PaaS Security, Hazards in Multitenant Software Platforms

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Outline

1 Introduction: PaaS Clouds & Security Challenges
- Multitenancy-induced Risks

2 Java Platform Security
- Standard Java Security
- Open Issues: Isolation, Accounting and Thread Termination
- Solutions to Open Security Issues
- Java-based Containers: J2EE and OSGi

3 .NET Platform Security
- Isolation, Accounting and Thread Termination in .NET

4 Conclusions
- Summing Up
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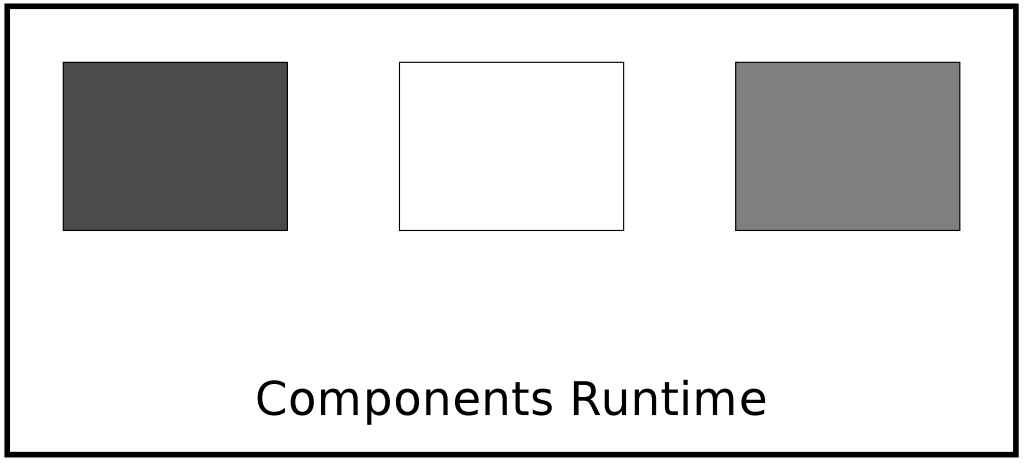

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- **Platform-as-a-Service** clouds provide a runtime for users' applications/components
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- New security challenge in PaaS clouds:
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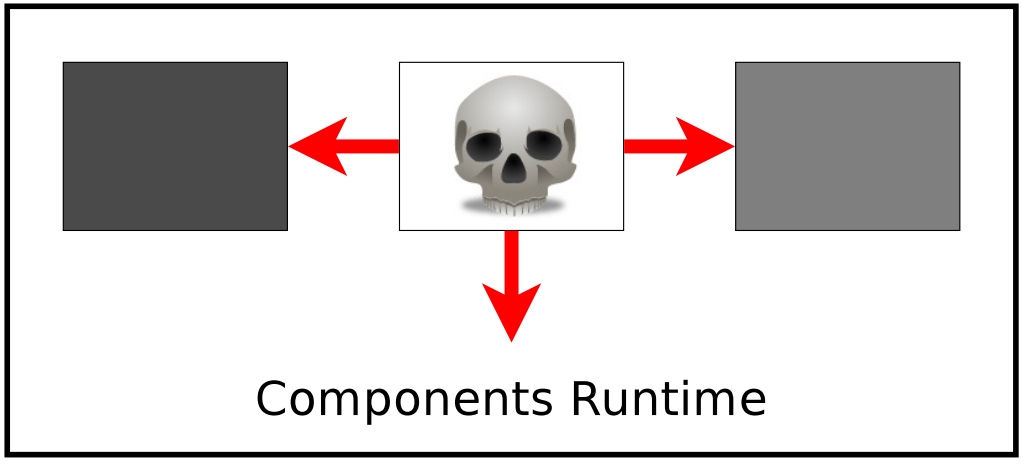
  - Must protect the platform and other users' components



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- APIs for encryption (PKI), secure communication...

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- **Safe Thread Termination**:
  - There is no safe way to terminate a Java process
  - `java.lang.Thread.stop()` is deprecated (it unlocks monitors, and so it can leave objects in inconsistent state)

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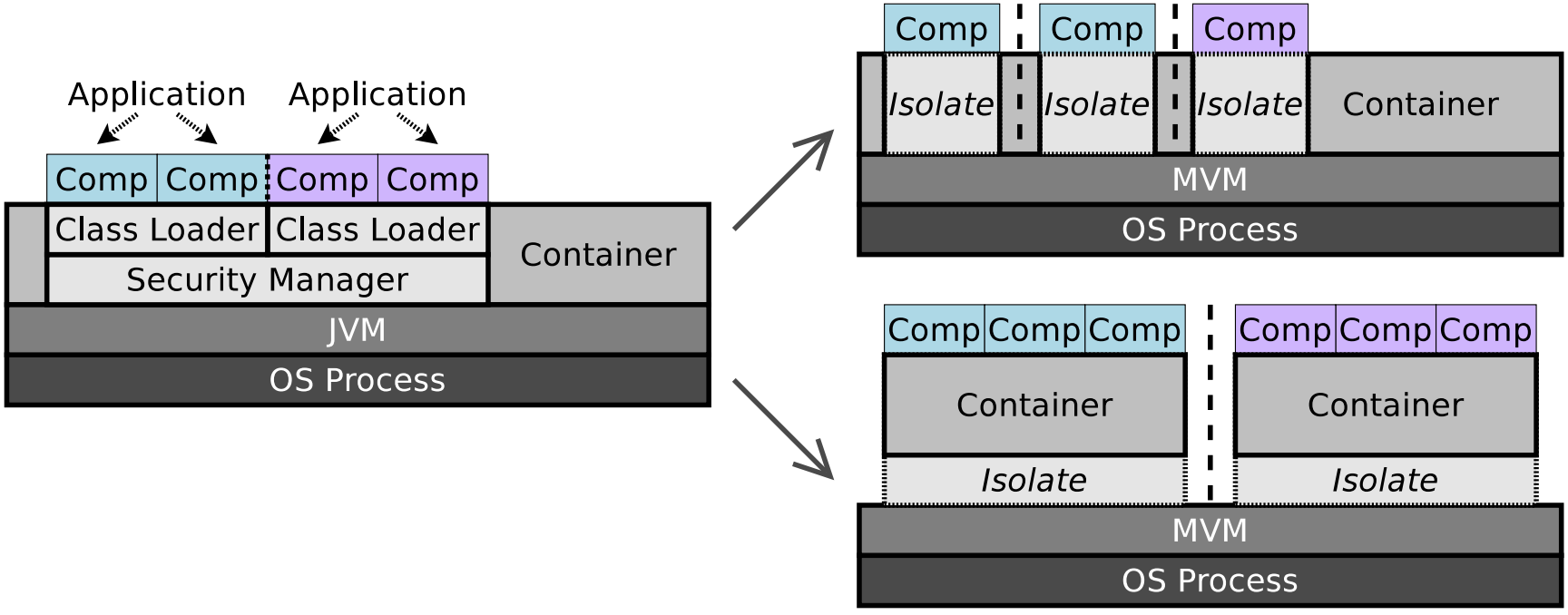

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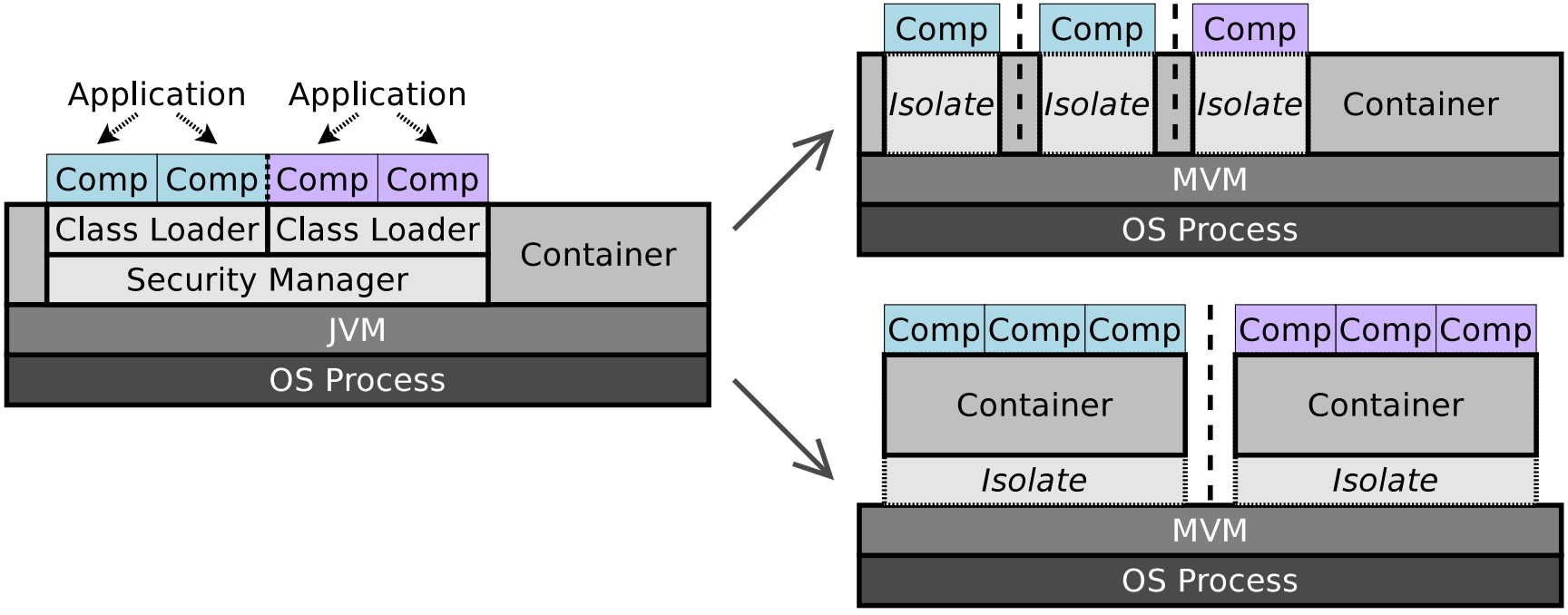

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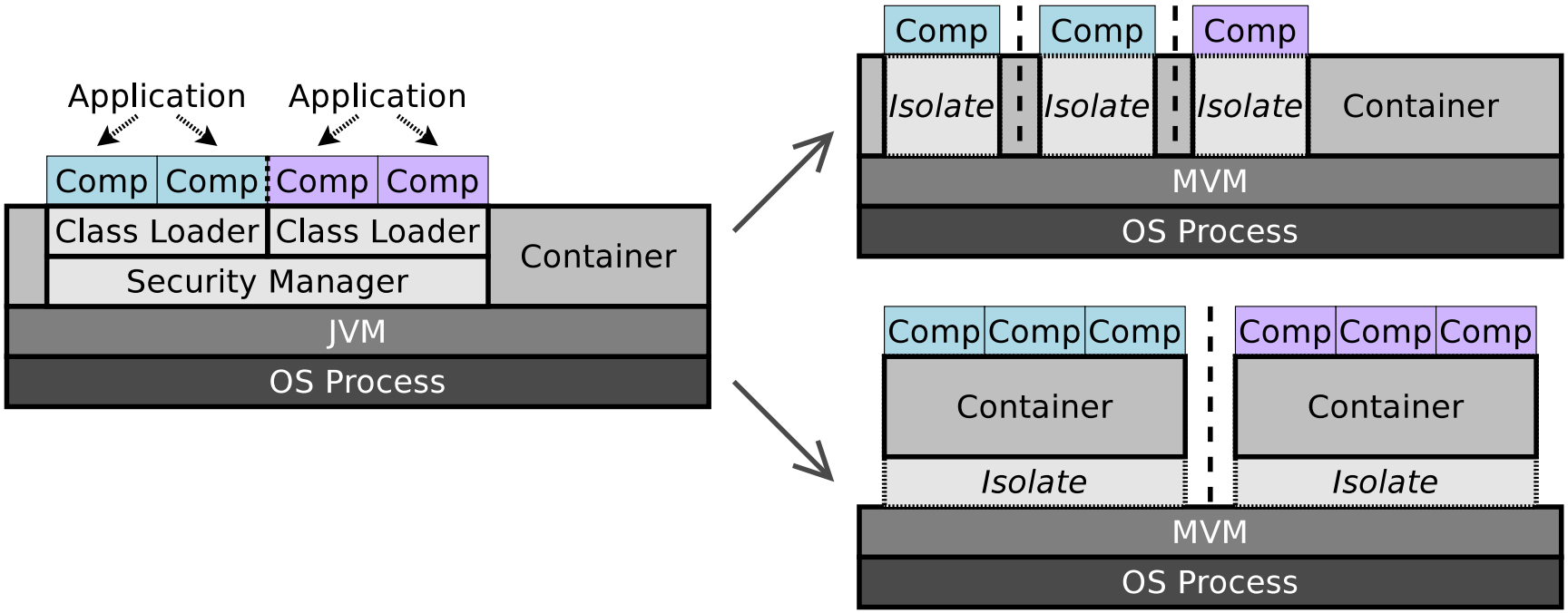

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  - MVM itself (all isolates in one single JVM)
  - New version of MVM "*ready*" from Sun/Oracle, but...

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- Jnode? JX?
  - They provide isolation too!
  - But they are Java-based OSs, not only modified JVMs. Hard to think about them as PaaS environments

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- I-JVM accounts resources used per bundle
  - CPU, mem, threads, connections., bytes r/w

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- In I-JVM, isolates are stopped by `StoppedIsolateException`
  - It cannot be caught inside the isolate, i.e. it cannot be ignored
  - But threads can traverse isolates, so synchronized entities outside the isolate can be left in an inconsistent state

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- Servlets
  - Apart from support for authentication and SSL, there is little about security enforcement
- Solution proposed:
  - MVM has been applied to isolate J2EE apps
  - Each J2EE app (along its servers) are deployed on a set of isolates

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  - Remaining 8 must be addressed at JVM level (all related to isolation, res accounting and thread termination)
- Solutions proposed:
  - I-JVM specifically aimed to solve OSGi security issues
  - OSGi + Isolation API on top of MVM

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  - Possible through *Application Domains* (AD)
  - ADs are isolated:
    - Not possible to call code of some AD from another
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- Comparatively, little research about multitenancy in .NET

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Virtual Platforms Summary

Security Feature	JVM	CLR	MVM	I-JVM	KaffeOS
Access control mechanisms	Based on Permissions and Policies	Based on Permissions and Policies	Similar to JVM	Similar to JVM	Similar to JVM
Reference leak	Not fixed	Fixed with ADs	Fixed with Isolations	Fixed with Isolations	Fixed with Processes
Shared static references	Not fixed	Fixed with ADs	Fixed with Isolations	Fixed with Isolations	Fixed with Processes
Block by synchronized static components	Not fixed	Fixed with ADs	Fixed with Isolations	Fixed with Isolations	Fixed with Processes
Thread termination	Not fixed	Not fixed	Fixed with Isolations	Not Fixed	Fixed with Processes
Resource accounting	Profiling by JVMTI. Res acc specified by JSR 284	Profiling mechanism	Generic resource manage-ment API	CPU, mem, #threads, #net conns, I/O	CPU and memory

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- To have in mind:
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  - Resource accounting
  - Thread termination
- There is not any container system that solves all issues

This was all...

Thank you!

Questions, comments?