Aspect Weaving for OSGi

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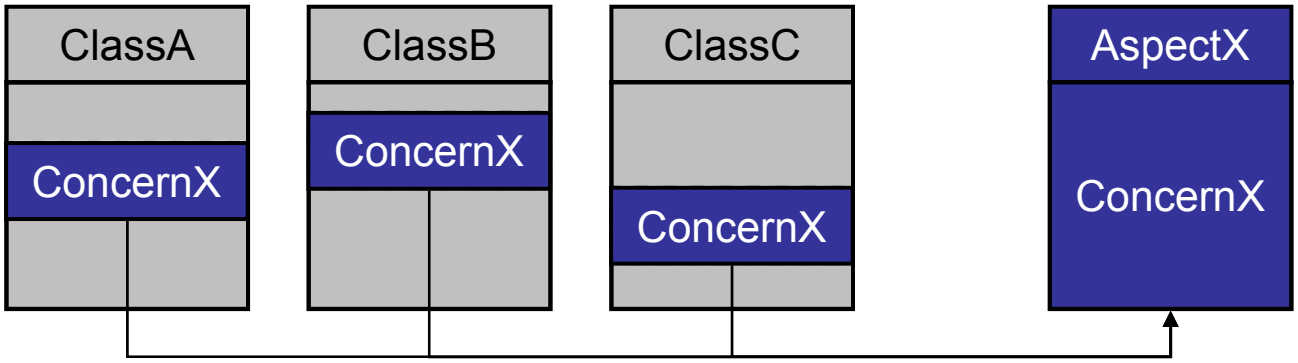
Aspect-oriented programming

- Modularity improved a lot by OO concepts
  - Classes, interfaces
  - Information hiding, polymorphism, inheritance
- AOP adds additional concepts
  - To modularize so called “cross-cutting concerns”



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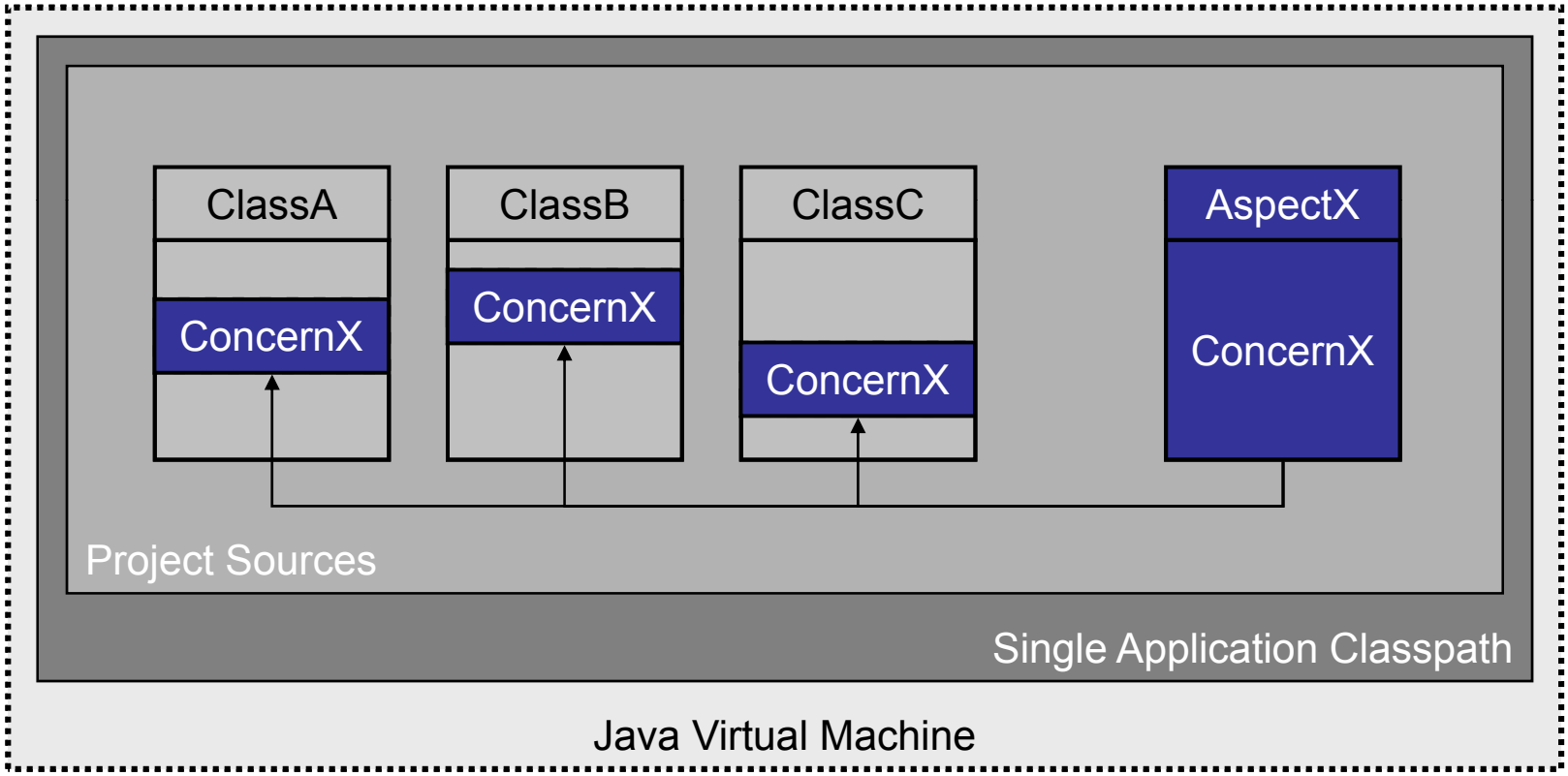
AOP today

- Meanwhile AOP is an established concept
  - Useful for many situations
  - Mostly technology-centric usage scenarios
- Established languages and frameworks available
  - AspectJ: powerful language extension to Java
  - Spring-AOP: simple to use AOP for enterprise apps
- Used in production:
  - Spring itself makes heavy use of AOP concepts
  - App-servers are using AOP inside
  - Direct AOP selectively used in enterprise apps

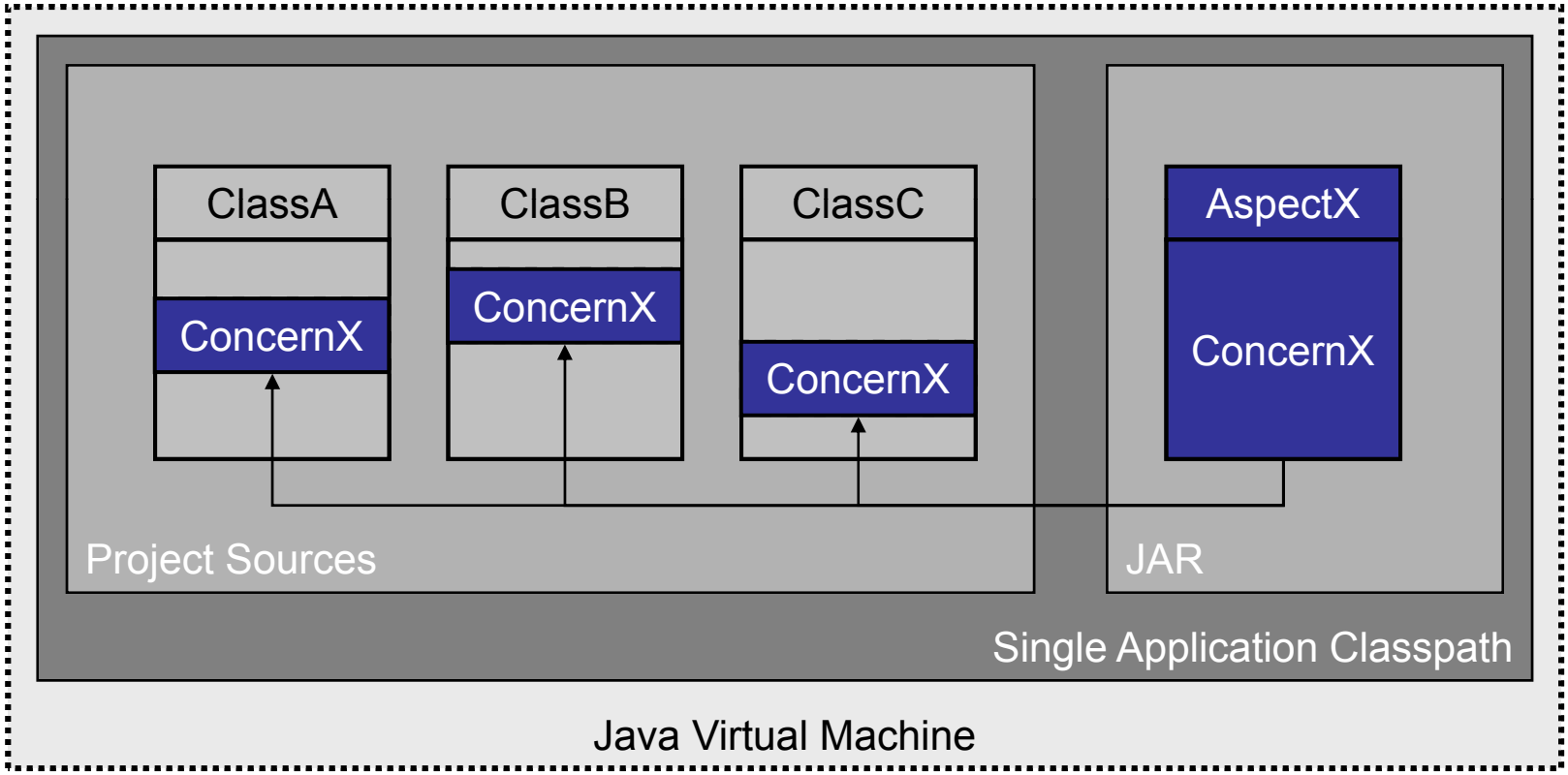
AspectJ = AOP for Java

- AspectJ is a powerful language extension for Java
  - Hosted as an Eclipse project
  - Still very active (latest release April 2008, upcoming release 1.6.1 close)
- AJDT:
  - Great tooling for the Eclipse IDE
  - Comes close to the JDT feeling
- Spring-IDE:
  - Integrates AJDT with Spring-AOP
  - AJDT feeling for Spring apps

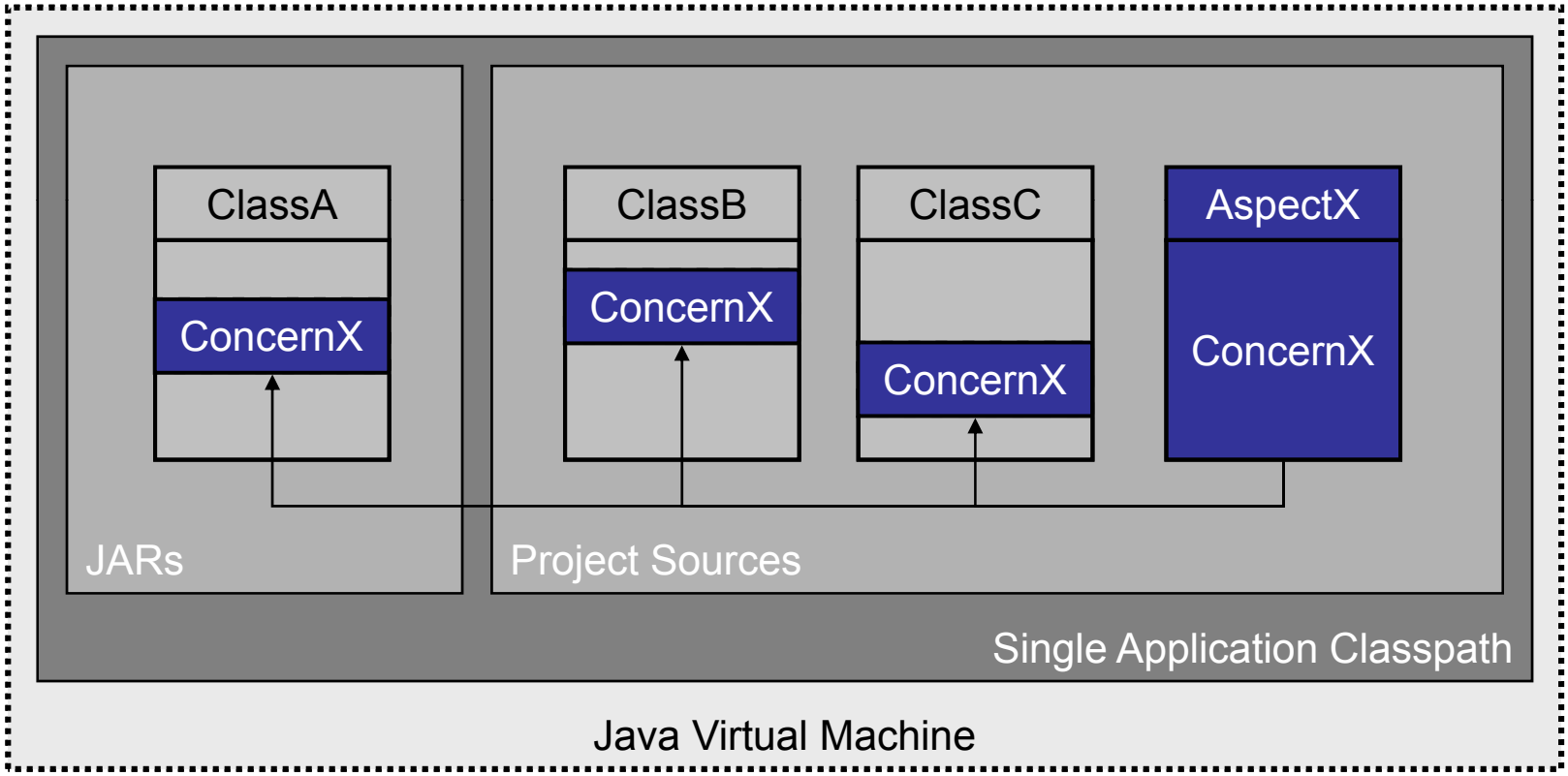
The Standard Use Case



Library Aspects



Aspects for Existing Code



Java + OSGi

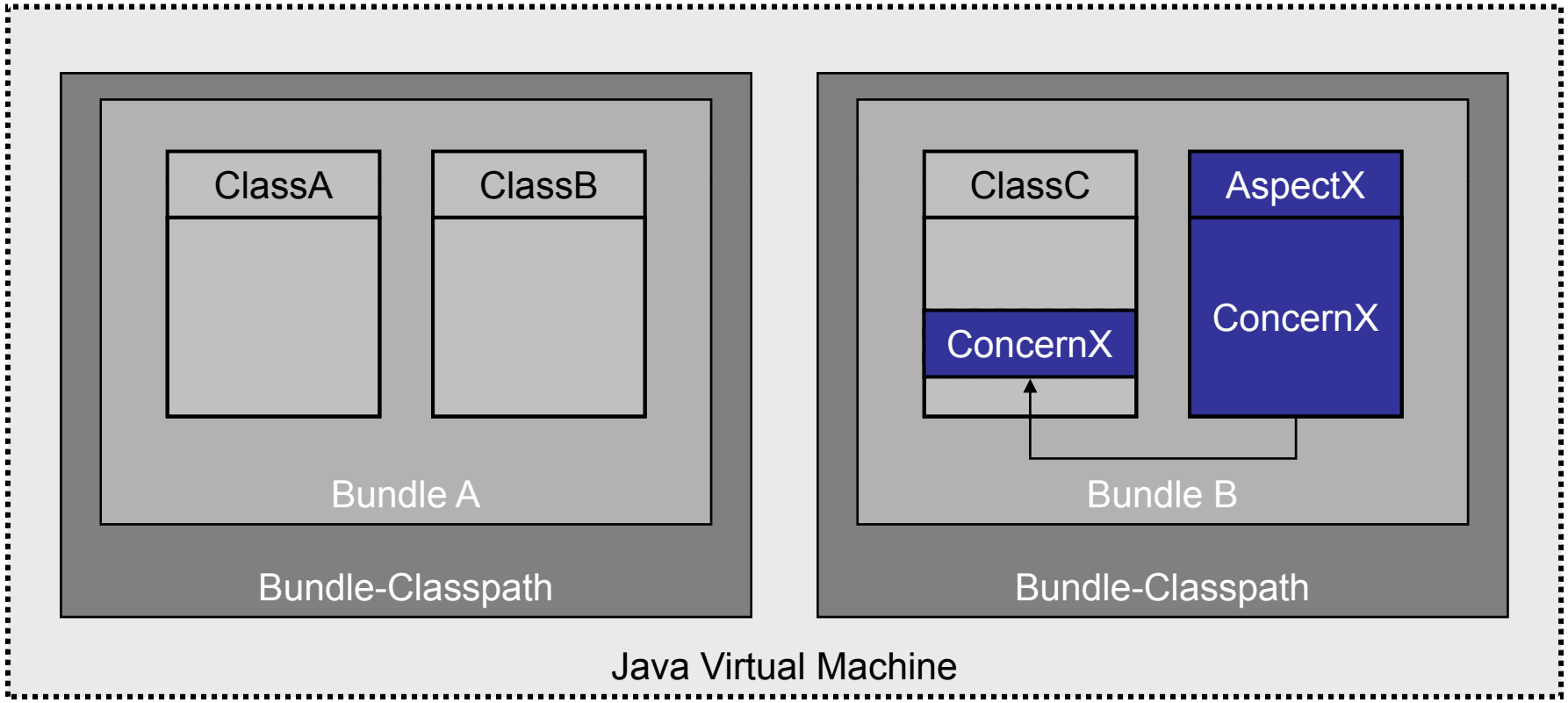
- **OSGi:**
  - **“A dynamic module system for Java”**

- Modularity
- Dynamic
- Service-Oriented

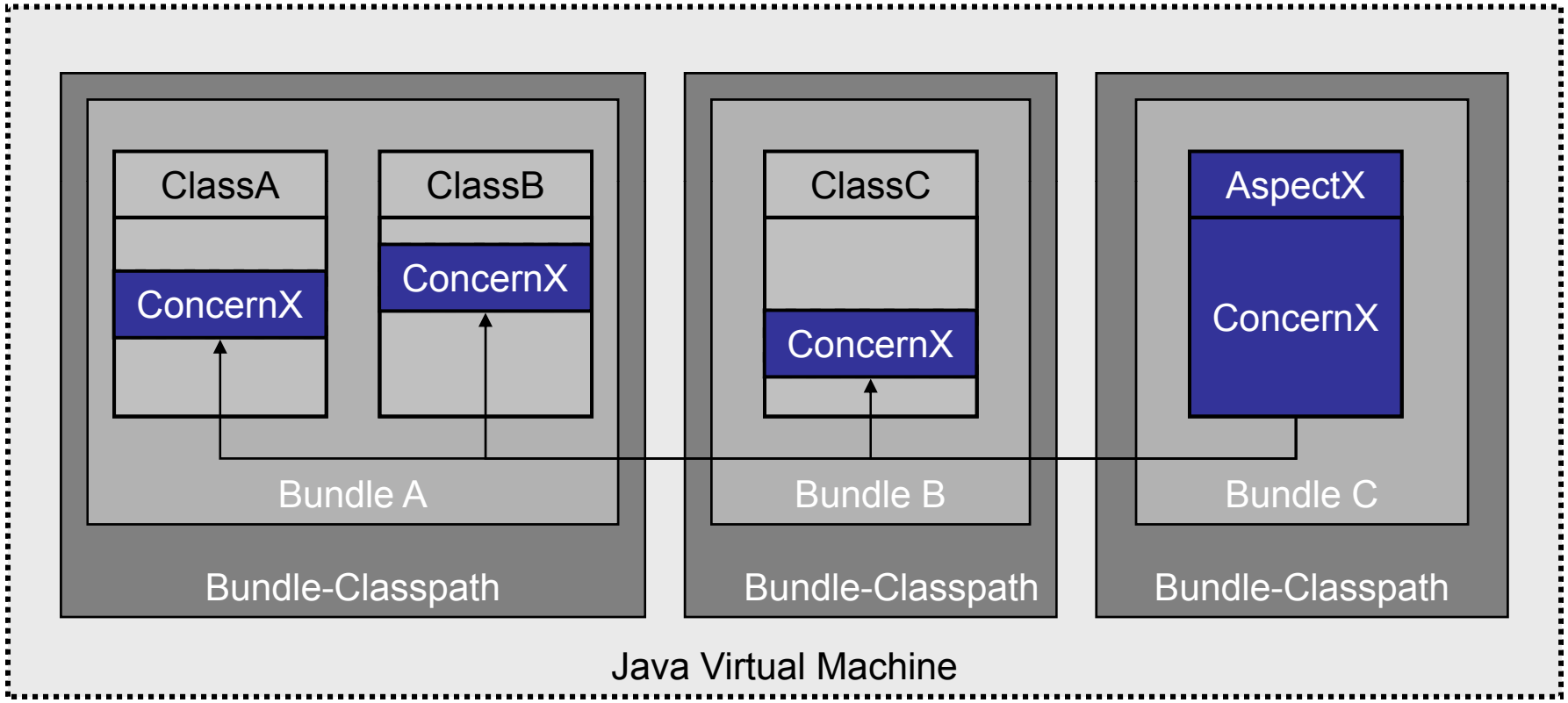
What does it mean for us?

- We would like to **modularize**
  - … classes and interfaces into bundles
  - … **and** aspects into bundles
- The obvious next step:
  - **modularize cross-cutting concerns into bundles**
- Takes modularity to the next level

Intra-Bundle Aspects



Co-Op Bundle Aspects



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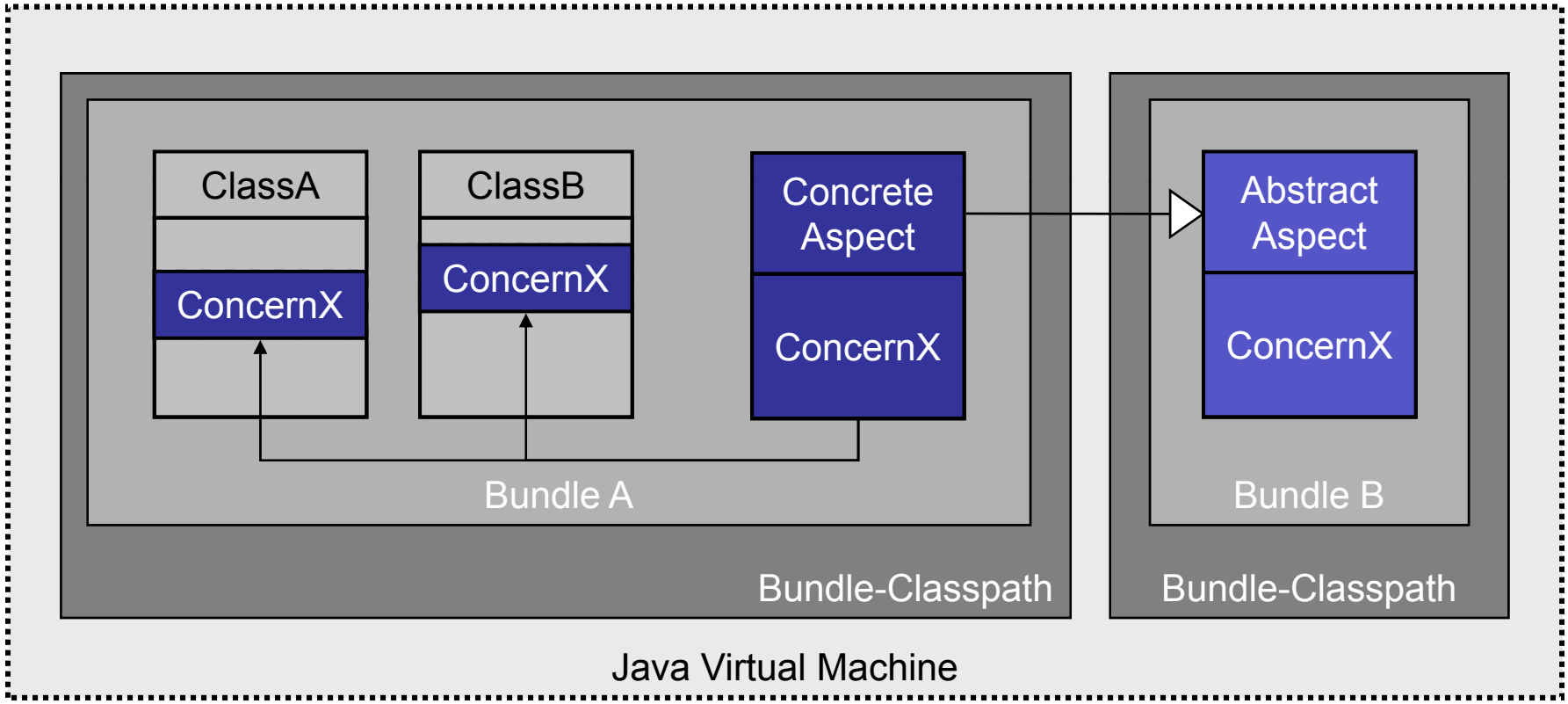
Abstract Aspect Bundles



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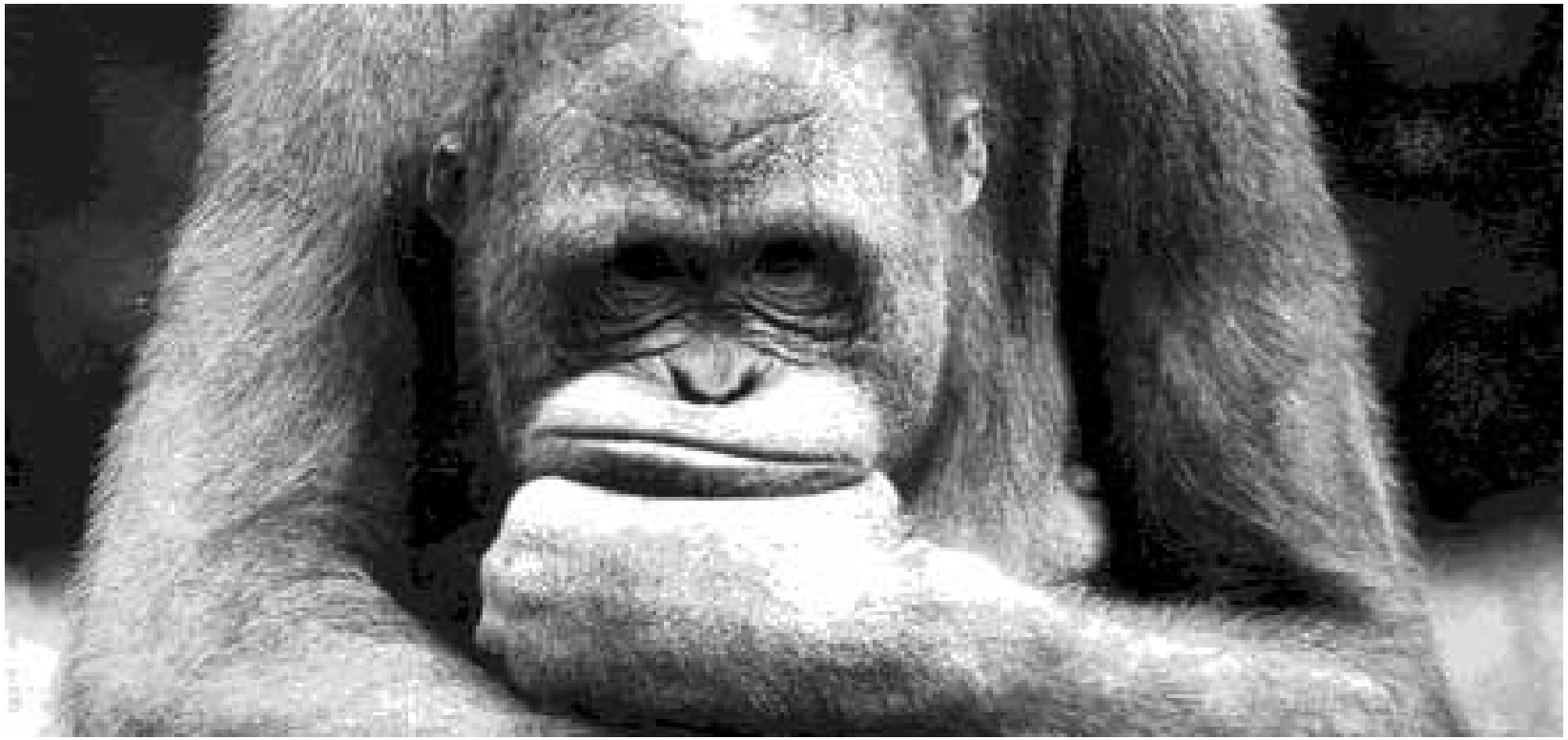
Dynamics for Aspect Bundles

- OSGi allows dynamic bundle
  - … installs
  - … uninstalls
  - … updates
- Same should be possible for aspect bundles
  - … dynamic installs, uninstalls and updates of aspect bundles
  - … dynamic installs, uninstalls and updates of bundles that are affected by aspects

How could all this possibly work?



Equinox Aspects

- Equinox Incubator Project
  - http://www.eclipse.org/equinox/incubator/aspects
- Enables AspectJ/AOP for OSGi
  - Supports all presented use-cases
  - Ready-to-use
- Setting
  - Works with Eclipse 3.3 and 3.4
  - Works with AJDT 1.5.2, 1.5.3, 1.6.0

What can I do?

- Put aspects into standard OSGi bundles
  - Just like Java classes
- Define what and where to weave
  - aop.xml and manifest headers
- Go!

- Feels like a natural combination of AOP and OSGi…

Load-Time Weaving for OSGi

- Let the OSGi runtime take care of weaving the aspects
  - (and not the compiler)
  - Leads to load-time weaving within OSGi

- This means:
  - No recompilation of existing bundles necessary
  - Supports “aop.xml” load-time weaving config of AspectJ

Live Demo

- Monitoring Eclipse bundles…

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Caching

- Wasn’t that a fast startup?

- The reason: caching for woven classes
  - Load-time weaving happens only once
  - Second time startup is same as without aspects
  - Available for standard JREs and IBM J9 shared classes
  - Supports configuration switching

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Dynamics

- Dynamics for aspect bundles
  - Means re- or un-weaving existing bundles
- How is it realized?
  - Silent update of bundles to be woven again
  - Bundles must behave nicely within dynamic situations

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Live Demo

- Installing,
  updating,
  uninstalling
  aspects at runtime…

AOP in Spring

- Spring uses AOP a lot for all kinds of purposes
- @Configurable is one example

- Realized by Spring via load-time aspect weaving

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Spring Dynamic Modules & Equinox Aspects

- Equinox Aspects can do load-time aspect weaving for Spring Dynamic Modules…

- Live Demo
  - @Configurable for Extensions (Views in Eclipse RCP apps)

Equinox Aspects in Production Systems

- Allianz Business System (ABS)
  - Mission critical system at the core of the insurance business.
  - Addresses all major concerns in the various classes of insurance.
  - Online, offline and integration scenarios.

- Uses Equinox Aspects for highly specific performance monitoring (QoS) in production

APIs and Implementation

- **org.eclipse.equinox.weaving.hook**
  - Hooks into the runtime
  - Provides API for injecting weaving and caching implementations
- **org.eclipse.equinox.weaving.aspectj**
  - Implements aspect weaving using AspectJ
- **org.eclipse.equinox.weaving.caching**
  - Implements caching for standard VMs
- **org.eclipse.equinox.weaving.caching.j9**
  - Implements caching for IBM J9 VMs (shared classes feature)

Conclusions

- Equinox Aspects brings full AOP to OSGi
  - Load-time weaving integrated into OSGi
  - Combines OSGi and AOP modularity features
- Can be used for production systems today

- **Give it a try**
  http://www.eclipse.org/equinox/incubator/aspects

Thank you for your attention!

Q&A

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