Ultra Density Optical technology

Tom Sas
Product Marketing Manager
Hewlett-Packard
Current 5.25” MO Technology

- Magneto-Optical uses hybrid of optical and magnetic technologies to reverse the polarity of magnetic domains
- CCW – Continuous Composite Worm
- Use 650nm red lasers and 0.6NA optics
- Maximum practical data density reached at 2.27 GB/sq in
- 14X (9.1GB) uses complex multi-layer MSR media
- Some 70% of applications are archival and use WORM media
- Media cost is relatively high at ~ $10/GB
- UDO is the next generation 5.25” professional optical storage technology
- Three generations of product will provide storage capacities of 30, 60 and 120GB
- Generation 1 began shipping in late 2004
- UDO is a convergent technology that provides the performance of 5.25” MO, the longevity of 12-inch WORM and the cost-effectiveness of DVD
- UDO sets new standards of capacity, performance and cost for optical storage technology
- UDO is the future standard in professional archival storage
Technology Fundamentals

- Standard half-height 5.25” format drives for library automation compatibility
- Media cartridge dimensionally identical to 5.25” MO for library automation compatibility
- No backwards compatibility with current MO technology
- Phase change WORM and rewritable media
- UDO employs far-field non-contact head media interface for robust recording performance.
- New dual shutter cartridge gives increased media protection
- First generation UDO will employ 0.7NA objective lens
  - Commercially available today as single element lens
  - Does not require active spherical aberration correction
  - Provides initial capacity of 30GB
Technology Fundamentals cont.

- 100μm (0.1mm) cover layer disk construction
- 405nm blue-violet laser and high NA optics give greatly increased data storage densities
  - 30GB - 7.4Gb/sq in
  - 60GB - 14.8Gb/sq in
  - 120GB - 29.6Gb/sq in
- Second and third generations of UDO drives and media will be backwards read compatible
- Lower cost media ~ $2/GB
5 1/4” MO/UDO Roadmap

1st Generation (1X) 650MB 1988
2nd Generation (2X) 1.3 GB 1993
3rd Generation (4X) 2.6 GB 1996
4th Generation (8X) 5.2 GB 1998
5th Generation (14X) 9.1 GB 2001

UDO 1 30 GB 2004
UDO 2 60 GB 2006
UDO 3 120 GB 2008

Key Glossary Terms

Since UDO and MO technologies are not read/write compatible with each other it may be good to understand the basic differences:

- **UDO technology**
  - Uses the heat of the blue laser to alter the physical state of the disk during writes. Reads are low power laser reflecting off changed bits.

- **MO technology**
  - Combination of magnet and red laser changing the properties of the disk during writes. Reads use a low power laser to detect optical polarization shifts caused by the recorded magnetic properties.
UDO Drive Technology

- First professional blue laser optical drive designed for long-term archival storage environments
- Multifunction drive
  - Supports read and write operations on both 30GB rewritable and write-once UDO media
- Records data using 8KB sectors
  - Maximizes media capacity and performance
  - Write pass followed by a verify pass
Blue Laser Technology

• A blue laser
  – Provide finer point than a red laser
  – Enables more data to be stored in a given space
  – Produces a stable recording surface
    • Does not degrade with use
    • Is insensitive to exposure to magnetic fields
    • Accommodates wider ranges of environmental conditions
    • Has a media life in excess of 50 years
UDO – MO Physical Differences

- **Option Switches**
  - UDO has no option switches
  - Functionality has been moved to the function connector, Mode Selector removed.

- **SCSI Connector**
  - MO 50 pin Ribbon (Narrow)
  - UDO 68 pin Micro-D (Wide)

- **Media**
  - UDO dual shutter (better for dust prevention/media protection)
  - Narrower shutter engage, notch at MO engage (prevents UDO media insertion into MO drive)
  - UDO longer detent (prevents loading MO media to UDO drive)
## High Density Recording
### Comparison of Capacities

Comparison Table: 2x, 4x, 8x, 14x, UDO

<table>
<thead>
<tr>
<th></th>
<th>2X</th>
<th>4X</th>
<th>8X</th>
<th>14X</th>
<th>UDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity/Cartridge</td>
<td>1.3GB</td>
<td>2.6GB</td>
<td>5.2GB</td>
<td>9.1GB</td>
<td>30GB</td>
</tr>
<tr>
<td>LD Wavelength</td>
<td>785nm</td>
<td>685nm</td>
<td></td>
<td>660nm</td>
<td>405nm</td>
</tr>
<tr>
<td>Rec. Geometry</td>
<td>Land</td>
<td>Groove</td>
<td>Land &amp;Groove</td>
<td>Land &amp;Groove</td>
<td></td>
</tr>
<tr>
<td>User Area</td>
<td>30 to 60mm</td>
<td>30 to 62mm</td>
<td></td>
<td>28.9 to 62.5mm</td>
<td></td>
</tr>
<tr>
<td>Modified CAV</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Modulation Code</td>
<td>RLL(2,7)</td>
<td>RLL(1,7)</td>
<td></td>
<td>RLL(1,7)</td>
<td></td>
</tr>
<tr>
<td>MSR</td>
<td>No</td>
<td></td>
<td>Yes</td>
<td>No (Phase Change)</td>
<td>Yes</td>
</tr>
<tr>
<td>ADRC</td>
<td>No</td>
<td></td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Max. Sector Size</td>
<td>1KB</td>
<td>2KB</td>
<td>4KB</td>
<td></td>
<td>8KB</td>
</tr>
<tr>
<td>Linear Density</td>
<td>0.86um/bit</td>
<td>0.50um/bit</td>
<td>0.40um/bit</td>
<td>0.3um/bit</td>
<td>0.11um/bit</td>
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<tr>
<td>Track Pitch</td>
<td>1.39um</td>
<td>1.15um</td>
<td>0.85um</td>
<td>0.65um</td>
<td>0.39um</td>
</tr>
</tbody>
</table>

*um = micrometer
UDO Media
Media

- UDO Media is "Automation Compatible" with existing MO libraries:
  - Critical cartridge dimensions are the same (form factor compatible)

- UDO Media is NOT compatible with MO drives (Physical Interlock)

- MO Media is NOT compatible with UDO drives (Physical Interlock)
UDO Media Quick Specs

- 8MB/sec Read (outer zone)
- 4MB/sec Write (write and verify)
- 8KB sectors
- VAP
- 40MB/sec Wide Ultra 2 LVD SCSI interface
- 35 msec average seek time
- 750,000 load/unload cycles
- 100,000 hour MTBF
## Media Comparison with MO

<table>
<thead>
<tr>
<th></th>
<th>MO 14x (4096 byte sectors)</th>
<th>UDO (8192 bytes sectors)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Media Types</strong></td>
<td>RW Only</td>
<td>RW (Direct overwrite)</td>
</tr>
<tr>
<td></td>
<td>CCW WORM</td>
<td>WORM (Different media stack)</td>
</tr>
<tr>
<td><strong>Write (RW)</strong></td>
<td>Erase Pass</td>
<td>Write Pass (Direct Overwrite)</td>
</tr>
<tr>
<td></td>
<td>Write Pass</td>
<td>Verify Pass</td>
</tr>
<tr>
<td></td>
<td>Verify Pass</td>
<td></td>
</tr>
<tr>
<td><strong>Write (WO)</strong></td>
<td>Blank Check Pass</td>
<td>Write Pass (VAP overwrite protection)</td>
</tr>
<tr>
<td></td>
<td>Write Pass</td>
<td>Verify Pass</td>
</tr>
<tr>
<td></td>
<td>Verify Pass</td>
<td></td>
</tr>
<tr>
<td><strong>Re-Write Cycles</strong></td>
<td>Unlimited</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sector is relocated if rewrite cycles exceeded.</td>
</tr>
<tr>
<td><strong>Max LBA</strong></td>
<td>1,095,839</td>
<td>1,831,791</td>
</tr>
<tr>
<td><strong>Spare Sectors</strong></td>
<td>8191 (0.75%)</td>
<td>36,800 (2.0 %)</td>
</tr>
<tr>
<td><strong>Writing</strong></td>
<td>Requires Electromagnet</td>
<td>No Magnet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supports direct overwrite – no erase pass required.</td>
</tr>
</tbody>
</table>
# Media Technical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Disk Diameter</td>
<td>130mm</td>
</tr>
<tr>
<td>Disk Thickness</td>
<td>2.4mm</td>
</tr>
<tr>
<td>Disk Size</td>
<td>5.25-inch (ISO Standard 135 x 153 x 11mm)</td>
</tr>
<tr>
<td>Capacity</td>
<td>30GB</td>
</tr>
<tr>
<td>Sector Size</td>
<td>8KB</td>
</tr>
<tr>
<td>Number of User Sectors /Side</td>
<td>1,834,348</td>
</tr>
<tr>
<td>Data Area</td>
<td>27.0 to 62.5mm</td>
</tr>
<tr>
<td>Recording Layer</td>
<td>Phase change</td>
</tr>
<tr>
<td>Recording Format</td>
<td>Land and groove</td>
</tr>
<tr>
<td>Recording Side</td>
<td>Both sides</td>
</tr>
<tr>
<td>Recording Density</td>
<td>7.4GB/in²</td>
</tr>
<tr>
<td>Data Encoding</td>
<td>RLL (1,7)</td>
</tr>
<tr>
<td>Rewrite Cycles (Rewritable Media)</td>
<td>10,000</td>
</tr>
<tr>
<td>Media Life</td>
<td>50+ years</td>
</tr>
<tr>
<td>Archival Temperature</td>
<td>5 to 55°C</td>
</tr>
<tr>
<td>Archival Relative Humidity</td>
<td>3 to 90%</td>
</tr>
</tbody>
</table>
Phase Change Technology

- **Write:**
  - High-intensity laser heat changes the special metal layer from **crystalline** to **amorphous**

- **Read:**
  - Different amounts of light are reflected from amorphous and crystalline areas:
    - High reflectivity (crystalline) = 1s
    - Low reflectivity (amorphous) = 0s
Optical Storage Technology Evolution

**CD**
- $\lambda = 780$ nm
- $NA = 0.45$
- 1.2 mm substrate

**DVD**
- $\lambda = 650$ nm
- $NA = 0.6$
- 0.6 mm substrate

**UDO/Blu-ray**
- $\lambda = 405$ nm
- $NA = 0.7/0.85$
- 0.1 mm cover layer
TEM Image of UDO Write Once
UDO Drives
## UDO Drive Specifications (1 of 2)

<table>
<thead>
<tr>
<th>Performance</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Media load time</td>
<td>5 seconds</td>
</tr>
<tr>
<td>Media unload time</td>
<td>3 seconds</td>
</tr>
<tr>
<td>Average seek time</td>
<td>35 msec</td>
</tr>
<tr>
<td>Maximum sustained read transfer rate</td>
<td>8MB/s</td>
</tr>
<tr>
<td>Maximum sustained write transfer rate</td>
<td>4MB/s (including verify)</td>
</tr>
<tr>
<td>Drive buffer size</td>
<td>32MB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drive operation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Error correction</td>
<td>Reed-Solomon</td>
</tr>
<tr>
<td>Objective lens numerical aperture</td>
<td>0.7NA</td>
</tr>
<tr>
<td>Laser wavelength</td>
<td>405nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions</td>
<td>CISPR 22 Class B (1985)</td>
</tr>
<tr>
<td></td>
<td>EN5502 Class B (1988)</td>
</tr>
<tr>
<td></td>
<td>FCC 47 CFR Part 15 Class B</td>
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<tr>
<td>Safety</td>
<td>UL 1950 IEC950</td>
</tr>
<tr>
<td></td>
<td>IEC825-1 CSA</td>
</tr>
<tr>
<td></td>
<td>950-93 21 CRF</td>
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</table>
## UDO Drive Specifications (2 of 2)

<table>
<thead>
<tr>
<th>Operating conditions</th>
<th>10 to 35°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating humidity</td>
<td>5 to 90% relative humidity (non-condensing)</td>
</tr>
<tr>
<td>Drive orientation</td>
<td>Horizontal or vertical</td>
</tr>
<tr>
<td>Dimensions and weight</td>
<td>H 41.1 x W 146 x D 203 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>Reliability</td>
<td>750K load/unload cycles</td>
</tr>
<tr>
<td>MTBF</td>
<td>100,000 hours</td>
</tr>
<tr>
<td>Drive interface</td>
<td>Wide Ultra 2 LVD SCSI</td>
</tr>
<tr>
<td>SCSI connector</td>
<td>Keyed 68 pin micro-D</td>
</tr>
<tr>
<td>Maximum SCSI transfer rate</td>
<td>40MB/s</td>
</tr>
</tbody>
</table>
## Drive Specs Comparison

<table>
<thead>
<tr>
<th></th>
<th>MO (14X)</th>
<th>UDO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>9.1 Gbytes (4.5 GB per side)</td>
<td>30 Gbytes (15 GB per side)</td>
</tr>
<tr>
<td><strong>Sector Sizes</strong></td>
<td>4KB, 2KB (1KB,512 Byte Emulation)</td>
<td>8 KB</td>
</tr>
<tr>
<td><strong>SCSI Connector</strong></td>
<td>50 pin Ribbon</td>
<td>68 pin Micro-D</td>
</tr>
<tr>
<td><strong>SCSI Bus</strong></td>
<td>Narrow Ultra SE (20 MB/s burst)</td>
<td>Wide Ultra 2 LVD/SE (40 MB/s burst)</td>
</tr>
<tr>
<td><strong>Buffer Size</strong></td>
<td>8 MB</td>
<td>32 MB</td>
</tr>
<tr>
<td><strong>Disk Rotation Rate</strong></td>
<td>3,000 RPM</td>
<td>2,010 Write Once (WO)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,950 ReWriteable (RW)</td>
</tr>
<tr>
<td><strong>Read Sustained Transfer Rate</strong></td>
<td>6.14 MB/s OD</td>
<td>8.0 MB/s OD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.57 MB/s ID WO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.73 MB/s ID RW</td>
</tr>
<tr>
<td><strong>Load Time (typ)</strong></td>
<td>5.5 s</td>
<td>5.0 s</td>
</tr>
<tr>
<td><strong>Unload Time (typ)</strong></td>
<td>3.5 s</td>
<td>3.0 s</td>
</tr>
</tbody>
</table>
## Specifications by Generation

<table>
<thead>
<tr>
<th></th>
<th>Generation 1</th>
<th>Generation 2</th>
<th>Generation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity</strong></td>
<td>30 GB</td>
<td>60 GB</td>
<td>120 GB</td>
</tr>
<tr>
<td><strong>Transfer Rate</strong></td>
<td>8 MB/s</td>
<td>12 MB/s</td>
<td>18 MB/s</td>
</tr>
<tr>
<td><strong>RPM</strong></td>
<td>2000 RPM</td>
<td>3000 RPM</td>
<td>3600 RPM</td>
</tr>
<tr>
<td><strong>Avg Seek Time</strong></td>
<td>35 msec</td>
<td>35 msec</td>
<td>35 msec</td>
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<tr>
<td><strong>Numerical Aperture</strong></td>
<td>0.7</td>
<td>0.7</td>
<td>0.85</td>
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<tr>
<td><strong>Media Layers</strong></td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Encoding</strong></td>
<td>1,7</td>
<td>1,7</td>
<td>ML</td>
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<tr>
<td><strong>Sector Size</strong></td>
<td>8KB</td>
<td>8KB</td>
<td>8KB</td>
</tr>
<tr>
<td><strong>SCSI Transfer Rate</strong></td>
<td>40 MB/s</td>
<td>80 MB/s</td>
<td>80 MB/s</td>
</tr>
<tr>
<td><strong>Load Time</strong></td>
<td>5 seconds</td>
<td>5 seconds</td>
<td>5 seconds</td>
</tr>
<tr>
<td><strong>Unload Time</strong></td>
<td>3 seconds</td>
<td>3 seconds</td>
<td>3 seconds</td>
</tr>
<tr>
<td><strong>MSBF</strong></td>
<td>750,000</td>
<td>750,000</td>
<td>750,000</td>
</tr>
</tbody>
</table>
Automation Changes

- I/O changes
  - LVD only (wide bus)
  - Lun mode is removed
    - Target ID’s 0-15
    - Map scheme is same as current products
    - Mixed media MO drives limited to 0-7
  - New SCSI buffer board and cabling
  - Fibre support (via n1200, m2402)
  - No plans for multi-initiator support

- Firmware/SCSI changes
  - Minimal changes to overall command set
  - Currently, changes limited to Read Element Status functions
    - Slight changes to report drive compatibility information in a mixed media library.
Automation Features Removed

- **Write Verify setting**
  - Drive will be set w/ Write Verify ON
  - Option removed from Front Panel
- **Lun Mode removed**
  - Wide Bus allowing Target ID’s 0-15
  - Option removed from Front Panel
  - Mapping scheme stays the same
  - Mixed media units requires MO drives at 0 - 7
- **Online Drive Repair removed**
  - Rarely implemented
  - Option removed from Front Panel
  - Associated R/W Buffer (128) removed
ISV Support
Optical Markets and Applications

Technologies

- DVD-RAM
- 5.25” MO
- DVD-R
- 5.25” CCW
- 12-inch WORM

Applications

- Voice Recording
- TeleCom
- General Document Management
- Data Warehousing
- Internet / E-Commerce
- Storage Management
- Investment Banking
- Legal
- Financial Records
- Online Publishing
- Medical Imaging
- Data Archiving
- Critical Records/Doc Management
- E-mail Archive
## ISV support

<table>
<thead>
<tr>
<th>ISV</th>
<th>Expected support date (as of 8/9/04)</th>
<th>Mixed Drive Support</th>
<th>Fibre Channel Support</th>
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</thead>
<tbody>
<tr>
<td>ADIC</td>
<td>October 2004</td>
<td>Not in 1st release</td>
<td>TBD</td>
</tr>
<tr>
<td>Comsquared</td>
<td>June 2004</td>
<td>No</td>
<td>No</td>
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<tr>
<td>DST</td>
<td>Launch + 180 days</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>EiStream</td>
<td>June 2004</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>FileNet</td>
<td>December 2004</td>
<td>Not in 1st release</td>
<td>No</td>
</tr>
<tr>
<td>IXOS</td>
<td>December 2004</td>
<td>Not in 1st release</td>
<td>Yes</td>
</tr>
<tr>
<td>KOM</td>
<td>June 2004</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>K-PAR</td>
<td>October 2004</td>
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<td>No</td>
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<tr>
<td>KVS</td>
<td>Support via Qstar</td>
<td></td>
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</tr>
<tr>
<td>Legato (AX)</td>
<td>June 2004</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Legato (DX/DXUL)</td>
<td>June 2004</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Optika</td>
<td>June 2004</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Pegasus</td>
<td>June 2004</td>
<td>Yes</td>
<td>Yes</td>
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<td>PoINT</td>
<td>June 2004</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Qstar</td>
<td>June 2004</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Seven Ten</td>
<td>July 2004</td>
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<td>Yes</td>
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<tr>
<td>Tivoli</td>
<td>Launch + 180 days</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Unisys</td>
<td>Launch + 180 days</td>
<td>TBD</td>
<td>No</td>
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<tr>
<td>US Design</td>
<td>Launch + 180 days</td>
<td>TBD</td>
<td>No</td>
</tr>
<tr>
<td>VERITAS</td>
<td>Support via Pegasus</td>
<td></td>
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</tr>
</tbody>
</table>
Comsquared

- Support for UNIX environments
- Strong U.S. focus
- Focus on Document Imaging solutions
  - Content Manager
    - Image capture
    - Report management
    - Web viewing
EiStream

- Multiple OS support
  - Unix/AIX/Windows
- Good U.S. and European sales/support
  - Previous Wang and Kodak software components
- Enterprise Content Management
  - All encompassing product covering
    - DIM
    - Archiving
    - Email
KOM

- Products for Windows and Unix
  • Also OpenVMS
- Strong Canada/North American presence, just announced A/P capabilities
- File Management
  • Working to position in ILM territory
- Working with HP Strategic Alliances Group
  • Configuring MSA, DL380 and Optical for HIPPA compliance
K-Par

- Windows and Solaris OS support
- Americas and EMEA presence
- Archmedia product
  - Provides transparent archiving
  - Extensive use of caching for speed
  - Good off line media manager
  - Automatic media copy for DR capability
Legato

- Strong WW sales/support
- Strong integration with secondary storage
- EMC affiliation
  - XtenderSolutions family of software
    - AX – Archive Extender
      - Storage management
    - DX – Disk Extender
      - Content management
    - EX – Email Extender
      - Email management (support on UDO w/AX)
- ILM Partner
Optika

– Strong North American presence
– Focusing on ECM solutions
  • Specific targets
    • PeopleSoft & Oracle users
– Recent merger with Stellent
  • Brings larger Content Management suite
    • Employee portals and other line-of-business web sites
Pegasus

- Strong NT/Windows platform
- Seamless virtualization of multiple storage volumes (looks like one big disk)
  - Storage management
- Strong sales as OEM to other ISVs
  - Provides driver capability for VERITAS suite of products allowing easy optical integration with VERITAS
- Working towards non-windows versions
- HP ILM Partner
PoINT

- Support on Windows platforms
- U.S. and European sales/support
- Optical first
  - Uses optical as the first storage medium
  - Then seamlessly migrated to other storage
- UDF file system format
- Large list of supported optical devices
Qstar

- Strong on Unix/Linux platforms
  - Also supports Windows
- Excellent U.S. and European sales/support
  - Works well with channel
  - Working on bringing back Asia/Pacific office
- HSM is their strength
  - Other products provide mirroring
- Provides driver capability for KVS and others
- HP ILM Partner
UDO compared to other storage technologies
Media Positioning for Long-term Data Archival Storage

<table>
<thead>
<tr>
<th>Archival Storage Attributes</th>
<th>RAID</th>
<th>Tape</th>
<th>DVD</th>
<th>MO</th>
<th>UDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>True Write Once Media</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Media Longevity</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Removable Media</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Professional Quality</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Media Capacity</td>
<td>Med/High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Read/Write Speed</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Access / Seek Speed</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Total Archive Cost</td>
<td>High</td>
<td>Low/Med</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>
Storage Technology Positioning

- **RAID**
  - Non-permanent
  - Higher total cost

- **UDO**
  - Permanent
  - Low cost
  - Medium media capacity

- **DVD**
  - Non-permanent
  - Low Cost
  - Low media capacity

- **Tape**
  - Non-permanent
  - Low Cost
  - High media capacity

- **Magneto Optical**
  - Permanent
  - Medium cost
  - Low media capacity
UDO as a part of ILM
Archiving as mean to gain control

archive
1. A place or collection containing records, documents, or other materials of historical interest. Often used in the plural: old land deeds in the municipal archives.
2. A repository for stored memories or information: the archive of the mind.

Which statement best represents your biggest archiving challenge?

- The ability to index, search and retrieve archived e-mail by subject, date, attachment type and other custom criteria: 36%
- Base level compliance with the Sarbanes-Oxley Act, and other requirements: 20%
- Getting the legal department and the IT staff on the same page with regard to how and when archiving is necessary: 20%
- Limiting expenditures and retaining as much existing infrastructure as possible: 13%
- Finding the best mix of archive products for our enterprise: 11%

Source: CMP online survey [www.storagepipeline.com](http://www.storagepipeline.com), March 23, 2004
HP Information Lifecycle Management Architecture

Virtualized Storage Resources

- Disk
- Tape
- Optical

API (CIFS, NFS, Web Svcs)

- Continuous Backup
- HSM
- Disk-to-Disk
- DICOM, HL7

Application Space
- Messaging
- Database
- ORACLE
- Lotus Notes
- MS-Exchange
- Voice
- MS Office
- Voice
- PACS (medical imaging)
- Custom
- AutoCAD
- PeopleSoft
- IP Telephony
- MS-Exchange
- ORACLE
- Lotus Notes
- SAP
- Siebel
- Photos
- MS-Exchange
- ORACLE
- Lotus Notes
- SAP
- Siebel
- Photos

Application Connectors

Policy Management

HP RISS/Storage GRID
HP StorageWorks Optical Jukeboxes

Create & modify
- Online disk arrays HP StorageWorks XP, EVA and MSA1000
- HP StorageWorks NAS portfolio

Replicate & distribute
- Replication: array, host and network based
- Local and remote replication

Protect & recover
- HP OpenView Storage Data Protector
- HP StorageWorks tape libraries and drives

Archive & recall
- HP StorageWorks MO Jukeboxes
- HP StorageWorks Reference Information Storage System

- Services at every stage
- Partnerships to augment our offering in key vertical markets
ILM solutions today: Archive and recall

- There are over 20 orderable HP partnered archive and HSM solutions today with HP StorageWorks MO Jukeboxes
- Solutions include HSM, COLD (computer output to laser disk), email archiving, and document image management solutions
- Designed for customers who value removable media, who are driven by regulatory requirements for WORM functionality and want a proven, tested solution
- Partners include Legato, Pegasus, QStar, IXOS, Veritas, ADIC/AMASS, and KVS
- Majority of ISVs to be certified with UDO
Sample UDO system configurations
Connectivity Types

Router
- Fiber Channel
- M2402 Router
- SCSI

SAN
- Fiber Channel
- M2402 Routers
- SAN - Optics Zone

Cluster

Direct
- SCSI
Data Center Approach

- App Servers
- Database Server
- Archive Servers
- Backup Server
- XP/EVA Disk Arrays
- M2402 Router
- UDO/MO Jukeboxes
- Tape Library
- Fibre Channel

Heterogeneous SAN

Fibre Channel

M2402 Router

SCSI
• UDO leverages next generation optical technology
• proven blue-violet laser/phase change recording
  – High NA optics with aberration correction
  – 0.1mm cover layer disk manufacturing process/equipment
• Quantum leap to 30GB with roadmap to 120GB
• Robust drives and media specifically designed for the professional data archival market
• Media level WORM archival storage
• 5 fold decrease in storage cost over current MO systems
• UDO is the future of professional optical storage
Resources

HP Links
- www.hp.com/go/optical
- www.hp.com/go/udo
- www.hp.com/go/ilm
- www.hp.com/go/storagemedia

UDO Technology Forum
- http://www.udo.com

Cohasset Records Management
- http://www.cohasset.com

Searchstorage.com
- http://www.searchstorage.com

Optical Storage Technology Association
- http://www.osta.org