Source Side Deduplication Guide

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Source Side Deduplication

Deduplication on the source (client) side identifies and eliminates redundant data from the client. This reduces the data transfer rate over the network from the client to the MediaAgent. Source side deduplication not only reduces the storage footprint on the disk, but also provides faster backups.

**HOW SOURCE SIDE DEDUPLICATION WORKS**

Source Side Deduplication works as follows. When data is backed up for first time:

- Source side process reads the data on the client.
- Data is compressed on the client computer.
- The compressed data is divided into individual data blocks based on the block size and then signatures are generated for each block on the client computer.
- This data blocks are transferred over the network to the MediaAgent to store on a disk library and generated signatures are stored in the deduplication database on the MediaAgent.

For subsequent backups, the signatures are generated in the client and compared with the existing signatures in the deduplication database (DDB) in the MediaAgent. Based on the comparison, the following is performed:

- If a signature is present in the DDB, then it indicates that the data block was already encountered in a previous backup and only the signature reference is transmitted.
- If a signature is not present in the DDB, then it indicates that the data block is new and the data as well as the signature is transmitted to the MediaAgent.
Source Side Deduplication

Deduplication on the source identifies and eliminates redundant data at the source client, thereby shrinking the storage space as well as the network bandwidth required for backups.

PRE-REQUISITES

- Install the CommServe
- Install a MediaAgent that can be used as Data Mover MediaAgent or Deduplication Database (DDB) MediaAgent
  See Install the MediaAgent - Windows or Install the MediaAgent - Linux for step-by-step instructions.
- Disk Library must be configured in the MediaAgent.

ENABLING SOURCE DEDUPLICATION

1. From the CommCell Browser, navigate to and expand Policies.
   Right-click Storage Policies, and then click New Storage Policy.

2. Click Next.
3. Enter the name in the **Storage Policy Name** box and click **Next**.

4. From the **Library** list, click the name of a disk library and click **Next**.

5. From the **MediaAgent** list, click the name of a MediaAgent that will be used to create the primary copy. Click **Next**.
6. Click **Next** to accept the default values.

   If necessary these values can be modified later.

7. By default, **Enable Client Side Deduplication** checkbox is selected.

   Click **Enable use of Partitioned Deduplication Database** check box to enable Partitioned DDB feature and then skip to step 9.

   Click **Next**.
8. From the MediaAgent list, click the name of the MediaAgent that will be used to host the Deduplication database.

   - It can be any MediaAgent which has enough space to store the deduplication database.
   - The deduplication database must be located in a folder and not directly under the root of a disk volume.

   In the DDB Location, type the name of the folder or click the Browse button to select the folder in which the deduplication database must be located.

   Click Next.

9. In the Enter the location to store the Deduplication Database dialog box, perform the following:

   a. From Number of Partitions list, type or select number of partitions for the deduplication database.

      You can set maximum of 2 partitions for deduplication database. In this example, 2 partition are selected for deduplication database.

   b. Click Choose Path under MediaAgent And Partition Path.

   c. From the Partition Path dialog box, select the following:

      From the MediaAgent list, click the name of the MediaAgent that will be used to store the deduplication database.

      In the Partition Path box, type the name of the folder or Browse to the folder in which the deduplication database must be located.

      - When hosting the deduplication databases on different MediaAgents, make sure all the MediaAgents are online and are 64-bit machines.
Repeat the above steps for each partition.

d. Click **OK**.

For better performance, host each deduplication database on different physical drives.

The added MediaAgent and partition path will be displayed under **MediaAgent And Partition Path** column.

Click **Next**.

![](image)

10. Click **Finish**.

If you enabled Partitioned deduplication database, summary screen will appear different.

![](image)

11. You can view the storage policy under **Storage Policies** node.
12. By default, **DDB subclient** is automatically created under the MediaAgent client computers where the deduplication database is hosted.

This **DDB subclient** allows you to protect the deduplication database so that it can be recovered in the unlikely event of an offline database. See DDB Protection for more information.

**CONGRATULATIONS YOU ARE NOW READY TO PERFORM YOUR FIRST BACKUP TO A SOURCE SIDE DEDUPLICATION ENABLED STORAGE POLICY.**

To perform backup, see corresponding Agents backup section.
Source Side Deduplication

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CONFIGURE SOURCE SIDE DEDUPLICATION ON A STORAGE POLICY COPY

By default, Source Deduplication is enabled in a storage policy copy. Use the following steps to enable Source Deduplication for an existing storage policy copy, if it was disabled.

1. From the CommCell Browser, navigate to Policies | Storage Policies | <Storage Policy>.
2. Right-click the storage policy displayed in the right pane and then click Properties.
3. In the Copy Properties dialog box, click the Deduplication tab and then click the Advanced tab.
4. Click to select Enable Deduplication on Clients check box.
   When this option is enabled the Use Storage Policy Settings option is enabled by default on the associated clients.
5. Click OK.

CONFIGURE SOURCE SIDE DEDUPLICATION FOR A CLIENT

You can also enable the source side deduplication for a specific client. This is useful when Client Side Deduplication option is not enabled on the Storage Policy copy and you want to enable source side deduplication on specific clients associated to that storage policy copy.

Use the following steps to enable source side deduplication on specific client.

1. From the CommCell Browser, navigate to Client Computers | <Client>.
2. Right-click the <Client> and then click Properties.
3. In the Client Properties dialog box, click the Advanced button.
4. Click the Deduplication tab.
5. By default, Use Storage Policy Settings option is selected.
6. Select Perform Client Side Deduplication option to perform source side deduplication on selected client and then click OK.

SIGNATURE CACHING ON THE SOURCE
The signature lookup process during source side deduplication can be optimized by setting up the cache locally on the source (client computer). For each backup, though the first lookup is a remote lookup, all subsequent lookups will be performed locally. Also, the remote lookups are performed in batches to optimize network usage. The signature cache can grow to a maximum of 32 GB.

Once you enable the signature cache on the client, the following will be performed:

For first backup:

- Source side process reads the data on the client and compresses the data on client computer.
- The compressed data is divided into individual data blocks based on the block size and then signatures are generated for each block on the client computer.
- This data blocks are transferred over the network to the MediaAgent to store on a disk library and generated signatures are stored in the deduplication database on the source (client computer) and on the MediaAgent.

For subsequent backups, the signatures are generated in the client and compared with the existing signatures in the local cache on client computer. Based on the comparison, the following is performed:

- If a signature is present in the local cache, then it indicates that the data block was already encountered in a previous backup and only the signature reference is updated in local cache and transmitted over network to update the DDB on MediaAgent.
- If a signature is not present in the local cache, then it indicated that the data block is new. The signature is inserted in the local cache and the data as well as the signature is transmitted to the MediaAgent.

**SPACE REQUIREMENT**

The source side signature cache must have minimum of 4 GB of free disk space. The following calculation can be used to determine the approximate amount of space required for the signature cache:

\[
\text{(Size of the Application data in bytes / Deduplication block size)} \times 200 \text{ bytes}
\]

For example, if the Application data size is 10 GB, and the Deduplication block size is 128 KB, then the cache size (in bytes) can be calculated as:

\[
[\frac{10 \times 1024 \times 1024}{128 \times 1024}] \times 200 \text{ bytes}
\]

Signature caching is not supported on Linux s390, Macintosh and FreeBSD platforms.

**ENABLING SIGNATURE CACHING ON THE CLIENT**

Use the following steps to enable signature caching on the client:

1. From the CommCell Browser, navigate to **Client Computers | <Client>**.
2. Right-click the **<Client>** and then click **Properties**.
3. In the **Client Computer Properties** dialog box, click **Advanced** button.
4. Click the **Deduplication** tab.
5. Ensure **Perform Client Side Deduplication** option is selected.
6. Select **Enable Client Side Disk Cache** check box.
   - In the **Limit the Max Cache size MB** box, enter the minimum disk space required for cache size.
   - The default value is set to 4 GB (4096 MB). The cache size value cannot be specified lower than 4096 MB.
7. Click **OK**.
8. Once the client side disk cache is enabled, the signatures are generated for any new data and a database of the signatures is maintained on the client computer.
   - To verify the signature database, on the client computer, start the windows explorer and navigate to following installation directory:
     \[
     \text{hds} <\text{Agent}> \text{\Job Results}\]
   - It contains a folder, **CV_CLDB**. This folder is the source side deduplication database directory. Note that the signatures that are inserted before 14 days are cleaned up everyday from the **CV_CLDB** folder.
CONFIGURE HIGH LATENCY OPTIMIZATION

High Latency Optimization increases backup speed and performance when

- Clients are in delayed network or in high latency environments like WAN. And,
- Data Mover MediaAgent and DDB MediaAgent are in fast network environments like LAN.

When high latency optimization is enabled, the signatures are looked up in the local cache. Based on the comparison, the following will be performed:

- If the signature exists in the local cache the data block is discarded.
- If the signature does not exists in the local cache, the data along with the signature is transmitted to the Data Mover MediaAgent.

The Data Mover MediaAgent with a local or remotely hosted deduplication database will compare signatures within the DDB. If the signature exists in the DDB then the Data Mover MediaAgent discards the data blocks and adds the additional entries in the DDB. If the signatures are not available in the DDB, both the local cache and the DDB will be updated with new signatures and data will be written to the disk.

Use the following steps to enable high latency optimization:

1. From the CommCell Browser, navigate to Client Computers | <Client>.
2. Right-click the <Client> and then click Properties.
3. In the Client Computer Properties dialog box, click Advanced button.
4. Click the Deduplication tab.
5. Ensure Perform Client Side Deduplication option and Enable Client Side Disk Cache check box is selected.
6. Select Enable High Latency Optimization check box.
7. Click OK.

VARIABLE CONTENT ALIGNMENT

Variable content alignment is a content aware approach to deduplication that further reduces the amount of data stored during backups. This may be more effective for certain database backups. It accomplishes this by aligning the segment boundaries of the backup data stream as minor changes to the data in the stream are made between incremental backups. Therefore, the effectiveness of deduplication increases more with this feature on client systems that experience small changes to the backup data.

Variable content alignment is performed on the client system and consequently you may experience some performance overhead, especially when used together with software compression. You can enable variable content alignment as follows:

1. From the CommCell Browser, right-click the <Client> you wish to enable variable content alignment and then click Properties.
2. From the Client Computer Properties dialog box, click Advanced button.
3. From the Advanced Client Properties dialog box, click Advanced button.
   - Click Deduplication tab.
   - Select Enable Variable Content Alignment check box.
   - You will be prompted with Warning message. Click OK.

   Enabling this option midway for a client which has already done some deduplication backups will result in consumption of more space on the disk library. This happens because a fresh copy of the deduplicated data blocks with new signature is created for that DDB. Hence, this new signature will not match the existing signatures available in the deduplication database and thus creates a new baseline for the DDB.

   o Click OK to close the Advanced Client Properties dialog box.
4. Click OK to close the Client Computer Properties dialog box.

**SETUP DATA COMPRESSION**

By default when source side deduplication storage policy is configured, compression is automatically enabled for the storage policy copy. This setting will override the subclient compression settings with Use Storage Policy Settings option enabled at subclient level. For most of the data types the compression is recommended. This process works by compressing the blocks and then generating a signature hash on the compressed block.

Use the following steps to enable data compression for all subclients associated to storage policy:

1. From the CommCell Browser, navigate to Policies | Storage Policies | <Storage_Policy>.
2. Right-click the storage policy copy displayed in the right pane and click Properties.
3. Click the Deduplication tab, and then click the Settings tab.
4. Select the Enable Software Compression with Deduplication box.
   
   This options is enabled by default. It is recommended to have data compression enabled when using deduplication.
   
   - When this option is enabled the Use Storage Policy Settings option is enabled by default on the corresponding subclients.
   - If Enable Software Compression with Deduplication check box is selected, the signature generation and compression will be done on client.

5. Click OK.

**COMPRESSION ON SUBCLIENT**

By default, the deduplicated storage policy compression settings will be honored for all associated subclients. The compression settings on the individual subclients associated to deduplicated storage policy can be disabled.

Use the following steps to modify or disable the compression setting on specific subclient:

1. From the CommCell Browser, navigate to Client Computers | <Client_Computer> | File System | defaultBackupSet.
2. Right-click the <Subclient> to which the deduplication storage policy is associated and then click Properties.
3. Click the Storage Device tab, and then click the Data Transfer Option tab.
4. Under Software Compression section, Using Storage Policy Settings option is selected by default.
   
   Select Off to turn off the compression.

5. Click OK.

**PRIME THE DEDUPLICATION DATABASE WITH DATA FROM EXISTING DDBS**
Whenever a new DDB is created, a fresh copy of the deduplicated data blocks is created for that DDB. However these data blocks may also be available in the sealed DDBs residing in the MediaAgent/data center. The DDB Priming feature discovers such data blocks from the previously sealed DDBs and uses them to baseline the new DDB. In source-side deduplication, this saves the need for clients to transfer data blocks that are already available in the MediaAgent.

Use this feature to reduce the data transfer between clients that have source-side deduplication enabled and connect to the MediaAgent over a WAN. This feature is not recommended if the clients exist in the data center or performance throughput is critical.

1. From the CommCell Browser, navigate to Policies | Storage Policies | <Storage Policy>.
2. Right-click the storage policy copy displayed in the right pane and then click Properties.
3. Click the Deduplication tab.
4. Click the Settings tab.
5. Select Use DDB Priming option with Source-Side clients to enable DDB priming.

DDB Priming is not supported with High Latency Optimization. To use DDB Priming, disable the High Latency Optimization option on the client computer properties and then enable this option on the storage policy copy.

6. Click OK.

**DISABLE SOURCE SIDE DEDUPLICATION FOR A CLIENT**

You can disable the source side deduplication for a specific client. This is useful when Client Side Deduplication option is enabled on the Storage Policy copy and you want to disable source side deduplication on specific clients associated to that storage policy copy.

Use the following steps to enable source side deduplication on specific client.

1. From the CommCell Browser, navigate to Client Computers | <Client>.
2. Right-click the <Client> and then click Properties.
3. In the Client Properties dialog box, click the Advanced button.
4. Click the Deduplication tab.
5. Select Disable Client Side Deduplication option and then click OK.
6. Click OK to close Client Computer Properties dialog box.

**INCREASING STREAMS FOR CONCURRENT BACKUPS**

To increase the number of streams for concurrent backups from large number of clients, enable the option optimize for concurrent backups. It increase the current stream count limit by 200 more streams.

On Unix Operating Systems, perform the following to use source side deduplication:

- It is recommended that you Disable Optimize for concurrent LAN Backups
- Configure the Shared Memory Segments as recommended

**DISABLE OPTIMIZE FOR CONCURRENT LAN BACKUPS**

1. From the CommCell Browser, navigate to Storage Resources | MediaAgents | <MediaAgent>.
2. Right-click the MediaAgent that you wish to optimize for concurrent LAN backups and then click Properties.
3. Click the Control tab.
4. Clear the Optimize for concurrent LAN backups to disable the option.
5. Click OK.

**SOURCE SIDE DEDUPLICATION ON UNIX OPERATING SYSTEM**

### CONFIGURE THE SHARED MEMORY SEGMENTS

**HP-UX**
The following table displays the possible range of values for each parameter:

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>DESCRIPTION</th>
<th>POSSIBLE RANGE OF VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMMNI*</td>
<td>Defines the maximum number of semaphore sets in the entire system.</td>
<td>1 – 65535</td>
</tr>
<tr>
<td>SEMMAP</td>
<td>Defines the maximum number of semaphore map entries.</td>
<td>1 – 65535 (SEMMNI + 2)</td>
</tr>
<tr>
<td>SEMMNS*</td>
<td>Defines the maximum semaphores in the system</td>
<td>1 – 2147483647 [MAXINT] (Default value 128 is too low.)</td>
</tr>
<tr>
<td>SEMVNX</td>
<td>Defines the maximum value of a semaphore</td>
<td>32768</td>
</tr>
<tr>
<td>SHMMNI*</td>
<td>Defines the maximum number of shared memory segments in the entire system</td>
<td>1 – 2147483647 [MAXINT]</td>
</tr>
<tr>
<td>SHMMAX</td>
<td>Defines the maximum allowable size of one shared memory segment</td>
<td>0 – 4294967295 (Available physical memory); recommended value is 2147483648</td>
</tr>
<tr>
<td>SHMSEG*</td>
<td>Defines the maximum number of shared memory segments that one process can attach</td>
<td>0 - 32767</td>
</tr>
<tr>
<td>SEMMNU</td>
<td>Defines the maximum number of System V IPC system-wide processes that can have &quot;undo&quot; operations pending at any given time.</td>
<td>1 - (nproc-4) [256]; preferred value: 1024</td>
</tr>
</tbody>
</table>

Use the following steps to modify the kernel parameters with System Administrator Menu (SAM) for HP-UX File System:

1. From the unix prompt, enter the command to open the System Administrator Menu (SAM).
   
   #sam

2. In the SAM utility window, double-click the **Kernel Configuration** icon.

3. Double-click the **Configurable Parameters** icon. SAM will display a screen containing a list of configurable parameters, including current and pending values.

4. Double-click on the parameter you wish to change.

5. Click **New Formula/Value** option and type the recommended value.

6. Click **OK**.

7. Restart the computer to allow the changes to take effect.

System Management Homepage (SMH) is the new tool introduced to manage HP-UX. Use the following steps to modify the kernel parameters using System Management Homepage (SMH) since the System Administration Manager (SAM) is deprecated in the current releases of HP-UX:

1. From the unix prompt, enter the command to open the System Management Homepage (SMH) window.
   
   #smh

2. In the SMH Text User Interface, select **k -Kernel Configuration** and press **Enter**.

   DISPLAY variable is not set. Starting the Text User Interface.
   Please wait...HP-UX System Management Homepage (Text User Interface)
   SMH
   ----------------------------------------------------------
   a - Auditing and Security
   c - Auditing and Security Attributes Configuration(new)
   d - Peripheral Devices
   e - Resource Management
   f - Disks and File Systems
   g - Display
   k - Kernel Configuration
   l - Printers and Plotters(new)
   m - Event Monitoring Service
   n - Networking and Communications
   p - Printers and Plotters
   s - Software Management
   u - Accounts for Users and Groups
   ----------------------------------------------------------
   x-Exit smh w-WebLaunch l-Help
   ENTER-Launch Functional Area v-SAM Log Viewer
3. Select the **t - Tunables** to view a list of configurable parameters, including current and pending values and press **Enter**.

   SMH->Kernel Configuration
   ------------------------------------------------------------
   t - Tunables View or modify kernel tunables
   m - Modules View or modify kernel modules and drivers
   a - Alarms View or modify alarms for kernel tunables
   l - Log Viewer View the changes made to kernel tunables or modules
   u - Usage View usage of kernel tunables
   c - Manage Configuration View the options available to manage configuration
   b - Restore Previous Boot Values Restores Previous Boot Values for Tunable
   <----------------------------------------------------------------------->
   x-Exit smh ENTER-Select ESC-Back 1-Help

4. Select the parameter you wish to change and press **Enter**. For Example, select **semmni** parameter.

   SMH->Kernel Configuration->Tunables (All)
   ---------------------------------------------------------------
   Tunable Capability Tuning Value Current Value Next Boot Value Default Value Usage Module
   semem Static    Static    16384    16384    16384    -    pm_usync
   semmi Static    Static    2048    2048    2048    1.4%    pm_usync
   semms Static    Static    4096    4096    4096    3.7%    pm_usync
   semmu Static    Static    256    256    256    -    pm_usync
   semms1 Dynamic    Dynamic    2048    2048    2048    -    pm_usync
   semume Static    Static    100    100    100    -    pm_usync
   semvmx Static    Static    32767    32767    32767    -    pm_usync
   shmax Dynamic    Dynamic    1073741824    1073741824    1073741824    3.1%    vm_asi
   shmmi Dynamic    Dynamic    400    400    400    2.2%    vm_asi
   shmsg Dynamic    Dynamic    300    300    300    -    vm_asi
   ---------------------------------------------------------------------
   x-Exit smh ESC-Back p-Pending b-Restore Previous Boot Values 2-kctune Manpage /-Search
   ENTER-Details m-Modify d-Dynamic 1-Help 3-Tunable Manpage

5. Press **m** to modify the selected parameter.

   Use the following formula to calculate the value for the parameter:
   parameter value = current value + (64 * number of desired streams)

   ○ If the client is configured as iDataAgent, be sure to allocate 10 streams per each affected parameter. If the client is configured as a MediaAgent, be sure to allocate at least 100 additional streams per each affected parameter.

   ○ If the system is configured as both an iDataAgent and a MediaAgent, be sure to consider the sum of the respective parameter values for this purpose.

   SMH->Kernel Configuration->Tunables (All)->Details
   Details : semmni
   ---------------------------------------------------------------
   Tunable semmni
   Description Maximum number of semaphore sets on the system
   Dynamic no
   Subsystem pm_usync
   Default Value 2048
   Current Value 2048
   Planned Value 2048
   Last Boot Value 2048
   Constraints semmni >= 2
   Constraints semmni <= 32767
   Constraints semmni <= semms
   Auto Tuning Not Supported
   Current Usage 28
   x-Exit smh m-Modify ESC-Back 1-Tunable Help
6. Specify the following:
   - Type the new parameter value in **New setting [Expression/value]**
   - Type the new evaluated value for expression if needed in **New setting [evaluated]** or select **Recalculate** and press **Enter**.
   - Select **Yes** to backup the current configuration before applying the change.
   - Type the reason for modification in **Reason for Change**.
   - Select **Modify** and press **Enter**.

   SMH->Kernel Configuration->Tunables (All)->Details->Modify

   Tunable semmni
   Description: Maximum number of semaphore sets on the system
   Module: pm_usync
   Current Value: 2048 [Default]
   Value at Next Boot: 2048 [Default]
   Value at Last Boot: 2048
   Default Value: 2048
   Constraints: semmni >= 2
   semmni <= 32767
   semmni <= semmns
   Can Change At Next Boot Only
   NOTE: If the new Value is specified as Default, the next boot value will be default value for the tunable as recommended by HP. However, if the tunable is being autotuned then the value assigned will be determined dynamically by kernel during run-time.
   New setting[Expression/Value]: ___________________
   New setting (evaluated): ___________________
   [ Recalculate ]
   Back up the current configuration before applying change: (X) Yes ( ) No
   Reason for change : _______________________________________
   [ Modify ] [ Preview ] [ Cancel ]

7. A Confirmation window will be displayed warning you that the requested changes have been saved and will take effect at next boot. Press **Enter** to continue.

   SMH->Kernel Configuration->Tunables (All)->Details->Modify

   mount: ignoring incomplete/incorrect entry for /dev/dsk/c0t0d0 in /etc/fstab
   NOTE: The requested changes could not be applied to the currently running system, for the following reasons:
   - The tunable 'semmni' cannot be changed without a reboot.
   * The requested changes have been saved, and will take effect at next boot.
   Tunable Value Expression
   semmni (now) 2048 Default
   (next boot) 2048 2048
   mount: ignoring incomplete/incorrect entry for /dev/dsk/c0t0d0 in /etc/fstab
   Command Successful
   press Enter Key to continue

8. Restart the computer.

**LINUX**

The following table displays the possible range of values for each parameter:

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>DESCRIPTION</th>
<th>POSSIBLE RANGE OF VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMMNL</td>
<td>Defines the minimum recommended semaphore value.</td>
<td>1 – 2147483647 [MAXINT]</td>
</tr>
<tr>
<td>SEMMNS</td>
<td>Defines the maximum semaphores in the system.</td>
<td>1 – 2147483647 [MAXINT]</td>
</tr>
<tr>
<td>SEMOPM</td>
<td>Defines the maximum number of operations for each semaphore call.</td>
<td>100</td>
</tr>
<tr>
<td>SEMMNI</td>
<td>Defines the maximum number of semaphore sets in</td>
<td>1 – 65535</td>
</tr>
</tbody>
</table>
Use the following steps to modify the kernel parameters:

1. From the UNIX prompt, log on to the client as root.

2. Navigate to the `/proc/sys/kernel`.
   ```bash
cd /proc/sys/kernel
   ```

3. View the current values of the parameters in the `sem` file.
   For example, view the values of all semaphore parameters. The output provides the current value for the following parameters in the order listed: `SEMMSL`, `SEMMNS`, `SEMOPM`, and `SEMMNI`.
   Example:
   ```bash
cat sem
   250 32000 32 128
   ```
   In this example, `SEMMSL=250`, `SEMMNS=32000`, `SEMOPM=32`, and `SEMMNI=128`

4. Modify the required parameter.
   For example, modify the `SEMMSL`, `SEMMNS`, `SEMOPM`, and `SEMMNI` parameters.
   Use the following formula to calculate the value for the parameter:
   \[
   \text{parameter value} = \text{current value} + (64 \times \text{number of desired streams})
   \]
   • If the client is configured as `iDataAgent`, be sure to allocate 10 streams per each affected parameter. If the client is configured as a `MediaAgent`, be sure to allocate at least 100 additional streams per each affected parameter.
   • If the system is configured as both an `iDataAgent` and a `MediaAgent`, be sure to consider the sum of the respective parameter values for this purpose.
   ```bash
   sysctl -w kernel.<parameter>="value1 value2 value3 value4"
   ```
   For example:
   ```bash
   sysctl -w kernel.sem="4096 512000 32 9005"
   ```
   To preserve the parameter settings permanently on a Red Hat Linux computer, add them to the `/etc/sysctl.conf` file after removing any existing entries for the parameters.

5. Run the command to allow the changes to take effect.
   ```bash
   sysctl -p
   ```

**SOLARIS**

By default, the kernel parameters are set during the installation. However, you can also modify the parameters at a later point in time if needed.

---

### FOR SOLARIS 9 AND BELOW VERSIONS

The following table displays the possible range of values for each parameter for Solaris 9 and below:

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>DESCRIPTION</th>
<th>POSSIBLE RANGE OF VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMMNI*</td>
<td>Defines the maximum number of semaphore sets in the entire system.</td>
<td>1 – 65535 (unsigned short)</td>
</tr>
<tr>
<td>SEMMNS*</td>
<td>Defines the maximum semaphores in the system.</td>
<td>1 – MAXINT</td>
</tr>
<tr>
<td></td>
<td>MAXINT = 0x7fffffff (2147483647)</td>
<td></td>
</tr>
<tr>
<td>SEMMSL*</td>
<td>Defines the minimum recommended semaphore value.</td>
<td>1 – MAXINT</td>
</tr>
<tr>
<td></td>
<td>MAXINT = 0x7fffffff (2147483647)</td>
<td></td>
</tr>
<tr>
<td>SHMMIN</td>
<td>Defines the minimum allowable size of a single shared memory segment in the entire system.</td>
<td>0 (Physical Ram)</td>
</tr>
</tbody>
</table>
Use the following steps to modify the kernel parameters for Solaris 9 and below:

1. From the UNIX prompt, create a backup copy of the /etc/system file.
   
   ```
   cp /etc/system /etc/system.copy
   ```

2. Open the /etc/system file.
   
   ```
   vi /etc/system
   ```

3. Change the desired parameter value as per the range given in the above table.

   For example, set the value for `semmni` parameter to 55680

   Use the following formula to calculate the value for the parameter:

   \[
   \text{parameter value} = \text{current value} + (64 \times \text{number of desired streams})
   \]

   - If the client is configured as iDataAgent, be sure to allocate 10 streams per each affected parameter. If the client is configured as a MediaAgent, be sure to allocate at least 100 additional streams per each affected parameter.
   - If the system is configured as both an iDataAgent and a MediaAgent, be sure to consider the sum of the respective parameter values for this purpose.

   Example:

   ```
   set semsys:seminfo_semmni=55680
   ```

4. Save the /etc/system file.

   Press the `Esc` key.

   Type `:wq`

5. Restart the computer to allow the changes to take effect.

**FOR SOLARIS 10 AND ABOVE VERSIONS**

The following table displays the possible range of values for each parameter for Solaris 10 and above:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>project.max-shm-memory</code></td>
<td>Defines the total amount of shared memory allowed for a project.</td>
<td>[Default = 25% of the physical memory]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It is recommended not to set this value. However, if you have to set the control to accommodate other resource consumers, ensure that the value is not less than 2MB = [2097152].</td>
</tr>
<tr>
<td><code>project.max-shm-ids*</code></td>
<td>Defines the maximum number of shared memory IDs allowed for a project</td>
<td>16777216 [Default = 128]</td>
</tr>
<tr>
<td><code>project.max-sem-ids*</code></td>
<td>Defines the maximum number of semaphores allowed for a project</td>
<td>16777216 [Default = 128]</td>
</tr>
</tbody>
</table>

For Solaris 10 and above, you can use any of the following commands to modify the kernel parameters:

- `projmod` command - changes made using this command are persistent
- `prctl` command

Use the following steps to modify the kernel parameters in Solaris 10 and above versions using the `projmod` command:

1. From the UNIX prompt, type the `projmod` command.
projmod [-n] [-f filename] [-p projid [-o]] [-c comment] [-a|-s|-r] [-U user [,user...]] [-G group [,group...]] [[-K name=value,value...]] [ -I new_projectname] project

Example:
projmod -s -K "project.xxx" user.root

2. Change the desired parameter value as per the range given in the above table.

   For example, set the value for project.max-shm-ids parameter

   Use the following formula to calculate the value for the parameter:
   parameter value = current value + (64 * number of desired streams)

   ☐ If the client is configured as iDataAgent, be sure to allocate 10 streams per each affected parameter. If the client is configured as a MediaAgent, be sure to allocate at least 100 additional streams per each affected parameter.

   ☐ If the system is configured as both an iDataAgent and a MediaAgent, be sure to consider the sum of the respective parameter values for this purpose.

   Example:
   projmod -s -K "project.max-shm-ids=(priv,1280,deny)" user.root

3. Restart the computer to allow the changes to take effect.

Use the following steps to modify the kernel parameters in Solaris 10 and above versions using the prctl command:

1. From the UNIX prompt, type the prctl command.
   
   prctl [-P] [-t[basic| privileged| system]] [-n name] [-v value] [-e| d action] [-p pid] [-i idtype] id...

2. Change the desired parameter value as per the range given in the above table.

   For example, set the value for project.max-shm-ids parameter

   Use the following formula to calculate the value for the parameter:
   parameter value = current value + (64 * number of desired streams)

   ☐ If the client is configured as iDataAgent, be sure to allocate 10 streams per each affected parameter. If the client is configured as a MediaAgent, be sure to allocate at least 100 additional streams per each affected parameter.

   ☐ If the system is configured as both an iDataAgent and a MediaAgent, be sure to consider the sum of the respective parameter values for this purpose.

   Example:
   prctl -n project.max-shm-ids -v 1280 -r -i project user.root

   Output:
   
   project: 1: user.root
   
   project.max-shm-ids privileged 1280 - deny -
   
   project.max-shm-ids system 16777216 max deny -

3. Restart the computer to allow the changes to take effect.

**LICENSE REQUIREMENTS**

You can choose to use one of the following licensing mechanisms:

- **Traditional License**, based upon products and features in your CommCell.
- **Capacity License**, based on the amount of data you want to protect.

For comprehensive information on licensing, see License Administration.

<table>
<thead>
<tr>
<th>TRADITIONAL LICENSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEATURE</td>
</tr>
<tr>
<td>Block Level Data Deduplication on Disk Media</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAPACITY LICENSE</th>
</tr>
</thead>
</table>

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You must obtain one of the following licenses:

<table>
<thead>
<tr>
<th>LICENSE TYPE</th>
<th>LICENSE CONSUMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Protection Enterprise infrastructure</td>
<td>1 license per CommCell for (n) Terabytes (TB) of protected data</td>
</tr>
<tr>
<td>Data Archive Enterprise infrastructure</td>
<td>1 license per CommCell for (n) Terabytes (TB) of protected data</td>
</tr>
</tbody>
</table>

**EFFECTS OF OTHER OPERATIONS ON SOURCE SIDE DEDUPLICATION**

Review the following consideration when using Source Side Deduplication:

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Latency Optimization</td>
<td>High Latency Optimization is not supported for Storage Policy Copy configured with Cloud Storage library.</td>
</tr>
<tr>
<td>Inline Copy</td>
<td>Inline Copy is not supported for Source Side deduplicated storage policy copies.</td>
</tr>
<tr>
<td>DDB Priming</td>
<td>DDB Priming is not supported for Storage Policy Copy configured with Cloud Storage library.</td>
</tr>
</tbody>
</table>

**RELATED TOPICS**

**Support**

Provides comprehensive information about Source Side Deduplication Support.

**Deduplication**

Provides comprehensive information on deduplication.

**Storage Policy**

Provides basic information about Storage Policy Setup.

**Storage Policy Copies**

Provides comprehensive information on storage policy copies.
**Source Side Deduplication**

---

**SOURCE SIDE DEDUPLICATION ENABLED JOB FOUND CACHE-DATABASE AND DEDUPLICATION-DATABASE ARE OUT OF SYNC.**

**SYMPTOM**

Backup jobs go pending with the following error message:

Error Code: 40:110:
Client-side deduplication enabled job found Cache-Database and Deduplication-Database are out of sync.
Job will be preceded by next resume.

**RESOLUTION**

This error occurs when Source Side Deduplication Database (SSDB) is out of sync with the Deduplication Database (DDB) on the MediaAgent. When this occurs the SSDB has reference pointers (signature hash) that the central DDB doesn't have. Therefore the job(s) of the client associated to the SSDB will go pending.

Once the job resumes automatically, every 20 minutes, or if manually resumed, the SSDB will automatically be created and repopulated as it processes signature hashes from the client to the MediaAgent.