Blu-ray Disc Overview / Update

The higher definition experience
About Blu-ray Disc (BD)?
Same Form Factor as CD/DVD

- Enables CD/DVD backwards compatibility
- Familiar to consumers

120 mm
1.2 mm thick
Blu-ray’s **ONE** Common Format Advantage

- **Blank Media**
- **Set-top Recorders and Players**
- **Prepackaged High Definition Movies**
- **High Definition Camcorders**
- **PC Storage and Entertainment**
- **Next Generation, High-Definition Gaming**
- **Advanced Interactivity and Internet Connection**
Creation of BD World: Creation of the HD Market

Expand HD Market by diversified cross-platform applications

- **HD Broadcast**
- **BD Camcorders**
- **BD Drives in PCs**
- **BD Theatre-in-a-Box systems**
- **BD Recorder-Players**
- **HD Displays** (Plasma, LCD)
- **BD-ROM** (Movies, Music)
- **BD-R/RE** (Recordable)

Record / Edit / Play

Edit & Play

Record
Blu-ray Disc (BD) – What is it?

- Next *revolution* in optical storage solutions for
  - PC products / Consumer Electronics / Gaming Consoles

- Huge capacity:
  - 25GB (single layer) / 50GB (dual layer)
  - Future capability to store 200GB (8 multi-layer)

- Three versions *at launch*: BD-ROM, BD-R, BD-RE

- Needed for high definition TV/video, PC data storage/archival, and next generation video gaming
  - Broadcast and Packaged Movies / Recording HDTV
  - Large Data Storage
  - Cinematic and High Definition Games

- Backed by most industry leading IT and CE companies

*Blu-ray Disc is High Definition *and more!!*
Complete Solution for High Def.

- BD devices can offer “one stop shopping”- recording high definition broadcasts and playing back High Definition movies.

BD Device

- HD program Recording or Multi-Session
- BD Package Distribution
- BD-ROM
- BD-R/RE

HDTV

HD Digital Broadcast

Content

Broadband Access
Optical Disc Technology Evolution

- **CD**
  - Diameter: 0.1 mm
  - Layer: 1
  - Capacity: 700MB
  - Optical Properties: Irrelevant
  - Laser Wavelength: 780nm

- **DVD**
  - Diameter: 0.6 mm
  - Layer: 1
  - Capacity: 4.7GB
  - Optical Properties: Irrelevant
  - Laser Wavelength: 650nm

- **HD DVD**
  - Diameter: 1.2 mm
  - Layer: 1
  - Capacity: 15GB / 20GB
  - Optical Properties: ROM / Writable
  - Laser Wavelength: 405nm

- **Blu-ray Disc**
  - Diameter: 0.1 mm
  - Layer: 3 (not approved)
  - Capacity: 50GB
  - Optical Properties: ROM/Writable
  - Laser Wavelength: 405nm

<table>
<thead>
<tr>
<th>Format</th>
<th>Layer</th>
<th>Capacity</th>
<th>Optical Properties</th>
<th>Laser Wavelength</th>
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<tbody>
<tr>
<td>CD</td>
<td>1</td>
<td>700MB</td>
<td>Irrelevant</td>
<td>780nm</td>
</tr>
<tr>
<td>DVD</td>
<td>1</td>
<td>4.7GB</td>
<td>Irrelevant</td>
<td>650nm</td>
</tr>
<tr>
<td>HD DVD</td>
<td>1</td>
<td>15GB / 20GB</td>
<td>ROM / Writable</td>
<td>405nm</td>
</tr>
<tr>
<td>Blu-ray</td>
<td>3</td>
<td>30GB / 30GB (-R 9/14 ver. 1.9)</td>
<td>ROM/Writable</td>
<td>405nm</td>
</tr>
</tbody>
</table>

Tony Jasionowski OSTA OSS 2005 45GB?/ (3 layer not approved)
Single Optical Pickup Units

- Single OPU’s can read/write to CD, DVD, and Blu-ray Disc (BD)
- Several companies have already developed and are making these components (Philips, Panasonic, Sony, Pioneer, others)
- We expect every Blu-ray Disc (BD) device to be backward compatible with CD’s and DVD’s
Blu-ray Disc (BD) Advantages
Blu-ray’s (BD-ROM) Capacity Advantage

• BD-ROM provides 67% more capacity than HD DVD-ROM
• Provides for better picture quality, more features, more content, better user experience
• BD-ROM (12 Mb/sec)
  – 3.7 hours (single layer)
  – 7.4 hours (double layer)
• HD DVD-ROM (12 Mb/sec)
  – 2.2 hours (single layer)
  – 4.4 hours (double layer)
• “Enough” capacity has never been enough for content owners
• Outgrew DVD-5 in <4 years

• BD-ROM can grow beyond two layers
  – (4, 6, and 8 layers have been proven)
  – up to 200GB future
DVD-5 was not sufficient

- High-Definition Capacity Needs will Likely Follow the Same Path

Source: ESA, Credit Suisse First Boston, VB, PWC, Internal Estimates
Blu-ray’s Capacity Advantage (continued)

- Enables better picture quality:
  - Picture quality is directly proportional to capacity

<table>
<thead>
<tr>
<th>Video Length</th>
<th>Bit Rate high=quality</th>
<th>Audio Length</th>
<th>Bit Rate high=quality</th>
<th>Lang/Tracks</th>
<th>Required Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>135 min</td>
<td>15 Mbps</td>
<td>135 min</td>
<td>3 Mbps</td>
<td>3 Tracks</td>
<td>24.3GB</td>
</tr>
<tr>
<td>(pristine picture quality)</td>
<td></td>
<td></td>
<td>(high quality)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250 min</td>
<td>15 Mbps</td>
<td>250 min</td>
<td>3 Mbps</td>
<td>3 Tracks</td>
<td>45GB</td>
</tr>
<tr>
<td>(pristine picture quality)</td>
<td></td>
<td></td>
<td>(high quality)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HD DVD would have to significantly lower bit rate (7Mbps) to fit this movie

What about bonus features?

Low bit rate reduces picture quality
Blu-ray’s Recording Advantage

• Recording designed into BD format from beginning
  - Introducing BD-ROM, BD-R, and BD-RE together
  - More like VCR introduction, less like DVD introduction
  - Double layer (50GB) already exists today

• HD DVD focusing on ROM primarily
  - HD DVD is expected to be limited to a single layer for recording, maximum = 20GB (per side)
  - HD DVD-R DL 30GB just approved Sept. 14 as draft ver. 1.9
Blu-ray’s Recording Advantage
(continued)

Next Generation Optical Media Must Have Recording Capability

Worldwide DVD Player/Recorder Shipments

Player sales are already starting to peak

Set-top recording on DVD is becoming popular

Source: IDC 2004
Blu-ray’s Recording Advantage (continued)

- Recording advantage is an easily tangible advantage for the consumer
  - HDTV recording/time shifting
  - HD Camcorders
  - PC data storage
- 12cm and 8cm Blu-ray Discs for recording versatility
- BD-R, BD-RE:
  - immediately available
  - 3.5 – 4.5 hours (single layer)
  - 6 – 9 hours (double layer)
- HD DVD-R/RW:
  - later
  - 2.5 – 3.0 hours (single layer)
- BD-R, BD-RE can grow beyond two layers
  - (4, 6, and 8 layers have been proven)
  - up to 200GB future

Lost Capacity With HD DVD
Blu-ray’s Durability Advantage

- Various hard-coat technologies make Blu-ray Discs most durable and more “family-friendly”
- Hard-coat technology provides resistance to:
  - Finger prints
  - Marks
  - Scratches
  - Dust
- Much more ROBUST than today’s polycarbonate-based CD/DVD’s (and HD DVD’s)
Blu-ray’s Density/Performance Advantage (continued)

- Higher density enables better data seek times

- Shorter distance to travel for same amount of data results in faster data seek times
  - important for random access of data
  - better for video game and PC data applications
## Blu-ray’s Broadest Industry Support

<table>
<thead>
<tr>
<th>Category</th>
<th>Blu-ray Disc</th>
<th>HD-DVD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer Electronics</strong></td>
<td>Panasonic, Sony, Philips, Samsung, Pioneer, LG, Mitsubishi, Hitachi, Sharp, Sanyo, Thomson, JVC, TDK</td>
<td>Toshiba, Sanyo, Thomson (*)</td>
</tr>
<tr>
<td><strong>IT Industry</strong></td>
<td>Dell, HP, Apple</td>
<td>Toshiba, NEC MS, Intel</td>
</tr>
<tr>
<td><strong>Studios</strong></td>
<td>Walt Disney, Sony Pictures / MGM 20th Century Fox</td>
<td>Warner Bros, Universal Studios, Paramount</td>
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<tr>
<td><strong>Video Games</strong></td>
<td>Sony Computer Entertainment Electronic Arts, Vivendi Universal Games</td>
<td></td>
</tr>
<tr>
<td><strong>Music</strong></td>
<td>Universal Music Sony – BMG Music</td>
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</tr>
</tbody>
</table>

*Excludes Chinese Manufacturers
Blu-ray Disc Association (BDA)

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**70+ General Members**
Current BD Products

BD Products Already Released

- Panasonic E700BD
- Sony BDZ-S77
- Sharp BD-HD100
- Samsung BDR1000
- LGE LGXBG420
- Panasonic LM-BRM50/25
- Sony BF-23G
- TDK BD-RE120N

BD Products Already Released

- Philips (CEATEC ’04)
- Pioneer (CEATEC ’04)
- JVC (CEATEC ’03)
- Mitsubishi (CEATEC ’04)
Paradigm shift to High Definition

Strong Market Opportunity for High Definition Package Media

Source: DEG/CES/Kagan
Summary – Do More with Blu…

- More Capacity, Density and Performance:
  - Hours of *high quality* HD and/or SD video content
  - 25 GB (single layer) / 50 GB (dual layer)
  - 67%-150% more than HD DVD, 6x more than DVD

- More Industry Support / Consumer Reach
  - 16 Powerful BOD Companies
    - Brand Power / Technical Capability / Products
  - BDA has 140+ members

- More Durable
- More Interactive User Experience
- More than cheap way to deliver HD Movies
- More Flexible Content Protection: AACS, BD+
  Renewability Technology and ROM Mark
Thank You!
Tony Jasionowski