Intel® RAID
Increased Server Performance & Exceptional Data Protection

Fall - Winter 2014
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Why Intel RAID?

1. Broadest Portfolio

   - Software RAID
   - Add-In Cards
   - Modules
   - Expanders

   GOOD | BETTER | BEST

   - 3rd Party RAID
   - Intel RAID

2. Full System Validation

   - HW Compatibility
   - Basic Functionality
   - Full Functionality
   - Supplemental
   - HDD, SSD, Backplane
   - RV, Shock & Vibe
   - Thermal

   1000’s of hours testing to ensure it “just works”
Why Intel RAID?

3. System Optimizations

Examples:
- Dedicated cache backup location in lower temperature regions allow for longer life expectancy
- Special brackets tested for “shock and vibe”

4. Exceptional Go To Market Support

Design-In Consultation

Customizations

Post Sales Support

5. Intel Programs such as AWR and Extended Warranty

No one else offers all this
Product Categories

1. Intel® Embedded Server RAID Technology
   • Software RAID included with Intel® Server Boards with key-enabled RAID 5 upgrade options

2. Intel® RAID Controllers (Standard Add-In Card)
   • Add-in cards designed to provide a wide variety of RAID solutions for Intel® and 3rd party server boards and systems

3. Intel® Integrated RAID Modules
   • Unique mezzanine boards that are designed to add value above that of a standard RAID adapter card for Intel® Server Boards and Systems

4. Intel® RAID Expanders
   • System boards designed to be combined with Intel® RAID Controllers or Intel® Integrated RAID Modules to allow for >8 drives in a system

Tailor a perfect solution for your customer
Mainstream Target Market
Architecture of the Majority of Servers

Intelligent RAID-On-Chip (ROC)-based products

• ROC are the most powerful RAID processors; capable of handling complex RAID parity calculation
• Embedded memory; typically 1GB DDR3
• RAID Levels 0,1,5,6 and Spans 10,50,60
• Best RAID throughput and IOPs
• Best data protection with proven LSI* MegaRAID Technology
• Best tools for management, diagnostics, scale up and scale out

The Right Balance of Performance, Features and Price
# Mainstream Intelligent RAID

## Recommended Products

<table>
<thead>
<tr>
<th>1. For Intel Servers with Storage I/O Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intel® Integrated RAID Module</strong></td>
</tr>
<tr>
<td>RMS3CC080/040</td>
</tr>
<tr>
<td>• LSI 3108 ROC</td>
</tr>
<tr>
<td>• 8 and 4 port models available</td>
</tr>
<tr>
<td>• Unique mezzanine form factor preserves add-in card slot in a 1U/2U system</td>
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<tr>
<td>• Optional MFBU</td>
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</table>

| Price: $590 MSRP (8P model) |

<table>
<thead>
<tr>
<th>2. For All Other Servers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intel® RAID Controller</strong></td>
</tr>
<tr>
<td>RS3DC080/040</td>
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<tr>
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</tr>
<tr>
<td>• MD2 PCIe low profile form factor</td>
</tr>
<tr>
<td>• Optional MFBU</td>
</tr>
</tbody>
</table>

| Price: $645 MSRP (8P model) |
Mainstream Intelligent RAID
System Optimizations

Wildcat Pass Storage I/O Connector
• Allows for RAID while preserving standard PCIe add-in card slots

Maintenance Free Backup Unit
• Dedicated location in lower temperature regions allow for longer life expectancy
• Special brackets tested for “shock and vibe”

Multiple Cable Kits
• Multiple lengths and end types allow for perfect fit in Intel server systems
• Tight bend radii and gold plated connectors deliver high quality
Mainstream Intelligent RAID
Cache backup and MFBU operation

“Write-Back” Cache
- Host writes IO data to RAID adapter, RAID adapter stores data in DRAM (cache), RAID adapter acknowledges write has completed before the data has been transferred from RAID adapter’s DRAM (cache) to the physical disks.

RAID Maintenance Free Backup Module
- Holds controller cache alive during a power outage long enough to copy “dirty” cache to flash memory. When power is restored, dirty cache is written back to controller cache and then flushed to the physical disks.

“Supercap Aging” and the Learn Cycle
- As a Supercap ages, its Capacitance decreases and its Effective Series Resistance (ESR) increases. A Learn Cycle detects these changes, and allows the RMFBU to increase charging voltage which extends the life of the SuperCap pack. If the SuperCap pack fails the learn cycle, it is declared bad and the system is notified of the failure via RWC2 background service (snmp, event log notification, email).
High IOPs
Databases and Virtual Server Applications

**SSD Cache-based products**

- Adds “Supersized” cache to ROC products allowing reads and writes optimization for hard drive-based RAID arrays
- Random writes are sequenced for faster transfer to hard drives
- Hot data is held in cache for quick reads
- Database performance acceleration of 5 to 10X typical
- Performance acceleration of 2 to 5X for many other applications (see backup for details)
- Rebuild in 20% of standard time typical
- Easy to use with near “plug and play” set up

**SSD Cache**

<table>
<thead>
<tr>
<th>Sales</th>
<th>Performance</th>
<th>Data Protection</th>
<th>Management</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best</td>
<td>Better</td>
<td>Good</td>
<td></td>
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</tr>
</tbody>
</table>

Streamline Random IOPs for up to Ten Times Performance
High IOPs

Recommended Products

1. All-in-one

Intel® RAID SSD Cache Controller
RCS25ZB040

- Up to 1TB embedded NAND
- NAND can be partitioned (to use portion for OS/application and remainder for cache)
- Elastic Cache feature optimizes NAND use by mirroring writes, but not reads

$1130 MSRP (256GB NAND model)

2. Detached SSD (separate from RAID card)

Intel® RAID SSD Cache Key
AXXRPFKSSD2

- Upgrades Mainstream RAID products to allow for off-the-shelf SSD to be used as SSD Cache
- Flexible for use with a broad range of SSD
- Does not allow for partitioning of SSD nor Elastic Cache

$230 MSRP
High Drive Count
Expand arrays >8 drives without sacrificing performance

Expander-based Products

- An Expander is basically a “switch” that sends and receives data from a high number of devices

- An Expander needs to be teamed with a 4 or 8 port RAID controller (add-in card or module)

- One Expander typically services 24 to 32 drives; Expanders can be daisy chained for up to 128 drives per a single RAID controller

- SAS-3 Expanders multiplex 6Gb/s inputs and send them to a SAS-3 RAID card at 12Gb/s

- Total solution is typically lower cost than a high port count RAID add-in card (ex. Save $300 on 24-drive solution)

** Expander Board

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>**</td>
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</table>

** Dependent on RAID controller teamed with the expander board
High Drive Count
Recommended Products

1. Intel 2U system with up to 24 x 2.5 drives
   - Intel® RAID Expander RES3TV360
   - 36 total ports; 8 in and 28 out
   - Mid-plane form factor mounts between drive bays and fans in Intel 2U systems
   - Includes short cables to connect expander board to drive backplane
   - $380 MSRP

2. Low profile 2U slot, all other systems and JBOD
   - Intel® RAID Expander RES3FV288
   - 36 total ports; 8 in and 20 out internal plus 8 out external
   - PCIe MD2 low profile form-factor
   - x4 PCIe connector for power; also can be wall mounted with 4-pin power
   - Includes 2 short cables
   - $380 MSRP
Small and Medium Business (Mid-Tier)
Business-critical servers suited to a lower budget

Hybrid I/O Controller (IOC) Based Products

- Less powerful processor than ROC, but...
- Plenty of performance for a small number of hard drives (4 to 6)
- Hardware RAID 0,1,10 with option for Hybrid RAID 5,50 (Hybrid RAID is firmware based, but requires Xeon and 128MB server memory resources)
- Same management tools and capabilities as Mainstream (ROC-based) products
- Priced $200 to $400 below Mainstream

Hybrid IOC

<table>
<thead>
<tr>
<th></th>
<th>Sales</th>
<th>Performance</th>
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<th>Management</th>
<th>Price</th>
</tr>
</thead>
</table>
| Advanced Management for Ease of Use and Flexibility

Best
Better
Good
# Small and Medium Business
## Recommended Mid-Tier RAID Products

<table>
<thead>
<tr>
<th>1. For Intel Servers with Storage I/O Connectors</th>
<th>2. For Cottonwood Pass SAS Server Board</th>
<th>3. For all other servers</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Intel® Integrated RAID Module RMS3HC080" /></td>
<td><img src="image2.png" alt="Intel® RAID Premium Feature Key AXXRPFKHY5" /></td>
<td><img src="image3.png" alt="Intel® RAID Controller RS3WC080" /></td>
</tr>
<tr>
<td><strong>Intel® Integrated RAID Module RMS3HC080</strong></td>
<td><strong>Intel® RAID Premium Feature Key AXXRPFKHY5</strong></td>
<td><strong>Intel® RAID Controller RS3WC080</strong></td>
</tr>
<tr>
<td>- LSI 3008 I/O Controller</td>
<td>- Enables Hybrid RAID 5/50 capabilities with Cottonwood SAS server board</td>
<td>- LSI 3008 I/O Controller</td>
</tr>
<tr>
<td>- 8 port internal</td>
<td>- RAID 5 allows for better use of drive capacity and higher performance for many solutions vs. RAID 1/10</td>
<td>- 8 port internal</td>
</tr>
<tr>
<td>- Advanced RAID and JBOD modes</td>
<td></td>
<td>- Approximately 3 times better performance than RS2WC080 for 8 x 6Gb/s target devices</td>
</tr>
<tr>
<td>- Unique mezzanine form factor preserves add-in card slot in a 1U/2U system</td>
<td></td>
<td>- Advanced management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price</th>
<th>Price</th>
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<tbody>
<tr>
<td>$300 MSRP</td>
<td>$125 MSRP</td>
<td>$315 MSRP</td>
</tr>
</tbody>
</table>
Entry-level
OS Mirroring or JBOD (Pass-through SAS) mode typical

Entry I/O Controller (IOC) Based Products

- Low performance processor and limited management features
- Hardware RAID 0,1,1E and JBOD mode
- Lowest priced hardware RAID option
- Often used for mirroring an OS or for attaching SAS drives to a server that does not require intelligent hardware RAID functionality

Basic RAID Capability for Budget Oriented Solutions
Entry-Level
Top OS Mirror and JBOD Mode Products

1. For Intel Servers with Storage I/O Connectors

   **Intel® Integrated RAID Module RMS3JC080**
   - LSI 3008 I/O Controller
   - 12Gb/s SAS 3.0 compliant
   - Unique mezzanine form factor preserves add-in card slot in a 1U/2U system
   
   **$245 MSRP**

2. For Other Servers

   **Intel® RAID Controller RS3UC080**
   - LSI 3008 I/O Controller
   - 12Gb/s SAS 3.0 compliant
   - Up to 1M IOPs in JBOD mode

   **$265 MSRP**
RS3 RAID 5 Read Performance

ROC-based Products

Max IOPs**

~750K IOPS

Max Throughput**
(MB/s)

~6.6K MB/s

= RS3 Family (12G SAS-3 ROC Products)
= Intel RS25 ROC Family (RMS25CB080)
= Intel SAS 1.0 ROC (SRCSASJV)

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Premium Features
Enabling SSD Cache, Disk Encryption Mgt & High Availability

Ready to go in minutes:

1. Add Premium Feature Key to Intel SAS-2 Mainstream or Scalable Performance RAID card

2. Connect appropriate devices (drives or JBOD)

3. Configure as appropriate in Intel RAID Web Console**

** Special firmware must be flashed onto the RAID product for High Availability. See instructions that ship with the High Availability upgrade kit.
SSD Cache

Upgrade Key allows for SSD benefits without a full array of SSD
Disk Encryption Management

- **Auto-Lock**
  - The drive locks, and the data is secured, the moment a drive is removed from a system
  - Makes data unreadable and useless to anyone who is not authorized to access it

- **Instant Erase**
  - <1 second sanitization of hard drive data for secure disposal or reuse of drive

Significantly Reduce the Chance of Data Being Compromised
High Availability

SAN Storage Based Solution
Two Servers + SAN + External Storage
Two External RAID Controllers
Complex set-up configuration and interoperability, expensive cables, etc.
Decent performance and latency

Intel RAID High Availability Solution
Two Intel Servers* + JBOD
Two Intel RAID High Availability Controllers
DAS simplicity
Lower latency and higher performance

A simpler, less expensive alternative to protect against server failure
For more information...

www.intel.com/go/RAID
Backup Information

Backup content is included in the following slides...
## Naming Convention

| Intel® | Integrated RAID Module | R | M | S | 3 | C | C | 0 | 8 | 0 |
|--------|------------------------|---|---|---|---|---|---|---|---|---|---|
| **Brand Prefix** | Intel® | | | | | | | | | | |
| **Suffix Suffix** | RAID Controller, Integrated RAID Module, Expander, or RAID SSD Cache Controller | | | | | | | | | | |
| **Type** | R = Standard Add-In Card | RM = Module | RE = Expander | RC = SSD Cache | | | | | | |
| **Architecture** | S3 = SAS-3; T3 = SATA-3 | | | | | | | | | | |
| **Codename** | CC = Coffee Canyon | | | | | | | | | | |
| **Internal Ports** | 08 for 8 ports | | | | | | | | | | |
| **External Ports** | 0 for 0 ports | | | | | | | | | | |

**Grantley generation codename transition: Beach to Canyon (XB → XC)**
- Example: RS25DB080 → RS3DC080
- More details on transition slide (Page 25)
## Grantley Transition Guidance

**Beach to Canyon (XB to XC**)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Romley</th>
<th>Grantley</th>
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</thead>
<tbody>
<tr>
<td>Integrated RAID</td>
<td>RMS25CB080</td>
<td>RMS3CC080</td>
</tr>
<tr>
<td></td>
<td>RMS25CB040</td>
<td>RMS3CC040</td>
</tr>
<tr>
<td></td>
<td>RMS25JB080</td>
<td>RMS3HC080 or RMS3JC080</td>
</tr>
<tr>
<td></td>
<td>RMS25JB040</td>
<td>RMS25JB040</td>
</tr>
<tr>
<td>Add-In Controller Card</td>
<td>RS25SB008</td>
<td>RS3SC008</td>
</tr>
<tr>
<td></td>
<td>RMS25AB080</td>
<td>RS3DC080</td>
</tr>
<tr>
<td></td>
<td>RMS25DB080</td>
<td>RS3DC080</td>
</tr>
<tr>
<td></td>
<td>RS2BL040</td>
<td>RS3DC040</td>
</tr>
<tr>
<td></td>
<td>RS2WC080</td>
<td>RS3WC080</td>
</tr>
<tr>
<td>Expander</td>
<td>RES2SV240</td>
<td>RES3FV288</td>
</tr>
<tr>
<td>SAS RAID Key</td>
<td>RKSAS8R5</td>
<td>RMS3JC080 or RS3UC080</td>
</tr>
</tbody>
</table>

**RED TEXT indicates exceptions to this “rule of thumb”**
Mainstream and Scalable Performance Add-In Cards

**RS3DC080**
- 8 Internal Ports
- LSI 3108 ROC
- 1GB DDR3 1866MHz
- Advanced Mgt
- Use for RAID 5,6 within the server

**RS3DC040**
- 4 Internal Ports
- LSI 3108 ROC
- 1GB DDR3 1866MHz
- Advanced Mgt
- Use for RAID 5 in 1U 3.5” drive-based or half-width systems

**RS3SC008**
- 8 External Ports
- LSI 3108 ROC
- 1GB DDR3 1866MHz
- Advanced Mgt
- Use for RAID 5,6 within JBOD storage (Virtual RBOD)

**RS3MC044**
- 4I & 4E Ports
- LSI 3108 ROC
- 1GB DDR3 1866MHz
- Advanced Mgt
- Use for **high flexibility** w/ RAID inside and external to server

Add Maintenance Free Backup Unit AXRMRBU4 to any of the above products for cache backup

**12G SAS-3 with up to 750M IOPs in RAID mode**
Integrated RAID Modules

**RMS3CC080/040**
- 8 or 4 Internal Ports
- LSI 3108 ROC
- Use for **intelligent RAID 0,1,5,6,10,50,60** while preserving add-in card slot in 1U or 2U system

**RMS3HC080**
- 8 Internal Ports
- LSI 3008 IOC
- Use for **advanced management** with RAID 0,1,10 and **Hybrid RAID 5/50** in 1U or 2U system

**RMS3JC080**
- 8 Internal Ports
- LSI 3008 IOC
- Use for **simple RAID 0,1,1E or JBOD mode** while preserving add-in card slot in 1U or 2U system

Preserve an add-in card slot and offer cost savings
Expander Overview:

**RES3FV288**
- 28 internal and 4 external ports
- Low profile form factor
- Power from PCIe slot or 4-pin power connector
- Allows RAID card performance optimization

**RES3TV360**
- 36 total ports
- Mid-plane form factor
- Power from 4-pin power connector
- Allows RAID card performance optimization

Bandwidth aggregation allows 12G performance with 6G devices