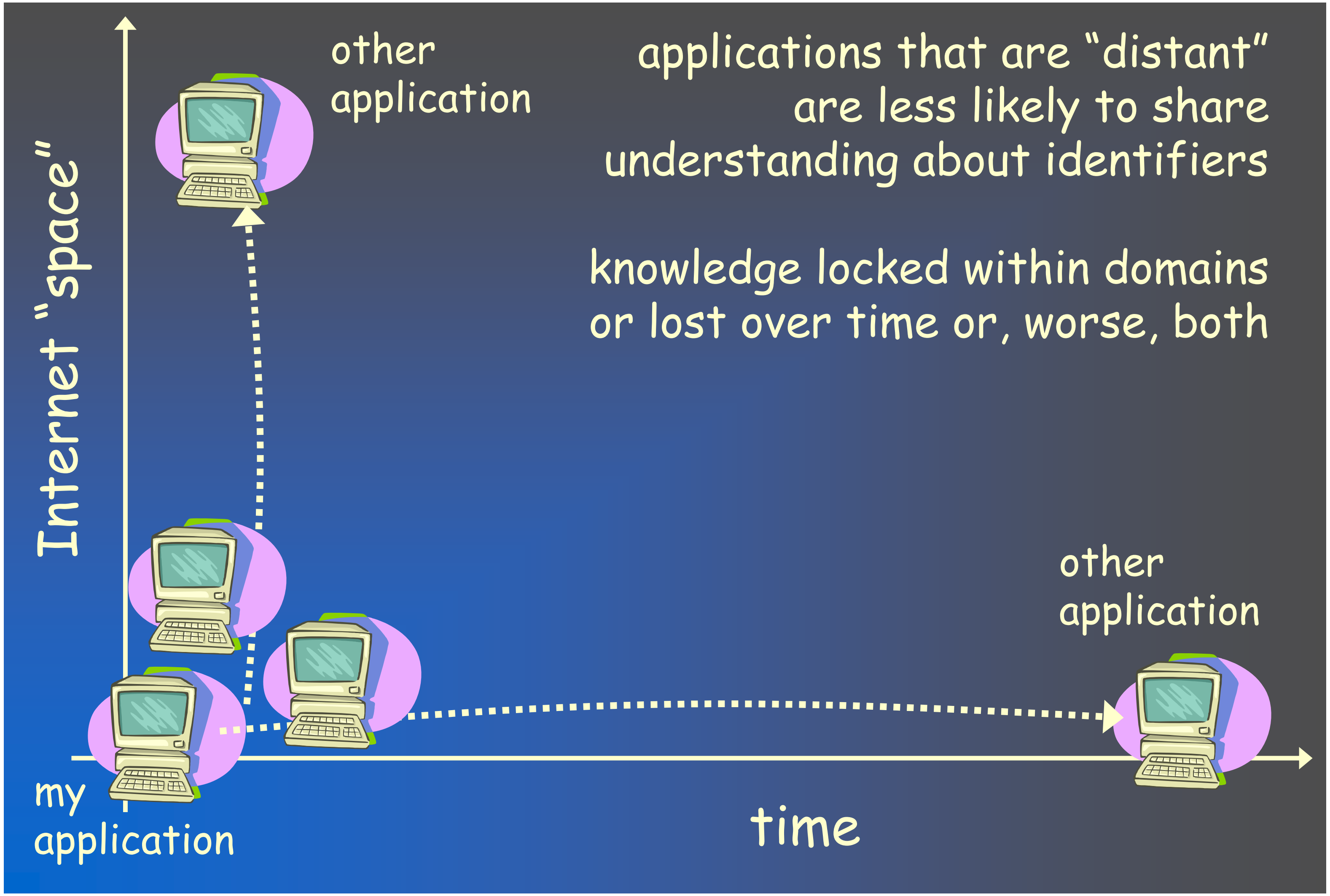
But what can you really count on?

- HTTP–based URIs (URLs) are what we can count on today
- Current URI registration procedures are unworkable
  - Scarcity of expertise
  - *Techeological:* strong ideologies are embedded in the process
- New URI Scheme registration standards are in the pipeline… will they help or hinder?

Arguments for http-based identifiers

- Application Ubiquity: every Web application recognizes them. Achieving similar ubiquity for other URI schemes is very difficult
- Actionable identifiers are good – immediacy is a virtue
- If the Web is displaced, everyone has the problem of coping; if you invent your own solution, and it is displaced, you are isolated
- Using Non-ubiquitous identifiers will make it harder to maintain persistence over time by complicating the technical layer, which will compromise the ability to sustain long-term institutional commitments

Internet Space/time continuum
Andy Powell - UKOLN



applications that are "distant" are less likely to share understanding about identifiers

knowledge locked within domains or lost over time or, worse, both

Arguments for NON http-URIs as identifiers

- Separation of IDENTITY and RESOLUTION is a small but important component of a complete naming architecture, and is poorly accommodated in current Web Architecture
- URLs make a promise: click-here-for-resolution
  - Sometimes you DON’T want resolution, or you want context-dependant action
- Not always clear what the action should be
- It is difficult to avoid branding in locators, and branding changes, threatening identifier persistance

Resolution of a conceptual asset can be problematic

- Conceptual assets should be inherently language independent:
  - Vietnamese War, 1961-1975 DDC/22/eng//959.7043

    (English language version of DDC 22)
  - American War, 1961-1975 DDC/22/vie//959.7043

    (Vietnamese language version of DDC 22)

Business Models may mitigate in favor of separating identity and resolution

- Content owners/managers may want to expressly decouple identity and resolution
- Appropriate Copy Problem (eg, reference linking of scholarly publishing content across subscription agencies
- Identifiers that embed domain servers (including most http-URIs) are likely to degrade over time due to business consolidations
- URIs are global file system identifiers, and file systems change

- Web naming architectures should neither enforce nor prevent any given business model

The "info" URI Scheme for Information Assets with Identifiers in Public Namespaces

- Internet Draft by Herbert Van de Sompel, Tony Hammond, Eammon Neylon, and Stuart L. Weibel
  - http://info-uri.info
- Separate resolution from identity
- An effort to provide a missing part of the naming architecture of the Web
- Bridge legacy identifiers and the Web
- Basis for the naming architecture of Open URLs
- Is it a (registered) URI scheme?

INFO URIs (continued)

- Controversy about separating identity and resolution; IETF resistance has been substantial
- Adoption and use will determine its future – will adopters find it provides sufficient additional value to offset cost of adoption?
- Early registrants:

Open URL LCCN DOI OCLC
PubMed OCLC SRW Web Services
Genbank Fedora SICI
Astrophysics Bibcodes National Library of Australia

What does an “info” URI look like?

- info:ddc/22/eng//004.678

  - Info: specifies the “info” namespace, or scheme
  - Namespace Token (ddc/ in this case) is a registered namespace or brand within the scheme
  - Everything that follows is at the discretion of the namespace authority that manages a given registered namespace, (and conforms to URI encoding standards)
  - No implication of resolution, though clearly services (including resolution) can be expected to emerge if “info” achieves wide use.

Opaque versus Semantic Identifiers

- Should identifiers carry semantics?
  - People like semantic identifiers
  - Semantic Drift can be a problem
  - Semantics can compromise persistence
  - Semantics is culturally laden

Varieties of semantics

- Opaque
  - Nothing can be inferred, including sequence
  - Cannot be reverse-engineered (feature or bug?)
  - See ARCs, California Digital Library (John Kunze)
- Low-resolution date semantics
  - LCCN 99-087253
- Encoded semantics
  - ISBN 1-58080-046-7
  - Country codes… agency codes… checksums…
- Sequential Semantics
  - OCLC numbers

More Varieties

- Domain Branding
  - http://elsevier.com/...
  - http://pubmed.com/...
  - http://LoC.gov

- Functional Branding: common behaviors established in the social or policy layers
  - http://purl.org/...
  - DOIs

Encodings matter

- the DOI “10.1000/182” can be encoded as a URI in several ways:
  - http://dx.doi.org/10.1000/182
  - doi:10.1000/182
  - urn:doi:10.1000/182
  - Info:doi:10.10000/182
- Which of these is a registered URI?
- Which is “understood” by all Web applications?
- Which is most useful?

Recommendations and Conclusions

- Be wary (but not ideological) about semantics in identifiers
- Deviate from widely-adopted standards at your own risk (and risk to your constituents)
- There be dragons beyond the safe seas of HTTP
- Technology will not save us – Institutional Commitment is key