Optical Disc & Long term Archiving for a sustainable society

Steve Murakami
Panasonic AVC Networks company
Panasonic Corporation
Dec, 2008
AGENDA

1. Data explosion & Energy
2. MIC and ITU activities
3. Hybrid Storage is the way
4. Why Optical based Archive
The Power consumption in US data center alone:
- 61BWh /2006, 100BWh /2011 (double in 5 years)
- Require 10 Power plants for just data centers by 2011

Source: U.S. Environmental Protection Agency STAR Program
Information Explosion

Available storage media capacity will not keep up with the amount of information. Going forward to 2010, storage media capacity CAGR = 35%, while information creation & replication CAGR = 57%. 2007 is a crossover year!

Source: IDC
The reasons for data explosion

- Pre 1990s — data was predominantly "structured" (i.e., within databases)
- Today and in the future — data is/will be essentially free form or "unstructured"

Source: IDC
Growing Archiving Importance by Regulation

Because Terrorism, Corp.-scandal, SOx

Source: DISC Corp.
WW Server market: Impact of Power

- Power & Cooling cost in 1996 is only 15% of total
- Power & Cooling cost in 2010 will be 40%

Source: IDC
Information explosion & In-active data

- Disc Capacity rapidly growing
- Majority of data are FIX data (In-active data)
In-active data = sleeping data

80% of the entire data are in-active (sleeping) data among the exploding data storage capacity

Source: IDC
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Japanese Gov. MIC report 2008. 4. 10

Amount of data for infrequently used and the Storage

Promote low power (low CO2) Storage devices, such as Optical Disc for inactive archive data

Source: Translated from Japanese Gov. MIC report 2008. 4. 10
ITU Activity for global warming problem


Study Group of ICT policy to prevent global warming

Report 10/Apr

ITU symp 15~16/Apr. @ Kyoto

Davos Forum 23~27/Jan. @ Davos

WEF working Level meeting 23~24/Apr. @ Tokyo

GIIC assembly 24~25/Apr @ Tokyo

ITU symp 17~18/Jun. @ London

ITU TSAG 2~11/Jul. @ Geneva

ITU Activity for global warming problem

G8 summit 7~9/Jul. @ Japan

OECD ministerial meeting 17~18/Jun @ Seoul

ITU WTSA 21~30/Oct. @ Johannesburg

G8 summit 7~9/Jul. @ Japan
Multi-tier Storage save energy and reduce CO2
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Hybrid is the way for sustainable society

- Resource pressure & Global warming issues makes the trend toward “Hybrid”

<table>
<thead>
<tr>
<th>Hybrid VEHICLE</th>
<th>Engine + Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid Storage</td>
<td>RAID + Optical</td>
</tr>
</tbody>
</table>

Resource pressure & Global warming issues makes the trend toward “Hybrid”.
Hybrid Storage save energy & reduce CO2

Case study;
Case for 400TB archived by BD for 1 year out of Total Capacity 1,000TB

- Power reduction: RAID 635 MWh to RAID + Blu-ray 384 MWh (40% reduction)
- CO2 reduction: RAID 215 tons to RAID + Blu-ray 130 tons (40% reduction)

MT or Blu-ray
No Metric nor Criteria in IT industry

- Automotive industry has the Criteria \([\text{Km/Litter}]\)
- Digital data has CFP, but NO Criteria in IT industry
- Metric & Criteria is the first step for the argument

<table>
<thead>
<tr>
<th>Industry</th>
<th>Metric</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive</td>
<td>Km/L</td>
<td>19 Km/L</td>
</tr>
<tr>
<td>Digital data</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

CFP: Carbon foot-print

Case for Japan

(PB·yr/KW)
Metric & Criteria in Automotive Industry

- Metric & Criteria is the essential
- Criteria (High hurdle) helped to reduce CO2 and Competitiveness

Source: An Inconvenient Truth / Al Gore
AGENDA

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# Why Optical based Archive (1)

## ① Longevity ② Data mining ③ T.C.O.

<table>
<thead>
<tr>
<th>Longevity</th>
<th>Data Mining</th>
<th>T.C.O.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 years</td>
<td>500 years</td>
<td>50 years</td>
</tr>
<tr>
<td>① Long archive life</td>
<td>② No power archive</td>
<td>① None-contact read</td>
</tr>
<tr>
<td>① No air condition req.</td>
<td>② CO2 less</td>
<td></td>
</tr>
<tr>
<td>⑤ Contact write &amp; read</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## ⑤ Contact write & read

<table>
<thead>
<tr>
<th>10-15 years (Re-refresh)</th>
<th>3-5 years (Re-place)</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Short life (mechanic)</td>
<td>② Powered Archive</td>
</tr>
<tr>
<td>③ Air conditioning req.</td>
<td>④ with CO2</td>
</tr>
<tr>
<td>⑤ Contact write &amp; read</td>
<td></td>
</tr>
</tbody>
</table>
Why Optical based Archive (2)

- Optical Media & Format are solid & stable (Physical and Logical)
- In case of RAID based Archive, you have to keep “RAT RACE”
- Because drive will fail by 3-5 yrs, and obsolete in every 5-7 Yrs

<table>
<thead>
<tr>
<th></th>
<th>2006-</th>
<th>2010-</th>
<th>2020-</th>
<th>2030-</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD Media (UDF format, Major manufacturers)</td>
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</tr>
<tr>
<td>BD Drive (major manufacturers)</td>
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<tr>
<td>(Drives &amp; parts available over 30+ years, CE maker backed Format)</td>
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<td></td>
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<tr>
<td>Tape Media</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tape Drives</td>
<td></td>
<td></td>
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<tr>
<td>(Drive obsolescence every 7-10 years = rat race)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD Drives</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>(Drive obsolescence every 5-7 years = rat race)</td>
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</tr>
</tbody>
</table>
Replacing HDDs creates mountains of junk

Rolling hardware and replacing failed HDDs, obsolete SANs and NAS units, creates mountains of junk.
Why Optical based Archive (3a)

- Real cost for Archiving is Operational Cost, not for H/W alone
- You need $3M for 5 migration cycles in 20 years (H/W & S/W)
- You need closed to $1M for electricity in 20 Years for 100 TB

T.C.O. (Total Cost of Ownership)

(Data Migration)
(Power Consumption)
(ITA cost)
(S/W)
(H/W)

Source: Buckley’s White Paper
Why Optical based Archive (3b)

- Real cost for Archiving is Operation Cost not for H/W
- Archive for 1,000TB requires 1000 person (Resource)
- Storage Operation cost in Wall St./NY : $300K/TB/Yr

T.C.O. (Total Cost of Ownership)

- $4 Migration cost for H/W
- $3 Migration cost for S/W
- $2 Power for Equipments
- $1 Air Conditioning required
- $0 CO2

“Eco” is not only “Ecology” but also “ECONOMY”

Source: IDC
Why Optical based Archive (4)

- Optical advantage for Volumetric density & CO2 emission

**Volumetric Density by Storage Type**

- HDD/RAID: 3.95 GB/cc
- Tape: 3.43 GB/cc
- Blu-ray 50GB: 3.7 GB/cc
- 100GB (next gen): 7.4 GB/cc

**Carbon foot Print for 1000TB-Year**

- HDD/RAID: 108 t
- Tape: 6.8 t
- Blu-ray 50GB: 2.4 t
- 100GB (next gen): 1.2 t

Source: Panasonic
Why Optical based Archive (5)

BD has superior characteristics as an archive media

Source: Panasonic
## Why Optical based Archive (6)

<table>
<thead>
<tr>
<th>Soft Archive (migration)</th>
<th>Hard Archive (Migration less)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical media (MTBF)</td>
<td>Disc solid media (No MTBF)</td>
</tr>
<tr>
<td>Short-Life (migration, drive obsolescence)</td>
<td>Long-Life (migration less)</td>
</tr>
<tr>
<td><strong>Powered</strong> (24hr/365d)</td>
<td>Power-less (No Power Archive)</td>
</tr>
<tr>
<td>(Powered/CO₂ Archive)</td>
<td></td>
</tr>
<tr>
<td>Air conditioning req. (with CO₂)</td>
<td>No Air conditioning (with out CO₂)</td>
</tr>
<tr>
<td>High T.C.O.</td>
<td>Low T.C.O.</td>
</tr>
</tbody>
</table>
Why Optical based Archive (7)

- All medical records from hospital were destroyed or severely damaged
- 98% of the data in Optical disc recovered, data in HDD & Tape are dead after a month later in the high temperature & humidity mud & dirty water

Hospital’s Data Survives Hurricane Katrina

The Southeast Louisiana Veterans Health Care System (formerly the VA Medical Center, New Orleans) and its outpatient clinics located throughout southeastern Louisiana are committed to providing high-quality, compassionate, and safe health care to the more than 220,000 veterans who live in the 23-parish region they serve. The 354-bed acute care facility was affected by flooding following Hurricane Katrina in August 2005.

“The media had been exposed to extremely high temperatures and humidity from brackish standing water, they were covered in debris and dust for more than a month,” said Allen. “We were able to recover all of the patient images off of the Plasmon libraries. We had just started to migrate to UDO™ (Ultra Density Optical) for an archive solution when the hurricane hit. We are now primarily using the Plasmon UDO Archive Appliance for its long-term recoverability.”
Case of BD Archive Installation

National Institute for Fusion Science (NIFS) in Japan
Blu-ray Discs are used to archive experimental data for fusion science. The volume of experimental data is increasing 50% every year.

Points for Adopting BD
- Long term data preservation
- Future capacity expandability
- Low Power, Low CO₂.
- Total cost of ownership (TCO)

LHD Control Floor

Exp. Device  Large Helical Device (LHD)
BD is the media with no power required for archiving you can save Energy and reduce CO2 emission and your operation cost drastically. These are the differences with RAID/HDD which require electricity 24Hr • 365 days.
Thank you very much!