

Implementing Fully Automated Storage Tiering (FAST) for EMC[®] Symmetrix[®] VMAX[™] Series Arrays

Technical Note

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Executive summary

Information infrastructure must continuously adapt to changing business requirements. EMC® Symmetrix® Fully Automated Storage Tiering (FAST) automates tiered storage strategies by easily moving workloads between Symmetrix tiers as performance characteristics change over time. FAST performs system reconfiguration, improving performance, and reducing costs, all while maintaining vital service levels.

Introduction

EMC Symmetrix VMAX™ FAST for standard provisioned, non-thin, environments automates the identification of data volumes for the purposes of allocating or re-allocating application data across different performance/capacity tiers within an array. FAST proactively monitors workloads at the volume (LUN) level in order to identify “busy” volumes that would benefit from being moved to higher performing drives. FAST will also identify less “busy” volumes that could be relocated to higher capacity drives, without existing performance being affected. This promotion/demotion activity is based on policies that associate a storage group to multiple drive technologies, or RAID protection schemes, based upon the performance requirements of the application contained within the storage group. Data movement executed during this activity is performed non-disruptively, without affecting business continuity and data availability.

Audience

This technical note provides an in-depth look at the Fully Automated Storage Tiering feature for Symmetrix VMAX enterprise storage arrays. The intended audience includes system and storage administrators, customers, EMC staff, and partners who need to understand how to implement and leverage FAST.

Fully Automated Storage Tiering

Fully Automated Storage Tiering (FAST) automates the identification of data volumes for the purposes of allocating or re-allocating application data across different performance/capacity tiers within an array.

The primary benefits of FAST include:

- ♦ Elimination of manually tiering applications when performance objectives change over time
- ♦ Automating the process of identifying volumes that can benefit from Enterprise Flash Drives or that can be kept on higher capacity, less expensive SATA drives without impacting performance
- ♦ Improving application performance at the same cost, or providing the same application performance at lower cost. Cost is defined as: acquisition (both HW and SW), space/energy, and management expense
- ♦ Optimizing and prioritizing business applications, allowing customers to dynamically allocate resources within a single array
- ♦ Delivering greater flexibility in meeting different price/performance ratios throughout the lifecycle of the information stored

Management and operation of FAST is provided by Symmetrix Management Console (SMC), as well as the Solutions Enabler Command Line Interface (SYMCLI).

FAST managed objects

There are three main elements related to the use of FAST on Symmetrix VMAX. These are:

- ♦ Symmetrix tier — A shared resource with common technologies
- ♦ FAST policy — A policy that manages data placement and movement across Symmetrix tiers to achieve service levels and for one or more storage groups
- ♦ Storage group — A logical grouping of devices for common management

Figure 1 shows the FAST managed objects.

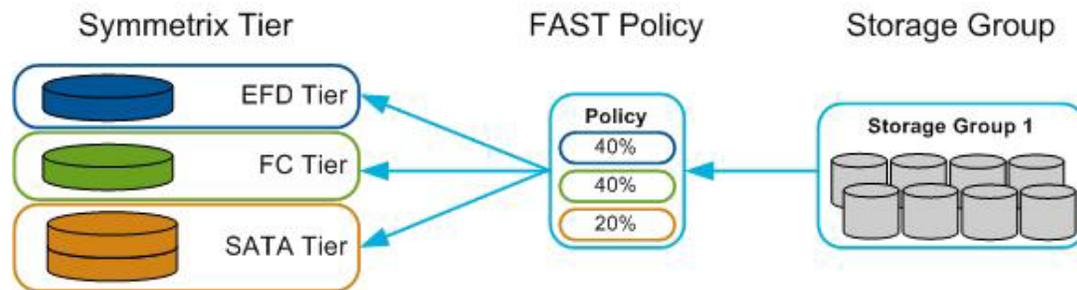


Figure 1. FAST managed objects

Each of the three managed objects can be created and managed by using either Symmetrix Management Console (SMC) or the Solutions Enabler Command Line Interface (SYMCLI).

Symmetrix tiers

A Symmetrix tier is a specification of a set of resources of the same disk technology type (EFD, FC, or SATA) combined with a given RAID protection type (RAID 1, RAID 5, or RAID 6).

When defined, a Symmetrix tier will contain one or more physical disk groups, of the same technology type, from the Symmetrix.

Note: A Symmetrix physical disk group is a collection of disks of the same technology, size, and speed, used for the creation of Symmetrix logical devices.

There are two types of Symmetrix tiers—dynamic and static. A dynamic tier will automatically contain all disk groups of the same disk technology, while a static tier will only contain physical disk groups explicitly specified.

A Symmetrix VMAX storage array will support up to 256 Symmetrix tiers. Each Symmetrix tier name may contain up to 32 alpha-numeric characters, hyphens (-), and underscores (_).

Dynamic Symmetrix tiers

To create a dynamic Symmetrix tier, only the disk technology and the desired RAID protection need be specified. When created, the Symmetrix tier will contain all Symmetrix physical disk groups that contain disks of the desired technology.

If the Symmetrix capacity is expanded, by adding additional storage to the array, dynamic Symmetrix tiers will automatically expand to accommodate newly added disk groups of the same technology type.

Note: When creating a dynamic tier, disk size and rotational speed are not considered, so a tier may contain disks of differing performance characteristics.

Static Symmetrix tiers

To create a static tier, each Symmetrix disk group to be included in the tier must be explicitly specified. Each physical disk group added to a static Symmetrix tier must be of the same disk technology.

If additional capacity is added to the Symmetrix, and it is added to a new physical disk group, expansion of a static Symmetrix tier must be performed manually. This is done by adding any newly added physical disk groups to the Symmetrix tier.

Overlapping Symmetrix tiers

Symmetrix physical disk groups may belong to more than one Symmetrix tier. However, care must be taken when combining dynamic and static Symmetrix tiers within an array, as individual disk groups may not belong to a static tier and a dynamic tier at the same time.

Also, when creating multiple static tiers utilizing the same physical disk groups, Symmetrix tiers may not be created if the creation of the tier partially overlaps with an existing Symmetrix tier. Symmetrix tiers are considered to partially overlap when they share only a subset of the physical disk groups of a particular disk technology.

Figure 2 illustrates an example of two legal, overlapping tiers.

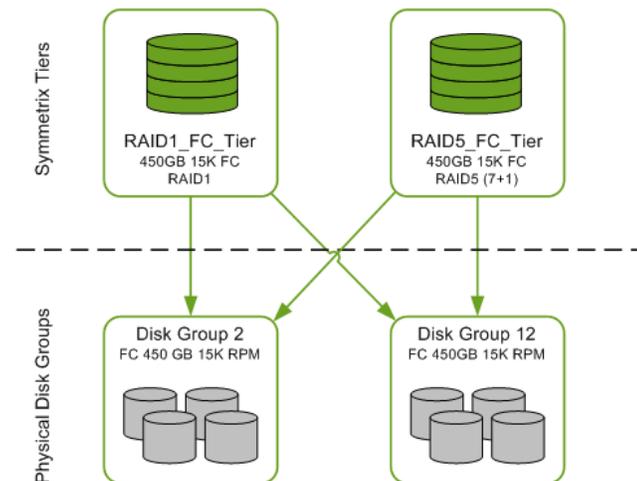


Figure 2. Overlapping tiers—Legal configuration

This configuration is considered to be legal as both Symmetrix tiers

contain the same physical disk groups.

Figure 3 illustrates an example of two illegal, partially overlapping tiers.

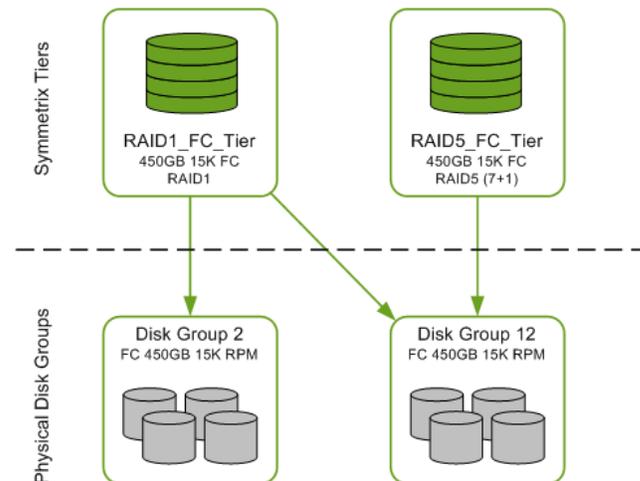


Figure 3. Partially overlapping tiers—Illegal configuration

This configuration is considered to be illegal as the first Symmetrix tier contains disk groups 2 and 12, while the second tier contains only disk group 12.

FAST policies

A FAST policy groups between one and three tiers and assigns an upper usage limit for each Symmetrix tier. The upper limit specifies how much capacity of a storage group associated with the policy can reside on that particular Symmetrix tier.

The upper capacity usage limit for each Symmetrix tier is specified as a percentage of the associated storage group, based upon the capacity of devices contained within the storage group. The limit defines the maximum amount of capacity of the storage group that can exist on a particular tier.

The usage limit for each tier must be between 0 percent and 100 percent. When combined, the upper usage limit for all Symmetrix tiers in the policy must total at least 100 percent, but may be greater than 100 percent.

Creating a policy with a total upper usage limit greater than 100 percent allows flexibility with the configuration of a storage group whereby

devices may be moved between Symmetrix tiers without necessarily having to relocate another device within the same storage group.

Multiple FAST policies may reuse the same tier, allowing different usage limits to be applied to different storage groups for the same Symmetrix tier. However, Symmetrix tiers that contain the same physical disk groups may not be used in the same policy.

A Symmetrix VMAX storage array will support up to 256 FAST policies. Each FAST policy name may be up to 32 alpha-numeric characters, hyphens (-), and underscores (_).

Storage groups

A storage group is a logical collection of Symmetrix devices that are to be managed together. Storage group definitions are shared between FAST and Auto-provisioning Groups. However, a Symmetrix device may only belong to one storage group that is under FAST control.

Storage groups are associated with a FAST policy, thereby defining the maximum percentage of devices in the storage group that can exist in a particular tier.

FAST for standard provisioning environments only supports the movement of certain device types within the Symmetrix. As a result of this, a storage group created for the purposes of FAST may not contain the following device types:

- ◆ Thin (TDEV)
- ◆ VDEV
- ◆ Diskless
- ◆ CKD EAV
- ◆ AS400, ICOS, ICL
- ◆ Metadevice members
- ◆ SAVE (SAVDEV)
- ◆ DATA (TDAT)
- ◆ DRV
- ◆ SFS
- ◆ Vault

A Symmetrix VMAX storage array will support up to 8192 storage groups associated with FAST policies. Storage groups may contain up to 4096 devices. Each storage group name may be up to 64 alpha-numeric characters, hyphens (-), and underscores (_).

FAST policy association

A policy associates a storage group with up to three tiers. The percentage of storage specified for each tier in the policy when aggregated must total at least 100 percent.

The same FAST policy may be applied to multiple storage groups. However, a storage group may only be associated with one policy.

When a storage group is associated with a FAST policy, a priority value must be assigned to the storage group. This priority value can be between 1 and 3, with 1 being the highest priority—the default is 2.

When multiple storage groups share the same policy, the priority value is used when the devices contained in the storage groups are competing for the same resources in one of the associated tiers. Storage groups with a higher priority will be given preference when deciding which devices need to be relocated to another tier.

Figure 4 shows four storage groups. Each storage group is associated with a policy. These policies associate the storage groups with up to three Symmetrix tiers that are defined in the array.

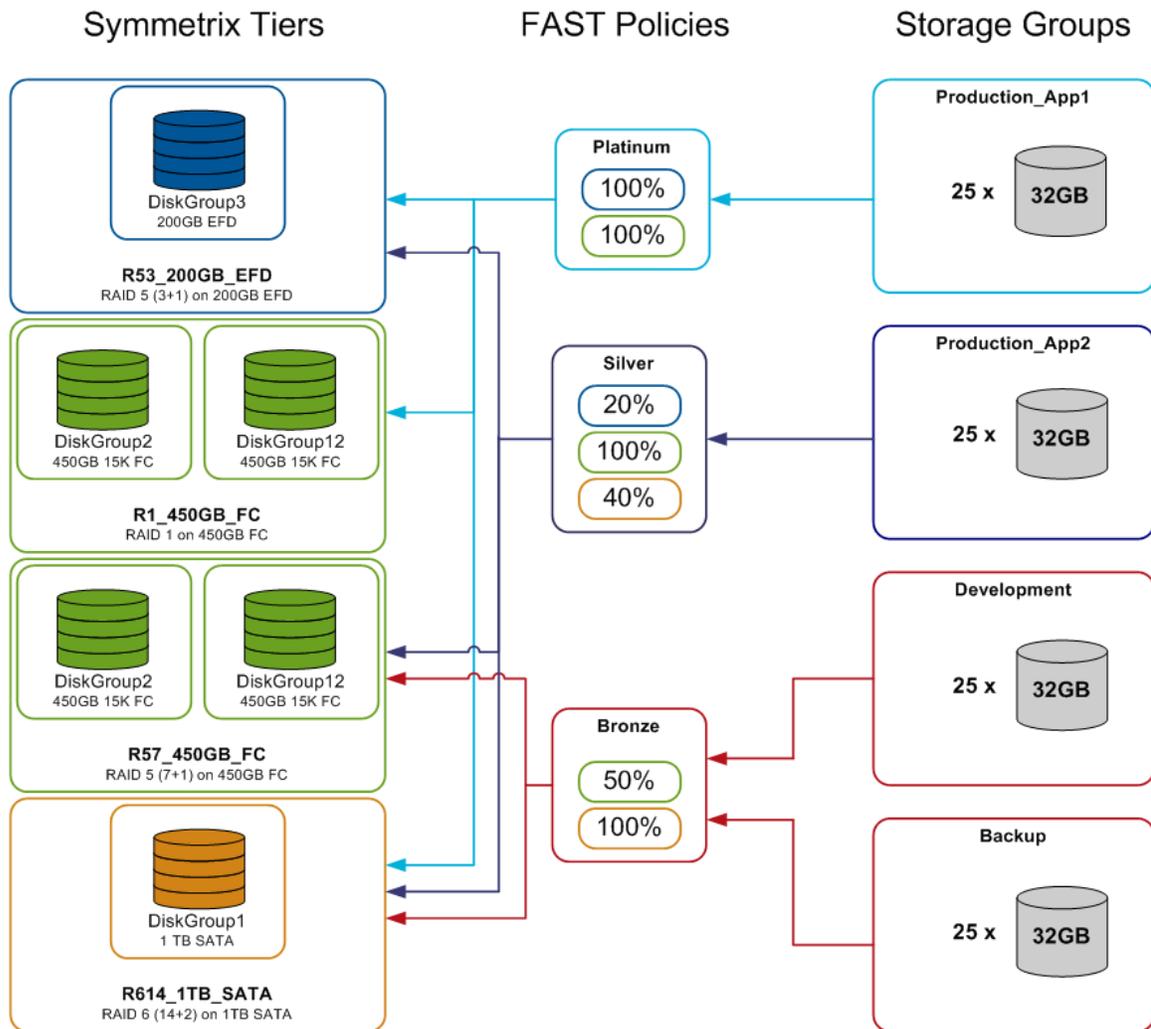


Figure 4. FAST policy association

Based on the Platinum policy, FAST can place up to 100 percent of the Symmetrix devices, based on capacity, in Production_App1 as RAID 5 (3+1) on EFD, and up to 100 percent as RAID 1 on FC. The ability to relocate 100 percent of the storage group's capacity to the EFD tier may be limited by the amount of EFD storage available in the array.

In the case of the Silver policy, as the total of the percentages for each tier is greater than 100 percent, up to 20 percent of the devices in Production_App2, based on capacity, will be configured as RAID 5 (3+1) on EFDs, up to 100 percent of the devices will be RAID 5 (7+1) on FC,

and up to 40 percent can be configured as RAID6 14+2) on SATA.

The Bronze policy, which has two associated storage groups, will not relocate any devices to EFD, but will allow up to all of the devices in the Development and Backup storage groups to exist as RAID 6 (14+2) on SATA drives while, depending on performance needs and utilization, up to 50 percent of the capacity of the storage group may be configured by FAST as RAID 5 (7+1) on FC.

FAST policy compliance

A storage group is considered to be compliant with the FAST policy it is associated with when all the devices in the storage group are fully configured within the bounds of the upper usage limits for each tier contained with the policy.

If all of the devices in the storage group are configured within the tiers contained within the FAST policy, but the devices in one tier exceed the upper usage limit for that tier, then the storage group is considered to be non-compliant. In such a case, the FAST controller will attempt to correct this non-compliance by relocating devices from the Symmetrix tier where the usage limit is exceeded to one, or both, of the other tiers contained in the policy in such a way as to bring the storage group into compliance.

A special case of non-compliance is when some or all of the devices in the storage group are configured on disks, or with a RAID protection type, not contained within any of the Symmetrix tiers within the FAST policy. In this case the storage group is considered to be non-compliant and the devices are considered to be out-of-policy. Again, the FAST controller will attempt to correct this situation by relocating the out-of-policy devices to one, two, or all three of the tiers contained in the policy.

FAST controller

The FAST controller runs as a service on the Symmetrix VMAX service processor. When active, the FAST controller has four primary responsibilities:

1. Performance data collection
2. Performance data and capacity usage analysis
3. Configuration change plan generation
4. Device movement execution

Figure 5 shows the FAST controller operation.

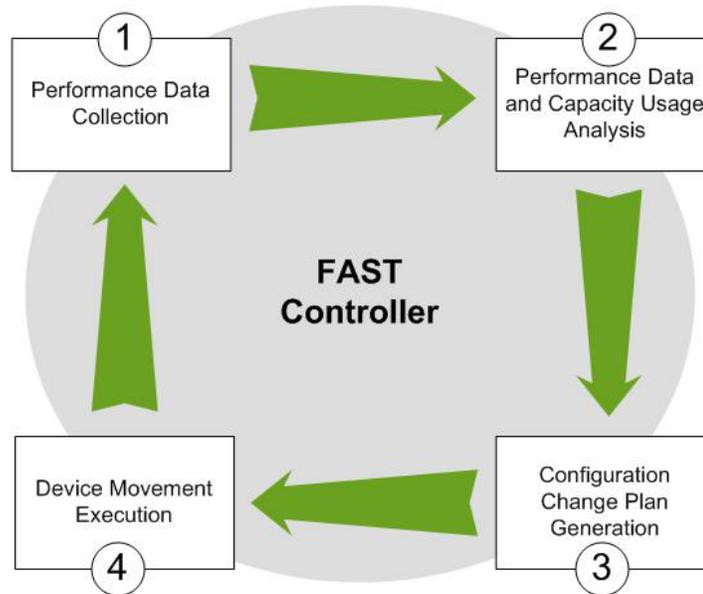


Figure 5. FAST controller operation

Performance statistics are collected at 10-minute intervals and are stored in a database file on the service processor.

At regular intervals, the data collected by the FAST controller is analyzed, and determinations made as to whether devices, under FAST control, need to be moved between Symmetrix tiers. The generated list of device movements created by FAST is known as a configuration change plan.

When a configuration change plan exists, the FAST controller is responsible for executing the plan, committing the required changes to the Symmetrix back-end configuration. When created, a configuration change plan can be executed automatically without user interaction, or execution can be delayed until user approval is granted manually.

Device movements within a configuration change plan are achieved by either a swap or a move. A swap occurs when two devices will exchange physical locations. A move involves only one device being relocated.

Note: *FAST device movement* provides more information on device swaps and moves.

FAST controller state

There are five possible states that the FAST controller can be reported in.

These are:

- ◆ Enabled — The FAST controller will perform all of its functions: performance data collection, performance data analysis, configuration change plan generation, and configuration change plan execution.
- ◆ Disabled — The FAST controller will only perform one of its functions: performance data collection. Data analysis and configuration change plan generation or execution will not be performed.
- ◆ Disabling — The FAST controller is transitioning from Enabled to Disabled.
- ◆ DisabledwithError — The FAST controller has stopped operation due to an internal error. None of the FAST controller operations will be performed.
- ◆ Degraded — The FAST controller can perform some or all of its functions. However, it cannot perform each function fully. For example, should no DRVs be configured in the system, FAST will be unable to perform device swaps.

Enabled state

When the state of the FAST controller is queried, and the state is Enabled, the current activity being performed by the controller will also be displayed. Valid activities include:

- ◆ Idle — The FAST controller is currently idle
- ◆ FetchingStats — The FAST controller is collecting Symmetrix device performance statistics
- ◆ AnalyzingStats — The FAST controller is performing analysis on the collected device performance statistics
- ◆ PendingPlan — A configuration change plan has been approved and its execution scheduled
- ◆ RunningPlan — A configuration change plan is currently being executed

Degraded state

When the state of the FAST controller is “Degraded,” a reason code will be displayed when the FAST state is queried, indicating the cause of the degraded state. Possible reason codes include:

- ♦ Not enough DRVs — There are no DRVs configured on the array to perform device swaps. To correct, DRV devices should be created.
- ♦ Invalid Swap/Performance time windows — At least one of the defined time windows is invalid. To correct, each time window should be checked, and any invalid time windows should be deleted or modified.
- ♦ Invalid device attributes — One or more storage groups have an invalid priority in a FAST policy. To correct, each storage group’s priority should be checked in the FAST policy they are associated with. Any invalid priority should be modified to a valid value.
- ♦ Invalid FAST parameters — One or more of the FAST controller configuration settings are invalid. To correct, each configuration setting should be checked and set to a valid value.
- ♦ Invalid Groups and Rules — An internal group or rule definition is invalid. To correct, customer service should be contacted.
- ♦ Broken metadevices — Members of the same metadevice are located on physical disks in different physical disk groups. To correct, customer service should be contacted.

FAST controller configuration

The FAST controller has multiple configuration parameters that control the behavior of FAST. These include time windows, which can control what performance data will be included in analysis and when device movements will take place. Other settings will determine how much data is to be analyzed when creating configuration change plans and the types of device movements that are allowed.

Note: By default, the FAST controller runs in “demo mode” on the service processor. In this mode, no software client connections can be made to the FAST controller from Solutions Enabler or the Symmetrix Management Console. Prior to making any configuration changes to the FAST controller, it must first be taken out of demo mode. This can only be done by an EMC customer service representative activating FAST on the service processor.

FAST controller time windows

The FAST controller utilizes time windows to define certain behaviors regarding performance data collection and device movement. There are two possible window types:

- ◆ Performance time window
- ◆ Device movement time window

The *performance* time windows are used to specify what performance data samples the FAST controller should include in data analysis when determining the appropriate tier for devices.

The *device movement* time windows define when to perform the configuration changes necessary to move the devices between tiers.

Time window characteristics

Both performance time windows and device movement windows may be defined as inclusion or exclusion windows. An inclusion time window indicates that the action should be performed during the defined time window. An exclusion time window indicates that the action should be performed outside the defined time window.

Multiple time windows of both types may be defined. Each type of window is hierarchical in nature and can be either periodic or nonperiodic. If multiple time windows of the same type have time ranges that overlap one another, the most recently added time window will override the others.

All defined time windows apply to all devices configured within the Symmetrix array.

A Symmetrix VMAX storage array will support up to 128 defined time windows. Each time window name may be up to 32 alpha-numeric characters, hyphens (-), and underscores (_).

Performance time window

The performance time windows are used to identify the business cycle for the Symmetrix array. They specify date and time ranges (past or future) when samples will be included in, or excluded from, the FAST performance data analysis. The intent of defining performance time windows is to distinguish periods of time when the Symmetrix is idle from periods when the Symmetrix is active, and to only include performance data collected during the active periods.

A default performance time window includes all performance data samples, 24 hours a day, 7 days a week, 365 days a year.

Device movement time window

Device movement time windows are used to specify date and time ranges when moves or swaps are allowed, or not allowed, to be performed. FAST device movements run as low priority tasks on the Symmetrix back end, however, they can introduce additional processing overhead. Device movement windows can be planned so as to minimize impact on the performance of other, more critical workloads.

The FAST controller will never start a move or swap session less than 30 minutes before the end of an inclusion device movement time window; however, a move or swap that has started may continue beyond the specified time window.

FAST controller settings

There are multiple FAST settings that affect the behavior of the FAST controller. These include:

- ◆ Operating Mode
- ◆ Maximum Moves Per Day
- ◆ Maximum Simultaneous Moves
- ◆ Workload Analysis Period
- ◆ Initial Analysis Period
- ◆ Move Type
- ◆ Use Host Invisible Devices

The following sections describe each one of these settings, their effect on the behavior of FAST, as well as possible and default setting values.

Operating Mode

The FAST controller, when enabled, may operate in one of two modes—User Approved or Automatic.

In *User Approved* mode, the FAST controller will generate configuration change plans on an hourly basis, but will not perform any device movements until such time that the plans are approved and scheduled by a user. Plans approved by a user may be scheduled to run during the next open device movement time window, or at a time specified by the user.

In *Automatic* mode, configuration change plans will be generated and executed at the beginning of each inclusion device movement window, without user involvement.

The default mode is Automatic.

Note: Even though the default mode is Automatic, the default device movement time window excludes all device movement.

Note: If the FAST controller does not generate a configuration change plan, then no movements will be performed in either User Approved or Automatic mode.

Maximum Moves Per Day

The Maximum Moves Per Day setting controls the number of swaps or moves the FAST controller will perform during a 24-hour period. As FAST device movements modify the back-end configuration of the Symmetrix, the number of movements may be limited each day until the effect of such movements is understood within the array.

Both swaps and moves count equally to this total. A single device move counts as one towards this total. In the case of a swap, even though two devices are involved in the swap, it will also only count as one towards this total.

The maximum moves per day setting may be configured between 2 and 200. The default setting is 200.

Maximum Simultaneous Moves

The Maximum Simultaneous Moves setting controls the amount of swaps or moves FAST will perform concurrently. As FAST device moves or swaps consume Symmetrix resources, the amount of concurrent movements may be limited until their impact is understood.

Both swaps and moves count equally to this total. A single device move counts as one towards this total. In the case of a swap, even though two devices are involved in the swap, it will also only count as one towards this total.

The maximum simultaneous moves setting may be configured between 2 and 32. The default value is 8.

Note: For device swaps, the maximum simultaneous device moves value is dependent on the number of DRVs configured on the Symmetrix. If there are only four DRVs configured, FAST will only be able to swap a maximum of four device pairs, regardless of whether the maximum simultaneous moves is set higher.

Workload Analysis Period

The FAST Workload Analysis Period defines the amount of historical statistical information that will be maintained by the FAST controller.

Subsequently, this will be the amount of data used for analysis in determining performance-based FAST movements. The data maintained will be that which was collected during the user-defined performance time windows.

Ideally, the workload analysis period should include the days of the week, and the hours of the day, during which the applications being managed experience their typical workload.

The workload analysis period can be configured to be between 1 hour and 4 weeks. The default is 1 week.

Initial Analysis Period

The FAST Initial Analysis Period defines the minimum amount of samples FAST should wait to collect before generating its first configuration change plan.

This value should be set to a long enough value so as to allow sufficient data samples for FAST to establish a good characterization of the typical workload in Symmetrix. This value allows FAST to commence analysis and movement activities prior to the full workload analysis period elapsing, if so desired.

The initial analysis period can be configured to be between 1 hour and 4 weeks, however, it cannot exceed that of the workload analysis period. The default is 1 week.

Move Type

The Move Type setting determines the type of device movements available to FAST, whether only swaps can be performed, or to allow both swaps and moves.

The Move Type setting can be configured to enable or disable the ability to perform only swaps. The default setting allows both swaps and moves (disable).

Note: *FAST device movement* provides more information on device swaps and moves.

Use Host Invisible Devices

The Use Host Invisible Devices setting determines whether FAST is allowed to use configured, but unmasked/unmapped devices as target devices in FAST swaps. If FAST is not allowed to use host invisible devices, then device swaps will only occur between devices that belong to storage groups that are associated with a FAST policy.

The Use Host Invisible Devices setting can be configured to enable or disable the use of unmapped/unmasked devices as the target of FAST

swaps. The default setting disables the use of host invisible devices (disable).

FAST controller performance data analysis

When collecting device performance data for use in its analysis, FAST only collects statistics related to Symmetrix back-end activity. The metrics collected are:

- ♦ DA logical volumes reads
- ♦ DA logical volumes writes
- ♦ Logical volume prefetch
- ♦ DA logical volumes blocks read
- ♦ DA logical volumes blocks written

FAST then runs up to three distinct algorithms against this data in order to determine the appropriate tier a device should belong to. The algorithms are:

- ♦ EFD promotion/demotion algorithm
- ♦ Capacity-based algorithm
- ♦ FC/SATA cross tier algorithm

Each algorithm is run against all the Symmetrix devices under FAST control. Optionally, unmapped and unmasked devices may also be considered when performance data is being analyzed.

The following sections provide additional data on each of the algorithms.

Enterprise Flash Drive promotion/demotion algorithm

The goal of the Enterprise Flash Drive (EFD) promotion/demotion algorithm is to maximize EFD utilization within the array. It only considers whether a device should, or should not, reside on EFDs.

When run, this algorithm models EFD performance for each device under FAST control. This modeling is based on each devices write percentage, average I/O size (in blocks), and total I/Os per second (IOPS). The I/O response time, or utilization, of a Flash drive depends largely on the write percentage, in addition to IOPS and I/O size.

In order to determine if a device is “busy,” the number of reads per GB is used. The importance of a device is determined by the priority assigned to the storage group to which the device belongs: 1 (high), 2 (medium), or 3 (low). With this, a weighted read density is calculated by combining the average read I/Os per GB (read density) and the average read I/O ratio.

When complete, the algorithm will list all the devices in the array in order of their EFD weighted read density. Those devices with a higher read density will be considered to be better served being configured on EFD.

When generating the configuration change plan, the algorithm will first attempt to find all possible moves to promote non-Flash devices to unconfigured space within the Flash Symmetrix tier. After all possible moves have been identified, the algorithm will attempt to generate swap suggestions that will move busier devices to Flash while demoting less busy devices to the lower tiers.

Capacity-based algorithm

The goal of the capacity-based algorithm is to enforce the FAST policy storage usage rules. A storage group is considered to be out of compliance when a higher percentage of devices exist on a tier than is configured in the policy for that tier. A storage group is also considered to be out of compliance if devices in the storage group are configured on a tier that is not included in the associated policy—such devices will be reported as being out of policy.

This algorithm will create a configuration change plan to align the devices in the storage group with the associated policy by moving or swapping devices into the other tiers included in the policy. When determining which devices to relocate, the algorithm will attempt to swap two devices that are currently “out-of-tier,” resulting in both devices being located in the correct tier. If no such swaps are possible, device moves will be generated to relocate a device to the correct tier.

Upon completion, this algorithm will generate a configuration change plan that may involve moving or swapping devices between all tiers.

FC/SATA cross-tier algorithm

The goal of the FC/SATA cross-tier algorithm is to balance utilization across Fibre Channel and SATA technologies. Only devices configured on Fibre Channel and SATA drives are considered.

When run, this algorithm will calculate the disk service time for each device configured on FC and SATA disks. The disk service time is calculated from the following metrics:

- ◆ Seek time — The time it takes the disk arm to move and position the disk head on the correct track.
- ◆ Latency time — The delay for disk rotation.
- ◆ Transfer time — The time that it takes the disk to transfer the data from/to the disk.

Devices are sorted by disk service time, in descending order and the most utilized devices will be moved to the least utilized disks.

When generating the configuration change plan, the algorithm will first attempt to find all possible moves to relocate devices to unconfigured space within the FC and SATA tiers. After all possible moves have been identified, the algorithm will attempt to generate swap suggestions between higher and lower utilized devices.

Optimizer algorithm

The goal of the Optimizer algorithm is to balance load within a physical disk group. Configuration change plans generated by Optimizer will only contain swaps. The device pairs involved in an Optimizer swap will belong to the same physical disk group and will be configured with the same RAID protection type. Optimizer will not perform a device move.

This algorithm is only run when Optimizer is enabled, and licensed, on the array.

Algorithm execution

When data analysis is performed, the FAST controller will pick one of the algorithms to run, based on system configuration and algorithm priority. Each of the algorithms is assigned a weighting value which affects the probability of the algorithm being chosen. The algorithms with a higher weighting value have a higher probability of being run first during the FAST controller data analysis.

The weighting value of each algorithm is as shown in Table 1.

Table 1. Weighting value of algorithms

Algorithm	Weighting factor
EFD promotion/demotion	4
Capacity	3
FC/SATA cross tier	2
Optimizer	1

The system configuration may affect these weighting values. For example, if there are no Enterprise Flash Drives configured in the array, then the EFD promotion/demotion algorithm will not be run. The weights of the remaining algorithms will be modified accordingly.

If the chosen algorithm generates a configuration change plan this will be automatically executed or submitted for approval, based on the FAST mode of operation.

In *Automatic* mode, the first algorithm will be run when the device movement window first opens. If the execution of the configuration change plan completes 30 minutes prior to the expiration of the window, a second algorithm will be chosen and executed. This continues until all algorithms have been executed or the time window expires.

In *User Approved* mode, an algorithm is selected to be run every hour.

Configuration change plans

When one of the FAST algorithms has been run, the FAST controller will generate one of two types of configuration change plan—performance or compliance.

Performance generated configuration change plans are the result of the EFD promotion/demotion algorithm or the FC/SATA cross-tier algorithm being executed.

Compliance generated configuration change plans are the result of the Capacity-based algorithm being run.

When a configuration change plan is generated, it may contain both device moves and device swaps. If it does, the moves and swaps will be separated into individual groups within the plan. When executed, each group will be executed in the order in which they appear within the plan.

In the case where the number of swaps, or the number of moves, within a plan exceed the maximum simultaneous device moves setting, then additional groups will be created within the plan.

Moves and swaps generated by any of the algorithms will be constrained by the relevant FAST policies. That means that the device movements created will not cause a storage group to fall out of compliance with the policy it is associated with. Generated device movements must also conform to Symmetrix configuration rules.

FAST device movement

There are two methods by which a device will be relocated to another tier—move or swap.

A *move* occurs when unconfigured space exists in the target tier.

A *swap* occurs when there is no unconfigured space in the target tier, and results in a corresponding device being moved out of the target tier.

Both swaps and moves are performed by completing a series of back-end configuration changes on the Symmetrix array, managed by the FAST controller, to associate and disassociate RAID groups to and from the devices involved in the move or swap. During FAST device movements, the Symmetrix external configuration lock (lock #15) is held for brief periods of time (approximately 2 minutes), while the Symmetrix configuration is being changed. However, the lock is not held while data is being copied between RAID groups, thus allowing other static configuration changes to be made to the Symmetrix while a FAST device movement is in progress.

The following sections detail the process followed in the case of both a move and swap, including when the configuration lock is held and when it is released.

FAST device move

When a determination has been made that a device should be promoted or demoted to another Symmetrix tier, a device move will be performed when there is unconfigured space in the target tier. A move affects only the device being relocated.

The amount of unconfigured space should be sufficient to allow the configuration of the device being moved with the correct target protection type.

Performing a device move will create new hypervisors, from free space, in the target tier, to be used as the target of the move. Once the data transfer

portion of the move has been completed, the physical space previously associated with the moved device will be returned to the free pool.

In the following illustration, FAST has determined that Symmetrix device 100, a device currently located in a RAID 1 Fibre Channel Symmetrix tier, is to be moved to a RAID 5 (3+1) EFD Symmetrix tier.

In performing the device move, five distinct stages are seen.

Stage 1

Figure 6 shows the device to be migrated prior to the move being started.

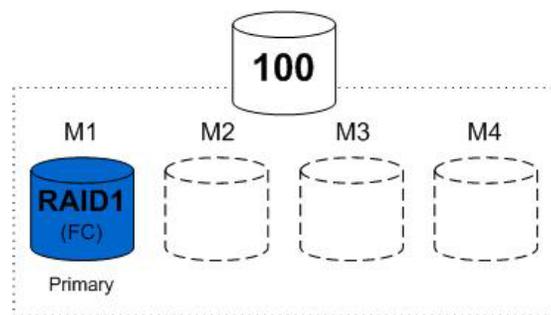


Figure 6. FAST device move—Stage 1

The FAST controller submits the move request to the Symmetrix.

Stage 2

Upon submission, the external Symmetrix configuration lock is placed on the array in order to perform the first of two configuration changes during the move.

Once the Symmetrix is locked, the target RAID group is created in the target Symmetrix tier and attached as a secondary mirror to the device being migrated.

The RAID group is added in the first available mirror position, in this case the second mirror (M2) position, as shown in Figure 7.

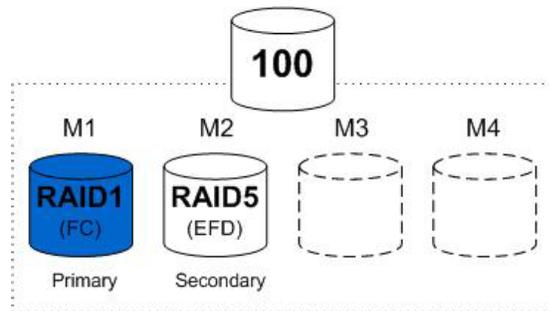


Figure 7. FAST device move—Stage 2

Once attached, the secondary RAID group is completely invalidated to be synchronized from the primary mirror and the configuration lock is released.

Stage 3

As the secondary mirror was invalidated when it was associated with the volume, it is then synchronized from the primary mirror of the volume. Figure 8 shows the secondary mirror now synchronized with the primary mirror.

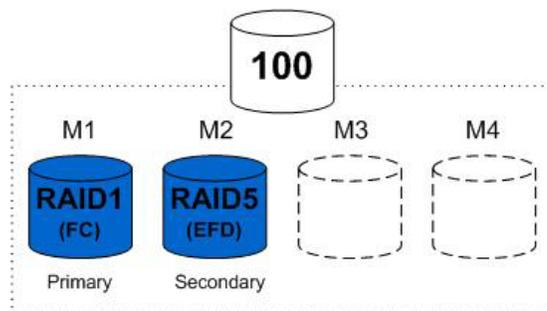


Figure 8. FAST device move—Stage 3

Stage 4

Following the completion of the synchronization, the Symmetrix configuration lock is acquired once again.

Once locked, the device configuration is updated to swap the primary and secondary roles of the attached RAID groups. In this case the original RAID 1 mirror is demoted to secondary, while the new RAID 5

mirror is promoted to be the primary mirror. This change is shown in Figure 9.

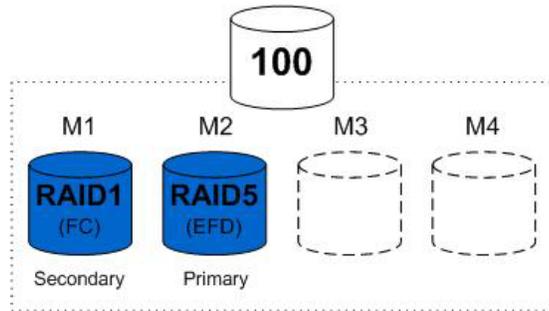


Figure 9. FAST device move—Stage 4

Stage 5

When the primary and secondary mirror roles are switched, the original RAID group is detached from the device and deleted. The space previously occupied by the RAID 1 group on the Fibre Channel storage is returned to the free pool, as illustrated in Figure 10.

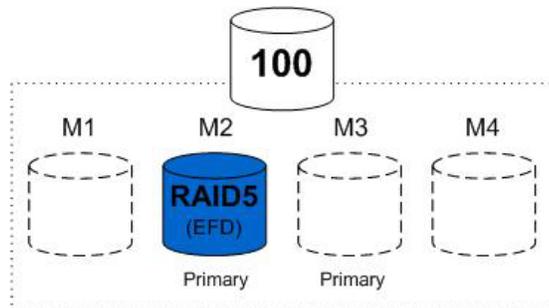


Figure 10. FAST device move—Stage 5

At this time, the configuration lock is released, and the move is considered to be complete.

Note: Following a move, the primary mirror may be located in a mirror position other than the M1 position on the Symmetrix. However, SYMCLI output will always display the primary mirror as being in the M1 position.

FAST device swap

When a determination has been made that a device should be promoted to another Symmetrix tier, and there is no unconfigured space in the target tier, FAST must demote another similarly sized device from the target tier. Similarly, if a device is to be demoted to a tier where there is no unconfigured space, a similarly sized device will be promoted. This promotion/demotion pair operation is completed by performing a FAST swap.

Performing a device swap exchanges the physical attributes of each device involved in the swap, including physical location, disk technology, and RAID protection type. In order to preserve data on both devices involved in the swap, and to maintain full RAID protection on each device during the entire swap, a single Dynamic Reallocation Volume (DRV) is used.

Note: *FAST DRV requirements* provides information on configuring DRVs.

In the following illustration, FAST has determined that Symmetrix device 100, a device currently located in a RAID 1 Fibre Channel Symmetrix tier, is to be demoted to a RAID 6 (14+2) SATA Symmetrix tier. At the same time, device 200 is to be promoted from the RAID 6 (14+2) SATA Symmetrix tier to the RAID 1 Fibre Channel tier. As the two devices are of the same size, FAST will perform a device swap.

In performing the device swap, eight distinct stages are seen.

Stage 1

Figure 11 shows the two devices that will be swapped.

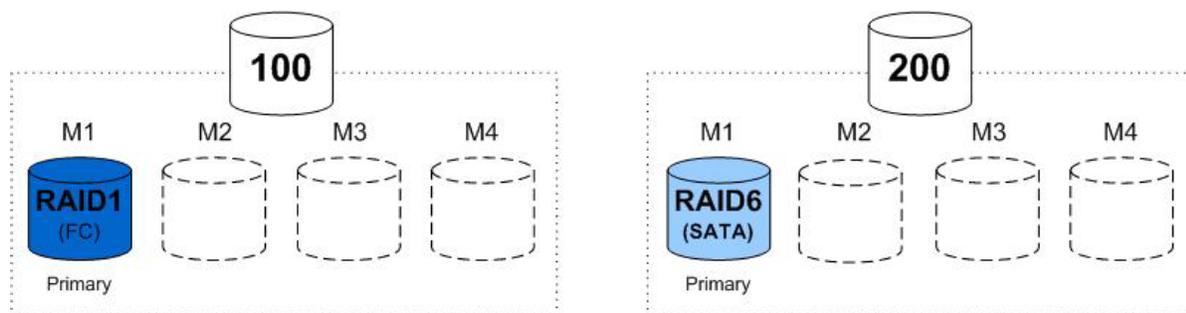


Figure 11. FAST device swap—Stage 1

The FAST controller submits the swap request to the Symmetrix.

Stage 2

Upon submission, the external Symmetrix configuration lock (lock 15) is placed on the array in order for a configuration change to be performed. During this configuration change, a DRV device is chosen, and its associated RAID group is detached and associated with one of the devices being swapped (in this case, device 100). The association of the device is shown in Figure 12.

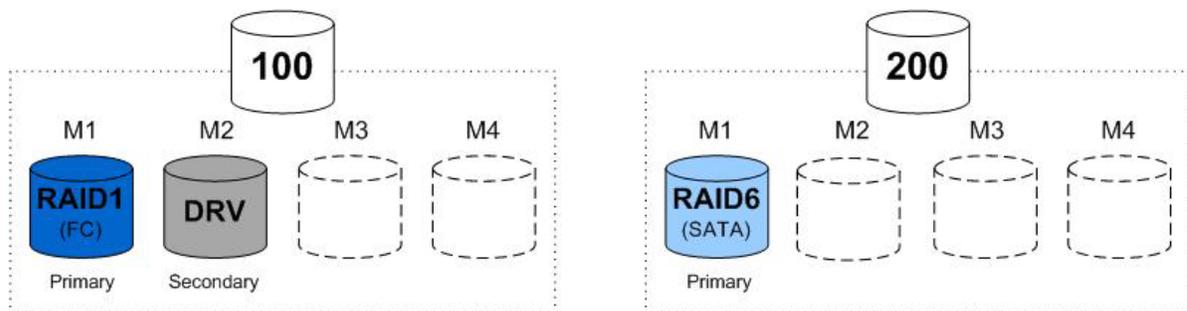


Figure 12. FAST device swap—Stage 2

When the configuration change has been completed, the configuration lock is released.

Stage 3

Following the configuration change, the DRV is synchronized from the original RAID group associated with device 100.

Stage 4

When the DRV has been completely synchronized, the configuration lock is once again placed on the Symmetrix. During this second configuration change session, the original RAID group of device 100 is detached from the device and associated with the other device in the swap, device 200, as shown in Figure 13.

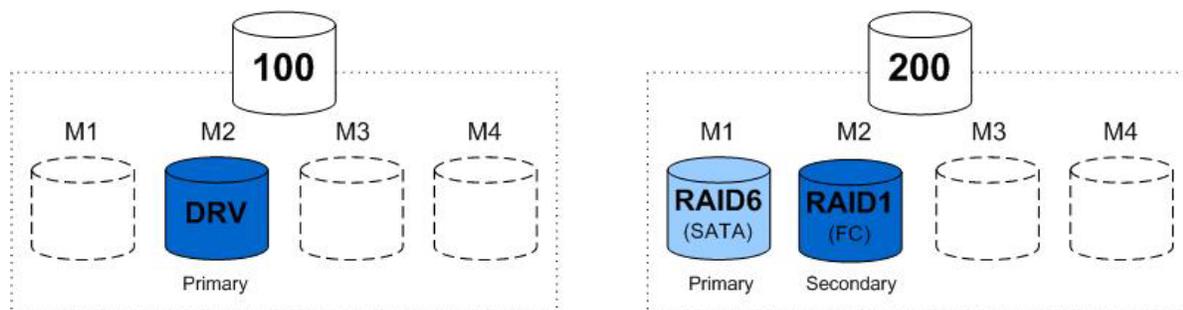


Figure 13. FAST device swap—Stage 4

Once again, when the configuration change has completed, the configuration lock is released.

Stage 5

Following this configuration change, the newly attached RAID group is synchronized from device 200's original RAID group.

Stage 6

After the data synchronization, the configuration lock is placed on the array for a third time. This third configuration change will detach the original RAID group from device 200, and attach it to device 100, as shown in Figure 14.

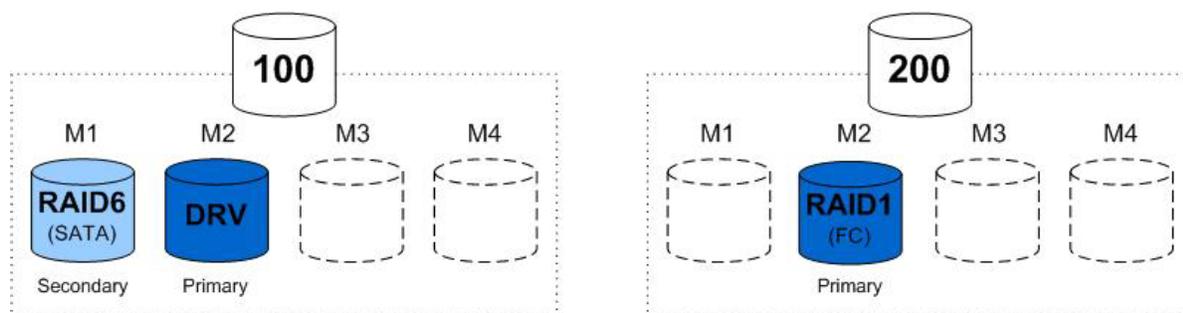


Figure 14. FAST device swap—Stage 6

Stage 7

When the configuration lock is released, the RAID group that was just attached to device 100 is synchronized from the DRV.

Stage 8

Once the synchronization from the DRV has completed, the configuration lock is placed on the array for the fourth and last time. During this final configuration change, the DRV RAID group is detached from device 100 and re-attached to the DRV device.

The final state of the two swapped devices is shown in Figure 15.

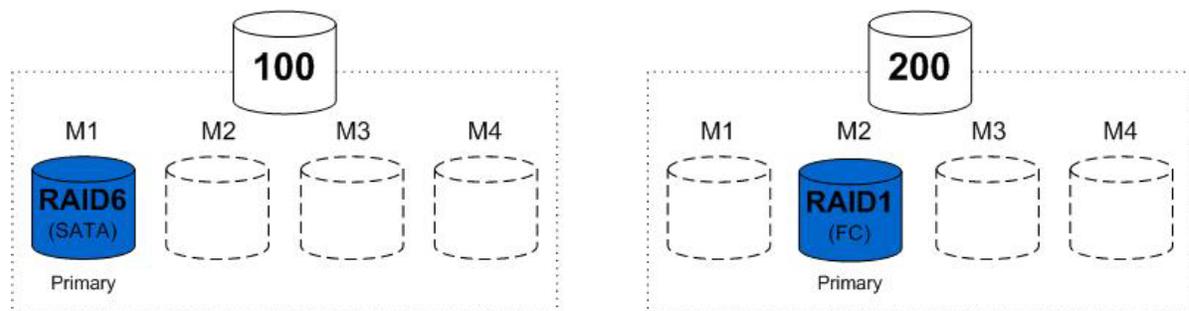


Figure 15. FAST device swap—Stage 8

Note: Following a swap, the primary mirror of either device may be located in a mirror position other than the M1 position on the Symmetrix. However, SYMCLI output will always display the primary mirror as being in the M1 position.

Metadevice movement considerations

When operating in an environment where FAST is managing Symmetrix metadevices, there are certain Enginuity configuration rules pertaining to metadevices which must be adhered to.

The first metadevice rule is that all metadevice members must be configured within the same Symmetrix physical disk group. This means that all members must be configured on the same disk technology, disk size and, if applicable, disk rotation speed.

The second rule prohibits metadevices from containing members of different RAID protection types.

Thirdly, when a metadevice is made up of members configured on either Fibre Channel or SATA disks, the physical hypervisors that make up each meta member may not be located on the same physical disk as another physical hyper of another member of the same metadevice.

Each of these rules will be a factor when either swapping or moving a metadevice between Symmetrix tiers.

FAST move of a Symmetrix metadevice

When FAST is moving a Symmetrix metadevice between tiers, the target Symmetrix tier must contain sufficient space to accommodate all the members of the metadevice being moved. Also, when moving to a FC or SATA-based tier, the target Symmetrix tier must contain sufficient disks for all the physical hypervisors of all of the members to be located on separate physical disks.

When FAST is attempting to move a Symmetrix metadevice, it will create a configuration change plan whereby all the metamembers will be moved at the same time.

FAST swap of a Symmetrix metadevice

If FAST has determined that a Symmetrix metadevice needs to be swapped in order to promote or demote the device, the FAST controller must locate sufficient devices in the target Symmetrix tier to satisfy the FAST request. The devices in the target tier may be members of a metadevice of the same size as the metadevice to be swapped. Alternately, multiple smaller metas, or a number of individual devices totaling the number of metamembers of the metadevice to be swapped may also be used.

As examples, a 16-member metadevice may be swapped with:

- ◆ A 16-member metadevice
- ◆ Two 8-member metadevices
- ◆ 16 individual devices
- ◆ An 8-member metadevice, and 8 individual devices

In each case, each of the target metadevice members, or individual devices, must match the size of the metadevice members to be swapped with.

When FAST is attempting to swap a Symmetrix metadevice, it will create a configuration change plan whereby all the metamembers will be swapped at the same time.

Multi-stage Symmetrix metadevice move or swap

A multi-stage move or swap occurs when FAST is unable to relocate all the members of a Symmetrix metadevice at the same time in a configuration change plan.

In the case of a move, this occurs when the number of metadevice members exceeds the maximum concurrent device movements configured in FAST.

In the case of a swap, it occurs when the number of metadevice members exceeds the maximum concurrent device movements configured in FAST, or the number of DRV devices configured in the array.

In both cases, during a multi-stage move or swap, metadevice members may temporarily reside in different physical disk groups or with different RAID protection levels.

If the data movement window expires during a multi-stage move or swap, FAST will continue the swaps and move operations until all metadevice members have been relocated.

Device movement rollback

In certain circumstances, the Symmetrix can provide the ability to “undo” or rollback device swaps to return the Symmetrix configuration to a point at which it was prior to a FAST device movement. The rollback capabilities available are limited to allow only device swaps to be rolled back automatically.

The ability to perform a rollback is provided through Symmetrix Optimizer, using either the **symoptmz** SYMCLI command or SMC. The Symmetrix Optimizer rollback is an “all or nothing” feature. All swaps are reversed from the present to a selected prior point-in-time.

Note: Swaps performed by both Optimizer and FAST will be affected.

Swap rollback

The rollback of a device swap, or swaps, is performed by reversing the original swap of the two devices. The rollback of a swap results in both devices being returned to their original locations.

As device moves cannot be automatically rolled back, swap rollbacks can only be performed back to a point-in-time after the most recent device move.



Figure 16. FAST device movement timeline

In the timeline shown in Figure 16, the most recent device move performed by FAST occurred on October 10, at 1 a.m. As such, only the swaps that have occurred since that time could be rolled back. Device swaps performed prior to October 10 could not be rolled back automatically.

Move rollback

In the case of device moves performed by FAST, the ability to reverse the move is a little more complicated. A device move leaves unconfigured space in the original Symmetrix tier the device was moved from. When attempting to rollback a move, there is no guarantee that the device that was moved will return to the exact physical locations it once occupied.

The ability to reverse a device move is provided through the enhanced Virtual LUN feature of Symmetrix VMAX using either the SYMCLI command, *symmigrate*, or the SMC LUN Migration Wizard. Virtual LUN allows for devices to be moved, or migrated, between physical disk types, RAID protection types, or both. These moves can be performed to unconfigured storage in the destination disk group.

Device movement control

Once a device movement begins (swap or move), there is no interface which allows the movement to be stopped. Any move that has started will need to be completed. This is true even if the movement will continue beyond the end of a defined device movement window.

Canceling a scheduled device movement

In a configuration change plan, there may be several groups of movements defined, with each group being executed serially. When running in user approved mode, while it is not possible to stop the movement of the current group that is in progress, subsequent groups can be stopped before they start by declining a plan that had previously been approved.

Changing the device movement copy pace

If the device movement in progress is impacting other applications or replication tasks within the Symmetrix, Quality of Service tools may be used to set the mirror copy pace to slow down the FAST device movement and give priority to other tasks running the Symmetrix back end.

The mirror copy pace can be set, between 0 and 16 inclusively, with 0 being the fastest and 16 being the slowest. The default QoS value is 0. Setting the pace value to 16 will allow the device move or swap to copy approximately one track per minute, per device, effectively suspending

the FAST device movement. Once the unrelated copy tasks have completed, the pace setting can be reset to 0.

FAST DRV requirements

As shown previously, a DRV is required in order to preserve the data on both devices involved in a FAST swap. One DRV is required for each device pair being swapped. As such, in order to swap multiple device pairs simultaneously, multiple DRVs should be configured. If no DRVs are configured, FAST will run in degraded mode and only have the ability to perform device moves.

When performing a device swap, the two devices being swapped must be of the same size. However, the DRV used during the swap can be equal to or larger in size than the devices being swapped. If the Symmetrix has devices of varying sizes configured, a single set of DRVs may be created equal in size to the largest device to be managed by FAST.

In order to perform a swap, the emulation of the DRV used must match that of the devices being swapped. FAST supports the swapping of FBA and CKD devices. In a mixed environment, DRV devices of both emulations should be configured.

Note: CKD metadevices must be swapped all at the same time. As such, a minimum of four DRVs is required where CKD metadevices will be managed by FAST.

During a device swap, there will be a period of time when the DRV RAID group is the only RAID group protecting one of the devices involved in the swap. Because of this, the RAID protection required for DRV devices in Symmetrix VMAX is RAID 1 (mirrored).

There are no restrictions on the disk technology DRV devices may be configured on, that is, DRV devices may be configured on EFD, FC, and SATA. When performing a swap, FAST will attempt to use a DRV of the same technology as the faster device being swapped. For example, if FAST is swapping a device configured on Fibre Channel with a device configured on SATA, FAST will look for an available DRV configured on a FC drive and attach it to the FC device being swapped. If no Fibre Channel DRV is available, a DRV on the fastest available technology will be used.

FAST interoperability

FAST is fully interoperable with all Symmetrix replication technologies—EMC SRDF®, EMC TimeFinder®/Clone, TimeFinder/Snap, and Open Replicator. Any active replication on a Symmetrix device remains intact while the device is being moved or swapped. Similarly, all incremental relationships are maintained for the moved or swapped devices. However, what must be kept in mind is that FAST device movements will consume array resources, so planning must be performed in determining when FAST device movements should occur so as to minimize impact on other replication processes.

FAST also operates alongside Symmetrix features such as Symmetrix Optimizer, Dynamic Cache Partitioning, and Auto-provisioning Groups.

SRDF

An RDF1 volume, with local protection, can be moved or swapped by FAST while also actively replicating to an RDF2 volume, in either synchronous or asynchronous mode. Similarly, an RDF2 volume can be moved or swapped while being replicated to by an RDF1 volume.

While there are no restrictions in the ability to move or swap SRDF devices with FAST, what must be considered is that device movements are restricted to the array upon which the FAST controller is operating. That is to say that if an RDF1 device is moved between two tiers, FAST will not automatically perform a corresponding move of the respective RDF2 device on a remote array. This means that, in a SRDF failover scenario, the remote Symmetrix array will have different performance characteristics than the local, production array being failed over from.

Also, in an SRDF/Asynchronous environment, FAST device movements on the production R1 array could result in an unbalanced configuration between R1 and R2 (where the performance characteristics of the R2 device is lower than that of the paired R1 device).

The FAST best practices technote available in the EMC Powerlink® website provides more information on using FAST in an SRDF environment, including considerations and best practices.

TimeFinder/Clone

The source device of the TimeFinder/Clone session, or Clone emulation session, can be moved or swapped by FAST. A device that is the target device of a TimeFinder/Clone session, or a Clone emulation session, can also be moved or swapped by FAST, provided that the target has been split or activated.

TimeFinder/Snap

The source device in a TimeFinder/Snap session can be moved or swapped by FAST.

Open Replicator for Symmetrix

The control device in an Open Replicator session, push or pull, can be moved or swapped by FAST.

Symmetrix Optimizer

While both FAST and Symmetrix Optimizer can be operated independently of each other on a Symmetrix VMAX array, they do share several configuration settings between them. These are:

- ◆ Max Moves Per Day
- ◆ Max Simultaneous Moves
- ◆ Workload Analysis Period
- ◆ Initial Analysis Period
- ◆ Performance Time Windows
- ◆ Device Movement Time Windows

Also, if FAST and Optimizer are both active and enabled, they will share the same Operating Mode—user approved or automatic.

Dynamic Cache Partitioning (DCP) considerations

Dynamic Cache Partitioning can be used to isolate storage handling of different applications. As device movements use the same cache partition as the application, movements of devices on behalf of one application do not affect the performance of applications that are not sharing the same cache partition.

Auto-provisioning Groups

Storage groups created for the purposes of FAST may also be used for Auto-provisioning, and the other way round. However, while a device may be contained in multiple storage groups for the purposes of Auto-provisioning, it may only be contained in one storage group that is associated with a FAST policy.

A storage group containing both standard provisioning devices (non-thin) and thin devices may be used by Auto-provisioning, but a FAST storage group may only contain standard provisioning devices.

FAST shares storage group definitions with Auto-provisioning Groups. However, while Auto-provisioning storage groups can share devices, FAST storage groups cannot share devices. As a result of this, it may not be possible to use already configured storage groups for the purposes of FAST, and new storage groups will need to be configured.

SMC FAST Configuration Wizard

Symmetrix Management Console (SMC) version 7.1 provides a FAST Configuration Wizard to allow a user to quickly configure the FAST environment on a Symmetrix VMAX storage array. The FAST Configuration Wizard guides the user through the process of configuring FAST, including:

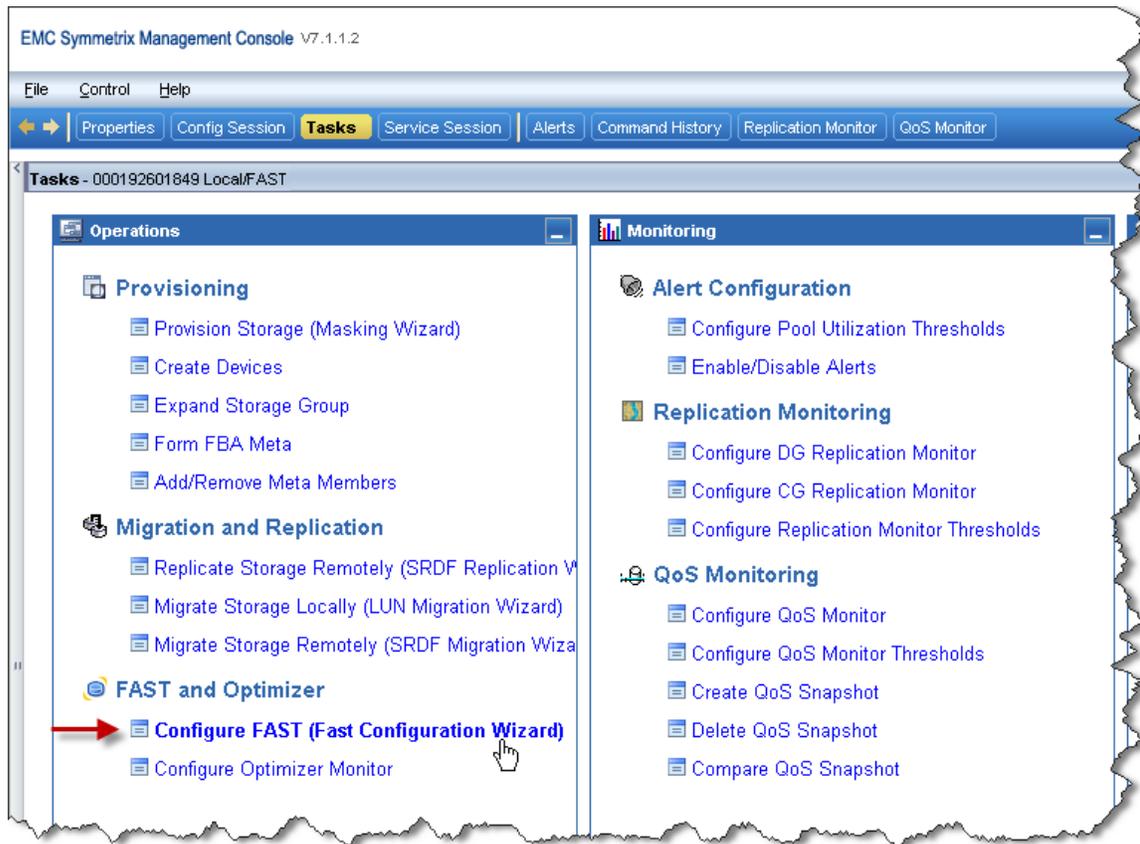
- ◆ Configuring FAST controller settings
- ◆ Creating a performance time window
- ◆ Creating a device movement time window
- ◆ Creating dynamic Symmetrix tiers
- ◆ Creating a performance improvement FAST policy
- ◆ Creating a cost reduction FAST policy

Use of the FAST Configuration Wizard is recommended for use in less complex environments. Possibly where only one Symmetrix physical disk group is configured for each disk technology type within the array, or where simple performance/device movement windows will suffice.

Note: The examples shown in this section were created using SMC version 7.1.1.2.

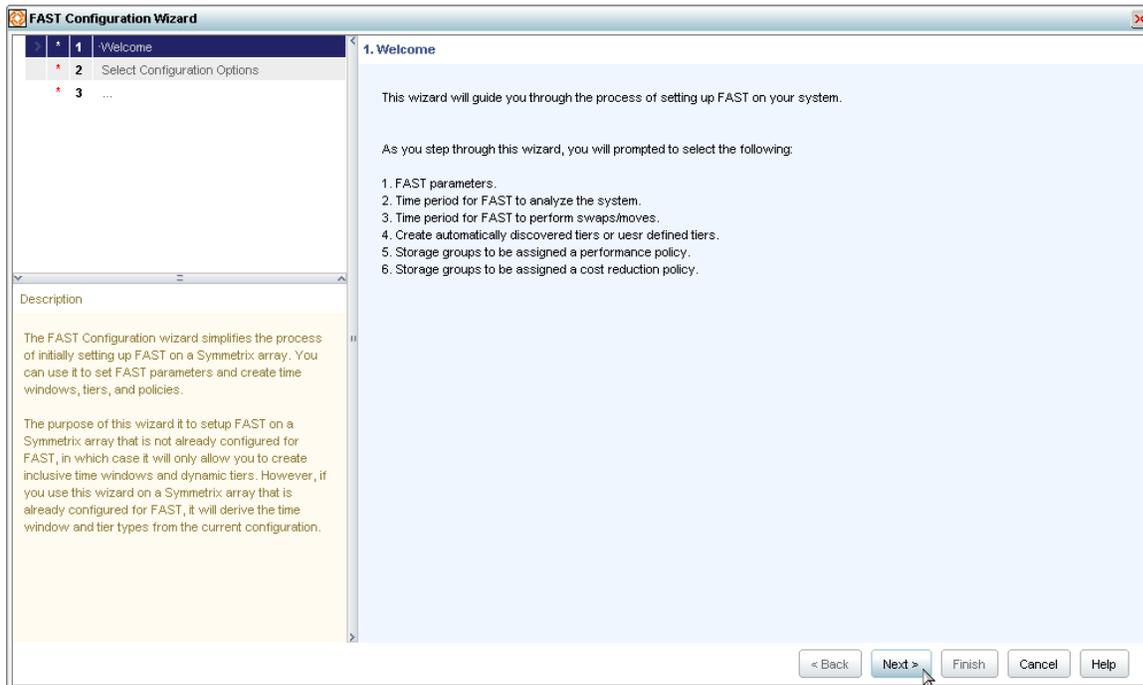
For more complex environments, FAST settings and managed objects can be created, or modified, directly using either SMC or SYMCLI. See the sections *Management Interface: SMC* or *Management Interface: SYMCLI*, respectively, for more information.

To access the FAST Configuration Wizard, users should click on the Tasks view button.



In the Operations panel, under FAST and Optimizer, the Configure FAST (FAST Configuration Wizard) link can be clicked to launch the wizard.

When the wizard is launched, a welcome page will be displayed, summarizing the steps that can be followed while running the wizard.

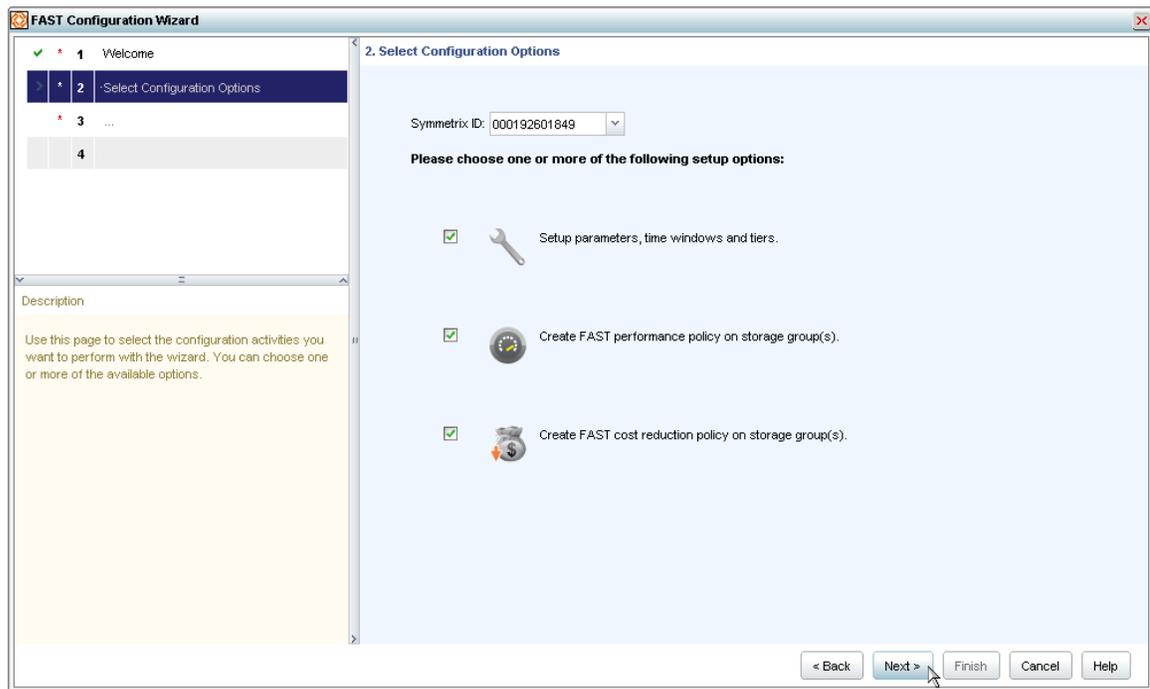


By clicking Next on the Welcome page, up to three setup options can be chosen to be executed by the wizard. These options are:

- ◆ Setup Parameters, Time Windows and Tiers
- ◆ Create FAST Performance Policy on Storage Group(s)
- ◆ Create FAST Cost Reduction Policy on Storage Group(s)

The Setup Parameters, Time Windows and Tiers option allows for the configuration of FAST controller settings such as mode of operation, and workload analysis period to be set. Also, performance and device movement time windows can be created. Finally, dynamic Symmetrix tiers can be created.

The Create FAST Performance Policy and FAST Cost Reduction Policy options will allow suggested FAST policies to be created and storage groups associated with them.



After the setup options have been selected, the Next button is clicked.

In this case, all three setup options have been chosen, so the full configuration wizard will be executed.

The wizard can only be run for one Symmetrix at a time, and can only be run against a locally connected Symmetrix. The selection of Symmetrix IDs will be limited to those that have a local connection to the SMC server from where the wizard is being run.

On the Set FAST Parameters screen, the following settings will be configured:

- ◆ Data movement mode
- ◆ Initial analysis period
- ◆ Workload analysis period
- ◆ FAST controller state

The screenshot shows the 'FAST Configuration Wizard' window at step 3, 'Set FAST Parameters'. The left sidebar shows a progress list with steps 1 through 9. Step 3 is currently selected. The main area contains the following configuration options:

- Symmetrix ID: 000192601849
- Data Movement mode: Automatic User approved
- Time to sample before first analysis: 3 day(s)
- Workload Analysis Period: 3 day(s)
- FAST state: Enabled Disabled

At the bottom right, there are five buttons: '< Back', 'Next >', 'Finish', 'Cancel', and 'Help'. A mouse cursor is pointing at the 'Next >' button.

When all the settings have been chosen, the Next button is clicked.

The first type of time window to be configured in the wizard is a Performance time window.

To create the time window, the checkbox to the left of Create Time Window must be selected.

Several default values are available for both the days on which to collect device performance statistics, as well as the time during those days.

If the default values are not appropriate for the environment, more specific settings can be chosen by clicking the radio button to the left of Other, and specifying the appropriate times and days, as shown next.

FAST Configuration Wizard

1 Welcome
2 Select Configuration Options
3 Set FAST Parameters
4 **Create Performance Time Window**
5 Create Move Time Window
6 Create Tiers
7 Create Performance Improvement Policy
8 Create Cost Reduction Policy
9 Summary

Description

Analysis Time Window
Use this page to create a performance time window. Performance time windows specify when FAST can take performance samples for analysis.

You can either except the default (24 hrs/day, 7 days a week) or create a new time window by selecting the days and times when FAST can take the samples.

4. Create Performance Time Window

Existing Time Windows

Order	Name	Flags	Start Time (EDT)	End time (EDT)	Recurrence
0	The Default Time Window	Exclusive	N/A	N/A	Once

Create Time Window

Performance time window name:

Select which days to perform analysis

Daily
 Mon - Fri
 Sat - Sun
 Other

Mon
 Tue
 Wed
 Thu
 Fri
 Sat
 Sun

Select the time of day to perform analysis

24 Hours
 9am - 5pm
 5pm - 9am
 Other

Daily start time:

Daily end time:

< Back Next > Finish Cancel Help

A default time window name will be generated based on the parameters selected, however, this can be modified by entering a specific name in the name field.

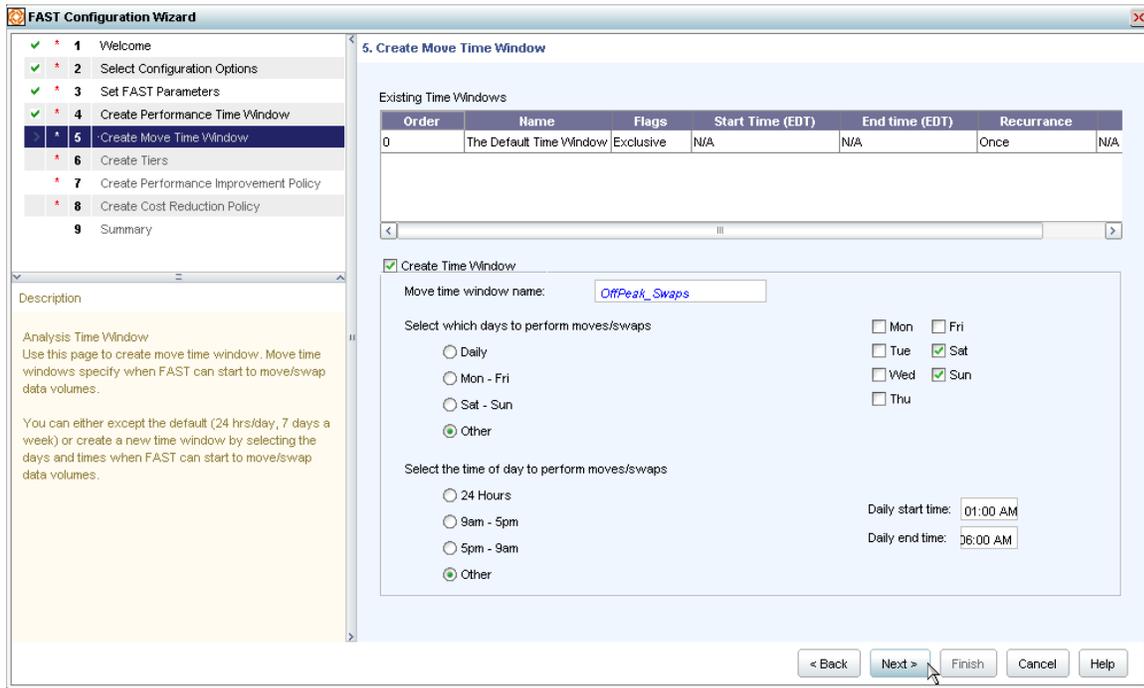
When all the required settings have been selected, the Next button is clicked.

The second type of time window to be configured in the wizard is a Device Movement time window.

To create the time window, the checkbox to the left of Create Time Window must contain a checkmark.

Several default values are available for both the days on which to perform FAST device movements, as well as the time during those days.

If the default values are not appropriate for the environment, more specific settings can be chosen by clicking the radio button to the left of Other, and specifying the appropriate times and days, as shown next.

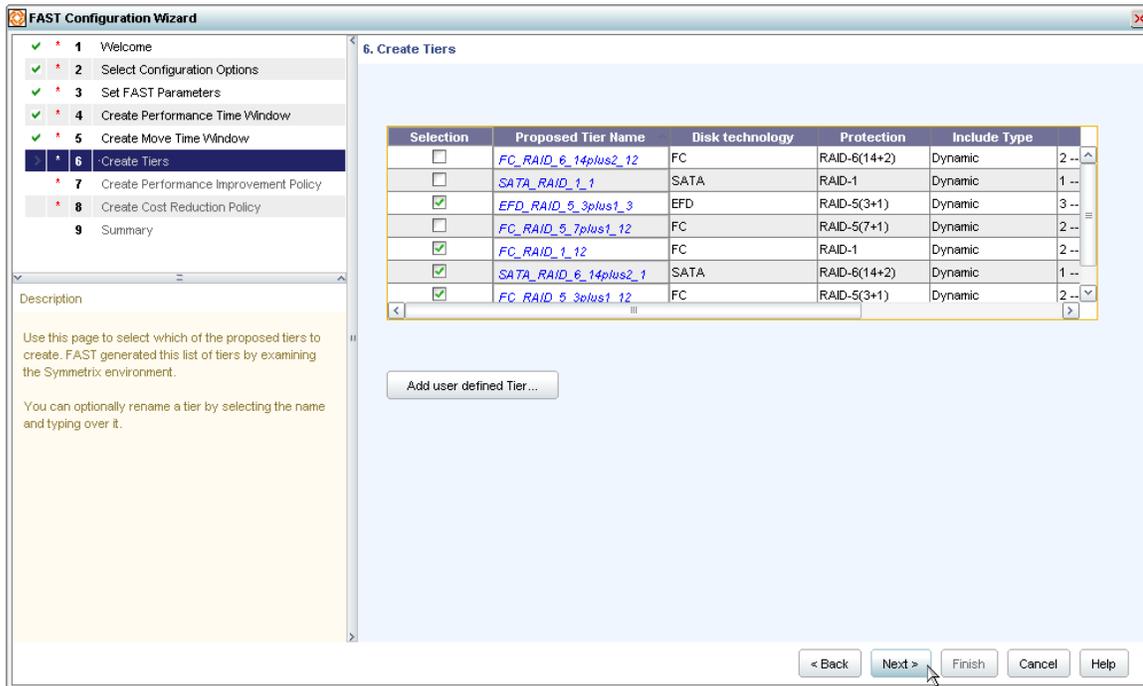


A default time window name will be generated based on the parameters selected, however, this can be modified by entering a specific name in the name field.

When all the required settings have been selected, the Next button is clicked.

After the time windows have been created, the wizard will propose dynamic Symmetrix tiers to be created. It will also discover any existing tiers that may have been previously created.

The proposed tiers to be created are based on the available disk technologies in the Symmetrix, as well as the device protection types that are already configured on those disk types. Names are automatically assigned to the tiers, however, these can be modified by clicking the name and editing it. The default naming scheme for tiers is a concatenation of the disk technology, the RAID protection, and a disk group number.



All suggested tiers will be created as dynamic. Static tiers may be created by clicking the “Add user defined Tier” button. This button may also be used to create additional tiers not proposed by the wizard.

Note: For more information on creating a static tier, see the section Creating a static Symmetrix tier.

By default, all proposed Symmetrix tiers will be created. However, the creation of some tiers can be prevented by clearing the checkbox to the left of those tiers.

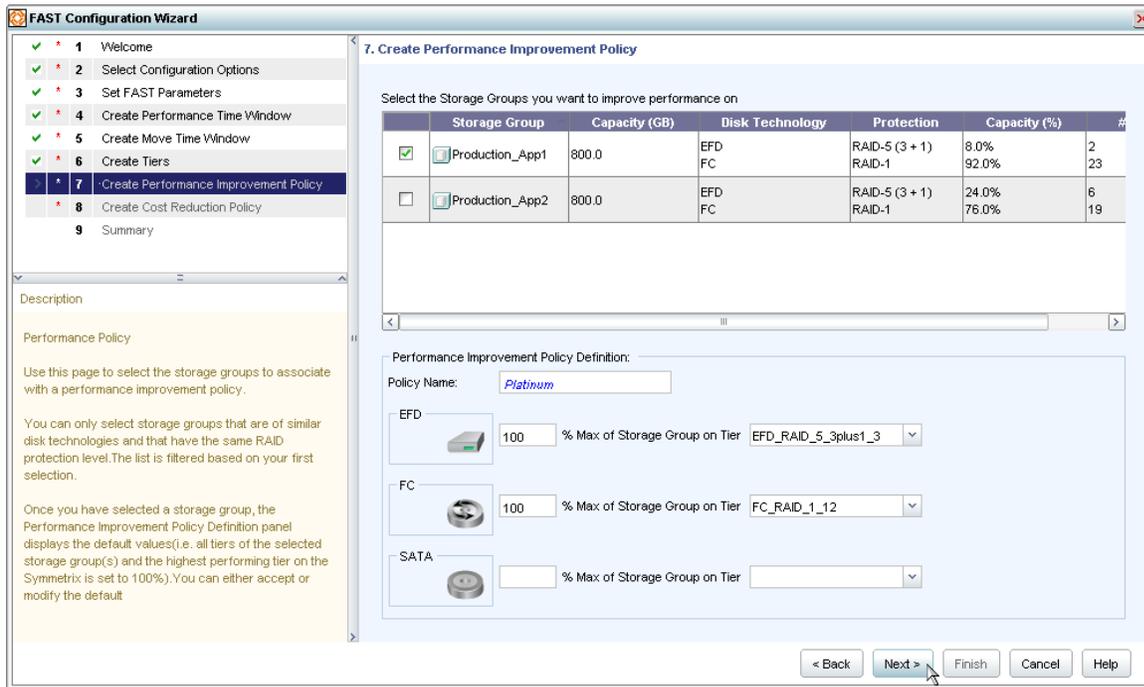
When all selections, and edits, have been made, the Next button is

clicked.

The first FAST policy that will be created is a Performance Improvement policy. The intent behind this policy is to increase the utilization of EFDs for associated storage groups. By default, the policy will have an upper usage limit of 100 percent for EFD, and an upper usage limit of 100 percent for FC. These values can, however, be modified.

After selecting the storage group, or groups, to be associated with the policy, Symmetrix tier names will automatically be filled in for both EFD and FC. Where multiple tiers exist for a technology type, the desired tier (with the desired RAID protection type) can be chosen from the list box to the right of the technology type.

To associate one or more storage groups with the policy being created, the checkboxes to the left of the appropriate storage group names should be selected.



By default the policy name will be "PerformancePolicy". This name can be modified by clicking inside the Policy Name field and editing the default name.

The creation of a performance improvement policy within the FAST Configuration Wizard is subject to certain rules. These rules include:

- ♦ A performance improvement policy may not be created if there are no Enterprise Flash Drives (EFDs) configured in the array—a warning message will be displayed.
- ♦ Storage groups that contain all EFD devices will not be displayed for selection to be associated with a performance improvement policy

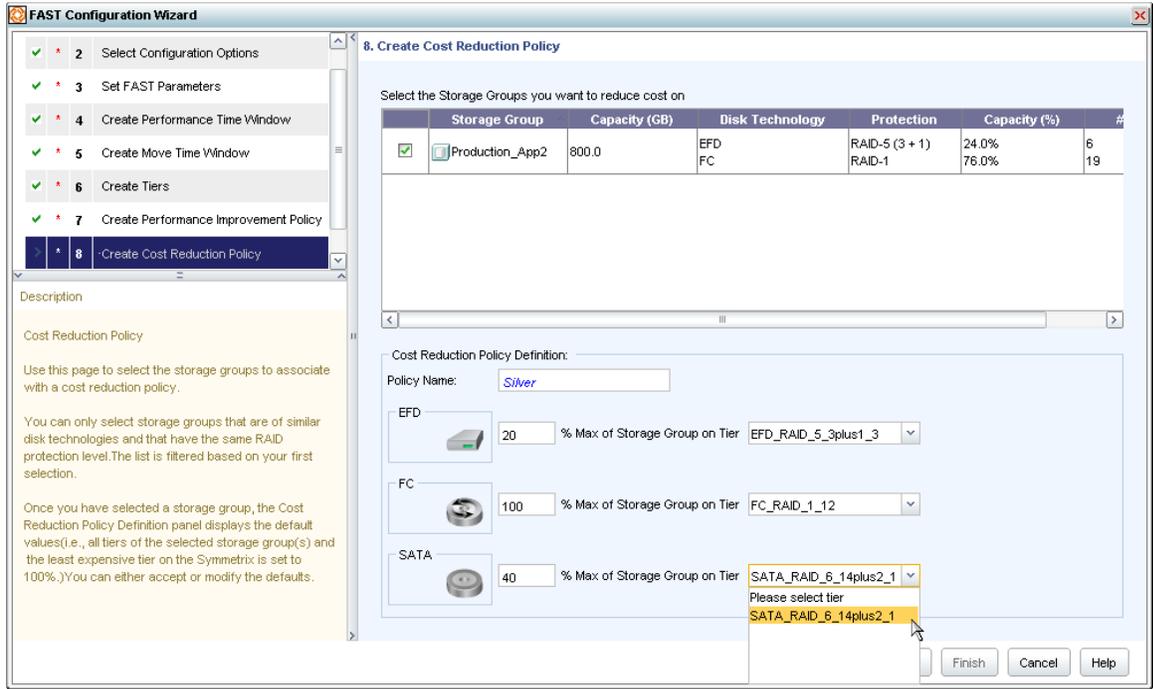
Note: These rules apply only to policies created within the FAST Configuration Wizard. To bypass these rules, FAST policies and storage group associations can be made through the dialog boxes discussed in *Management Interface: SMC*.

Once configured, the next step in the wizard can be reached by clicking Next.

The second FAST policy that will be created is a Cost Reduction policy. The intent behind this policy is to increase the utilization of SATA disks for associated storage groups. By default, the policy will have an upper usage limit of 100 percent for FC, and an upper usage limit of 20 percent for SATA. These values can, however, be modified.

After selecting the storage group, or groups, to be associated with the policy, Symmetrix tier names will automatically filled in for both FC and SATA. Where multiple tiers exist for a technology type, the desired tier (with the desired RAID protection type) can be chosen from the list box to the right of the technology type.

To associate one or more storage groups with the policy being created, the checkboxes to the left of the appropriate storage group names should be selected.



When finished, a performance improvement policy with the name *CostReductionPolicy* will be created by the wizard. Subsequent cost reduction policies created through the configuration wizard will be named *CostReductionPolicy1*, *CostReductionPolicy2*, and so on.

The creation of a cost reduction policy within the FAST Configuration Wizard is subject to certain rules. These rules include:

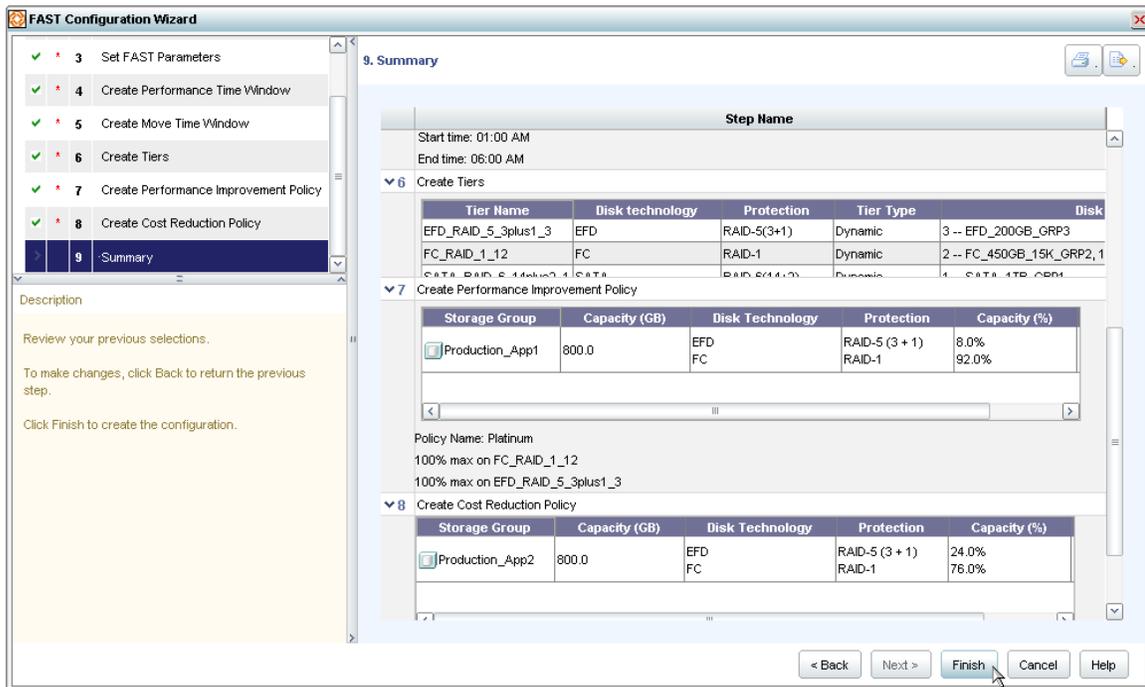
- ◆ A cost reduction policy may not be created if there are no SATA disks configured in the array—a warning message will be displayed.
- ◆ Storage groups that contain all EFD devices will not be displayed for selection to be associated with a cost reduction policy.

Note: These rules apply only to policies created within the FAST Configuration Wizard. To bypass these rules, FAST policies and storage group associations can be made through the dialog boxes discussed in *Management Interface: SMC*.

Once configured, the next step in the wizard can be reached by clicking Next.

After all steps of the wizard have been completed, a summary of all the changes to be made to the Symmetrix is displayed. The scroll bar to the right of the dialog box can be used to review all the information.

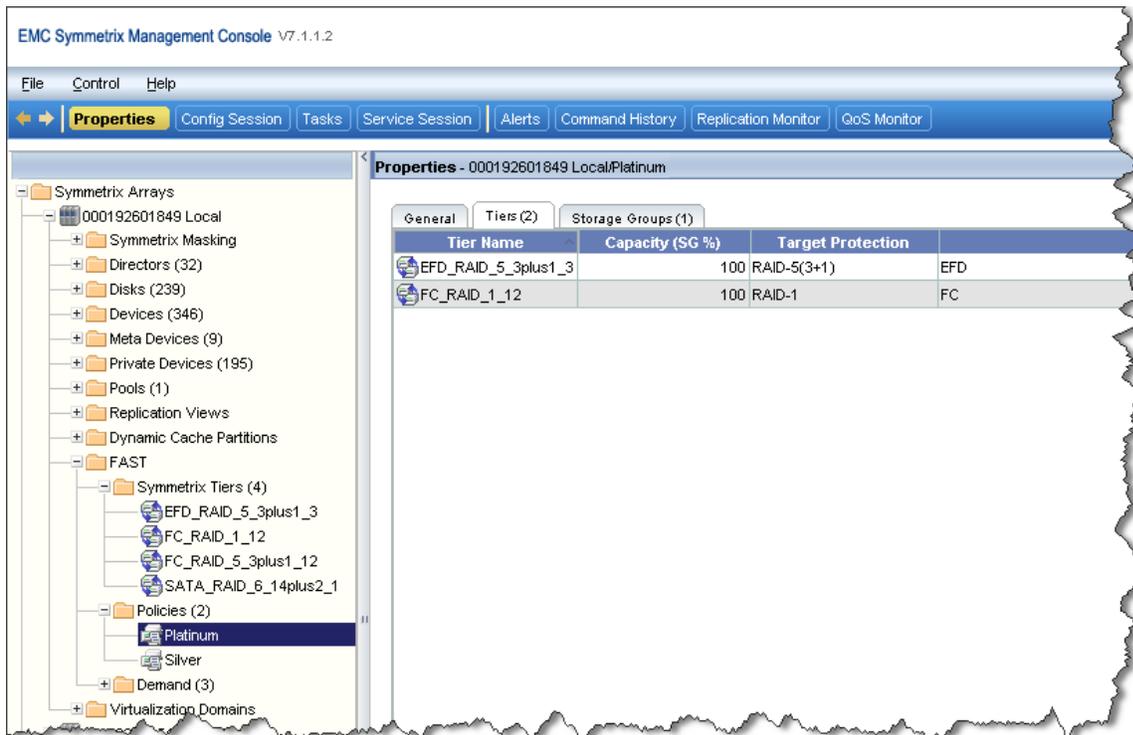
Should any changes need to be made the Back button can be used to review and modify any of the settings. When no further changes are needed, the Finish button is clicked, and all settings, tiers, and policies will be committed to the Symmetrix.



A confirmation window is displayed to verify success.



Changes can also be confirmed by looking at the properties for the created Symmetrix tiers and FAST policies.



Management Interface: SMC

Symmetrix Management Console 7.1 adds features and functionality for managing FAST. All FAST managed objects and associations may be created and managed directly through menu options. Configuration settings and time windows may also be created through the menu driven interface.

The following sections detail the use of the individual menu options within SMC for managing and controlling FAST.

Note: The examples shown in this section were created using SMC version 7.1.1.2.

Examining Symmetrix physical disk groups

Prior to enabling configuring the FAST controller, and configuring Symmetrix tiers and FAST policies, it is important to understand the existing configuration of the Symmetrix. SMC can be used to take an inventory of the existing disks and physical disk groups within the array.

Properties - 000192601849 Local/2 -- DISK_GROUP_002	
General	
Data Disks (86)	
Number of Disks	86
Data Disks	86
Hot Spares	0
Disk Products (Num disks: Vendor: Product: Rev)	86: SEAGATE: ST345085 CLAR450: HUC4515
Number of Hypers	626
Used (GB / MB / Cyl)	10112 / 10354198 / 10895984
Free (GB / MB / Cyl)	25054 / 25654862 / 26922774
Capacity (GB / MB / Cyl)	35165 / 36009060 / 37818758
Actual Capacity (GB / MB / Cyl)	35165 / 36009060 / 37818758
Technology	FC

The properties view for each disk group shows the physical disk group number, the number of drives in the group, along with the disk technology, and the size.

Note: Disk group 0 only contains disk spares, and as such, reports 0 for total, free, and actual capacity.

Clicking the Data Disks tab will display the actual physical disks and their location within the array.

EMC Symmetrix Management Console v7.1.1.2

File Control Help

Properties Config Session Tasks Service Session Alerts Command History Replication Monitor QoS Monitor

Properties - 000192601849 Local/2 -- DISK_GROUP_002

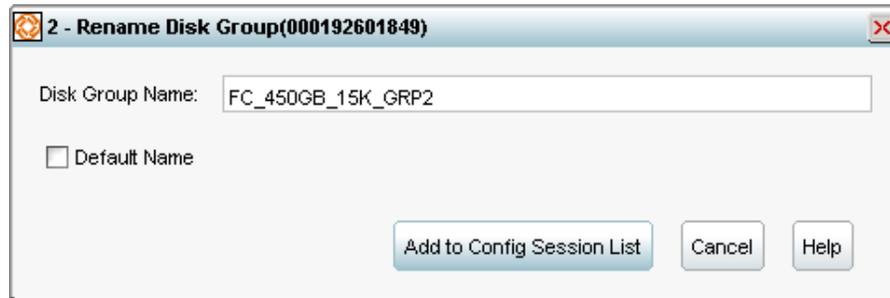
Disk ID	Int	TID	Hypers	Disk Group	Cap (GB/Cyl)
DF-7A:C:A	C	A	8 2	-- DISK_GROUP_002	409 / 439753 306 / 328
DF-7A:C:C	C	C	8 2	-- DISK_GROUP_002	409 / 439753 312 / 335
DF-7A:D:7	D	7	8 2	-- DISK_GROUP_002	409 / 439753 306 / 328
DF-7A:D:9	D	9	8 2	-- DISK_GROUP_002	409 / 439753 94 / 10127
DF-7A:D:B	D	B	7 2	-- DISK_GROUP_002	409 / 439753 338 / 3637
DF-7A:D:D	D	D	7 2	-- DISK_GROUP_002	409 / 439753 338 / 3637
DF-7B:C:3	C	3	8 2	-- DISK_GROUP_002	409 / 439753 333 / 356
DF-7B:C:5	C	5	8 2	-- DISK_GROUP_002	409 / 439753 306 / 328
DF-7B:C:9	C	9	7 2	-- DISK_GROUP_002	409 / 439753 345 / 370
DF-7B:C:B	C	B	8 2	-- DISK_GROUP_002	409 / 439753 306 / 328

Renaming physical disk group names

Another new feature, alongside FAST, provides the ability to assign a name to physical disk groups. This allows for a more meaningful label to be associated with the disk group, rather than a single number.

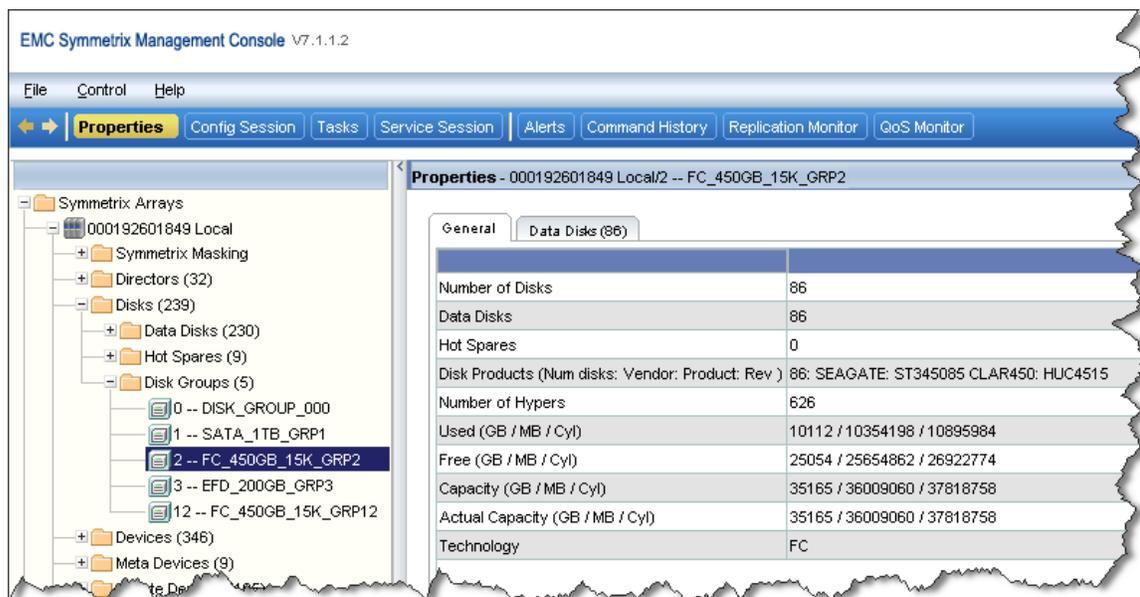
By default, the disk group names follow the format DISK_GROUP_XXX, where XXX corresponds to the disk group number. Disk group names can contain up to 32 alpha-numeric characters, hyphens (-), and underscores (_).

To rename a physical disk group, right-click on the physical disk group name in the left-hand navigation pane, and select Tier Management, Rename DiskGroup. A new name can be typed in the resulting dialog box.



After typing the name, the Add to Config Session List is clicked. Additional changes can be added for each of the physical disk groups and committed on the Symmetrix at the same time.

Once changed, the Disk Groups properties view will look appear as follows:



SMC dialog boxes that accept the disk group number as an input, will also now display the disk group name, making it easier to select the correct disk group an operation.

Configuring the Symmetrix FAST controller

There are multiple FAST settings and parameters that affect the behavior of the FAST controller. These include:

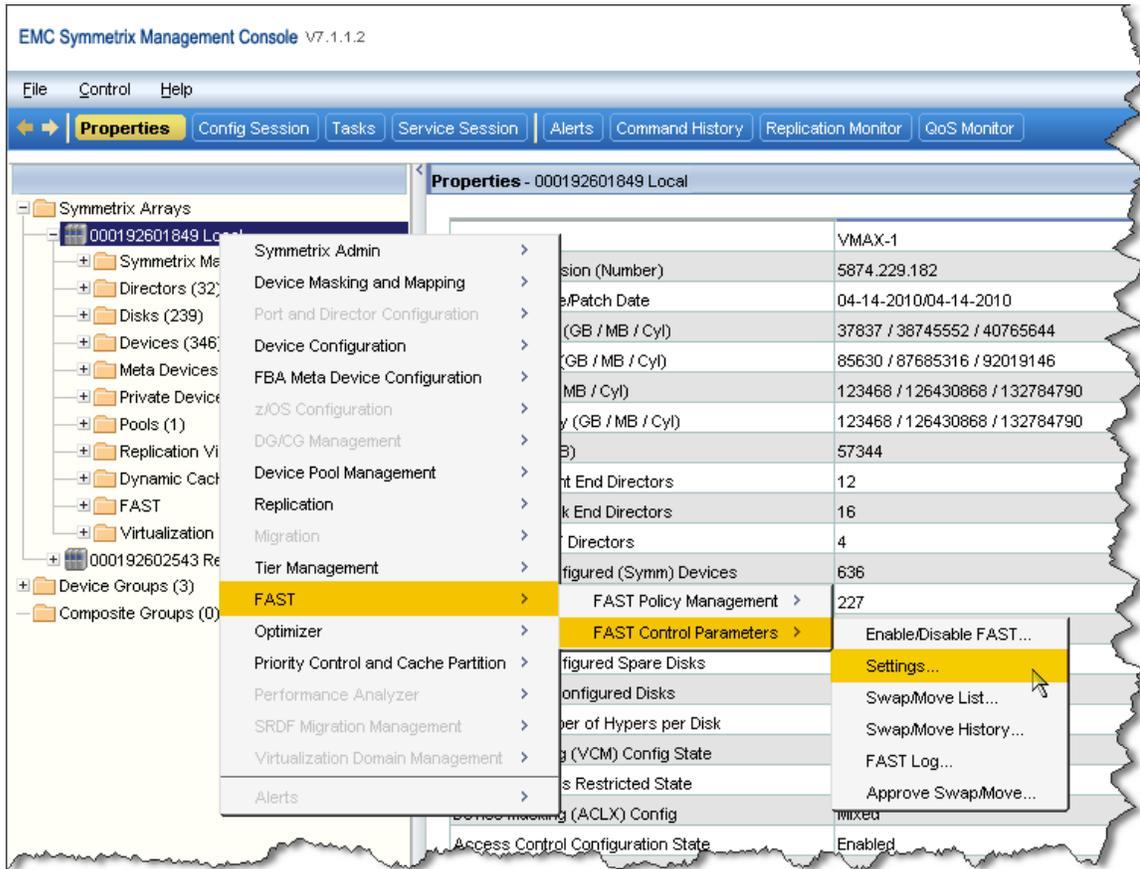
- ◆ Operating Mode

- ◆ Maximum Moves Per Day
- ◆ Maximum Simultaneous Moves
- ◆ Workload Analysis Period
- ◆ Initial Analysis Period
- ◆ Move Type
- ◆ Use Host Invisible Devices
- ◆ Performance Time Window
- ◆ Device Movement Time Window

The following sections detail the SMC interface used to list modify each of these settings.

FAST controller settings

The same interface is used to display the existing FAST controller settings and to modify them. To launch the FAST settings display, right-click on the appropriate Symmetrix serial number in the left-hand navigation pane, then select FAST, FAST Control Parameters, and Settings.



The following dialog box will be displayed.

FAST - Settings (000192601849)

General | Time Window

Shared Parameters

Data Movement Mode: Automatic User Approved

Maximum Number of Volume(s) Moved per Day:

Maximum Simultaneous Volume(s) Moved:

Workload Analysis Period: week(s) ▾

Initial Period: week(s) ▾

FAST Specific Settings

Migration Restriction: Allow Swaps and Moves Allow Only Swaps

Use Host Invisible Devices For Swaps: Enabled Disabled

FAST is **Disabled**

Apply OK Cancel Help

Setting the Operating Mode

There are two possible values for the data movement mode: Automatic and User Approved. The default value is Automatic.

To set the mode to User Approved, click the radio button to the left of User Approved, and click Apply.

Setting the Maximum Moves Per Day

Maximum Device Moves Per Day can be set between 2 and 200. The default value is 200.

To set the Maximum Device Moves Per Day for FAST, type the desired value in the field to the right of Maximum Number of Volume(s) Moved per Day, and click Apply.

Setting the Maximum Simultaneous Moves

Maximum Simultaneous Device Moves can be set between 2 and 32. The default value is 8.

To set the Maximum Simultaneous Device Moves for FAST, type the desired value in the field to the right of Maximum Simultaneous Volumes Moved, and click Apply.

Setting the Workload Analysis Period

The Workload Analysis Period can be set between 1 hour and 4 weeks. The default value is 1 week.

To set the Workload Analysis Period for FAST, type the desired value in the field to the right of Workload Analysis Period, select the desired unit of time, and click Apply.

Setting the Initial Analysis Period

The Initial Analysis Period can be set between 1 hour and 4 weeks. The default value is 1 week (168 hours).

To set the Initial Analysis Period for FAST, type the desired value in the field to the right of Initial Period, select the desired unit of time, and click Apply.

Setting the Allowed Move Type

The FAST controller move type can be set to Allow Swaps and Moves or Allow Only Swaps. The default value is to Allow Swaps and Moves.

To set the Move Type to allow only swaps, click the radio button to the left of Allow Only Swaps, and click Apply.

Setting the Use of Host Invisible Devices

The Use of Host Invisible Devices can be set to Enabled or Disabled. The default value is Disabled.

To set the Use of Host Invisible Devices to enabled, click the radio button to the left of Enabled, and click Apply.

Modifying all FAST controller settings

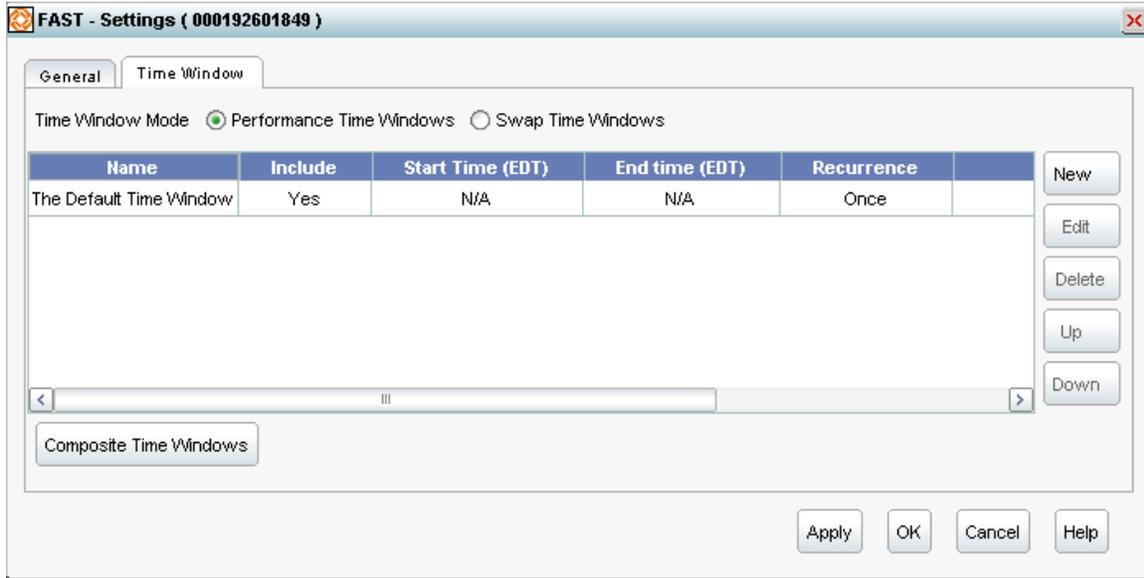
Alternatively, all settings can be modified at the same time, by editing each value and clicking Apply, or OK.

FAST controller time window list information

To view, create, edit, or delete FAST time windows the same FAST Settings dialog box as shown in the previous section is used. However, in this case the Time Window tab will be selected.

To launch the FAST settings display, right-click on the appropriate

Symmetrix serial number in the left-hand navigation pane, then select FAST, FAST Control Parameters, and Settings. After clicking the Time Window tab on the resulting dialog box, the following will be displayed.

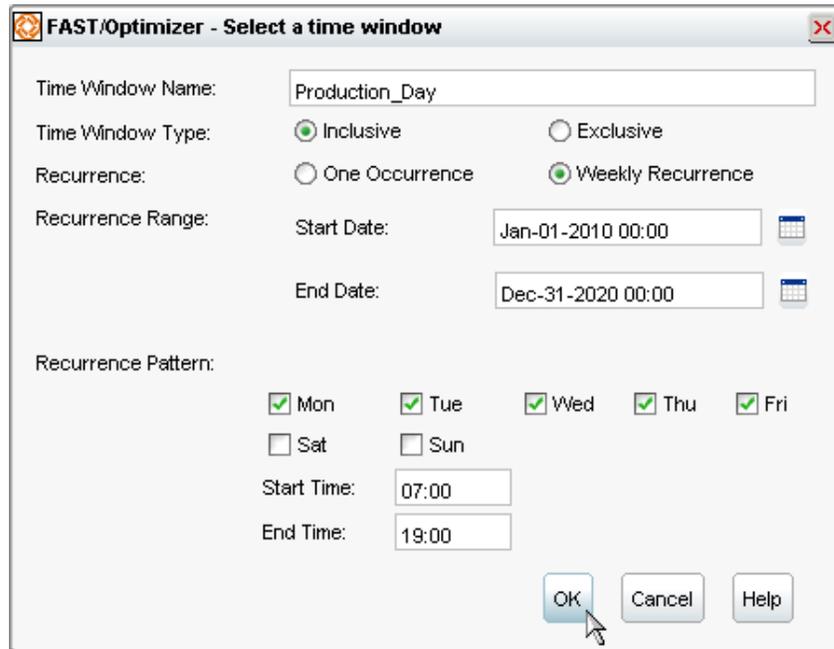


To view existing time windows of each type, the radio buttons next to Performance Time Windows or Swap Time Windows may be clicked. In the above output, only the default time performance time window has been defined.

Creating a FAST controller performance time window

To create a performance time window to be used by FAST, ensure that the radio button to the left of Performance Time Windows has been clicked, and click New.

As an example, to create a performance time window that will collect data samples between 7 a.m. and 7 p.m. on each day, Monday through Friday, fill out the information as shown below, and click OK.



FAST/Optimizer - Select a time window

Time Window Name:

Time Window Type: Inclusive Exclusive

Recurrence: One Occurrence Weekly Recurrence

Recurrence Range: Start Date:
 End Date:

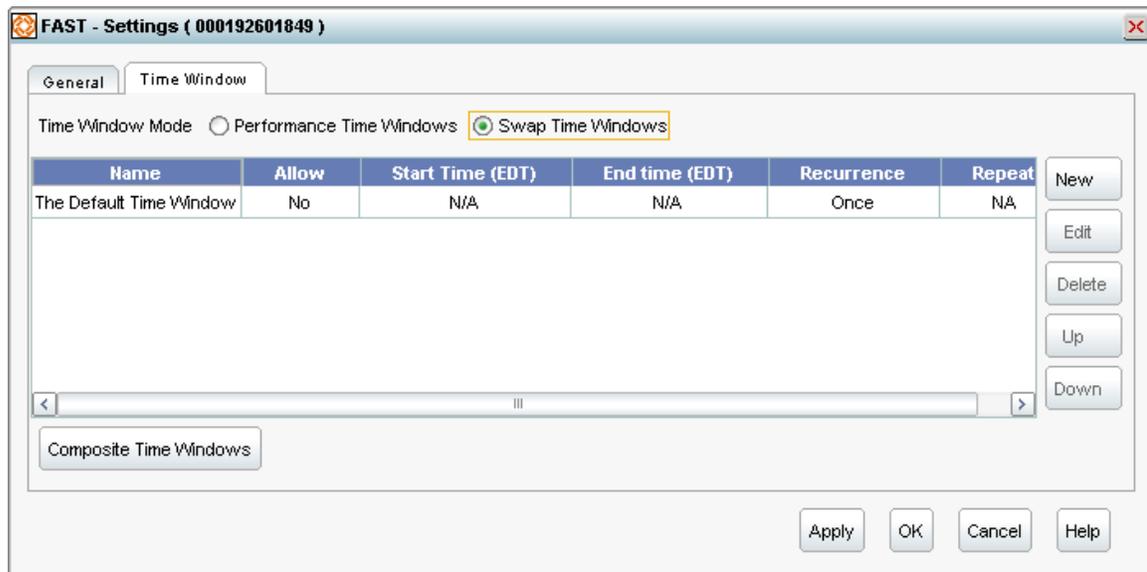
Recurrence Pattern:

Mon Tue Wed Thu Fri
 Sat Sun

Start Time:
 End Time:

Creating a FAST controller device movement time window

To create a device movement time window to be used by FAST, ensure that the radio button to the left of Swap Time Windows has been clicked, and click New.



FAST - Settings (000192601849)

General | Time Window

Time Window Mode Performance Time Windows Swap Time Windows

Name	Allow	Start Time (EDT)	End time (EDT)	Recurrence	Repeat
The Default Time Window	No	N/A	N/A	Once	NA

As an example, to create a device movement time window that will perform FAST moves or swaps between 1 a.m. and 6 a.m. on Saturdays and Sundays, fill out the information as shown below, and click OK.

FAST/Optimizer - Select a time window

Time Window Name:

Time Window Type: Inclusive Exclusive

Recurrence: One Occurrence Weekly Recurrence

Recurrence Range: Start Date:

End Date:

Recurrence Pattern:

Mon Tue Wed Thu Fri

Sat Sun

Start Time:

End Time:

Creating FAST managed objects

There are three managed objects related to the use of FAST in the Symmetrix VMAX. These are:

- ◆ Symmetrix tiers
- ◆ FAST policies
- ◆ Storage groups

When created, storage groups are associated with a FAST policy which in turn associates the storage group with up to three Symmetrix tiers, while defining the upper usage limit for the storage group in each tier.

The following sections detail the SMC interfaces used to create each of the managed objects, and the methods for associating them. Information is also shown for removing these associations, and removing each of the objects.

Creating a static Symmetrix tier

A static Symmetrix tier is one in which individual physical disk groups are explicitly added to the tier. When creating a static Symmetrix tier the following information must be known:

- ◆ The Symmetrix tier name
- ◆ The desired protection type of the tier
- ◆ The disk technology to be used for the tier
- ◆ The physical disk group numbers/names to be added to the tier

Once this information has been decided, the tier can be created by right-clicking on the appropriate Symmetrix serial number in the left-hand navigation pane, and selecting Tier Management, Create Tier.

To create a static tier, the checkbox to the left of Manually select disk groups should be selected. When this is done, each of the disk groups of the selected technology may be selected individually to be added to the Symmetrix tier.

Tier - Create Dialog (000192601849)

Tier Name:

Technology:

Protection:

Manually select disk groups.

Capacity Numbers for new Tier:

Symmetrix Capacity:	123468 GB
Total Tier Capacity:	745 GB
Total Used:	365 GB
Total Free:	380 GB

Note: As this tier is static, only disk groups which have been manually added will be included.

Selection	# Disk Group	Disk Group Name	Disk Speed	Disk Count	Capacity (GB)	Used (GB)	Free (GB)
<input checked="" type="checkbox"/>	3	3	0	4	745	365	380

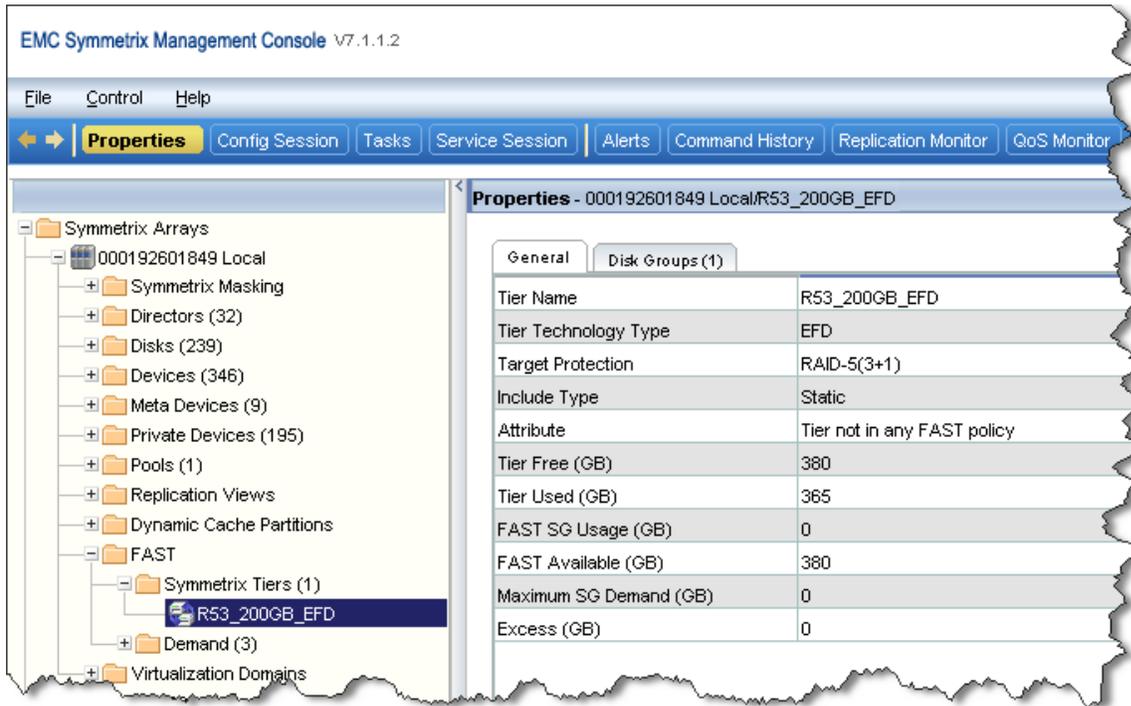
Select All Deselect All

OK Cancel Help

Clicking OK will create a static Symmetrix tier with target protection type of RAID 5 (3+1), and disk technology of EFD. The Symmetrix tier name was chosen to indicate the RAID protection type (RAID 5 3+1), the

size (200 GB), and the drive type (EFD)—R53_200_EFD.

Once created, the information on the Symmetrix tier can be seen in the Properties view.



Creating a dynamic Symmetrix tier

A dynamic Symmetrix tier is one in which all physical disk groups of a specified disk technology are automatically added to the tier. When creating a dynamic Symmetrix tier the following information must be known:

- ◆ The Symmetrix tier name
- ◆ The desired protection type of the tier
- ◆ The disk technology to be used for the tier

Once this information has been decided, the tier can be created by right-clicking on the appropriate Symmetrix serial number in the left-hand navigation pane, and selecting Tier Management, Create Tier.

To create a dynamic tier, the checkbox to the left of Manually select disk groups should be left unselected. When this is done, each of the disk groups of the selected technology will be automatically selected to be added to the Symmetrix tier.

Tier - Create Dialog (000192601849)

Tier Name:

Technology:

Protection:

Manually select disk groups.

Capacity Numbers for new Tier:

Symmetrix Capacity: 123468 GB

Total Tier Capacity: 64219 GB

Total Used: 25978 GB

Total Free: 38240 GB

The following disk group(s) have been automatically included in this tier.

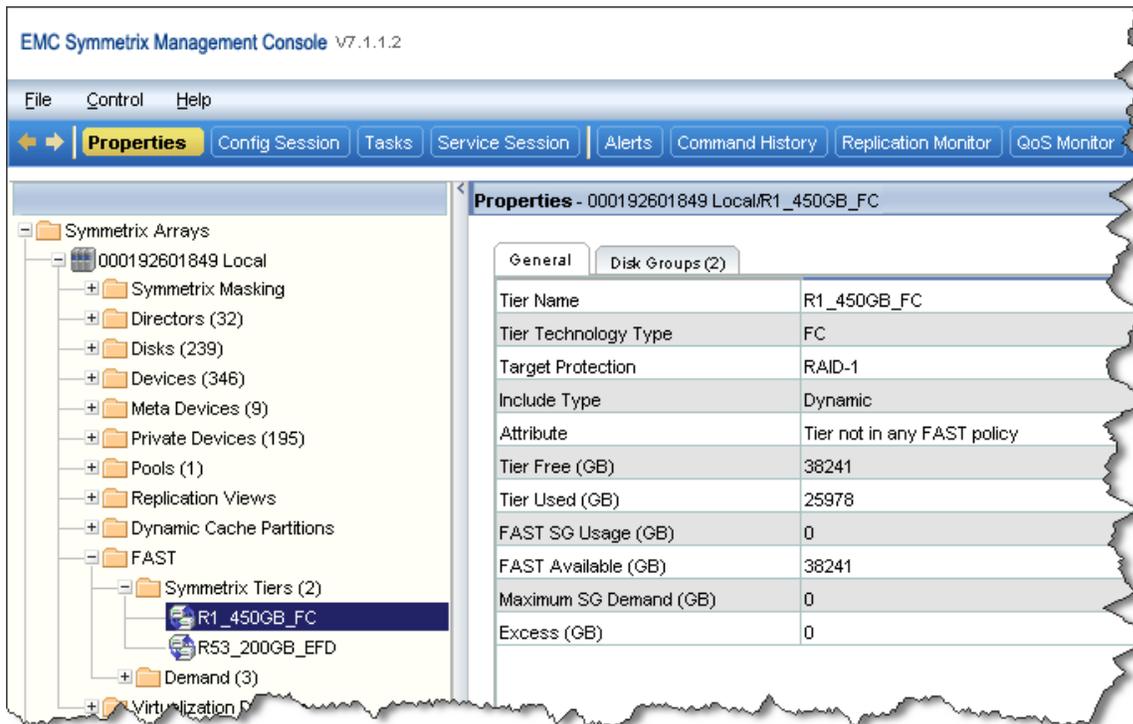
Note: As this tier is dynamic, future disk groups with the same technology and protection will be automatically included.

#Disk Group	Disk Group Name	Disk Speed	Disk Count	Capacity (GB)	Used (GB)	Free (GB)
2	2	15000	86	35165	10112	25054
12	12	15000	82	33530	20343	13187

OK Cancel Help

Clicking OK will create a dynamic Symmetrix tier with target protection type of RAID 1, and disk technology of FC. The Symmetrix tier name was chosen to indicate the RAID protection type (RAID 1), drive size (450 GB), and drive type (FC)—R1_450GB_FC.

Once created, the information on the Symmetrix tier can be seen in the Properties view.



Symmetrix tier list information

Information on all Symmetrix tiers in the Symmetrix can be viewed by clicking the Symmetrix Tiers folder under the FAST folder in the left-hand navigation pane.

The screenshot shows the EMC Symmetrix Management Console (SMC) interface. The main window displays the 'Properties' view for '000192601849 Local/Symmetrix Tiers (4)'. The left-hand navigation pane shows a tree structure under 'Symmetrix Arrays' with 'Symmetrix Tiers (4)' selected. The right-hand pane contains a table with the following data:

Name	Tech	Target Protection	Type	Total (GB)	Free (GB)	Used (GB)
R1_450GB_FC	FC	RAID-1	Dynamic	64218	38240	25978
R53_200GB_EFD	EFD	RAID-5(3+1)	Static	745	380	365
R57_450GB_FC	FC	RAID-5(7+1)	Dynamic	38377	38240	137
R614_1TB_SATA	SATA	RAID-6(14+2)	Static	51685	47010	4675

The “Free” column indicates the sum of the unconfigured space of all the physical disk groups contained in the tier.

The “Used” column displays the total capacity of the physical hypervisors of each of the devices that are configured in the physical disks contained in the tier, and that match the Symmetrix tiers RAID protection type.

The “Total” column is the sum of the “Free” and “Used” columns.

Note: The disk group free capacity will be reported as 0 if the disk groups contained in the Symmetrix tier do not have enough usable disks to support the tier’s target RAID protection type.

Creating a Symmetrix FAST policy

A FAST policy defines the upper usage limits for up to three tiers for any storage groups associated with the policy.

When creating a FAST policy, the following information must be known:

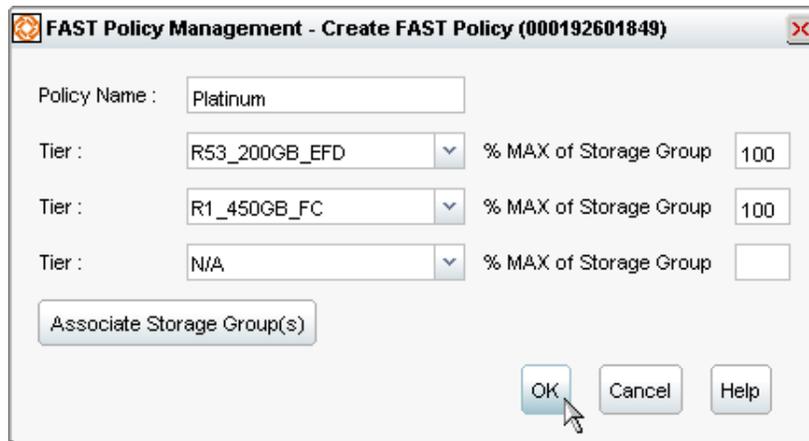
- ◆ The FAST policy name
- ◆ Up to three Symmetrix tiers to be used in the policy
- ◆ The upper usage limits for each of the Symmetrix tiers being added

Once this information has been decided, the FAST policy can be created by right-clicking on the appropriate Symmetrix serial number in the left-hand navigation pane, and selecting FAST, FAST Policy Management, Create Policy.

In the resulting dialog box, the policy name will be specified along with up to three Symmetrix tiers and their upper usage limits within the policy.

When a tier is selected, the % MAX of Storage Group value will default to 100%. To set a lower value, click inside the box and edit the percentage.

To create the policy, click OK.



Prior to clicking OK, it is also possible to click the Associate Storage Group(s) button, which will allow storage groups to be associated to the policy upon creation of the policy. *Associating a storage group with a FAST policy* provides more information on associating storage groups to FAST policies.

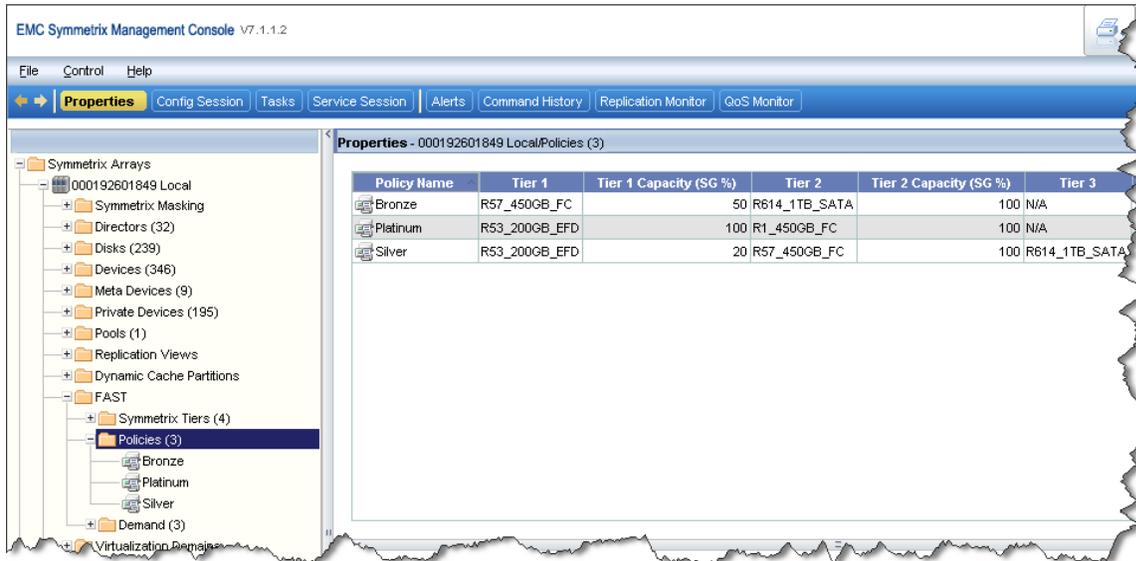
Once created, the information on the policy can be seen in the Properties view.

The screenshot displays the EMC Symmetrix Management Console (SMC) interface. The main window is titled "EMC Symmetrix Management Console v7.1.1.2". The left-hand navigation pane shows a tree structure under "Symmetrix Arrays" for the array "000192601849 Local". The "FAST" folder is expanded, showing "Symmetrix Tiers (4)", "Policies (1)", and "Demand (3)". The "Policies (1)" folder is selected, and the "Platinum" policy is highlighted. The right-hand pane shows the "Properties - 000192601849 Local/Platinum" window, which is divided into "General" and "Tiers (2)" tabs. The "Tiers (2)" tab is active, displaying a table of tier information.

Properties - 000192601849 Local/Platinum	
Tiers (2)	
FAST Policy Name	Platinum
Tier 1 Name	R53_200GB_EFD
Tier 1 Capacity (SG %)	100
Tier 2 Name	R1_450GB_FC
Tier 2 Capacity (SG %)	100
Tier 3 Name	N/A
Tier 3 Capacity (SG %)	0

FAST policy list information

Information on all FAST policies in the Symmetrix can be viewed by clicking the Policies folder under the FAST folder in the left-hand navigation pane.



Creating a Symmetrix storage group

A storage group logically combines Symmetrix devices to be managed together. When creating a storage group for FAST, the following information must be known:

- ◆ The storage group name
- ◆ The standard provisioning devices to be added to the group

Once this information has been decided, the storage group can be created by right-clicking on the appropriate Symmetrix serial number, and selecting Device Masking and Mapping, Storage Group Maintenance, Create Storage Group.

In the resulting dialog box, provide a storage group name and select the devices to be added to the group, and click OK.

Storage Group Management - Create (000192601849)

Storage Group Name :

Device Source Type :

Device Source Name :

DG/CG Device Type :

SSID:

Available Devices FILTERED 320 of 345 items

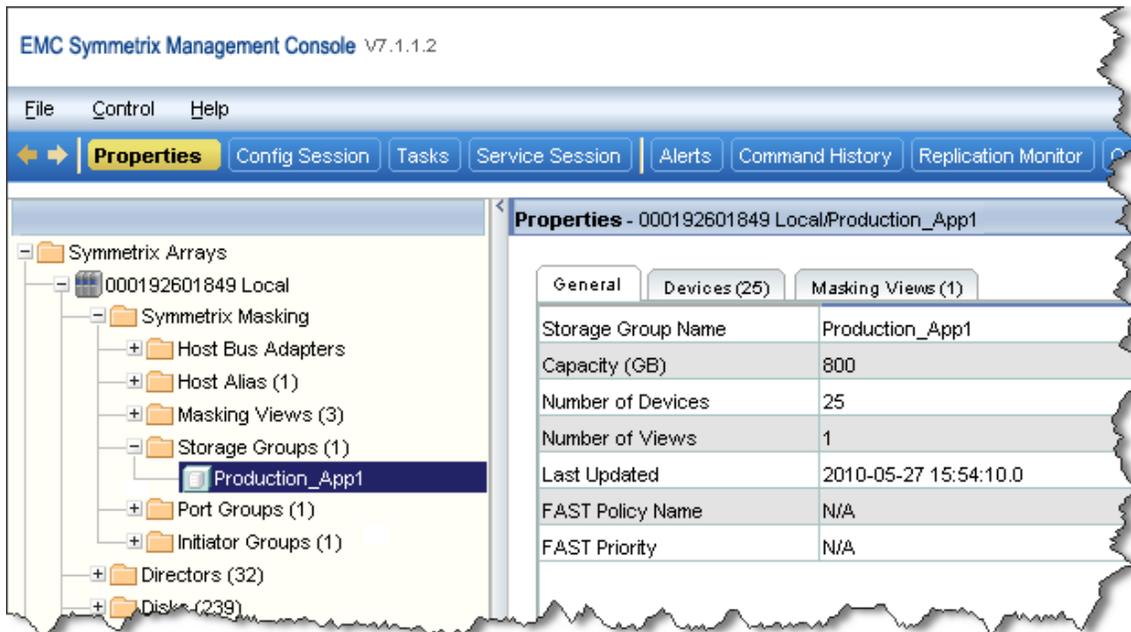
Dev	Cap (MB/Cyl)	Dev Config	
0055	6 / 6	2-Way Mir	FB
0056	6 / 6	2-Way Mir	FB
0057	6 / 6	2-Way Mir	FB
0058	6 / 6	2-Way Mir	FB
0059	6 / 6	2-Way Mir	FB
005A	6 / 6	2-Way Mir	FB

Group Members

Dev	Cap (MB/Cyl)	Dev Config
00F5	32768 / 34952	2-Way Mir
00F6	32768 / 34952	2-Way Mir
00F7	32768 / 34952	2-Way Mir
00F8	32768 / 34952	2-Way Mir
00F9	32768 / 34952	2-Way Mir
00FA	32768 / 34952	2-Way Mir
00FB	32768 / 34952	2-Way Mir

Page 1 of 2 Items 1 to 250 of 320 Page 1 of 1 Items 1 to 25 of 25

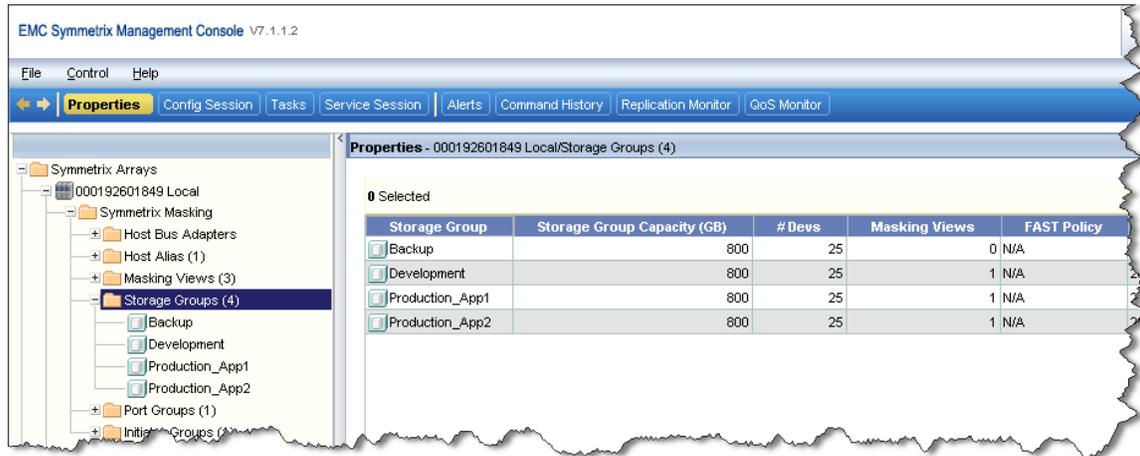
Information on the created storage group can be displayed in the Properties view.



Storage group list information

Clicking the Storage Groups folder, under Symmetrix Masking, in the left-hand navigation pane displays all storage groups configured in the array. The Properties view will show:

- ◆ The names of all created storage groups
- ◆ The number of devices in each storage group
- ◆ Whether the storage group is associated with a FAST policy
- ◆ Whether the storage group is used in a masking view



Associating a storage group with a FAST policy

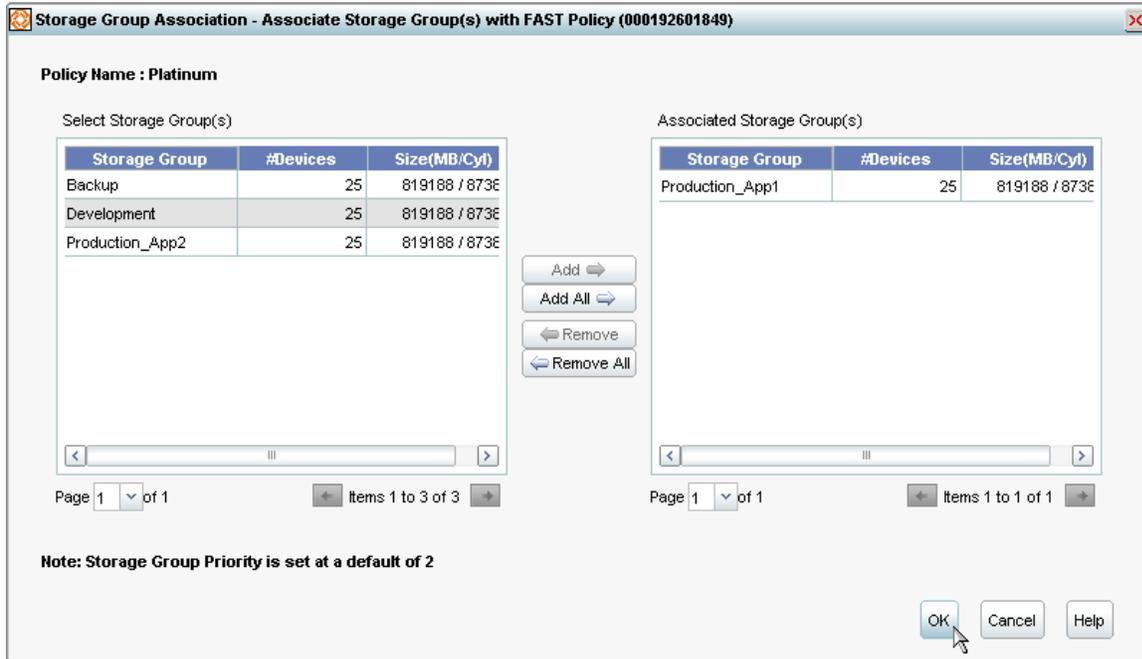
Associating a storage group with a FAST policy brings the devices in the storage group under FAST control. All devices in the storage group will be considered candidates for promotion or demotion when FAST performs its analysis and creates a configuration change plan.

When creating a FAST policy association, the following information must be known:

- ◆ The FAST policy name
- ◆ The storage group name
- ◆ The priority of the storage group within the policy

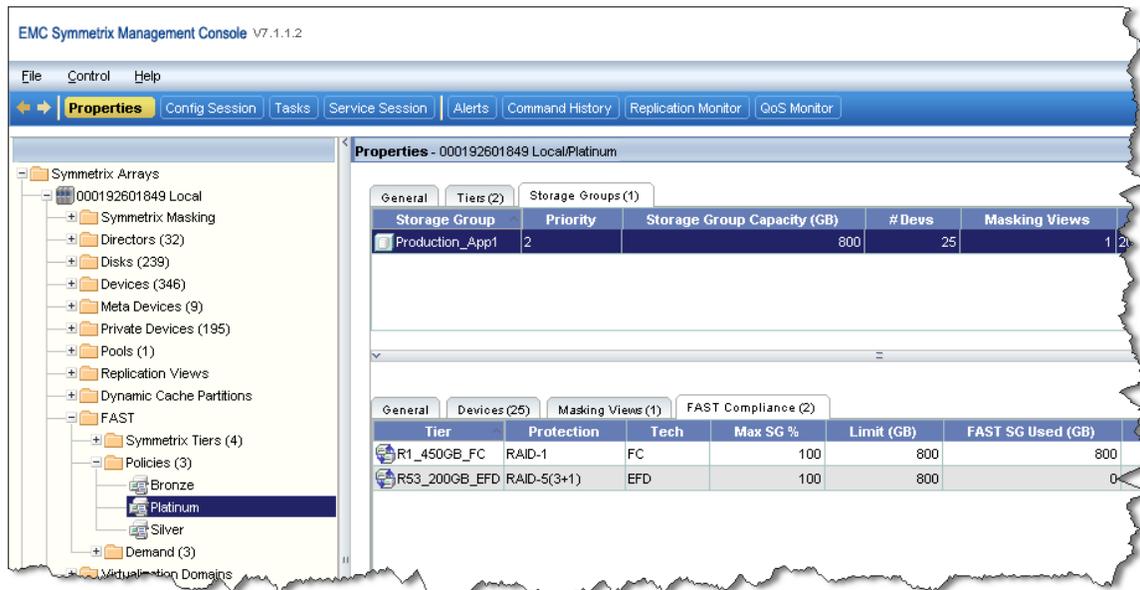
Once this information has been decided, the association is performed by right-clicking on the appropriate FAST policy in the left-hand navigation pane, then selecting FAST, FAST Policy Management, Storage Group Association.

Select the storage group(s) to be associated with the policy in the left-hand pane and click Add to move them to the right-hand pane. When all the groups have been selected, click OK.



Note: Storage groups are associated to the policy with a default value of 2. The following section describes how to modify a storage group priority within a FAST policy.

Properties of the associated storage groups can be viewed by clicking the FAST policy name in the left-hand navigation pane.



Modifying a storage group's priority in a FAST policy

When a storage group is associated to a FAST policy in SMC, it is added with a default priority of 2. After the association is complete, the priority can be raised to 1, or lowered to 3.

To modify the storage group's priority in the FAST policy, right-click on the FAST policy name in the left-hand navigation pane, and select FAST, FAST Policy Management, Edit Priority.

In the resulting dialog box, double-click in the Priority field for the appropriate storage group and type a valid priority value—1, 2, or 3. When done, click OK.



Modifying a Symmetrix tier in a FAST policy

After some time, it may be determined that the upper usage limit of a particular tier within a FAST policy needs to be adjusted. This can be done dynamically in SMC. If there are storage groups associated with the policy being modified, the change in the usage limit cannot cause the sum of the usage limits for all tiers in the policy to fall below 100 percent.

To modify the usage limit for a Symmetrix tier within a policy, right-click on the policy name in the left-hand navigation pane, and select FAST, FAST Policy Management, Modify Policy. After modifying the percentage for one or more of the Symmetrix tiers, click OK.



Controlling FAST device movement

Aside from using the FAST controller device movement window, there are several other ways of controlling when device movements can take place. These include disabling the FAST controller, or running in user approved mode to allow specific scheduling of device movements.

Enabling/disabling the FAST controller

In order for FAST to perform device movements, the FAST controller must be enabled on the Symmetrix.

To check the current state of the FAST controller, right-click on the appropriate Symmetrix serial number in the left-hand navigation pane, and select FAST, FAST Control Parameters, Enable/Disable FAST.

The state of the controller can be changed by clicking the Enable or Disable button that is available.



Note: While the FAST controller is in a disabled state, performance statistics will continue to be collected.

Reviewing FAST configuration change plans

When running in user approved mode, in order for the device movement to take place, it must be manually reviewed and then approved.

Alternatively, the recommended changes can be declined in order for additional changes to be proposed during the next data analysis.

The following information is available when reviewing a configuration change plan:

- ◆ Number of groups in the plan
- ◆ The devices being moved or swapped
- ◆ The plan state
- ◆ Whether FAST or Optimizer generated the plan

To review a generated configuration change plan, right-click on the

appropriate Symmetrix serial number in the left-hand navigation pane, and select FAST, FAST Control Parameters, Swap/Move List.

FAST - Swap/Move List (000192601849)

Plan Type : Auto Generated
 Plan State : NotApproved
 Start Time : N/A
 Plan Percent Complete : 0%
 Estimated Time to Completion : N/A
 Number Of Groups : 1

Type	Group	Device1	Device2	Status	Execution Time (EDT)	Group Percent Complete
FAST Generated(Performance)	1	00F5	N/A	Not Started	Dec-31-1969 06:59 PM	0%
FAST Generated(Performance)	1	00F6	N/A	Not Started	Dec-31-1969 06:59 PM	0%
FAST Generated(Performance)	1	00F7	N/A	Not Started	Dec-31-1969 06:59 PM	0%
FAST Generated(Performance)	1	00F8	N/A	Not Started	Dec-31-1969 06:59 PM	0%
FAST Generated(Performance)	1	0119	N/A	Not Started	Dec-31-1969 06:59 PM	0%
FAST Generated(Performance)	1	0120	N/A	Not Started	Dec-31-1969 06:59 PM	0%
FAST Generated(Performance)	1	0121	N/A	Not Started	Dec-31-1969 06:59 PM	0%

Buttons: Refresh, Show Details, Close, Help

Note: Until approved, and scheduled, the execution time for the configuration change plan will display as January 1, 1970, 00:00 GMT—adjusted for the local time zone setting of the SMC server.

Additional details on each group can be seen by highlighting a single row and clicking the Show Details button.

Optimizer/FAST - Swap/Move Detail (000192601849) Group 1

Group Attributes : FAST Generated(Performance)

Device	Storage Group Name	Target Tier Name	Target Disk Protection	Target Disk Group
00F5	Production_App1	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3
00F6	Production_App1	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3
00F7	Production_App1	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3
00F8	Production_App1	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3
0119	Production_App2	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3
0120	Production_App2	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3
0121	Production_App2	R53_200GB_EFD	Raid5 3+1	3 -- EFD_200GB_GRP3

Close Help

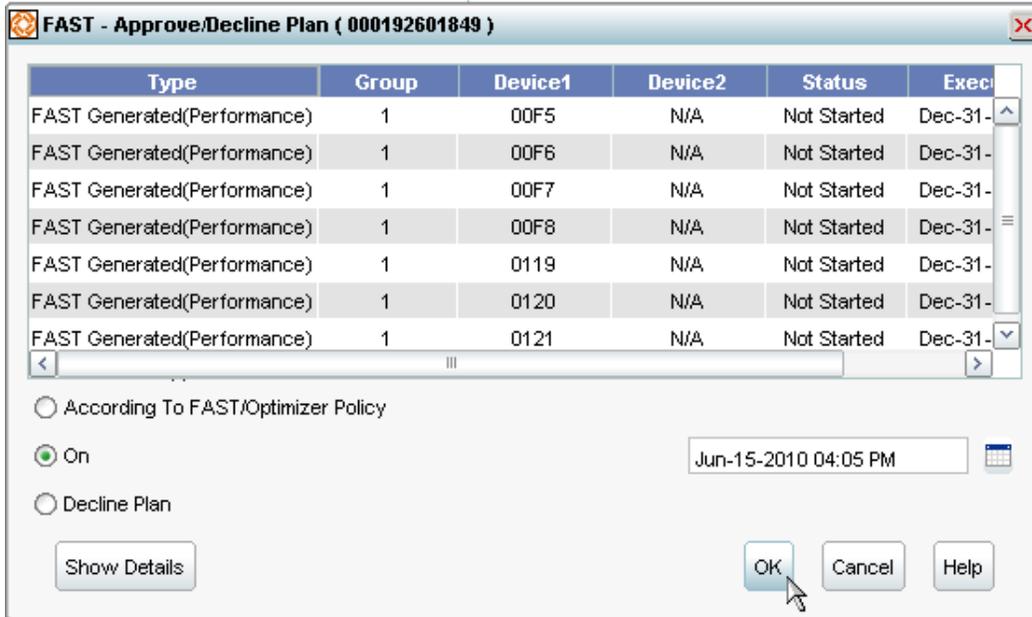
Approving a FAST configuration change plan

When a configuration change plan has been reviewed, and it is going to be approved, the execution of the plan needs to be scheduled. The device movements can be scheduled to occur during the next available device movement window, or at a user-specified time.

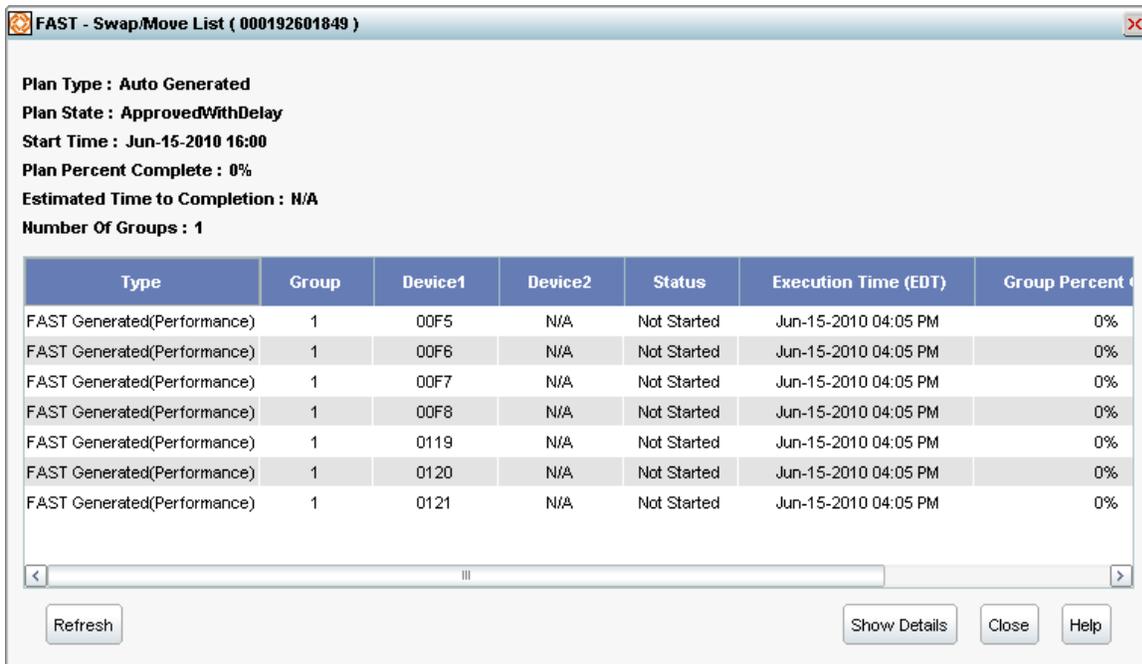
To approve a plan, right-click on the appropriate Symmetrix serial number in the left-hand navigation pane, and select FAST, FAST Control Parameters, Approve Swap/List.

To schedule the device movement to occur during the next device movement time window, click on the radio button to the left of According to FAST/Optimizer policy, and then click OK.

To schedule the device movement to occur at a specific time, click on the radio button to the left of On and specify a date and time, and then click OK.



Once approved and scheduled, the execution time can be viewed by reviewing the swap list again.



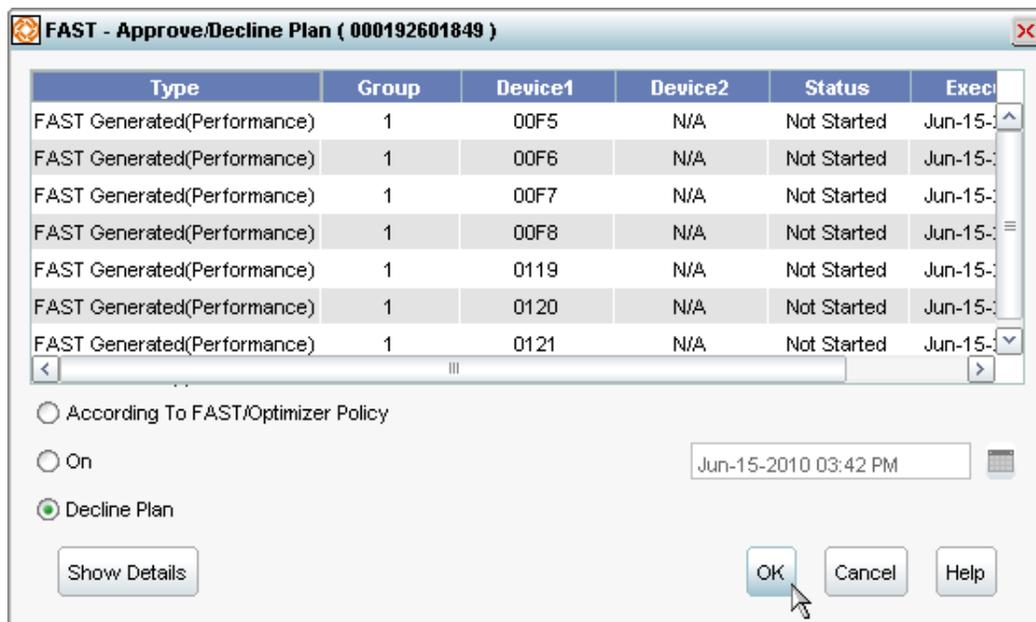
The device movement can also be rescheduled anytime prior to the previously scheduled start time.

Declining a FAST configuration change plan

When a configuration change plan has been reviewed, and it is going to be declined, the decline operation will remove the plan from the FAST controller, and cannot be subsequently approved.

To decline a plan, right-click on the appropriate Symmetrix serial number in the left-hand navigation pane, and select FAST, FAST Control Parameters, Approve Swap/List.

In the resulting dialog box, click on the radio button to the left of Decline Plan, and click OK.



When the plan has been declined, the FAST controller will not report on any plans until a new one has been generated.

Monitoring FAST device movement

During the execution of the configuration change plan, the progress of the plan can be monitored by viewing the FAST Swap/Move list, and looking at the status column.

To monitor the configuration change plan, right-click on the appropriate Symmetrix serial number in the left-hand navigation pane, and select

FAST, FAST Control Parameters, Swap/Move List.

FAST - Swap/Move List (000192601849)

Plan Type : Auto Generated
 Plan State : CnfigInProgress
 Start Time : Jun-15-2010 16:05
 Plan Percent Complete : 13%
 Estimated Time to Completion : 00:39:08
 Number Of Groups : 1

Type	Group	Device1	Device2	Status	Execution Time (EDT)	Group Percent Complete
FAST Generated(Performance)	1	00F5	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%
FAST Generated(Performance)	1	00F6	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%
FAST Generated(Performance)	1	00F7	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%
FAST Generated(Performance)	1	00F8	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%
FAST Generated(Performance)	1	0119	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%
FAST Generated(Performance)	1	0120	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%
FAST Generated(Performance)	1	0121	N/A	Step 63 of 100	Jun-15-2010 04:05 PM	13%

Buttons: Refresh, Show Details, Close, Help

While executing swaps or moves defined, the Plan State will display as CnfigInProgress. While in this state, a percent complete value will be displayed for the entire plan. This percent value is based on the amount of data that has already been relocated in relation to the amount of data to be relocated in total.

An estimated time to completion is also displayed, indicating the remaining time expected to complete all groups within the plan.

At the group level, the same percent complete and estimated time to completion values will be shown for each individual group.

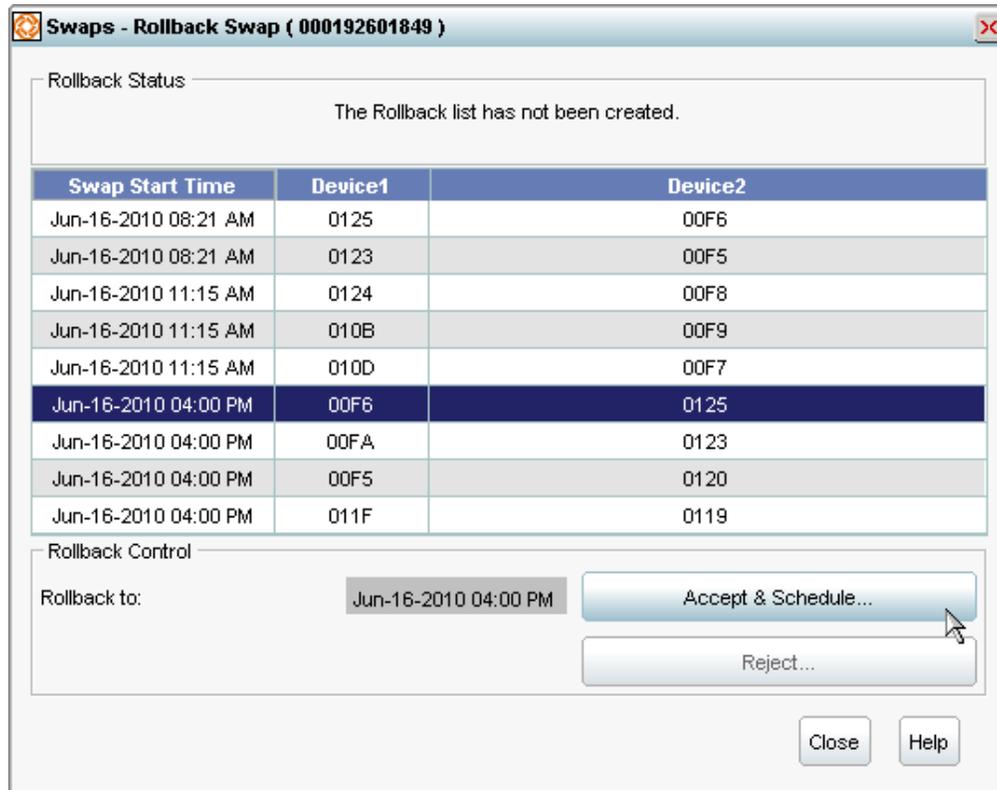
The Status field shows how many steps are complete in the Symmetrix-based script that is being run, performing the device movement.

Performing a FAST swap rollback

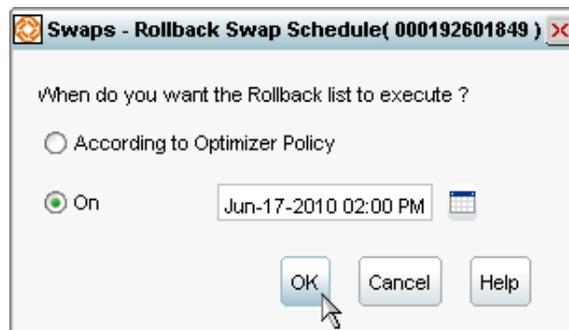
The rollback of swaps performed by FAST (or Optimizer) is controlled through the Optimizer interface in SMC. Prior to requesting a rollback, the point-in-time to which the rollback will be performed should be decided.

To perform the rollback, right-click on the appropriate Symmetrix serial number in the left-hand navigation pane, and select Optimizer, Swap/Move, Rollback.

In the resulting dialog box, select the point-in-time to rollback to, and then click on Accept & Schedule.



The rollback can be scheduled to occur at a specific time, or during the next available device movement window.



Modifying the copy pace of a FAST device movement

As previously stated, Symmetrix Quality of Service (QoS) tools can be used to control the pace at which data is copied during a FAST device movement. The QoS setting that needs to be changed is the mirror copy pace.

To change the setting, the devices to be edited should be placed into a device group. Once in a device group, the copy pace can be set by right-clicking on the device group name in the left-hand navigation pane, and selecting Replication, QoS.

In the resulting dialog box, set the Operation Type to Mirror Copy, and the desired Copy Pace, and then click OK.



The same interface can be used later to set the copy pace back to 0.

Removing FAST managed objects

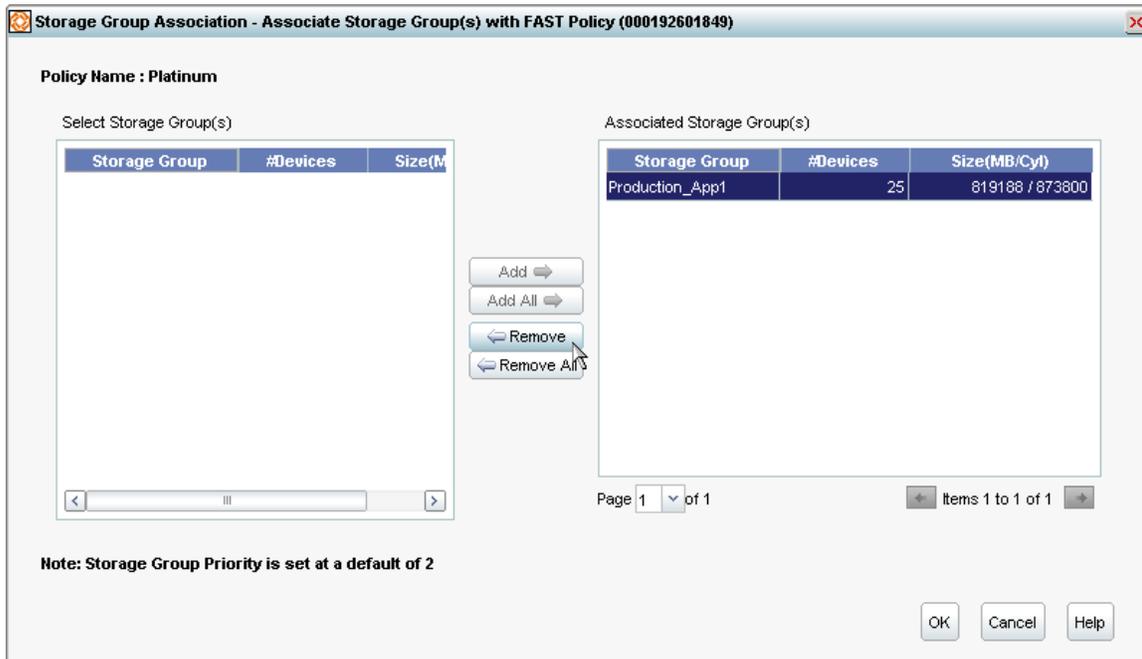
The following sections detail the SMC interfaces used to break each of the associations, and to remove each of the managed objects.

Disassociating a storage group from a FAST policy

Disassociating the storage group from a FAST policy removes the devices in the storage group from FAST control. Devices no longer under FAST control will not be automatically moved between tiers.

To disassociate a storage group from a FAST policy, right-click on the appropriate FAST policy in the left-hand navigation pane, and select FAST, FAST Policy Management, Storage Group Association.

In the resulting dialog box, select the storage group, or groups, in the right-hand pane and click Remove.



When all desired storage groups have been removed, click OK.

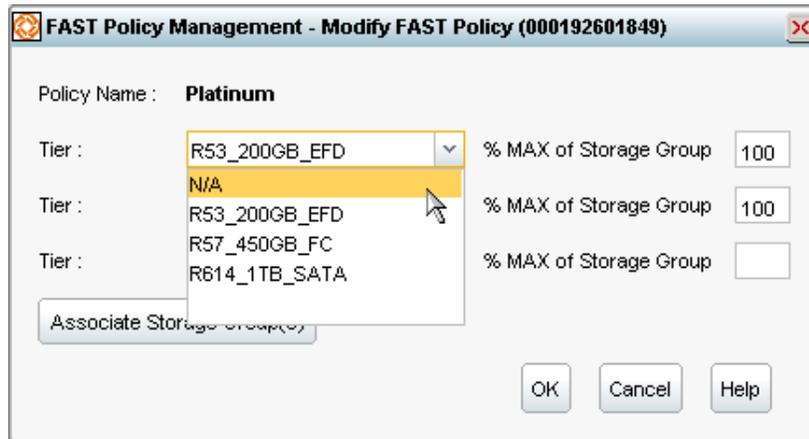
Removing a Symmetrix tier from a FAST policy

As previously stated, the sum of the upper usage limits for each Symmetrix tier contained in a policy must total a minimum of 100 percent. If a policy has associated storage groups, the removal of a tier will fail if in doing so will cause the total tier usage limits to drop below 100 percent.

To successfully remove a Symmetrix tier from a FAST policy, the upper usage limits of the remaining tiers must be modified such that they total more than 100 percent. Alternatively, the Symmetrix tier can be removed if all storage groups associations for the policy are removed in advance.

To remove a Symmetrix tier from a FAST policy, right-click on the appropriate FAST policy in the left-hand navigation pane, and select FAST, FAST Policy Management, Modify Policy.

In the resulting dialog box, set the tier value to N/A for the tier to be removed, and click OK.

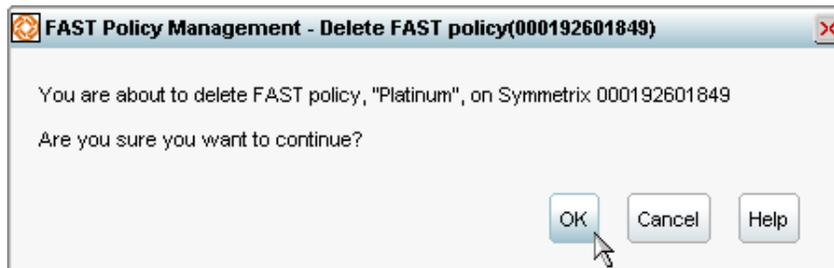


Deleting a FAST policy

A FAST policy may not be deleted if any storage groups are associated with a policy. Prior to deleting the policy, all storage group associations should be removed. Also, prior to deleting a policy, all tiers contained in the policy should be removed.

To delete a FAST policy, right-click on the appropriate FAST policy in the left-hand navigation pane, and select FAST, FAST Policy Management, Delete Policy.

Confirm the deletion of the policy in the resulting dialog box by clicking OK.

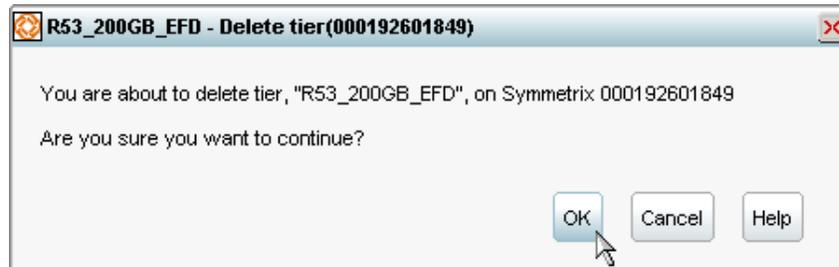


Deleting a Symmetrix tier

To delete a Symmetrix tier, it should not be contained within any FAST policy on the Symmetrix. Also, in the case of a static Symmetrix tier there should be no physical disk groups associated with the Symmetrix tier.

To delete a Symmetrix tier, right-click on the appropriate Symmetrix tier in the left-hand navigation pane, and select Tier Management, Delete Tier.

In the resulting dialog box, confirm the deletion of the tier by clicking OK.

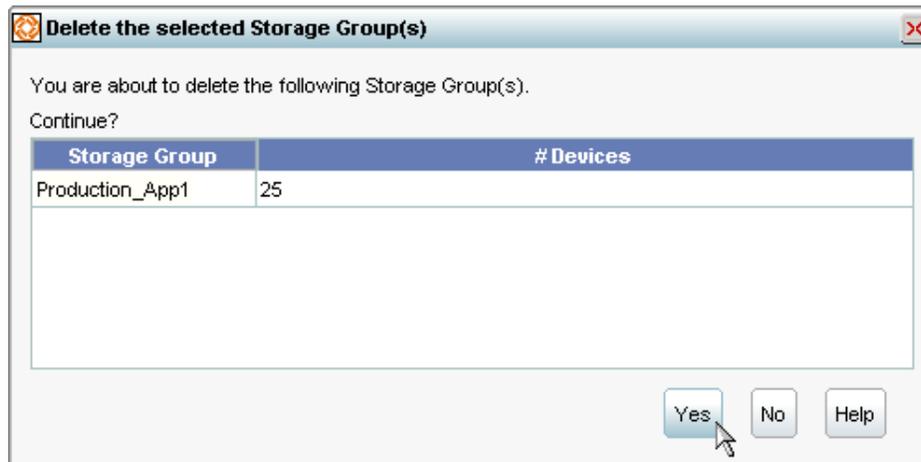


Deleting a storage group

Before deleting a storage group, the group should not be associated with any FAST policy. Also, the storage group should not contain any devices.

To delete a storage group, right-click on the appropriate storage group name in the left-hand navigation pane, and select Device Masking and Mapping, Storage Groups Maintenance, Delete Storage Group.

In the resulting dialog box, confirm the deletion of the storage group by clicking the Yes button.



Note: As storage groups may be used for the purposes of FAST and Auto-provisioning, prior to deleting the storage group, any masking views that use the storage group will also need to be deleted.

Management Interface: SYMCLI

Solutions Enabler 7.1 introduces three new SYMCLI commands used for the purposes of managing FAST:

- ♦ `symtier`
- ♦ `symfast`
- ♦ `symsg`

The **symtier** command provides the ability to create and manage Symmetrix tiers to be used with FAST policies.

The **symfast** command allows for the creation and management of FAST policies, including their association with storage groups and Symmetrix tiers. The command also provides management control of the FAST controller, including modifying settings and enabling or disabling the controller.

The **symsg** command is used to create and manage storage groups on the Symmetrix array for the purpose of being used with FAST.

Note: The **symaccess** command introduced in Solutions Enabler 7.0 can also be used to create storage groups for use with FAST. The **symsg** command may also be used to create storage groups to be used in creating masking views as a part of Auto-provisioning Groups.

The following sections detail the use of all three commands in building, managing, and enabling a FAST environment using the Solutions Enabler SYMCLI.

Note: The examples shown in this section were created using Solutions Enabler version 7.1.1.

Examining Symmetrix physical disk groups

Prior to enabling and configuring the FAST controller, and configuring Symmetrix tiers and FAST policies, it is important to understand the existing configuration of the Symmetrix. The `syndisk list` command can be used to take an inventory of the existing disks and physical disk groups within the array:

```
syndisk -sid 1849 list -dskgrp_summary
```

```
Symmetrix ID: 000192601849
```

Disk Group		Disk			Capacity			
Num	Name	Cnt	Tech	Speed (RPM)	Size (MB)	Total (MB)	Free (MB)	Actual (MB)
0	DISK_GROUP_000	0	N/A	N/A	N/A	0	0	N/A
1	DISK_GROUP_001	58	SATA	7200	953870	55324443	48138159	55324443
2	DISK_GROUP_002	86	FC	15000	418710	36009099	25654886	36009099
3	DISK_GROUP_003	4	EFD	0	190782	763129	389103	763129
12	DISK_GROUP_012	82	FC	15000	418710	34334257	13503216	34334257
Total						126430927	87685363	126430927

Legend:

(Tech)nology : SATA = SATA, FC = Fibre Channel, EFD = Enterprise Flash Drive

The output of the command shows the physical disk group number, the number of drives in the group, along with the disk technology, the speed, and the size.

Note: Disk group 0 only contains disk spares, and as such, reports 0 for total, free, and actual capacity.

To see the actual physical disks and their location within the array, the following command can be run:

```
syndisk -sid 1849 list -by_diskgroup
```

```
Symmetrix ID           : 000192601849
Disks Selected         : 239

Disk Group             : 0
Disk Group Name        : DISK_GROUP_000
Technology              : N/A
Speed (RPM)            : N/A
```

Management Interface: SYMCLI

Ident	Symb	Int	TID	Vendor	Type	Hypr	Total	Capacity (MB)	
								Free	Actual
DF-8A	08A	C	5	SATAHGST	N01THGK	0	0	0	953870
DF-8A	08A	C	B	SEAGATE	HUC4515	0	0	0	418710
DF-10A	10A	C	5	SATAHGST	N01THGK	0	0	0	953870
DF-10A	10A	D	E	STEC	STC0200	0	0	0	190782
DF-8B	08B	C	E	SEAGATE	HUC4515	0	0	0	418710
DF-10B	10B	C	C	SEAGATE	HUC4515	0	0	0	418710
DF-10B	10B	D	D	SEAGATE	HUC4515	0	0	0	418710
DF-9C	09C	C	E	SEAGATE	HUC4515	0	0	0	418710
DF-7D	07D	C	D	SEAGATE	HUC4515	0	0	0	418710
Total							0	0	4610784

Disk Group : 1
 Disk Group Name : DISK_GROUP_001
 Technology : SATA
 Speed (RPM) : 7200

Ident	Symb	Int	TID	Vendor	Type	Hypr	Total	Capacity (MB)	
								Free	Actual
DF-7A	07A	C	0	SATAHGST	N01THGK	32	953870	847772	953870
DF-7A	07A	C	2	SATAHGST	N01THGK	33	953870	745738	953870
DF-7A	07A	D	1	SATAHGST	N01THGK	32	953870	847772	953870
DF-7A	07A	D	3	SATAHGST	N01THGK	9	953870	914605	953870
DF-8A	08A	C	1	SATAHGST	N01THGK	32	953870	847772	953870
DF-8A	08A	C	3	SATAHGST	N01THGK	33	953870	745738	953870
DF-8A	08A	D	0	SATAHGST	N01THGK	33	953870	847364	953870
DF-8A	08A	D	2	SATAHGST	N01THGK	9	953870	906291	953870
...									
DF-9D	09D	C	1	SATAHGST	N01THGK	32	953870	847772	953870
DF-9D	09D	C	3	SATAHGST	N01THGK	33	953870	847763	953870
DF-9D	09D	D	0	SATAHGST	N01THGK	32	953870	847373	953870
DF-9D	09D	D	2	SATAHGST	N01THGK	33	953870	745738	953870
DF-10D	10D	C	0	SATAHGST	N01THGK	33	953870	745738	953870
DF-10D	10D	C	2	SATAHGST	N01THGK	9	953870	906291	953870
DF-10D	10D	D	1	SATAHGST	N01THGK	33	953870	847751	953870
Total							55324443	48138159	55324443

Disk Group : 2
 Disk Group Name : DISK_GROUP_002
 Technology : FC
 Speed (RPM) : 15000

Ident	Symb	Int	TID	Vendor	Type	Hypr	Total	Capacity (MB)	
								Free	Actual
DF-7A	07A	C	A	SEAGATE	HUC4515	8	418710	313325	418710
DF-7A	07A	C	C	SEAGATE	HUC4515	8	418710	319585	418710
DF-7A	07A	D	7	SEAGATE	HUC4515	8	418710	313325	418710

DF-7A	07A	D	9	SEAGATE	HUC4515	8	418710	96505	418710
DF-7A	07A	D	B	SEAGATE	HUC4515	7	418710	346607	418710
DF-7A	07A	D	D	SEAGATE	HUC4515	7	418710	346607	418710
DF-8A	08A	C	9	SEAGATE	HUC4515	8	418710	313325	418710
DF-8A	08A	C	D	SEAGATE	HUC4515	8	418710	96505	418710
DF-8A	08A	D	C	SEAGATE	HUC4515	8	418710	313325	418710
DF-8A	08A	D	E	SEAGATE	HUC4515	7	418710	352868	418710
...									
DF-9D	09D	C	9	SEAGATE	HUC4515	8	418710	313325	418710
DF-9D	09D	C	B	SEAGATE	HUC4515	8	418710	96505	418710
DF-9D	09D	D	A	SEAGATE	HUC4515	8	418710	313325	418710
DF-10D	10D	C	A	SEAGATE	HUC4515	8	418710	313325	418710
DF-10D	10D	C	E	SEAGATE	HUC4515	7	418710	352868	418710
DF-10D	10D	D	3	SEAGATE	HUC4515	8	418710	341407	418710
DF-10D	10D	D	5	SEAGATE	HUC4515	8	418710	313325	418710
DF-10D	10D	D	7	SEAGATE	HUC4515	7	418710	352868	418710
DF-10D	10D	D	9	SEAGATE	HUC4515	8	418710	96505	418710
DF-10D	10D	D	B	SEAGATE	HUC4515	7	418710	346607	418710
DF-10D	10D	D	D	SEAGATE	HUC4515	2	418710	352145	418710
Total							36009099	25654886	36009099

Disk Group : 3
 Disk Group Name : DISK_GROUP_003
 Technology : EFD
 Speed (RPM) : 0

Ident	Symb	Int	TID	Vendor	Type	Hypr	Capacity(MB)		
							Total	Free	Actual
DF-7A	07A	C	E	STEC	STC0200	8	190782	97275	190782
DF-10B	10B	C	E	STEC	STC0200	8	190782	97275	190782
DF-8D	08D	C	E	STEC	STC0200	8	190782	97275	190782
DF-9D	09D	D	E	STEC	STC0200	8	190782	97275	190782
Total							763129	389103	763129

Disk Group : 12
 Disk Group Name : DISK_GROUP_012
 Technology : FC
 Speed (RPM) : 15000

Ident	Symb	Int	TID	Vendor	Type	Hypr	Capacity(MB)		
							Total	Free	Actual
DF-7A	07A	C	4	SEAGATE	HUC4515	3	418710	162781	418710
DF-7A	07A	C	6	SEAGATE	HUC4515	2	418710	124234	418710
DF-7A	07A	C	8	SEAGATE	HUC4515	2	418710	167146	418710
DF-7A	07A	D	5	SEAGATE	HUC4515	2	418710	167146	418710
DF-8A	08A	C	7	SEAGATE	HUC4515	2	418710	124234	418710
DF-8A	08A	D	4	SEAGATE	HUC4515	3	418710	162781	418710
DF-8A	08A	D	6	SEAGATE	HUC4515	2	418710	167146	418710
DF-8A	08A	D	8	SEAGATE	HUC4515	2	418710	167981	418710

DF-8A	08A	D	A	SEAGATE	HUC4515	3	418710	123607	418710
...									
DF-9D	09D	C	5	SEAGATE	HUC4515	2	418710	124234	418710
DF-9D	09D	C	7	SEAGATE	HUC4515	3	418710	123607	418710
DF-9D	09D	D	4	SEAGATE	HUC4515	3	418710	162781	418710
DF-9D	09D	D	6	SEAGATE	HUC4515	1	418710	168608	418710
DF-9D	09D	D	8	SEAGATE	HUC4515	2	418710	124234	418710
DF-9D	09D	D	C	SEAGATE	HUC4515	2	418710	167146	418710
DF-10D	10D	C	4	SEAGATE	HUC4515	3	418710	162781	418710
DF-10D	10D	C	6	SEAGATE	HUC4515	2	418710	135326	418710
DF-10D	10D	C	8	SEAGATE	HUC4515	2	418710	373708	418710
DF-10D	10D	C	C	SEAGATE	HUC4515	2	418710	135326	418710
Total							34334257	13503216	34334257

Renaming physical disk group names

Another new feature, alongside FAST, provides the ability to assign a name to physical disk groups. This allows for a more meaningful label to be associated with the disk group, rather than a single number.

By default, the disk group names follow the format DISK_GROUP_XXX, where XXX corresponds to the disk group number. Disk group names can contain up to 32 alpha-numeric characters, hyphens (-), and underscores (_).

To rename a physical disk group, the `symconfigure` command is used with the following syntax:

```
symconfigure -sid 1849 -cmd "set disk_group 2, disk_group_name = FC_450GB_15K_GRP2;" commit
```

```
Execute a symconfigure operation for symmetrix '000192601849' (y/[n]) ? y
```

```
A Configuration Change operation is in progress. Please wait...
```

```
Establishing a configuration change session.....Established.
Processing symmetrix 000192601849
Performing Access checks.....Allowed.
Checking Device Reservations.....Allowed.
Initiating COMMIT of configuration changes.....Queued.
COMMIT requesting required resources.....Obtained.
Step 018 of 046 steps.....Executing.
Step 040 of 046 steps.....Executing.
Step 056 of 146 steps.....Executing.
...
Step 131 of 146 steps.....Executing.
Step 134 of 146 steps.....Executing.
Local: COMMIT.....Done.
Terminating the configuration change session.....Done.
```

```
The configuration change session has successfully completed.
```

Once changed, the symdisk disk group summary output will look like:

```
symdisk -sid 1849 list -dskgrp_summary
```

Symmetrix ID: 000192601849

Disk Group		Disk			Capacity			
Num	Name	Cnt	Tech	Speed (RPM)	Size (MB)	Total (MB)	Free (MB)	Actual (MB)
0	DISK_GROUP_000	0	N/A	N/A	N/A	0	0	N/A
1	DISK_GROUP_001	58	SATA	7200	953870	55324443	48138159	55324443
2	FC_450GB_15K_GRP2	86	FC	15000	418710	36009099	25654886	36009099
3	DISK_GROUP_003	4	EFD	0	190782	763129	389103	763129
12	DISK_GROUP_012	82	FC	15000	418710	34334257	13503216	34334257
Total						126430927	87685363	126430927

Legend:

(Tech)nology : SATA = SATA, FC = Fibre Channel, EFD = Enterprise Flash Drive

After all, non-spare, physical disk groups have been renamed, the output will look like this:

```
symdisk -sid 1849 list -dskgrp_summary
```

Symmetrix ID: 000192601849

Disk Group		Disk			Capacity			
Num	Name	Cnt	Tech	Speed (RPM)	Size (MB)	Total (MB)	Free (MB)	Actual (MB)
0	DISK_GROUP_000	0	N/A	N/A	N/A	0	0	N/A
1	SATA_1TB_GRP1	58	SATA	7200	953870	55324443	48138159	55324443
2	FC_450GB_15K_GRP2	86	FC	15000	418710	36009099	25654886	36009099
3	EFD_200GB_GRP3	4	EFD	0	190782	763129	389103	763129
12	FC_450GB_15K_GRP12	82	FC	15000	418710	34334257	13503216	34334257
Total						126430927	87685363	126430927

Legend:

(Tech)nology : SATA = SATA, FC = Fibre Channel, EFD = Enterprise Flash Drive

Solutions Enabler commands that accept the disk group number as an input option may also be used by specifying the disk group name.

Configuring the Symmetrix FAST controller

There are multiple FAST settings and parameters that affect the behavior of the FAST controller. These include:

- ◆ Operating Mode
- ◆ Maximum Moves Per Day
- ◆ Maximum Simultaneous Moves
- ◆ Workload Analysis Period
- ◆ Initial Analysis Period
- ◆ Move Type
- ◆ Use Host Invisible Devices
- ◆ Performance Time Window
- ◆ Device Movement Time Window

The following sections detail the SYMCLI commands to modify each of these settings.

FAST controller settings list information

To view the existing FAST controller settings, the `symfast list` command can be used with the `-control_parms` option:

```
symfast -sid 1849 list -control_parms

Symmetrix ID: 000192601849

Data Movement Mode           : Auto_Approve
Min Initial Workload Period(hrs) : 168
Workload Analysis Period(hrs)  : 168
Max Simultaneous Device Moves  : 8
Max Device Moves Per Day       : 200
Swap Not Visible Devices       : Disabled
Allow Only Swap                : Disabled
```

Setting the Operating Mode

There are two possible values for the data movement mode: Automatic (`auto_approve`) and User Approved (`user_approve`). The default value is `auto_approve`.

To set the mode to User Approved, run:

```
symfast -sid 1849 set -control_parms -mode user_approve

Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y

The FAST SET CONTROL PARAMETERS operation finished successfully
```

Setting the Maximum Moves Per Day

Maximum Device Moves Per Day (max_devs) can be set between 2 and 200. The default value is 200.

To set the Maximum Device Moves Per Day for FAST, run:

```
symfast -sid 1849 set -control_parms -max_devs 64
```

```
Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y
```

```
The FAST SET CONTROL PARAMETERS operation finished successfully
```

Setting the Maximum Simultaneous Moves

Maximum Simultaneous Device Moves (max_simult_devs) can be set between 2 and 32. The default value is 8.

To set the Maximum Simultaneous Device Moves for FAST, run:

```
symfast -sid 1849 set -control_parms -max_simult_devs 16
```

```
Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y
```

```
The FAST SET CONTROL PARAMETERS operation finished successfully
```

Setting the Workload Analysis Period

The Workload Analysis Period (workload_period) can be set between 1 hour and 4 weeks, but its value is specified in hours. The default value is 1 week (168 hours).

To set the Workload Analysis Period for FAST, run:

```
symfast -sid 1849 set -control_parms -workload_period 72
```

```
Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y
```

```
The FAST SET CONTROL PARAMETERS operation finished successfully
```

Setting the Initial Analysis Period

The Initial Analysis Period (min_perf_period) can be set between 1 hour and 4 weeks, but its value is specified in hours. The default value is 1 week (168 hours).

To set the Initial Analysis Period for FAST, run:

```
symfast -sid 1849 set -control_parms -min_perf_period 72
```

```
Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y
```

```
The FAST SET CONTROL PARAMETERS operation finished successfully
```

Setting the allowed move type

The FAST controller move type (`allow_only_swap`), which can allow only swaps to be performed, or swaps and moves, can be set to ENABLE or DISABLE. The default value is DISABLE.

To set the Allowed Move Type to allow only swaps, run:

```
symfast -sid 1849 set -control_parms -allow_only_swap enable
```

```
Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y
```

```
The FAST SET CONTROL PARAMETERS operation finished successfully
```

Setting the Use of Host Invisible Devices

The Use of Host Invisible Devices (`swap_notvisible_devices`) can be set to ENABLE or DISABLE. The default value is DISABLE.

To set the Use of Host Invisible Devices to enable, run:

```
symfast -sid 1849 set -control_parms -swap_notvisible_devs enable
```

```
Execute SET CONTROL PARAMETERS operation for FAST (y/[n]) ? y
```

```
The FAST SET CONTROL PARAMETERS operation finished successfully
```

Verifying FAST controller settings

When all changes have been made to the FAST controller settings, the changes can be verified by once again listing all the control settings:

```
symfast -sid 1849 list -control_parms
```

```
Symmetrix ID: 000192601849
```

```
Data Movement Mode           : User_Approve
Min Initial Workload Period(hrs) : 72
Workload Analysis Period(hrs)   : 72
Max Simultaneous Device Moves  : 16
Max Device Moves Per Day       : 64
Swap Not Visible Devices       : Enabled
Allow Only Swap                : Enabled
```

FAST controller time window list information

The performance and device movement time windows used by the FAST controller are shared with Optimizer. As such, management of these time windows is managed through the SYMCLI `symoptmz` command.

To view existing time windows configured on the Symmetrix, the following command can be run:

```
symoptmz -sid 1849 show -parms
```

Optimizer Control Parameters

```
Swap Mode           : UserOK
Min Perf Period     : 72
Workload Period     : 72
Max Simult Swaps    : 16
Max Swaps Per Day   : 64
```

Advanced Parameter Settings

```
Max Days to keep Rollbacks : 30
Hot Spot Analysis           : False
```

```
Number of Swap Time Windows : 1
```

```
Time Window ID      : The Default Time Window
Type                 : Swap
Flags                : Exclusive
Periodicity         : Once
Start Date           : None
Stop Date            : None
```

```
Performance Time Windows : 1
```

```
Time Window ID      : The Default Time Window
Type                 : Performance
Flags                : Inclusive
Periodicity         : Once
Start Date           : None
Stop Date            : None
```

In the above output, only the default time windows are set.

Creating FAST controller time windows

To create time windows to be used by FAST (or Optimizer) a text file needs to be created containing syntax defining the desired windows. Prior to creating the text file, the following information will need to be decided:

- ◆ Time window name
- ◆ Time window type—performance of device movement
- ◆ Whether the time window is inclusive or exclusive
- ◆ The frequency of occurrence

- ◆ Days of the week the window will be used
- ◆ Times of the day the window will be used
- ◆ Time period for which the time window is valid

Note: Using Solutions Enabler, it is necessary to create all desired performance and device movement windows at the same time.

As an example, to create a performance time window that will collect data samples between 7 a.m. and 7 p.m. on each day, Monday through Friday, the following syntax would need to be placed in a text file:

```
set time_window id=Production_Day,
type=PERF,
flag=INCLUDE,
period=WEEKLY_BY_DAY,
starting=01012010:000000,
ending=12312020:000000,
days=MON,TUE,WED,THU,FRI,
start_time=07:00,
end_time=19:00;
```

To create a device movement window that will perform FAST moves or swaps between 1 a.m. and 6 a.m. on Saturdays and Sundays, the following syntax would need to be added to the previously created text file:

```
set time_window id=OffPeak_Swaps,
type=SWAP,
flag=INCLUDE,
period=WEEKLY_BY_DAY,
starting=01012010:000000,
ending=12312020:000000,
days=SAT,SUN,
start_time=01:00,
end_time=06:00;
```

When the text file has been created, to commit the changes, run:

```
symoptmz -sid 1849 -f time_windows.txt commit
```

```
Processing Command file : swap_window.txt
PREVIEW .....Started.
PREVIEW .....Done.
PREPARE .....Started.
PREPARE .....Done.
COMMIT .....Started.
```

COMMITDone.

To verify whether the time windows have been created correctly, run:

symoptmz -sid 1849 show -parms

Optimizer Control Parameters

```
Swap Mode           : UserOK
Min Perf Period     : 72
Workload Period     : 72
Max Simult Swaps    : 16
Max Swaps Per Day   : 64
```

Advanced Parameter Settings

```
Max Days to keep Rollbacks : 30
Hot Spot Analysis          : False
```

Number of Swap Time Windows : 2

```
Time Window ID      : The Default Time Window
Type                 : Swap
Flags                : Exclusive
Periodicity          : Once
Start Date           : None
Stop Date            : None
```

```
Time Window ID      : OffPeak_Swaps
Type                 : Swap
Flags                : Inclusive
Periodicity          : WeeklyByDay
Start Date           : Fri Jan 1 00:00:00 2010
Stop Date            : Thu Dec 31 00:00:00 2020
Days of the week     : Sunday Saturday
Start Time (hh:mm)   : 01:00
Stop Time (hh:mm)    : 05:00
```

Performance Time Windows : 2

```
Time Window ID      : The Default Time Window
Type                 : Performance
Flags                : Inclusive
Periodicity          : Once
Start Date           : None
Stop Date            : None
```

```
Time Window ID      : Production_Day
Type                 : Performance
Flags                : Inclusive
Periodicity          : WeeklyByDay
Start Date           : Fri Jan 1 00:00:00 2010
```

```
Stop Date           : Thu Dec 31 00:00:00 2020
Days of the week    : Monday Tuesday Wednesday Thursday Friday
Start Time (hh:mm)  : 07:00
Stop Time (hh:mm)   : 19:00
```

Creating FAST managed objects

There are three managed objects related to the use of FAST in the Symmetrix VMAX. These are:

- ◆ Symmetrix tiers
- ◆ FAST policies
- ◆ Storage groups

When created, storage groups are associated with a FAST policy which in turn associates the storage group with up to three Symmetrix tiers, while defining the upper usage limit for the storage group in each tier.

The following sections detail the SYMCLI commands used to create each of the managed objects, and the methods for associating them.

Commands are also shown for removing these associations, and removing each of the objects.

Creating a static Symmetrix tier

A static Symmetrix tier is one in which individual physical disk groups are explicitly added to the tier. The creation and management of static Symmetrix tiers is performed using the **symtier** command.

When creating a static Symmetrix tier the following information must be known:

- ◆ The Symmetrix tier name
- ◆ The desired protection type of the tier
- ◆ The disk technology to be used for the tier
- ◆ The physical disk group numbers/names to be added to the tier

Once this information has been decided, an empty tier can be created by running:

```
symtier -sid 1849 create -name R53_200GB_EFD -tgt_raid5 -tgt_prot 3+1
-technology EFD -inc_type static
```

This command created a static Symmetrix tier with target protection type of RAID 5 (3+1), and disk technology of EFD. The Symmetrix tier name chosen was R53_200GB_FC to indicate the RAID protection type (RAID 1), drive size (200 GB), and drive type (EFD)—R53_200GB_EFD.

The **symtier list** command can be used to verify the successful creation of the Symmetrix tier.

```
symtier -sid 1849 list
```

```
Symmetrix ID          : 000192601849
```

```
-----
Tier Name              Target      Inc      Total      Free      Used
                       Tech Protection Type      (GB)      (GB)      (GB)
-----
R53_200GB_EFD         EFD RAID-5(3+1) S           0          0          0
```

Legend:

```
Inc Type      : S = Static, D = Dynamic
```

As no disk groups were added to the tier during the creation, a 0 will be displayed for the Total, Free, and Used columns in the output.

Once the empty static Symmetrix tier has been created, physical disk groups can be added to it, again using the **symtier** command.

To add a disk group by disk group number, run:

```
symtier -sid 1849 add -tier_name R53_200GB_EFD -dsk_grp 3
```

Or, to add a disk group by disk group name, run:

```
symtier -sid 1849 add -tier_name R53_200GB_EFD -dsk_grp name:
EFD_200GB_GRP3
```

Once the disk group has been added, the new tier capacity totals can be seen using the **symtier show** command:

```
symtier -sid 1849 show -tier_name R53_200GB_EFD
```

```
Symmetrix ID          : 000192601849
```

```
Tier Name             : R53_200GB_EFD
```

```
Technology            : EFD
```

```
Target Protection     : RAID-5(3+1)
```

```
Include Type          : Static
```

```
Disk Groups(1)
```

```
{
```

```
-----
Dsk Dsk      Speed  Disk   Total   Free   Used
Grp Group Name (RPM) Count (GB)   (GB)   (GB)
-----
003 EFD_200GB_GRP3 -      4     745    380    365
-----
Total                4     745    380    365
}
```

Creating a dynamic Symmetrix tier

A dynamic Symmetrix tier is one in which all physical disk groups of a specified disk technology are added to the tier. The creation and management of dynamic Symmetrix tiers is also performed using the **symtier** command.

When creating a dynamic Symmetrix tier the following information must be known:

- ◆ The Symmetrix tier name
- ◆ The desired protection type of the tier
- ◆ The disk technology to be used for the tier

Once this information has been decided, a dynamic Symmetrix tier can be created by running:

```
symtier -sid 1849 create -name R1_450GB_FC -tgt_raid1 -technology FC
-inc_type dynamic
```

This command created a dynamic Symmetrix tier with target protection type of RAID 1, and disk technology of FC. All of the Symmetrix physical disk groups that contain Fibre Channel disks will be added to the tier automatically.

The Symmetrix tier name chosen was R1_450GB_FC to indicate the drive type (FC), drive size (450 GB), and RAID protection type (RAID 1)—R1_450GB_FC.

The **symtier show** command can be used to verify the successful creation of the Symmetrix tier:

```
symtier -sid 1849 show -tier_name R1_450GB_FC
```

```
Symmetrix ID           : 000192601849
```

```
Tier Name              : R1_450GB_FC
```

```
Technology             : FC
```

```
Target Protection     : RAID-1
```

```
Include Type          : Dynamic
```

```
Disk Groups(2)
```

```
{
```

```
-----
```

Dsk Grp	Dsk Group Name	Speed (RPM)	Disk Count	Total (GB)	Free (GB)	Used (GB)
002	FC_450GB_15K_*	15000	86	32210	25054	7156
012	FC_450GB_15K_*	15000	82	32009	13187	18822
Total			168	64219	38241	25978

```
-----
}
```

Symmetrix tier list information

The `symtier list` command provides the following information:

- ◆ Symmetrix tier name
- ◆ Symmetrix tier disk technology
- ◆ Symmetrix tier target RAID protection
- ◆ Symmetrix tier type – static or dynamic
- ◆ Total tier capacity
- ◆ Free tier capacity
- ◆ Used tier capacity

`symtier -sid 1849 list`

Symmetrix ID : 000192601849

Tier Name	Tech	Target Protection	Inc Type	Total (GB)	Free (GB)	Used (GB)
R1_450GB_FC	FC	RAID-1	D	64219	38241	25978
R53_200GB_EFD	EFD	RAID-5(3+1)	S	745	380	365
R57_450GB_FC	FC	RAID-5(7+1)	D	38378	38241	137
R614_1TB_SATA	SATA	RAID-6(14+2)	S	51685	47010	4675

Legend:

Inc Type : S = Static, D = Dynamic

The “Free” column indicates the sum of the unconfigured space of all the physical disk groups contained in the tier.

The “Used” column displays the total capacity of the physical hypervisors of each of the devices that are configured in the physical disks contained in the tier, and that match the Symmetrix tier's RAID protection type.

The “Total” column is the sum of the “Free” and “Used” columns.

Note: The disk group free capacity will be reported as 0 if the disk groups contained in the Symmetrix tier do not have enough usable disks to support the tier's target RAID protection type.

To see detailed information regarding each tier, including all contained physical disk groups, the `-v` option can be added to the `symtier list` command.

Creating a Symmetrix FAST policy

A FAST policy defines the upper usage limits for up to three tiers for any storage groups associated with the policy. The creation and management of FAST policies are performed using the **symfast** command.

When creating a FAST policy the following information must be known:

- ♦ The FAST policy name
- ♦ Up to three Symmetrix tiers to be used in the policy
- ♦ The upper usage limits for each of the Symmetrix tiers being added

Once this information has been decided, the FAST policy can be created by running:

```
symfast -sid 1849 -fp create -name Platinum
```

Symmetrix tiers can then be added, one at a time, by running:

```
symfast -sid 1849 -fp -fp_name Platinum add -tier_name R53_200GB_EFD
-max_sg_percentage 100
```

```
symfast -sid 1369 -fp -fp_name Platinum add -tier_name R1_450GB_FC -
max_sg_percentage 100
```

The creation of the FAST policy can be verified by running:

```
symfast -sid 1849 show -fp_name Platinum
```

```
Symmetrix ID           : 000192601849
```

```
Policy Name           : Platinum
```

```
Tiers(2)
```

```
{
```

```
-----
Tier Name                Max SG      Target
                        Percent Tech  Protection
-----
R53_200GB_EFD            100 EFD    RAID-5(3+1)
R1_450GB_FC              100 FC     RAID-1
}
```

```
No Storage Groups associated with Policy Platinum
```

FAST policy list information

The **symfast list** command is available with several options to provide information regarding all defined FAST policies.

The **symfast list -fp** command will provide:

- ◆ All defined FAST policy names
- ◆ Number of Symmetrix tiers contained in each policy
- ◆ Number of storage groups associated with each policy

```
symfast -sid 1849 list -fp
```

```
Symmetrix ID          : 000192601849
```

```
-----
Policy Name           Tiers  Assocs
-----
Bronze                2      0
Platinum              2      0
Silver                3      0
```

To see detailed information on every FAST policy, including all contained Symmetrix tiers, usage limits, storage group associations, and priorities, the **-v** option can be added to the **symfast list -fp** command.

Creating a Symmetrix storage group

A storage group logically combines Symmetrix devices to be managed together. The creation and management of storage groups is performed using the **symmsg** command.

When creating a storage group the following information must be known:

- ◆ The storage group name
- ◆ The standard provisioning devices to be added to the group

Once this information has been decided, the storage group can be created by running:

```
symmsg -sid 1849 create Production_App1
```

Devices can be added to the storage group in a number of ways:

- ◆ One device at a time

```
symmsg -sid 1849 -sg Production_App1 add dev F5
```

- ◆ A contiguous range of devices

```
symmsg -sid 1849 -sg Production_App1 addall devs -range F5:10D
```

- ◆ A comma-separated list of devices

```
symmsg -sid 1849 -sg Production_App1 addall devs -devs F5,F6,F7
```

- ◆ A comma separate list of devices and device ranges

```
symmsg -sid 1849 -sg Production_App1 addall devs -devs F5,F6:10D
```

- ◆ A device file

```
symmsg -sid 1849 -sg Production_App1 addall devs -file mydevices.txt
```

To verify the successful creation of the storage group, and the addition of the devices, run:

```
symmsg -sid 1849 show Production_App1
```

```
Name: Production_App1
```

```
Symmetrix ID      : 000192601849
Last updated at   : Thu May 27 15:54:10 2010
Masking Views     : Yes
FAST Policy       : Yes
```

```
Devices (25):
```

```
{
```

Sym Dev	Pdev Name	Device Config	Sts	Cap (MB)
00F5	/dev/rdisk/emcpower28c	2-Way Mir	RW	32768
00F6	/dev/rdisk/emcpower31c	2-Way Mir	RW	32768
00F7	/dev/rdisk/emcpower34c	2-Way Mir	RW	32768
00F8	/dev/rdisk/emcpower37c	2-Way Mir	RW	32768
00F9	/dev/rdisk/emcpower40c	2-Way Mir	RW	32768
00FA	/dev/rdisk/emcpower43c	2-Way Mir	RW	32768
00FB	/dev/rdisk/emcpower46c	2-Way Mir	RW	32768
00FC	/dev/rdisk/emcpower49c	2-Way Mir	RW	32768
00FD	/dev/rdisk/emcpower52c	2-Way Mir	RW	32768
00FE	/dev/rdisk/emcpower53c	2-Way Mir	RW	32768
00FF	/dev/rdisk/emcpower55c	2-Way Mir	RW	32768
0100	/dev/rdisk/emcpower57c	2-Way Mir	RW	32768
0101	/dev/rdisk/emcpower56c	2-Way Mir	RW	32768
0102	/dev/rdisk/emcpower54c	2-Way Mir	RW	32768
0103	/dev/rdisk/emcpower25c	2-Way Mir	RW	32768
0104	/dev/rdisk/emcpower23c	2-Way Mir	RW	32768
0105	/dev/rdisk/emcpower21c	2-Way Mir	RW	32768
0106	/dev/rdisk/emcpower19c	2-Way Mir	RW	32768
0107	/dev/rdisk/emcpower17c	2-Way Mir	RW	32768
0108	/dev/rdisk/emcpower15c	2-Way Mir	RW	32768
0109	/dev/rdisk/emcpower13c	2-Way Mir	RW	32768
010A	/dev/rdisk/emcpower11c	2-Way Mir	RW	32768
010B	/dev/rdisk/emcpower9c	2-Way Mir	RW	32768

```

010C /dev/rdisk/emcpower7c 2-Way Mir RW 32768
010D /dev/rdisk/emcpower5c 2-Way Mir RW 32768
}

```

Storage group list information

The **symmsg list** command is available with several options to provide information for storage groups, including:

- ◆ The names of all created storage groups
- ◆ The number of devices in each storage group
- ◆ Whether the storage group is associated with a FAST policy
- ◆ Whether the storage group is used in a masking view

symmsg -sid 1849 list

```

          S T O R A G E   G R O U P S

Symmetrix ID:          000192601849

Storage Group Name      Number  Use
                        Devices  F M
-----
Backup                  25    . .
Development             25    . X
Production_App1         25    . X
Production_App2         25    . X

```

Legend:

Use Flags:

(F)ast Policy, X = Associated with Fast Policy, . = N/A
(M)asking View, X = Contained in Mask View(s), . = N/A

Associating a storage group with a FAST policy

Associating a storage group with a FAST policy brings the devices in the storage group under FAST control. All devices in the storage group will be considered candidates for promotion or demotion when FAST performs its analysis and creates a configuration change plan.

When creating a FAST policy association, the following information must be known:

- ◆ The FAST policy name
- ◆ The storage group name
- ◆ The priority of the storage group within the policy

Once this information has been decided, the association is performed by

running:

```
symfast -sid 1849 -fp_name Platinum associate -sg Production_App1
-priority 2
```

To verify the successful association of the storage group to the FAST policy, run:

```
symfast -sid 1849 show -association -sg Production_App1
```

```
Symmetrix ID          : 000192601849
```

```
Storage Group        : Production_App1
```

```
Devices(25)
```

```
{
```

```
-----
```

Sym	Protection	Policy Tier Name	Dsk Grp	Dsk Group Name	Tech	Cap (GB)
00F5	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00F6	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00F7	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00F8	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00F9	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00FA	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00FB	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00FC	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00FD	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00FE	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
00FF	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0100	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0101	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0102	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0103	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0104	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0105	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0106	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0107	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0108	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
0109	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
010A	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
010B	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
010C	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32
010D	RAID-1	R1_450GB_FC	002	FC_450GB_15K_*	FC	32

```
}
```

```
Policy Name          : Platinum
```

```
Priority              : 2
```

```
Tiers(2)
```

```
{
```

```
-----
```

Max SG	Target
--------	--------

```

Tier Name                               Percent Tech Protection
-----
R53_200GB_EFD                          100 EFD   RAID-5(3+1)
R1_450GB_FC                             100 FC    RAID-1
}

```

FAST policy association list information

The **symfast list** command is available with several options to provide information regarding all defined FAST policy associations.

The **symfast list -association** command will provide:

- ◆ All storage group names associated with a FAST policy
- ◆ All associated FAST policies
- ◆ The priority of the storage group within the associated policy

To list all storage groups and the policies they are associated with, run:

```
symfast -sid 1849 list -association
```

```
Symmetrix ID           : 000192601849
```

```

-----
Storage Group Name      Policy Name              Pri
-----
Backup                  Bronze                   2
Development              Bronze                   2
Production_App1         Platinum                 2
Production_App2         Silver                   2

```

Modifying a storage group's priority in a FAST policy

After a storage group has been associated with a FAST policy, it is possible to modify the priority of the storage group within the policy using the **symfast** command.

To modify the storage group's priority in the FAST policy, run the following command:

```
symfast -sid 1849 -fp_name Bronze modify -sg Development_SG -priority 1
```

To verify the priority of the storage group was changed successfully, run:

```
symfast -sid 1849 list -association
```

```
Symmetrix ID           : 000192601849
```

Storage Group Name	Policy Name	Pri
Backup	Bronze	2
Development	Bronze	1
Production_App1	Platinum	2
Production_App2	Silver	2

Modifying a Symmetrix tier in a FAST policy

After some time, it may be determined that the upper usage limit of a particular tier within a FAST policy needs to be adjusted. This can be done dynamically through the **symfast** command. If there are storage groups associated with the policy being modified, the change in the usage limit cannot cause the sum of the usage limits for all tiers in the policy to fall below 100 percent:

```
symfast -sid 1849 show -fp_name Bronze
```

```
Symmetrix ID      : 000192601849
```

```
Policy Name       : Bronze
```

```
Tiers(2)
```

```
{
```

Tier Name	Max SG Percent	Tech	Target Protection
R57_450GB_FC	50	FC	RAID-5(7+1)
R614_1TB_SATA	100	SATA	RAID-6(14+2)

```
}
```

```
Storage Groups(2)
```

```
{
```

Storage Group Name	Pri
Backup	2
Development	1

```
}
```

To modify the usage limit for a Symmetrix tier within a policy, run:

```
symfast -sid 1849 -fp modify -fpname Bronze -tier_name R57_450GB_FC  
-max_sg_percent 40
```

To verify the change was successful, run:

```
symfast -sid 1849 show -fp_name Bronze
```

Symmetrix ID : 000192601849

Policy Name : Bronze

Tiers(2)

```
{
-----
Tier Name                               Max SG      Target
                               Percent Tech Protection
-----
R57_450GB_FC                           40 FC      RAID-5(7+1)
R614_1TB_SATA                          100 SATA   RAID-6(14+2)
}
```

Storage Groups(2)

```
{
-----
Storage Group Name                     Pri
-----
Backup                                 2
Development                            1
}
```

Controlling FAST device movement

Aside from using the FAST controller device movement window, there are several other ways of controlling when device movements can take place. These include disabling the FAST controller, or running in user approved mode to allow specific scheduling of device movements.

Enabling/disabling the FAST controller

In order for FAST to perform device movements, the FAST controller must be enabled on the Symmetrix.

To check the current state of the FAST controller, run:

```
symfast -sid 1849 list -state
```

Symmetrix ID: 000192601849

```
Fast State           : Disabled
Reason:              : N/A
Current Activities   : Idle
```

If disabled, the FAST controller can be enabled by running:

```
symfast -sid 1849 enable
```

```
Execute ENABLE operation for FAST (y/[n]) ? y
```

The FAST ENABLE operation finished successfully

If enabled, the FAST controller can be disabled by running:

```
symfast -sid 1849 disable
```

```
Execute DISABLE operation for FAST (y/[n]) ? y
```

The FAST DISABLE operation finished successfully

<p>Note: While the FAST controller is in a disabled state, performance statistics will continue to be collected during the periods defined by the performance time window.</p>

Reviewing FAST configuration change plans

When running in user approved mode, in order for a configuration change plan to be executed, it must be manually reviewed and then approved.

The following information is available when reviewing a configuration change plan:

- ◆ A unique plan ID
- ◆ The plan state
- ◆ Number of groups in the plan
- ◆ Whether FAST or Optimizer generated the plan
- ◆ Whether the plan contains moves, or swaps, or both
- ◆ The devices being moved or swapped

To review a generated configuration change plan, run:

```
symfast -sid 1849 list -plan
```

```
Symmetrix ID           : 000192601849

Plan ID                : 06152010:152110
Plan Type              : Auto Generated
Plan State             : NotApproved
Start Time             : N/A
Percent Complete       : 0%
Estimated time to completion : N/A
Number of Groups       : 1

Group 1
{
  Group Attributes      : FAST Generated(Performance)
  Group State           : NotStarted
```

```
Percent Complete           : 0%
Estimated time to completion : N/A
```

```
Device Moves (4)
```

```
{
  Source Device                Target
-----
  Storage                      Dsk Dsk
Sym  Group Name                Tier Name          Prot      Grp Group Name
-----
00F5 Production_App1          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
00F6 Production_App1          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
00F7 Production_App1          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
00F8 Production_App1          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
}
```

```
Device Moves (3)
```

```
{
  Source Device                Target
-----
  Storage                      Dsk Dsk
Sym  Group Name                Tier Name          Prot      Grp Group Name
-----
0119 Production_App2          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
0120 Production_App2          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
0121 Production_App2          R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
}
}
```

The Plan State of “NotApproved” with a Start Time of “N/A” indicates that the plan requires approval before being executed.

Approving a FAST configuration change plan

When a configuration change plan has been reviewed, and it is going to be approved, the execution of the plan needs to be scheduled. The device movements can be scheduled to occur during the next available device movement window, or they can be scheduled to be performed at any time of the user’s choice.

To approve a plan, and to schedule it to occur during the next device movement window, run:

```
symfast -sid 1849 -plan approve -id 06152010:152110
```

```
Execute APPROVE operation for FAST (y/[n]) ? y
```

```
The FAST APPROVE operation finished successfully
```

To approve a plan, and to schedule it at a specific time, run:

```
symfast -sid 1369 -plan approve -id 06152010:152110 -begin_at
```

06152010:160500

Execute APPROVE operation for FAST (y/[n]) ? y

The FAST APPROVE operation finished successfully

To verify that the plan was approved and is now scheduled, run:

symfast -sid 1849 list -plan

```
Symmetrix ID           : 000192601849
Plan ID                : 06152010:153310
Plan Type              : Auto Generated
Plan State             : ApprovedWithDelay
Start Time             : Tue Jun 15 16:05:00 2010
Percent Complete      : 0%
Estimated time to completion : N/A
Number of Groups      : 1
```

```
Group 1
{
  Group Attributes      : FAST Generated(Performance)
  Group State          : NotStarted
  Percent Complete     : 0%
  Estimated time to completion : N/A
```

```
Device Moves (4)
{
  Source Device                Target
  -----
  Storage                      Dsk Dsk
  Sym  Group Name              Tier Name      Prot      Grp Group Name
  -----
  00F5 Production_App1         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
  00F6 Production_App1         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
  00F7 Production_App1         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
  00F8 Production_App1         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
}
```

```
Device Moves (3)
{
  Source Device                Target
  -----
  Storage                      Dsk Dsk
  Sym  Group Name              Tier Name      Prot      Grp Group Name
  -----
  0119 Production_App2         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
  0120 Production_App2         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
  0121 Production_App2         R53_200GB_EFD R5(3+1)   003 EFD_200GB_GRP3
}
```

}

Once approved, the Plan State will be displayed as "ApprovedWithDelay" with the requested start time.

Declining a FAST configuration change plan

When a configuration change plan has been reviewed, and it is going to be declined, the decline operation will remove the plan from the FAST controller, and cannot be subsequently approved.

To decline a plan, run:

```
symfast -sid 1849 -plan decline -id 06152010:153310
```

```
Execute DECLINE operation for FAST (y/[n]) ? y
```

```
The FAST DECLINE operation finished successfully
```

When the plan has been declined, the FAST controller will not report on any plans until a new one has been generated:

```
symfast -sid 1369 list -plan
```

```
Symmetrix ID : 000192601849
```

```
No Data Movement Plan
```

Monitoring FAST device movement

During the execution of the configuration change plan, the progress of the plan can be monitored using the **symfast** command and looking at the state of the plan.

To monitor the configuration change plan, run:

```
symfast -sid 1849 list -plan
```

```
Symmetrix ID : 000192601849
Plan ID : 06152010:153310
Plan Type : Auto Generated
Plan State : CnfigInProgress
Start Time : Tue Jun 15 16:05:00 2010
Percent Complete : 16%
Estimated time to completion : 00:34:14
Number of Groups : 1
```

```
Group 1
```

```

{
Group Attributes           : FAST Generated(Performance)
Group State                : InProgress
Percent Complete          : 16%
Estimated time to completion : 00:34:14

Device Moves (4)
{
  Source Device                Target
-----
  Storage                    Dsk Dsk
Sym  Group Name              Tier Name          Prot      Grp Group Name
-----
00F5 Production_App1        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
00F6 Production_App1        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
00F7 Production_App1        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
00F8 Production_App1        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
}

Device Moves (3)
{
  Source Device                Target
-----
  Storage                    Dsk Dsk
Sym  Group Name              Tier Name          Prot      Grp Group Name
-----
0119 Production_App2        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
0120 Production_App2        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
0121 Production_App2        R53_200GB_EFD     R5(3+1)   003 EFD_200GB_GRP3
}
}

```

While executing swaps or moves defined, the Plan State will display as CnfigInProgress. While in this state, a percent complete value will be displayed for the entire plan. This percent value is based on the amount of data that has already been relocated in relation to the amount of data to be relocated in total.

An estimated time to completion is also displayed, indicating the remaining time expected to complete all groups within in the plan.

At the group level, the same percent complete and estimated time to completion values will be shown for each individual group.

Performing a FAST swap rollback

The rollback of swaps performed by FAST (or Optimizer) is controlled through the **symoptmz** command. Prior to requesting a rollback, the point-in-time to which the rollback will be performed should be decided.

The list of swaps, both FAST and Optimizer, which are available to be rolled back can be seen by running:

```
symoptmz -sid 1849 show -rollback_list
```

```
Symmetrix ID           : 000192601849
Number of Groups       : 3
```

```
Group 1
{
Time Started           : Wed Jun 16 08:21:37 2010
Time Completed         : Wed Jun 16 09:07:46 2010
Group Attributes       : FAST Generated(Performance)
```

```
Device Pairs (2)
```

```
{
      Source Device                               Target Device
-----
Sym  Tier Name  Prot  Storage Group Name  Sym  Tier Name  Prot  Storage Group Name
-----
0125 R1_450GB_FC R1    Production* 00F6 R53_200GB_* R5(3+1) Production*
0123 R1_450GB_FC R1    Production* 00F5 R53_200GB_* R5(3+1) Production*
}
```

```
Group 2
{
Time Started           : Wed Jun 16 11:15:24 2010
Time Completed         : Wed Jun 16 12:47:52 2010
Group Attributes       : FAST Generated(Performance)
```

```
Device Pairs (3)
```

```
{
      Source Device                               Target Device
-----
Sym  Tier Name  Prot  Storage Group Name  Sym  Tier Name  Prot  Storage Group Name
-----
0124 R1_450GB_FC R1    Production* 00F8 R53_200GB_* R5(3+1) Production*
010B R1_450GB_FC R1    Production* 00F9 R53_200GB_* R5(3+1) Production*
010D R1_450GB_FC R1    Production* 00F7 R53_200GB_* R5(3+1) Production*
}
```

```
Group 3
{
Time Started           : Wed Jun 16 16:00:05 2010
Time Completed         : Wed Jun 16 17:36:47 2010
```

Group Attributes : FAST Generated(Performance)

Device Pairs (4)

```
{
  Source Device                               Target Device
-----
Sym  Tier Name  Prot  Storage Group Name  Sym  Tier Name  Prot  Storage Group Name
-----
00F6 R1_450GB_FC R1      Production* 0125 R53_200GB_* R5(3+1) Production*
00FA R1_450GB_FC R1      Production* 0123 R53_200GB_* R5(3+1) Production*
00F5 R1_450GB_FC R1      Production* 0120 R53_200GB_* R5(3+1) Production*
011F R1_450GB_FC R1      Production* 0119 R53_200GB_* R5(3+1) Production*
}
}
```

Note: The output of the `symoptmz show -rollback_list` command will only display swaps that have occurred since the most recent move. If the most recent FAST movement was a device move, then the rollback list will be empty.

To perform the rollback, a text file with the following syntax should be created:

```
set swap approve,
TIMESTAMP=06162010:160000,
ROLLBACK;
```

Once created, the rollback can be executed by running:

```
symoptmz -sid 1369 -f rollback.txt commit -v
```

```
Processing Command file : rollback.txt
PREVIEW .....Started.
Set Swap Command
{
  set swap APPROVE
    TIMESTAMP = Thu Jun 17 16:00:00 2010
    ROLLBACK;
}
PREVIEW .....Done.
PREPARE .....Started.
Optimizer has Validated the Rollback List.
PREPARE .....Done.
COMMIT .....Started.
COMMIT .....Done.
```

By default, the rollback will be executed during the next available device movement time window. Optionally, a specific time can be given for the rollback to be performed:

```
set swap approve,
begin_at=06162010:160000,
timestamp=06172010:140000,
ROLLBACK;
```

Note: The timestamp fields in the rollback command file are of the format MMDDYYYY:HHMMSS.

Modifying the copy pace of a FAST device movement

As previously stated, Symmetrix Quality of Service (QoS) tools can be used to control the pace at which data is copied during a FAST device movement. The QoS setting that needs to be changed is the mirror copy pace. To change the setting, the devices to be edited should be placed into a device group. Once in a device group, the copy pace can be set by running:

```
symqos -g Production_Appl set MIR pace 8
```

```
Device Group (DG) Name: Production_Appl
DG's Type           : REGULAR
DG's Symmetrix ID   : 000192601849
```

Device Name		Copy Pace					
Logical	Physical	Sym	Config	BCV	RDF	MIR	CLN
DEV001	/dev/rdisk/emcpower28c	00F5	2-Way Mir	0	0	8	0
DEV002	/dev/rdisk/emcpower31c	00F6	2-Way Mir	0	0	8	0
DEV003	/dev/rdisk/emcpower34c	00F7	2-Way Mir	0	0	8	0
DEV004	/dev/rdisk/emcpower37c	00F8	2-Way Mir	0	0	8	0
DEV005	/dev/rdisk/emcpower40c	00F9	2-Way Mir	0	0	8	0
DEV006	/dev/rdisk/emcpower43c	00FA	2-Way Mir	0	0	8	0
DEV007	/dev/rdisk/emcpower46c	00FB	2-Way Mir	0	0	8	0
DEV008	/dev/rdisk/emcpower49c	00FC	2-Way Mir	0	0	8	0
DEV009	/dev/rdisk/emcpower52c	00FD	2-Way Mir	0	0	8	0
DEV010	/dev/rdisk/emcpower53c	00FE	2-Way Mir	0	0	8	0
DEV011	/dev/rdisk/emcpower55c	00FF	2-Way Mir	0	0	8	0
DEV012	/dev/rdisk/emcpower57c	0100	2-Way Mir	0	0	8	0
DEV013	/dev/rdisk/emcpower56c	0101	2-Way Mir	0	0	8	0
DEV014	/dev/rdisk/emcpower54c	0102	2-Way Mir	0	0	8	0
DEV015	/dev/rdisk/emcpower25c	0103	2-Way Mir	0	0	8	0
DEV016	/dev/rdisk/emcpower23c	0104	2-Way Mir	0	0	8	0
DEV017	/dev/rdisk/emcpower21c	0105	2-Way Mir	0	0	8	0
DEV018	/dev/rdisk/emcpower19c	0106	2-Way Mir	0	0	8	0
DEV019	/dev/rdisk/emcpower17c	0107	2-Way Mir	0	0	8	0
DEV020	/dev/rdisk/emcpower15c	0108	2-Way Mir	0	0	8	0
DEV021	/dev/rdisk/emcpower13c	0109	2-Way Mir	0	0	8	0
DEV022	/dev/rdisk/emcpower11c	010A	2-Way Mir	0	0	8	0

DEV023	/dev/rdisk/emcpower9c	010B 2-Way Mir	0	0	8	0
DEV024	/dev/rdisk/emcpower7c	010C 2-Way Mir	0	0	8	0
DEV025	/dev/rdisk/emcpower5c	010D 2-Way Mir	0	0	8	0

A similar command can be run at a later time to reset the copy pace back to 0.

Removing FAST managed objects

The following sections detail the SYMCLI commands used to break each of the associations, and removing each of the managed objects.

Disassociating a storage group from a FAST policy

Disassociating the storage group from a FAST policy removes the devices in the storage group from FAST control. Devices no longer under FAST control will not be automatically moved between tiers.

To disassociate a storage group from a FAST policy, run:

```
symfast -sid 1849 -fp_name Platinum disassociate -sg Production_App1
```

Removing a Symmetrix tier from a FAST policy

As previously stated, the sum of the upper usage limits for each Symmetrix tier included in a policy must total a minimum of 100 percent. If a policy has associated storage groups, the removal of a tier will fail and will cause the total tier usage limits to drop below 100 percent.

To successfully remove a Symmetrix tier from a FAST policy, the upper usage limits of the remaining tiers must be modified such that they total more than 100 percent. Alternatively, the Symmetrix tier can be removed if all storage groups associations for the policy are removed in advance.

To remove a Symmetrix tier from a FAST policy, run:

```
symfast -sid 1849 -fp -fp_name Platinum remove -tier_name R53_200GB_EFD
```

Deleting a FAST policy

A FAST policy may not be deleted if any storage groups are associated with a policy. Prior to deleting the policy, all storage group associations should be removed.

Also, prior to deleting a policy, all tiers contained in the policy should also be removed.

To delete a FAST policy, run:

```
symfast -sid 1849 delete -fp -fp_name Platinum
```

A FAST policy that contains tiers, and as no storage group associations, may be deleted by adding the `-force` option to the `symfast delete` command.

Deleting a Symmetrix tier

To delete a Symmetrix tier, it should not be contained within any FAST policy on the Symmetrix. Also, in the case of a static Symmetrix tier there should be no physical disk groups associated with the Symmetrix tier.

To delete a Symmetrix tier, run:

```
symtier -sid 1849 delete -tier_name R53_200GB_EFD
```

A static Symmetrix tier that contains physical disk groups may be deleted by adding the `-force` option to the `symtier delete` command.

Deleting a storage group

Before deleting a storage group, the group should not be associated with any FAST policy. Also, the storage group should not contain any devices.

To delete a storage group, run:

```
symsg -sid 1849 delete Production_App1
```

A storage group that contains devices may be deleted by adding the `-force` option to the `symsg delete` command.

Note: As storage groups may be used for the purposes of FAST and Auto-provisioning, prior to deleting the storage group, and masking views that use the storage group will also need to be deleted.

Logging

As FAST will modify the back end configuration of the Symmetrix array it is running on, it is highly important from the perspective of the storage administrator to be able to track FAST activity. Several methods exist within the Symmetrix and Solutions Enabler to allow an administrator to determine both what changes were made, and when the changes occurred, both from a FAST configuration, and a Symmetrix back end configuration point of view. These include:

- ◆ FAST history
- ◆ The Symmetrix audit log
- ◆ Symmetrix-based FAST/Optimizer logs
- ◆ The Solutions Enabler event daemon
- ◆ SMC Alerts
- ◆ The Solutions Enabler host symapi log

The following sections detail the methods for tracking FAST activity, and what information is available with each of the methods.

FAST history

The FAST controller maintains a history of all device movements, swaps or moves, for up to 1 year on the Symmetrix service processor. The information included in the FAST history is:

- ◆ The type of movement
- ◆ The originator of the movement
- ◆ The movement start time
- ◆ The movement end time
- ◆ Devices involved in the movement

To see a complete history of all FAST activity, the following command is run:

symfast -sid 1849 list -history

Symmetrix ID : 000192601849
Number of Groups : 6

Group 1

```
{
  Time Started      : Tue Jun 15 16:05:03 2010
  Time Completed   : Tue Jun 15 16:34:41 2010
  Group Attributes : FAST Generated(Performance)
```

Device Moves (7)

```
{
  Source Device      Target
-----
  Storage           Dsk Dsk
  Sym  Group Name   Tier Name   Prot      Grp Group Name
-----
  00F5 Production_App1 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
  00F6 Production_App1 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
  00F7 Production_App1 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
  00F8 Production_App1 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
  0119 Production_App2 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
  0120 Production_App2 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
  0121 Production_App2 R53_200GB_EFD R5(3+1)  003 EFD_200GB_GRP3
}
```

...

Group 5

```
{
  Time Started      : Wed Jun 16 16:00:05 2010
  Time Completed   : Wed Jun 16 17:36:47 2010
  Group Attributes : FAST Generated(Performance)
```

Device Pairs (4)

```
{
  Source Device      Target Device
-----
  Storage           Storage
  Sym  Tier Name   Prot  Group Name  Sym  Tier Name   Prot  Group Name
-----
  00F6 R1_450GB_FC R1      Production* 0125 R53_200GB_* R5(3+1) Production*
  00FA R1_450GB_FC R1      Production* 0123 R53_200GB_* R5(3+1) Production*
  00F5 R1_450GB_FC R1      Production* 0120 R53_200GB_* R5(3+1) Production*
  011F R1_450GB_FC R1      Production* 0119 R53_200GB_* R5(3+1) Production*
}
```

Logging

```
Group 6
{
  Time Started           : Thu Jun 17 14:00:05 2010
  Time Completed        : Thu Jun 17 15:22:32 2010
  Group Attributes      : Optimizer Manual Rollback
}
```

Device Pairs (4)

```
{
  -----
  Source Device                               Target Device
  -----
  Dsk Dsk                                     Dsk Dsk
  Sym  Grp Group Name                         Prot  Sym  Grp Group Name                         Prot
  -----
  011F 003 EFD_200GB_GRP3                     R1     0119 002 FC_450GB_15K_GR*                   R5(7+1)
  00F5 003 EFD_200GB_GRP3                     R1     0120 002 FC_450GB_15K_GR*                   R5(7+1)
  00FA 003 EFD_200GB_GRP3                     R1     0123 002 FC_450GB_15K_GR*                   R5(7+1)
  00F6 003 EFD_200GB_GRP3                     R1     0125 002 FC_450GB_15K_GR*                   R5(7+1)
}
}
```

Optionally, a start date and end date can be specified to limit the list of FAST activity to a specific time period:

```
symfast -sid 1849 list -history -start_date 06152010:000000  
-end_date 06162010:000000
```

```
Symmetrix ID           : 000192601849  
Number of Groups       : 1
```

```
Group 1
{
  Time Started           : Tue Jun 15 16:05:03 2010
  Time Completed        : Tue Jun 15 16:34:41 2010
  Group Attributes      : FAST Generated(Performance)
}
```

Device Moves (7)

```
{
  Source Device                               Target
  -----
  Storage                                     Dsk Dsk
  Sym  Group Name                           Tier Name  Prot  Grp Group Name
  -----
  00F5 Production_App1 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
  00F6 Production_App1 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
  00F7 Production_App1 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
  00F8 Production_App1 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
  0119 Production_App2 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
  0120 Production_App2 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
  0121 Production_App2 R53_200GB_EFD R5(3+1) 003 EFD_200GB_GRP3
}
}
```

Symmetrix audit log

The Symmetrix audit log is a Symmetrix-based log used to correlate application-based control operations run against the array. Entries to the audit log are categorized into applications, function classes, and action codes, with each product feature having its own application and function class.

FAST-related activities logged to the Symmetrix audit log include:

- ◆ Symmetrix tier modification
- ◆ FAST policy modification
- ◆ Storage group association
- ◆ FAST controller state changes
- ◆ FAST settings modifications
- ◆ Configuration change plan approval/decline
- ◆ RAID group relocation during a device movement

Contents of this audit log can be viewed and filtered using the SYMCLI **symaudit** command. FAST activities are logged under the function class—FAST.

To view a list of all FAST-related activities, the following command is run:

```
symaudit -sid 1849 list -function_class FAST
```

A U D I T L O G D A T A

```
Symmetrix ID           : 000192601849
```

Record Number	Date	Time	Application	Host	Function Class	Action Code
745	06/11/10	15:49:01	SMC	LICOA065	Fast	Create
746	06/11/10	15:49:01	SMC	LICOA065	Fast	Create
747	06/11/10	15:51:37	SMC	LICOA065	Fast	Create
748	06/11/10	15:51:37	SMC	LICOA065	Fast	Create
749	06/11/10	15:52:08	SMC	LICOA065	Fast	Create
750	06/11/10	15:52:08	SMC	LICOA065	Fast	Create
762	06/11/10	16:25:28	SMC	LICOA065	Fast	Assoc
763	06/11/10	16:25:28	SMC	LICOA065	Fast	Assoc
764	06/11/10	16:28:14	SMC	LICOA065	Fast	Assoc
765	06/11/10	16:28:14	SMC	LICOA065	Fast	Assoc
766	06/11/10	16:28:35	SMC	LICOA065	Fast	Assoc
767	06/11/10	16:28:35	SMC	LICOA065	Fast	Assoc
768	06/11/10	16:28:36	SMC	LICOA065	Fast	Assoc

Logging

```
769 06/11/10 16:28:36 SMC LICOA065 Fast Assoc
770 06/11/10 16:30:11 SMC LICOA065 Fast Modify
771 06/11/10 16:30:11 SMC LICOA065 Fast Modify
906 06/14/10 11:32:30 SMC LICOA065 Fast Enable
907 06/14/10 11:32:30 SMC LICOA065 Fast Enable
929 06/14/10 15:56:34 OPTIMIZER HK192601849 Fast FASTSchd
977 06/15/10 15:40:16 OPTIMIZER HK192601849 Fast FASTSchd
978 06/15/10 15:40:16 SMC LICOA065 Fast Commit
979 06/15/10 15:40:16 SMC LICOA065 Fast Commit
981 06/15/10 16:02:09 OPTIMIZER HK192601849 Fast FASTSchd
982 06/15/10 16:02:36 OPTIMIZER HK192601849 Fast FASTSchd
983 06/15/10 16:03:10 OPTIMIZER HK192601849 Fast FASTSchd
991 06/15/10 16:04:56 OPTIMIZER HK192601849 Fast FASTMove
992 06/15/10 16:06:01 SWPROC Fast FASTMove
993 06/15/10 16:06:01 SWPROC Fast FASTMove
994 06/15/10 16:06:02 OPTIMIZER HK192601849 Fast FASTSchd
995 06/15/10 16:06:01 SMC LICOA065 Fast Commit
996 06/15/10 16:06:01 SMC LICOA065 Fast Commit
997 06/15/10 16:33:55 SWPROC Fast FASTMove
998 06/15/10 16:33:56 SWPROC Fast FASTMove
999 06/15/10 16:34:07 SWPROC Fast FASTMove
1000 06/15/10 16:34:07 SWPROC Fast FASTMove
1001 06/15/10 16:34:34 OPTIMIZER HK192601849 Fast FASTMove
1002 06/15/10 16:34:34 OPTIMIZER HK192601849 Fast FASTSchd
1005 06/15/10 17:22:56 OPTIMIZER HK192601849 Fast FASTSchd
1007 06/15/10 17:22:57 SMC LICOA065 Fast Commit
1008 06/15/10 17:22:57 SMC LICOA065 Fast Commit
```

...

The audit log entry contains a hostname indicating from where the control operation initiated. In the case where the hostname is a Symmetrix serial number, this means the FAST or Optimizer application submitted a configuration change plan to be performed.

Changes to the FAST configuration settings, or managed object modification, will be logged from the host upon which the control (**symfast** or **symtier**) commands were run.

To see a particular audit log entry in more detail, the **symaudit** command can be run with the **-v** option and specifying the entry's record number:

```
symaudit -sid 1849 list -record_num 745 -n 1 -v
```

A U D I T L O G D A T A

```
Symmetrix ID          : 000192601849
Record Number         :      745
Records in Seq        :         2
Offset in Seq         :         1
Time                  : 06/11/10 15:49:01
Vendor ID             : EMC Corp
```

```

Application ID      : SMC
Application Version : 7.1.1.2
API Library        : SEK
API Version        : V7.1.1.0 (Edit Level: 1026)
Host Name          : LICOA065
OS Name            : SunOS
OS Revision        : 5.10Generi
Client Host        :
Process ID         : 00018775
Task ID           : 00002255
Function Class     : Fast
Action Code        : Create
Text               : Starting a FAST 'CREATE' operation. Symm=000192601849,
Policy_Name=Platinum, Symmetrix_Tier=[R1_450GB_FC, 100%SG][R53_200GB_EFD,
100%SG].
Username           : H:LICOA065\smc
Activity ID        : SE40323c39fb

```

```
symaudit -sid 1849 list -record_num 929 -n 1 -v
```

```

Symmetrix ID      : 000192601849

Record Number     :      977
Records in Seq    :      1
Offset in Seq     :      1
Time              : 06/15/10 15:40:16
Vendor ID         : EMC Corp
Application ID    : OPTIMIZER
Application Version : 8.1.10.27
API Library       : SEK
API Version       : V7.1.1.0 (Edit Level: 1026)
Host Name         : HK192601849
OS Name           : WinNT
OS Revision       : 5.1.2600Se
Client Host       :
Process ID        : 00005812
Task ID           : 00000316
Function Class    : Fast
Action Code       : FASTSchedule
Text              : FAST Move plan has been approved by Remote client SMC
(6150) on LICOA065 to be executed on 6/15/2010 8:00:00 PM.
Username          : H:HK192601849\SYSTEM
Activity ID       : SE61568da42f

```

Symmetrix-based FAST/Optimizer logs

Both the FAST and Optimizer Controllers maintain runtime and error logs on the service processor. Activities for both controllers are maintained in the same set of log files. Retrieval of these log files is performed using the **symoptmz** command.

The runtime log file contains the following information:

- ◆ Device performance statistics being collected
- ◆ Configuration change plan generation
- ◆ Configuration change plan execution
- ◆ Changes to FAST/Optimizer controller settings and time windows
- ◆ Client connections to FAST/Optimizer controllers

To view the runtime log, run:

```
symoptmz -sid 1849 read -log_type RUNTIME -start 06162010:0000
```

```
Size of Log file data read: 407332 characters
```

```
Optimizer File Data:
```

```
Symmetrix Id: 000192601849
```

```
File Type : LOG
```

```
Log Type : RUNTIME
```

```
Start date: 06162010:0000
```

```
Stop date: NONE
```

```
Data      :
```

```
06/16/2010 04:00:42 AM (04:00:42 AM GMT)
(I00500) Successfully fetched volume statistics
```

```
06/16/2010 04:10:42 AM (04:10:42 AM GMT)
(I00500) Successfully fetched volume statistics
```

```
...
```

```
06/16/2010 01:00:47 PM (01:00:47 PM GMT)
(I00500) Successfully fetched volume statistics
```

```
06/16/2010 01:08:49 PM (01:08:49 PM GMT)
(I07513) Configuration suggestion summary:
Configuration suggestion summary:
```

```
Algorithm: Fast Promotion/Demotion
Start Time: Wed Jun 16 13:08:44 2010
End Time: Wed Jun 16 13:08:49 2010
#Swaps: 1
#Validate Moves Failed: 0
#Validate Moves Succeed: 1
```

```
06/16/2010 01:08:49 PM (01:08:49 PM GMT)
(I07503) Configuration change suggestions found!
```

```
06/16/2010 01:08:49 PM (01:08:49 PM GMT)
(I00502) Successfully generated new swap plan
```

```
06/16/2010 01:08:49 PM (01:08:49 PM GMT)
(I10500) New configuration change plan:
```

```

06/16/2010 01:08:49 PM (01:08:49 PM GMT)
(I10501) Group 1:
Device 00F5 (RAID1) <-> Device 00F9 (RAID5)
00F5 (RAID1)
    DA-09a:C0A H1 Start Offset 40012885
    DA-07a:C0A H1 Start Offset 4001288

00F9 (RAID5)
    DA-07a:C0E H16 Start Offset 1492a408
    DA-09d:D0E H16 Start Offset 1492a408
    DA-08d:C0E H16 Start Offset 1492a408
    DA-10b:C0E H16 Start Offset 1492a408

```

...

The error log file contains the following information:

- ◆ Errors encountered by the FAST/Optimizer controllers

To view the error log, run:

```
symoptmz -sid 1849 read -log_type ERROR -start 06152010:0000
```

```
Size of Log file data read: 5224 characters
```

```
Optimizer File Data:
```

```
Symmetrix Id: 000192601849
```

```
File Type : LOG
```

```
Log Type : ERROR
```

```
Start date: 06152010:0000
```

```
Stop date: NONE
```

```
Data :
```

...

```
06/17/2010 12:50:40 AM (12:50:40 AM GMT)
```

```
(E00504) Failed to generate swap plan:
```

```
No new swap suggestions could be generated because
```

```
there are either no samples available during the workload period,
or all samples are excluded according to performance time windows
```

Note: Retrieval of runtime or error log activity can be filtered by start and end times. The format of the date and time for each option is mmddyyyy:hhmm.

Event Daemon

In UNIX, Linux, and Windows environments, the event daemon—**storevntd**—enables monitoring of Symmetrix operations by detecting and reporting events as they happen. The event daemon continually collects Symmetrix event information in real-time, filters the events by severity and type, and responds by logging events to specified targets. When configuring the daemon to log events, you can specify to log the

events to the UNIX Syslog, the Windows Event log, SNMP, or a file on disk.

Several event codes have been added to Symmetrix operations to track FAST activities. Table 2 shows the event code and the related activity being tracked

FAST administration event codes

Event codes tracking administrative changes to Symmetrix tiers, FAST policies, policy associations, and FAST controller configuration settings are shown in Table 2.

Table 2. FAST administration event codes

Event code	Event description
1289	A FAST Symmetrix tier has been changed
1290	A FAST policy has been changed
1291	A FAST policy/storage group association has changed
1292	A FAST/Optimizer time window has been changed
1293	A FAST/Optimizer configuration setting has been changed

FAST activity event codes

Event codes tracking FAST activities such as device movements and the availability of configuration change plans for approval are shown in Table 3.

Table 3. FAST activity event codes

Event code	Event description
1503	A FAST device swap has been performed
1504	A FAST device move has been performed
1505	FAST controller configuration change (from Audit Log)
1506	A FAST/Optimizer rollback has been performed
1507	A FAST/Optimizer configuration change plan has been generated, and user approval is required
1508	The state of the FAST controller has changed

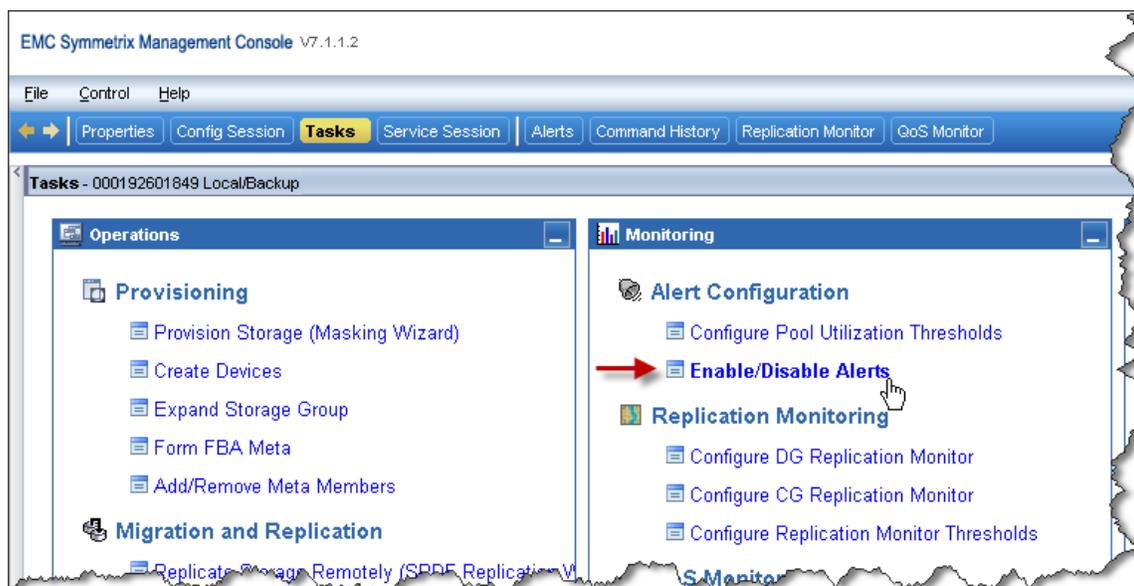
The *EMC Solutions Enabler Installation Guide* provides more information on configuring and using the Solutions Enabler event daemon.

Symmetrix Management Console alerts

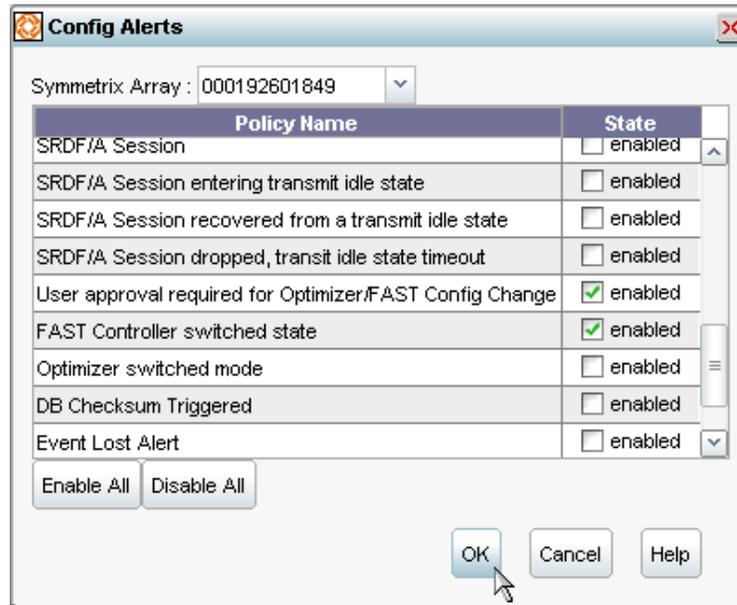
In addition to the events that can be monitored through the Solutions Enabler event daemon, two alerts can be configured in SMC to also track FAST activity. The two events that can be tracked are:

- ◆ A FAST/Optimizer configuration change plan has been generated, and user approval is required
- ◆ The state of the FAST controller has changed

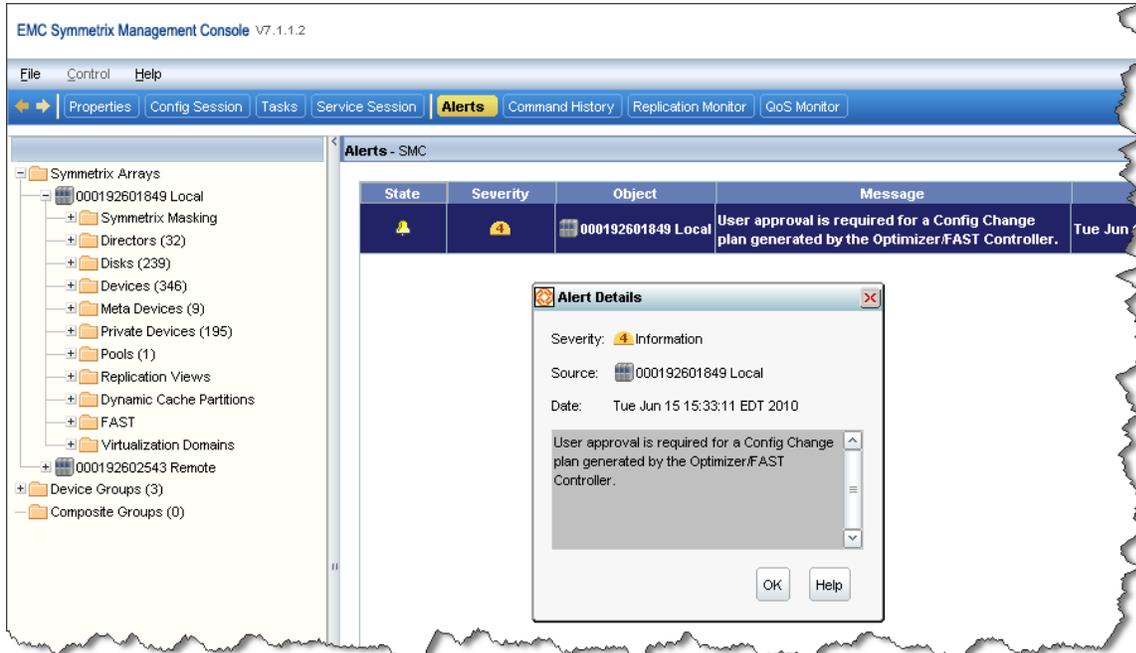
To configure these alerts, the user must select the Tasks view in SMC and click on the Config Alerts link in the Setup pane.



From the resulting dialog box, the FAST-related alerts can be selected.



Once configured, alerts can be viewed through the Alerts view for a particular Symmetrix.



Reporting

Capacity and performance planning, reporting, and analysis with EMC Ionix ControlCenter and Symmetrix Performance Analyzer

EMC Ionix™ ControlCenter® StorageScope™ and Symmetrix Performance Analyzer have been enhanced to provide visibility into the use of storage types in FAST environments and the resulting impact on performance. With Symmetrix Performance Analyzer, storage administrators can quickly view key performance indicators such as IOPs and response time of a storage group before and after the execution of a FAST change plan to assess the impact on performance. With EMC Ionix ControlCenter, storage teams can schedule, execute, and distribute detailed reports to support capacity planning, reporting, and analysis including:

- ◆ Host capacity consumption by storage type to enable application chargeback or show-back processes
- ◆ Capacity by storage type for a storage group to support performance troubleshooting and analysis
- ◆ Allocated and unallocated capacity by storage type within an array to enhance capacity planning

The white paper *Managing Your FAST environment with EMC Ionix ControlCenter and Symmetrix Performance Analyzer* provides more information on managing FAST environments with EMC Ionix ControlCenter and Symmetrix Performance Analyzer.

Compliance reporting

As previously stated, a storage group is considered to be compliant with the FAST policy it is associated with when all the devices in the storage group are fully configured within the bounds of the upper usage limits for each tier contained with the policy.

The information contained in the compliance report includes:

- ◆ FAST policy name
- ◆ Associated storage group name
- ◆ Associated Symmetrix tiers
- ◆ Storage group usage of associated Symmetrix tiers

Each compliance report output will contain the following values for each tier included in the policy:

- ◆ Max SG Percent — Indicates the maximum usage limit of the storage group per tier. This upper usage limit is as defined in the FAST policy.
- ◆ Limit — Shows the calculated upper limit, in GB, for the storage group on the tier, based on capacity of the storage group.
- ◆ FAST SG Used — Shows the current occupancy of the storage group in a Symmetrix tier.
- ◆ Growth — Indicates how much additional capacity of the storage group can be added to that tier, as per the FAST policy.

Note: If the growth value is negative, the storage group has exceeded the capacity limit for this tier, and will be considered to be non-compliant.

SYMCLI

The **symfast** command can be run with certain options to determine current capacity usage by storage groups of the Symmetrix tiers contained within their associated FAST policies. The report will indicate the compliance of the storage group within the FAST policy, or any non-compliance, including storage that is out-of-policy.

To list the association, and storage demand, of all storage groups under FAST control, the following command can be run:

```
symfast -sid 1849 list -association -demand
```

```
Symmetrix Id      : 000192601849
```

```
Policy Name       : Bronze
```

```
Storage Group    : Backup
```

```
Priority          : 2
```

```
Tiers (2)
```

```
{
```

Name	Target Prot	Max SG Percent	Limit (GB)	FAST SG Used(GB)	Growth (GB)
R57_450GB_FC	R5(7+1)	50	400	0	+400
R614_1TB_SATA	R6(14+2)	100	800	800	+0

```
    Total
```

```
                1200    800
```

```
}
```

```
Policy Name       : Bronze
```

```
Storage Group    : Development
```

Priority : 2

Tiers (2)

```
{
-----
Name          Target    Max SG    Limit  FAST SG    Growth
Prot          Percent  (GB)     Used(GB)  (GB)
-----
R57_450GB_FC  R5(7+1)    50       400       0          +400
R614_1TB_SATA R6(14+2)   100      800      800        +0

      Total                -----
                                1200      800
}
```

Policy Name : Platinum
Storage Group : Production_App1
Priority : 2

Tiers (2)

```
{
-----
Name          Target    Max SG    Limit  FAST SG    Growth
Prot          Percent  (GB)     Used(GB)  (GB)
-----
R53_200GB_EFD R5(3+1)    100      800       64         +736
R1_450GB_FC   R1         100      800      736         +64

      Total                -----
                                1600      800
}
```

Policy Name : Silver
Storage Group : Production_App2
Priority : 2

Tiers (3)

```
{
-----
Name          Target    Max SG    Limit  FAST SG    Growth
Prot          Percent  (GB)     Used(GB)  (GB)
-----
R53_200GB_EFD R5(3+1)    20       160      192         -32
R57_450GB_FC  R5(7+1)   100      800      608         +192
R614_1TB_SATA R6(14+2)   40       320       0          +320

      Total                -----
                                1280      800
}
```

The compliance report can also be run for an individual storage group by running:

```
symfast -sid 1849 list -association -demand -sg Production_Appl
```

```
Symmetrix Id      : 000192601849
Policy Name       : Platinum
Storage Group     : Production_Appl
Priority          : 2
```

```
Tiers (2)
```

```
{
-----
Name          Target   Max SG   Limit  FAST SG   Growth
Prot          Percent  (GB)    Used(GB) (GB)
-----
R53_200GB_EFD R5(3+1)   100     800     64       +736
R1_450GB_FC   R1        100     800     736      +64

      Total          -----
                          1600     800
}
```

To see the compliance report for all storage groups associated with a particular FAST policy, run:

```
symfast -sid 1849 list -association -demand -fp_name Bronze
```

```
Symmetrix Id      : 000192601849
Policy Name       : Bronze
Storage Group     : Backup
Priority          : 2
```

```
Tiers (2)
```

```
{
-----
Name          Target   Max SG   Limit  FAST SG   Growth
Prot          Percent  (GB)    Used(GB) (GB)
-----
R57_450GB_FC  R5(7+1)   50      400     0        +400
R614_1TB_SATA R6(14+2)  100     800     800      +0

      Total          -----
                          1200     800
}
```

```
Policy Name       : Bronze
Storage Group     : Development
Priority          : 2
```

```
Tiers (2)
```

```
{
-----
Name          Target      Max SG      Limit  FAST SG      Growth
Prot          Percent    (GB)    Used(GB)    (GB)
-----
R57_450GB_FC  R5 (7+1)   50       400        0           +400
R614_1TB_SATA R6 (14+2)  100      800        800         +0

Total
-----
1200      800
}

```

SMC

Similar reports can be viewed in SMC for each individual storage group. When looking at the properties for a storage group, clicking the FAST Compliance tab will display the compliance report for that group.

The screenshot shows the EMC Symmetrix Management Console (SMC) interface. The left pane displays a tree view of Symmetrix Arrays, including Symmetrix Masking, Directors, Disks, Devices, Meta Devices, Private Devices, Pools, Replication Views, Dynamic Cache Partitions, FAST, Symmetrix Tiers, Policies, Bronze, Platinum, Silver, Demand, and Virtualization Domains. The right pane shows the Properties window for a storage group (000192601849 Local/Platinum). The FAST Compliance tab is selected, displaying a table with the following data:

Tier	Protection	Tech	Max SG %	Limit (GB)	FAST SG Used (GB)	Growth (GB)
R1_450GB_FC	RAID-1	FC	100	800	736	+64
R53_200GB_EFD	RAID-5(3+1)	EFD	100	800	64	+736

Technology demand reporting

The compliance reports shown in the previous section, report on FAST capacity usage from the perspective of the FAST policies and their associated storage groups. A second report type, technology demand, exists to display capacity usage from the perspective of the disk technologies and defined Symmetrix tiers.

The information contained in the technology demand report is divided into two sections—a technology section and a tier section.

The technology section contains the following fields:

- ◆ Total — The sum of the capacities of all disks that match the technology type.
- ◆ Free — The total of all unconfigured capacity on all disks that match the technology type. This is shown as raw capacity.
- ◆ Used — The total capacity of all configured devices on all the disks that match the technology type.
- ◆ FAST SG Usage Total — The total capacity of all configured devices that reside on this technology and that are part of a storage group associated with a FAST policy.
- ◆ FAST Available — The amount of space available to be used by FAST for device moves or swaps. This is calculated as the sum of the FAST SG Usage Total, Free space, and space occupied by unmapped/unmasked devices.

Note: Free space is only included if the FAST Move Type is set to allow both swaps and moves. Similarly, space occupied by unmapped/unmasked devices is only included if the Use Host Invisible Devices setting is enabled.

- ◆ Max SG Demand Total — The total capacity of all FAST managed devices if they were to occupy the full allowed quota of space in a tier of the technology type, based upon the FAST policies.
- ◆ Excess (GB) — The difference between FAST Available and Max FAST SG Demand.

The tier section contains the following:

- ◆ Name — Shows the names of all Symmetrix tiers that have been created on the technology type.
- ◆ Attr — Shows the status of the Symmetrix tier on the technology type.
Possible values are :
 - F — In a FAST policy associated with a storage group
 - P — In a FAST policy or policies where none of the FAST policies are associated with a storage group
 - N — Not in any FAST policy
- ◆ Target Prot — What the target protection of the tier is
- ◆ Free — Unconfigured space available in the tier (raw capacity).
- ◆ Used — Total capacity of all physical hypervisors of all devices with matching RAID protection on the tier
- ◆ FAST SG Usage — Total capacity of all physical hypervisors of all devices in FAST storage groups with matching RAID protection that reside on the tier.

- ♦ **FAST Available** — Indicates the available capacity in the tier if the tier is included in a FAST policy that has associated storage groups. This is calculated as the sum of the FAST SG Usage Total, Free space, and space occupied by unmapped/unmasked devices.

Note: Free space is only included if the FAST Move Type is set to allow both swaps and moves. Similarly, space occupied by unmapped/unmasked devices is only included if the Use Host Invisible Devices setting is enabled.

- ♦ **Max SG Demand** — The total capacity of all FAST managed devices if they were to occupy the full allowed quota of space in a tier of the technology type, based upon the FAST policies.
- ♦ **Excess (GB)** — The difference between FAST Available and Max FAST SG Demand.

SYMCLI

The **symfast** command can be run with certain options to determine the current FAST technology demands within a Symmetrix.

To list the demand for all technologies, run:

```
symfast -sid 1849 list -demand -tech ALL
```

```
Symmetrix ID           : 000192601849
```

```
Technology             : EFD
Total(GB)              :          745
Free (GB)              :           33
Used (GB)              :          712
FAST SG Usage Total (GB) :          347
FAST Available (GB)    :          380
Max SG Demand Total (GB) :          1280
Excess (GB)           :          -900
```

```
Tiers (1)
```

```
{
```

```
-----
              A                      Raw Capacities (GB)
              T                      -----
Tier          T Target      Tier    Tier FAST SG    FAST    Max SG    Excess
              R Prot        Free    Used  Usage    Avail    Demand
-----
R53_200GB_EFD F R5(3+1)      33     712   347     380     1280     -900
Total
              -----
              712     347           1280
```

```
}
```

```
Technology             : FC
Total(GB)              :        68695
Free (GB)              :        39290
Used (GB)              :        29405
```

Reporting

```
FAST SG Usage Total (GB) : 2201
FAST Available (GB) : 42668
Max SG Demand Total (GB) : 3428
Excess (GB) : +39240
```

Tiers (2)

```
{
-----
                A                               Raw Capacities (GB)
                T                               -----
Tier           T Target      Tier   Tier FAST SG   FAST   Max SG   Excess
                R Prot       Free   Used  Usage   Avail  Demand
-----
R1_450GB_FC   F R1          39290 24223 1495   41825 1600   +40225
R57_450GB_FC F R5(7+1) 39290 843   706   40133 1828   +38305
[OutOfTier]  - N/A          -     4339 0      0      -      -
Total                                     -----
                                                3428
}
```

```
Technology : SATA
Total(GB) : 54029
Free (GB) : 47010
Used (GB) : 7019
FAST SG Usage Total (GB) : 1858
FAST Available (GB) : 48868
Max SG Demand Total (GB) : 2194
Excess (GB) : +46674
```

Tiers (1)

```
{
-----
                A                               Raw Capacities (GB)
                T                               -----
Tier           T Target      Tier   Tier FAST SG   FAST   Max SG   Excess
                R Prot       Free   Used  Usage   Avail  Demand
-----
R614_1TB_SATA F R6(14+2) 47010 4675 1858   48868 2194   +46674
[OutOfTier]  - N/A          -     2344 0      0      -      -
Total                                     -----
                                                2194
}
```

Legend:

```
ATTR : F = Tier in a FAST policy associated with SG(s)
      : P = Tier in a FAST policy unassociated with SG(s)
      : N = Tier not in any FAST policy
```

The demand report can also be run for a single technology type by running:

```
symfast -sid 1849 list -demand -tech FC
```

Symmetrix ID : 000192601849

Technology : FC
 Total(GB) : 68695
 Free (GB) : 39290
 Used (GB) : 29405
 FAST SG Usage Total (GB) : 2201
 FAST Available (GB) : 42668
 Max SG Demand Total (GB) : 3428
 Excess (GB) : +39240

Tiers (2)

```
{
-----
              A                      Raw Capacities (GB)
              T                      -----
Tier          T Target      Tier   Tier FAST SG   FAST   Max SG   Excess
              R Prot        Free   Used  Usage  Avail  Demand
-----
R1_450GB_FC  F R1          39290 24223 1495   41825   1600   +40225
R57_450GB_FC F R5(7+1) 39290 843   706   40133   1828   +38305
[OutOfTier] - N/A          -     4339 0      0      -      -
Total
              -----
              29405 2201           3428
}
```

Legend:

ATTR : F = Tier in a FAST policy associated with SG(s)
 : P = Tier in a FAST policy unassociated with SG(s)
 : N = Tier not in any FAST policy

The `-v` option can be added to the above command to provide information on the storage groups that are associated with each of the tiers that contain the disk groups of a particular technology:

symfast -sid 1849 list -tech FC -demand -v

Symmetrix ID : 000192601849

Technology : FC
 Total(GB) : 68695
 Free (GB) : 39290
 Used (GB) : 29405
 FAST SG Usage Total (GB) : 2201
 FAST Available (GB) : 42668
 Max SG Demand Total (GB) : 3428
 Excess (GB) : +39240
 [OutOfTier] Used (GB) : 4339
 [OutOfTier] FAST SG Usage (GB): 0

Tiers (2)

```

{
Tier Name           : R1_450GB_FC
Target Prot        : R1
Tier Free (GB)     :      39290
Tier Used (GB)     :      24223
FAST SG Usage Total (GB) :      1495
FAST Available (GB) :      41825
Max SG Demand Total (GB) :      1600
Excess (GB)       :      +40225
Tier Status       : Tier in a FAST policy associated with SG(s)

```

Storage Groups (1)

```

{
-----
                P  FAST SG   Max SG
                r   Usage   Demand
SG Name        Policy   i Raw (GB) Raw (GB)
-----
Production_*   Platinum  2    1495    1600
                Total                1495    1600
}

```

```

Tier Name           : R57_450GB_FC
Target Prot        : R5(7+1)
Tier Free (GB)     :      39290
Tier Used (GB)     :      843
FAST SG Usage Total (GB) :      706
FAST Available (GB) :      40133
Max SG Demand Total (GB) :      1828
Excess (GB)       :      +38305
Tier Status       : Tier in a FAST policy associated with SG(s)

```

Storage Groups (3)

```

{
-----
                P  FAST SG   Max SG
                r   Usage   Demand
SG Name        Policy   i Raw (GB) Raw (GB)
-----
Backup         Bronze    2     0     457
Development    Bronze    2     0     457
Production_*   Silver    2    706    914
                Total                706    1828
}

```

```

Tier Name           : [OutOfTier]
Target Prot        : N/A
Tier Free (GB)     :      -
Tier Used (GB)     :      4339
FAST SG Usage Total (GB) :      0
FAST Available (GB) :      0

```

```

Max SG Demand Total (GB) : -
Excess (GB) : -
Tier Status : -

```

```
No devices in a FAST SG on tier [OutOfTier]
```

```
}
```

SMC

In SMC, the technology demand reports can be accessed through the Demand folder, located under the FAST folder in the left-hand navigation pane.

The screenshot shows the EMC Symmetrix Management Console interface. The left-hand navigation pane is expanded to show the 'Demand' folder under the 'FAST' folder. The main window displays the 'Properties - 000192601849 Local/FC' dialog, which includes a table of tier properties.

Tier	Attr	Protection	Free (GB)	Used (GB)	FAST SG Usage (GB)	FAST Avail (GB)	Max SG Demand (GB)
[OutOfTier]	N/A	N/A	N/A	4339	0	0	N/A
R1_450GB_FC	F	RAID-1	39290	24223	1495	41825	1600
R57_450GB_FC	F	RAID-5(7+1)	39290	843	706	40133	1828

Conclusion

EMC Symmetrix VMAX FAST for standard provisioned environments automates the identification of data volumes for the purposes of allocating or re-allocating application data across different performance tiers within an array. FAST proactively monitors workloads at the volume (LUN) level and in order to identify “busy” volumes that would benefit from being moved to higher performing drives. Data movement executed during this activity is performed non-disruptively, without affecting business continuity and data availability.

References

- ◆ *EMC Solutions Enabler Symmetrix Array Controls CLI Product Guide*
- ◆ *EMC Solutions Enabler Symmetrix Array Management CLI Product Guide*
- ◆ *EMC Solutions Enabler Symmetrix CLI Command Reference HTML Help*
- ◆ *EMC Solutions Enabler Installation Guide*
- ◆ *EMC Symmetrix VMAX Product Guide*
- ◆ *FAST Theory and Best Practices for Planning and Performance Technical Note*
- ◆ *Managing Your FAST Environment with EMC Ionix ControlCenter and Symmetrix Performance Analyzer*
- ◆ *Best Practices for Nondisruptive Tiering via EMC Symmetrix Virtual LUN Technical Note*

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