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Application Isolation

Is there an alternative to Subsystems?

Tim Diekmann
Principal Architect
TIBCO Software Inc.

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Overview

- why multiple applications
- brief history of approaches
- OSGi solution
- why another solution
- Alternative OSGi solution

Why multiple applications?

… in a single JVM that is

- save memory (objects and classes)
- reduce management and monitoring overhead
- save CPU on startup and load of applications
- *multiple applications vs multi-tenancy*

very brief History

- web resources
- web applications
- JEE application servers
- application servers like Apache Karaf, Eclipse Virgo, Paremus Service Fabric, IBM WebSphere, etc.
- *what are applications?*

Application Definition

*"**Application software** is all the computer software that causes a computer to perform useful tasks beyond the running of the computer itself."*

Wikipedia - http://en.wikipedia.org/wiki/Application_software

my Application Definition*

* in the context of this presentation, Java, and OSGi

- packaged software deployed to an app server:
  - versioned unit of release/maintenance
  - providing coherent business function
  - with a common life cycle
  - possibly modular in composition

Problems

- no isolation
  - same OS process, OutOfMemoryErrors, in-memory access to other application data
- trade-off between sharing versus protecting
- no accounting
- unwanted side effects
- unit of certified deliverable
  - cannot possibly test all potential interactions

Approaches

- servlet bridge
- nested / child OSGi frameworks
- Apache Karaf
- Eclipse features
- Eclipse Virgo
- IBM WebSphere, Paremus Service Fabric

OSGi Approaches

- Deployment Admin Service, Application Admin Service (older)
- nested OSGi framework
- Subsystems
  - part of Enterprise Specification, introduced in R5
  - based on experience in Eclipse Equinox, Virgo, Apache Aries, and others
  - explicit model of sharing policies: share all, share selected, share nothing
  - visibility boundaries for services, packages, events
  - implementation boundary already provided by OSGi service model

Advantages

- rich metadata supports large number of use cases
- common life cycle for constituents
- declarative approach
- independent of OSGi implementation
- reduces memory consumption by sharing
- supports dynamic resolution and installation of applications
  - unresolved deployment
  - SUBSYSTEM.MF vs DEPLOYMENT.MF

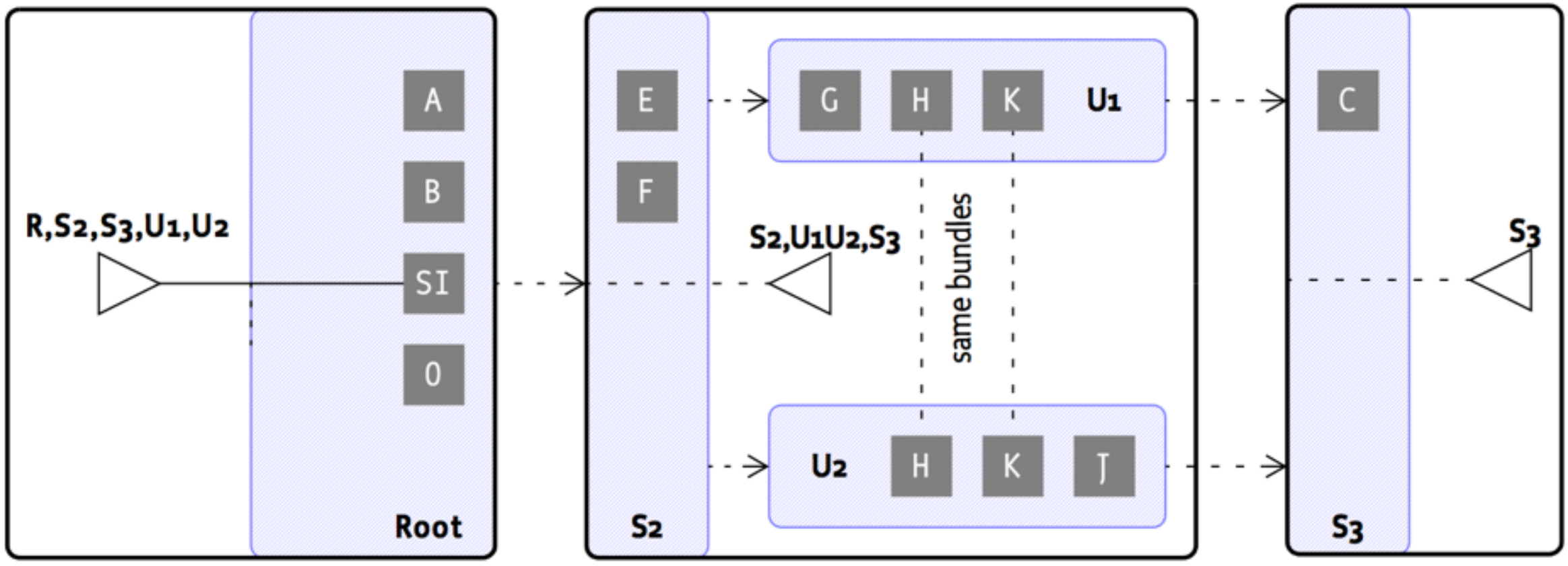
Example of Subsystems Metadata

SUBSYSTEM.MF

```
Manifest-Version: 1.0
Subsystem-ManifestVersion: 1.0
Subsystem-Name: Bank Account
Subsystem-SymbolicName: com.mybank.account.app
Subsystem-Version: 1.0
Subsystem-Type: osgi.subsystem.application
Subsystem-Content:
com.mybank.account.bankWeb; version=1.0.0,
com.mybank.account.bankAccount; version=1.0.0,
com.mybank.account.common; version=1.0.0,
com.mybank.account.utility; version=1.0.0
Use-Bundle: com.mybank.account.admin;version="[1.0.0,2.0.0)"
Subsystem-ExportService: com.mybank.account.service.AccountService
Subsystem-ImportService:
com.mybank.security.UserAuthService;filter="(security=strong)"
```

Drawbacks

- complicated
- complex policy definitions



Drawbacks

- complicated
- complex policy definitions
- configuration vs convention
- missing tooling: details exposed to users, application developers
- issues with common infrastructure services
  - e.g. Configuration Admin, Event Admin, Declarative Services, Blueprint and other extenders
- application is aware of subsystem environment, not functional in OSGi environment without it
- modular applications require updates of metadata in multiple places
  - think distributed application development
  - dynamic changes to the application
- subsystem needs to be started to share code

Drawbacks

SUBSYSTEM.MF

```
Manifest-Version: 1.0
Subsystem-ManifestVersion: 1.0
Subsystem-Name: Bank Account
Subsystem-SymbolicName: com.mybank.account.app
Subsystem-Version: 1.0
Subsystem-Type: osgi.subsystem.application
Subsystem-Content:
com.mybank.account.bankWeb; version=1.0.0,
com.mybank.account.bankAccount; version=1.0.0,
com.mybank.account.common; version=1.0.0,
com.mybank.account.utility; version=1.0.0
Use-Bundle: com.mybank.account.admin;version="[1.0.0,2.0.0)"
Subsystem-ExportService: com.mybank.account.service.AccountService
Subsystem-ImportService:
com.mybank.security.UserAuthService;filter="(security=strong)"
```

Subsystems Improvements

- enhancements worked out in RFC 201 scheduled for a later release of the Enterprise Specification
  - header localization
  - weaving hook integration / interaction
  - provide deployment manifest at install time
  - improve API for management agent
  - determine service dependencies of applications
  - revisit rules for preferred provider and application resolution

Alternative

10.1.8.19 public Bundle installBundle (String location) throws BundleException

location The location identifier of the bundle to install.

- Installs a bundle from the specified location identifier.

  This method performs the same function as calling installBundle(String,InputStream) with the specified location identifier and a null InputStream.

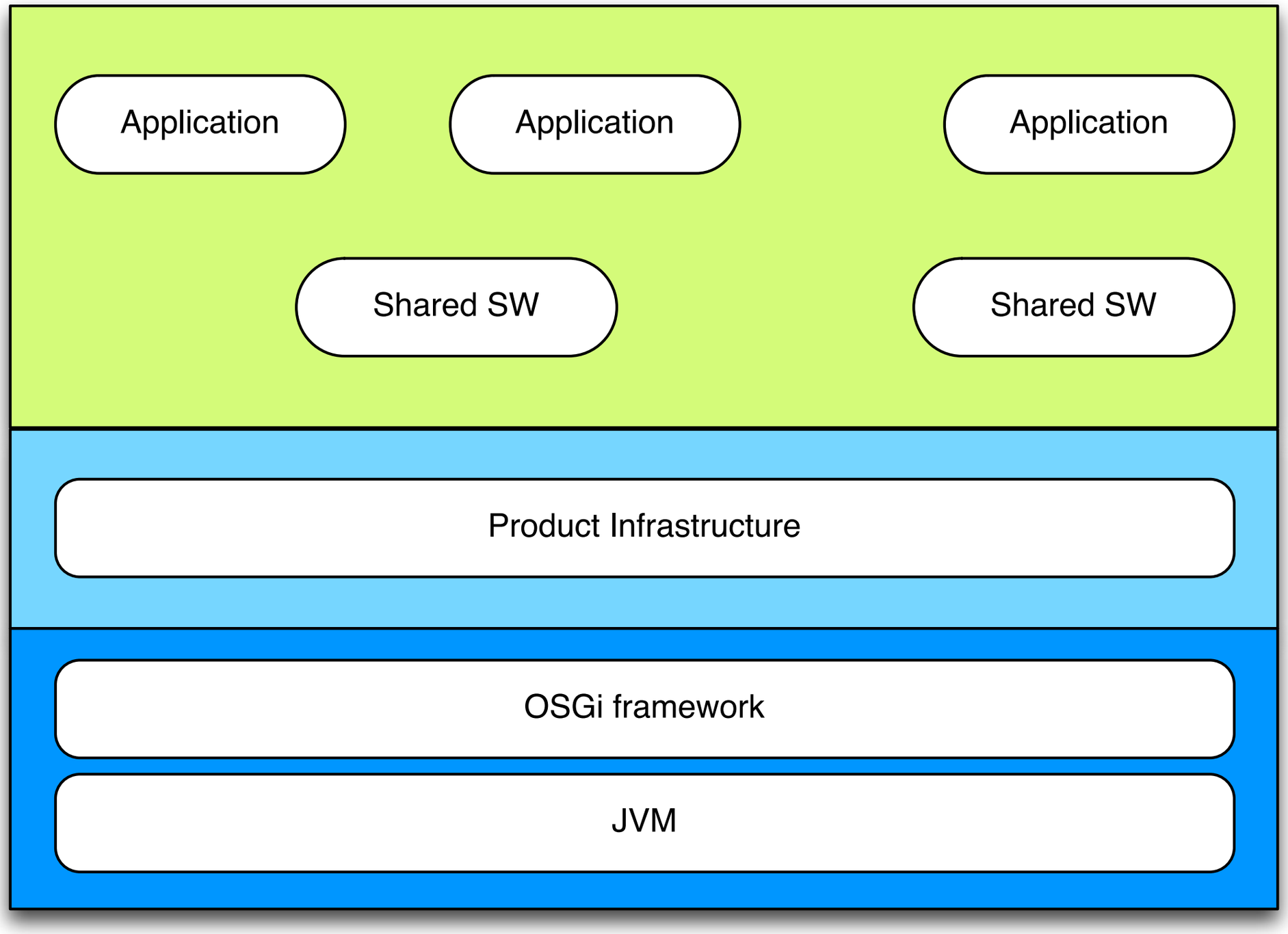
Returns The Bundle object of the installed bundle.

Throws BundleException – If the installation failed. BundleException types thrown by this method include: BundleException.READ_ERROR , BundleException.DUPLICATE_BUNDLE_ERROR, BundleException.MANIFEST_ERROR, and BundleException.REJECTED_BY_HOOK.

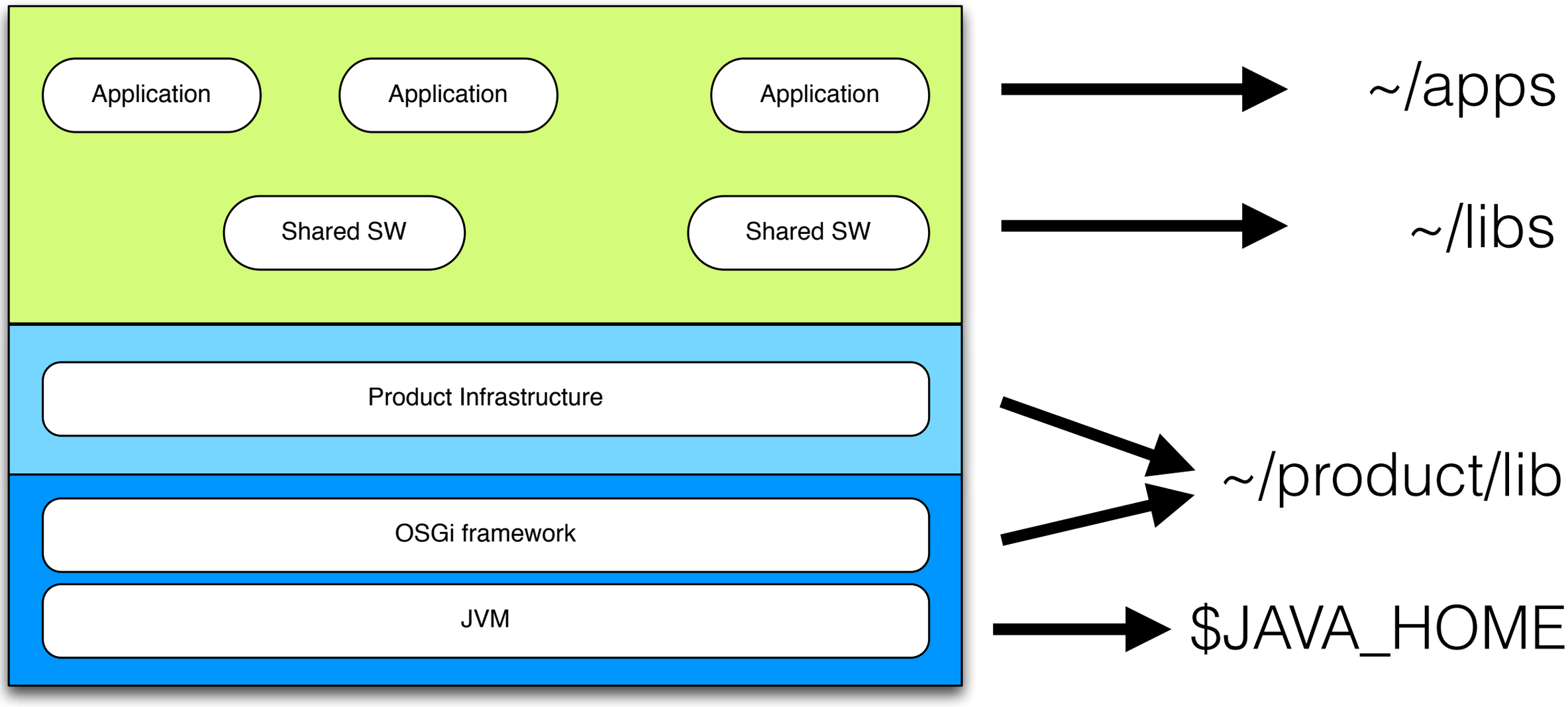
SecurityException – If the caller does not have the appropriate AdminPermission[installed bundle, LIFECYCLE], and the Java Runtime Environment supports permissions.

IllegalStateException – If this BundleContext is no longer valid.

Layering



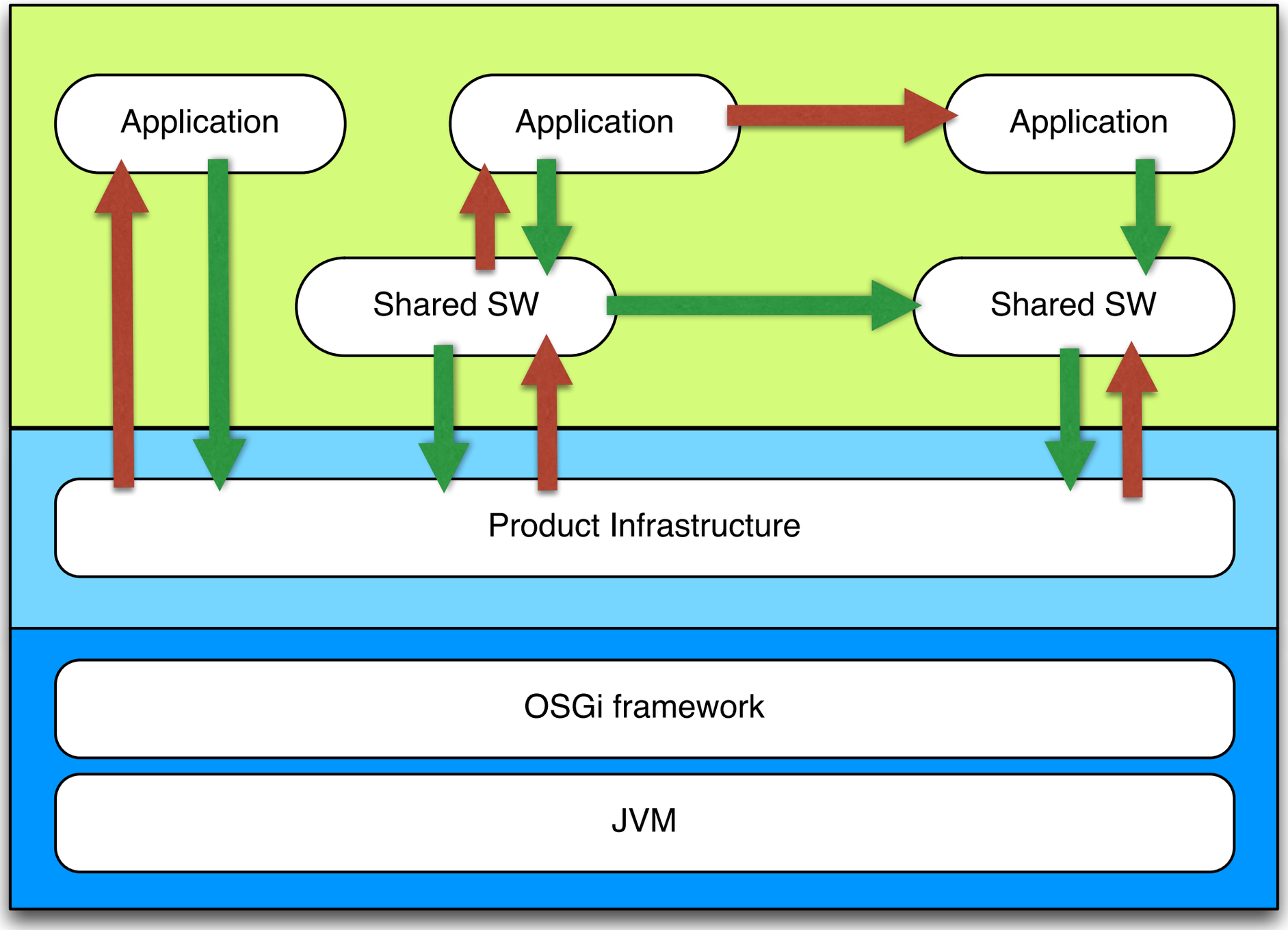
File System Layout



Solution

- file system is source of truth for deployment
- use the JVM as-is with its boot and ext class loaders
- place product code in one folder or structure
  - e.g. system or product
- place common infrastructure code in separate folder
- place shared libraries in separate folders
  - not necessarily part of the product, separate lifecycle
- place applications in separate folders

Visibility Boundaries



Advantages

- simple
- understandable
- changeable, flexible
- structured by location in file system
- no other metadata required
  - unless you want to model other dependencies and visibility boundaries
- compatible

Implementation

- different strategies possible
  - multi-tier level visibility
  - sensitive vs public services and code
    - visibility boundaries enforced via ResolverHooks, EventHooks, FindHooks, even WaevingHooks
- change strategy via configuration
- support multiple singletons if required by business logic, e.g. static variables in common classes

Disadvantages

- may not support all complex use cases
- requires additional metadata to support finer grain sharing policies
- too simple?

Real World Example

TIBCO ActiveMatrix BusinessWorks™ 6

TIBCO BusinessWorks™ 6

- ESB product, hosting multiple applications in single OSGi based runtime environment

- install product in one folder

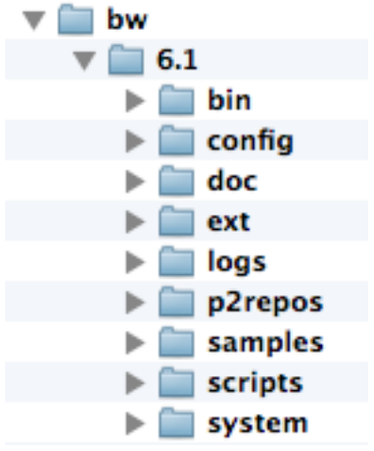
- install applications in a different folder

- determine visibility and accessibility based on folder location

Entitites

- product
  - BusinessWorks 6
- palettes (part of the product)
  - ~16 Palettes
- product extensions
  - palettes like salesforce.com, Twitter, etc.
- applications

Folder Layout



product layout:

system contains all product code

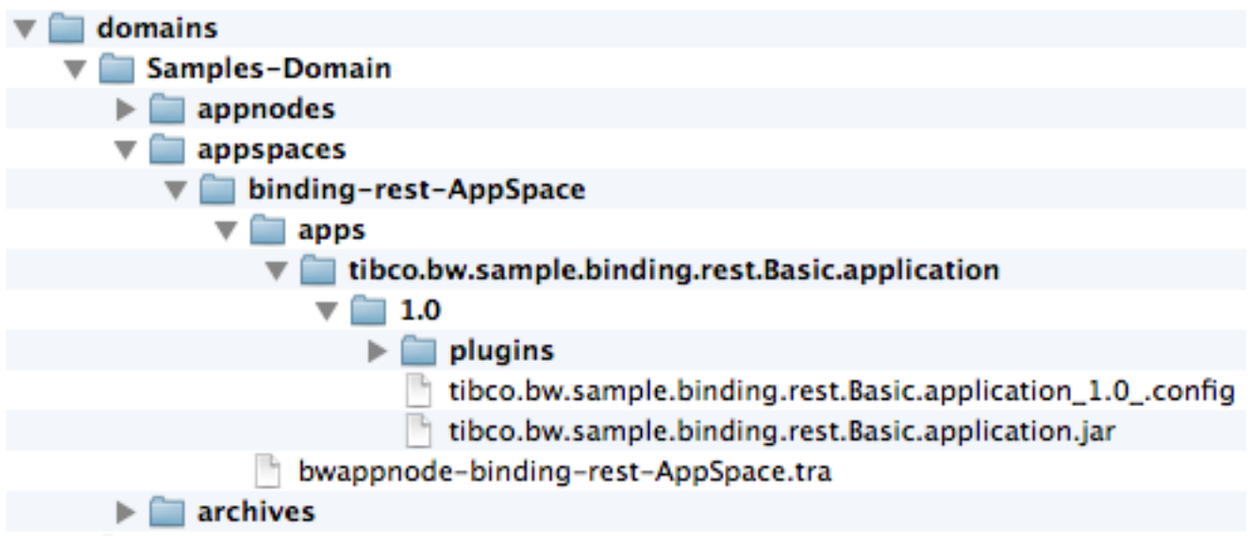
ext contains links to product extensions

application layout:

grouped in AppSpaces

versioned

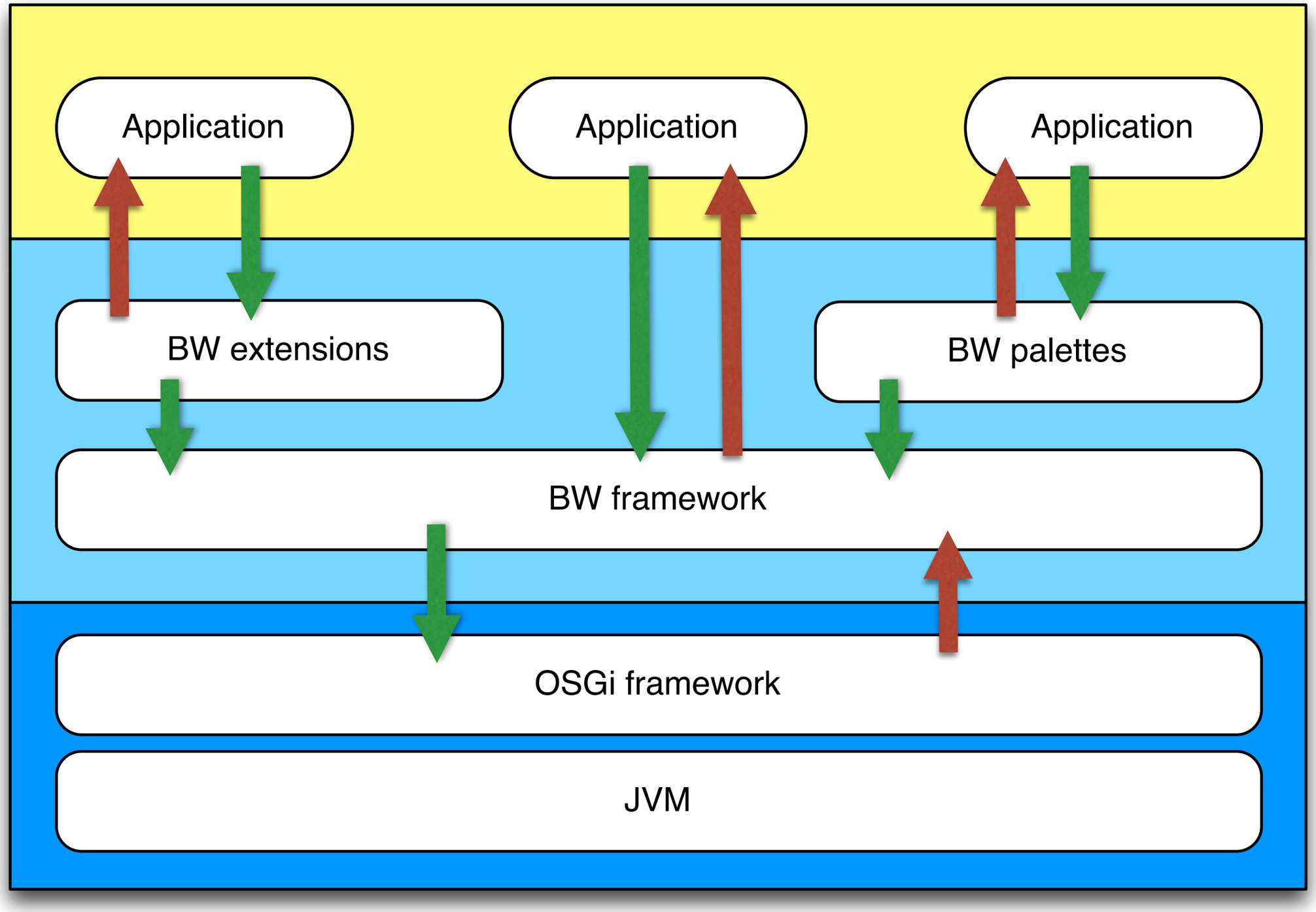
contains code and configuration



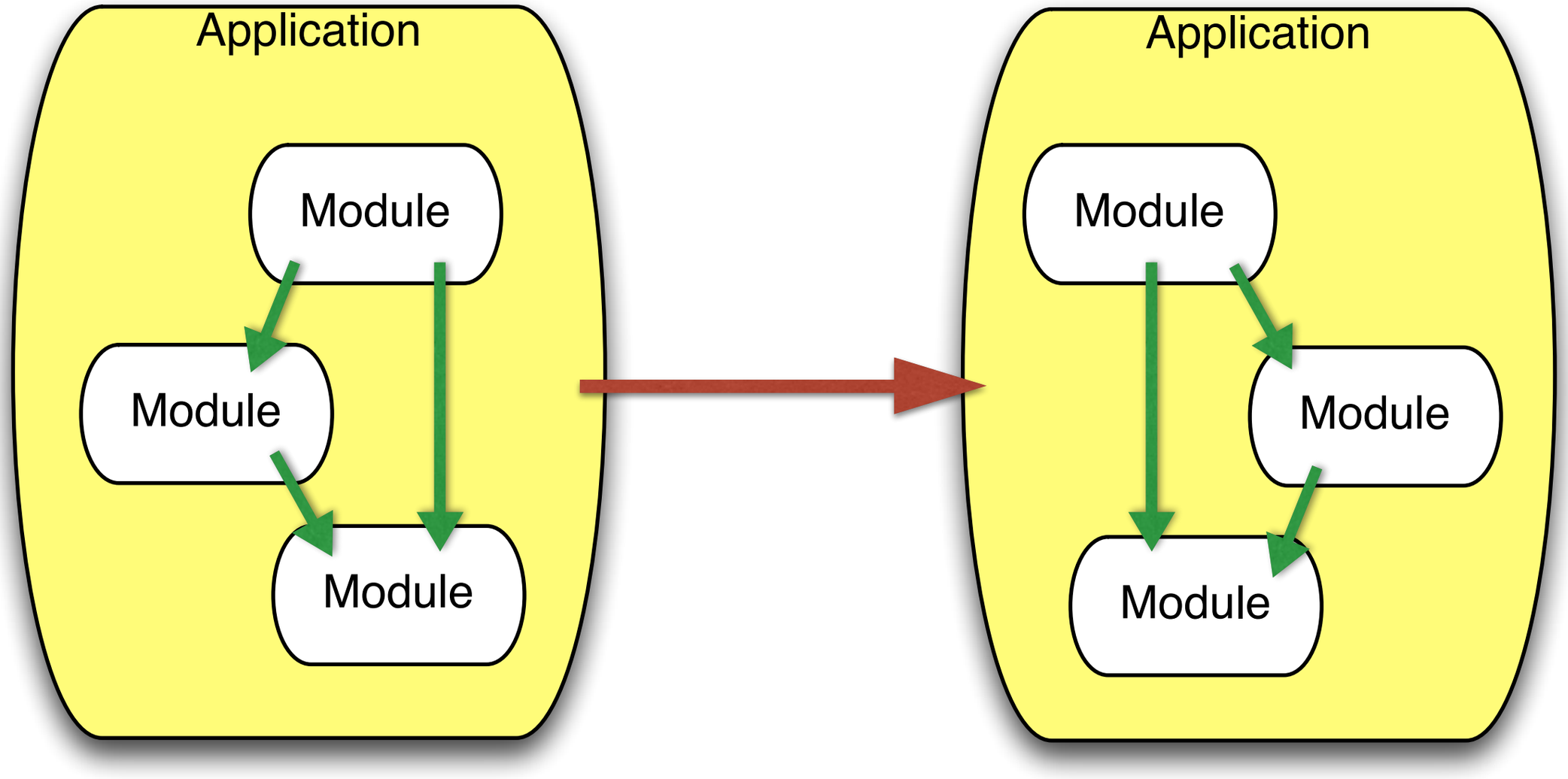
Visibility Boundaries

- product is self-contained in *system* folder
  - does not get wired outside of system folder
- product extensions are able to see and use anything in product folder
  - can also supply their own versions of infrastructure bundles
  - visible to all applications
- palettes sit above product and product extensions
- applications sit above palettes
  - can provide infrastructure that is confined to application

Visibility Boundaries



Applications



Specifics

- separate public from internal APIs
  - product internals are hidden from upper layers
- application support provided by Eclipse based designer
- additional application metadata
  - application identification and versioning
  - dependency management
- same hotfix mechanism for product as well as applications and extensions

Hotfixing

- simple, file system based
- system/hotfix folder repeats structure under system
- any files in hotfix override files in original location
- works for outer flat class path as well as OSGi class path environments

the end

questions?

References

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