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TECHNICAL REPORT

Tornado:
A Run-Fail-Grow approach
for
Dynamic Application Tayloring

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Abstract

Producing a small deployment version of an application is a challenge because static abstractions such as packages cannot anticipate the use of their parts. As such, an application often occupies more memory than actually needed. To solve this problem we propose Tornado, a technique to dynamically tailor applications to only embed code (classes and methods) they use. Tornado uses a run-fail-grow approach to prepare an application for deployment. It launches minimal version of an application and installs a minimal set of statements that will start the user's application. This application is run and these statements are executed. When the application fails because there are classes or methods missing, the necessary code is installed. The application is executed until it reaches a stable point, allowing possibly human interaction for applications with UIs. Thus, Tornado creates minimal memory footprint versions of applications by tailoring the whole application's code, including run-time and third party libraries.

In this report, we present the results we obtained from using Tornado to tailor two different applications. We succeeded to tailor a *hello world* application to occupy 1% of its original size. We also experimented with a Seaside web application tailoring in one case only the application's and framework's code and the whole application's code in the other case. In this latter example, we reached memory savings of about 97%. In this report we present an overview on Tornado, and we give details of the results we obtained.

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1 Used Methodology

We tested our Tornado implementation by tailoring two different Pharo applications: a hello world application and a simple but yet interactive web application based on the Seaside framework [1]. Our methodology consisted in: setting up a seed for the application, preparing the application entry points and executing the application. In the case of the interactive web application, we interacted with it through a web browser. Once we finished the process, we extracted the resulting application by making a snapshot of it in a Pharo image file. We tested the generated snapshots to verify they work properly (under the assumption that only the previously used features of the application should work).

Finally, to present our results we measured the size of the generated snapshots files and compared them with the snapshots of the full applications under Pharo’s production option¹. The results prove the soundness of our solution.

2 Hello World Application

We used Tornado to tailor a *hello world* application writing 10 times the ‘hello world’ string to the standard output (stdout). In this case study we used an empty seed to grow both base libraries and the application’s code. Figure 1 shows the installed entry point to tailor this application. Table 1 shows our results for this case. We succeed to reduce the application’s size to 1% of its original counterpart.

```
1 FileStream startUp: true.  
2 1 to: 10 do: [ :i | FileStream stdout nextPutAll: 'hello'; crlf ].
```

Figure 1: Entry point of the Hello World application with an empty seed.

	Size(KB)	Ocuppied(%)	Saved(%)
Reference	12872	100%	0%
Tailored	131	1%	99%

Table 1: Results of the tailored Hello World application.

3 Seaside Web Application

We also used Tornado to tailor a simple web application consisting in a webpage with a counter containing two buttons. These two buttons perform requests to the web server to increase and decrease the counter. The Seaside application framework was configured with its default values, without making any customizations.

¹Pharo allows to prepare a snapshot for production. This option cleans some caches and removes some well known objects from the system, thus, freeing space.

In this case, we used two different seeds for tailoring: a seed containing all Pharo base libraries and an empty seed. Appendix B presents the entry points for these both seeds. The tailoring was done by starting the application and exercising it by generating requests through a web browser, clicking on its decrease and increase buttons.

	Size (KB)		
Ref. Pharo Base Libraries (P)	12872		
Ref. Seaside Framework (S)	4326		
Ref. Counter Application (R)	52		
Total Ref. Application ($P+S+C$)	17250		

	Size (KB)	Occupied (%)	Saved (%)
$P'+S'+C' / P+S+C$	573	3%	97%
$P''+S''+C'' / P+S+C$	13090	76%	24%
$S''+C'' / S+C$	218	5%	95%

Table 2: **Results of second case study.** Results of tailoring a web application with two different seeds. On the left, the total sizes of the original application deployment components (base libraries, application framework and counter application). On the right, our results when applying after tailoring. The first two results rows are compared against the total of the reference application. The third row presents the comparison without including base libraries, already inside the seed.

Table 2 shows the results obtained when tailoring this application with each of these two seeds. Figure 2 presents a tailoring map illustrating how Tornado selects the code units from a reference application given a seeds. This figure also presents the notation we use in Table 2: P is the Pharo base libraries, S is the Seaside Framework and C is the Counter application code units present in the reference application. P' , S' and C' are their counterparts selected by Tornado when using an empty seed. P'' , S'' and C'' are their counterparts, as selected by Tornado when using a seed with all base libraries. In the latter, we can note that $P=P''$.

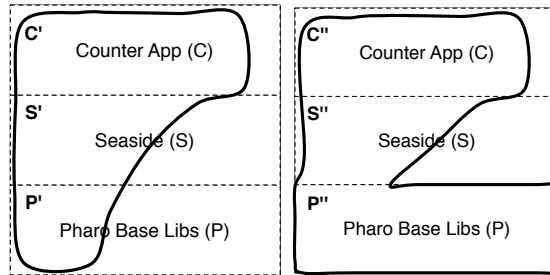


Figure 2: **Tailoring Map.** Tailoring map describing the Seaside application generated with the empty seed (left) and the full Pharo seed (right).

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(CPER) 2007-2013’, the Cutter ANR project, ANR-10-BLAN-0219.

References

- [1] A. Bergel, S. Ducasse, and L. Renggli. Seaside – advanced composition and control flow for dynamic web applications. *ERCIM News*, 2008.

A Appendix: Method List of a Nurtured Hello World Application

List of methods extracted from the nurtured Hello World application. This list includes all methods installed from the Pharo base libraries and the simple Hello World application.

Array class»new:	FileStream»openOnHandle:name:forWrite:Standard
ArrayedCollection»size	FileStream»primWrite:from:startingAt:count:Standard
Association class»key:value:	GreekEnvironment class»supportedLanguages
Association»value:	HashTableSizes class»atLeast:
Association»value	HashTableSizes class»sizes
BlockClosure»on:do:	HashedCollection class»newProto
BlockClosure»repeat	HashedCollection»atNewIndex:put:
BlockClosure»valueNoContextSwitch	HashedCollection»findElementOrNil:
ByteString class»compare:with:collated:	HashedCollection»fullCheck
ByteString class»findFirstInString:inSet:startingAt:	HashedCollection»grow
ByteString class»stringHash:initialHash:	HashedCollection»initialize:
ByteString»at:put:	Integer»asCharacter
ByteString»at:	JapaneseEnvironment class»supportedLanguages
ByteString»isByteString	KoreanEnvironment class»supportedLanguages
ByteString»replaceFrom:to:with:startingAt:	LanguageEnvironment class»currentPlatform
ByteTextConverter class»unicodeToByteTable	LanguageEnvironment class»defaultSystemConverter
ByteTextConverter»nextPut:toStream:	LanguageEnvironment class»initKnownEnvironments
ByteTextConverter»unicodeToByte:	LanguageEnvironment class»knownEnvironments
Character class»cr	LanguageEnvironment class»localeID:
Character class»lf	LanguageEnvironment»localeID:
Character class»value:	Latin1Environment class»supportedLanguages
Character»=	Latin2Environment class»supportedLanguages
Character»asInteger	Latin9Environment class»supportedLanguages
Character»asciiValue	Latin9Environment class»systemConverterClass
Character»charCode	Locale class»currentPlatform
Collection»detect:ifNone:	Locale class»determineCurrentLocale
Dictionary»at:ifAbsent:	Locale»determineLocaleID
Dictionary»at:ifPresent:	Locale»determineLocale
Dictionary»at:put:	Locale»fetchISO2Language
Dictionary»noCheckAdd:	Locale»languageEnvironment
Dictionary»scanFor:	Locale»localeID:
FileStream class»newForStdio	Locale»localeID
FileStream class»new	Locale»primCountry
FileStream class»standardIOStreamNamed:forWrite	Locale»primLanguage
FileStream class»startUp:	LocaleID class»isoLanguage:isoCountry:
FileStream class»stdioHandles	LocaleID class»isoLanguage:
FileStream class»stdoutCharacter»isCharacter	LocaleID class»isoString:
FileStream class»voidStdioFiles	LocaleID»=
FileStream»collectionSpeciesStandard	LocaleID»hash
FileStream»enableReadBufferingSmalltalkImage»vm	LocaleID»isoCountry
FileStream»isBinaryStandard	LocaleID»isoLanguage:isoCountry:
FileStream»next:putAll:startingAt:Standard	LocaleID»isoLanguage
FileStream»nextPut:Standard	LookupKey class»key:

LookupKey»key:	Semaphore»critical:
LookupKey»key	SequenceableCollection»copyFrom:to:
Magnitude»max:	SequenceableCollection»copyUpTo:
MultiByteFileStream»basicNext:putAll:startingAt:	SequenceableCollection»do:
MultiByteFileStream»basicNextPut:	SequenceableCollection»first:
MultiByteFileStream»converter:	SequenceableCollection»first
MultiByteFileStream»converter	SequenceableCollection»identityIndexOf:ifAbsent:
MultiByteFileStream»installLineEndConventionInCornerRadius:	SequenceableCollection»identityIndexOf:
MultiByteFileStream»nextPut:	SequenceableCollection»indexOf:ifAbsent:
MultiByteFileStream»nextPutAll:	SequenceableCollection»second
Number»negative	SequenceableCollection»writeStream
OSPlatform class»isWin32	SimplifiedChineseEnvironment class»supportedLanguages
OSPlatform class»platformName	SmallInteger»bitXor:
Object»=	SmallInteger»hash
Object»at:put:Object»isCharacter	Stream»basicNextPut:
Object»at:	String class»new:
Object»class	String class»with:
Object»hash	String»=
Object»isInteger	String»compare:with:collated:
Object»species	String»findDelimiters:startingAt:
Object»~~	String»findTokens:
OrderedCollection class»arrayType	String»hash
OrderedCollection class»new:	String»indexOf:startingAt:ifAbsent:
OrderedCollection class»new	String»isString
OrderedCollection»add:	String»skipDelimiters:startingAt:
OrderedCollection»addLast:	TextConverter class»defaultSystemConverter
OrderedCollection»at:	TextConverter class»initializeLatin1MapAndEncodings
OrderedCollection»ensureBoundsFrom:to:	TextConverter class»latin1Encodings
OrderedCollection»resetTo:	TextConverter class»latin1Map
OrderedCollection»reset	TextConverter»initialize
OrderedCollection»setCollection:	TextConverter»installLineEndConvention:
OrderedCollection»size	TextConverter»nextPutAll:toStream:
PositionableStream class»on:	TextConverter»nextPutByteString:toStream:
PositionableStream»isBinary	VirtualMachine class»getSystemAttribute:
PositionableStream»on:	WriteStream»contentsStandard
ProtoObject»basicIdentityHash	WriteStream»crLf
ProtoObject»flag:	WriteStream»nextPut:
ProtoObject»identityHash	WriteStream»on:
ProtoObject»initialize	WriteStream»reset
RussianEnvironment class»supportedLanguages	

B Appendix: Entry Points to Tailor the Seaside Web Application

Entry points as used to tailor the Seaside web application with a full Pharo seed and an empty seed. The first one (Figure 3) only consists in starting the web server as the base libraries are initialized and available in the seed. The latter one (Figure 4) includes the initialization of the minimal runtime needed to do networking.

```
1 ZnZincServerAdaptor startOn: 8888.
```

Figure 3: Entry point of the Seaside application with a full Pharo seed.

```
1 "We initialize some classes of the system"
2 SmalltalkImage initializeForTornado.
3 Symbol initializeForTornado.
4 Object initialize.
5 ExternalSemaphoreTable initialize.
6 Socket initialize.
7 Delay initialize.
8 Delay startUp: true.
9 Delay shutDown: true.
10 OSPlatform initialize.
11 DiskStore initialize.
12 FileStream initialize.
13 NetNameResolver initialize.
14 DateAndTime initialize.
15 ProcessorScheduler initialize.
16 WeakFinalizationList initialize.
17 UUIDGenerator initialize.
18 WeakArray initialize.
19 GRPharoRandomProvider initialize.
20 WASlime initialize.
21 UIManager basicDefault: DummyUIManager new.
22 ZnServer initialize.
23 WAServerManager initialize.
24 Smalltalk instVarNamed: 'session' put: Smalltalk newSessionObject.
25 Smalltalk startupImage: true snapshotWorked: true.
26
27 "Finally we start the web server"
28 ZnZincServerAdaptor startOn: 8888.
```

Figure 4: Entry point of the Seaside application with an empty seed.

C Appendix: Method List of Seaside Counter Application with Full Pharo Seed

List of methods extracted from the nurtured Web application when using a seed containing all base libraries from Pharo. This list includes all methods installed from Seaside framework and the counter application. The list of methods part of the base library are excluded as it is the same list of the methods found in Pharo base library.

WAAccessIntervalReapingStrategy»defaultConfiguration	WAAccessIntervalReapingStrategy»initializeWithKey:
WAAccessIntervalReapingStrategy»initialize	WAAccessIntervalReapingStrategy»isAttributeInheritedOn:
WAAccessIntervalReapingStrategy»interval	WAAccessIntervalReapingStrategy»isAttributeLocalOn:
WAAccessIntervalReapingStrategy»reap	WAAccessIntervalReapingStrategy»key
WAAccessIntervalReapingStrategy»stored:key:	WABrush»initialize
WAActionCallback»block:	WABrush»parent
WAActionCallback»evaluateWithArgument:	WABrush»setParent:canvas:
WAActionCallback»isEnabledFor:	WABrush»with:
WAActionCallback»signalRenderNotification	WABufferedResponse class»on:
WAActionPhaseContinuation»continue	WABufferedResponse»contents
WAActionPhaseContinuation»handleRequest	WABufferedResponse»destroy
WAActionPhaseContinuation»renderContext:	WABufferedResponse»initializeOn:
WAActionPhaseContinuation»renderContext	WABufferedResponse»stream
WAActionPhaseContinuation»runCallbacks	WACache»at:ifAbsent:
WAActionPhaseContinuation»shouldRedirect	WACache»expiryPolicy
WAAAdmin class»defaultServerManager	WACache»initializeCollections
WAAAdmin class»serverAdaptors	WACache»initializeMutex
WAAAnchorTag»callback:	WACache»initialize
WAAAnchorTag»tag	WACache»keyAtValue:ifAbsent:
WAAAnchorTag»url	WACache»keyAtValue:
WAAAnchorTag»with:	WACache»keySize
WAAApplication»contentType	WACache»missStrategy
WAAApplication»doesHandlerSupportCookies:	WACache»notifyRemoved:key:
WAAApplication»handleDefault:	WACache»notifyRetrieved:key:
WAAApplication»handleFiltered:	WACache»notifyStored:key:
WAAApplication»isApplication	WACache»pluginsDo:
WAAApplication»isImplemented:	WACache»reapingStrategy
WAAApplication»keyField	WACache»reap
WAAApplication»libraries	WACache»removalAction
WAAApplication»mainClass	WACache»setExpiryPolicy:
WAAApplication»mimeType	WACache»setMissStrategy:
WAAApplication»newSession	WACache»setReapingStrategy:
WAAApplication»resourceBaseUrl	WACache»setRemovalAction:
WAAApplication»sessionClass	WACache»store:
WAAApplicationConfiguration»parents	WACacheCapacityConfiguration»describeOn:
WAAAttributeSearchContext class»key:target:	WACacheMissStrategy»missed:
WAAAttributeSearchContext»at:ifPresent:	WACachePlugin»configuration
WAAAttributeSearchContext»at:put:	WACachePlugin»defaultConfiguration
WAAAttributeSearchContext»attribute	WACachePlugin»initialize
WAAAttributeSearchContext»cachedValues	WACachePlugin»removed:key:
WAAAttributeSearchContext»findAttributeAndSelectAndStore	WACachePlugin»retrieved:key:

WACachePlugin»setCache:	WADocument»close
WACachePlugin»stored:key:	WADocument»destroy
WACacheReapingStrategy»reap	WADocument»initializeWithStream:codec:
WACallback class»on:	WADocument»nextPut:
WACallback»convertKey:	WADocument»nextPutAll:
WACallback»evaluateWithFieldValues:	WADocument»open:
WACallback»key	WADynamicVariable class»use:during:
WACallback»setKey:callbacks:	WADynamicVariable class»value
WACallback»valueForField:	WAEncoder class»on:table:
WACallbackRegistry»advanceKey	WAEncoder class»on:
WACallbackRegistry»handle:	WAEncoder»initializeOn:table:
WACallbackRegistry»increaseKey	WAEncoder»nextPut:
WACallbackRegistry»initialize	WAEHandler class»exceptionSelector
WACallbackRegistry»nextKey	WAEExampleComponent»rendererClass
WACallbackRegistry»store:	WAEExceptionFilter»exceptionHandler
WACanvas»brush:	WAEExceptionFilter»handleFiltered:
WACanvas»flush	WAEExceptionHandler class»context:
WACanvas»nest:	WAEExceptionHandler class»exceptionSelector
WACanvas»render:	WAEExceptionHandler class»handleExceptionsDuring:context:
WACanvas»text:	WAEExceptionHandler class»handles:
WAComponent»accept:	WAEExceptionHandler»handleExceptionsDuring:
WAComponent»acceptDecorated:	WAEExceptionHandler»handles:
WAComponent»decoration	WAEExceptionHandler»initializeWithContext:
WAComponent»initialize	WAHeaderFields»checkValue:
WAComponent»updateStates:	WAHeaderFields»privateAt:put:
WAConfigurationDescription»add:to:	WAHeadingTag»initialize
WAConfigurationDescription»addAttribute:	WAHeadingTag»level1
WAConfigurationDescription»attributes	WAHeadingTag»level
WAConfigurationDescription»expressions	WAHeadingTag»tag
WAConfigurationDescription»initialize	WAHtmlAttributes»encodeOn:
WAConfigurationDescription»integer:	WAHtmlAttributes»privateAt:put:
WAConfiguredRequestFilter»configuration	WAHtmlCanvas»anchor
WACounter»count:	WAHtmlCanvas»heading:
WACounter»decrease	WAHtmlCanvas»heading
WACounter»increase	WAHtmlCanvas»spaceEntity
WACounter»initialize	WAHtmlDocument»scriptGenerator:
WACounter»renderContentOn:	WAHtmlDocument»scriptGenerator
WACounter»states	WAHtmlElement class»root:
WADefaultScriptGenerator»close:on:	WAHtmlElement»attributeAt:put:
WADefaultScriptGenerator»open:on:	WAHtmlElement»attributes
WADevelopmentConfiguration»parents	WAHtmlElement»encodeBeforeOn:
WADispatcher class»default	WAHtmlElement»encodeOn:
WADispatcher»handleFiltered:named:	WAHtmlElement»initializeWithRoot:
WADispatcher»handleFiltered:	WAHtmlElement»isClosed
WADispatcher»handlerAt:ifAbsent:	WAHtmlRoot»add:
WADispatcher»handlerAt:with:	WAHtmlRoot»beXhtml10Strict
WADispatcher»handlers	WAHtmlRoot»bodyAttributes
WADispatcher»nameOfHandler:	WAHtmlRoot»closeOn:
WADispatcher»urlFor:	WAHtmlRoot»docType:
WADocument class»on:codec:	WAHtmlRoot»htmlAttributes

WAHtmlRoot»initialize	WAMimeType»greaseString
WAHtmlRoot»meta	WAMimeType»main:
WAHtmlRoot»openOn:	WAMimeType»main
WAHtmlRoot»title:	WAMimeType»parameters
WAHtmlRoot»writeElementsOn:	WAMimeType»sub:
WAHtmlRoot»writeFootOn:	WAMimeType»sub
WAHtmlRoot»writeHeadOn:	WAMutex»critical:
WAHtmlRoot»writeScriptsOn:	WAMutex»initialize
WAHtmlRoot»writeStylesOn:	WAMutualExclusionFilter»handleFiltered:
WAHttpVersion class»fromString:	WAMutualExclusionFilter»initialize
WAHttpVersion class»major:minor:	WAMutualExclusionFilter»shouldTerminate:
WAHttpVersion class»readFrom:	WANotifyRemovalAction»removed:key:
WAHttpVersion»initializeWithMajor:minor:	WAOBJECT»application
WAINitialRequestVisitor class»request:	WAOBJECT»requestContext
WAINitialRequestVisitor»initializeWithRequest:	WAOBJECT»session
WAINitialRequestVisitor»request	WAPainter»renderWithContext:
WAINitialRequestVisitor»visitPresenter:	WAPainter»updateRoot:
WAKeyGenerator class»current	WAPainter»updateUrl:
WAKeyGenerator»keyOfLength:	WAPainterVisitor»visitComponent:
WALastAccessExpiryPolicy»defaultConfiguration	WAPainterVisitor»visitDecorationsOfComponent:
WALastAccessExpiryPolicy»initialize	WAPainterVisitor»visitPainter:
WALastAccessExpiryPolicy»isExpired:key:	WAPainterVisitor»visitPresenter:
WALastAccessExpiryPolicy»retrieved:key:	WAPathConsumer class»path:
WALastAccessExpiryPolicy»stored:key:	WAPathConsumer»atEnd
WALastAccessExpiryPolicy»timeout	WAPathConsumer»initializeWith:
WALeastRecentlyUsedExpiryPolicy»defaultConfiguration	WAPathConsumer»next
WALeastRecentlyUsedExpiryPolicy»initialize	WAPathConsumer»upToEnd
WALeastRecentlyUsedExpiryPolicy»isExpired:key:	WAPresenter»childrenDo:
WALeastRecentlyUsedExpiryPolicy»maximumAge	WAPresenter»children
WALeastRecentlyUsedExpiryPolicy»removed:key:	WAPresenter»initialRequest:
WALeastRecentlyUsedExpiryPolicy»retrieved:key:	WAPresenter»script
WALeastRecentlyUsedExpiryPolicy»stored:key:	WAPresenter»style
WAMergedRequestFields class»on:	WAPresenter»updateRoot:
WAMergedRequestFields»allAt:	WAPresenter»updateStates:
WAMergedRequestFields»at:ifAbsent:	WAPresenterGuide class»client:
WAMergedRequestFields»includesKey:	WAPresenterGuide»client
WAMergedRequestFields»initializeOn:	WAPresenterGuide»initializeWithClient:
WAMergedRequestFields»keysAndValuesDo:	WAPresenterGuide»visit:
WAMergedRequestFields»keysDo:	WAPresenterGuide»visitPainter:
WAMetaElement»content:	WASRegistryConfiguration»parents
WAMetaElement»contentScriptType:	WARenderContext»actionBaseUrl:
WAMetaElement»contentType:	WARenderContext»actionUrl:
WAMetaElement»encodeBeforeOn:	WARenderContext»actionUrl
WAMetaElement»responseHeaderName:	WARenderContext»callbacks
WAMetaElement»tag	WARenderContext»defaultVisitor
WAMimeType class»fromString:	WARenderContext»destroy
WAMimeType class»main:sub:	WARenderContext»document:
WAMimeType class»text.Javascript	WARenderContext»document
WAMimeType class»text.Plain	WARenderContext»initialize
WAMimeType»charset:	WARenderContext»resourceUrl:

WAServletContext»visitor:	WAServletRequest»setHeaders:
WAServletContext»visitor	WAServletRequest»setPostFields:
WAServletContext»parents	WAServletRequest»setRemoteAddress:
WAServletContext»createActionContinuation	WAServletRequest»uri
WAServletContext»createRenderContinuation	WAServletRequest»url
WAServletContext»presenter	WAServletRequestContext class»request:response:codec:
WAServletContext»toPresenterSendRoot:	WAServletRequestContext»application
WAServletContext»updateRoot:	WAServletRequestContext»charset
WAServletContext»updateStates:	WAServletRequestContext»codec
WAServletContext»updateUrl:	WAServletRequestContext»consumer
WAServletContext»withNotificationHandler	WAServletRequestContext»destroy
WAServletContext»createRoot	WAServletRequestContext»handlers
WAServletContext»prepareRoot:	WAServletRequestContext»handler
WAServletContext»rootClass	WAServletRequestContext»initializeWithRequest:response:codec:
WAServletContext»rootDecorationClasses	WAServletRequestContext»newDocument
WAServletContext»start	WAServletRequestContext»push:during:
WAServletContext»createHtmlRootWithCharset	WAServletRequestContext»registry
WAServletContext»createRenderContext	WAServletRequestContext»request
WAServletContext»handleRequest	WAServletRequestContext»respond:
WAServletContext»processRendering:	WAServletRequestContext»respond
WAServletContext»context:	WAServletRequestContext»responseGenerator
WAServletContext»initializeWithContext:	WAServletRequestContext»response
WAServletContext»renderContext	WAServletRequestContext»session
WAServletContext»visitPainter:	WAServletRequestFilter»handleFiltered:
WAServletContext»context:	WAServletRequestFilter»initialize
WAServletContext»actionUrl	WAServletRequestFilter»next
WAServletContext»callbacks	WAServletRequestFilter»setNext:
WAServletContext»context	WAServletRequestFilter»updateStates:
WAServletContext»document	WAServletRequestHandler»addFilter:
WAServletContext»flush	WAServletRequestHandler»addFilterLast:
WAServletContext»initializeWithContext:	WAServletRequestHandler»basicUrl
WAServletContext»render:	WAServletRequestHandler»configuration:
WAServletContext»text:	WAServletRequestHandler»configuration
WAServletRequest class»method:uri:version:	WAServletRequestHandler»defaultConfiguration
WAServletRequest»at:ifAbsent:	WAServletRequestHandler»documentClass
WAServletRequest»cookiesAt:	WAServletRequestHandler»filters
WAServletRequest»cookies	WAServletRequestHandler»filter
WAServletRequest»destroy	WAServletRequestHandler»handle:
WAServletRequest»fields	WAServletRequestHandler»initialize
WAServletRequest»headerAt:ifAbsent:	WAServletRequestHandler»isApplication
WAServletRequest»headerAt:	WAServletRequestHandler»isRoot
WAServletRequest»initializeWithMethod:uri:version:	WAServletRequestHandler»parent
WAServletRequest»isGet	WAServletRequestHandler»preferenceAt:
WAServletRequest»isPrefetch	WAServletRequestHandler»responseGenerator
WAServletRequest»isXmlHttpRequest	WAServletRequestHandler»serverHostname
WAServletRequest»method	WAServletRequestHandler»serverPath
WAServletRequest»postFields	WAServletRequestHandler»serverPort
WAServletRequest»queryFields	WAServletRequestHandler»serverProtocol
WAServletRequest»setBody:	WAServletRequestHandler»setFilter:
WAServletRequest»setCookies:	WAServletRequestHandler»setParent:

WRequestHandler»url	WServerAdaptor»requestHandler
WResponse class»messageForStatus:	WServerAdaptor»responseFor:
WResponse class»statusFound	WServerAdaptor»start
WResponse»contentType:	WServerManager class»default
WResponse»contentType	WServerManager»adaptors
WResponse»cookies	WServerManager»canStart:
WResponse»destroy	WServerManager»register:
WResponse»found	WServerManager»start:
WResponse»headerAt:ifAbsent:	WSession»actionField
WResponse»headerAt:put:	WSession»actionUrlForContinuation:
WResponse»headers	WSession»actionUrlForKey:
WResponse»initializeOn:	WSession»application
WResponse»initialize	WSession»clearJumpTo
WResponse»location:	WSession»createCache
WResponse»redirectTo:	WSession»handleFiltered:
WResponse»status:message:	WSession»initializeFilters
WResponse»status:	WSession»initialize
WResponse»status	WSession»isSession
WResponseGenerator class»on:	WSession»presenter
WResponseGenerator»expiredRegistryKey	WSession»properties
WResponseGenerator»initializeOn:	WSession»start
WResponseGenerator»requestContext	WSession»unknownRequest
WResponseGenerator»request	WSession»updateRoot:
WResponseGenerator»respond	WSession»updateStates:
WResponseGenerator»response	WSession»updateUrl:
WRoot class»context:	WSession»url
WRoot»setContext:	WSessionContinuation»basicValue
WScriptGenerator»initialize	WSessionContinuation»captureAndInvoke
WScriptGenerator»loadScripts	WSessionContinuation»captureState
WScriptGenerator»writeLoadScriptsOn:	WSessionContinuation»redirectToContinuation:
WScriptGenerator»writeScriptTag:on:	WSessionContinuation»registerForUrl:
WServerAdaptor class»default	WSessionContinuation»registerForUrl
WServerAdaptor class»manager:	WSessionContinuation»request
WServerAdaptor class»new	WSessionContinuation»respond:
WServerAdaptor class»port:	WSessionContinuation»setStates:
WServerAdaptor class»startOn:	WSessionContinuation»states
WServerAdaptor»codec	WSessionContinuation»updateStates:
WServerAdaptor»contextFor:	WSessionContinuation»updateUrl:
WServerAdaptor»defaultPort	WSessionContinuation»value
WServerAdaptor»defaultRequestHandler	WSessionContinuation»withUnregisteredHandlerDo:
WServerAdaptor»handle:	WSnapshot»initialize
WServerAdaptor»handlePadding:	WSnapshot»register:
WServerAdaptor»handleRequest:	WSnapshot»reset
WServerAdaptor»initializeWithManager:	WSnapshot»restore
WServerAdaptor»initialize	WTagBrush»after
WServerAdaptor»manager	WTagBrush»attributes
WServerAdaptor»port:	WTagBrush»before
WServerAdaptor»port	WTagBrush»close Tag
WServerAdaptor»process:	WTagBrush»document
WServerAdaptor»requestFor:	WTagBrush»isClosed

WATagBrush»openTag	WAXmlDocument»nextPutAll:
WATagBrush»storeCallback:	WAXmlDocument»destroy
WATagBrush»with:	WAXmlDocument»initializeWithStream:codec:
WATagCanvas»space	WAXmlDocument»openTag:attributes:closed:
WAXmlDocument»initializeWithStream:codec:	WAXmlDocument»openTag:attributes:
WAXmlDocument»localAttributeAt:ifAbsent:	WAXmlDocument»openTag:
WAXmlDocument»parents	WAXmlDocument»print:
WAXmlDocument»determineValueWithContext:configuration:	WAXmlDocument»urlEncoder
WAXmlDocument»value	WAXmlDocument»xmlEncoder
WAXmlDocument»with:	WAXmlEncoder»nextPutAll:
WAXmlDocument»contents:	ZnSeasideServerAdaptorDelegate class»with:
WAXmlDocument»contents	ZnSeasideServerAdaptorDelegate»adaptor:
WAXmlDocument»visitPresenter:	ZnSeasideServerAdaptorDelegate»adaptor
WAXmlDocument»start:	ZnSeasideServerAdaptorDelegate»handleRequest:
WAXmlDocument»visit:	ZnZincServerAdaptor»basicStart
WAXmlDocument»closeTag:	ZnZincServerAdaptor»configureDelegate
WAXmlDocument»destroy	ZnZincServerAdaptor»configureServerForBinaryReading
WAXmlDocument»initializeWithStream:codec:	ZnZincServerAdaptor»defaultCodec
WAXmlDocument»openTag:attributes:closed:	ZnZincServerAdaptor»defaultDelegate
WAXmlDocument»openTag:attributes:	ZnZincServerAdaptor»defaultZnServer
WAXmlDocument»openTag:	ZnZincServerAdaptor»isStopped
WAXmlDocument»print:	ZnZincServerAdaptor»requestAddressFor:
WAXmlDocument»urlEncoder	ZnZincServerAdaptor»requestBodyFor:
WAXmlDocument»xmlEncoder	ZnZincServerAdaptor»requestCookiesFor:
WAXmlEncoder»nextPutAll:	ZnZincServerAdaptor»requestFieldsFor:
ZnSeasideServerAdaptorDelegate class»with:	ZnZincServerAdaptor»requestHeadersFor:
ZnSeasideServerAdaptorDelegate»adaptor:	ZnZincServerAdaptor»requestMethodFor:
ZnSeasideServerAdaptorDelegate»adaptor	ZnZincServerAdaptor»requestUrlFor:
ZnSeasideServerAdaptorDelegate»handleRequest:	ZnZincServerAdaptor»requestVersionFor:
ZnZincServerAdaptor»basicStart	ZnZincServerAdaptor»responseFrom:
ZnZincServerAdaptor»configureDelegate	ZnZincServerAdaptor»server
ZnZincServerAdaptor»configureServerForBinaryReading	
ZnZincServerAdaptor»defaultCodec	
ZnZincServerAdaptor»defaultDelegate	
ZnZincServerAdaptor»defaultZnServer	
ZnZincServerAdaptor»isStopped	
ZnZincServerAdaptor»requestAddressFor:	
ZnZincServerAdaptor»requestBodyFor:	
ZnZincServerAdaptor»requestCookiesFor:	
ZnZincServerAdaptor»requestFieldsFor:	
ZnZincServerAdaptor»requestHeadersFor:	
ZnZincServerAdaptor»requestMethodFor:	
ZnZincServerAdaptor»requestUrlFor:	
ZnZincServerAdaptor»requestVersionFor:	
ZnZincServerAdaptor»responseFrom:	
ZnZincServerAdaptor»server	

D Appendix: Method List of Seaside Counter Application with Empty Seed

List of methods extracted from the nurtured Web application when using an empty seed. This list includes all methods installed from Seaside framework, the Counter application and the base library of Pharo.

Array class»new:	BlockClosure»renderOn:
Array»isSelfEvaluating	BlockClosure»repeatWithGClf:
Array»printOn:	BlockClosure»repeat
Array»replaceFrom:to:with:startingAt:	BlockClosure»startpc
Array»shouldBePrintedAsLiteral	BlockClosure»value:value:value:
ArrayedCollection class»new:withAll:	BlockClosure»value:value:
ArrayedCollection class»new	BlockClosure»valueNoContextSwitch
ArrayedCollection class»with:with:with:	BlockClosure»valueWithArguments:
ArrayedCollection class»with:with:	BlockClosure»valueWithPossibleArguments:
ArrayedCollection class»with:	ByteArray»asByteArray
ArrayedCollection»mergeSortFrom:to:by:	ByteArray»replaceFrom:to:with:startingAt:
ArrayedCollection»size	ByteString class»compare:with:collated:
ArrayedCollection»sort:	ByteString class»findFirstInString:inSet:startingAt:
Association class»key:value:	ByteString class»indexOfAscii:inString:startingAt:
Association class»key:value:	ByteString class»stringHash:initialHash:
Association»expireWeakKey	ByteString class»translate:from:to:table:
Association»expiredWeakKey	ByteString»asByteArray
Association»key:WeakKey	ByteString»at:put:
Association»key:value:WeakKey	ByteString»at:
Association»keyWeakKey	ByteString»beginsWith:
Association»value:WeakKey	ByteString»byteAt:put:
Association»value:	ByteString»byteSize
Association»valueWeakKey	ByteString»findSubstring:in:startingAt:matchTable:
Association»value	ByteString»findSubstringViaPrimitive:in:startingAt:matchTable:
BlockClosure»argumentCount	ByteString»isByteString
BlockClosure»asContextWithSender:	ByteString»isOctetString
BlockClosure»asContext	ByteString»replaceFrom:to:with:startingAt:
BlockClosure»assert	ByteSymbol class»stringHash:initialHash:
BlockClosure»cull:	ByteSymbol»at:
BlockClosure»ensure:	ByteSymbol»findSubstring:in:startingAt:matchTable:
BlockClosure»fixCallbackTemps	ByteSymbol»isByteString
BlockClosure»forkAt:named:	ByteSymbol»privateAt:put:
BlockClosure»forkAt:	ByteSymbol»species
BlockClosure»ifCurtailed:	ByteSymbol»string:
BlockClosure»ifError:	CNGBTextConverter class»encodingNames
BlockClosure»isClosure	CP1250TextConverter class»encodingNames
BlockClosure»newProcess	CP1253TextConverter class»encodingNames
BlockClosure»numArgs	ChangesLog class»default
BlockClosure»numCopiedValues	ChangesLog»recordStartupStamp
BlockClosure»on:do:	Character class»codePoint:
BlockClosure»on:fork:	Character class»cr
BlockClosure»outerContext	Character class»lf

Character class»space	CompiledMethod»numTemps
Character class»value:	CompiledMethod»objectAt:
Character»=	CompiledMethod»primitive
Character»asCharacter	CompoundTextConverter class»encodingNames
Character»asInteger	ContextPart class»contextEnsure:
Character»asSymbol	ContextPart class»contextOn:do:
Character»asUppercase	ContextPart class»newForMethod:
Character»asciiValue	ContextPart class»theReturnMethod
Character»charCode	ContextPart»activateMethod:withArgs:receiver:class:
Character»characterSet	ContextPart»activateReturn:value:
Character»codePoint	ContextPart»at:put:
Character»digitValue	ContextPart»at:
Character»greaseInteger	ContextPart»bottomContext
Character»isAlphaNumeric	ContextPart»cut:
Character»isCharacter	ContextPart»doPop
Character»isDigit	ContextPart»exceptionClass
Character»isLetter	ContextPart»exceptionHandlerBlock
Character»isOctetCharacter	ContextPart»exceptionHandlerIsActive:
Character»isSeparator	ContextPart»exceptionHandlerIsActive
Character»isVowel	ContextPart»findContextSuchThat:
Character»leadingChar	ContextPart»findNextHandlerContextStarting
Character»to:	ContextPart»findNextUnwindContextUpTo:
Collection class»withAll:	ContextPart»handleSignal:
Collection»addAll:	ContextPart»insertSender:
Collection»allSatisfy:	ContextPart»isDead
Collection»anySatisfy:	ContextPart»jump
Collection»asArray	ContextPart»methodReturnTop
Collection»detect:ifNone:	ContextPart»nextHandlerContext
Collection»emptyCheck	ContextPart»pop
Collection»inject:into:	ContextPart»privSender:
Collection»isCollection	ContextPart»push:
Collection»isEmptyOrNil	ContextPart»pushTemporaryVariable:
Collection»isEmpty	ContextPart»releaseTo:
Collection»noneSatisfy:	ContextPart»resume:through:
Collection»notEmpty	ContextPart»resume:
Collection»printElementsOn:	ContextPart»return:from:
Collection»printNameOn:	ContextPart»return:through:
Collection»printOn:	ContextPart»return:
Collection»removeAll:	ContextPart»runUntilErrorOrReturnFrom:
Collection»removeAllFoundIn:	ContextPart»sender
Collection»sorted:	ContextPart»singleRelease
Collection»sorted	ContextPart»stackp:
CommandLineUIManager class»replacing:	ContextPart»stepToCallee
CommandLineUIManager»initialize	ContextPart»step
CommandLineUIManager»replacing:	ContextPart»terminateTo:
CompiledMethod»frameSize	Date class»fromSeconds:
CompiledMethod»header	Date class»fromString:
CompiledMethod»initialPC	Date class»readFrom:
CompiledMethod»isPrimitive	Date class»starting:
CompiledMethod»numLiterals	Date class»year:month:day:

Date»dayMonthYearDo:	DateAndTime»second
Date»monthIndex	DateAndTime»setJdn:seconds:nano:offset:
Date»printOn:format:	DateAndTime»ticks:offset:DateAndTime»dayOfWeek
Date»printOn:	DateAndTime»ticks
DateAndTime class»clock	DateAndTime»year
DateAndTime class»fromSeconds:offset:	Delay class»forMilliseconds:
DateAndTime class»fromSeconds:	Delay class»handleTimerEvent
DateAndTime class»fromString:	Delay class»initialize
DateAndTime class»initializeOffsets	Delay class»primSignal:atMilliseconds:
DateAndTime class»initialize	Delay class»restoreResumptionTimes
DateAndTime class»localOffset	Delay class»runTimerEventLoop
DateAndTime class»localTimeZone	Delay class»saveResumptionTimes
DateAndTime class»milliSecondsSinceMidnight	Delay class»scheduleDelay:
DateAndTime class»millisecondClockValue	Delay class»shutDown
DateAndTime class»now	Delay class»startTimerEventLoop
DateAndTime class»readFrom:	Delay class»startUp
DateAndTime class»readOptionalSeparatorFrom:	Delay class»stopTimerEventLoop
DateAndTime class»readTimezoneOffsetFrom:	Delay class»unscheduleDelay:
DateAndTime class»readTwoDigitIntegerFrom:	Delay»beingWaitedOn:
DateAndTime class»startUp:	Delay»beingWaitedOn
DateAndTime class»todayAtMilliSeconds:	Delay»delayDuration
DateAndTime class»waitForOffsets	Delay»resumptionTime:
DateAndTime class»year:month:day:hour:minute:offset:	Delay»resumptionTime
DateAndTime class»year:month:day:hour:minute:seconds:offset:	Delay»second:offset:
DateAndTime class»year:month:day:hour:minute:seconds:offset:	Delay»setDelay:forSemaphore:
DateAndTime class»year:month:day:hour:minute:seconds:offset:	Delay»signalWaitingProcess
DateAndTime class»year:month:day:hour:minute:	Delay»unschedule
DateAndTime class»year:month:day:offset:	Delay»wait
DateAndTime class»year:month:day:	DelayWaitTimeout»isExpired
DateAndTime»<	DelayWaitTimeout»setDelay:forSemaphore:
DateAndTime»asDateAndTime	DelayWaitTimeout»signalWaitingProcess
DateAndTime»asTimeStamp	DelayWaitTimeout»wait
DateAndTime»asUTC	Dictionary»addAll:GRSsmall
DateAndTime»dayMonthYearDo:	Dictionary»associationsDo:
DateAndTime»dayOfMonth	Dictionary»at:ifAbsent:GRSsmall
DateAndTime»dayOfWeekAbbreviation	Dictionary»at:ifAbsent:Small
DateAndTime»dayOfWeekName	Dictionary»at:ifAbsent:
DateAndTime»hour24	Dictionary»at:ifAbsentPut:GRSsmall
DateAndTime»hour	Dictionary»at:ifAbsentPut:
DateAndTime»julianDayNumber	Dictionary»at:ifPresent:GRSsmall
DateAndTime»julianDayOffset	Dictionary»at:ifPresent:
DateAndTime»localSeconds	Dictionary»at:put:GRSsmall
DateAndTime»minute	Dictionary»at:put:Small
DateAndTime»monthAbbreviation	Dictionary»at:put:
DateAndTime»monthName	Dictionary»at:
DateAndTime»month	Dictionary»do:
DateAndTime»normalize:ticks:base:	Dictionary»findIndexFor:GRSsmall
DateAndTime»offset:DateAndTime»midnight	Dictionary»findIndexForKey:Small
DateAndTime»offset	Dictionary»fixCollisionsFrom:
DateAndTime»printHMSON:	Dictionary»includesKey:GRSsmall

Dictionary»includesKey:	Exception class»,
Dictionary»initialize:GRSmall	Exception class»handles:
Dictionary»initializeSmall	Exception class»signal:
Dictionary»isEmptyGRSmall	Exception class»signal
Dictionary»keyAtValue:ifAbsent:	Exception»description
Dictionary»keysAndValuesDo:SmallDictionary	Exception»isResumable
class»new	Exception»messageText:
Dictionary»keysAndValuesDo:	Exception»messageText
Dictionary»keysAndValuesDo:	Exception»printOn:
Dictionary»keysDo:GRSmall	Exception»privHandlerContext:
Dictionary»noCheckAdd:	Exception»receiver
Dictionary»postCopyGRSmall	Exception»resume:
Dictionary»privateAt:put:GRSmall	Exception»resumeUnchecked:
Dictionary»privateAt:put:Small	Exception»signal:
Dictionary»rehash	Exception»signalerContext
Dictionary»removeKey:ifAbsent:	Exception»signal
Dictionary»scanFor:	ExceptionSet»,
Dictionary»seasideRequestFieldsGRSmall	ExceptionSet»add:
Dictionary»sizeGRSmall	ExceptionSet»handles:
Dictionary»valuesDo:	ExceptionSet»initialize
DiskStore class»checkVMVersion	ExtendedNumberParser»allowPlusSign
DiskStore class»initialize	ExtendedNumberParser»nextNumber
DiskStore class»reset	ExternalSemaphoreTable class»clearExternalObjects
DiskStore class»shutDown:	ExternalSemaphoreTable class»collectionBasedOn:withRoomFor:
DiskStore class»startUp:	ExternalSemaphoreTable class»freedSlotsIn:ratherThanIncreaseSizeTo:
DiskStore class»useFilePlugin	ExternalSemaphoreTable class»initialize
Duration class»days:hours:minutes:seconds:nanoSeconds:	ExternalSemaphoreTable class»registerExternalObject:
Duration class»days:hours:minutes:seconds:	ExternalSemaphoreTable class»safelyRegisterExternalObject:
Duration class»days:	ExternalSemaphoreTable class»safelyUnregisterExternalObject:
Duration class»nanoSeconds:	ExternalSemaphoreTable class»slotFor:in:
Duration class»seconds:nanoSeconds:	ExternalSemaphoreTable class»unprotectedExternalObjects:
Duration class»seconds:	ExternalSemaphoreTable class»unprotectedExternalObjects
Duration»+	ExternalSemaphoreTable class»unregisterExternalObject:
Duration»-	False»not
Duration»asDuration	False»
Duration»asMilliseconds	FilePath class»pathName:isEncoded:
Duration»asNanoSeconds	FilePath»asSqueakPathName
Duration»asSeconds	FilePath»pathName:isEncoded:
Duration»days	FilePath»pathName
Duration»isZero	FileStream class»flushAndVoidStdioFiles
Duration»negated	FileStream class»initialize
Duration»seconds:nanoSeconds:	FileStream class»shutDown:
Duration»ticks	FileStream class»startUp:
DynamicVariable class»value:during:	FileStream class»stdioHandles
DynamicVariable»value:during:	FileStream class»voidStdioFiles
EUCJPTTextConverter class»encodingNames	Float class»precision
EUCKRTextConverter class»encodingNames	Float»adaptToInteger:andSend:
EncodedCharSet class»charsetAt:	Float»asFloat
EventManager class»actionMaps	Float»isInfinite
EventManagerclass»flushEvents	Float»timesTwoPower:

Float»truncated	GRSmallDictionary class»withAll:
Fraction class»numerator:denominator:	HashTableSizes class»atLeast:
Fraction»>=	HashTableSizes class»sizes
Fraction»reduced	HashedCollection class»new:
Fraction»setNumerator:denominator:	HashedCollection class»new
Fraction»truncated	HashedCollection class»sizeFor:
GRCodecStream class»on:	HashedCollection»array
GRCodecStream»atEnd	HashedCollection»atNewIndex:put:
GRCodecStream»initializeOn:	HashedCollection»findElementOrNil:
GRNullCodec class»codecName	HashedCollection»fullCheck
GRNullCodec class»supportsEncoding:	HashedCollection»grow
GRNullCodec»encoderFor:	HashedCollection»initialize:
GRNullCodec»url	HashedCollection»size
GRNullCodecStream»nextPutAll:	Heap class»withAll:sortBlock:
GRObjct class»new	Heap»add:
GRObjct»initialize	Heap»do:
GROrderedMultiMap»allAt:	Heap»downHeapSingle:
GROrderedMultiMap»at:add:	Heap»growHeap»reSort
GRPharoConverterCodecStream class»on:converter:	Heap»growSize
GRPharoConverterCodecStream»contents	Heap»growTo:
GRPharoConverterCodecStream»initializeOn:converter:	Heap»isEmpty
GRPharoConverterCodecStream»size	Heap»privateRemoveAt:
GRPharoGenericCodec class»supportedEncodingNames	Heap»remove:ifAbsent:
GRPharoGenericCodec class»supportsEncoding:	Heap»removeFirst
GRPharoLatin1Codec class»supportedEncodingNames	Heap»setCollection:tally:
GRPharoLatin1Codec class»supportsEncoding:	Heap»size
GRPharoPlatform»addToShutDownList:	Heap»sortBlock:
GRPharoPlatform»addToStartUpList:	Heap»sorts:before:
GRPharoPlatform»includesUnsafeUrlCharacter:	Heap»upHeap:
GRPharoPlatform»includesUnsafeXmlCharacter:	Heap»updateObjectIndex:
GRPharoPlatform»semaphoreClass	ISO885915TextConverter class»encodingNames
GRPharoRandomProvider class»initialize	ISO88592TextConverter class»encodingNames
GRPharoRandomProvider class»nextInt:	IdentitySet»scanFor:
GRPharoRandomProvider class»randomClass	InstructionStream»interpretExtension:in:for:
GRPharoRandomProvider class»startUp	InstructionStream»interpretNextInstructionFor:
GRPharoUtf8Codec class»basicForEncoding:	Integer class»readFrom:base:
GRPharoUtf8Codec class»supportsEncoding:	Integer class»readFrom:
GRPharoUtf8Codec»decode:	Integer»*
GRPharoUtf8Codec»decoderFor:	Integer»+
GRPharoUtf8Codec»encoderFor:	Integer»<
GRPharoUtf8Codec»name	Integer»=
GRPharoUtf8Codec»url	Integer»»
GRPharoUtf8CodecStream»encodeFast:	Integer»asCharacter
GRPharoUtf8CodecStream»next:	Integer»asInteger
GRPharoUtf8CodecStream»nextPut:	Integer»copyto:
GRPharoUtf8CodecStream»nextPutAll:	Integer»denominator
GRPlatform class»current	Integer»digitCompare:
GRPlatform»reducedConflictDictionary	Integer»digitDiv:neg:
GRSmallDictionary class»new:	Integer»digitMultiply:neg:
GRSmallDictionary class»new	Integer»digitSubtract:

Integer»floor	MethodContext»blockReturnTop
Integer»isFraction	MethodContext»closure
Integer»isInteger	MethodContext»contextTag
Integer»noMask:	MethodContext»methodReturnContext
Integer»normalize	MethodContext»method
Integer»numerator	MethodContext»privRefresh
Integer»printOn:	MethodContext»receiver
Integer»printStringBase:length:padded:	MethodContext»setSender:receiver:method:arguments:
Integer»printStringLength:padded:	MethodContext»setSender:receiver:method:closure:startpc:
Integer»quo:	MethodContext»tempAt:put:
Integer»rounded	MethodContext»tempAt:
Integer»timesRepeat:	MethodDictionary»at:ifAbsent:
Integer»truncated	MethodDictionary»includesKey:
Interval class»from:to:by:	MethodDictionary»scanFor:
Interval class»new	Month class»daysInMonth:forYear:
Interval»collect:	Month class»indexOfMonth:
Interval»setFrom:to:by:	Month class»nameOfMonth:
Interval»size	Mutex»critical:
Interval»species	Mutex»initialize
KOI8RTextConverter class»encodingNames	NetNameResolver class»initializeNetwork
LanguageEnvironment class»defaultFileNameConverter	NetNameResolver class»initialize
LargeNegativeInteger»negative	NetNameResolver class»primNameResolverStatus
LargeNegativeInteger»normalize	NetNameResolver class»resolverStatus
LargePositiveInteger>*	Number class»one
LargePositiveInteger»+	Number class»readFrom:
LargePositiveInteger»-	Number»//
LargePositiveInteger»//	Number»%
LargePositiveInteger»<	Number»\
LargePositiveInteger»asFloat	Number»abs
LargePositiveInteger»digitAt:	Number»asDuration
LargePositiveInteger»digitLength	Number»floor
LargePositiveInteger»highBitOfMagnitude	Number»fractionPart
LargePositiveInteger»negated	Number»integerPart
LargePositiveInteger»negative	Number»isNumber
LargePositiveInteger»normalize	Number»isZero
LargePositiveInteger»quo:	Number»negated
LimitedWriteStream»nextPut:	Number»negative
LimitedWriteStream»nextPutAll:	Number»quo:
LimitedWriteStream»setLimit:limitBlock:	Number»raisedToInteger:
LookupKey class»key:	Number»rem:
LookupKey»key:	Number»strictlyPositive
LookupKey»key	Number»to:
MacOSXPlatform class»isActivePlatform	NumberParser class»on:
MacRomanTextConverter class»encodingNames	NumberParser»nextElementaryLargeIntegerBase:
Magnitude»>	NumberParser»nextIntegerBase:
Magnitude»between:and:	NumberParser»nextUnsignedIntegerBase:
Magnitude»max:	NumberParser»nextUnsignedIntegerOrNilBase:
Magnitude»min:	NumberParser»on:
MethodContext class»sender:receiver:method:arguments:	NumberParser»peekSignIsMinus
MethodContext»aboutToReturn:through:	NumberParser»readExponent

OSPlatform class»determineActivePlatformStartingAt	Object»perform:withArguments:inSuperclass:
OSPlatform class»initialize	Object»perform:withArguments:
OSPlatform class»isMacOS	Object»perform:
OSPlatform class»platformName	Object»postCopy
OSPlatform class»shutDown:	Object»printOn:
OSPlatform class»startUp:ISO88597	Object»printStringLimitedTo:
OSPlatform class»version	Object»printString
OSPlatform»shutDown:	Object»readFromString:
OSPlatform»startUp:	Object»renderOn:
Object class»flushDependents	Object»respondsTo:
Object class»flushEvents	Object»restoreFromSnapshot:
Object class»initializeDependentsFields	Object»shallowCopy
Object class»initialize	Object»shouldBePrintedAsLiteral
Object class»newFrom:	Object»snapshotCopy
Object»=	Object»species
Object»actAsExecutor	Object»split:do:
Object»as:	Object»split:
Object»asSetElement	Object»value
Object»asString	Object»yourself
Object»assert:	Object»~=
Object»at:put:	OrderedCollection class»arrayType
Object»at:	OrderedCollection class»new:
Object»basicAt:put:	OrderedCollection class»new
Object»basicAt:	OrderedCollection»add:
Object»basicSize	OrderedCollection»addAll:
Object»breakDependents	OrderedCollection»addAllLast:
Object»class	OrderedCollection»addFirst:
Object»copyFrom:	OrderedCollection»addLast:
Object»copySameFrom:	OrderedCollection»asArray
Object»copy	OrderedCollection»at:
Object»enclosedSetElement	OrderedCollection»collect:
Object»encodeOn:	OrderedCollection»copyEmpty
Object»executor	OrderedCollection»do:
Object»greaseString	OrderedCollection»ensureBoundsFrom:to:
Object»hash	OrderedCollection»growAtLast
Object»instVarAt:put:	OrderedCollection»makeRoomAtFirst
Object»instVarAt:	OrderedCollection»makeRoomAtLast
Object»instVarNamed:put:	OrderedCollection»postCopy
Object»isArray	OrderedCollection»remove:ifAbsent:
Object»isCharacter	OrderedCollection»removeFirst
Object»isInteger	OrderedCollection»removeIndex:
Object»isKindOf:	OrderedCollection»resetTo:
Object»isLiteral	OrderedCollection»reset
Object»isMemberOf:	OrderedCollection»reverseDo:
Object»isSelfEvaluating	OrderedCollection»select:
Object»isString	OrderedCollection»setCollection:
Object»isSymbol	OrderedCollection»size
Object»myDependents:	PositionableStream class»on:
Object»notNil	PositionableStream»atEnd
Object»perform:with:	PositionableStream»isBinary

PositionableStream»isEmpty	ProtoObject»identityHash
PositionableStream»on:	ProtoObject»initialize
PositionableStream»originalContents	ProtoObject»instVarsInclude:
PositionableStream»peekFor:	ProtoObject»isNil
PositionableStream»peek	ProtoObject»pointsTo:
PositionableStream»position:	ProtoObject»~~
PositionableStream»position	Random»initialize
PositionableStream»reset	Random»nextInt:
PositionableStream»skip:	Random»nextValue
PositionableStream»skipSeparators	Random»next
PositionableStream»skipTo:	ReadStream class»on:from:to:
Process class»forContext:priority:	ReadStream»next
Process»activateReturn:value:	ReadStream»on:from:to:
Process»calleeOf:	ReadStream»upTo:
Process»complete:	ReadStream»upToEnd
Process»isActiveProcess	Semaphore class»forMutualExclusion
Process»name:	Semaphore class»new
Process»popTo:	Semaphore»critical:ifError:
Process»primitiveResume	Semaphore»critical:
Process»priority:	Semaphore»initSignals
Process»priority	Semaphore»signal
Process»psValueAt:put:	Semaphore»waitTimeoutMsecs:
Process»psValueAt:	Semaphore»wait
Process»resume	SequenceableCollection class»new:streamContents:
Process»return:value:	SequenceableCollection class»ofSize:
Process»suspendedContext:	SequenceableCollection class»streamContents:limitedTo:
Process»suspendingList	SequenceableCollection class»streamContents:
Process»suspend	SequenceableCollection class»streamSpecies
Process»terminate	SequenceableCollection»,
ProcessLocalVariable class»value:	SequenceableCollection»allButFirst:
ProcessLocalVariable»value:	SequenceableCollection»at:ifAbsent:
ProcessSpecificVariable class»soleInstance	SequenceableCollection»atAllPut:
ProcessSpecificVariable class»value	SequenceableCollection»copyAfter:
ProcessSpecificVariable»default	SequenceableCollection»copyFrom:to:
ProcessSpecificVariable»value	SequenceableCollection»copyReplaceFrom:to:with:
ProcessorScheduler class»idleProcess	SequenceableCollection»copyUpTo:
ProcessorScheduler class»initialize	SequenceableCollection»do:separatedBy:
ProcessorScheduler class»relinquishProcessorForMsecs:processor:	SequenceableCollection»do:
ProcessorScheduler class»startUp	SequenceableCollection»doWithIndex:
ProcessorScheduler»activePriority	SequenceableCollection»first:
ProcessorScheduler»activeProcess	SequenceableCollection»first
ProcessorScheduler»highIOPriority	SequenceableCollection»from:to:put:
ProcessorScheduler»highestPriority	SequenceableCollection»grownBy:
ProcessorScheduler»lowIOPriority	SequenceableCollection»includes:
ProcessorScheduler»lowestPriority	SequenceableCollection»indexOf:ifAbsent:
ProcessorScheduler»terminateActive	SequenceableCollection»indexOf:startingAt:ifAbsent:
ProcessorScheduler»timingPriority	SequenceableCollection»indexOf:
ProcessorScheduler»userInterruptPriority	SequenceableCollection»indexOfSubCollection:startingAt:
ProtoObject»basicIdentityHash	SequenceableCollection»keysAndValuesDo:
ProtoObject»flag:	SequenceableCollection»last

SequenceableCollection»readStream	SmalltalkImage»logStartupErrorDuring:into:tryDebugger:
SequenceableCollection»replaceFrom:to:with:	SmalltalkImage»lowSpaceThreshold
SequenceableCollection»reverseDo:	SmalltalkImage»lowSpaceWatcher
SequenceableCollection»second	SmalltalkImage»newSessionObject
SequenceableCollection»select:	SmalltalkImage»primImagePath
SequenceableCollection»split:indicesDo:	SmalltalkImage»primSignalAtBytesLeft:
SequenceableCollection»splitOn:	SmalltalkImage»primitiveGetSpecialObjectsArray
SequenceableCollection»swap:with:	SmalltalkImage»processShutDownList:
SequenceableCollection»withIndexDo:	SmalltalkImage»processStartupList:
SequenceableCollection»writeStream	SmalltalkImage»recordStartupStamp
Set class»new	SmalltalkImage»registerExternalObject:
Set»add:	SmalltalkImage»send:toClassesNamedIn:with:
Set»do:	SmalltalkImage»shutDownImage:
Set»fixCollisionsFrom:	SmalltalkImage»specialObjectsArray
Set»grow	SmalltalkImage»startupImage:snapshotWorked:
Set»includes:	SmalltalkImage»unregisterExternalObject:
Set»noCheckAdd:	SmalltalkImage»vm
Set»remove:ifAbsent:	SmalltalkImage»wordSize
Set»scanFor:	Socket class»acceptFrom:
SmallInteger class»maxValCP1252	Socket class»initializeNetwork
SmallInteger»*	Socket class»initialize
SmallInteger»/	Socket class»newTCP
SmallInteger»asFloat	Socket class»register:
SmallInteger»decimalDigitLength	Socket class»registry
SmallInteger»gcd:	Socket class»standardTimeout
SmallInteger»hashMultiply	Socket class»unregister:
SmallInteger»hash	Socket»acceptFrom:
SmallInteger»highBitOfPositiveReceiver	Socket»accept
SmallInteger»highBit	Socket»closeAndDestroy:
SmallInteger»identityHash	Socket»closeAndDestroy
SmallInteger»isLarge	Socket»close
SmallInteger»numberOfDigitsInBase:	Socket»dataAvailable
SmallInteger»printOn:base:length:padded:	Socket»destroy
SmallInteger»printOn:base:	Socket»initialize:
SmallInteger»printString	Socket»isConnected
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SmalltalkImage»addToShutDownList:	Socket»primAcceptFrom:receiveBufferSize:sendBufSize:semaIndex:readSemaIndex:writeSemaIndex:
SmalltalkImage»addToStartupList:	Socket»primSocket:receiveDataInto:startingAt:count:
SmalltalkImage»at:ifAbsent:	Socket»primSocket:sendData:startIndex:count:
SmalltalkImage»at:	Socket»primSocket:setOption:value:
SmalltalkImage»clearExternalObjects	Socket»primSocketConnectionStatus:
SmalltalkImage»executeDeferredStartupActions:	Socket»primSocketDestroy:
SmalltalkImage»garbageCollectMost	Socket»primSocketReceiveDataAvailable:
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Socket»sendSomeData:startIndex:count:	String»isWideString
Socket»setOption:value:	String»match:
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Socket»waitForDataFor:ifClosed:ifTimedOut:	String»startingAt:match:startingAt:
Socket»waitForDataFor:	String»subStrings:
Socket»waitForDisconnectionFor:	String»translateFrom:to:table:
Socket»waitForSendDoneFor:	String»translateToLowercase
SparseLargeTable»at:	String»translateToUppercase
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SparseLargeTable»pvtCheckIndex:	String»trimBoth:
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String class»empty	Symbol»asString
String class»new:	TextConverter class»allEncodingNames
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String»compare:with:collated:	Time class»dateAndTimeNow
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String»encodeOn:	Time class»hour:minute:second:nanoSecond:
String»findString:startingAt:caseSensitive:	Time class»millisecondClockValue
String»findString:	Time class»milliseconds:since:
String»find	Time class»millisecondsSince:
String»greaseInteger	Time class»primSecondsClock
String»hash	Time class»readFrom:
String»includesSubstring:	Time class»seconds:nanoSeconds:
String»indexOf:startingAt:ifAbsent:	Time class»secondsWhenClockTicks
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Time»second	WAAccessIntervalReapingStrategy»interval
Time»ticks:	WAAccessIntervalReapingStrategy»reap
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Timespan class»starting:duration:	WAActionCallback»block:
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Timespan»dayOfMonth	WAActionCallback»isEnabledFor:
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Timespan»month	WAActionPhaseContinuation»continue
Timespan»start:	WAActionPhaseContinuation»handleRequest
Timespan»start	WAActionPhaseContinuation»renderContext:
Timespan»year	WAActionPhaseContinuation»renderContext
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True»not	WAActionPhaseContinuation»shouldRedirect
True»	WAdmin class»defaultServerManager
UIManager class»basicDefault:	WAdmin class»serverAdaptors
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ZnEntity class»new	ZnLineReader»processNext
ZnEntity class»stringEntityClass	ZnLineReader»reset
ZnEntity class»text:	ZnLineReader»store:
ZnEntity class»textCRLF:	ZnLogSupport»debug:
ZnEntity class»type:length:	ZnLogSupport»disable
ZnEntity class»type:	ZnLogSupport»enabled:
ZnEntity»contentLength:	ZnLogSupport»enabled
ZnEntity»contentLength	ZnLogSupport»info:
ZnEntity»contentType:	ZnLogSupport»initialize
ZnEntity»contentType	ZnLogSupport»transaction:
ZnEntityReader»allowsReadingUpToEnd	ZnManagingMultiThreadedServer»closeConnections
ZnEntityReader»binary	ZnManagingMultiThreadedServer»closeSocketStream:
ZnEntityReader»canReadContent	ZnManagingMultiThreadedServer»connections
ZnEntityReader»hasContentLength	ZnManagingMultiThreadedServer»lock

ZnManagingMultiThreadedServer»socketStreamOn:	ZnMultiValueDictionary»at:add:
ZnManagingMultiThreadedServer»stop:	ZnMultiValueDictionary»at:put:
ZnMessage class»readBinaryFrom:UTF8	ZnMultiValueDictionary»checkLimitForKey:
ZnMessage»entity:	ZnMultiValueDictionary»defaultLimit
ZnMessage»entityReaderOn:	ZnMultiValueDictionary»initialize:
ZnMessage»entityWriterOn:	ZnMultiValueDictionary»keysAndValuesDo:
ZnMessage»entity	ZnMultiValueDictionary»limit
ZnMessage»hasEntity	ZnNetworkingUtils class»defaultSocketStreamTimeout
ZnMessage»hasHeaders	ZnNetworkingUtils class»default
ZnMessage»headers:	ZnNetworkingUtils class»ipAddressToString:
ZnMessage»headersDo:	ZnNetworkingUtils class»listenBacklogSize
ZnMessage»headers	ZnNetworkingUtils class»serverSocketOn:
ZnMessage»isConnectionClose	ZnNetworkingUtils class»socketBufferSize
ZnMessage»readBinaryFrom:	ZnNetworkingUtils class»socketStreamOn:
ZnMessage»readHeaderFrom:	ZnNetworkingUtils class»socketStreamTimeout
ZnMessage»setConnectionClose	ZnNetworkingUtils»bufferSize
ZnMessage»wantsConnectionClose	ZnNetworkingUtils»serverSocketOn:
ZnMessage»writeOn:	ZnNetworkingUtils»setServerSocketOptions:
ZnMimeType class»applicationOctetStream	ZnNetworkingUtils»setSocketStreamParameters:
ZnMimeType class»fromString:	ZnNetworkingUtils»socketStreamClass
ZnMimeType class»main:sub:parameters:	ZnNetworkingUtils»socketStreamOn:
ZnMimeType class»main:sub:	ZnNetworkingUtils»timeout
ZnMimeType class»textPlain	ZnNullEncoder class»handlesEncoding:
ZnMimeType»=	ZnPercentEncoder»characterEncoder:
ZnMimeType»asZnMimeType	ZnPercentEncoder»characterEncoder
ZnMimeType»charSet:	ZnPercentEncoder»decode:to:
ZnMimeType»charSet	ZnPercentEncoder»decode:
ZnMimeType»main:	ZnPercentEncoder»encode:to:
ZnMimeType»main	ZnPercentEncoder»encode:
ZnMimeType»parameterAt:ifAbsent:	ZnPercentEncoder»safeSet:
ZnMimeType»parameters:	ZnPercentEncoder»safeSet
ZnMimeType»parameters	ZnRequest»isHttp10
ZnMimeType»printOn:	ZnRequest»method
ZnMimeType»setCharSetUTF8	ZnRequest»readHeaderFrom:
ZnMimeType»sub:	ZnRequest»requestLine:
ZnMimeType»sub	ZnRequest»requestLine
ZnMultiThreadedServer»augmentResponse:forRequest:	ZnRequest»uri
ZnMultiThreadedServer»closeSocketStream:	ZnRequest»wantsConnectionClose
ZnMultiThreadedServer»exceptionSet:	ZnRequestLine class»readFrom:
ZnMultiThreadedServer»executeOneRequestResponse:	ZnRequestLine»isHttp10
ZnMultiThreadedServer»executeRequestResponseLine:	ZnRequestLine»method:
ZnMultiThreadedServer»listenLoop	ZnRequestLine»method
ZnMultiThreadedServer»readRequestBadException:	ZnRequestLine»readFrom:
ZnMultiThreadedServer»readRequestSafely:	ZnRequestLine»uri:
ZnMultiThreadedServer»readRequestTerminationException:	ZnRequestLine»uri
ZnMultiThreadedServer»serveConnectionsOn:	ZnRequestLine»version:
ZnMultiThreadedServer»workerProcessName	ZnRequestLine»version
ZnMultiThreadedServer»writeResponseBad:on:	ZnResourceMetaUtils class»decodePercent:
ZnMultiThreadedServer»writeResponseSafely:on:	ZnResourceMetaUtils class»encodePercent:safeSet:encoding:
ZnMultiThreadedServer»writeResponseTerminationException:	ZnResourceMetaUtils class»parseQueryFrom:

ZnResourceMetaUtils class»queryKeyValueSafeSet	ZnSingleThreadedServer»logResponse:
ZnResourceMetaUtils class»urlPathSafeSet	ZnSingleThreadedServer»log
ZnResourceMetaUtils class»writeQueryFields:on:	ZnSingleThreadedServer»noteAcceptWaitTimedOut
ZnResourceMetaUtils class»writeQueryFields:withText	ZnSingleThreadedServer»periodicTasks
ZnResponse»setConnectionCloseFor:	ZnSingleThreadedServer»process
ZnResponse»setKeepAliveFor:	ZnSingleThreadedServer»readRequest:
ZnResponse»statusLine:	ZnSingleThreadedServer»releaseServerSocket
ZnResponse»statusLine	ZnSingleThreadedServer»serverProcessName
ZnResponse»useConnection:	ZnSingleThreadedServer»serverSocket
ZnResponse»writeOn:	ZnSingleThreadedServer»socketStreamOn:
ZnSeasideServerAdaptorDelegate class»with:	ZnSingleThreadedServer»start
ZnSeasideServerAdaptorDelegate»adaptor:	ZnSingleThreadedServer»stop:
ZnSeasideServerAdaptorDelegate»adaptor	ZnSingleThreadedServer»withMaximumEntitySizeDo:
ZnSeasideServerAdaptorDelegate»handleRequest:	ZnSingleThreadedServer»writeResponse:on:
ZnServer class»defaultServerClass	ZnStatusLine class»badRequest
ZnServer class»initialize	ZnStatusLine class»code:
ZnServer class»managedServers	ZnStatusLine»code:
ZnServer class»on:	ZnStatusLine»code
ZnServer class»shutDown:	ZnStatusLine»reason
ZnServer class»startUp:	ZnStatusLine»version:
ZnServer class»unregister:	ZnStatusLine»version
ZnServer»authenticator	ZnStatusLine»writeOn:
ZnServer»bindingAddress	ZnStringEntity class»designatedMimeType
ZnServer»delegate:	ZnStringEntity class»text:
ZnServer»delegate	ZnStringEntity»computeContentLength
ZnServer»maximumEntitySize	ZnStringEntity»contentLength
ZnServer»optionAt:ifAbsent:	ZnStringEntity»encoder:
ZnServer»optionAt:ifAbsentPut:	ZnStringEntity»encoder
ZnServer»optionAt:put:	ZnStringEntity»hasEncoder
ZnServer»port:	ZnStringEntity»initializeEncoder
ZnServer»port	ZnStringEntity»string:
ZnServer»reader:	ZnStringEntity»string
ZnServer»reader	ZnStringEntity»writeOn:
ZnServer»stop	ZnUTF8Encoder class»handlesEncoding:
ZnServer»unregister	ZnUTF8Encoder class»newForEncoding:
ZnServer»useGzipCompressionAndChunking	ZnUTF8Encoder»decodeBytes:
ZnSignalProgress class»enabled	ZnUTF8Encoder»encodedByteCountFor:
ZnSingleThreadedServer class»default	ZnUTF8Encoder»findFirstNonASCIIIn:startingAt:
ZnSingleThreadedServer class»on:Latin1	ZnUTF8Encoder»next:putAll:startingAt:toStream:
ZnSingleThreadedServer»acceptWaitTimeout	ZnUTF8Encoder»next:putAllASCII:startingAt:toStream:
ZnSingleThreadedServer»augmentResponse:forRequest:	ZnUTF8Encoder»next:putAllByteString:startingAt:toStream:
ZnSingleThreadedServer»authenticateAndDelegateRequest:	ZnUTF8Encoder»nextFromStream:
ZnSingleThreadedServer»authenticateRequest:do:	ZnUTF8Encoder»nextPut:toStream:
ZnSingleThreadedServer»closeDelegate	ZnUnknownHttpMethod class»method:
ZnSingleThreadedServer»handleRequest:	ZnUnknownHttpMethod»method:
ZnSingleThreadedServer»handleRequestProtected:	ZnUrl class»fromString:
ZnSingleThreadedServer»initializeServerSocket	ZnUrl class»schemesNotUsingPath
ZnSingleThreadedServer»isRunning	ZnUrl»addPathSegment:
ZnSingleThreadedServer»logRequest:response:start:	ZnUrl»decodePercent:
ZnSingleThreadedServer»logRequest:	ZnUrl»encodePath:on:

ZnUrl»enforceKnownScheme
ZnUrl»hasFragment
ZnUrl»hasHost
ZnUrl»hasPath
ZnUrl»hasPort
ZnUrl»hasQuery
ZnUrl»hasScheme
ZnUrl»hasUsername
ZnUrl»isSchemeUsingPath
ZnUrl»parseFrom:defaultScheme:
ZnUrl»parseFrom:
ZnUrl»parsePath:
ZnUrl»printAuthorityOn:
ZnUrl»printOn:
ZnUrl»printPathOn:
ZnUrl»printPathQueryFragmentOn:
ZnUrl»printQueryOn:
ZnUrl»query:
ZnUrl»query
ZnUrl»scheme
ZnUtils class»httpDate:
ZnUtils class»httpDate
ZnUtils class»nextPutAll:on:

ZnUtils class»signalProgress:total:
ZnUtils class»streamingBufferSize
ZnZincServerAdaptor»basicStart
ZnZincServerAdaptor»configureDelegate
ZnZincServerAdaptor»configureServerForBinaryReading
ZnZincServerAdaptor»defaultCodec
ZnZincServerAdaptor»defaultDelegate
ZnZincServerAdaptor»defaultZnServer
ZnZincServerAdaptor»isRunning
ZnZincServerAdaptor»isStopped
ZnZincServerAdaptor»requestAddressFor:
ZnZincServerAdaptor»requestBodyFor:
ZnZincServerAdaptor»requestCookiesFor:
ZnZincServerAdaptor»requestFieldsFor:
ZnZincServerAdaptor»requestHeadersFor:
ZnZincServerAdaptor»requestMethodFor:
ZnZincServerAdaptor»requestUrlFor:
ZnZincServerAdaptor»requestVersionFor:
ZnZincServerAdaptor»responseFrom:
ZnZincServerAdaptor»server
ZnZincServerAdaptor»shutDown
ZnZincServerAdaptor»startUp