
GemStone®

Topaz Programming Environment for GemStone/S 64 Bit

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PATENTS

GemStone software is covered by U.S. Patent Number 6,256,637 "Transactional virtual machine architecture", Patent Number 6,360,219 "Object queues with concurrent updating", Patent Number 6,567,905 "Generational garbage collector with persistent object cache", and Patent Number 6,681,226 "Selective pessimistic locking for a concurrently updateable database". GemStone software may also be covered by one or more pending United States patent applications.

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Preface

About This Manual

This manual describes Topaz, the command-driven GemStone programming environment. You can use Topaz with the other GemStone development tools such as GemBuilder for C to build 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.

Prerequisites

To make use of the information in this manual, you must be familiar with the GemStone/S 64 Bit system and the GemStone Smalltalk programming language. In addition, you should be familiar with your host operating system.

You should have the GemStone system installed correctly on your host computer, as described in the *GemStone/S 64 Bit Installation Guide* for your platform.

How This Manual Is Organized

- ▶ Chapter 1, “Getting Started with Topaz,” introduces you to Topaz. You’ll learn how to run Topaz, how to log in to the GemStone server, how to create and execute GemStone Smalltalk code, and how to inspect GemStone objects.
- ▶ Chapter 2, “Debugging Your GemStone Smalltalk Code,” shows how to use Topaz to debug your GemStone Smalltalk code.
- ▶ Chapter 3, “Command Dictionary,” describes the Topaz commands in alphabetical order.

- ▶ Appendix A, “Topaz Command-Line Syntax,” lists the Topaz command line syntax.
- ▶ Appendix B, “Network Resource String Syntax,” lists the syntax for specifying the host machine for a GemStone file or process.

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.

Other GemStone Documentation

In addition to the full set of GemStone/S 64 Bit documentation, the following documents may be particularly useful in working with topaz:

- ▶ *Programming Guide for GemStone/S 64 Bit* – a programmer’s guide to GemStone Smalltalk, GemStone’s object-oriented programming language.
- ▶ *System Administration Guide for GemStone/S 64 Bit* – describes maintenance and administration of your GemStone/S system.

A description of the behavior of each GemStone kernel class is available in the class comments in the GemStone Smalltalk repository. Method comments include a description of the behavior of methods.

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- ▶ **Product download** for the current and selected recent versions of GemTalk software.
- ▶ **Bugnotes**, identifying performance issues or error conditions that you may encounter when using a GemTalk product.
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Website: techsupport.gemtalksystems.com

Email: techsupport@gemtalksystems.com

Telephone: (800) 243-4772 or (503) 766-4702

When submitting a request, please include the following information:

- ▶ Your name and company name.
- ▶ The versions of GemStone/S 64 Bit and of all related GemTalk products, and of any other related products, such as client Smalltalk products.
- ▶ The operating system and version you are using.
- ▶ A description of the problem or request.
- ▶ Exact error message(s) received, if any, including log files if appropriate.

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Table of Contents

Chapter 1. Getting Started with Topaz13

1.1 Getting started with Topaz	14
Overview of a GemStone Session.	14
Remote Versus Linked Versions	14
Invoking Topaz	15
Topaz Commands	15
Logging In to GemStone.	16
Configurations that do not require setting host information	19
Setting Up a Login Initialization File .topazini	20
Error handling and output.	21
Alternatives to automatic initialization	21
Setting gemnetid in .topazini	21
Multiple Concurrent GemStone Sessions	21
Multiple sessions in the RPC version of Topaz	22
Multiple sessions in the Linked version of Topaz.	22
Topaz sessions vs. GemStone sessions	23
Transaction state	24
1.2 Interacting with Topaz	25
The Help Command	25
Interrupting Topaz and GemStone	25
Logging Out.	25
Leaving Topaz	25
1.3 Executing GemStone Smalltalk Expressions	26
Strings vs. Unicode strings	26
Controlling the Display of Results	27
Display Level	27
Setting Limits on Object Displays.	28
Displaying Variable Names, OOPs, and Hex Byte Values	28
Committing and Aborting Transactions	29

1.4 Input from and Output to Files	30
Topaz Scripts	30
Taking Topaz Input from a File	30
Embedding Topaz within shell scripts	31
Handling text outside the ASCII range	31
Capturing Your Topaz Session In a File	32
Writing to multiple log files	32
1.5 Invoking Operating System Functionality	33
1.6 Using Topaz for Code Development	34
Creating Methods	34
Using a Text Editor to Edit Methods	35
Listing Methods, Categories, and other information	36
Filing Out Classes and Methods.	37
Code outside the ASCII range	37
1.7 Advanced Topaz features	38
Structural Access To Objects	38
Examining Instance Variables with Structural Access.	38
Specifying Objects.	39
Object Identity Specification Formats	39
Literal Object Specification Formats.	39
Specifying Method Selectors	40
Topaz Variables	40
Creating Variables.	41
Displaying Current Variable Definitions	42
Clearing Variable Definitions	42
Sending Messages.	42

Chapter 2. Debugging Your GemStone Smalltalk Code45

2.1 Step Points and Breakpoints	45
2.2 Setting, Clearing, and Examining Breakpoints	46
2.3 Examining the GemStone Smalltalk Call Stack	48
Proceeding After a Breakpoint.	49
Examining and Modifying Temporaries and Arguments	50
Select a Context for Examination and Debugging	51
Multiple Call Stacks.	52

Chapter 3. Command Dictionary53

ABORT	54
ALLSTACKS.	55
BEGIN	56
BREAK	57
Method Breakpoints	57
Displaying Breakpoints.	58

Disabling and Enabling Breakpoints	58
Deleting Breakpoints	58
Examples	58
CATEGORY	60
CLASSMETHOD	61
COMMIT	62
CONTINUE/C	63
DEBUGRUN	64
DEFINE	65
DISASSEM	66
DISPLAY	67
oops	67
bytes	67
classoops	67
flushoutput	67
errorcheck	67
lineeditor	68
names	68
pauseonerror	68
pauseonwarning	68
pushonly	69
resultcheck	69
stacktemps	69
zerobased	69
DOIT	70
DOWN	71
EDIT	72
Creating or Modifying Blocks of GemStone Smalltalk Code	72
Creating or Modifying GemStone Smalltalk Methods	72
ERRORCOUNT	74
EXEC	75
EXIT	76
EXITIFNOERROR	77
EXPECTBUG	78
EXPECTERROR	79
Further arguments to EXPECTERROR	80
EXPECTVALUE	82
FILEFORMAT	84
utf8	84
8bit	84
FILEOUT	85
FR_CLS	86
FRAME	87
GCITRACE	88
HELP	89
HIERARCHY	90
HISTORY	91
IFERR	92
IFERR_CLEAR	93
IFERR_LIST	94

IFERROR	95
IMPLEMENTORS	96
INPUT	97
INSPECT	98
INTERP	99
LEVEL	100
LIMIT	101
bytes	101
oops	101
lev1bytes	101
LIST	102
Browsing Dictionaries and Classes	102
Listing Methods	102
Listing Step Points	103
Listing Breakpoints	104
LISTW / L	106
LITERALS	107
LOADUA	108
LOGIN	109
LOGOUT	110
LOGOUTIFLOGGEDIN	111
LOOKUP	112
Finding and Listing Methods	112
Pasting from stack frames	113
METHOD	114
NBRESULT	115
NBRUN	116
NBSTEP	117
OBJ1 / OBJ2	118
OBJ1Z / OBJ2Z	119
OBJECT	120
OMIT	122
bytes	122
classoops	122
errorcheck	122
flushoutput	122
lineeditor	122
names	122
oops	122
pauseonerror	123
pauseonwarning	123
pushonly	123
resultcheck	123
stacktemps	123
zerobased	123
OUTPUT	124
only	124
pop	125
PAUSEFORDEBUG	126
PKGLOOKUP	127

PRINTIT.	.128
PROTECTMETHODS	.129
QUIT.	.130
RELEASEALL	.131
REMARK	.132
REMOVEALLCLASSMETHODS.	.133
REMOVEALLMETHODS.	.134
RUN	.135
SEND	.136
SENDERS	.137
SET.	.138
cachename	.138
category	.138
class	.138
compile_env	.139
editorname	.139
gemnetid	.139
gemstone	.140
history	.140
hostpassword	.140
hostusername	.140
inconversion	.141
limit	.141
listwindow	.141
nrsdefaults	.141
password	.141
session	.141
sourcestringclass	.141
stackpad	.142
tab	.142
transactionmode	.142
username	.142
SHELL.	.143
STACK	.144
Display the Active Call Stack	.144
Display or Redefine the Active Context	.145
Save the Active Call Stack During Further Execution	.146
Display All Call Stacks.	.146
Redefine the Active Call Stack	.147
Remove Call Stacks.	.147
STATUS	.148
STEP	.149
STK	.150
STRINGS	.151
STRINGSIC	.152
SUBCLASSES.	.153
TEMPORARY.	.154
THREAD	.156
THREADS.	.157
TIME.	.158

UNPROTECTMETHODS	159
UP.	160
WHERE	161
<i>Appendix A. Topaz Command-Line Syntax</i>	163
<i>Appendix B. Network Resource String Syntax</i>	165

Getting Started with Topaz

Topaz is a GemStone programming environment that provides keyboard command 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. Chapter 3 provides descriptions of 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.

Your environment must contain a definition of the `$GEMSTONE` environment variable and your execution path must include the GemStone binary directory `$GEMSTONE/bin`. Consult your system administrator if you need help with this.

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.

GemStone Smalltalk and Ruby

Topaz is designed to support the GemStone Ruby environment (MAGLEV) as well as GemStone/S 64 Bit. A number of Topaz commands and options are provided for use with Ruby but are not used in GemStone Smalltalk installations; the use of these commands is not described in this manual.

The environmentId specifies a method lookup environment that is primarily used in Ruby environments, although it may be available for Smalltalk applications. By default, it is 0 in Smalltalk applications.

1.1 Getting started with Topaz

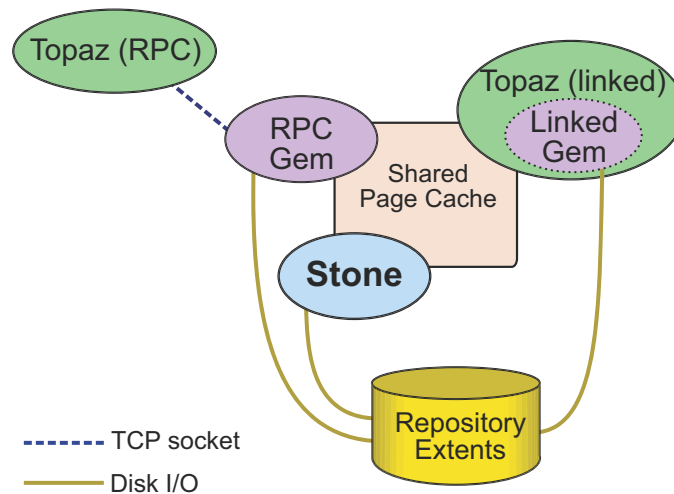
Topaz provides an environment in which you can get a GemStone session and use that session to find out information about GemStone, and to execute Smalltalk code. To perform any server interaction, you must first log in. All server interaction is performed using the logged-in session. The sessions that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

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 of which allows RPC logins only, the other allowing both Linked and RPC.

- ▶ Topaz RPC is the default, although you may specify the `-r` command line argument. You can run multiple RPC sessions, but in Topaz RPC, linked logins are not possible.
- ▶ Topaz Linked requires specifying the `-l` command line argument to topaz. The `-l` argument is required to allow topaz to login linked; you may additionally run multiple RPC sessions.

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

```
% topaz
```

```

GemStone/S64 Object-Oriented Data Management System
Copyright (C) GemTalk Systems 1986-2015
All rights reserved.
-----
PROGRAM: topaz, Linear GemStone Interface (Remote Session)
VERSION: 3.3.0, Thu Aug 18 14:47:21 US/Pacific 2015
BUILD: 64bit-37204
BUILT FOR: x86-64 (Linux)
MODE: 64 bit
RUNNING ON: 4-CPU benton x86_64 (Linux 3.2.0-58-generic #88-Ubuntu SMP Tue
Dec 3 17:37:58 UTC 2013) 5965MB
PROCESS ID: 27630      DATE: 09/10/15 15:41:54 PDT
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 most 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.

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. You may include multiple topaz commands on a single line by separating each expression with a semicolon (;).

Any text following a command that does not have arguments 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 a GemStone user name and password.

The examples given here will be for RPC logins. Linked logins are similar. These examples also assume that the GemStone server configuration requires authentication in order to start the Gem session. This may not always be the case; see "Configurations that do not require setting host information" on page 19.

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 use 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`. Appendix B describes the syntax of network resource strings.

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. You may enter the user name and omit the password, in which case you will be interactively prompted for the password.

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`.

- ▶ **host user name and password.** The UNIX name and password for the account on the server that will own the Gem process. This are needed only for RPC sessions, and only if the NetLDI is configured to require this for authentication. You may enter the host user name and omit the host password, in which case you will be interactively prompted for the host password.

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`.

This is set using the command `set hostusername` and `hostpassword`.

- ▶ **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 caution in using set gemnetid in topaz initialization files.

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 of the form `!@<remoteNode>#netldi:<netldiName>!gemnetobject`. For example,

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

The GemStone service name is configured using the `set` command: `set gemnetid serviceName`.

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

```
topaz> set gemstone gs64stone
topaz> set username Isaac_Newton
```

For RPC login, you may need to also provide the host login credentials:

```
topaz> set hostusername newtoni
topaz> set hostpassword
Host Password? (Type your host password; it won't be echoed)
```

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

```
topaz 1> status
```

Current settings are:

```
display level: 0
byte limit: 0 lev1bytes: 0
omit bytes
display instance variable names
display oops  omit classoops  omit stacktemps
oop limit: 0
omit automatic result checks
omit interactive pause on errors
omit interactive pause on warnings
listwindow: 20
stackpad: 45
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)
```

Connection Information:

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

Browsing Information:

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

If you are will be logging in linked, certain login parameters (HostUserName and HostPassword) have no effect. Setting GemNetId will result in an RPC login.

If any login settings are incorrect, use the **set** command to fix them.

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

```
topaz> login
GemStone password? (type your GemStone password)
[Info]: libssl-3.3.0-64.so: loaded
[05/14/2015 15:02:40.874 PDT]
  gci login: currSession 1  rpc gem processId 1363
successful login
topaz 1>
```

As this example shows, Topaz displays a session number in its prompt once you have logged in. In the topaz RPC version, these numbers start with 1. In the linked version of topaz, session 1 is the linked session, and the RPC session numbering starts with session 2.

You may supply several of these login parameters on a single command line in any order, and abbreviate the parameter names:

```
topaz> set gemstone gs64stone user Isaac_Newton pass gravity
topaz> set hostuser 'newtoni'
topaz> set hostpass <return>
Host Password? (type your host password)
topaz> login
[Info]: libssl-3.3.0-64.so: loaded
[05/14/2015 15:02:40.874 PDT]
  gci login: currSession 1  rpc gem processId 1363
successful login
topaz 1>
```

Because setting the host user name causes Topaz to discard the current host password, you must set **hostusername** before **hostpassword**.

If you are using the linked version of Topaz, you can login with fewer **set** commands:

```
topaz> set gemstone gs64stone user Isaac_Newton pass gravity
topaz> login
[Info]: LNK client/gem GCI levels = 33000/33000
[Info]: libssl-3.3.0-64.so: loaded
[Info]: User ID: Isaac_Newton
[Info]: Repository: gs64stone
[Info]: Session ID: 5
[Info]: GCI Client Host: <Linked>
[Info]: Page server PID: -1
[Info]: Login Time: 05/14/2015 15:00:39.542 PDT
[05/14/2015 15:00:39.543 PDT]
  gci login: currSession 1  linked session
successful login
topaz 1>
```

Configurations that do not require setting host information

You do not always have to enter the hostusername and hostpassword for logins.

For RPC logins, if the NetLDI that you are using to login is running in guest mode with captive account, you do not need to specify hostusername or hostpassword. Your gem will run according the account specified in the NetLDI.

More information on netldi modes can be found in the *System Administration Guide for GemStone/S 64 Bit*.

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 hostpassword** and **login** 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 \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 mypassword
set hostusername 'newtoni'
set hostpassword hostpassword
login
```

If you choose not to include your password in an initialization file, Topaz will start up with the following prompt.

```
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 an 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.

Setting gemnetid in .topazini

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

```
set gemnetid gemnetobject
```

The .topazini file is executed for both RPC and linked topaz. If this line is present in a .topazini file, and that .topazini file is executed by linked topaz, the effect is to turn the linked login into an RPC login.

For more on the behavior of gemnetid in linked and RPC topaz, see under **gemnetid** starting on page 139.

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
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
gci login: currSession 2 rpc gem processId 141
successful login
topaz 2> printit
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` 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 OS credentials if your server configuration requires this, so you can get an RPC login.

If you are running linked topaz (`topaz -l`), 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
GemStone password? <password typed here but not echoed>
[Info]: libssl-3.3.0-64.so: loaded
[09/10/2015 14:40:49.338 PDT]
  gci login: currSession 1  rpc gem processId 31427
successful login
topaz 2> set gemnetid ""
topaz 2> login
[Info]: LNK client/gem GCI levels = 33001/33001
--- 09/10/2015 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
[09/10/2015 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 20.

See the *System Administration Guide for GemStone/S 64 Bit* for more information on managing transactions and handling `sigAborts`.

WARNING

Idle topaz sessions should not be left logged into 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 session may be terminated.

1.2 Interacting with Topaz

The 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**.

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                2015
  dayOfYear           126
  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                2015
  dayOfYear           126
  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; the 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. This is 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 141.

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 specific command used to execute the code.

A level of 0 displays only the object itself; 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                2015
  dayOfYear           126
  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
%
06/05/2015 15:04:35
```

You can set the level explicitly using the `level` command, and the `run` command will use the current level setting to display the results.

For example, with level 0, the `run` command produces the same display as the `doit` command:

```
topaz 1> level 0
topaz 1> run
DateTime now
%
06/05/2015 15:05:23
```

Setting the level to 2 would give this view:

```
topaz 1> level 2
topaz 1> run
DateTime now
%
a DateTime
  year                2015
  dayOfYear           126
  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. The maximum display level is 32767.

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 Hex 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 67).

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
%
[25521409 sz:4 cls: 118785 DateTime] a DateTime
  year          [16114 sz:0 cls: 74241 SmallInteger] 2014 == 0x7de
  dayOfYear     [362 sz:0 cls: 74241 SmallInteger] 45 == 0x2d
  milliseconds  [665595786 sz:0 cls: 74241 SmallInteger] 83199473 == 0x4f585f1
  timeZone     [12049153 sz:9 cls: 14631169 TimeZone] a TimeZone
```

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

Hexadecimal Byte Values

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

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

Entering **omit bytes** restores the default byte 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.

1.4 Input from and Output to Files

Some of the most important functionality that Topaz provides are related to working with file system files. Topaz uses files:

- ▶ as the way to import code into to the GemStone repository.
- ▶ to provide scripting capability, so you can automatically run administrative operations on the repository.

Topaz also provides one way to file code out from the repository.

Topaz Scripts

The Topaz commands you have entered interactively to login and execute code can alternatively be stored in an external text file. This allows you to execute a sequence of commands as often as needed and whenever needed without having to type it in each time.

You have already seen the `.topazini` initialization file, which is a specialized use of scripting capability. Topaz provides the ability to run any of its commands, invoke other topaz scripts or operating system functions, and perform error checking and logging. It is not itself a complete scripting environment and does not provide flow-of-control operators; topaz invocations can be embedded in shell script as needed.

If you have complicated queries, sequences of repository updates, reports, or administrative tasks that you repeat on a regular basis, this is an easy way to do it. You can type the Topaz commands into a file, and test and edit them until they run correctly. If your procedures change, you can easily edit the script.

Taking Topaz Input from a File

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.

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 32.

Embedding Topaz within shell scripts

To perform automatic repository administrative operations, such as backup or markForCollection, you may create topaz scripts and embed them 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
```

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/sh
#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
```

Handling text outside the ASCII range

Character with codepoints over 127 are outside the ASCII range, and how they 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.

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.

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
05/07/2015 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.

1.5 Invoking Operating System Functionality

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, simply invoke the **shell** command.

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

```
topaz> shell echo $GEMSTONE
/lark1/users/gadmin/GemStone64Bit3.3.0-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/GemStone64Bit3.3.0-x86_64.Linux
% exit

topaz>
```

1.6 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 102.

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 85.

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.

1.7 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. The following example retrieves the first instance variable of MyAnimal's third instance variable.

```
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. That is, if an indexed object also had three named instance variables, 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 kinds of object specification acceptable in such Topaz commands as **object at:**. The others include object identity specification formats and literal object specification formats.

Object Identity Specification Formats

@integer

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

integer

A 61-bit literal SmallInteger.

\$character

A literal Character.

aVariableName

This can be either a GemStone Smalltalk variable name or a local variable created with the **define** command.

****** 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).

Literal Object Specification Formats

'text'

A literal String.

#text

A literal Symbol (no white space allowed).

#'text'

A quoted literal Symbol.

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]]

The OOP specifications and ****** (last result) are especially interesting. For example:

```
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, not `@1335297`.

Specifying Method Selectors

When specifying a method selector in a Topaz command, you can use any of the following formats:

text

'text'

A literal String.

#text

A literal Symbol (no white space allowed).

#'text'

A quoted literal Symbol.

The resulting token becomes a String object and is subsequently converted to a Symbol object if required by the command.

Topaz Variables

As you saw in the last section, Topaz lets you refer to objects via their OOPs. Because long numerical OOPs are hard to remember, Topaz also provides a facility for defining local Topaz variables so that you can name those OOPs.

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:19 cls: 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.

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.

As the last example shows, local variables can be used in **object** commands. When used in this way, the local definition of a symbol always overrides any definition of the symbol in GemStone. For example, if "thirdvar" were defined in UserGlobals, that definition would be ignored in **object** commands.

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
  SourceStringClass    = 74753
  CurrentCategory      = nil
  CurrentClass         = nil
  LastResult           = nil
  LastText             = nil
  myUserProfile        = nil
```

Note that **define** reports values as OOPs rather than literals.

In this status report the user-defined local variables are listed first. The last items are local variables that Topaz automatically creates for you. They refer, respectively, to:

- ▶ the OOP of the current method
- ▶ the OOP of the number of Topaz and GemStone errors made since you started Topaz
- ▶ the OOP of the class to which sourcestringclass is set
- ▶ the OOP of the current category
- ▶ the OOP of the current class
- ▶ the OOP of the last execution result
- ▶ the OOP of the text of the last GemStone Smalltalk expression executed or compiled
- ▶ the OOP of your UserProfile

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

Usually you'll send messages only inside methods or within **printit** commands. If you can point to an object only via a local Topaz variable or via an OOP, however, this won't work.

Therefore, Topaz provides the **send** command, which lets you send a message to an object identified by any of the means described in “Specifying Objects” on page 39. 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. Also note that 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.

Generally, step points correspond to the message selector and, within the method, message-sends, assignments, and returns of nonatomic objects. (However, compiler optimizations 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:

```
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      *****
```

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 (described below) to step through this method, the first step halts execution at the beginning of the method. The second step takes you to the point where `_validateClass:` is about to be sent to `aCharacter`. Stepping again would execute that message-send and halt execution at the point where `asCharacter` is about to be sent. Another step would cause that message to be sent and then halt execution just before the message `includesValue:` is sent to `self`.

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). As explained earlier, you can set a breakpoint at any step point. You can use the **break** command (described below) to set method breakpoints that halt execution at a particular step point within a method. In general, you can choose to set a method break before a message-send, an assignment, or a method return.

You can set a breakpoint on any method. Some methods, 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.

2.2 Setting, Clearing, and Examining Breakpoints

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

```
break method aClassName aSelector [@ stepNumber]
break classmethod aClassName aSelector [@ stepNumber]
```

For example:

```
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).

The Topaz **list breaks** command allows you to display all method breakpoints currently set in the active method context. By supplying a selector as an argument to the **list breaks** command, you can display all breakpoints set in a given instance or class method for the current class, as shown in the following 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
```

Alternatively, you can use the **break list** command to list all currently set method or message breakpoints:

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

In the break list, 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
```

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
```

2.3 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 method Animal name: @1
```

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]
```

```
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 **level 1**, or higher levels, 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 level 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
```

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 39.

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 157.

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 142).

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

This command cannot be abbreviated.

BREAK

break *aSubCommand*

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

Method Breakpoints

You can set method breakpoints within an instance method at step points: assignments, message sends, or method returns. Use the **list steps** command to display all valid step points for a method.

In each of the following commands, the optional argument *anInt* specifies the step point within that method where the break is to occur. If you do not specify *anInt*, 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 may supply the class name parameter in these four formats:

@integer

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

aVariableName

This can be either a GemStone Smalltalk variable name or a local variable created with the **define** command.

****** 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:**, **removeallmethods**, **removeallclassmethods**, or **fileout class:** command).

break method *aClassName selectorSpec* [**@** *anInt*]

Establishes a method breakpoint on the given instance method.

break classmethod *aClassName selectorSpec* [**@** *anInt*]

Establishes a method breakpoint on the given class method.

break method **^** *selectorSpec* [**@** *anInt*]

Establishes a method breakpoint on the given instance method for the current class.

break classmethod **^** *selectorSpec* [**@** *anInt*]

Establishes a method breakpoint on the given class method for the current class.

break method *@anObjectSpec selectorSpec*

Establishes a method breakpoint at step point 1 of the given instance method for the class with the specified *objectId*.

break method *@anObjectSpec*

Establishes a method breakpoint at step point 1 of the GsNMethod with the specified objectId.

break *@anInt*

Establishes a method breakpoint at the specified step point of the method selected by the previous **down**, **frame**, **lookup**, **list**, or **up** command.

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 39.

For more information about breakpoints, see the discussion of the **break** command on page 57, 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.

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 149) 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 39) are legal in **define** commands.

define

Lists all current local variable definitions.

define *aVarName*

Deletes the definition of the variable *aVarName*.

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*. The variable name *aVarName* must begin with a letter (a..z) or an underscore, can be up to 255 characters in length, and cannot contain white space.

```
topaz 1> define CurrentSessions System currentSessionNames
```

```
topaz 1> define UserId myUserProfile userId
```

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.;

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.

Default: **omit oops**

bytes

display bytes

When displaying string objects, includes the hexadecimal value of each byte.

Default: **omit bytes**

classoops

display classoops

If **display oops** is set, enables the display of OOPs of classes along with class names in object display. 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 classoops**

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 140).

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

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

Default: **display lineeditor**

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, ctrl-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 `ctrl-C` on `stdin` will terminate the pause and terminate further processing of input files.

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

`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 **object push** command. To disable this effect, use the **omit pushonly** command.

Default: **omit 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**

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**

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 100). 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 146.

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
```

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.

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 100).

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. 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).

This command cannot be abbreviated.

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 76). 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 82).

errorCategory and *errNumCls*

are specified as in the **expecterror** command (described on page 79).

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 39) 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 a literal object specification (described on page 39), Topaz regards it as matching the result if the two are equal (=).

If *anErrorArg* is an object identity specification (described on page 39), 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 39”) 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 the argument is a literal object specification (*literalObjectSpec*), Topaz regards it as matching the result if the two are equal (=).

If the argument is an object specification (*ObjectSpec*), 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_CLS

fr_cls [*anInteger*]

Similar to the **frame** command (described on page 87), 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 145, the **up** command on page 160 and the **down** command on page 71.

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*]

Prints the class hierarchy up to Object for the specified class. If you don't specify a class, Topaz prints the hierarchy for the current class.

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 138) establishes the maximum number of command lines to retain in the Topaz line editor 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 a number 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.

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 example uses **expecterror** to test for an error returned by the **printit** command. If Topaz finds one, it displays the active call stack for debugging. That behavior is specified by making the Topaz **stack** command an argument on the **iferr** command line.

```
topaz 1> iferr 1 stack
topaz 1> expecterror GemStoneError MessageNotUnderstood
topaz 1> printit
...
%
```

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 92.

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 92.

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 92.

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.

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.

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> 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 is identical to the **run** command (page 135), except that the **interp** command does not use native code, the Smalltalk code execution is interpreted.

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 32767.

Note the following:

- ▶ The **run** command (page 135) displays results using the current display level, as set by the **level** command.
- ▶ The **doit** command (page 70) always displays results at level 0, regardless of the current display level.
- ▶ The **printit** command (page 128) 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 **up**, **down**, or **frame** command.

Browsing Dictionaries and Classes

list dictionaries

Lists the SymbolDictionaries in your GemStone symbol list. This executes the GemStone Smalltalk method `UserProfile>>dictionaryNames`.

list classesIn: *aDictionary*

Lists the classes in *aDictionary*. For example,

```
topaz 1> list classesIn: UserGlobals
```

lists all of the classes in your UserGlobals dictionary.

list classes

Lists all of the classes in all of the dictionaries in your symbol list.

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.

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.

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.

list selectors

Lists selectors of all instance methods. May be abbreviated as `list sel`.

list cselectors

Lists selectors of all class methods. May be abbreviated as `list csel`.

Listing Methods

list selectorSpec

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:`.

For any method whose selector is the same as, or is some subset of, one of the **list** subcommands (for example, a method with the selector **steps**) you must explicitly include the **method:** keyword. For example:

```
topaz 1> list method: steps           (not list steps)
```

list method: *@anObjectSpec*

Lists the category and source of the method with the given objectId. You can also enter this command as `list imethod:`.

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:`.

list classmethod: *@anObjectSpec*

Lists the category and source of the method with the given objectId. You can also enter this command as `list cmethod:`.

list

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.

Listing Step Points

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.

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.

Listing Breakpoints

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.

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 %
```

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 `gcilinkobj` for the linked version (**topaz -l** command))

set gemstone:

name of the Stone (repository monitor) process, including node and protocol information in the form of a network resource string, if necessary. Appendix B describes network resource string syntax.

set username:

your GemStone user ID.

set password:

your GemStone password. If you do not specify a password (for security reasons, for example), Topaz prompts you for it.

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. If you enter this command without a password, Topaz prompts you for it.

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 set to anything other than " (null) or `gcilinkobj`, 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, 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, see the description of **set** on page 138. Also see "Topaz Commands" on page 15.

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 110), 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) *selectorSpec*

lookup *className* [class] *selectorSpec*

The **lookup** command is used in conjunction with the **set** command to search upwards through the hierarchy of superclasses to locate the implementation of a given method. Related commands include **senders** and **implementors**.

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.

Finding and Listing Methods

lookup classmethod *selectorSpec*

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 *selectorSpec*

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
%      [GsMethod objId 2198273]
```

lookup *className* *selectorSpec*

Lists the source code of the specified instance method for the given class, or searching the superclasses, the first superclass that implements this method. (The *className* argument may not be **meth**, **method**, **cmeth**, or **classmethod**.)

lookup *className* class *selectorSpec*

Lists the source code of the specified class method for the given class, or searching the 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 39 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: $1
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 67.

bytes

omit bytes

When displaying string objects, do not include the hexadecimal value of each byte.

classoops

omit classoops

Disables the display of OOPs of classes along with class names in object display, stopping the effect of **display classoops**.

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.

lineditor

omit lineditor

Disables the use of the Topaz line editor, stopping the effect of **display lineditor**. 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.

stacktemps**omit stacktemps**

Disables effect of **display stacktemps**.

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 84).

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 100 (inclusive), and where `foo_N.out` did not previously exist. If more than 100 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 112.

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 100). The **printit** command does not alter the current level setting. The **run** command (page 135) displays according to the current level setting, and the **doit** command (page 70) 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. If you do not specify this 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).

This command cannot be abbreviated.

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 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 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 100), whereas **printit** always displays the result as if level 1 were the most recent **level** command.

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 39) 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
```

cachename

set cachename: *aString*

This option is valid for linked sessions only, not for RPC sessions. The colon is not required.

Sets the name that will be used for this session in cache statistics collected by statmonitor. 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 assigned using `System class >> cacheName :.`

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 category you name doesn't 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.

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.

To display the name of the current class, issue the **set class** command without a class name.

compile_env

set compile_env: *anInteger*

Not normally used in Smalltalk. Sets the compilation environmentId used for method complications and **run**, **printit**, etc. *anInteger* must be between 0 and 255 and is 0 by default.

editorname

set editorname: *aHostName*

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.

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`, which is the GemStone service name in most GemStone installations. 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**), the default **gemnetid** is `gcilnkobj`. Use the `status` command to verify that this parameter is `gcilnkobj` or `"`. This makes the first session to log in a linked session. It is only possible to have one linked session per topaz process.

If **gemnetid** is set to a gem service such as `gemnetobject`, **topaz -l** starts RPC sessions. In this case, the lowest number for the prompt is `topaz 2>`, because `topaz 1>` is reserved for a linked session. 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.

After you start an RPC session, you can still start a linked session by resetting the **gemnetid** to an empty string:

```
set gemnetid: ''
```

This only applies if you started linked topaz (**topaz -l**). **topaz -r** cannot start linked sessions.

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`. Appendix B describes network resource string syntax.

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`. Appendix B describes network resource string syntax.

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 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 hostusername:** 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.

hostusername

set hostusername: *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.)

inconversion

set inconversion

For use only by repository upgrade scripts in \$GEMSTONE/upgrade. Sets the interal variable GciSupDbInConversion to TRUE .

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 106).

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 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.

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.

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)

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.

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 3.2.0 BUILD: 64bit-32623
```

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** is active)
- ▶ the OOP of the GsNMethod (if **display oops** is active)

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

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.

Here is an example of the 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
```

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.

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 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 157)

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 156).

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
```

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 156)

stack delete all

Removes all call stacks.

STATUS

Displays your current login settings and other information about your Topaz session.

For example:

```
topaz 1> status

Current settings are:
display level: 0
byte limit: 0 lev1bytes: 0
omit bytes
display instance variable names
display oops   omit classoops   omit stacktemps
oop limit: 0
omit automatic result checks
omit interactive pause on errors
omit interactive pause on warnings
listwindow: 20
stackpad: 45
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)

Connection Information:
UserName_____ 'Isaac_Newton'
Password _____ (set)
HostUserName_____ 'newtoni'
HostPassword_____ (set)
NRSdefaults_____ '#netldi:gs64ldi'
GemStone_____ 'gs64stone'
GemStone NRS_____ '!#netldi:gs64ldi#server!gs64stone'
GemNetId_____ 'gemnetobject'
CacheName_____ (default)

Browsing Information:
Class_____
Category_____ (as yet unclassified)
```

These settings are set to default values when Topaz starts, and may be modified using the **set** (page 138) command, **display** (page 67) and **omit** (page 122), and using individual commands such as **level** (page 100), **limit** (page 101), and **fileformat** (page 84).

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 144.

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. 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
UserProfileSet >> _oldUserId:newUserId:for:
```

The **strings** command is equivalent to the following:

```
topaz 1> doit
ClassOrganizer new strings: 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*.

STRINGSIC

stringsic *selectorSpec*

Displays a list of all methods that contain the given *selectorSpec* (either a String or a Symbol) in their source string. 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> doit
```

```
ClassOrganizer new stringsIc: 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*.

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
```

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 39) 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
```

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.

```
topaz 1> time
02/14/2014 12:12:37.612 PST
CPU time:  0.050 seconds
topaz 1> run
Array allInstances size
%
23515
topaz 1> time
02/14/2014 12:12:57.082 PST
CPU time:  0.100 seconds
Elapsed Real time:  19.470 seconds
Elapsed CPU  time:  0.050 seconds
```

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 146.

```
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 ] [ -u useName ]
```

When invoked with the **-l** option, Topaz runs in linked mode. The command line accepts additional options that apply only when starting linked version:

```
topaz -l [ -q ] [ -i | -I topazini ] [ -u useName ] [ -e exeConfig ] [ -z systemConfig ]
[ -T tocSizeKB ] [ -C configParams ]
```

In linked topaz (topaz -l, you may also login RPC sessions, as well as login a 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
```

- | | |
|-------------------------------|---|
| -C <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 -C syntax in the Gem's NRS). |
| -e <i>exeConfig</i> | The GemStone executable configuration file. This only applies to linked sessions. See "Executable Configuration File" on page 263. |
| -h | Displays a usage line and exits. |
| -i | Ignore the initialization file, <code>.topazini</code> . |
| -I <i>topazini</i> | Specify a complete path and file to a topazini initialization files, and use this rather than any <code>.topazini</code> in the default location. |
| -l | Invoke the linked version of Topaz. |

- q** Start Topaz in quiet mode, suppressing printout of the banner and other information.
- r** Invoke the RPC (remote procedure call) version of Topaz.
- 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*** The value is not used by the topaz executable, but may be useful in identifying processes in OS utilities such as `top` or `ps`.
- v** Prints version and exits.
- w** On Windows client only; forces terminal behavior regardless of I/O device.
- z *systemConfig*** The GemStone system configuration file (applies only to linked sessions). See “System Configuration File” on page 262.

Network Resource String Syntax

This appendix describes the syntax for network resource strings. A network resource string (NRS) provides a means for uniquely identifying a GemStone file or process by specifying its location on the network, its type, and authorization information. GemStone utilities use network resource strings to request services from a NetLDI.

Overview

One common application of NRS strings is the specification of login parameters for a remote process (RPC) GemStone application. An RPC login typically requires you to specify a GemStone repository monitor and a Gem service on a remote server, using NRS strings that include the remote server's hostname. For example, to log in from Topaz to a Stone process called "gs64stone" running on node "handel", you would specify two NRS strings:

```
topaz> set gemstone !@handel!gs64stone
topaz> set gemnetid !@handel!gemnetobject
```

Many GemStone processes use network resource strings, so the strings show up in places where command arguments are recorded, such as the GemStone log file. Looking at log messages will show you the way an NRS works. For example:

```
Opening transaction log file for read,
filename = !@oboe#dbf!/user1/gemstone/data/tranlog0.dbf
```

An NRS can contain spaces and special characters. On heterogeneous network systems, you need to keep in mind that the various UNIX shells have their own rules for interpreting these characters. If you have a problem getting a command to work with an NRS as part of the command line, check the syntax of the NRS recorded in the log file. It may be that the shell didn't expand the string as you expected.

NOTE

Before you begin using network resource strings, make sure you understand the behavior of the software that will process the command.

See each operating system's documentation for a full discussion of its own rules about escaping certain characters in NRS strings that are entered at a command prompt.

If there is a space in the NRS, you can replace the space with a colon (:), or you can enclose the string in quotes (" "). For example, the following network resource strings are equivalent:

```
% waitstone !@oboe#auth:user@password!gs64stone
% waitstone "!@oboe#auth user@password!gs64stone"
```

Defaults

The following items uniquely identify a network resource:

- ▶ Communications protocol— such as TCP/IP
- ▶ Destination node— the host that has the resource
- ▶ Authentication of the user— such as a system authorization code
- ▶ Resource type— such as server, database extent, or task
- ▶ Environment— such as a NetLDI, a directory, or the name of a log file
- ▶ Resource name— the name of the specific resource being requested.

A network resource string can include some or all of this information. In most cases, you need not fill in all of the fields in a network resource string. The information required depends upon the nature of the utility being executed and the task to be accomplished. Most GemStone utilities provide some context-sensitive defaults. For example, the Topaz interface prefixes the name of a Stone process with the **#server** resource identifier.

When a utility needs a value for which it does not have a built-in default, it relies on the system-wide defaults described in the syntax productions in "Syntax" on page 167. You can supply your own default values for NRS modifiers by defining an environment variable named GEMSTONE_NRS_ALL in the form of the *nrs-header* production. If GEMSTONE_NRS_ALL defines a value for the desired field, that value is used in place of the system default. (There can be no meaningful default value for "resource name.")

A GemStone utility picks up the value of GEMSTONE_NRS_ALL as it is defined when the utility is started. Subsequent changes to the environment variable are not reflected in the behavior of an already-running utility.

When a client utility submits a request to a NetLDI, the utility uses its own defaults and those gleaned from its environment to build the NRS. After the NRS is submitted to it, the NetLDI then applies additional defaults if needed. Values submitted by the client utility take precedence over those provided by the NetLDI.

Notation

Terminal symbols are printed in boldface. They appear in a network resource string as written:

```
#server
```

Nonterminal symbols are printed in italics. They are defined in terms of terminal symbols and other nonterminal symbols:

username ::= nrs-identifier

Items enclosed in square brackets are optional. When they appear, they can appear only one time:

address-modifier ::= [protocol] [@ node]

Items enclosed in curly braces are also optional. When they appear, they can appear more than once:

nrs-header ::= ! [address-modifier] {keyword-modifier} !

Parentheses and vertical bars denote multiple options. Any single item on the list can be chosen:

protocol ::= (tcp | serial | default)

Syntax

nrs ::= [nrs-header] nrs-body

where:

nrs-header ::= ! [address-modifier] {keyword-modifier} [resource-modifier]!

All modifiers are optional, and defaults apply if a modifier is omitted. The value of an environment variable can be placed in an NRS by preceding the name of the variable with "\$". If the name needs to be followed by alphanumeric text, then it can be bracketed by "{" and "}". If an environment variable named `foo` exists, then either of the following will cause it to be expanded: `$foo` or `{foo}`. Environment variables are only expanded in the *nrs-header*. The *nrs-body* is never parsed.

address-modifier ::= [protocol] [@ node]

Specifies where the network resource is.

protocol ::= (tcp | serial | default)

Supports heterogeneous connections by predicating address on a network type. If no protocol is specified, `GCI_NET_DEFAULT_PROTOCOL` is used. On UNIX hosts, this default is **tcp**.

node ::= nrs-identifier

If no node is specified, the current machine's network node name is used. The identifier may also be an Internet-style numeric address. For example:

```
!@120.0.0.4#server!cornerstone
```

nrs-identifier ::= identifier

Identifiers are runs of characters; the special characters `!`, `#`, `$`, `@`, `^` and white space (blank, tab, newline) must be preceded by a `^`. Identifiers are words in the UNIX sense.

keyword-modifier ::= (authorization-modifier | environment-modifier)

Keyword modifiers may be given in any order. If a keyword modifier is specified more than once, the latter replaces the former. If a keyword modifier takes an argument, then the keyword may be separated from the argument by a space or a colon.

authorization-modifier ::= ((#auth | #encrypted) [:] username [@ password])

#auth specifies a valid OS user name on the target network. A valid OS user password is needed only if the resource type requires authentication. **#encrypted** is used by GemStone utilities. This type of authorization is the default.

username ::= nrs-identifier

If no OS user name is specified, the default is the current OS user. See the earlier discussion of *authorization-modifier*.

password ::= nrs-identifier

Only needed if the resource type requires authentication; see the earlier discussion of *authorization-modifier*.

environment-modifier ::= (#netldi | #dir | #log) [:] nrs-identifier

#netldi causes the named NetLDI to be used to service the request. If no NetLDI is specified, the default is `gs64ldi`. When you specify the **#netldi** option, the *nrs-identifier* is either the name of a NetLDI service or the port number at which a NetLDI is running.

#dir sets the default directory of the network resource. It has no effect if the resource already exists. If a directory is not set, the pattern “%H” (home directory) is used. (See the definition of *nrs-identifier*.)

#log sets the name of the log file of the network resource. It has no effect if the resource already exists. If the log name is a relative path, it is relative to the working directory. If a log name is not set, the pattern “%N%M.log” is used, as described below, and following the syntax in the definition of *nrs-identifier*

The argument to **#dir** or **#log** can contain patterns that are expanded in the context of the created resource. The following patterns are supported:

- %H - home directory
- %D - A variable configured in the NetLDI
- %M - machine’s network node name
- %N - executable’s base name, such as `gemnetid` for a Gem
- %P - process pid
- %U - user name
- %% - (escaped) %

resource-modifier ::= (#server | #spawn | #task | #dbf | #monitor | #file)

Identifies the intended purpose of the string in the *nrs-body*. An NRS can contain only one resource modifier. The default resource modifier is context sensitive. For instance, if the system expects an NRS for a database file, then the default is **#dbf**.

#server directs the NetLDI to search for the network address of a server, such as a Stone or another NetLDI. If successful, it returns the address. The *nrs-body* is a network server name. A successful lookup means only that the service has been defined; it does not indicate whether the service is currently running. A new process will not be started. (Authorization is needed only if the NetLDI is on a remote node and is running in secure mode.)

#task starts a new Gem. The *nrs-body* is a NetLDI service name (such as “gemnetobject”), followed by arguments to the command line. The NetLDI creates the named service by looking first for an entry in `$GEMSTONE/sys/services.dat`, and then in the user’s home directory for an executable having that name. The NetLDI returns the network address of the service. (Authorization is needed to create a new

process unless the NetLDI is in guest mode.) The **#task** resource modifier is also used internally to create page servers.

#dbf is used to access a database file. The *nrs-body* is the file spec of a GemStone database file. The NetLDI creates a page server on the given node to access the database and returns the network address of the page server. (Authorization is needed unless the NetLDI is in guest mode).

#spawn is used internally to start the garbage collection and other service Gem processes.

#monitor is used internally to start up a shared page cache monitor.

#file means the *nrs-body* is the file spec of a file on the given host (not currently implemented).

nrs-body ::= unformatted text, to end of string

The *nrs-body* is interpreted according to the context established by the *resource-modifier*. No extended identifier expansion is done in the *nrs-body*, and no special escapes are needed.

Index

Symbols

^ (current class) 39, 57
! (remark) 132
** (last result) 39, 57
@ (for OOP literal) 39, 57
@ (for step point index) 49
==> (indicating active context) 49
\$ (for character literal) 39

A

abort command 29, 54
aborting transactions 29
allstacks command 55
automatic batch processing 30

B

batch processing from an input file 30
begin command 56
break command 57
 classmethod 57
 clear 47, 58
 clear all 47
 delete 58
 delete all 58
 disable all 58
 display 47, 58
 enable 58
 enable all 58
 message 46
 method 46, 57

breakpoints 45, 57
 and special methods 57
 clearing 47, 58
 continuing GemStone Smalltalk execution
 after 63
 deleting 47
 listing 47, 58, 104
 method 46, 57
 methods that cannot have 57
 setting 46, 57

byte objects
 limiting display of 28, 101
 storing into with structural access 120
 structural access 121
byte values, displaying 28, 67, 122

C

c command 63
cacheName
 System method 138
CacheName (status output) 138
cachename (option to **set**) 138
call stack
 displaying contents of active 144
 examining 48, 144
 redefining 147
 removing 147
category
 current 35
 listing 36
 setting the current 138
category (option to **set**) 138

- category** command 60
- characters, Topaz syntax for 39
- class
 - creating with **set class** command 138
 - current 35
 - filing out 37
 - modifying with **set class** command 138
 - setting the current 138
- class (option to **set**) 138
- class instances
 - Topaz syntax for 80, 82
- class methods
 - changing 35
 - compiling 61
 - creating 35, 72
 - editing 35
 - modifying 73
- classmethod** command 35, 61
- command-line syntax 163
- commands
 - abbreviation of 53
 - abort** 29, 54
 - allstacks** 55
 - begin** 56
 - break** 57
 - c** 63
 - case-sensitivity of 53
 - category** 60
 - classmethod** 61
 - commit** 29, 62
 - continue** 49, 63
 - debugrun** 64
 - define** 41, 65
 - disassem** 66
 - display** 28, 67, 122
 - doit** 70
 - down** 71
 - edit** 72
 - errorcount** 74
 - exit** 25, 76, 130
 - exitifnoerror** 77
 - expectbug** 78
 - expecterror** 79
 - expectvalue** 82
 - fileformat** 37, 84
 - fileout** 37, 85
 - frame** 52, 87
 - fr_cls** 86
 - gcitrace** 88
 - help** 89
 - hierarchy** 90
 - history** 91
 - iferr** 92
 - iferr_clear** 93
 - iferr_list** 94
 - iferror** 95
 - implementors** 96
 - input** 97
 - inspect** 98
 - interp** 99
 - l** 106
 - level** 28, 100
 - limit** 28, 101
 - list** 102
 - listw** 106
 - login** 109
 - logout** 25, 110
 - logoutifloggedin** 111
 - lookup** 112
 - method** 34, 35, 114
 - nbresult** 115
 - nbrun** 116
 - nbstep** 117
 - obj1** 118
 - obj1z** 119
 - obj2** 118
 - obj2z** 119
 - object** 120
 - omit** 28, 67, 122
 - output** 124
 - pausefordebug** 126
 - pkglookup** 127
 - printit** 26, 128
 - protectmethods** 129
 - quit** 130
 - releaseall** 131
 - remark** 132
 - removeallclassmethods** 133
 - removeallmethods** 134
 - run** 135
 - send** 43, 136
 - senders** 137
 - set** 17, 138
 - shell** 143
 - spawn** 143
 - stack** 48, 51, 144
 - status** 25, 35, 148
 - step** 46, 149
 - stk** 48, 150
 - strings** 151
 - stringsic** 152
 - subclasses** 153
 - syntax of 53
 - temporary** 50, 154

thread 156
threads 157
time 158
unprotectmethods 159
up 160
where 48, 161

comments 132

commit command 29, 62

committing transactions 29

compile_env (option to **set**) 139

compile_env: 139

context

displaying the active 145
 listing method breakpoints 47, 104
 listing step points in 103
 redefining the active 51, 145
 selecting 51

continue command 49, 63

Control-C handling 25

current category, setting 60, 138

current class

and **classmethod** command 61

and **method** command 114

setting 138

D

debugging 45–47, 149, 150, 154
 and execution context 51

debugrun command 64

define command 41, 65

disassem command 66

display command 28, 67, 122
oops and stack display 144

display level 27–28
 maximum 100

display of results, controlling 27

doit command 70

down command 71

E

edit command 72
 and **set editorname:** command 139

classmethod 35, 73

last 72

method 35, 73

new classmethod 36, 72

new method 36, 72

editorname (option to **set**) 139

environmentId 13, 139, 144

error status 76, 130

errorcount command 74

errors, continuing GemStone Smalltalk execution
 after 63

examining the call stack 48

execution, stepping through 45, 103

exit command 25, 76, 130

exitifnoerror command 77

expectbug command 78

expecterror command 79

expectvalue command 82

F

file

appending to 32

input 30

output 30, 32

redirection 32

fileformat command 37, 84

fileout command 37, 85

finding method in hierarchy 112

Floats, Topaz syntax for 40

frame command 52, 87

fr_cls command 86

ftplogin. 20

G

gcitrace command 88

gemnetid (option to **set**) 139

gemnetobject 139

GemStone

aborting a transaction 54

committing a transaction 62

examining the call stack 144

interrupting 25

logging in 16

logging out 25

multiple sessions 21, 141

service, setting 139

gemstone (option to **set**) 140

GemStone name 16, 140

setting 109

GemStone password

setting 109, 141

GemStone service name, setting 109

GemStone Smalltalk

breakpoints 57, 104

continuing execution 49, 63

debugging 45–47, 149, 150, 154

editing source code 72, 139

executing expressions 26, 70, 75, 99, 128, 135

sending messages 136

GemStone username 16
 setting 109, 142

H

help command 25, 89
 hexadecimal values, displaying 28, 67, 122
hierarchy command 90
 history (option to **set**) 140
history command 91
 history, setting size using **set history** 140
 host password 140
 setting 109
 host username 140
 hostpassword (option to **set**) 140
 hostusername (option to **set**) 140

I

iferr command 92
iferr_clear command 93
iferr_list command 94
iferror command 95
implementors command 96
 initialization file
 and **set host password** command 140
 and **set password** command 141
 used to set login parameters 109
input command 30, 97
 pop 97
inspect command 98
 instance methods
 compiling 114
 creating 72
 modifying 73
 instance variables
 displaying 27, 28, 67, 100, 122
 returning the values of 120
 instances of a class, Topaz syntax for 80, 82
 integers, Topaz syntax for 39
interp command 99
 interrupting execution 25

L

l command 106
level command 28, 100
limit command 28, 101
 bytes 101
 oops 101
list command 102
 breaks 47, 104

breaks classmethod 105
breaks method 104
method 36
steps 103
steps classmethod 104
steps method 46, 103

listw command 106
 listwindow
 141
 listwindow (argument to **set**) 141
 logging a session 30
 logging in to GemStone 16, 109
login command 109
 login initialization file 20
 login parameters 16–20
 and **set** command 138
 displaying the value of 148
logout command 25, 110
logoutifloggedin command 111
lookup command 112

M

message breakpoints
 listing 47, 58
 setting 46
 method breakpoints 46, 57
 listing 47, 58, 104
 setting 46, 57
method command 34, 35, 114
 method compilations and **set category** command 138
 methods
 compilation 114
 compilation and current category 60
 creating 34, 72
 editing 35
 examining and modifying arguments 50
 filing out 37
 finding in hierarchy 112
 listing 36, 112
 modifying 34
 stepping through execution 103, 149
 multiple sessions 21, 141

N

nbresult command 115
nbrun command 116
nbstep command 117
 .netrc 20
 network

resource string (NRS)
 syntax 165

network communications and login parameters
 109

network initialization file 20

network resource string (NRS) 109

network server process, establishing the name of
 139

nonsequenceable collections (NSCs)
 structural access 120

NRS (network resource string)
 syntax 165

nrsdefaults 141

nrsdefaults (argument to **set**) 141

O

obj1 command 118

obj1z command 119

obj2 command 118

obj2z command 119

object command 120
 at: 38, 120
 at:put: 120

object headers 29

objects, syntax for specifying 39

omit command 28, 67, 122
 oops, and stack display 144

OOPs
 displaying 28, 67, 122
 limiting display of 101
 Topaz syntax for 39, 57

operating system error status 76, 130

output command 124
 and host environment names 124
 pop 124
 push 32, 124

output to a file 32

P

padding for stack display, using **set stackpad**
 142

password
 GemStone 141
 host 140

password (option to **set**) 141

pause message, continuing GemStone Smalltalk
 execution after 63

pausefordebug command 126

pkglookup command 127

prerequisites 3

printit command 26, 128

editing the text of 72

protectmethods command 129

Q

quit command 130

quitting Topaz 25

R

recording a session 30

releaseall command 131

remark command 132

removeallclassmethods command 133

removeallmethods command 134

Ruby
 and GemStone Smalltalk 13

run command 135

S

send command 43, 136

senders command 137

service name, GemStone 139

session (option to **set**) 141

session numbers 23, 141

sessions, multiple 21, 141

set command 17, 138
 cachename
 138
 category 138
 class 138
 and **edit classmethod** command 73
 and **edit method** command 73
 and **edit new classmethod** command 72
 and **edit new method** command 72
 compile_env: 139
 editorname 72
 editorname: 139
 establishing login parameters 109, 138
 gemnetid 139
 gemstone 140
 hostpassword 140
 hostusername 140
 listwindow
 141
 nrsdefaults
 141
 password 141
 session 21, 141
 and local variables 65
 sourcestringclass 142

stackpad
142

username 142

setcommand
history
140

shell command 143

SourceStringClass 84

sourcestringclass (option to **set**) 141

spawn command 143

special methods
and breakpoints 57

stack command 48, 144
all 52, 146
change 52, 147
delete 147
nosave 146
save 146
scope 51, 145

stack, redefining the active 52

stackpad 142

stackpad (option to **set**) 142

standard input, redirecting 30

standard output, redirecting 32

status command 25, 35, 148

stdin 32

stdout 32

step command 46, 149
into 50, 149
over 50, 149

step points 45
examining 45, 103
methods that have no 57

stk command 48, 150

stopping execution 25

#StringConfiguration 142

Strings
limiting display of 28, 101
Topaz syntax for 39

strings command 151

stringsic command 152

structural access 38–120
and **object** command 120

subclasses command 153

Symbols, Topaz syntax for 39

T

tab (option to **set**) 142

temporaries, examining and modifying 50, 154

temporary command 50, 154

thread command 156

threads command 157

time command 158

Topaz
command-line syntax 163
exiting 25
initialization file 20
interrupting 25
invoking 15
linked version 14
redirecting input 97
redirecting output 124
RPC version 14
syntax for characters 39
syntax for commands 53
syntax for Floats 40
syntax for instances of a class 80, 82
syntax for integers 39
syntax for literals 39
syntax for OOPs 39, 57
syntax for Strings 39
syntax for Symbols 39
syntax for variable names 39, 57

Topaz initialization file
and **set host password** command 140
and **set password** command 141

Topaz variables
and **define** command 65
and **object** command 120

topaz.ini 20

topazini.tpz 20

transactionmode (option to **set**) 142

transactions, aborting 29, 54

transactions, committing 29

U

Unicode16 84, 142

Unicode32 142

Unicode7 142

unprotectmethods command 159

up command 160

username
GemStone 16, 142
host 140

username (option to **set**) 142

UTF-8 38, 84, 124

V

variable names, Topaz syntax for 39, 57

variables, local
and **define** command 65
and **object** command 120

clearing definition of 42
variables, predefined
LastText 72

W

where command 48, 161
writing to a file 85