



J-Fall

12 november 2008 Spant!



# Java op het witte doek?

## *Java-applicaties voor Blu-ray*

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**TASK**<sup>24</sup>

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jug



## Java op het witte doek?





## About me...



- Personal:
  - 38 years old, married, 2 children, Sittard
- Background:
  - Hs Zuyd, Technical Information Systems
- Employed:
  - 1997 – ...: Bergson / Ordina TA / TASK24
  - 2005 – ...: Philips Applied Technologies
    - Design/Create/Deploy BD Test Tools
    - Middleware Interoperability & Conformance
    - Standardization: Philips BD team



## Agenda

- **Introduction to Blu-ray Disc**
- **Blu-ray Disc Java (BD-J) Overview**
- **BD-J in more detail**
- **So I wanna create a cool BD-J application...**
- **Conclusion**
- **Q & A**



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## Introduction to Blu-ray

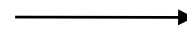
- Next revolution in optical storage solutions for consumer electronics / PC products / game consoles (PS3)

- Incredible audio/video quality:

Blu-ray Disc: 1920 x 1080

DVD: 720 x 480

Analog broadcast TV: 352 x 240



- Huge capacity

- 25GB (single layer) / 50GB (double layer)

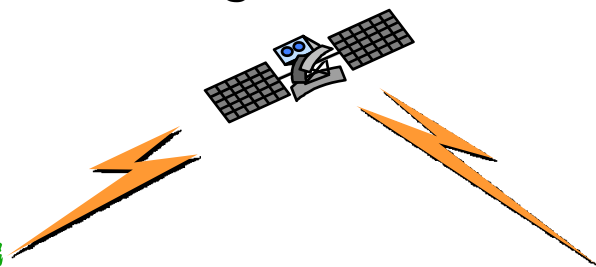
- Future capability to store 200GB (multi-layer)

**Advanced Java technology-based interactivity**



# Introduction to Blu-ray

HD Digital Broadcast



Broadband Services



Studios / Broadcasters

BD-ROM



HD Packaged Distribution

BD-R



HD Broadcast Recording

BD-RE





## Blu-ray Disc Association

- Standardization of Blu-ray Disc
- Founded by Sony, Panasonic & Philips



The current 18 board members (as of January 2008) are:

[Apple Inc.](#)

[Dell Inc.](#)

[Hewlett-Packard Company](#)

[Hitachi, Ltd.](#)

[LG Electronics](#)

[Mitsubishi Electric](#)

[Panasonic \(Matsushita Electric\)](#)

[Pioneer Corporation](#)

[Royal Philips Electronics](#)

[Samsung Electronics](#)

[Sharp Corporation](#)

[Sony Corporation](#)

[Sun Microsystems](#)

[TDK Corporation](#)

[Thomson SA](#)

[Twentieth Century Fox](#)

[Walt Disney Motion Pictures Group / Walt](#)

[Disney Studios Home Entertainment](#)

[Warner Bros. Entertainment, Inc.](#)



## Blu-ray Disc Formats

- BD-ROM
- BD-R
- BD-RE
- DVD-ROM



## BD-ROM and BD-Live

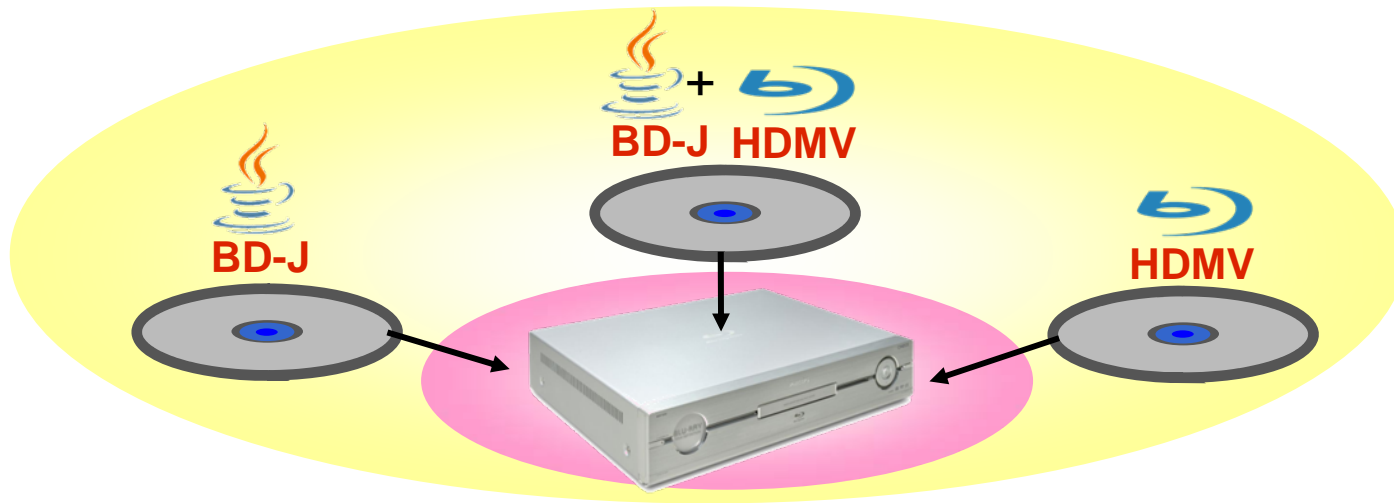
### Two Profiles for BD-ROM Players:

- Profile 1: BD-VIDEO – without network connectivity
- Profile 2: BD-LIVE – with network connectivity
  - **Additional applications for network connectivity include:**
    - **Downloading Games**
    - **Downloading Subtitles or Audio streams**
    - **Downloading Trailers**



## BD-ROM: HDMV and BD-J

- Two “modes”:
  - Movie mode (like DVD): HDMV
  - Java platform: BD-J





# Application Layer Structure

## Index Table

TopMenu

Title #1 (HDMV)

Title #2 (BD-J)

...

## BD-ROM Resident System Software

Module Manager

Key Event Handler

Navigator

## Movie Module

Movie Object

## BD-J Module

BD-J Object

Application Manager

## AMT for Title #2

Xlet #1

Xlet #2 (autostart)

Xlet #3

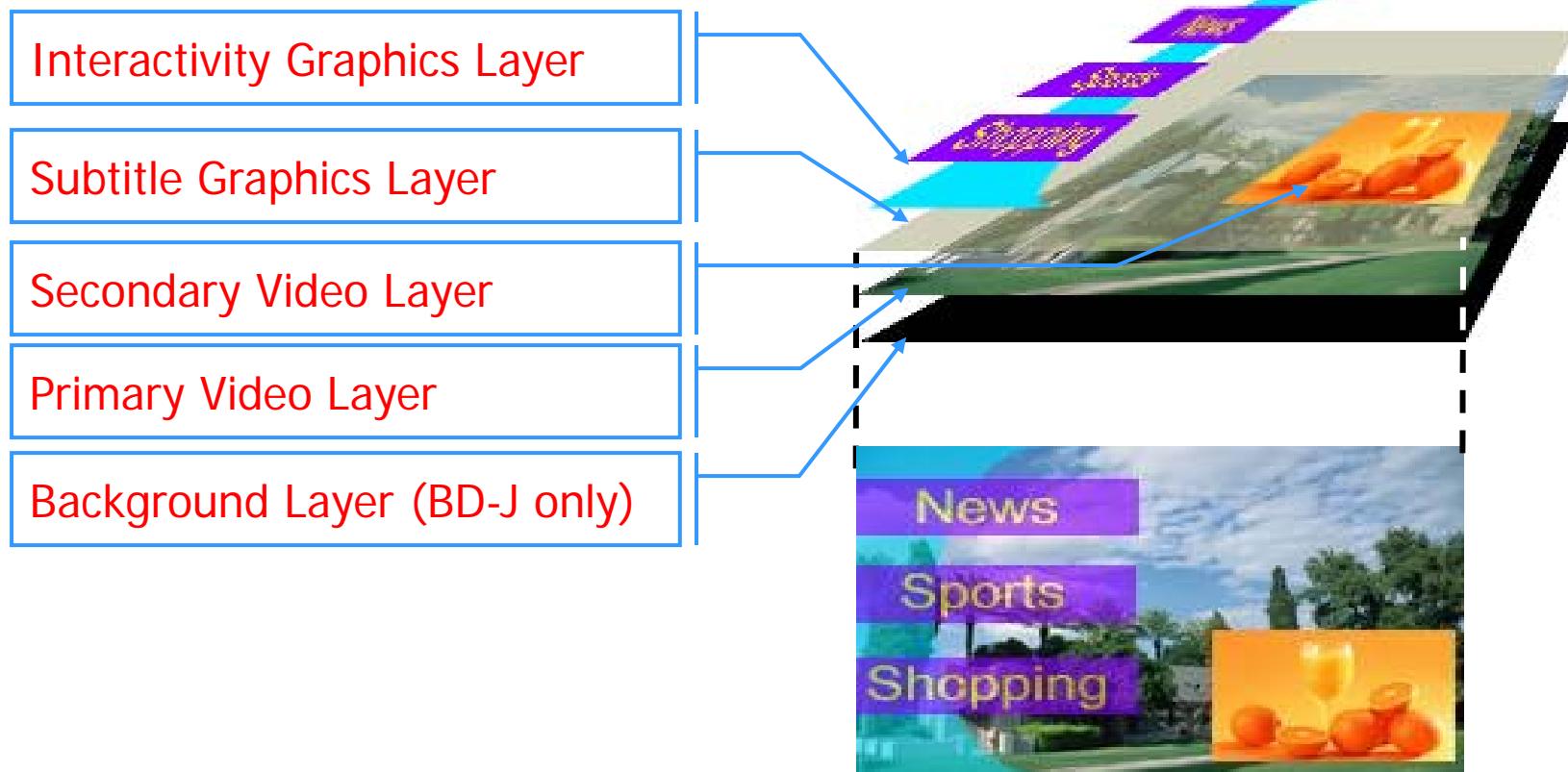
JAR file  
for Title  
#2

BD-ROM Resources  
Playback Control Engine

Player Registers



## Plane model





## Picture-in-Picture (PiP)

PiP enabling new application images such as “video” director’s commentary and bonus video preview

- provides the ability to present **two video streams simultaneously**



← PiP Video

- Both HDMV and BD-J can control PiP
- MPEG-4 AVC / VC-1 / MPEG-2 can all be used for PiP video



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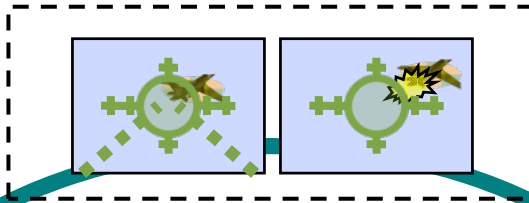


# Blu-ray Disc Java (BD-J)

Advanced Menus



Games



Broadband Services



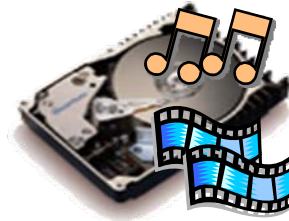
Network Connectivity



Media Playback Control



Local Storage





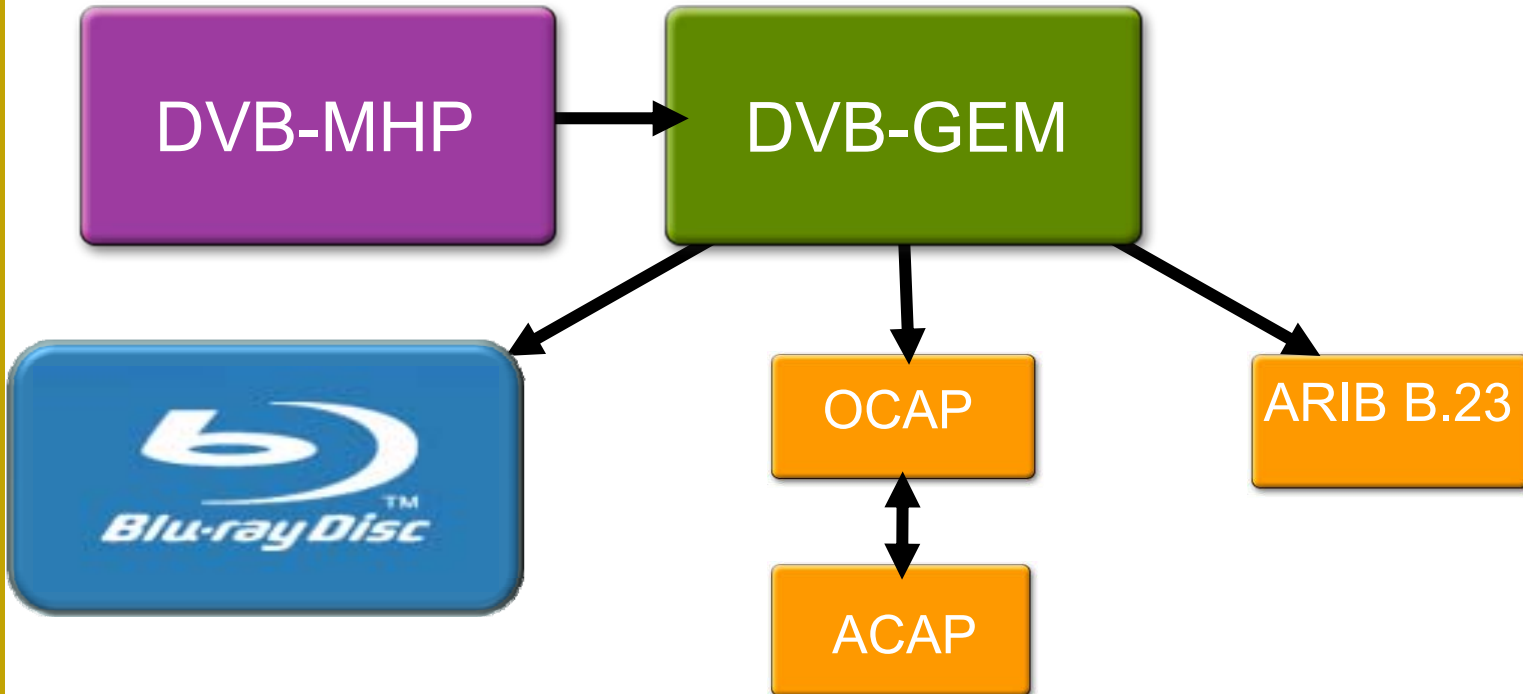
## BD-J and GEM

- The DVB-GEM specification is the global “common core” of interactive television
  - Multimedia Home Platform (MHP)
    - Cable, Satellite and Terrestrial in Europe, parts of Asia, Australia
  - OpenCable Application Platform (OCAP)
    - US Cable
  - ATSC ACAP and ARIB B.23
    - Terrestrial in US and Japan
  - China and Brazil national DTV standards (in progress)
- BD-J is based on DVB-GEM
  - GEM “packaged media target”
    - Eliminates broadcast-specific features, like electronic program guide support
    - Internet connectivity is still optional



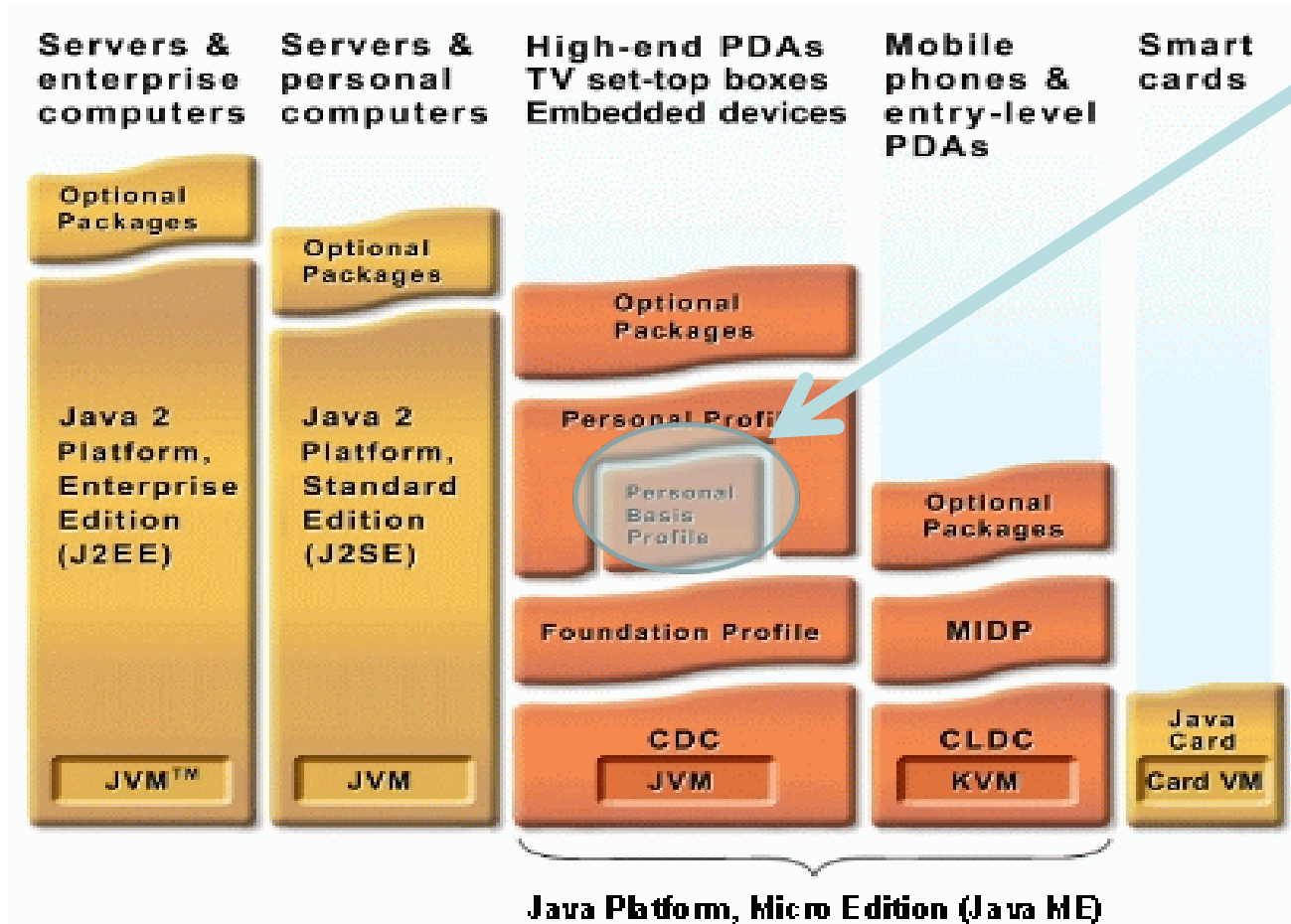


# MHP, GEM and BD-J





# Java ME PBP profile





## BD-J “limitations”

- GUI Toolkit is different
  - No Swing
  - HAVi is included through GEM
- Not all “newer” SE APIs are available
  - Can be compared with J2SE 1.3
  - E.g. no java.nio
- Typically “resource constrained” implies that the (available) resources are defining many boundaries to be aware of



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## BD-J in more detail

- The specification of the “Audio Visual Specification” for BD-ROM
  - In total >1100 pages
  - BD-J >400 pages
  - GEM ~100 pages, MHP ~800 pages
- So many, many aspects have been specified in detail



## BD-J in more detail

- Some “highlights” will be discussed
  - Xlets and Xlet lifecycle
  - JMF Player
  - Devices and resolutions
  - Frame Accurate Animations
  - Storage and Virtual File System
  - Security Aspects



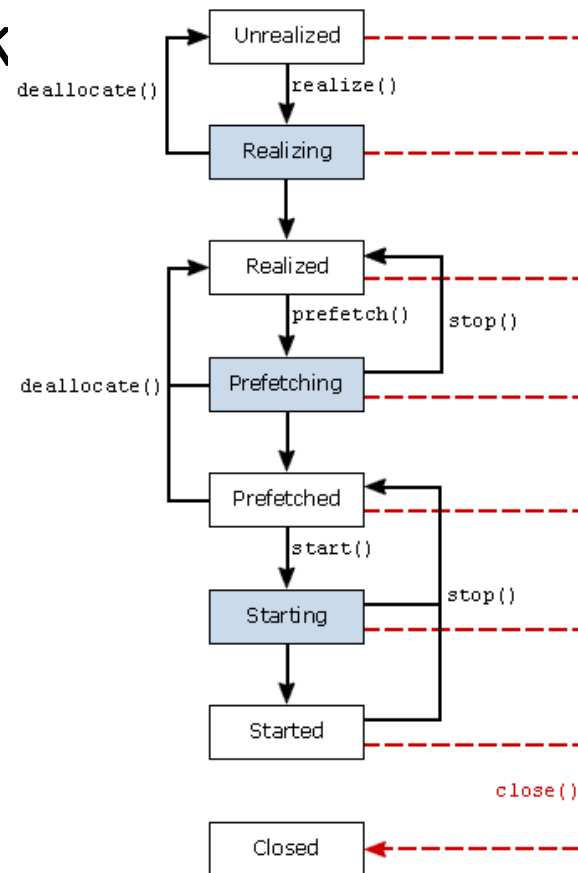
## Xlets and Xlet lifecycle

- Xlets are “applications” within BD-J
  - Like MIDlets and Applets
- Lifecycle from javax.tv.Xlet
  - initXlet
  - startXlet
  - (pauseXlet)
  - destroyXlet



# JMF Player

- Java Media Framework
- State based
- 'Easy' access to media





## Xlet & Player examples (1/4)

```
public void startXlet() throws XletStateChangeException {  
    Thread t;  
    try {  
        getServiceContext().addListener(this);  
        t = new Thread(this);  
        t.start();  
    } catch (Throwable t) {  
        throw new XletStateChangeException(t.toString());  
    }  
}
```



## Xlet & Player examples (2/4)

```
public void run() {  
    try {  
        getPlayer().addControllerListener(this);  
        getPlayer().start();  
    } catch(Throwable t) {  
        destroy();  
    }  
}
```



## Xlet & Player examples (3/4)

```
private javax.media.Player player;
private Player getPlayer() throws NoPlayerException, IOException,
    SecurityException, ServiceContextException {
    if (player == null) {
        Locator l = getPlayList().getLocator();
        MediaLocator ml = new MediaLocator((org.davic.net.Locator) l);
        player = Manager.createPlayer(ml);
    }
    return player;
}
```



## Xlet & Player examples (4/4)

```
public void destroyXlet(boolean unconditional) {  
    if (player != null) {  
        player.removeControllerListener(this);  
        player.stop();  
        player.close();  
    }  
    try {  
        getServiceContext().removeListener(this);  
    } catch(Throwable t) { }  
}
```



## Devices and Resolutions

- Several “Devices” (planes) like:
  - Background
  - Video
  - Graphics
- Each device may have its own ‘resolution’ set
  - Several rules for resolution handling
  - Preserving can be done as well
- Device & configuration & resolution requires some time to understand...



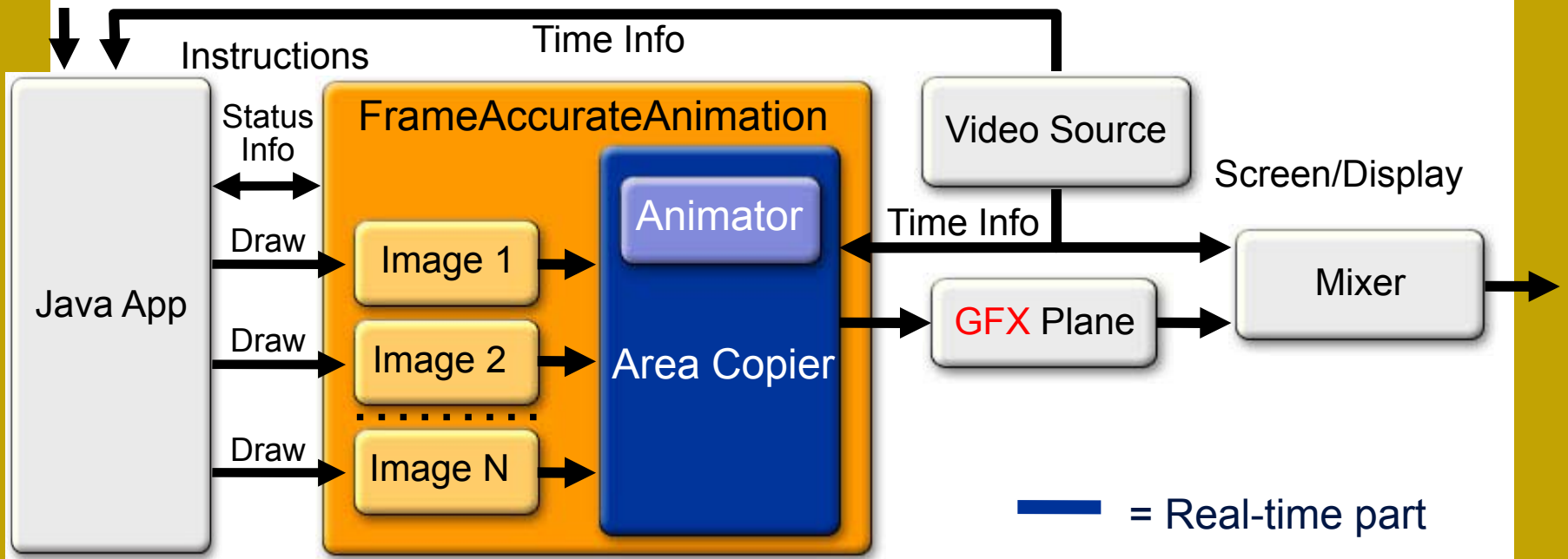
## Devices & Resolutions example

```
HScreen screen = HScreen.getDefaultHScreen();
HVideoDevice videoDevice = screen.getDefaultHVideoDevice();
HVideoConfiguration oldVConfig = videoDevice.getCurrentConfiguration();
HVideoConfigTemplate template = oldVConfig.getConfigTemplate();
template.setPreference(BDVideoConfigTemplate.KEEP_RESOLUTION,
    new Object(), BDVideoConfigTemplate.REQUIRED);
template.setPreference(HVideoConfigTemplate.PIXEL_RESOLUTION,
    new Dimension(1920, 1080), HVideoConfigTemplate.REQUIRED);
HVideoConfiguration newVConfig = videoDevice.getBestConfiguration(template);
videoDevice.reserveDevice(this);
if (newVConfig != null) {    try {
    videoDevice.setVideoConfiguration(newVConfig); } ... } ...
```



# Frame Accurate Animation

- AWT Component with sequence of images and start-time displays a new image each frame





## Sync Frame Accurate Animation

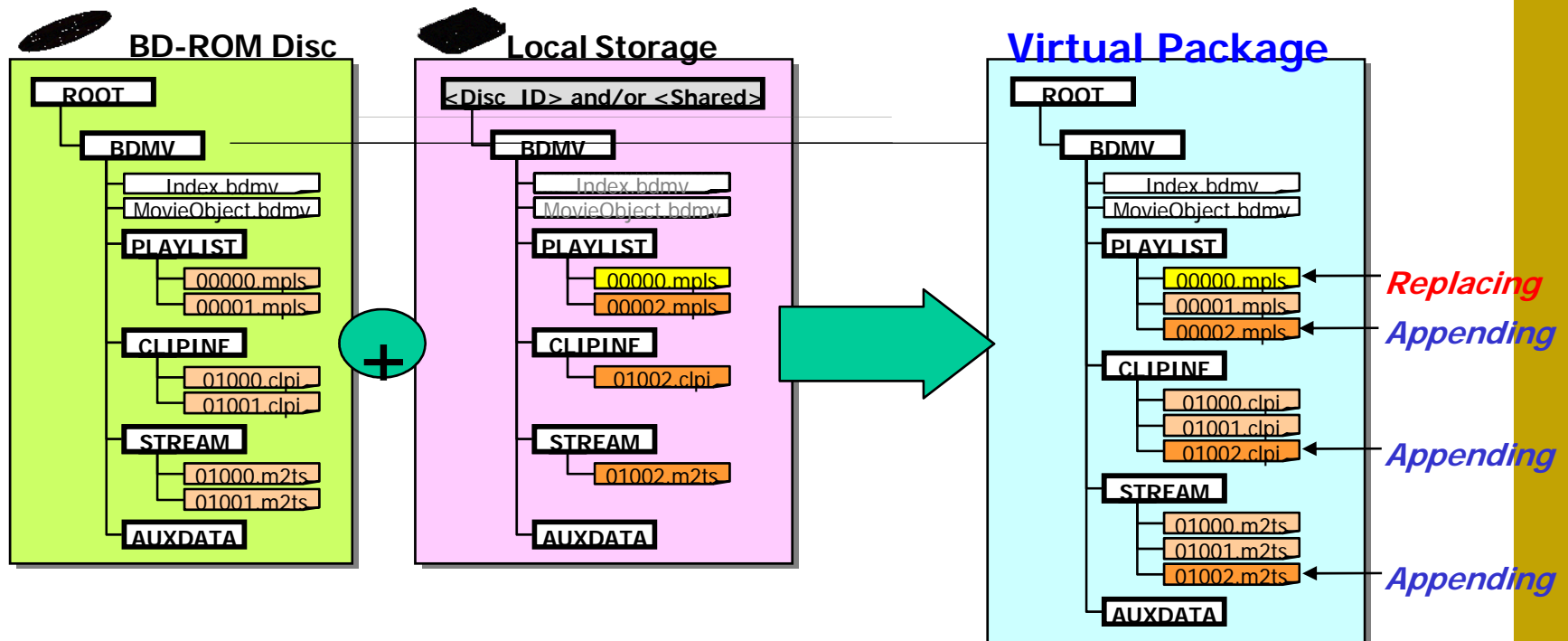
```
private org.bluray.SyncFrameAccurateAnimation faa;  
void animationLoop() {  
    int frame = 0;  
    for (;;) {  
        Graphics g = faa.startDrawing(frame); // can block  
        // ... draw the contents of the frame, using g;  
        faa.finishDrawing(frame++);  
    }  
}
```



# Storage & Virtual File System

Local Storage provides persistent storage for updating **Titles/Discs**

- “Virtual Package” used to provide update during playback
- Organizes downloaded A/V material





## VFS example

```
String buda = System.getProperty("bluray.bindingunit.root");
String dddir = buda + "/" + orgid + "/" + discid;
// ... typically do some downloading here and prepare VP
VFSManager manager = VFSManager.getInstance();
try {
    manager.requestUpdating(dddire + "/sample.bumf",
        dddire + "/sample.busf", true);
} catch (PreparingFailedException e) {
    System.out.println("Updating the Virtual Package failed");
}
changeTitle(); //implementation not discussed here
```



## Security aspects

- BD-J uses the Java platform security model
  - Signed applications can get more permissions
- Signing is based on JAR file signing
  - Linked with BD copy protection scheme
- Permissions are required for
  - Read/Write access to local storage
  - Using the network connection
  - Title selection of other titles on the BD-ROM disc
  - Control of other running BD-J applications

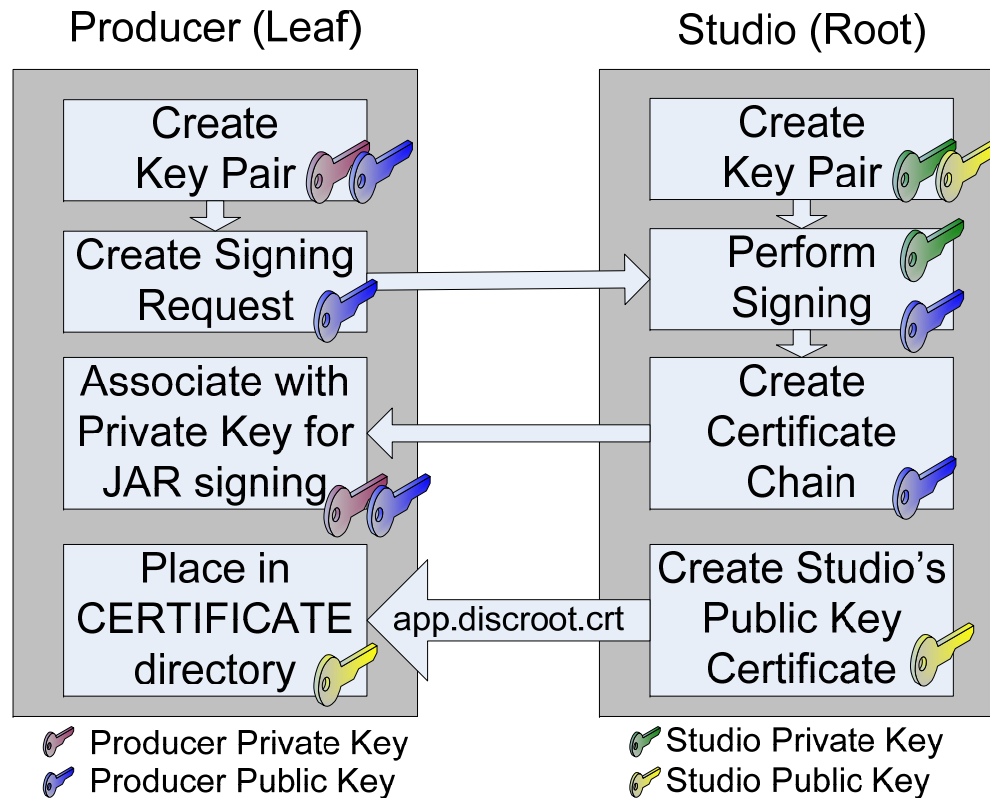


## Security aspects

- JAR signing requires a BD specific signer
- Secured by Public Key Infrastructure (PKI):
  - Private key to be kept private
  - Public key stored on disc (certificate)
- Note that the content protection systems like AACCS and BD+ are not discussed here.



# Certificate structure





## Obtaining permissions

- To extend default limited access for Xlets:
  - Make sure that an Xlet is signed
    - Requires the application id to be in a specific range
  - Use a permission request file
    - Allows extending rights to resources
    - Xml document



## VFS example

bluray.VFSExample.perm

```
<?xml version="1.0"?>
```

```
<n:permissionrequestfile xmlns:n="urn:BDA:bdmv;PRF"
```

```
    orgid="0x56789abc"
```

```
    appid="0x4010">
```

```
    <bd-bindingunitarea value="true"></bd-bindingunitarea>
```

```
    <bd-vfs value="true"></bd-vfs>
```

```
</n:permissionrequestfile>
```



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## Public available data

- To receive the specification a license to the format is required
  - For individuals rather expensive
- BD-J Javadocs can be retrieved from the BDA
  - Requires a request to the BDA
  - Requires signing some legal papers
- Unified BD-J, GEM and PBPJavadoc can be “easily” composed
  - See *More information...* for a website how to do this.



## Tooling

- A lot of tooling is required to “develop”
  - An HD compliant screen
  - A BD player (in several tastes available)
  - Tooling to create the disc structure
  - Tooling to sign your jars, create certificates etc.
- Note that BD-ROM and BD-R(E) do not differ that much and many players are able to play both!



## Support

- Book: HD Cookbook (Zink/Starner/Foote)
  - Very useful with many examples
  - Useless HD-DVD part for free
- Several companies can provide “support” with tools, knowledge and consultancy:
  - Philips Applied Technologies
  - Sun Microsystems



## And much more background info

- Watch or read the JavaOne presentations held in the past, like
  - TS-1685 “Java Technology goes to the movies” (2006)
  - TS-6464 “Blu-ray Disc Security” (2008)
  - TS-5449 “Creating your own Blu-ray Java Discs” (2008)



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## Conclusion

- You can...
  - Develop your own cool BD-J application
    - Despite the “hurdles” to overcome
    - MHP+OCAP (GEM) allow a ‘broader’ platform

**Blu-ray (BD-J) is a standard interactive multimedia platform for the living room**

***And it is based on Java!***



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## More information...

- Specifications
  - <http://www.blu-raydisc.com>
  - <http://www.dvb.org>
  - <http://www.mhp.org>
  - <http://www.etsi.org>
  - <http://www.interactivetvweb.org>
- JavaDocs
  - <http://java.sun.com/javame/reference/bluray-technote.html>
  - [http://www.blu-raydisc.info/license\\_app.php](http://www.blu-raydisc.info/license_app.php)
- Development
  - <http://java.sun.com/javame/downloads/sdk30ea.jsp>



## Acknowledgements...

- Erik Moll (Philips Applied Technologies)
- Joe Rice (MX productions)
- Nancy Zentner (Sonic Solutions)
- Michael Lagally (Sun Microsystems)



## Contact...

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- Trademarks
  - Java™ is a registered trademark by Sun Microsystems
  - Blu-ray Disc™ and BD-Live™ are registered trademarks by the Blu-ray Disc Association
- Copyright
  - Most examples are snippets derived from examples published by the Blu-ray Disc Association



Questions?





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