Using UID Mapping in Lustre 2.7 and GSS Shared Key Update

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UID Mapping

• IU’s Software Development Contract with OpenSFS
  – IU developed UID Mapping solution now called “nodemap”
    • Coordinates client access across administrative domains
    • Allows workflows involving geographically distributed resources
    • Enables easy data sharing to facilitate collaboration
    • Misnomer to think of this as “WAN” code
  – This portion of the talk will detail the basics of using the nodemap feature in its current state
What does Preview Mean?

• The core nodemap features are in 2.7
  – Administrative tools are coming soon

• Currently
  • Nodemap commands need to be run on both MDS and OSS nodes and configurations do not persist between module reloads
    – Scripts can be used to redeploy nodemap configuration
    – Map synchronization will be in 2.8
  • Maps can only be listed through /proc
    – an lctl command will be in 2.8

• We would like your help to test this feature in the wild and share your thoughts and experiences
A mature Lustre system may have UID and GID sets that conflict with another system being integrated. Nodemap enables that system to be seamlessly mounted to the existing Lustre installation.
Nodemap Elements

Nodemap is deployed on the MDS and OSS nodes and is invisible to clients. Key elements include:

- NIDs, to which a unique mapping is defined
- Policy groups, which consist of one or more sets of NIDs
- Two properties, “trust” and “admin”, which can optionally be applied to a policy group
- A collection of identity maps or idmaps which determine the translation table for a policy group
Configuring Nodemap

• Before activating the nodemap feature, create a policy group for your Lustre servers

  # lctl nodemap_add LustreServers

• Add the NID numbers (or range) of your servers
  – 1 MDS, 2OSS, 1 Management Client

  # lctl nodemap_add_range --name LustreServers -range 192.168.4.[1-4]@cp
Configuring Nodemap (cont’d)

• Set properties for Lustre servers
  – admin = exempt from root squash (on by default)

    # lctl nodemap_modify --name LustreServers --property admin --value 1

  – trusted = used for a policy group that is unmapped

    # lctl nodemap_modify --name LustreServers --property trusted --value 1
Basic Mapping

To span administrative domains, a nodemap idmap translates client UID / GIDs to canonical UID / GIDs to prevent namespace collision.

Lustre Clients At GenomeChi 192.168.0.30

avis
UID 501

lagus
UID 1512

piscis
UID 3793

Lustre MDS/OSS

avis
UID 21150

lagus
UID 21151

piscis
UID 21152
Basic Mapping Commands

• Create a policy group for machine GenomeChi
  # lctl nodemap_add GenomeChi

• Add GenomeChi’s NID to the policy group
  # lctl nodemap_add_range --name GenomeChi --range 192.168.0.30@tcp

• Populate GenomeChi’s idmap with the three users to be mapped nothing
  that not all users of GenomeChi need to be mapped, only those who will be
  using the Lustre file system.

  # lctl nodemap_add_idmap --name GenomeChi --idtype uid --idmap 501:21150
  # lctl nodemap_add_idmap --name GenomeChi --idtype uid --idmap 1512:21151
  # lctl nodemap_add_idmap --name GenomeChi --idtype uid --idmap 3793:21152
Listing Maps in 2.7

- To examine the contents of the GenomeChi idmap

```bash
# cat /proc/fs/lustre/nodemap/GenomeChi/idmap
[
    { idtype: uid, client_id: 501, fs_id: 21150 },
    { idtype: uid, client_id: 1512, fs_id: 21151 },
    { idtype: uid, client_id: 3793, fs_id: 21152 }
]
# cat /proc/fs/lustre/nodemap/GenomeChi/ranges
[
    { id: 1, start_nid: 192.168.0.30@192.168.0.30, end_nid: 192.168.0.30@192.168.0.30 }
]
```
Example: Mapping Two Identities to One

Two user identities can be mapped to a single identity. The below example shows Mr. Bird using his accounts on two different systems to access a single Lustre filesystem.
Two to One Mapping Commands

- Create a second policy group called GenomeDet
  ```bash
  # lctl nodemap_add GenomeDet
  ```

- Add a NID for GenomeDet
  ```bash
  # lctl nodemap_add_range --name GenomeDet --range 11.22.33.44@cp
  ```

- Add an idmap for the user
  ```bash
  # lctl nodemap_add_idmap --name GenomeDet --idtype uid --idmap 8433:21150
  ```

This map is kept independently of the map for GenomeChi
GSS Shared Key Security

- IU developing Shared Key Security solution using GSS
  - Think of GSS as a vacuum cleaner
    - Kerberos is an attachment
    - Shared key would be another GSS attachment
  - Shared key as an alternative to kerberos
    - File System admins shouldn’t have to run a KDC
    - Kerberos shops adding new service can be difficult
    - Politics can affect kerberos cross-realm
Shared Key Mechanism and Flavors

- Two modes of operations supported
  - Shared Key Integrity (ski)
    - Shared key for HMACs for assurance of message integrity
  - Shared Key Privacy (skpi)
    - Uses Two keys
    - Shared key for HMACs (integrity)
    - Generated session key using Diffie-Hellman (privacy)
    - Provides Perfect Forward Secrecy
GSS

- Security context initialization through userspace upcalls

- Client Side
  - Uses /usr/sbin/lgss_keyring
  - Called from the kernel key ring request_key binary
  - Requires setting up a file in /etc/request.d named after the key_type's name (lgssc)

```bash
# cat /etc/request-key.d/lgssc.conf
create lgssc * * /usr/sbin/lgss_keyring %o %k %t %d %c %u %g %T %P %S
```
GSS (cont’d)

• Server Side
  – Uses /usr/sbin/lsvcgssd
  – Reads and writes to a proc file
  – Must be running or SEC_CTX_INITRPCs will be missed

• Basic Flow
  – Requests received
  – Unpacked in sptlrpc_svc_unwrap_request
  – Instantiated through upcalls in sunrpc caching layer
  – Upcall handles mechanism specific initialization
Current GSS Work

lgss_keyring and lsvcgsd code
  Restructuring some existing code
  Upcall passes the mechanism type
  Determines which service handler to call

lgss_keyring work complete
lsvcgsd work nearing completion and untested

Loading Keys
  Uses a mount.lustre command option
  File on Client
  Directory on servers (multiple keys/clusters)
  Parses and adds keys to kernel keyring

mount command is next on the agenda
Thank you!

Questions?