These release notes contain supplemental information about EMC Virtual Provisioning version 04.30.000.5.511. Topics include:

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Revision history

The following table presents the revision history of this document.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A04</td>
<td>February 25, 2011</td>
<td>Update for patch release</td>
</tr>
<tr>
<td>A03</td>
<td>December 17, 2010</td>
<td>Updates for patch release</td>
</tr>
<tr>
<td>A02</td>
<td>September 10, 2010</td>
<td>Updates to “Fixed Problems” and “Known Problems and Limitations”</td>
</tr>
<tr>
<td>A01</td>
<td>August 11, 2010</td>
<td>Initial release</td>
</tr>
</tbody>
</table>

Product description

This release of EMC® Virtual Provisioning™ software provides several new features, including expanded ease of provisioning, auto-tiering, and compression.

Virtual Provisioning

EMC Virtual Provisioning software provides simplified storage provisioning. To accomplish this, all LUNs are provisioned out of a storage pool, thereby simplifying the creation and allocation of the storage capacity. The basic elements of Virtual Provisioning used to allocate the storage are storage pools, fully provisioned LUNs, and thinly provisioned LUNs. For thinly provisioned LUNs, you need to install the Thin Provisioning enabler on the storage system. All LUNs in a storage pool support shrink and expand operations. Virtual provisioning can allocate storage from pools that have mixed drives and different performance characteristics by assigning a tier preference to the LUN.

Storage pools

A storage pool is a set of disks with the same RAID protection (RAID 5, RAID 6 or RAID 1/0 only). A storage pool shares its user capacity with one or more pool LUNs. You can expand the user capacity by adding more disks to the storage pool. Since all LUNs are created from a storage pool, the storage behaves very much like a traditional LUN because the storage is assigned from the shared storage pool.
Thick LUNs

A thick LUN is a logical unit of storage created within a storage pool. This specific LUN is a fully provisioned LUN that reserves the physical storage of the LUN size from the storage pool, when the LUN is created. You can shrink or expand a thick LUN.

Thin LUNs

A thin LUN is a logical unit of storage created within a thin pool. Unlike thick LUNs, it does not reserve storage at the time of LUN creation. Instead, it consumes physical storage from the thin pool only when data is written to it and competes with other thin LUNs in the pool for available thin pool storage. The host-visible size of the thin LUN is independent of the available physical storage in the thin pool. You can shrink or expand thin LUNs.

Limits

The following tables list the maximum pool capacities. Table 1 lists the storage pool limits.

<table>
<thead>
<tr>
<th>Storage pool limits</th>
<th>CX4-960</th>
<th>CX4-480</th>
<th>CX4-240</th>
<th>CX4-120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of storage pools</td>
<td>60</td>
<td>40</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Maximum number of disks in a storage pool</td>
<td>955</td>
<td>475</td>
<td>235</td>
<td>115</td>
</tr>
<tr>
<td>Maximum number of usable disks for all storage pools</td>
<td>955</td>
<td>475</td>
<td>235</td>
<td>115</td>
</tr>
<tr>
<td>Maximum number of disks that can be added to a pool at a time</td>
<td>180</td>
<td>120</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>Maximum number of pool LUNs per storage pool</td>
<td>2048</td>
<td>2048</td>
<td>1024</td>
<td>512</td>
</tr>
</tbody>
</table>

Table 1 lists the Pool LUN limits.

<table>
<thead>
<tr>
<th>Pool LUN limits</th>
<th>CX4-960</th>
<th>CX4-480</th>
<th>CX4-240</th>
<th>CX4-120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum user capacity</td>
<td>1 block</td>
<td>1 block</td>
<td>1 block</td>
<td>1 block</td>
</tr>
<tr>
<td>Maximum user capacity</td>
<td>14 TB</td>
<td>14 TB</td>
<td>14 TB</td>
<td>14 TB</td>
</tr>
<tr>
<td>Maximum number of pool LUNs per storage system</td>
<td>2048</td>
<td>2048</td>
<td>1024</td>
<td>512</td>
</tr>
</tbody>
</table>
Easy-to-use web-based application

Virtual Provisioning is integrated into EMC Unisphere® software, the easy-to-use, web-based management tool for the EMC CLARiiON® storage systems. Unisphere lets you easily configure and manage storage pools and LUNs.

Managing Virtual Provisioning

To manage Virtual Provisioning, you can use either the UI-based Unisphere or EMC Navisphere® Secure CLI as described in the Unisphere help.

Use with other CLARiiON software

If the storage system supports replication technology, such as EMC SnapView™, EMC Virtual LUN Migration, EMC MirrorView™, EMC SAN Copy™, or EMC RecoverPoint Splitter, you can use these replication technologies with pool LUNs in the same way that you use them with traditional LUNs.

Use with Unisphere Quality of Service Manager software

I/O to thin LUNs exhibits different behavior from traditional LUNs. The response time of I/O to thin LUNs is not as predictable as traditional LUNs and is more difficult for the control algorithms to manage. When thin LUNs are in an I/O class, you will see slightly longer times set on cruise control policies and wider variations in limits policies. Cruise control policies with narrow tolerances can be expected to fail more frequently. Wider tolerances will deliver better results.

New features and enhancements

The following new features or enhancements have been added in this release:

- Thick LUNs
- LUN expand and shrink
- Tiering preference
- Per-tier tracking support of pool usage
- RAID 1/0 support for pools
- Increased limits for drive usage in pools
Environment and system requirements

Hardware

This version of software runs on the following EMC CX4™ series storage systems: CX4-960, CX4-480, CX4-240, and CX4-120 storage systems.

Storage-system software

This version of EMC Virtual Provisioning requires EMC FLARE® Operating Environment version 04.30.000.5.xxx. In addition, if you want to create and manage thin LUNs, you must install the Thin Provisioning enabler version 01.01.5.001. However, you do not need this enabler to create and manage storage pools or thick LUNs.

Unisphere management software

Virtual Provisioning is compatible with the following minimum revisions of EMC Unisphere management software:

- Navisphere Secure CLI 7.30.0.x.x
- Unisphere 1.0.0

Fixed problems

This section lists significant problems that users encountered in earlier versions and describes the solutions that this new version provides.

Visit the EMC Powerlink® Issue Tracker website at http://Powerlink.EMC.com for the most recent updates and information on previous Auto Tiering versions.
# Troubleshooting and getting help

## Problems fixed in version 04.30.000.5.511

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
</table>
| All supported platforms    | Trespassing a FAST cache enabled pool LUN may result in a single storage processor bugcheck (0xe117b264) or the LUN failing to enable. 38191504/397153 38249280/398938 38599124/400350 38733948/401441 | Trespassing a FAST cache enabled pool LUN may result in a single storage processor bugcheck (0xe117b264) or the LUN failing to enable if an I/O request is cancelled during the trespass. | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
| All supported platforms    | I/O requests to pool LUNs can fail. 395166, 396757, 403198                       | Incorrect handling of internal resources results in performance degradation and ultimately inability to service I/O requests. | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
| All supported platforms    | Unexpected storage processor reboot. (various codes) 395529, 404011, 404231, 403582, 403168 | Sequential I/O to pool LUNs can result in an internal resource becoming exhausted, resulting in a storage processor reboot. | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
| All supported platforms    | Storage processor reboots unexpectedly (code 0x7e) 398499, 397840, 397193        | When a commit operation is done, following an upgrade from FLARE 29 to FLARE 30, a storage processor may reboot unexpectedly. | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
## Troubleshooting and getting help

### EMC® Virtual Provisioning™ for FLARE OE Version 04.30.000.5.511 Release Note

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
</table>
| All supported platforms | Memory leak in Virtual Provisioning feature can lead to management restarts or SP Panics. 38442962 / 399255 38809228 / 402243 38825338 / 402934 38703796 / 403149 Frequency of occurrence: Always under a specific set of circumstances. Severity: Medium | Memory leak in Virtual Provisioning feature can lead to management restarts or SP Panics. | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |

### Problems fixed in version 04.30.000.5.509

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
</table>
| All supported platforms | Space not reclaimed after LUN shrink. 381959 Frequency of occurrence: Always under a specific set of circumstances. Severity: Medium | If a LUN exists before a storage system is upgraded to FLARE Release 30, and is then shrunk, the space saved is not made available for reuse | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
| All supported platforms | Can’t create thin LUNs 37395890 / 389018 Frequency of occurrence: Unlikely under a specific set of circumstances. Severity: Critical | Following an upgrade to FLARE Release 30 and a commit, in some cases thin LUNs can no longer be created | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
| All supported platforms | Thin LUN may become inaccessible after an NDU 37010678 / 385377 Frequency of occurrence: Unlikely under a specific set of circumstances. Severity: Critical | If I/O is ongoing during an upgrade to FLARE Release 30, the upgrade may fail and leave thin LUNs inaccessible | Fixed in code  
Exists in versions:  
04.30.000.5.004  
04.30.000.5.005  
04.30.000.5.509  
Fixed in version:  
04.30.000.5.511 |
## Troubleshooting and getting help

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>Alerts that a pool is becoming full are not generated &lt;br&gt; 37075318 / 387037 &lt;br&gt; 37184264 / 387424 &lt;br&gt; <strong>Frequency of occurrence:</strong> Likely under a specific set of circumstances. &lt;br&gt; <strong>Severity:</strong> Medium</td>
<td>Following an upgrade to FLARE Release 30, Unisphere may fail to display alerts as a pool becomes full, possibly allowing the pool to become full without notification</td>
<td>Fixed in code &lt;br&gt; Exists in versions: &lt;br&gt; 04.30.000.5.004 &lt;br&gt; 04.30.000.5.005 &lt;br&gt; Fixed in version: &lt;br&gt; 04.30.000.5.509</td>
</tr>
<tr>
<td>All supported platforms</td>
<td>Thin LUN recovery can fail 36450378 / 381193 &lt;br&gt; <strong>Frequency of occurrence:</strong> Unlikely under a specific set of circumstances. &lt;br&gt; <strong>Severity:</strong> Critical</td>
<td>Recovery of a thin LUN can fail, resulting in loss of data from the LUN</td>
<td>Fixed in code &lt;br&gt; Exists in versions: &lt;br&gt; 04.30.000.5.004 &lt;br&gt; 04.30.000.5.005 &lt;br&gt; Fixed in version: &lt;br&gt; 04.30.000.5.509</td>
</tr>
</tbody>
</table>

### Problems fixed in version 04.30.000.5.005

- Possible impact to pre-existing Thin LUNs after NDU to R30 software. 381817<br> **Frequency of occurrence:** Infrequent <br> **Severity:** High | After an upgrade to R30, any storage allocated to a pre-existing Thin LUN could potentially be freed if the SP owning the Thin LUN is rebooted prior to commit of R30 software. | Fixed in code. <br> Fixed in version: <br> 04.30.000.5.005 <br> Exists in versions: <br> 04.30.000.5.004 |

### Problems fixed in version 04.30.000.5.004

This is the initial release of Virtual Provisioning for thick LUNs.

The following table describes the solutions for various problems with thin provisioning.

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>A single SP panic may occur after recovering thin LUNs that were cache dirty. 234605 &lt;br&gt; <strong>Frequency of occurrence:</strong> Rare &lt;br&gt; <strong>Severity:</strong> Medium</td>
<td>Fixing cache dirty conditions could result in a data inconsistency that leaves the SP vulnerable to the panic on a rare timing related condition.</td>
<td>Fixed in code. &lt;br&gt; Fixed in version: &lt;br&gt; 04.30.000.5.004 &lt;br&gt; Exists in versions: &lt;br&gt; 04.29.000.5.001 &lt;br&gt; 04.28.000.5.501 &lt;br&gt; 04.28.000.5.504 &lt;br&gt; 04.28.000.5.704</td>
</tr>
</tbody>
</table>
## Troubleshooting and getting help

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
</table>
| All supported      | A single SP panic can occur if the CPU usage is above 80% and more than 1000 thin LUNs are present on the storage system. The following events may trigger this panic:  
- Enabling/disabling performance statistics.  
- Enabling/disabling cache settings.  
- Disk failures.  
- Back-end bus failures.  
231270  
Frequency of occurrence: Rare  
Severity: Medium | When a very high CPU load exists on a storage system in a large configuration, the extra load that the events generate is not serviced fast enough and causes a timeout. | Fixed in code.  
Fixed in version:  
04.30.000.5.004  
Exists in versions:  
04.29.000.5.001  
04.28.000.5.501  
04.28.000.5.504  
04.28.000.5.704 |
| platforms          |                                                                                   |                                                                                      |                                                               |
| All supported      | Thin LUNs being destroyed are not displayed under the thin pool that owns the LUNs in Unisphere.  
217247  
Frequency of occurrence: Always  
Severity: Low | The association between the thin LUN and its thin pool is not displayed in the UI while the thin LUN is being destroyed. This may lead you to believe that the thin pool no longer has the thin LUN although the LUN is still in the process of being destroyed. | Fixed in code.  
Fixed in version:  
04.30.000.5.004  
Exists in version:  
04.29.000.5.001 |
| platforms          | Failed thin pool expansion operations must be cancelled before the thin pool can be destroyed.  
211695  
Frequency of occurrence: Frequently  
Severity: Low | If a thin pool expansion operation fails for any reason, you cancel the failed thin pool expansion before the thin pool can be destroyed. If you attempt to destroy a thin pool that has a failed expansion, the thin pool will not be destroyed and you will see an error message indicating that you must cancel the failed expansion first. | Fixed in code.  
Fixed in version:  
04.30.000.5.004  
Exists in versions:  
04.29.000.5.001  
04.28.000.5.501  
04.28.000.5.504  
04.28.000.5.704 |
Troubleshooting and getting help

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Solution (or workaround)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>A single-SP panic may occur under a heavy I/O load to a large number of thin LUNs (more than 100). 221954 Frequency of occurrence: Likely under a specific set of circumstances Severity: Medium</td>
<td>If many writes on a large number of thin LUNs hit a specific boundary condition at the same time on all thin LUNs, a single SP panic is possible.</td>
<td>Fixed in code. Fixed in version: 04.30.000.5.004 Exists in versions: 04.29.000.5.001 04.28.000.5.501 04.28.000.5.504 04.28.000.5.704</td>
</tr>
</tbody>
</table>

Known problems and limitations

This section identifies:
- Current bugs likely to be of interest to all customers
- Functionality that is intentionally not included, but may be expected
- Issues that may arise, such as known performance limits under certain conditions

Visit the EMC Powerlink Issue Tracker website at http://Powerlink.EMC.com for the most recent updates and information on previous Auto Tiering versions.

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Prevention/resolution or workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>Thin LUNs and thin pools are not reported as Faulted after a single SP back-end path failure to a thin pool. 204861 Frequency of occurrence: Infrequent Severity: Low</td>
<td>If a single SP back-end path failure occurs to one or more drives that make up a thin pool, the thin pool and its thin LUNs may not transition to the Faulted state.</td>
<td>If there is a single SP back-end path failure to drives in a thin pool, an alert will be generated to inform you of the failure(s). Exists in versions: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
</tbody>
</table>
## Troubleshooting and Getting Help

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Prevention/resolution or workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>The pool LUN is reported as READY instead of NOT READY when the pool the LUN belongs to requires recovery. 373411</td>
<td>The LUN may report its status as READY when a pool requires recovery. This causes migration to be stuck once the pool comes online.</td>
<td>If any interrupted LUN migrations do not automatically restart after a pool comes back online, manually trespass the migrating LUN to restart the migration. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
<tr>
<td></td>
<td>Frequency of occurrence: Likely under a specific set of circumstances. Severity: Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All supported platforms</td>
<td>The pool may never be reported as 100% consumed, even after receiving I/O errors, because there is no pool space. 372356</td>
<td>Even after all the available storage has been consumed from a pool, it may continue to report 99% consumption while failing writes that require additional storage to be allocated.</td>
<td>To avoid write failures due to unavailable pool storage, proactively add new storage or free up storage to a pool once alerts that indicate the available pool space is getting low are generated. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
<tr>
<td></td>
<td>Frequency of occurrence: Likely under a specific set of circumstances. Severity: Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All supported platforms</td>
<td>Active LUN shrink and LUN expansion operations may fail with status 0xc0000010 after an SP failure with heavy I/O in progress occurs. 371961</td>
<td>Once a LUN shrink or LUN expansion resumes on the peer SP after an SP failure, the SP will attempt to quiesce the LUN. If an evacuation operation is in progress on the LUN when the SP attempts to quiesce that LUN, the evacuation operation will fail.</td>
<td>If a LUN shrink or LUN expansion operation fails with status 0xc0000010, manually trespassing the LUN will resume the failed operation. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
<tr>
<td></td>
<td>Frequency of occurrence: Likely under a specific set of circumstances. Severity: Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EMC® Virtual Provisioning™ for FLARE OE Version 04.30.000.5.511 Release Notes
## Platforms

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Prevention/resolution or workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported</td>
<td>The pool creation may fail if it is running while the peer SP is booting.</td>
<td>A timing window exists where the creation of internal components of the pool may fail while the peer SP is booting. If this component creation is performed as part of a pool creation, the operation will fail and will display this error Bind request failed because it was rejected by the peer SP board.</td>
<td>If a pool creation fails with the error message Bind request failed because it was rejected by the peer SP board, delete the failed pool, wait for the peer SP to complete booting, and retry the pool creation operation. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
<tr>
<td>platforms</td>
<td>350674</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency of occurrence: Likely under a specific set of circumstances.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severity: Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expected storage may not be returned to the pool after a LUN shrink operation.</td>
<td>For performance optimization, the storage is prefetched for pool LUNs. Therefore, shrinking a LUN will not return all the storage previously assigned to the &quot;shrunken&quot; portion of the LUN.</td>
<td>No exact solution exists for this particular issue. However, if you need to add more storage to a pool, you can expand the pool by adding drives or free more storage by shrinking or deleting LUNs. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
<tr>
<td></td>
<td>349167</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency of occurrence: Likely under a specific set of circumstances.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severity: Low</td>
<td></td>
<td></td>
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</tbody>
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## Troubleshooting and getting help

### EMС® Virtual Provisioning™ for FLARE OE Version 04.30.000.5.511 Release Note

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<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
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</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>A single SP panic can occur while I/O is in progress on a storage system that has maximum thin LUNs. 369144</td>
<td>On a storage system with the maximum number of thin LUNs and with many thin LUNs consuming the maximum capacity, I/O that occurs in a certain pattern to thin LUNs that are not 100% consumed can cause a single SP panic. If the I/O is sent in a burst to a large set of thin LUNs, and then to another large set of thin LUNs and so on, memory exhaustion can occur, causing an SP to panic. The SP will return to functioning as usual after the panic and will behave normally. The peer SP will continue to service the I/O to all thin LUNs until the SP returns to normal functioning.</td>
<td>Avoid writing to thin LUNs in the pattern defined in the &quot;Problem description&quot; section. If an SP panic occurs because data is written in this particular pattern, the SP will return to its usual functioning and behave normally. The peer SP will continue to service the I/O to all thin LUNs. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
<tr>
<td>All supported platforms</td>
<td>I/O to pool LUNs may receive a busy status during trespassing of 1024 mirrored thick LUNs with heavy I/O going to the LUNs. 368420</td>
<td>You can encounter this error when the system is very busy due to heavy I/O or to hundreds of mirrored pool LUNs trespassing at the same time. This situation causes pool LUN objects to deactivate and activate on the peer SP. Due to the large number of these objects and the heavy I/O load, the system returns a busy status during I/O until the objects reach ready state.</td>
<td>Avoid trespassing the maximum number of pool LUNs at the same time while the storage system is under a heavy I/O load. Once the LUNs have successfully trespassed, you can resume the heavy I/O load. Exists in version: 04.30.000.5.004 04.30.000.5.005 04.30.000.5.507 04.30.000.5.509 04.30.000.5.511</td>
</tr>
</tbody>
</table>
### Troubleshooting and getting help

<table>
<thead>
<tr>
<th>Platforms</th>
<th>Symptom details</th>
<th>Problem description</th>
<th>Prevention/resolution or workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>All supported platforms</td>
<td>After an upgrade to version 04.30, any storage deallocated from a pre-existing thin LUN is available for reuse only to that thin LUN. <strong>381959, 382132</strong></td>
<td>After an upgrade to version 04.30, any storage deallocated from a pre-existing thin LUN (as a result of the shrinking of a pre-existing thin LUN or doing WRITE_SAME zeroes to a pre-existing thin LUN) is available only to that thin LUN for reuse when that storage should be available to all thin LUNs in the pool.</td>
<td>Create a new Thin LUN after committing the R30 code base and migrate the pre-existing Thin LUN to it. This will allow the deallocated storage to be returned back to the pool for other Thin LUNs in the pool to use. <strong>Exists in version:</strong> 04.30.000.5.004, 04.30.000.5.005, 04.30.000.5.507, 04.30.000.5.509, 04.30.000.5.511</td>
</tr>
</tbody>
</table>

### Technical notes

This section includes information that is important and does not appear anywhere else.

#### Generic notes (apply to all platforms)

- **Storage pools and vault drives**
  
  You cannot use the vault drives (the first five drives in a storage system) to create or expand a storage pool.

- **Available space in a storage pool**
  
  When you destroy or shrink a pool LUN, available space in a storage pool is not updated immediately. Although you can no longer see the pool LUN or the old LUN size, the space it had consumed is incrementally added back to the storage pool in a background process.

- **Pool consumption alerts and thick LUNs**
  
  Alerts are generated when a storage pool’s consumption threshold has been reached, as well as at regular intervals, until the pool runs out of space. This gives storage administrators time to either add new storage to the pool, or free up storage currently allocated from the pool. However, if you create a large thick LUN which consumes the remaining storage in a pool, storage administrators may not have sufficient time to add storage before write failures begin occurring to the thin LUN in that pool.
• **SnapView rollback limit**  
  Limit the number of SnapView rollbacks in progress at one time to 64. If more than 64 rollbacks are in progress at one time, a single SP panic may occur. (208424)

• **Host interaction**  
  Plan for the intended growth rate of pool LUNs and have contingencies for over-provisioning. By doing this, you can set a consumption threshold for generating warnings to help monitor storage pool usage. For example, warnings can be set when the pool consumption goes above 75 percent of its capacity, that is, when only 25 percent free space is remaining in the pool. When the pool LUNs associated with the storage pool consumes all the available space from the pool, any writes to a thin LUN region that is unallocated will fail. Under these conditions, host applications may produce unexpected failures.

  The used space reported by Navisphere for a thin LUN can vary from the usage reported by the OS on an attached host, depending on the operating system and where the operating system chooses to write.

  Solaris native multipath failover, known as MPxIO or StorEdge Traffic Manager (STMS), cannot take control of thin LUNs in the storage system’s default Active/Passive (PNR) failover mode. The workaround is for MPxIO to take control of thin LUNs in ALUA failover mode (Failover Mode = 4).

• **Maximum limits**  
  A system configured with the maximum number of pool LUNs supported on that platform may not be able to support the creation of the maximum number of all replication objects (clones, snapshots, and so on) due to resource exhaustion.

  Similarly, a system configured with the maximum number of replication objects (clones, snapshots, and so on) may not be able to support the creation of the maximum number of pool LUNs. (209108, 209538)

• **LUN IDs**  
  If you assign a LUN ID of 2000 or higher, you may receive a message that this ID is already being used by a private FLARE LUN. If you receive this message, assign a new ID to the LUN, preferably one that is 1999 or lower. (210421)
• **Write cache disabled**
  If you run a storage system with the write cache disabled, it may take several minutes to complete certain storage pool and pool LUN operations. Disabling the write cache may also result in the timeout of host I/O.

• **Deleting an offline pool**
  If a storage pool that contains LUNs is offline, and cannot be brought back online, you will not be able to destroy the pool. A service call will be required to clean up the failed pool and its LUNs.

• **Deleting LUNs in an offline pool**
  If you delete a LUN in an offline pool, the system will only mark the LUN to be deleted. The LUN will not be deleted until the storage pool comes back online. When this happens, the pool will automatically destroy the LUN. There is no way to determine if a LUN in an offline storage pool has been marked for deletion.

• **Thick LUN consumption per tier**
  When you create a thick LUN, the pool storage required for that thick LUN is not actually allocated, but rather it is reserved. Since these reservations are based on the pool rather than the tier, this reserved storage is not reflected in the tier breakdown at the thick LUN level until the thick LUN is written to and the storage is actually allocated.

  Additionally, when you set a tiering preference for a thick LUN, the storage is reserved for the LUN only, even if the thick LUN appears to be fully provisioned. Since these reservations are not made on a per-tier level, by the time the data is actually allocated to the thick LUN as the result of a write, the originally requested tier of storage may no longer be available. If you enable FAST, this problem will be resolved during subsequent relocations.

• **Pool LUNs and replication private LUNs**
  You cannot use pool LUNs as private LUNs (Clones Private LUN, MirrorView Write Intent Log LUN) for SnapView and MirrorView replication software. You cannot use thin LUNs in a reserved LUN pool.

• **Pool LUN offset**
  Pool LUNs that are a maximum size (14 TB) and have an offset greater than 2 TB do not support compression.
Pool management
In order to create a pool with the maximum number of drives, you must add some drives to pools during creation and then expand the pool by adding more drives in increments.

Commit required
In order to perform pool and LUN management the FLARE 04.30 software must be committed.

Documentation
The table below lists the documents and help that apply to Virtual Provisioning. The most up-to-date documentation and help are available in the EMC Unisphere help.

<table>
<thead>
<tr>
<th>Part number</th>
<th>Publication</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Unisphere help (available in the Unisphere UI)</td>
</tr>
</tbody>
</table>

Software media, organization, and files
The following table lists the applicable software media for this product version:

<table>
<thead>
<tr>
<th>Part number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>053-002-301</td>
<td>EMC Thin Provisioning Enabler - CX4 Series</td>
</tr>
</tbody>
</table>

Installation
To install Virtual Provisioning software on a storage system, use the Unisphere Service Manager (USM). To enable thin provisioning, install the Thin Provisioning enabler. You can download the USM from the Powerlink website. Unless noted otherwise, EMC recommends that a service provider perform the installation or update.

Installation notes
IMPORTANT - When you install new software on a storage system, do not remove or reboot a storage processor while installation is in progress. If you do, you risk leaving the storage system in a transient state where it cannot be restarted. Wait for the entire upgrade process including the automatic reboot of the storage processors to complete.
Troubleshooting and getting help

This section provides specific instructions for contacting EMC Customer Service and lists where users can obtain additional information about EMC products.

Where to get help

EMC support, product, and licensing information can be obtained as follows.

Product information
For documentation, release notes, software updates, or for information about EMC products, licensing, and service, go to the EMC Powerlink website (registration required) at:

http://Powerlink.EMC.com

Technical support
For technical support, go to Powerlink and choose Support. On the Support page, you will see several options, including one for making a service request. Note that to open a service request, you must have a valid support agreement. Contact your EMC sales representative for details about obtaining a valid support agreement or with questions about your account.