

REST

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Introduction

The REST Architectura Style

Requirements Network Communicatio

Distributed System

Together

The REST Architecture

Summary

Representational State Transfer (REST) Applications and Services in Internet 2009 (4 cr)

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The REST

- Towards mid-1990's, WWW began to increase dramatically
- Old way: WWW protocols were what CERN libwww implemented



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Architecture

- Towards mid-1990's, WWW began to increase dramatically
- Old way: WWW protocols were what CERN libwww implemented
- Drawbacks: Non-open, hard to understand, cannot rely on functionality, ...



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- Towards mid-1990's, WWW began to increase dramatically
- Old way: WWW protocols were what CERN libwww implemented
- Drawbacks: Non-open, hard to understand, cannot rely on functionality, ...
- Needed: A specification for WWW protocols



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- Old way: WWW protocols were what CERN libwww implemented
- Drawbacks: Non-open, hard to understand, cannot rely on functionality, ...
- Needed: A specification for WWW protocols
- ... and also architecture



Development of REST

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- Ad-hoc ways of adding functionality no longer sufficient
 - Apache group took initiative in nailing down the principles of WWW
 - Goal: Make sure "modern" WWW can scale
 - HTTP 1.0 as a proving ground, HTTP 1.1 as a "finalized" version



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Architecting Distributed Systems

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The REST Architecture

- Requirements phase
- Using requirements to pick styles
- Identifying components and their communication
- Optimizing architecture



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• Berners-Lee: "a shared information space through which people and machines could communicate"



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- Berners-Lee: "a shared information space through which people and machines could communicate"
- Information space \Rightarrow Repository of information



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- Berners-Lee: "a shared information space through which people and machines could communicate"
- Information space \Rightarrow Repository of information
- Communicate \Rightarrow Store and access information



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- Berners-Lee: "a shared information space through which people and machines could communicate"
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- Shared \Rightarrow References to other information



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- Berners-Lee: "a shared information space through which people and machines could communicate"
 - Information space \Rightarrow Repository of information
 - Communicate \Rightarrow Store and access information
- Shared \Rightarrow References to other information
- People \Rightarrow Simplicity of use



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- Berners-Lee: "a shared information space through which people and machines could communicate"
 - Information space \Rightarrow Repository of information
- Communicate \Rightarrow Store and access information
- Shared \Rightarrow References to other information
- People \Rightarrow Simplicity of use
- Machines \Rightarrow Automated processing



Environmental Requirements

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- Simplicity and referencing requirements translated to hypermedia and text-based protocols
- Innovation of the Web: the 404 page (see also: zangelding)
- User-perceived latency vs. network latency
- Runs over the Internet: Anarchic scalability
- Requirements evolve!



Architectural Style Derivation

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The REST Architecture

- Two design processes
 - Put together familiar building blocks until requirements are satisfied
 - Identify constraints in requirements to limit design space
- Different constraints lead to different fundamental styles
- Fundamental styles need to be combined into derived styles



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Client–Stateless-Server

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- Client-server architecture provides separation of user interface from content management
- Stateless-server benefits: visibility, reliability, and scalability
- Stateless-server drawbacks: network overhead, inconsistent clients





Caching

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- The best way to use the network: Don't!
- Remote access always more expensive than local access
- Interaction with dynamic content
- Benefits: efficiency, scalability, latency
- Drawbacks: staleness



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Layered System

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- System composed of layers, each abstracted to a well-defined interface
- Client-mediator-server architecture





Uniform Interface

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The REST Architecture

- Key REST constraint: each component has the same interface
- · Especially useful when combined with layering
- Resembles Pipes-and-filters pattern
- Drawback: efficiency



Code-On-Demand

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- Final piece: Virtual Machine on clients, leads to code-on-demand capability
- Permits arbitrary extensions
- Difference from mobile agents: no state is transferred
- Rule of Least Power



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Complete Derivation

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Style and Architecture

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The REST Architecture

- Architectural style is not an architecture
- Pieces of architecture: data, connectors, components
- Components use connectors to access each other
- Data is sent by components through connectors



REST Data Elements

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Resource Nameable information Resource identifier Durable identifier for resource Representation Transferred version of resource Representation metadata Specific information on representation

Resource metadata General information on resource Control data Information on message



Interface Constraints

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The REST Architecture

- Identification of resources
- Ø Manipulation of resources through representations
- Self-descriptive messages
- 4 Hypermedia as the engine of application state



REST Connectors

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Client Communication initiator Server Responder to requests Cache Serves cacheable responses Resolver Maps resource identifiers to network address Tunnel Passive component, needed for non-proxyable communication



REST Components

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Origin server Governs resources, source for representations Gateway Intermediary imposed by server or network Proxy Intermediary selected by client User agent Request initiator, response recipient



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- Large systems need design from the ground up
- Architectural style dictated by application needs
- Style derivation by adding constraints
- Cacheability, stateless server, uniform interface



Lecture Over

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Have a good week!