Spaces, tokens and descriptions

- Storage classes
- What is a space?
- Space reservation
- Spaces and quotas
- Spaces and paths
- Space usage

Storage classes

- A storage class is a quality of storage defined by the Retention Policy and Access Latency

- The WLCG SRM v2.2 <u>MoU</u> defines 3 cases:
  - Custodial x Nearline → "<u>Tape1Disk0</u>"
  - Custodial x Online → "<u>Tape1Disk1</u>"
  - Replica x Online → "<u>Tape0Disk1</u>"

- Tape<u>N</u> → <u>N</u> copies guaranteed on tape
  - Or other <u>high-quality</u> media
    - Tape1/Custodial → "Do not lose this data!"
    - Tape0/Replica → "No disaster if this data is lost." (a custodial copy may be elsewhere)
- Disk<u>M</u> → <u>M</u> copies guaranteed on disk
  - Disk0 managed by system, Disk1 managed by VO

- WLCG SURLs are <u>permanent</u>, can only be removed by the user
  - Volatile files do not imply Tape0Disk0 (**!**)

What is a space?

- A space is a chunk of <u>disk</u> storage with given:
  - <u>Retention Policy</u>
    - Custodial $\leftrightarrow$ Replica
  - <u>Access Latency</u>
    - Nearline $\leftrightarrow$ Online
  - Size
  - Lifetime
    - Infinite for <u>static</u> spaces
  - Access Control List
  - Use case(s)

- <u>Nearline</u> access latency applies when the disk is a <u>system-managed cache</u> in front of a tape system back-end
  - A file need not always have a copy on disk for immediate use
    - It may need to be <u>temporarily</u> brought <u>online</u> first

- Tape storage (when applicable) considered infinite as far as space reservation is concerned

Space reservation

- srmReserveSpace allows space to be reserved for use by a DN or a VOMS role/group
  - Space is taken from the unnamed "basin" of resources available to the VO
  - An opaque, site-dependent space token is returned
  - A space token user description can be associated with the space
    - Allows for site-independent identification of spaces

- TapeNDiskM storage classes only require <u>static</u> reservations by <u>admins</u>
  - For a certain VOMS role/group per space
  - Space token user description indicates intended use
    - LHCb_RAW, LHCb_RDST, ...
    - Can be published in information system

- <u>Dynamic</u> (temporary) reservations by <u>users</u> can be used to guarantee room for job output files
  - Requires significant portion of "basin" not to be allocated statically
  - Not supported by CASTOR

Spaces and quotas

- In SRM v2.2 one cannot reserve a dynamic space within another space
  - May become possible in future extension

- Static spaces are for well-behaved activities
  - Typically controlled by production managers of big VOs
  - Not accessible (for writing) by ordinary users
  - Overbooking normally avoided

- Dynamic spaces allow for some protection of user jobs
  - But CASTOR does not support it
  - Overbooking can only be prevented with quotas

- SRM v2.2 does not support quotas
  - Implementations may support them through proprietary APIs

Spaces and paths

- In SRM v1.1 the quality of storage is defined by the path

- In SRM v2.2 spaces and paths are <u>orthogonal</u>
  - A directory may contain files of different storage classes
  - The <u>logical</u> name space need not be driven by storage considerations
    - Name space indicates <u>type</u> of data, run number etc.
    - A site will have custodial responsibility for a subset of the VO's files
    - Files may have been replicated from other sites into the same directories
  - Some implementations can still offer better quality of storage when the name space is used as before
    - E.g. fine-grained tape set selection

- A file may be moved into a different space
  - The SURL remains the same
  - srmChangeSpaceForFiles can be used to <u>change</u> the storage class
    - Only Tape1Disk0 ←→ Tape1Disk1 is supported

Space usage

- WLCG MoU: token can only be specified when file is <u>written</u>

  ```
  lcg-cr --vo lhcb file:/… -d se.domain --st LHCb_RDST
  glite-transfer-submit -t LHCB_RAW …
  ```

- The room in an <u>online</u> space shrinks by the file size
  - The room can only be recovered by deleting the file

- The room in a <u>nearline</u> space <u>temporarily</u> shrinks by the file size
  - The room will be recovered when the file has been written to tape and the copy on disk is not in use

- Some implementations allow a token to be specified on <u>reads</u>
  - Get a copy of the file into a preferred space
  - By default the SE will decide where to stage the copy
    - Depending on the storage class, user DN, VOMS attributes, client IP address, pool load, ...