



gx-map, a system for maintaining grid-mapfiles

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January 20, 2004

(Updated and expanded 2004-01-27; post-talk updates starting at slide 16)

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grid-mapfile overview

- The Globus grid-mapfile is a plain text file mapping DNs (GSI distinguished names) to Unix user names.
- The default location is `/etc/grid-security/`
- Protecting the grid-mapfile from unauthorized updates is critical.
- Keeping it up to date can be tedious and time-consuming.

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gx-map

- gx-map allows users to request grid-mapfile updates without administrative intervention. Updates are typically applied within a few minutes.
- Requests can be automatically propagated to multiple systems.
- The actual updates are performed from cron jobs running under a privileged account.

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gx-map

- The system is implemented in about 2700 lines of Perl. It's currently deployed at SDSC and on the TeraGrid clusters.
- gx-map is a work in progress.
- Why the funny name? An earlier version was part of "globus-extras", a set of auxiliary tools for Globus users at SDSC. gx-map is the sole survivor.

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The “gx-map” command

- This is the user’s interface to the gx-map system. It can be run with many confusing command-line options or in interactive mode.
- Just type “gx-map -interactive” and follow the prompts.
- The result is a plain text request file, written to a world-writable directory.

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Sample request file

```
{
    comment      Just testing
    dn           "/O=Earth/CN=Keith Thompson"
    email        kst@sdsc.edu
    hostname     uffda.sdsc.edu
    map_to_name   kst
    map_to_uid    500
    operation     add
    requested_by_name kst
    requested_by_uid 500
    timestamp     1071007538 Tue 2003-12-09 22:05:38 UTC
}
```

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gx-map and cacI

- Another cron job (not part of the gx-map system) checks for new certificates issued by “cacI” and automatically invokes the gx-map command.
- Thus a user can obtain a certificate and have the DN added to multiple grid-mapfiles, all without administrative intervention.

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The “gx-check-requests” command

- The “gx-check-requests” command is run from a cron job under a privileged account (typically “root” or “globus”).
- It checks for new request files generated by gx-map.
- Each new request is validated, annotated, and logged.

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Sample annotated request

```
{
  NAMESPACE      UFFDA
  OWNER_NAME     kst
  OWNER_UID      500
  PROCESSED       1071007620 Tue 2003-12-09 22:07:00 UTC
  REQUEST_FILE    1071007538-uffda.sdsc.edu-kst-16532.request
  comment        Just testing
  dn              "/O=Earth/CN=Keith Thompson"
  email           kst@sdsc.edu
  hostname        uffda.sdsc.edu
  map_to_name     kst
  map_to_uid      500
  operation       add
  requested_by_name kst
  requested_by_uid 500
  timestamp       1071007538 Tue 2003-12-09 22:05:38 UTC
}
```

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The “gx-gen-mapfile” command

- The “gx-gen-mapfile” command is run from a cron job under a privileged account on each host that needs a grid-mapfile.
- If the request log has been updated, it reads it, sorts it by timestamp, and traverses it, generating a new grid-mapfile from scratch.
- Multiple request logs can be read via http or ftp.

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Sample cron jobs

```
#
# Every 5 minutes, check for new requests
#
4,9,14,19,24,29,34,39,44,49,54,59 * * * * \
    /usr/local/apps/gx-map/sbin/gx-check-requests -namespace SDSC

#
# Every 5 minutes, update the grid-mapfile (if needed)
#
0,5,10,15,20,25,30,35,40,45,50,55 * * * * \
    /usr/local/apps/gx-map/sbin/gx-gen-mapfile \
        -req default \
        -req ftp://ftp.sdsc.edu/pub/sdsc/globus/software/gx-
        map/sdsc-data/requests.log \
        /users/globus/gx/grid-mapfile
# (/etc/grid-security/grid-mapfile is a symlink to
# /users/globus/gx/grid-mapfile)
```

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Installation

- Unpack the tarball.
- Write a config file.
- Run “./configure-gx-map foo.conf”.
- Run “make install”.
- Sample config file:

```
PERL          /usr/bin/perl
PATH          /bin:/usr/bin
NAMESPACE     SAMPLE
INSTALL_DIR   /usr/local/apps/gx-map-0.4beta
DATA_DIR      /var/gx-map-0.4beta
GLOBUS_ADMINS globus
ADMIN_EMAIL   globus@sdsc.edu      # not currently used
```

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Namespaces

- A gx-map “namespace” is a consistent mapping of Unix user names and numeric UIDs to people.
- There are hooks to allow mappings across different namespaces.
- The “John Smith” problem: How do I know whether “jsmith@site1” and “jsmith@site2” are the same person?
- gx-map supports a user map file specifying this relationship. Ideally this should be generated from a definitive user database. Work on this is in progress.

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Security

- The worst-case scenario: Allowing you to map your DN to my Unix account.
- The gx-map command itself is unprivileged; anyone can easily create a fake request file.
- The gx-check-requests command validates the ownership of the request file. If the OS allows non-root users to use chown (as HP-UX does by default), this can break.
- Be careful out there.

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Availability

- The gx-map home page is <http://www.sdsc.edu/~kst/gx-map/>.
- The current release is 0.3; expect 0.4 Real Soon Now.
- Any questions: contact me, Keith Thompson, <kst@sdsc.edu>.
- If you find a security hole, *please* let me know ASAP.
- Released as open source under a BSD-like license.

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Updated slides

- I gave this talk at GlobusWorld 2004.
- Here are a few more points that didn't make it into the original slides.

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Security, Security, Security

- gx-map is a security-critical application.
- The author is not a security expert.
- Does this make you nervous? Good!
- gx-map has no known security bugs.
- Equivalently (and perhaps more accurately), all the security bugs are unknown ones.
- I think it's fairly robust, but there are no guarantees.

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Paranoid mode

- The command-line arguments to gx-gen-mapfile allow you to specify the location of the grid-mapfile. This doesn't have to be `/etc/grid-security/grid-mapfile`.
- If you don't quite trust gx-map, you can have it update a separate file; periodically, you can examine the separate file and manually copy it to `/etc/grid-security` if it looks ok.
- When/if you've decided to trust gx-map, you can modify the cron job so it writes directly to `/etc/grid-security/grid-mapfile` (or you can make `/etc/grid-security/grid-mapfile` a symlink).

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Authentication by ownership

- gx-map depends on file ownership for authentication; it assumes that users can't use chown (see slide 14). HP-UX allows this by default; other Unix-like systems may be configurable to allow it.
- Open question: Does HP-UX allow non-root chowns across NFS?
- Three cases: HP-UX client, HP-UX server, HP-UX client *and* server.
- How else can the file ownership authentication model break?

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Numeric UIDs?

- We assume that both user names and numeric UIDs are consistent within a namespace (typically a site or organization).
- Q: Why worry about UIDs? They don't appear in the grid-mapfile.
- A: The system on which gx-check-requests runs may not have all user accounts in /etc/passwd. In this case, gx-check-requests records the UID; it doesn't know the user name.

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Numeric UIDs? (cont.)

- This is workable but ugly. Possible alternatives:
 - Assume/require that gx-check-requests runs on a system with all accounts, or make UID dependence configurable at installation time.
 - If a user doesn't have an account on the system running gx-check-requests, require administrative intervention.
 - Get username/UID information from somewhere other than /etc/passwd (system-specific).

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User interface

- The first version of gx-map had only a command-line interface, with a dozen or so options. It all seemed perfectly clear to me (there's even a "-help" option) until I let someone else use it.
- The command-line interface is too complex, especially for a tool that most users will run only once.
- The command-line interface is still supported (mostly for use by automated tools), but the main user interface is now interactive, prompting the user for each required piece of information.

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Command-line options

(See, I told you they were confusing)

```
\ gx-map --long-help
Usage: gx-map [options]
Option names may be abbreviated.
  -help                : Show a brief usage message and exit.
  -version             : Show version information and exit.
  -interactive         : Run interactively (recommended).
  -long-help           : Show this long usage message (recommended
                        : only for Globus administrators and masochists).
  -add                 : Add the specified mapping.
  -remove              : Remove the specified mapping.
  -remove-dn           : Remove all mappings for the specified
                        : distinguished name. For use only by Globus
                        : administrators.
  -remove-user         : Remove all mappings for the specified user.
  -update              : Request an update of all grid-mapfiles.
                        : This normally isn't necessary, but it can be
                        : useful if you already have a certificate and
                        : get a new account on a machine.
Note: Exactly one of "--interactive", "--add", "--remove", "--remove-dn",
      "--remove-user", and "--update"
      (or "--help", "--usage", or "--long-usage") must be specified.
-----
  -quiet              : Work silently.
                        : Implies -force.
  -force              : Apply mapping without prompting.
                        : Default is to ask for verification before
                        : proceeding.
  -no-admin            : Assume the user is not a Globus administrator.
                        : Intended for testing only; has no effect if
                        : you're not already a Globus administrator.
  -dn "string"        : Distinguished name.
                        : Default is extracted from ~/.globus/usercert.pem
  -certificate-file file : Name of file from which to extract DN.
                        : If neither "-dn" nor "-certificate-file" is
                        : specified, extract DN from
                        : $HOME/.globus/usercert.pem
  -force-dn            : Normally, gx-map (initially) checks the DN for
                        : proper syntax; this option overrides that check.
  -username name       : This option is for use by Globus
                        : administrators only.
  -directory dir       : Specify an alternate data directory.
                        : This option is for use by Globus administrators
                        : only.
                        : The default data directory is
                        : /usr/local/apps/gx-map-0.3/var .
  -email addr          : Your contact e-mail address.
                        : This may be used to contact you if there's
                        : a problem with your certificate. If you
                        : prefer not to submit your e-mail address,
                        : you can use "-no-email".
  -no-email            : Don't submit an e-mail address.
  -comment "string"    : Comment to be added to request log (optional)
  -debugging           : Enable debugging output.
Note: If this help message has scrolled off the top of your screen, try
gx-map --long-help | less
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```

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User interface (cont.)

- GUI? No.
- Web interface? No.
- Two reasons:
 1. I haven't had much practice implementing GUIs or web interfaces.
 2. I don't know how to integrate the gx-map security model into a fancy interface.
- gx-map runs only on Unix-like systems.

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What's next?

- Future releases will have better support for propagating information among sites.
- If all systems using gx-map share an NFS-mounted file system, it's easy, but we have to deal with the hard case.
- I'll probably implement a central repository. Sites can upload their requests.log files to an ftp dropbox. A job running on the repository system checks for new uploads, merges everything together, and makes it all available by ftp or http.

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What's next? (cont.)

- Uploaded requests.log files must be signed using a Globus proxy. If the repository doesn't recognize the certificate from which the proxy was generated, the upload is rejected.
- The merged log doesn't need to be signed; we assume that whatever is at the specified URL is authentic.
- Open questions: Should the merged log should be signed? Should uploaded logs be encrypted as well as signed? How private is this information?

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What's next? (cont.)

- The grid-mapfile format allows multiple user names per DN; the next release will support this. (Not all Globus tools can use this.)
- `"/O=Foobar/CN=John Smith" user1,user2`
- (Multiple DNs per user name are already supported; each DN is on a separate line.)
- The gx-map client program will be able to extract a DN from a proxy certificate.

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What's next? (cont.)

- In the next release, the grid-mapfile will automatically be checked into an RCS repository (this might be optional).
- It may also keep a log of all gx-map commands executed by users, as an aid to debugging and auditing.

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What's next? (cont.)

- It would be possible to restrict gx-map so that a user can only map a certificate that he owns. (A user would need a valid proxy.)
- Is this necessary or desirable?
- Should a user be allowed to map somebody else's Globus certificate to his own account? (Such a mapping could be applied by an administrator if necessary.)

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What's next? (cont.)

- Another possible feature: Automated maintenance of CRLs (Certificate Revocation Lists).
- A configuration file specifies which CAs (Certificate Authorities) are accepted and how to download the current CRL.
- A new tool, using gx-map's existing URL caching capability, keeps the CRLs up to date.
- Run the new tool from a cron job, perhaps once an hour. Details TBD.

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What's next? (cont.)

- What else does gx-map need to do?
- Any suggestions are welcome; e-mail Keith Thompson <kst@sdsc.edu>.
- Security will always take precedence over bells and whistles.