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# JavaOne<sup>SM</sup>

## Optimizing Java<sup>TM</sup> ME Platform for Blu-ray Players and Interactive DTVs/STBs

Todo:

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# Goals of This Talk

- > Understand Java ME CDC Platform
- > Learn about essential features of high performance Java ME CDC Platform

# Agenda

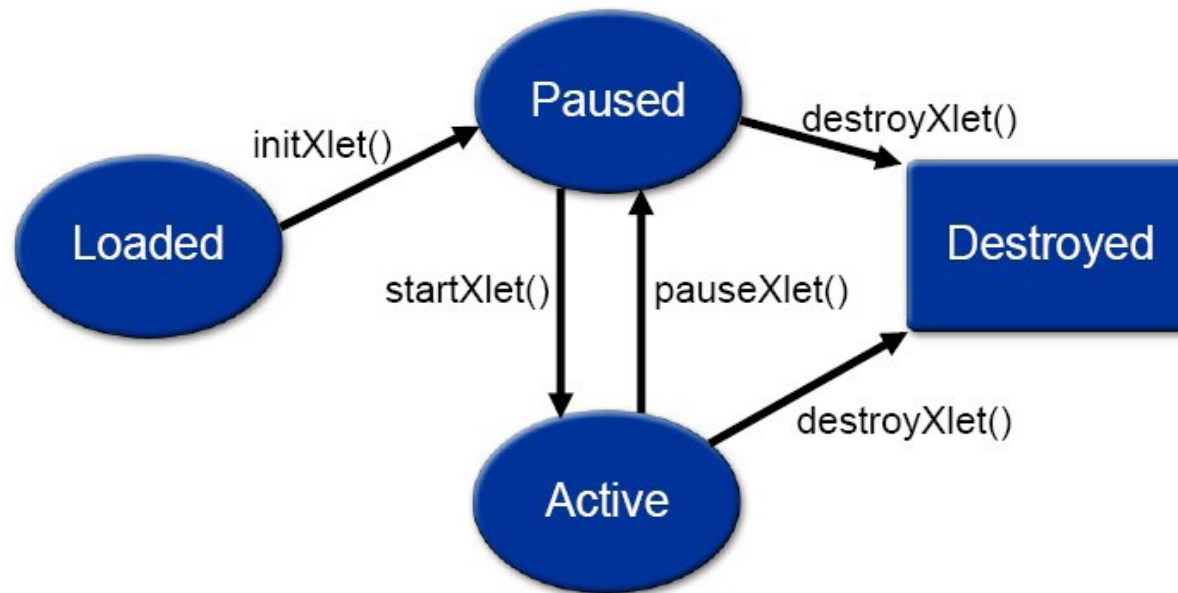
- > Summary of Java ME CDC Runtime
- > Xlet Application for OCAP/MHP/BD-J
- > Running Multiple Xlets on CDC Platform
- > Optimization Techniques
- > Thread-based Multitasking VM
- > Resource Management Framework (JSR-278)
- > Summary
- > Q&A

# Summary of Java ME CDC Runtime

- > Supporting JSRs
  - Connected Device Configuration 1.1 (JSR 219)
  - Foundation Profile 1.1 (JSR 218)
  - Personal Basis Profile 1.1 (JSR 217)
- > Strict subset of Java SE 1.4.2 API
- > Mobile phones with CDC are available in market
- > What can be running on top of CDC Platform?
  - BD-J Middleware
  - OCAP/MHP/ACAP Middleware
  - MSA (MIDP 3.0 supports both CDC and CLDC)

# Xlet Application for OCAP/MHP/BD-J

## > Xlet Lifecycle



# Xlet Application for OCAP/MHP/BD-J

## > Xlet Interface

```
public interface Xlet {  
    public void initXlet(XletContext ctx)  
        throws XletStateChangeException;  
  
    public void startXlet()  
        throws XletStateChangeException;  
  
    public void pauseXlet();  
  
    public void destroyXlet(boolean unconditional)  
        throws XletStateChangeException;  
}
```

## BD-J (Blu-ray Disc Java)?

- > The Java specification for Blu-ray Disc is called BD-J
- > Fully programmable platform for highly interactive movie titles
- > Java platform was chosen to be used as the platform for advanced interactive application specification
- > BD-J includes the HAVi UI device model and widget set along with Personal Basis Profile

# OCAP/MHP

- > OCAP and MHP in general
  - Java™ technology-based middleware platform for Digital TV & STB
- > OCAP
  - Allows Java technology-based applications to be delivered with television content
  - Allows cable operators to distribute applications nationwide, to diverse platforms
- > MHP
  - Another middleware platform but not limited to cable operators (Satellite, terrestrial)



# How to measure Java ME CDC performance?

- > JVM Performance: EEMBC, SPECjvm98
- > Good EEMBC and SPECjvm98 score don't necessarily guarantee good GUI application performance
  - Java Graphics API performance is more directly related to the overall performance of GUI application
- > Several proprietary graphic performance benchmarks available
  - Not easy to find commonly used benchmark for GUI Application

# Optimization Techniques 1

- > Profile first: Must profile your platform accurately
  - You must understand which Java methods and native functions are taking time
  - TIP: Profile Java and native methods simultaneously
- > Must utilize every HW accelerated rendering provided in your device
  - SW rendering is terribly slow
- > Don't underestimate system calls
  - Avoid system calls as much as possible

## Optimization Techniques 2

- > Consider native implementation over Java
  - e.g. PNG/JPEG decoders
- > Use pooling mechanism if frequent creation and termination are expected
- > Cache font information smartly
  - Consider Java level font information caching
- > Carefully check every line of image/text/rectangle drawing Java methods and native functions because they are called tremendously often

# Running Multiple Xlets on CDC Platform

- > BD-J and OCAP specification allow multiple Xlets running concurrently
- > Frequent invocation of start and destroy Xlets from AMS
- > Require multitasking feature to improve reliability and performance
- > In addition, to avoid slow-down by starvation of resource, resource management framework is necessary

# Thread-based Multitasking Engine

- > Xlet applications are isolated logically
- > All Xlets are running within single JVM instance

Todo:

Picture will be added

# Resource Management Framework

- > API specification is available in [jcp.org](http://jcp.org) (JSR-278)

Todo:

Picture will be added

# Summary

- > Java ME CDC is being used in
  - Blu-ray Disc Player
  - OCAP DTV/STB
  - MHP DTV/STB
  - Smart phones
- > Profiling your platform for both Java and native layers are first and foremost step to improve performance
  - Based on profiling result, consider applying listed techniques

## Q&A





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# Thank You

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