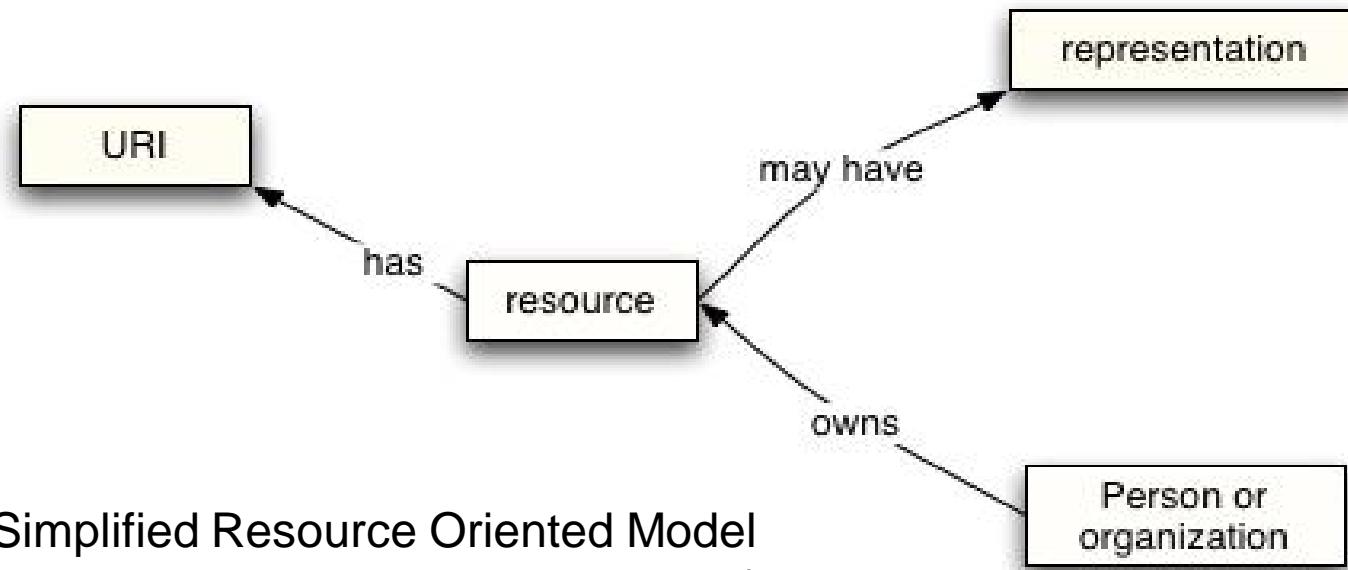


SPRING REST

Resource-Oriented Architecture

is a style of [software architecture](#) and [programming paradigm](#) for designing and developing [software](#) in the form of [resources](#) with "[RESTful](#)" [interfaces](#)

- en.wikipedia.org



Simplified Resource Oriented Model

Source : <http://www.w3.org/TR/ws-arch/>

What is REST?

- REpresentational State Transfer
 - PhD by Roy Fielding
 - The Web is the most successful application on the Internet
 - What makes the Web so successful?
- A different way to look at writing Web Services
 - Many say it's the anti-WS-*
 - In my experience, hard for CORBA or WS-* to accept/digest
- REST isn't protocol specific
 - But, usually REST == REST + HTTP

What is REST?

- Addressable Resources
 - Every “thing” should have an ID
 - Every “thing” should have a URI
 - Every “thing” should be referenceable
- Constrained interface
 - Use the standard methods of the protocol
 - HTTP: GET, POST, PUT, DELETE, etc.
- Resources with multiple representations
 - Different applications need different formats
 - Different platforms need different representations (AJAX + JSON)
- Communicate statelessly
 - Stateless application scale

The Resource Oriented Architecture

ROA – Concepts & Properties

Concepts

- Resources
- Their names (URIs)
- Their representations
- The links between them

Properties

- Addressability
- Statelessness
- Connectedness
- A uniform interface

REST Data Elements

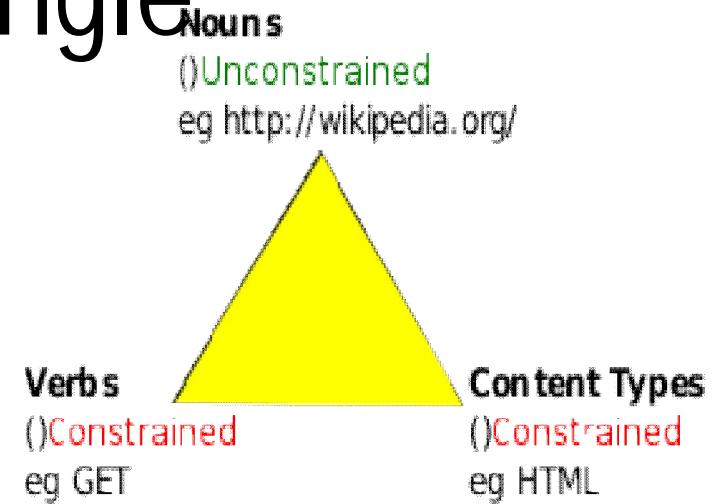
Data Element	Modern Web Examples
resource	the intended conceptual target of a hypertext reference
resource identifier	URL, URN
representation data	HTML document, JPEG image
representation metadata	media type, last-modified time
resource metadata	source link, alternates, vary
control data	if-modified-since, cache-control

Source : http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm#sec_5_2

REST Triangle

Nouns: Know Your URIs

- is an identifier for a resource
- Generally a URL, URN, URI
- Eg
http://example.com/=model/person/id/
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Verbs: Know Your CRUD

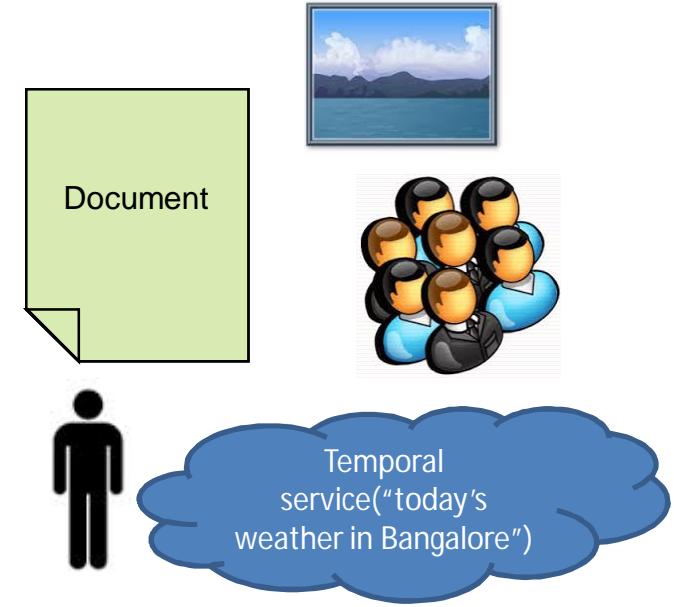
- common changes made to data: Create, Read, Update, and Delete
 - GET performs a read operation
 - POST performs a create operation
 - PUT performs an update operation
 - DELETE performs a delete operation
- Not mandatory to have all the operations in a RESTful web service

Content Types: Know Your MIME

- Format of data used in the RESTful application
- "Content-Type" header

What's a Resource ?

- ▶ key abstraction of information in REST
 - any item of interest :
document/image, non virtual object
etc.
- ▶ conceptual mapping to a set of entities
- ▶ *A resource R is a temporally varying membership function $MR(t)$, which for time t maps to a set of entities, or values, which are equivalent.*
- ▶ *The values in the set may be resource representations and/or resource identifiers.*



Source : http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm#sec_5_2

URIs

Each resource is identified by one or more Uniform Resource Identifiers (URIs)

Twitter: <https://dev.twitter.com/docs/api>

Facebook: <http://developers.facebook.com/docs/reference/api/>

LinkedIn: <https://developer.linkedin.com/apis>

URIs – Criteria for good URI

- Nouns, not verbs
- Short (as possible)
- Hackable ‘up the tree’.
 - remove the leaf path and get an expected page back
- Meaningful
- Predictable. Human-guessable. Readable
- Consistent
- Stateless
- Return a representation (e.g. XML or json) based on the request headers
- Tied to a resource. Permanent
- Report canonical URIs.
- Uses name1=value1;name2=value2 (aka matrix parameters) when filtering collections of resources.

Addressability

- Every “thing” has a URI

<http://sales.com/customers/323421>

<http://sales.com/customers/32341/address>

- From a URI we know
 - The protocol (How do we communicate)
 - The host/port (Where it is on network)
 - The resource path(What resource are we communicating with)

Addressability

- Its standardized and well-known
 - Anybody that has used a browser understands URIs
 - Java EE has no standard addressability for components. Isn't that a portability headache?
- Linkability
 - Support finds a problem? Have them email you a URI that reproduces the problem
 - Resource representations have a standardized way of referencing other resource representations
 - Representations have a standardized way to compose themselves:

```
<order id="111">
  <customer>http://sales.com/customers/32133</customer>
  <order-entries>
    <order-entry>
      <quantity>5</quantity>
      <product>http://sales.com/products/111</product>
    ...
  </order-entries>
</order>
```

Describing a URI

- Human readable URIs: Desired but not required
- URI Parameters

<http://sales.com/customers/323421>
`/customers/{customer-id}`

- Query parameters to find other resources

`http://sales.com/customers?zip=02115`

<http://sales.com/customers?name=John+Doe&age=30>
Matrix parameters to define resource attributes

Constrained, Uniform Interface

- Hardest thing for those with CORBA and/or WS-* baggage to digest
- The idea is to have a well-defined, fixed, finite set of operations
 - Resources can only use these operations
 - Each operation has well-defined, explicit behavior
 - In HTTP land, these methods are GET, POST, PUT, DELETE
- How can we build applications with only 4+ methods?
 - SQL only has 4 operations: INSERT, UPDATE, SELECT, DELETE
 - JMS has a well-defined, fixed set of operations
 - Both are pretty powerful and useful APIs with constrained interfaces

Implications of a Uniform Interface

- Intuitive
 - You know what operations the resource will support
- Predictable behavior
 - GET - readonly and idempotent. Never changes the state of the resource
 - PUT - an idempotent insert or update of a resource. Idempotent because it is repeatable without side effects.
 - DELETE - resource removal and idempotent.
 - POST - non-idempotent, “anything goes” operation
- Clients, developers, admins, operations know what to expect
 - Much easier for admins to assign security roles
 - For idempotent messages, clients don’t have to worry about duplicate messages.

Implications of a Uniform Interface

- Simplified
 - Nothing to install, maintain, upgrade
 - No stubs you have to generate distribute
 - No vendor you have to pay big bucks to
- Platform portability
 - HTTP is ubiquitous. Most (all?) popular languages have an HTTP client library
 - CORBA, WS-*, not as ubiquitous
 - (We'll talk later about multiple representations and HTTP content negotiation which also really helps with portability)
- Interoperability
 - HTTP a stable protocol
 - WS-*, again, is a moving target
 - Ask Xfire, Axis, and Metro how difficult Microsoft interoperability has been
 - Focus on interoperability between applications rather focusing on the interoperability between vendors.

Implications of Uniform Interface

- Familiarity
 - Operations and admins know how to secure, partition, route, and cache HTTP traffic
 - Leverage existing tools and infrastructure instead of creating new ones
- Easily debugged
 - How cool is it to be able to use your browser as a debugging tool!

Designing with a Uniform Interface

```
public interface OrderEntryService {  
  
    void submitOrder(Order order);  
    Order[] getOrders();  
    void updateOrder(Order order);  
    void cancelOrder(int orderId);  
    Order[] getCustomerOrders(Customer customer);  
    double calculateAverageSale();  
}  
  
public interface CustomerService {  
  
    void createCustomer(Customer cust);  
    void deleteCustomer(int custId);  
    Customer[] getCustomers();  
    Customer findCustomer(String first, String last);  
}
```

Designing services with a Uniform Interface

- When in doubt, define a new resource
- /orders
 - GET - list all orders
 - POST - submit a new order
- /orders/{order-id}
 - GET - get an order representation
 - PUT - update an order
 - DELETE - cancel an order
- /orders/average-sale
 - GET - calculate average sale
- /customers
 - GET - list all customers
 - POST - create a new customer
- /customers/{cust-id}
 - GET - get a customer representation
 - DELETE - remove a customer
- /customers/{cust-id}/orders
 - GET - get the orders of a customer

Resources with Multiple Representations

- Through URIs and the uniform interface we exchange data
- HTTP allows the client to specify the type of data it is sending and the type of data it would like to receive
- Depending on the environment, the client negotiates on the data exchange
 - An AJAX application may want JSON
 - A Ruby application my want the XML representation of a resource
 - A server may want to serve up a CSV, MS Excel, or PDF representation of a resource

Resources with Multiple Representations

- HTTP Headers manage this negotiation
 - CONTENT-TYPE: specifies MIME type of message body
 - ACCEPT: comma delimited list of one or more MIME types the client would like to receive as a response
 - In the following example, the client is requesting a customer representation in either xml or json format

```
GET /customers/33323
ACCEPT: application/xml,application/json
```

- Preferences are supported and defined by HTTP specification

```
GET /customers/33323
ACCEPT: text/html;q=1.0,
        application/json;q=0.5;application/xml;q=0.7
```

Resources with Multiple Representations

- Internationalization can be negotiated to
 - CONTENT-LANGUAGE: what language is the request body
 - ACCEPT-LANGUAGE: what language is desired by client

```
GET /customers/33323
ACCEPT: application/xml
ACCEPT-LANGUAGE: en_US
```

Resources with Multiple Representations

- This data exchange pattern already exists in many applications
 - Swing->RMI->Hibernate
 - Hibernate objects exchanged to and from client and server
 - Client modifies state, uses entities as DTOs, server merges changes
 - No different than how REST operates
 - No reason a RESTful webservice and client can't exchange Java objects!

Implications of Multiple Representations

- Evolvable integration-friendly services
 - Common consistent location (URI)
 - Common consistent set of operations (uniform interface)
 - Slap on an exchange formats as needed
- Built-in service versioning
 - Add newer exchange format as an additional MIME type supported
 - application/xml;version=1.0
 - Application/xml;version=1.1
- Internationalization becomes easy for clients
 - Most browsers can configure default ACCEPT-LANGUAGE

Statelessness

- A RESTful application does not maintain sessions/conversations on the server
- Doesn't mean an application can't have state
- REST mandates
 - That state be converted to resource state
 - Conversational state be held on client and transferred with each request
- Sessions are not linkable
 - You can't link a reference to a service that requires a session
- A stateless application scales
 - Sessions require replication
 - A simplified architecture is easier to debug
- Isolates client from changes on the server
 - Server topology could change during client interaction
 - DNS tables could be updated
 - Request could be rerouted to different machines

REST in Conclusion

- REST answers questions of
 - Why does the Web scale?
 - Why is the Web so ubiquitous?
 - How can I apply the architecture of the Web to my applications?
- REST is tough to swallow
 - Make you rethink how you do things
 - Those with CORBA/WS-* baggage will resist (sometimes violently)
- Promises
 - Simplicity
 - Interoperability
 - Platform independence
 - Change resistance

Spring MVC + REST

RESTful Web Services using Spring
MVC

Content Negotiation

- A URL suffix (path extension)
 - `http://...accounts.json` to indicate JSON format.
- Or a URL parameter can be used. By default it is named `format`
 - `http://...accounts?format=json`.
- Or the HTTP `Accept` header property will be used (which is actually how HTTP is defined to work)
 - Not always convenient to use - especially when the client is a browser)

ViewResolver Vs HttpMessageConverter

Handler	When to use
ViewResolvers	Resolve a view or the content you are trying to serve is in elsewhere (e.g. a controller method that returns the string "index" that will be mapped to the index.xhtml page)
HttpMessageConverters	when you use the @ResponseBody annotations for returning the response directly from the method without mapping to an external file

References

- <http://spring.io/guides/tutorials/rest/>
 - Step by step procedure to build a full-fledged Spring RESTful web application