Apache Sling – A REST-based Web Application Framework

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About
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- RnD Team at Adobe Research Switzerland
- Member of the Apache Software Foundation
  - Apache Felix and Apache Sling (PMC and committer)
  - And other Apache projects
- OSGi Core Platform and Enterprise Expert Groups
- Member of the OSGi Board
- Book / article author, technical reviewer, conference speaker

Web Challenges

- Publish and process huge amount of information
  - Highly dynamic
  - Different types
  - Different output formats
- Collaboration and integration
- Fast changing requirements
  - Rapid prototyping and development
  - Dynamic, extensible but maintainable

Web Challenges – Entering Apache Sling

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  - Highly dynamic
  - Different types
  - Different output formats
- Collaboration and integration
- Fast changing requirements
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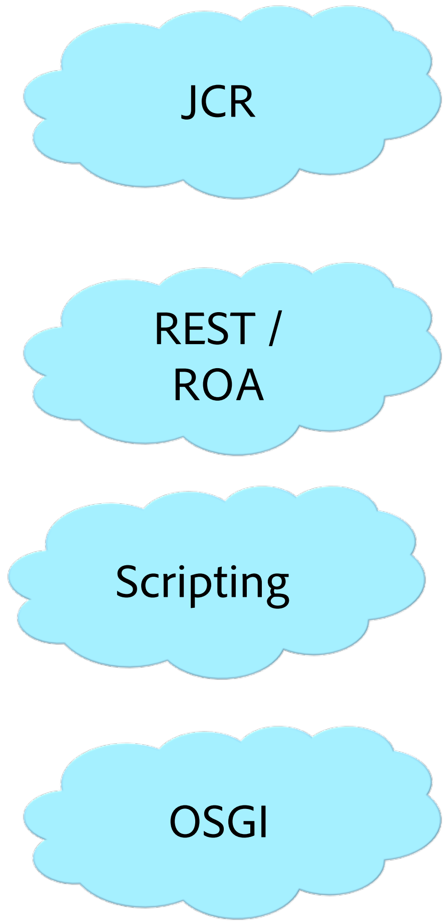


Apache Sling – The Fun is Back

- Web framework
- Java Content Repository (JCR)
- ROA / REST
- Scripting Inside
- OSGi
- Apache Open Source top level project
  - http://sling.apache.org
- Driving force behind several OSGi related projects at Apache

Key General Takeaways

- Leveraging REST
- Embracing OSG
- Hidden gems in Apache projects

Apache Jackrabbit - A Java Content Repository

Motivation for JCR

- Tried and trusted NoSQL solution
- Standard Java API
  - First spec released in May 2005
  - Various implementations, products, and solutions
  - Open Source implementation since 2006 (Apache Jackrabbit)
- Think about your data use cases / problems
  - JCR might help!

Consider JCR

- Data structure
- Supporting the web
- ACID
- Security
- Additional features

The Structure of Data

- A data storage should be flexible and
- Allow to model app data in the “right” way
  - Optimal way of dealing with the data in the app

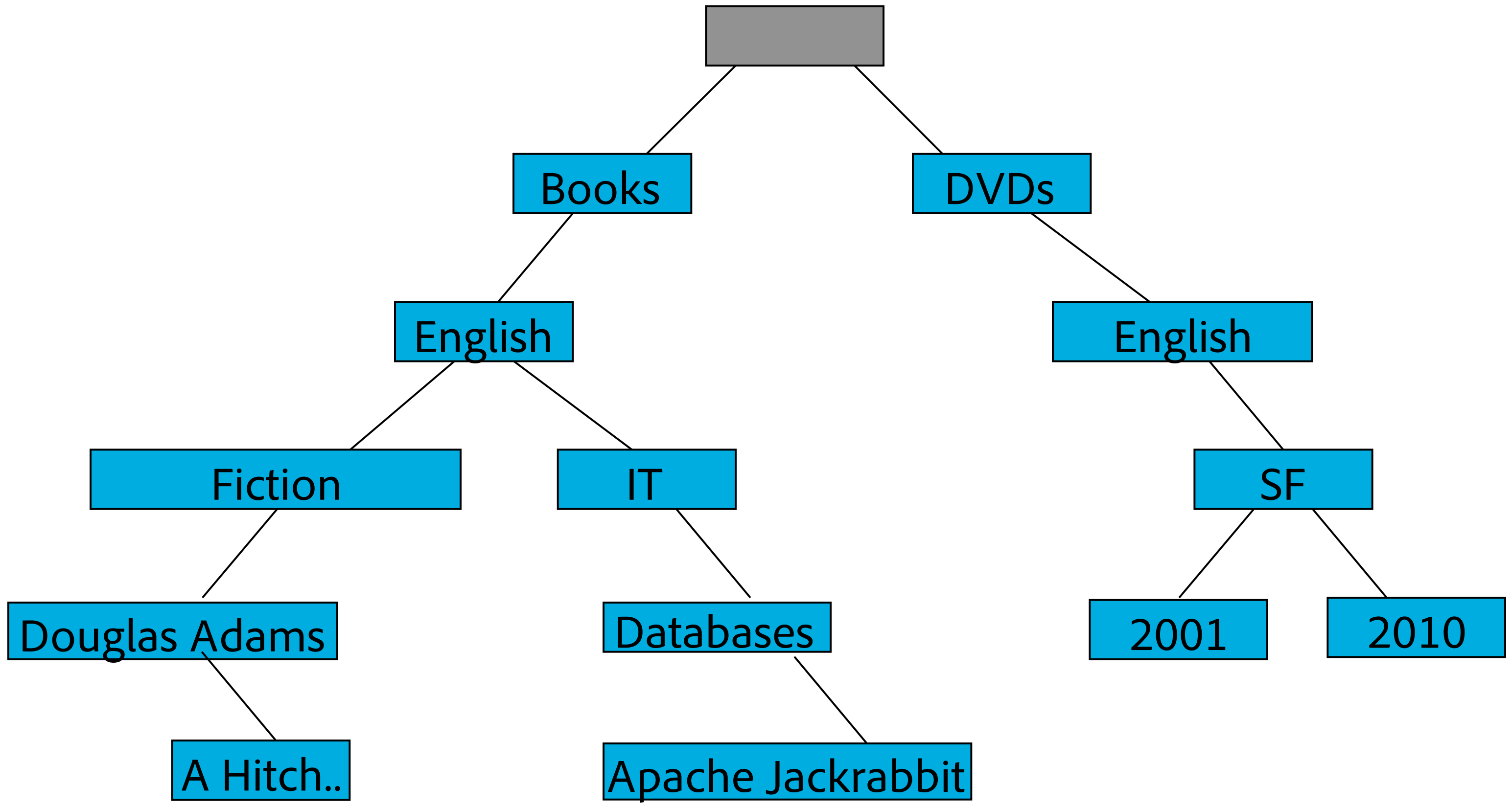
The Structure of Data

- A data storage should be flexible and
- Allow to model data in the “right” way
- What **is** the “right” way?
  - Tables?
  - Key-Value-Pairs?
  - Schema based?
  - Semi structured or even unstructured?
  - Flat, hierarchical or graph?

The Structure of Data

- The right way depends on the application:
  - Tables
  - Key-Value-Pairs
  - Schema based
  - Semi structured and unstructured
  - Flat, hierarchical, and graph
  - …
- An app might have more than one “right” way
- But: A lot of data can be modeled in a hierarchy

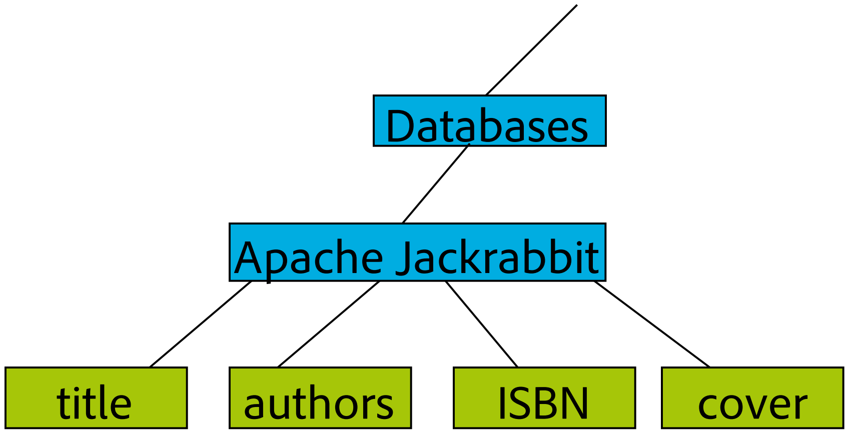
Sample: Product Catalog



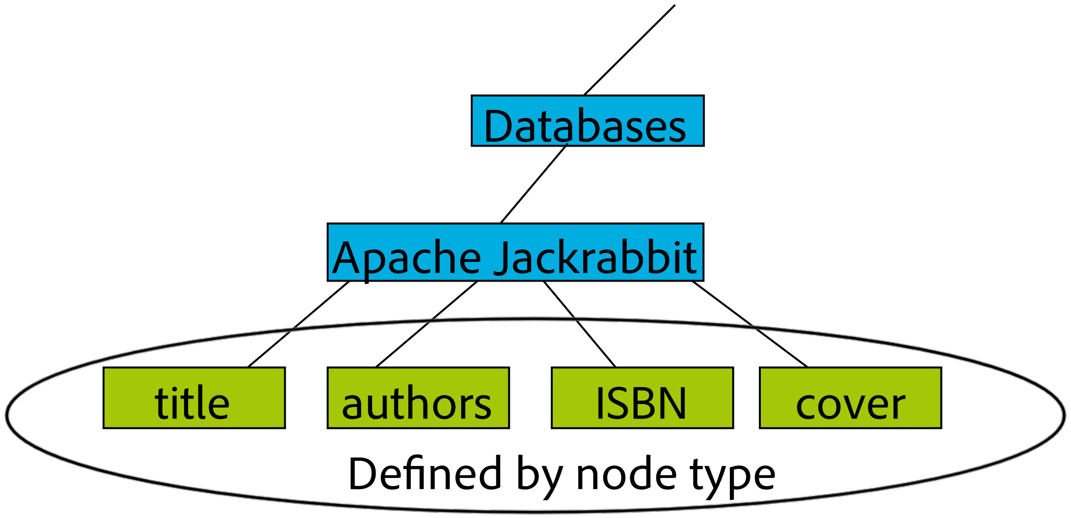
Java Content Repository

- Hierarchical content
  - Nodes with properties
  - (Table is a special tree)
- Structured
  - Nodetypes with typed properties
- And/or semi structured and unstructured
- Fine and coarse-grained
- Single repository for **all** content!

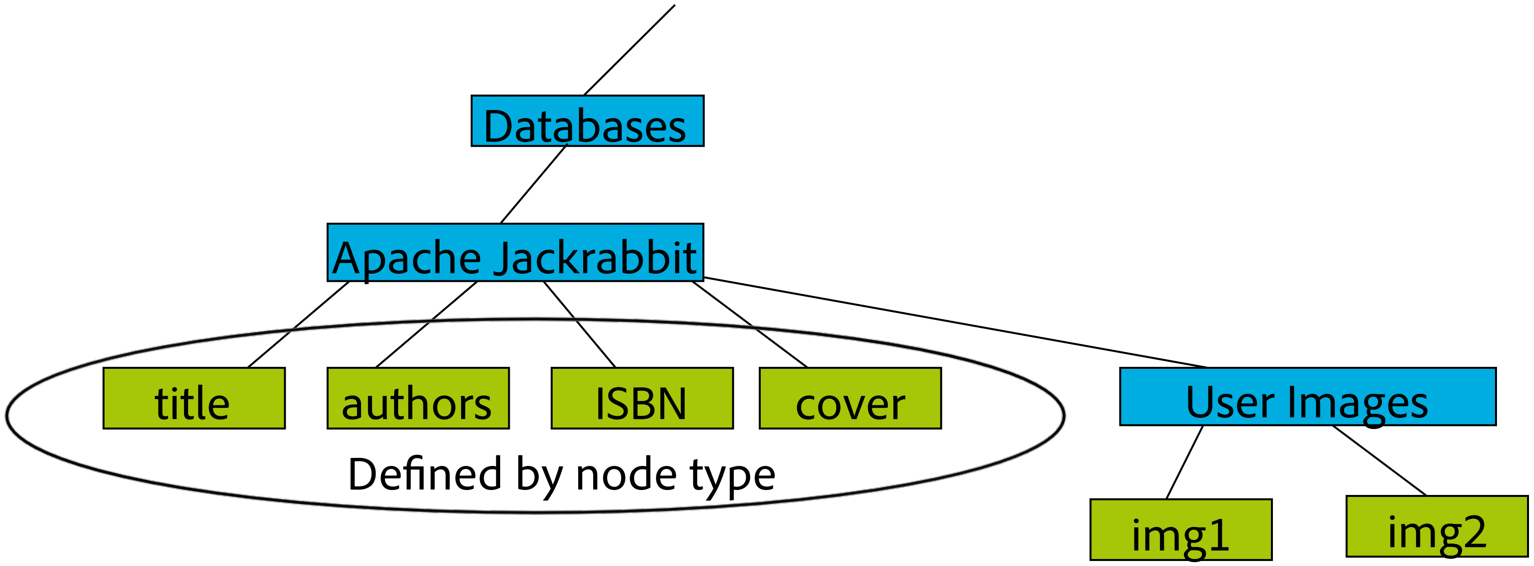
Sample: Product Catalog



Sample: Product Catalog



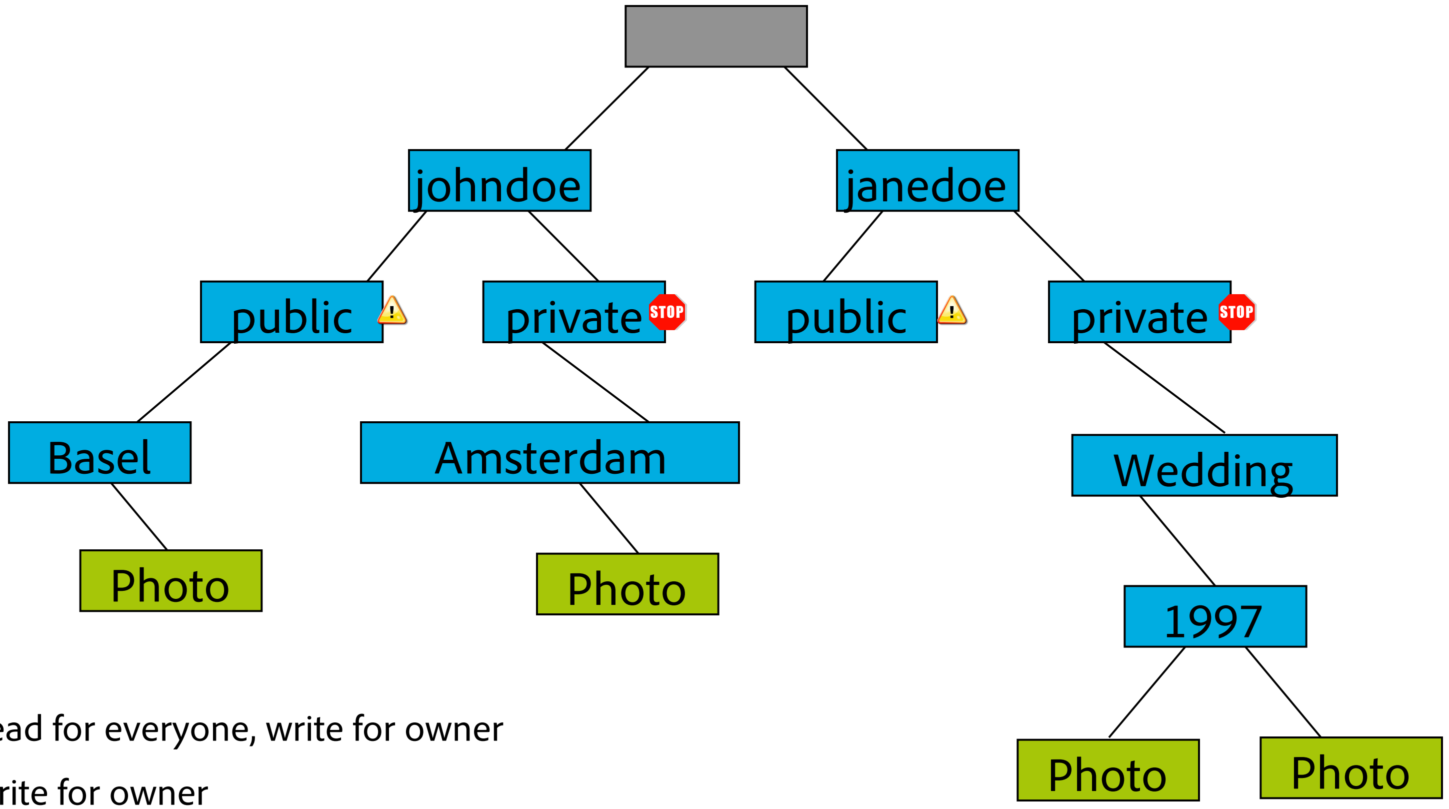
Sample: Product Catalog



Authentication and Access Control

- Apache Jackrabbit supports JAAS
  - Custom login modules possible
- Deny / Allow of privileges on a node
  - Like read, write, add, delete
  - Inheritance from parent
- Tree allows structuring based on access rights
- Access control is done in the data tier!

Sample Content Structure with ACLs



⚠ Read for everyone, write for owner

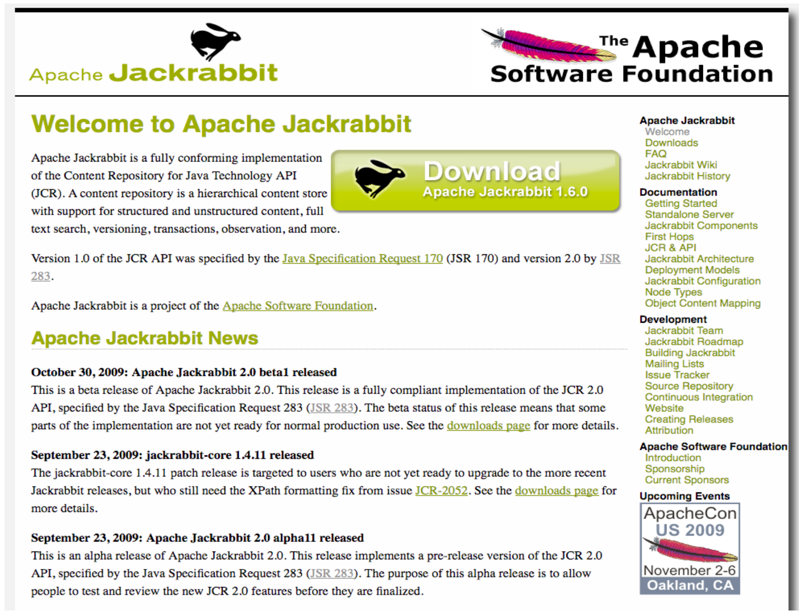
🛑 Write for owner

JSR 170 / JSR 283: Content Repository for JavaTM technology API

- (Java) **Standard** – Version 1.0 and 2.0
  - Supported by many vendors
  - Used by many products and projects
  - Several open source solutions
- Data model and features
- Query and observation

Apache Jackrabbit

- JSR 170/283 reference implementation
- Apache TLP since 2006
- Vital community
- New implementation: OAK (!)



Apache Jackrabbit — The Apache Software Foundation

Welcome to Apache Jackrabbit

Apache Jackrabbit is a fully conforming implementation of the Content Repository for Java Technology API (JCR). A content repository is a hierarchical content store with support for structured and unstructured content, full text search, versioning, transactions, observation, and more.

Download Apache Jackrabbit 1.6.0

Version 1.0 of the JCR API was specified by the Java Specification Request 170 (JSR 170) and version 2.0 by JSR 283.

Apache Jackrabbit is a project of the Apache Software Foundation.

Apache Jackrabbit News

October 30, 2009: Apache Jackrabbit 2.0 beta1 released
This is a beta release of Apache Jackrabbit 2.0. This release is a fully compliant implementation of the JCR 2.0 API, specified by the Java Specification Request 283 (JSR 283). The beta status of this release means that some parts of the implementation are not yet ready for normal production use. See the downloads page for more details.

September 23, 2009: jackrabbit-core 1.4.11 released
The jackrabbit-core 1.4.11 patch release is targeted to users who are not yet ready to upgrade to the more recent Jackrabbit releases, but who still need the XPath formatting fix from issue JCR-2052. See the downloads page for more details.

September 23, 2009: Apache Jackrabbit 2.0 alpha11 released
This is an alpha release of Apache Jackrabbit 2.0. This release implements a pre-release version of the JCR 2.0 API, specified by the Java Specification Request 283 (JSR 283). The purpose of this alpha release is to allow people to test and review the new JCR 2.0 features before they are finalized.

Apache Jackrabbit
Welcome
Downloads
FAQ
Jackrabbit Wiki
Jackrabbit History

Documentation
Getting Started
Standalone Server
Jackrabbit Components
First Hops
JCR & API
Jackrabbit Architecture
Deployment Models
Jackrabbit Configuration
Node Types
Object Content Mapping

Development
Jackrabbit Team
Jackrabbit Roadmap
Building Jackrabbit
Mailing Lists
Issue Tracker
Source Repository
Continuous Integration
Website
Creating Releases
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Oakland, CA

http://jackrabbit.apache.org/

ROA and REST

Data and the Web?

- A website is hierarchical by nature
- Web applications provide data in different ways
  - HTML
  - JSON
- Provide your data in a RESTful way
  - http://.../products/books/english/it/databases/apachejackrabbit.(html|json)
- Avoid mapping/conversion
  - http://.../products.jsp?id=5643564

Resource Oriented Architecture I

- Every piece of information is a resource
  - News entry, book, book title, book cover image
  - Descriptive URI
- Stateless web architecture (REST)
  - Request contains all relevant information
  - Targets the resource
- Leverage HTTP
  - GET for rendering, POST/PUT/DELETE for operations

Resource Oriented Architecture II

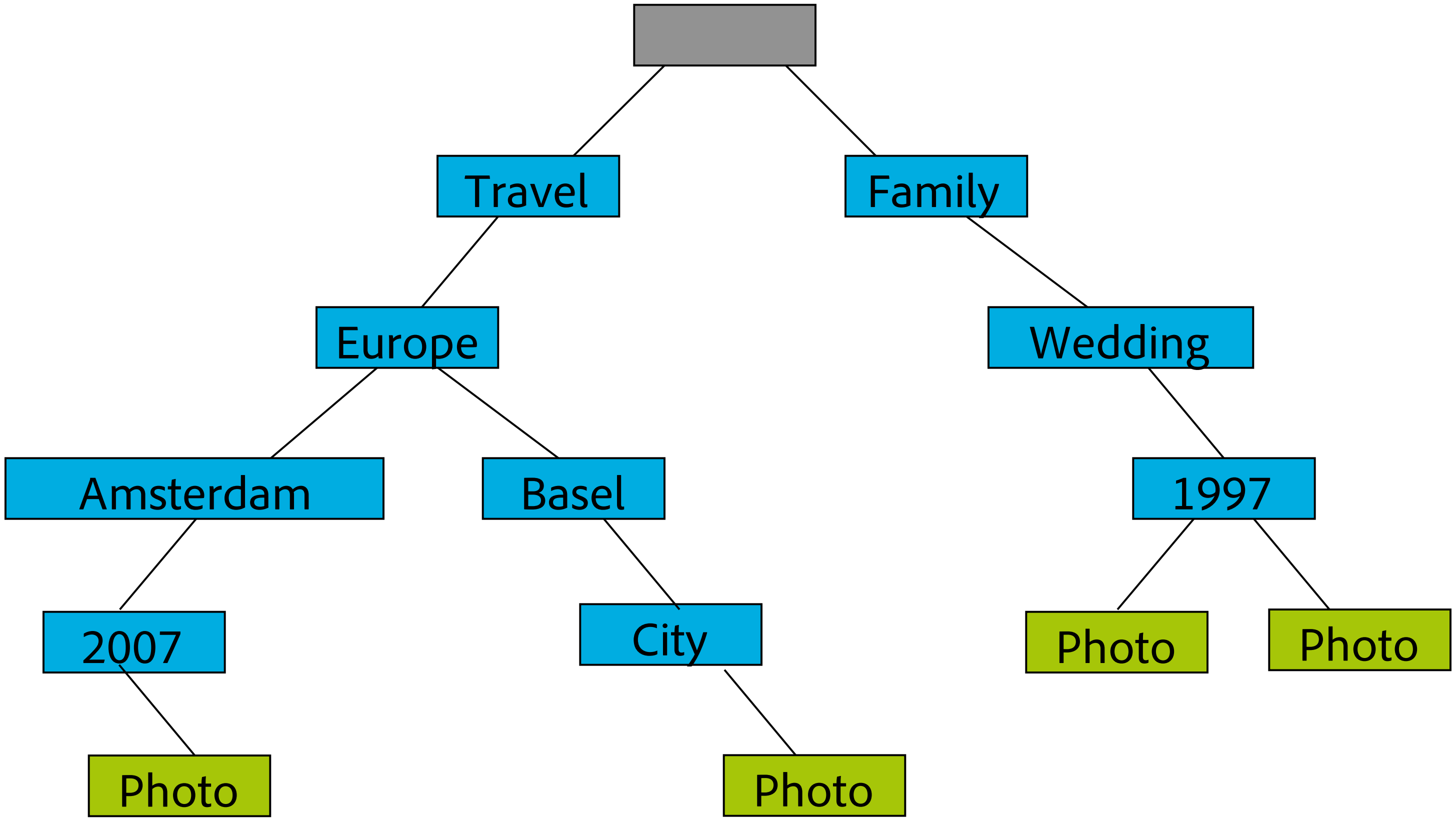
- JCR and Apache Jackrabbit are a perfect match for the web
  - Hierarchical
  - From a single piece of information to binaries
- Elegant way to bring data to the web
- Apache Sling is (the|one) web framework

Sample Application: Slingshot

- Digital Asset Management
  - Hierarchical storage of pictures
  - Upload
  - Tagging
  - Searching
  - Automatic thumbnail generation
- Sample application from Apache Sling

Poor man's flickr...

Slingshot Content Structure



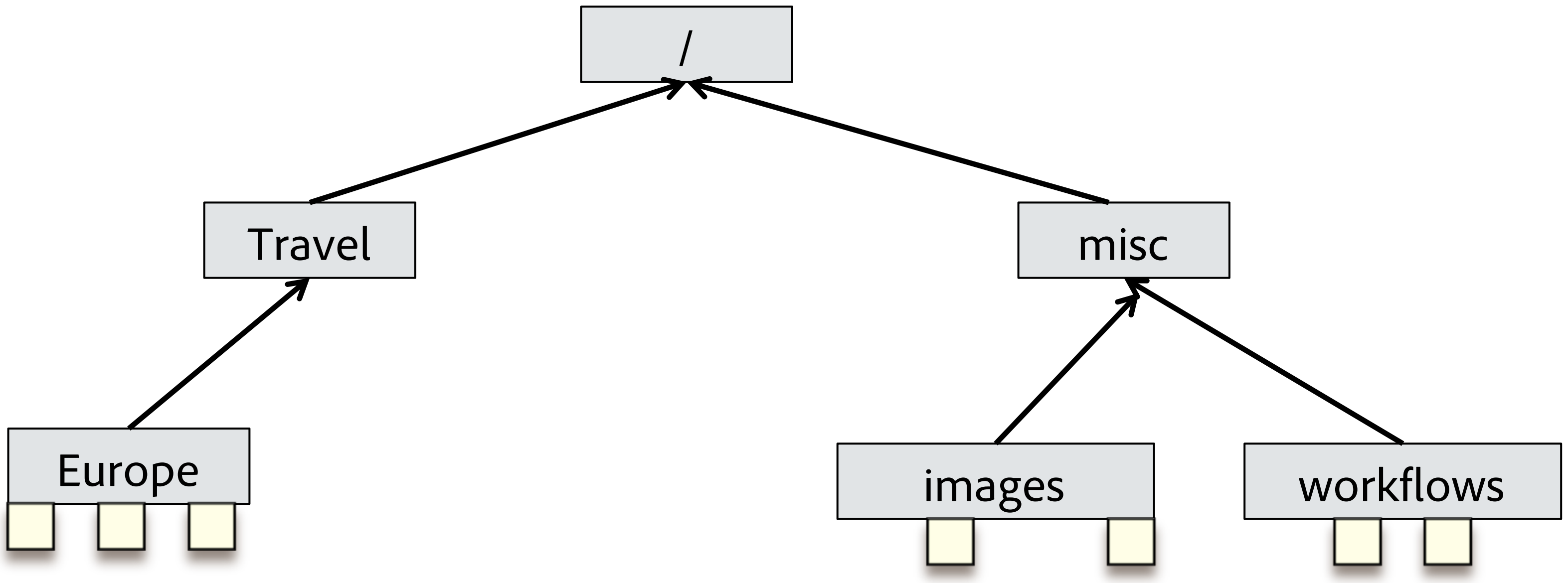
Facts About Slingshot

- Java web application
- Uses Apache Sling as web framework
- Content repository managed by Apache Jackrabbit
- Interaction through Sling‘s Resource API

REST with Apache Sling

- Default behavior for GET
- Creating/Updating content through POST
  - Default behavior
- Additional operations/methods
- Resource-first request processing!

Resource Tree



http://localhost/Travel/Europe

Resource: /Travel/Europe

Resource

- Apache Sling's abstraction of the *thing* addressed by the request URI
  - Usually mapped to a JCR node
  - File system, bundle, Cassandra, MongoDB, database..
- Attributes of resources
  - Path in the resource tree
  - Resource type
  - Metadata, e.g. last modification date

Resource-first Request Processing

- URI Decomposition
  - Resource and representation
  - $\underbrace{\text{/Travel/Europe/Basel}}_{\text{Resource Path}}.\underbrace{\text{print.a4}}_{\text{Selectors}}.\underbrace{\text{html}}_{\text{Extension}}$
- Content retrieved from resource tree
- Rendering based on resource type, selectors and extension

Basic Request Processing Steps

- Resolve the resource (using URI)
  - Decomposition
- Resolve rendering script
  - Source: resource type, selectors and extension
  - Scripts wrapped by generic servlet
- Create rendering chain
  - Configurable (servlet) filters
  - Rendering servlet
- Invoke rendering chain

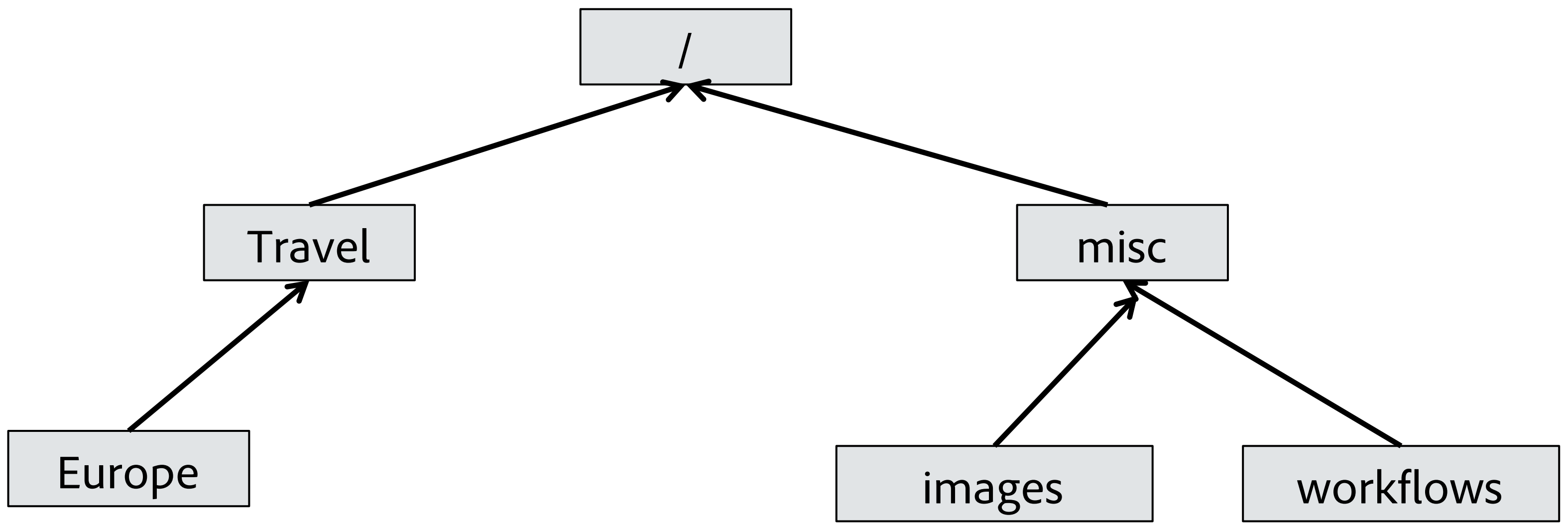
Resource Resolver I

- Tasks:
  - Finding resources
  - Getting resources
  - Querying resources
- Not Thread Safe!
  - Includes all objects fetched via resolver

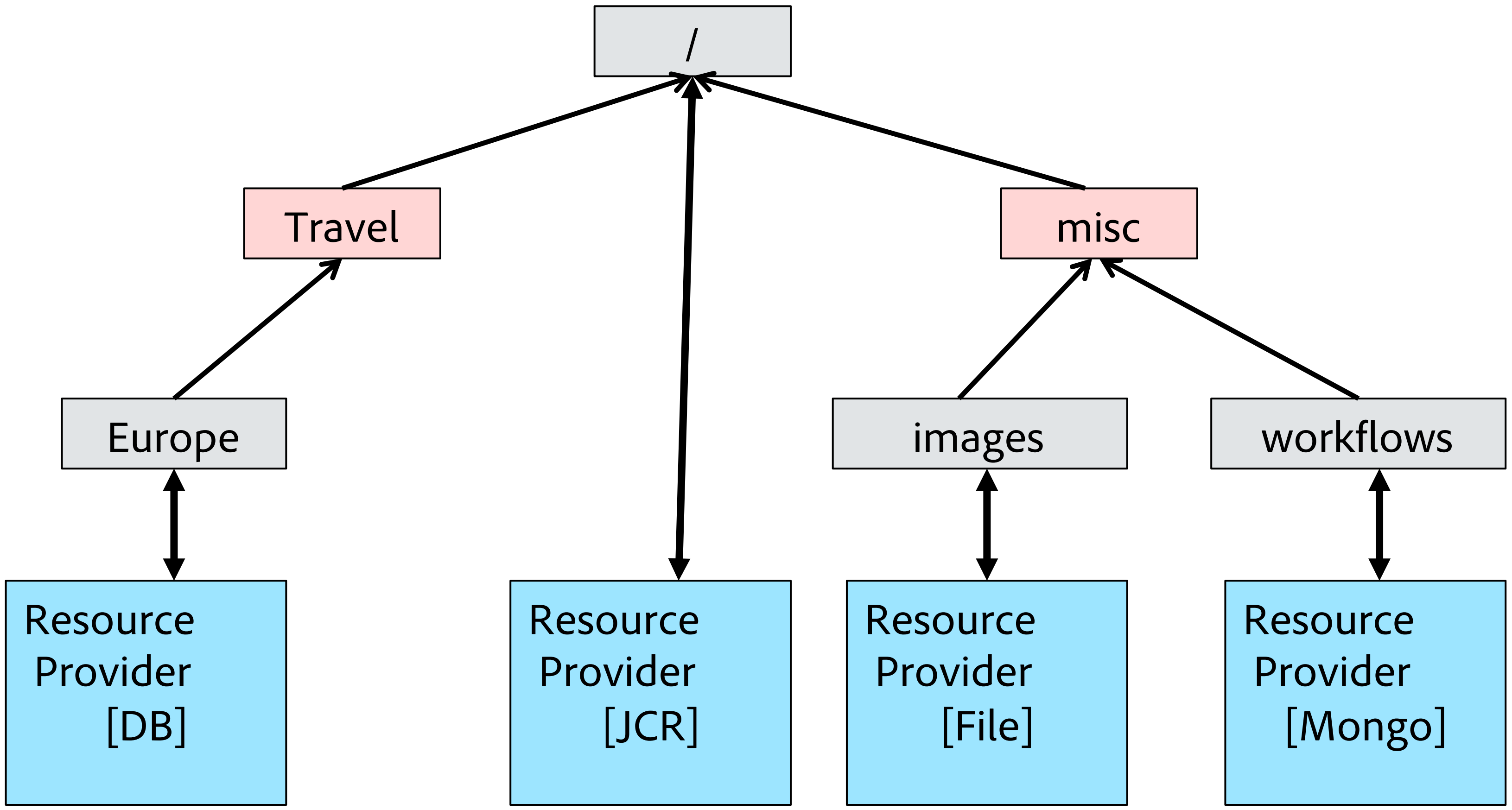
Resource Resolver II

- Central gateway for resource handling
- Abstracts path resolution
- Abstracts access to the persistence layer(s)
- Configurable
  - Mappings (Multi site mgmt, beautify paths)

Resource Tree



Mounting Resource Providers



Scripting

Scripting Inside

- It’s your choice
  - JSP, servlet, ESP, Scala
  - javax.script
  - own script handlers
- Scripts stored in OSGi bundles or the resource tree
- Scripts are searched at configured locations
- Default servlets
  - JSON, XML
  - Error Handling

Script Resolving I

- Path to script is build from…
  - Configured search paths (/apps, /libs)
  - Resource type converted to path (slingshot/Album)
  - Selector string (print/a4)
  - Request method & extension
    - GET → Extension (html)
    - Else -> Method (POST, PUT, DELETE…)

Script Resolving Example

- URI: /Travel/Europe/Basel.print.a4.html
- Resource: /Travel/Europe/Basel
- Resource Type: slingshot:Album
- Script for GET:
  - /apps/slingshot/Album/print/a4/html.*
- Script for POST:
  - /libs/slingshot/Album/print/a4/POST.*

Script Resolving II

- Scripts are searched by best matching
  - /apps/slingshot/Album/print/a4/html.*
  - /libs/slingshot/Album/print/a4/html.*
  - /apps/slingshot/Album/html.*
  - /libs/slingshot/Album/html.*
- Resource has a type and a super type
  - Script inheritance
  - Default script (JSON...)

Sample JSP Script

```
<%@page import="org.apache.sling.api.resource.Resource,
                org.apache.sling.api.resource.ValueMap" %><%
%><%@taglib prefix="sling" uri="http://sling.apache.org/taglibs/sling/1.0" %><%
%><sling:defineObjects/><%

    final ValueMap attributes = resource.getValueMap();
    final String albumName = attributes.get(”title”,Resource.getName());
%><html>
  <head>
    <title>Album <%= albumName %></title>
  </head>
<body>
   …

 <h2>Contained Albums</h2>
    <%
    for ( final Resource current : resource.getChildren() ) {
        if ( current.isResourceType(Constants.RESOURCETYPE_ALBUM) ) {
            %><sling:include resource="<%= current %>”/><%
        }
    }
    %>
```

Resource-first Request Processing

- ROA
- URI decomposition
- Resource resolving
- Script resolving
  - Recursion
- Flexible script search algorithm

OSGi

Runtime Requirements

- Modularization – Modularity is key
  - Manage growing complexity
  - Support (dynamic) extensibility
- Lifecycle management
- Configuration management
- Modules, services
- Different distributions/feature sets
- Dynamic system changes

OSGi in 5..ehm..1 Minute

- Specification of a framework
- Module concept (bundles) with lifecycle
- Simple but powerful component model
  - Lifecycle management
  - Publish/Find/Bind service registration
- Dynamic!
- Uses the concept of bundles

An OSGi Bundle

- Leverages the Java packaging mechanism: JAR files
- Contains Java classes and resources
- Additional meta-data
- Implicit dependencies to other bundles
- Package imports/exports
- Semantic versioning of API

Services

- OSGi offers an API to register services
- Service is registered by its interface name(s)
- Implementation is bundle private
- Several components for same service possible (from different bundles)
- Bundles can find and use services
  - By interface names
  - With additional filters

The OSGi Core

- Minimal but sufficient API for services
- Minimal overhead: Good for simple bundles
- No support for component management
- No support for configuration management
- Requires sometimes a lot of Java coding
- Additional (optional) OSGi extensions
  - Declarative Service Specification
  - Configuration Admin Service Specification

OSGi Declarative Service Specification

- Component model
- Component lifecycle management
- Publishing services
- Consuming services
- Default configuration
- Support for Config Admin

Config Admin and Metatype

- OSGi Config Admin
  - Configuration Manager
  - Persistence storage
  - API to retrieve/update/remove configs
  - Works with Declarative Services
- OSGi Metatype Service
  - Description of bundle metadata
  - Description of service configurations

Apache Felix

- Top-level project (March 2007)
- Healthy and diverse community
- OSGi R5 implementation
- Framework (frequent releases)
- Various interesting subprojects
- Tools
  - Maven Plugins, Web Console

Contributions to Apache Felix

- Declarative service implementation
- Config admin implementation
- Metatype implementation
- Preferences implementation
- Web console (!)
- Maven SCR Plugin (!) and SCR tooling

Apache Sling Runtime

- Uses Apache Felix
- Runtime: Apache Sling Launchpad
- Two flavors
  - Standalone Java Application
  - Web application
- But Sling can be deployed in any OSGi framework!

Standalone Java Application

- One single executable JAR file
- Small Launcher
- Starts OSGi Framework (Apache Felix)
- Uses Jetty in an OSGi Bundle

Web Application

- Extends Standalone Application
- Replaces Main with a Servlet
- Uses a bridge to connect Sling to the Servlet Container

Facts About Apache Sling

- Sling API
- Uses resource abstraction
  - Use JCR, MongoDB, Cassandra...
- Highly modular and runtime configurable
- Everything is a OSGi bundle
  - Deploy what you need!
- Commons Bundles (Threads, Scheduling...)
- OSGi Provisioning
- Cloud discovery
- Distributed eventing

Apache Sling – The Fun is Back

- Web Framework
- Java Content Repository
- **REST**
- Scripting inside
- **OSGi**
- Apache Open Source project
- **Check it out today!**