



# IBM SPECTRUM PROTECT

## Container Storage Pool

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# Agenda

- History of storage pool
- Introduction: Container pool
- Feature of Container pool
- Benefits
- New container pool commands
- Container related operations
- Troubleshooting

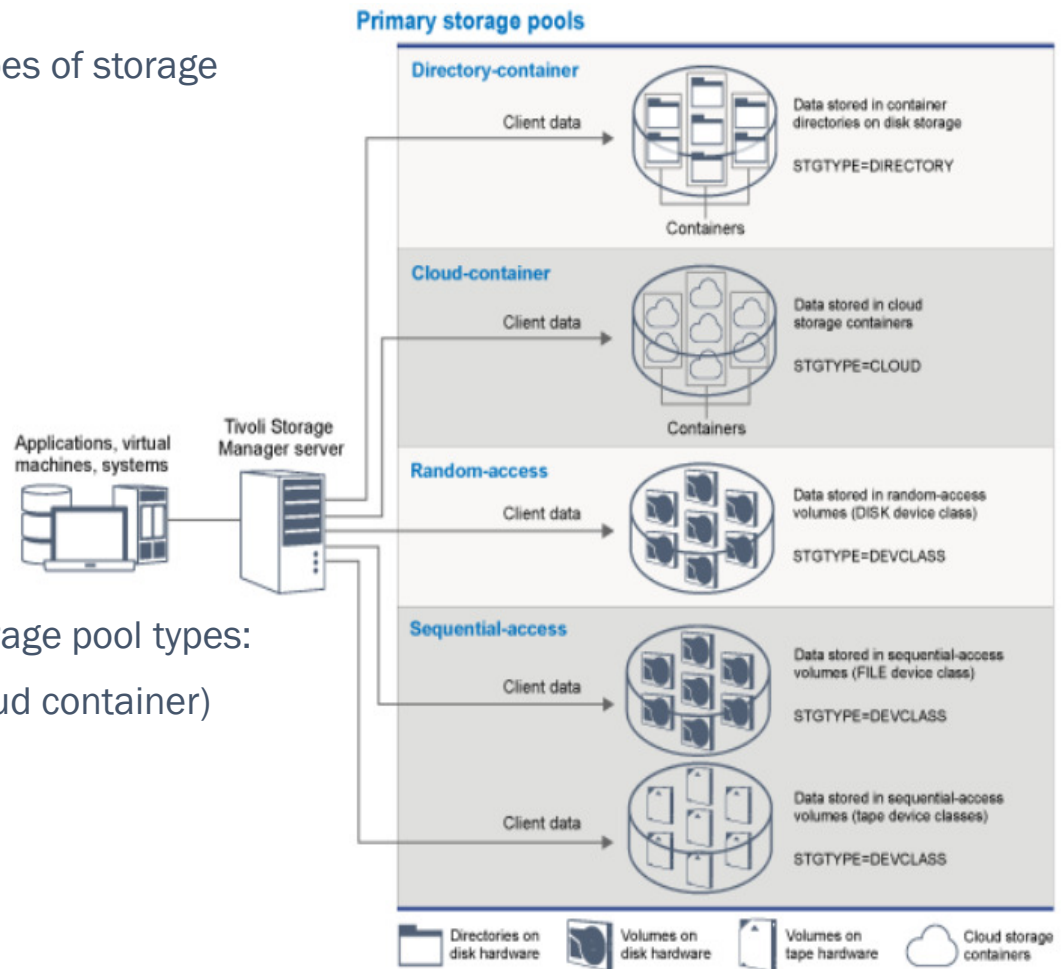
# History

Before v7.1.3 we had the following types of storage pool:

- Disk
- File
- Tape/LTO

After v7.1.3 we have the following storage pool types:

- Container pool (Directory and Cloud container)
- Disk
- File
- Tape/LTO



# Introduction

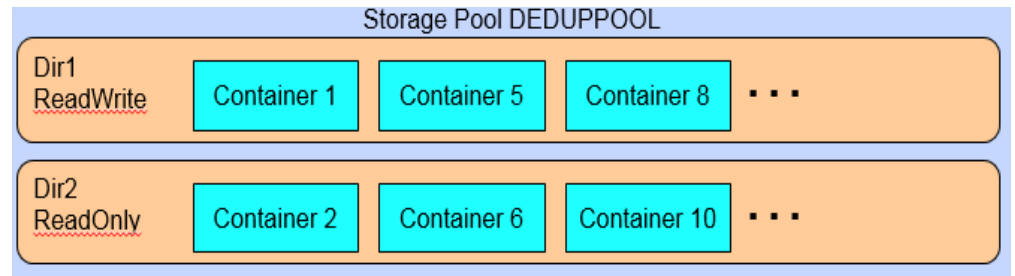


## Container Pool:

A container storage pool is a new type of storage pool that is designed specifically for In-line data deduplication.

There are 2 types of Container Pools:

1. Directory Container Pool
2. Cloud Container pool



There are 2 types of containers:

1. De-dup container (stores the dedup data)
2. Non-dedup container (stores non-dedup data like encrypted data)

# Introduction



## Directory container Pool:

- It is a container which resides in storage pool directories (disk)
- When data backs up into container pool, at the time same it gets de-dup so it has in-line de-dup feature
- Remember we had VOLUMES in file pool or disk pool but here we have introduced containers hence, no more requirement to do all volume operation like:
  - o Reclamation
  - o Migration
  - o collocation
  - o stgpool backup

## Cloud Container Pool:

- It is the same as directory container pool but here we have containers on cloud storage
- The Spectrum Protect writes deduplicated and encrypted data directly to the cloud

# Features



- There is no requirement to define the device class for directory container pool like we do for Disk/File/LTO stgpools
- Directory Storage Pools, which reside on disk, and have characteristics of Sequential FILE pools and random DISK pools:
  - *Dynamic allocation and removal of files like Sequential FILE volumes*
  - *Re-usable space within a container like Random DISK volumes*
  - *More intelligent space utilization and I/O balancing across directories*
- Server In-line dedup
- Server In-line Compression
- Extent-level of data Management instead of object level

## NOTE:

- A directory-container storage pool cannot be used as a copy storage pool till v7.1.6
- A directory-container storage pool cannot be used as an active-data storage pool

# Benefits



- Simplified storage management
  - No device classes, libraries, mount points, volumes.
- Optimized data-deduplication processing
  - In-line data deduplication and compression so no post processing.
- Reduced Spectrum Protect server database growth and size
  - In-dedup and compression feature reduce the storage requirement.
- Increased server performance and scalability
  - Reduce the need for offline table REORG
  - Faster ingestion capabilities
- Improved recoverability of damaged extents
  - Data managed at extent level
  - From AUDIT and real-time detection

# Define Directory Container



Here are the commands to define the directory type container pool:

1. Create the file systems or dynamic disks

2. Define the storage pool:

```
DEFINE STGPOOL DEDUPPOOL STGTYPE=DIRECTORY
```

3. Define a storage pool directory for each file system

```
DEFINE STGPOOLDIRECTORY DEDUPPOOL /dir1
```

```
DEFINE STGPOOLDIRECTORY DEDUPPOOL E:\
```

```
>>-DEFine STGPOOL--pool_name--STGType----Directory----->
. -Pooltype----Primary-.
>+-----+-----+-----+-----+-----+-----+-----+----->
' -Pooltype----Primary-' '-DESCription----description-'

. -ACcess----READWrite-----
>+-----+-----+-----+-----+-----+-----+-----+----->
' -ACcess----+READWrite---+-'
      +READOnly----+
      '-UNAVailable-'

. -MAXSIze----NOLimit-----
>+-----+-----+-----+-----+-----+-----+-----+----->
' -MAXSIze----+NOLimit-----+-'
      '-maximum_file_size-'

. -MAXWriters----NOLimit-----
>+-----+-----+-----+-----+-----+-----+-----+----->
' -MAXWriters--++NOLimit-----+-'
      '-maximum_writers-'

>+-----+-----+-----+-----+-----+-----+-----+----->
' -NEXTstgpool----pool_name-'

>+-----+-----+-----+-----+-----+-----+-----+----->
' -PROTECTstgpool----target_stgpool-'

. -REUsedelay----1----- . -COMPRession----No-----
>+-----+-----+-----+-----+-----+-----+-----+----->
' -REUsedelay----days-' '-COMPRession--++Yes+-'
```



# Define Cloud Container

- Define the storage pool:

```
DEFINE STGPOOL CLOUDPOOL STGTYPE=CLOUD
```

- Additional keywords required

```
CLOUDURL=<url>
```

```
IDENTITY=<cloud identity>
```

```
PASSWORD=<cloud password>
```

- Optional keywords (\* = default)

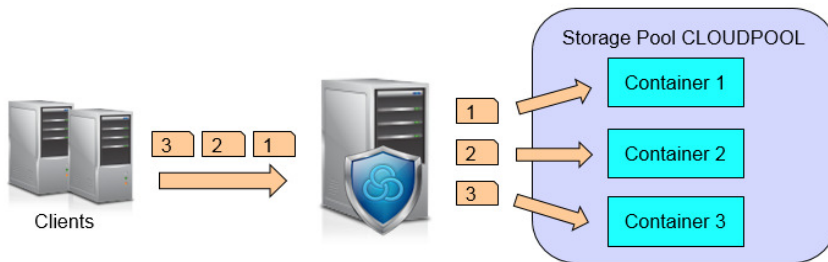
```
CLOUDTYPE= [ SWIFT* | AZURE | S3 | IBMCloudswift | V1SWIFT ]
```

```
CLOUDLOCATION=[ OFFPREMISE* | ONPREMISE ]
```

```
ENCRYPT=[ YES* | NO ]
```

- Define a storage pool directory (Applicable from v7.1.6)

```
DEFINE stgpooldirectory <cloudpoolname> /storage/dir3
```



## Syntax

```
>>-DEFine STGpool--pool_name--STGType---Cloud-->
    .-Pooltype---Primary-.
>+-----+-----+
    '-Pooltype---Primary-' '-Description---description-'
    .-CloudType---Swift-----
>+-----+-----+
    '-CloudType---+Azure-----+'
                        +-S3-----+
                        +-IBMCloudswift+
                        +-Swift-----+
                        '-V1Swift-----'

>--CLOUDUrl---cloud_url--Identity---cloud_identity--(1)
>-PAssword---password--
    .-CLOUDLocation---Offpremise-----
>+-----+-----+
    '-CLOUDLocation---+Offpremise+-'
                        '-ONpremise--'

|-----|-----|
|-----|-----| (2) |
'-BUCKETName---bucket_name-----'

    .-ACcEss---READWrite-----
>+-----+-----+
    '-ACcEss---+READWrite+-'
                        +-READOnly----+
                        '-UNAVailable-'


    .-MAXWriters---NOLimit-----
```



# Define Container pool from Operation Center



- Open Operation Center
  - Go to Storage
- > Storage Pools
- > +Storage pool


### Add Storage Pool

 The server is configured for replication but does not use a standard replication schedule. You cannot use this wizard to configure **storage pool protection** for a directory-container pool. [Learn more](#)

Type  

SS2\_ADSM\_GROUP\_SE... NEWPOOL

Choose the type of pool that best supports your business goals. [Learn more](#)

 Container pools are easier to manage, and reduce storage costs by deduplicating data.

Container-based storage	Traditional volume-based storage
<input checked="" type="radio"/> <b>Directory</b> File-based storage on disk	<input type="radio"/> <b>Disk (primary)</b> Storage on disk or in a mountable deduplicating appliance
<input type="radio"/> <b>On-premises cloud</b> Object-based storage that is managed by internal IT staff in your data center	<input type="radio"/> <b>Tape (primary)</b> Storage on tape or in a deduplicating VTL
<input type="radio"/> <b>Off-premises cloud</b> Storage in vendor-managed repositories, using IBM SoftLayer or OpenStack Swift	<input type="radio"/> <b>Tape (copy)</b> Copies of primary storage on tape or in a VTL

# Container Extents

## What are extents?

- A piece of data stored in containers
- Some are deduplicated extents
  - *Object file data*
- Some are non deduplicated extents
  - *Encrypted data*
  - *Object meta data*
- As extents are deleted, the space is re-used for subsequent extents

## What is the size of an extent?

- 50KB is the minimum extent size and 4MB is the maximum size
- Files smaller than 2KB are not deduplicated

# New commands

Few Important commands used for container pool:

- Protect stgpool
- Repair stgpool
- Audit container
- Move container
- Convert stgpool
- Show sdpool
- Query Container

# How to Protect Container Pool

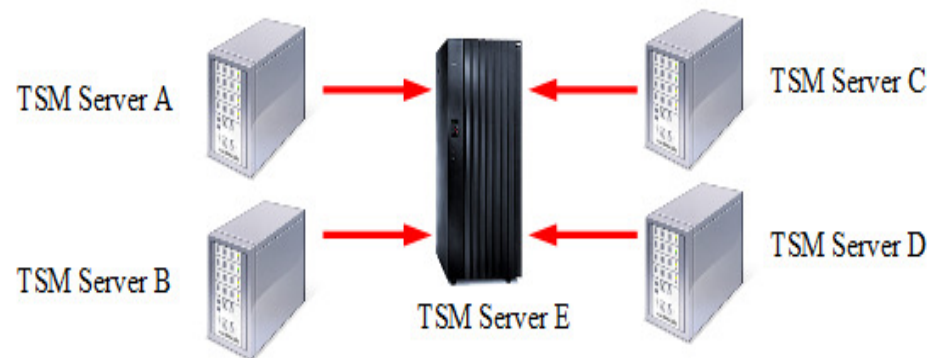
Here are three methods to protect container pool data:

- Node Replication
- Protect stgpool (Replication)
- Protect stgpool (Local)

# Node Replication



- Provides the ability to incrementally replicate a node's data to a remote target server for disaster recover purposes
- Whichever node is configured for replication can recover their data if any disaster occurs on primary servers
- Replication occurs between a source and target server
- A source server can have only 1 replication target server
- A target server can be the replication target for more than 1 source server



# Protect Stgpool



Use '**Protect stgpool**' command to protect data in a directory-container storage pool by storing a copy of the data in another storage pool on a replication target server or on the same server by protecting the data to tape.

**Protect stgpool** have 2 types of protection:

1. Protect stgpool on Replication server
2. Protect stgpool on Same server (Tape pool)

There are following phases of Protect stgpool:

Prior v7.1.7:

- *Protect new chunk*
- *Send deletes to the target for chunks that were deleted on the source*

From v7.1.7 and later:

- *Protect new chunks*
- *Delete chunks from target that no longer exist on source*
- *Reclaim*

# Protect Stgpool (Replication)



Use '*Protect stgpool type=repl*' command to protect data in directory-container storage pools by storing the data in another directory-container storage pool on the **target server**.

- **Command syntax:**

```
>protect stgpool type=repl
```

- Replicates backups and archive data to the target server without the associated metadata
- It is important to run the replication node in conjunction with protect stgpool
- It improves replication performance
- Enables the repair of damaged files on the source server



# Protect Stgpool (Local)



- Prior 7.1.7 you must have a secondary server to protect directory container pool data, so without having secondary server you can't backup/copy directory container pool data
- If you don't have secondary server or to eliminate the secondary server requirement, we have introduced a new stgpool "copy-container pool" in v7.1.7
- Container-copy storage pool is used only to store a copy of data from a directory-container storage pool
- You need to define a copy-container pool on same server where you have directory container pool to locally copy directory pool data into copy-container
- Copy container pool only supports TAPE library (not tested on FILE or VTL yet)
- Copy container pool id used only for repair directory container pool
- You cannot restore client data directly from copy container pool in case primary directory pool has some issue

# Protect Stgpool (Local) contd...



## Protect stgpool on Local server: (How to setup)

1. Define copy-container pool
2. Define directory container stgpool, make sure to specify “*PROTECTLOCALstgpools*” parameter that points to copy-container pool
3. Run protect stgpool command with “Type=Local”

## Command syntax:

- *Define stgpool <stgpool\_name> <device\_classname> pooltype=copycontainer*
- *Define stgpool <stgpool\_name> type=directory PROTECTLOCALstgpools=<copy-container\_poolname>*
- *Protect stgpool <directory\_stgpool> type=local*

# Repair Stgpool



- During restore or retrieve operations, if an extent cannot be read or is corrupt, the extent is immediately marked “Damaged”
  - *All logical files using that extent are also marked “Damaged”*
- Repair Stgpool is used to fix damaged chunks
  - *Uses the data stored by Protect Stgpool*

## Requirement:

You must issue the PROTECT STGPPOOL command to back up data extents to the directory-container storage pool on the target server before you issue the REPAIR STGPPOOL command.

Repair fails from replication server if:

- *The target replication server is unavailable*
- *The target storage pool is damaged*
- *A network outage occurs*

Repair fails from local copy container pool if:

- *The container-copy storage pool is unavailable*
- *The container-copy storage pool is damaged*
- *The container-copy storage pool volumes are unavailable or damaged*

## Syntax when the source is the replication server

```
.-SRCLOCation---Replserver-.  
>>-REPAir STGPool--pool_name--+-----+----->  
'-SRCLOCation---Replserver-'
```

## Syntax when the source is a storage pool on the same server

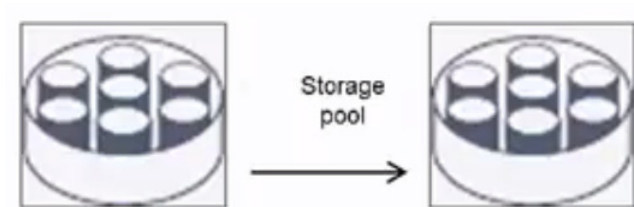
```
>>-REPAir STGPool--pool_name--SRCLOCation---Local----->
```

# Move Container

- Use this command to move the contents of a storage pool container to another container if a storage pool directory is removed or if a container is damaged
- This is similar to move volume command that we have for legacy storage pool volume
- You can also use this command under these conditions:
  - *When you upgrade hardware*
  - *If I/O errors occur on a disk*

## Command syntax:

```
>>-MOVE CONTainer--container_name----->
>+-----+----->
'-STGPOOLDirectory---directory_name-'
.-Wait---Yes-----.
>+-----+-----><
'-Wait---+Yes-+-'
'-No--'
```



# Audit Container

- AUDIT CONTAINER command is used to scan for inconsistencies between database information and a container in either a cloud or a directory storage pool
- If a file system has issues, containers can be independently audited
- Audit can be done on complete directory STGPOOL or specific STGPOOLDIR or only on CONTAINERS as well
  
- There are 4 actions which can be performed through audit containers:
  - *Scanall*
  - *Scandamaged*
  - *removedamaged*
  - *markdamaged*

- **Command Syntax:**

```
>>-AUDit CONTainer--+container_name-----+>
                    +-STGpool---pool_name-----+
                    '-STGpool---pool_name--STGPOOLDIRectory---directory_name-'

.-Action---SCANAll-----.
>--+-----+----->
'-Action---+SCANAll-----+'
                    +-REMOVEDamaged-+
                    +-MARKDamaged---+
                    '-SCANDamaged---'
```

# Query Damaged

- This command displays information about damaged data extents in a directory-container or cloud-container storage pool.
- **Command syntax:**

```
>>-Query DAMaged--pool_name----->

.-Type---Status-----
>--+-----+-----><
'-Type---+Inventory-----+'
      +-Node--| A |-----+
      '-CONTAINER--| A |-'
```

A (Additional filter by node name)

```
|--+-----+-----|
      '-Nodename---node_name-'
```

# Convert Stgpool



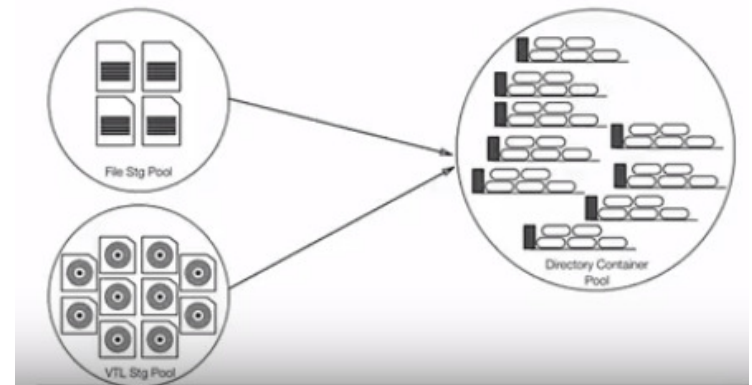
Want to use the benefits of container pool?

Want to change the legacy pool into container pool?

- Use '*convert stgpool*' command to convert a primary storage pool that uses a FILE device class, a tape device class, or a virtual tape library (VTL) to a directory-container or a cloud-container storage pool.

## Note:

- Before v8.1.0 only FILE and VTL conversion was possible
- From v8.1.0 and later conversion is also possible for Tape pool
- NDMP, TOC, Virtual volume data cannot be converted



# Convert Stgpool contd..

- Convert stgpool process also identifies the damaged data and it won't convert that data
- From “**q cleanup**” command you can identify the damaged data from file/vtl pool
- You can fix the damaged filepool data from cospool (restore stgpool) or run the “**remove damaged**” command to delete the damaged data in case if you can't recover that damaged data
- Conversion process have 4 states:
  - *Conversion Active*
  - *Conversion Inactive*
  - *Conversion complete – Cleanup Needed*
  - *Conversion completed*
- During conversion data is also removed from copy and active stgpools
- **Command syntax:**

```
>>-CONvert STGpool--source_stgpool--target_stgpool----->
. -MAXPRocess----8-----
>+-----+-----+-----+-----<
' -MAXPRocess----number---' '-Duration----minutes-'
```



# Versions and Features



Version	Feature Introduced for Containers
7.1.3	Container Storage Pool
7.1.5	In-line compression
	S3 cloud computing to support ICO (IBM Cloud storage)
7.1.6	Convert storage pool
	Local storage directory pool for cloud pool
7.1.7	Amazon Web Service (AWS) for cloud storage
	Copy Container storage pool
8.1.2	Microsoft Azure for cloud storage
	Encryption feature (Encryption=Yes/No)
8.1.3	Cloud tiering

# Troubleshooting

Important commands:

*>query stgpooldir*

*>query container*

*>query stgpool*

*>show sdpool*

Log files:

- dsmffdc.log
- Activity log

# Troubleshooting contd..

## Example:

- When is an extent marked as damaged?

During restore or retrieve operations, if an extent cannot be read or is corrupt, the extent is immediately marked “Damaged”.

## How to fix it?

- If the filesystem has some issue, then run the “audit container”

(Run “q damaged <poolname>” to identify the damage)

- Repair Stgpool is used to fix damaged chunks assuming a copy of data is stored by Protect Stgpool
- Subsequent backup of same extent will also fix a damaged extent

# References



- Cloud-container storage pools FAQs

<https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Tivoli%20Storage%20Manager/page/Cloud-container%20storage%20pools%20FAQs>

- Directory-container storage pools FAQs

<https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Tivoli%20Storage%20Manager/page/Directory-container%20storage%20pools%20FAQs>

- Best practices for IBM Spectrum Protect storage pool conversion

<http://www-01.ibm.com/support/docview.wss?uid=swg21993088>

- PROTECT STGPOOL and REPLICATE NODE recommended order of operations

<https://www-01.ibm.com/support/docview.wss?uid=swg21978041>

- Storage pool types

[https://www.ibm.com/support/knowledgecenter/en/SSEQVQ\\_8.1.5/srv.admin/r\\_stgpools\\_compare.html](https://www.ibm.com/support/knowledgecenter/en/SSEQVQ_8.1.5/srv.admin/r_stgpools_compare.html)

QUESTIONS?