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# **Topaz User's Guide for GemStone/S 64 Bit™**

**Version 3.6**

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## PATENTS

GemStone software is or has been covered by U.S. Patent Number 6,256,637 "Transactional virtual machine architecture" (1998-2018), Patent Number 6,360,219 "Object queues with concurrent updating" (1998-2018), Patent Number 6,567,905 "Generational garbage collector with persistent object cache" (2001-2021), and Patent Number 6,681,226 "Selective pessimistic locking for a concurrently updateable database" (2001-2021).

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# Preface

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## About This Manual

This manual describes Topaz, the command-line interface for GemStone/S 64 Bit™. You can use Topaz with the other GemStone development tools to build and maintain comprehensive database applications.

Topaz is especially useful for database administration tasks and batch-mode procedures. Because it is command driven and generates character-based output on standard output channels, Topaz offers access to GemStone without requiring a window manager or additional language interfaces.

## Terminology Conventions

The term “GemStone” is used to refer to the server products GemStone/S 64 Bit and GemStone/S, and the GemStone family of products; the GemStone Smalltalk programming language; and may also be used to refer to the company, now GemTalk Systems, previously GemStone Systems, Inc. and a division of VMware, Inc.

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**Email:** [techsupport@gemtalksystems.com](mailto:techsupport@gemtalksystems.com)

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Please include the following, in addition to a description of the issue:

- ▶ The versions of GemStone/S 64 Bit and of all related GemTalk products, and of any other related products, such as client Smalltalk products, and the operating system and version you are using.
- ▶ Exact error message received, if any, including log files and statmonitor data if appropriate.

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# Getting Started with Topaz

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Topaz is a linear interface for GemStone/S 64 Bit™ that provides scripting and command-line access to the GemStone system. Topaz does not require a windowing system, and so is a useful interface for batch work and for many system administration functions.

This chapter explains how to run Topaz and how to use some of the most important Topaz commands.

To run Topaz, GemStone/S 64 Bit must be installed on your system. You must have an running repository monitor (Stone) that is the same version of GemStone as Topaz, and in some cases an accessible network service process (NetLDI). The *GemStone/S 64 Bit Installation Guide* explains how to install these components.

In most cases, your environment should contain a definition of the `$GEMSTONE` environment variable and your execution path should include the GemStone binary directory `$GEMSTONE/bin`.

Examples throughout this book were created on a UNIX system. Topaz is also available with the GemStone/S 64 Bit Windows Client distribution, which allows Topaz to run on Windows, logging in remotely to a GemStone server running on UNIX. Topaz on Windows cannot login in linked mode, nor with a Gem session on Windows. Otherwise, Topaz operates similarly on UNIX and Windows. Differences are noted in the text.

## 1.1 Getting started with Topaz

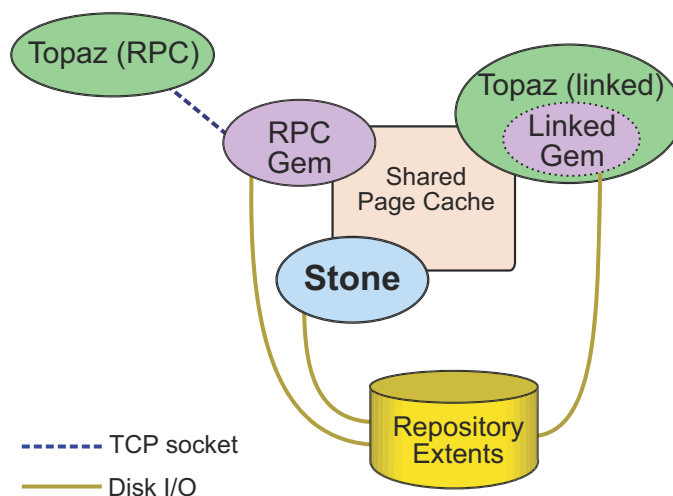
Topaz provides an environment in which you can login a GemStone session and use that session to find out information about GemStone, and to execute Smalltalk code. To perform any server interaction, you must first log in. All server interaction is performed using the logged-in session. The sessions that Topaz uses are the same as sessions acquired via any other GemStone interface, such as GemBuilder for Smalltalk (GBS).

## Overview of a GemStone Session

A GemStone session consists of four parts, as shown in Figure 1.1. These are:

- ▶ An **application**, in this case, Topaz.
- ▶ One **repository** and repository monitor (**Stone**), and the associated server processes. An application has one repository to hold its persistent objects.
- ▶ At least one GemStone session, or **Gem** process. All applications, including Topaz, must communicate with the repository through Gem processes. A Gem provides a work area within which objects can be used and modified. Several Gem processes can coexist, communicating with the repository through a single Stone process.

**Figure 1.1 GemStone Object Server Components**



## Remote Versus Linked Versions

Figure 1.1 includes the two types of topaz sessions -- *Remote Procedure Call (RPC)* and *Linked*. With a Topaz RPC login, the Topaz application and the Gem session that provides the repository services exist in two separate processes. In a linked login, the Topaz application process includes the Gem session. These two types of sessions and configuration details are described in more detail in the *System Administration Guide for GemStone/S 64 Bit*.

To allow control over the use of linked logins, GemStone client libraries and Topaz provide separate versions; one which allows RPC logins only, the other allowing Linked and RPC.

- ▶ Topaz RPC is the default, although you may specify the **-r** command line argument. You can run multiple RPC sessions from the Topaz RPC executable, but linked sessions are not possible.
- ▶ Topaz Linked requires specifying the **-L** or **-l** command line argument to topaz. You can run a single linked session and multiple RPC sessions from the linked topaz executable.

In Figure 1.2, notice that the Topaz startup banner's PROGRAM line refers to Remote Session. In a linked login, it will say Linked Session.

Under Windows, only the RPC version of Topaz is available. The Gem, which is part of the server code, can only run on a server platform.

The examples in this chapter can be executed equally well from either linked or RPC Topaz. For additional command-line options, see Appendix A.

## Invoking Topaz

To invoke Topaz, simply type **topaz** on the command line. The program responds by printing its copyright banner and issuing a prompt, as shown in Figure 1.2.

**Figure 1.2 Topaz Banner and Prompt**

```

unix> topaz
|
|           GemStone/S64 Object-Oriented Data Management System
|           Copyright (C) GemTalk Systems 1986-2019
|           All rights reserved.
|-----|
|   PROGRAM: topaz, Linear GemStone Interface (Remote Session)
|   VERSION: 3.6.0, Mon Oct 19 22:04:14 2020
|   COMMIT: 2020-10-19T17:31:08-07:00 925e19317f5ac852dd751da32230481ad24c31
|   BUILT FOR: x86-64 (Linux)
|   RUNNING ON: 8-CPU lark x86_64 (Linux 4.15.0-117-generic #118-Ubuntu SMP Fri
|   Sep 4 20:02:41 UTC 2020)
|   PROCESSOR: 4-core Intel(R) Xeon(R) CPU W3565 @ 3.20GHz (Bloomfield)
|   MEMORY: 18049 MB
|   PROCESS ID: 31009      DATE: 10/19/2020 18:33:07 PDT (UTC -7:00)
|   USER IDS: REAL=gsuser (534) EFFECTIVE=gsuser (534) LOGIN=gsuser (534)
|
topaz>

```

## Topaz Commands

Topaz interaction is performed by sending commands. Each command begins with a keyword, and may have optional or required arguments. Some commands are only meaningful in certain contexts. Chapter 3 provides a list of the commands you will be using and the options and arguments for each command.

The first thing you will do is use the **set** command to provide login parameters, and use the **login** command to perform the login to GemStone. This is described in more detail in the next section.

The commands and keywords in Topaz are case-insensitive; so for example, the command **login** can be entered as LOGIN or Login. Arguments to topaz commands, however, such as user names or the names of Smalltalk classes, will follow their specific rules for case sensitivity.

You can abbreviate many Topaz command to uniqueness, so for example you can type **log** instead of **login**. Some commands such as **logout** may not be abbreviated, to avoid

accidental use. The colon indicating arguments is often omitted, and the examples in this manual generally do not include the colon.

To enter an argument to a Topaz command that includes white space, enclose it within single quotes. For example, a username such as 'Issac Newton' requires quotes, while Issac\_Newton does not.

Normally, each topaz command is on a separate line, and the command is terminated by the return at the end of the line. For most commands, you can include multiple topaz commands on a single line by separating each expression with a semicolon (;), however, commands that interpret the rest of the line in specific ways, such as run, do not allow this usage. Commands may not be longer than 64K characters.

Any text following a command that does not have arguments, or text following the argument, is ignored; topaz will print a warning to that effect after executing the valid portion of the line.

## Logging In to GemStone

The first step in establishing a connection to GemStone and logging in is to give Topaz some information about the GemStone repository you will be using. To log in to the repository you must provide the Stone's name, and a valid GemStone user name and password.

### Note

*This section does not apply to X509-Secured GemStone, which takes a completely different set of login parameters. Logins using X509-Secured GemStone are described in the GemStone/S 64 Bit X509-Secured GemStone Administration Guide.*

Here are the parameters to be established to log in to GemStone through Topaz:

- ▶ **GemStone name.** This is the name of the Stone process to login into, and, optionally, the name of the network node on which it resides. The default name is `gs64stone`. If your Stone process is named `gs64stone` and is running on the local node, and the Gem process will also run on the local node, you don't have to set the GemStone name.

Otherwise, specify the name of the Stone. If the node where the Stone is running is not the one where the Gem will run, you also need the name of the Stone host and perhaps the type of network connection between the Stone and Gem hosts. To specify a process named `gs64stone` running on node `central`, you can use a network resource string of the form `!@central!gs64stone`.

For details on using NRS and NRS syntax, see the *System Administration Guide for GemStone/S 64 Bit*.

This is configured using the set command: `set gemstone stonename`.

- ▶ **GemStone user name and password.** These are defined within the GemStone server. You can log in using your personal username and password, created by your GemStone Administrator, or as predefined GemStone system users such as DataCurator.

These are configured using the set command, set username `gemStoneUserName` and set password `gemStoneUserPassword`. You may abbreviate and combine them as `set user gemStoneUserName pass gemStoneUserPassword`.

You may omit the argument to the `set password` command, in which case you will be prompted to enter the password.

The default password for predefined GemStone users such as DataCurator is `swordfish`. However, it is strongly recommended that this is changed, to provide some basic system security.

- ▶ **host user name and password.** The UNIX name and password for the account on the server that will own the Gem process. These are needed only for RPC sessions, and only if the NetLDI is configured to require this for authentication. More information on NetLDI modes can be found in the *System Administration Guide for GemStone/S 64 Bit*.

These are configured using the `set` command, `set hostusername osUserName` and `set hostpassword osPassword`. You may abbreviate and combine them as `set hostuser osUserName hostpass osPassword`.

You may omit the argument to the `set hostpassword` command, in which case you will be prompted to enter the password.

- ▶ **GemStone service name.** For the RPC version the default is `gemnetobject`. You may also use `gemnetdebug`, if you are debugging memory issues, or the name of a customized version of the `gemnetobject` script that you have created.

For the linked version of Topaz, do **not** set `gemnetid`, nor set the `gemnetid` to "".

#### NOTE

*If you are running the linked version of topaz, and set gemnetid to gemnetobject, all your sessions will be RPC, in spite of having invoked the linked version. Use -L to start linked topaz to avoid this issue.*

The GemStone service name is configured using the `set` command `set gemnetid serviceName`. The gem service can be provided an NRS, in order to specify that the Gem process is running on a remote node. To do this, for the `gemnetid`, specify a network resource string (NRS) of the form

```
!@<remoteNode>#netldi:<netldiName>!gemnetobject.
```

For example,

```
!@lark.gemtalksystems.com#netldi:gs64ldi!gemnetobject.
```

Additional NRS directives and `gemnetobject` arguments can be included. For details on using NRS and NRS syntax and the `gemnetobject` utility, see the *System Administration Guide for GemStone/S 64 Bit*.

## Logging In Linked

Use the Topaz `set` command to establish the parameters. For example:

```
topaz> set gemstone gs64stone
topaz> set username Isaac_Newton
topaz> set password
GemStone Password? (type the GemStone password for Issac_Newton)
```

You may supply several of these login parameters on a single command line in any order, except that a password must follow the user name that it is associated with; and parameter names may be abbreviated. Instead of the above three statements, you could just enter:

```
topaz> set gemstone gs64stone user Isaac_Newton pass gravity
```

When logging in linked, do **not** set the **gemnetid** parameter. Any values set for **hostusername** and **hostpassword** are ignored.

You are now ready to issue the **login** command, connecting your Topaz session to the GemStone repository.

```
topaz> login
[Info]: LNK client/gem GCI levels = 36000/36000
--- 09/26/2020 11:21:22.943 PDT Login
[Info]: User ID: DataCurator
[Info]: Repository: gs64stone
[Info]: Session ID: 5 login at 09/26/2020 11:51:22.948 PDT
[Info]: GCI Client Host:
[Info]: Page server PID: -1
[Info]: using libicu version 58.2
[Info]: Gave this process preference for OOM killer: wrote to
/proc/24238/oom_score_adj value 250
[09/26/2020 11:51:22.951 PDT]
  gci login: currSession 1 linked session
successful login
topaz 1>
```

## Logging In RPC

For RPC login, there are additional parameters you may or may not need to specify, depending on how the NetLDI is set up.

The Stone name and the username and password are needed:

```
topaz> set gemstone gs64stone
topaz> set username Isaac_Newton
topaz> set password
GemStone Password? (type the GemStone password for Issac_Newton)
```

If your NetLDI requires host authentication, you will need to provide the host login credentials. These settings can be skipped if the NetLDI is in guest mode.

```
topaz> set hostusername newtoni
topaz> set hostpassword
Host Password? (type the unix password for newtoni)
```

When you are running the RPC version of Topaz, by default **gemnetid** is set to **gemnetobject**, which is sufficient for login when the Stone, NetLDI and Gem are all running on the same node. If the Stone is running on another node, and the NetLDI is not named **gs64ldi**, you may need to include further details:

```
topaz> set gemnetid !@lark#netldi:54321!gemnetobject
```

You are now ready to issue the **login** command:

```
topaz> login
[09/26/2020 11:44:05.849 PDT]
  gci login: currSession 1 rpc gem processId 20964 socket 6
successful login
topaz 1>
```

Topaz displays a session number in its prompt once you have logged in. In topaz RPC, where multiple logins are allowed, the prompt will indicate which session is the current one.

To see your current login settings and other information about your Topaz session, type **status**:

```
topaz 1> status
```

Current settings are:

```
display : 0
byte limit: 0 lev1bytes: 0
omit bytes
include deprecated methods in lists of methods
display instance variable names
display oops    omit alloops    omit stacktemps
oop limit: 0
omit automatic result checks
omit interactive pause on errors
omit interactive pause on warnings
listwindow: 20
stackpad: 45 singlecolumn: Off  tab (ctl-H) equals 8 spaces when
  listing method source
transactionmode autoBegin
using line editor
  line editor history: 100
  topaz input is from a tty on stdin
EditorName_____ vi
CompilationEnv____ 0
Source String Class String
fileformat          8bit (tty stdin is utf8)
SessionInit         On
EnableRemoveAll     On
CacheName_____ 'TopazR'
```

Connection Information:

```
UserName_____ 'Isaac_Newton'
Password _____ (set)
HostUserName_____ 'newtoni'
HostPassword_____ (set)
NRSdefaults_____ '#netldi:gs64ldi'
GemStone_____ 'gs64stone'
GemStone NRS_____ '!'#encrypted:newtoni@password#server!gs64stone'
GemNetId_____ 'gemnetobject'
GemNetId NRS_____ '!'#encrypted:newtoni@password!gemnetobject'
```

Browsing Information:

```
Class_____
Category_____ (as yet unclassified)
```

## Setting Up a Login Initialization File .topazini

You can streamline the login process by creating an initialization file that contains the **set** commands needed for logging in. When you invoke Topaz, it automatically executes those commands for you. If you insert **set password** and **hostpassword** commands without parameters, Topaz automatically prompts you for the necessary values.

**Table 1.1 Topaz Initialization File Names**

Platform	Name of Topaz Initialization File	Locations searched for initialization file
UNIX	.topazini	Current directory, then user's home directory
Windows	topazini.tpz	Current directory, then user's home directory. If home directory is undefined, uses home directory of the account that started Windows, if any, or C:\users\default.

You may also explicitly specify a path for a topazini file on the command line where you started up the Topaz executable. Using this option overrides any topazini files that Topaz would otherwise use.

```
% topaz -I /gemstone/utils/mylogin.topazini
```

If you want to run Topaz non-interactively, you must explicitly specify both the GemStone and host passwords in this initialization file.

**CAUTION:**

*Entering your passwords in a file can pose a security risk.*

The Topaz initialization file shown in Figure 1.3 performs most of the same functions as the interactive commands shown in the previous discussion.

**Figure 1.3 Topaz Initialization File**

```
set gemstone gs64stone
set username Isaac_Newton
set password gravity
set hostusername 'newtoni'
set hostpassword calculus
login
```

If you choose not to include your password in an initialization file, Topaz will start up with prompts, for example.

```
GemStone Password?      Type your password. It will not be echoed.
topaz 1>
```



## Error handling and output

Commands that are executed from a login initialization file are not echoed to the display. However, if an error occurs, the output is reported to the topaz display, so you can determine the cause of the problem. In this case, the password and host password are struck out, for security.

## Alternatives to automatic initialization

If a topaz initialization file exists in one of the search directories, it will be executed each time topaz is started. You can prevent this by starting Topaz using the **-i** argument, which suppresses loading of an initialization file.

You can also explicitly provide the initialization file to use on the topaz command line, by using the **-I** command, passing in the name of the initialization file. If you name your file other than the default, or locate this file in a directory other than the ones searched for, you can control the specific one you wish to load.

This also allows you to have multiple initialization files for different uses.

See Appendix A for more details on command line options.

## Special care needed when setting gemnetid in .topazini

Use caution in including commands to set the gemnetid in a .topazini file. For example, using a line such as:

```
set gemnetid gemnetobject
```

The .topazini file is executed for RPC topaz, and for linked topaz started using the **-l** option. If this line is present in a .topazini file, and that .topazini file is executed by **topaz -l**, the effect is to turn the linked login into an RPC login.

When linked topaz is started using the **-L** option, **set gemnetid** commands in .topazini files are ignored. For this reasons, using **-L** rather than **-l** is recommended. Otherwise there is no difference between starting linked topaz using **topaz -l** vs. **topaz -L**.

For more on the behavior of gemnetid in linked and RPC topaz, see under **gemnetid** starting on page 154.

## Multiple Concurrent GemStone Sessions

Topaz can keep several independent GemStone sessions alive simultaneously. This allows you to switch from one session to another, for instance to access more than one GemStone repository. Both RPC and linked versions of Topaz allow you to run multiple sessions by using the **login** and **set session** commands; however, you can only have one linked session at a time. While you can login both RPC and linked session from the linked version of topaz, the RPC version of topaz does not allow linked sessions.

## Multiple sessions in the RPC version of Topaz

The following example shows how you might login a second session to a different GemStone server, make the new session your current session, then return to the original session. With the RPC version of Topaz, all sessions are always RPC.

```
topaz> login
[09/26/2020 12:34:02.292 PDT]
gci login: currSession 1 rpc gem processId 95
successful login
topaz 1> set gemstone !@srv2!gs64stone
topaz 1> set username Isaac_Newton
Warning: GemStone is clearing previous GemStone password.
GemStone password? <password typed here but not echoed>
topaz 1> login
[09/26/2020 12:34:05.548 PDT]
gci login: currSession 2 rpc gem processId 141
successful login
topaz 2> exec UserGlobals at: #myVar put: 1 %
1
topaz 2> set session 1
topaz 1>
```

## Multiple sessions in the Linked version of Topaz

If you use the **topaz -L** or **-l** command to invoke Topaz, you may run multiple sessions, but only one of them may be linked. Normally, this is the first session that logs in. In order to run two sessions, you must specify a value for **gemnetid**, and provide OS credentials if your server configuration requires this, so you can get an RPC login.

If you are running linked topaz, and you first login an RPC session, then wish to login the linked session, you will need to clear the setting for **gemnetid**. For example:

```
topaz> set gemnetid gemnetobject
topaz> login
[09/26/2020 14:40:49.338 PDT]
gci login: currSession 1 rpc gem processId 31427 socket 6
successful login
topaz 2> set gemnetid "
topaz 2> login
[Info]: LNK client/gem GCI levels = 36000/36000
--- 09/26/2020 14:37:56.603 PDT Login
[Info]: User ID: DataCurator
[Info]: Repository: gs64stone
[Info]: Session ID: 5
[Info]: GCI Client Host: <Linked>
[Info]: Page server PID: -1
[Info]: Gave this VM preference for OOM killer, Wrote to
/proc/4458/oom_adj value 250
[09/26/2020 14:37:56.609 PDT]
gci login: currSession 1 linked session
successful login
topaz 1>
```

The messages displayed during login indicate if the session is linked or RPC.

## Topaz sessions vs. GemStone sessions

Notice that the Topaz prompt always shows the number of the current session. These sequential session numbers are assigned by your individual Topaz environment, and do not correspond to the session numbers that are assigned by the GemStone server to each logged-in session.

To get a list of current GemStone sessions and the users who own them, you can execute the GemStone Smalltalk expression `System currentSessionNames`. For example:

```
topaz 1> printit
System currentSessionNames
%
session number: 2 UserId: GcUser
session number: 3 UserId: GcUser
session number: 4 UserId: SymbolUser
session number: 5 UserId: DataCurator
session number: 6 UserId: Isaac_Newton
session number: 7 UserId: Isaac_Newton
session number: 8 UserId: Gottfried_Leibniz
```

The GcUser session (or sessions) represent the garbage collection processes that usually (though not always) operate when GemStone is active. The SymbolUser session represents the process that administers Symbols to ensure canonicity.

This list includes all sessions that are currently logged into the GemStone system, not only the sessions within your Topaz environment.

## Transaction state

GemStone is a transactional system. The process of making persistent changes in the GemStone repository require that you begin a transaction, make the changes, then commit the transaction.

To make this easier, GemStone provides automatic transaction mode (`autoBegin`). In this mode, the session is always in transaction. Each commit or abort automatically starts a new transaction.

When you login through Topaz, your session is in automatic transaction mode. This allows you to make changes and commit them without having to explicitly start a transaction.

However, being in transaction on a system in which other users are also committing changes incurs a risk. GemStone must maintain your transactional view of the repository as long as you are in the transaction and do not commit or abort. These commit records require space in the repository, and in a rapidly changing system, an idle session in transaction can create a "commit record backlog". Under worst-case conditions, this can cause the repository to fill up with this old data, run out of space, and shut down. If you are logging into a system that is in use, avoid remaining logged in and idle.

If you use topaz to log into a multiple-user system, you may wish to configure your system to default to not being in a transaction; this mode is manual transaction mode (`manualBegin`). In manual transaction mode, you are out of transaction until you explicitly begin a transaction (either by the `begin` command, or by executing a Smalltalk expression such as `System beginTransaction`), and when you commit, your session becomes out of transaction.

You can set topaz to be in manual transaction mode:

```
topaz> set transactionmode manualBegin
no transaction was in progress, transaction mode changed to
manualBegin
```

Note that if you are logged in, using this command will abort any transaction in progress, so it is better to execute this before login. You may wish to add this to the .topazini initialization file; see details starting on page 16.

You can also change the default for the entire system, by using the Stone configuration parameter STN\_GEM\_INITIAL\_TRANSACTION\_MODE. This sets the initial transaction mode for all sessions logging in, and may be particularly beneficial in production systems in which an inadvertent login can create problems.

See the *System Administration Guide for GemStone/S 64 Bit* for more information on managing transactions, handling sigAborts, and configuring STN\_GEM\_INITIAL\_TRANSACTION\_MODE.

#### WARNING

*Idle topaz sessions should not be left in transaction in active multi-user systems. Even if the session is not in transaction and does not cause serious problems, your stale commit record requires extra work for the stone, and sessions may be terminated.*

## Other Types of Logins

### X509-Secured

The GemStone server supports both traditional password-based login, and X509 secured certificate-based logins. These two types of login use a disjoint set of login parameters. When any of the traditional login parameters are set, all the X509 login parameters are unset, and vice versa. When you intend to authenticate using X509 certificates, do not set any of the following: **username**, **password**, **hostusername**, **hostpassword**, **gemstone**, **gemnetid**, or **solologin**

For X509 login, the following are required: **cert**, **cacert**, **key**, **netldi**

and the following are optional: **logfile**, **directory**, and **extragemargs**

You must also create the appropriate keyfiles, and have a Stone that is running with a keyfile that allows X509 logins.

X509-Secured topaz and other logins are described in detail in the *X509-Secured GemStone System Administration Guide*.

### Solo Scripting

Topaz supports login without a running Stone, for scripting. See "Topaz Solo for Scripting" on page 30.

## Multiple Execution Environments

The GemStone server has multiple compilation/execution environments available, which define separate environments for method lookup and code execution.

The default, and the location of the GemStone kernel, is environment 0. Most applications will only use environment 0 and can disregard references to execution environments.

The environmentId is set using commands:

```
set compile_env: anInteger
env anInteger
```

Most topaz commands operate on the current environment, and many accept an optional argument specifying the environmentId; see the command comments for exceptions.

## 1.2 Interacting with Topaz

### Help Command

You can type **help** at the Topaz prompt for information about any Topaz command. For example:

```
topaz 1> help time
```

```
TIME
```

```
The first execution of TIME during the life of a topaz
process displays current date and time from the operating
system clock, total CPU time used by the topaz process.
```

```
Subsequent execution of TIME will display in addition
elapsed time since the previous TIME command, CPU time used
by the topaz process since the previous TIME command.
```

```
Topic?
```

You may enter further help topics at the Topic> prompt.

The enter key brings you back to the topaz command prompt.

For a full list of help topics, use **help** without specifying an argument.

### Interrupting Topaz and GemStone

The Ctrl-C key combination interrupts Topaz and GemStone:

- ▶ When Topaz is awaiting input from your terminal, such as when you're entering a command, you can enter Ctrl-C to terminate entry of the command and prepare Topaz for accepting a new command.
- ▶ When GemStone is compiling or executing some GemStone Smalltalk code sent to it by Topaz, such as in a **printit** command, typing Ctrl-C sends a request to GemStone to interrupt its activities as soon as possible. GemStone stops execution at the conclusion of the current method, and Topaz displays the message: A soft break was received.

## Logging Out

To log out from your current GemStone session, just type **logout**.

```
topaz 1> logout
topaz>
```

Logging out implicitly aborts your transaction.

## Leaving Topaz

To leave Topaz and return to your host operating system, just type **exit**:

```
topaz> exit
```

If you are still logged in when you type **exit**, this will implicitly abort all your transactions and log out all active sessions.

You can also use **quit**, which has the same effect as **exit**.

These commands can include return values to the operating system shell; see **exit** (page 82) or **quit** (page 142) for details.

## 1.3 Executing GemStone Smalltalk Expressions

There are a number of commands allowing you to execute Smalltalk expressions: **run**, **printit**, **doit**, and **exec**. The following use of **printit**, for example, creates an instance of `DateTime` representing the current Date and Time:

```
topaz 1> printit
DateTime now
%
a DateTime
  year                2020
  dayOfYear           38
  milliseconds        83048864
  timeZone            a TimeZone
```

All of the lines after the **printit** command and before a line in which `%` is the first character are sent to GemStone for execution as GemStone Smalltalk code. Topaz then displays the result and prompts you for a new command.

The **doit**, **run**, and **printit** commands differ in the way the output is displayed; this is described in the next section.

The **exec** command allows the expression to be entirely on one line, which can improve readability of input and output files when there are many brief lines to be executed. For example:

```
topaz 1> exec DateTime now %
a DateTime
  year                2020
  dayOfYear           38
  milliseconds        67995686
  timeZone            a TimeZone
```

If there is an error in your code, Topaz displays an error message instead of a legitimate result. You can then retype the expression with errors corrected, or use the Topaz **edit** function to correct and refine the expression.

## Strings vs. Unicode strings

GemStone Smalltalk supports two set of string classes; traditional Strings, including String, DoubleByteString and QuadByteString; and Unicode strings, including Unicode7, Unicode16, and Unicode32. Traditional Strings are native GemStone, while Unicode strings rely on the ICU libraries to provide sophisticated national language support. Both sets of string classes support the full Unicode character range. String classes are described in more detail in the *Programming Guide for GemStone/S 64 Bit*.

When you execute a Smalltalk expression in Topaz that creates a string object, the class of this object depends on the Topaz setting for SourceStringClass. The default is String, in which case a traditional string is created, of the lowest order in which all Characters of the result can be contained. Or it can be set to Unicode16, in which case a Unicode string is created, either a Unicode7, Unicode16, or Unicode32.

```
topaz 1> set sourcestringclass unicode16
topaz 1> display oops
topaz 1> exec 'hello' %
[4582145 sz:5 cls: 154369 Unicode7] hello
```

For further details, see **sourcestringclass** on page 158.

When a repository is in Unicode Comparison Mode, topaz detect this on login, and automatically changes the sourcestringclass to Unicode16, and the fileformat to utf8, and prints a message on this change on the topaz console. See the *Programming Guide for GemStone/S 64 Bit* for details on Unicode Comparison Mode.

## Controlling the Display of Results

The result of the Smalltalk expression is returned to Topaz, and this object is displayed on the topaz console. Topaz provides several options to allow you to control the level of detail that is displayed for the object.

### Display Level

When Topaz displays a result object, it always displays the object itself, but the display of the name and value of each instance variable is controlled by the level and the topaz command used to execute the code.

A level of 0 indicates that only the object itself is displayed; level 1 displays the object and its instance variables, level 2 include the instance variables of the instance variables of the object, and so on.

The **printit** command always displays results with level 1:

```
topaz 1> printit
DateTime now
%
a DateTime
  year                2020
  dayOfYear           38
  milliseconds        83048864
  timeZone            a TimeZone
```

This display is one level deep: the instance variables are displayed, but not the instance variables of any complex objects in the instance variable values.

The **doit** command displays 0 levels:

```
topaz 1> doit
DateTime now
%
09/26/2020 15:04:35
```

The **run** command uses the current level setting to display the results. By default, this is 0, and produces the same display as the **doit** command. You can set the level explicitly using the **level** command, to display more of the object.

For example, at the default level 0, the **run** command produces the same display as the **doit** command:

```
topaz 1> level 0
topaz 1> run
DateTime now
%
09/26/2020 15:05:23
```

Setting the level to 2 would give this view:

```
topaz 1> level 2
topaz 1> run
DateTime now
%
a DateTime
  year                2020
  dayOfYear           38
  milliseconds        83121913
  timeZone            a TimeZone
    transitions       an Array
    leapSeconds       nil
    stream            nil
    types            nil
    charcnt          nil
    standardPrintString PST
    dstPrintString   PDT
    dstStartTimeList an IntegerKeyValueDictionary
    dstEndTimeList  an IntegerKeyValueDictionary
```

As you can see, setting the display level to 2 causes Topaz to display each instance variable for the objects that are within each of `DateTime`'s instance variables. If the display level setting is high enough and the object to be displayed is cyclic (that is, if it contains itself in an instance variable), Topaz will faithfully follow the circularity, displaying the object repeatedly.

## Setting Limits on Object Displays

By default, Topaz attempts to display all of a result, no matter how long. So for example if an expression returns a collection, every item in the collection will be displayed.



The **limit oops** controls how much Topaz displays of pointer or NSC objects, such as Arrays and Sets, that come back as a result. Similarly, **limit bytes** command controls how much Topaz displays of a byte object (instance of String or one of String's subclasses) that comes back as a result. To avoid

The following example shows how you could use **limit bytes** to make Topaz limit the display to the first 4 bytes:

```
topaz 1> limit bytes 4
topaz 1> printit
'this and that'
%
this
...(9 more bytes)
```

Setting the limit to 0 restores the default condition.

## Displaying Variable Names, OOPs, and Byte Values

Two complementary commands, **display** and **omit**, control some features of how objects are displayed in topaz. For more details on the options, see **display** (page 70).

### OOP Values

It's useful in debugging to be able to examine the numeric object identifiers that GemStone uses internally. If you tell Topaz to **display oops**, it prints a bracketed object header with each object, which looks like this:

```
[21336065 sz:3 cls: 110849 Symbol]
```

Each object header contains:

- ▶ The object's OOP (a 64-bit unsigned integer)
- ▶ the object's size, calculated by summing all of its named, indexed, and unordered instance variable fields
- ▶ the OOP of the object's class and the class name

For example:

```
topaz 1> display oops
topaz 1> printit
DateTime now
%
[42370305 sz:4 cls: 118785 DateTime] a DateTime
  year          [16138 sz:0 cls: 74241 SmallInteger] 2020 == 0x7e1
  dayOfYear     [2266 sz:0 cls: 74241 SmallInteger] 38 == 0x11b
  milliseconds  [594793738 sz:0 cls: 74241 SmallInteger] 74349217 =
  = 0x46e7aa1
  timeZone     [10528513 sz:12 cls: 13530113 TimeZone] a TimeZone
```

You can turn off the display of OOPs by typing **omit oops** at the Topaz prompt.

## Byte Values

Topaz ordinarily displays byte objects such as Strings literally, with no additional information. If you enter **display bytes** or **display decimalbytes**, Topaz includes the hexadecimal or decimal value of each byte. For example:

```
topaz 1> display bytes
topaz 1> exec 'this and that' %
1 'this and that' 74 68 69 73 20 61 6e 64 20 74 68 61 74
```

Entering **omit bytes** or **omit decimalbytes** restores the default display mode.

## Committing and Aborting Transactions

To commit a transaction while using Topaz, you can execute the GemStone Smalltalk expression `System commitTransaction` within a **printit** command, or you can enter the Topaz **commit** command:

```
topaz 1> commit
Successful commit
```

Similarly, you abort a transaction by executing the GemStone Smalltalk expression `System abortTransaction` within a **printit** command, or by entering **abort** at the Topaz command prompt. Entering **abort** does not reset Topaz system definitions, such as your current class and category.

The topaz command **begin**, or executing `System beginTransaction`, may also be used to begin a transaction if you are not in automatic transaction mode, or to abort your transaction.

Although you can abbreviate most Topaz commands and parameter names, **commit**, **abort**, and **begin** (as well as some others such as **quit** and **exit**) must be typed in full.

## Importing files: topaz commands and GemStone code

The Topaz interactive environment takes its input from standard input, such as your terminal. You can also use the **input** command to make Topaz take its input from a file. Topaz treats the lines in the input file as if they were entered on the command line; this file may contain commands to perform work, or code to be filed in; there is no difference.

For example, the following command, would make Topaz read and execute the commands in a file called `animal.gs` in your UNIX `$HOME` directory:

```
topaz 1> input $HOME/animal.gs
```

The UNIX environment variable `$HOME` is expanded to the full filename before the **input** command is carried out.

When you have code that was filed out of GemStone, the input command allows you to load this code into another Stone. You will need to check for errors and commit to make the code persistent.

```
topaz 1> input $HOME/animal.gs
<input by default echos all input>
topaz 1 +> errorcount
0
topaz 1 +> commit
Successful commit
```

Input files can be nested. The prompt adds a + to indicate the depth of nesting of input files.

Batch processing goes very quickly. It is a good idea to record your topaz session to a file, use **output push**, so you can check for errors. This is described starting on page 27.

## Handling text outside the ASCII range

Character with codepoints between 128 and 255 are outside the ASCII range, but the codepoints only require one byte. Since UTF-8 encoding is identical only for characters with up to 7 bits, how Characters in this range are encoded in a text file or paste buffer depends on how your system is configured.

If all your code and text file contents, and all commands entered via scripts, are limited to the ASCII range, there is no difference in behavior and your system requires no further configuration.

Terminal input such as pasting into your command line is always decoded from UTF-8. If you are copying from a text editor, and the text you are pasting includes characters outside the range, ensure that the copy buffer encoding is UTF-8.

Text files that are input into Topaz are interpreted based on Topaz's **fileformat** setting. The default is 8BIT. With this setting, text files are interpreted as 8-bit extended ASCII, the way GemStone historically has encoded this range.

With the setting of UTF8, text files are assumed to be encoded as UTF-8, and it will attempt to decode any bytes in the 128-255 range.

To input text files that are encoded as UTF-8 into Topaz, use:

```
topaz> fileformat UTF8
```

**If you use any characters with codepoints over 127, the fileformat must be set according to the encoding of the input file, otherwise the results will be corrupted.**

If you have logged in, and topaz detects that the repository is in Unicode mode, then it will automatically change the fileformat to UTF8. For more information on Unicode mode, see the *Programming Guide for GemStone/S 64 Bit*.

The same considerations apply for text files output from topaz. Log files produced by the **output** command are always encoded as UTF-8. Code fileouts produced by the topaz **fileout** command include a header line specifying the file format, so these files can be filed in again without problems.

Topaz displays characters in the range 0-31 using caret notation, for example, Character cr is displayed as ^M. The exceptions are Character lf and Character tab, which control display as designed. Characters with codePoints 128-159 and Characters with codePoints over 255 are displayed using C\Java hex format, for example, \u012c.

## Capturing Your Topaz Session In a File

It's often useful to keep a record of your interactions with GemStone during testing and debugging, and when executing scripts to simplifying finding errors.

You can do this with the Topaz command **output**. This command causes Topaz to write all input and output to a named file as well as to standard input and standard output (your terminal).

For example, either of these lines cause all subsequent interactions to be captured in a file called `animaltest.log`:

```
topaz 1> output animaltest.log
```

```
topaz 1> output push animaltest.log
```

Using **output** alone or **output push**, if the file you name doesn't exist, Topaz creates it. Under UNIX, if you name an existing file, Topaz will overwrite the previous file.

To add output to an existing file without losing its current contents, use **output append**, or precede the file name with an ampersand (&). For example:

```
topaz 1> output push &animaltest.log
```

To have topaz create a new file if a file with the given name already exists, use **pushnew**:

```
topaz 1> output pushnew animaltest.log
```

If `animaltest.log` already exists, the file `animaltest_1.log` is created.

To stop writing to the current log, use **output pop**.

```
topaz 1> output pop
```

## Writing to multiple log files

As the command names **push** and **pop** imply, Topaz can maintain a stack of up to 20 output files. Topaz input and results are written to each file on the stack.

You can specify topaz only write only to the file on the top of the stack using the keyword **only**.

For example:

```
topaz 1> output push animaltest.log only
```

The keyword **only** will also prevent the results of any topaz commands from being displayed on your screen; they will only be written to the log file.

The following sequence would capture one set of commands in the file `mathtest.log`, and a second set of commands in `mathtest2.log`:

```
topaz 1> ! Capture the next command and result in mathtest.log
topaz 1> output push mathtest.log
topaz 1> time
09/26/2020 14:49:47.558 PDT
CPU time: 0.013 seconds
topaz 1> exec 5 * 8 %
40
topaz 1> ! Capture the next command and result in mathtest2.log
topaz 1> output push mathtest2.log only
topaz 1> time
topaz 1> exec 5 * 9 %
topaz 1> ! Close mathtest2.log and resume using mathtest.log
topaz 1> output pop
```

Notice that the result of the second time and the result of 45 did not appear on the screen. If the second **push** command line did not have the **only** keyword, the entire sequence would have been recorded in `mathtest.log`, and the second command duplicated in `mathtest2.log`.

Also notice the use of the exclamation mark ! in this example, to indicate a comment line. You can use either exclamation point or pound sign as the first character in a line, or the command **remark**, to begin a comment. Comments are important for annotating Topaz input files created for batch processing or testing.

## 1.4 Using Topaz for Scripting

The Topaz commands that are entered interactively to login and execute code can be stored in external text files. When these files are input into topaz, the command are executed, just as if they were entered interactively. These files of topaz commands can login to GemStone and perform GemStone code, input other topaz files, invoke operating system functionality, and perform error checking and logging.

However, topaz does not provide flow of control. If you have complicated queries, sequences of repository updates, reports, or administrative tasks that you repeat on a regular basis, you can combine topaz with bash shell processing, or use GemStone itself to provide the flow of control.

### Topaz commands in text files

To perform automatic repository administrative operations, such as backup or markForCollection, you may create topaz scripts. These can be embedded within shell scripts which are invoked automatically.

For example, this might be the content of a text file script that runs markForCollection, with the name `runmfc.topaz`:

```
set user DataCurator password swordfish gemstone gs64stone
login
! run garbage collection mark/sweep
exec SystemRepository markForCollection %
exit
```

You can execute this script by starting topaz and inputting the file.

```
topaz 1> input runmfc.topaz
```

For more automation, this file can be specified as an input to the topaz command itself, using the **-I** or **-S** topaz argument.

For example:

```
unix> topaz -I runmfc.topaz > MFC.out
```

The **-I** suppresses the use of a `.topazini` and suppresses output; while **-S** does read a `.topazini` (which can be suppressed manually by also specifying **-i**), and does not suppress output (which can be suppressed manually by also specifying **-q**).

## Embedding Topaz within shell scripts

You can embed the topaz code within a UNIX shell script, to create a file that can be easily executed on the command line.

```
#!/bin/bash
#set -x
$GEMSTONE/bin/topaz -il <<EOF >>MFC.out
set user DataCurator password swordfish gemstone gs64stone
login
! run garbage collection mark/sweep
exec SystemRepository markForCollection %
exit
EOF
```

## Topaz Solo for Scripting

A solo login is a special kind of login, which does not require a running Stone. This allows a Gem session to start up and execute GemStone Smalltalk code (based on reading from a GemStone extent file), without any connection to a Stone. Without a Stone, a solo session is single-user, and changes to persistent objects cannot be committed. Solo sessions cannot, for example, run markForCollection in their own environments, nor execute methods that make or restore backups.

By default, a solo login uses the read-only extent in the GemStone distribution (`$GEMSTONE/bin/extent0.dbf`). However, you can configure it, by setting the Stone configuration parameter `GEM_SOLO_EXTENT`, to use another single extent file that contains scripting code or that contains your application code and data, provided that the following are true for the repository extent:

- ▶ The extent must not part of a multi-extent repository
- ▶ The extent file must either have read-only file permissions, or it will be exclusive-locked by the solo session.
- ▶ If not read-only, the extent repository must have been previously cleanly shutdown by the Stone

To login solo from topaz linked or RPC, execute `set solologin on`, then login.

For example:

```
topaz> set solologin on
topaz> login
[Info]: LNK client/gem GCI levels = 36000/36000
[Info]: Read-Only Repository:
/lark1/users/gadmin/3.6/bin/extent0.dbf
[Info]: using libicu version 58.2
[Info]: Gave this process preference for OOM killer: wrote
to /proc/20027/oom_score_adj value 250
[03/26/2020 16:40:33.628 PDT]
gci login: currSession 1 linked session
successful Solo login
topaz 1>
```

Any setting for `gemstone` is not used.

In topaz RPC, you may perform a solo login while also logged into a GemStone Stone, provided the extent file used by the Solo session is not in use by another solo session.

## Object creation and memory use

Each Solo RPC or linked Gem also opens a 10MB read-write temporary file, `/tmp/gemRO_<pid>_extent1.dbf`, which is deleted on logout or process exit.

Object creation in a Solo session is limited to temporary object memory, but you may create objects as needed up to the limit of memory. To ensure there is sufficient memory, you may:

- ▶ Set a larger value for `GEM_TEMPOBJ_CACHE_SIZE` in the configuration file used by the topaz or Gem session.
- ▶ For linked sessions, use `-T cachesize` on the topaz command line.
- ▶ For RPC sessions, include `-T cachesize` in the NRS gemnetid login parameter. For example,

```
topaz> set gemnetid 'gemnetobject -T 200000'
```

## Topaz solo connecting to a running stone

While a solo session cannot run operations such as `markForCollection`, it can establish an `ExternalSession` to a running Stone and invoke operations such as `markForCollection` remotely.

See the *Programming Guide for GemStone/S 64 Bit* for details on `GsTsExternalSession` and `GsExternalSession`.

## Scripting with topaz solo using she-bang

You may create executable text files containing GemStone code, and execute these in a solo session at the command line. The following restrictions apply:

- ▶ The environment variable `$GEMSTONE` must be set
- ▶ she-bang scripts execute in a solo session, that is, do not log into a running stone.
- ▶ she-bang scripts run in a linked topaz session
- ▶ no topaz command line options can be passed in
- ▶ No `.topazini` files are read

The first line of the she-band can be defined two ways:

```
#!/usr/bin/env topaz
    $GEMSTONE/bin must be on the machine executable search path.
```

```
#!/fullPathToExecutable/topaz
    GEMSTONE/bin does not need to be on the machine executable search path, but
    fullPathToExecutable must be the full path, not including environment variables.
```

For example, if you define a executable text file, `myscript`, with the following contents:

```
#!/usr/bin/env topaz
set u DataCurator p swordfish
login
run
  | files sz |
  files := GsFile
    contentsOfDirectory: '$GEMSTONE/data/tranlog*.dbf'
    onClient: false.
  sz := 0.
  files do: [:ea | sz := sz + (GsFile sizeOfOnServer: ea)].
  'tranlogs consume ', (sz / 1024) asInteger asString, ' KB'.
%
```

This file can be executed, with or without a running stone, to report the sum total size of tranlog files in the given directory.

Note that this will (in a default configuration) execute using the empty distribution extent, and checks the file sizes on disk rather than using any internal representation in the repository that is actually generating the transaction logs.

Topaz exits when the script completes.

## Topaz Solo Scripting using bash to pass arguments

By using bash to invoke topaz, you can perform topaz scripting that can include command line arguments. This uses a number of topaz features.

- ▶ the topaz `-q` argument suppresses output, as does passing in the script using the `-S` argument.
- ▶ Logins can be normal, that is topaz can login to a running stone, or solo. The advantage of solologin is that the script can run GemStone code whether or not the Stone is running, and without impact on anything going on in the Stone.
- ▶ topaz command line arguments passed in after a `--` are available from Smalltalk code using `System commandLineArguments`.

The following example uses three files to demonstrate writing a command-line script that executes GemStone Smalltalk code. The top-level bash script invokes topaz with the login information in a topaz initialization file and the actual script file, passing in a single argument. For simplicity, this example does no error checking. An actual script, of course, should check that the arguments are present and valid.

### Example 1.1 Example bash script

#### Contents of executable `gettranlogspace`:

```
#!/bin/bash
export GEMSTONE=/lark1/users/gadmin/3.6
$GEMSTONE/bin/topaz -lq -I $GEMSTONE/scripts/myini -S
  $GEMSTONE/scripts/reporttranlogspace.tpz -- $1
```

This invokes linked topaz (`-I`), passing in the initialization file (`-I`) and the script file (`-S`). The use of the `-q` flag suppresses topaz output that will clutter the output. Arguments following `--` are passed to topaz, in this case, the bash shell's (0-based) second element.



By setting `$GEMSTONE` explicitly and specifying the path to topaz, there is no need to perform GemStone environment setup before executing this script - it can be run in any environment.

#### Contents of file `myini`:

```
set user DataCurator pass swordfish
set gemstone gs64stone
set solologin on
```

This sets solo login, so no stone login is required. This script logs in as DataCurator, but creating a specific user with limited privileges would be sufficient, since the script will only perform limited operations.

#### Contents of file `reporttranlogspace.tpz`:

```
login
run
  | dir files sz |
  dir := System commandLineArguments last.
  files := GsFile
    contentsOfDirectory: dir
    onClient: false.
  sz := 0.
  files do: [:ea | sz := sz + (GsFile sizeOfOnServer: ea)].
  GsFile gciLogClient: dir, ': tranlogs consume total ',
    (sz / 1024) asInteger asString, ' KB'.
%
logout
exit
```

The use of `System commandLineArguments` gets the full set of tokens that invoked topaz, so the last element is the bash argument. Again, no error checking is done.

#### Executing the example:

```
unix> ./gettranlogspace /lark1/users/gsadmin/tranlogs
/lark1/users/gsadmin/tranlogs: tranlogs consume total 98477 KB
```

## Invoking Operating System Functionality from Topaz

From within topaz, you can easily execute operating system commands, or escape to an operating system shell and execute commands directly on the command line. To do this, invoke the topaz **shell** command.

You can enter your operating system command on the **shell** command line, as for example:

```
topaz> shell echo $GEMSTONE
/lark1/users/gsadmin/GemStone64Bit3.6.0-x86_64.Linux

topaz>
```

Or you can enter **shell** with no arguments, in which case you can interactively enter a sequence of operating system commands. When you are done, type **exit** or control-D to return to topaz.

```
topaz> shell
% echo $GEMSTONE
/lark1/users/gadmin/GemStone64Bit3.6.0-x86_64.Linux
% exit
```

```
topaz>
```

You can, of course, also execute operating system functionality from GemStone Smalltalk using:

```
topaz 1> run
System performOnServer: codeToBeExecuted
%
```

## 1.5 Using Topaz for Code Development

Topaz, in conjunction with methods in GemStone Smalltalk, can be used to examine and write classes and methods.

### Creating Methods

Creating a class is done using GemStone Smalltalk class creation protocol. For more on class creation, refer to the *GemStone Programming Guide*.

For example,

```
topaz 1> printit
Object subclass: 'Animal'
  instVarNames: #('name' 'favoriteFood' 'habitat')
  classVars: #()
  classInstVars: #()
  poolDictionaries: #()
  inDictionary: UserGlobals
%
a metaAnimal
  superClass          a metaObject
  format              0
  instVarsInfo        1125899906846723
  instVarNames        an Array
  constraints          an Array
  classVars           nil
  methDicts           a GsMethodDictionary
  poolDictionaries    nil
  categorys           a GsMethodDictionary
  primaryCopy         nil
  name                Animal
  classHistory         a ClassHistory
  transientMethDicts  an Array
  destClass           nil
  timeStamp           a DateTime
  userId              DataCurator
  extraDict           a SymbolDictionary
  classCategory       nil
  subclasses          nil
```

Once you have a class, you can create methods for it in topaz.

You can begin the definition of an instance method by issuing the **method:** command at the Topaz prompt. This command takes a single argument: the name of the class for which the method will be compiled.

```
topaz 1> set category 'Accessing'
topaz 1> method: Animal
habitat
      "Return the value of the instance variable 'habitat'."
      ^habitat
%
```

A class method definition is similarly initiated by the Topaz command **classmethod:**. For example:

```
topaz 1> set category 'Instance creation'
topaz 1> classmethod: Animal
returnAString
    "Returns an empty String"
    ^String new
%
```

Topaz maintains state for the Class and method category, so if you have multiple methods, you do not need to specify these values for each method definition. Expressions such as the above will set the Class and the category, and this will be used for subsequent methods until changed.

To set the current class, use the **set class** command:

```
topaz 1> set class Animal
```

To set the current category, use the **set category** command:

```
topaz 1> set category Updating
```

If the category you name doesn't exist, Topaz creates it when you compile the method.

You can examine your current class and category settings by typing **status**.

```
topaz 1> status
```

Current settings are:

*(display of current settings and connection information appears here)*

browsing information:

Class\_\_\_\_\_ Animal

Category\_\_\_\_\_ Updating

Once you've established a class and a category, you can define a method simply:

```
topaz 1> method:
habitat: newValue
    "Modify the value of the instance variable 'habitat'."
    habitat := newValue
%
```

Like the text of a **printit** command, the text of a method definition is terminated by the first line that starts with the % character. As soon as you enter the %, Topaz sends the method's text to GemStone for compilation and inclusion in the selected class and category.

## Using a Text Editor to Edit Methods

The **edit** command allows you to use a host text editor to edit GemStone Smalltalk expressions, including method text.

To use the **edit** function, you must first have established the name of the host editor you wish to use. Topaz can read the UNIX environment variable **EDITOR**, if you have it set. Otherwise, use the Topaz **set editorname** command, interactively or in your Topaz initialization file.

```
topaz 1> set editorname vi
```

Then, to edit the text of the last **printit** command, you need only do this:

```
topaz 1> edit last
```

Topaz opens your editor, as a subprocess, on the text of the last command that defined Smalltalk expressions: including `printit`, `exec`, `run`, `doit`, `method`, and `classmethod`. When you exit the editor, Topaz saves the edited text in a temporary file and asks you whether you'd like to compile the altered code. If you type `y` or `yes`, Topaz effectively reissues your command with the new text.

For example, to edit the existing instance method `habitat`: in the current class, you would enter **edit** as shown below:

```
topaz 1> edit method habitat:
```

To edit an existing class method, use an expression of the form:

```
topaz 1> edit classmethod returnAString
```

To create an entirely new method with the editor, you can enter **edit new method** or **edit new classmethod**.

## Listing Methods, Categories, and other information

The `topaz list` command provides a way to find out information about classes and methods, as well as other information about your system.

To list the instances method selectors for a class, use **list selectors**:

```
topaz 1> list selectors
habitat
habitat:
```

To see the categories and methods that are in the current class, use **list categoriesin**. Topaz lists all of the class and instance method selectors in the selected class by category.

```
topaz 1> list categoriesin
----- Instance Methods:
category (as yet unclassified)
habitat
category Updating
habitat:
----- Class Methods:
category (as yet unclassified)
returnAString
```

To list the source code of an instance method, use **list method:**

```
topaz 1> list method: habitat:
habitat: newValue
"Modify the value of the instance variable 'habitat'."
habitat := newValue
```

A parallel command, **list classmethod:**, lists the source of the given class method.

Other **list** options allow you to examine the classes in one or all of your symbol list dictionaries or to examine the methods in some class other than the current class. The `list` command by itself is used in debugging, to display source for a method on the current execution stack. For more information, see the options described under **list** starting on page 110.

## Filing Out Classes and Methods

You will commonly want to file out GemStone Smalltalk code at some level of granularity, by Method, Method Category, Class, or SymbolDictionary. Some reasons to do this are:

- ▶ transport your code to other GemStone systems,
- ▶ perform global edits and recompilations,
- ▶ produce paper copies of your work, and
- ▶ recover code that would otherwise be lost when you are unable to commit.

GemStone fileouts are in topaz executable form. You can process this text using editors or other operating system utilities and then execute it with the Topaz **input** command.

Fileouts are commonly done using GemStone Smalltalk methods, including *Class fileOutMethod:on:*, *Class fileOutCategory:on:*, *Class fileOutClassOn:*, and similar methods; and *ClassOrganizer fileOutClassesAndMethodsInDictionary:on:*. For more information on these methods, see the methods in the image.

Fileout can also be performed using the Topaz **fileout** command. For example, the following command:

```
topaz 1> fileout class: Animal toFile: animal.gs
```

would create in the file `animal.gs`, a Topaz script containing a definition of class `Animal` and all of its categories and methods. Here is how `animal.gs` would look:

```
fileformat 8Bit
set sourcestringclass String
run
Object subclass: 'Animal'
    instVarNames: #( 'name' 'favoriteFood' 'habitat' )
    classVars: #()
    classInstVars: #()
    poolDictionaries: {}
    inDictionary: UserGlobals
%
category: 'Updating'
method: Animal
habitat: newValue
    "Modify the value of the instance variable 'habitat'."
    habitat := newValue
%
...
```

“Filing in” this script with the **input** command would create a new class `Animal` exactly like the original.

In addition to **class:**, the **fileout** command has other subcommands, to allow you to fileout a method or other granularity of code. For more details, see the options under **fileout** starting on page 91.

### Code outside the ASCII range

The **fileout** command encodes the resulting file according to the current **fileformat** setting. By default, this is 8BIT, specifying 8-bit extended ASCII.

If your application code contains characters outside the ASCII range (with values over 127), you may want to fileout your code encoded as UTF-8. This setting is required if you will file out text with any Characters with values over 255; characters with these values cannot be filed out as 8BIT.

To configure your system to fileout in UTF-8:

```
topaz 1> fileformat UTF8
```

The current fileformat and SourceStringClass settings are automatically added to the results of **fileout**. This ensures that the same format is used to filein as was used to fileout. Do not remove these statements, unless you are certain the correct settings will be used on any later filein; the incorrect settings can cause the input to be corrupted.

## 1.6 Advanced Topaz features

The features previously described to manage your session, execute Smalltalk server code, and accept input from and write to files, are sufficient for most application needs.

Topaz also provides additional features that support sophisticated debugging of GemStone Smalltalk code and streamline access to specific objects.

### Structural Access To Objects

In your GemStone Smalltalk programs, you should generally access the values stored in objects only by sending messages. During debugging, however, it's sometimes useful to be able to read an instance variable or store a value in it without sending a message. For example, if an instance variable is normally read only by a message with side effects, it won't do to examine its value during debugging by sending that message.

To allow you to "peek" and "poke" at objects without passing messages, Topaz provides the commands **object at:** and **object at:put:**.

### Examining Instance Variables with Structural Access

The command **object at:** returns the value of an instance variable within an object at some integral offset. Suppose, for example, that you had created an instance of **Animal**:

```
topaz 1> printit
UserGlobals at: #MyAnimal put: Animal new.
%
an Animal
  name          nil
  favoriteFood  nil
  habitat       nil
topaz 1> printit
MyAnimal habitat: 'water'
%
an Animal
  name          nil
  favoriteFood  nil
  habitat       water
```

The following example shows how you could use **object at:** to display the value of `MyAnimal`'s third instance variable.

```
topaz 1> object MyAnimal at: 3
water
```

You can string together **at:** parameters after **object** to descend as far as you like into the object of interest.

```
topaz 1> object MyAnimal at: 3 at: 1
$w
```

As far as **at:** is concerned, named, indexed, and unordered instance variables are all numbered, with named instance variables appearing first, followed by indexed instance variables, then unordered instance variables. E.g., if an indexed object also had three named instvars, the first indexable field would be addressed with **object at: 4**. Offsets into the unordered portions of NSCs are not consistent across `add:` or `remove:` commands.

## Specifying Objects

As you have seen, objects can be identified within an **object** command by global GemStone Smalltalk variable names. This is only one of several ways you can specify objects in Topaz commands.

### Object Specification Formats

*@integerOop*

An unsigned 64-bit decimal OOP value that denotes an object.

*integer*

An Integer.

*float*

A Float object (C double-precision Float). The syntax for literal floating point numbers in Topaz commands is:

```
[sign]digits[ . [digits] ][E[sign]digits]
```

*\$character*

A literal Character.

*aVariableName*

This can be either a GemStone Smalltalk variable name (such as a Class name, or a variable set in a SymbolDictionary), a local variable created with the **define** command, or a predefined Topaz variable. See "Topaz Variables" on page 41

**\*\*** The object that was the result of the last execution.

**^** The current class (as defined by the most recent **set class**, **list categoriesIn:**, **method:**, **classmethod:**, or **fileout** command).

*'aLiteralString'*

A literal String.

*#aLiteralSymbol*

A literal Symbol (no white space allowed).

*#'a Quoted Symbol'*

A quoted literal Symbol.



**Example 1.2 Using OOP and \* (last result) specifications**


---

```

topaz 1> display oops
topaz 1> object Animal
[1337089 sz:19 cls: 150617 Animal class] Animal class
  superClass    [72193 sz:19 cls: 206081 Object class] Object class
  format        [2 sz:0 cls: 74241 SmallInteger] 0
  instVars      [26 sz:0 cls: 74241 SmallInteger] 3
  instVarNames  [1335297 sz:3 cls: 66817 Array] an Array

...
topaz 1> ! Look at first element of instVarNames array
topaz 1> object @1335297 at: 1
[1248257 sz:4 cls: 110849 Symbol] name
topaz 1> ! Look at first character of first instvarname
topaz 1> omit oops
topaz 1> object ** at: 1
$n

```

---

Note that when you look at the first element of the `instVarNames` array, you need to use the OOP returned by your own GemStone system, which is very unlikely to be `@1335297`.

**Topaz Variables**

Topaz lets you refer to any object in a command by using the OOP of that object. Long numerical OOPs are difficult to work with, so Topaz also allows you to define local Topaz variables to refer to the OOPs by name. This is done using the **define** command.

Since Topaz is flexible about resolving strings to names, use some care in choosing the names of variables. Names that are set using **define** take precedence over Smalltalk variable names (such as the names of Classes), and over the Topaz build-in variables (see the next section).

**Creating Variables**

The following example shows the use of the Topaz **define** command to create a reasonable name for an object previously known by its OOP.

```

topaz 1> display oops
topaz 1> object Animal
[1337089 sz:19cls: 1337601 Animal class] Animal class
  superClass    [72193 sz:19 cls: 206081 Object class] Object class
  format        [2 sz:0 cls: 74241 SmallInteger] 0
  instVars      [26 sz:0 cls: 74241 SmallInteger] 3
  instVarNames [1335297 sz:3 cls: 66817 Array] an Array

...
topaz 1> define animalVars @1335297
topaz 1> omit oops
topaz 1> object animalVars at: 1
name

```

A local variable must begin with a letter or an underscore, can be up to 255 characters in length, and cannot contain white space. Local variables are case-sensitive.

If additional tokens follow **define**'s second parameter, Topaz will try to interpret them as a message to the object represented by the second parameter. For example:

```
topaz 1> define thirdvar animalVars at: 3
topaz 1> object thirdvar
habitat
```

Note that Topaz does not parse message expressions exactly as the GemStone Smalltalk compiler does; Topaz requires you to separate tokens with white space.

All Topaz object specification formats (described above in "Specifying Objects") are legal in **define** commands. For example:

```
topaz 1> define sum 1.0e1 + 500
topaz 1> define mystring 'this and that'
topaz 1> define mycharacter $z
```

## Displaying Current Variable Definitions

To see all current local variable definitions, just type **define** with no arguments:

```
topaz 1> define
Current definitions are:
    mycharacter          = 142538
    mystring            = 150133
    sum                 = 147709
    thirdvar           = 114793
    animalVars         = 147682
-----
    CurrentMethod      = nil
    ErrorCount         = 2
    CurrentCategory    = nil
    CurrentClass       = nil
    LastResult         = nil
    LastText           = nil
    myUserProfile      = 1458177
```

**define** reports values as OOPs rather than literals; so an ErrorCount of 2 means that there were zero errors.

In this status report there are two sections. User-defined local variables are listed first, followed by the topaz predefined variables. These are local variables that Topaz automatically creates for you:

**CurrentMethod** – the OOP of the current method (set by lookup or list)

**ErrorCount** – the OOP of the count of Topaz and GemStone errors since Topaz started.

**CurrentCategory** – the OOP of the current category

**CurrentClass** – the OOP of the current class

**LastResult** – the OOP of the last execution result

**LastText** – the OOP of the text of the last GemStone Smalltalk expression executed or compiled

**myUserProfile** – the OOP of UserProfile for the current session's login.

You cannot modify the definitions of these predefined variables with **define**.

## Clearing Variable Definitions

To clear a definition, type **define** *aVarName* with no second argument.

For example:

```
topaz 1> define abc 'this string'
topaz 1> object abc
this string
topaz 1> define abc
topaz 1> object abc
GemStone could not find an object named abc.
```

## Sending Messages

In addition to the usual ways of sending messages with Smalltalk code, Topaz allows you to send messages to an object identified by any of the means described in "Specifying Objects" on page 40. This lets you use OOPs or Topaz variables directly.

For example:

```
topaz 1> send @71425 class
a Metaclass
  superClass      a Metaclass
  format 1040
  ...
  categories      a GsMethodDictionary
  secondarySuperclasses nil
  thisClass       UndefinedObject class
```

The **send** command's first argument is an object specification identifying a receiver. That argument is followed by a message expression built almost as it would be in GemStone Smalltalk. Here's another example:

```
topaz 1> send 2 - 1
1
```

There are some differences between **send** syntax and GemStone Smalltalk expression syntax.

- ▶ Only one message send can be performed at a time with **send**.
- ▶ Cascaded messages, parenthetical messages, and the like are not recognized by this command.
- ▶ Each item must be delimited by one or more spaces or tabs.



# Debugging Your GemStone Smalltalk Code

---

Topaz can maintain up to eight simultaneous GemStone Smalltalk call stacks that provide information about the GemStone state of execution. Each call stack consists of a linked list of method or block contexts. Topaz provides debugging commands that enable you to:

- ▶ Step through execution of a method. After each step, you can examine the values of arguments, temporaries, and instance variables.
- ▶ Inspect or change the values of arguments, temporaries, and receivers in any context on the call stack, then continue execution. This means that you can find out what the system was doing at the time a soft break, a breakpoint, or an error interrupted execution.
- ▶ Set, clear, and examine GemStone Smalltalk breakpoints. When a breakpoint is encountered during normal execution, you can issue Topaz commands to explore the contexts on the stack.

This chapter introduces you to the Topaz debugging commands and provides some examples. For a detailed description of each of these commands, see Chapter 3.

## 2.1 Step Points and Breakpoints

For the purpose of determining exactly where a step will go during debugging, a GemStone Smalltalk method can be decomposed into step points. The locations of step points also determine where breakpoints can be set, although not all step points are legal for breakpoints.

Generally, step points correspond to the message selector and, within the method, message-sends, assignments, and returns of nonatomic objects. Compiler optimizations, however, may occasionally result in a different, nonintuitive step point, particularly in a loop.

The Topaz **list steps method:** command lists the source code of a given instance method and displays all step points (allowable breakpoints) in that source code.

For example:

### Example 2.1 listing step points in a method

```

topaz 1> set class Dictionary
topaz 1> list steps method: removeKey:ifAbsent:
  removeKey: aKey ifAbsent: aBlock
* ^^                               1,2                               *****
  "Removes the Association with key equal to aKey from the receiver and returns
  the value of that Association. If no Association is present with key
  equal to aKey, evaluates the zero-argument block aBlock and returns the
  result of that evaluation."

  | anAssoc |
  anAssoc:= self removeKey: aKey otherwise: nil .
*   ^4   ^3                               *****
  anAssoc == nil ifTrue:[
*   ^5                               *****
    aBlock == nil ifTrue:[^ nil ].
*   ^6   ^7                               *****
    ^aBlock value
*   ^9   ^8                               *****
  ].
  ^ anAssoc value
* ^11   ^10                               *****

```

As shown here, the position of each method step point is marked with a caret (^) and a number.

If you use the Topaz **step** command to step through this method, the first step stops execution at the beginning of the method. The next step takes you to the point where `removeKey:otherwise:` is about to be sent to `self`. Stepping again would execute that message-send and halt execution at the point where `anAssoc` is about to be assigned. Another step would cause that assignment to be happen, and then halt execution just before the message `==` is sent to `anAssoc`.

The call stack becomes active, and the debugging commands become accessible, when you execute GemStone Smalltalk code containing a breakpoint (as well as when you encounter an error).

You can use the **break** command to set a method breakpoint at a particular step point within a method.

While you can set a breakpoint on any method, methods with optimized selectors, such as `Boolean>>ifTrue:` never hit the break points unless you invoke them with `perform:` or one of the **GciPerform...** functions, because sends of special selectors are optimized by the compiler. Note that in the step points listed above for `Dictionary >> removeKey:ifAbsent:`, above, there are no step points on `ifTrue:`.

## Breakpoints

You can use the **break** command to establish method breakpoints within your GemStone Smalltalk code:

```

break aClassName >> aSelector [@ stepNumber]
break aClassName class >> aSelector [@ stepNumber]

```

For example:

```
topaz 1> break GsFile class >> openRead: @ 2
```

Establishes a breakpoint at step point 2 of the class method `openRead:` for `GsFile`. There are a number of ways to specify the specific class and method: see **break** on page 59 for details.

The **break list** command allows you to see all breakpoints set

```
topaz 1> break list
1: GsFile >> nextLine @ 1
2: GsFile class >> openRead: @ 2
3: String >> < @ 2
```

In the **break list** result, each breakpoint is identified by a break index. To disable a breakpoint, supply that break index as the single argument to the **break disable** command:

```
topaz 1> break disable 2
topaz 1> break list
1: GsFile >> nextLine @ 1
2: GsFile class >> openRead: @ -2 (disabled)
3: String >> < @ 2
```

A similar command line reenables the break point:

```
topaz 1> break enable 2
```

To delete a single breakpoint, supply that break index as the argument to the **break delete** command:

```
topaz 1> break delete 2
```

To delete all currently set breakpoints, type the following command:

```
topaz 1> break delete all
```

## 2.2 Examining the GemStone Smalltalk Call Stack

When you execute the code on which you have enabled a breakpoint, execution pauses. For example, if we put a breakpoint on the setter method for `Animal`'s instance variable `#name`:

```
topaz 1 > break Animal >> name:
```

Then run this code:

```
topaz 1 > run
Animal new name: 'Dog'
%
a Breakpoint occurred (error 6005), Method breakpoint encountered.
1 1 Animal >> name: @1 line 1
```

You can display all of the contexts in the active call stack by issuing the **where**, **stk** or **stack** commands with no arguments. The **where** and **stk** command display a summary call stack, with one line for each context. Use the **stack** command to display method arguments and temporaries. When using the **stack** command, the volume of output displayed is controlled by the current level setting.

This is an example of the **where** summary:

```
topaz 1> where
==> 1 Animal >> name: @1 line 1
2 Executed Code @3 line 1
```

```
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

With display oops active, the **where** command provides more detail for each frame:

```
topaz 1> display oops
topaz 1> where
==> 1 Animal >> name:                @1 line 1 [methId 25534209]
2 Executed Code                        @3 line 1  [methId
25504513]
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1 [methId 4912641]
  [GsProcess 27551489]
```

Using the **stack** command provides additional information about the instance and temporary variable names and values for each context. With level 0 (the default), only the variable values themselves are displayed. This example is with **display oops**.

```
topaz 1> stack
==> 1 Animal >> name:                @1 line 1 [methId 25534209]
  receiver [25517313 sz:3 cls: 27556097 Animal] a Animal
    name           [20 sz:0 cls: 76289 UndefinedObject] nil
    favoriteFood   [20 sz:0 cls: 76289 UndefinedObject] nil
    habitat        [20 sz:0 cls: 76289 UndefinedObject] nil
    newValue [25481729 sz:3 cls: 74753 String] Dog
2 Executed Code                @3 line 1  [methId
25504513]
  receiver [20 sz:0 cls: 76289 UndefinedObject] nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1 [methId 4912641]
  receiver [20 sz:0 cls: 76289 UndefinedObject] nil
```

With **1**, or higher **s**, the variables for each instance variable is included in the display for **stack**. For example, with **omit oops**:

```
topaz 1> omit oops
topaz 1> level 1
topaz 1> stack
==> 1 Animal >> name:                @1 line 1
  receiver a Animal
    name           nil
    favoriteFood   nil
    habitat        nil
  newValue Dog
2 Executed Code                @3 line 1
  receiver nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
  receiver nil
```

The display of each context includes:

- ▶ an indicator of the active context, a preceding ==>
- ▶ the number of the context;
- ▶ the OOP of the GsMethod (if **display oops** is active)
- ▶ the class of the method invoked



- ▶ the selector of the method
- ▶ the current step point within the method, indicated by *@anInteger*
- ▶ line number of the step point within the source code
- ▶ for the stack command, the receiver, parameters and temporaries for this context (including method temporaries and OOPs, if **display oops** is active).

The display is governed by the setting of other Topaz commands such as **limit**, **level**, and **display** or **omit**.

## Proceeding After a Breakpoint

When GemStone Smalltalk encounters a breakpoint during normal execution, Topaz halts and waits for your reply. Topaz provides commands for continuing execution, and for stepping into and over message-sends.

### **continue**

Tells GemStone Smalltalk to continue execution from the context at the top of the stack, if possible. If execution halts because of an authorization error, for example, then the virtual machine can't continue. As an option, the **continue** command can replace the value on the top of the stack with another object before it attempts to continue execution.

### **c**

Same as **continue**.

### **step over**

Tells GemStone Smalltalk to advance execution to the next step point (message-send, assignment, etc.) in the active context or its caller, and halt. The active context is indicated by the ==> in the stack; it is the context specified by the last **frame**, **up**, **down** or another command. Initially it is the top of the stack (the first context in the list).

### **step into**

Tells GemStone Smalltalk to advance execution to the next step point (message-send, assignment, etc.) and halt. If the current step point is a message-send, then execution will halt at the first step point within the method invoked by that message-send.

Notice how this differs from **step over**; if the next message in the context contains step points itself, execution halts at the first of those step points. That is, the virtual machine "steps into" the new method instead of silently executing that method's instructions and halting after the method has completed. The next **step over** command will then take place within the context of the new method.

## Examining and Modifying Temporaries and Arguments

The Topaz **temporary** command lets you examine or modify the values of temporaries in the active context. If, for example, the method under inspection had a temporary variable named *count*, that currently had a value of 5, you could obtain its value by typing **temporary** and the variable name:

```
topaz 1> temporary count
5
```

Similarly, you can use the **temporary** command to assign a new value to a temporary variable:

```
topaz 1> temporary count 8
```

For example, the following code sets a breakpoint, executes code, views and updates the value of a temporary variable, then continues execution to return the results of the code; which has been changed during debugging.

```
topaz 1> break classmethod String withAll:
topaz 1> run
String withAll: 'abc'
%
a Breakpoint occurred (error 6005), Method breakpoint encountered.
1 String class >> withAll: @1 line 1
topaz 1> stack
==> 1 String class >> withAll: @1 line 1
    receiver String
    aString abc
2 Executed Code @2 line 1
    receiver nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
    receiver nil
topaz 1> temporary
aString abc
topaz 1> temporary aString 'xyz'
topaz 1> stack
==> 1 String class >> withAll: @1 line 1
    receiver String
    aString xyz
2 Executed Code @2 line 1
    receiver nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
    receiver nil
topaz 1> continue
xyz
```

## Select a Context for Examination and Debugging

The Topaz commands **frame**, **up**, and **down**, as well as **stack up**, **stack down**, and **stack scope**, let you redefine the active context (used by the **temporary**, **stack**, and **list** commands) within the current call stack. Consider the call stack we examined earlier, with **level 0** and **omit oops**:

```
topaz 1> stack
==> 1 Animal >> name: @1 line 1
    receiver anAnimal
    newValue Dog
2 Executed Code @3 line 1
    receiver nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
    receiver nil
```

The active context is indicated by ==>. You can also show the active context by using the frame command with no arguments:

```
topaz 1> frame
1 Animal >> name: @1 line 1
  receiver anAnimal
  newValue Dog
```

The following command selects the caller of this context as the new active context:

```
topaz 1> frame 2
2 Executed Code @3 line 1
  receiver nil
```

Now confirm that Topaz redefined the active context:

```
topaz 1> where
1 Animal >> name: @1 line 1
==> 2 Executed Code @3 line 1
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

You can also use **up** and **down** commands to make a different frame the active context.

## Multiple Call Stacks

By default, when you continue executing code and encounter another breakpoint, the original call stack is lost.

The Topaz command **stack save** lets you retain the previous stack. This needs to be invoked for each stack you want to save.

The Topaz command **stack all** lets you display your list of saved call stacks. This display includes the top context of every call stack:

```
topaz 1> stack all
0: 1 Animal >> habitat @1 line 1
1: 1 AbstractException >> _signalWith: @6 line 25
*2: 1 Executed Code @3 line 1
```

The asterisk (\*) indicates the active call stack, if one exists. If there are no saved stacks, a message to that effect is displayed.

When you type the **stack change** command, Topaz sets the active call stack to the call stack indicated by the integer in the **stack all** command output, and displays the newly selected call stack:

```
topaz 1> stack change 1
Stack 1 , GsProcess 27447553
1 AbstractException >> _signalWith: @6 line 25
```

## 2.3 Debugging in a different Gem

Normally, you will debug problems that you encounter within your running topaz session. However, you can also connect to another Gem (the executing session) from another topaz session (the debugging session), to debug a problem in the executing session. This is particularly useful when the executing session is executing via a script.

To do this, the executing Gem (the Gem with the problem that you wish to debug) must be configured to start a separate thread in the VM that listens for the command to connect. This can be done in two ways.

- ▶ Before login of the executing session, set the configuration parameter `GEM_LISTEN_FOR_DEBUG = true;`. With this defined, during login the Gem will print a line to the stdout (the linked console or gem log file):

```
Listening for debug: DEBUGGEM pid random32BitDebugToken
```

- ▶ By invoking `System class >> listenForDebugConnection` in the executing session. This method returns the `random32BitDebugToken.token` (a random 32-bit integer), that is the argument to the call to attach. To get the PID of the gem, which is also required for login, invoke `System class >> gemProcessId` in the remote Gem (the Gem you will be debugging).

In order to debug, you must also have the OOP of the instance of `GsProcess` that is executing and encounters an error or breakpoint in the executing session. This is printed when you have **display oops** set, and enter a **where** or **stk** command. When setting up the executing session, include these commands:

```
display oops
iferr 1 where
```

Then, in the debugging session, make the calls to connect, specifying both the PID of the executing Gem session, and the token.

```
topaz> DEBUGGEM pid random32BitDebugToken
successful attach
topaz 1>
```

If the connection is successful, the debugging session will have debugging control over the executing session.

- ▶ If a Smalltalk execution is in progress, the equivalent of a soft break occurs in the executing Gem, and the debugging gem can examine the stack. Operations that modify the stack, such as **step** are disallowed, and the debugging session cannot commit.
- ▶ If execution is not in progress, the debugging gem takes control and further servicing of GCI calls or topaz commands in the executing session are blocked.
- ▶ If a fetch or store traversal is in progress, the debugging session will get control after this completes.

When you are done debugging, use the **logout** command (or **continue**) in the debugging session will close that session and allow the executing session to continue.

For example, say you have a shell script with the following contents:

```
topaz -il -C 'GEM_LISTEN_FOR_DEBUG=TRUE' << EOF
  set user DataCurator password swordfish gemstone gs64stone
  login
  display oops
  iferr 1 where
  iferr 2 topazwaitfordebug
  exec { 'foo' } at: 3 %
  logout
  exit
EOF
```

When this shell script is executed, the executing topaz session will encounter the index-out-of-bounds error, print the error information, and wait for the debugging session to attach.

In the executing session:

```
<login details>
Listening for debug: DEBUGGEM 21213 10219491105650816486
successful login
topaz 1> display oops
topaz 1> iferr 1 where
topaz 1> iferr 2 topazwaitfordebug
topaz 1> exec { 'foo' } at: 3 %
ERROR 2003 , a OffsetError occurred (error 2003),
reason:objErrBadOffsetIncomplete, max:1 actual:3
topaz > exec iferr 1 : where
==> 1 OffsetError (AbstractException) >> _signalWith: @5 line
25
2 OffsetError (AbstractException) >> signal @2 line 47
3 Array (Object) >> _error:args: @15 line 11
4 Array (Object) >> _errorIndexOutOfRange: @2 line 6
5 Array >> at: @4 line 12
6 Executed Code @2 line 1
7 GsNMethod class >> _gsReturnToC @1 line 11
 [GsProcess 42086145]
topaz > exec iferr 2 : topazwaitfordebug
11/05/2020 16:45:37.423 PST
Waiting for debugger to attach, topaz process 21213 gem
process 21213
```

To attach to this, you will need to start another topaz, execute the **debuggem** command, followed by **stack set**. The information needed for these commands is in bold in the above output from the executing session.

Startup topaz and attach to the executing session:

```
topaz> debuggem 21213 10219491105650816486
successful attach
topaz 1> stack set @42086145
```

At this point you can get the stack trace and examine variables.

```
topaz 1> where
==> 1 OffsetError (AbstractException) >> _signalWith: @5 line
25
2 OffsetError (AbstractException) >> signal @2 line 47
3 Array (Object) >> _error:args: @15 line 11
4 Array (Object) >> _errorIndexOutOfRange: @2 line 6
5 Array >> at: @4 line 12
6 Executed Code @2 line 1
7 GsNMethod class >> _gsReturnToC @1 line 11
topaz 1> frame 5
5 Array >> at: @4 line 12
    receiver a Array
    #1 foo
    anIndex 3
(skipped 2 evaluationTemps)
```

When you are done debugging in the debugging session, execute the **logout** command. This detaches the debugger and allows the executing session to proceed.

# Command Dictionary

---

This chapter provides descriptions of each Topaz command, in alphabetical order.

## Command Syntax

Most Topaz commands can be abbreviated to uniqueness. For example, **set password:** can be shortened to **set pass**. Exceptions to this rule are a few commands whose actions can affect the success or failure of your current transaction and, thus, the integrity of your data: **abort**, **begin**, **commit**, **exit**, and so on. Commands that cannot be abbreviated are described in the individual command documentation.

If a command abbreviation is ambiguous, it is not executed. Note however that if a command's first letters are abbreviated and this matches another command, the other command is executed; for example, the **l** form of **listw**, and the **c** form of **continue**.

Topaz commands are case-insensitive. **Time**, **TIME**, and **time** are understood by Topaz as the same command. However, arguments you supply to Topaz commands may be subject to case-sensitivity constraints. For example, the commands **category: animal** and **category: Animal** specify two different categories, since GemStone Smalltalk is case-sensitive. The same is true of UNIX path names, user names, and passwords.

Objects passed as arguments to Topaz commands can usually be specified using the formats described in "Specifying Objects" on page 40.

Command lines can have as many as 511 characters. You can stop a command at any time by typing **Ctrl-C**. Topaz may take a moment or two before responding.

# ABORT

Aborts the current GemStone transaction. Your local variables (created with the **define** command) may no longer have valid definitions after you abort.

If your session is outside a transaction, use **abort** to give you a new view of the repository. This command cannot be abbreviated.



# ALLSTACKS

Print the stacks of all instances of GsProcess that are known to the ProcessorScheduler instance in the VM and stacks associated with previous topaz **stack save** commands.

See also **threads** on page 176.

## BEGIN

Begins a GemStone transaction. If the session is already in a transaction, this has the effect of an abort. The **begin** command is only useful if your session is not in automatic transaction mode, i.e., in manual or transactionless transaction mode.

You can change transaction mode using the method System class >> transactionMode: with an argument of #autoBegin, #manualBegin, or #transactionless, or by using the topaz **set transactionmode** command (page 159).

This command cannot be abbreviated.

### Example

```
topaz 1> set transactionmode manualbegin
transaction aborted and mode changed to manualBegin
topaz 1> begin
<perform database operations>
topaz 1> commit
Successful commit
```

# BREAK

## break *aSubCommand*

Establishes or displays a method breakpoint within GemStone Smalltalk code. Subcommands are **method**, **classmethod**, **list**, **enable**, **disable**, and **delete**. For more information about using breakpoints, see Chapter 2, "Debugging Your GemStone Smalltalk Code".

## Setting Breakpoints

You can set breakpoints on a method, or at any step point within a method. Step points includes assignments, message sends, and method returns. To display the step points for a method, use the **list steps** command.

In the following commands, the argument *@ stepPoint* specifies the step point within that method where the break is to occur. If you omit the step point, the breakpoint is established at step 1 of the method.

You may not set method breakpoints in any method whose sole function is to perform any of the following actions: return self, return nil, return true, return false, return or update the value of an instance variable, return the value of a literal, or return the value of a literal variable (that is, a class variable, a pool variable, or a variable defined in your symbol list).

You can specify the method using method/classmethod, or using the >> syntax.

**break method** *classSpecification methodName* [ *@ stepPoint* ]

**break classmethod** *classSpecification methodName* [ *@ stepPoint* ]

**break method** *methodSpecification* [ *@ stepPoint* ]

**break classmethod** *methodSpecification* [ *@ stepPoint* ]

**break** *@ stepPoint*

*classSpecification* can be defined in these ways:

*className*    The name of the class that implements *methodName*.

*@integer*    An unsigned 64-bit decimal OOP value that denotes the class.

**\*\***            The class that was the result of the last execution.

**^**             The current class, as defined by the most recent **set class** (or other command that sets the current class)

*methodSpecification* is an unsigned 64-bit decimal OOP value of a GsNMethod instance, which defines both the class and method.

The *@ stepPoint* format applies after certain other commands that set a specific selected method, such as **lookup** and **list**.

The **break** command accepts the >> syntax to specify a method, using the following forms:

**break** *className* >> *methodName* [ *@ stepPoint* ]

**break** *className* **class** >> *methodName* [ *@ stepPoint* ]

**break** *className* (*implementationClassName*) >> *methodName* [ *@ stepPoint* ]

**break** *className* **class** (*implementationClassName*) >> *methodName* [ @ *stepPoint* ]

The *implementationClassName* specifies that the method lookup begins with *implementationClassName*, normally a superclass of *className*. This style is used in topaz stack summaries, and allows paste in of lines from the stack.

## Examples

The following expressions set breaks in the same method, the `KeyValueDictionary` instance method `at:put:`. The same patterns apply for class methods.

```
break KeyValueDictionary >> at:put: @ 1

break @79361 >> at:put: @ 2

break IdentityDictionary (KeyValueDictionary) >> at:put: @ 3

break method KeyValueDictionary at:put: @ 4

break method @79361 at:put: @ 5

set class KeyValueDictionary
break method ^ at:put: @ 7

exec KeyValueDictionary %
break method ** at:put: @ 6

break method @5094401 @ 8

lookup KeyValueDictionary >> at:put:
break @9
```

## Displaying Breakpoints

### **break list**

Lists all currently set breakpoints. In the display, each breakpoint is identified by a break index for subsequent use in **break disable**, **break enable**, and **break delete** commands.

## Disabling and Enabling Breakpoints

### **break disable** *anIndex*

Disables the breakpoint identified by *anIndex* in the **break list** command.

### **break disable all**

Disables all currently set breakpoints.

### **break enable** *anIndex*

Reenables the breakpoint identified by *anIndex* in the **break list** command.

### **break enable all**

Reenables all disabled breakpoints.

## Deleting Breakpoints

**break delete** *anIndex*

Deletes the breakpoint identified by *anIndex* in the **break list** command.

**break delete all**

Deletes all currently set breakpoints.

## Examples

```
topaz 1> break method GsFile nextLine
```

Establishes a breakpoint at step point 1 of the instance method `nextLine` for `GsFile`.

```
topaz 1> break classmethod GsFile openRead: @ 2
```

Establishes a breakpoint at step point 2 of the class method `openRead:` for `GsFile`.

```
topaz 1> set class String
```

```
topaz 1> break method ^ < @ 2
```

Establishes a breakpoint at step point 2 of the instance method "`<`" for the current class (`String`).

```
topaz 1> break list
```

```
1: GsFile >> nextLine @ 1
```

```
2: GsFile class >> openRead: @ 2
```

```
3: String >> < @ 2
```

```
topaz 1> break disable 2
```

```
topaz 1> break list
```

```
1: GsFile >> nextLine @ 1
```

```
2: GsFile class >> openRead: @ 2 (disabled)
```

```
3: String >> < @ 2
```

```
topaz 1> break enable 2
```

```
topaz 1> break list
```

```
1: GsFile >> nextLine @ 1
```

```
2: GsFile class >> openRead: @ 2
```

```
3: String >> < @ 2
```

```
topaz 1> break delete 1
```

```
topaz 1> break list
```

```
2: GsFile class >> openRead: @ 2
```

```
3: String >> < @ 2
```

```
topaz 1> break delete all
```

```
topaz 1> break list
```

```
No breaks set
```

# CATEGORY

## **category:** *aCategoryName*

Sets the current category, the category for subsequent method compilations. If you try to compile a method without first selecting a category, the new method is inserted in the default category "as yet unspecified." This command has the same effect as the **set category:** command.

If the category you name doesn't already exist, Topaz creates it when you first compile a method. If you wish to include spaces in the category name you specify, enclose the category name in single quotes.

Specifying a new class with **set class** does not change your category. However, when you **edit** or **fileout** a method, that method's category becomes the current category.

The current category is cleared by the **logout**, **login**, and **set session** commands.

```
topaz 1> category: Accessing
topaz 1> category: 'Public Methods'
```

# CLASSMETHOD

## **classmethod** [: *aClassName*]

Compiles a class method for the class whose name is given as a parameter. The class of the method you compile is automatically selected as the current class. If you don't supply a class name, the method is compiled for the current class (as defined by the most recent **set class**, **list categoriesin**, **method**, **classmethod**, **removeAllMethods**, **removeAllClassMethods**, or **fileout class**: command).

Text of the method should follow this command on subsequent lines. The method text is terminated by the first line that contains a % character as the first character in the line. For example:

```
topaz 1> classmethod: Animal  
returnAString  
    ^String new  
%
```

Topaz sends the method's text to GemStone for compilation and inclusion in the current category of the specified class. If you haven't yet selected a current category, the new method is inserted in the default category "as yet unspecified."

# COMMIT

Ends the current GemStone transaction and stores your changes in the repository.  
This command cannot be abbreviated.



# CONTINUE/C

## **continue** [*anObjectSpec*]

### **c** [*anObjectSpec*]

Attempts to continue GemStone Smalltalk execution on the active call stack after encountering a breakpoint, a pause message, or a user-defined error. The call stack becomes active, and the **continue** command becomes accessible, when you execute GemStone Smalltalk code containing a breakpoint.

#### **continue**

Attempts to continue execution.

#### **continue** *anObjectSpec*

Replaces the value on the top of the stack with *anObjectSpec* and attempts to continue execution.

The argument *anObjectSpec* can be specified using any of the formats described in “Specifying Objects” on page 40.

For more information about breakpoints, see the discussion of the **break** command on page 59, or see Chapter 2, “Debugging Your GemStone Smalltalk Code”.

For information about replacing the value on the top of the stack, see the **GciContinueWith** function in the *GemBuilder for C Manual*

For information about Object's pause method, see the method comments for `Object>>pause`.

For information about user-defined errors, see the discussion of error-handling in the *Programming Guide for GemStone/S 64 Bit*. User manuals for the GemStone interfaces, such as *GemBuilder for Smalltalk*, also contain discussions of error-handling.

# DEBUGGEM

## **debuggem** *processId token*

Takes two integer arguments, a processId and a token.

The processId must be the PID of a gem or topaz -l, running on localhost, which was either configured with GEM\_LISTEN\_FOR\_DEBUG=true, or which has previously executed `System class >> listenForDebugConnection`.

The token is a random integer printed by that target gem process to its log file (or stdout and current .out file of the topaz -l), or returned by `System class >> listenForDebugConnection`.

**debuggem** attempts to attach to the target gem and create a topaz session in this topaz process which has debugging control over the target gem.

If Smalltalk execution is in progress in the target gem, it is interrupted with equivalent of `GciSoftBreak()` and the resulting stack can be examined by the topaz session created by **debuggem**.

If execution is not in progress, then the **debuggem** topaz gets control of the target gem, blocking further GCI calls from the target gem's client or blocking further topaz commands from the target's topaz -l.

If a fetch or store traversal is in progress, the **debuggem** topaz will get control of the target gem when the traversal completes.

While a topaz session from **debuggem** is control of a target gem, commit by the target gem is not allowed.

**logout** or **continue** will close the topaz session created by **debuggem** and release the target gem or topaz -l to continue execution and servicing of GCI or topaz commands.

Certain topaz commands such as **break**, **step**, **stack trim** that would alter the stack are disallowed in the **debuggem** session; the stack from the synthesized soft break can be examined and then continued with **continue** or **logout**.

**debuggem** cannot be abbreviated, it must be typed in full.

For more information, see "Debugging in a different Gem" on page 52.

## DEBUGRUN

Like **run**, but sets flags so that execution will stop at the first step point within the source text. The text following the **debugrun**, and up to the first line that contains a % as the first character in the line, is sent to GemStone for execution as GemStone Smalltalk code.

Execution stops at the first step point within this code, and you may use the **step** command (page 166) to step through execution.

For example:

```
topaz 1> debugrun
Time now
%
a Breakpoint occurred (error 6002), Single-step breakpoint encountered.
1 1 Executed Code @1 line 1
topaz 1> step
a Breakpoint occurred (error 6002), Single-step breakpoint encountered.
1 1 Executed Code @2 line 1
topaz 1> step into
a Breakpoint occurred (error 6002), Single-step breakpoint encountered.
1 1 Time class >> now @2 line 1
topaz 1> step into
a Breakpoint occurred (error 6002), Single-step breakpoint encountered.
1 1 Time class >> now @3 line 9
topaz 1> step into
a Breakpoint occurred (error 6002), Single-step breakpoint encountered.
1 1 DateAndTime class (DateAndTimeANSI class) >> now @2 line 1
...
```

See Chapter 2, “Debugging Your GemStone Smalltalk Code”, for more information on breakpoints and debugging code.

**debugrun** cannot be abbreviated, it must be typed in full

# DEFINE

## **define [*aVarName* [*anObjectSpec* [*aSelectorOrArg*]...]]**

Defines local Topaz variables that allow you to refer to objects in commands such as **send** and **object**.

All Topaz object specification formats (as described in "Specifying Objects" on page 40) are legal in **define** commands. The variable name *aVarName* must begin with a letter (a..z or A..Z) or an underscore, can be up to 255 characters in length, and cannot contain white space.

You may not redefine the topaz predefined variables *CurrentMethod*, *ErrorCount*, *CurrentCategory*, *CurrentClass*, *LastResult*, *LastText*, and *myUserProfile*.

### **define**

Lists all current local variable definitions.

### **define** *aVarName*

Deletes the definition of the variable *aVarName*.

### **define** *aVarName anObjectSpec*

Define a local variable whose value is result of *anObjectSpec*.

### **define** *aVarName anObjectSpec aSelectorOrArg ...*

Sends a message to the object specified by *anObjectSpec*, and saves the result as a local variable with the name *aVarName*.

For example:

```
topaz 1> define CurrentSessions System currentSessionNames
topaz 1> define UserId myUserProfile userId
topaz 1> define
Current definitions are:
  UserId           = 2673409
  CurrentSessions  = 33659905
-----
  CurrentMethod   = nil
  ErrorCount      = 2
  CurrentCategory = nil
  CurrentClass    = nil
  LastResult      = nil
  LastText        = nil
  myUserProfile   = 1458177
```

Topaz tries to interpret all command line tokens following *anObjectSpec* as a message to the specified object.

# DISASSEM

## **disassem** [ *aClassParameter* ] *aParamValue*

The **disassem** command allows you to disassemble the specified GsNMethod, displaying the assembly code instructions.

The **disassem** command is intended for use in a linked (**topaz -L**) session only. If the session is remote, the output goes to stdout of the remote Gem, which is the gem log.

**disassem** @*anOop*

Disassemble the method or code object with the specified oop.

**disassem method:** *aSelectorSpec*

Disassemble the specified instance method for the class previous set by the **set class** command.

**disassem classmethod:** *aSelectorSpec*

Disassemble the specified class method for the class previous set by the **set class** command.

# DISPLAY

## display *aDisplayFeature*

The **display** and **omit** commands control the display of Gemstone Smalltalk objects and other features related to output.

The **display** command turns on these display attributes, and the **omit** command turns them off.;

### alloops

#### display alloops

If **display alloops** is set, enables the display of OOPs of classes along with class names in object display, and displaying the oops of primitive specials. Also causes the OOPs of classes to be printed by stack display and method lookup commands, and enables the printing of evaluation temporary objects in stack frame printouts from the **frame** command.

Default: **omit alloops**

### bytes

#### display bytes

When displaying byte-format objects such as Strings and ByteArrays, include the hexadecimal value of each byte.

Default: **omit bytes**

for example,

```
topaz 1> exec #[ 97 98 99 ] %
1 'abc'                               61 62 63
```

### classoops

#### display classoops

Legacy; equivalent to **display alloops**.

### decimalbytes

#### display decimalbytes

When displaying byte-format objects such as Strings and ByteArrays, include the decimal value of each byte.

Default: **omit decimalbytes**

for example,

```
topaz 1> exec #[ 97 98 99 ] %
1 'abc'                               97 98 99
```

### deprecated

#### display deprecated

For topaz commands such as **strings** and **senders**, which return lists of methods, display deprecated causes those results to include methods which contain sends of deprecated, deprecated:, or deprecatedNotification:.

Default: **display deprecated**

Deprecated methods are those that send one of the following messages:

```
deprecated
deprecated:
deprecatedNotification:
```

For example, the method `concurrencyMode` is deprecated:

```
topaz 1> implementors concurrencyMode
System class >> concurrencyMode
topaz 1> omit deprecated
topaz 1> implementors concurrencyMode
(Omitted 1 deprecated methods)
```

## flushoutput

`display flushoutput`

enables immediate flushing of topaz output files other than stdout. **display flushoutput** causes an `fflush()` call to be made to each active topaz log file (files specified by **output push**) other than stdout, after each line of topaz output is written. This allows a `tail -f` to have a more up-to-date view of a topaz output file.

Default: **omit flushoutput**

## errorcheck

`display errorcheck`

Allows Topaz programs to automatically record the results of error checking. Using this command creates the `./topazerrors.log` file or opens the file to append to it, if it already exists.

As long as **display errorcheck** is set, every time `ErrorCount` is incremented, a summary of the error is added to `topazerrors.log`. The summary includes the line number in the Topaz output file, if possible. If the only output file open is stdout, then line numbers are not available. To close the `topazerrors.log` file, use the **omit errorcheck** command. Subsequent results are not recorded.

Default: **omit errorcheck**

## lineeditor

`display lineeditor`

Enables the use of the Topaz line editor, using the open source `linenoise` library. This is not available on Windows.

The number of lines of history kept for the lineeditor is controlled using the **set history** command (page 155).

The **status** command includes one of the following lines to indicate if the lineeditor is in use:

```
using line editor
not using line editor
```

Default: **display lineeditor**

## oops

### **display oops**

For each object, displays a header containing the object's OOP (a 64-bit unsigned integer), the object's size (the sum of its named, indexed, and unordered instance variable fields), and the OOP of the object's class.

The oops of certain primitive special objects, such as Characters, SmallIntegers, Booleans, and nil, do not display their oops. To enable display of their oops, use **display alloops**.

Default: **omit oops**

## names

### **display names**

For each of an object's named instance variables, displays the instance variable name along with its value.

When instance variable name display is off, named instance variables appear as i1, i2, i3, and so on.

Default: **display names**

## pauseonerror

### **display pauseonerror**

When an error occurs, if Topaz is receiving input from a terminal, displays the message:

```
Execution has been suspended by a "pause" message.  
Topaz pausing after error, type <return> to continue, ctl-C to  
quit ?
```

and waits for the user to press the **Return** key to continue execution. Pressing **Ctrl-C** ends the pause and stops the processing of input files altogether.

If **display resultCheck** is also set, then Topaz only pauses when the result or error is contrary to the current **resultCheck**, **expectvalue**, and **expecterror** settings.

The **status** command includes one of the followings lines to indicate status of this attribute:

```
display interactive pause on errors  
omit interactive pause on errors
```

Default: **omit pauseonerror**

## pauseonwarning

### **display pauseonwarning**

When a compiler warning occurs, and if the topaz stdin is from a terminal, then write a message "Pausing after warning ..." to stdout, and wait for an end of line on stdin before continuing topaz execution. A **ctl-C** on stdin will terminate the pause and terminate further processing of input files.

The **status** command includes one of the followings lines to indicate status:

```
display interactive pause on warnings  
omit interactive pause on warnings
```

Default: **omit pauseonwarning**



## pushonly

### **display pushonly**

Enables the effect of the **only** keyword in an **output push** command. Does not effect output to stdout within a topaz -S script. To disable this effect, use the **omit pushonly** command.

Default: **display pushonly**

## resultcheck

### **display resultCheck**

Allows Topaz programs to check input values and record the results. This command creates the `./topazerrors.log` file or opens the file to append to it, if it already exists. Specifying **display resultCheck** is equivalent to setting **expectvalue true**, except that it affects the behavior of all **run** and **printit** commands, not only the next one.

As long as **display resultCheck** is set, every time ErrorCount is incremented, a summary of the error is added to `topazerrors.log`. This includes the line number in the Topaz output file, if possible. If the only output file open is stdout, then line numbers are not available. To close the file, use the **omit resultCheck** command. Then the results of a successful **run** or **printit** command will no longer be checked, unless an **expectvalue** command precedes the **printit** command.

Default: **omit resultcheck**

## singlecolumn

### **display singlecolumn**

rather than displaying large numbers (more than eight) of method and temporary variable definitions with a debugger stack frame in columns, display in a single column.

Default: **omit singlecolumn**

## stacktemps

### **display stacktemps**

enables the display of stack frames to include un-named evaluation temps which have been allocated by bytecodes within the method.

Default: **omit stacktemps**

## versionedclassnames

When **display versionedclassnames** is set, which is the default, topaz includes `[versionNumber]` following the class name, for instances of classes that are not the last one in the classHistory of that class. This is limited to when **display oops** is also set.

## zerobased

### **display zerobased**

Shows offsets of instance variables as zero-based when displaying objects. With **display zerobased**, offsets are zero-based, with **omit zerobased**, offsets are one-based.

Default: **omit zerobased** (offsets are one-based, as in Smalltalk) .

## DOIT

Sends the text following the **doit** command to the object server for execution and displays the OOP of the resulting object. If there is an error in your code, Topaz displays an error message instead of a legitimate result. GemStone Smalltalk text is terminated by the first line that contains a % as the first character in the line. For example:

```
topaz 1> doit
2 + 1
%
result oop is 26
```

The text executed between the **doit** and the terminating % can be any legal GemStone Smalltalk code, and follows all the behavior documented in the *Programming Guide for GemStone/S 64 Bit*.

If the configuration parameter GEM\_NATIVE\_CODE\_ENABLED is set to FALSE, or if any breakpoints are set, execution defaults to interpreted mode. Otherwise, execution defaults to using native mode.

For details about GemStone configuration parameters, see the *System Administration Guide*.

Note that **doit** always displays results at level 0, regardless of the current display level setting (page 108). The **doit** command does not alter the current level setting.

# DOWN

## down [*anInteger*]

Moves the active frame down within the current stack, and displays the frame selected as a result. The optional argument *anInteger* specifies how many frames to move down. If no argument is supplied, the scope will go down one frame. See also **stack down** on page 163. The frame displayed includes parameters and temporaries for the frame, unlike the results displayed by **stack down**.

```
topaz 1> where
1 ZeroDivide (AbstractException) >> __signalWith: @6 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> __errorDivideByZero @6 line 7
=> 4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsnMethod class) >> __gsReturnToC @1 line 1
```

```
topaz 1> down
3 SmallInteger (Number) >> __errorDivideByZero @6 line 7
  receiver 1
```

```
topaz 1> where
1 ZeroDivide (AbstractException) >> __signalWith: @6 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
=> 3 SmallInteger (Number) >> __errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsnMethod class) >> __gsReturnToC @1 line 1
```

# DUMPOBJ

## **dumpobj** *anObjectSpecification*

This command does a low-level dump of an object, the node of a large object, or the node of an IdentityBag. For a byte format object, it displays the integer values of the bytes. This command cannot be abbreviated

For example

```
topaz 1> dumpobj Globals
aSymbolDictionary
#1 657
#2 112
#3 20260
#4 1013
#5 nil
#6 anIdentityCollisionBucket
#7 ReadWriteStreamPortable
#8 aSymbolAssociation
#9 nil
#10 anIdentityCollisionBucket
#11 PositionableStreamPortable
#12 aSymbolAssociation
#13 nil
#14 anIdentityCollisionBucket
#15 ReadStreamLegacy
#16 aSymbolAssociation
...
```

# EDIT

## **edit** *aSubCommandOrSelector* [*aSelector*]

Allows you to edit GemStone Smalltalk source code. You can create or modify methods or blocks of code to be executed. You can also edit the text of the last **run**, **printit**, **doit**, **method:**, or **classmethod:** command.

Before you can use this command, you must first establish the name of the host operating system editor you wish to use. You can do this by setting the host environment variable `EDITOR` or by invoking the Topaz **set editorname** command interactively or in your Topaz initialization file.

Do not use the **edit** command for batch processing. Instead, use the **method:** and **classmethod:** commands to create methods in batch processes, and the **run**, **printit** or **doit** commands to execute blocks of code in batch.

If you supply any parameter to **edit**, other than one of its subcommands, Topaz assumes that you are naming an existing instance method to be edited.

## Creating or Modifying Blocks of GemStone Smalltalk Code

### **edit last**

Allows you to edit the text of the last **run**, **printit**, **doit**, **method:**, or **classmethod:** command. (You can inspect that text before you edit by issuing the Topaz command **object LastText**.) Topaz opens, as a subprocess, the editor that you've selected. When you exit the editor, Topaz saves the edited text in its temporary file and asks you whether you'd like to compile and execute the altered code. If you tell Topaz to execute the code, it effectively reissues your **run** or **printit** command with the new text.

### **edit new text**

Allows you to create a new block of GemStone Smalltalk code for compilation and execution. This is similar to **edit last**, but with a new text object.

## Creating or Modifying GemStone Smalltalk Methods

### **edit new**

If you type **edit new** with no additional keywords, Topaz assumes that you want to create a new instance method for the current class.

### **edit new method**

Allows you to create a new instance method for the current class and category. Before you can use this command, you must first use **set class** to select the current class. If you haven't yet selected a current category, the new method is inserted in the default category, "as yet unspecified."

### **edit new classmethod**

Allows you to create a new class method for the current class and category. Before you can use this command, you must first use **set class** to select the current class. If you haven't yet selected a current category, the new method is inserted in the default category, "as yet unspecified."

### **edit selectorSpec**

**edit method:** *selectorSpec*

Allows you to edit the source code of an existing instance method. Before you can use this command, you must first use **set class** to select the current class. The category of the method you edit is automatically selected as the current category. For example:

```
topaz 1> set class Animal  
topaz 1> edit habitat
```

edits the instance method in class Animal whose selector is habitat.

**edit classmethod:** *selectorSpec*

Allows you to edit the source code of an existing class method. Before you can use this command, you must first use **set class** to select the current class. The category of the method you edit is automatically selected as the current category.

# ENV

## **env** [*anInteger*]

Sets the compilation environmentId used for method compilations, lookups of senders and implementors, and **run**, **printit**, etc. *anInteger* must be between 0 and 255 and is 0 by default. Values other than 0 are invoked in additional execution environments and are used in specialized applications.

With no arguments, prints the current compilation environmentId.

The compilation environment may also be set using the command **set compile\_env**:

## ERRORCOUNT

Displays the Topaz `errorCount` variable, which stores the number of errors made in all sessions since you started Topaz. This includes GemStone Smalltalk errors generated by compiling or a **run** or **printit** command, as well as errors in Topaz command processing.

If **expecterror** is specified immediately before a compile or execute command (**run**, **printit**, **doit**, **method:**, **classmethod:**, **send**, or **commit**) and the expected error occurs during the compile or execute, the `ErrorCount` is not incremented. The `ErrorCount` is not reset by **login**, **commit**, **abort**, or **logout**.

You can use the **errorcount** command at the `topaz >` prompt before you log in, as well as after login.

```
topaz> errorcount
```

```
0
```

It is equivalent to

```
topaz 1> object ErrorCount
```

except that **errorcount** does not require a valid session.

This command cannot be abbreviated.



## EXEC

Sends the text following the **exec** command to GemStone for execution as GemStone Smalltalk code, and displays the result.

The **exec** command, unlike related commands such as **run** and **printit**, accept text on the same line as the **exec** command itself, up to a % character on that line. If there is no % on the exec command line, subsequent lines are included as part of the Smalltalk code to be executed, up to a % character appearing as the first character in a line.

For example:

```
topaz 1> exec 2 + 2 %  
4
```

The text executed between the **exec** and the terminating % can be any legal GemStone Smalltalk code, and follows the behavior documented in the *Programming Guide for GemStone/S 64 Bit*.

If there is an error in your code, Topaz displays an error message instead of a legitimate result.

If the configuration parameter `GEM_NATIVE_CODE_ENABLED` is set to `FALSE`, or if any breakpoints are set, execution defaults to interpreted mode. Otherwise, execution defaults to using native mode. For details about GemStone configuration parameters, see the *System Administration Guide*.

Like **run**, **exec** uses the current display level setting (page 108).

# EXIT

## **exit**[*aSmallInt* | *anObjectSpec*]

Leaves Topaz, returning to the parent process or operating system. If you are still logged in to GemStone when you type **exit**, this aborts your transactions and logs out all active sessions.

You can include an argument (a `SmallInteger`, or an object specification that resolves to a `SmallInteger`) to specify an explicit `exitStatus` for the Topaz process. Only 8 bits of the integer are returned. To get valid return values, the argument should always resolve to a value in the range 0..255. To use an object specification, including `errorcount`, you must be logged in when the **exit** command is executed.

If you do not specify an argument, the `exitStatus` will be either 0 (no errors occurred during Topaz execution) or 1 (there was a GCI error or the Topaz `errorCount` was nonzero).

For example:

```
topaz 1> exec ( 42 - 3 ) %
topaz 1> exit **
Logging out session 1.
--- 08/11/2020 14:11:53.619 PDT Logging out
unix> echo $?
39
```

**exit** is ignored when reading a file using **input**, when `stdin` is a `tty`. If topaz `stdin` is redirected to a file and the file does not end with a **quit** or **exit**, topaz considers EOF on `stdin` to be an error, and will result in a non-zero topaz exit status.

This command cannot be abbreviated.

To exit from topaz with an exit status directly from Smalltalk code, you can use the `ExitClientError` class. For example,

```
topaz 1> run
ExitClientError
  signal: 'Disallowed Operation'
  status: 34
%
ERROR 3004 , a ExitClientError occurred (error 3004), ,
  Disallowed Operation (ExitClientError)
Logging out session 1.
--- 08/11/2020 15:21:17.137 PDT Logging out
```

## EXITIFNOERROR

If there have been no errors — either GemStone Smalltalk errors or Topaz command processing errors — in any session since you started Topaz, this command has the same effect as **exit 0** (described on page 82). Otherwise, this command has no effect.

This command cannot be abbreviated.

## EXPECTBUG

**expectbug** *bugNumber* **value** *resultSpec* [ *integer* ] | **error**  
*errCategory* *errNumCls* [ *resultSpec* [ *resultSpec* ]..]

Specifies that the result of the following execution results in the specified answer (either a value or an error). If the expected result occurs, Topaz prints a confirmation message and increments the error count.

The **expectbug** command is intended for use in self-checking scripts to verify the existence of a known error. Only one **expectbug** command (at most) can be in effect during a given execution. Topaz honors the last **expectbug** command issued before the execution occurs. **Expectbug** can be used in conjunction with the **expecterror** and **expectvalue** commands—an **expectbug** command does not count against the maximum of five such **expecterror** and **expectvalue** commands permitted.

*bugNumber* is a parameter identifying the bug or behavior you expect to see. In most cases this would be a number, but it can equally well be a character string. (If it contains white space, enclose the string in single quotes.) The parameter is included in the confirmation message.

*resultSpec* is specified as in the **expectvalue** command (described on page 88).

*errorCategory* and *errNumCls*

are specified as in the **expecterror** command (described on page 85).

For example, suppose you know that the '\*' operator has been reimplemented in a way that returns the erroneous answer '5' for the expression '2 \* 3'. You can use the **expectbug** command in a script to verify that the bug is present:

```
topaz 1> expectbug 123 value 5
topaz 1> printit
2 * 3
%
5
BUG EXPECTED: BUG NUMBER 123
```

If the expected bug does not occur, Topaz checks for an **expecterror** or **expectvalue** command that matches the answer received. If it finds a match, Topaz displays a "FIXED BUG" message. If not, the error is reported in the same way the **expecterror** or **expectvalue** command would report it ("ERROR: WRONG VALUE" for example). If no **expecterror** or **expectvalue** commands are in effect, execution proceeds without comment.

# EXPECTERROR

**expecterror** *anErrorCategory anErrorNumCls* [*anErrorArg*

[*anErrorArg*] ...]

Indicates that the next compilation or execution is expected to result in the specified error. If the expected result occurs, Topaz reports the error in the conventional manner but does not increment its error count and allows execution to proceed without further action or comment.

If the execution returns a result other than the expected error (including unexpected success), Topaz increments the error count and invokes any **iferror** actions that have been established.

Up to five **expecterror** or **expectvalue** commands may precede an execution command. If the result of the execution satisfies any one of them, the error count variable is not incremented. This mechanism allows you to build self-checking scripts to check for errors that can't be caught with GemStone Smalltalk exception handlers.

**expecterror** must be reset for each command; it is only checked against a single return value. **expecterror** is normally used before the commands **run**, **printit**, **doit**, **method:**, **classmethod:**, **commit**, and **send**. You must also use it before executing **continue** after a breakpoint.

*anErrorCategory* must be a Topaz object specification that evaluates to the object identifier of an error category; normally, `GemStoneError`.

*anErrorNumCls* must be a Topaz object specification that evaluates either to a `SmallInteger` legacy error number, or to the object identifier of a subclass of `AbstractException`.

All Topaz object specification formats (as described in "Specifying Objects" on page 40) are legal in **expecterror** commands.

The following example shows an **expecterror** command followed by the expected error. Note that although the error is reported, the error count is not incremented.

```
topaz 1> errorcount
0
topaz 1> expecterror GemStoneError MessageNotUnderstood
topaz 1> printit
1 x
%
ERROR 2010 , a MessageNotUnderstood occurred (error 2010), a
SmallInteger does not understand #'x' (MessageNotUnderstood)
topaz 1> errorcount
0
```

If execution returns unanticipated results, Topaz prints a message (in this example, "ERROR: WRONG CLASS of Exception"), then invokes the actions established by the **iferror** command (in this example, a stack dump) and bumps the error count:

```
topaz 1> errorcount
0
topaz 1> iferror where
topaz 1> expecterror GemStoneError MessageNotUnderstood
topaz 1> printit
1 / 0
%
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, attempt to divide 1 by zero
(ZeroDivide)
ERROR: WRONG CLASS of Exception, does not match expected class
topaz > exec iferr 1 : where
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 Executed Code @2 line 1
6 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
topaz 1> errorcount
1
```

## Further arguments to EXPECTERROR

In addition to the error category and class, you may optionally specify additional arguments. The **expecterror** argument values are tested against the argument values returned with the error. If one or more of the argument values do not match, errorcount is incremented. .

In addition to standard object specification formats, you may use additional formats to specify instances of classes as error arguments:

*%className* An instance of the class *className*.

*/className* An instance of the class *className* or an instance of any of its subclasses. (In other words, an instance of a 'kind of' *className*.)

If *anErrorArg* is specified as a String or Symbol (enclosed in single quotes and/or with a leading #), then it will be regarded as matching if the result if the two are equal (=).

Otherwise, Topaz regards it as matching the result if the two are identical (==).

You may omit arguments, which will not count as an error. If you specify more **expecterror** arguments than the actual error returns, then errorcount will be incremented. To match any error argument, use */Object*.

For example:

```
topaz 1> errorcount
2
topaz 1> expecterror GemStoneError OffsetError %Array 3 6
topaz 1> run
  (Array new: 3) at: 6
%
ERROR 2003 , a OffsetError occurred (error 2003),
reason:objErrBadOffsetIncomplete, max:3 actual:6 (OffsetError)
topaz 1> errorcount
2
```

# EXPECTVALUE

## expectvalue *anObjectSpec* [*anInt*]

Indicates that the result of the following compilation or execution is expected to be a specified value, denoted by *anObjectSpec*. If it is not, the error count is incremented. Up to five **expectvalue** or **expecterror** commands may precede an execution command. If the result of the execution satisfies any one of them, the error count variable is not incremented.

**expectvalue** must be reset for each command; it is only checked against a single return value. **expectvalue** is normally used before the commands **run**, **printit**, **doit**, **method:**, **classmethod:**, **commit**, and **send**. You must also use it before executing **continue** after a breakpoint.

All Topaz object specification formats (as described in "Specifying Objects" on page 40") are legal in **expectvalue** commands. In addition, this command takes further formats that allow you to specify instances of classes:

*%className*

An instance of the class *className*.

*%@OOPOfClass*

An instance of the class that has the OOP *OOPOfClass*.

*/className*

An instance of the class *className* or an instance of any of its subclasses. (In other words, an instance of a 'kind of' *className*.)

*/@OOPOfClass*

An instance of the class that has the OOP *OOPOfClass*, or an instance of any of its subclasses.

If *anObjectSpec* is specified as a String or Symbol (enclosed in single quotes and/or with a leading #), then it will be regarded as matching if the result if the two are equal (=).

Otherwise, Topaz regards it as matching the result if the two are identical (==).

If the *anInt* argument is present, the result of sending the method `size` to the result of the following execution must be the integer *anInt*.

The **commit** command has an internal result of true for success and false for failure. All other Topaz commands have an internal result of true for success and @0 for failure.

The following example uses **expectvalue** to test that the result of the **printit** command is a SmallInteger. The expected result is returned, so execution proceeds without comment:

```
topaz 1> expectvalue %SmallInteger
topaz 1> printit
2 * 5
%
10
```



If execution returns unanticipated results, Topaz prints a message (in this example, "ERROR: WRONG VALUE"), then invokes the actions established by the **iferror** command (in this example, a stack dump) and bumps the error count:

```
topaz 1> errorcount
0
topaz 1> iferror stack
topaz 1> expectvalue %SmallInteger
topaz 1> printit
2 * 5.5
%
1.1000000000000000E+01
ERROR: WRONG VALUE
Now executing the following command saved from "iferror":
    stack
    Stack is not active
topaz 1> errorcount
1
```

# FILEFORMAT

## fileformat 8bit | utf8

This command controls the interpretation of Character data for input and fileout, to allow strings containing Characters with codepoints over 255 to be input and output.

This is meaningful if you are using text that contains any Characters with values over 127. Characters 127 and below are 7-bit, and the code points are the same as the UTF-8 encoded values, and so are not affected by this setting.

Characters in the range of 128-255 can be read and written with their 8-bit codepoints, or read and written encoded as UTF-8; these produce different results. So if such text is written as UTF8, it must be read in with a fileformat of UTF8 in order to get correct results, and similarly both written and read as 8-bit in order to recreate the same text.

To avoid misinterpretation of fileouts, the **fileout** command writes a fileformat command at the start of the fileout. A **fileformat** command within a file only has effect within that file and any nested files.

Note that this setting does not apply to files produced by the **output** command. **output push**, etc. write files in UTF-8 format, regardless of the setting for **fileformat**.

The following options are supported:

### utf8

#### **fileformat utf8**

Sets the fileformat to UTF-8. Code that is filed out using **fileout** is encoded in UTF-8, and files read using **input** are interpreted as being UTF-8 and are decoded accordingly.

### 8bit

#### **fileformat 8bit**

Sets the fileformat to 8-bit, for compatibility with older releases. Code that is filed out using **fileout** is not encoded. Fileout of code containing Characters with codePoints over 255 will error.

The default at topaz startup is 8BIT. After login, if the repository's value for **#StringConfiguration** resolves to Unicode16, this will change the fileformat to UTF8.

Input from stdin that is a tty is always interpreted as UTF-8; changing the FILEFORMAT of a tty stdin to 8BIT is not allowed.

# FILEOUT

## **fileout** [*command*] *clsOrMethod* [**tofile:** *filename*] [**format:** *fileformat*]]

Writes out class and method information in a format that can be fed back into Topaz with the **input** command. Subcommands are used to specify whether to file out the entire class, or specific method or methods. If none of the defined subcommands follow the **fileout**, then the next word is assumed to be a selector for an instance method on the current class.

By default, the fileout command outputs the fileout text to stdout. To direct this to a file, follow the specification of what to fileout with the **tofile:** keyword. For example:

```
topaz 1> fileout class: Object tofile: object.gs
```

If you specify a host environment name such as \$HOME/foo.bar as the output file, Topaz expands that name to the full filename. If the output file does not include an explicit path specification, Topaz writes to the named file in the directory where you started Topaz.

When using the **tofile:** keyword, you may also optionally specify the **format:** keyword. This must be either 8bit or UTF8, and specifies whether the file is written out in bytes, or encoded in UTF-8. This overrides the current topaz setting for **fileformat**.

All fileout output generated from the **fileout** command include commands setting the **fileformat** and **set sourcestringclass**, based on the current settings or the **format:** command.

### **fileout class:** [*aClassName*]

Writes out the class definition and all the method categories and their methods. To write out the definition of the current class, type:

```
topaz 1> fileout class: ^
```

If you omit the class name parameter, the current class is written out.

The class that you file out becomes the current class for subsequent Topaz commands.

### **fileout category:** *aCategoryName*

Writes out all the methods contained in the named category for the current class.

### **fileout classcategory:** *aCategoryName*

Writes out all the class methods contained in the named category for the current class.

### **fileout classmethod:** *selectorSpec*

Writes out the specified class method (as defined for the current class). The category of that method will automatically be selected as the current category.

### **fileout method:** *selectorSpec*

Writes out the specified method (as defined for the current class). The category of that method will automatically be selected as the current category.

### **fileout** *selectorSpec*

Writes out the specified method (as defined for the current class). You may use this form of the **fileout** command (that is, you may omit the **method:** keyword) only if the selector that you specify does not conflict with one of the other **fileout** keywords. For example, to file out a method named `category:`, you would need to explicitly include the **method:** keyword.

## FR\_1

### **fr\_1** [*anInteger*]

Similar to the **frame** command (described on page 94), but for large numbers (more than eight) of method and temporary variables, these are displayed one per line rather than in four columns.

This command cannot be abbreviated.

## FR\_CLS

### **fr\_cls** [*anInteger*]

Similar to the **frame** command (described on page 94), but also displays OOPs of classes along with class names in the specified stack frames.

This command cannot be abbreviated.

# FRAME

## frame [*anInteger*]

Moves the active frame to the frame specified by *anInteger*, within the current stack, and displays the frame selected as a result. The display includes parameters and temporaries.

If no argument is supplied, displays the current frame.

See also **stack scope** on page 162, the **up** command on page 181 and the **down** command on page 75.

For example:

```
topaz 1> printit
{ 1 . 2} do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, An attempt was made to divide 1 by
zero. (ZeroDivide)
```

```
topaz 1> where
==> 1 ZeroDivide (AbstractException) >> _signalWith: @6 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

```
topaz 1> frame 4
4 SmallInteger >> / @6 line 7
receiver 1
aNumber 0
```

```
topaz 1> where
1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
==> 4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

```
topaz 1> frame 7
7 Executed Code @2 line 1
receiver nil
```

# GCITRACE

## **gcitrace** *aFileName*

Turns GCI tracing on. Subsequent GCI calls are logged to the file *aFileName*. If *aFileName* is "" (empty string), then turns GCI tracing off.

This command cannot be abbreviated.

# HELP

## help [*aTopicName*]

Invokes a hierarchically-organized help facility that can provide information about all Topaz commands. Enter ? at a help prompt for a list of topics available at that level of the hierarchy. Help topics can be abbreviated to uniqueness.

To display help text for **fileout**:

```
topaz 1> help fileout
```

To display help text for **last**:

```
topaz 1> help edit last
```

Press *Return* at a help prompt to go up a level in the hierarchy until you exit the help facility.



# HIERARCHY

## hierarchy [*aClassName*] [*environmentId*]

Prints the class hierarchy up to Object for the specified class, in the specified environmentId, or the current environmentId if no environmentId is specified.

If you do not specify a class, Topaz prints the hierarchy for the current class.

### Example

```
topaz 1> hierarchy SmallFraction
Object
  Magnitude
    Number
      AbstractFraction
        SmallFraction
```

### See Also

[subhierarchy](#) (page 171)

# HISTORY

## history [*anInteger*]

Displays the specified number of recently executed commands, as listed in the Topaz line editor history. Has no effect if the line editor is not enabled. (Not available on Windows.)

The **set history** command (page 152) establishes the maximum number of command lines to retain in the Topaz line editor history.

### Example

```
topaz 1> history
0 login
1 run
2 2 / 0
3 %
4 stk
5 display oops
6 stk
7 frame 3
8 history
```

# IFERR

## **iferr** *bufferNumber* [*aTopazCommandLine*]

The **iferr** command works whenever an error is reported and the ErrorCount variable is incremented.

This command saves *aTopazCommandLine* in the post-error buffer specified by *bufferNumber* as an unparsed Topaz command line. There are 10 buffers; *bufferNumber* must be an integer between 1 and 10, inclusive.

The post-error buffer commands apply under any of the following conditions:

- ▶ an error occurs (other than one matching an **expecterror** command and other than one during parsing of the **iferr** command)
- ▶ a result fails to match an **expectvalue** command
- ▶ a result matches an **expectbug** command

Whenever any of these conditions arise, any non-empty post-error buffers are executed. Execution starts with buffer 1, and proceeds to buffer 10, executing each non-empty post-error buffer in order. This allows you to execute a number of handling commands. For example:

```
topaz 1> iferr 1 where
topaz 1> iferr 2 allstacks
topaz 1> iferr 3 topazwaitfordebug
```

If an error occurs while executing one of post-error buffers, execution proceeds to the next non-empty post-error buffer. Error and result checking implied by **display resultcheck**, **display errorcheck**, **expectvalue**, etc., are not performed while executing from post-error buffers.

If a post-error buffer contains a command that would terminate the topaz process, then later buffers will have no effect. If a post-error buffer contains a command that would terminate the session, execution later buffers will be attempted but they will not have a session, unless one of the contains "login".

To remove the contents of a specific post-error buffer, enter **iferr** *bufferNumber* without a final argument. The command **iferr\_clear** will clear all buffers.

The **iferr\_list** command will display the contents of all post-error buffers.

The following examples demonstrate how to use **expecterror** to test the kind of error that is returned from Smalltalk code execution, so you can conditionally avoid triggering the **iferr** command.

The following reports an error, but does not perform the **iferr** operations:

```
topaz 1> iferr 1 stk
topaz 1> expecterror GemStoneError MessageNotUnderstood
topaz 1> exec 2 foo %
ERROR 2010 , a MessageNotUnderstood occurred (error 2010), a
SmallInteger does not understand #'foo'
topaz 1>
```

But in the following, since divide-by-zero is an unexpected error, does print the stack:

```
topaz 1> iferr 1 stk
topaz 1> expecterror GemStoneError MessageNotUnderstood
topaz 1> exec 2 / 0 %
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, attempt to divide 2 by zero
ERROR: WRONG CLASS of Exception, does not match expected class
topaz > exec iferr 1 : stk
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 Executed Code @2 line 1
6 GsNMethod class >> _gsReturnToC @1 line 11
```

This command cannot be abbreviated.

## IFERR\_CLEAR

The **iferr\_clear** command clears all the post-error command buffers.

For details on the post-error command buffers, see the **iferr** command on page 99.

This command cannot be abbreviated.

## IFERR\_LIST

The **iferr\_list** command prints all the non-empty post-error command buffers.

For details on the post-error command buffers, see the **iferr** command on page 99.

This command cannot be abbreviated.

# IFERROR

## **iferror** [*aTopazCommandLine*]

The **iferror** command saves *aTopazCommandLine* to the post-error command buffer 1, or when used without an argument, clearing buffer 1.

The command:

```
topaz 1> iferror stack
```

has the same effect as:

```
topaz 1> iferr 1 stack
```

For details **iferr** and the post-error command buffers, see page 99.

This command cannot be abbreviated.

# IMPLEMENTORS

## implementors *selectorSpec*

Displays a list of all classes that implement the given *selectorSpec* (either a String or a Symbol). For example:

```
topaz 1> implementors asByteArray  
Collection >> asByteArray  
MultiByteString >> asByteArray  
String >> asByteArray
```

This command is equivalent to the following:

```
topaz 1> doit  
ClassOrganizer new implementorsOfReport: aString  
%
```

This command may use significant temporary object memory. Depending on your repository, you may need to increase the value of the GEM\_TEMPOBJ\_CACHE\_SIZE configuration parameter beyond its default. For details about GemStone configuration parameters, see the *System Administration Guide*.



# INPUT

## input [*aFileName* | pop]

Controls the source from which Topaz reads input. Normally Topaz reads input from standard input (stdin). This command causes Topaz to take input from a file or device of your choice.

If you specify a host environment name such as `$HOME/foo.bar` as the input file, Topaz expands that name to the full filename. If you don't provide an explicit path specification, Topaz looks for the named input file in the directory where you started Topaz.

When input commands are echoed, as they are by default, the topaz prompt indicates that the given command is located in a particular level of nested file by including a + (plus sign) for each level of file input nesting.

For example, assuming *aFile* contains a series of commands which include **import** *nestedFile*:

```
topaz 1> input aFile
topaz 1 +> <commands in aFile>
topaz 1 +> input nestedFile
topaz 1 ++> <commands in nestedFile>
topaz 1 +> <further commands in aFile>
```

### **input** *aFileName*

Reads input from the specified file. This pushes the current input file onto a stack and starts Topaz reading from the given file. There is a limit of 20 nested **input** *aFileName* commands. If you exceed the limit, an error is displayed, and execution continues in the current file.

### **input** pop

Pops the current input file from the stack of input files and resumes reading from the previous file. If there is no previous file, or the previous file cannot be reopened, Topaz once again takes its input from standard input.

# INSPECT

## **inspect** [*anObjectSpec*]

Sends the message `describe` to the designated object.

This command is equivalent to the following

```
topaz 1> send anObjectSpec describe  
%
```

# INTERP

Sends the text following the **interp** command to GemStone for execution as GemStone Smalltalk code, and displays the result.

This command is identical to the **run** command (page 147), except that the **interp** command does not use native code, the Smalltalk code execution is interpreted.

GemStone Smalltalk text is terminated by the first line that contains a % as the first character in the line. For example:

```
topaz 1> interp  
2 + 2  
%  
4
```

The text executed between the **interp** and the terminating % can be any legal GemStone Smalltalk code, and follows the behavior documented in the *Programming Guide for GemStone/S 64 Bit*.

This command cannot be abbreviated.

# LEVEL

## **level** *anIntegerLevel*

Sets the Topaz display level; that is, this command tells Topaz how much information to include in the result display. A level of 1 (the default) means that the first level of instance variables within a result object will be displayed. Similarly, a level of 2 means that the variables *within* those variables will be displayed. Setting the level to 0 inhibits the display of objects (though object headers will still be displayed if you specify **display oops**). The maximum display level is 10000.

Note the following:

- ▶ The **run** command (page 147) displays results using the current display level, as set by the **level** command.
- ▶ The **doit** command (page 74) always displays results at level 0, regardless of the current display level.
- ▶ The **printit** command (page 140) always displays results at level 1, regardless of the current display level.

# LIMIT

## limit [**bytes** | **oops** | **lev1bytes**] *anInteger*

Tells Topaz how much of any individual object to display in GemStone Smalltalk results. The display can be limited by OOPs, to control the number of objects displayed (for example, the number of elements in a collection). It can also be limited by bytes, to control the number of bytes of byte objects, such as Strings, that are displayed.

For example, `limit bytes 100` would tell Topaz to only display 100 bytes of any String (or other byte object).

A limit of 0 tells Topaz to not limit the size of the output. This is the default.

If the amount that would be displayed is limited by limit bytes setting, the display indicates missing text using `...(NN more bytes)`. If the number of objects is limited by a limit oops setting, then it prints `... NN more instVars`.

### bytes

`limit anInteger`

`limit bytes anInteger`

Tells Topaz how much of any byte object (instance of String or one of String's subclasses) to display in GemStone Smalltalk results.

If *anInteger* is non-zero, then when displaying frame temporaries, or when displaying an object with a display level of 1 or greater, any byte-valued instance variable with a byte object value will be limited to one line (about 80 characters) of output. To display the full contents of that byte object (up to the limit set by *anInteger*), use the **object** command.

For debugging source code, we suggest `limit bytes 5000`.

### oops

`limit oops anInteger`

Tells Topaz how much of any pointer or nonsequenceable collection to display in GemStone Smalltalk results.

### lev1bytes

`limit lev1bytes anInteger`

When the topaz **level** is set to 1 or greater, this limit controls how many bytes to display of instVar values and frame temporaries. If **lev1bytes** is set to zero, then the value of "limit bytes" is used for instVar values and frame temporaries.

# LIST

The **list** command is used in conjunction with the **set** and **edit** commands to browse through dictionaries, classes, and methods in the repository. The **list** command is also useful in debugging.

When no arguments are included on the command line, the **list** command lists the source code for the currently selected stack frame, as selected by the most recent **lookup**, **up**, **down**, or **frame** command.

## Browsing Dictionaries and Classes

### dictionaries

#### **list dictionaries**

Lists the SymbolDictionaries in your GemStone symbol list. This executes the GemStone Smalltalk method `UserProfile>>dictionaryNames`.

### classesIn:

#### **list classesIn: aDictionary**

Lists the classes in *aDictionary*. For example,

```
topaz 1> list classesIn: UserGlobals
```

lists all of the classes in your UserGlobals dictionary.

### classes

#### **list classes [subStringPattern]**

Lists all of the classes in all of the dictionaries in your symbol list.

To limit the displayed classes, you can include an argument *subStringPattern*. Only results that match, case insensitive, some portion of the *subStringPattern* are displayed. For example,

```
topaz 1> list classes cert
GsX509Certificate
GsX509CertificateChain
```

### categoriesIn:

#### **list categoriesIn: [aClass]**

Lists all of the instance and class method selectors for class *aClass*, by category, and establishes *aClass* as the current class for further browsing.

If you omit the class name parameter, method selectors are listed by category for the current class.

### icategories

#### **list icategories [className]**

Lists all of the instance method selectors for the named class, by category. If you specify a class name, that class becomes the current class for subsequent Topaz commands. If you omit the class name parameter, lists the categories of the current class.

**ccategories:****list ccategories:** [*className*]

Lists all of the class method selectors for the named class, by category. If you specify a class name, that class becomes the current class for subsequent Topaz commands. If you omit the class name parameter, lists the categories of the current class.

**selectors****list selectors** [*token*]

Lists selectors of all instance methods in the current class, for which the argument *token* is a case-insensitive substring of the selector. If *token* is omitted, list all instance method selectors in the current class. May be abbreviated as `list sel`.

For example,

```
topaz 1> set class Array
topaz 1> list sel at:p
at:put:
_at:put:
_basicAt:put:
```

**cselectors****list cselectors** [*token*]

Lists selectors of all class methods in the current class, for which the argument *token* is a case-insensitive substring of the selector. If *token* is omitted, list all class method selectors in the current class. May be abbreviated as `list csel`.

**primitives****list primitives** [*token*]

Lists selectors of all class methods in the current class that invoke primitives. If *token* is specified, only return the selectors that contain a case-insensitive substring matching the given token string. May be abbreviated as `list prim`.

**cprimitives****list cprimitives** [*token*]

Lists selectors of all instance methods in the current class that invoke primitives. If *token* is specified, only return the selectors that contain a case-insensitive substring matching the given token string. May be abbreviated as `list cprim`.

**Listing Methods**

**list** with no arguments lists the source code of the active method context. See Chapter 2, "Debugging Your GemStone Smalltalk Code", starting on page 45.

**list** @*anObjectSpec*

Lists the source code of the GsNMethod or ExecBlock with the specified *objectId*. That method, or the block's home method, becomes the default method for subsequent `list` or `disassem` commands.

**method:**

**list method:** *selectorSpec*

Lists the category and source code of the specified instance method selector for the current class. You can also enter this command as `list imethod`.

**classmethod:**

**list classmethod:** *selectorSpec*

Lists the category and source of the given class method selector for the current class. You can also enter this command as `list cmethod:` or `list cmethod`.

**imethod:**

**list imethod:** is the equivalent to `list method:`.

**linenumbers**

**list linenumbers**

This is an additional option to one of the above commands, preceding the method specification. When this is used, the line number is included in the listing. For example:

```
topaz 1> set class String
topaz 1> list linenumbers method: includesValue:
  1 includesValue: aCharacter
  2
  3 "Returns true if the receiver contains aCharacter, false
  otherwise.
  4 The search is case-sensitive."
  5
  6 <primitive: 94>
  7 aCharacter _validateClass: AbstractCharacter .
  8 ^ self includesValue: aCharacter asCharacter .
```

**Listing Step Points****step**

**list step**

Lists the source code of the current frame, and display only the step point corresponding to the step point of the current frame.

**steps**

**list steps**

Lists the source code of the current frame, and displays step points in that source code.



**list steps method:** *selectorSpec*

Lists the source code of the specified instance method for the current class, and displays all step points (allowable breakpoints) in that method. For example:

```
topaz 1> set class String
topaz 1> list steps method: includesValue:
includesValue: aCharacter
* ^1 *****

"Returns true if the receiver contains aCharacter, false
otherwise. The search is case-sensitive."

<primitive: 94>
aCharacter _validateClass: AbstractCharacter .
* ^2 *****
^ self includesValue: aCharacter asCharacter .
* ^5 ^4 ^3 *****
```

You can use the **break** command to set method breakpoints before assignments, message sends, or method returns. As shown here, the position of each method step point is marked with a caret and a number. Each line of step point information is indicated by asterisks (\*).

For more information about method step points, see Chapter 2, “Debugging Your GemStone Smalltalk Code”, starting on page 45.

**list steps classmethod:** *selectorSpec*

Lists the source code of the specified class method for the current class, and displays all step points in that method.

## stepips

**list stepips**

**list stepips**, **list stepips method:**, and **list stepips classmethod:** list source code and display the IPs (instructions pointers) of the step points. These commands are intended for low-level debugging and not normally useful for customer development debugging.

## Listing Breakpoints

In addition to **list breaks**, you can use the **break list** command to list all currently set breakpoints. For more information about using breakpoints, see Chapter 2, “Debugging Your GemStone Smalltalk Code”, starting on page 45.

## breaks

**list breaks**

Lists the source code of the current frame, and displays the step points for the method breakpoints currently set in that method. Disabled breakpoints are displayed with negative step point numbers.

**list breaks method:** *selectorSpec*

Lists the source code of the specified instance method for the current class, and displays the method breakpoints currently set in that method. For example:

```
topaz 1> list breaks method: <
< aCharCollection
  "Returns true if the receiver collates before the
  argument. Returns false otherwise.
  The comparison is case-insensitive unless the receiver
  and argument are equal ignoring case, in which case
  upper case letters collate before lower case letters.
  The default behavior for SortedCollections and for
  the sortAscending method in UnorderedCollection is
  consistent with this method, and collates as follows:

  #( 'c' 'MM' 'Mm' 'mb' 'mM' 'mm' 'x' ) asSortedCollection

  yields the following sort order:

  'c' 'mb' 'MM' 'Mm' 'mM' 'mm' 'x'
  "
<primitive: 28>
aCharCollection _stringCharSize bitAnd: 16r7) ~~ 0 ifTrue:[
  ^ (DoubleByteString withAll: self) < aCharCollection .
].
aCharCollection _validateClass: CharacterCollection .
*                ^2                *****
^ aCharCollection > self
```

**list breaks classmethod:** *selectorSpec*

Lists the source code of the specified class method for the current class, and displays the method breakpoints currently set in that method.

# LISTW / L

## listw

### I

For the method implied by the current stack frame, limit the list to the number of source lines defined by the **set listwindow** command. The list is centered around the current insertion point for the frame.

For example:

```
topaz 1> stk
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

```
topaz 1> frame 4
4 SmallInteger >> / @6 line 7
    receiver 1
    aNumber 0
```

```
topaz 1> listw
/ aNumber

>Returns the result of dividing the receiver by aNumber."

<primitive: 10>
(aNumber _isInteger) ifTrue:[
    (aNumber == 0) ifTrue: [^ self _errorDivideByZero].
*                               ^6
*****
    ^ Fraction numerator: self denominator: aNumber
].
    ^ super / aNumber
```

The **listw** command cannot be abbreviated, other than by **I**.

# LITERALS

## literals *anObject*

Reports all methods in which *anObject* is contained as a literal reference. *anObject* is typically a String, Symbol, or Number.

**literals** is equivalent to:

```
topaz 1> exec ClassOrganizer new literalsReport: anObject %
```

for example,

```
topaz 1> Literals TimeZone  
TimeZone >> =  
TimeZone class >> default:  
TimeZone class >> fromLinux  
TimeZone class >> fromSolaris
```

# LOADUA

## **loadua** *aFileName*

Loads the application user action library specified by *aFileName*. This command must be used before **login**.

This command cannot be abbreviated.

User action libraries contained user-defined C functions to be called from GemStone Smalltalk. See the *GemBuilder for C* manual for information about dynamically loading user action libraries.

# LOGIN

Lets you log in to a GemStone repository. Before you attempt to log in to GemStone, you'll need to use the **set** command – either interactively or in your Topaz initialization file – to establish certain required login parameters. The required parameters for network communications are:

**set gemnetid:**

name of the GemStone service on the host computer (defaults to `gemnetobject` for the RPC version (**topaz** command) or `gcilnkobj` for the linked version (**topaz** command))

**set gemstone:**

name of the Stone (repository monitor) process, if necessary including node and protocol information in the form of a network resource string (NRS). See the *System Administration Guide* for more on NRS syntax and usage.

**set username:**

your GemStone user ID.

**set password:**

your GemStone password.

**set hostusername:**

your user account on the host computer. Required for the RPC version of Topaz or for RPC sessions spawned by the linked version.

**set hostpassword:**

your password on the host computer. Required for the RPC version of Topaz or for RPC sessions spawned by the linked version of Topaz.

Topaz allows you to run your Gem (GemStone session), Stone (repository monitor), and Topaz processes on separate network nodes. For more information about this, see the discussion of **set gemnetid** and **set gemstone**.

If you are using linked Topaz (**topaz -L**), also note the following:

- ▶ If the `gemnetid` is explicitly set, Topaz starts an RPC session instead of a linked one.
- ▶ Topaz can only be linked with a single GemStone session process. If you issue the **login** command to create multiple sessions, you must set **gemnetid**, and the new sessions are RPC rather than linked.
- ▶ You cannot use the **set** command to run Gem and Topaz on separate nodes for the linked session (obviously). However, you may still run the Stone process on a separate node. For any RPC sessions started from the linked version, you may run the Gems on separate nodes from Topaz.

For more information about logging in to GemStone, read the section “Logging In to GemStone” on page 12. The **set** command is described on page 152.

# LOGOUT

Logs out the current GemStone session. This command aborts your current transaction. Your local variables (created with the **define** command) will no longer have valid definitions when you log in again.

This command cannot be abbreviated.

## LOGOUTIFLOGGEDIN

If logged in, logs out the current GemStone session. If there is no current session, does not increment the Topaz error count.

As with the **logout** command (page 119), this command aborts your current transaction. Your local variables (created with the **define** command) will no longer have valid definitions when you log in again.

This command cannot be abbreviated.



# LOOKUP

**lookup** (meth | method | cmeth | cmethod) *selector* [*envId*]

**lookup** *className* [*class*] [(*implementingclass*)] >> *selector* [*envId*]

The **lookup** command to search upwards through the hierarchy of superclasses to locate the implementation of a given method selector. If no *envId* is specified, the current compilation environment **env** is used.

There are two ways to specify the class, selector, and if it is a class or instance method:

- ▶ using the **set** command to specify the class, and either **method** or **classmethod** to indicate a class or instance method;
- ▶ using *className* [**class**] >> to identify this information

All arguments to **lookup** are case sensitive.

The *selector* argument is string or symbol with the full method selector. The following are all acceptable *selector* specifications:

```
lookup hash
lookup 'hash'
lookup #hash
lookup #'hash'
```

Or you may use syntax such as:

```
lookup SmallInteger >> +
lookup String class >> new
```

The **lookup** command also accepts the text generated in stack frame, so you can copy and paste from a stack frame to lookup a method.

```
lookup String (SequenceableCollection) >> at:ifAbsent:
```

Using this syntax, *implementingClass* is used as the starting point for lookup, and the *class* argument is ignored.

Related commands include **senders** and **implementors**.

## Finding and Listing Methods

**lookup classmethod** *selector*

Lists the source code of the specified class method for the current class, or searching the superclasses, the first superclass that implements this method. (May be abbreviated as **lookup cmeth**.)

**lookup method** *selector*

Lists the source code of the specified instance method for the current class, or searching the superclasses, the first superclass that implements this method. (May be abbreviated as **lookup meth**.)

```
topaz 1> set class Symbol
topaz 1> lookup meth match:

category: 'Comparing'
method: CharacterCollection
match: prefix

>Returns true if the argument prefix is a prefix of the
receiver, and false if not. The comparison is
case-sensitive."

self size == 0 ifTrue: [ ^ prefix size == 0 ].
^ self at: 1 equals: prefix
%
```

**lookup** *className* >> *selector*

Lists the source code of the specified instance method for the given class, or searching its superclasses, the first superclass that implements this method. (The *className* argument may not be **meth**, **method**, **cmeth**, or **classmethod**.)

**lookup** *className* **class** >> *selector*

Lists the source code of the specified class method for the class *className*, or searching its superclasses, the first superclass that implements this method. (The *className* argument may not be **meth**, **method**, **cmeth**, or **classmethod**.)

**lookup** *className* (*implementingClass*) >> *selector*

Lists the source code of the specified instance method for the class *implementingClass*, or searching its superclasses, the first superclass that implements this method. (The *className* argument may not be **meth**, **method**, **cmeth**, or **classmethod**.)

**lookup** *className* (*implementingClass*) **class** >> *selector*

Lists the source code of the specified class method for the class *implementingClass*, or searching its superclasses, the first superclass that implements this method. (The *className* argument may not be **meth**, **method**, **cmeth**, or **classmethod**.)

## Pasting from stack frames

When you are stepping through code or examining the call stack for an error, topaz displays stack frames containing the individual message sends. You can cut and paste the printed methods into the lookup command, to lookup the source code that was executed.

For example:

```
topaz 1> run
1 / 0
%
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, attempt to divide 1 by zero
(ZeroDivide)

topaz 1> where
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 Executed Code @2 line 1
6 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
select the section of the line after the frame number and before the step point, and use that
as an argument to lookup:
topaz 1> lookup SmallInteger (Number) >> _errorDivideByZero
category: 'Error Handling'
method: Number
_errorDivideByZero

"Generates a divide by 0 error."

^ ZeroDivide new _number: 2026 ; reason:
'numErrIntDivisionByZero';
dividend: self ;
signal
%
```

# METHOD

## **method[: *aClassName*]**

Compiles an instance method for the class whose name is given as a parameter. The class of the method you compile will automatically be selected as the current class. If you don't supply a class name, the method is compiled for the current class, as defined by the most recent **set class:**, **list categoriesin:**, **method:**, **classmethod:**, **removeAllMethods**, **removeAllClassMethods**, or **fileout class:** command.

Text of the method should follow this command on subsequent lines. The method text is terminated by the first line that contains a % character as the first character in the line. For example:

```
topaz 1> method: Animal  
habitat  
    ^habitat  
%
```

Topaz sends the method's text to GemStone for compilation and inclusion in the current category of the specified class. If you haven't yet selected a current category, the new method is inserted in the default category, "as yet unspecified."

## NBRESULT

Wait for and display the result of a previous **nbrun** call. This call may be preceded by a **set session** to switch to the session of an outstanding **nbrun**; otherwise, the current Topaz session is used.

May be immediately preceded by **expectvalue** or **expectbug**, provided that the **expect** commands contain only Integers or numerically coded OOPS (i.e. @NNN), so that no GemStone code is executed before the **nbresult**.

If the **nbrun** has compilation errors, those will be displayed by the **nbresult**. If there is no outstanding **nbrun** for the session the result is:

```
[276 sz:0 cls: 76289 UndefinedObject] remoteNil
```

Note that nonblocking operations do block in linked sessions, and in a linked session the result with no outstanding **nbrun** is `nil`, not `remoteNil`.

This command is the equivalent of calling the GemBuilder for C function **GciNbEnd**.

## NBRUN

Similar to **run**, but execution is nonblocking, so the application can proceed with non-GemStone tasks while the expression is executed. To get the results of the execution, use **nbresult**.

In a linked session, **nbrun** is blocking (necessarily). In this case a warning message is displayed. For example:

```
topaz 1> nbrun
Time now
%
Current session not remote, nbrun executing synchronously
topaz 1> nbresult
09:48:17
```

**nbrun** should not be immediately preceded by **expect** commands, since this command has no result. May be followed by a **set session** and another **nbrun** to start an execution in another session.

The text of this command is not accessible from **edit last**.

This command is the equivalent of calling the GemBuilder for C function **GciNbExecute**.

## NBSTEP

Similar to **step**, but execution is nonblocking. To get the results of the execution, use **nbresult**.

In a linked session, **nbstep** is blocking (necessarily). In this case a warning message is displayed.

Should not be immediately preceded by **expect** commands, since this command has no result. May be followed by a **set session** and another **nbrun** or **nbstep** to start an execution in another session.

This command is the equivalent of calling the GemBuilder for C function **GciNbStep**.

## OBJ1 / OBJ2

**obj1***anObjectSpec*

**obj2** *anObjectSpec*

Equivalent to the **object** command, but with the following difference: results are displayed at level 1 (if `obj1`) or level 2 (if `obj2`), with offsets of instance variables shown as one-based. After execution, previous settings for `level` and `omit|display zerobased` are restored.

These commands cannot be abbreviated.



## OBJ1Z / OBJ2Z

**obj1z** *anObjectSpec*

**obj2z** *anObjectSpec*

Equivalent to the **object** command, but with the following difference: results are displayed at level 1 (if `obj1`) or level 2 (if `obj2`), with offsets of instance variables shown as zero-based. After execution, previous settings for `level` and `omit|display zerobased` are restored.

These commands cannot be abbreviated.

# OBJECT

## **object** *anObjectSpec* [**at:** *anIndex* [**put:** *anObjectSpec*]]

Provides structural access to GemStone objects, allowing you to peek and poke at objects without sending messages. The first *anObjectSpec* argument is an object specification in one of the Topaz object specification formats. All formats described in “Specifying Objects” on page 40 are legal in **object** commands.

You can use local variables (created with the **define** command) in **object** commands. The local definition of a symbol always overrides any definition of the symbol in GemStone. For example, if you defined the local variable `thirdvar`, and your UserGlobals dictionary also defined a GemStone symbol named `thirdvar`, the definition of that GemStone symbol would be ignored in **object** commands.

**object** *anObjectSpec* **at:***anIndex*

Returns the value of an instance variable within the designated object at the specified integer offset. You can string together **at:** parameters after **object** to descend as far as you like into the object of interest.

As far as **object at:** is concerned, named and indexed instance variables are both numbered, and indexed instance variables follow named instance variables when an object has both. That is, if an indexable object also had three named instance variables, the first indexed field would be addressed with `object theIdxObj at:4`.

Unordered collections (NSCs) are also considered indexable via **object at:**.

**object** *anObjectSpec* **at:** *anIndex* **put:** *anotherObjectSpec*

Lets you store values into instance variables. This command stores the second *anObjectSpec* object into the first *anObjectSpec* object at the specified integer offset.

You cannot store into an NSC with **object at: put:**, although you can scrutinize its elements with **object at:**.

### CAUTION

*Because **object at: put:** bypasses all the protections built into the GemStone Smalltalk kernel class protocol, you risk corrupting your repository whenever you permanently modify objects with this command.*

The following example shows how you could use **object at: put:** to store a new String in MyAnimal's *habitat* instance variable:

```
topaz 1> object MyAnimal at: 3 put: 'pond'
an Animal
  name          nil
  favoriteFood  nil
  habitat       pond
```

Like **object at:**, the **object at: put:** command can take a long sequence of parameters. For example:

```
topaz 1> object MyAnimal at: 3 at: 1 put: $l
liver
```

This example stores the character “l” into the first instance variable of MyAnimal's third instance variable.

With this command you can store Characters or SmallIntegers in the range from 0–255 (inclusive) into a byte object. You can also store other byte objects such as Strings. For example:

```
topaz 1> object 'this' at: 5 put: ' and that'  
this and that
```

The **object at: put:** command behaves differently for objects with byte-array and pointer-array implementations. You may store the following kinds of objects into byte-array type objects:

**Character.** This stores the character '9':

```
topaz 1> object '123' at: 1 put: $9
```

**SmallInteger.** This stores a byte with the value 48:

```
topaz 1> object '123' at: 1 put: 48
```

**Byte arrays.** This stores 'b' and 'c' at offsets 2 and 3:

```
topaz 1> object '1234' at: 2 put: 'bc'
```

# OMIT

## **omit** *aDisplayFeature*

The **display** and **omit** commands control the display of Gemstone Smalltalk objects and other features related to output.

The **display** command turns on these display attributes, and the **omit** command turns them off.;

For more details on these attributes and the default values, see the **display** command on page 70.

### **alloops**

**omit alloops**

Disables the display of OOPs of classes along with class names in object display and of the oops of primitive specials, stopping the effect of **display alloops**.

### **bytes**

**omit bytes**

When displaying byte-format objects, do not include the decimal or hexadecimal value of each byte.

### **classoops**

**omit classoops**

Legacy; equivalent to **omit alloops**.

### **decimalbytes**

**omit bytes**

When displaying byte-format objects, do not include the decimal or hexadecimal value of each byte.

### **deprecated**

**omit deprecated**

For topaz commands such as **strings** and **senders**, which return lists of methods, **omit deprecated** causes those results to omit methods which contain sends of `deprecated`, `deprecated:`, or `deprecatedNotification:`.

### **errorcheck**

**omit errorcheck**

Disables automatic result recording, stopping the effect of **display errorcheck**. Closes the `./topazerrors.log` file.

### **flushoutput**

**omit flushoutput**

displays the immediate flushing of topaz output files other than stdout.

## lineeditor

### `omit lineeditor`

Disables the use of the Topaz line editor, stopping the effect of `display lineeditor`. Always disabled on Windows.

## names

### `omit names`

For each of an object's named instance variables, do not display the instance variable's name along with its value. When you have issued `omit names`, named instance variables appear as i1, i2, i3, etc.

## oops

### `omit oops`

Do not display OOP values with displayed results.

## pauseonerror

### `omit pauseonerror`

Disables pauses in Topaz execution after errors, stopping the effect of `display pauseonerror`.

## pauseonwarning

### `omit pauseonwarning`

Disables pause in Topaz execution after a compiler warning occurs.

## pushonly

### `omit pushonly`

Disables the effect of the `only` keyword in an `object push` command, stopping the effect of `display pushonly`.

## resultcheck

### `omit resultCheck`

Disables automatic result checking, stopping the effect of `display resultCheck`. Closes the `./topazerrors.log` file and stops checking the results of successful `run`, `printit`, etc. commands. You can still check the result of an individual `run` command by entering an `expectvalue` command just before it.

## singlecolumn

### `omit singlecolumn`

Disables effect of `display singlecolumn`.

## stacktemps

### `omit stacktemps`

Disables effect of `display stacktemps`.

## versionedclassnames

### `omit versionedclassnames`

Disable the display of the class version for instances of classes that are not the last one in the classHistory of that class.

## **zerobased**

### **omit zerobased**

Shows offsets of instance variables as one-based when displaying objects. To show offsets as zero-based, use the **display zerobased** command.

# OUTPUT

## **output [push | append | pushnew | pop] *aFileName* [only]**

Controls where Topaz output is sent. Normally Topaz sends output to standard output (stdout): generally the topaz console. This command redirects all Topaz output to a file (or device) of your choice.

If you specify a host environment name such as `$HOME/foo.bar` as the output file, Topaz expands that name to the full filename. If you don't provide an explicit path specification, Topaz output is sent to the named file in the directory where you started Topaz.

Output is written with UTF-8 encoding, regardless of the current state of **fileformat** (page 90).

As the command names **push** and **pop** imply, Topaz can maintain a stack of up to 20 output files, with current interactions captured in each file.

**output** *aFileName*

**output push** *aFileName*

Sends output to the specified file, as well as echoing to stdout. If the file you name doesn't yet exist, Topaz will create it. If you name an existing file, Topaz overwrites it.

To append output to an existing file, precede the file name with an ampersand (&), or use **append** instead of **push**.

If you use **output** without a subsequent **push**, **pushnew**, **append**, or **pop**, then **push** is assumed and the following token is used as the filename.

The command **push** must be typed in full, it cannot be abbreviated.

**output append** *aFileName*

Sends output to the specified file, as well as echoing to stdout. If the file you name doesn't yet exist, Topaz will create it. If you name an existing file, Topaz will append to it. This behavior is the same as **output push &aFileName**.

The command **append** must be typed in full, it cannot be abbreviated.

**output pushnew** *aFileName*

Sends output to the specified file, as well as echoing to stdout. If the file you name doesn't exist, Topaz will create it. If you name an existing file, Topaz will create a new file. For a filenames of the form `foo.out`, the new filename will be `foo_N.out`, where `N` is some integer between 1 and 99 (inclusive), and where `foo_N.out` did not previously exist. If more than 1000 versions of the file exist, the oldest version will be overwritten.

The command **push** must be typed in full, it cannot be abbreviated.

### **only**

The above output commands will send output to both stdout and the each file on the stack. Using the **only** command both limits output to only go to the specific named file, and turns off the echo of results to stdout.

```
output aFileName only  
output push aFileName only  
output append aFileName only  
output pushnew aFileName only
```

Sends output to the specified file, but does not echo that output to stdout.

## **pop**

```
output pop
```

Stops output to the current output file (that is, the file most recently named in an **output push** command). The file is closed, and output is again sent to the previously named output file.

The command **pop** must be typed in full, it cannot be abbreviated.



# PAUSEFORDEBUG

## **pausefordebug** [*errorNumber*]

Provided to assist internal debugging of a session.

With no argument, this command has no effect.

This command cannot be abbreviated.

## PKGLOOKUP

**pkglookup** (meth | method | cmeth | cmethod) *selectorSpec*

**pkglookup** *className* [**class**] *selectorSpec*

Similar to the **lookup** command, but with one key exception: **pkglookup** looks first in GsPackagePolicy state, then in the persistent method dictionaries for each class up the hierarchy. The **pkglookup** command does not look at transient (session method) dictionaries.

For details, see the description of the **lookup** command on page 121.

# POLLFORSIGNAL

## pollforsignal

Provided to assist debugging signal handling.

This command causes topaz to wait for out-of-band activity from the Gem processing, using GciPollForSignal. It can be interrupted by control-C.

# PRINTIT

Sends the text following the **printit** command to GemStone for execution as GemStone Smalltalk code, and displays the result. If there is an error in your code, Topaz displays an error message instead of a legitimate result. GemStone Smalltalk text is terminated by the first line that contains a % as the first character in the line. For example:

```
topaz 1> printit  
2 + 2  
%  
4
```

The text executed between the **printit** and the terminating % can be any legal GemStone Smalltalk code, and follows all the behavior documented in the *GemStone/S Programming Guide*.

If the configuration parameter `GEM_NATIVE_CODE_ENABLED` is set to `FALSE`, or if any breakpoints are set, execution defaults to interpreted mode. Otherwise, execution defaults to using native mode.

For details about GemStone configuration parameters, see the *System Administration Guide*.

Note that **printit** always displays results at level 1, regardless of the current display level setting (page 108). The **printit** command does not alter the current level setting. The **run** command (page 147) displays according to the current level setting, and the **doit** command (page 74) displays results at level 0.

## PROTECTMETHODS

After this command, all subsequent method compilations during the current session must contain either a <protected> or <unprotected> directive.

Used for consistency checking in filein scripts.

This command cannot be abbreviated.

# QUIT

## **quit** [*aSmallInt* / *anObjectSpec*]

Leaves Topaz, returning to the operating system. If you are still logged in to GemStone when you type **quit**, this aborts your transaction and logs out all active sessions.

You can include an argument (a `SmallInteger`, or an object specification that resolves to a `SmallInteger`) to specify an explicit `exitStatus` for the Topaz process. Only 8 bits of the integer are returned. To get valid return values, the argument should always resolve to a value in the range 0..255. To use an object specification, including `errorCount`, you must be logged in when the **quit** command is executed.

If you do not specify an argument, the `exitStatus` will be either 0 (no errors occurred during Topaz execution) or 1 (there was a GCI error or the Topaz `errorCount` was nonzero).

**quit** is ignored when reading a file using **input**, when `stdin` is a `tty`. If topaz `stdin` is redirected to a file and the file does not end with a **quit** or **exit**, topaz considers EOF on `stdin` to be an error, and will result in a non-zero topaz exit status.

This command cannot be abbreviated.

The command has the same behavior as **exit**. for more information and examples, see **exit** on page 82.

## RELEASEALL

Empty Topaz's internal buffer of object identifiers (the export set). Objects are placed in the export set as a result of object creation and certain other object operations. **releaseall** is performed automatically prior to each **run**, **doit**, **printit**, or **send**.

For more information, see the *GemBuilder for C* Manual. **releaseall** is equivalent to the GemBuilder for C call **GciReleaseOops**.

# REMARK

## **remark** *commentText*

Begins a remark (comment) line. Topaz ignores all succeeding characters on the line.

You can also use an exclamation point (!) or pound sign (#) as the first character in the line to signal the beginning of a comment.

```
topaz 1>      remark this is a comment
topaz 1> ! another comment
topaz 1> #      and yet another one
```

Comments are important in annotating Topaz batch processing files, such as test scripts.



# REMOVEALLCLASSMETHODS

## `removeallclassmethods [aClassName]`

Removes all class methods from the class whose name you give as a parameter. The specified class automatically becomes the current class.

If you don't supply a class name, the methods are removed from the current class, as defined by the most recent **set class:**, **list categoriesin:**, **method:**, or **classmethod:** command.

This command removes all methods in all compilation environments, not just **env 0**.

This command cannot be abbreviated.

# REMOVEALLMETHODS

## **removeallmethods** [*aClassName*]

Removes all instance methods from the class whose name you give as a parameter. The specified class automatically becomes the current class.

If you don't supply a class name, the methods are removed from the current class, as defined by the most recent **set class:**, **list categoriesin:**, **method:**, or **fileout class:** command.

This command removes all methods in all compilation environments, not just **env 0**.

This command cannot be abbreviated.

# RUN

Sends the text following the **run** command to GemStone for execution as GemStone Smalltalk code, and displays the result.

If there is an error in your code, Topaz displays an error message instead of a legitimate result.

GemStone Smalltalk text is terminated by the first line that contains a % as the first character in the line. For example:

```
topaz 1> run  
2 + 2  
%  
4
```

The text executed between the **run** and the terminating % can be any legal GemStone Smalltalk code, and follows all the behavior documented in the *GemStone/S Programming Guide*.

If the configuration parameter `GEM_NATIVE_CODE_ENABLED` is set to `FALSE`, or if any breakpoints are set, execution defaults to interpreted mode. Otherwise, execution defaults to using native mode. For details about GemStone configuration parameters, see the *System Administration Guide*.

The **run** command is similar to **printit**, with one significant difference. The **run** command uses the current display level setting (page 108), whereas **printit** always displays the result as if level 1 were the most recent **level** command.

# RUNBLOCK

The topaz command **runblock** is primarily intended to support internal debugging.

**runblock** takes two arguments on the command line, and the following lines up to the next % must be the source for a block with between 0 and 10 block variables. The arguments are both objects per object specification format, see "Specifying Objects" on page 40.

The first argument is used for self in the block, and can be anything that can be specified on the command line.

The second argument must specify an Array of size N,  $N \leq 10$ , where N is the number of argument variables. This second argument can be specified using \*\* or @OOP, or named in UserGlobals.

## Example

```
topaz 1> run
  { 5 . 66 }.
%
a Array
  #1 5
  #2 66
topaz 1> runblock 'abc' **
  [:a :b | self copy , a asString , b asString ]
%
abc566
```

## **RUNENV *envId***

Similar to `run`, but takes one integer argument  $\geq 0$  and  $\leq 255$ , specifying compilation environment for the code to execute in. The argument takes precedence over the value set by `env` or `set compile_env`.

If `GEM_NATIVE_CODE_ENABLED=FALSE` in the gem configuration file, or if any breakpoints are set, execution defaults to interpreted mode, otherwise execution defaults to using native code.

# SEND

## **send** *anObjectSpec aMessage*

Sends a message to an object.

The **send** command's first argument is an object specification identifying a receiver. The object specification is followed by a message expression built almost as it would be in GemStone Smalltalk, by mixing the keywords and arguments. For example:

```
topaz 1> level 0
topaz 1> send System myUserProfile
a UserProfile
topaz 1> send 1 + 2
3
topaz 1> send @10443 deleteEntry: @33234
```

There are some differences between **send** syntax and GemStone Smalltalk expression syntax. Only one message send can be performed at a time with **send**. Cascaded messages and parenthetical messages are not recognized by this command. Also, each item must be delimited by one or more spaces or tabs.

All Topaz object specification formats (as described in "Specifying Objects" on page 40) are legal in **send** commands.

If the configuration parameter GEM\_NATIVE\_CODE\_ENABLED is set to FALSE, or if any breakpoints are set, execution defaults to interpreted mode. Otherwise, execution defaults to using native mode.

For details about GemStone configuration parameters, see the *System Administration Guide*.

# SENDERS

## **senders** *selectorSpec*

Displays a list of all classes that are senders of the given *selectorSpec* (either a String or a Symbol). For example:

```
topaz 1> senders asByteArray
ByteArray >> copyReplaceAll:with:
ByteArray >> copyReplaceFrom:to:with:
```

This command is equivalent to the following

```
topaz 1> doit
ClassOrganizer new sendersOfReport: aString
%
```

This command may use significant temporary object memory. Depending on your repository, you may need to increase the value of the GEM\_TEMPOBJ\_CACHE\_SIZE configuration parameter beyond its default. For details about GemStone configuration parameters, see the *System Administration Guide*.

# SET

## set *aTopazParameter* [*aParamValue*]

The **set** command allows you to set session-specific values for your topaz session. This includes the GemStone login parameters, and settings that affect your topaz user interface.

You can combine two or more set items on one command line, and you can abbreviate token names to uniqueness. For example:

```
topaz 1> set gemstone gs64stone user DataCurator
```

### cacert

**set cacert:** *aCaCertFilePath*

Sets the path to the trusted X509 certificate authority (CA) certificate to be used to validate certificates presented by peers. The certificate must be in PEM format.

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, **gemnetid**, or **solologin**).

### cachename

**set cachename:** *aString*

Sets the current cachename, which applies to subsequent logins for all sessions. This cache name is recorded in the cache statistics collected by statmonitor for viewing in VSD. The name must be 31 characters or less, and is truncated if too long. The cachename can also be set using the command line **-u** argument. The colon is not required.

Using **set cachename** or the **-u** option has advantages over the programmatic assignment using `System class >> cacheName:.` Setting the name prior to login allows statistics to be collected and displayed under a single meaningful name, rather than being split between the initial default name and a later meaningful name.

### category

**set category:** *aCategory*

Sets the current category, the category for subsequent method compilations. You must be logged in to use this command. If you try to compile a method without first selecting a category, the new method is inserted in the default category "as yet unspecified." The **set category:** command has the same effect as the **category:** command.

If the specified category does not already exist, Topaz will create it when you first compile a method.

Specifying a new class with **set class** does not change your category. However, when you **edit** or **fileout** a method, that method's category becomes the current category.

The current category is cleared by the **logout**, **login**, and **set session** commands.



## cert

**set cert:** *aCertFilePath*

Sets the path to the X509 certificate to be used for login. The certificate must be in PEM format. The file may contain multiple certificates which comprise a certificate chain. The user certificate must be the first certificate in the file and may be followed by certificate authority (CA) certificates. All certificates must be ordered within the file such that the a given certificate is signed by the certificate which follows it.

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, **gemnetid**, or **solologin**).

## class

**set class:** *aClassName*

Sets the current class. You must be logged in to use this command. After setting the current class, you can list its categories and methods with the **list categories** command. You can select a category to work with through either the **set category:** or **category:** command.

The current class may also be redefined by the **list categoriesin:**, **method:**, **classmethod:**, **removeAllMethods**, **removeAllClassMethods**, and **fileout class:** commands.

The current class is cleared by the **logout**, **login**, and **set session** commands, or by executing **set class nil**.

To display the name of the current class, issue the **set class** command without a class name.

## compile\_env

**set compile\_env:** *anInteger*

Sets the compilation environmentId used for method compilations and **run**, **printit**, etc. *anInteger* must be between 0 and 255 and is 0 by default. The compilation environment may also be set using the command **env**.

## directory

**set directory:** *directoryPath*

Set the name of the working directory for the RPC gem created by an X509 login.

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, **gemnetid**, or **solologin**).

## editorname

**set editorname:** *aHostEditorName*

Sets the name of the editor you want to use in conjunction with the **edit** command. For example:

```
topaz 1> set editorname: vi
```

The default is set from your \$EDITOR environment variable, if it is defined.

## enableremoveall

**set enableremoveall** *onOrOff*

When **set enableremoveall** is set to ON, it enables the commands **removeallmethods** and **removeallclassmethod**. When it set to OFF, these commands have no effect. The default is ON.

## envvar

**set envvar:** *varName varValue*

Set an environment variable value in the topaz process. For example,

```
topaz 1 > set envvar MyRootDir /users/gdmin/project
```

The word **envvar** cannot be abbreviated.

## extragemargs

**set extragemargs:** *aStringOfArgs*

Sets a list of extra command line arguments to be used when starting an RPC gem for an X509 login.

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, or **gemnetid**).

## gemnetid

**set gemnetid:** *aServiceName*

*aServiceName* is a network resource string specifying the name of the GemStone service (that is, the host process to which your Topaz session will be connected) and its host computer.

For the RPC version of Topaz the default **gemnetid** parameter is **gemnetobject**. You may also use **gemnetdebug** or your own custom gem service. RPC versions of Topaz cannot start linked sessions.

For linked Topaz (started with **topaz -L** or **-l**), the default **gemnetid** is **gcilnkobj**. Use the status command to verify that this parameter is **gcilnkobj**. This makes the first session to log in a linked session. It is only possible to have one linked session per topaz process.

This command, like other set options, can be used in a **.topazini** initialization file that is executed when topaz starts up. When using **topaz -L**, any option to **gemnetid** within a **.topazini** file is ignored

When using linked topaz, if **gemnetid** is explicitly set to a gem service such as **gemnetobject**, login starts RPC sessions. Note that when you login an RPC session that way, the configuration parameters reported for the linked session do not apply; the rules governing configuration parameters for RPC sessions take effect.

You can run your GemStone session (Gem), repository monitor (Stone) process, and your Topaz processes on separate nodes in your network. The one exception is the linked Topaz session, when Topaz and the Gem run as a single process. Network resource strings allow you to designate the nodes on which the Gem and Stone processes run. For example, a Gem process called **gemnetobject** on node **lichen** could be described in network resource string syntax as:

```
!@lichen!gemnetobject
```

To specify a Gem running on the current node, omit the *node* portion of the string, and specify only the Gem name: `gemnetobject`. See the *System Administration Guide* for more on NRS syntax and usage.

This setting is used only by traditional logins and is cleared if any X509 login parameters are set. (**cert**, **cacert**, **key**, **netldi**, **logfile**, **directory**, or **extragemargs**)

## gemstone

**set gemstone:** *aGemStoneName*

Specifies the name of the GemStone you want to log in to. The standard name is `gs64stone`.

You can run your GemStone session (Gem), repository monitor (Stone) process, and your Topaz processes on separate nodes in your network. The one exception is the linked Topaz session, when Topaz and the Gem run as a single process. Network resource strings allow you to designate the nodes on which the Gem and Stone processes run. For example, a Stone process called `gs64stone` on node `lichen` could be described in network resource string syntax as:

```
!@lichen!gs64stone
```

To specify a Stone running on the same node as the Gem, omit the *node* portion of the string, and specify only the Stone name: `gs64stone`. See the *System Administration Guide* for more on NRS syntax and usage.

This setting is used only by traditional logins and is cleared if any X509 login parameters are set. (**cert**, **cacert**, **key**, **netldi**, **logfile**, **directory**, or **extragemargs**)

## history

**set history:** *anInt*

Sets the history size of the Topaz line editor. The argument *anInt* may be between 0 and 1000, inclusive. Not available on Windows.

## hostpassword

**set hostpassword:** *aPassword*

Sets the host password to be used when you next log in. If you don't include the host password argument on the command line, Topaz prompts you for it. Prompted input taken from the terminal is not echoed. This lets you put a **set hostpassword:** command in your Topaz initialization file so that Topaz automatically prompts you for your password. Note, however, that this command must *follow* the **set hostname:** command.

For a linked Topaz session, **set hostpassword** has no effect, because no separate Gem process is created on the host computer. The password is required, however, if you spawn new sessions while you are running linked Topaz, because the additional sessions are always RPC Topaz.

This setting is used only by traditional logins and is cleared if any X509 login parameters are set. (**cert**, **cacert**, **key**, **netldi**, **logfile**, **directory**, or **extragemargs**)

## hostname

**set hostname:** *aUsername*

Sets the account name you use when you log in to the host computer. When you run Topaz, a Gem (GemStone session) process is started on the host computer specified by

the **set gemnetid:** command. The **set hostusername:** command tells Topaz which account you want that process to run under.

To clear the hostusername field, enter:

```
topaz 1> set hostusername *
```

For a linked Topaz session, **set hostusername** has no effect, since no separate Gem process is created on the host computer.)

This setting is used only by traditional logins and is cleared if any X509 login parameters are set. (**cert**, **cacert**, **key**, **netldi**, **logfile**, **directory**, or **extragemargs**)

## inconversion

**set inconversion**

For use only by repository upgrade scripts in \$GEMSTONE/upgrade. Sets the internal variable GciSupDbInConversion to TRUE.

## inputpauseonerror

**set inputpauseonerror:** *onOrOff*

The argument must be a case-insensitive string, ON or OFF. If ON, and stdin is a tty, then the first **input** command issued interactively will transition topaz to **display pauseonerror**. This remains in effect until topaz input returns to stdin, at which point the previous state of **display pauseonerror** is restored.

The default is OFF

May not be abbreviated.

## key

**set key:** *privateKeyPath*

For an X509 login, sets the path to the private key for the certificate specified by the SET CERT: command. The key must be in PEM format and must not be protected by a passphrase.

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, **gemnetid**, or **solologin**).

## limit

**set limit:** *anInt*

Sets the limit on the number of bytes to display. The equivalent of **limit bytes** *anInt*

## listwindow

**set listwindow:** *anInt*

Defines the maximum number of source lines to be listed by the **listw /l** command (page 115).

## logfile

**set logfile:** *pathAndFilename*

For an X509 login, sets the name of the RPC gem's log file.

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, **gemnetid**, or **solologin**).

## netldi

**set netldi:** *hostOrIp:portOrServiceName*

Sets the host and port for the netldi to be used for X509 certificate login. The argument format must include the hostName or the IP of the NetLDI host, and the listening port number of NetLDI service name, separated by a colon character. For example,

```
set netldi devhost.acme.com:54321
```

This setting is used only by X509 logins and is cleared if traditional login parameters are set (**username**, **password**, **hostusername**, **hostpassword**, **gemstone**, or **gemnetid**).

## nrsdefaults

**set nrsdefaults:** *aNRShheader*

Sets the default components to be used in network resource string specifications. The parameter *aNRShheader* is a network resource string header that may specify any NRS modifiers' default values. The initial value of nrsdefaults is the value of the GEMSTONE\_NRS\_ALL environment variable. The Topaz **status** command shows the value of **nrsdefaults** unless it is the empty string.

## password

**set password:** *aGemStonePassword*

Sets the GemStone password to be used when you next log in. If you don't include the password argument on the command line, Topaz prompts you for it. Prompted input is taken from the terminal and not echoed. This lets you put a **set password:** command in your Topaz initialization file so that Topaz will automatically prompt you for your password. Note, however, that this command must *follow* the **set username:** command.

This setting is used only by traditional logins and is cleared if any X509 login parameters are set. (**cert**, **cacert**, **key**, **netldi**, **logfile**, **directory**, or **extragemargs**)

## session

**set session:** *aSessionNumber*

Connects Topaz to the session whose ID is *aSessionNumber*. When you log in to GemStone, Topaz displays the session ID number for that connection. This command allows you to switch among multiple sessions. (The Topaz prompt always shows the number of the current session.)

If you specify an invalid session number, an error message is displayed, and the current session is retained.

This command clears the current class and category. After you switch sessions with **set session**, your local variables (created with the **define** command) no longer have valid definitions.

## sessioninit

**set sessionInit** *ONorOFF*

Provided to allow the execution of `GsCurrentSession >> initialize` to be skipped during login, in the case of upgrade or other special cases in which code

invoked by `GsCurrentSession` cannot be executed and logins cannot complete. This requires that the Stone configuration parameter `STN_ALLOW_NO_SESSION_INIT` be enabled, which can be done at runtime by `SystemUser`.

This should be left at the default, `ON`, except for such exceptional cases.

### singlecolumn

**set singlecolumn:** *onOrOff*

When stacks are printed, methods that have more than eight method arguments and temporary variables print their variables in four columns. The default is off. After executing **set solologin: on**, each variable will be displayed on a single line.

### solologin

**set solologin:** *onOrOff*

The argument must be a case-insensitive string, `ON` or `OFF`. When `ON`, subsequent logins will be Solo, using the `extent0.dbf` specified by the `GEM_SOLO_EXTENT` config item. The default is `OFF`.

Setting solo login to on clears the X509 parameters; only traditional logins with **set user** and **set password** settings are legal for solo login.

May be abbreviated as `SOLO`.

### sourcestringclass

**set sourcestringclass:** *ClassRangeSpecifier*

Sets the class of strings used to instantiate Smalltalk source strings generated by the **run**, **printit**, **doit**, **edit**, **method**, and **classmethod** commands. This includes any literal strings in the evaluated code.

This command expects one argument, which must be `String` or `Unicode16`. The options are:

**set sourcestringclass String**

New instances of literal strings are created as instances of `String`, `DoubleByteString`, or `QuadByteString`.

**set sourcestringclass Unicode16**

New instances of literal strings are created as instances of `Unicode7`, `Unicode16`, or `Unicode32`.

The Topaz **status** command shows the current setting.

On topaz startup, **sourcestringclass** is set to `String`. On login, the setting will be updated from the setting for `#StringConfiguration` in the GemStone Globals SymbolDictionary. If `#StringConfiguration` resolves to `Unicode16`, then **sourcestringclass** will be set to `Unicode16`.

To avoid misinterpretation of fileouts, the **fileout** command writes a **set sourcestringclass** command at the start of the fileout. A **set sourcestringclass** command within a file only has effect within that file and any nested files.

### stackpad

**set stackpad:** *anInt*

Defines the minimum size used when formatting lines in a stack display. The argument *anInt* may be between 0 and 256, inclusive. (Default: 45)

`stackpad` cannot be abbreviated.

## **tab**

**set tab:** *anInt*

Defines the number of spaces to insert when translating a tab (CTRL-I) character when printing method source strings. The argument *anInt* may be between 1 and 16, inclusive. (Default: 8)

## **transactionmode**

**set transactionmode** *aMode*

Set the current session's transaction mode, and set the transaction mode to this mode after each subsequent login. Must be one of (case-insensitive) `autoBegin`, `manualBegin`, or `transactionless`.

This command does an abort. If in a transaction, any uncommitted changes in the transaction will be lost. If the new mode is `autoBegin`, then a new transaction will be started.

## **username**

**set username:** *aGemStoneUsername*

Establishes a GemStone user ID for the next login attempt.

This setting is used only by traditional logins and is cleared if any X509 login parameters are set. (**cert**, **cacert**, **key**, **netldi**, **logfile**, **directory**, or **extragemargs**)

# SHELL

## shell [*aHostCommand*]

## spawn [*aHostCommand*]

When issued with no parameters, this command creates a child process in the host operating system, leaving you at the operating system prompt. To get back into Topaz, exit the command shell by typing **Control-D** (from the UNIX Bourne or Korn shells), typing **logout** (from the UNIX C shell), or typing **exit** (from a DOS shell).

For example, on Windows:

```
topaz 2> shell
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\GS64\32> dir *.txt
Volume in drive C is Windows7_OS
Volume Serial Number is 9ECC-468B

Directory of C:\GS64\32

02/11/2014  04:38 PM                54,298 open_source_licenses.txt
02/11/2014  04:38 PM                 3,209 PACKING.txt
02/11/2014  04:38 PM                 104 version.txt
               3 File(s)              57,611 bytes
               0 Dir(s) 135,272,591,360 bytes free

C:\GS64\32>exit
topaz 2>
```

On UNIX systems, a **shell** command issued without parameters creates a shell of whatever type is customary for the user account (C, Bourne, or Korn).

If you supply parameters on the **shell** command line, they pass to a subprocess as a command for execution, and the output of the command is shown.

For example:

```
topaz 1> shell startnetldi -v
startnetldi 3.6.0 COMMIT: 2020-10-17T17:31:08-07:00
925e19317f5ac852dd751da32230481ad24c31a7
```

When issued with parameters, **shell** always creates a shell of the system default type (either Bourne or Korn).

**spawn** is the same as shell, and is included for compatibility with previous versions.



# STACK

## **stack** [*aSubCommand*]

Topaz can maintain up to 500 simultaneous GemStone Smalltalk process call stacks that provide information about the GemStone state of execution. Each call stack consists of a linked list of contexts.

The call stack becomes active, and the **stack** command becomes accessible, when you execute GemStone Smalltalk code containing a breakpoint. The **stack** command allows you to examine and manipulate the contexts in the active call stack.

Debugging usually proceeds on the active call stack, but you may also save the active call stack before executing other code, and return to it later.

This command cannot be abbreviated.

## Display the Active Call Stack

### **stack**

Displays all of the contexts in the active call stack, starting with the active context. For each context in the stack display, the following items are displayed:

- ▶ the level number
- ▶ the class of the GsNMethod
- ▶ selector of the method
- ▶ the environmentId (not used by Smalltalk)
- ▶ the current step point (that is, assignment, message send, or method return) within the method
- ▶ the line number of the current step point within the source code of the method
- ▶ the receiver and parameters for this context.
- ▶ the method temporaries (if **display oops/alloops** is active)
- ▶ the OOP of the GsNMethod (if **display oops/alloops** is active)

The resulting display is governed by the setting of other Topaz commands such as **limit**, **level**, and **display/omit** subcommands.

Any further commands that execute GemStone Smalltalk code: **run**, **printit**, **send**, **doit**, **step**, **edit last**, or **edit new text**, discards the active call stack unless **stack save** is executed.

### **stack** *anInt*

Displays contexts in the active call stack, starting with the active context. The argument *anInt* indicates how much of the stack to display. For example, if *anInt* is 1, this command shows only the active context. If *anInt* is 2, this command also shows the caller of the active context, etc.

---

### Example 3.1 Example of stack display

---

```

topaz 1> run
{ 1 . 2 } do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, attempt to divide 1 by zero
(ZeroDivide)

topaz 1> stack
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
    receiver a ZeroDivide occurred (error 2026),
    reason:numErrIntDivisionByZero, attempt to divide 1 by zero
    handleInCextensionBool nil
    res nil
(skipped 1 evaluationTemps)
2 ZeroDivide (AbstractException) >> signal @2 line 47
    receiver a ZeroDivide occurred (error 2026),
    reason:numErrIntDivisionByZero, attempt to divide 1 by zero
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
    receiver 1
4 SmallInteger >> / @6 line 7
    receiver 1
    aNumber 0
5 [] in Executed Code @2 line 1
    self nil
    receiver anExecBlock1
    x 1
6 Array (Collection) >> do: @5 line 10
    receiver anArray
    aBlock anExecBlock1
    i 1
(skipped 4 evaluationTemps)
7 Executed Code @2 line 1
    receiver nil
8 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
    receiver nil

```

---

## Display or Redefine the Active Context

### **stack scope**

Displays the current context (Scope is an alternate older name for context or frame). For example:

```

topaz 1> stack scope
1 AbstractException >> _signalWith: @6 line 25

```

### **stack scope anInt**

Redefines the active context within the active call stack and displays the new context. The integer 1 represents the current context, while the integer 2 represents the *caller* of the active context.

**stack up**

Moves the current context up one level toward the top of the stack and displays the new context.

**stack down**

Moves the current context down one level away from the top of the stack and displays the new context.

**stack set** *aGsProcess*

The argument is an object specification that resolves to a *GsProcess*. Make that *aGsProcess* the currently active stack for debugging.

**stack terminate**

Sends `#terminate` to the *GsProcess* of the current stack, if the stack is not owned by the scheduler.

**stack trim**

Trims the stack so that the current context becomes the new top of the stack. Execution resumes at the first instruction in the method at the new top of the stack. If that method has been recompiled, **stack trim** installs the new version of the method. The new top of the stack must not represent the context of an *ExecutableBlock*.

For more about this, see the method comments for  
*GsProcess*>>\_trimStackToLevel: and  
*GsProcess*>>\_localTrimStackToLevel:.

If the stack is trimmed, any resumption of execution will take place in interpreted mode.

## Save the Active Call Stack During Further Execution

When you have an active call stack, and execute any of the commands **run**, **printit**, **send**, **doit**, **edit last**, or **edit new text**, it results in the current call stack being discarded.

**stack save**

Save the active call stack before executing any of the commands that normally clear the stack:.

**stack nosave**

Cancel the previous **stack save**.

## Display All Call Stacks

**stack all**

Displays your list of saved call stacks. The list includes the top context of every call stack (stack 1). For example:

```
topaz 1> stack all
0: 1 Animal >> habitat @1 line 1
1: 1 AbstractException >> _signalWith: @6 line 25
*2: 1 Executed Code @3 line 1
```

The \* indicates the active call stack, if one exists. If there are no saved stacks, a message to that effect is displayed.

Equivalent to **threads** (page 176)

## Redefine the Active Call Stack

### **stack change** *anInt*

Sets the active call stack to the call stack indicated by *anInt* in the **stack all** command output, and displays the top context of the newly selected call stack.

Equivalent to **thread** *anInt* (page 175).

For example:

```
topaz 1> stack all
 0:  1 Animal >> habitat                @1 line 1
 1:  1 AbstractException >> _signalWith: @6 line 25
*2:  1 Executed Code                    @3 line 1
topaz 1> stack change 1
Stack 1 , GsProcess 27447553
1 AbstractException >> _signalWith:      @6 line 25
topaz 1> stack all
 0:  1 Animal >> habitat                @1 line 1
*1:  1 AbstractException >> _signalWith: @6 line 25
 2:  1 Executed Code                    @3 line 1
```

### **stack set** *aGsProcessSpecification*

The argument is an object specification that resolves to a GsProcess. This GsProcess is made the active call stack for debugging.

## Remove Call Stacks

### **stack delete** *aStackInt*

Removes the call stack indicated by *aStackInt* in the **stack all** command output.

Topaz maintains up to eight simultaneous call stacks. If all eight call stacks are in use, you must use this command to delete a call stack before issuing any of the following commands: **run**, **printit**, **send**, **doit**, **edit last**, or **edit new text**.

Equivalent to **thread** *anInt* **clear** (page 175)

### **stack delete all**

Removes all call stacks.

## Terminate the process

### **stack terminate**

Sends #terminate to the GsProcess of the current stack, if the stack is not owned by the scheduler.

# STATUS

Displays your current login settings and other information about your Topaz session. These settings are set to default values when Topaz starts, and may be modified using the **set** (page 152) command, **display** (page 70) and **omit** (page 132), and using individual commands such as **level** (page 108), **limit** (page 109), and **fileformat** (page 90).

For example:

```
topaz 1> status
```

Current settings are:

```
display : 0
byte limit: 0 lev1bytes: 0
omit bytes
include deprecated methods in lists of methods
display instance variable names
display oops    omit alloops    omit stacktemps
oop limit: 0
omit automatic result checks
omit interactive pause on errors
omit interactive pause on warnings
listwindow: 20
stackpad: 45 singlecolumn: Off  tab (ctl-H) equals 8 spaces when
listing method source
transactionmode autoBegin
using line editor
  line editor history: 100
  topaz input is from a tty on stdin
EditorName_____ vi
CompilationEnv____ 0
Source String Class String
fileformat          8bit (tty stdin is utf8)
SessionInit         On
EnableRemoveAll     On
CacheName_____ 'TopazR'
```

Connection Information:

```
UserName_____ 'Isaac_Newton'
Password _____ (set)
HostUserName_____ 'newtoni'
HostPassword_____ (set)
NRSdefaults_____ '#netldi:gs64ldi'
GemStone_____ 'gs64stone'
GemStone NRS_____ '!#encrypted:newtoni@password#server!gs64stone'
GemNetId_____ 'gemnetobject'
GemNetId NRS_____ '!#encrypted:newtoni@password!gemnetobject'
```

Browsing Information:

```
Class_____
Category_____ (as yet unclassified)
```

# STEP

## step (over | into | thru)

Advances execution to the next step point (assignment, message send, or method return) and halts. You can use the step command to continue execution of your GemStone Smalltalk code after an error or breakpoint has been encountered. For examples and other useful information, see Chapter 2, "Debugging Your GemStone Smalltalk Code", starting on page 45.

### **step**

Equivalent to **step over**.

### **step over**

Advances execution to the next step point in the current frame or its caller. The current frame is the top of the stack or the frame specified by the last **frame**, **up**, **down**, **stack scope**, **stack up**, or **stack down** command.

### **step into**

Advances execution to the next step point in your GemStone Smalltalk code.

### **step thru**

Advances execution to the next step point in the current frame, or its caller, or the next step point in a block for which current frame's method is the home method.

# STK

## stk [*aSubCommand*]

Similar to **stack**, but does not display parameters and temporaries for each frame. All frames for the active call stack are displayed, with the current active frame indicated by an arrow.

For more information on *s*, see the **stack** command on page 161.

This command cannot be abbreviated.

```
topaz 1> printit
{ 1 . 2} do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, An attempt was made to divide 1 by
zero. (ZeroDivide)
topaz 1> stk
==> 1 ZeroDivide (AbstractException) >> _signalWith: @6 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

# STRINGS

## **strings** *selectorSpec*

Displays a list of all methods that contain the given *selectorSpec* (either a String or a Symbol) in their source string, and class comments in which the text includes *selectorSpec*.

Search is case-sensitive; for a case-insensitive search, see **stringsic**. This command cannot be abbreviated.

For example:

```
topaz 1> strings ChangeUserId
UserProfile >> privileges
UserProfile >> userId:password:
UserProfile >> _privileges
UserProfile class >> _initPrivilegeNames
UserProfileSet >> _oldUserId:newUserId:for:
```

The **strings** command is equivalent to the following:

```
topaz 1> run
| org |
org := ClassOrganizer new.
org stringsReport: aString ignoreCase: false
    includeClassComments: true
%
```

This command may use significant temporary object memory. Depending on your repository, you may need to increase the value of the GEM\_TEMPOBJ\_CACHE\_SIZE configuration parameter beyond its default. For details about GemStone configuration parameters, see the *System Administration Guide*.



# STRINGSIK

## **stringsic** *selectorSpec*

Displays a list of all methods that contain the given *selectorSpec* (either a String or a Symbol) in their source string, and class comments that include *selectorSpec*.

This search is case-insensitive; for a case-sensitive search, see the **strings** command. This command cannot be abbreviated.

The **stringsic** command is equivalent to the following:

```
topaz 1> run
| org | org := ClassOrganizer new.
org stringsReport: 'referencesToLiteral:' ignoreCase: true
  includeClassComments: true
%
```

This command may use significant temporary object memory. Depending on your repository, you may need to increase the value of the `GEM_TEMPOBJ_CACHE_SIZE` configuration parameter beyond its default. For details about GemStone configuration parameters, see the *System Administration Guide*.

# SUBCLASSES

## **subclasses [*aClassName*]**

Prints immediate subclasses of the specified class. If you don't specify a class name, prints subclasses of the current class.

```
topaz 1> subclasses MultiByteString  
DoubleByteString  
QuadByteString
```

```
topaz 1> set class DoubleByteString  
topaz 1> subclasses  
DoubleByteSymbol  
Unicode16
```

For command to print the complete hierarchy, see **subhierarchy** on page 171.

# SUBHIERARCHY

## subhierarchy [*aClassName*]

Print print a hierarchy report for all subclasses of the specified class. If you don't specify a class name, prints hierarchy report for the current class.

### Example

```
topaz 1> subhierarchy MultiByteString
MultiByteString
  DoubleByteString
    DoubleByteSymbol
    Unicode16
  QuadByteString
    QuadByteSymbol
    Unicode32
```

### See Also

[hierarchy](#) (page 97)

# TEMPORARY

## temporary [*aTempName*[/*anInt*] [*anObjectSpec*] ]

Displays or redefines the value of one or more temporary variables in the current frame of the current stack. For examples and other useful information, see Chapter 2, “Debugging Your GemStone Smalltalk Code”, starting on page 45.

All Topaz object specification formats (as described in “Specifying Objects” on page 40) are legal in **temporary** commands.

### **temporary**

Displays the names and values of all temporary objects in the current frame.

### **temporary** *aTempName*

Displays the value of the first temporary object with the specified name in the current frame.

```
topaz 1> temporary preferences
preferences      an Array
```

### **temporary** *aTempName* *anObjectSpec*

Redefines the specified temporary in the current frame to have the value *anObjectSpec*.

### **temporary** *anInt*

Displays the value of the temporary at offset *n* in the current frame. Use this form of the command to access a temporary with a duplicate name, because **temporary** *aTempName* always displays the first temporary with the specified name.

### **temporary** *anInt* *anObjectSpec*

Redefines the temporary at offset *n* in the current frame to have the value *anObjectSpec*.

For example, to view the temporary variable values:

```
topaz 1> break classmethod String withAll:
topaz 1> run
String withAll: 'abc'
%
a Breakpoint occurred (error 6005), Method breakpoint encountered.
1 String class >> withAll:          @1 line 1
topaz 1> stack
==> 1 String class >> withAll:      @1 line 1
    receiver String
    aString abc
2 Executed Code                      @2 line 1
    receiver nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
    receiver nil
```

and to modify the value of the temporary:

```
topaz 1> temporary aString 'xyz'
topaz 1> stack
==> 1 String class >> withAll: @1 line 1
    receiver String
    aString xyz
2 Executed Code @2 line 1
    receiver nil
3 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
    receiver nil
```

the method will return the modified value:

```
topaz 1> continue
xyz
```

When the Topaz command **display oops** has been set, temporaries displayed as .tN are un-named temporaries private to the virtual machine. The example below displays the temporaries used in evaluation of the optimized to:do:, both as shown by the **frame** command and by the **temporary** command.

```
topaz 1> run
| a |
1 to: 25 do: [:j | a := j. a pause]
%
...
topaz 1> display oops
topaz 1> frame 5
5 Executed Code @4 line 2 [methId 25464833]
    receiver [20 sz:0 cls: 76289 UndefinedObject] nil
    a [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
    j [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
    .t1 [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
    .t2 [202 sz:0 cls: 74241 SmallInteger] 25 == 0x19
    .t3 [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
    .t4 [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
topaz 1> temporary
a [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
j [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
.t1 [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
.t2 [202 sz:0 cls: 74241 SmallInteger] 25 == 0x19
.t3 [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
.t4 [10 sz:0 cls: 74241 SmallInteger] 1 == 0x1
```

# TFILE

## **tfile** *aFile*

Input a tonel format class definition or class extension file. The methods within the file are all compiled.

The Class specified in the file must already exist (i.e. class definition execution is not attempted).

# THREAD

## thread [*anInt*] [clear]

Displays the currently selected GemStone process from among the stack saved from the last error, or from those retrieved by the most recent **threads** command.

```
topaz 1> thread
Stack 0 , GsProcess 27462401
1 Animal >> habitat @1 line 1
```

### **thread** *anInt*

Changes the currently selected GemStone process. You can specify an integer value from among those shown in the most recent **threads** command.

```
topaz 1> thread 1
Stack 1 , GsProcess 27447553
1 AbstractException >> _signalWith: @6 line 25
```

### **thread** *anInt* **clear**

Clears the selected GsProcess from the Topaz stack cache.

# THREADS

## threads [clear]

Force any dirty instances of GsProcess cached in VM stack memory to be flushed to object memory. It then executes a message send of

```
ProcessorScheduler >> topazAllProcesses
```

and retrieves and displays the list of processes.

```
topaz 1> threads
      0: 27462401 debug
=> 1: 27447553 debug (topaz current)
      2: 27444225 debug
```

### **threads clear**

Clears the Topaz cache of all instances of GsProcess.



# TIME

The first execution of **time** during the life of a topaz process displays current date and time from the operating system clock, total CPU time used by the topaz process.

Subsequent execution of **time** will display in addition elapsed time since the previous **time** command, CPU time used by the topaz process since the previous **time** command.

The **time** command can be executed when not logged in as well as after login.

## Example

```
topaz 1> time
02/06/2019 13:37:13.545 PST
CPU time: 0.035 seconds
topaz 1> run
Array allInstances size
%
23515
topaz 1> time
02/06/2019 13:37:48.459 PST
CPU time: 0.232 seconds
Elapsed Real time: 8.649 seconds
Elapsed CPU time: 0.083 seconds
```

## TMETHOD

Compile a method from tonel format used by the Rowan open source project. This is intended for interactive use.

```
topaz 1 > tmethod
{ #category : 'test' }
TestClass >> version[
    ^5
]
```

This compiles the method using the class from the tonel method definition (in the example, TestClass), and using the current compilation environment. It does not affect topaz's current class.

The closing ] must be the first character on a line.

## TOPAZWAITFORDEBUG

Waits forever in a sleep loop until a debugger is attached to continue execution.

This can be a C debugger (gdb, etc.), or if in linked topaz that is configured with `GEM_LISTEN_FOR_DEBUG`, another topaz session attaching via **debuggem**.

This command should be used with caution; it may require an OS-level kill to terminate the process. Intended for use in debugging; see “Debugging in a different Gem” on page 52 and the **debuggem** (page 66) and **iferr** (page 99) commands.

## UNPROTECTMETHODS

Cancels the effect of **protectmethods**, which is used for consistency checking in filein scripts.

This command cannot be abbreviated.

# UP

## up [*anInteger*]

In the current stack, change the current frame to be the caller of the current frame, and display the new selected frame. The optional argument *anInteger* specifies how many frames to move up. If no argument is supplied, the scope will go up one frame.

The behavior is similar to **stack up**, except that **stack up** does not accept an argument, and the frame display for **stack up** does not include parameters and temporaries for the frame. **stack up** is described on page 163.

```
topaz 1> run
{ 1 . 2 } do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026),
reason:numErrIntDivisionByZero, attempt to divide 1 by zero
(ZeroDivide)
topaz 1> where
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsnMethod class) >> _gsReturnToC @1 line 1

topaz 1> up 4
5 [] in Executed Code @2 line 1
self nil
receiver anExecBlock1
x 1

topaz 1> where
1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
==> 5 [] in Executed Code @2 line 1
6 Array (Collection) >> do: @5 line 10
7 Executed Code @2 line 1
8 UndefinedObject (GsnMethod class) >> _gsReturnToC @1 line 1
```

# WHERE

## where [*anInteger* | *aString*]

Displays the current call stack, with one line per frame.

### where

Displays all lines of the current call stack. Equivalent to the **stk** command.

```
topaz 1> where
==> 1 ZeroDivide (AbstractException) >> _signalWith: @6 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
4 SmallInteger >> / @6 line 7
5 Executed Code @2 line 1
6 UndefinedObject (GsNMethod class) >> _gsReturnToC @1 line 1
```

### where *anInteger*

Displays the specified number of frames of the stack, starting with the current frame.

```
topaz 1> where 3
==> 1 ZeroDivide (AbstractException) >> _signalWith: @6 line 25
2 ZeroDivide (AbstractException) >> signal @2 line 47
3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
```

### where *aString*

Searches all frames in the current stack, and displays only those for which the output of where for that frame matches a case-sensitive search for *aString* anywhere in that frame's output (not including the frame number or ==> marker at the start of the frame's line). The current frame is set to the first frame matched by the search.

The string must not begin with a decimal digit, whitespace, or any of the three characters (' + -), and must not contain whitespace. To specify a string that contains digits or whitespace characters, enclose it in single-quotes. For example:

```
topaz 1> where error
==> 3 SmallInteger (Number) >> _errorDivideByZero @6 line 7
```

## A

# Topaz Command-Line Syntax

This section presents the formal command syntax and the available command-line options. By default the **topaz** command invokes an RPC executable. This is the same as specifying the **-r** option on the topaz command line:

```
topaz [-r] [-q] [-i | -I topazini] [-S scriptFile] [-n hostName:netldiName] [-u userName]
      [-X caCertPaths] [-- other args]
```

When invoked with the **-L** or **-l** option, Topaz runs in linked mode. The command line accepts additional options that apply only when starting linked version:

```
topaz -l | -L [-q] [-i | -I topazini] [-S scriptFile] [-u userName] [-e exeConfig]
      [-z systemConfig] [-T tocSizeKB] [-C configParams] [-- other args]
```

In linked topaz (topaz -l or -L), you may also login RPC sessions, as well as login a single linked session. Settings that only apply to linked sessions (**-e**, **-z**, **-T**, and **-C**) do not apply for RPC sessions started from linked topaz.

topaz can also provides usage and version information:

```
topaz -h | -v
```

<b>-C</b> <i>configParams</i>	Provides configuration parameters, in configuration file syntax, that override settings in the configuration files. Only applies to linked sessions (RPC sessions may use the <b>-C</b> syntax in the Gem's NRS). For example, topaz -l -C 'GEM_TEMPOBJ_CACHE_SIZE = 1GB; GEM_TEMPOBJ_OOMSTATS_CSV = TRUE;'
<b>-e</b> <i>exeConfig</i>	The GemStone executable configuration file. This only applies to linked sessions. See "Executable Configuration File" on page 309.
<b>-h</b>	Displays a usage line and exits.
<b>-i</b>	Ignore the initialization file, <code>.topazini</code> .

- I** *topazini* Specify a complete path and file to a topazini initialization files, and use this rather than any `.topazini` in the default location.
- l** Invoke the linked version of Topaz.
- L** Invoke the linked version of Topaz, and do not apply any command **set gemnetid** that may appear in the `.topazini` file or a file passed in using **-I**.
- n** *hostName:netldiName* For a login using X509-Secured GemStone only, to specify the NetLDI to spawn the Gem, part of the X509-secured GemStone login parameters. The host name or IP, and the netldi name or listening port, for an X509-secured NetLDI.
- q** Start Topaz in quiet mode, suppressing printout of the banner and other information.
- r** Invoke the RPC (remote procedure call) version of Topaz.
- S** *scriptFile* Specifies a script file that will be processed with INPUT.
- T** *tocSizeKB* The GEM\_TEMPOBJ\_CACHE\_SIZE that will be used. Overrides any settings provided in configuration files passed as arguments with the **-e** or **-z** options. Only applies to linked sessions.
- u** *useName* Sets the cache name, as recorded by statmonitor for viewing in VSD. This is also useful for identifying processes in OS utilities such as `top` or `ps`.
- v** Prints version and exits.
- X** *CaCertPaths* For a login using X509-Secured GemStone only, to set certificates. Requires additional infrastructure to be running, including X509-secured NetLDIs and caches. The argument must specify three paths in the defined order: `cacert`, `chained key for user`, and `private key for user`.  
For example:  
`-X 'stoneCA-dev.cert.pem;DataCurator.chain.pem;DataCurator.privkey.pem'`
- z** *systemConfig* The GemStone system configuration file (applies only to linked sessions). See "System Configuration File" on page 308.
- *otherArgs* Arbitrary text arguments *otherArgs* may be included after the "--" end of arguments marker, which must follow any of the above topaz arguments are included.