Java™ Technology Goes to the Movies: Java Technology in Next-Generation Optical Disc Formats

Bill Sheppard

Sr Industry Mktg Manager, DTV
Sun Microsystems, Inc.
http://java.sun.com

Erik Moll

System Architect
Philips Applied Technologies
http://www.philips.com

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Understanding Java™ Technology in Blu-ray Disc

Learn about the dramatic capabilities Blu-ray Disc enables relative to today's DVD technology and understand the Java platform essentials upon which Blu-ray Disc Java (BD-J) is based

Agenda

What Is Blu-ray Disc?
BD-J Stack Overview
BD-J Technical Specifics
New Features of Blu-ray and BD-J
BD-J Authoring
Demo
Q&A

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What Is Blu-ray Disc?

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Blu-ray Disc—What Is It?

- 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

Blu-ray Disc Delivers More Capacity

Full HDTV 1920 x 1080 Resolution with Advanced Video Codec (12Mb/s Video)

For Films
- HD Feature (132 min)
- Audio (3 languages)
- HD Bonus (95 min.)

For Films
- HD Feature (3 Hours)
- Audio (3 Languages)
- HD Bonus (4.5 Hours)

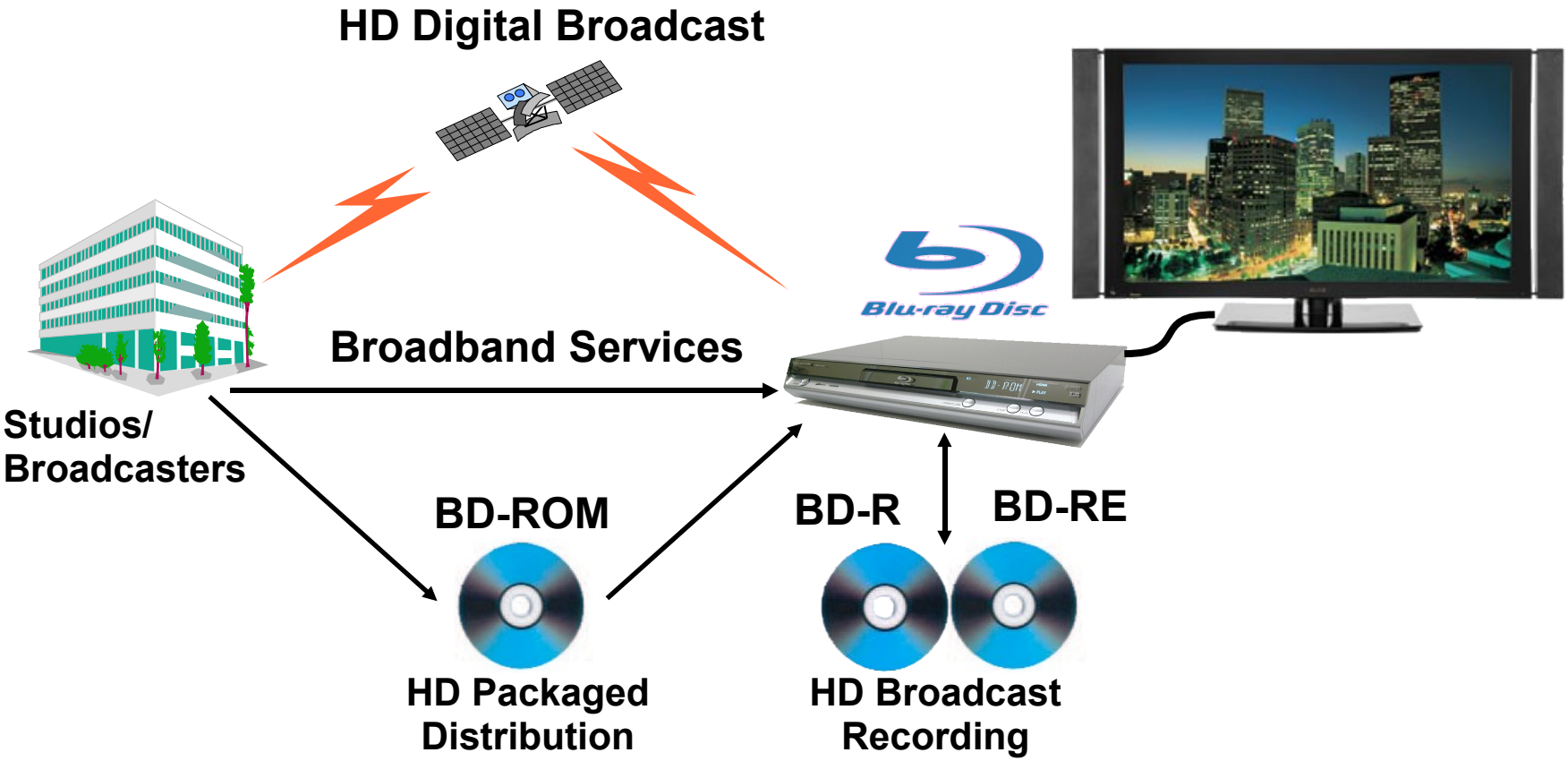
For TV Programs
- SD Features (11 Hours)
- Audio (3 Languages)

For TV Programs
- SD Feature (23 Hours)
- Audio (3 Languages)

Single Layer BD-ROM (25GB)

Dual Layer BD-ROM (50GB)

Blu-ray Disc: High-Definition Entertainment



Blu-ray will have both a pre-packaged format, for distribution of movies and other HDTV content, and a recordable format.

Attributes of Blu-ray Disc

Best Quality from Large Capacity and High Bitrate

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

40Mbps (4 times larger than DVD)

“No compromise” on image and audio quality

Broad Industry Support

Backed by most industry-leading CE and IT companies

Backed by majority of movie studios and music labels

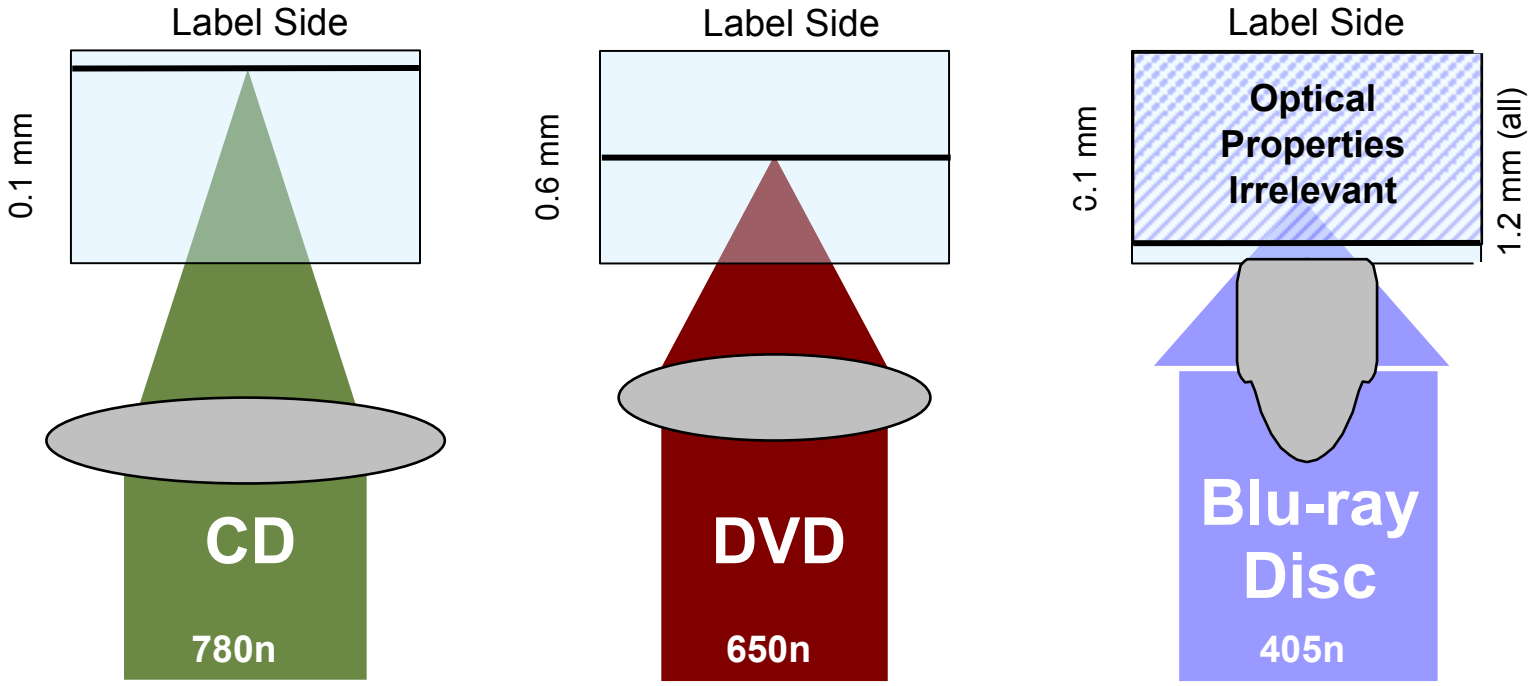
Durable Discs

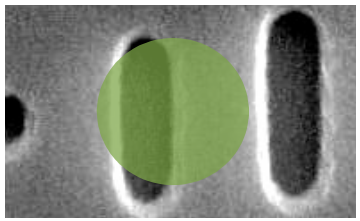
Hard Coat technology is resistant to scratches, fingerprints, marks, dust, etc.

More “family friendly” than DVD

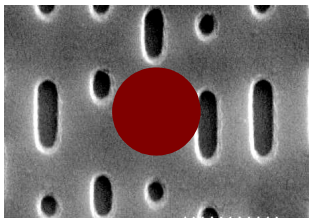
Damage Resistant Even to Steel Wool

Blue Lasers Enable Increased Capacity

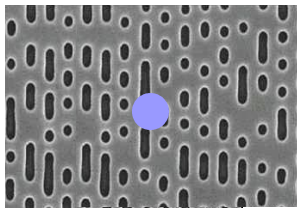




700 MB



4.7 GB



25 GB (5 x DVD)

Note: Single Layer Comparison

Key BD-ROM Features

Interactivity and Next-Generation A/V

Rich Interactivity

Graphics: High-Definition, true-color graphics with effects

Navigation: Highly flexible, supports wide variety of content

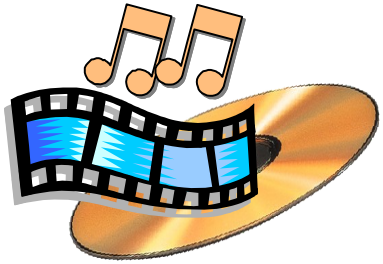
Connectivity: Supports many new use cases, i.e., content updates

Best Possible Quality Audio and Video

Video: High Def video up to 40Mbps, including 1920x1080@24p

Audio: Lossless multi-channel audio up to 24Mbps

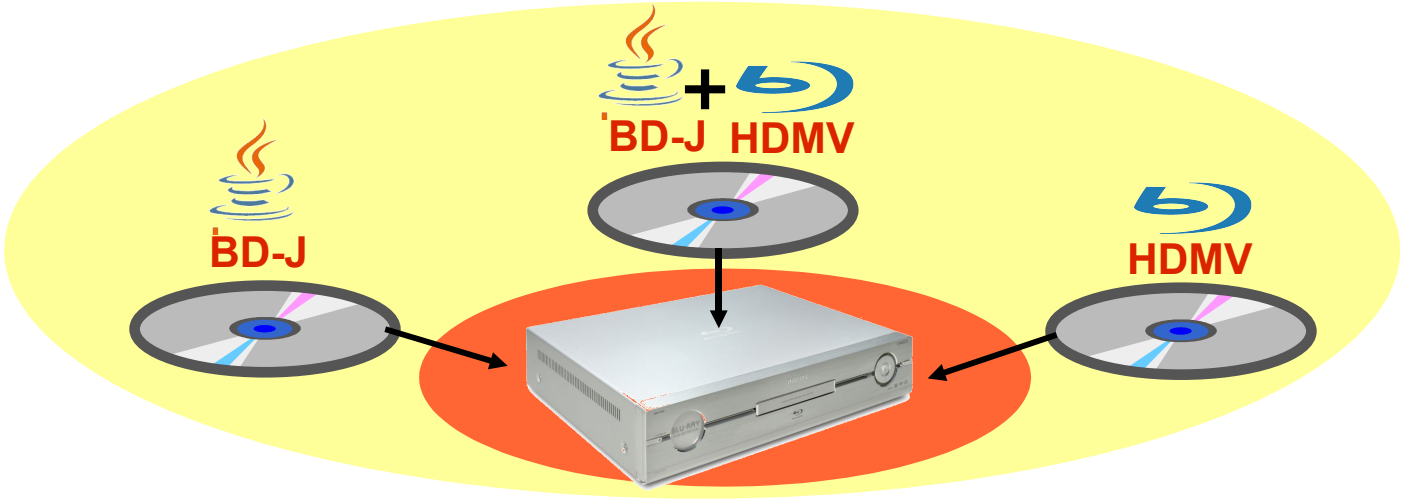
Subtitles: High Definition with true-color



Key BD-ROM Features

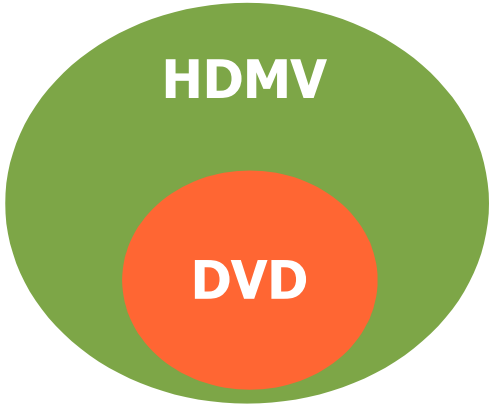
Interactivity: One Platform/Two Modes

- **High-Definition Movie (HDMV)—**created from the ground-up to improve on DVD, while maintaining production continuity with DVD
- **Blu-ray Disc Java (BD-J)—**a fully programmable platform with network connectivity thereby enabling new types of interactivity



Overview of HDMV

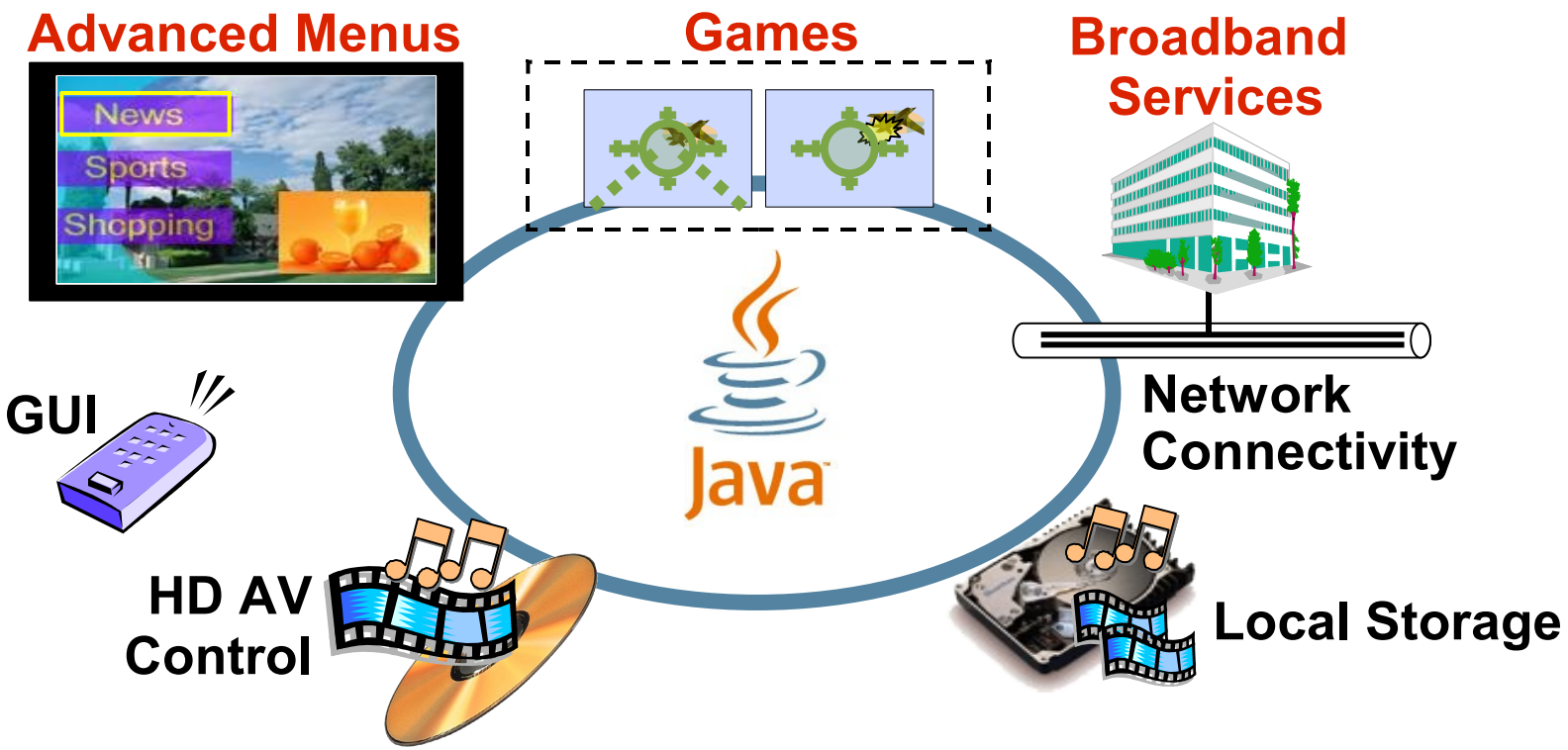
Supports all DVD Features Including Multi-angle, Multi Story, etc.



- Key additional features offered by HDMV
  - Improved menu and subtitle image quality
    - High Definition with full color (8-bit palette) and transparency
  - Improved menu features
    - “Pop-up”: seamless menus that don’t interrupt movie playback
    - “Effects”: full color animated transitions and animated buttons
  - Support for new Applications
    - “Picture-in-Picture”: composite two independent video streams
    - “Audio mixing”: mix two independent audio streams together

Overview of Blu-ray Disc Java (BD-J)

- Fully programmable platform for highly interactive, updateable titles
- Supports all HDMV features



Why Does Interactivity Matter?

- Consumers and Studios want:
  - Richer interaction
    - Viewers enticed by a richer interactive experience far beyond the limited menus of DVD-Video
  - Special features
    - Studios want to include many special features and games to clearly distinguish titles
    - Studios want to update the viewing experience with fresh content produced after the disc is sold
  - New business models
    - Blu-ray will enable new revenue streams through innovative content and services

Why Java Technology for Blu-ray Disc?

- The Blu-ray Disc Association (BDA) selected Java technology to be used as the platform for their advanced interactive application specification
- Java technology was selected because:
  - Java technology has proven to be a technically sound solution in the mobile domain and in interactive television (MHP/OCAP)
  - Java technology has proven cross-platform technology support in embedded devices
  - Java technology provides an open-ended platform for content development with secure network support
- The Java specification for Blu-ray Disc is called BD-J

New Capabilities Enabled by BD-J

- Far richer consumer experience
  - Freedom of UI design
  - Studio-skinned A/V playback control
- Dynamic content updates via broadband
  - Download of new trailers
  - Additional subtitle options
  - Add-on bonus materials
- New forms of added content
  - Playing games from disc and on-line
  - Live events
  - On-line shopping

Limitations of Legacy DVD Content

- No support for menus over video
- Programming limited to 32 registers
  - 32 bits/register
- Very weak performance guarantees
  - For example, skipping to a screen can take 100ms to 3s, depending on player
- Inflexible format
- Limited to standard definition
- No Internet connectivity

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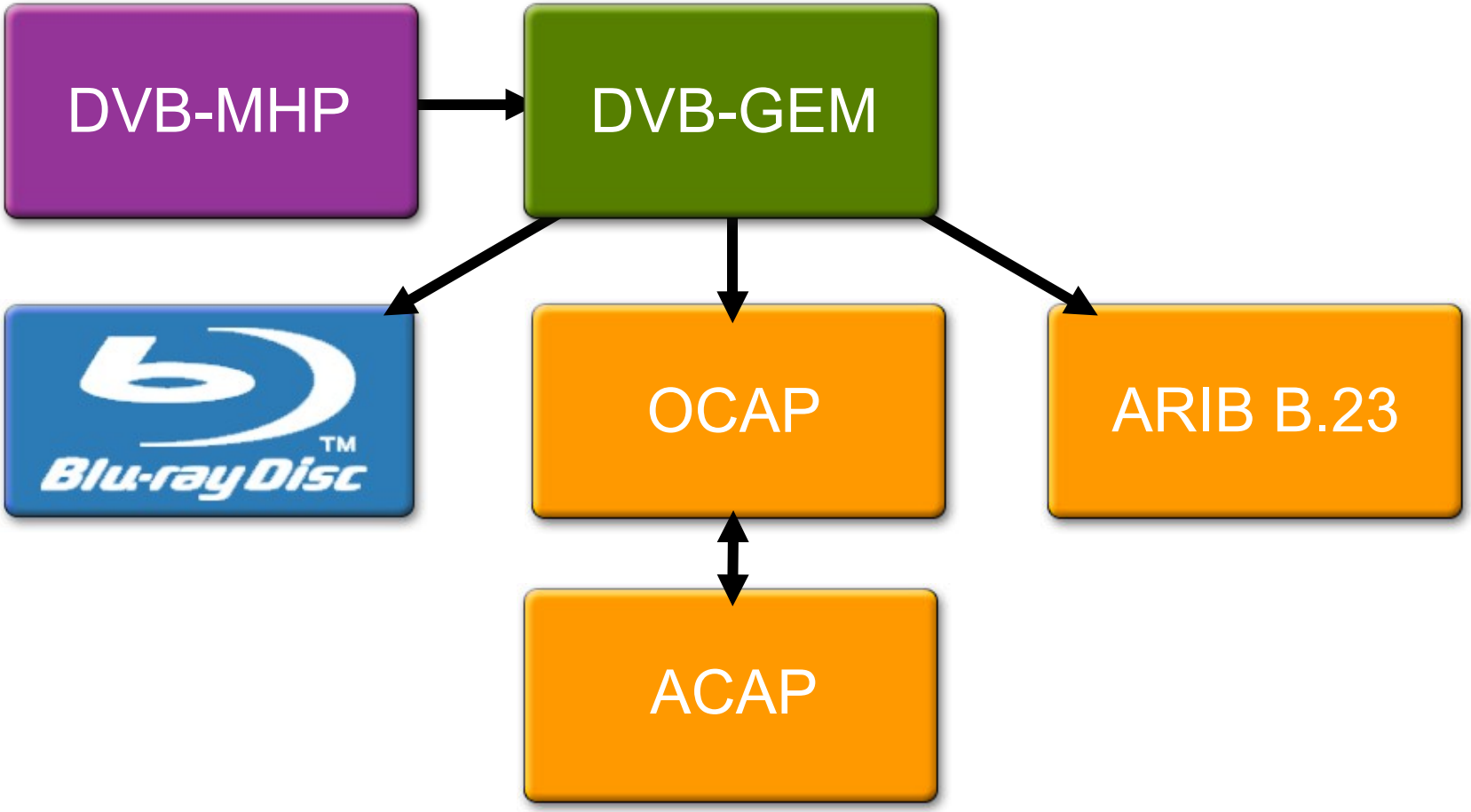
BD-J's Basis—DVB-GEM

- 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 adds a new "packaged media target"
    - Eliminates broadcast-specific features, like electronic program guide support
    - Internet connectivity is still optional

Relationship of Digital TV Standards



GEM Java Technology Stack Components

- For all devices:
  - Connected Device Configuration (CDC) 1.0 or 1.1 (JSR-36/218)
  - Foundation Profile (FP) 1.0 or 1.1 (JSR-46/219)
  - Personal Basis Profile Specification (PBP) 1.0 or 1.1 (JSR-129/217)
    - May be implemented on Personal Profile (PP) 1.0 or 1.1 (JSR-62/216)
  - Java TV™ 1.1 (JSR-927)
- Networked devices also require:
  - Add Java Secure Socket Extension (JSSE) for CDC 1.0 or SecOp for CDC/FP 1.1

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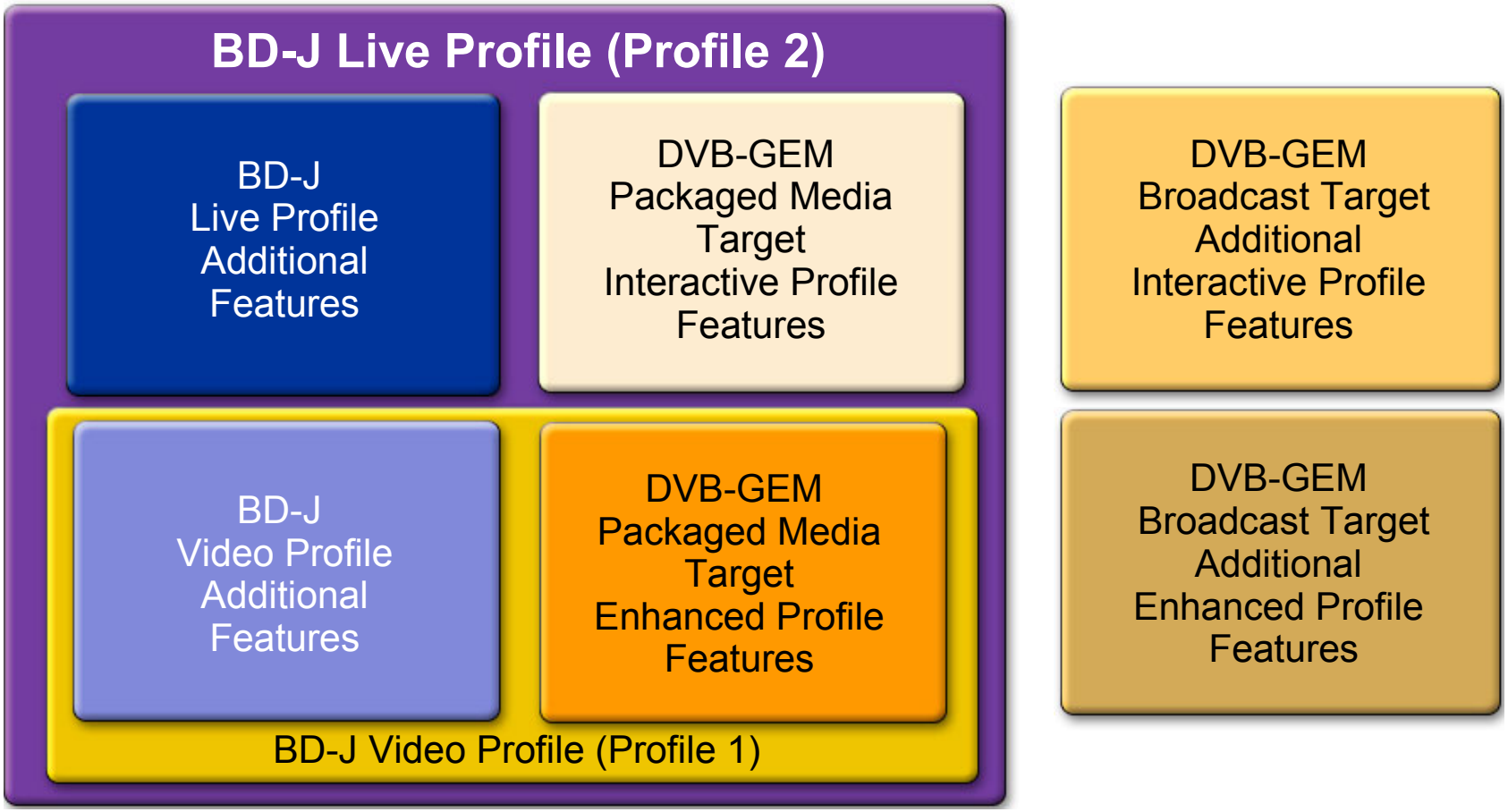
BD-J Basics—Relation With DVB-GEM Packaged Media



BD-J Basics

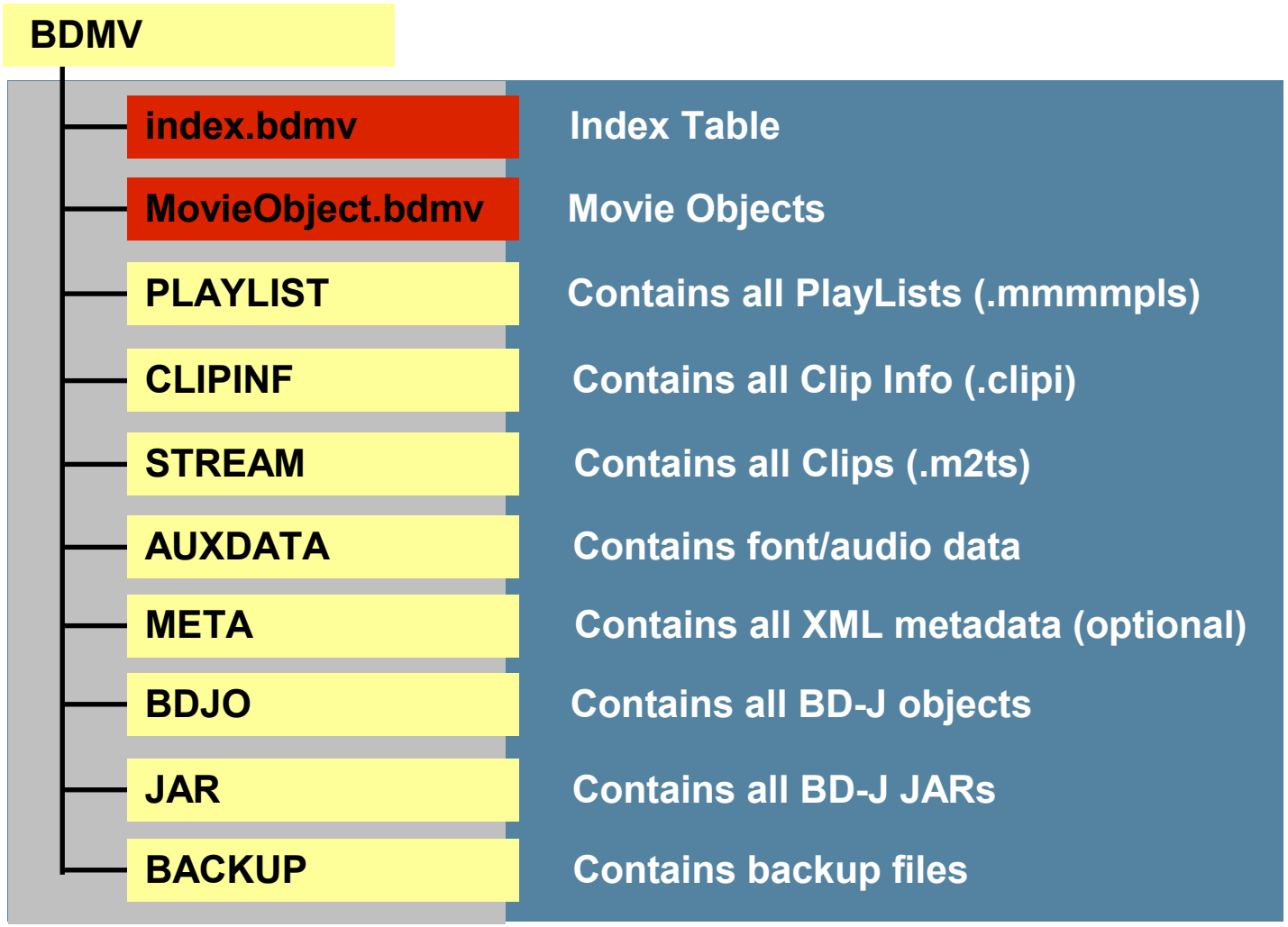
Two BD-ROM Profiles

- 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

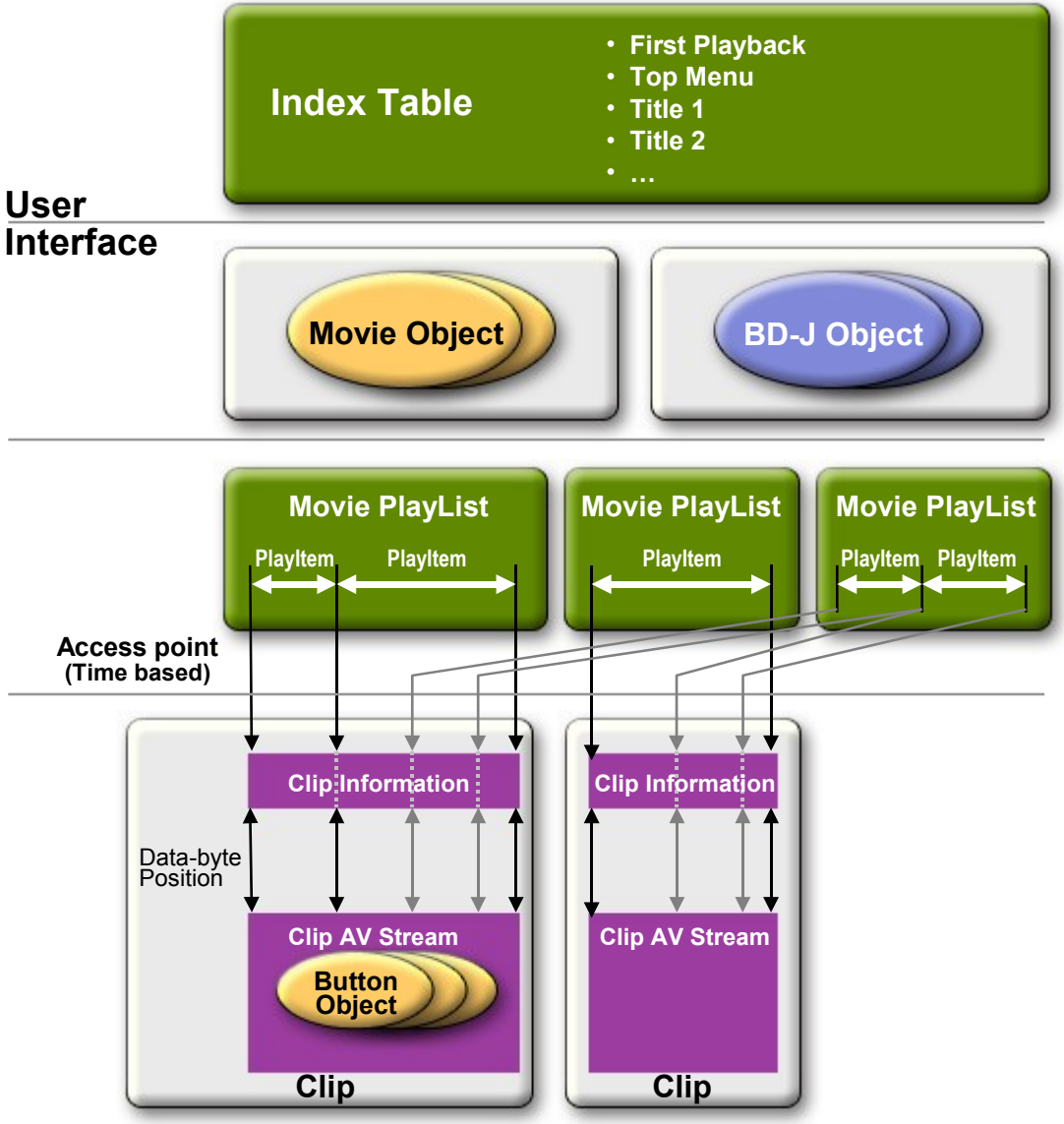
    And more and more

BD-J Basics:
BD-ROM Disc Directory Structure



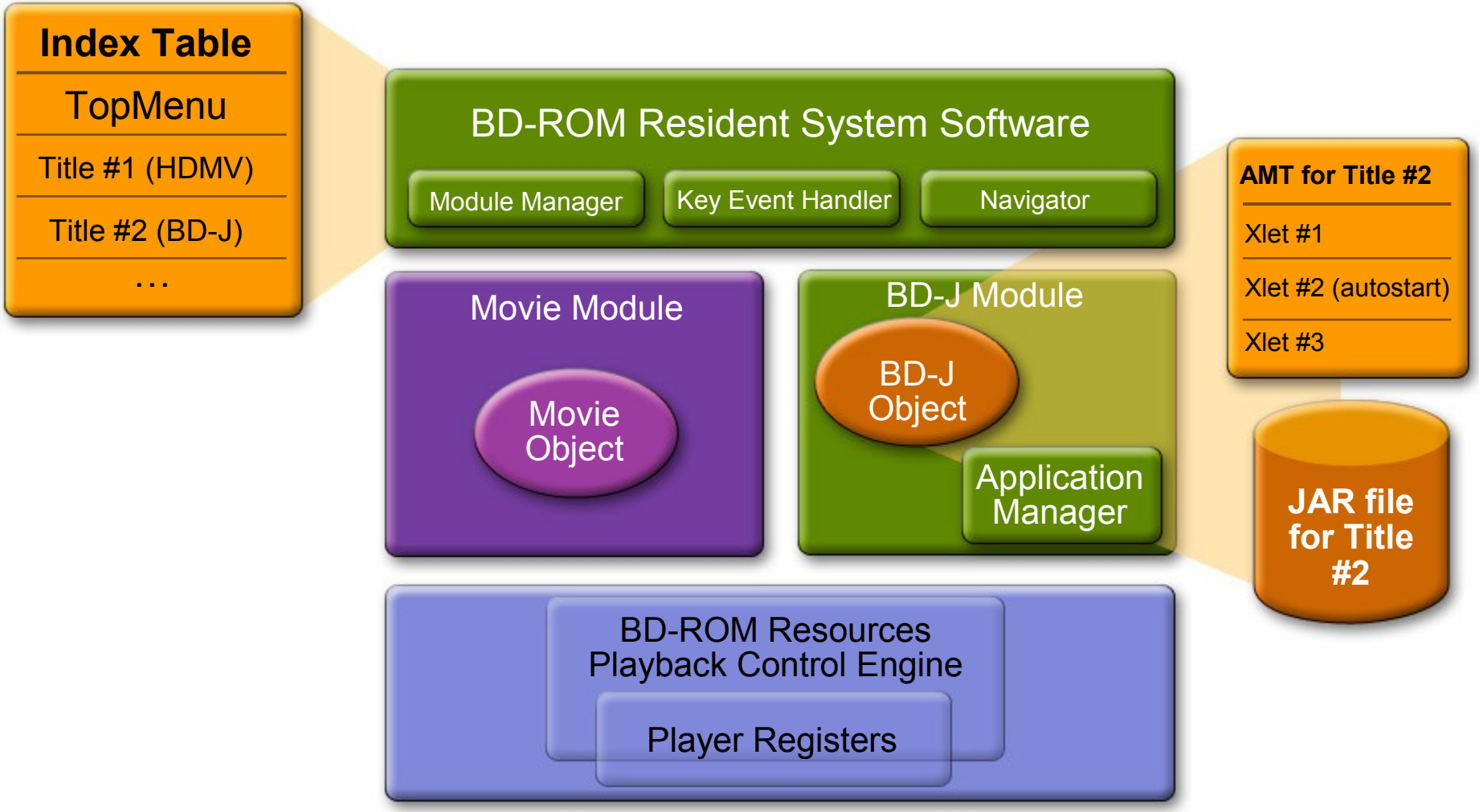
BD-J Basics

Simplified Structure of BD-ROM



BD-J Basics:

BD-ROM Application Layer Structure



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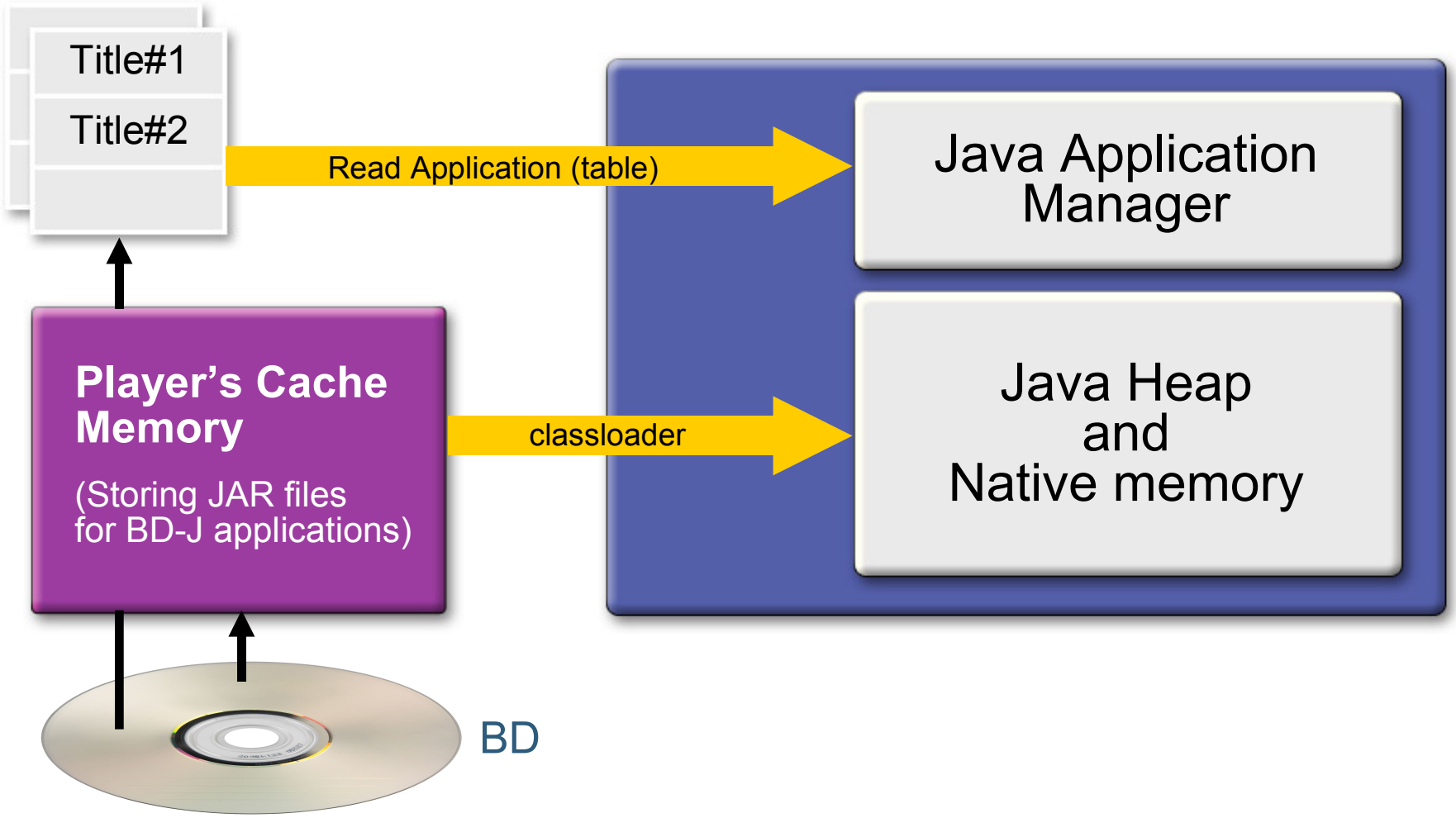
BD-ROM/BD-J
New Format Features

- Application cache
- Plane model
- Picture-in-picture
- Frame accurate animations
- Audio-mixing
- Local storage
- Multi-disc application lifecycle
- Security aspects

Application Cache to Guarantee Seamless A/V Playback



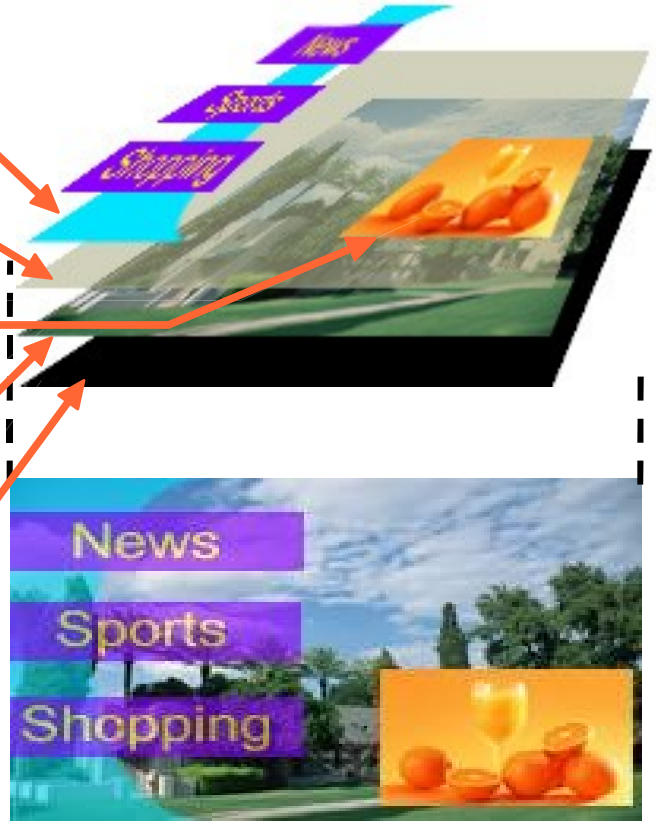
Plane Model—BD-J Graphics and UI

- BD-J includes the HAVi UI device model and widget set
  - Includes an extended device model with five planes
  - Includes a customizable widget set aimed at remote control usage
    - org.havi is from GEM
  - Extended for BD supported resolutions
  - Extended for BD A/V control keys

Plane Model

Five independent full High-Definition Graphics Planes enabling high-quality, visually-rich High-Definition presentations

- Interactivity Graphics Layer
- Subtitle Graphics Layer
- Secondary Video Layer
- Primary Video Layer
- Background Layer (BD-J)



Picture-in-Picture

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

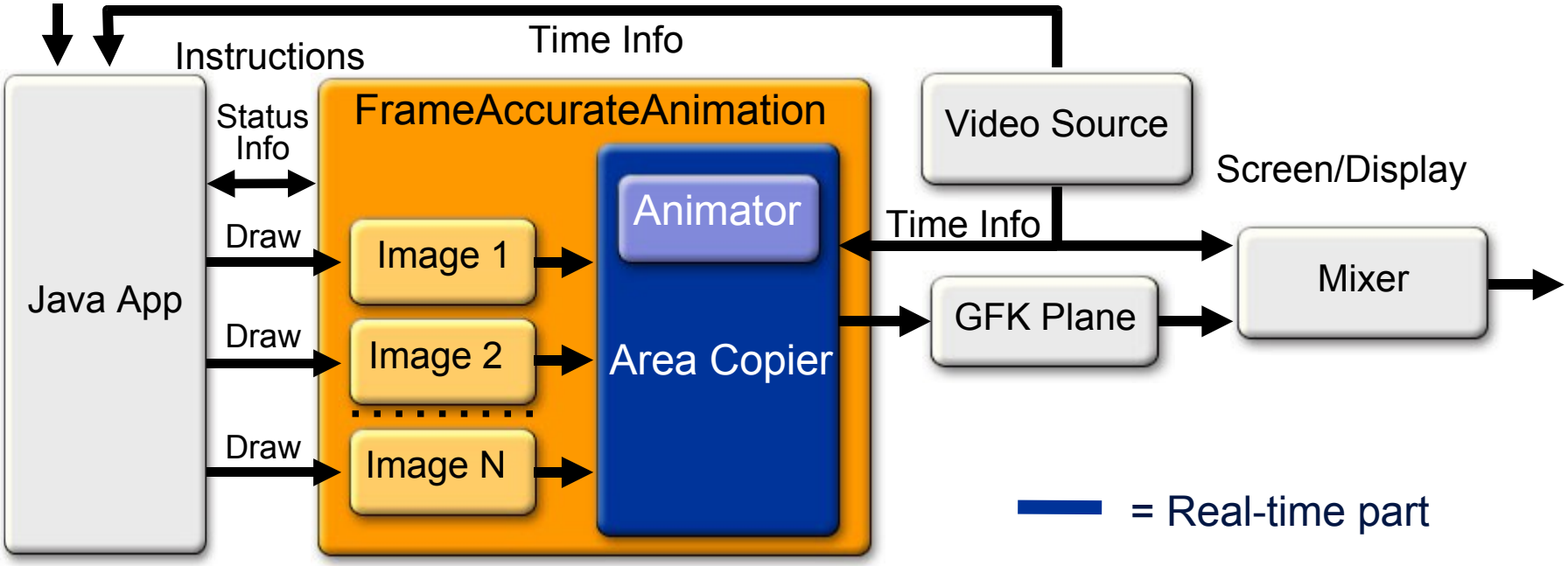
- Both HDMV and BD-J can control PiP
- MPEG-4 AVC/VC-1/MPEG-2 can all be used for PiP video
  - PiP video can be luma keyed

Frame Accurate Animations: Synchronizing gfx to Video

- "Loose" video sync: Callback
  - Trigger API: org.dvb.dsmcc, org.davic.media
  - Mapped to on-disc timecodes
  - No guarantees on exact video frame on which the graphics will appear
- "Tight" video sync: Frame-accurate animation
  - In org.bluray package
  - Based on timecodes (javax.media.Time)
  - Provides guarantees for exact frames

Frame Accurate Animation Model

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



Synchronized Frame-Accurate Animation

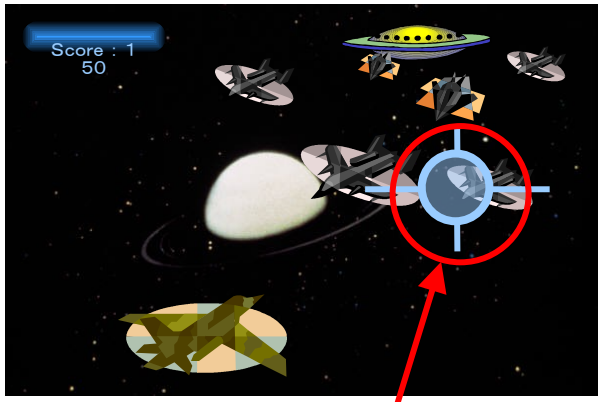
```
private org.bluray.SyncFrameAccurateAnimation faa;


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

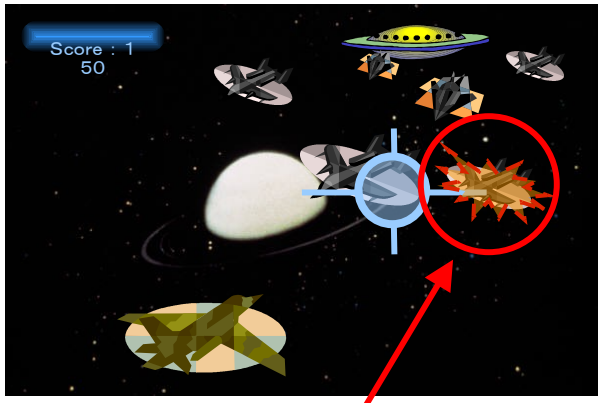
BD-J Interactivity

BD-Java incorporates support for Frame Accurate Animations enabling new types of applications where dynamic graphics interact with objects in the video

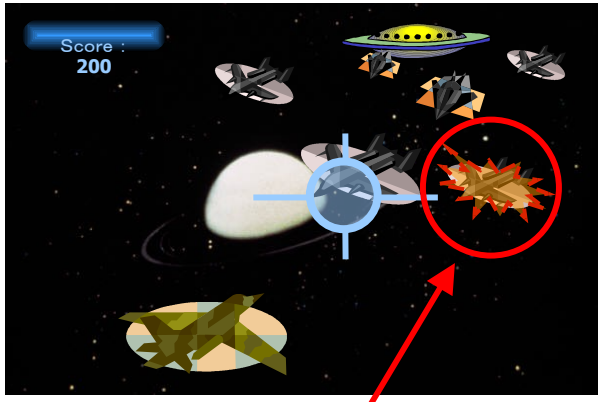
Example:



User has target on object



User hits target, graphic overlay of explosion shown



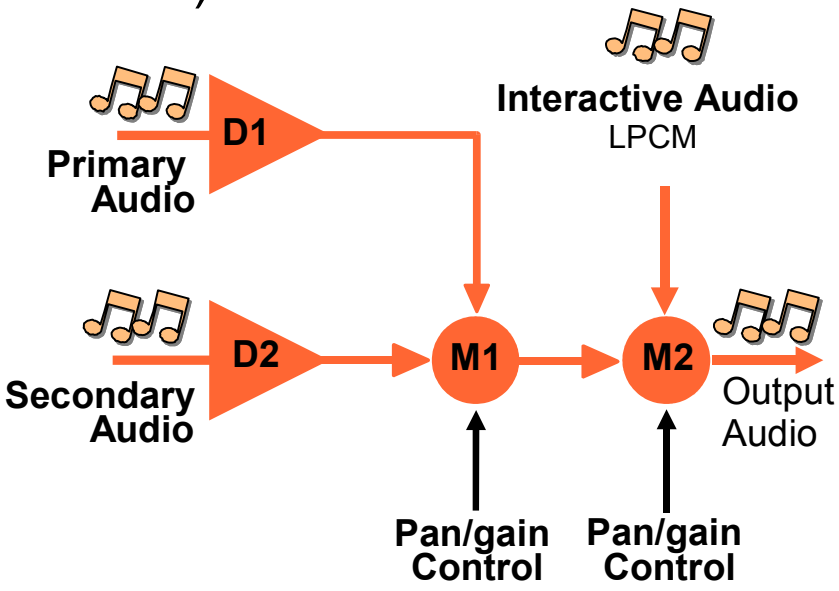
Graphic overlay follows video object as it travels across screen

BD-ROM/BD-J Audio Mixing

Audio Mixing Enables New Audio Applications

- "**Secondary Audio**" provides the ability to present two audio streams simultaneously (for stream applications like director's commentary)
- "**Interactive Audio**" provides the ability to present multiple LPCM audio simultaneously (for game sounds)

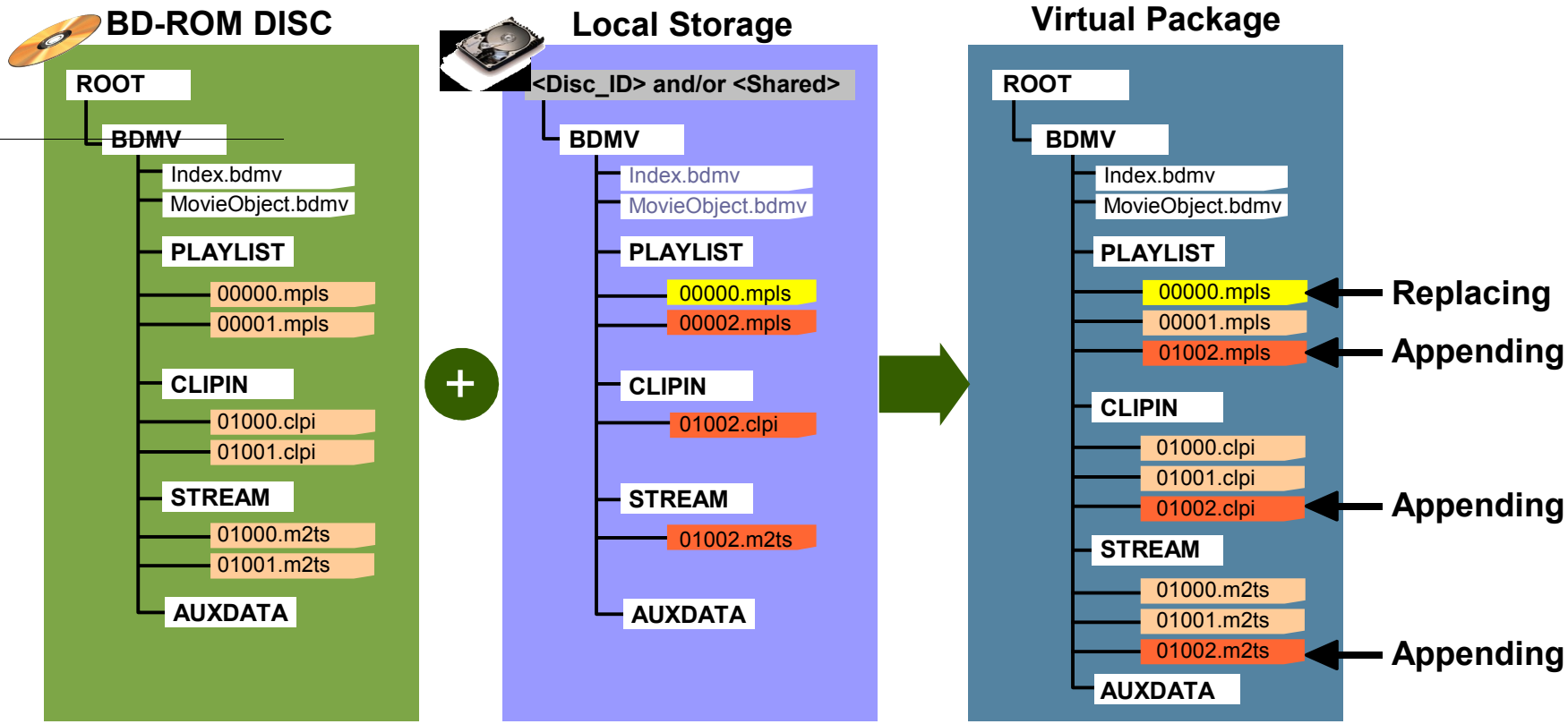
	Secondary Audio	
	DD+	DTS-HD (LBR)
Sampling	48kHz	48 kHz
Channel	5.1	5.1
Bit Rate	256Kbps	256Kbps



Local Storage

Local Storage Provides Persistent Storage for Updating Titles

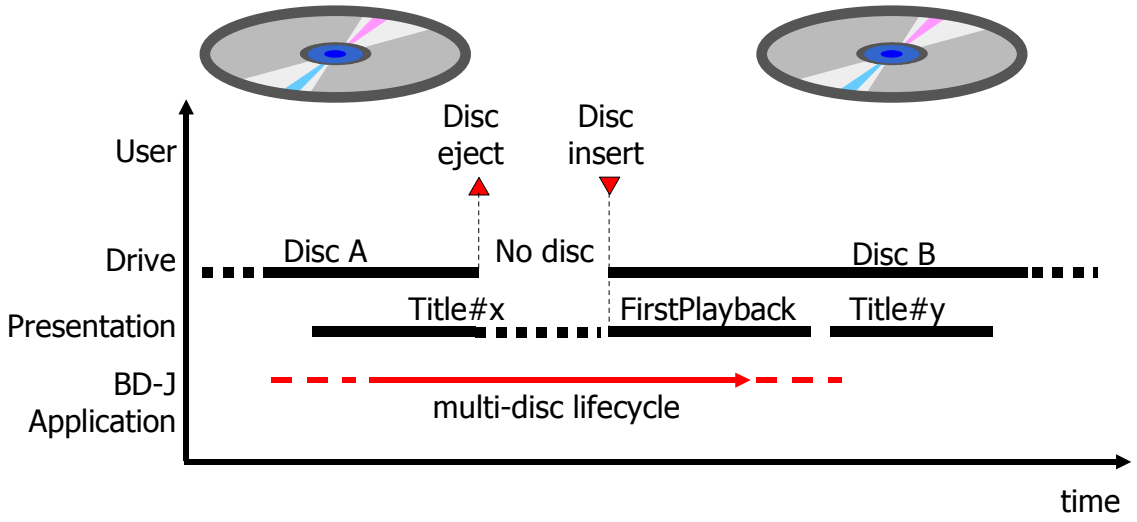
- "Virtual Package" used to provide update during playback
- Organizes downloaded A/V material



Multi-Disc Lifecycle

BD-J Applications Can Run Between Disc

- A series of related disc titles can offer applications, e.g., games to collect items during video play, that can run across these discs
- A Studio's disc catalogue application or enhanced search application can offer navigation across all Studio's discs, even ones that are not yet bought by the user



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

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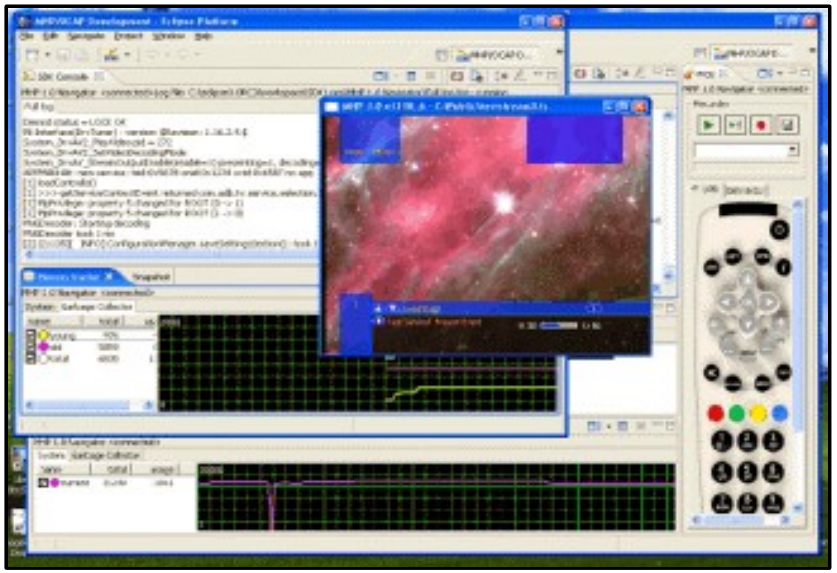
Blu-ray Disc Java Authoring

- A range of BD content authoring toolsets will be required in the marketplace
- Flexibility to choose authoring style and tool best suited to task
  - Advanced content will often be developed directly by Java programmers for performance and flexibility
  - Graphically-oriented tools for creative professionals (non-programmers) will be preferred by the studios to leverage existing staff
- Current tools simply multiplex existing BD-J xlets into BD-ROM format (i.e., Sonic Scenarist, Sony Blu-print)

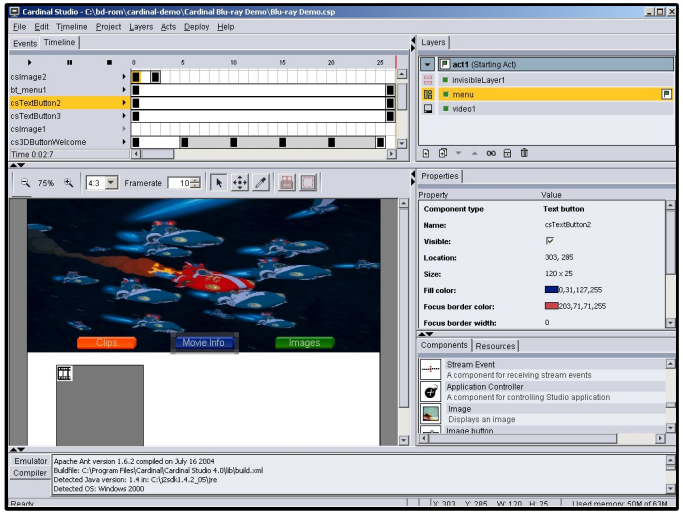
IDE-based Tools

- Target: Java programmer
- Typically integrated with Eclipse or NetBeans
- Most flexible, but requires highest skill level
- Examples
  - MediaHighway Development Kit (NDS)
  - Vision Workbench (Vidiom)
  - Osmosys SDK 2.0



GUI-based Tools

- Target: Creative Professional
- Generally timeline-based paradigm (like Macromedia Director)
- Good mix of flexibility and rapid development
- Examples:
  - Cardinal Studio
  - Alticast AltiComposer 2.0



HTML/XML Markup Tools

- Target: Creative Professional, Web Developer
- Use appropriate XML or HTML markup language with embedded browser or XML rendering xlet
- Once markup environment is defined, very rapid deployment of new applications
- Markup environment can be enhanced as desired
- Examples:
  - Espial and Pontegra browsers
  - Sofia Digital Browser Platform
  - Icareus iTV Integrator

DEMO

For More Information

- Blu-ray disc: http://www.blu-raydisc.com
  - See Technical info, public specifications
- DVB-GEM/MHP/OCAP/Java TV™:
  - http://www.dvb.org
  - http://www.mhp.org
  - http://www.interactivetvweb.org
  - Official Specs available from ETSI: http://www.etsi.org
- Java TV™ API Forum
  - http://forum.java.sun.com/forum.jspa?forumID=36

Q&A

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Bill Sheppard

Sr Industry Mktg Manager, DTV
Sun Microsystems, Inc.
http://java.sun.com

Erik Moll

System Architect
Philips Applied Technologies
http://www.philips.com

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