Using OSGi for script deployment in Apache Sling

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OSGi™ Community Event 2019

Who are we?

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- Computer Scientist @ Adobe, Basel, Switzerland
- Member of the Apache Software Foundation
- Apache Sling PMC member
- Maintainer of HTL for Apache Sling

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- Computer Scientist @ Adobe, Basel, Switzerland
- Member of the Apache Software Foundation
- Apache Sling and Apache Felix PMC (VP) member
- Co-Author of OSGi in Action

Sling™

Do you have a minute to talk about Apache Sling[0]?

- REST-centric web framework, based on an extensible content tree
- JCR for persistence (Apache Jackrabbit Oak)
- Collection of OSGi modules, deployed in Apache Felix
- Powers Adobe Experience Manager

Apache Sling - Bringing Back the Fun!

Apache Sling™ is a framework for RESTful web-applications based on an extensible content tree.

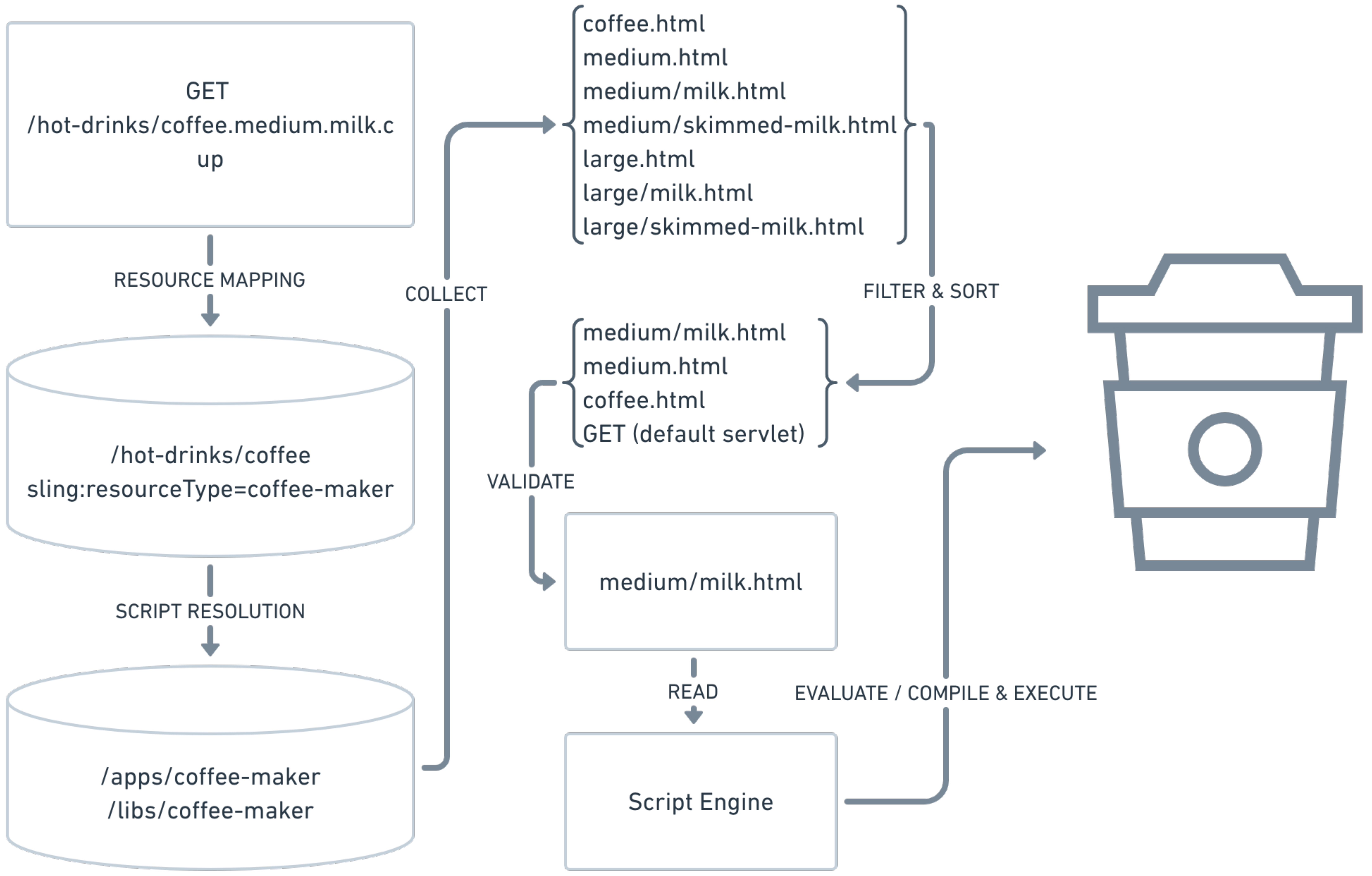
In a nutshell, Sling maps HTTP request URLs to content resources based on the request's path, extension and selectors. Using convention over configuration, requests are processed by scripts and servlets, dynamically selected based on the current resource. This fosters meaningful URLs and resource driven request processing, while the modular nature of Sling allows for specialized server instances that include only what is needed.

Sling serves as basis for a variety of applications ranging from blogging engines all the way to enterprise content management systems.

Our Getting Started page will help you start playing with Sling.

Discussions about Sling happen on our mailing lists, see our Project Information page for more info.

From URLs to Scripts - a simplified view



Scripts and Servlets are equal

```java
@Component(service = Servlet.class,
    name="org.apache.sling.servlets.get.DefaultGetServlet",
    property = {
            "service.description=Default GET Servlet",
            "service.vendor=The Apache Software Foundation",

            // Use this as a default servlet for Sling
            "sling.servlet.resourceTypes=sling/servlet/default",
            "sling.servlet.prefix:Integer=-1",

            // Generic handler for all get requests
            "sling.servlet.methods=GET",
            "sling.servlet.methods=HEAD"
    })
@Designate(ocd=DefaultGetServlet.Config.class)
public class DefaultGetServlet extends SlingSafeMethodsServlet {
}
```

Versioning and dependencies

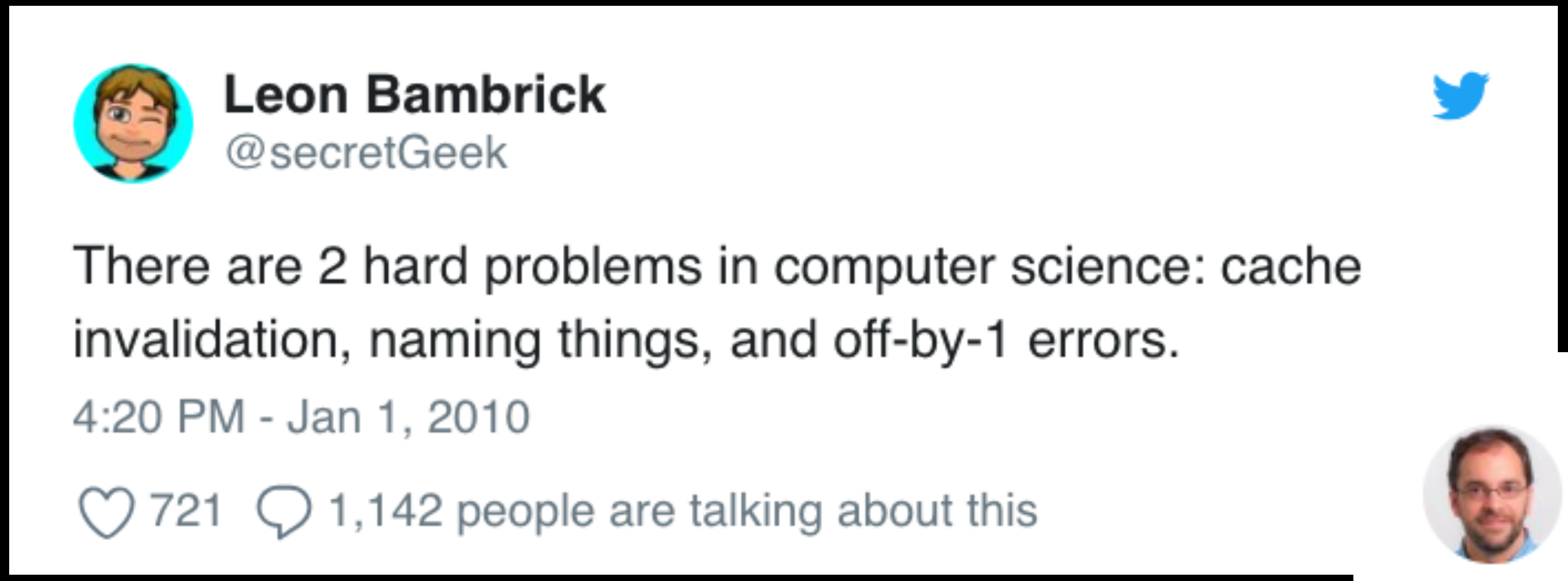
- There is no standard way of defining either.
- An option would be to use resource type versioning through path conventions.
- Dependencies can only be checked at runtime (but not enforced).
- What happens if your evil colleagues delete a script you were delegating to? Or worse, if they change the whole markup?

Performance

- Each script requires two trips to the persistence layer when first compiled, only to read the script.
- Sling needs to maintain some caches to keep things snappy.

Performance

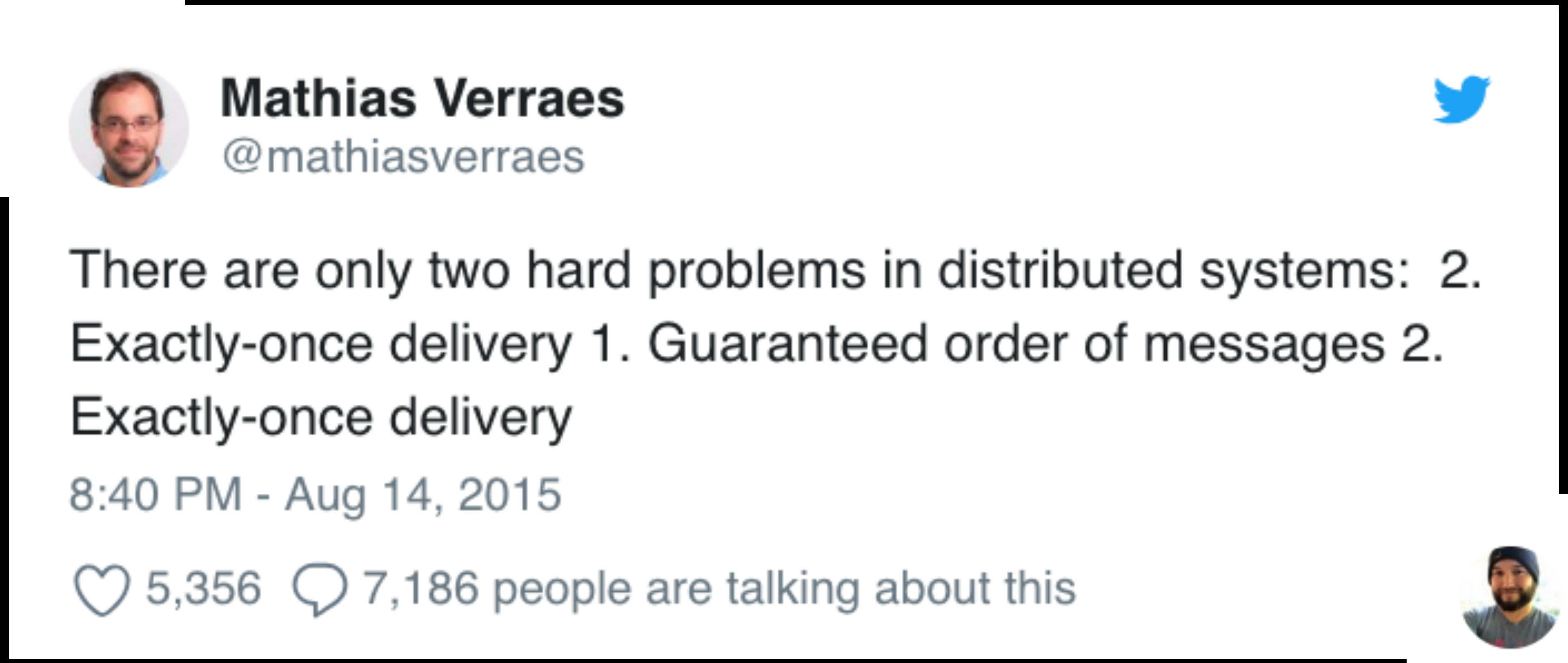
"There are only two hard things in Computer Science: cache invalidation and naming things." -- Phil Karlton


Leon Bambrick
@secretGeek

There are 2 hard problems in computer science: cache invalidation, naming things, and off-by-1 errors.

4:20 PM - Jan 1, 2010

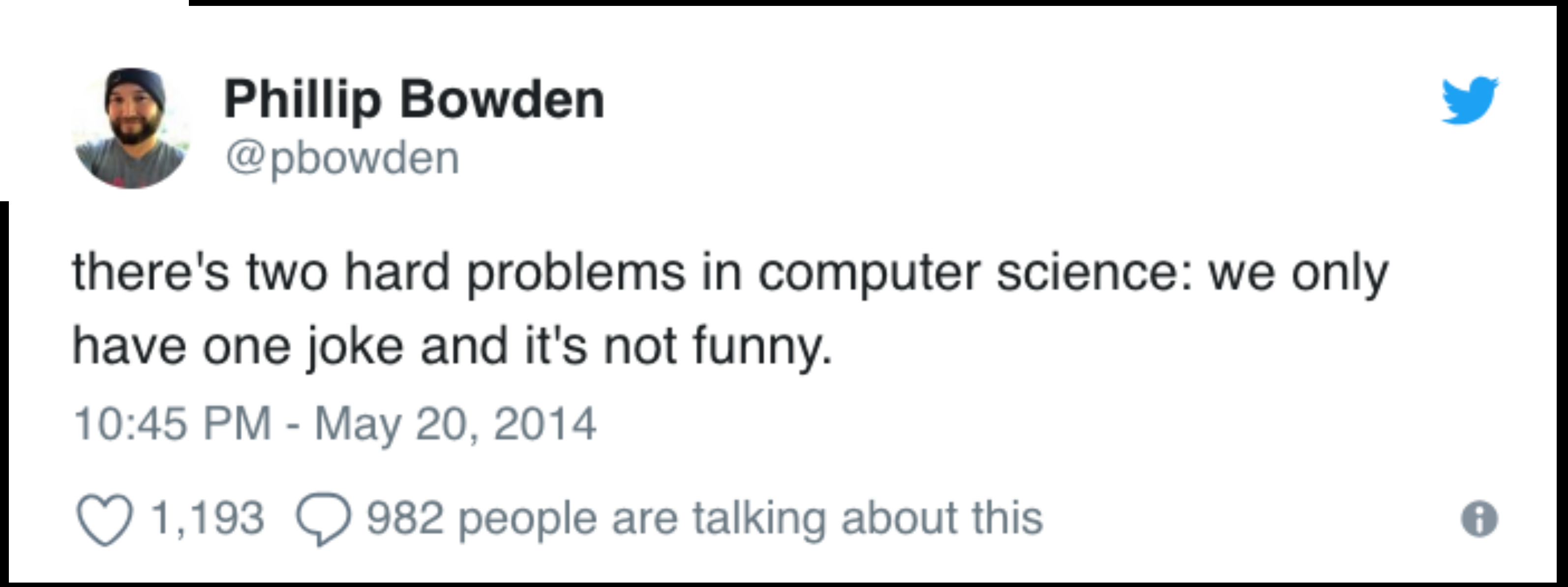
721 1,142 people are talking about this


Mathias Verraes
@mathiasverraes

There are only two hard problems in distributed systems: 2. Exactly-once delivery 1. Guaranteed order of messages 2. Exactly-once delivery

8:40 PM - Aug 14, 2015

5,356 7,186 people are talking about this


Phillip Bowden
@pbowden

there's two hard problems in computer science: we only have one joke and it's not funny.

10:45 PM - May 20, 2014

1,193 982 people are talking about this

Reality check

1. What are scripts actually: *content* or *code*?
2. Are scripts *authored* or *developed*?
3. Can scripts be used *freely* or do they have *constraints*?
4. If scripts are code, then why do we treat them differently?

Reality check

Code:

1. provides or implements an API (HTTP in our case)
2. evolves semantically
3. is bundled into a cohesive unit, managed by one or more developers

But what if we…

1. pack scripts into OSGi bundles
2. define the resource types as *versioned capabilities*, with *versioned requirements* (Java APIs, other resource types to which scripts delegate or which scripts extend)
3. allow the platform to do what it’s made to: wire things

Let’s quickly consult the OSGi specification

Capability - Describing a feature or function of the Resource when installed in the Environment. A capability has attributes and directives.

Requirement - An assertion on the availability of a capability in the Environment. A requirement has attributes and directives.
The filter directive contains the filter to assert the attributes of the capability in the same Namespace.

https://osgi.org/specification/osgi.core/7.0.0/framework.module.html#framework.module.dependencies

How? Use the Apache Sling Scripting Bundle Tracker[1]

What:

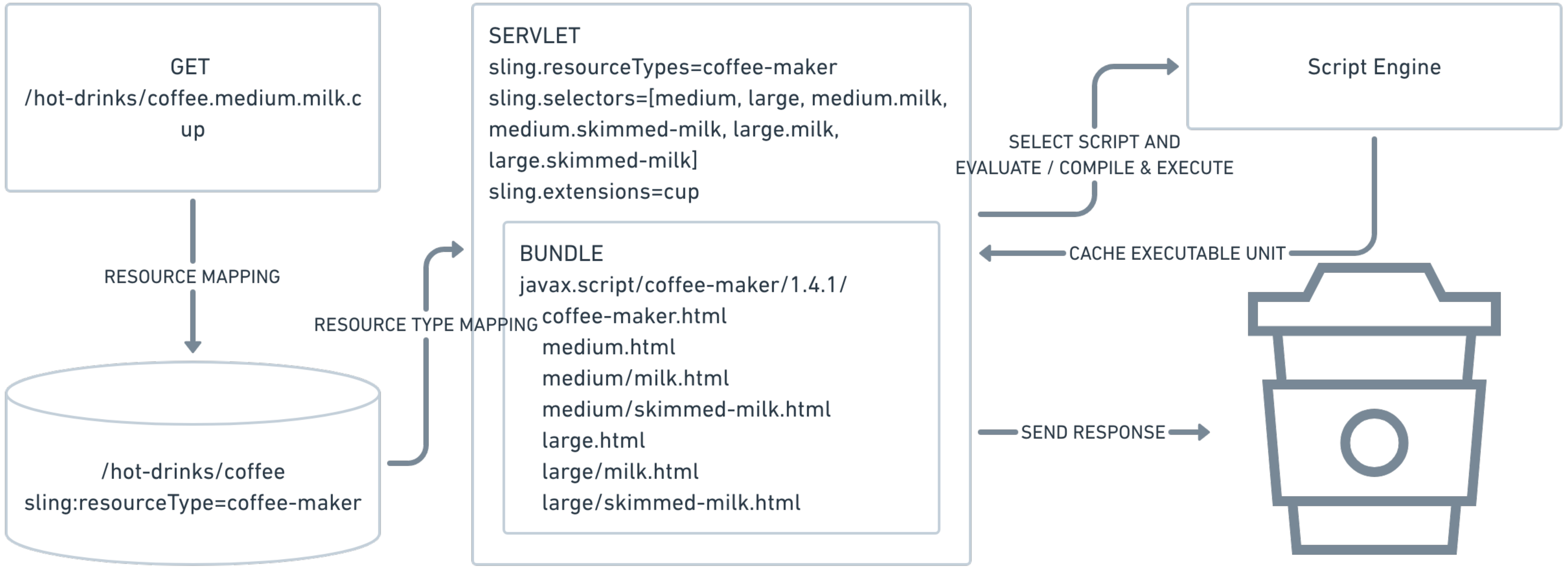
1. add-on module to which bundles that provide scripts have to be wired explicitly
2. reuses the already established mechanisms for registering servlets in Apache Sling
3. allows building light-weight instances that can be thrown into production with very little warm-up, when using precompiled scripts

How? Use the Apache Sling Scripting Bundle Tracker[1]

4. provides the mechanism for deploying truly versionable scripts, with explicit dependencies, by relying on the OSGi framework
5. removes the need of a separate `ScriptCache`
6. removes additional pressure on the persistence layer
7. simplifies instance and application upgrades
8. there's also a Maven plugin for generating requirements and capabilities

So what's different?

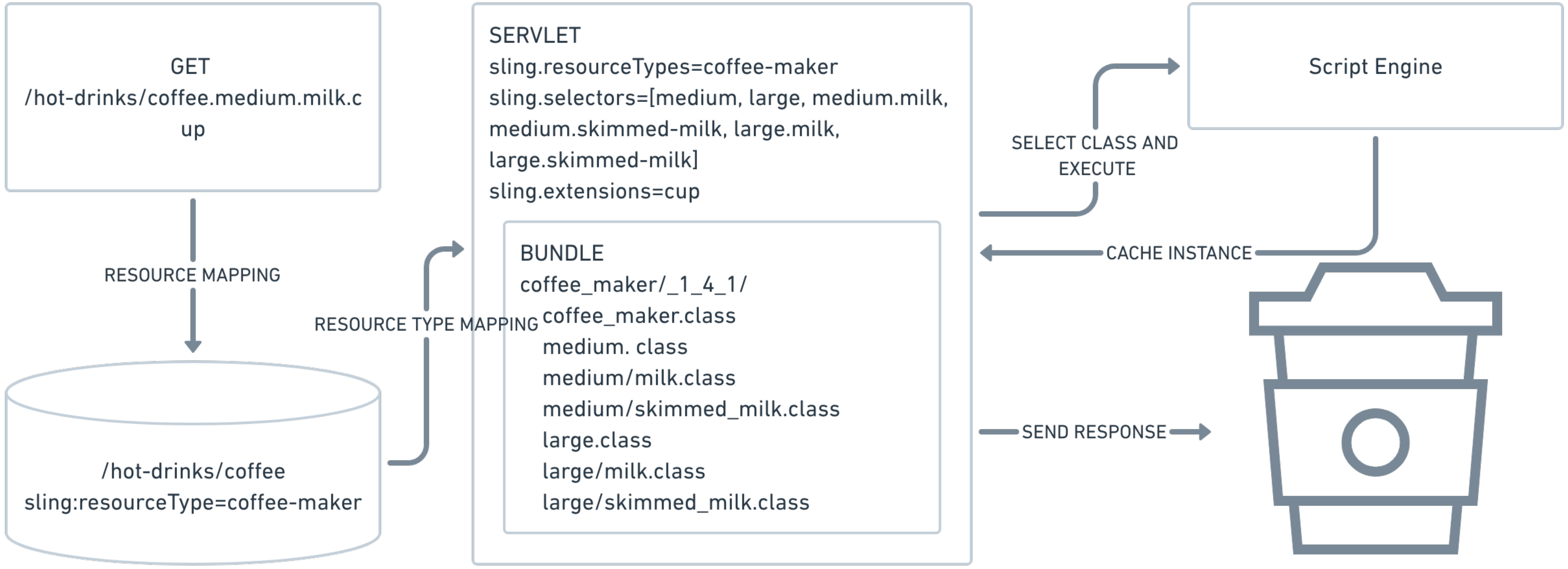
Option 1: scripts packed as bundle entries



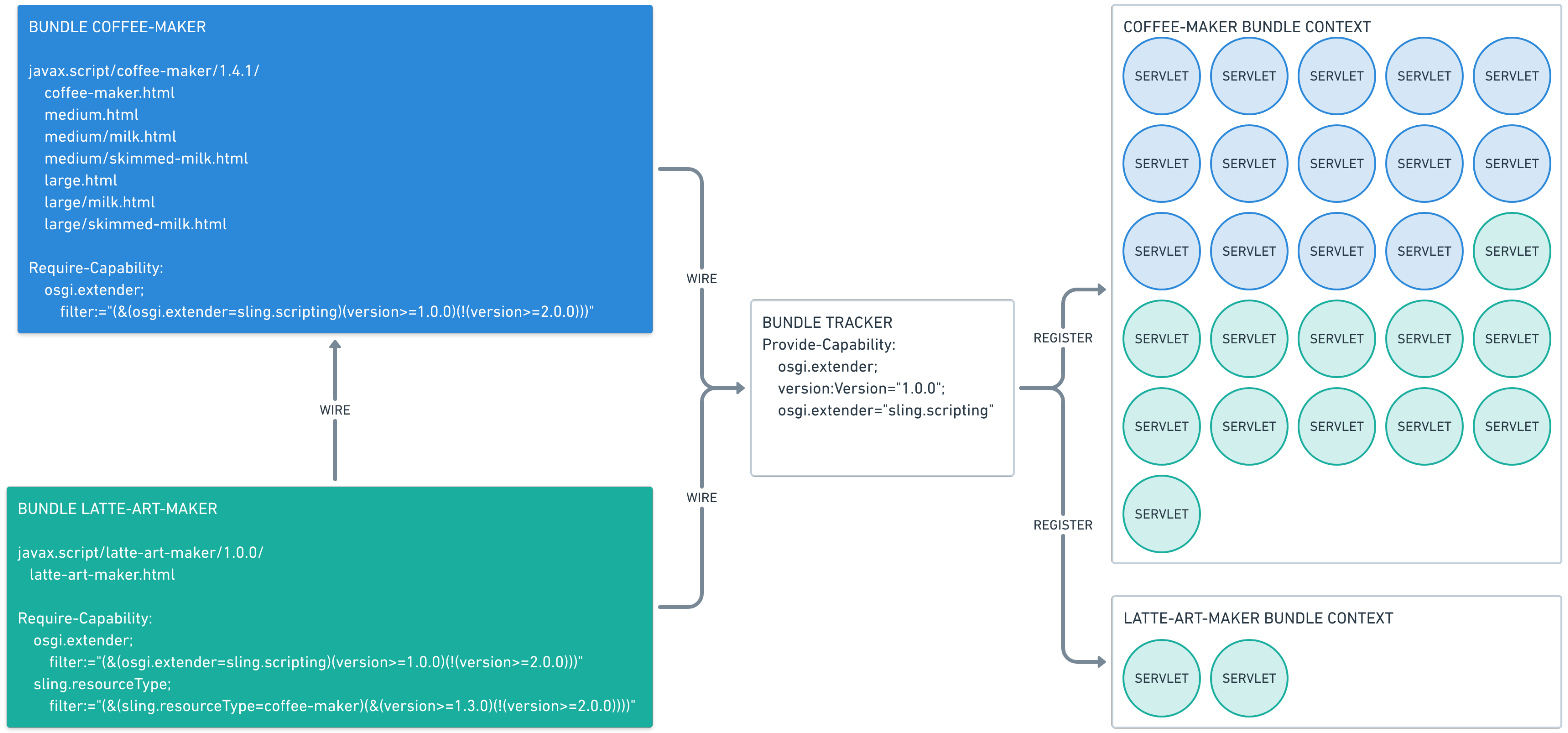
GET
/hot-drinks/coffee.medium.milk.cup
RESOURCE MAPPING
/hot-drinks/coffee
sling:resourceType=coffee-maker
RESOURCE TYPE MAPPING
SERVLET
sling.resourceTypes=coffee-maker
sling.selectors=[medium, large, medium.milk, medium.skimmed-milk, large.milk, large.skimmed-milk]
sling.extensions=cup
BUNDLE
javax.script/coffee-maker/1.4.1/
coffee-maker.html
medium.html
medium/milk.html
medium/skimmed-milk.html
large.html
large/milk.html
large/skimmed-milk.html
SELECT SCRIPT AND EVALUATE / COMPILE & EXECUTE
Script Engine
CACHE EXECUTABLE UNIT
SEND RESPONSE

So what's different?

Option 2: precompiled scripts



How does it work in practice?



BUNDLE COFFEE-MAKER

```
javax.script/coffee-maker/1.4.1/
   coffee-maker.html
   medium.html
   medium/milk.html
   medium/skimmed-milk.html
   large.html
   large/milk.html
   large/skimmed-milk.html

Require-Capability:
   osgi.extender;
      filter:="(&(osgi.extender=sling.scripting)(version>=1.0.0)(!(version>=2.0.0)))"
```

BUNDLE LATTE-ART-MAKER

```
javax.script/latte-art-maker/1.0.0/
   latte-art-maker.html

Require-Capability:
   osgi.extender;
      filter:="(&(osgi.extender=sling.scripting)(version>=1.0.0)(!(version>=2.0.0)))"
   sling.resourceType;
      filter:="(&(sling.resourceType=coffee-maker)(&(version>=1.3.0)(!(version>=2.0.0))))"
```

BUNDLE TRACKER

```
Provide-Capability:
   osgi.extender;
   version:Version="1.0.0";
   osgi.extender="sling.scripting"
```

Sure, but how?

1 Provide-Capability / Script -> 1 Servlet / Script

Provide-Capability

```
sling.resourceType="latte-art-maker";
    sling.servlet.methods:List<String>="GET";
    version:Version="1.0.0"
```

Demo*

* or how we can embarrass ourselves if things don't work

Where does all this lead?

OSGi RFP 196[2]

- Provides a way to use an OSGi framework with custom classloaders (a.k.a. OSGi Connect/PojoSR)

Graal/Substrate VM

- Ahead-of-Time (AOT) Java code compilation

Together with the precompiled bundled scripts it should be possible to perform an AOT compilation of a Sling application as a native image[3].

Resources

[0] - https://sling.apache.org

[1] - https://github.com/apache/sling-org-apache-sling-scripting-bundle-tracker

[2] - https://github.com/osgi/design/blob/master/rfps/rfp-0196-OSGiConnect.pdf

[3] - https://adapt.to/2019/en/schedule/from-0-to-hero-in-under-10-seconds.html

Assets licensed from https://stock.adobe.com

Our diagrams were designed with https://whimsical.co/flowcharts

Demo available at https://github.com/raducotescu/eclipsecon-demo eclipsecon Europe 2019

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