MICROSERVICES WITH OSGI

Microservices with OSGi
Speaker

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Microservices with OSGi
Speaker

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MOTIVATION

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Microservices with OSGi
Motivation

- Microservices are one of the current hype topics
- A lot of people are actually doing microservices with different approaches
- OSGi has a mature service design
  - OSGi Core R6 – Chapter 5 Service Layer
  - OSGi Compendium R6 – Chapter 112 Declarative Services
- OSGi has specifications for remote services
  - OSGi Compendium R6 – Chapter 100 Remote Services
  - OSGi Compendium R6 – Chapter 122 Remote Service Admin Service
- There are several talks about OSGi, microservices and remote services
  - But mostly about architecture, cool demos but little about the technical details

OVERVIEW

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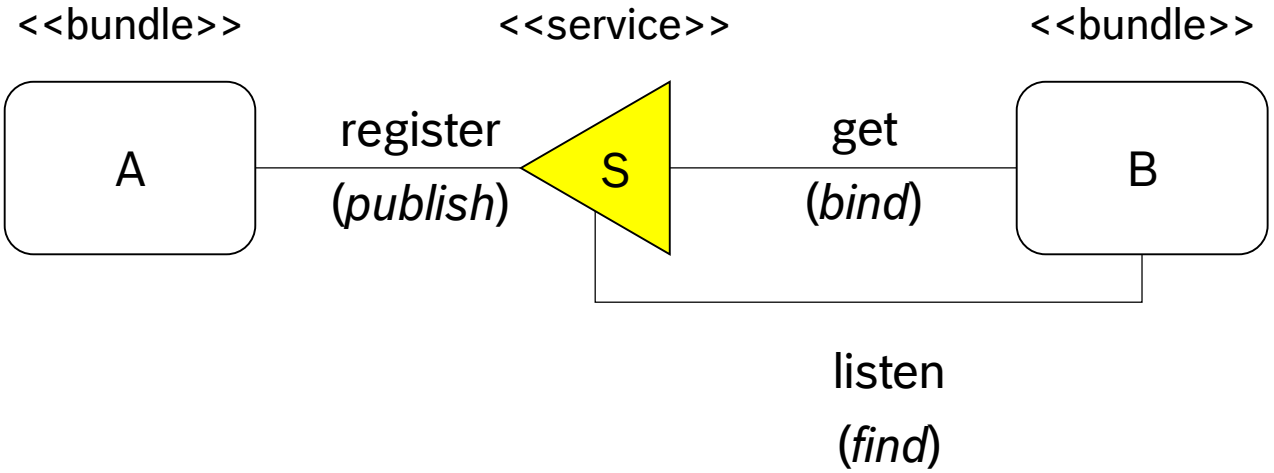
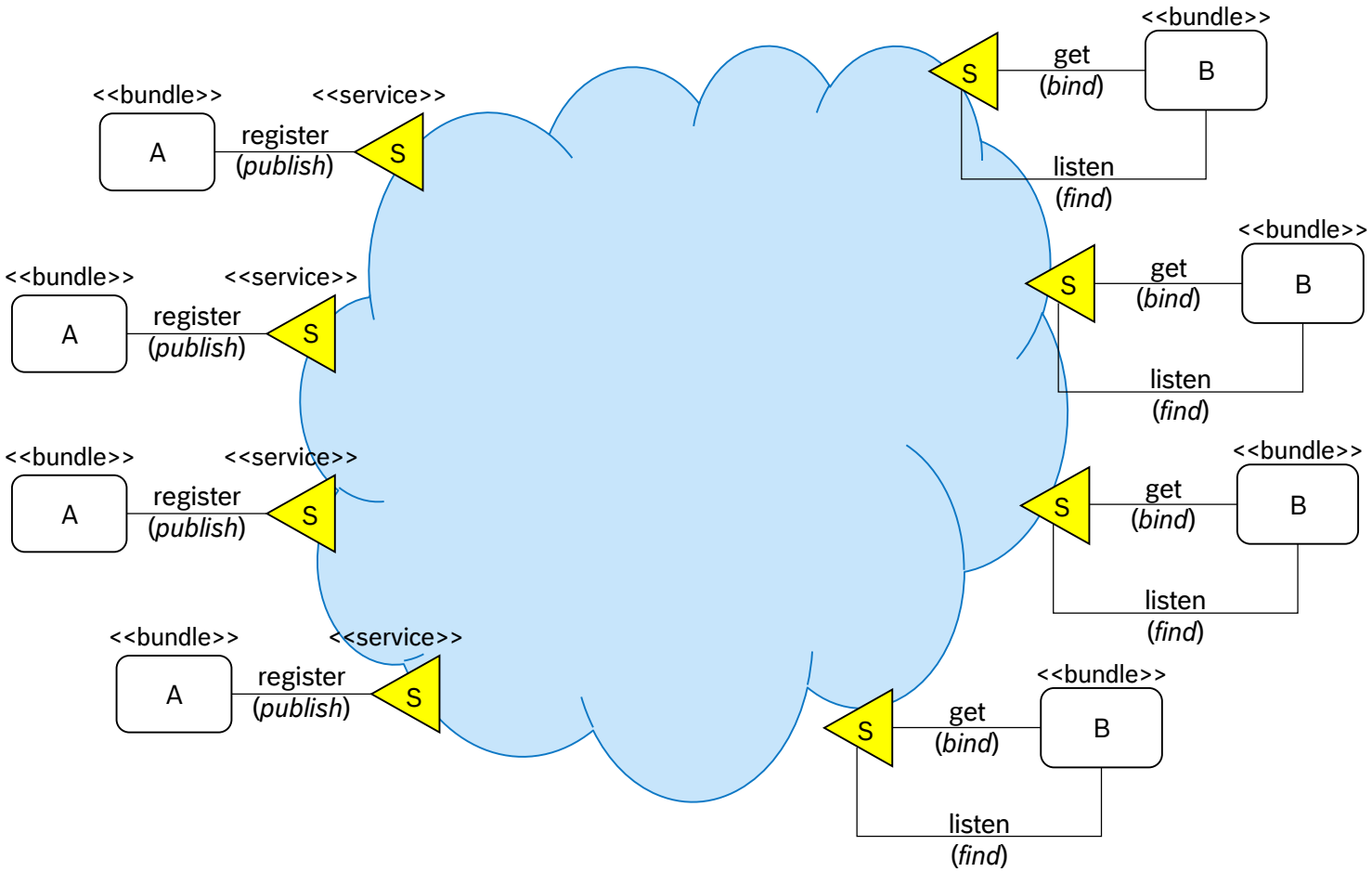
Microservices with OSGi
Publish-Find-Bind

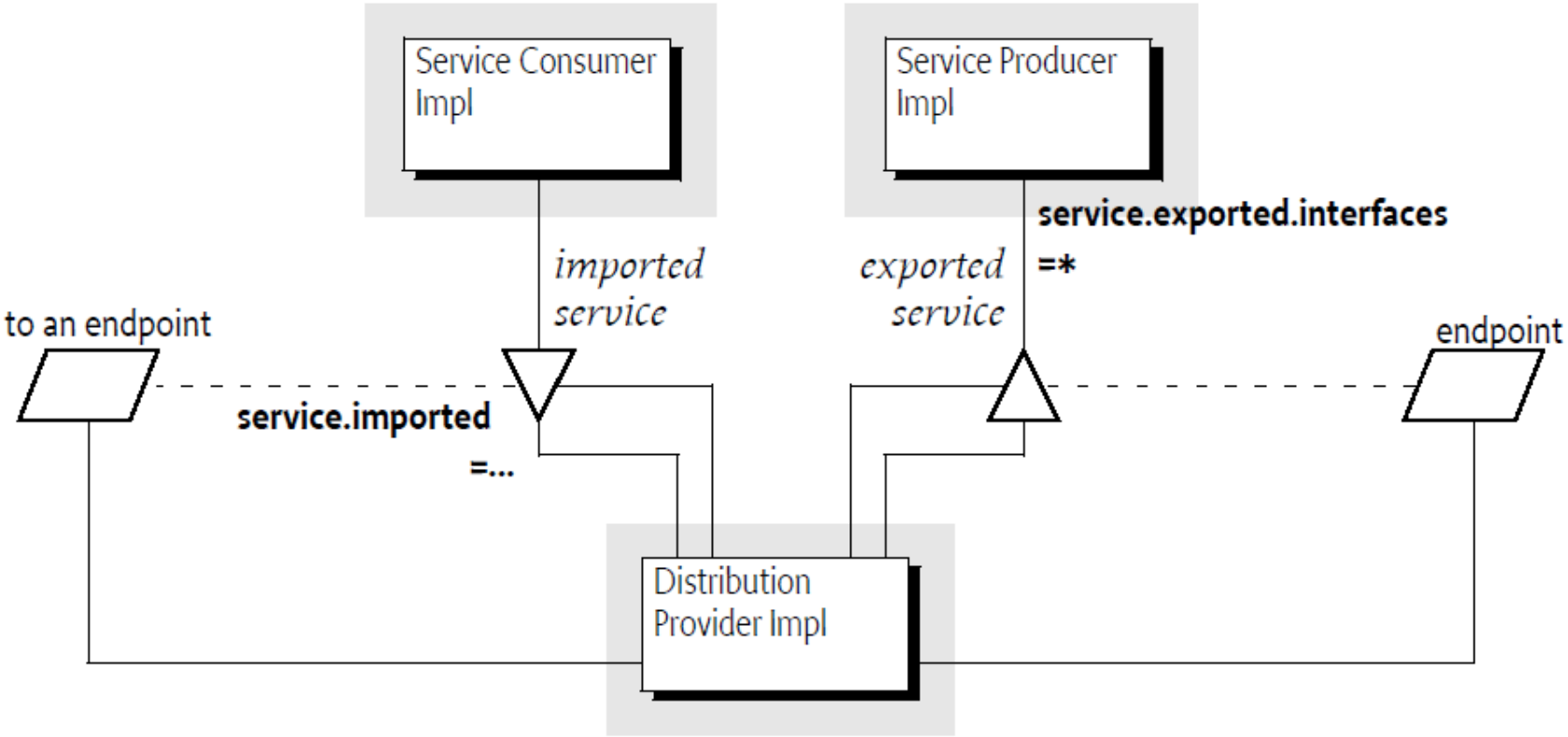
- Bundles **register (publish)** services
- Bundles **get (bind)** services
- Bundles **listen (find)** services



Microservices with OSGi
Publish-Find-Bind - Remote



Microservices with OSGi
Remote Services



OSGi Compendium Specification R6 – Figure 100.1 Architecture

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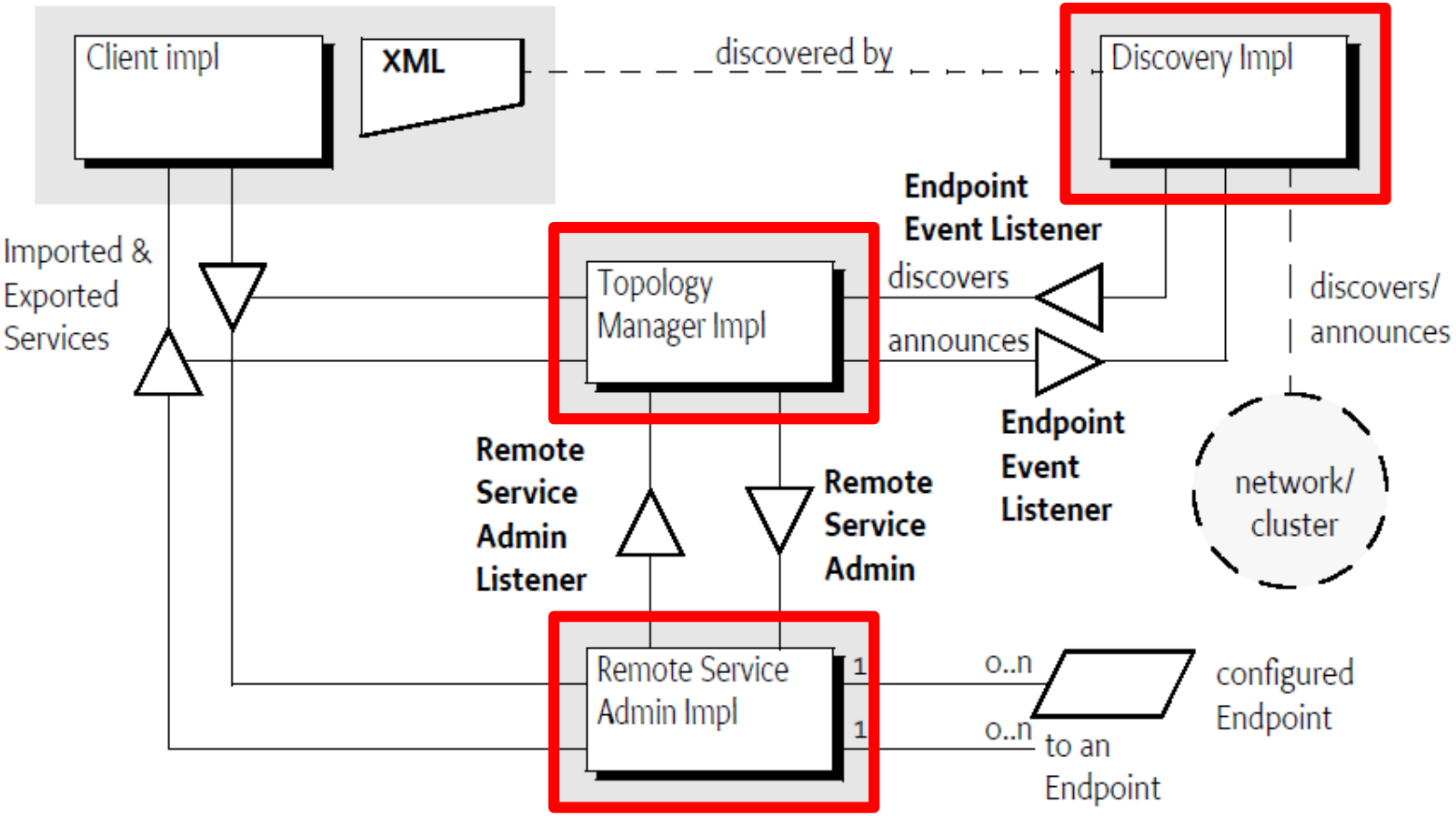
Microservices with OSGi
Terminology

- **Remote Service (*aka Distributed Service*)**
  - OSGi service that is available across container boundaries
- **Distribution Provider**
  - Exports services by creating endpoints
  - Imports services by creating proxies to access endpoints
  - Manage policies around the topology
  - Discover remote services
- **Endpoint**
  - Communication access mechanism to a remote service that requires some protocol for communications
- **Topology**
  - Mapping between services and endpoints as well as their communication characteristics

Microservices with OSGi
Remote Service Admin



OSGi Compendium Specification R6 – Figure 122.1 Remote Service Admin Entities

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Microservices with OSGi
Terminology

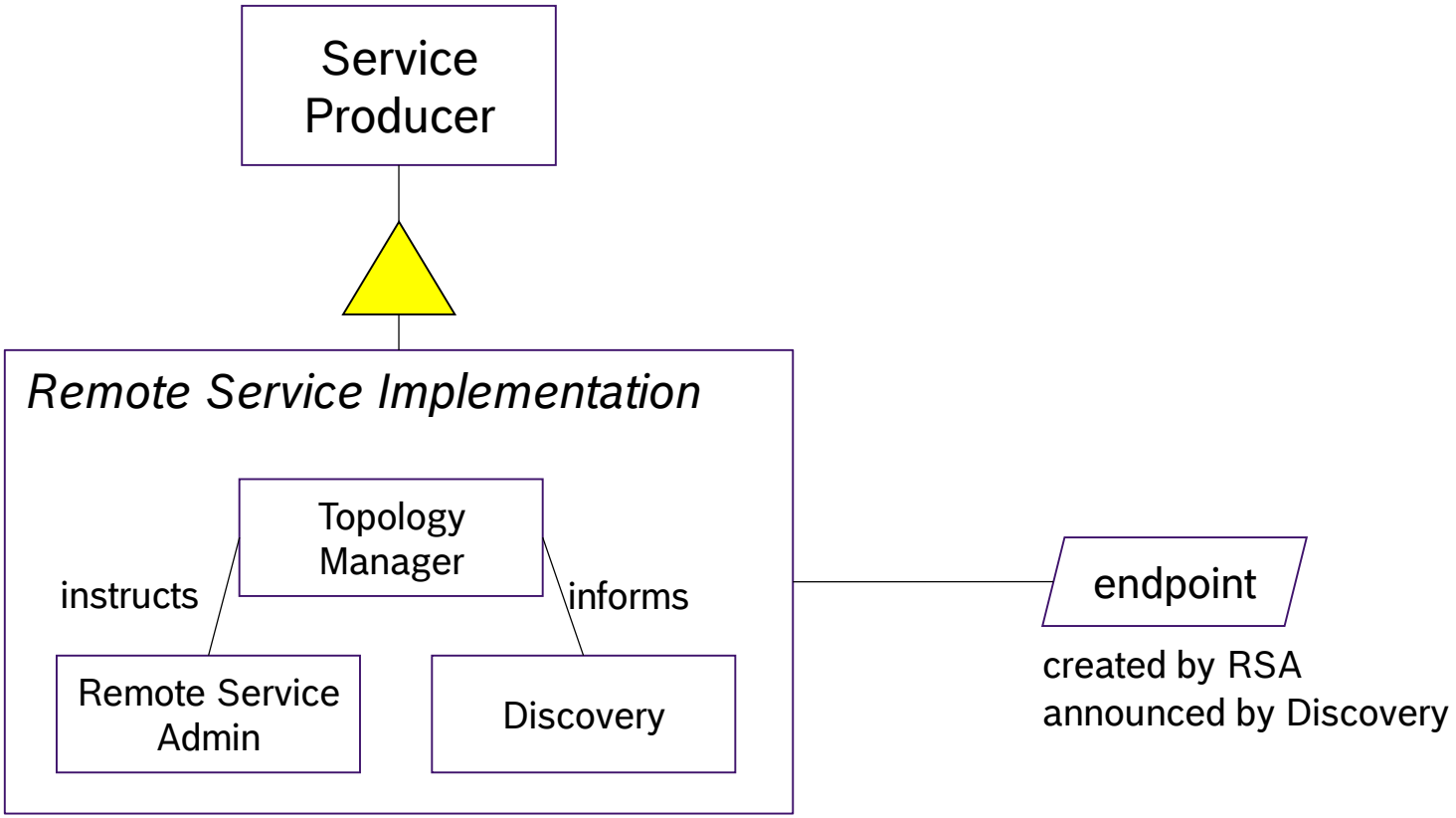
- **Remote Service Admin**
  Passive Distribution Provider providing the mechanism but actually does not export or import services itself

- **Topology Manager**
  Provides the policy for importing and exporting services via RSA
  Implements a topology by using the RSA

- **Discovery**
  Discover / announce Endpoint Descriptions via some discovery protocol

- **Endpoint Description**
  Describes an Endpoint via configuration type (name and set of properties)

Microservices with OSGi
Remote Service Admin – Export Simplified



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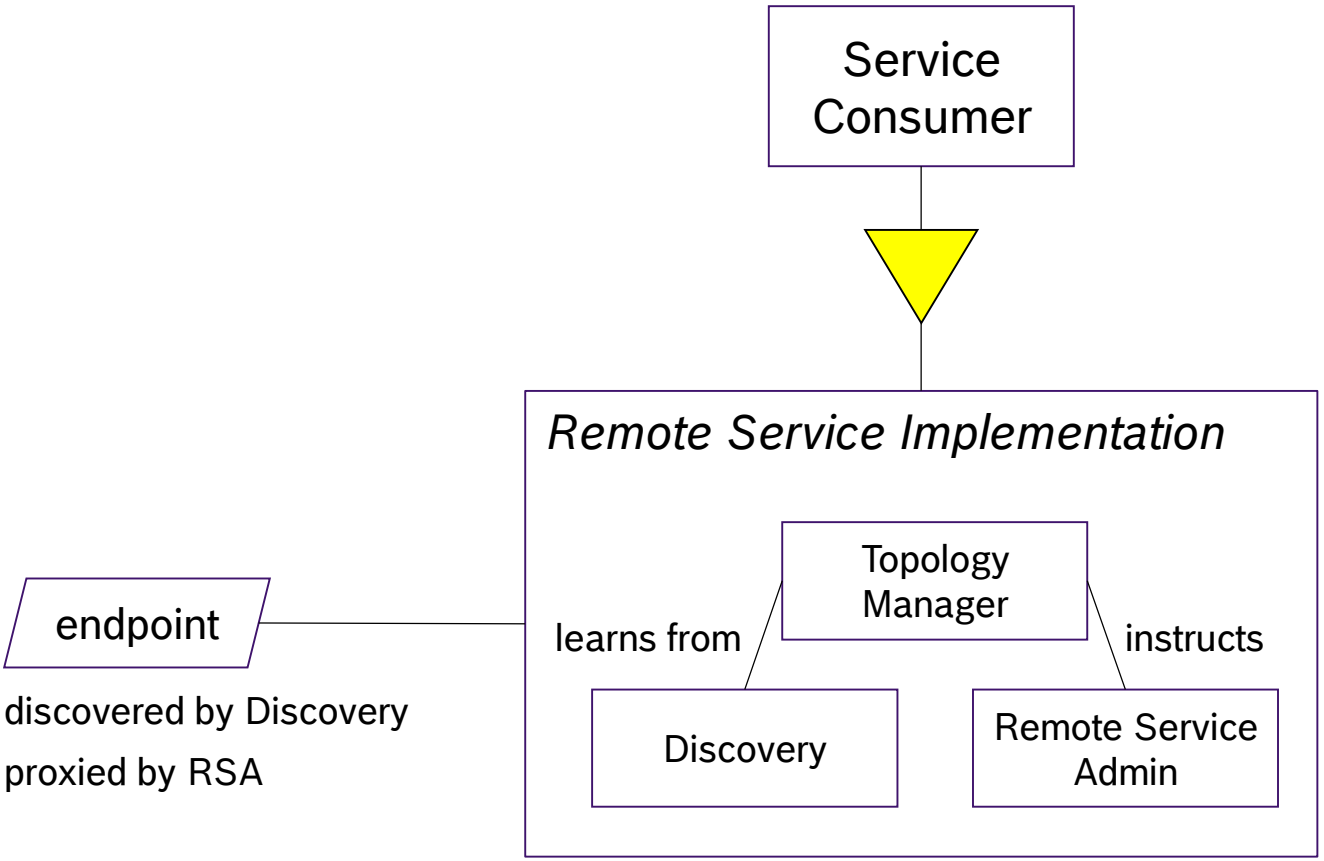
Microservices with OSGi
Remote Service Admin – Import Simplified



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IMPLEMENTATION

Microservices with OSGi
Remote Service Implementation

```
@Component(property= {
    "service.exported.interfaces=*",
    "service.exported.configs=ecf.generic.server"
})
public class UppercaseModifier implements StringModifier {

    @Override
    public String modify(String input) {
        return input.toUpperCase(Locale.getDefault());
    }

}
```

Microservices with OSGi
Remote Service Properties

- `service.exported.interfaces=*`
  Required property to mark a service for export. Specifies which service interfaces should be exported. Using the wildcard it says that all the interfaces that are registered should be exported.

- `service.exported.configs`
  The configuration types that should be used to export a service. Each configuration type (endpoint type) represents the configuration parameters for endpoints. For example:
  - ECF Generic Provider = `ecf.generic.server`
  - CXF DOSGi provider RS = `org.apache.cxf.rs`

https://wiki.eclipse.org/Distribution_Providers

https://github.com/apache/cxf-dosgi

Microservices with OSGi
Implementations

- Eclipse Communication Framework
  https://www.eclipse.org/ecf/
- Apache Aries Remote Service Admin
  http://aries.apache.org/modules/rsa.html
- Amdatu
  https://amdatu.org/application/remote/
- Paremus RSA
  https://docs.paremus.com/display/SF113/Remote+Service+implementation
- Apache CXF Distributed OSGi (distribution providers for Aries RSA)
  http://cxf.apache.org/distributed-osgi.html

Microservices with OSGi
Required Bundles – Equinox OSGi Application

Bundle-SymbolicName	Bundle-Name
org.fipro.modifier.api	**Application Bundles**
org.fipro.modifier.uppercase	
org.apache.felix.gogo.command	**OSGi Console**
org.apache.felix.gogo.runtime	
org.apache.felix.gogo.shell	
org.eclipse.equinox.console	
org.eclipse.osgi	**Equinox OSGi System Bundle**
org.eclipse.osgi.services	**Equinox OSGi Service Interfaces**
org.eclipse.equinox.common	**Common Eclipse Runtime**
org.eclipse.equinox.event	**Event Admin**
org.eclipse.equinox.util	**Equinox Util Bundle**
org.apache.felix.scr	**Apache Felix Declarative Services**
org.eclipse.osgi.util	**OSGi Utility Classes**

Microservices with OSGi
Required Bundles – ECF with Generic Provider

Bundle-SymbolicName	Bundle-Name
org.eclipse.core.jobs	Eclipse Jobs Mechanism
org.eclipse.equinox.concurrent	Equinox Concurrent API
org.eclipse.ecf	ECF Core Bundle
org.eclipse.ecf.discovery	ECF Discovery API Bundle
org.eclipse.ecf.identity	ECF Identity Bundle
org.eclipse.ecf.osgi.services.distribution	ECF RSA Basic Topology Manager
org.eclipse.ecf.osgi.services.remoteserviceadmin	ECF RSA Implementation
org.eclipse.ecf.osgi.services.remoteserviceadmin.proxy	ECF RSA Proxy
org.eclipse.ecf.provider	ECF Generic Provider
org.eclipse.ecf.provider.jmdns	ECF Discovery Zeroconf/JMDNS Provider
org.eclipse.ecf.provider.remoteservice	ECF Generic Provider RemoteServices Support
org.eclipse.ecf.remoteservice	ECF RemoteServices API
org.eclipse.ecf.remoteservice.asyncproxy	ECF RemoteServices AsyncProxy API
org.eclipse.ecf.sharedobject	ECF SharedObject API
org.eclipse.osgi.services.remoteserviceadmin	OSGi RSA API

Microservices with OSGi
ECF – Providers

- Discovery
  - Zeroconf/aka Bonjour/Rendevous (JmDNS) `org.eclipse.ecf.provider.jmdns`
  - jSLP aka SLP/RFC2608 `org.eclipse.ecf.provider.jslp`
- Distribution Provider
  - Generic Provider
    `org.eclipse.ecf.provider`
    `org.eclipse.ecf.provider.remoteservice`
  - r-OSGi Provider
    `org.eclipse.ecf.provider.r_osgi`
    `ch.ethz.iks.r_osgi.remote`
  - Apache CXF Jax-RS Implementation
    `org.eclipse.ecf.provider.cxf.server`
    `org.eclipse.ecf.provider.jaxrs.server`
    `org.eclipse.ecf.provider.jaxrs`
  - …

https://wiki.eclipse.org/Distribution_Providers

https://github.com/apache/cxf-dosgi

Microservices with OSGi
Troubleshooting with Equinox

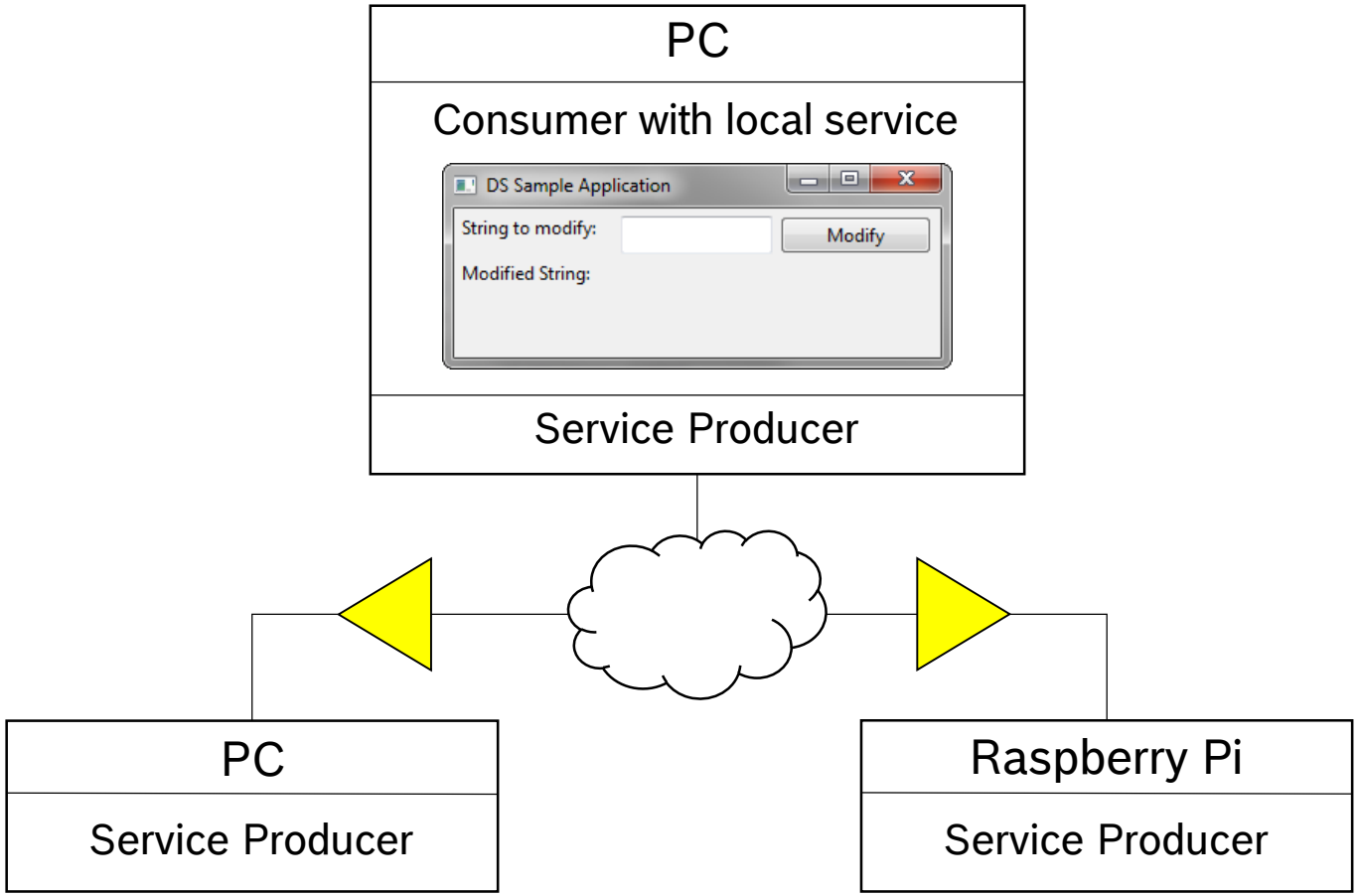
- Bundles that need to auto-started
  - ***org.eclipse.osgi***
  - ***org.apache.felix.scr***
  - ***org.eclipse.equinox.event***
  - ***org.eclipse.ecf.osgi.services.distribution***
  - ***org.eclipse.ecf.provider.jmdns***
  - ***org.eclipse.ecf.provider.remoteservice***
- On the producer side when using a product file additional bundles needed
  - ***org.eclipse.equinox.app***
  - ***org.eclipse.equinox.registry***
- On the consumer side
  - Eclipse RCP and `@Service`: configure the service interface bundles for a lower start level than the default
  - Eclipse RCP with low level OSGi API: ensure the bundle is started (UI bundles are typically not started)

Microservices with OSGi
Conclusion

- Simple at service implementation
- Complicated at runtime definition
- Even more complicated on DevOps side
  - ***Fallacies of Distributed Computing***
    https://de.wikipedia.org/wiki/Fallacies_of_Distributed_Computing
  - ***Service interface evolution***
  - ***...***
- Developer specifies topology via service property, not the administrator

DEMO

Microservices with OSGi
Demo Setup



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