GemStone®

Topaz Programming Environment for GemStone/S 64 Bit

Version 3.2

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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 ASCII 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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http://gemtalksystems.com/techsupport

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- **Documentation** for released versions of all GemTalk products, in PDF form.
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- **Bugnotes**, identifying performance issues or error conditions that you may encounter when using a GemTalk product.
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This material is updated regularly; we recommend checking this site on a regular basis.

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Website: http://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 version of GemStone/S 64 Bit, and versions of all related GemTalk products and of any other related 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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Chapter

1 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 all 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 linked, nor with a gem or cache on the local node. 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. These commands are identified as such in Chapter 3, Command Dictionary.

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 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 1.1.

Figure 1.1 Topaz Banner and Prompt

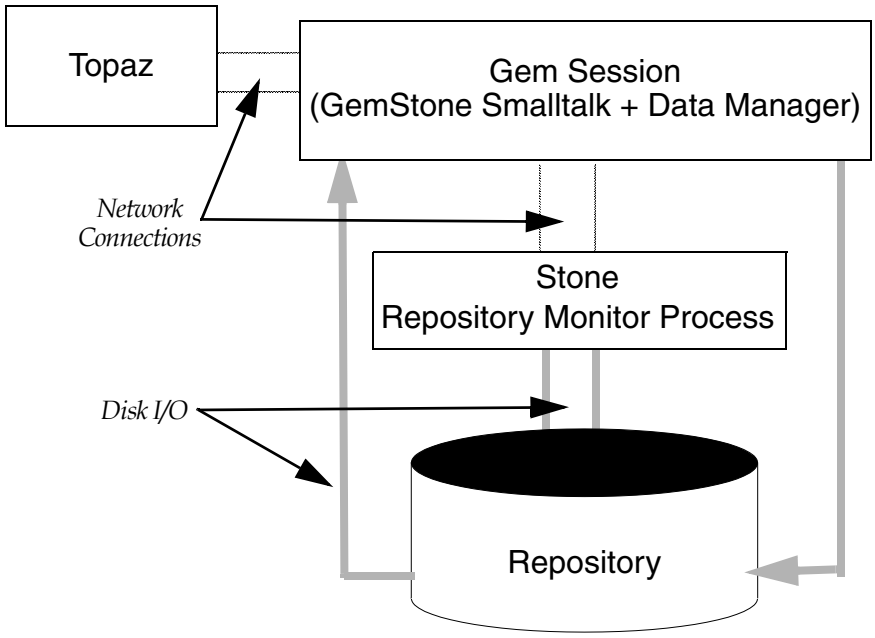
```
% topaz
 ______________________________________________________________________________
|              GemStone/S64 Object-Oriented Data Management System             |
|                Copyright (C) GemTalk Systems 1986-2014.                      |
|                            All rights reserved.                              |
|                           Covered by U.S Patents:                            |
|              6,256,637 Transactional virtual machine architecture            |
|                6,360,219 Object queues with concurrent updating              |
|                    6,567,905 Generational Garbage Collector.                 |
| 6,681,226 Selective Pessimistic Locking for a Concurrently Updateable Database
+------------------------------------------------------------------------------+
|    PROGRAM: topaz, Linear GemStone Interface (Remote Session)                |
|    VERSION: 3.2.0, Thu Feb 13 12:57:05 US/Pacific 2014                       |
|      BUILD: 64bit-32625                                                      |
|  BUILT FOR: x86-64 (Linux)                                                   |
|       MODE: 64 bit                                                           |
| RUNNING ON: 4-CPU benton x86_64 (Linux 2.6.32-50-generic #112-Ubuntu SMP Tue|
| Jul 9 20:28:23 UTC 2013) 5977MB                                              |
| PROCESS ID: 27630     DATE: 02/17/14 15:41:54 PST                            |
|   USER IDS: REAL=gsuser (531) EFFECTIVE=gsuser (531)                         |
|______________________________________________________________________________|
neither .topazini nor $HOME/.topazini were found
topaz>
```

1.2 Overview of a GemStone Session

A GemStone session consists of four parts, as shown in Figure 1.2. These are:

- An **application**, in this case, Topaz.
- One **repository**. An application has one repository to hold its persistent objects.
- One repository monitor, or **Stone** process, to control access to the repository.
- 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 1.2 GemStone Object Server Components



1.3 Remote Versus Linked Versions

In Figure 1.1, notice that the Topaz startup banner's `PROGRAM` line refers to `Remote Session`. Two versions of Topaz are available to you: *remote procedure call* (or RPC) and *linked*. Unless you specify otherwise, the **topaz** command invokes the RPC version. The RPC version of Topaz allows you to run multiple RPC Topaz sessions. These run separately from their Gem processes, so you can run Topaz and the Gem processes on separate nodes.

The **topaz -l** (for linked) command line invokes the linked version of Topaz. The linked version allows you to run multiple Topaz sessions, but session number one is always a linked session, where the Topaz session and a Gem exist as a single process. Any additional sessions are RPC. Linked sessions do not require a NetLDI to be running.

Under Windows, only the RPC version of Topaz is available, and the Gem sessions must be 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.

1.4 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. If you are running the RPC version of Topaz, you also need to provide your operating system user name and password for the host on which your GemStone session resides.

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

- **GemStone name**. This 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 set using the command `set gemstone`.

- **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.

  This is set using the command `set username` and `password`.

- **host user name and password**. The name and password that you use when you log in to the host operating system. These are needed only for RPC sessions. You may enter the host user name and omit the host password, in which case you will be interactively prompted for the host password.

  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 create a custom `gemnetobject` service.

  For the linked version of Topaz, do not set the gemnetid, or set the gemnetid to ''. If you set it to `gemnetobject`, all your sessions will be RPC, in spite of having invoked the linked version of topaz.

  You can use a network resource string of the form `!@central!gemnetobject` to start a Gem process on a remote node.

  This is set using the command `set gemnetid`.

You can abbreviate most Topaz command to uniqueness. Topaz commands (such as **set gemnetid** and **login**) are case-insensitive. The arguments you specify, however, must meet your operating system's requirements for capitalization and spelling.

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

```
topaz> set gemstone gs64stone
topaz> set username 'Isaac Newton'
```

Whenever a Topaz parameter such as "Isaac Newton" contains white space, it must be enclosed within single quotes.

This is sufficient for the linked logins. If you are logging in RPC, you must also provide the following information:

```
topaz> set gemnetid gemnetobject
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> status

Current settings are:
 display level: 0
 byte limit: 0 lev1bytes: 0
 omit bytes
 display instance variable names
 omit oops
 oop limit: 0
 omit automatic result checks
 omit interactive pause on errors
 listwindow: 20
 stackpad: 45
 tab (ctl-H) equals 8 spaces when listing method source
 using line editor
   line editor history: 100
   topaz input is from a tty on stdin
EditorName________ vi

CompilationEnv____ 0
Connection Information:
UserName_________ 'Isaac Newton'
Password _________ (not set)
HostUserName_____ 'newtoni'
HostPassword ____ (set)
GemStone_________ 'gs64stone'
GemStone NRS_____ '!#encrypted:newtoni@password#server!gs64stone'
GemNetId_________ 'gemnetobject'
GemNetId NRS_____ '!#encrypted:newtoni@password!gemnetobject'
CacheName_________(default)

SourceStringClass    String
fileformat           8bit
```

If you are using the linked version of Topaz, 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-3.2.0-64.so: loaded
[03/14/2014 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.

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

```
topaz> set gemstone gs64stone user 'Isaac Newton'
topaz> set gemnetid gemnetobject hostuser 'newtoni'
topaz> set hostpass <return>
Host Password? (type your host password)
topaz> login
[Info]: libssl-3.2.0-64.so: loaded
[03/14/2014 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 = 860/860
[Info]: libssl-3.2.0-64.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: 03/14/2014 15:00:39.542 PDT
[03/14/2014 15:00:39.543 PDT]
  gci login: currSession 1  linked session
successful login
topaz 1>
```

Host user account alternatives

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*.

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 Topaz Initialization File Names

Platform	Name of Topaz Initialization File	Expected Location
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 gemnetid gemnetobject
set username 'Isaac Newton'
set password mypassword
set hostusername 'newtoni'
set hostpassword hostpassword
login
```

If you have an initialization file, to start Topaz without using the initialization file, use the **-i** option. See Appendix A. You may also pass in the initialization file as an argument to topaz using the -I command.

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.

1.5 The Help Command

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

```
topaz 1> help exit

  EXIT [<status>]

    Terminates Topaz, returning to the parent process or operating
    system. If you are still logged in to GemStone when you type
    EXIT, this will abort your transaction and log out all active
    sessions. Although you can abbreviate most other Topaz commands
    and parameter names, EXIT must be typed in full.

    If this command has a <status> argument and it is an integer,
    then the integer is used as the exitStatus.  If the status argu-
    ment is an object specification that resolves to an integer,
    then that value is used as the exitStatus.  Only 8 bits of the
    integer are returned, exitStatus should be 0..255.  If it is not
    an integer then an error is returned and the process does not
    exit.

    If the command does not have a <status> argument, the exitStatus
    will be either 1 if there were GCI errors or the topaz error-
    count is not zero, or 0 if no errors had occurred.

    EXIT has the same function as QUIT.

Topic?(press Return to exit the help utility)
topaz 1>
```

1.6 Executing GemStone Smalltalk Expressions

By following the examples in the rest of this chapter, you'll learn how to create and execute GemStone Smalltalk code, and how to inspect GemStone objects. If you need to log out of your session before you finish, you can use the **commit** command to save the classes and methods you have created. To start where you left off in a new session, you will have to reset the current class and category, but usually not the default screen display settings.

Once you've logged in to GemStone, you can execute Smalltalk expressions with the **printit** command. 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                2014
  dayOfYear           45
  milliseconds        83048864
  timeZone            a TimeZone
```

All of the lines after the **printit** command and before the first 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.

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.

1.7 Invoking Operating System Functionality

Executing shell commands

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.

Escaping to an Editor

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 **printit** command. When you exit the editor, Topaz saves the edited text in a temporary file and asks you whether

you'd like to compile and execute the altered code. If you type **yes**, Topaz effectively reissues your **printit** command with the new text.

To use the editor for creating an entirely new block of code for execution, use **edit new text** instead of **edit last**.

See "Editing Methods" on page 26 for more on **edit**.

1.8 Controlling the Display of Results

Topaz provides several commands that let you control the amount and kind of information it displays about results.

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 variables is controlled by the level, and the particular command used to execute the code.

```
topaz 1> printit
DateTime now
%
a DateTime
  year                2014
  dayOfYear           45
  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 **printit** command always displays results with one level, as shown above. The **doit** command displays 0 levels:

```
topaz 1> doit
DateTime now
%
14/02/2014 15:04:35
```

You can use the **level** and **run** commands to ask for more or less information about results. The **run** command executes code and displays the results according to the most recent **level** execution. 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
%
14/02/2014 15:05:23
```

Setting the level to 2 would give this view:

```
topaz 1> level 2
topaz 1> run
DateTime now
```

```
%
a DateTime
  year                2014
  dayOfYear           45
  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

The **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. Similarly, **limit oops** controls how much Topaz displays of pointer or NSC objects that come back as a result.

By default, Topaz attempts to display all of a result, no matter how long. 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
```

Setting the limit to 0 restores the default condition.

Displaying Variable Names, OOPs, and Hex Byte Values

Two complementary commands, **display** and **omit**, control the display of instance variable names, hexadecimal byte values, and OOPs (the *object-oriented pointers* that uniquely identify GemStone objects internally).

Instance Variable Names

As you saw in the display of an instance of DateTime, Topaz normally prints the name of each named instance variable with its value. If you don't need this information, you can speed up the display of results by telling Topaz to **omit names**, as in the following example:

```
topaz 1> omit names
topaz 1> printit
DateTime now
%
a DateTime
  i1 2014
  i2 45
  i3 83171373
  i4 a TimeZone
```

Entering **display names** restores Topaz to the default condition.

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.

OOP Values

It's occasionally useful in debugging 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.

1.9 Creating and Changing 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. The first step in creating or editing a method is to tell Topaz the name of the method's class. Do this with the **set class** command:

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

This establishes a context for your subsequent work so that you don't need to supply the class name each time you create or edit a method.

Similarly, you'll need to supply the name of the method category in which you want to work:

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

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

Topaz maintains this information about the current class and category until you explicitly change it. 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
Source String Class__ String
```

Once you've established a class and a category, you can begin an instance method definition by issuing the **method:** command at the Topaz prompt:

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

The **method:** command takes a single argument: the name of the class for which the method will be compiled. As shown here, wherever Topaz expects the name of a class, you can simply type a caret (**^**) to tell Topaz to use the current class (in this case, Animal).

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

```
topaz 1> classmethod: ^
returnAString
 "Returns an empty String"
 ^String new
%
```

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.

Editing Methods

You can debug and refine methods by using Topaz's **edit** function in much the same way you use that function to create and modify **printit** commands. 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:
```

Here is how you would edit an existing class method:

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

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

If you omit the **method** and **classmethod** keywords, you must specify an instance method to be edited; for example, **edit habitat:**.

1.10 Listing Methods and Categories

If you need to see which categories and methods are in the current class, use the Topaz **list** command. The command **list categoriesIn:** causes Topaz to list all of the class and instance method selectors in the selected class by category.

To list the source code of an instance method, type **list method:** *aMethodName* as in the following example:

```
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. If you omit the keywords **method:** and **classmethod:** from your **list** command, you must specify an instance method you wish to list.

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. For more information, see the description of **list** in Chapter 3 of this manual.

1.11 Committing and Aborting Transactions

In GemStone, each session's operations normally exist in a transaction that maintains a temporary, private workspace. The **commit** command ends your current transaction and stores this information in the repository, for use in later sessions and by other users.

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.

Although you can abbreviate most other Topaz commands and parameter names, **commit**, **abort**, **logout**, and **exit** (the last two of which implicitly abort your transaction) must be typed in full.

1.12 Capturing Your Topaz Session In a File

It's often useful to keep a record of your interactions with GemStone during testing and debugging. You might also want to record a typical series of GemStone operations that could be used as a training guide or edited into a batch processing file.

You can do this with the Topaz command **output push**. 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).

The following example causes all subsequent interactions to be captured in a file called `animaltest.log`:

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

If the file you name doesn't exist, Topaz creates it. Under UNIX, if you name an existing file, Topaz overwrites it.

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

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

The following example stops output to the current file:

```
topaz 1> output pop
```

As the command names **push** and **pop** imply, Topaz can maintain a stack of up to 20 output files. If you add the keyword **only** to the **push** command lines, current interactions are captured only in the file on top of the stack. This prevents the results from showing on your screen, however.

```
topaz 1> output push animaltest2.log only
```

Otherwise, the output is duplicated in each file on the stack. For example, the following sequence would capture one command in the file `mathtest.log`, and a second command in `mathtest2.log`:

```
topaz 1> remark Capture the next command
topaz 1> remark and result in mathtest.log
topaz 1> output push mathtest.log
topaz 1> printit
5 * 8
%
40
topaz 1> remark Capture the next command
topaz 1> remark and result in mathtest2.log
topaz 1> output push mathtest2.log only
topaz 1> printit
5 * 9
%
topaz 1> remark Close mathtest2.log
topaz 1> remark and resume using mathtest.log
topaz 1> output pop
```

Notice that the result of the second command, 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 **remark** in this example—you can use either **remark** or an exclamation point in column 1 to begin a comment. Comments are often useful for annotating Topaz input files created for batch processing or testing.

1.13 Filing Out Classes and Methods

Sometimes you'll want to create, edit, or archive a class and some large fraction of its methods as a monolithic chunk of source code. This makes it possible to:

- 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.

The Topaz **fileout** command can create an executable Topaz script defining a class and/or any or all of the class's methods. You can process the script using editors or other operating system utilities and then execute it with the Topaz **input** command.

By default, the fileout command will output text as 8-bit bytes. 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 settting is required if you will file out text with any Characters with values over 255.

To configure your system to fileout in UTF-8:

```
topaz 1> fileformat UFT8
```

You must use this same mode to file in later; this will be done automatically in the topaz fileout.

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 utf8
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 four other subcommands:

fileout category:
Files out all the methods in the named category.

fileout classcategory:
Files out all the class methods in the named category.

fileout classmethod:
Files out the source code of the method identified in the argument by its selector.

fileout method:
Files out the specified instance method. You can omit the **method:** portion of a **fileout** command, unless the instance method's selector is also the name of one of the other **fileout** subcommands. For example, to file out a method named **habitat:**, you could simply enter:

```
topaz 1> fileout habitat:
```

To file out a method named **category:**, however, you would need to enter:

```
topaz 1> fileout method: category:
```

1.14 Creating a Topaz Script for Batch Processing

Just as the **fileout** command creates an executable Topaz script defining a class, you can create your own Topaz script that performs any series of GemStone operations. If you have complicated queries or a long series of repository updates that you repeat on a regular basis, this is an easy way to do it. You can type the Topaz commands into a file, test and edit them until they run with no errors, and then you have a script that will do automatic batch processing for you. If your procedure changes slightly from day to day, you can easily edit the script. Because the files duplicate what you would do interactively, they are also useful training tools.

Another way to produce such a script is to capture a typical Topaz session in a file, using **output push**. Edit the output file to remove the prompts and results, leaving only the Topaz commands and GemStone Smalltalk code. For example, suppose you wanted to make a script of the `mathtest2.log` file you created earlier. This is how it looks:

```
topaz 1> printit
5 * 9
%
45
topaz 1> remark Close mathtest2.log
topaz 1> remark and resume using mathtest.log
topaz 1> output pop
```

To make it an executable script, remove the prompts, results, and unnecessary commands, and make the comments helpful.

```
remark This multiplies two numbers
printit
5 * 9
%
```

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

1.15 Taking Topaz Input from a File

Although Topaz ordinarily takes its input from standard input, such as your terminal, you can use the **input** command to make Topaz take its input from a file. This file may contain commands to perform work, or code to be filed in; there is no difference.

You can file in text files that are encoded in UTF8, provided the topaz command **fileformat UTF8** has been executed. Terminal input such as pasting into your command line is always decoded from UTF-8.

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 use **output push** to record the session, so you can check for errors.

1.16 Interrupting Topaz and GemStone

Three kinds of interruption (break) using **Ctrl-C** are possible when you're using Topaz:

- 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`.
- Typing **Ctrl-C** three times immediately halts Topaz. Do this only in an emergency. All GemStone work performed since you last committed is lost.

1.17 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.

The following example shows how you might create a second session, make the new session your current session, then return to the original session.

```
topaz> login
gci login: currSession 1 rpc gem processId 95
successful login
topaz 1> set gemstone !@srv2!gs64stone
topaz 1> set username isaac
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>
```

Notice that the Topaz prompt always shows the number of the current 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: SymbolUser
session number: 4 UserId: DataCurator
session number: 5 UserId: Isaac Newton
session number: 6 UserId: Isaac Newton
session number: 7 UserId: Gottfried Leibniz
topaz 1>
```

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 canonicality.

Keep in mind that this list includes all sessions that are currently logged into the system, not only the sessions within Topaz. The session numbers reported here do not correspond to the sequential session numbers assigned by your Topaz.

If you use the **topaz** command to invoke Topaz, you get an RPC session. With every subsequent login command you get another RPC session.

If you use the t**opaz -l** command to invoke Topaz, your first session is linked. You may have only one linked session, so you need to enter a gemnetid in order to be able to log in a second session. All sessions after the first linked session will be RPC.

The messages displayed during login indicate if you have a linked or RPC session. In particular note the processId of the gem. If the processId is -1, it indicates a linked session. A positive value is the operating system processId (pid) of the gem.

```
topaz> set gemnetid gemnetobject
topaz> login
GemStone password? <password typed here but not echoed>
gci login: currSession 2 rpc gem processId 1363
successful login
topaz 2> set gemnetid "
topaz 2> login
[Info]: LNK client/gem GCI levels = 860/860
[Info]: libssl-3.2.0-64.so: loaded
[Info]: User ID: DataCurator
[Info]: Repository: stone32priv
[Info]: Session ID: 5
[Info]: GCI Client Host: <Linked>
[Info]: Page server PID: -1
[Info]: Login Time: 03/14/2014 15:08:56.220 PDT
Gave this VM preference for OOM killer, Wrote to
/proc/4458/oom_adj value 4
[03/14/2014 15:08:56.222 PDT]
  gci login: currSession 1  linked session
successful login
topaz 1>
```

1.18 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).

#'*t e x t***'**
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).

#'*t e x t***'**
A quoted literal Symbol.

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

1.19 Defining Local 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.
```

1.20 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 34. 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.

1.21 Logging Out

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

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

As noted above, logging out implicitly aborts your transaction.

1.22 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 use **quit**, which has the same effect as **exit**.

Chapter

2 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]
    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
```

Chapter

3 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. Non-abbreviatable commands 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 34.

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.

BEGIN

Begins a GemStone transaction when your session is outside a transaction.

When you have ended your transaction by invoking the GemStone Smalltalk method

```
System transactionMode: #manualBegin
```

use **begin** to start a new transaction. For more information, see the protocol for System Class.

This command cannot be abbreviated.

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: *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[: *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 in column 1. 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 [*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 34.

For more information about breakpoints, see the discussion of the **break** command on page 50, 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 *GemStone/S 64 Bit Programming Guide*. User manuals for the GemStone interfaces, such as *GemBuilder for Smalltalk*, also contain discussions of error-handling.

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 34) 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 *[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 *aDisplayFeature*

The **display** and **omit** commands control the display of instance variable names, hexadecimal byte values, and OOPs (object-oriented pointers). The **display** command turns on these display attributes, and the **omit** command turns them off.

`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.

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

`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.

`display names`
For each of an object's named instance variables, displays the instance variable name along with its value. (This is the default condition.) To turn off this display, use the **omit names** command.

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

`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.

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

```
Execution has been suspended by a "pause" message.

Topaz pausing after error, type <return> to continue, ctl-C to
quit ?
```

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

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

When **display pauseonerror** is set, the **status** command output includes:

```
display interactive pause on errors
```

Use **omit pauseonerror** to cancel this mode.

`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.

`display lineeditor`
Enables the use of the Topaz line editor, using the open source linenoise library. (This is the default condition.) To disable use of the line editor, use the **omit lineeditor** command. Not available on Windows.

`display pushonly`
Enables the effect of the **only** keyword in an **object push** command. To disable this effect, use the **omit pushonly** command.

`display zerobased`
Shows offsets of instance variables as zero-based when displaying objects. (By default, offsets are one-based.) To show offsets as one-based, use the **omit zerobased** command.

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

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 `%` in column 1. 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 *GemStone/S 64 Bit.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 for GemStone/S 64 Bit*.

Note that **doit** always displays results at level 0, regardless of the current display level setting (page 91). The **doit** command does not alter the current level setting.

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 137.

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
```

DOWNR [*anInteger*]
DOWNRB [*anInteger*]

These commands are used with Ruby applications, but not with Smalltalk applications.

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.

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** (see page 67). Otherwise, this command has no effect.

This command cannot be abbreviated.

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 (page 72).

errorCategory and *errNumCls*
are specified as in the **expecterror** command (page 70).

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
topaz 1>
```

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 *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 Abstract Exception.

All Topaz object specification formats (as described in "Specifying Objects" on page 34) 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
topaz 1>
```

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 additional 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 (page 35), Topaz regards it as matching the result if the two are equal (=).

If *anErrorArg* is an object identity specification (page 34), 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 *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 34) 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
topaz 1>
```

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
topaz 1>
```

FILEFORMAT *fileFormatDesignator*

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.

The following options are supported:

`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.

`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 the FILEFORMAT of a tty stdin to 8BIT is not allowed.

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 [*anInteger*]

Similar to the `frame` command (page 77), but also displays OOPs of classes along with class names in the specified stack frames.

This command cannot be abbreviated.

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 137, the up command on page 153 and the down command on page 62.

For example:

```
topaz 1> printit
{ 1 . 2} do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026), reason:numErrInt-
DivisionByZero, An attempt was made to divide 1 by zero. (ZeroDi-
vide)
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 *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 [*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 [*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 [*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 130) establishes the maximum number of command lines to retain in the Topaz line editor history.

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 82.

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 82.

This command cannot be abbreviated.

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 82.

This command cannot be abbreviated.

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 for GemStone/S 64 Bit*.

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 [*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 `%` in column 1. 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 125), except that the interp command does not use native code, the Smalltalk code execution is interpreted.

This command cannot be abbreviated.

INTERPENV

This command is used with Ruby applications, but not with Smalltalk applications.

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 125) displays results using the current display level, as set by the **level** command.
- The **doit** command (page 61) always displays results at level 0, regardless of the current display level.
- The **printit** command (page 117) always displays results at level 1, regardless of the current display level.

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 seting, then it prints ... *NN* more instVars.

`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`.

`limit oops` *anInteger*
Tells Topaz how much of any pointer or nonsequenceable collection to display in GemStone Smalltalk results.

`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.

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.

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".

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

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 **l**.

LOADUA *aFileName*

Loads the application user action library specified by *aFileName*. This command must be used before **login**.

This command cannot be abbreviated.

User action libraries contained user-defined C functions to be called from GemStone Smalltalk. See the *GemBuilder for C* manual for information about dynamically loading user action libraries.

LOGIN

Lets you log in to a GemStone repository. Before you attempt to log in to GemStone, you'll need to use the **set** command—either interactively or in your Topaz initialization file—to establish certain required login parameters. The required parameters for network communications are:

`set gemnetid:`
name of the GemStone service on the host computer (defaults to `gemnetobject` for the RPC version (**topaz** command) or `gcilnkobj` for the linked version (**topaz -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 130. Also see the section of Chapter 1 entitled "Logging In to GemStone."

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 **logout** (page 100), 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 (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:numErrInt-
DivisionByZero, 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: 'numErrIntDivisionByZ-
ero';
    dividend: self ;
    signal
%
```

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 in column 1. 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 *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 *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 *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 34 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`.

Nonsequenceable collections are also considered indexable via **object at:**.

object *anObjectSpec* **at:** *anIndex* **put:** *anotherObjectSpec*

Lets you store values into instance variables. This command stores the second *anObjectSpec* object into the first *anObjectSpec* object at the specified integer offset.

You cannot store into an NSC with **object at: put:**, although you can scrutinize its elements with **object at:**.

CAUTION

*Because **object at: put:** bypasses all the protections built into the GemStone Smalltalk kernel class protocol, you risk corrupting your repository whenever you permanently modify objects with this command.*

The following example shows how you could use **object at: put:** to store a new String in MyAnimal's *habitat* instance variable:

```
topaz 1> object MyAnimal at: 3 put: 'pond'
an Animal
  name            nil
  favoriteFood    nil
  habitat        pond
```

Like **object at:**, the **object at: put:** command can take a long sequence of parameters. For example:

```
topaz 1> object MyAnimal at: 3 at: 1 put: $l
liver
```

This example stores the character "l" into the first instance variable of MyAnimal's third instance variable.

With this command you can store Characters or SmallIntegers in the range from 0—255 (inclusive) into a byte object. You can also store other byte objects such as Strings. For example:

```
topaz 1> object 'this' at: 5 put: ' and that'
this and that
```

The **object at: put:** command behaves differently for objects with byte-array and pointer-array implementations. You may store the following kinds of objects into byte-array type objects:

Character. This stores the character '9':

```
topaz 1> object '123' at: 1 put: $9
```

SmallInteger. This stores a byte with the value 48:

```
topaz 1> object '123' at: 1 put: 48
```

Byte arrays. This stores 'b' and 'c' at offsets 2 and 3:

```
topaz 1> object '1234' at: 2 put: 'bc'
```

OMIT *aDisplayFeature*

The **display** and **omit** commands control the display of instance variable names, hexadecimal byte values, and OOPs (object-oriented pointers). The **omit** command turns off these display attributes, and the **display** command turns them on.

omit oops
Do not display OOP values with displayed results. (This is the default condition.)

omit bytes
When displaying string objects, do not include the hexadecimal value of each byte. (This is the default condition.)

omit errorcheck
Disables automatic result recording, stopping the effect of **display errorcheck**. Closes the `./topazerrors.log` file.

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.

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.

omit pauseonerror
Disables pauses in Topaz execution after errors, stopping the effect of **display pauseonerror**. When pause-on-error mode is turned off, the **status** command output includes:

```
omit interactive pause on errors
```

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

omit lineeditor
Disables the use of the Topaz line editor, stopping the effect of **display lineeditor**. (Not available on Windows.)

omit pushonly
Disables the effect of the **only** keyword in an **object push** command, stopping the effect of **display pushonly**.

omit zerobased
Shows offsets of instance variables as one-based when displaying objects. (This is the default condition.) To show offsets as zero-based, use the **display zerobased** command.

omit stacktemps
Disables effect of **display stacktemps**.

OUTPUT (PUSH | APPEND | PUSHNEW | POP) *aFileName* [ONLY]

Controls where Topaz output is sent. Normally Topaz sends output to standard output (stdout): normally 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.

As the command names **push** and **pop** imply, Topaz can maintain a stack of up to 20 output files, with current interactions captured in the file on top of the stack.

`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 (`&`).

The command **push** must be typed in full, it cannot be abbreviated.

`output append` *aFileName*
Sends output to the specified file. 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*.

Although you can abbreviate most other Topaz commands and parameter names, **append** must be typed in full.

`output pushnew` *aFileName*
Sends output to the specified file. 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 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.

The aboce output commands will send output to both stdout and the designated file. Using the **only** command turns off the echo 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.

`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. If there is no previous output file, an error message is issued and the I/O stacks are reset.

The command **push** must be typed in full, it cannot be abbreviated.

PAUSEFORDEBUG *[errorNumber]*

Provided to assist internal debugging of a session.

With no argument, this command has no effect.

This command cannot be abbreviated.

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 102.

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 `%` in column 1. 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 for GemStone/S 64 Bit*.

Note that **printit** always displays results at level 1, regardless of the current display level setting (page 91). The **printit** command does not alter the current level setting. The **run** command (page 125) displays according to the current level setting, and the **doit** command (page 61) 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 [*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 *GemStone/S 64 Bit GemBuilder for C* manual. This is equivalent to the GemBuilder for C call **GciReleaseOops**.

REMARK *commentText*

Begins a remark (comment) line. Topaz ignores all succeeding characters on the line. You can also use an exclamation point (!) in column 1 of a line to signal the beginning of a comment. Comments are often useful in annotating Topaz batch processing files, such as test scripts.

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 [*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.

RUBYCLASSMETHOD
RUBYHIERARCHY
RUBYIMPLEMENTORS
RUBYLIST
RUBYLOOKUP
RUBYMETHOD
RUBYRUN

These commands are used with Ruby applications, but not with Smalltalk applications.

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 `%` in column 1. 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 for GemStone/S 64 Bit*.

The **run** command is similar to **printit**, with one significant difference. The **run** command uses the current display level setting (page 91), whereas **printit** always displays the result as if level 1 were the most recent **level** command.

RUNENV

This command is used with Ruby applications, but not with Smalltalk applications.

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 34) 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 for GemStone/S 64 Bit*.

SENDENV

This command is used with Ruby applications, but not with Smalltalk applications.

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 for GemStone/S 64 Bit*.

SET *aTopazParameter* [*aParamValue*]

The **set** command allows you to set session-specific values for your topaz sesssion. 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
```

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:`.

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.

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.

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.

set editorname: *aHostEditorName*
Sets the name of the editor you want to use in conjunction with the **edit** command. For example:

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

The default is set from your `$EDITOR` environment variable, if it is defined.

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

```
set gemnetid: ''
```

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.

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.

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.)

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.

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.)

set listwindow: *anInt*
Defines the maximum number of source lines to be listed by the **listw** command (page 97).

set nrsdefaults: *aNRSheader*
Sets the default components to be used in network resource string specifications. The parameter *aNRSheader* 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.

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.

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.

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 orUnicode16. 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 command within a file only has effect within that file and any nested files.

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.)

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.)

set username: *aGemStoneUsername*
Establishes a GemStone user ID for the next login attempt.

set limit: *anInt*
Sets the limit on the number of bytes to display. The equivalent of **limit bytes** *anInt*

SHELL [*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 [*aHostCommand*]

Included for compatibility with previous versions. See the **shell** command on page 134.

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 GsMethod
- 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:numErrInt-
DivisionByZero, attempt to divide 1 by zero (ZeroDivide)

topaz 1> stack
==> 1 ZeroDivide (AbstractException) >> _signalWith: @5 line 25
    receiver a ZeroDivide occurred (error 2026), reason:numErrInt-
DivisionByZero, 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:numErrInt-
DivisionByZero, 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 149)

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 148).

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 148)

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

 display level: 0
 byte limit: 0
 omit bytes
 display instance variable names
 display oops
 oop limit: 0
 omit automatic result checks
 omit interactive pause on errors
 listwindow: 20
 stackpad: 45
 tab (ctl-H) equals 8 spaces when listing method source
 using line editor
   line editor history: 100
   topaz input is from a tty on stdin
EditorName________ vi

CompilationEnv____ 0
Connection Information:
UserName___________ 'Isaac Newton'
Password ___________ (set)
HostUserName_______ 'newtoni'
HostPassword_______ (set)
NRSdefaults________ '#netldi:nldi30'
GemStone___________ 'gs64stone'
GemNetId___________ 'gemnetobject'
GemStone NRS__________'!#netldi:gs64ldi#server!gs64stone'

browsing information:
Class_____________
Category__________ (as yet unclassified)
Source String Class__ String
```

These settings are set to default values when Topaz starts, and may be modified using the **set** command. See page 130 for details on **set** and the specific settings.

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."

`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 [*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 136.

This command cannot be abbreviated.

```
topaz 1> printit
{ 1 . 2} do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026), reason:numErrInt-
DivisionByZero, An attempt was made to divide 1 by zero. (ZeroDi-
vide)
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 *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 for GemStone/S 64 Bit*.

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-insenstive; 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 for GemStone/S 64 Bit*.

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 [*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."

All Topaz object specification formats (as described in "Specifying Objects" on page 34) 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 [*anInt*] [CLEAR]

thread
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 [CLEAR]

threads

Forces any dirty instances of GsProcess cached in VM stack memory to be flushed to object memory. 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
```

TOPAZPAUSEFORDEBUG [*errorNumber*]
TOPAZWAITFORDEBUG
STACKWAITFORDEBUG

These functions are provided to assist in internal debugging of sessions, and are not designed for customer use.

UNPROTECTMETHODS

Cancels the effect of **protectmethods**, which is used for consistency checking in filein scripts.

This command cannot be abbreviated.

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 includes parameters and temporaries for the frame. **stack up** is described on page 137.

```
topaz 1> run
{ 1 . 2 } do: [:x | x / 0 ]
%
ERROR 2026 , a ZeroDivide occurred (error 2026), reason:numErrInt-
DivisionByZero, 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
```

UPR [*anInteger*]
UPRB [*anInteger*]

These commands are used with Ruby applications, but not with Smalltalk applications.

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
```

WHRB [*anInteger*]
WHRUBY [*anInteger*]

These commands are used with Ruby applications, but not with Smalltalk applications.

Appendix

A Topaz Command-Line Syntax

When Topaz is invoked with the **-l** option, it initiates the program with a linked, as opposed to a remote (RPC) session. Other command-line options give additional control. This section presents the formal command syntax followed by a complete list of command-line options.

A.1 Command-Line Syntax

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 ] [ -n netLdiName ] [ -q ] [-I topazini] [ -i ]
    [ -u useName ] [ -h ] [ -v ]
```

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 [ -n netLdiName ] [ -e exeConfig ] [ -z systemConfig ] [-T
tocSizeKB] [ -q ] [-I topazini] [ -i ] [ -u useName ]
    [ -h ] [ -v ]
```

A.2 Options

Arguments are optional. Other than the -l option to specify linked topaz, these arguments may not be needed for a standard GemStone configuration.

-e *exeConfig*
Executable-specific configuration file. If this argument is not present, the Topaz command uses the customary GEMSTONE_EXE_CONF search sequence described in the "Configuration Files" chapter of your *GemStone/S 64 Bit System Administration Guide*. Only applies to linked sessions, and not available on Windows.

-h Print a usage line. Do not start topaz.

-i Ignore the topaz startup file `.topazini` (or on Windows, `topazini.tpz`).

-I *topazini*
Specify a complete path and file to a topazini initialization files, and use this rather then any `.topazini` (or on windows, `topazini.tpz`) in the default location.

-l Invoke the linked version of Topaz. In this version, Topaz and Gem (the GemStone session) exist as a single process. The linked version can run only one linked session; additional sessions are initiated as RPC sessions.

If subsequent login parameters set gemnetid to a version of `gemnetobject`, topaz will login RPC rather than linked, regardless of the -l option.

Not available on Windows.

-n *netLdiName*
The name of the NetLDI to use when connecting to the server. If you don't explicitly specify this parameter, Topaz will look for a NetLDI process with the name specified by the GEMSTONE_NRS_ALL environment variable, with the name 'gs64ldi'.

-q Start Topaz in quiet mode, suppressing printout of the banner and other information.

-r Invoke the remote procedure call version of Topaz. In this version, Gems exist as separate processes; linked sessions are not allowed. If you intend to run multiple GemStone sessions simultaneously, or if you will be running Topaz and your GemStone session on separate nodes, then you must use this version. This is the only type of login supported on Windows. If you don't specify **-l** or **-r**, Topaz defaults to the remote procedure call version.

-T *tocSizeKB*
Sets the GEM_TEMPOBJ_CACHE_SIZE that will be used. This overrides any settings provided in configuration files passed as arguments with the **-e** or **-z** options. Only applies to linked sessions, and not available on Windows.

-u *descriptiveString*
Pass a string to the topaz executable, which is not used by the executable itself, but may be useful in identifying processes in OS utilities such as `top` or `ps`.

-v Print topaz version, do not start topaz.

-z *systemConfig*
System configuration file. If this argument is not present, the topaz command uses the customary GEMSTONE_SYS_CONF search sequence described in the "Configuration Files" chapter of your *GemStone/S 64 Bit System Administration Guide*. Only applies to linked sessions, and not available on Windows.

Appendix

B 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.

B.1 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"
```

B.2 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 161. 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 described in the Syntax section. 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.

B.3 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**)

B.4 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 user on the target network. A valid password is needed only if the resource type requires authentication. **#encrypted** is used by GemStone utilities. If no authentication information is specified, the system will try to get it from the `.netrc` file. This type of authorization is the default.

username ::= *nrs-identifier*

If no user name is specified, the default is the current user.
(See the earlier discussion of *nrs-identifier*.)

password ::= *nrs-identifier*

If no password is specified, the system will try to obtain it from the user's `.netrc` file.
(See the earlier discussion of *nrs-identifier*.)

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`" (defined below) is used. (See the earlier discussion 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%P%M.log`" (defined below) is used. (See the earlier discussion 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
%M	machine's network node name
%N	executable's base name
%P	process pid
%U	user name
%%	%

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.

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