



Using Node.js with InterSystems

Version 2019.1
2019-03-19

Using Node.js with InterSystems

InterSystems IRIS Data Platform Version 2019.1 2019-03-19

Copyright © 2019 InterSystems Corporation

All rights reserved.



InterSystems, InterSystems Caché, InterSystems Ensemble, InterSystems HealthShare, HealthShare, InterSystems TrakCare, TrakCare, InterSystems DeepSee, and DeepSee are registered trademarks of InterSystems Corporation.



InterSystems IRIS Data Platform, InterSystems IRIS, InterSystems iKnow, Zen, and Caché Server Pages are trademarks of InterSystems Corporation.

All other brand or product names used herein are trademarks or registered trademarks of their respective companies or organizations.

This document contains trade secret and confidential information which is the property of InterSystems Corporation, One Memorial Drive, Cambridge, MA 02142, or its affiliates, and is furnished for the sole purpose of the operation and maintenance of the products of InterSystems Corporation. No part of this publication is to be used for any other purpose, and this publication is not to be reproduced, copied, disclosed, transmitted, stored in a retrieval system or translated into any human or computer language, in any form, by any means, in whole or in part, without the express prior written consent of InterSystems Corporation.

The copying, use and disposition of this document and the software programs described herein is prohibited except to the limited extent set forth in the standard software license agreement(s) of InterSystems Corporation covering such programs and related documentation. InterSystems Corporation makes no representations and warranties concerning such software programs other than those set forth in such standard software license agreement(s). In addition, the liability of InterSystems Corporation for any losses or damages relating to or arising out of the use of such software programs is limited in the manner set forth in such standard software license agreement(s).

THE FOREGOING IS A GENERAL SUMMARY OF THE RESTRICTIONS AND LIMITATIONS IMPOSED BY INTERSYSTEMS CORPORATION ON THE USE OF, AND LIABILITY ARISING FROM, ITS COMPUTER SOFTWARE. FOR COMPLETE INFORMATION REFERENCE SHOULD BE MADE TO THE STANDARD SOFTWARE LICENSE AGREEMENT(S) OF INTERSYSTEMS CORPORATION, COPIES OF WHICH WILL BE MADE AVAILABLE UPON REQUEST.

InterSystems Corporation disclaims responsibility for errors which may appear in this document, and it reserves the right, in its sole discretion and without notice, to make substitutions and modifications in the products and practices described in this document.

For Support questions about any InterSystems products, contact:

InterSystems Worldwide Response Center (WRC)

Tel: +1-617-621-0700

Tel: +44 (0) 844 854 2917

Email: support@InterSystems.com

Table of Contents

About This Book	1
1 Introduction	3
1.1 Background	3
1.2 Installation	4
1.2.1 UNIX and Related Operating Systems	5
1.2.2 Windows	5
2 Using iris.node NoSQL Methods	7
2.1 Comparing Globals and JSON Objects	7
2.2 iris.node Methods: (Synchronous vs. Asynchronous)	8
2.3 Opening and Closing the InterSystems IRIS Database	9
2.3.1 Connecting Via the InterSystems IRIS API	9
2.3.2 Connecting to InterSystems IRIS Via the Network	10
2.3.3 Multiple Instances of InterSystems IRIS Connectivity	11
2.3.4 Closing Access to the InterSystems IRIS Database	11
2.4 Optional open() Settings	12
2.4.1 Specifying Character Encoding	12
2.4.2 Disabling the InterSystems IRIS Serialization Lock	12
2.4.3 Enabling Debug Mode	12
2.4.4 Specifying an Interrupt Signal Handler	14
2.5 Utility Functions	14
2.5.1 Pausing a Node.js Operation: sleep()	14
2.5.2 Getting Version Information: version() and about()	14
2.5.3 Invoking an InterSystems IRIS Function: function()	15
3 NoSQL Methods for Global Nodes	17
3.1 Save a Global Node: set()	17
3.2 Retrieve a Global Node: get()	18
3.3 Delete a Global Node: kill()	18
3.4 Test for the Existence of a Global Node: data()	19
3.5 Get the Next Global Subscript: next()	20
3.6 Get the Previous Global Subscript: previous()	21
3.7 Get the Next Global Node: next_node()	22
3.8 Get the Previous Global Node: previous_node()	23
3.9 Get the Next Value for an Integer Held in a Global Node: increment()	24
3.10 Copy a Global: merge()	25
3.11 Get a List of Globals in the Directory: global_directory()	26
3.12 Lock and Unlock Global Nodes: lock() and unlock()	26
4 NoSQL Methods for Structured JSON Objects	29
4.1 Retrieve a List of Global Nodes: retrieve("list")	29
4.2 Retrieve a List of Global Nodes Recursively: retrieve("array")	30
4.3 Save a List of Global Nodes: update("array")	31
4.4 Retrieve a Structured Data Object: retrieve("object")	32
4.5 Save a Structured Data Object: update("object")	32
4.6 Controlling the Amount of Data Returned by Retrieve Operations	33
5 Integration with InterSystems IRIS Objects	37
5.1 NoSQL Based Object-Oriented Development Methodology	38

5.2 Invoke a Class Method: <code>invoke_classmethod()</code>	38
5.3 Create a New InterSystems IRIS Object: <code>create_instance()</code>	39
5.4 Open an Existing InterSystems IRIS Object: <code>open_instance()</code>	39
5.5 Set the Value for a Property: <code>set_property()</code>	40
5.6 Get the Value for a Property: <code>get_property()</code>	40
5.7 Invoke an Instance Method: <code>invoke_method()</code>	41
5.8 Save an InterSystems IRIS Object: <code>save_instance()</code>	41
5.9 Close an InterSystems IRIS Object: <code>close_instance()</code>	42
5.10 Putting it All Together	42

About This Book

This book describes how to install and use the `iris.node` module, which provides access to InterSystems IRIS™ from a Node.js application.

This book contains the following sections:

- [Introduction](#)
- [Using `iris.node` NoSQL Methods](#)
- [NoSQL Methods for Global Nodes](#)
- [NoSQL Methods for Structured JSON Objects](#)
- [Integration with InterSystems IRIS Objects](#)

There is also a detailed [Table of Contents](#).

1

Introduction

This document describes an add-on module for the Node.js environment: `iris.node`. This module implements high performance access to data held in the InterSystems IRIS™ database for software developed in the Node.js environment.

1.1 Background

Node.js provides a JavaScript operating environment based on Google's highly optimized V8 JavaScript engine. Most will be familiar with JavaScript running on a client computer within the context of a web browser. Node.js, by contrast, is predominantly a middle-tier and/or server side operating environment.

The stated aim of the Node.js project is to provide a means through which high performance and highly scalable network infrastructure can be easily created. Node.js attempts to differentiate itself from conventional thread based networking software (such as web servers) by providing a non-blocking event based architecture.

Most modern web servers (with the notable exception of the newer event based servers such as Nginx and Lighttpd) are implemented using a hybrid multi-process/multithreaded server architecture where a thread is dedicated to serving each request. All resources associated with that thread remain allocated until the request is satisfied and a response dispatched to the client. In the Node.js architecture a single process is used per instance (of node) and threads are only used as a means through which operations and system calls that would otherwise block can be called asynchronously with respect to the primary thread of execution. Everything happens asynchronously in Node.js and a primary design feature of Node.js (and software written in Node.js) is that no function should block, but rather accept a callback function that Node.js will use to notify the initiating program that the operation has completed.

A consequence of the event based server architecture is that system resources (such as heap memory) are never consumed while waiting for some other operation to complete. Because of this, network programs developed using Node.js occupy a very small footprint in terms of system resource and memory usage and a high level of scalability is the key benefit.

Developers using Node.js need to be familiar with the following two technology areas:

- Event based architecture and asynchronous operation.
- Data represented using JavaScript Object Notation (JSON).

A key add-on requirement for the high-performance Node.js environment is a similarly high-performing database engine. This is where the InterSystems IRIS database comes in. The InterSystems IRIS database is provided by InterSystems. InterSystems IRIS is a mature database, the underlying technology for which has been under continual development and improvement since its launch in the late 1970s. InterSystems IRIS provides a multi-model database capability in that it can concurrently provide NoSQL, Relational and Object based access to the same physical data.

At its most basic level, the InterSystems IRIS database engine can be regarded as a NoSQL database providing B-Tree based storage, but with one important difference. Whereas conventional B-Tree databases implement one-dimensional key/value storage, InterSystems IRIS uses a multi-dimensional multiple key/value storage model. This provides the basis for a highly structured NoSQL data repository. In InterSystems IRIS terminology, a set of stored key-value pairs is known as a *global*, and each pair is a *global node*. For example:

One-dimensional Global storage:

```
MyGlobal("key1")="value1"
MyGlobal("key2")="value2"
MyGlobal("key3")="value3"
```

Multi-dimensional Global storage:

```
MyGlobal("key1")="value1"
MyGlobal("key1", "key1a")="value1a"
MyGlobal("key1", "key1a", "key1b")="value1b"
MyGlobal("key2")="value2"
MyGlobal("key2", 1)="value21"
MyGlobal("key2", 2)="value22"
MyGlobal("key3")="value3"
MyGlobal("key3", 1, 2, 3)="value3123"
MyGlobal("key3", 1, 3)="value313"
```

1.2 Installation

This section describes the procedure for installing a pre-built `iris.node` module.

Requirements

The following components should be installed:

- An InterSystems IRIS installation
- Node.js version 0.4.2 or later

Quick Installation Guide

The following instructions are provided for those already familiar with Node.js installations. Later sections in this chapter describe the installation procedure in more detail.

- *UNIX and Related Operating Systems*

Copy the appropriate version of `iris.node` for the version of Node.js in use (renaming the file to `iris.node`) to the `Node.js /lib/node/` directory. For example:

```
/opt/local/node/lib/node/iris.node
```

- *Windows*

Copy the appropriate version of `iris.node` for the version of Node.js in use (renaming the file to `iris.node`) to the Node.js home directory. For example:

```
C:\Program Files\nodejs\iris.node
```

Versions

Node.js is available for a number of UNIX platforms. Native support for Windows was added in version 0.6.

The InterSystems IRIS module is named using the Node.js `.node` extension for both UNIX and Windows. In the kits supplied by InterSystems, the module to be used with a specific Node.js version is indicated by the name. For example, the module to be used with Node.js version 0.12 is named `iris0120.node`. The version-specific name may be changed to `iris.node` before

deployment to avoid having to modify the `'require'` statement in existing Node.js software. The following versions are available:

- Node.js version 0.4.x: `iris.node`
- Node.js version 0.6.x: `iris061.node`
- Node.js version 0.8.x: `iris082.node`
- Node.js version 0.10.x: `iris0100.node`
- Node.js version 0.12.x: `iris0120.node`
- Node.js version 4.2.x: `iris421.node`
- Node.js version 5.x.x: `iris550.node`
- Node.js version 6.x.x: `iris610.node`

The rest of this chapter is concerned with creating a working installation of `iris.node` with the hosting Node.js environment.

1.2.1 UNIX and Related Operating Systems

The module `iris.node` is actually a standard UNIX shared object (for example, `iris.so`) but with an unusual Node.js-specific file extension. Copy `iris.node` to the following location in the node file system:

```
.../node/lib/node/
```

For example:

```
/opt/local/node/lib/node/iris.node
```

Placing the module in the recognized library path will remove the need to specify the full path in the JavaScript files. For example, in JavaScript, it will be possible to write:

```
var irisobj = require('iris');
```

instead of a hard-coded path like this example:

```
var irisobj = require('/opt/local/build/default/iris');
```

1.2.2 Windows

The module `iris.node` is actually a standard Windows DLL (for example, `iris.dll`) but with an unusual Node.js-specific file extension. The standard Windows installer (provided by the Node.js Group) usually places the Node.js software in the following location: `C:\Program Files\nodejs`. The installation mechanism usually adds this location to the Windows `PATH` environment variable. If this is not the case, then add it manually. Also, the `NODE_PATH` environment variable should be set and it, too, should be set to the Node.js installation directory. For example:

```
NODE_PATH=C:\Program Files\nodejs
```

Copy `iris.node` to the location specified in the `NODE_PATH` environment variable:

```
C:\Program Files\nodejs
```

Placing the module in the recognized Node.js path will remove the need to specify the full path in the JavaScript files. For example, in JavaScript, it will be possible to write:

```
var globals = require('iris');
```

instead of a hard-coded path like the following examples:

```
var globals = require('/Program Files/nodejs/iris');  
var globals = require('c:/Program Files/nodejs/iris');
```

2

Using iris.node NoSQL Methods

This chapter introduces some basic concepts and describes how to connect iris.node to the database. The following topics are discussed:

- Comparing Globals and JSON Objects
- iris.node Methods: (Synchronous vs. Asynchronous)
- Opening and Closing the InterSystems IRIS™ Database
 - Connecting via the InterSystems IRIS API
 - Connecting to InterSystems IRIS Via the Network
 - Multiple Instances of InterSystems IRIS Connectivity
 - Closing Access to the InterSystems IRIS Database
- Optional open() Settings
 - Specifying Character Encoding
 - Disabling the InterSystems IRIS Serialization Lock
 - Enabling Debug Mode
 - Specifying an Interrupt Signal Handler
- Utility Functions
 - Pausing a Node.js Operation: sleep()
 - Getting Version Information: version() and about()
 - Invoking an InterSystems IRIS Function: function()

2.1 Comparing Globals and JSON Objects

In this section we will look at the basic relationship between JSON objects in the Node.js environment and InterSystems IRIS.

Consider the following global node:

```
^Customer(1)="Jane K. White"
```

Note: By convention, global names are prefixed with the '^' character in InterSystems IRIS. However, this convention need not be followed in the corresponding JSON representation.

The equivalent JSON construct will be:

```
{global: "Customer", subscripts: [1], data: "Jane K. White"}
```

Adding further nodes to this data construct:

globals:

```
^Customer(1)="Jane K. White"
^Customer(1, "Address", 1)="London"
^Customer(1, "Address", 2)="UK"
^Customer(1, "DateOfRegistration")="1 May 2010"
```

JSON:

```
{ global: "Customer",
  subscripts: [1],
  data: "Jane K. White"
}
{ global: "Customer",
  subscripts: [1, "Address", 1],
  data: "London"
}
{ global: "Customer",
  subscripts: [1, "Address", 2],
  data: "UK"
}
{ global: "Customer",
  subscripts: [1, "DateOfRegistration"],
  data: "1 May 2010"
}
```

2.2 iris.node Methods: (Synchronous vs. Asynchronous)

All methods provided by `iris.node` can be invoked either synchronously or asynchronously. While synchronous operation is conceptually easier to grasp and can be useful for debugging, the expectation in the Node.js environment is that all operations should be implemented asynchronously with a completion event raised by means of a callback function. For this reason, most of the examples given in this guide are coded to run asynchronously. To run them synchronously simply omit the callback function from the arguments list.

- *Synchronous operation:* Method does not return until the operation is complete.
- *Asynchronous operation:* Method returns immediately and your program is notified when the operation is complete. In order to accept notification, you must pass a callback function as an argument to the original method call. By convention, the callback will always be the last argument in the list.

Consider the method to determine the version of the `iris.node` module in use:

Synchronous operation:

```
var result = mydata.version();
```

Asynchronous operation:

```
mydata.version(
  function(error, result) {
    if (error) { // error
    }
    else { // success
    }
  }
);
```

The standard convention for reporting errors in Node.js is implemented in `iris.node`. If an operation is successful, `error` will be false. If an error occurs then `error` will be true and the `result` object will contain the details according to the following JSON construct:

```
{
  "ErrorMessage": [error message text],
  "ErrorCode": [error code],
  "ok": [true|false]
}
```

For synchronous operation, you should check for the existence of these properties in the result object to determine whether or not an error has occurred.

2.3 Opening and Closing the InterSystems IRIS Database

- [Connecting via the InterSystems IRIS API](#)
- [Connecting to InterSystems IRIS Via the Network](#)
- [Multiple Instances of InterSystems IRIS Connectivity](#)
- [Closing Access to the InterSystems IRIS Database](#)

Before any other methods can be called, the `iris.node` module must be loaded, an instance of the InterSystems IRIS object created and the target InterSystems IRIS database opened before any data (or InterSystems IRIS functionality) can be accessed.

Loading the `iris.node` Module

If the `iris.node` module has been installed in the correct location for your Node.js installation, the following line will successfully load it from the default location:

```
var irisobj = require('iris');
```

If the module is installed in some other location the full path should be specified. For example:

```
var irisobj = require('/opt/cm/node0120/build/default/iris');
```

Creating an Instance

The next task is to create an instance of the `iris.node` object.

```
var mydata = new irisobj.Iris();
```

There are two ways to connect to InterSystems IRIS. First, there is the option of API level connectivity to a local InterSystems IRIS instance and, second, network based connectivity to either a local or remote InterSystems IRIS instance.

2.3.1 Connecting Via the InterSystems IRIS API

Connecting to a local instance of InterSystems IRIS via its API offers high performance integration between Node.js and InterSystems IRIS.

```
mydata.open(parameters[, function(error, result){}]);
```

where:

- `parameters.path` — Path to the mgr directory of the target InterSystems IRIS installation.
- `parameters.username` — User name for access.

- *parameters.password* — Password for access.
- *parameters.namespace* — Target InterSystems IRIS namespace.

Example:

```
mydata.open({ path: "/iris20151/mgr",
              username: "_SYSTEM",
              password: "SYS",
              namespace: "USER"
            }, function(error, result){})
);
```

The InterSystems IRIS Principal Device

The InterSystems IRIS principal input and output device for the iris.node session can be specified by defining the `input_device` and `output_device` properties respectively.

Example (using the standard input/output device):

```
mydata.open({ path: '/opt/iris20151/mgr',
              username: "_system",
              password: "SYS",
              namespace: "user",
              input_device: "stdin",
              output_device: "stdout"
            }, function(error, result){})
);
```

The default is to use the NULL device for iris.node sessions.

2.3.2 Connecting to InterSystems IRIS Via the Network

Network based connectivity to InterSystems IRIS can be used to connect to either a local or remote instance of InterSystems IRIS. This method is particularly useful for connecting to InterSystems IRIS systems installed on platforms for which Node.js is not natively available.

Also, if Node.js is hosting a public facing web application then network based connectivity to InterSystems IRIS will provide the basis for a secure architecture in which the database is physically separated from the web server tier:

```
mydata.open(parameters[, function(error, result){}]);
```

where:

- *parameters.ip_address* — Network name or IP address of the target InterSystems IRIS installation.
- *parameters.tcp_port* — Superserver TCP port of the target InterSystems IRIS installation.
- *parameters.username* — User name for access.
- *parameters.password* — Password for access.
- *parameters.namespace* — Target InterSystems IRIS namespace.

Example:

```
mydata.open({ ip_address: "127.0.0.1",
              tcp_port: 56773,
              username: "_SYSTEM",
              password: "SYS",
              namespace: "USER"
            }, function(error, result){})
);
```

2.3.3 Multiple Instances of InterSystems IRIS Connectivity

The `iris.node` module will allow multiple instances of the InterSystems IRIS class to be created per hosting Node.js process if (and only if) TCP based connectivity to InterSystems IRIS is used.

Example 1: Creating two instances of the InterSystems IRIS class

```
var irisobj = require('iris');
var user = new irisobj.Iris();
var samples = new irisobj.Iris();

user.open({ ip_address: "127.0.0.1",
            tcp_port: 51773,
            username: "_SYSTEM",
            password: "SYS",
            namespace: "USER",
            });

samples.open({ ip_address: "127.0.0.1",
              tcp_port: 51773,
              username: "_SYSTEM",
              password: "SYS",
              namespace: "SAMPLES",
              });

console.log("'user' instance in namespace: " + user.get_namespace());
console.log("'samples' instance in namespace: " + samples.get_namespace());

user.close();
samples.close();
```

If InterSystems IRIS API based connectivity is used, it is still the case that only one instance can be created in a single Node.js process. This is because the InterSystems IRIS executable to which the hosting Node.js process binds is inherently single threaded. However, it is possible to create one connection using API based connectivity together with one or more TCP based connections.

Example 2: Creating two instances of the InterSystems IRIS class (one API and one TCP)

```
var irisobj = require('iris');
var user = new irisobj.Iris();
var samples = new irisobj.Iris();

// API based connection to InterSystems IRIS
user.open({ path: "/iris20152/mgr",
            username: "_SYSTEM",
            password: "SYS",
            namespace: "USER",
            });

// TCP based connection to InterSystems IRIS
samples.open({ ip_address: "127.0.0.1",
              tcp_port: 51773,
              username: "_SYSTEM",
              password: "SYS",
              namespace: "SAMPLES",
              });

console.log("'user' instance in namespace: " + user.get_namespace());
console.log("'samples' instance in namespace: " + samples.get_namespace());

user.close();
samples.close();
```

2.3.4 Closing Access to the InterSystems IRIS Database

The following method will gracefully close a previously opened InterSystems IRIS database.

```
mydata.close([function(error, result){}]);
```

2.4 Optional open() Settings

- [Specifying Character Encoding](#)
- [Disabling the InterSystems IRIS Serialization Lock](#)
- [Enabling Debug Mode](#)
- [Specifying an Interrupt Signal Handler](#)

2.4.1 Specifying Character Encoding

The default character encoding used in `iris.node` is UTF-8. Alternatively, 16-bit Unicode (UTF-16) can be used by defining this character encoding in the `open()` method.

Example:

```
mydata.open({  path: "/iris20151/mgr",
               username: "_SYSTEM",
               password: "SYS",
               namespace: "USER",
               charset: "UTF-16"
             }, function(error, result){})
```

2.4.2 Disabling the InterSystems IRIS Serialization Lock

An InterSystems IRIS process is inherently single threaded. Events fired asynchronously in the Node.js environment depend on the use of multiple threads to complete tasks concurrently within the context of a single process. For this reason, a serialization lock is applied to all InterSystems IRIS operations (invoked through `iris.node`) to ensure that only one command at a time is submitted to the associated InterSystems IRIS process.

However, locking is expensive. As a performance enhancement, the serialization lock may be disabled in the `open()` method if it can be ascertained that the Node.js application will only submit one task at a time to InterSystems IRIS. The lock should not be disabled if `iris.node` methods are used asynchronously. Even if synchronous mode is used throughout (with respect to the `iris.node` methods), it must be ascertained that calls to InterSystems IRIS fired synchronously cannot overlap as a result of events firing asynchronously elsewhere in the application. If in doubt, the lock should remain enabled. If an application crash occurs with the lock disabled then it should be re-enabled as a first step in diagnosing the problem.

Example: Disabling the serialization lock

```
mydata.open({  path: "/iris20151/mgr",
               username: "_SYSTEM",
               password: "SYS",
               namespace: "USER",
               lock: 0
             }, function(error, result){})
```

2.4.3 Enabling Debug Mode

A trace facility is included in the `iris.node` module to facilitate easier debugging when problems occur. The trace will record all calls to the InterSystems IRIS Call-in API, the input arguments used and the result returned. If TCP based connectivity is used the trace will record all request buffers submitted to, and response buffers received from, InterSystems IRIS.

The trace facility is enabled by defining the `debug` property in the `open()` method.

Example 1: Write a trace to the console (i.e. stdout)

```
mydata.open({ path: "/iris20151/mgr",
              username: "_SYSTEM",
              password: "SYS",
              namespace: "USER",
              debug: 1
            }, function(error, result){});
```

Example 2: Write a trace to a file (debug.log)

```
mydata.open({ path: "/iris20151/mgr",
              username: "_SYSTEM",
              password: "SYS",
              namespace: "USER",
              debug: "debug.log"
            }, function(error, result){});
```

Example trace:

Node.js Code:

```
var irisobj = require('iris');
var mydata = new irisobj.Iris();
mydata.open({ path: "/opt/iris20151/mgr",
              username: "_SYSTEM",
              password: "SYS",
              namespace: "USER",
              debug: "debug.log",
            });
mydata.set("Person", "1", "Jane K. White");
var data = mydata.get("Person ", 1);
mydata.close();
```

This will produce the following trace (or similar):

```
>>> 000007FEF9E39340==fopen(debug.log, "a")
(Debug trace file opened)
>>> iris_open
>>> 0000000180000000==sys_dso_load(
/opt/iris20151/bin/libiris.so)
>>> 0==IrisSetDir(/opt/iris20151/mgr)
>>> 0==IrisSecureStartA(000000000126CC0(_SYSTEM),
000000000116CA0(SYS),
00000000010EC90(Node.JS), 56, 15,
000000000106C80(//./nul), 00000000012ECD0(//./nul))
>>> iris_set
>>> 0==IrisPushGlobal(6, Person)
>>> 00000000269E7010==IrisExStrNew(000000002682D770, 2)
>>> 0==IrisPushExStr(000000002682D770)
>>> 1
>>> 00000000269E7010==IrisExStrNew(000000002682D788, 11)
>>> 0==IrisPushExStr(000000002682D788)
>>> Jane K. White
>>> 0==IrisGlobalSet(1)
>>> 0==IrisExStrKill(000000002682D770)
>>> 0==IrisExStrKill(000000002682D788)

>>> iris_get
>>> 0==IrisPushGlobal(6, Person)
>>> 00000000269E7010==IrisExStrNew(000000002682D770, 2)
>>> 0==IrisPushExStr(000000002682D770)
>>> 1
>>> 0==IrisGlobalGet(1, 0)
>>> 0==IrisPopExStr(00000000013F410)
>>> 0==IrisExStrKill(00000000013F410)
>>> Jane K. White
>>> 0==IrisExStrKill(000000002682D770)

>>> iris_close
>>> 0==IrisEnd()
```

2.4.4 Specifying an Interrupt Signal Handler

The `cache.node` module includes an optional signal handler to facilitate the clean interrupt of Node.js processes connected to InterSystems IRIS. Ideally, instead of relying on this facility, applications should include a suitable termination signal handler in the JavaScript code.

For example: to respond to the `SIGINT` signal (Control-C) in JavaScript code:

```
process.on( 'SIGINT', function() {  
  // clean up and close down gracefully  
});
```

In the absence of such an application level signal handler, the `iris.node` module can be instructed to register its own termination signal handler. Use the `stop_signal` property in the `open()` method to specify that `iris.node` should terminate execution on receiving signal `SIGINT` or `SIGTERM` (or both).

For example, to instruct `iris.node` to close the Node.js process on receiving either a `SIGINT` or `SIGTERM` signal:

```
user.open({path: "/iris20163/mgr",  
  username: "_SYSTEM",  
  password: "SYS",  
  namespace: "USER",  
  stop_signal: "SIGINT,SIGTERM"  
});
```

The signal handlers implemented in the `iris.node` module do no more than simply close down connectivity to InterSystems IRIS and halt the hosting Node.js process.

2.5 Utility Functions

- [Pausing a Node.js Operation: `sleep\(\)`](#)
- [Getting Version Information: `version\(\)` and `about\(\)`](#)
- [Invoking an InterSystems IRIS Function: `function\(\)`](#)

2.5.1 Pausing a Node.js Operation: `sleep()`

When troubleshooting Node.js applications, particularly those making extensive use of asynchronous completion techniques, it is often convenient to pause a function. The `iris.node` module contains a `sleep()` method to pause the current thread of execution for a period of time (in milliseconds) defined as the argument.

Example: (sleep for 5 seconds)

```
mydata.sleep(5000);
```

Note: This facility should only be used for troubleshooting as Node.js is architected according to the principle that no operation should block the main thread of execution.

2.5.2 Getting Version Information: `version()` and `about()`

The `version()` and `about()` methods return basic version information about the `iris.node` module in use and the associated InterSystems IRIS database (if open).

Synchronous:

```
var result = mydata.version();
```

Or:

```
var result = mydata.about();
```

Asynchronous:

```
mydata.version(function(error, result){});
```

Or:

```
mydata.about(function(error, result){});
```

Example:

```
mydata.version(
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

Result:

If the InterSystems IRIS database is not open:

```
Node.js Adaptor for InterSystems IRIS: Version: 1.1.112 (CM)
```

If the InterSystems IRIS database is open:

```
Node.js Adaptor for InterSystems IRIS: Version: 1.1.112 (CM); InterSystems IRIS Version:
2016.3 build 168
```

2.5.3 Invoking an InterSystems IRIS Function: function()

Functions contained within the InterSystems IRIS environment can be called directly via the **function()** method.

Synchronous:

```
var result = mydata.function(iris_function);
```

Asynchronous:

```
var result = mydata.function(iris_function, function(error, result){});
```

The Math routine

The examples in this section will be based on calls to the following InterSystems IRIS routine:

```
Math          ; Math Functions
              ;
Add(X,Y)      ; Add two numbers
              Quit (X * Y)
              ;
Multiply(X,Y) ; Add two numbers
              Quit (X * Y)
              ;
```

This is a simple InterSystems IRIS routine called **Math** containing functions to perform basic mathematical functions (**Add** and **Multiply**).

Example 1 (Synchronous/Non-JSON)

```
result = mydata.function("Add^Math", 3, 4);
```

result: 7

Example 2: (Synchronous/JSON)

```
result = mydata.function({function: "Add^Math", arguments: [3, 4]},
```

result:

```
{
  "function": "Add^Math",
  "arguments": [3, 4],
  "result": 7
}
```

Example 3: (Asynchronous/JSON)

```
mydata.lock(
  {function: "Add^Math", arguments: [3, 4]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

```
{
  "ok": 1
  "function": " Add^Math ",
  "arguments": [3, 4],
  "result": 7
}
```

3

NoSQL Methods for Global Nodes

In the following subsections we will discuss the basic NoSQL-style methods which include the following operations:

Create, read, update, and delete operations

- Save a Global Node: `set()`
- Retrieve a Global Node: `get()`
- Delete a Global Node: `kill()`

Iteration

- Test for the Existence of a Global Node: `data()`
- Get the Next Global Subscript: `next()`
- Get the Previous Global Subscript: `previous()`
- Get the Next Global Node: `next_node()`
- Get the Previous Global Node: `previous_node()`

Other operations

- Get the Next Value for an Integer Held in a Global Node: `increment()`
- Copy a Global: `merge()`
- Get a List of Globals in the Directory: `global_directory()`
- Lock and Unlock Global Nodes: `lock()` and `unlock()`

Note: **Data used in Basic NoSQL examples**

In this chapter the examples will be based on the following simple InterSystems IRIS™ data set:

```
^Customer(1)="Jane K. White"  
^Customer(1, "address")="Banstead"  
^Customer(2)="John P.Jackson"  
^Customer(3)="Jane Smith"
```

3.1 Save a Global Node: `set()`

Synchronous:

```
var result = mydata.set(node);
```

Asynchronous:

```
mydata.set(node, function(error, result){});
```

Example:

```
mydata.set(
  {global: "Customer", subscripts: [1], data: "Jane K. White"},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

Operation successful if no error reported.

3.2 Retrieve a Global Node: get()

Synchronous:

```
var result = mydata.get(node);
```

Asynchronous:

```
mydata.get(node, function(error, result){});
```

Example 1 (Synchronous)

```
result = mydata.get({global: "Customer", subscripts: [9]});
```

result:

```
{global: "Customer", subscripts: [9], data: "", defined: 0}
```

Example 2 (Asynchronous)

```
mydata.get(
  {global: "Customer", subscripts: [1]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

```
{global: "Customer", subscripts: [1], data: "Jane K. White", defined: 1}
```

Note that the defined property is set to 1 if the global node is actually defined and set to 0 if it is not.

3.3 Delete a Global Node: kill()

Synchronous:

```
var result = mydata.kill(node);
```

Asynchronous:

```
mydata.kill(node, function(error, result){});
```

Example:

```
mydata.kill(
  {global: "Customer", subscripts: [1]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

Operation successful if no error reported.

3.4 Test for the Existence of a Global Node: data()

This method will return one of the following numeric values:

- 0 — Node does not exist.
- 1 — Node contains data but has no subnodes.
- 10 — Node does not contain data but has subnodes.
- 11 — Node contains data and has subnodes.

This method will return one of the following numeric values:

- 0: Global node is undefined.
- 1: Global node points to a data value. Global(1)="Data" data(Global(1))
- 10: Global node does not point to data but is further subscripted. Global(1,1)="Data" data(Global(1))
- 11: Global node points to a data value and is further subscripted. Global(1)="Data 1", ^Global(1,1)="Data 1" data(Global(1))

Synchronous:

```
var result = mydata.data(node);
```

Asynchronous:

```
mydata.data(node, function(error, result){});
```

Example:

```
mydata.data(
  {global: "Customer", subscripts: [1]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

```
{defined: 11}
```

3.5 Get the Next Global Subscript: next()

Get the next value in the collating sequence for a particular level of subscript.

Synchronous:

```
var result = mydata.order(node);
```

Asynchronous:

```
mydata.order(node, function(error, result){});
```

Example 1 (Synchronous)

```
result = mydata.order({global: "Customer", subscripts: [""]},
```

result:

```
{global: "Customer", subscripts: [1], result: "1"}}
```

Example 2 (Synchronous)

```
result = mydata.next({global: "Customer", subscripts: [3]},
```

result:

```
{global: "Customer", subscripts: [""], result: ""}}
```

Example 3 (Asynchronous)

```
mydata.next(  
  {global: "Customer", subscripts: [1]},  
  function(error, result) {  
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)  
    }  
    else { // success  
    }  
  }  
);
```

result:

```
{global: "Customer", subscripts: [2], result: "2"}}
```

Example 4 (Parse at the first level)

```
key = {global: "Customer", subscripts: [""]};  
while ((key = user.next(key)).result != "") {  
  console.log(JSON.stringify(key, null, '\t'))  
}
```

result:

```
{global: "Customer", subscripts: [1], result: "1"}  
{global: "Customer", subscripts: [2], result: "2"}  
{global: "Customer", subscripts: [3], result: "3"}}
```

If there is no further subscript defined in the sequence then the result property will be returned as empty string ("").

3.6 Get the Previous Global Subscript: previous()

Get the previous value in the collating sequence for a particular level of subscript.

Synchronous:

```
var result = mydata.previous(node);
```

Asynchronous:

```
mydata.previous(node, function(error, result){});
```

Example 1 (Synchronous)

```
result = mydata.previous({global: "Customer", subscripts: [""]},
```

result:

```
{global: "Customer", subscripts: [3], result: "3"}}
```

Example 2 (Synchronous)

```
result = mydata.previous({global: "Customer", subscripts: [2]},
```

result:

```
{global: "Customer", subscripts: ["1"], result: "1"}}
```

Example 3 (Asynchronous)

```
mydata.previous(
  {global: "Customer", subscripts: [1]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

```
{global: "Customer", subscripts: [""], result: ""}}
```

Example 4 (Parse at the first level)

```
key = {global: "Customer", subscripts: [""]};
while ((key = user.previous(key)).result != "") {
  console.log(JSON.stringify(key, null, '\t'))
}
```

result:

```
{global: "Customer", subscripts: [3], result: "3"}}
{global: "Customer", subscripts: [2], result: "2"}}
{global: "Customer", subscripts: [1], result: "1"}}
```

If there is no further subscript defined in the sequence then the result property will be returned as empty string ("").

3.7 Get the Next Global Node: `next_node()`

Get the next whole global node in the collating sequence regardless of the level of subscript.

Synchronous:

```
var result = mydata.next_node(node);
```

Asynchronous:

```
mydata.next_node(node, function(error, result){});
```

Example 1 (Synchronous)

```
result = mydata.next_node({global: "Customer"},
```

result:

```
{global: "Customer", subscripts: [1], data: "Jane K. White, defined: 1}}
```

Example 2 (Synchronous)

```
result = mydata.next_node({global: "Customer", subscripts: [3]},
```

result:

```
{global: "Customer", defined: 0}}
```

Example 3 (Asynchronous)

```
mydata.next_node(
  {global: "Customer", subscripts: [1]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

```
{
  global: "Customer",
  subscripts: [1, "address"],
  data: "Banstead",
  defined: 1
}
```

Example 4 (Parse global)

```
key = {global: "Customer"};
while ((key = user.next_node(key)).defined) {
  console.log(JSON.stringify(key, null, '\t'));
}
```

key:

```
{
  global: "Customer",
  subscripts: [1],
  data: "Jane K. White",
  defined: 1
}
{
  global: "Customer",
  subscripts: [1, "address"],
  data: "Banstead",
  defined: 1
}
```

```

    defined: 1
  }
  {
    global: "Customer",
    subscripts: [2],
    data: "John P.Jackson",
    defined: 1
  }
  {
    global: "Customer",
    subscripts: [3],
    data: "Jane Smith",
    defined: 1
  }
}

```

If there is no further node defined in the sequence then the defined property will be set to zero.

3.8 Get the Previous Global Node: `previous_node()`

Get the previous whole global node in the collating sequence regardless of the level of subscript.

Synchronous:

```
var result = mydata.previous_node(node);
```

Asynchronous:

```
mydata.previous_node(node, function(error, result){});
```

Example 1 (Synchronous)

```
result = mydata.previous_node({global: "Customer", subscripts: ["z"]},
```

result:

```
{global: "Customer", subscripts: [3], data: "Jane Smith", defined: 1}}
```

Example 2 (Synchronous)

```
result = mydata.previous_node({global: "Customer", subscripts: [2]},
```

result:

```
{
  global: "Customer",
  subscripts: [1, "address"],
  data: "Banstead",
  defined: 1
}
```

Example 3 (Asynchronous)

```
mydata.previous_node(
  {global: "Customer", subscripts: [1]},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

```
{global: "Customer", defined: 0}}
```

Example 4 (Parse global)

```
key = {global: "Customer", subscripts: ["z"]};
while ((key = user.previous_node(key)).defined) {
  console.log(JSON.stringify(key, null, '\t'));
}
```

result:

```
{
  global: "Customer",
  subscripts: [3],
  data: "Jane Smith",
  defined: 1
}
{
  global: "Customer",
  subscripts: [2],
  data: "John P.Jackson",
  defined: 1
}
{
  global: "Customer",
  subscripts: [1, "address"],
  data: "Banstead",
  defined: 1
}
{
  global: "Customer",
  subscripts: [1],
  data: "Jane K. White",
  defined: 1
}
```

If there is no further node defined in the sequence then the defined property will be set to zero.

3.9 Get the Next Value for an Integer Held in a Global Node: `increment()`

This method provides an efficient way of uniquely assigning an (incremented) integer to a process without using locking. When called, the integer value held in the global is incremented and the new value returned to the calling program. InterSystems IRIS will guarantee that a unique number is assigned to multiple processes that may be accessing this function simultaneously.

Synchronous:

```
var result = mydata.increment(node);
```

Asynchronous:

```
mydata.increment(node, function(error, result){});
```

Example 1 (Increment ^Counter by one)

```
mydata.increment(
  {global: "Counter"},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

If successful the integer value held in global `^Counter` will be incremented and the new value returned as the result.

Example 2 (Increment `^Counter` by one – JSON based argument)

```
result = mydata.increment({global: "Counter", increment: 1})
```

Example 3 (Increment `^Counter(1)` by two)

```
result = mydata.increment({global: "Counter", subscripts: [1], increment: 2})
```

3.10 Copy a Global: merge()

The `merge()` method copies either a whole global or a section of a global to another global.

Synchronous:

```
var result = mydata.merge(
  {to: {destination_node},
   from: {source_node}};
);
```

Asynchronous:

```
mydata.merge(
  {{ to: {destination_node},
     from: {source_node}},
   function(error, result){}
);
```

Example 1: Copy a whole global

```
mydata.merge(
  {to: {global: "CopyOfCustomer"},
   from: {global: "Customer"}},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

If successful, the whole of global `^Customer` will be copied to `^CopyOfCustomer`.

Example 2: Copy a section of global

```
mydata.merge(
  {to: {global: "Customer", subscripts: [7, "address"]},
   from: {global: "Customer", subscripts: [1, "address"]}},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

If successful, the subsection of global contained under `"Customer(1, 'address')"` will be copied to `"Customer(7, 'address')"`.

3.11 Get a List of Globals in the Directory: `global_directory()`

This method will obtain a list of globals held in the directory. The number of names returned can be controlled using the range limiting properties `lo`, `hi` and `max`.

Synchronous:

```
var result = mydata.global_directory(range);
```

Asynchronous:

```
mydata.global_directory (range, function(error, result){});
```

Example 1: Obtain a list of all globals in the directory

```
mydata.global_directory({},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

If successful, an array containing all global names found will be returned.

Example 2: Obtain a list of all globals whose name begins with "Cust"

```
mydata.global_directory(
  {lo: "Cust", hi: "Cust~"},
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result:

If successful, an array containing all global names beginning with `Cust` will be returned.

3.12 Lock and Unlock Global Nodes: `lock()` and `unlock()`

The InterSystems IRIS database contains the facility to lock either whole (for example, `^Customer`) or subsections of a global (for example, `^Customer(1)`) for exclusive use.

Synchronous:

```
var result = mydata.lock(node, timeout);
var result = mydata.unlock(node);
```

Asynchronous:

```
mydata.lock(node, timeout, function(error, result){});
mydata.unlock(node, function(error, result){});
```

Example:

```
mydata.lock(  
  {global: "Customer", subscripts: [1]}, 10,  
  function(error, result) {  
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)  
    }  
    else { // success  
    }  
  }  
);
```

result:

Operation successful if no error reported. The return value will be 1 if the Global was successfully locked, or 0 if the lock request timed out.

Remember to, at some point, unlock all global nodes that your code previously locked in order to avoid deadlock situations. The lock request is placed on a wait queue if the node is already locked by another process, and will wait indefinitely (until the process terminates) if no *timeout* is specified.

Finally, to release all locks held by your program call the **unlock()** method with no node argument.

```
var result = mydata.unlock();  
mydata.unlock(function(error, result){});
```

All locks held by a Node.js process will be released if and when the process terminates.

4

NoSQL Methods for Structured JSON Objects

This section describes advanced methods that perform operations that could otherwise be achieved by combining several of the basic NoSQL-style methods.

- Retrieve a List of Global Nodes: `retrieve("list")`
- Retrieve a List of Global Nodes Recursively: `retrieve("array")`
- Save a List of Global Nodes: `update("array")`
- Retrieve a Structured Data Object: `retrieve("object")`
- Save a Structured Data Object: `update("object")`
- Controlling the Amount of Data Returned by Retrieve Operations

The following InterSystems IRIS™ data will be used to illustrate these methods:

Data used in advanced NoSQL examples

```
^Customer(1)="Jane K. White"  
^Customer(1, "Address", 1)="London"  
^Customer(1, "Address", 2)="UK"  
^Customer(1, "DateOfRegistration")="1 May 2010"  
^Customer(2)="John P. Jackson"  
^Customer(2, "Address", 1)="Reigate"  
^Customer(2, "Address", 2)="UK"  
^Customer(2, "DateOfRegistration")="7 May 2010"  
^Customer(3)="Jane Smith"  
^Customer(3, "Address", 1)="London"  
^Customer(3, "Address", 2)="UK"  
^Customer(3, "DateOfRegistration")="9 June 2010"
```

4.1 Retrieve a List of Global Nodes: `retrieve("list")`

This method will return a list of subscript values that are defined directly beneath a given level in the global.

Synchronous:

```
var result = mydata.retrieve(node, "list");
```

Asynchronous:

```
mydata.retrieve(node, "list", function(error, result){});
```

Example 1: Retrieve a list of customer numbers

```
mydata.retrieve(  
  {global: "Customer"},  
  "list",  
  function(error, result) {  
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)  
    }  
    else { // success  
    }  
  }  
);
```

result (three Customer records):

```
[1, 2, 3]
```

Example 2: Retrieve a list of address lines for a specific customer

```
mydata.retrieve(  
  {global: "Customer", subscripts: [1, "address"]},  
  "list"  
  function(error, result) {  
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)  
    }  
    else { // success  
    }  
  }  
);
```

result (two lines in the address for customer number 1):

```
[1, 2]
```

4.2 Retrieve a List of Global Nodes Recursively: retrieve("array")

This method will return a list of subscript values together with their associated data values that are defined beneath a given level in the global. The method is recursive and will retrieve all global nodes defined beneath a chosen level.

The result will be expressed as an array of global nodes: each global node expressed as a single JSON object.

Synchronous:

```
var result = mydata.retrieve(node, "array");
```

Asynchronous:

```
mydata.retrieve(node, "array", function(error, result){});
```

Example 1: Retrieve all data for a customer

```
mydata.retrieve({global: "Customer", subscripts: [1]}, "array",  
  function(error, result) {  
    if (error) {  
      // error (see result.ErrorMessage  
      // and result.ErrorCode)  
    }  
    else {  
      // success  
    }  
  }  
);
```

Result:

```
[
  {
    global: "Customer",
    subscripts: [1],
    data: "Jane K. White"
  },
  {
    global: "Customer",
    subscripts: [1, "Address", 1],
    data: "London"
  },
  {
    global: "Customer",
    subscripts: [1, "Address", 2],
    data: "UK"
  },
  {
    global: "Customer",
    subscripts: [1, "DateOfRegistration"],
    data: "1 May 2010"
  }
]
```

4.3 Save a List of Global Nodes: update("array")

This method performs the opposite task to that performed by the retrieve method. In other words the update method takes an array of global nodes, each expressed as a single JSON object and writes them back to the InterSystems IRIS database.

Synchronous:

```
var result = mydata.update(node, "array");
```

Asynchronous:

```
mydata.update(node, "array", function(error, result){});
```

Example 1: Create or update a record for a customer

```
mydata.update([
  {
    global: "Customer",
    subscripts: [1],
    data: "Jane K. White"
  },
  {
    global: "Customer",
    subscripts: [1, "Address", 1],
    data: "London"
  },
  {
    global: "Customer", subscripts: [1, "Address", 2],
    data: "UK"
  },
  {
    global: "Customer",
    subscripts: [1, "DateOfRegistration"],
    data: "1 May 2010"
  }
],
"array",
function(error, result) {
  if (error) {
    // error (see result.ErrorMessage
    // and result.ErrorCode)
  }
  else {
    // success
  }
});
```

Result:

Operation successful if no error reported.

4.4 Retrieve a Structured Data Object: retrieve("object")

This method will retrieve a structured data object defined beneath a given level in a global. This method provides a structured alternative to the array of global nodes described previously.

The result will be expressed as a single JSON object.

Synchronous:

```
var result = mydata.retrieve(node, "object");
```

Asynchronous:

```
mydata.retrieve(node, "object", function(error, result){});
```

Example: Retrieve all data for a customer

Consider the following structured InterSystems IRIS global:

```
^Customer(1, "Name")="Jane K. White"
^Customer(1, "Address", 1)="London"
^Customer(1, "Address", 2)="UK"
^Customer(1, "DateOfRegistration")="1 May 2010"
```

In Node.js:

```
mydata.retrieve({global: "Customer", subscripts: [1]}, "object"
  function(error, result) {
    if (error) {
      // error (see result.ErrorMessage
      // and result.ErrorCode)
    }
    else {
      // success
    }
  }
);
```

Result:

```
{
  node: { global: "Customer",
    subscripts: [1]
  },
  object: { Name: "Jane K. White",
    Address: {"1": "London", "2": "UK"},
    DateOfRegistration: "1 May 2010",
  }
}
```

4.5 Save a Structured Data Object: update("object")

This method performs the opposite task to that performed by the retrieve method. In other words it writes the contents of a structured JSON object back to the InterSystems IRIS database.

Synchronous:

```
var result = mydata.update(node, "object");
```

Asynchronous:

```
mydata.update(node, "object", function(error, result){});
```

Example 1: Create or update a record for a customer

```

mydata.update({  node: {global: "Customer",
                      subscripts: [1]
                    },
                Object: {Name: "Jane K. White",
                        DateOfRegistration: "1 May 2010",
                        Address: {"1": "London", "2": "UK"}
                    },
                "object",
                function(error, result) {
                    if (error) {
                        // error (see result.ErrorMessage
                        //         and result.ErrorCode)
                    }
                    else {
                        // success
                    }
                }
            });

```

Result:

Operation successful if no error reported. If successful, the following set of global nodes will be created for this example:

```

^Customer(1, "Address", 1)="London"
^Customer(1, "Address", 2)="UK"
^Customer(1, "DateOfRegistration")="1 May 2010"
^Customer(1, "Name")="Jane K. White"

```

4.6 Controlling the Amount of Data Returned by Retrieve Operations

Clearly the retrieve operations are capable, depending on the underlying global structure, of returning enormous volumes of data to the Node.js environment. The following properties can be added to the requesting JSON object (i.e. the object defining the root global node) to limit the amount of data returned.

- *max* — The maximum number of global nodes to return.
- *lo* — The lowest global subscript to return.
- *hi* — The highest global subscript to return.

If all three properties are defined, the retrieve operation will terminate when the *max* number of global nodes have been returned, even if the global subscript defined in *hi* has not been reached.

Consider the following InterSystems IRIS global:

```

^Customer(1, "Address", 1)="London"
^Customer(1, "Address", 2)="UK"
^Customer(1, "DateOfRegistration")="1 May 2010"
^Customer(1, "Name")="Jane K. White"
^Customer(1, "Orders", 20100501, "Reference")="Order001"
^Customer(1, "Orders", 20100503, "Reference")="Order002"
^Customer(1, "Orders", 20100507, "Reference")="Order003"
^Customer(1, "Orders", 20100509, "Reference")="Order004"
^Customer(1, "Orders", 20100510, "Reference")="Order005"
^Customer(1, "Orders", 20100520, "Reference")="Order006"
^Customer(1, "Orders", 20100527, "Reference")="Order007"
^Customer(1, "Orders", 20100906, "Reference")="Order008"
^Customer(1, "Orders", 20110104, "Reference")="Order011"
^Customer(1, "Orders", 20110203, "Reference")="Order012"
^Customer(2, "Address", 1)="Reigate"
^Customer(2, "Address", 2)="UK"
^Customer(2, "DateOfRegistration")="7 May 2010"
^Customer(2, "Name")="John P.Jackson"
^Customer(2, "Orders", 20101204, "Reference")="Order009"

```

```
^Customer(2, "Orders", 20101206, "Reference")="Order010"
^Customer(3, "Address", 1)="London"
^Customer(3, "Address", 2)="UK"
^Customer(3, "DateOfRegistration")="9 June 2010"
^Customer(3, "Name")="Jane Smith"
^Customer(4, "Name")="Jim Cooper"
^Customer(5, "Name")="Eve Simpson"
^Customer(6, "Name")="John Cotton"
^Customer(7, "Name")="Alison Clarke"
^Customer(8, "Name")="Paul Francis"
^Customer(9, "Name")="Susan Reed"
^Customer(10, "Name")="Mary Dodds"
```

Note: The third subscript in the `Orders` section is the date in YYYYMMDD format.

Example 1: List the registered Customer numbers between 2 and 7 (inclusive)

```
mydata.retrieve(
  {global: "Customer", lo: 2, hi: 7},
  "list",
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result (six Customer records):

```
[2, 3, 4, 5, 6, 7]
```

Example 2: List the Orders placed by Customer number 1 between 7 May 2010 and 24 December 2010 (inclusive)

```
mydata.retrieve(
  { global: "Customer",
    subscripts: [1, "Orders"],
    lo: 20100507,
    hi: 20101224
  },
  "list",
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result (six Customer Order records):

```
[20100507, 20100509, 20100510, 20100520, 20100527, 20100906]
```

Example 3: List the full details for Orders placed by Customer number 1 in September 2010

```
mydata.retrieve(
  { global: "Customer",
    subscripts: [1, "Orders"],
    lo: 20100901,
    hi: 20100930
  },
  "array",
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

result (one Customer Order record):

```
[
  {
    global: "Customer",
    subscripts: [1, "Orders", 20100906, "Reference"]
    data: "Order008"
  }
]
```

Example 4: List first three Customers registered (by Customer number) in the database

```
mydata.retrieve(
  {global: "Customer", max: 3},
  "list",
  function(error, result) {
    if (error) { // error (see result.ErrorMessage and result.ErrorCode)
    }
    else { // success
    }
  }
);
```

Result (three Customer records):

```
[1, 2, 3]
```


5

Integration with InterSystems IRIS Objects

The `iris.node` module provides methods to allow Node.js applications to integrate directly with InterSystems IRIS™ objects. (instances of classes defined in the InterSystems IRIS class library).

- [NoSQL Based Object-Oriented Development Methodology](#)
- [Invoke a Class Method: `invoke_classmethod\(\)`](#)
- [Create a New InterSystems IRIS Object: `create_instance\(\)`](#)
- [Open an Existing InterSystems IRIS Object: `open_instance\(\)`](#)
- [Set the Value for a Property: `set_property\(\)`](#)
- [Get the Value for a Property: `get_property\(\)`](#)
- [Invoke an Instance Method: `invoke_method\(\)`](#)
- [Save an InterSystems IRIS Object: `save_instance\(\)`](#)
- [Close an InterSystems IRIS Object: `close_instance\(\)`](#)
- [Putting it All Together](#)

The examples in this chapter are based on the contrived, but simple, InterSystems IRIS `%Persistent` class listed below:

Example: Class `User.customer`

```
Class User.customer Extends %Persistent
{
    Property number As %Integer;
    Property name As %String;

    ClassMethod MyClassMethod(x As %Integer) As %Integer
    {
        Quit x * 2
    }

    Method MyMethod(x As %Integer) As %Integer
    {
        Quit x * 3
    }
}
```

5.1 NoSQL Based Object-Oriented Development Methodology

The examples shown earlier in this book have illustrated the use of the InterSystems IRIS database as a raw NoSQL engine. The code in this chapter illustrates how the `iris.node` methods together with the JSON notation in JavaScript can be used to create a more object orientated development methodology.

Example:

```
var irisobj = require('iris');
var user = new irisobj.Iris();
user.open({
  path: "/iris20102/mgr",
  username: "_SYSTEM",
  password: "SYS",
  namespace: "USER"});

var customers = new Customers();
var customer = customers.getCustomer(1);

console.log("customer number 1 is " + customer.data);
customers.setCustomer(9, "Tom Smith");
user.close();

function Customers() {
  this.global = "Customer";
  this.subscripts = new Array();

  this.getCustomer = function(id) {
    this.subscripts[0] = id;
    var person = user.get(this);
    return person;
  }

  this.setCustomer = function(id, name) {
    this.subscripts[0] = id;
    this.data = name;
    var person = user.set(this);
    return;
  }
}
```

5.2 Invoke a Class Method: `invoke_classmethod()`

A method is an executable element defined by a class. InterSystems IRIS supports two types of methods: instance methods (keyword `Method`) and class methods (keyword `ClassMethod`). An instance method is invoked from a specific instance of a class and typically performs some action related to that instance. A class method is a method that can be invoked without reference to any instance; these are called static methods in other languages. The term method usually refers to an instance method. The more specific phrase class method is used to refer to class methods.

Synchronous:

```
var result = mydata.invoke_classmethod(class_method);
```

Asynchronous:

```
mydata.invoke_classmethod(class_method, function(error, result){});
```

Example:

```
var result = mydata.invoke_classmethod(
  {class: "User.customer",
   method: "MyClassMethod",
   arguments: [7]}
);
```

result:

```
{
  "ok": 1,
  "class": "User.customer",
  "method": "MyClassMethod",
  "arguments": ["7"],
  "result": "14"
}
```

5.3 Create a New InterSystems IRIS Object: create_instance()

Synchronous:

```
var instance = mydata.create_instance(class);
```

Asynchronous:

```
mydata.create_instance(class, function(error, instance){});
```

Example:

```
var instance = mydata.create_instance({class: "User.customer"});
```

instance:

```
{
  "ok": 1,
  "class": "User.customer",
  "method": "%New",
  "oref": 1
}
```

5.4 Open an Existing InterSystems IRIS Object: open_instance()

Synchronous:

```
var instance = mydata.open_instance(class);
```

Asynchronous:

```
mydata.open_instance(class, function(error, instance){});
```

Example:

```
var instance = mydata.open_instance({class: "User.customer", arguments: [1]});
```

instance:

```
{
  "ok": 1,
  "class": "User.customer",
  "method": "%OpenId",
  "arguments": ["1"],
  "oref": 1
}
```

5.5 Set the Value for a Property: `set_property()`

Synchronous:

```
var result = mydata.set_property(instance, property_value);
```

Asynchronous:

```
mydata.set_property(instance, property_value, function(error, result){});
```

Example 1:

```
var result = mydata.set_property(
  instance,
  {property: "number",
   value: 100000}
);
```

result:

```
{
  "ok": 1,
  "oref": 1,
  "property": "number",
  "value": 100000
}
```

Example 2:

```
var result = mydata.set_property(
  instance,
  {property: "name",
   value: "Chris Munt"}
);
```

result:

```
{
  "ok": 1,
  "oref": 1,
  "property": "name",
  "value": "Chris Munt"
}
```

5.6 Get the Value for a Property: `get_property()`

Synchronous:

```
var result = mydata.get_property(instance, property);
```

Asynchronous:

```
mydata.get_property(instance, property, function(error, result){});
```

Example:

```
var get_property = mydata.get_property(instance, {property: "name"});

get_property:
{
  "ok": 1,
  "oref": 1,
  "property": "name",
  "value": "Chris Munt"
}
```

5.7 Invoke an Instance Method: `invoke_method()`

Synchronous:

```
result = mydata.invoke_method(instance, method);
```

Asynchronous:

```
mydata.invoke_method(instance, method, function(error, result){});
```

Example:

```
var result = mydata.invoke_method(instance, {method: "MyMethod", arguments: [3]});

result:
{
  "ok": 1,
  "oref": 1,
  "method": "MyMethod",
  "arguments": ["3"],
  "result": "9"
}
```

5.8 Save an InterSystems IRIS Object: `save_instance()`

Synchronous:

```
var result = mydata.save_instance(instance);
```

Asynchronous:

```
mydata.save_instance(instance, function(error, result){});
```

Example:

```
var result = mydata.save_instance(instance);

result:
{
  "ok": 1,
  "oref": 1
}
```

5.9 Close an InterSystems IRIS Object: `close_instance()`

Synchronous:

```
var result = mydata.close_instance(instance);
```

Asynchronous:

```
mydata.close_instance(instance, function(error, result){});
```

Example:

```
var result = mydata.close_instance(instance);
```

result:

```
{
  "ok": 1,
  "oref": 1
}
```

5.10 Putting it All Together

Adopting an object oriented approach based on InterSystems IRIS objects.

Example:

```
var new_customer = new customer();

new_customer.create();
new_customer.number = 100000;
new_customer.name = "Chris Munt";
new_customer.save();
new_customer.close();

function customer() {
  this.class = "User.Customer";
  this.instance = {};
  this.number = 0;
  this.name = "";

  this.create = function() {
    this.instance = user.create_instance({class: this.class});
    return this.instance;
  }

  this.save = function() {
    var set_number = user.set_property(this.instance,
      {property: "number", value: this.number});
    var set_name = user.set_property(this.instance,
      {property: "name", value: this.name});
    var save = user.save_instance(this.instance);
    return save;
  }

  this.close = function() {
    var close = user.close_instance(this.instance);
    return close;
  }
}
```