GemStone

GemStone Topaz

Programming Environment

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GemStone

Version 5.0

IMPORTANT NOTICE

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.

Assumptions

To make use of the information in this manual, you must be familiar with the GemStone system, described in the book *GemStone Technical Overview*, and the GemStone Smalltalk programming language, described in the *GemStone Programming Guide*. In addition, you should be familiar with your host operating system. This manual assumes that the GemStone database system has been correctly installed on your host computer, using the instructions in the *GemStone Installation Guide.*

How This Manual Is Organized

- Chapter 1 introduces you to Topaz. You'll learn how to run Topaz, how to log in to GemStone, how to create and execute GemStone Smalltalk code, and how to inspect GemStone objects.
- Chapter 2 shows how to use Topaz to debug your GemStone Smalltalk code.
- Chapter 3 describes the Topaz commands in alphabetical order.
- Appendix A lists the Topaz command line syntax.
- Appendix B lists the syntax for specifying the host machine for a GemStone file or process.

Typographical Conventions

This document uses the following typographical conventions:

- Command lines you type are shown in **bold** type. For example:

  ```
  % env | grep GEM
  ```

- Topaz commands and UNIX commands and are shown in **bold** type. For example:

  copyextent

- Smalltalk methods and instance variables, file names and paths, and screen dialogue examples are shown in `monospace` type. For example:

  ```
  markForCollection
  ```

- Place holders that are meant to be replaced with real values are shown in *italic* type. For example:

  StoneName.conf

Related GemStone Documentation

For more information about the GemStone database system and its development tools, refer to the following manuals:

- *GemStone Technical Overview*. Provides a general overview of the GemStone Object Database Management System. Use this book as a starting point for becoming familiar with GemStone.
- *Release Notes.* Describes information specific to current release of GemStone.

- *Installation Guide.* Describes installation and configuration of your GemStone system.
- *GemStone System Administration Guide.* Describes maintenance and administration of your GemStone system. System administrators often prefer the Topaz interface for its simplicity.
- *GemStone Programming Guide.* A programmer's guide to GemStone Smalltalk, GemStone's object-oriented programming language.
- *GemStone Kernel Reference.* A reference guide that provides descriptions of each of the GemStone kernel classes.

Technical Support

GemStone provides several sources for product information and support. GemStone product manuals provide extensive documentation, and should always be your first source of information. GemStone Technical Support engineers will refer you to these documents when applicable. However, you may need to contact Technical Support for the following reasons:

- Your technical question is not answered in the documentation.
- You receive an error message that directs you to contact GemStone Technical Support.
- You want to report a bug.
- You want to submit a feature request.

Questions concerning product availability, pricing, keyfiles, or future features should be directed to your GemStone account manager.

When contacting GemStone Technical Support, please be prepared to provide the following information:

- Your name, company name, and GemStone license number,
- the GemStone product and version you are using,
- the hardware platform and operating system you are using,
- a description of the problem or request,
- exact error message(s) received, if any.

Your GemStone support agreement may identify specific individuals who are responsible for submitting all support requests to GemStone. If so, please submit

your information through those individuals. All responses will be sent to authorized contacts only.

For non-emergency requests, you should contact Technical Support by email, Web form, or facsimile. You will receive confirmation of your request, and a request assignment number for tracking. Replies will be sent by email whenever possible, regardless of how they were received.

Email:support@gemstone.com
The preferred method of contact. Please do not send files larger than 100K (for example, core dumps) to this address. A special address for large files will be provided on request.

World Wide Web:http://www.gemstone.com
Technical Support is located under Services. A Help Request Form is available for request submissions. This form requires a password, which is free of charge but must be requested by completing the Registration Form, found in the same location. Allow 24 hours for your registration to be recorded and a password assigned.

Facsimile:(503) 629-8556
When you send a fax to Technical Support, you should also leave a voicemail message to make sure your fax will be picked up as soon as possible.

We recommend you use telephone contact only for more serious requests that require immediate evaluation, such as a production database that is non-operational.

Telephone:(800) 243-4772 or (503) 690-3503
Emergency requests will be handled by the first available engineer. If you are reporting an emergency and you receive a recorded message, do not use the voicemail option. Transfer your call to the operator, who will take a message and immediately contact an engineer.

Non-emergency requests received by telephone will be placed in the normal support queue for evaluation and response.

24x7 Emergency Technical Support

GemStone offers, at an additional charge, 24x7 emergency technical support. This support entitles customers to contact GemStone 24 hours a day, 7 days a week, 365 days a year, if they encounter problems that cause their production application to go down, or that have the potential to bring their production application down. Contact your GemStone account manager for more details.

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Chapter 1

Getting Started with Topaz

Topaz is a GemStone programming environment that provides keyboard command access to the GemStone ODBMS. Topaz does not require a windowing system and so is the interface of choice 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, your system administrator or GemStone data curator must first have installed the GemStone ODBMS on your system. You must have an operating repository monitor (or Stone process), and, to run the remote version of Topaz, an accessible network service process (netldi). The GemStone *Installation Guide* explains how to install these components.

Your environment must contain a definition of the `GEMSTONE` variable and your execution path must include the GemStone binary directory (`$GEMSTONE/bin` on UNIX systems, `GEMSTONE\bin` on Windows NT). Consult your system administrator or GemStone data curator if you need help with this.

Examples throughout this book were created on a UNIX system. Behavior and appearance of Topaz on Windows systems is the same, except where noted.

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 Object-Oriented Data Management System      |
|        Copyright (C) GemStone Systems, Inc. 1986-1996.      |
|              All rights reserved.             |
+-------------------------------------------------------------------------+
|  PROGRAM: TOPAZRPC, Linear GemStone Interface (Remote Session)    |
|  VERSION: 5.0, Thu Mar 7 21:01:16 US/Pacific 1996          |
| BUILT FOR: SPARC (Solaris 2.3)                     |
| RUNNING ON: 1-CPU handel sun4c (Solaris 2.4 Generic_101945-27)40MHz,64Mb|
| PROCESS ID: 3462    DATE: Wed 24 Apr 1996 13:42:41 PDT        |
|_________________________________________________________________________|
topaz>
```

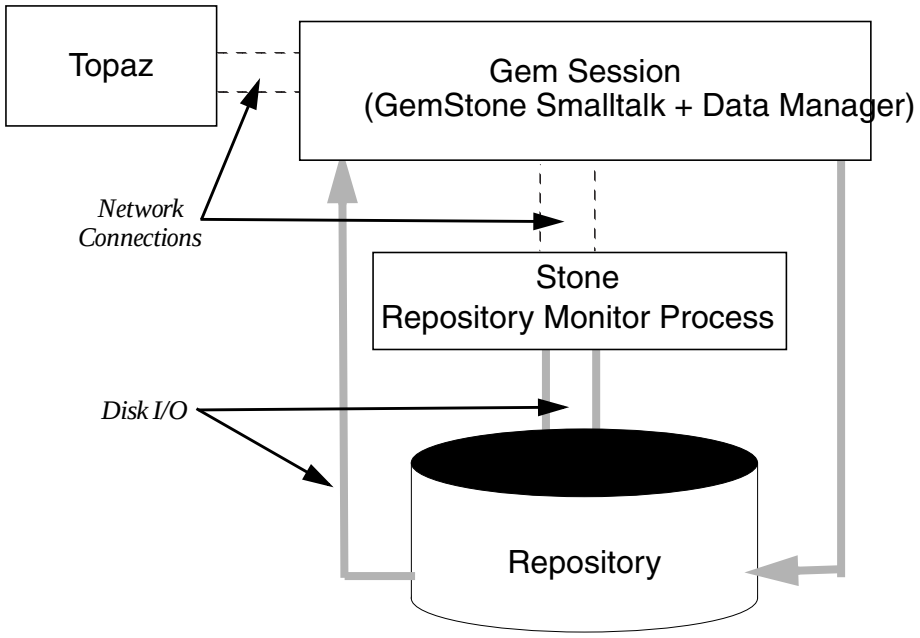
Type the **topaz** command and verify that it responds as shown. If you have problems invoking Topaz, review the requirements listed on the previous page or consult your system administrator or your GemStone data curator.

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 `TOPAZRPC` and `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. The linked Topaz session provides faster throughput than the RPC version and is required for certain system administration tasks, such as upgrading the repository.

Under Windows NT, the linked and RPC versions of Topaz can be invoked by double-clicking their icons in the program manager.

The examples in this chapter can be executed equally well from either version of 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:

- **The GemStone name** (gemstone). 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 `gemserver50`. If your Stone process is named `gemserver50` 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 `gemstone50` running on node `central`, you can use a network resource string of the form `!@central!gemstone50`. This assumes TCP/IP, the default network connection for UNIX. Your GemStone data curator can give you the exact string to use. Appendix B describes the syntax of network resource strings.

- **Your GemStone user name and password** (username). Your GemStone data curator can give you these.

- **Your host user name and password** (hostusername and hostpassword). The name and password that you use when you log in to the host operating system. These are needed only for RPC sessions.

- **The GemStone service name** (gemnetid). For the RPC version the default is `gemnetobject`. Under UNIX, if you use the C shell (`/bin/csh`) on the node where your Gem process will run, you should use the GemStone service name `gemnetobjcsh` instead. For the linked version of Topaz, set the gemnetid to '' (null) or `gcilinkobj`. Otherwise, all your sessions will be RPC. You can use a network resource string of the form `!tcp@central!gemnetobject` to start a Gem process on a remote node.

Your GemStone data curator can assist you if you encounter difficulties.

In general, you can abbreviate any 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 gemserver50
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 version of Topaz. If you are running the RPC version, 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: 1
 omit oops
 omit bytes
 display instance variable names
 omit automatic result checks
 omit interactive pause on errors
EditorName_________
Connection Information:
UserName___________ 'Isaac Newton'
Password __________ (set)
HostUserName______ 'newtoni'
HostPassword _____ (set)
GemStone___________ 'gemserver50'
GemNetId___________ 'gemnetobject'
GemStone
NRS____________'!#auth:newtoni@password#server!gemserver50'
browsing information:
Class_______________
Category____________ (as yet unclassified)
Source String Class__ String
```

If you are using the linked version of Topaz, certain login parameters (`HostUserName`, `HostPassword`, and `GemNetId`) have no effect.

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)
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 gemserver50 user 'Isaac Newton'
topaz> set gemnetid gemnetobject hostuser 'newtoni'
topaz> set hostpass <return>
Host Password?   (type your host password)
topaz> login
...
```

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 use a single **set** command line to log in:

```
topaz> set gemstone gemserver50 user 'Isaac Newton' password gravity
topaz> login
...
```

Setting Up a Login Initialization File

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

Table 1.1 Topaz Initialization File Names

Platform	Name of Topaz Initialization File	Expected Location
UNIX	.topazini	Current directory, then user's home directory
Windows NT	topazini.tpz	Current directory, then user's home directory. If home directory is undefined, uses home directory of the account that started NT, if any, or `DRIVE:\users\default` where `DRIVE` is the local device on which NT is installed.

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 gemserver50
set gemnetid gemnetobject
set username 'Isaac Newton'
set password   mypassword
set hostusername 'newtoni'
set hostpassword   hostpassword
login
```

To start Topaz without using the initialization file, use the **-i** option. See Appendix A.

Once Topaz has read an initialization file like this one, logging in is quite simple:

```
% topaz
```

With TCP/IP, you can store user account information in a network initialization file. If you do not explicitly supply a host username and password, on UNIX hosts Topaz tries to find a username and password for the designated node in the file $HOME/.netrc. If that file is properly configured, you won't need to explicitly supply a host user name and password each time you log in. For information about how to configure your network initialization file, see the discussion of **set hostusername** in Chapter 3 of this manual.

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>
```

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
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.

Help is available for:
                (list of topics)
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 a class named Animal.

```
topaz 1>  printit
Object subclass: 'Animal'
      instVarNames: #('name' 'favoriteFood' 'habitat')
      inDictionary: UserGlobals
%
Animal class
 superClass          Object class
 format              0
 instVars            3
 instVarNames        an Array
 constraints         an Array
 classVars           a SymbolDictionary
 methodDict          a SymbolDictionary
 poolDictionaries    an Array
 categories          a SymbolDictionary
 secondarySuperclasses nil
 name                Animal
 ...
 UserId              Isaac Newton
 extraDict           a SymbolDictionary
topaz 1>
```

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 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 1-16 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 ordinarily prints the name and value of each of the object's instance variables.

```
topaz 1> printit
Animal
%
Animal class
 superClass          Object class
 format              0
 instVars            3
 instVarNames        an Array
 constraints         an Array
 classVars           a SymbolDictionary
 methodDict          a SymbolDictionary
 poolDictionaries    an Array
 categories          a SymbolDictionary
 secondarySuperclasses nil
 name                Animal
 ...
 UserId              Isaac Newton
 extraDict           a SymbolDictionary
```

In other words, the default Topaz result display is one level deep. You can use the **level** command to ask for more or less information about results. Setting the level to 0 would give this view of Animal:

```
topaz 1>  level 0
topaz 1>  printit
Animal
%
Animal
```

The following example shows part of a two-level display:

```
topaz 1>  level 2
topaz 1>  printit
Animal
%
Animal class
      superClass         Object class
            superClass         NIL
            format             0
            instVars           0
            instVarNames       an InvariantArray
            constraints        an InvariantArray
            classVars          a SymbolDictionary
            methodDict         a SymbolDictionary
            poolDictionaries   an Array
            categories         a SymbolDictionary
            secondarySuperclasses nil
            name               Object
            classHistory       a ClassHistory
            description        a GsClassDocumentation
            migrationDestination nil
            timeStamp          27/06/1995 18:34:01
            userId             SystemUser
      format             0
      instVars           3
      instVarNames       an Array
            #1 name
            #2 favoriteFood
            #3 habitat
...
```

As you can see, setting the display level to 2 causes Topaz to display each instance variable within each of class Animal'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 class Animal, 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
Animal
%
Animal class
 i1 Object class
 i2 0
 i3 3
 i4 an Array
 i5 an Array
 i6 a SymbolDictionary
 i7 a SymbolDictionary
 i8 an Array
 i9 a SymbolDictionary
 i10 nil
 i11 Animal
      ...
```

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:

```
[151141 sz:6 cls: 1733 Symbol]
```

Each object header contains:

- The object's OOP (a 32-bit signed 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

For example:

```
topaz 1>  display oops
topaz 1>  printit
Animal
%
[150621 sz:19 cls: 150617 Animal class] Animal class
 superClass    [1045 sz:19 cls: 18945 Object class] Object class
 format     [19 sz:0 cls: 1161 SmallInteger] 4
 instVars    [3 sz:0 cls: 1161 SmallInteger] 0
 instVarNames  [150613 sz:0 cls: 1045 Array] an Array
 constraints   [150593 sz:0 cls: 1045 Array] an Array
 classVars    [150589 sz:14 cls: 1741 SymbolDictionary] a SymbolDictionary
 methodDict    [150633 sz:112 cls: 1549 GsMethodDictionary] a GsMethodDictionary
 poolDictionaries [150561 sz:0 cls: 1045 Array] an Array
 categories    [150637 sz:28 cls: 1549 GsMethodDictionary] a GsMethodDictionary
 secondarySuperclasses [10 sz:0 cls: 1193 UndefinedObject] nil
 name      [147877 sz:9 cls: 1733 Symbol] Animal
...
```

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

1.9 Creating and Changing Methods

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
```

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 circumflex (^) 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

- 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. 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:

```
printit
Object subclass: 'Animal'
 instVarNames: #( 'name' 'favoriteFood' 'habitat')
 classVars: #()
 classInstVars: #()
 poolDictionaries: #[]
 inDictionary: UserGlobals
 constraints: #[ ]
 instancesInvariant: false
 isModifiable: false
%
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 (usually your terminal), you can use the **input** command to make Topaz take its input from a file. The following command, for instance, 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 **Control-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 **Control-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 **Control-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 **Control-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.

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
topaz 1>  set gemstone !tcp@srv2!gemserver50
topaz 1>  set username isaac
 Warning: clearing previous GemStone password.
GemStone password?   <password typed here but not echoed>
topaz 1>  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: 1 UserId: GcUser
session number: 2 UserId: Isaac Newton
session number: 3 UserId: Isaac Newton
session number: 4 UserId: Gottfried Leibniz
topaz 1>
```

The GcUser session represents the garbage collection process that usually (though not always) operates when GemStone is active.

Keep in mind that this list is useful only as a general reminder of how many sessions you have on the system; 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 **topaz -l** command to invoke Topaz, your first session is linked. All other sessions are RPC. However, if you type **topaz -l** and get any number other than 1 in your Topaz prompt, you have an RPC session. If you want a linked session, you need to reset the gemnetid to '' (null) and log in again. The new linked session will have a prompt of `topaz 1>` .

```
topaz> set gemnetid gemnetobject
topaz> login
GemStone password?   <password typed here but not echoed>
topaz 2>  set gemnetid ''
topaz 2>  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*
A signed 32-bit decimal OOP value that denotes an object.

integer
A 31-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).

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
[150621 sz:19 cls: 150617 Animal class] Animal class
 superClass    [1045 sz:19 cls: 18945 Object class] Object class
 format      [19 sz:0 cls: 1161 SmallInteger] 4
 instVars     [3 sz:0 cls: 1161 SmallInteger] 0
 instVarNames  [150613 sz:0 cls: 1045 Array] an Array
[4786 sz:10 cls: 4789] Animal class
 superClass    [282 sz:10 cls: 805]   Object class
 format      [-1073741824 sz:0 cls: 290] 0
 instVars     [-1073741821 sz:0 cls: 290] 3
instVarNames [4792 sz:3 cls: 261] an Array
...
topaz 1> ! Look at first element of instVarNames array
topaz 1> object @4792 at: 1
[4797 sz:4 cls: 293]   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 @4792.

1.19 Defining Local Variables

As you saw in the last section, Topaz lets you refer to objects via their OOPs. Because 32-bit 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
[4786 sz:10 cls: 4789]  Animal class
 superClass   [282 sz:10 cls: 805]  Object class
 format     [-1073741824 sz:0 cls: 290] 0
 instVars    [-1073741821 sz:0 cls: 290] 3
instVarNames   [4792 sz:3 cls: 261]  an Array
...
topaz 1>  define animalVars @4792
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
------------------------
 ErrorCount     = nil
 SourceStringClass = 1169
 CurrentCategory  = nil
 CurrentClass    = nil
 ErrorProcess    = nil
 LastResult     = 147709
 LastText      = nil
 myUserProfile   = 13837
```

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

In this status report the user-defined local variables are listed first. The last seven items are local variables that Topaz automatically creates for you. They refer, respectively, to the number of Topaz and GemStone errors made since you started Topaz, the current category and class, the last GemStone Smalltalk execution error stack, the last execution result, the text of the last GemStone Smalltalk expression executed or compiled, and 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 1-25. For example:

```
topaz 1>  send @4230 class
a Metaclass
 superClass   a Metaclass
 format 24
 ...
 categories   a SymbolDictionary
 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. It happens that the locations of step points also determine where breakpoints can be set.

Generally, step points correspond to message-sends, method returns and assignments. 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 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 _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

You can display all of the contexts in the active call stack by issuing the **stack** command with no arguments. Here's an example of the stack display when **display oops** is active:

```
topaz 1>  display oops
topaz 1>  stack
1 Behavior >> new @ 1  [GsMethod 10941]
  receiver [208201 sz:19 cls: 208173 Animal class] Animal class
2 Executed Code @ 2  [GsMethod 208709]
  receiver [10 sz:0 cls: 1193 UndefinedObject] nil
  aDog [10 sz:0 cls: 1193 UndefinedObject] nil
 [GsProcess 208669]
```

Here's the equivalent display when **omit oops** is active:

```
topaz 1>  omit oops
topaz 1>  stack
1 Behavior >> new @ 1
  receiver Animal class
2 Executed Code @ 2
  receiver nil
  aDog nil
```

As shown here, the display of each context includes the following information:

- the level number of the context (for subsequent use with the **stack scope** command, described later)
- the OOP of the GsMethod (if **display oops** is active)
- the class of the receiver (and its OOP, if **display oops** is active)
- the class of the method invoked
- the selector of the method

- the current step point within the method, if any (an integer)
- parameters and temporaries for this context (including 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**.

In the example stack list given above, an invocation of the method new is found at the top of the stack. The message was sent to the class Animal. Execution of the method was halted at step point 1.

In the next item on the stack, the method was send to an undefined receiver. Execution of this method halted at step point 2.

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 replaces the value on the top of the stack with another object before it attempts to continue execution.

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 the context specified by the last **stack scope**, **stack up**, or **stack down** command, or otherwise the top of the stack.

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 virutal 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`, you could obtain its value by typing **temporary** and the variable name:

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

which returns a count of 5 in this example. Similarly, you can use the **temporary** command to assign a new value to a temporary variable:

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

When program execution pauses at a breakpoint, Topaz adds some temporaries to your local scope. The nature of these temporaries depends on the type of the current expression:

return
Topaz creates a temporary called `_returnValue` that shows the value to be returned.

assignment
Topaz creates `_newValue`, which holds the value to be assigned.

message-send
Topaz creates `_receiver` to show the receiver, and argument temporaries called `_arg1`, `_arg2`, and so on, to hold argument values.

The **temporary** command displays the values of these Topaz-created temporaries, when they exist.

Select a Context for Examination and Debugging

The Topaz command **stack scope** lets you redefine the active context (used by the **temporary**, **stack**, and **list** commands) within the current call stack. Recall the stack we examined earlier:

```
topaz 1>  stack
1 Behavior >> new @ 1
  receiver Animal class
2 Executed Code @ 2
  receiver nil
  aDog nil
```

To show the active context, type:

```
topaz 1>  stack scope
1 Behavior >> new @ 1
```

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

```
topaz 1>  stack scope 2
2 Executed Code @ 2
```

Now confirm that Topaz redefined the active context:

```
topaz 1>  stack scope
2 Executed Code @ 2
```

Redefine the Active Call Stack

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

```
topaz 1>  stack all
*1  Behavior >> new @ 1
 2  Animal >> habitat @ 3
 3  Executed Code @ 2
```

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 2
Stack 2 selected
1 Animal >> habitat @ 3
2 Executed Code @ 3
```

Chapter 3

Command Dictionary

This chapter provides brief descriptions of the Topaz commands for quick reference. The commands are presented 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**, **logout**, **removeallmethods:**, **removeallclassmethods:**, **output push**, and **output pop**.

Topaz commands are case-insensitive. Thus, **Time**, **TIME**, and **time** are regarded 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, because GemStone Smalltalk, the language of category names, is case-sensitive. The same is true of UNIX path names, in commands such as **output push myFile.out**, and UNIX user names and passwords.

In general, objects passed as arguments to Topaz commands can be specified using any of the formats described in "Specifying Objects" on page 1-25.

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

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.

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

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 in the *GemStone Kernel Reference.* Although you can abbreviate most other Topaz commands and parameter names, **begin** must be typed in full.

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*
A signed 32-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 aSelector* **`[@`** *anInt*`]`
Establishes a method breakpoint on the given instance method.

`break classmethod` *aClassName aSelector* **`[@`** *anInt*`]`
Establishes a method breakpoint on the given class method.

break method ^ *aSelector* **[@** *anInt***]**
Establishes a method breakpoint on the given instance method for the current class.

break classmethod ^ *aSelector* **[@** *anInt***]**
Establishes a method breakpoint on the given class method for the current class.

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

CONTINUE [*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 1-25.

For more information about breakpoints, see the discussion of the **break** command on page 3-5, 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 protocol for Object in the *GemStone Kernel Reference*.

For information about user-defined errors, see the discussion of error-handling in the *GemStone Programming Guide*. User manuals for the GemStone interfaces, such as GemBuilder for *Smalltalk* and GemBuilder for C++ , 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 1-25) 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.

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 32-bit signed 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 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. 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 **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 **`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:

`Pausing after error...`

and waits for the user to press the **Return** key to continue execution. Pressing **Control-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.

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 -1073741821
```

If you use this command to execute a GemStone Smalltalk host file access method, such as `GsFile | openRead:` or `openWrite:`, and you do not supply an explicit path specification as part of the method argument, the default directory for the method depends on the version of the Topaz that you are running. With linked Topaz, the default directory is the directory in which Topaz was started. With RPC Topaz, the default directory is the `$HOME` directory of the hostuser account.

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 **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 **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 **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 **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 *aSelector*

edit method: *aSelector*
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: *aSelector*
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 **printit** command, as well as errors in Topaz command processing.

If **expecterror** is specified immediately before a compile or execute command (**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. It is equivalent to

topaz 1> **`object ErrorCount`**

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

EXIT

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

EXPECTBUG *bugNumber*

value *resultSpec* **[** *integer* **]** **|**
error *errCategory errNumber* **[** *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 3-24).

errorCategory and *errNumber* are specified as in the **expecterror** command (page 3-21).

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 anErrorNumber* **[***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 **printit**, **doit**, **method**:, **classmethod**:, **commit**, and **send**.

anErrorCategory must be the object identifier of an error category, and *anErrorNumber* must be a SmallInteger. For example:

```
GemStoneError 2010
```

All Topaz object specification formats (as described in "Specifying Objects" on page 1-25) are legal in **expecterror** commands. In addition, this command takes two more formats that allow you 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 (*literalObjectSpec*), Topaz regards it as matching the result if the two are equal (=).

If *anErrorArg* is an object specification (*ObjectSpec*), Topaz regards it as matching the result if the two are identical (==).

If you care about the number of error arguments, put that many *anErrorArg* tokens on the command line. The error count is incremented if the actual error contains fewer arguments than were specified in the **expecterror** command; it is not

incremented if the error contains more arguments than specified. If you don't care about the class of the error arguments, specify /Object for each one.

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, nor is any additional annotation returned.

```
topaz 1>  errorcount
0
topaz 1>  expecterror GemStoneError 2010 1 /Symbol
topaz 1>  printit
1 x
%
------------------------------------------------------
GemStone: Error     Nonfatal
No method was found for the selector #x when sent to 1
with arguments
contained in anArray( ).
Error Category: [GemStone] Number: 2010 Arg Count: 3
Arg 1: 1
Arg 2: x
Arg 3: an Array
topaz 1>  errorcount
0
topaz 1>
```

If execution returns unanticipated results, Topaz prints a message (in this example, "ERROR: WRONG ERROR CATEGORY / NUMBER"), 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>  expecterror GemStoneError 2010 1 /Symbol
topaz 1>  printit
'abc' at: 5
%
------------------------------------------------------
GemStone: Error     Nonfatal
An indexable object or NSC 'abc' was referenced with an
index 5 that was out of range.
Error Category: [GemStone] Number: 2003 Arg Count: 2
Arg 1: abc
Arg 2: 5
ERROR: WRONG ERROR CATEGORY/NUMBER
Now executing the following command saved from "iferror":
  stack
1 System class >> signal:args:signalDictionary: @ 10
 anInteger  2003
 anArray  an Array
  #1 abc
  #2 5
 anErrorDict  a LanguageDictionary
...
topaz 1>  errorcount
1
topaz 1>
```

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 **printit**, **doit**, **method**:, **classmethod**:, **commit**, and **send**.

All Topaz object specification formats (as described in "Specifying Objects" on page 1-25) are legal in **expectvalue** commands. In addition, this command takes two more formats that allow you to specify instances of classes:

`%`*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 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>  iferror stack
topaz 1>  expectvalue %SmallInteger
topaz 1>  errorcount
0
%
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>
```

FILEOUT *aSubCommandOrSelector* **[TOFILE:** *aFileName***]**

Writes out class-related information in a format that can be fed back into Topaz with the **input** command. To send this information to a file, use the **toFile:** keyword. For example:

```
topaz 1> fileout class: Object toFile: object.opl
```

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.

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: *aSelector*
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: *aSelector*
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 *aSelector*
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 as shown here.

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

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.

IFERROR [*aTopazCommandLine*]

The **iferror** command works whenever an error is reported.

This command executes *aTopazCommandLine* whenever a later command returns an unexpected error or unexpected return value. You can use up to five **expecterror** and **expectvalue** commands to specify expected errors and return values.

The *aTopazCommandLine* argument is saved as an unparsed Topaz command line, which is executed each time the ErrorCount variable is incremented.

To turn off the behavior, enter **ifError** without an argument.

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 **ifError** command line.

```
topaz 1>  iferror stack
topaz 1>  expecterror GemStoneError 2109
topaz 1>  printit
...
%
```

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.

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.

LIMIT [BYTES | OOPS] *anInteger*

Tells Topaz how much of any individual object to display in GemStone Smalltalk results. For example, a limit of 80 would tell Topaz to display no more than 80 bytes (or oops) of any individual object. Setting a limit of 0 tells Topaz not to limit the size of the output. By default, Topaz attempts to display all of an object, no matter how long.

`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.

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

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.

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.

Listing Methods

`list` *aSelector*

`list method:` *aSelector*
Lists the source code of the specified instance method for the current class.

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 classmethod:` *aSelector*
Lists the category and the source code of the specified class method for the current class.

list
Lists the source code of the active method context. See Chapter 2, “Debugging Your GemStone Smalltalk Code.

Listing Step Points

list steps
Lists the source code of the active method context, and displays step points in that source code.

list steps method: *aSelector*
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: *aSelector*
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 active method context, 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: *aSelector*
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 _validateClass: CharacterCollection .
*         ^2                *******
  ^ aCharCollection > self
```

list breaks classmethod: *aSelector*
Lists the source code of the specified class method for the current class, and displays the method breakpoints currently set in that method.

LOADUA *aFileName*

Loads the application user action library specified by *aFileName*. This command must be used before **login**. This command can not 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. 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 3-52. 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.

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

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`."

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 1-25 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 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 **`printit`** commands. You can still check the result of an individual **printit** 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
```

OPAL

Included for compatibility with previous versions. See the **doit** command on page 3-15.

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

Controls where Topaz output is sent. Normally Topaz sends output to standard output (stdout). 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. 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 (`&`).

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

`output` *aFileName* **`only`**

`output push` *aFileName* **`only`**
Sends output to the specified file, but does not echo that output to standard output (usually, your screen).

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

`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.

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

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
```

Executing GemStone Smalltalk Host File Access Methods

If you use this command to execute a GemStone Smalltalk host file access method, and you do not supply an explicit path specification as part of the method argument, the default directory for the GemStone Smalltalk method depends on the version of the Topaz that you are running. With linked Topaz, the default directory is the directory in which Topaz was started. With the RPC version, the default directory is the $HOME directory of the hostuser account.

QUIT

Leaves Topaz, returning to the operating system. If you are still logged in to GemStone when you type **quit**, this aborts your transactions and logs out all active sessions. Although you can abbreviate most other Topaz commands and parameter names, **quit** must be typed in full.

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.

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.

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

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.

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

RUN

Included for compatibility with previous versions. See the **printit** command on page 3-45.

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 1-25) are legal in **send** commands.

SET *aTopazParameter* **[***aParamValue***]**

The **set** command allows you to select a class and category to work with in examining, modifying, and creating classes with the **list** and **edit** commands. You'll also use **set** in establishing your GemStone login parameters.

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 gemserver50 user DataCurator
```

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.

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 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. However, if you use the UNIX C shell (`/bin/csh`) on the given Gem network node, specify the GemStone service name `gemnetobjcsh` instead of `gemnetobject`.

For a linked Topaz session, the default is `gcilnkobj`. Before you log in, use the status command to make sure that this parameter is `gcilnkobj` or '' (null). This causes **topaz -l** to make the first session a linked session. If **gemnetid** is set to anything else, **topaz -l** starts RPC sessions. In this case, the prompt for the first session 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 nil:

```
set gemnetid: ''
```

or to `gcilnkobj`. Once you have a linked session, any additional sessions are RPC, regardless of the **gemnetid** setting.

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:

```
!tcp@lichen!gemnetobject
```

To specify a Gem running on the current node, omit the *protocol*`@`*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 `gemserver50`; if this doesn't work for you, see your GemStone data curator.

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 `gemserver50` on node lichen could be described in network resource string syntax as:

```
!tcp@lichen!gemserver50
```

To specify a Stone running on the same node as the Gem, omit the *protocol*`@`*node* portion of the string, and specify only the Stone name: `gemserver50`. Appendix B describes network resource string syntax.

`set hostpassword:` *aPassword*
Sets the host 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 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.

With TCP/IP, if you do not explicitly supply a host username and password, Topaz will try to find a username for the designated node in a file in your home directory. See the following discussion of **set hostusername**.

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.

With TCP/IP, if you do not explicitly supply a host username and password, Topaz tries to find a username and password for the designated node in a network initialization file in your home directory. Under UNIX, that file is `$HOME/.netrc` and should contain lines of the form

`machine` *aNode* `login` *aUsername* `password` *aPassword*

For example, `$HOME/.netrc` under UNIX:

```
machine alf login joebob password mypassword
```

Because the network initialization file contains your password, you should ensure that others — group or world — do not have authorization to read it.

To clear the hostusername field, enter:

```
topaz 1>  set hostusername *
```

For a linked Topaz session, **set hostusername** has no effect. (No separate Gem process is created on the host computer.) It is required, however, if you spawn new sessions while you are running linked Topaz, because the additional sessions are always RPC Topaz.

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: *aClass*
Sets the class used to instantiate Smalltalk source strings generated by the **run**, **edit**, **method**, and **classmethod** commands. For example:

```
set sourcestringclass String
set sourcestringclass DoubleByteString
set sourcestringclass IsoLatin
```

The Topaz **status** command shows the current source class. The default source class is String. The **set session** command resets the source string class to the default.

`set username:` *aGemStoneUsername*
Establishes a GemStone user ID for the next login attempt. Your GemStone data curator can tell you your user name.

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).

If you supply parameters on the **shell** command line, they pass to a subprocess as a command for execution. For example:

```
topaz 1>  shell ls -l /user1/janec.topaz
total 4
-rw-r--r-- 1 janec 196 Jul 1 22:31 animal.opl
-rw-r--r-- 1 janec 139 Jul 1 22:31 animaltest.log
-rw-r--r-- 1 janec 287 Jul 1 22:31 mathtest.log
-rw-r--r-- 1 janec 110 Jul 1 22:32 mathtest2.log
topaz 1>
```

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). 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 3-57.

STACK [*aSubCommand*]

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 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 display the contexts in the active call stack; redefine the active context for debugging commands within the active call stack; reset whether the active call stack is automatically saved before certain Topaz execution commands are performed; display the top context of each saved call stacks; redefine the active call stack; or remove one or all call stacks.

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 OOP of the GsMethod (if **display oops** is active)
- the class of the receiver (and its OOP, if you have specified **display oops**)
- the class of the GsMethod
- selector of the method
- its level number (as used in the **stack scope** command)
- the current step point (that is, assignment, message send, or method return) within the method (an integer, as in **list steps**)
- parameters and temporaries for this context (including OOPs, if you have specified **display oops**)

If any context in the display is a block, the display for that context begins with SimpleBlock or ComplexBlock, as shown in the examples below.

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

The active context resets to 1 whenever any of the following commands is executed: **printit**, **send**, **doit**, **step**, **edit last**, or **edit new text**.

Here are two examples of the stack display when **display oops** is active:

```
topaz 1>  run
#[ 1, 2] do:[ :x | x pause ]
%
Execution has been suspended by a "pause" message.
topaz 1>  lev 0
topaz 1>  display oops
topaz 1>  stack
1 Object >> pause @ 2  [GsMethod 49341]
  receiver [7 sz:0 cls: 1161 SmallInteger] 1
2 SimpleBlock in Executed Code @ 3  [GsMethod 152081]
  self [10 sz:0 cls: 1193 UndefinedObject] nil
  receiver [152077 sz:9 cls: 1329 SimpleBlock] aSimpleBlock
  x [7 sz:0 cls: 1161 SmallInteger] 1
3 Collection >> do: @ 5  [GsMethod 33553]
  receiver [152041 sz:2 cls: 1045 Array] anArray
  aBlock [152077 sz:9 cls: 1329 SimpleBlock] aSimpleBlock
  i [7 sz:0 cls: 1161 SmallInteger] 1
  _temp1 [7 sz:0 cls: 1161 SmallInteger] 1
  _temp2 [11 sz:0 cls: 1161 SmallInteger] 2
  _temp3 [7 sz:0 cls: 1161 SmallInteger] 1
4 Executed Code @ 4  [GsMethod 152081]
  receiver [10 sz:0 cls: 1193 UndefinedObject] nil
 [GsProcess 152025]
```

```
topaz 1>  run
| y |
#[ 1, 2] do:[ :x | y := x . x pause ]
%
Execution has been suspended by a "pause" message.
topaz 1>  display oops
topaz 1>  stack
1 Object >> pause @ 2  [GsMethod 49341]
  receiver [7 sz:0 cls: 1161 SmallInteger] 1
2 ComplexBlock in Executed Code @ 4  [GsMethod 151533]
  self [10 sz:0 cls: 1193 UndefinedObject] nil
  receiver [151501 sz:11 cls: 1333 ComplexBlock] aComplexBlock
  x [7 sz:0 cls: 1161 SmallInteger] 1
```

```
3 Collection >> do: @ 5  [GsMethod 33553]
  receiver [151505 sz:2 cls: 1045 Array] anArray
  aBlock [151501 sz:11 cls: 1333 ComplexBlock] aComplexBlock
  i [7 sz:0 cls: 1161 SmallInteger] 1
  _temp1 [7 sz:0 cls: 1161 SmallInteger] 1
  _temp2 [11 sz:0 cls: 1161 SmallInteger] 2
  _temp3 [7 sz:0 cls: 1161 SmallInteger] 1
4 Executed Code @ 5  [GsMethod 151533]
  receiver [10 sz:0 cls: 1193 UndefinedObject] nil
  y [7 sz:0 cls: 1161 SmallInteger] 1
 [GsProcess 151497]
```

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 scope, starting with the active context. For example:

```
topaz 1>  stack scope
1 Behavior >> new @ 1
```

stack scope *anInt*
Redefines the active context within the active call stack and displays the new context. The integer 1 represents the currently active context, while the integer 2 represents the *caller* of the active context.

stack up
Moves the current scope up one level toward the top of the stack and displays the new context. This is equivalent to the command line:

stack scope < *current scope + 1*>

stack down
Moves the current scope down one level away from the top of the stack and displays the new context. This is equivalent to the command line:

stack scope < *current scope - 1*>

stack trim
Trims the stack so that the current scope 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 activation of an ExecutableBlock.

Save or Delete the Active Call Stack During Execution

stack nosave
Causes your active call stack to be deleted before executing any of the following commands: **printit**, **send**, **doit**, **edit last**, or **edit new text**.

This is the default condition.

stack save
Automatically saves the active call stack before executing any of the commands listed for **stack nosave** (above).

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
*1 Behavior >> new @ 1
 2 Animal >> habitat @ 3
 3 Executed Code @ 2
```

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

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 one frame of the newly selected call stack.

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: **printit**, **send**, **doit**, **edit last**, or **edit new text**.

stack delete all
Removes all call stacks.

STATUS

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

For example:

```
topaz 1>  status
Current settings are:
   display level: 1
   omit oops
   omit bytes
   display instance variable names
   omit automatic result checks
   omit interactive pause on errors
EditorName_________ gnumacs -nw
Connection Information:
UserName___________ 'Isaac Newton'
Password ___________ (set)
HostUserName_______ 'newtoni'
HostPassword_______ (set)
GemStone___________ 'gemserver50'
GemNetId___________ 'gemnetobject'
GemStone
NRS___________'!#auth:newtoni@password#server!gemserver50'
browsing information:
Class______________
Category___________ (as yet unclassified)
Source String Class__ String
```

STEP (OVER | INTO)

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 active context or its caller. The active context is the top of the stack or the context specified by the last **stack scope**, **stack up**, or **stack down** command.

`step into`
Advances execution to the next step point in your GemStone Smalltalk code.

TEMPORARY [*aTempName*[*/anInt*] [*anObjectSpec*]]

Displays or redefines the value of one or more temporaries in the active context previously specified by a **stack** or **stack scope** command. The **stack 1** command shows the currently active context. 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 1-25) are legal in **temporary** commands.

temporary
Displays the names and values of all temporary objects in the active context.

temporary *aTempName*
Displays the value of the first temporary object with the specified name in the active context.

```
topaz 1> temporary preferences
preferences    an Array
```

temporary *aTempName anObjectSpec*
Redefines the specified temporary in the active context to have the value *anObjectSpec*.

temporary *anInt*
Displays the value of the temporary at offset *n* in the active context. 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 active context to have the value *anObjectSpec*.

Temporaries displayed as _temp# are un-named temporaries private to the virtual machine, like the temporaries used in evaluation of the optimized to:do:, shown in the example below.

```
topaz 1>  run
| a |
1 to: 25 do:[:j | a := j . a pause ]
%
Execution has been suspended by a "pause" message.
topaz 1> stack
1 Object >> pause @ 2  [GsMethod 49341]
  receiver [7 sz:0 cls: 1161 SmallInteger] 1
2 Executed Code @ 4  [GsMethod 151081]
  receiver [10 sz:0 cls: 1193 UndefinedObject] nil
  a [7 sz:0 cls: 1161 SmallInteger] 1
  j [7 sz:0 cls: 1161 SmallInteger] 1
  _temp1 [7 sz:0 cls: 1161 SmallInteger] 1
  _temp2 [103 sz:0 cls: 1161 SmallInteger] 25
  _temp3 [7 sz:0 cls: 1161 SmallInteger] 1
 [GsProcess 151069]
```

TIME

Displays the current time from the system clock.

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 ] [ -i ]  [ -h ]
```

When invoked with the **-l** option, Topaz runs in linked mode. The command line accepts some additional options for the linked version:

```
topaz -l [  -n netLdiName ] [  -e exeConfig ] [  -z systemConfig ]
[  -i ] [ -h ]
```

A.2 Options

Arguments are optional, and are not needed for a standard GemStone configuration.

-l Invoke the linked version of Topaz. In this version, Topaz and Gem (the GemStone session) exist as a single process, which significantly enhances performance. The linked version can run only one linked session. Any additional sessions are initiated as remote procedure call sessions. If you don't specify this parameter, the remote procedure call version of Topaz is invoked.

-r Invoke the remote procedure call version of Topaz. In this version, Gems exist as separate processes. 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. If you don't specify **-l** or **-r**, Topaz defaults to the remote procedure call version.

-n *netLdiName*
The name of the network server process. This may be specified as a GemStone network resource specification. If you don't explicitly specify this parameter, Topaz will look for

(1) a name specified by the GEMSTONE_NRS_ALL environment variable

(2) a GemStone network server named netldi50

-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 System Administration Guide.*

-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 System Administration Guide.*

-i Ignore the topaz startup file (on UNIX ignore the file `.topazini`).

-h Print a usage line and exit.

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 "gemserver50" running on node "handel", you would specify two NRS strings:

```
topaz> set gemstone !@handel!gemserver50
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 = !tcp@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. For example, under the UNIX C shell, you must escape an exclamation point (!) with a preceding backslash (\) character:

```
% waitstone \!tcp@oboe\!gemserver50 -1
```

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 !tcp@oboe#auth:user@password!gemserver50
% waitstone "!tcp@oboe#auth user@password!gemserver50"
```

B.2 Defaults

The following items uniquely identify a network resource:

- communications protocol— such as TCP/IP, DECnet, or SNA
- 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 B-4. 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** | **decnet** | **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** | **decnet** | **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:

```
!tcp@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*] | **#krb**)

#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.

#krb specifies that kerberos authentication is to be used instead of a user name and password.

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 `netldi50`. (See the earlier discussion of *nrs-identifier*.)

#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/bin/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 Gem process.

#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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