A bit of REST (Representational State Transfer)

Roy T. Fielding | Senior Principal Scientist, Adobe

Warning

Ph.D. Dissertation

Why talk about REST?

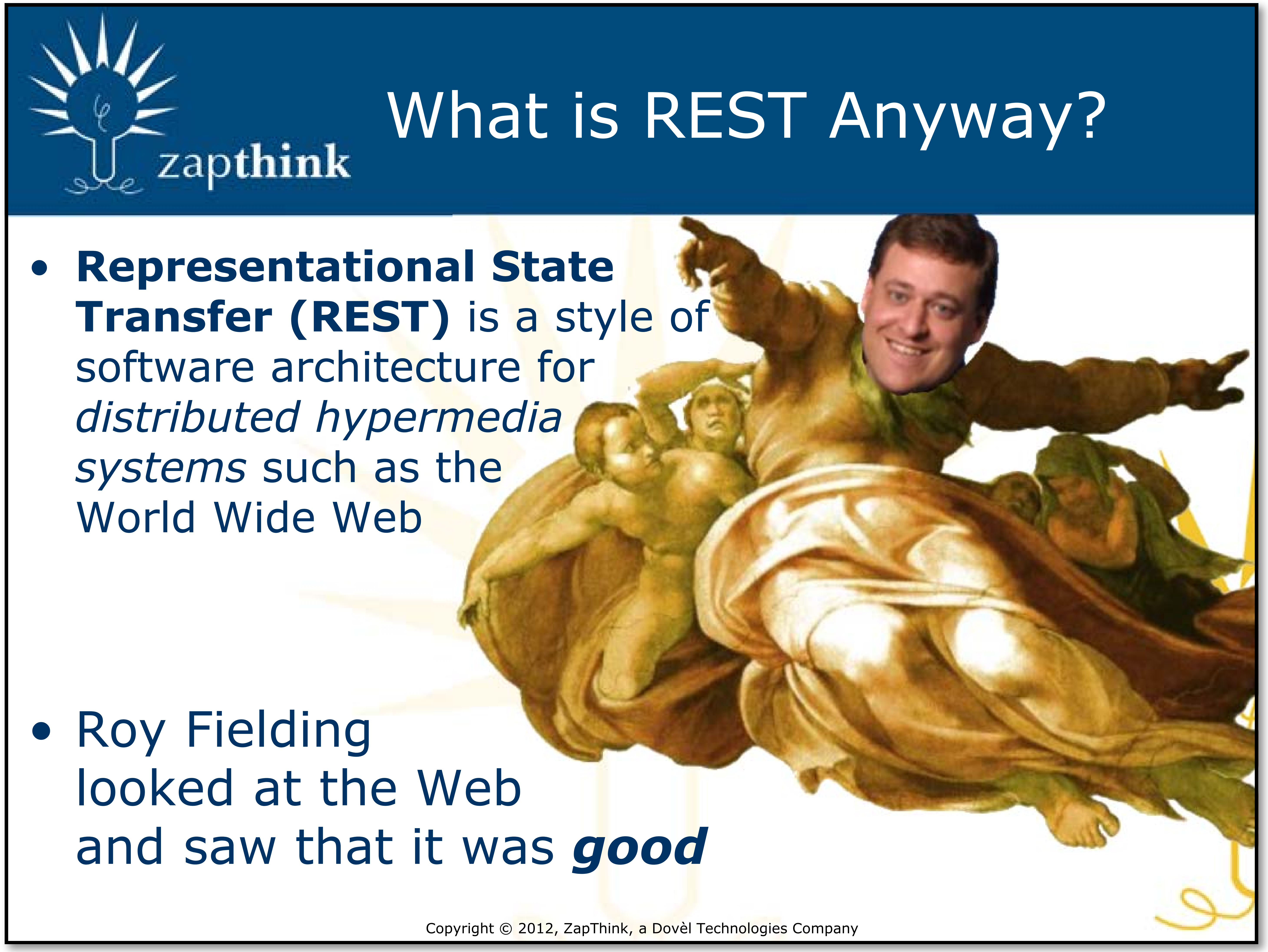
Because

REST

has become a

BUZZWORD

There's nothing particularly wrong with that…
unless you happen to be me…
or working with me



zapthink

What is REST Anyway?

- **Representational State Transfer (REST)** is a style of software architecture for *distributed hypermedia systems* such as the World Wide Web
- Roy Fielding looked at the Web and saw that it was ***good***

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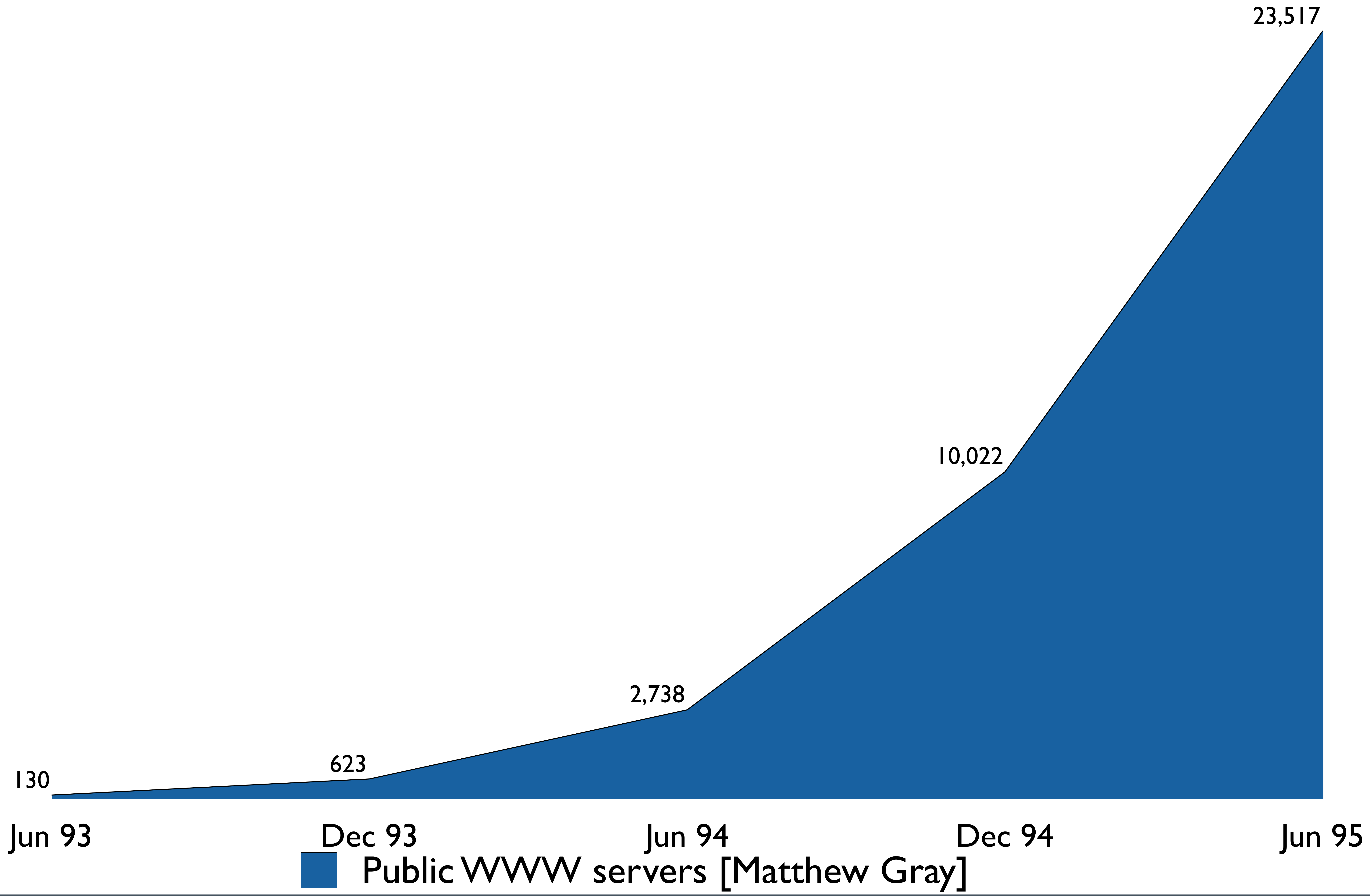
A bit of context: REST also began 20 years ago



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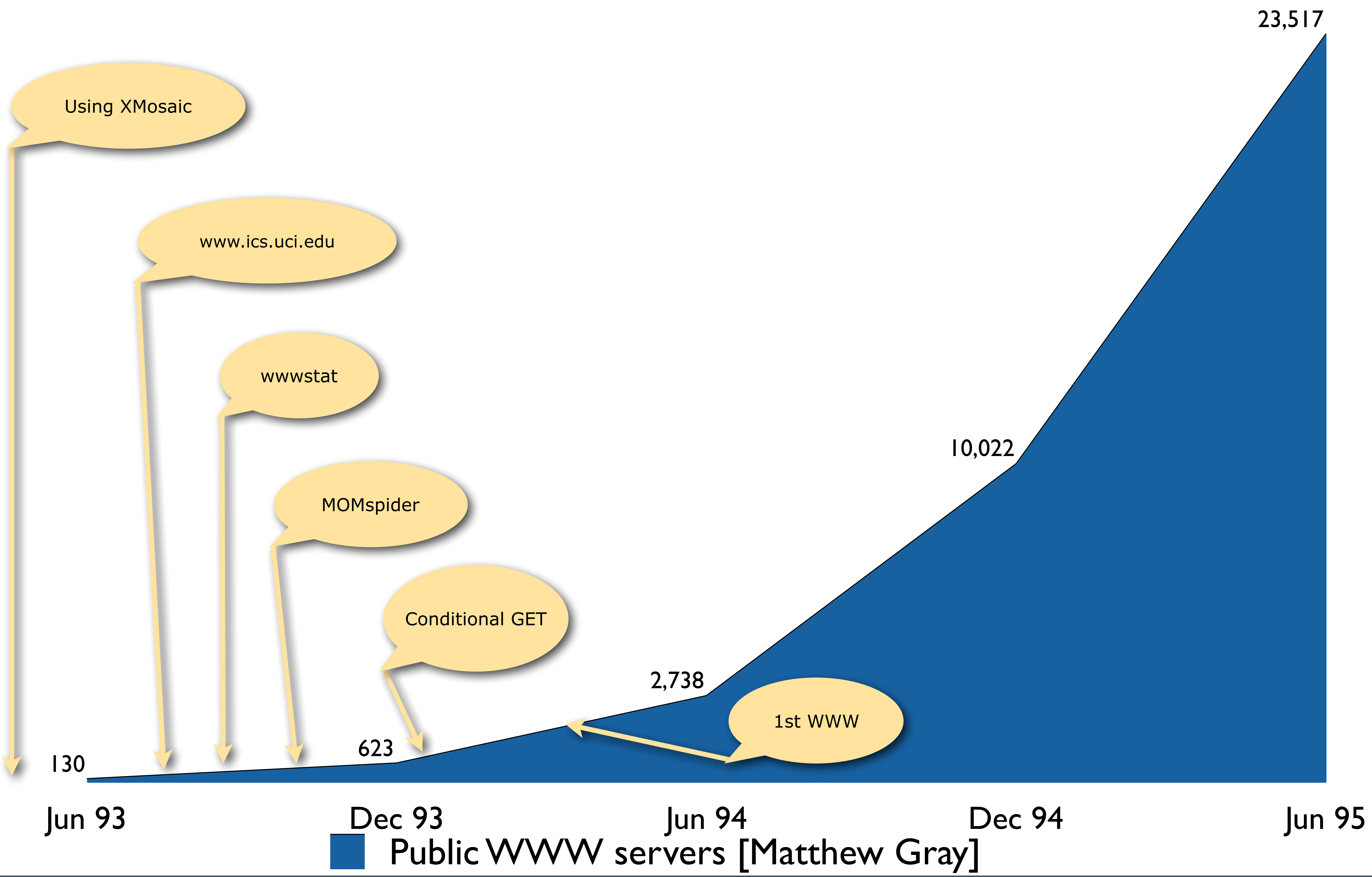

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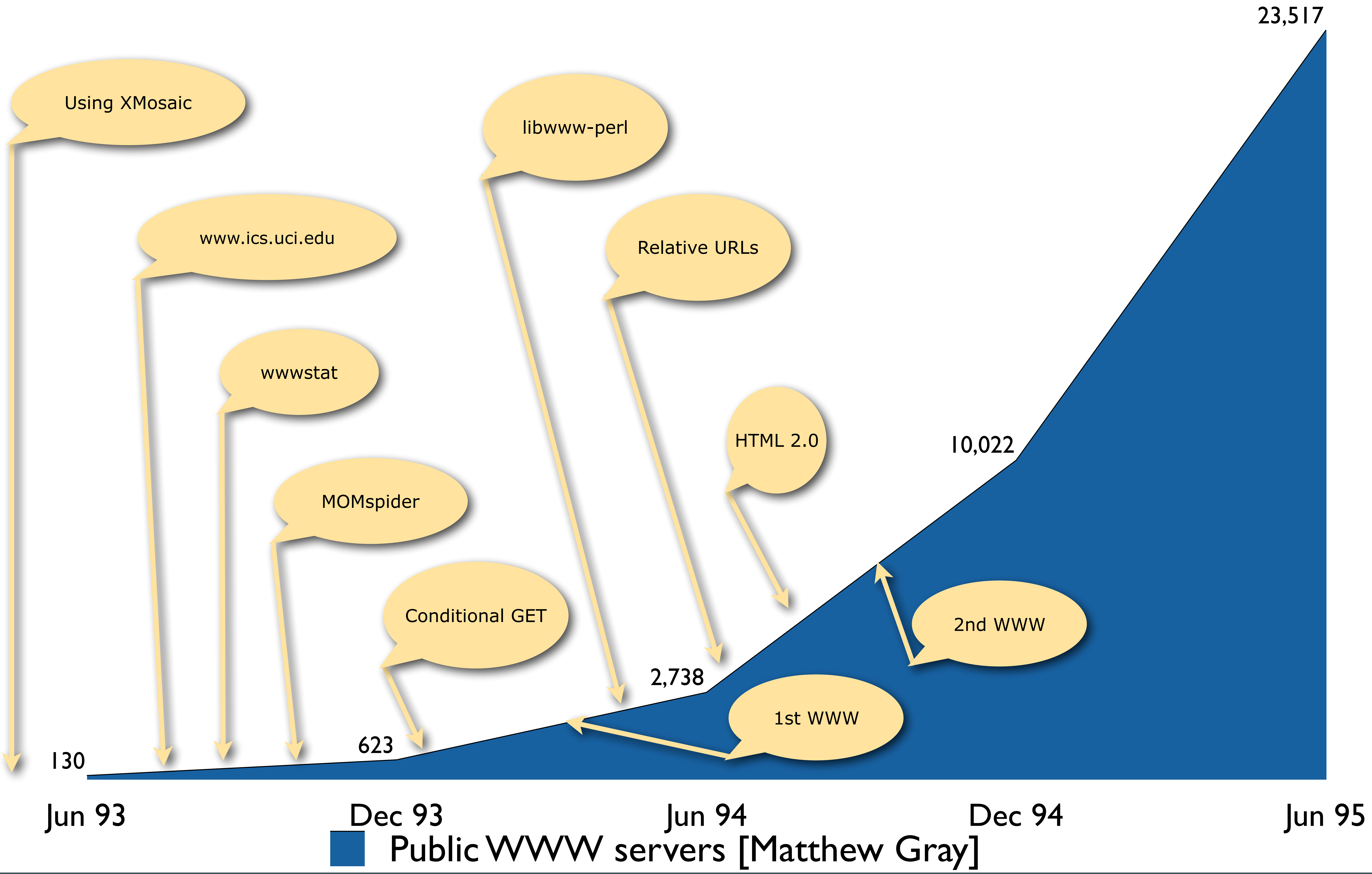

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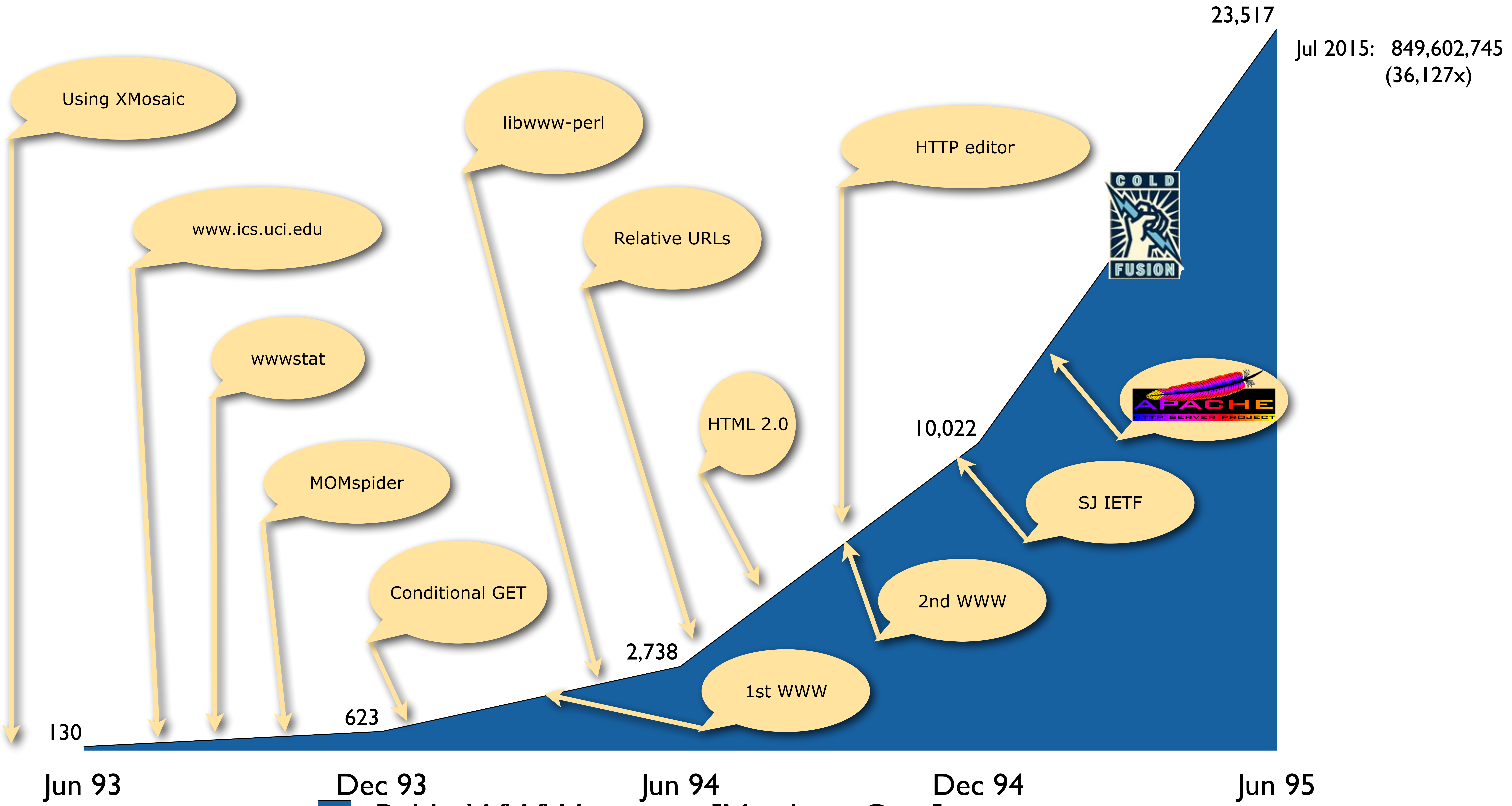

🟦 Public WWW servers [Matthew Gray]

We all know about REST in ColdFusion, right?

Adobe ColdFusion Documentation [Sep 2014]:

ColdFusion 10 lets you create and publish REST (Representational State Transfer) services that can be consumed by clients over HTTP/HTTPS request.

What is REST

The following URL takes you to the Java Tutorial that provides conceptual information on REST: http://download.oracle.com/javaee/6/tutorial/doc/gijqy.html

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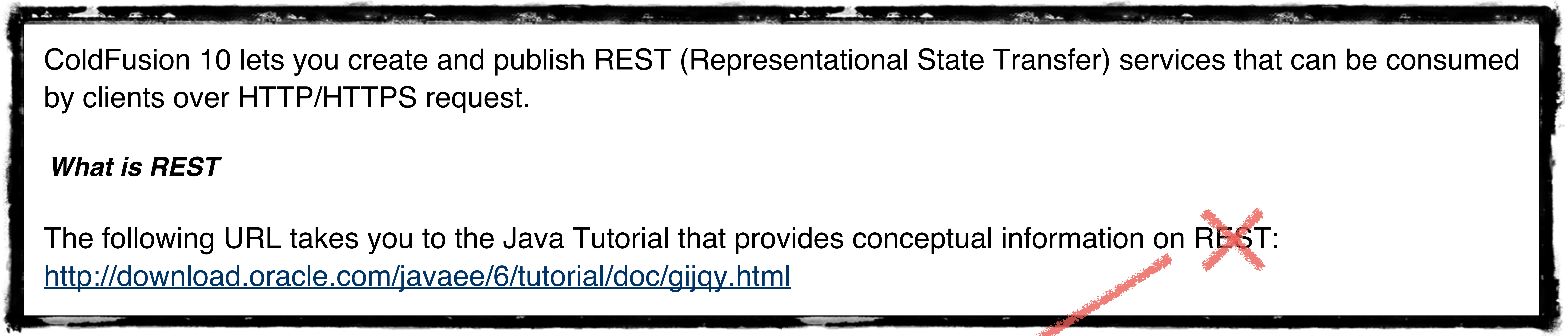

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JAX-RS (Jersey)

Java API for RESTful Web Services

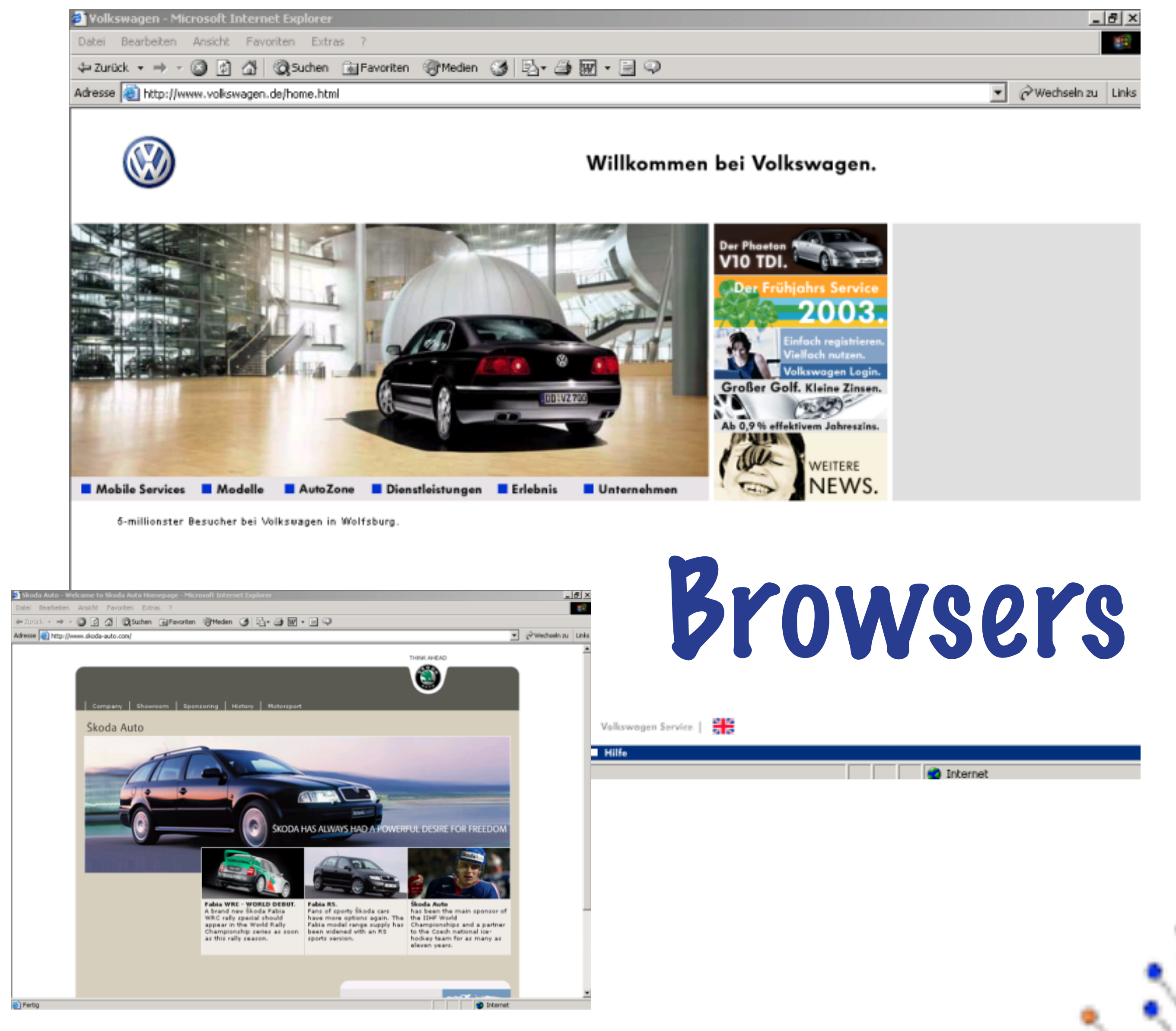
Am I going to talk about ColdFusion's implementation of REST APIs and API Management?

No,

REST

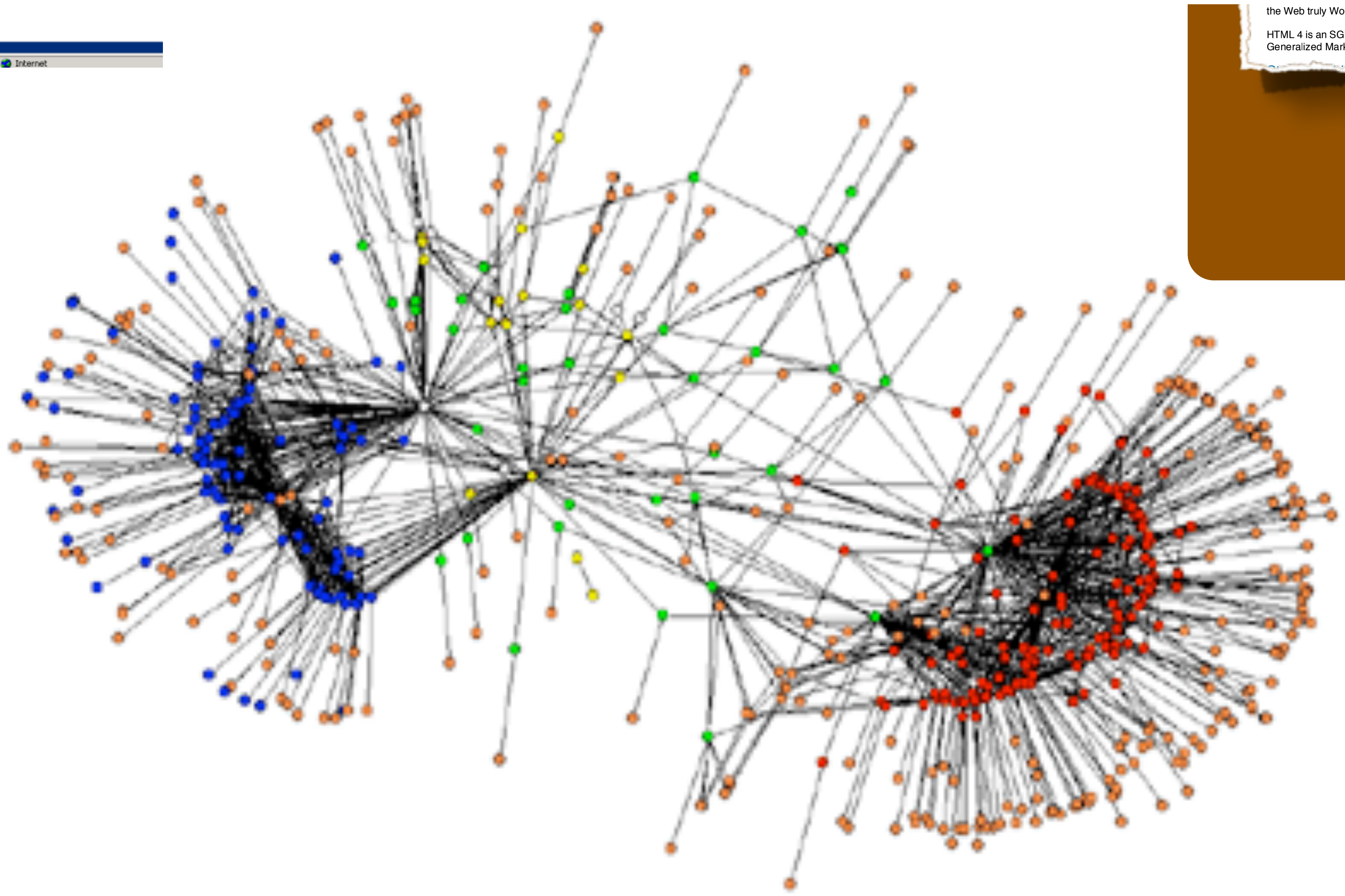
is NOT an implementation

Three (very different) perspectives of the Web

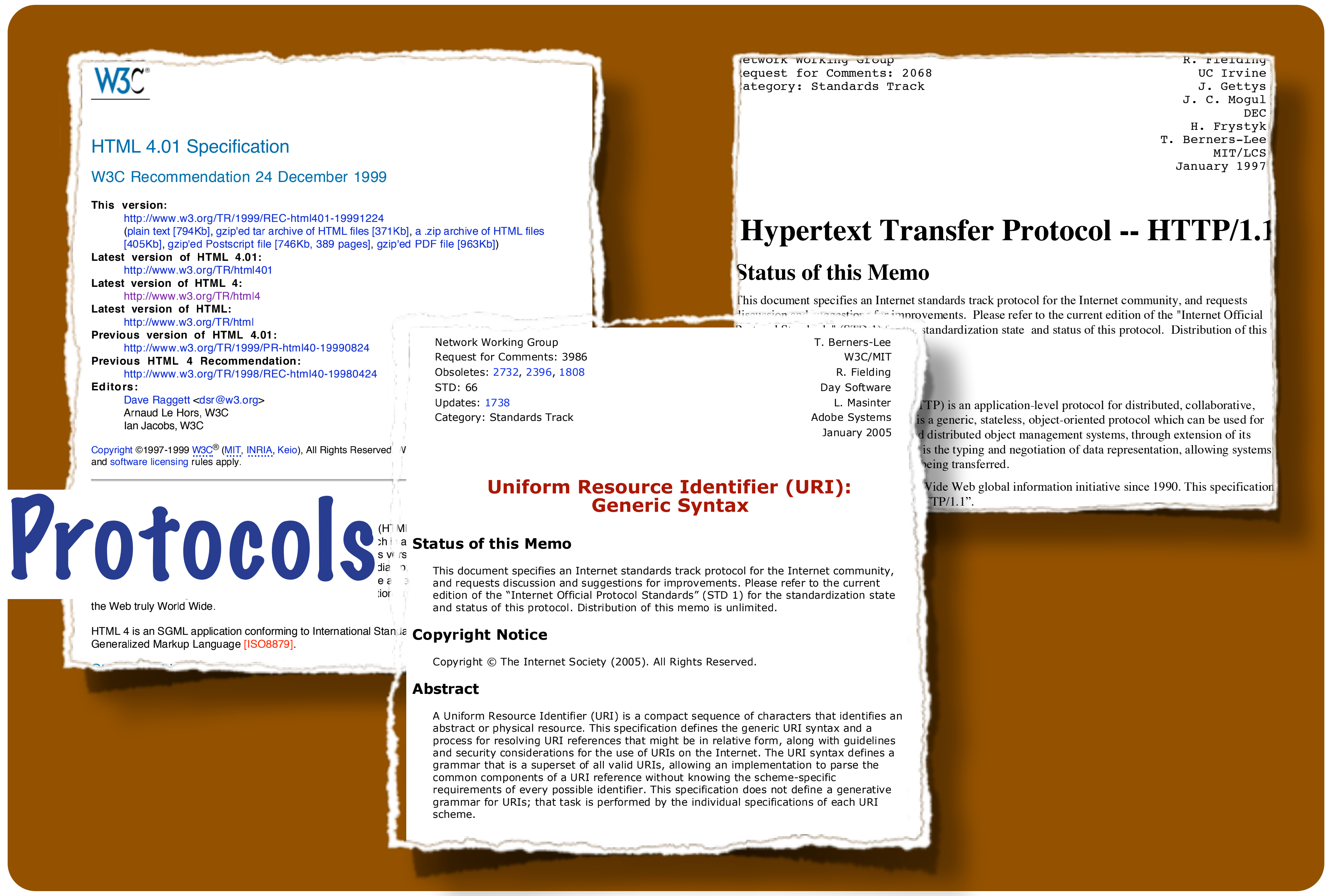

Volkswagen - Microsoft Internet Explorer
http://www.volkswagen.de/home.html
Willkommen bei Volkswagen.
Der Phaeton V10 TDI.
Der Frühjahrs Service 2003.
Großer Golf. Kleine Zinsen.
WEITERE NEWS.
Mobile Services
Modelle
AutoZone
Dienstleistungen
Erlebnis
Unternehmen
Skoda Auto
SKODA HAS ALWAYS HAD A POWERFUL DESIRE FOR FREEDOM

Browsers

Information



Protocols



W3C®

HTML 4.01 Specification

W3C Recommendation 24 December 1999

This version:
http://www.w3.org/TR/1999/REC-html401-19991224
(plain text [794Kb], gzip'ed tar archive of HTML files [371Kb], a .zip archive of HTML files [405Kb], gzip'ed Postscript file [746Kb, 389 pages], gzip'ed PDF file [963Kb])
Latest version of HTML 4.01:
http://www.w3.org/TR/html401
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http://www.w3.org/TR/html
Previous version of HTML 4.01:
http://www.w3.org/TR/1999/PR-html40-19990824
Previous HTML 4 Recommendation:
http://www.w3.org/TR/1998/REC-html40-19980424
Editors:
Dave Raggett <dsr@w3.org>
Arnaud Le Hors, W3C
Ian Jacobs, W3C

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the Web truly World Wide.

HTML 4 is an SGML application conforming to International Standa
Generalized Markup Language [ISO8879].

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etwork Working Group                                         R. Fielding
equest for Comments: 2068                                      UC Irvine
ategory: Standards Track                                       J. Gettys
                                                             J. C. Mogul
                                                                     DEC
                                                              H. Frystyk
                                                          T. Berners-Lee
                                                                 MIT/LCS
                                                            January 1997
```

Hypertext Transfer Protocol -- HTTP/1.1

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests
improvements. Please refer to the current edition of the "Internet Official
standardization state and status of this protocol. Distribution of this

TP) is an application-level protocol for distributed, collaborative,
is a generic, stateless, object-oriented protocol which can be used for
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being transferred.

Vide Web global information initiative since 1990. This specification
TP/1.1".

Network Working Group	T. Berners-Lee
Request for Comments: 3986	W3C/MIT
Obsoletes: 2732, 2396, 1808	R. Fielding
STD: 66	Day Software
Updates: 1738	L. Masinter
Category: Standards Track	Adobe Systems
	January 2005

Uniform Resource Identifier (URI): Generic Syntax

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

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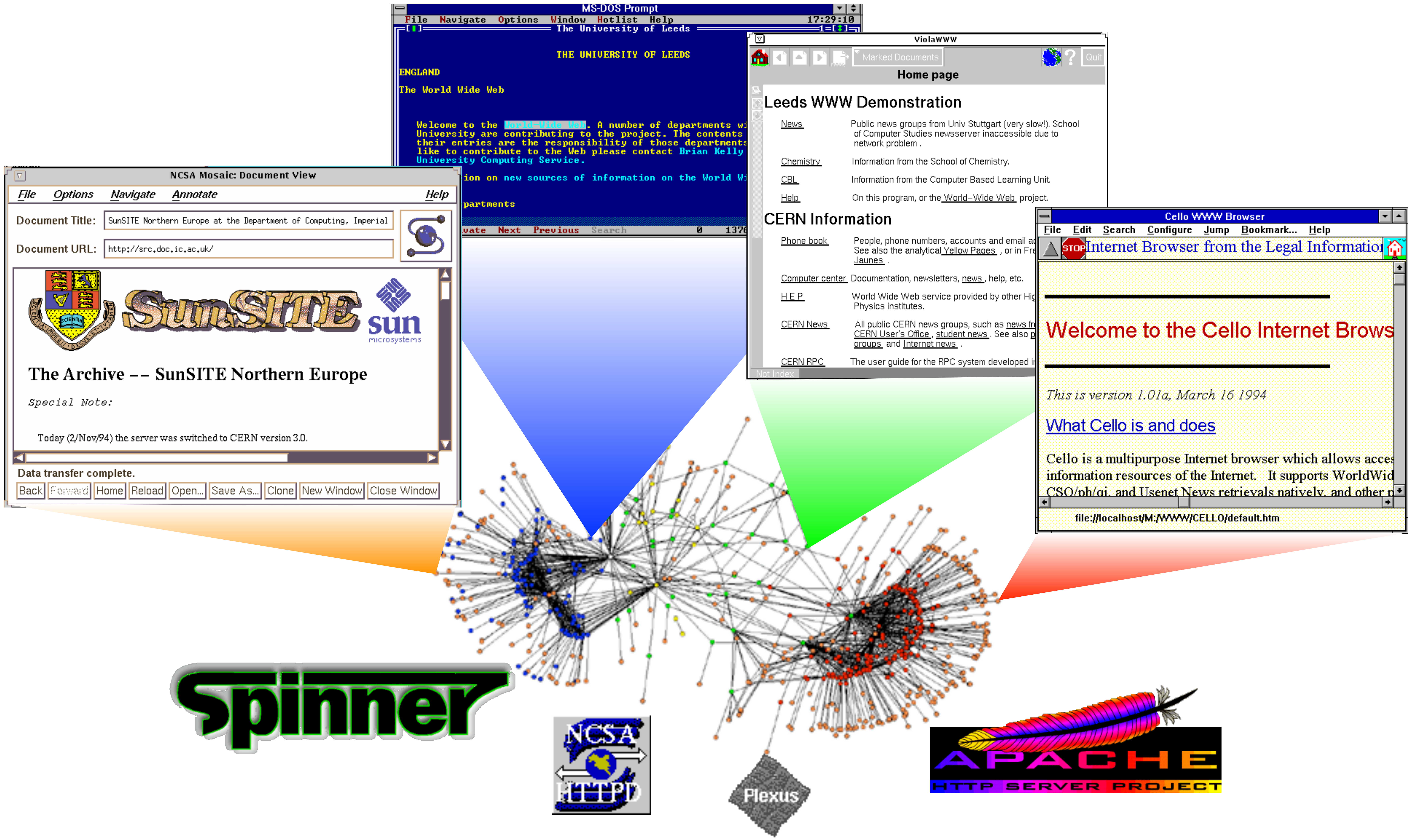
Abstract

A Uniform Resource Identifier (URI) is a compact sequence of characters that identifies an abstract or physical resource. This specification defines the generic URI syntax and a process for resolving URI references that might be in relative form, along with guidelines and security considerations for the use of URIs on the Internet. The URI syntax defines a grammar that is a superset of all valid URIs, allowing an implementation to parse the common components of a URI reference without knowing the scheme-specific requirements of every possible identifier. This specification does not define a generative grammar for URIs; that task is performed by the individual specifications of each URI scheme.

Web Implementation (user view)



MS-DOS Prompt
File Navigate Options Window Hotlist Help 17:29:10
The University of Leeds
ViolaWWW
Marked Documents
Quit
Home page
NCSA Mosaic: Document View
File Options Navigate Annotate Help
Back Forward Home Reload Open... Save As... Clone New Window Close Window
Cello WWW Browser
File Edit Search Configure Jump Bookmark... Help
STOP
Spinner
NCSA HTTPD
Plexus
APACHE
HTTP SERVER PROJECT

THE UNIVERSITY OF LEEDS

ENGLAND

The World Wide Web

Welcome to the World-Wide Web. A number of departments wi
University are contributing to the project. The contents
their entries are the responsibility of those departments
like to contribute to the Web please contact Brian Kelly
University Computing Service.

ion on new sources of information on the World Wi

partments

vate Next Previous Search 0 1376

Leeds WWW Demonstration

News	Public news groups from Univ Stuttgart (very slow!). School of Computer Studies newsserver inaccessible due to network problem .
Chemistry	Information from the School of Chemistry.
CBL	Information from the Computer Based Learning Unit.
Help	On this program, or the World-Wide Web project.

CERN Information

Phone book	People, phone numbers, accounts and email ad See also the analytical Yellow Pages , or in Fre Jaunes .
Computer center	Documentation, newsletters, news , help, etc.
H E P	World Wide Web service provided by other Hig Physics institutes.
CERN News	All public CERN news groups, such as news fr CERN User's Office , student news . See also p groups and Internet news .
CERN RPC	The user guide for the RPC system developed i

Not Index

Document Title: SunSITE Northern Europe at the Department of Computing, Imperial

Document URL: http://src.doc.ic.ac.uk/

SunSITE sun microsystems

The Archive -- SunSITE Northern Europe

Special Note:

Today (2/Nov/94) the server was switched to CERN version 3.0.

Data transfer complete.

Internet Browser from the Legal Information

Welcome to the Cello Internet Brows

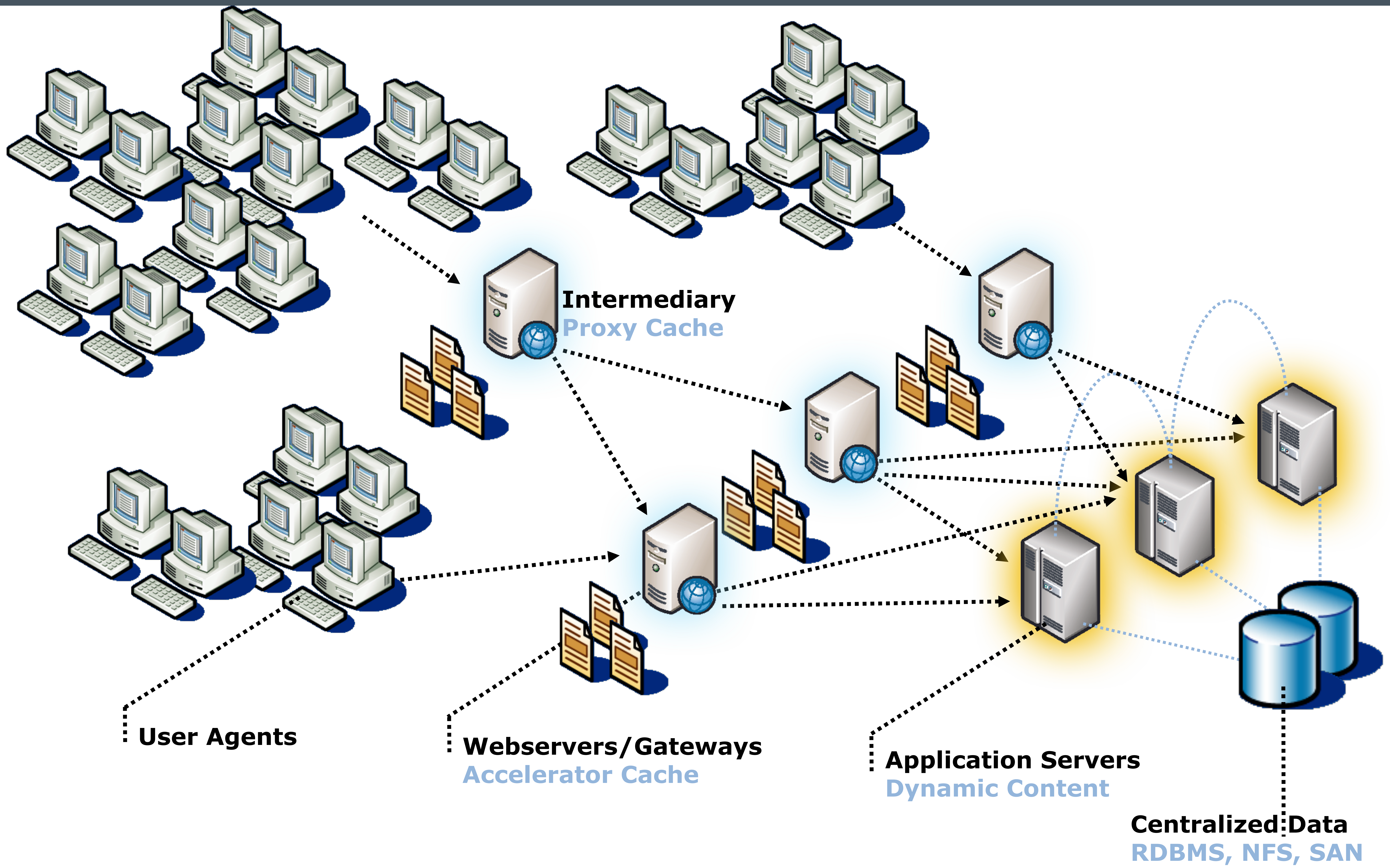
This is version 1.01a, March 16 1994

What Cello is and does

Cello is a multipurpose Internet browser which allows acces information resources of the Internet. It supports WorldWid CSO/ph/qi, and Usenet News retrievals natively, and other r

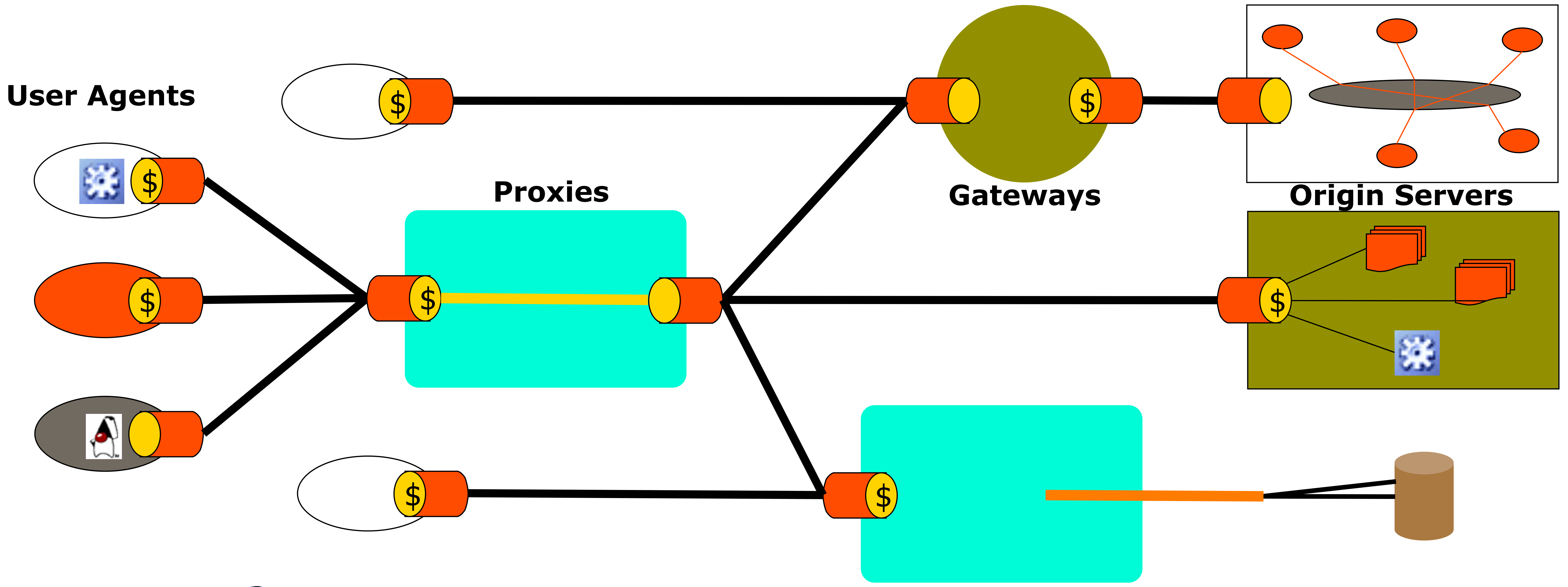
file://localhost/M:/WWW/CELLO/default.htm

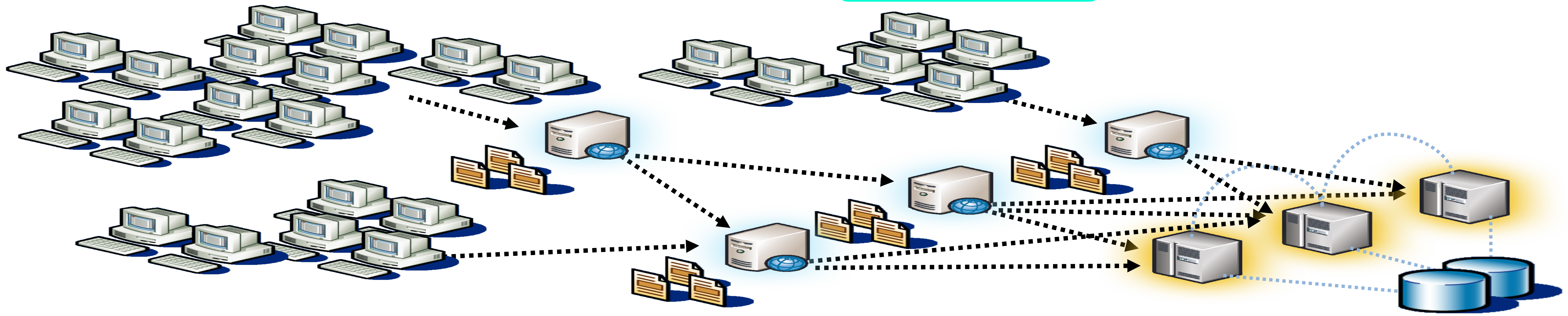
Web Implementation (origin view)



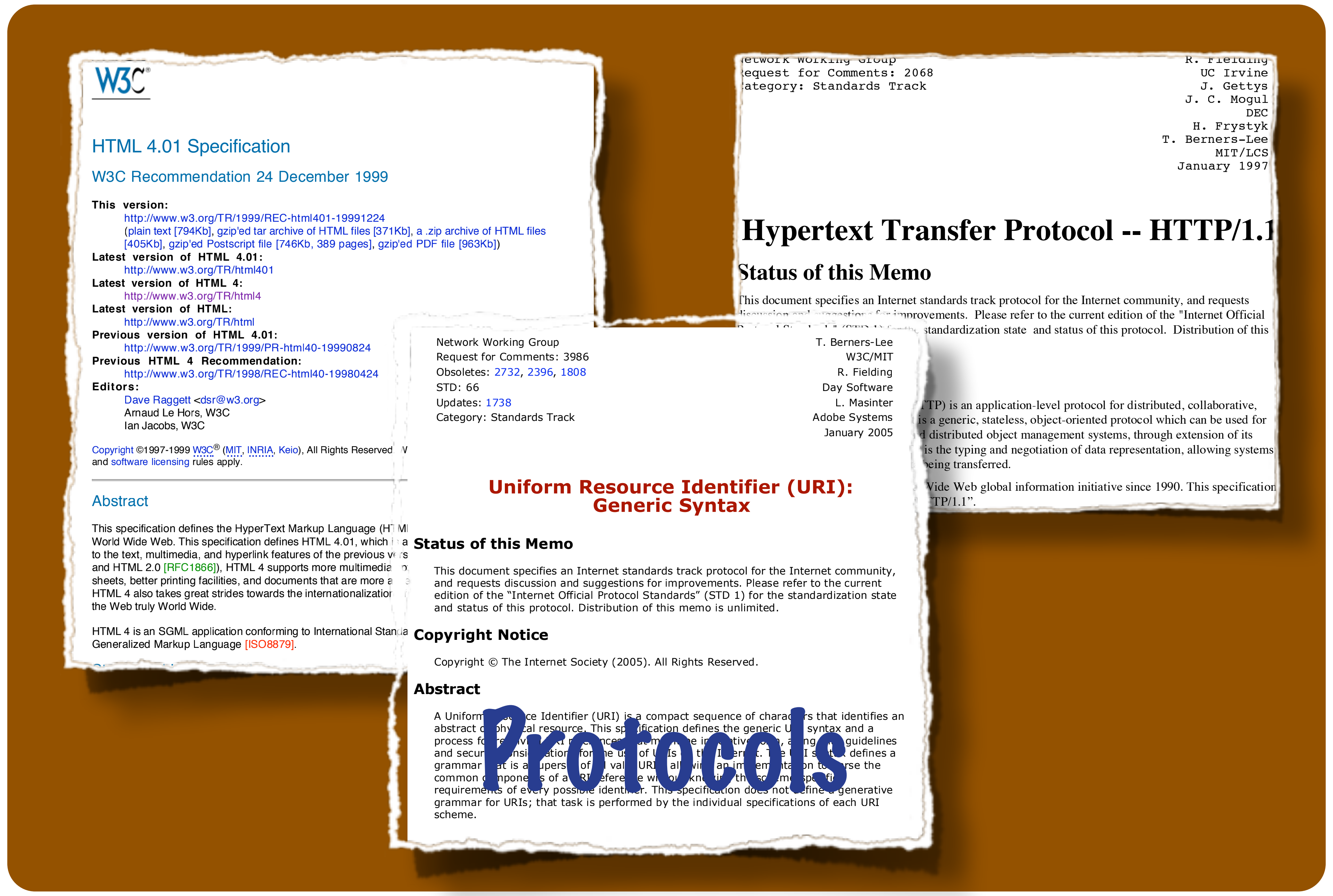
Web Architecture

Architecture is a vertical abstraction on implementation





Web protocols define that vertical abstraction on implementation



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Editors:
Dave Raggett <dsr@w3.org>
Arnaud Le Hors, W3C
Ian Jacobs, W3C

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Abstract

This specification defines the HyperText Markup Language (HTML
World Wide Web. This specification defines HTML 4.01, which is a
to the text, multimedia, and hyperlink features of the previous vers
and HTML 2.0 [RFC1866]), HTML 4 supports more multimedia o
sheets, better printing facilities, and documents that are more a
HTML 4 also takes great strides towards the internationalization
the Web truly World Wide.

HTML 4 is an SGML application conforming to International Standa
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etwork Working Group                                        R. Fielding
equest for Comments: 2068                                     UC Irvine
ategory: Standards Track                                      J. Gettys
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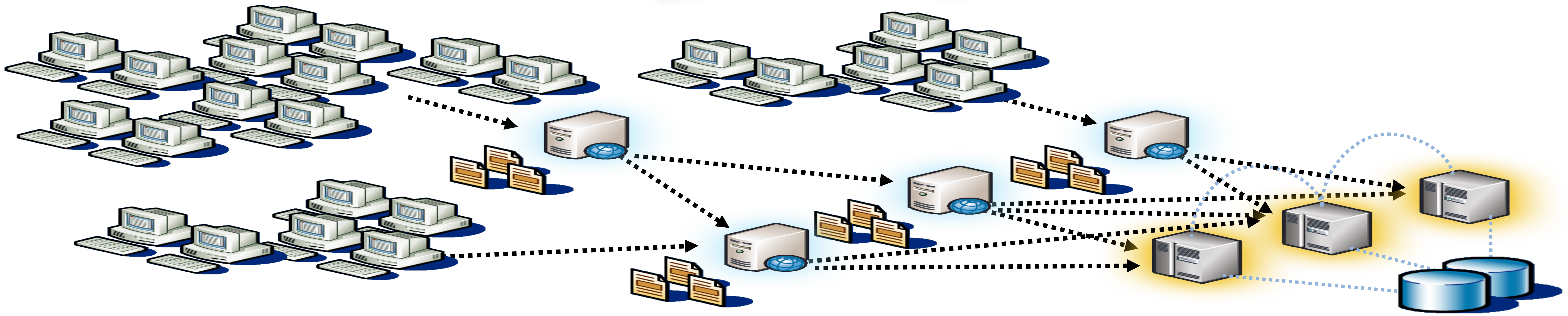


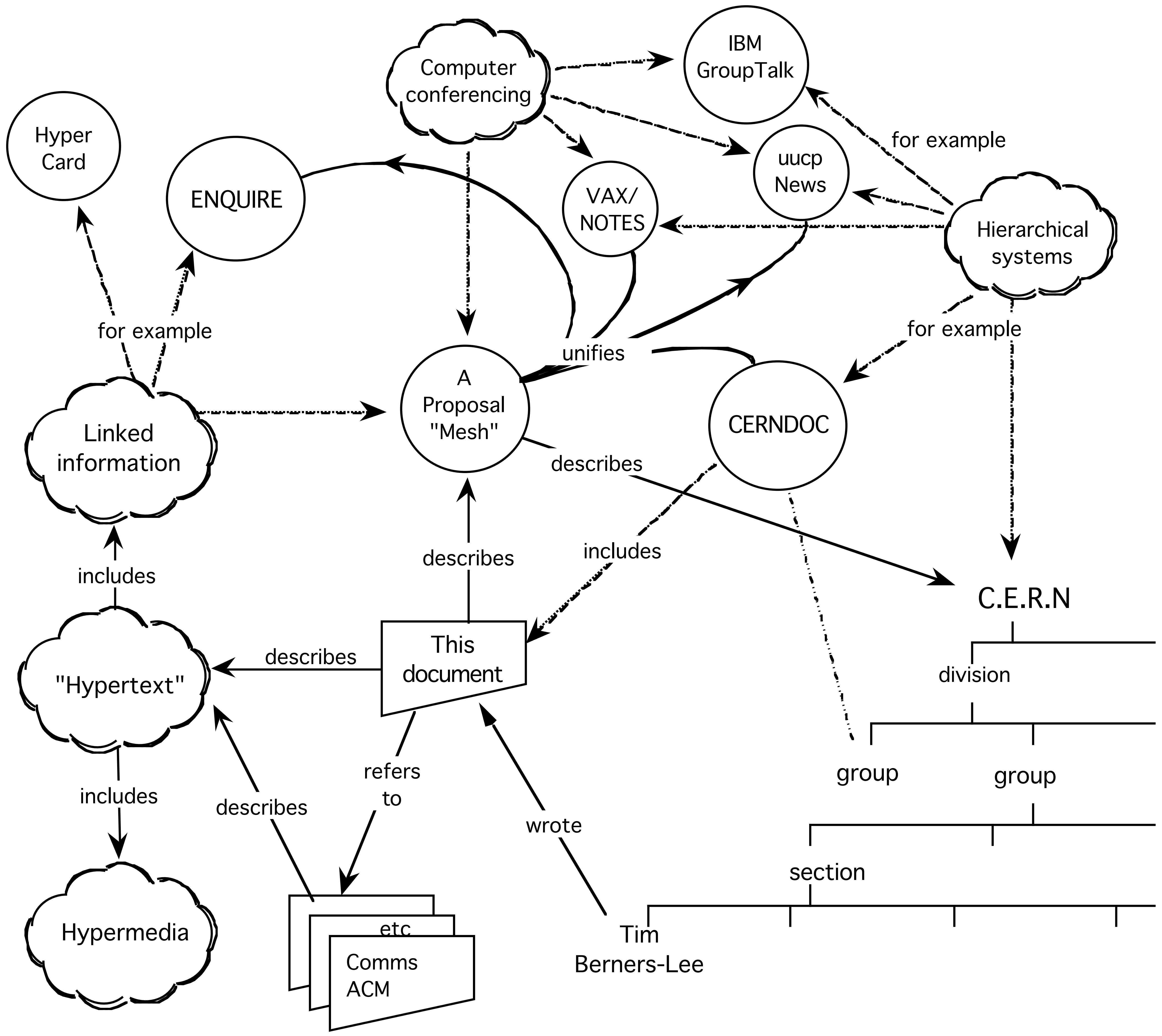
So, is REST the Web Architecture?

No,

REST

is NOT an architecture!

Original proposal for the World Wide Web



[Berners-Lee, 1989]

The Web is an application integration system

Computer conferencing
IBM GroupTalk
Hyper Card
ENQUIRE
VAX/ NOTES
uucp News
for example
Hierarchical systems
for example
unifies
for example
A Proposal "Mesh"
Linked information
CERNDOC
describes

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[Berners-Lee, 1989]

Network-based Applications

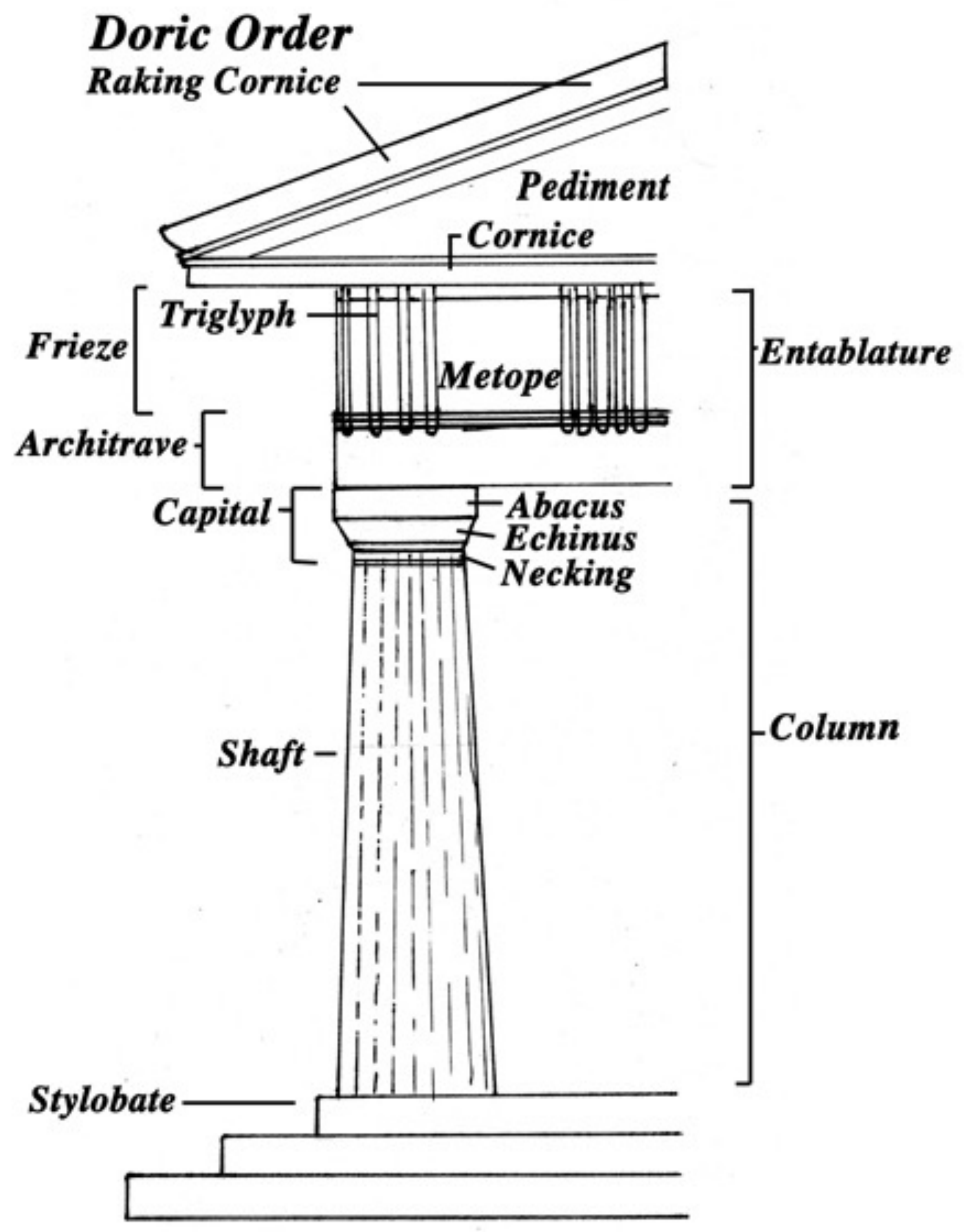
- Application
  - short for “applying a computer to accomplish a given purpose”
  - examples: finding a document, managing a bank account, or buying a travel ticket

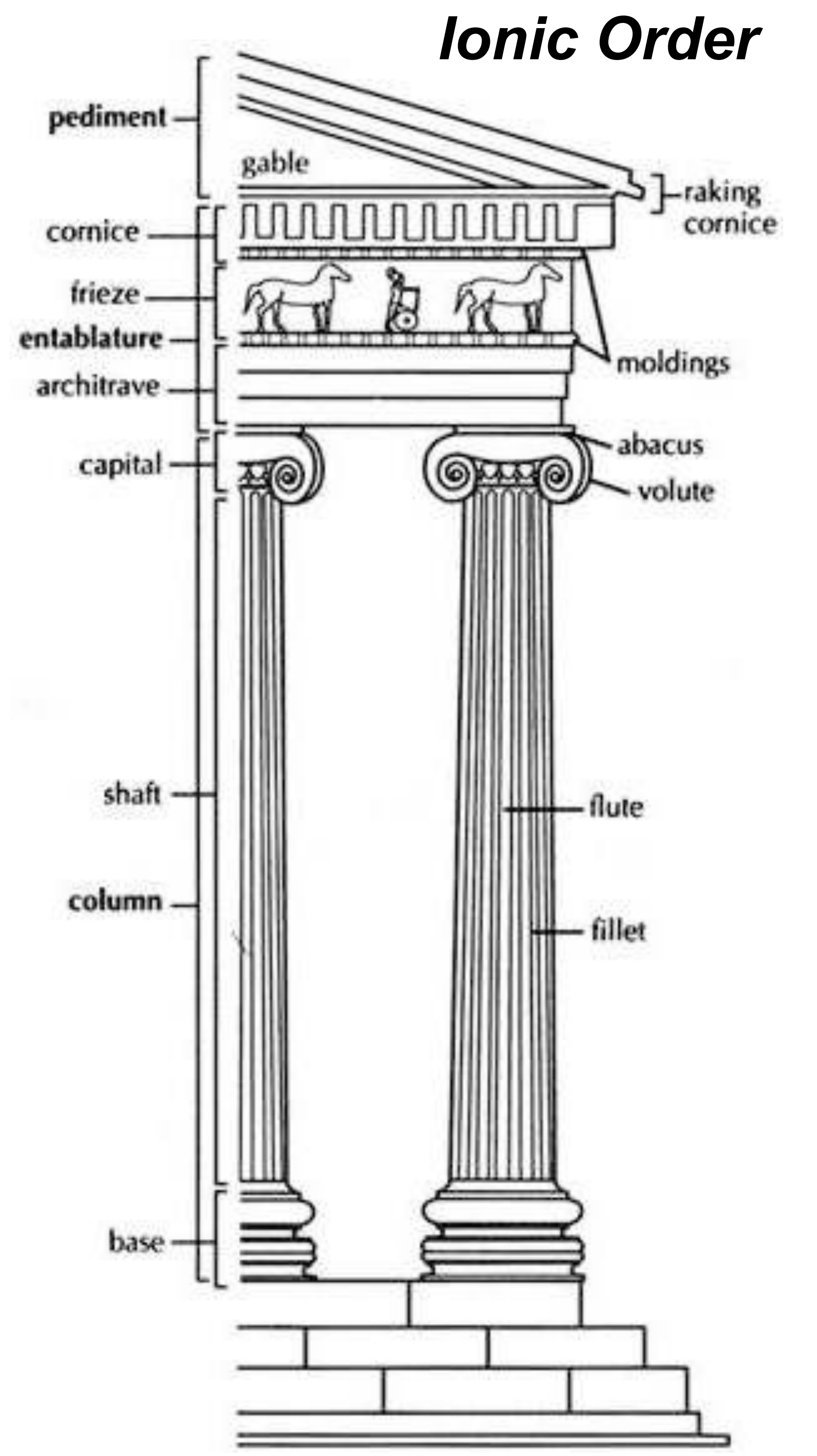
- Network-based
  - operating over the network with full knowledge of the user
  - i.e., unlike distributed, which intentionally hides the network

Architectural Styles

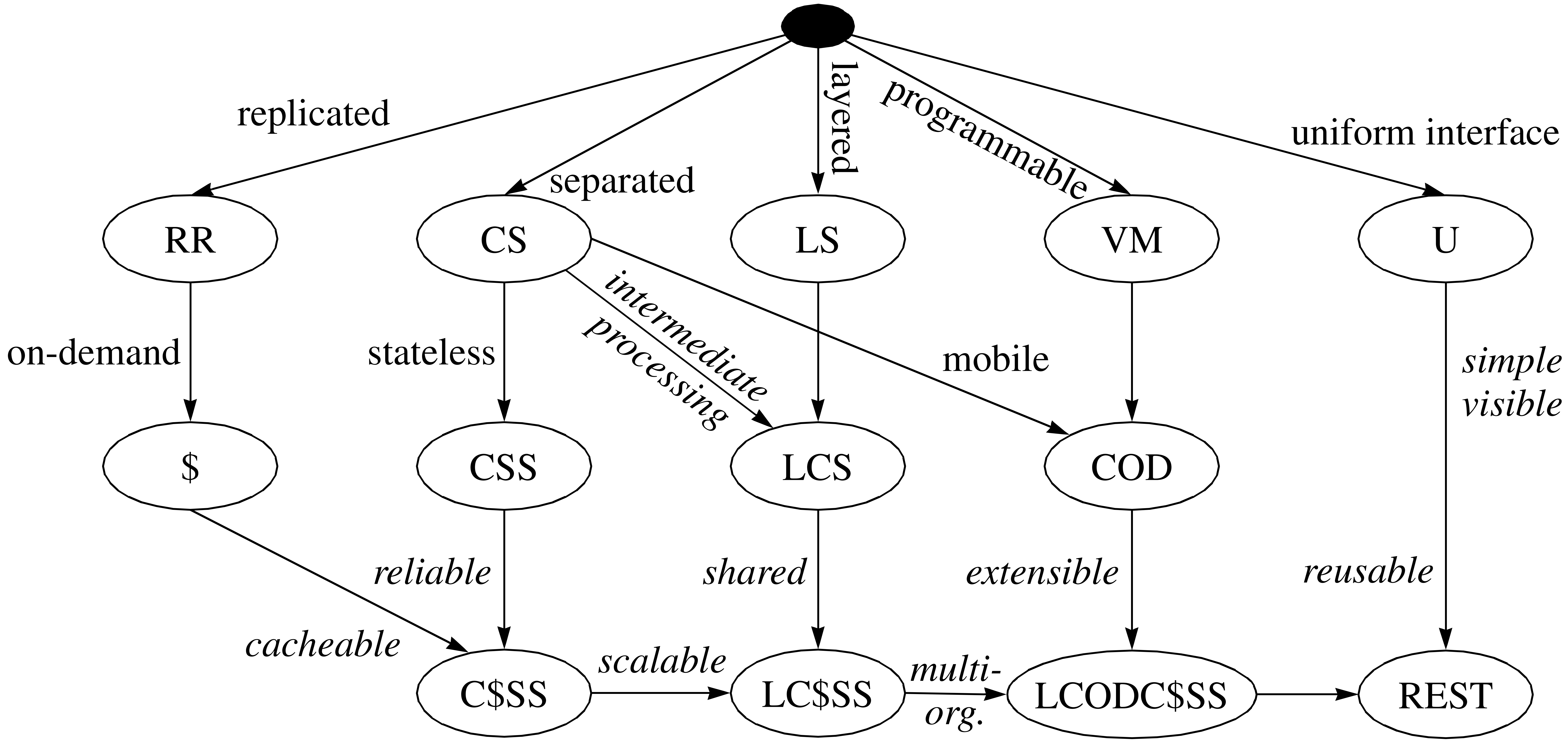
- A **horizontal abstraction** across multiple architectures (vertical abstractions)
  - names a repeated architectural pattern
  - defined by its design constraints
  - chosen for the properties they induce

- **REST is an architectural style**
  - for network-based applications
  - to induce a specific set of architectural properties
  - desired for the World Wide Web





REST is an accumulation of design constraints that induce architectural properties



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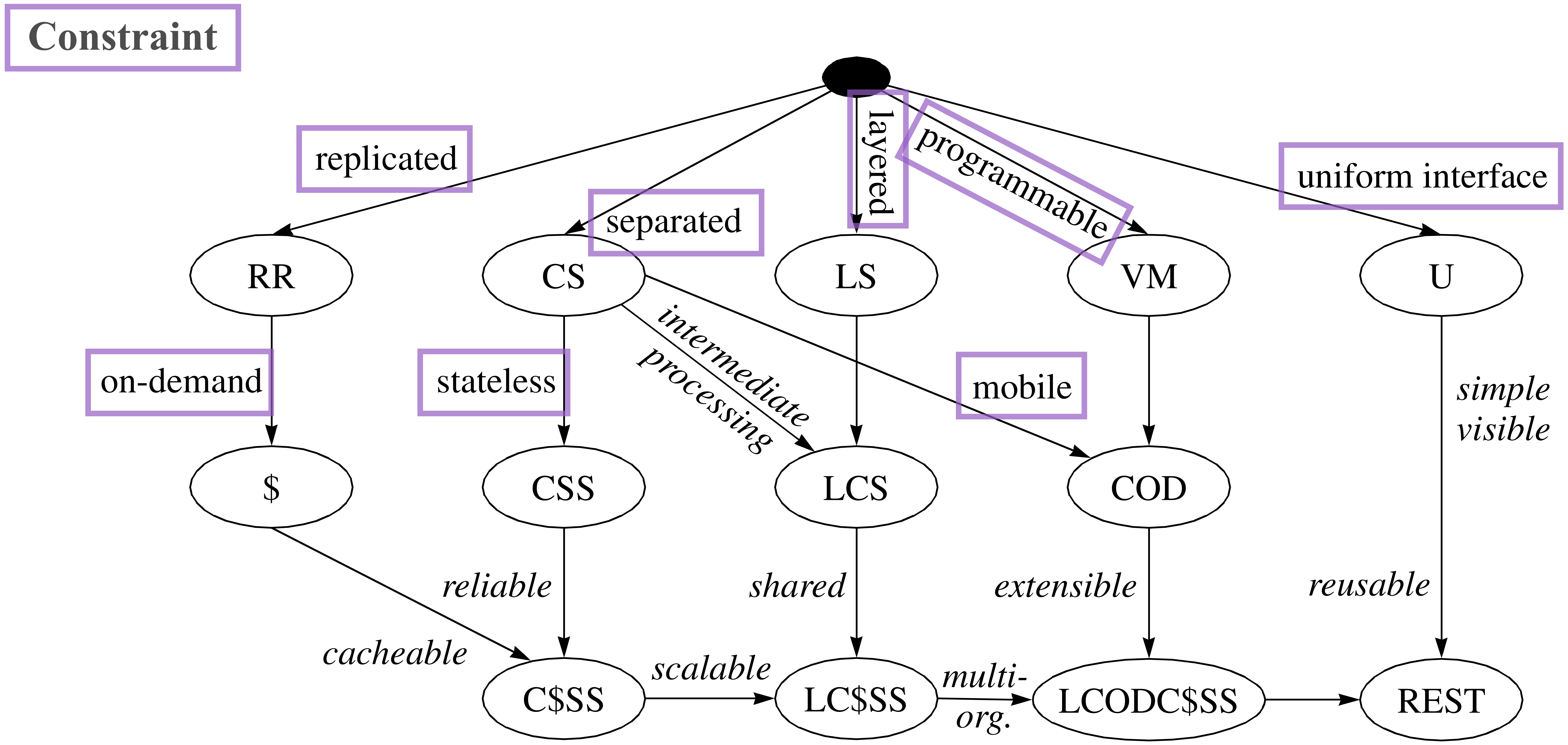

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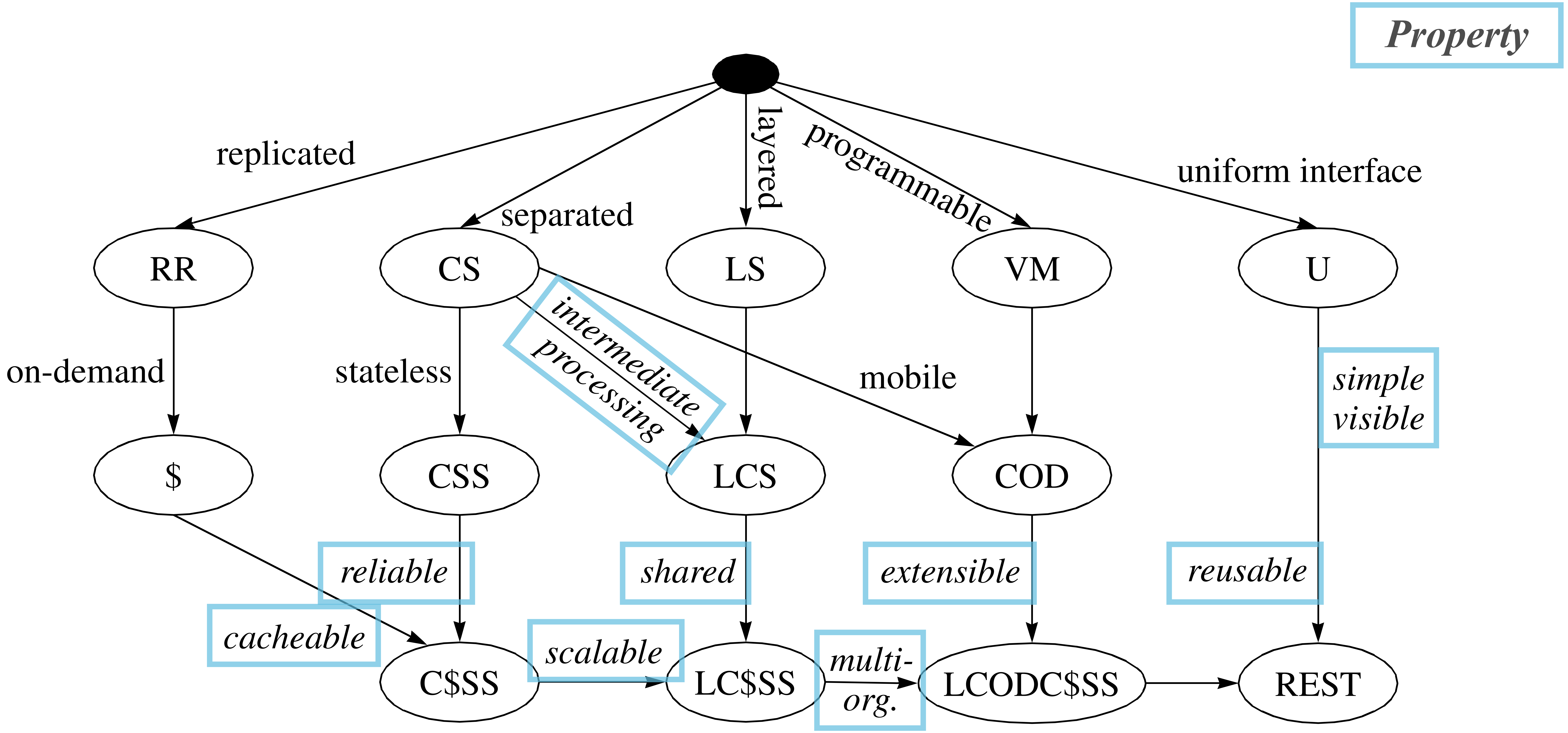
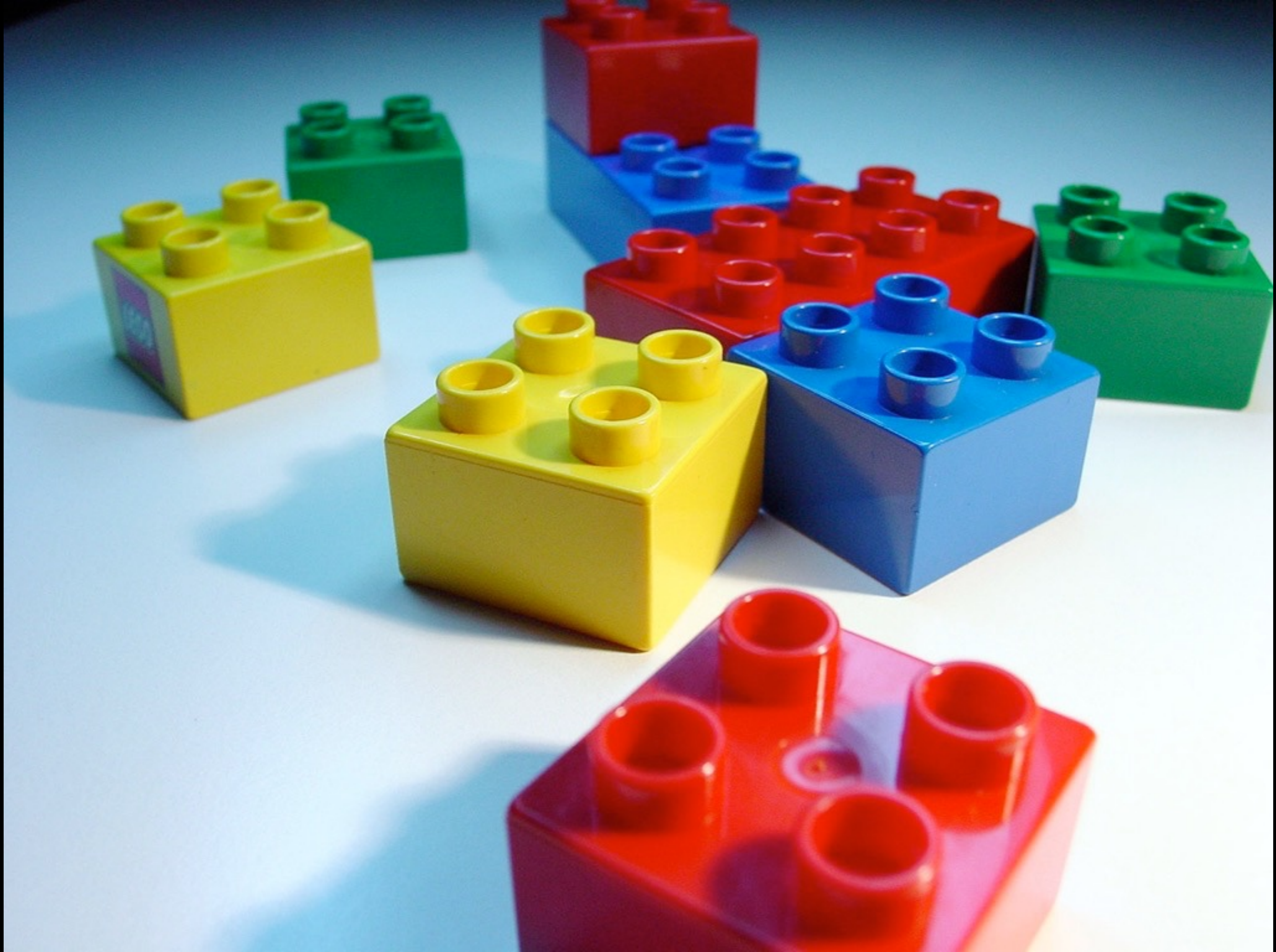




[photo by dhester: http://mrg.bz/xVLmr1]

[photo by EmmiP: http://mrg.bz/P7BJRi]

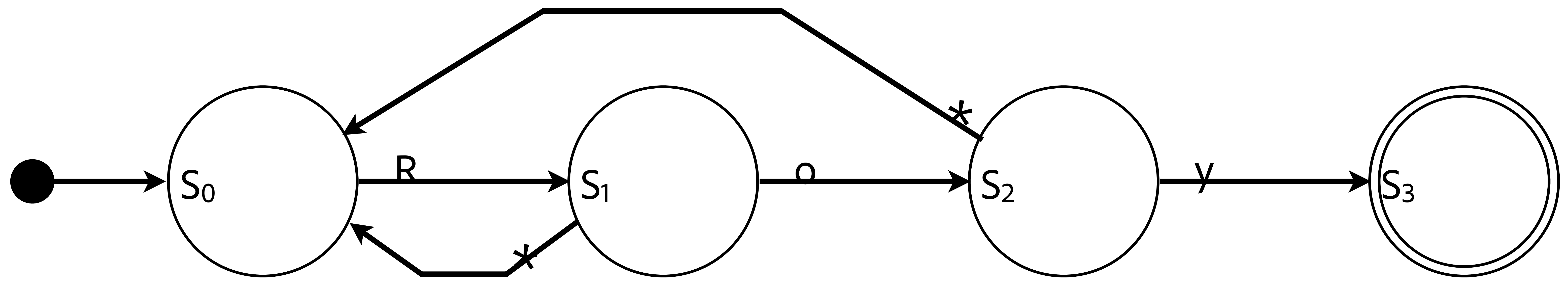
[photo by rupertjefferies: http://mrg.bz/Y9XThf]

REST’s Five Uniform Interface Constraints

- All important resources are identified by one resource identifier mechanism
  - induces simple, visible, reusable, stateless communication
- Access methods have the same semantics for all resources
  - induces visible, scalable, available through layered system, cacheable, and shared caches
- Resources are manipulated through the exchange of representations
  - induces simple, visible, reusable, cacheable, and evolvable (information hiding)
- Representations are exchanged via self-descriptive messages
  - induces visible, scalable, available through layered system, cacheable, and shared caches
  - induces evolvable via extensible communication
- Hypertext as the engine of application state
  - induces simple, visible, reusable, and cacheable through data-oriented integration
  - induces evolvable (loose coupling) via late binding of application transitions

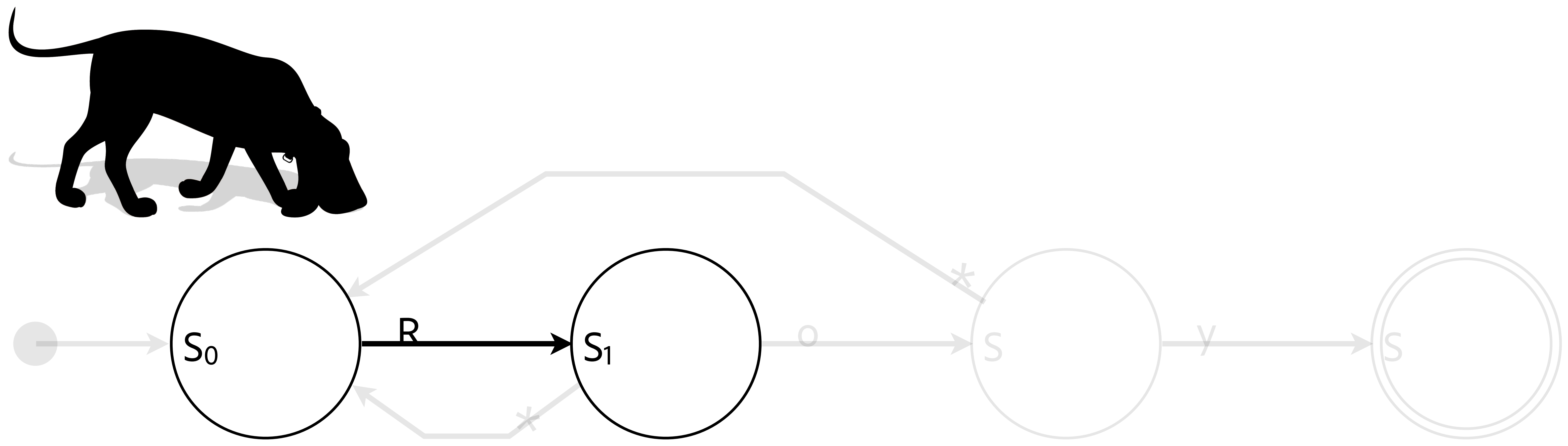
Why the hypermedia constraint?

Hypertext as the Engine of Application State



each state can be dynamic
each transition can be redirected

The client only needs to know one state and its transitions!



Follow Your Nose

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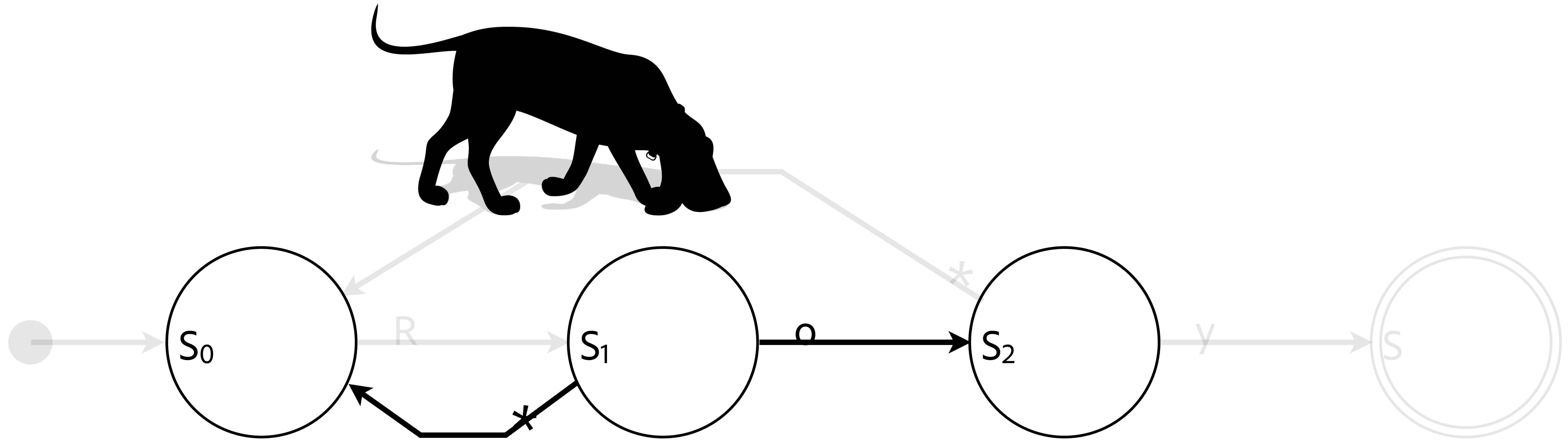

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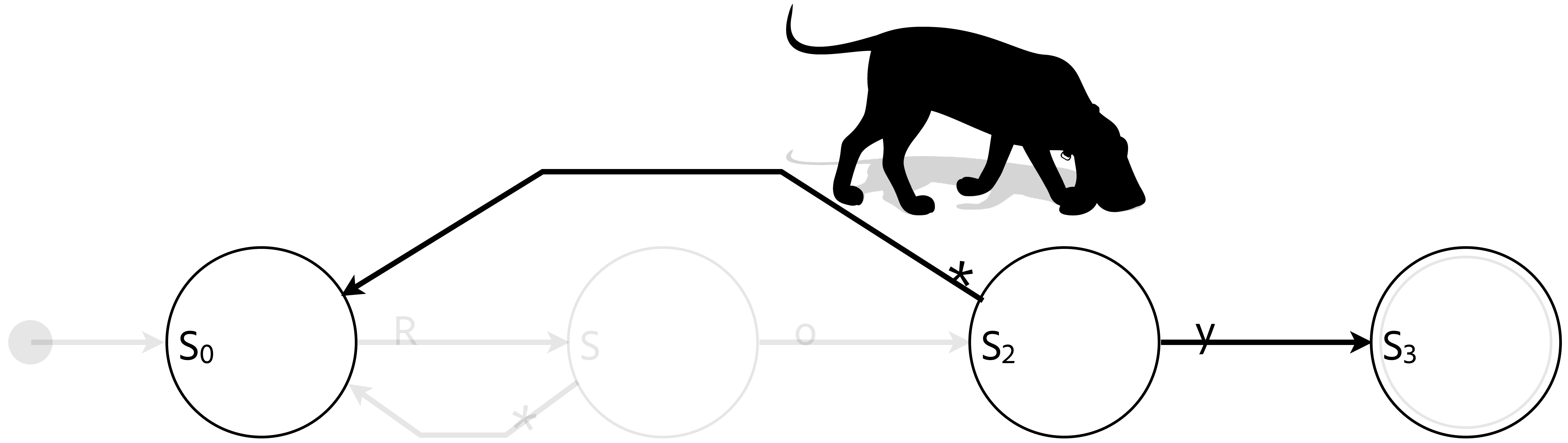

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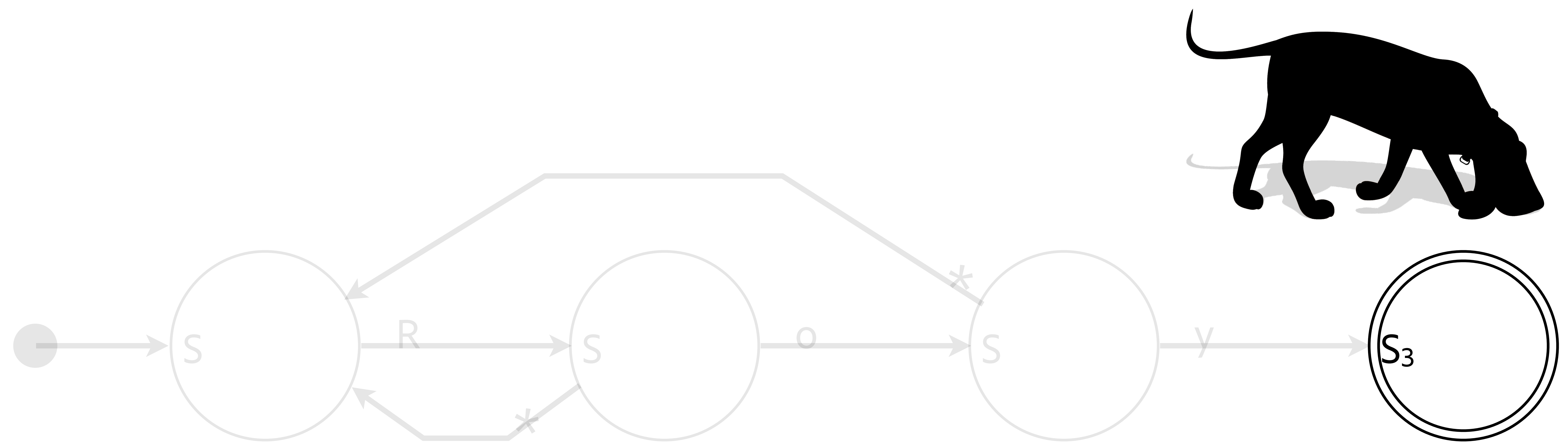

Follow Your Nose

Know Your Audience

REST
emphasizes evolvability
to sustain an uncontrollable system

If you think you have control over the system
or aren’t interested in evolvability,
don’t waste your time arguing about REST

What is the most common question about REST?

So, where is your …

REST

API?

Sorry, it's not that simple

An API that
provides network-based access to resources
via a uniform interface of self-descriptive messages
containing hypertext to indicate potential state transitions
might
be part of an overall system that is
a RESTful application

Some tips for building an API for RESTful applications

- Identify all of the resources
  - few resources are atomic; most are collections or views of other resources
  - don't confuse identity (naming) with containment (storage)
  - use access control, not obscurity, to control publication
  - resources have more in common with stored procedures than they do with records or files
- Iteratively develop resources and state transitions (use cases)
  - don't try to do everything at once
  - don't make any assumptions about received content, order, versioning, etc.
- Be flexible regarding media types and access protocols
  - start by prototyping in HTML and exploring with browsers and spiders
  - if you need to publish JSON, use a profile that defines hypertext semantics
  - use relative URLs wherever possible (to save space and improve portability)

Don’t over-think the problem space

a RESTful API is just a website
for users with a limited vocabulary
(machine to machine interaction)

Don’t under-think the problem space

building a good website
is not easy
(but it has been done before)

So, what does that mean for ColdFusion?

Why are we using an API designed by Sun/Oracle to build a website?

So, what does that mean for ColdFusion?

Why are we using an API designed by Sun/Oracle
to build a website?

Wouldn't it be better to use
a language for rapid application development
that could automatically select its output serialization
to match the media type in which it is embedded?

Adobe