Hybrid ODD
ODD with SSD Cache

Bob Chang / NOVACHIPS
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Laptop with HDD

2 Spindle based on standard laptop form factor
Today’s Laptop Solutions

Laptop with SSD Replacement

Performance goes up but cost and capacity are traded off
Laptop with Dual Drive Solution

Performance gain with small amount of SSD but requires system design changes

[Higher is Better]
SSD Controller with port multiplier can merge 2 medias into one

Small amount of SSD within ODD to eliminate design complexity and cost within system
Hybrid SSD Usage – NV Cache

Boost up HDD performance by using SSD as a read cache

Concept
Using SSD as Read cache by storing read-only files by host cache control (own device driver). Taking advantages of faster transfer rate and seek-less (SSD), and better data longevity (HDD).

Performance Simulation (vs HDD)

Boost Up!  
PC Booting Time  50~60%  Fast
Multitasking Time *  8x ~ 10x  Fast
Game Loading Time **  2x  Fast
What is HDD Booster?

To speed up HDD performance by using SSD as a read cache managed by HLDS own device driver

What is the user benefit?

Faster PC booting time, multitasking, game loading by just changing ODD to HyDrive
HDD Booster Performance Comparison

Time Checking Benchmark Test

Testing Criteria

- Booting: Shutting Down the system and reboot
- Multitasking: Launch 10 programs simultaneously
- Game Loading: Launch a heavy game

Testing Solutions

- HLDS*: Hybrid ODD with 8GB MLC NAND
- HDD: Western Digital* 500GB 7200 rpm
- SSD: Intel* V40 40GB
- 40GB SSD + Western Digital* 500GB 7200 rpm + Smart Response
- Seagate Momentus XT* 320GB

Test conditions – DT PC

<table>
<thead>
<tr>
<th>PC</th>
<th>INTEL Z68</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel Core i5 520M 2.4GHz</td>
</tr>
<tr>
<td>Memory</td>
<td>8GB</td>
</tr>
<tr>
<td>HDD</td>
<td>Western Digital 500G 7200rpm</td>
</tr>
<tr>
<td>SSD</td>
<td>Intel V40 40GB</td>
</tr>
<tr>
<td>AHCI Driver</td>
<td>v.10.1.0.1008</td>
</tr>
<tr>
<td>HDD Booster</td>
<td>v.0.0.5.1</td>
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HDD Booster Performance Comparison
Booting

DEMO MOVIE: http://www.youtube.com/watch?v=mfxSBGw7wbU
HDD Booster Performance Comparison
Multitasking

DEMO MOVIE: http://www.youtube.com/watch?v=mfxSBGw7wbU
HDD Booster Performance Comparison
Game Loading

DEMO MOVIE: http://www.youtube.com/watch?v=mfxSBGw7wbU
**HDD Booster Performance Result**

Hybrid ODD with “HDD Booster (8GB)”

Offers cost competitiveness with the same performance level as SSD and other caching solutions

*Time Checking Benchmark TEST*

![Bar Chart](image)

**Test conditions – DT PC**

<p>| | |</p>
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Unit: sec
### Price Simulation with Hybrid ODD

<table>
<thead>
<tr>
<th>Processor</th>
<th>Core™ i3-2310M (2.1GHz, 3M Cache)</th>
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</thead>
<tbody>
<tr>
<td>OS</td>
<td>Windows® 7 Professional 64-bit</td>
<td>Windows® 7 Professional 64-bit</td>
<td>Windows® 7 Professional 64-bit</td>
</tr>
<tr>
<td>Memory</td>
<td>2GB (1x2GB) 1333MHz DDR3 SDRAM</td>
<td>2GB (1x2GB) 1333MHz DDR3 SDRAM</td>
<td>2GB (1x2GB) 1333MHz DDR3 SDRAM</td>
</tr>
<tr>
<td>Display</td>
<td>14.0” HD (1366x768) LED</td>
<td>14.0” HD (1366x768) LED</td>
<td>14.0” HD (1366x768) LED</td>
</tr>
<tr>
<td>ODD</td>
<td>8X DVD+/RW Hybrid ODD</td>
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<td>8X DVD+/RW Hybrid ODD</td>
</tr>
<tr>
<td>HDD</td>
<td>250GB 7200RPM HDD</td>
<td>250GB 5400RPM HDD</td>
<td>128GB Solid State Drive</td>
</tr>
<tr>
<td>Graphic</td>
<td>Intel® HD Graphic 3000</td>
<td>Intel® HD Graphic 3000</td>
<td>Intel® HD Graphic 3000</td>
</tr>
<tr>
<td>Battery</td>
<td>6 Cell (60Wh) Battery</td>
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<td>6 Cell (60Wh) Battery</td>
</tr>
<tr>
<td>Network Solution</td>
<td>Dell Wireless™ 1501 (802.11b/g/n Mini card)</td>
<td>Dell Wireless™ 1501 (802.11b/g/n Mini card)</td>
<td>Dell Wireless™ 1501 (802.11b/g/n Mini card)</td>
</tr>
<tr>
<td>Retail Price</td>
<td>$1,425</td>
<td>$1,623</td>
<td>$1,623</td>
</tr>
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</table>

**Note**
- The prices of Dell Latitude E5420* are quoted from dell on-line shop on 2011 July 28
- The price of Hybrid ODD is simulated
Hybrid SSD Value Proposition in Laptop

- **Without System Design Modification**
- **High Capacity**
- **Space Saving**
- **Faster Performance**

SSD Like Performance

- Booting Time
- Multitasking
- Game Loading
Hybrid SSD Value Proposition in Laptop

Current Laptop
(2 Spindle based on standard laptop form factor)
Couldn’t take SSD in compact size, then limited to performance enhancement

Newly created 3Spindle Laptop
(with Hybrid SSD)
Hybrid SSD makes it possible to integrate 3 storage
Hybrid SSD Value Proposition in Desktop

Current Mini PC
(2 Spindle; HDD+ODD, on mini ITX form factor)
Couldn’t take SSD in compact size, then limited to performance enhancement

Newly created 3Spindle Mini PC
(with Hybrid SSD)
Hybrid SSD makes it possible to integrate 3 storage
Hybrid SSD Value Proposition in Application

All-in-One PC

HTPC

Server
Hybrid SSD Value Proposition in Application
Thank you

For Any Questions;
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Email: bobchang@novachips.com