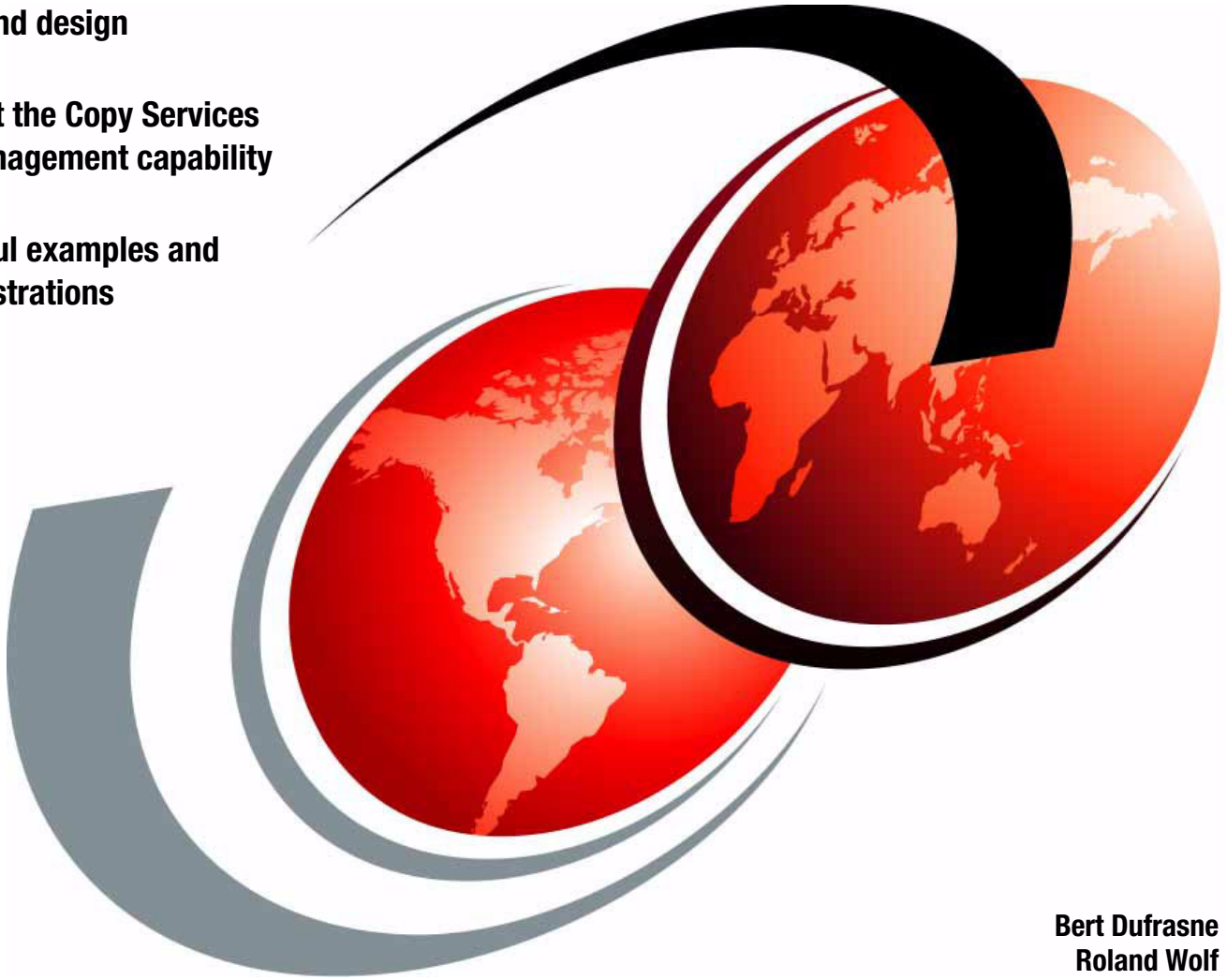
IBM System Storage DS8000
Copy Services Scope Management and Resource Groups

- Understand the resource group concept and design
- Implement the Copy Services scope management capability
- View useful examples and usage illustrations



Bert Dufrasne
Roland Wolf

Redpaper

ibm.com/redbooks

International Technical Support Organization

IBM System Storage DS8000 Copy Services Scope Management and Resource Groups

January 2013

REDP-4758-01

Note: Before using this information and the product it supports, read the information in “Notices” on page v.

Second Edition (January 2013)

This edition applies to IBM System Storage DS8700 with DS8000 Licensed Machine Code (LMC) level 6.6.1.xx, the IBM System Storage DS8800 with DS8000 Licensed Machine Code level 7.6.1.xx, and the IBM System Storage DS8870.

Contents

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at http://www.ibm.com/legal/copytrade.shtml

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

DS8000®
FICON®
FlashCopy®
IBM®
Redbooks®
Redpaper™
Redbooks (logo) ®
System Storage®
System z®
XIV®
z/OS®

The following terms are trademarks of other companies:

Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Other company, product, or service names may be trademarks or service marks of others.

Preface

The IBM® System Storage® DS8000® offers a policy-based resource management capability. This capability, named resource groups or Copy Services scope management, is the topic of this paper.

With Copy Services scope management, Copy Service relationships can be limited to the domain of a set of user-specified resources. Additionally, user IDs can be configured to only allow them to issue Copy Services requests against a specific domain. This capability facilitates multi-tenancy by preventing any host or user from initiating a Copy Services operation that would cross a specific tenant's domain boundaries. In addition to the multi-tenant capability, Copy Services domains can also provide general-purpose partitioning to isolate heterogeneous environments from each other. The Copy Services scope management capability is available for any host type on any volume type.

This IBM Redpaper™ publication is intended for anyone interested in Copy Services scope management. The paper starts with a general overview of the Copy Services scope management capability, its intended usage, and explanations of the underlying concept of resource groups. Subsequent chapters provide implementation details for both open systems and System z® perspectives and include usage illustrations with the DS8000 command-line interface (DSCLI).

The team who wrote this paper

A team of specialists from around the world working at the International Technical Support Organization, San Jose Center produced this paper.

Bert Dufrasne is an IBM Certified IT Specialist and Project Leader for System Storage disk products at the International Technical Support Organization, San Jose Center. He has worked at IBM in various IT areas. He has written many IBM Redbooks® publications and has also developed and taught technical workshops. Before joining the ITSO, he worked for IBM Global Services as an Application Architect. He holds a Masters degree in Electrical Engineering.

Roland Wolf is a Certified IT Specialist in Germany. He has worked at IBM for 26 years and has extensive experience with high-end disk-storage hardware in System z and open systems. He works in Technical Sales Support and his areas of expertise include performance analysis and disaster recovery solutions in enterprises that use the unique capabilities and features of the IBM disk storage servers, DS8000, and IBM XIV®. His contributions include various IBM Redbooks publications on the topics of ESS, DS8000 Architecture, and DS8000 Copy Services. He holds a Ph.D. in Theoretical Physics.

Thanks to the authors of the previous edition:

Amit K Dixit, Hans-Paul Drumm, Richard Moore, Richard Murke, Lee Newton, Massimo Rossichini, and Wolf Wittenbecker.

Thanks to the following people for their contributions to this project:

Richard Ripberger, Dale Anderson, Robert Suchanek, Mark Smith, Jens Wissenbach
IBM

Now you can become a published author, too!

Here is an opportunity to spotlight your skills, grow your career, and become a published author - all at the same time! Join an ITSO residency project and help write a book in your area of expertise, while honing your experience using leading-edge technologies. Your efforts will help to increase product acceptance and customer satisfaction, as you expand your network of technical contacts and relationships. Residencies run from two to six weeks in length, and you can participate either in person or as a remote resident working from your home base.

Find out more about the residency program, browse the residency index, and apply online at:

ibm.com/redbooks/residencies.html

Comments welcome

Your comments are important to us!

We want our papers to be as helpful as possible. Send us your comments about this paper or other IBM Redbooks publications in one of the following ways:

- Use the online **Contact us** review Redbooks form found at:

  ibm.com/redbooks
- Send your comments in an email to:

  redbooks@us.ibm.com
- Mail your comments to:

  IBM Corporation, International Technical Support Organization
  Dept. HYTD Mail Station P099
  2455 South Road
  Poughkeepsie, NY 12601-5400

Stay connected to IBM Redbooks

- Find us on Facebook:

  http://www.facebook.com/IBM-Redbooks
- Follow us on twitter:

  http://twitter.com/ibmredbooks
- Look for us on LinkedIn:

  http://www.linkedin.com/groups?home=&gid=2130806
- Explore new Redbooks publications, residencies, and workshops with the IBM Redbooks weekly newsletter:

  https://www.redbooks.ibm.com/Redbooks.nsf/subscribe?OpenForm
- Stay current on recent Redbooks publications with RSS Feeds:

  http://www.redbooks.ibm.com/rss.html

1

Resource group overview

Copy Services scope management, also called Copy Services scope limiting, is a function that enables policy-based limitations on DS8000 Copy Services. It enables the secure use of Copy Services functions by multiple users on a DS8000 storage system.

This functionality is implemented through a new DS8000 logical configuration object that is called a *resource group*.

1.1 Resource groups and Copy Services scope management

Copy Services scope management is the ability to specify policy-based limitations on Copy Services requests. With the combination of policy-based limitations and the DS8000 inherent volume-addressing limitations, it is now possible to control which volumes can be in a Copy Services relationship, which network users or host servers (or LPARs) issue Copy Services requests on which resources, and other Copy Services operations. This functionality is implemented through a new logical construct called a resource group.

With the Copy Services scope management capabilities, by using resource groups, you can separate and protect volumes in a Copy Services relationship from each other. This capability can facilitate multi-tenancy support by assigning specific resources to specific tenants, limiting Copy Services relationships so that they exist only between resources within each tenant's scope of resources.

When managing a single-tenant installation, the partitioning capability of resource groups can be used to isolate various subsets of the environment as though they are separate tenants. This capability can be used to separate mainframes from open servers, Windows from UNIX, or accounting department applications from marketing applications.

1.2 Business context

At the business level, clients face three major storage challenges:

- Managing storage growth

  Storage needs continue to grow at over 50% per year. Managing storage is becoming more complex than ever because we now have to deal with multiple server platforms and different operating systems.

- Increasing complexity

  Although the declining cost of storage per megabyte makes it attractive to add more disks, the increasing complexity of managing this storage results in over-utilized staff and under-utilized IT resources. Combined with the shortage of skilled storage administrators, it is possible to add significant cost and introduce risk to storage management.

- Maintaining availability

  The added complexity of 24x7 environments significantly reduces, for example, the efficiency of conducting routine maintenance, scheduling backups, migrating data, and introducing new software and hardware. This problem is compounded by the fact that as availability increases, so does the cost inherent with increasing availability.

Despite many technological improvements in recent years to provide better connectivity, improved performance, distance flexibility, and scalability, the complexity of storage remains a challenge for clients to manage today. Resource groups provide a level of added protection against potential data loss due to user errors in such environments.

1.2.1 The cloud challenge

Cloud has become the new reality for IT shops. Lines of business bypass their own IT shops to take advantage of external providers of cloud offerings. However, many of the users of public cloud services often do not consider concerns involving data security, compliance, and availability. Cloud represents a new business model that requires a process discipline as well as the use of a corresponding set of technology. The new model requires an understanding of the hardware configuration, software images, virtualized storage infrastructure, and network management.

The demand for cloud-computing resources requires that resources are provided to computers and other devices on demand. A virtualized storage infrastructure model needs to address the cloud challenge that demands that it address the performance, distance flexibility, and scalability that are required for both dedicated and shared environments through the resource group feature. The DS8000 Series proven capacity to efficiently provide the secure sharing of resources contributes to its position as a key component of any cloud environment.

1.2.2 The multi-tenancy challenge

As clients and service providers seek to reduce the cost of managing infrastructure through operational efficiencies and to meet their environmental challenges to reduce their carbon footprint through reduction of power and physical space in data centers, the need to drive up storage utilization and use the functional efficiency of storage devices becomes greater. Business pressures to optimize virtualized storage infrastructures necessitate treating storage hardware as an abstraction of the IT system where users of the service are unaware of the underlying components and whether they share it with others.

1.2.3 Data sharing challenge

Storage consolidation is the starting point of the data sharing approach. When you consolidate storage for homogeneous servers, data can be shared.

There are three categories of data sharing, which are valid for any data sharing approach, not just storage subsystem data sharing:

- *Storage sharing* splits the storage into physical partitions that are each owned by an individual, attached platform. Participants in storage sharing might be aware of the presence of the other participants, but it is not necessary. With storage sharing, two or more homogeneous or heterogeneous servers share a single storage subsystem whose capacity is physically partitioned so that each attached server can access only the units that are allocated to it. Multiple servers can own the same partition, but only with homogeneous servers, such as in a S/390 Parallel Sysplex configuration.
- *Data-copy sharing* involves replicating the data through a copy process so that another platform can access it. Data-copy sharing allows different platforms to access the same data by sending a copy of the data from one platform to another. There are two approaches to data-copy sharing between platforms:
  - Flat file transfer
  - Piping
- *True data sharing* refers to data in a continuous storage space that can be concurrently accessed by different platforms without any replication. This category implies concurrent access to files potentially with a mixture of readers and writers. In true data sharing, only one copy of the data is accessed by multiple platforms, whether homogeneous or

heterogeneous. Every attached platform has read and write access to the single copy of data. Participants must be aware of the presence of other sharers to ensure data integrity. True data sharing is usually implemented by a locking mechanism.

1.3 The multi-tenancy model

Multi-tenancy, in storage terms, is an IT system architecture in which a single instance of a hardware component or software application services the needs of multiple customers. Each customer is referred to as a tenant. Tenants can be given the ability to customize and execute functions for the parts of the infrastructure to which they are granted permission.

Definitions of shared storage model types

Within the IT industry, there are many definitions that are used to describe a shared storage model type. To illustrate the use of DS8000 resource group functions in the context of these model types, we provide definitions to help you understand the typical delineation of ownership of resources within a shared storage infrastructure. We describe the roles and responsibilities for the shareable components of that infrastructure. There are three types of shared models:

- Multi-client environment

  A multi-client service delivery platform can be described as an IT system that consists of storage hardware and applications that allow a service provider to supply managed storage services to multiple clients with the appropriate data and functional segregation between clients. The clients in this case delegate the management of all their IT services to an internal or external service provider.

  A typical example of a multi-client environment is an Internet service with which users have an email account. Using the facilities, the user stores personal data and uses the applications that are provided by the Internet Service Provider (ISP). The user has no control over or knowledge of how these applications are delivered.

- Multi-tenant environment

  A multi-tenant service delivery platform can be described as an IT system that consists of storage hardware and software applications where clients want to retain partial control over parts of the IT Infrastructure. The multi-tenant service delivery platform allows access, ownership, and a certain level of collaboration between the external service provider, the customer's internal service provider, and other third-party service suppliers.

  An example of a multi-tenant environment is where a customer is located on the premises of an outsourcing service provider, sharing IT infrastructure with other customers.

- Single client with multi-operating systems environment

  The single client multi-operating systems environment can be described as consisting of one or more disk storage systems hosting a single client's operating systems, where the client wants to retain partial control over the IT Infrastructure. The single client with a multi-operating systems environment allows access, ownership, and a certain level of collaboration between the external service provider, the customer's internal service provider, and other third-party suppliers of service. The operating system platforms can consist of any OS platform that is supported by the DS8000 series.

Within a single tenant's OS platform, resource groups enable a further partitioning capability to isolate volumes at an application, organizational, or departmental level. A fourth shared storage model type is a DS8000 that hosts an intermix of multi-client and multi-tenant services.

1.4 The need for enhanced data protection

Most organizations cite data protection as their most important security issue. Typical concerns include how data is stored and accessed, compliance and audit requirements, and business issues that involve the cost of data breaches, notification requirements, and damage to brand value. All sensitive or regulated data, including archived data, needs to be properly segregated on the cloud and shared storage infrastructure.

Significant restrictions about data collocation can arise with cloud and shared storage infrastructures, depending on an organization's location, the type of data that it handles, and the nature of its business.

Threats and security challenges

Exposure to attack can no longer be assumed to come from outside the organization. In today's world, an attack can potentially come from anywhere. The threat of attack to SAN-based managed data becomes increasingly important as IT solutions and hosting services increase their use of highly scalable technologies. Co-occupancy increases the need to ensure that vulnerabilities within devices are eradicated so that there is no risk of attack or inadvertent data loss through the actions of one tenant that affect another tenant.

1.5 The benefits of resource groups

Resource groups offer an enhanced security capability that supports hosting multiple customers with copy services requirements and the single customer with requirements to isolate the data of multiple operating system environments.

Resource groups for clients offer these benefits:

- Enables greater sharing of the DS8000 resources to help reduce cost pressures for clients in that it allows them to buy only what they need
- Offers greater flexibility to provide capacity on demand to clients who are unable to forecast capacity needs accurately and have requirements to rent capacity during peak usage periods during their business year

Resource groups for service providers offer these benefits:

- The ability to offer capacity on demand with high-availability copy services functions to their clients
- The ability to drive up utilization of primary, secondary, and tertiary site storage through secure sharing of the infrastructure and the ability to drive down the total cost of ownership (TCO) through sharing techniques

1.5.1 Benefits of multi-tenancy storage in a shared environment

Resource groups introduce the logical separation of DS8000 resources and offer these benefits:

- Enable the secure use of Point-in-Time copy (FlashCopy) functions by multiple clients that are hosted on a single shared DS8000 storage system, where Point-in-Time copy functions are restricted to the resources (volumes) within each client's domain.
- Enable the secure use of Remote Mirror and Copy functions by multiple clients that are hosted on shared primary, secondary, and tertiary DS8000 storage systems to perform controlled data migration and disaster recovery.

- Enable role-based management that provides granular levels of authority and access to DS8000 resources.
- Ease problem diagnosis. The simple structure of the solution can aid in identifying where any problems might exist.

When the IT infrastructure is managed by a service provider, the overall administration of resource groups for a storage system should be owned and managed by the service provider, with subordinate administrator roles defined to each hosted client or tenant's subdomain. Ownership of the subordinate Copy Services operator roles can be with either the service provider or the client, depending on how much control the client wants to retain.

1.5.2 Benefits of resource groups for the single client

For the single client that operates in a multiple operating systems environment, resource groups offer the following benefits:

- Resource groups provide more data protection against inadvertent human errors or deliberate malicious acts through the use of Copy Services functions.
- Role-based management that provides granular levels of authority and access to DS8000 resources.
- Ease of problem diagnosis. The simple structure of the solution can aid in identifying where problems might exist.

1.6 Preserving existing capabilities

The resource groups (or Copy Services scope management) function works with dedicated and shared usage so that nothing affects how existing DS8000 storage systems are configured and used today.

If a client has no requirement for the use of resource groups, all licensed Copy Services functions continue to operate as they have so far. For example, it still is possible for a single client with an application regression testing requirement to clone data by using FlashCopy from within the same DS8000 from a production or development z/OS LPAR to a test z/OS LPAR. Likewise, if a client is a tenant on a shared DS8000 and has a similar requirement to clone data, this type of configuration is supported within the bounds of the resource groups function by using a subset domain or set of domains to restrict FlashCopy commands to work for only source and target volumes that are defined to the client's domain.

The use of resource groups with or without new policies does not affect the performance of the storage unit.

2

Resource group concepts

In Chapter 1, “Resource group overview” on page 1, we briefly introduced the concept of resource groups, a new logical configuration object that enables the Copy Services scope management functionality in the DS8000.

In this chapter, we provide more details about resource groups and the policy-based methodologies that they employ to limit the span of control of tenants.

Resource group functions: It is not required that a system administrator configure resource group functions when upgrading to a microcode level that supports resource groups. By default, the behavior of the storage unit is unchanged. There is no change to the behavior of commands and scripts.

2.1 Resource group functional overview

Resource group functions enforce additional policy-based limitations to DS8000 users that use Copy Services. The process of specifying the appropriate limitations is performed by an administrator using resource group functions.

With the resource group concept, you can define the following information:

- Groups of resources, for example, a group of logical unit numbers (LUNs) of a tenant
- Actions that can be performed for a group, for example, FlashCopy®
- Who can perform the actions, for example, a Copy Services operator of a tenant

The resource groups feature provides policy-based limiting of the following actions:

- Copy Services relationships
- Pass-through operations of z/OS® users for open systems volumes
- Global Mirror sessions/masters

2.1.1 Resource group semantics and terminology

We explain how the resource group object is implemented and we define the terminology that is used in that context.

Resource group (RG)

A resource group is a collection of resources, LUNs or volumes, and logical subsystems (LSSs) or logical control units (LCUs). Copy Services operations can be limited among members of this group or to a defined resource group in another DS8000 as required for remote mirroring.

The resource group object has these characteristics:

- A resource group number, which is the string RG followed by a number (for example, RG1). The resource group number must be unique within one DS8000. By default, all resources (LUNs/volumes and LSSs/LCUs) are in resource group RG0. Resources in RG0 are *not restricted*.
- A resource group label (RGL), which is a string, for example “ClientA”. The label must be unique within one DS8000 system. The syntax for naming an RGL is a string of 1 - 32 characters (A-Z, a-z, 0-9, underscore, or period). There is one label name that is restricted, the label *PUBLIC,* which is associated with RG0.

Figure 2-1 on page 9 illustrates the concept of resource group numbers and labels.

Restriction: A total of 64 resource groups is supported, including the default resource group RG0.

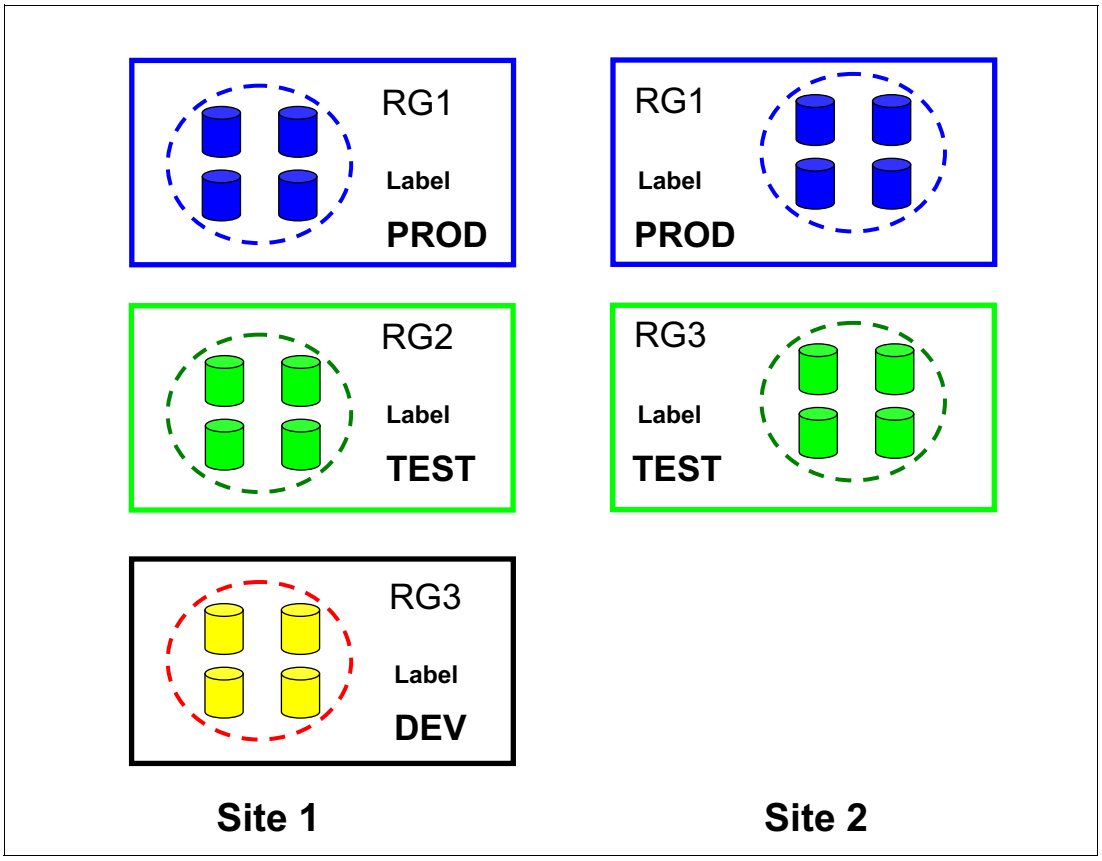


Figure 2-1 Resource group numbers and labels

Resource group scope

The actions on a resource group can be limited by a *resource group scope*. Currently, there are four action types that are implemented. A resource group can have several of these action types:

- Copy Services Global Resource Scope (CS_GRS)

  The global resource scope controls most of the common Copy Services actions, such as FlashCopy, Metro Mirror, Global Copy, and establishing mirroring paths.

  CS_GRS is by default associated with the label PUBLIC, which actually *disables* all Copy Services operations if resources are in a resource group other than RG0. Therefore, you have to change the resource scope to an existing RGL or to an asterisk (*). Specifying an asterisk as a global resource scope actually *allows any Copy Services operations across resource groups*. Therefore, this approach is not the normal mode of operation but it can be used to temporarily allow such operations.

  The Copy Services Global Resource Scope (CS_GRS) applies to the Establish Peer-to-Peer Remote Copy (PPRC) Pair (**`mkpprc`**) and Establish FlashCopy Pair (**`mkflash`**) operations that are issued from any source (a network user ID or a host system). The primary/source logical volume of the volume pair verifies that the secondary/target logical volume is within the scope of the CS_GRS in its associated resource group. The secondary/target logical volume of the volume pair verifies that the primary/source logical volume is within the scope of the CS_GRS in its associated resource group. If either check fails, the requested operation is rejected.

- Pass-thru Global Resource Scope (P_GRS)

  This action type is for the use of Copy Services of open systems (fixed block (FB)) volumes by a z/OS system. A z/OS operator can issue Copy Services requests for open systems volumes by using a z/OS address to *pass* the command *through* to an FB volume. This action can be restricted by the Pass-thru Global Resource Scope. P_GRS is associated with an RGL.

  Pass-through operations include any of the following operations:

  – Count key data (CKD) connection volume pass-through to an FB logical volume
  – CKD connection volume pass-through to an FB logical system
  – CKD connection device pass-through to an FB local device that is associated with a remote FB destination device
  – CKD device pass-through to a CKD device in the same LSS group for a command that performs Release Space or Withdraw FlashCopy with Space Release on Target (when the target is not in a FlashCopy relationship)

- GM Sessions Allowed

  This resource group scope is for Global Mirror management. It must be set in addition to the Copy Services Global Resource Scope. You must specify which Global Mirror (GM) session numbers (1 - 255) are allowed.

- GM Masters Allowed

  This resource group scope is for Global Mirror management. It must be set in addition to the Copy Services Global Resource Scope. You must specify which Global Mirror (GM) session numbers (1 - 255) are allowed to manage a Global Mirror master through an LSS that is associated with the resource group.

  Figure 2-2 shows resource group scopes for the CS_GRS Copy Services actions.

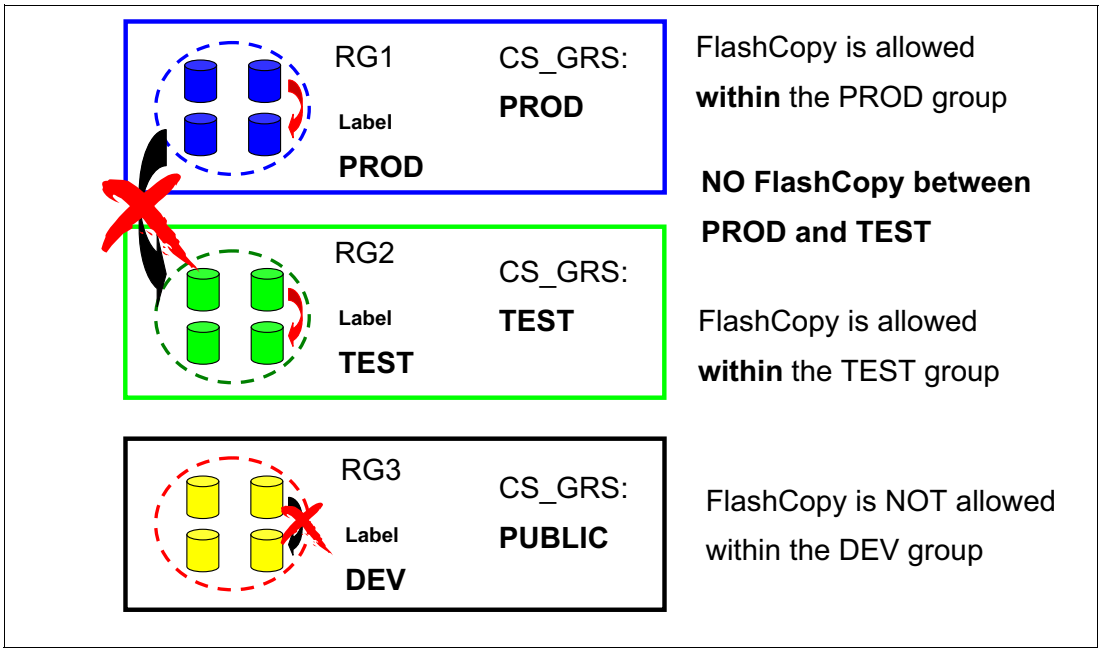


Figure 2-2 Resource group scope

To be able to perform Copy Services operations, the *CS_GRS scope* of the *source* volume must match the *RG label* of the *target* volume and vice versa. This requirement is illustrated in Figure 2-3 on page 11.

Figure 2-3 shows three cases:

- Case A in Figure 2-3 shows the preferred configuration for resource groups. We used the same resource group number, label, and resource group scope on both sites to set up mirroring between the two resource groups.
- Case B is a valid configuration and remote Copy Services are allowed between the two groups of volumes. We used different resource group numbers but the Copy Services Global Resource Scope (CS_GRS) of Site 1 (Beta) matches the RGL in Site 2 (Beta). Also, the Copy Services Global Resource Scope (CS_GRS) of Site 2 (Alpha) matches the RGL in Site 1 (Alpha). This approach is *not* the suggested way to define resource groups. It also prevents you from using FlashCopy within one group as shown in Case C.
- Case C shows that the RGL and the resource group scope are different. Therefore, a check between source and target volume never matches. FlashCopy is not possible within this group.

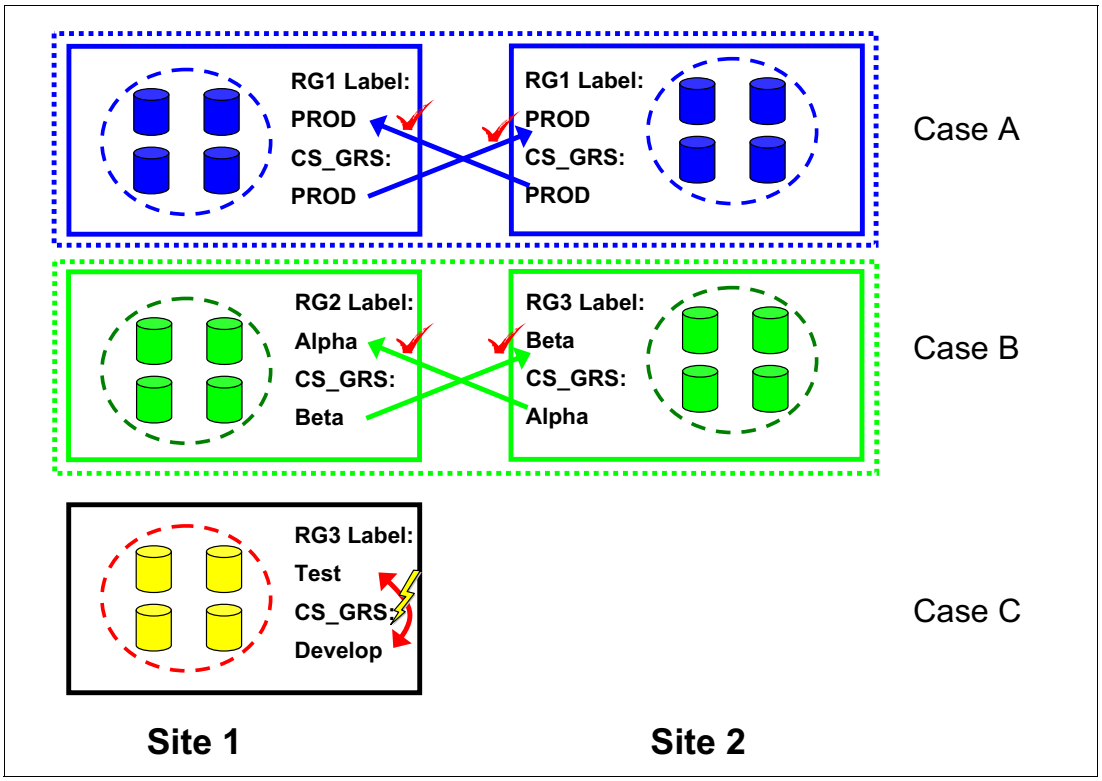


Figure 2-3 Interplay of RGLs and resource group scope

User resource scope (URS)

The other aspect is to define *who* can perform Copy Services operations. Each user ID has an associated resource scope, which is designated as the URS that defines the user's scope of access to any resources that are associated with resource groups.

The following values are possible:

- Global: *
- A specific URS: 1 - 32 characters (A-Z, a-z, 0-9, underscore, or period)

The user resource scope determines which objects the user is allowed to manage. Only a user ID with an admin access authority and global (*) URS can manage an authorization policy. A user ID with admin authority is limited to managing local user IDs that are subordinate to their user resource scope.

Tip: When you create an admin user by using the GUI, PUBLIC is the default user scope. To allow the new admin user to define subordinate users, such as Copy Services operators, ensure that you select the * (asterisk) scope for the new admin user.

Within the DS8000, there is a role concept that can further limit the actions that can be performed by a user.

Each user account has an assigned user role that has an access authority. The following list is a reminder of the various roles that can be assigned to a DS8000 user and their updated definitions in the context of resource groups:

- Administrator

  Can define and modify user IDs and Lightweight Directory Access Protocol (LDAP) policies, including assigning the user resource scope (URS) if the administrator's own scope is * (asterisk) and the administrator also has physical operator authority.

- Copy Services operator

  Can issue Copy Services operations to logical volumes in a resource group within their user resource scope and also has monitor authority.

  By assigning an appropriate URS to a user ID with a Copy Services operator authority, it is possible to define a tenant user ID that is limited to issuing Copy Services requests to resources within that user's scope.

- Logical operator

  Can create, delete, or modify a resource group (if URS set to *), logical volume, or LSS; can address group objects within that logical operator's resource scope; and also has host attachment operator authority.

- Physical operator

  Can create, delete, or modify a resource group (if URS set to *), arrays, ranks, extent pools, and I/O port objects within their resource scope and also has logical operator authority and Copy Services operator authority.

- Security administrator

  Can perform operations that relate to the security role for the encryption recovery key and also has monitor authority.

- Monitor

  Can view any object. Cannot create, modify, or delete objects or initiate operations.

Figure 2-4 shows the relationship between user scopes and resource groups.

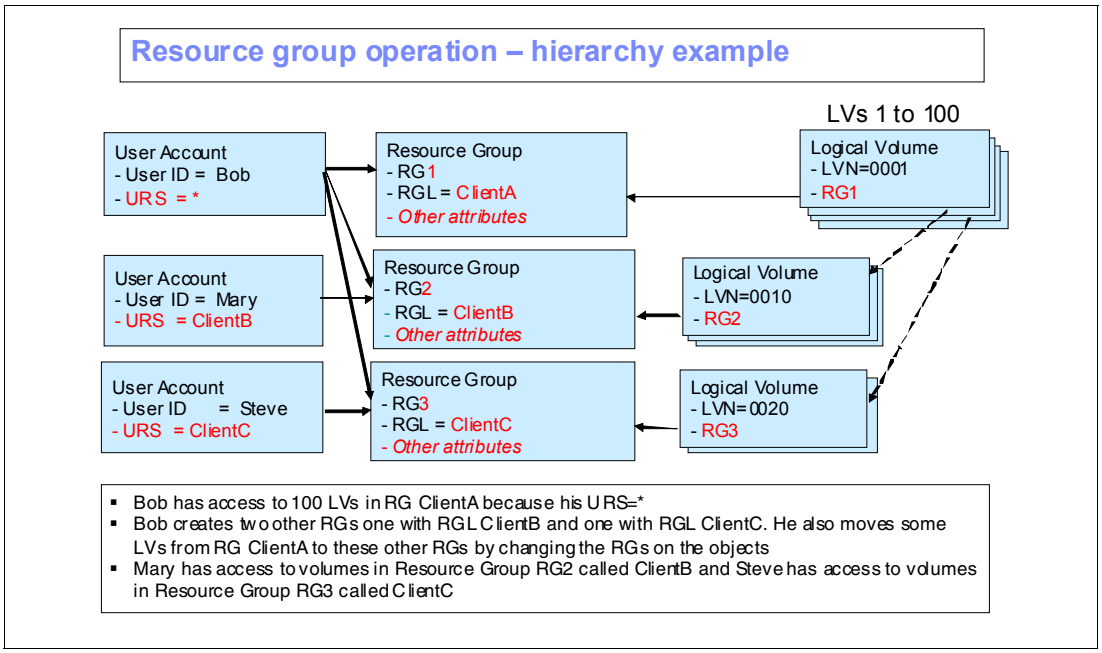


Figure 2-4 User scopes and resource groups

You set resource groups and relevant attributes through the DSCLI or GUI. For detailed information and illustrations of the corresponding commands and parameters, see Chapter 3, “Configuring resource groups” on page 23.

On the DS8000 system with microcode R6.1, you must use the DSCLI to set up and configure resource groups because there is no support for resource groups within the GUI.

2.1.2 Limitations and general considerations

Resource groups can limit the actions that can be performed with DS8000 Copy Services commands. You can also limit *who* can perform these actions. You can restrict the ability to perform these actions to certain users.

Fibre Channel connection (FICON®)-attached hosts can issue Copy Services commands, such as FlashCopy, or establish Metro Mirror pairs with *in-band* commands that are sent through the FICON channel. *No DS8000 user ID* is involved in such operations; therefore, user resource scopes do not apply here. Any Copy Services request from a z/OS system is treated like a user resource scope of * (asterisk). Therefore, a z/OS user can start FlashCopy operations, for example, for the PROD resource group. The z/OS user can copy a volume from this pool to another volume within the PROD pool *and* can copy a volume from the TEST resource group to another volume within the TEST resource group. However, the z/OS user *cannot* copy a volume from the TEST group to a volume of the PROD group, for example. With the resource group concept, you *cannot* limit a z/OS user to operations for a certain resource group only.

Resource groups control Copy Services operations of the DS8000 only. For example, you can prevent the use of FlashCopy operations. However, resource groups do not prevent you from using host commands to copy one volume onto another if both volumes are online to the same system.

In z/OS, copy operations are usually performed with the **DFSMSdss COPY** command. For this command, you can specify whether FlashCopy *must* be used (FASTREPLICATION(REQUIRED) option) or whether FlashCopy *can* be used (FASTREPLICATION(PREFERRED) option). If you enforce the use of FlashCopy and the resource group settings do not allow the copy, the copy operation fails. However, if you specify the use of FlashCopy as an option, you get a warning that FlashCopy cannot be used, but the copy operation - forbidden by the resource groups construct - *is performed* by a normal copy operation of the host. This result is true for other systems that have volumes online from different resource groups and use server commands to copy data.

The DS8000 provides a means to restrict LUN access of servers. Do not attach volumes from different resource groups to the same host.

Logical subsystem considerations

Resource groups are designed to function at the LSS level with all Remote Copy functions. This capability is necessary for consistency purposes to ensure that all Copy Services functions still operate as they did before. The capabilities that are provided with resource groups support the creation of a multi-tenancy environment where the tenants have authority to issue Copy Services requests to resources that are created and managed by the multi-tenancy manager. Partitioning between tenants is limited to LSS granularity because certain Copy Services requests operate at the LSS level.

For example, in a Metro Mirror implementation, a freeze operation is performed at the LSS level, causing all Metro Mirror volumes in that LSS to go into a suspended state with a queue full condition and terminate all associated paths. If you assign LSSs to each of your applications, you can control the impact of the queue full condition that is caused by the freeze operation at an application level. On the contrary, if you put volumes that are used by several different applications into the same LSS, all those applications that share the LSS and their Metro Mirror volumes are affected by the queue full condition.

Copy Services operations that act on volumes and LUNs are checked if *both* source and target volumes are within the scope limits. For LSSs and LCUs, only the *source* LSS/LCU is checked and compared with the user resource scope. The target LSS/LCU is not checked. See Example 4-10 on page 50.

Important: Do not create more than one resource group per LSS.

A system administrator is not required to configure resource groups when code is installed that supports resource groups. The default policy settings (all resources/volumes in RG0 with scope PUBLIC) for preexisting user IDs and resources do not change the behavior of the storage unit from the behavior of a unit that has no resource group support. There is no change to the behavior of commands and scripts.

2.1.3 Copy Services operations

We describe the use of resource groups to set up remote mirroring between groups or to restrict a FlashCopy operation to a group of volumes.

FlashCopy, Metro Mirror, and Global Mirror

We explained that to be able to perform Copy Services operations, the *CS_GRS scope* of the *source* volume must match the *RG label* of the *target* volume and vice versa as shown in Figure 2-3 on page 11. Otherwise, Copy Services operations are rejected. With an appropriate setup of resource groups and scopes on the local and remote sites, you can limit

the possible Copy Services relationships between the groups of resources or within one group.

Pass-through Copy Services requests

When an FB entity is accessed through a CKD or fixed-block architecture (FBA) connection device, that access is referred to as *pass-through* access. When a Copy Service requests a pass-through operation, the connection device's resource group's Pass-thru Global Resource Scope (P_GRS) attribute must select the RGL of the appropriate device. For a non-remote command, the appropriate device is the destination device. For a remote command, the appropriate device is the local device (PPRC primary of the destination device). Several examples are listed:

- An Establish/Suspend/Terminate PPRC Pair request between two FB volumes is issued to a CKD connection device. The FB primary volume must be in a resource group that is selected by the CKD connection device's P_GRS.
- An Establish PPRC Path request between two FB LSSs is issued to a CKD connection device. The FB primary LSS must be in a resource group that is selected by the CKD connection device's P_GRS.
- An Establish FlashCopy request is issued to a CKD connection device for two FB volumes, and the source volume is a remote FB device. The FlashCopy source device (remote device) must be the PPRC secondary of a PPRC primary FB volume (local device) in the same LSS group as the connection device. The local device must be a resource group that is selected by the CKD connection device's P_GRS.
- A Withdraw FlashCopy with space release on the target command is issued to a CKD connection device for a different CKD or FB target, and the target is not in a FlashCopy relationship. The target device must be in the same LSS group as the connection device. The target device must be in a resource group that is selected by the connection volume's P_GRS.
- A release space command is issued to the CKD device for a different CKD or FB volume. The volume must be in the same LSS group as the connection device and in a resource group that is selected by the connection volume's P_GRS.

In this example, a host or user issues a Copy Services request to a connection volume that specifies a destination volume that is different from the connection volume. Assume that the request to copy FB volume A to FB volume B is issued through a CKD connection volume. The volumes are labeled:

- The connection volume in RG1: RGL=`TenantB.1 P_GRS=TenantB.2`
- The destination volume in RG2: RGL=`TenantB.2`

The Copy Services request is valid because the connection volume's P_GRS matches the request's destination volume (that is, the Copy Services source volume) RGL. The FB Volume A (source volume) to FB Volume B pairing is also subject to Copy Services establish checking.

Work with Global Mirror sessions

If a Global Mirror (GM) session is opened or closed on an LSS, the LSS's resource group must allow the session number that is specified in the request. If a logical volume is added or removed from a GM session that is open on the LSS that is associated with the logical volume, the LSS's resource group must allow the session number that is specified in the request.

When a Copy Services request operates on a GM master, the session ID that is specified in the request must be allowed in the GM session's attribute. Also, the GM master must be

allowed in the GM Masters Allowed attribute of the resource group of the LSS that is associated with the GM master request.

The following examples show GM sessions:

- Issuing a start, pause, resume, or terminate request to a GM master. The request specifies an LSS that must be in the same LSS group as the GM master and also determines the resource group that limits the request.
- When a Copy Services request manages a GM master, the session ID that is specified in the request must be allowed by both the GM Session Allowed attribute and by the GM Masters Allowed attribute in the specified LSS's resource group, or the request is rejected.

2.2 Resource group use cases

The following use case scenarios illustrate the use of resource groups. We describe how to implement secure storage sharing in single, multiple client, and multi-tenancy environments by using the resource groups function.

Notice that the scenario used covers some tenant situations but not all of them. You can easily combine the concepts from several scenarios to create a more complex scenario that covers different profiles of tenants.

2.2.1 Remote Copy with RGs in a multiple client environment

Figure 2-5 on page 17 illustrates one possible implementation of an environment that uses resource groups to limit Copy Services operations. Figure 2-5 on page 17 shows two tenants (tenants A and B). Each tenant has its own assigned LPARs on these hosts and its *own assigned volumes* on the storage systems. Resource groups are configured to ensure that one tenant cannot cause any Copy Services relationships to be initiated between their volumes and the volumes of another tenant.

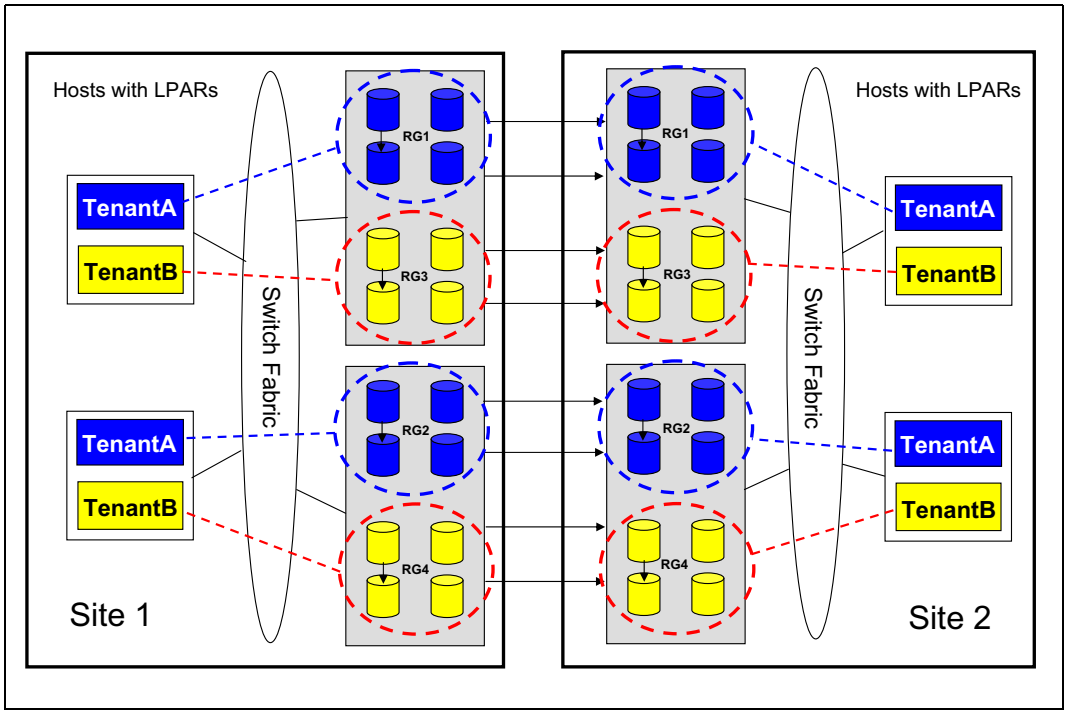


Figure 2-5 The scope of tenants A and B

By defining the appropriate rules, you can ensure the following conditions in Figure 2-5:

- Tenant A can only access LUNs within the blue scope. This rule must be enforced by the hardware configuration definition (HCD) definitions.
- Tenant B can only access LUNs within the red scope. This rule must be enforced by the HCD definitions.
- The host access is limited to connection volumes that are allowed by configuration controls:
  - The *Open System host LPAR* is limited by the DS8000 Volume Group/SCSI Host Port configuration.
  - The *System z host LPAR* is limited by the System z HCD configuration.
- Each tenant has a DS8000 resource group that is configured on each DS8000 with an RGL and other policies that control Copy Services operations.
- The tenant's logical volumes and LSSs are assigned to the tenant's resource group.
- DS8000 user sessions are limited to the volumes or the LSS within the user resource scope (URS).
- Establishing PPRC Pair and FlashCopy Pair commands from a user ID implies that the following conditions are true:
  - The user is allowed to perform this operation.
  - The source validates that the target volume is allowed by the source's RG policies.
  - The target validates that the source is allowed by the target's RG policies.
- Additional Copy Services controls exist for Global Mirror (GM) sessions and pass-through.

All of these rules are transparent to tenants as long as they do not issue an invalid request. Invalid requests are rejected with a resource group violation error.

2.2.2 Using RGs in a multiple client environment

In Figure 2-6, we see three client operating systems that are hosted on two servers that are connected to a DS8000 across a switch fabric.

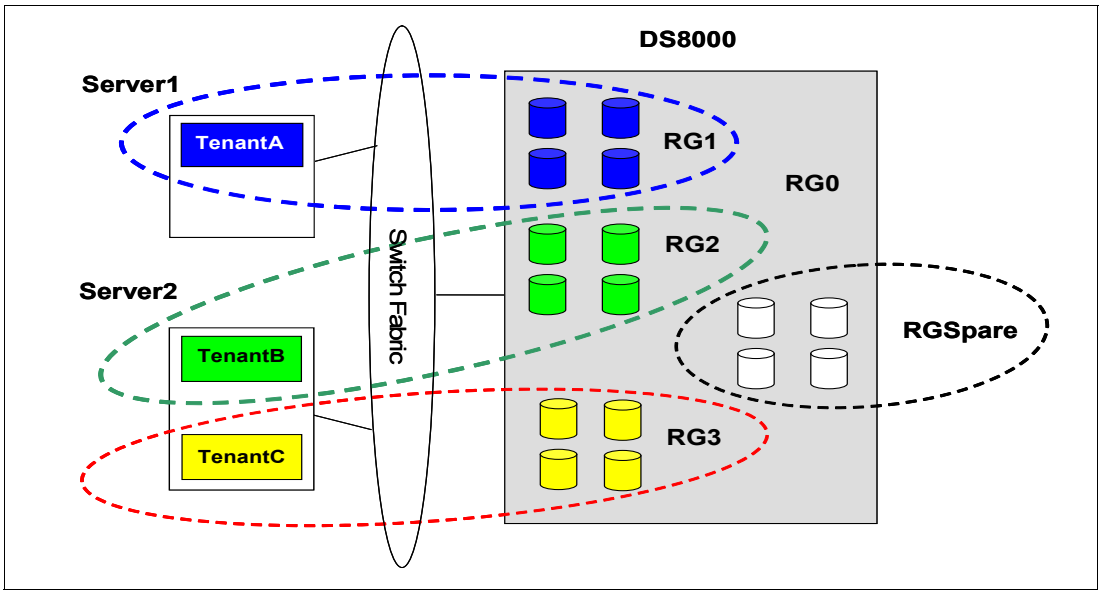


Figure 2-6 Use case B - Using resource groups in a multi-client environment

By defining the appropriate rules, you can ensure that the following conditions are met:

- Tenants can only access LUNs within their scope by the correct host attachment definitions within the DS8000.
- Each tenant's storage volumes are assigned to a unique private resource group.
- Each RG is associated with an operator with a user scope for this RG only.
- The client has the authority to manage the resources within their respective resource group.
- The scope of each RG is limited to invoking FlashCopy functions for the volumes within the RG.
- All spare volumes are assigned to resource group RGSpare (which stands for an unused RG*n*) from their default resource group RG0 to prevent tenants from using unassigned volumes for a FlashCopy operation.

In this example, each tenant uses Copy Services functions in secure isolation. This type of configuration is ideal for these situations:

- Service providers that want to offer secure Copy Services functions to existing and new clients that are hosted in DS8000 based shared storage infrastructure environments.
- Clients that are hosted on shared storage that want to retain control of point-in-time invocation of FlashCopy during application or batch processing.

2.2.3 Using RGs in a multiple tenant environment

The use case that is shown in Figure 2-7 on page 19 illustrates two tenants' operating systems that are hosted on two servers that are connected to a DS8000 across a switch fabric. Tenant B has two operating environments that share a single resource group.

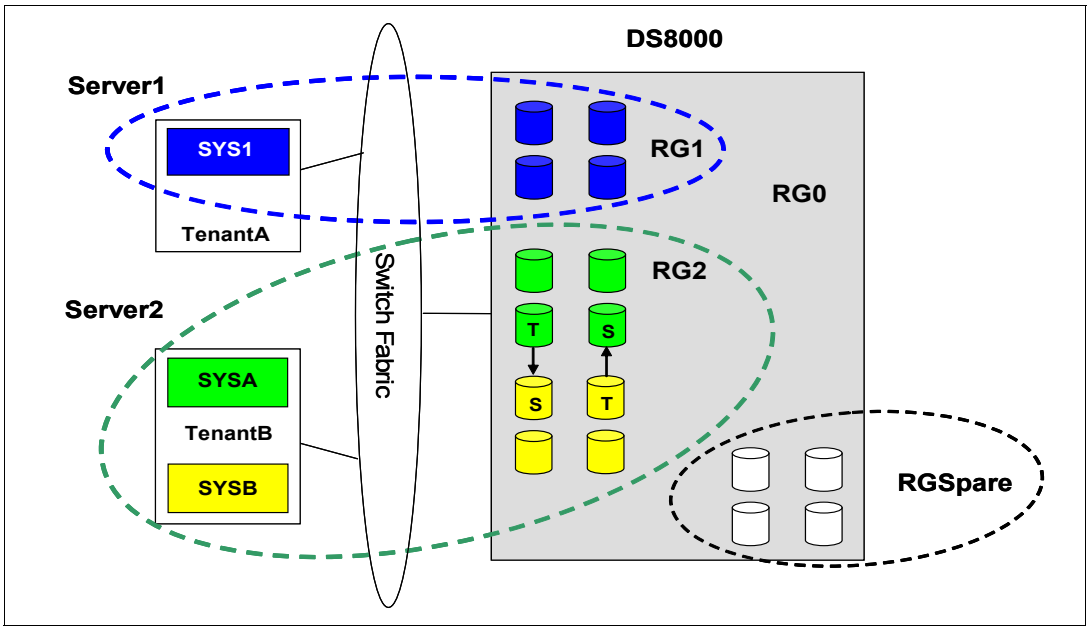


Figure 2-7 Use case C - Using resource groups in a multi-tenant environment

By defining the appropriate rules, you can ensure that the following conditions are met:

- Tenants can only access LUNs within their scope.
- Each tenant's storage volume is assigned to a unique private resource group.
- Each RG is associated with operating systems on a server.
- The client has the authority to manage the resources within its respective resource group.
- The scope of each RG is limited to invoking FlashCopy functions for the volumes with the RG. Tenant B operational requirements in this example are for protection from other clients that are hosted on the DS8000 system while it retains the capability to replicate data both to and from operating systems in LPARs SYSA and SYSB.
- All spare volumes are assigned to resource group RGSpare from their default resource group RG0 to prevent the tenant from using unassigned volumes for a FlashCopy operation.

In this example, you can see that each tenant uses Copy Services functions in secure isolation. This type of configuration is ideal for the following situations:

- Service providers that want to offer secure Copy Services functions to existing and new clients that are hosted in DS8000 based shared storage infrastructure environments.
- Clients that are hosted on shared storage that want to retain control of point-in-time invocation of FlashCopy during application or batch processing.
- Clients that want to retain the flexibility of moving data between services.

2.2.4 Using RGs in a single client with multiple environments

In the use case that is shown in Figure 2-8 on page 20, we see a single client with three operating systems or environments that are hosted on two servers that are connected to a DS8000 across a switch fabric. The client created a single resource group RG1 for the PRODA LPAR. The DEVT1 and TEST1 operating system volumes all reside in resource group RG0.

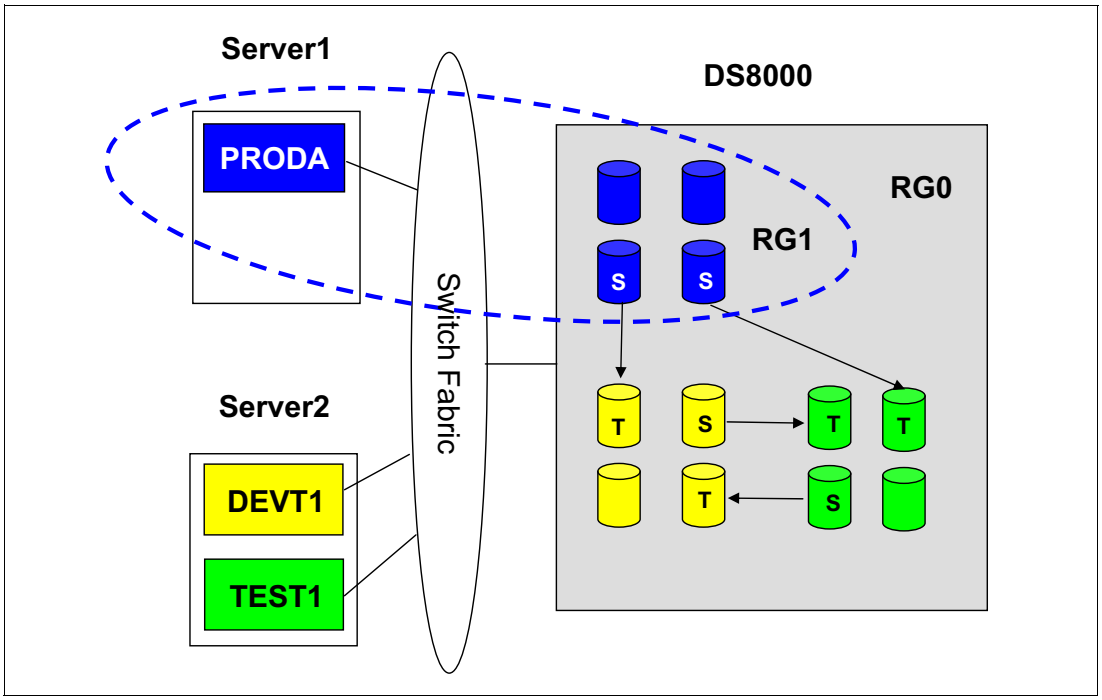


Figure 2-8 Use case D - Using resource groups in a single client multi-operating environment

By defining the appropriate rules, you can ensure that the following conditions are met:

- All volumes within RG1 cannot be overwritten by Copy Services-related operations from operating systems DEVT1 and TEST1.
- Data can be replicated from source PRODA volumes to target volumes in RG0.
- You can replicate data both to and from operating systems with volumes that reside in the default resource group RG0.

In this scenario, resource groups benefit a single client by offering an enhanced level of data protection through isolation of resources, protecting a critical operating system while it retains the ability to clone production data to other operating systems that share the DS8000.

2.2.5 Using RGs in a multi-client and multi-tenant environment

Figure 2-9 illustrates the case of three client operating systems that are hosted on two servers across two sites.

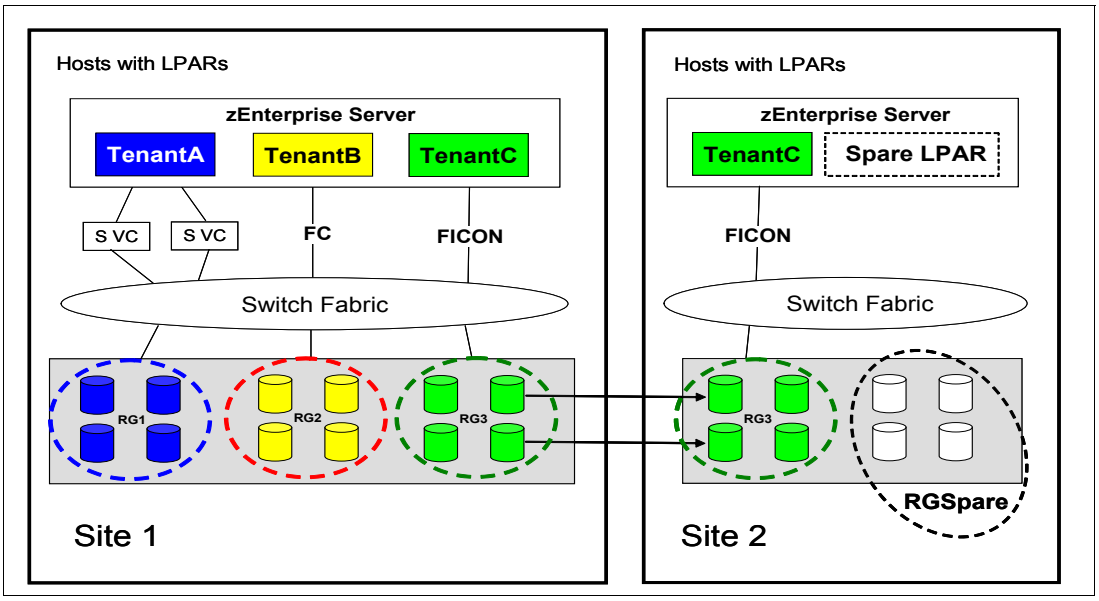


Figure 2-9 Use case B - Using resource groups in an intermixed environment

By defining the appropriate rules, you can ensure that the following conditions are met:

- Tenants can only access LUNs or CKD volumes within their scope.
- Each tenant's storage volumes are assigned to a unique private resource group.
- The client has the authority to manage the resources within its respective resource group.
- All spare volumes are assigned to resource group RGSpare from their default resource group RG0 to prevent the tenant from using unassigned volumes for a FlashCopy operation.

In this example, you can see that each tenant uses Copy Services functions in secure isolation. This type of configuration is ideal for the following situations:

- Service providers that want to offer secure Copy Services functions to existing and new clients that are hosted in DS8000 based shared storage infrastructure environments.
- Clients that are hosted on shared storage that want to retain control of point-in-time invocation of FlashCopy during application or batch processing.

3

Configuring resource groups

This chapter describes how to configure resource groups by using the DS8000 Command Line Interface (DSCLI) and the DS8000 GUI.

3.1 Configuring resource groups with the DSCLI

Several new commands support the resource group functionality. Table 3-1 lists the new commands.

Table 3-1 New DSCLI resource group commands

Command	Description
mkresgrp	Creates a resource group object (resgrp) in a storage image
chresgrp	Modifies a resource group object (resgrp) in a storage image
rmresgrp	Deletes a resource group object (resgrp) in a storage image
manageresgrp	Manages the contents of any resource group object (resgrp) in a storage image, except resource group 0 (RG0)
lsresgrp	Displays a list of resource group objects (resgrp) in a storage image
showresgrp	Displays a resource group (resgrp) object's properties in a storage image

3.1.1 Resource group 0 (RG0)

Resource group 0 (zero) (RG0) is predefined and cannot be created, deleted, or modified. By default, all resources belong to this group unless otherwise specified.

3.1.2 Creating resource groups (mkresgrp)

There are actually two commands that define a resource group. You have to define the resource group with the **mkresgrp** command. And, you have to set the options with the **manageresgrp** command (see 3.1.5, "Managing resource groups (manageresgrp)" on page 26).

The **mkresgrp** command creates a resource group object (resgrp) in the DS8000:

- Syntax

```
mkresgrp
[ -dev storage_image_ID ]
-label resource_group_label
[ -name resource_group_name ]
[ resource_group_ID | -]
```

- Parameters:
  - *-dev storage_image_ID*

    Storage Image ID: manufacturer.type-serial number

    Example:

    IBM.2107-75LH321
  - *-label resource_group_label*

    A resource group label (RGL) is 1 - 32 characters and is limited to the uppercase and lowercase alphabetic characters, numeric characters, and the special characters dash (-), underscore (_), and period (.).

– *-name resource_group_name*

The user-assigned nickname for this resource group object. It can be up to 32 characters long.

– *resource_group_ID*

Resource group ID. A resource group ID consists of the letters RG followed by a decimal number. If not specified, a decimal number is assigned. Alternatively, this parameter accepts input from stdin when the dash (-) is specified.

Example 3-1shows the **mkresgrp** command.

Example 3-1 The mkresgrp command

```
dscli> mkresgrp –dev IBM.2107-75FA120 –label “TenantA” –name “TenantA_Grp” RG1

Date/Time: Sun Aug 11 02:23:49 PST 2004 IBM DSCLI Version: 5.0.0.0 DS: IBM.2107
Resource Group RG1 successfully created.
```

3.1.3 Modifying resource groups (chresgrp)

The **chresgrp** command modifies a resource group object (resgrp) in a storage image:

- Syntax

```
chresgrp
[ -dev storage_image_ID ]
[ -label resource_group_label ]
[ -name resource_group_name ]
resource_group_ID | -
```

Example 3-2 shows the **chresgrp** command.

Example 3-2 The chresgrp command

```
dscli> chresgrp –dev IBM.2107-75FA120 –name “TenantA is the one” RG1

Date/Time: Sun Aug 11 02:23:49 PST 2004 IBM DSCLI Version: 5.0.0.0 DS: IBM.2107
Resource Group RG1 successfully modified.
```

3.1.4 Deleting resource groups (rmresgrp)

The **rmresgrp** command deletes a resource group object (resgrp) in a storage image:

- Syntax

```
rmresgrp
[ -dev storage_image_ID ]
[ -quiet ]
resource_group_ID […] | -
```

- Parameters:

  – *-quiet*

  Turns off the confirmation prompt for this command

– *resource_group_ID*

An array of one or more resource group IDs or resource group ID ranges to be removed:

- A resource group ID range is defined by two resource group IDs that are separated by a hyphen.
- Multiple resource group IDs or resource group ID ranges must be separated with a space between each ID. Alternatively, it accepts input from stdin when the dash (-) is specified.

The resource group ID format is the letters RG followed by a decimal number.

Example 3-3 shows the **rmresgrp** command.

Example 3-3 The rmresgrp command

```
dscli> rmresgrp –dev IBM.2107-75FA120 RG1

Date/Time: Sun Aug 11 02:23:49 PST 2004 IBM DSCLI Version: 5.0.0.0 DS: IBM.2107
Resource Group RG1 successfully deleted.
```

3.1.5 Managing resource groups (manageresgrp)

The **manageresgrp** command is used to manage the contents of any resource group object (resgrp) in a DS8000, except resource group 0 (RG0):

- Syntax

```
manageresgrp
[ -dev storage_image_ID ]
-action set | add | remove
-ctrl copyglobal | passglobal | gmsession | gmmaster
[ -scope resource_scope ]
[ -sessions all | none | session_ID[,session_ID…] ]
resource_group_ID | -
```

- Parameters:

– `-action set | add | remove`

Actions to apply to the specified resource control.

See the following control definitions for explanations of controls and actions.

– `-ctrl copyglobal | passglobal | gmsession | gmmaster`

Controls to apply the specified action.

See the following control definitions for explanations of controls and actions.

– `-scope` *resource_scope*

A resource scope for the specified control.

See the following control definitions for explanations of controls and actions.

– `-sessions all | none |` *session_ID* [,*session_ID…*]

A Global Mirror session ID.

See the following control definitions for explanations of controls and actions.

– *resource_group_ID*

Resource group ID. A resource group ID consists of the letters RG followed by a decimal number. Alternatively, it accepts input from stdin when a dash (-) is specified.

Control definitions

The following parameters and the actions that they perform are for the control function:

- `-ctrl copyglobal`

  The **`copyglobal`** parameter defines the Copy Services Global Resource Scope. This resource scope applies to the establish PPRC pair (**`mkpprc`**) and establish FlashCopy pair (**`mkflash`**) operations.

- `-ctrl passglobal`

  The **`passglobal`** parameter defines the Pass-thru Global Copy Services Resource Scope.

  Certain host commands can be issued to a certain logical volume, but they operate on a different logical volume or logical subsystem (LSS) that is specified in the command parameters. In this case, the logical volume that receives the command is called a pass-through device, and the logical volume or LSS that the command operates on is called the destination device (logical volume or destination LSS).

- `-ctrl gmsession`

  The **`gmsession`** parameter defines the list of sessions that are allowed to be Global Mirror sessions.

- `-ctrl gmmaster`

  The **`gmmaster`** parameter defines the list of sessions that are allowed to be Global Mirror master sessions.

Example 3-4 shows the control function.

Example 3-4 Control function

```
dscli> manageresgrp –dev IBM.2107-75FA120 –action set –ctrl copyglobal –scope
“TenantA” RG1

Date/Time: Sun Aug 11 02:23:49 PST 2004 IBM DSCLI Version: 5.0.0.0 DS: IBM.2107-75
Resource Group RG1 successfully modified.
```

3.1.6 Displaying a list of resource groups (lsresgrp)

The **`lsresgrp`** command is used to display a list of resource group objects (resgrp):

- Syntax

```
lsresgrp
[ -dev storage_image_ID ]
[ -s | -l ]
[ -label resource_group_label ]
[ -name resource_group_name ]
[ resource_group_ID […] | -]
```

Example 3-5 shows the **lsresgrp** command.

Example 3-5 The lsresgrp command

```
dscli> lsresgrp
Date/Time: October 9, 2012 4:57:55 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM
ID  Name                  State  Label
=======================================
RG0 Default_Resource_Group Normal PUBLIC
RG2 RG_Alpha              Normal Alpha
RG3 RG_Beta               Normal Beta
dscli>
```

3.1.7 Display resource group properties (showresgrp)

The **showresgrp** command displays a resource group (resgrp) object's properties in a storage image:

- Syntax

```
showresgrp
[ -dev storage_image_ID ]
resource_group_ID | -
```

Example 3-6 shows the **showresgrp** command.

Example 3-6 The showresgrp command

```
dscli> showresgrp rg2
Date/Time: October 9, 2012 5:02:40 PM CEST IBM DSCLI Version: 7.7.0.566 DS:
IBM.2107-75ZA571
ID                  RG2
Name                Subgroup Alpha
State               Normal
Label               Alpha
CS_Global_RS        Alpha
Passthru_Global_RS  Alpha
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF
dscli>
```

3.1.8 Defining resources with a resource group attribute

When you create a volume with the **mkfbvol** or **mkckdvol** command, you now can specify the resource group to which this volume belongs. Specify the **-resgrp** option as shown in Example 3-7 for a fixed block (FB) volume.

Example 3-7 Creating a volume with a resource group attribute

```
dscli> mkfbvol -extpool p3 -cap 1 -name ITSO_0104 -resgrp RG2 0104
Date/Time: October 9, 2012 4:11:15 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM...
CMUC00025I mkfbvol: FB volume 0104 successfully created.
```

Similarly, you can specify a resource group for a logical control unit (LCU) or LSS. For z/OS count key data (CKD) volumes, you explicitly must define an LCU, and here, you can add the **-resgrp** option. For open systems FB volumes, LSSs are implicitly defined when a LUN is

created. But, you can use the **chlss** command to modify an LSS and assign it a resource group attribute as shown in Example 3-8. We first list the properties of an LSS and then modify it to be part of a resource group.

Example 3-8 Setting a resource group attribute for an LSS

```
dscli> showlss 01
Date/Time: October 9, 2012 4:21:25 PM CEST IBM DSCLI Version: 7.7.0.566 DS:
IBM.2107-75ZA571
ID             01
Group          1
addrgrp        0
stgtype        fb
confgvols      4
subsys         0xFF01
pprcconsistgrp Disabled
xtndlbztimout  60 secs
resgrp         RG0

dscli> chlss -resgrp RG2 01
Date/Time: October 9, 2012 4:21:50 PM CEST IBM DSCLI Version: 7.7.0.566 DS:
IBM.2107-75ZA571
CMUC00029I chlss: LSS 01 successfully modified.
dscli>
```

3.1.9 Creating a new user with a user scope

To restrict a user to Copy Services operations for a resource group, you have to specify the user scope when you define a new user or modify an existing user. You need a user with admin rights and with scope * (asterisk) to set the scope for other users. With the option **-scope**, you define the resource group that this user can work with. See Example 3-9.

Example 3-9 Defining a new user with a user scope

```
dscli> mkuser -pw passw0rd -group op_copy_services -scope Alpha AlphaOper
```

3.1.10 Updated DSCLI commands

It is not the intent of this section to list every DSCLI command and its syntax. Table 3-2 shows the updated DSCLI commands.

If you need a list of all available commands or require assistance to use the DSCLI commands, read the *IBM System Storage DS8000 Command-Line Interface User's Guide*, SC26-7916, or use the online help.

Table 3-2 Updated DSCLI commands

Command	Parameter
mkckdvol	Added parameter: -resgrp *resource_group_ID*
chckdvol	Added parameter: -resgrp *resource_group_ID*
lsckdvol	Added parameter: -resgrp *resource_group_ID*
showckdvol	Added additional output: resgrp

Command	Parameter
mkfbvol	Added parameter: -resgrp *resource_group_ID*
chfbvol	Added parameter: -resgrp *resource_group_ID*
lsfbvol	Added parameter: -resgrp *resource_group_ID*
showfbvol	Added additional output: resgrp
mklcu	Added parameter: -resgrp *resource_group_ID*
chlcu	Added parameter: -resgrp *resource_group_ID*
lslcu	Added parameter: -resgrp *resource_group_ID*
showlcu	Added additional output: resgrp
chlss	Added parameter: -resgrp *resource_group_ID*
lslss	Added parameter: -resgrp *resource_group_ID*
showlss	Added additional output: resgrp
mkuser	Added parameter: -scope *user_resource_scope*
chuser	Added parameter: -scope *user_resource_scope*
lsuser	Added parameter: scope
showuser	Added additional output: resgrp
setauthpool	Added parameter: -scope *user_resource_scope*
showauthpool	Added additional output: scope

Follow these rules:

- When you specify the **-resgrp *resource_group_ID*** parameter, the resource group ID begins with the letters RG and ends with a decimal number. The default is RG0.
- When you specify the **scope *user_resource_scope*** parameter, the user resource scope name must meet the following criteria:
  - Must be one - 32 characters long
  - The characters are limited to uppercase and lowercase alphabetic characters, numeric characters, and the special characters dash (-), underscore (_), and period (.). You can also define the scope as a single asterisk (*).

  The default scope is an asterisk for users in the admin authority group and PUBLIC for users in all other authority groups.

Authorization: The user resource scope is matched to one or more resource group IDs that are assigned to resource groups. If the resource group ID of a resource group matches the user resource scope, the user is authorized to issue Copy Services requests to a logical volume, LSS, or LCU that is assigned to the resource group. To issue a Copy Services request to establish a volume pairing, an LSS pairing, or LCU pairing, the user must be authorized to access the source volume, source LSS, or source LCU. To issue a Copy Services request that operates on an LSS or LCU or has a session parameter, the user must be authorized to access that LSS or LCU.

When a scope mapping is removed from an -extuser or -extgroup, the default scope still applies.

3.2 Defining resource groups with the DS8000 GUI

The steps are explained to define resource groups with the DS8000 GUI.

DS8000 systems with LMC level 6.1: On DS8000 systems with LMC level 6.1, the GUI does not support the definition of resource groups. You must use the DSCLI.

3.2.1 Defining a resource group with the GUI

Figure 3-1 shows how to select resource groups on the main page of the GUI. Then, select **Actions** and select **Create Resource Group**. You specify the label and the name or description.

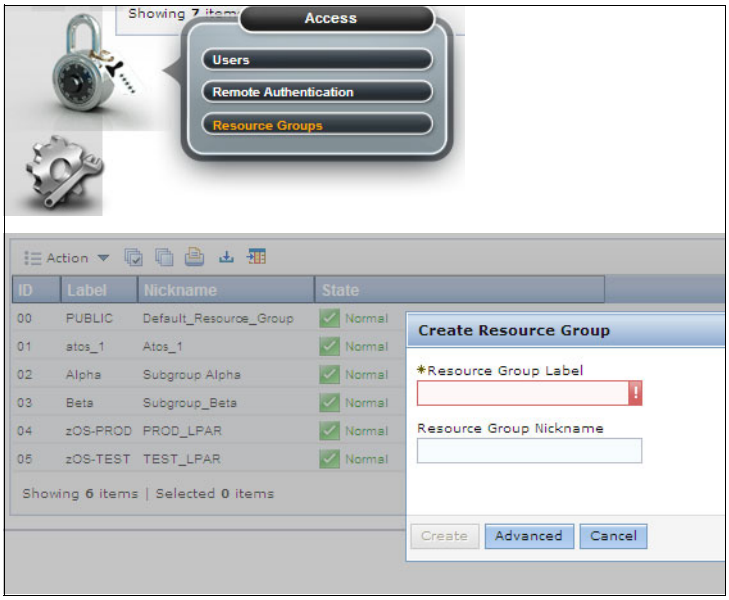


Figure 3-1 Defining a resource group with the DS8000 GUI

Click **Advanced** to select a resource group number manually and to specify the Copy Services Global Resource Scope (shown in Figure 3-2). It defaults to the resource group label (RGL). Here, you can also define the Global Mirror parameters for resource groups.

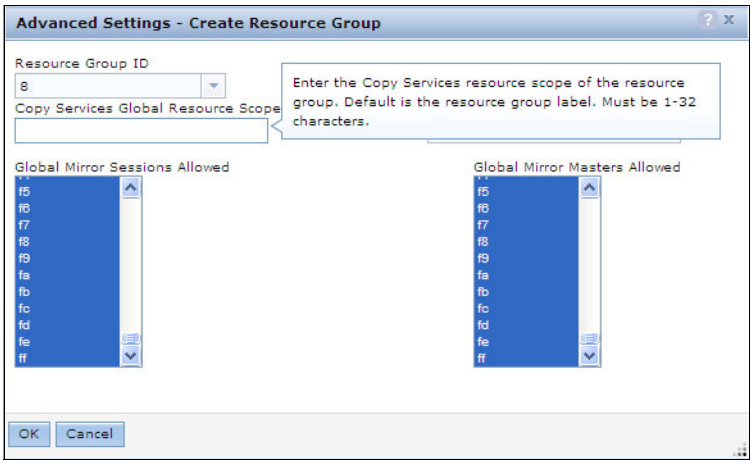


Figure 3-2 Advanced settings for resource groups

You can see a list of your defined resource groups as shown in Figure 3-3.

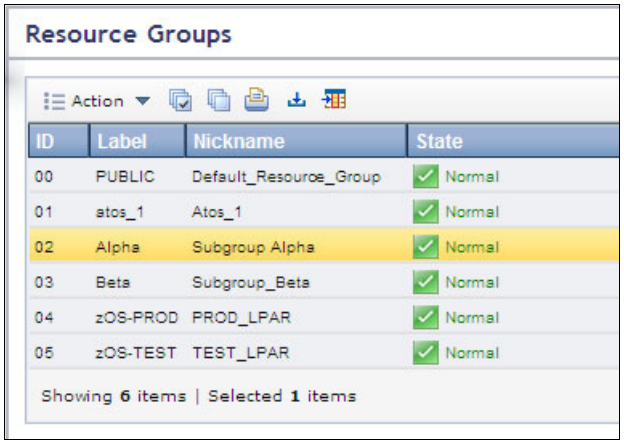


Figure 3-3 List of defined resource groups

You can select a resource group, click **Actions**, and select **Properties** to see and modify settings (see Figure 3-4).

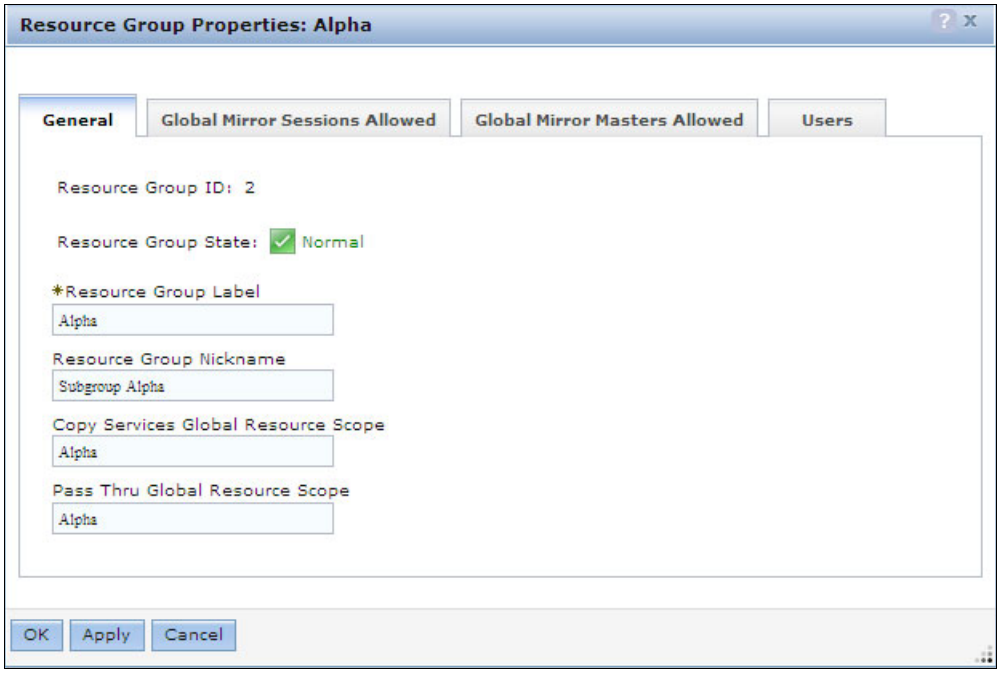


Figure 3-4 Resource Group properties

By selecting the Users tab, you can see what DS8000 users have a user scope for the selected resource group (see Figure 3-5).

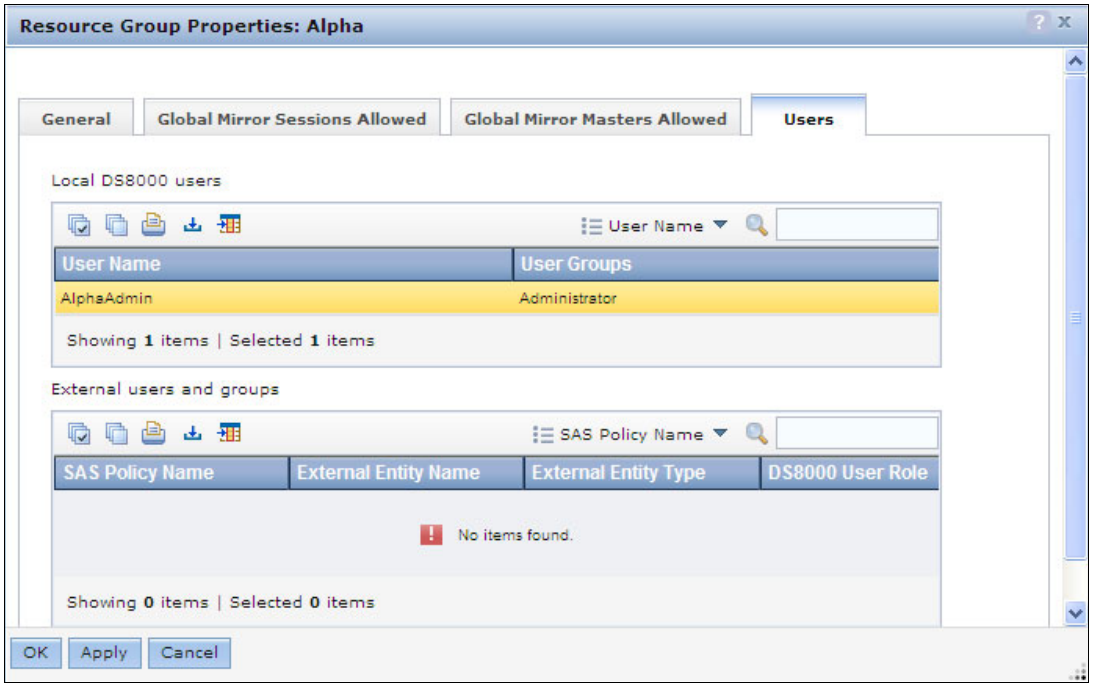


Figure 3-5 Users with a scope for the selected resource group

3.2.2 Defining volumes and LSS/LCUs with a resource group attribute

Figure 3-6 shows how you can select a predefined resource group for a volume. The example shows the creation of an FB volume. When you define a CKD volume, the procedure is similar.

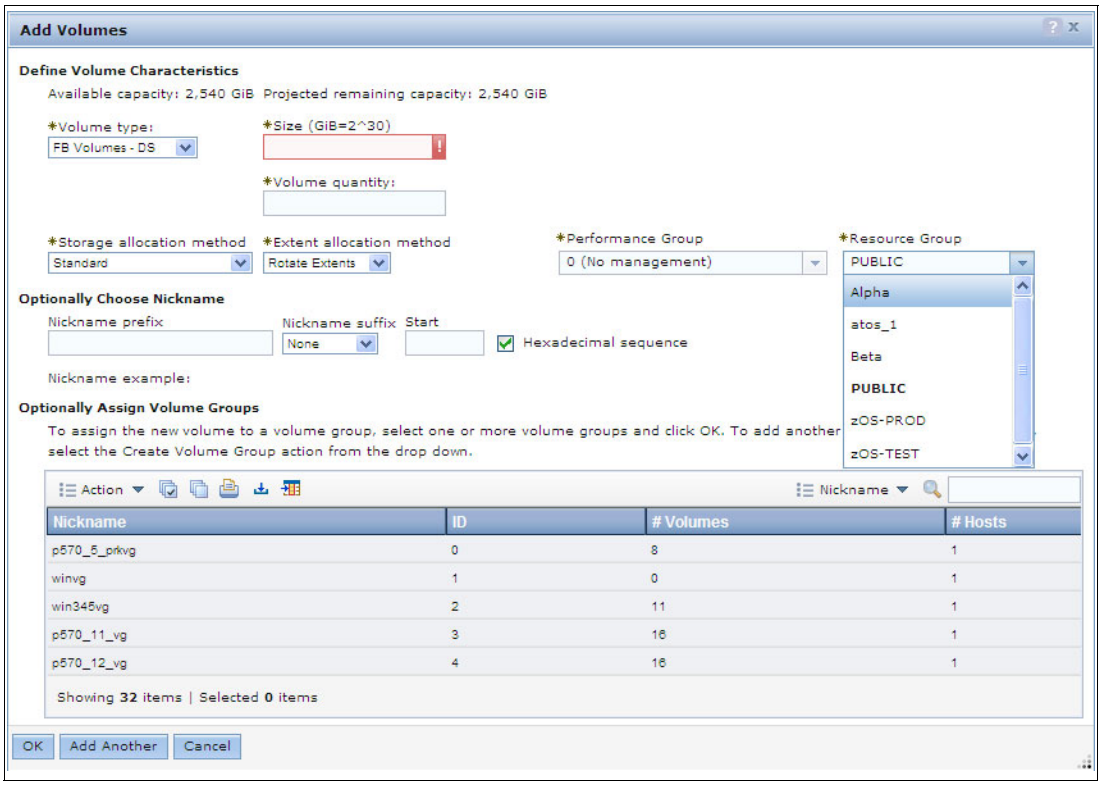


Figure 3-6 Specifying a resource group for an FB volume

When you use resource groups, also specify the resource group for the involved LSS and LCUs. Open systems LSSs are automatically created when a LUN is defined. You can modify an LSS by selecting it and selecting **Actions** → **Properties**. Figure 3-7 shows the LSS Properties window where you can select a predefined resource group.

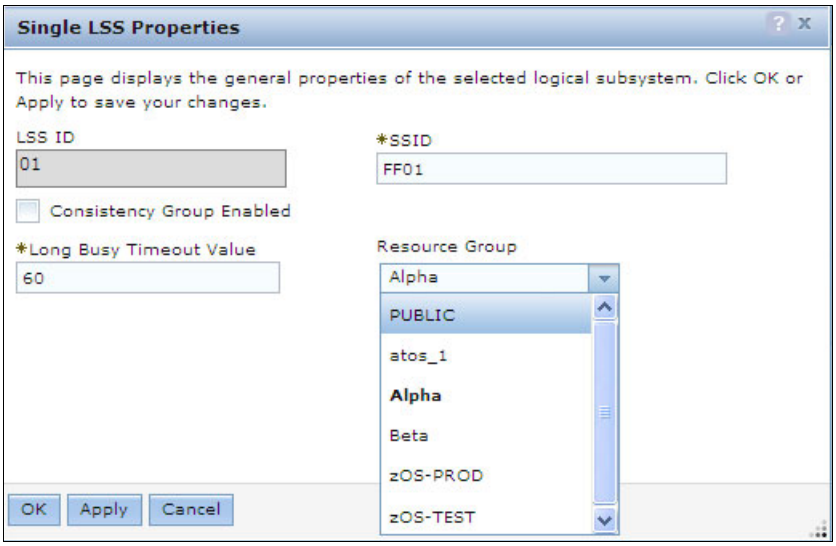


Figure 3-7 Selecting a resource group for an LSS

3.2.3 Creating a user with a resource scope

When you add or modify a user, you can set the user resource scope as shown in Figure 3-8. The scope of the user that creates the user must be an asterisk (*) or identical to the scope of the new user.

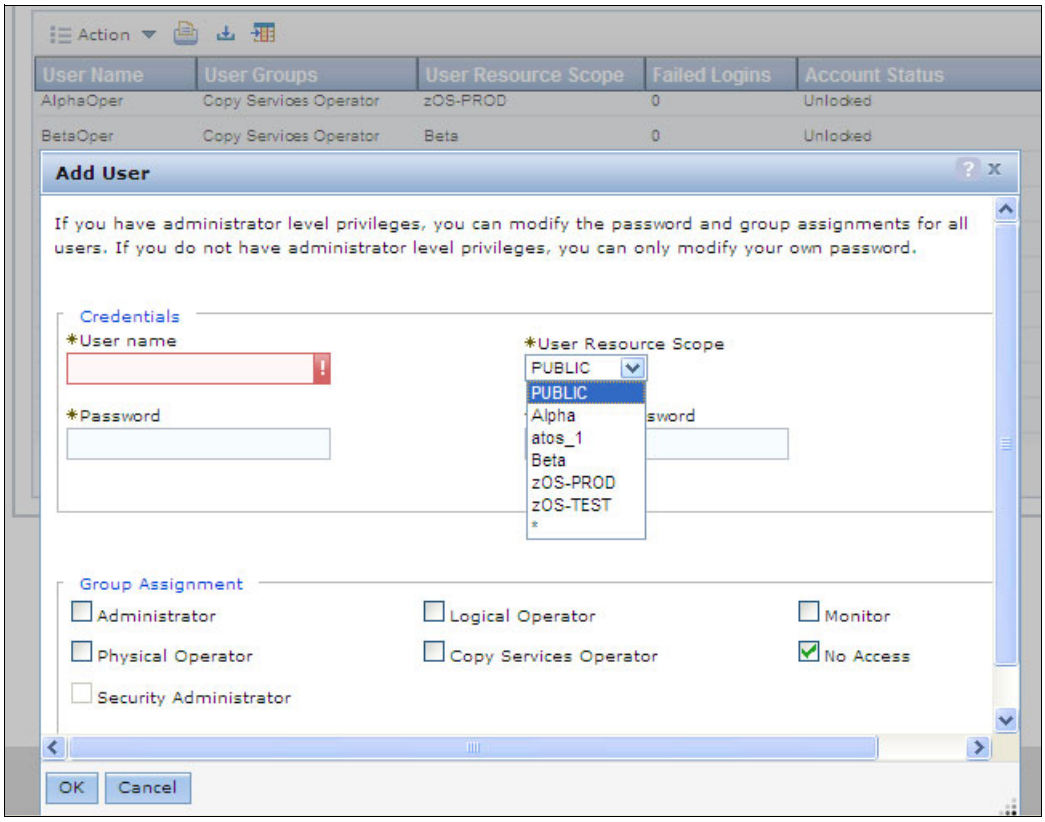


Figure 3-8 Adding a user with a user resource scope

3.3 Usage examples

The use of resource groups in an existing environment is described. Changes are required to use resource groups. Assume that you want to set up the following environment:

- Working with three tenants: TenantA, TenantB, and TenantC.
- Working with three users: Wolf, Klaus, and Thomas.
- Wolf needs to be able to manage (CopyServices) *all* volumes (0100 - 0103, 0200 - 0203, and 0300 - 0303).
- Klaus only manages TenantA volumes (RG2) (0200 - 0203).
- Thomas only manages TenantC volumes (RG3) (0300 - 0303).

When resource groups are used to partition the resources of the storage facility between tenants of a multi-tenancy environment, usually all of the resources that are assigned to a tenant are associated with a single resource group that is configured for the tenant's resources.

A resource group for tenant TenantA might typically have RGL=TenantA, CS_GRS=TenantA, P_GRS=TenantA, GMMastersAllowed=TenantA_Sessions, and GMSessionsAllowed=TenantA_Sessions. TenantA_Sessions specify one or more Global Mirror session numbers that are to be used exclusively by the tenant. When a tenant is enabled to use Copy Services, any LCUs or LSSs that are associated with the tenant's logical volumes must also be assigned to the tenant's resource group, along with the tenant's logical volumes to use the policies of the resource group effectively.

3.3.1 Defining resource groups

Use the **mkregrp** command to define a resource group for each tenant:

```
dscli> mkresgrp -label TenantA rg1
Date/Time: 10. März 2011 18:16:13 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00432I mkresgrp: Resource group RG1 successfully created.

dscli> mkresgrp -label TenantB rg2
Date/Time: 10. März 2011 18:16:25 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00432I mkresgrp: Resource group RG2 successfully created.

dscli> mkresgrp -label TenantC rg3
Date/Time: 10. März 2011 18:16:40 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00432I mkresgrp: Resource group RG3 successfully created.
```

The definitions can be verified with the **showsgrp** command:

```
dscli> showresgrp rg1
Date/Time: 10. März 2011 18:18:35 MEZ IBM DSCLI Version: 5.4.34.33 DS:
IBM.2107-1303241
ID                  RG1
Name                -
State               Normal
Label               TenantA
CS_Global_RS        PUBLIC
Passthru_Global_RS  PUBLIC
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF

dscli> showresgrp rg2
Date/Time: 10. Mörz 2011 18:18:40 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
ID                  RG2
Name                -
State               Normal
Label               TenantB
CS_Global_RS        PUBLIC
Passthru_Global_RS  PUBLIC
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF

dscli> showresgrp rg3
Date/Time: 10. Mörz 2011 18:18:42 MEZ IBM DSCLI Version: 5.4.34.33 DS:
IBM.2107-1303241
ID                  RG3
Name                -
State               Normal
Label               TenantC
```

```
CS_Global_RS        PUBLIC
Passthru_Global_RS  PUBLIC
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF
```

3.3.2 Managing resource groups

Use the **manageresgrp** command to assign control policies:

```
dscli> manageresgrp -action set -ctrl copyglobal -scope TenantA rg1
Date/Time: 10. Mörz 2011 18:19:22 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00436I manageresgrp: Resource group rg1 successfully modified.

dscli> manageresgrp -action set -ctrl passglobal -scope TenantA rg1
Date/Time: 10. Mörz 2011 18:19:31 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00436I manageresgrp: Resource group rg1 successfully modified.

dscli> manageresgrp -action set -ctrl copyglobal -scope TenantB rg2
Date/Time: 10. Mörz 2011 18:20:00 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00436I manageresgrp: Resource group rg2 successfully modified.

dscli> manageresgrp -action set -ctrl passglobal -scope TenantB rg2
Date/Time: 10. Mörz 2011 18:20:09 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00436I manageresgrp: Resource group rg2 successfully modified.

dscli> manageresgrp -action set -ctrl copyglobal -scope TenantC rg3
Date/Time: 10. Mörz 2011 18:20:22 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00436I manageresgrp: Resource group rg3 successfully modified.

dscli> manageresgrp -action set -ctrl passglobal -scope TenantC rg3
Date/Time: 10. Mörz 2011 18:20:30 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00436I manageresgrp: Resource group rg3 successfully modified.
```

Again, use the **showresgrp** command for verification:

```
dscli> showresgrp rg1
Date/Time: 10. Mörz 2011 18:20:37 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
ID                  RG1
Name                -
State               Normal
Label               TenantA
CS_Global_RS        TenantA
Passthru_Global_RS  TenantA
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF

dscli> showresgrp rg2
Date/Time: 10. Mörz 2011 18:20:44 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
ID                  RG2
Name                -
State               Normal
Label               TenantB
CS_Global_RS        TenantB
Passthru_Global_RS  TenantB
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF
```

```
dscli> showresgrp rg3
Date/Time: 10. Mörz 2011 18:20:46 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
ID                  RG3
Name                -
State               Normal
Label               TenantC
CS_Global_RS        TenantC
Passthru_Global_RS  TenantC
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF
```

3.3.3 Changing volumes and adding the RG

In our example, we modify existing CKD volumes to change the resource group from the default RG0 to a specific resource group. For open systems FB volumes, you use the **chfbvol** command.

Use the **chckdvol** command to assign specific resource groups to the appropriate volumes:

```
dscli>  chckdvol -resgrp rg1 0100-0103
Date/Time: 10. Mörz 2011 18:25:00 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00022I chckdvol: CKD Volume 0100 successfully modified.
CMUC00022I chckdvol: CKD Volume 0101 successfully modified.
CMUC00022I chckdvol: CKD Volume 0102 successfully modified.
CMUC00022I chckdvol: CKD Volume 0103 successfully modified.

dscli>  chckdvol -resgrp rg2 0200-0203
Date/Time: 10. Mörz 2011 18:25:13 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00022I chckdvol: CKD Volume 0200 successfully modified.
CMUC00022I chckdvol: CKD Volume 0201 successfully modified.
CMUC00022I chckdvol: CKD Volume 0202 successfully modified.
CMUC00022I chckdvol: CKD Volume 0203 successfully modified.

dscli>  chckdvol -resgrp rg3 0300-0303
Date/Time: 10. Mörz 2011 18:25:24 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00022I chckdvol: CKD Volume 0300 successfully modified.
CMUC00022I chckdvol: CKD Volume 0301 successfully modified.
CMUC00022I chckdvol: CKD Volume 0302 successfully modified.
CMUC00022I chckdvol: CKD Volume 0303 successfully modified.
```

We check the status by using the **showckdvol** command:

```
dscli> showckdvol 0201
Date/Time: 10. Mörz 2011 18:25:50 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
Name           -
ID             0201
accstate       Online
datastate      Normal
configstate    Normal
deviceMTM      3390-3
volser         -
datatype       3390
voltype        CKD Base
orgbvols       -
addrgrp        0
```

```
extpool        P0
exts           3
cap (cyl)      3339
cap (10^9B)    2.8
cap (2^30B)    2.6
ranks          1
sam            Standard
repcapalloc    -
eam            rotatevols
reqcap (cyl)   3339
cap (Mod1)     3.0
realextents    3
virtualextents 0
resgrp         RG2
```

3.3.4 Changing the user and adding the scope

We show an example with CKD volumes for z/OS. Normally, z/OS users use z/OS host commands to send Copy Services commands in-band through the FICON channels to the DS8000. In this case, no DS8000 user ID is involved, and the commands are treated as though they come from a scope * (asterisk) user. In our example, we manage Copy Services by DS8000 users in the same way as in an open systems environment.

When you create a DS8000 user, assign it a scope or use the **chuser** command to set the user's scope of control for an existing user. You need an admin user with scope * (in our example, the user wolf) to be able to change a scope of another user. In our example, user wolf must already have scope *. Scope * is the default when you create a user with the DSCLI, but scope PUBLIC is the default when you create a user with the DS GUI:

```
dscli> showuser wolf
Date/Time: 10. Mörz 2011 18:42:17 MEZ IBM DSCLI Version: 5.4.34.33 DS: -
Name        wolf
Group       admin
State       active
FailedLogin 0
Scope       *
```

Now, user wolf changes the scope for the other users:

```
dscli> chuser -scope TenantB klaus
Date/Time: 10. Mörz 2011 18:41:36 MEZ IBM DSCLI Version: 5.4.34.33 DS: -
CMUC00134I chuser: User klaus successfully modified.

dscli> chuser -scope TenantC thomas
Date/Time: 10. Mörz 2011 18:42:00 MEZ IBM DSCLI Version: 5.4.34.33 DS: -
CMUC00134I chuser: User thomas successfully modified.
```

We check the settings:

```
dscli> showuser klaus
Date/Time: 10. Mörz 2011 18:42:25 MEZ IBM DSCLI Version: 5.4.34.33 DS: -
Name        klaus
Group       admin
State       active
FailedLogin 0
Scope       TenantB
```

```
dscli> showuser thomas
Date/Time: 10. Mörz 2011 18:42:34 MEZ IBM DSCLI Version: 5.4.34.33 DS: -
Name        thomas
Group       admin
State       active
FailedLogin 0
Scope       TenantC
```

3.3.5 Testing FlashCopy

The use of the FlashCopy function according to our sample environment is illustrated:

- Working with three RGs: TenantA, TenantB, and TenantC.
- Working with three users: Wolf, Klaus, and Thomas.
- Wolf must be able to manage (CopyServices) *all* volumes (0100 - 0103, 0200 - 0203, and 0300 - 0303). However, Wolf is restricted to FlashCopy operations within a resource group, so Wolf cannot copy volume 0100 to volume 0200, for example. Klaus can only manage TenantA volumes (RG2) (0200 - 0203). And, Thomas can manage only TenantC volumes (RG3) (0300 - 0303).

In Example 3-10, the commands are issued by user Wolf.

Example 3-10 User Wolf

```
dscli> mkflash 0100:0102
Date/Time: 10. Mörz 2011 18:47:16 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00137I mkflash: FlashCopy pair 0100:0102 successfully created.

dscli> mkflash 0200:0202
Date/Time: 10. Mörz 2011 18:47:24 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00137I mkflash: FlashCopy pair 0200:0202 successfully created.

dscli> mkflash 0300:0302
Date/Time: 10. Mörz 2011 18:47:33 MEZ IBM DSCLI Version: 5.4.34.33 DS:
IBM.2107-1303241
CMUC00137I mkflash: FlashCopy pair 0300:0302 successfully created.

But a FlashCopy crossing Resource Group boundaries fails:

dscli> mkflash 0203:0303
Date/Time: 10. Mörz 2011 18:49:37 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUN03176E mkflash: 0203:0303: The task cannot be initiated because a user
resource scope policy violation has occurred on the destination logical volume.
```

In Example 3-11, the commands are issued by user Klaus.

Example 3-11 User Klaus

```
dscli> mkflash 0101:0103
Date/Time: 10. Mörz 2011 18:52:59 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUN03176E mkflash: 0101:0103: The task cannot be initiated because a user
resource scope policy violation has occurred on the destination logical volume.

dscli> mkflash 0201:0203
Date/Time: 10. Mörz 2011 18:53:07 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00137I mkflash: FlashCopy pair 0201:0203 successfully created.
```

```
dscli> mkflash 0301:0303
Date/Time: 10. Mörz 2011 18:53:13 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUN03176E mkflash: 0301:0303: The task cannot be initiated because a user
resource scope policy violation has occurred on the destination logical volume.
```

In Example 3-11 on page 41, the commands are issued by user Thomas.

Example 3-12 User Thomas

```
dscli> mkflash 0101:0103
Date/Time: 10. Mörz 2011 18:56:16 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUN03176E mkflash: 0101:0103: The task cannot be initiated because a user
resource scope policy violation has occurred on the destination logical volume.

dscli> mkflash 0201:0203
Date/Time: 10. Mörz 2011 18:56:24 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUN03176E mkflash: 0201:0203: The task cannot be initiated because a user
resource scope policy violation has occurred on the destination logical volume.

dscli> mkflash 0301:0303
Date/Time: 10. Mörz 2011 18:56:32 MEZ IBM DSCLI Version: 5.4.34.33 DS: IBM.2107-13
CMUC00137I mkflash: FlashCopy pair 0301:0303 successfully created.
```

3.3.6 Delete environment

If an environment must be deleted, all parts (volumes/LSS) have to be reassigned to a valid resource group. As a preferred security practice, all spare volumes must be reassigned to a Service Domain RG of RGSpare (RG*n*) to prevent the accidental or deliberate overwriting of data. Before it can be deleted, the resource group must be empty (that is, with nothing assigned to it anymore).

4

Implementing and using resource groups

This chapter includes additional practical information that relates to the implementation and use of the resource group functionality.

4.1 Required code level

The functionality of resource groups is enabled by default and does not require an activation license key. The functions of resource groups are automatically activated when you install the Release 6.1 microcode (that is, Licensed Machine Code (LMC) level 6.6.1.*xx* for the DS8700 and LMC level 7.6.1.*xx* for the DS8800). The functions of resource groups are available on all LMC levels of the DS8870.

4.2 Migration considerations

Several practical considerations are involved when you migrate from a non-resource group microcode environment on a DS8000 that has resource group support.

Initially, all volumes are automatically placed into resource group 0 (RG0) with a resource group label (RGL) = 'PUBLIC'. By itself, this assignment of volumes to RG0 does not affect the current Copy Services environment.

Assume that you migrate to RGs in a multi-tenant environment and with two sets of client data on a single DS8000 (Figure 4-1). Assume also that no remote mirroring connection is established with the remote site yet. The approach is to verify how the two sets of data are securely protected from each other.

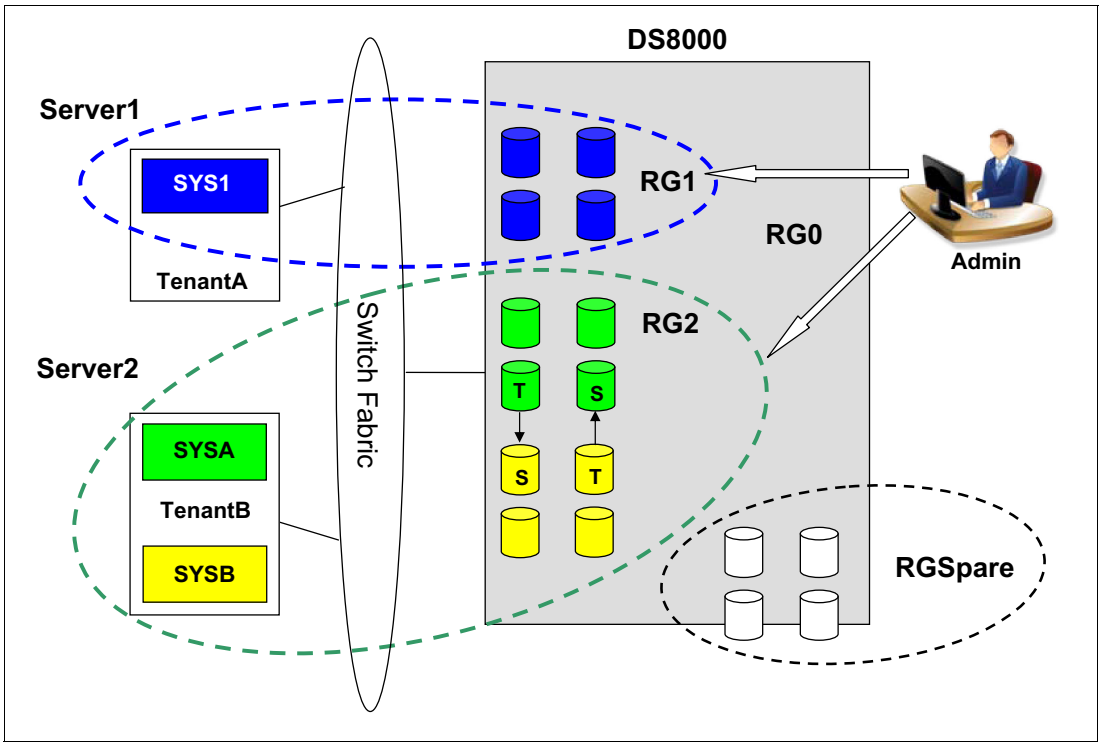


Figure 4-1 Multi-tenant environment

Example 4-1 illustrates the status of the resource group if resource groups are not yet used. Each volume is placed into the default RG0, which does not affect the existing environment. The procedures that are used to manage the mirrored environment also are not changed.

Example 4-1 Default resource group RG0

```
dscli> lsresgrp
Date/Time: May 20, 2011 10:49:41 PM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.210
ID  Name                  State  Label
=======================================
RG0 Default_Resource_Group Normal PUBLIC
dscli>
```

To set up the environment as depicted in Figure 4-1 on page 44, first define the resource groups and set the resource group scope. This task is shown in 3.3.1, “Defining resource groups” on page 37 and 3.3.2, “Managing resource groups” on page 38.

Next, set the user resource scope by using the **chuser** command. This function can be performed by the admin user with scope * only. Example 4-2 shows two defined resource groups.

Example 4-2 Listing resource groups

```
dscli> lsresgrp -dev IBM.2107-75H1351 -l
Date/Time: May 23, 2011 10:44:58 PM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.210
ID  Name                  State  Label
=======================================
RG0 Default_Resource_Group Normal PUBLIC
RG1 TenantA_DATA          Normal TenantA
RG2 TenantB_DATA          Normal TenantB
```

In Example 4-3, we use the **chuser** command with the **-scope** parameter to assign a user resource scope to a specific tenant. The two users with the role of Copy Services operator are assigned in the following way:

- TenantA with resources in RG1 is managed by user RGrich.
- TenantB with resources in RG2 is managed by user RGmax.

Example 4-3 Changing the -scope on the RG user ID

```
dscli> chuser -scope TenantA RGrich
Date/Time: May 26, 2011 7:43:46 PM CEST IBM DSCLI Version: 7.6.10.464 DS: -
CMUC00134I chuser: User RGrich successfully modified.

dscli> chuser -scope TenantB RGmax
Date/Time: May 26, 2011 7:43:46 PM CEST IBM DSCLI Version: 7.6.10.464 DS: -
CMUC00134I chuser: User RGrich successfully modified.
```

In Example 4-4 on page 46, we implicitly assign LCU 20 to be managed by user RGrich (RG1) and LCU 22 to be managed by user RGmax (RG2). To verify that all volumes 2000 - 2004 in LCU 20 are protected against any action from user RGmax, we assign LCU20 to RG1 and LCU22 to RG2.

For open systems, use the **chlss** command to modify a logical subsystem (LSS).

Example 4-4 Assigning LCUs to resource groups

```
dscli> chlcu -resgrp RG1 20
Date/Time: May 27, 2011 12:34:07 AM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.210
CMUC00018I chlcu: LCU 20 successfully modified.
dscli> chlcu -resgrp RG2 22
Date/Time: May 27, 2011 12:38:49 AM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.210
CMUC00018I chlcu: LCU 22 successfully modified.
```

In Example 4-5, we also tie the volumes to the relevant RG ID. This action dedicates the volumes to the respective tenants and their corresponding Copy Services operator. In our scenario, volumes 2200 - 2204 belong to TenantB and volumes 2000 - 2004 belong to TenantA.

For open systems fixed block (FB) volumes, use the **chfbvol** with the **-resgrp** option.

Example 4-5 Assigning volumes to resource groups

```
dscli> chckdvol -dev ibm.2107-75H1351 -resgrp RG2
Date/Time: May 23, 2011 11:39:27 PM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.210
CMUC00022I chckdvol: CKD Volume 2200 successfully modified.
CMUC00022I chckdvol: CKD Volume 2201 successfully modified.
CMUC00022I chckdvol: CKD Volume 2202 successfully modified.
CMUC00022I chckdvol: CKD Volume 2203 successfully modified.
CMUC00022I chckdvol: CKD Volume 2204 successfully modified.

dscli> chckdvol -dev ibm.2107-75H1351 -resgrp RG1
Date/Time: May 26, 2011 8:23:09 PM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.2107
CMUC00022I chckdvol: CKD Volume 2000 successfully modified.
CMUC00022I chckdvol: CKD Volume 2001 successfully modified.
CMUC00022I chckdvol: CKD Volume 2002 successfully modified.
CMUC00022I chckdvol: CKD Volume 2003 successfully modified.
CMUC00022I chckdvol: CKD Volume 2004 successfully modified.
```

In Example 4-6, we define the activity that the user can perform in a multi-tenant environment and its associated RGs. The **copyglobal** parameter defines the Copy Services Global Resource Scope (CS_GRS), which is used in this example.

Example 4-6 Setting Global Copy Services Resource Scope

```
dscli> manageresgrp -action set -ctrl copyglobal -scope TenantA RG1
Date/Time: May 24, 2011 1:57:08 AM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.2107
CMUC00436I manageresgrp: Resource group RG1 successfully modified.

dscli> manageresgrp -action set -ctrl copyglobal -scope TenantB RG2
Date/Time: May 24, 2011 1:57:38 AM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.2107
CMUC00436I manageresgrp: Resource group RG2 successfully modified.
```

Important: When you want to set up a remote mirroring environment, define resource groups also at the remote DS8000. You are highly advised to use the same resource group number, labels, and scopes as you use on the local system.

We assume that we created the same resource groups at the remote DS8000.

To verify that the protection works as expected, we log in as user RGrich (TenantA) and try to manipulate one volume pair, 2200:2200 (the first volume in the local DS8000 and the second

volume in the remote DS8000, that both belong to TenantB). As shown in Example 4-7, we receive a resource policy violation, as expected.

Example 4-7 Trying to access TenantB data from the TenantA user ID

```
dscli> mkpprc -dev IBM.2107-75h1351 -remotedev IBM.2107-75WR901 -type mmir
2200:2200
Date/Time: May 26, 2011 8:36:55 PM CEST IBM DSCLI Version: 7.6.10.464 DS: IBM.2107
CMUN03162E mkpprc: 2200:2200: The CKD PPRC relationship cannot be created because
a resource scope policy violation has occurred.
```

4.3 Example with remote mirroring

Another example of the use of resource groups in a Metro Mirror environment is described. We use count key data (CKD) volumes, but we compare Copy Services operations that are performed by a z/OS operator with operations that can be performed by a DS8000 user.

We prepared an environment as shown in Figure 4-2. Two address ranges 3A*nn* and 3B*nn* with LCUs 3A and 3B are shown in both the local (Site 1) DS8000 and the remote (Site 2) DS8000. Address range 3A*nn* and LCU 3A are in resource group RG4 with label zOS-PROD in both Site 1 and Site 2. Address range 3B*nn* and LCU 3B are in resource group RG5 with label zOS-TEST in both Site 1 and Site 2 DS8000 systems.

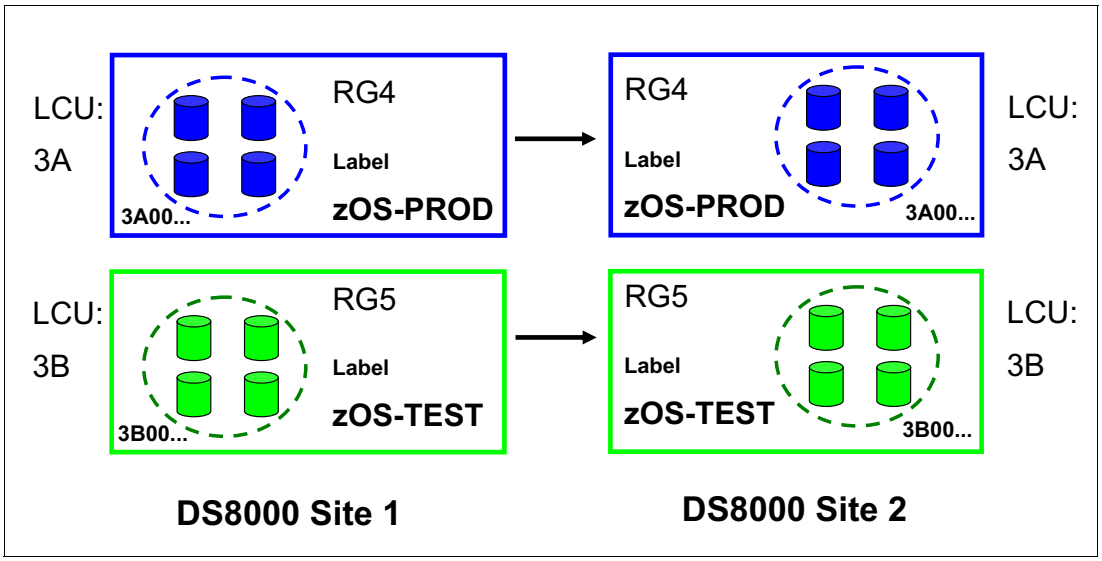


Figure 4-2 Environment for Metro Mirror example

Example 4-8 shows the query commands to verify the setup. The output of several commands is truncated to show only the relevant parts of the output.

Example 4-8 Test environment as queried with DSCLI (edited to show only the relevant parts)

```
Primary:
dscli> showresgrp rg4
Date/Time: October 12, 2012 11:56:46 AM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
ID                  RG4
Name                PROD_LPAR
State               Normal
Label               zOS-PROD
```

```
CS_Global_RS        zOS-PROD
Passthru_Global_RS  zOS-PROD

dscli> showresgrp rg5
Date/Time: October 12, 2012 12:05:15 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
ID                  RG5
Name                TEST_LPAR
State               Normal
Label               zOS-TEST
CS_Global_RS        zOS-TEST
Passthru_Global_RS  zOS-TEST


dscli> lsckdvol -l 3A00-3A01
Date/Time: October 12, 2012 12:06:49 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
Name     ID    deviceMTM volser  voltype  extpool cap (cyl)  perfgrp resgrp
==========================================================================
ckd_3A00 3A00  3390-3    RS3A00  CKD Base P0           1113  PG0     RG4
ckd_3A01 3A01  3390-3    RS3A01  CKD Base P0           1113  PG0     RG4

dscli> lsckdvol -l 3B00-3B01
Date/Time: October 12, 2012 12:07:13 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
Name     ID    deviceMTM volser  voltype  extpool cap (cyl)  perfgrp resgrp
============== ============================================================
ckd_3B00 3B00  3390-3    RS3B00  CKD Base P1           1113  PG0     RG5
ckd_3B01 3B01  3390-3    RS3B01  CKD Base P1           1113  PG0     RG5

dscli> lslcu -l 3A-3B
Date/Time: October 12, 2012 12:08:45 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
ID Group addrgrp confgvols subsys conbasetype resgrp
=================================================
3A     0 3             256 0x3A00 3990-6      RG4
3B     1 3             256 0x3B00 3990-6      RG5

Secondary:
dscli> showresgrp rg4
Date/Time: October 12, 2012 12:05:50 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA181
ID                  RG4
Name                zOS-PROD
State               Normal
Label               zOS-PROD
CS_Global_RS        zOS-PROD
Passthru_Global_RS  zOS-PROD

dscli> showresgrp rg5
Date/Time: October 12, 2012 12:06:08 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA181
ID                  RG5
Name                zOS-TEST
State               Normal
Label               zOS-TEST
CS_Global_RS        zOS-TEST
Passthru_Global_RS  zOS-TEST

dscli> lsckdvol -l 3A00-3A01
Date/Time: October 12, 2012 12:07:50 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA181
```

```
Name      ID   deviceMTM volser  voltype  extpool cap (cyl)  perfgrp resgrp
==========================================================================
ITSO_3A00 3A00 3390-3    RS3A00  CKD Base P0           1113  PG0     RG4
ITSO_3A00 3A01 3390-3    -       CKD Base P0           1113  PG0     RG4

dscli> lsckdvol -l 3B00-3B01
Date/Time: October 12, 2012 12:08:11 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA181
Name      ID   deviceMTM volser  voltype  extpool cap (cyl)  perfgrp resgrp
==========================================================================
ITSO_3B00 3B00 3390-3    RS3B00  CKD Base P1           1113  PG0     RG5
ITSO_3B01 3B01 3390-3    -       CKD Base P1           1113  PG0     RG5


dscli> lslcu -l 3A-3B
Date/Time: October 12, 2012 12:09:50 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA181
ID Group addrgrp confgvols subsys conbasetype resgrp
==================================================
3A     0 3               6 0x3A00 3990-6      RG4
3B     1 3               6 0x3B00 3990-6      RG5
```

Now, we try to establish Metro Mirror paths for the following relationships:

- LCU 3A (Site 1) to LCU 3A (Site 2) by a DS8000 user with scope for zOS-PROD
- LCU 3B (Site 1) to LCU 3B (Site 2) by a DS8000 user with scope for zOS-PROD
- LCU 3A (Site 1) to LCU 3B (Site 2) by a DS8000 user with scope for zOS-PROD
- LCU 3A (Site 1) to LCU 3A (Site 2) by a z/OS operator (implicit scope *)
- LCU 3B (Site 1) to LCU 3B (Site 2) by a z/OS operator (implicit scope *)
- LCU 3A (Site 1) to LCU 3B (Site 2) by a z/OS operator (implicit scope *)

Figure 4-3 shows the two users and the Metro Mirror paths that they try to set up.

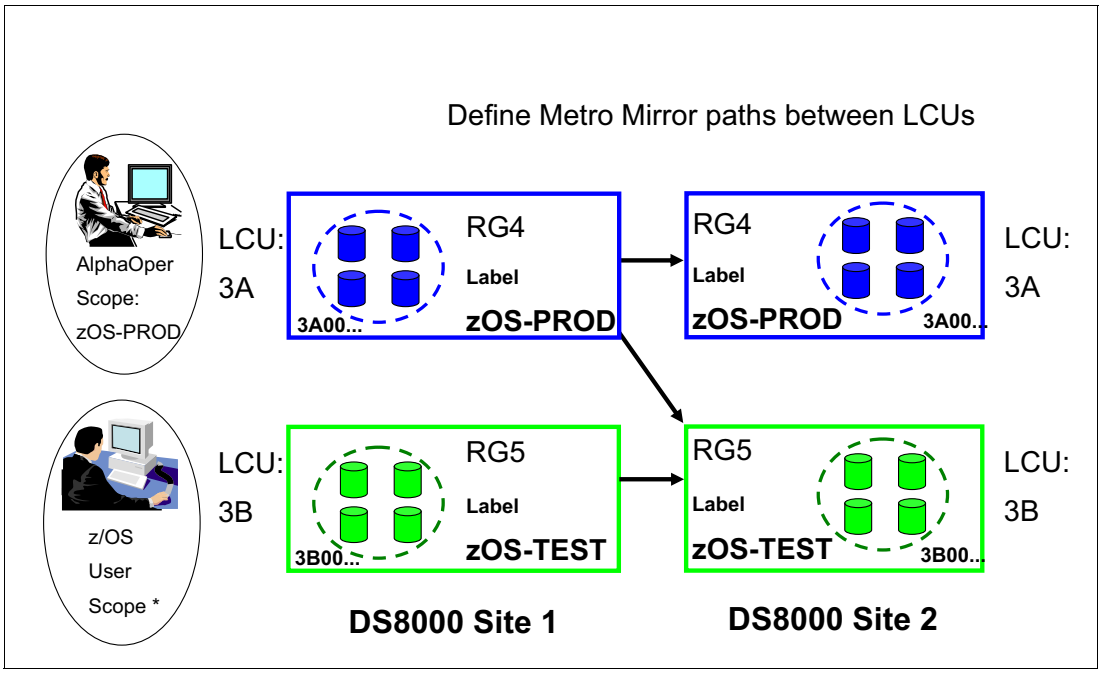


Figure 4-3 Setup of Metro Mirror paths by two users

Example 4-9 shows the output of a **showuser** command to verify that DS8000 user AlphaOper has a user resource scope of zOS-PROD.

Example 4-9 Scope of user AlphaOper

```
dscli> showuser AlphaOper
Date/Time: October 12, 2012 12:50:46 PM CEST IBM DSCLI Version: 7.7.0.566 DS: -
Name         AlphaOper
Group        op_copy_services
State        active
FailedLogin  0
DaysToExpire 356
Scope        zOS-PROD
```

Example 4-10 shows the results of the efforts of AlphaOper to establish Metro Mirror paths between the LCUs. AlphaOper can establish the paths between LCU 3A (Site 1) and 3A (Site 2) and also establish paths between LCU 3A (Site 1) and 3B (Site 2). AlphaOper *cannot* establish paths between LCU 3B (Site 1) and 3B (Site 2). To establish Metro Mirror paths by a DS8000 user, the scope of the user must match the *source* LCU/LSS scope. The *target LCU/LSS, however, is not checked*.

Example 4-10 Metro Mirror path setup by a DS8000 user with a scope of zOS-PROD

```
dscli> mkpprcpath -remotewwnn 5005076303FFD4D4 -srclss 3a -tgtlss 3a IO033:IO233
Date/Time: October 12, 2012 12:54:41 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
CMUC00149I mkpprcpath: Remote Mirror and Copy path 3a:3a successfully established.

dscli> mkpprcpath -remotewwnn 5005076303FFD4D4 -srclss 3A -tgtlss 3B IO033:IO233
Date/Time: October 12, 2012 12:55:02 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
CMUC00149I mkpprcpath: Remote Mirror and Copy path 3A:3B successfully established.

dscli> mkpprcpath -remotewwnn 5005076303FFD4D4 -srclss 3B -tgtlss 3B IO033:IO233
Date/Time: October 12, 2012 12:55:15 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
CMUN03177E mkpprcpath: 3B:3B: The task cannot be initiated because a user resource
scope policy violation has occurred on the destination logical subsystem.
```

Next, the results of a z/OS user or operator who wants to set up the same paths are shown. A z/OS user is treated like a DS8000 user with scope *. Example 4-11 shows the outcome of the CESTPATH jobs to establish Metro Mirror paths.

Example 4-11 Establish Metro Mirror paths by a z/OS user

```
ANTP8802I    CESTPATH  DEVN(X'3A00') PRIM(X'3A00' 5005076303FFD5AA X'3A') SEC (X'3A00' 5005076303FFD4D4 X'3A') LINK(X'00330233
ANTP0001I CESTPATH COMMAND COMPLETED FOR DEVICE 3A00. COMPLETION CODE: 00
ANTP8802I    CESTPATH  DEVN(X'3A00') PRIM(X'3A00' 5005076303FFD5AA X'3A') SEC (X'3B00' 5005076303FFD4D4 X'3B') LINK(X'00330233
ANTP0001I CESTPATH COMMAND COMPLETED FOR DEVICE 3A00. COMPLETION CODE: 00
ANTP8802I    CESTPATH  DEVN(X'3B00') PRIM(X'3B00' 5005076303FFD5AA X'3B') SEC (X'3B00' 5005076303FFD4D4 X'3B') LINK(X'00330233
ANTP0001I CESTPATH COMMAND COMPLETED FOR DEVICE 3B00. COMPLETION CODE: 00
```

All paths are established. So, the establishment of Metro Mirror paths is not limited for a z/OS user. However, the establishment of Metro Mirror volume pairs is limited by resource groups.

In the following example, we establish Metro Mirror volume pairs. The paths are established as shown in Example 4-11.

Example 4-12 on page 51 shows the results of the efforts of AlphaOper to establish some pairs.

Example 4-12 Establishment of Metro Mirror pairs by a DS8000 user with a scope of zOS-PROD

```
dscli> mkpprc -type mmir 3A00:3A00
Date/Time: October 12, 2012 12:56:20 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
CMUC00153I mkpprc: Remote Mirror and Copy volume pair relationship 3A00:3A00
successfully created.

dscli> mkpprc -type mmir 3A01:3B01
Date/Time: October 12, 2012 12:57:02 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
CMUN03162E mkpprc: 3A01:3B01: The CKD PPRC relationship cannot be created because
a target resource scope policy violation has occurred.

dscli> mkpprc -type mmir 3B00:3B00
Date/Time: October 12, 2012 12:57:31 PM CEST DSCLI: 7.7.0.566 DS: IBM.2107-75ZA571
CMUN03176E mkpprc: 3B00:3B00: The task cannot be initiated because a user resource
scope policy violation has occurred on the destination logical volume.
```

We see that AlphaOper *can* establish the 3A00:3A00 pair because the AlphaOper scope (zOS-PROD) matches the resource group scope of the source and target volumes. However, AlphaOper *cannot* establish the 3A01:3B01 pair because the target volume is in resource group zOS-TEST. AlphaOper *cannot* establish the pair 3B00:3B00 because AlphaOper is not authorized for volumes in resource group zOS-TEST.

Next, you see the result of a z/OS user who wants to establish the same volume pairs (see Example 4-13).

Example 4-13 z/OS user that establishes Metro Mirror pairs

```
CESTPAIR  DEVN(X'3A00') PRIM(X'3A00' ZA571 X'00' X'3A') SEC (X'3A00' ZA181 X'00' X'3A') ONLINSEC(YES) MODE(COPY) MSGREQ(YES)
ANTP0001I CESTPAIR COMMAND COMPLETED FOR DEVICE 3A00. COMPLETION CODE: 00
READY
CESTPAIR  DEVN(X'3B00') PRIM(X'3B00' ZA571 X'00' X'3B') SEC (X'3B00' ZA181 X'00' X'3B') ONLINSEC(YES) MODE(COPY) MSGREQ(YES)
ANTP0001I CESTPAIR COMMAND COMPLETED FOR DEVICE 3B00. COMPLETION CODE: 00
READY
 CESTPAIR  DEVN(X'3A01') PRIM(X'3A00' ZA571 X'01' X'3A') SEC (X'3B00' ZA181 X'01' X'3B') ONLINSEC(YES) MODE(COPY) MSGREQ(YES)
ANTP0274E PPRC CESTPAIR COMMAND FAILED FOR DEVICE 3A01. RESOURCE GROUP POLICY HAS BEEN VIOLATED, RSN=00.
ANTP0001I CESTPAIR COMMAND UNSUCCESSFUL FOR DEVICE 3A01. COMPLETION CODE: 08
```

The z/OS user can establish the pair 3A00:3A00 *and* the z/OS user can establish the pair 3B00:3B00 because of the user scope of *. The z/OS user *cannot* establish the pair 3A01:3B01. This action is prohibited by the resource group settings because source (Site 1) and target (Site 2) are in different resource groups.

4.4 Multi-tenancy considerations

The considerations are shown for IT service providers that provide outsourcing services to their clients and host multiple tenants on the same host servers and storage servers so that the tenants are isolated from each other.

To be effective, the IT service provider must control the host systems on which the tenants are hosted. Also, the IT service provider must control the I/O fabrics and storage devices that are attached to the servers that host the tenants. The IT service provider must control network attachments to these systems so that the tenant user IDs are prohibited from invoking functions that might compromise the isolation.

The following guidelines are provided for the IT services provider to implement with the resource group support that is defined for DS8000:

- On z/OS hosts, access to logical volumes is controlled through the z/OS host HCD. Tenant access to the host must be limited to prevent it from modifying the hardware configuration definition (HCD).
- On open systems hosts or logical partitions (LPARs), access to DS8000 logical volumes is controlled through logical volume assignment to volume groups and volume group assignments to SCSI host ports. Verify that implementations use the correct worldwide port name (WWPN) for the servers/LPARs in the SCSI host port objects. Tenants must be given access to only their assigned logical volumes.
- Licensed Internal Code (LIC) features for any Copy Services functions that you want must be installed on the applicable storage system.
- If the z/OS Distributed Data Backup LIC feature is enabled on Fibre Channel connection (FICON) interfaces, the volume group that is associated with the I/O port or the FICON host only supports a data sharing attribute that is set to the group-dependent default. This setting provides uncontrolled access to all FB volumes though a FICON I/O interface. The HCD for each System z LPAR must be defined so that the logical devices for any configured FB volumes are appropriately included or excluded.
- LIC versions that support resource groups must be installed on any DS8000 system that is expected to control Copy Services operations of tenants to the policies that are specified in resource groups.

  In particular, if for remote mirroring, a primary logical subsystem supports resource groups and a secondary logical subsystem does not support resource groups, there is generally no limiting of Peer-to-Peer Remote Copy (PPRC) relationships to the secondary logical volumes. The secondary logical volumes behave as though they are assigned to the default resource group.
- Each tenant must have a defined resource group with RGL='*x*', where '*x*' is a unique resource group label (RGL) that is assigned to that tenant. Set the following resource group attributes:
  - Set the Pass-thru Global Resource Scope (P_GRS) as P_GRS='*x*' if pass-through operations are allowed to be invoked by the tenant. Set P_GRS=(null) if pass-through operations are not allowed to be invoked by the tenant.
  - Set the Copy Services Global Resource Scope (CS_GRS) as CS_GRS='*x*' if Copy Services operations are allowed to be invoked by the tenant. Set CS_GRS=(null) if Copy Services operations are not allowed to be invoked by the tenant.
- If the tenant is not allowed to use Global Mirror or Metro-Global Mirror, use the **manageresgrp** command to set the GM Sessions Allowed attribute to none:

  ```
  manageresgrp –action set –ctrl gmsession –sessions none
  ```

  If the tenant is allowed to use Global Mirror or Metro-Global Mirror, set the GM Sessions Allowed attribute to enable one GM session number that is assigned to only this tenant.

  For more information, see the **managersgrp** command syntax.
- All LSSs that are assigned to the tenant are associated with the resource group of the tenant.
- All logical volumes that are assigned to the tenant are configured on LSSs that are assigned to the tenant and are associated with the resource group of the tenant. CKD and FB logical volumes for a certain tenant can be mixed in the same RG.
- Logical volumes that are not assigned to any tenant need to be placed in a resource group other than the default resource group to prevent tenants from accessing these volumes as Copy Services targets/secondaries.

- Copy Services operations are allowed to be invoked from a System z LPAR through FICON I/O attachment interfaces (in-band), including commands that are associated with any of the following facilities:
  - Concurrent Copy
  - RMZ (XRC)
  - RMZ Incremental Resync
  - PPRC
  - Metro Mirror
  - Global Mirror
  - Metro-Global Mirror
  - FlashCopy
  - FlashCopy SE

  Any requested Copy Services logical volume relationships are limited to operations within resource groups.
- Tenant user IDs on DS8000 must be limited to no access, monitor, or Copy Services operator access authority. The user resource scope (URS) that is assigned to a tenant user ID must be identical to the tenant's assigned RGL='*x*'.

4.5 IBM System z considerations

In a z/OS environment, in addition to the DSCLI, several interfaces are available to configure and manage the DS8000 Copy Services functions, such as FlashCopy and Metro Mirror (PPRC):

- TSO commands
- ICKDSF utility commands
- DFSMSdss utility
- ANTRQST application programming interface (API)

4.5.1 z/OS examples

Several examples of the z/OS DFSMSdss COPY command are used to illustrate how resource groups work in a z/OS environment. We set up an environment with two resource groups as shown in Example 4-14.

Example 4-14 Define resource groups for DFSMSdss test

```
dscli> mkresgrp -label zOS-PROD -name PROD_LPAR RG4
Date/Time: October 5, 2012 2:45:56 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
CMUC00432I mkresgrp: Resource group RG4 successfully created.

dscli> mkresgrp -label zOS-TEST -name TEST_LPAR RG5
Date/Time: October 5, 2012 2:46:50 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
CMUC00432I mkresgrp: Resource group RG5 successfully created.
```

We assigned CKD volumes to these resource groups as shown in Example 4-15.

Example 4-15 Set up RG environment for DFSMSdss test

```
dscli> chckdvol -resgrp RG4 3A00-3A03
Date/Time: October 5, 2012 2:47:56 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
CMUC00022I chckdvol: CKD Volume 3A00 successfully modified.
CMUC00022I chckdvol: CKD Volume 3A01 successfully modified.
```

```
CMUC00022I chckdvol: CKD Volume 3A02 successfully modified.
CMUC00022I chckdvol: CKD Volume 3A03 successfully modified.

dscli> chckdvol -resgrp RG5 3B00-3B03
Date/Time: October 5, 2012 2:48:51 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
CMUC00022I chckdvol: CKD Volume 3B00 successfully modified.
CMUC00022I chckdvol: CKD Volume 3B01 successfully modified.
CMUC00022I chckdvol: CKD Volume 3B02 successfully modified.
CMUC00022I chckdvol: CKD Volume 3B03 successfully modified.
```

We put the volumes into a resource group that is not the default RG0. The Copy Services scope is not yet set; it is still PUBLIC as shown in Example 4-16.

Example 4-16 Properties of created resource groups

```
dscli> showresgrp RG4
Date/Time: October 5, 2012 2:51:54 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
ID                  RG4
Name                PROD_LPAR
State               Normal
Label               zOS-PROD
CS_Global_RS        PUBLIC
Passthru_Global_RS  PUBLIC
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF

dscli> showresgrp RG5
Date/Time: October 5, 2012 2:52:17 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
ID                  RG5
Name                TEST_LPAR
State               Normal
Label               zOS-TEST
CS_Global_RS        PUBLIC
Passthru_Global_RS  PUBLIC
GM_Masters_Allowed  01-FF
GM_Sessions_Allowed 01-FF
```

Because CS_Global_RS is still PUBLIC, but the resource group is no longer RG0, FlashCopy operations are no longer allowed. General Copy Services, such as FlashCopy and Metro Mirror, are allowed by specifying a Copy Services Global Resource Scope with the **manageresgrp** command as shown in Example 4-17.

Example 4-17 Setting a resource scope

```
dscli> manageresgrp -action set -ctrl copyglobal -scope zOS-PROD RG4
Date/Time: October 5, 2012 4:24:20 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
CMUC00436I manageresgrp: Resource group RG4 successfully modified.

dscli> manageresgrp -action set -ctrl copyglobal -scope zOS-TEST RG5
Date/Time: October 5, 2012 4:24:39 PM CEST IBM DSCLI Version: 7.7.0.566 DS: IBM.21
CMUC00436I manageresgrp: Resource group RG5 successfully modified.
```

We use FlashCopy to copy volumes within a resource group as shown in Example 4-18.

Example 4-18 DFSMSdss FlashCopy within the zOS-PROD resource group

```
//INCR1  EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//IO1      DD UNIT=3390,VOL=SER=RS3A00,DISP=SHR
//OO1      DD UNIT=3390,VOL=SER=RS3A01,DISP=SHR
//SYSIN    DD *

COPY  FULL INDD  (IO1)                                          -
              OUTDD (OO1)                                           -
                    PURGE WAIT (00,00) CANCELERROR                  -
                    ALLDATA(*) ALLX                                 -
                    DEBUG(FRMSG(DTL)) ADMIN                         -
                    DUMPCOND                                        -
                    FASTREP (REQUIRED)

2012.279 16:18:14 EXECUTION BEGINS
TARGET VTOC BEGINNING AT 000000001:00 AND ENDING AT 000000010:14 IS OVERLAID
VOLUME RS3A00 WAS COPIED USING A FAST REPLICATION FUNCTION
2012.279 16:18:14 EXECUTION ENDS
2012.279 16:18:14 TASK COMPLETED WITH RETURN CODE 0000
```

But, we can also copy a volume within the zOS-TEST resource group as shown in Example 4-19.

Example 4-19 DFSMSdss FlashCopy within the zOS-TEST resource group

```
//INCR1  EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//IO1      DD UNIT=3390,VOL=SER=RS3B01,DISP=SHR
//OO1      DD UNIT=3390,VOL=SER=RS3B02,DISP=SHR
//SYSIN    DD *

COPY  FULL INDD  (IO1)                                          -
             OUTDD (OO1)                                            -
                   PURGE WAIT (00,00) CANCELERROR                   -
                   ALLDATA(*) ALLX                                  -
                   DEBUG(FRMSG(DTL)) ADMIN                          -
                   DUMPCOND                                         -
                   FASTREP (REQUIRED)

2012.284 16:44:07 EXECUTION BEGINS
TARGET VTOC BEGINNING AT 000000001:00 AND ENDING AT 000000010:14 IS OVERLAID
VOLUME RS3B01 WAS COPIED USING A FAST REPLICATION FUNCTION
2012.284 16:44:07 EXECUTION ENDS
2012.284 16:44:07 TASK COMPLETED WITH RETURN CODE 0000
```

We test whether we can copy a volume from RG4 (VOLSER RS3A00, DS8000 address 3A00) to a volume in RG5 (VOLSER RS3B00, DS8000 address 3B00). We specify that the use of FlashCopy is required (FASTREPLICATION). In Example 4-20, you can see that the copy operation fails.

Example 4-20 COPY FULL with FlashCopy but not allowed by resource group policy

```
//INCR1  EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//IO1      DD UNIT=3390,VOL=SER=RS3A00,DISP=SHR
//OO1      DD UNIT=3390,VOL=SER=RS3B00,DISP=SHR
//SYSIN    DD *
-    COPY  FULL INDD  (IO1)                                     -
```

```
              OUTDD (001)                                        -
                    PURGE WAIT (00,00) CANCELERROR               -
                    ALLDATA(*) ALLX                              -
                    DEBUG(FRMSG(DTL)) ADMIN                      -
                    DUMPCOND                                     -
                    FASTREP (REQUIRED)

ADR006I (001)-STEND(01), 2012.279 14:51:51 EXECUTION BEGINS
ADR241I (001)-DDTFP(01), TARGET VTOC BEGINNING AT 000000001:00 AND ENDING AT 000000010:14 IS OVERLAID
ADR935W (001)-TOMI (01), 2012.279 14:51:51 A FAILURE OCCURRED WHILE ATTEMPTING TO PERFORM FAST REPLICATION FOR VOLUME RS3A00.
0                        DIAGNOSTIC INFORMATION: 00001E19-08040F7B-14
ADR938E (001)-DDTFP(04), FASTREPLICATION(REQUIRED) WAS SPECIFIED BUT FAST REPLICATION COULD NOT BE USED FOR VOLUME RS3A00
ADR006I (001)-STEND(02), 2012.279 14:51:51 EXECUTION ENDS
ADR013I (001)-CLTSK(01), 2012.279 14:51:51 TASK COMPLETED WITH RETURN CODE 0008
```

Now, we rerun the job. However, this time, we request only that FlashCopy use is *preferred* (not required) as shown in Example 4-21.

Example 4-21 DFSMSdss COPY with FlashCopy PREFERRED

```
//INCR1  EXEC PGM=ADRDSSU
//SYSPRINT DD SYSOUT=*
//I01      DD UNIT=3390,VOL=SER=RS3A00,DISP=SHR
//O01      DD UNIT=3390,VOL=SER=RS3B00,DISP=SHR
//SYSIN    DD *
COPY  FULL INDD  (I01)                                          -
               OUTDD (O01)                                          -
                     PURGE WAIT (00,00) CANCELERROR                 -
                     ALLDATA(*) ALLX                                -
                     DEBUG(FRMSG(DTL)) ADMIN                        -
                     DUMPCOND                                       -
                     FASTREP (PREF)

2012.279 15:01:13 EXECUTION BEGINS
TARGET VTOC BEGINNING AT 000000001:00 AND ENDING AT 000000010:14 IS OVERLAID
2012.279 15:01:14 A FAILURE OCCURRED WHILE ATTEMPTING TO PERFORM FAST REPLICATION FOR VOLUME RS3A00.
 DIAGNOSTIC INFORMATION: 00001E19-08040F7B-14
2012.279 15:01:14 EXECUTION ENDS
2012.279 15:01:14 TASK COMPLETED WITH RETURN CODE 0004
```

Only a warning return code 004 is displayed. The copy operation is performed with normal host copy operations, not FlashCopy.

4.5.2 z/OS resource group error message support

To benefit from the error message support of resource groups, upgrade your system environment:

- PTFs or APARs for z/OS 1.10 - z/OS 1.13

  The RG function is compatible with earlier versions to z/OS V1.10 and requires the application of new function APARs.

- These updates are also required:
  - ICKDSF R17 with OA34969
  - SDM with OA31313 and OA34969
  - Omegamon with OA33115

Important: Before you migrate to RGs, ensure that all z/OS-related PTFs are applied according to the last PSP information. Otherwise, various error messages are shown.

4.5.3 Error messages and codes for z/OS resource groups

Resource group violations are reported to the host software with sense bytes 07 - 09 = '0F7Bxx'X:

- '*xx*'X reason codes are in the subsequent tables.
- z/OS documentation references the DS8000 Information Center and provides a reason code.
- The information center has a cross-reference between sense codes and DS8000 message codes.

Information center message codes have explanatory text to help you isolate the resources and attributes that are associated with the error. You might need to look at the attributes values to determine the error.

Table 4-1 list the various resource group error codes. The error codes are not exposed by the DSCLI.

Table 4-1 Resource group error codes

Error code	Policy attribute	Resource RG with policy attribute	Resource RG with resource group label (RGL)	Case
'10'x	CSGRS	PPRC Primary	PPRC Secondary	Establish PPRC Pair - CKD.
'11'x	CSGRS	PPRC Secondary	PPRC Primary	Establish PPRC Pair - CKD.
'12'x	CSGRS	FC Source	FC Target	Establish FlashCopy Pair - CKD Full Vol.
'13'x	CSGRS	FC Target	FC Source	Establish FlashCopy Pair - CKD Full Vol.
'14'x	CSGRS	FC Source	FC Target	Establish FlashCopy Pair - CKD Dataset.
'15'x	CSGRS	FC Target	FC Source	Establish FlashCopy Pair - CKD Dataset.
'20'x	CSGRS	PPRC Primary	PPRC Secondary	Establish PPRC Pair - CKD.
'21'x	CSGRS	PPRC Secondary	PPRC Primary	Establish PPRC Pair - CKD.
'22'x	CSGRS	FC Source	FC Target	Establish FlashCopy Pair - CKD Full Vol.
'23'x	CSGRS	FC Target	FC Source	Establish FlashCopy Pair - CKD Full Vol.
'01'x	Allow GM Sessions	Destination LSS	N/A	► Manage PPRC Session. ► Manage PPRC Session Members.
		Connection LSS		► Start/resume Global Mirror Master. ► Pause/terminate Global Mirror Master.

Error code	Policy attribute	Resource RG with policy attribute	Resource RG with resource group label (RGL)	Case
’02’x	Allow GM Masters	Connection LSS	N/A	► Start/resume Global Mirror Master. ► Pause/terminate Global Mirror Master.
’30’x	PGRS	Connection Device	Destination Device	► Establish PPRC Pair. ► Suspend PPRC Pair. ► Terminate PPRC Pair. ► Establish FlashCopy Pair. ► Withdraw FlashCopy Pair. ► Release Allocated Space.
’31’x	PGRS	Connection Device	Destination LSS	► Establish Logical Paths. ► Remove Logical Paths. ► Freeze PPRC Group. ► Consistency Group Established. ► Manage PPRC Sessions. ► Manage PPRC Session Members.
’32’x	PGRS	Connection Device	Local Device	► Establish FlashCopy Pair (Remote). ► Withdraw FlashCopy Pair (Remote).
’40’x	URS	N/A	Destination Device	► Establish PPRC Pair. ► Suspend PPRC Pair. ► Terminate PPRC Pair. ► Establish FlashCopy Pair. ► Withdraw FlashCopy Pair. ► Release Allocated Space.
’41’x	URS	N/A	Destination LSS	► Establish Logical Paths. ► Remove Logical Paths. ► Freeze PPRC Group. ► Consistency Group Established. ► Manage PPRC Sessions. ► Manage PPRC Session Members.
’42’x	URS	N/A	Local device	► Establish FlashCopy Pair (Remote). ► Withdraw FlashCopy Pair (Remote).

4.5.4 Resource group error message example

Reason code ‘10’x shows the following error message:

```
CMUN03162E CKD PPRC Secondary Resource Scope violation (Primary detected
violation)
```

To get an expanded explanation of the error message, use the **helpmsg** command:

```
helpmsg CMUN03162E
```

Error description

The Copy Services Global Resource Scope (CS_GRS) attribute that is defined in the resource group of the primary volume is not consistent with the RGL that is specified in the resource group of the secondary volume. Either the Copy Services request was specified incorrectly, or its CS_GRS attribute must be modified.

Terminology

Source/Primary Resource Scope violation: Volume's resource group policies rejected source/primary specified as out of scope.

Target/Secondary Resource Scope violation: Volume's resource group policies rejected target/secondary specified as out of scope.

Action

Either change the Copy Services request for an operation that is allowed by the resource group policies or modify the resource group policy of the primary volume to allow the requested operation.

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics that we cover in this paper.

IBM Redbooks

For information about ordering these publications, see “How to get Redbooks” on page 62. Note that some of the documents referenced here may be available in softcopy only:

- *IBM System Storage DS8000 Series: Architecture and Implementation*, SG24-6786
- *IBM System Storage DS8000: Copy Services in Open Environments*, SG24-6788
- *DS8000 Copy Services for IBM System z*, SG24-6787

Other publications

These publications are also relevant as further information sources:

- *IBM System Storage DS8000 Introduction and Planning Guide*, GC35-0515
- *IBM System Storage DS8000: User’s Guide*, SC26-7623
- *IBM System Storage DS8000: Command-Line Interface User’s Guide*, SC26-7916
- *z/OS DFSMS Advanced Copy Services*, SC35-0428

Online resources

The following websites are also relevant as further information sources:

- IBM System Storage DS8000 FlashCopy SE Implementation Considerations and Recommendations

  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/FLASH10617
- Documentation for the DS8000

  http://www.ibm.com/systems/storage/disk/ds8000/index.html
- The IBM System Storage Interoperation Center

  http://www.ibm.com/servers/storage/support/config/ess/index.jsp
- IBM Disk Storage Feature Activation (DSFA) website

  https://www.ibm.com/storage/dsfa/index.jsp

How to get Redbooks

You can search for, view, or download Redbooks, Redpapers, Webdocs, draft publications and Additional materials, as well as order hardcopy Redbooks, at this website:

ibm.com/redbooks

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services

IBM System Storage DS8000
Copy Services Scope Management and Resource Groups

Understand the resource group concept and design

Implement the Copy Services scope management capability

View useful examples and usage illustrations

The IBM System Storage DS8000 offers a policy-based resource management capability. This capability, named resource groups or Copy Services scope management, is the topic of this paper.

With Copy Services scope management, Copy Service relationships can be limited to the domain of a set of user-specified resources. Additionally, user IDs can be configured to only allow them to issue Copy Services requests against a specific domain. This capability facilitates multi-tenancy by preventing any host or user from initiating a Copy Services operation that would cross a specific tenant's domain boundaries. In addition to the multi-tenant capability, Copy Services domains can also provide general-purpose partitioning to isolate heterogeneous environments from each other. The Copy Services scope management capability is available for any host type on any volume type.

This IBM Redpaper publication bookis intended for anyone interested in Copy Services scope management. The paper starts with a general overview of the Copy Services scope management capability, its intended usage, and explanations of the underlying concept of resource groups. Subsequent chapters provide implementation details for both open systems and System z perspectives and include usage illustrations with the DS8000 command-line interface (DSCLI).

REDP-4758-01

INTERNATIONAL TECHNICAL SUPPORT ORGANIZATION

BUILDING TECHNICAL INFORMATION BASED ON PRACTICAL EXPERIENCE

IBM Redbooks are developed by the IBM International Technical Support Organization. Experts from IBM, Customers and Partners from around the world create timely technical information based on realistic scenarios. Specific recommendations are provided to help you implement IT solutions more effectively in your environment.

For more information:
ibm.com/redbooks