GT 5.0.4 GSI-OpenSSH: Developer’s Guide
Introduction

This document provides information for GSI-OpenSSH developers.

The changes to OpenSSH\(^1\) to add GSI support are limited, because we build on the existing GSSAPI support in OpenSSH for Kerberos. See the GSI-OpenSSH Internals\(^2\) page for more details.

\(^1\) http://www.openssh.org/
\(^2\) http://dev.globus.org/wiki/GSI-OpenSSH/Internals
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Chapter 1. Before you begin

1. Feature summary

Supported Features

- The `gsissh` command provides a secure remote login service with forwarding of X.509 proxy credentials.
- The `gsiscp` and `gsisftp` commands provide a secure file transfer service authenticated with X.509 proxy credentials, mimicking the `rcp/scp` and `ftp/sftp` commands.
- All standard OpenSSH features are supported, excluding Kerberos authentication. Kerberos authentication is not compatible with GSI-enabled OpenSSH.
- The GSI-OpenSSH server can replace the standard system SSH server in typical environments.
- If no username is given on the command-line, GSI-OpenSSH automatically determines the username that corresponds to the X.509 proxy certificate subject in the server's `grid-mapfile`.

Deprecated Features

- None

2. Tested platforms

Tested Platforms for GSI-OpenSSH

- Mac OS X 10.5
- x86/x86_64 GNU/Linux
- PPC AIX 5.3
- Sun4u Solaris 5.10

3. Backward compatibility summary

GSI-OpenSSH is backward compatible.

4. Technology dependencies

GSI-OpenSSH depends on the following GT components:

- **GSI C**

GSI-OpenSSH depends on the following 3rd party software:

- **OpenSSH**¹

¹ [http://www.openssh.org/](http://www.openssh.org/)
5. GSI-OpenSSH Security Considerations

GSI-OpenSSH is a modified version of OpenSSH\(^2\) and includes full OpenSSH functionality. For more information on OpenSSH security, see the OpenSSH Security\(^3\) page.

\(^{2}\) http://www.openssh.org/
\(^{3}\) http://www.openssh.org/security.html
Chapter 2. Usage scenarios

The GSI-OpenSSH interface is through command-line tools only.
Chapter 3. Tutorials

There are no tutorials available at this time
Chapter 4. Architecture and design overview

See the GSI-OpenSSH Internals\(^1\) page.

\(^1\) http://dev.globus.org/wiki/GSI-OpenSSH/Internals
GSI-OpenSSH Commands

The `gsissh(1)`, `gsiscp(1)`, and `gsisftp(1)` commands provide the same interfaces as the standard OpenSSH `ssh`, `scp`, and `sftp` commands, respectively, with the added ability to perform X.509 proxy credential authentication and delegation.
Name

gsissh -- Secure remote login

gsissh

Tool description

Use the gsissh command to securely login to a remote machine.

Command syntax

gsissh [-l login_name] hostname | user@hostname [command]
Name

gsiscp -- Secure remote file copy

gsiscp

Tool description

Use the gsiscp command to securely copy files to or from a remote machine.

Command syntax

gsiscp [-P port] [[user@]host1:]file1 [...] [[user@]host2:]destfile
**Name**

gsisftp -- Secure file transfer

gsisftp

**Tool description**

The *gsisftp* command provides an interactive interface for transferring files to and from remote machines.

**Command syntax**

`gsisftp [[user@]host[:dir/]][`
Chapter 5. Configuring

The GSI-enabled OpenSSH software is installed with a default set of configuration files, described below. You may want to modify the `ssh_config` file before using the clients and the `sshd_config` file before using the server.

If the GSI-enabled OpenSSH install script finds existing SSH key pairs, it will create symbolic links to them rather than generating new key pairs. The SSH key pairs are not required for GSI authentication. However, if you wish to support other SSH authentication methods, make sure the sshd (running as root) can read the key pair files (i.e., beware of NFS mounts with root_squash). If running multiple sshds on a system, we recommend configuring them so they all use the same key pairs (i.e., use symbolic links) to avoid client-side confusion.

- `$GLOBUS_LOCATION/etc/ssh/moduli`
  
  moduli is a crypto parameter for generating keys.

- `$GLOBUS_LOCATION/etc/ssh/ssh_config`
  
  `ssh_config` contains options that are read by ssh, scp, and sftp at run-time. The installed version is the default provided by OpenSSH, with GSI authentication and X11Forwarding enabled. You may need to customize this file for compatibility with your system SSH installation (i.e., compare it with `/etc/ssh/ssh_config`).

- `$GLOBUS_LOCATION/etc/ssh/ssh_host_key[.pub]`
  
  Your system's RSA public-/private-key pair for SSH protocol 1 communications.

- `$GLOBUS_LOCATION/etc/ssh/ssh_host_dsa[.pub]`
  
  Your system's DSA public-/private-key pair for SSH protocol 2 communications.

- `$GLOBUS_LOCATION/etc/ssh/ssh_host_rsa[.pub]`
  
  Your system's RSA public-/private-key pair for SSH protocol 2 communications.

- `$GLOBUS_LOCATION/etc/ssh/ssh_prng_cmds`
  
  `ssh_prng_cmds` contains paths to a number of files that ssh-keygen may need to use if your system does not have a built-in entropy pool (like /dev/random).

- `$GLOBUS_LOCATION/etc/ssh/sshd_config`
  
  `sshd_config` contains options that are read by sshd when it starts up. The installed version is the default provided by OpenSSH, with X11Forwarding enabled. You may need to customize this file for compatibility with your system SSH installation (i.e., compare it with `/etc/ssh/sshd_config`). For example, to enable PAM authentication, you may need to set "UsePAM yes" in this file.
Chapter 6. Environment variable interface

1. Environmental variables for GSI-OpenSSH

The GSI-enabled OpenSSHD needs to be able to find certain files and directories in order to properly function.

The items that OpenSSHD needs to be able to locate, their default location and the environment variable to override the default location are:

- **Host key**
  
  Default location: /etc/grid-security/hostkey.pem
  
  Override with X509_USER_KEY environment variable

- **Host certificate**
  
  Default location: /etc/grid-security/hostcert.pem
  
  Override with X509_USER_CERT environment variable

- **Grid map file**
  
  Default location: /etc/grid-security/grid-mapfile
  
  Override with GRIDMAP environment variable

- **Certificate directory**
  
  Default location: /etc/grid-security/certificates
  
  Override with X509_CERT_DIR environment variable
Chapter 7. Troubleshooting

1. Common GT Errors

For a list of common errors in GT, see Error Codes.
2. Errors

Table 7.1. GSI-OpenSSH Errors

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Definition</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSS-API error Failure acquiring GSSAPI credentials: GSS_S_CREDENTIALS_EXPIRED</td>
<td>This means that your proxy certificate has expired.</td>
<td>Run grid-proxy-init to acquire a new proxy certificate, then run gsssh again.</td>
</tr>
<tr>
<td>...no proxy credentials...</td>
<td>Failing to run grid-proxy-init to create a user proxy with which to connect will result in the client notifying you that no local credentials exist. Any attempt to authenticate using GSI will fail in this case.</td>
<td>Verify that your GSI proxy has been properly initialized via grid-proxy-info. If you need to initialize the proxy, use the command grid-proxy-init.</td>
</tr>
<tr>
<td>...bad file system permissions on private key; key must only be readable by the user...</td>
<td>The host key that the SSH server is using for GSI authentication must only be readable by the user which owns it. Any other permissions will cause this error.</td>
<td>Make sure that the host key's UNIX permissions are mode 400 (that is, it should only have mode readable for the user that owns the file, and no other mode bits should be set).</td>
</tr>
<tr>
<td>...gssapi received empty username; failed to set username from gssapi context; Failed external-keyx for &lt;user&gt; from &lt;host&gt; &lt;port&gt;...</td>
<td>If the server was passed an &quot;implicit username&quot; (i.e. requested to map the incoming connection to a username based on some contextual clues such as the certificate's subject), and no entry exists in the grid-mapfile for the incoming connection's certificate subject, the server should output a clue that states it is unable to set the username against which to authenticate.</td>
<td>Add an entry for the user to the Section 1.2, “Gridmap file”.</td>
</tr>
<tr>
<td>...INTERNAL ERROR: authenticated invalid user xxx...</td>
<td>If the subject name given in the system's grid-mapfile points to a non-existent user, the server will give an internal error which is best caught when it is running in debugging mode.</td>
<td>Add a new account to the system matching the username pointed at by the user's subject in the grid-mapfile.</td>
</tr>
<tr>
<td>...gssapi received empty username; no suitable client data; failed to set username from gssapi context; Failed external-keyx for &lt;user&gt; from &lt;host&gt; &lt;port&gt;...</td>
<td>Should the user attempt to connect without first creating a proxy certificate, or if the user is connecting via a SSH client that does not support GSI authentication, the server will note that no GSSAPI data was sent to it. Verify that the client is able to connect through another GSI service (such as the gatekeeper) to make sure that the user's proxy has been created correctly.</td>
<td>Verify that you are using a GSI-enabled SSH client and that your GSI proxy has been properly initialized via grid-proxy-info. If you need to initialize this proxy, use the command grid-proxy-init.</td>
</tr>
</tbody>
</table>

3. Additional GSI-OpenSSH Troubleshooting

Please see the GSI-OpenSSH Troubleshooting Page¹ at NCSA.

¹ http://grid.ncsa.illinois.edu/ssh/ts_common.html
Chapter 8. Related Documentation

Please see the GSI-OpenSSH Home Page\footnote{http://grid.ncsa.uiuc.edu/ssh/} at NCSA for more information.
Glossary

C
certificate subject  An identifier for the certificate owner, e.g. \\
"/DC=org/DC=doegrids/OU=People/CN=John Doe 123456". The \\
subject is part of the information the CA binds to a public key when creating a \\
certificate.

G
grid map file  A file containing entries mapping certificate subjects to local user names. This file \\
can also serve as a access control list for GSI enabled services and is typically \\
found in /etc/grid-security/grid-mapfile. For more information see the Gridmap section here.

H
host certificate  An EEC belonging to a host. When using GSI this certificate is typically stored in \\
/etc/grid-security/hostcert.pem. For more information on possible \\
host certificate locations see the GSI C Developer's Guide.

P
proxy credentials  The combination of a proxy certificate and its corresponding private key. GSI \\
typically stores proxy credentials in /tmp/x509up_u<uid> , where <uid> is \\
the user id of the proxy owner.