

2 a	A communications method call is made to the i2b2.CELLCODE.ajax.METHODNAME .
2 b	The generic communicator code performs a synchronous or asynchronous call to the i2b2 hive back-end and retrieves the results.
2 c	The cell communicator returns a standardized <i>Communications Message Object</i> containing the resultant XML as well as an optional method called parse () .
2 d	Calling the parse () method of the <i>Communications Message Object</i> will cause a JavaScript array called data to be added to the object which contains information extracted by the default associated parser routine. If an error is encountered data === false .

Creating a Communicator Object

Object Instantiation and Definition of Data Namespaces

Create an instance of the generic communicator object using a call to **i2b2.hive.communicatorFactory()** function and save it to the **ajax** namespace of your cell or plug-in. You will also need to define a namespace to hold the XML message templates used to send requests to the i2b2 Hive.

You may optionally define a namespace to hold any functions you plan on using to process the returned XML document into a more easily worked with native-JavaScript format. Best practice is to call these namespaces **msgs** and **parsers** respectively and to add them to your cell / plug-in's **cfg** namespace.

```
// create the communicator Object i2b2.ONT.ajax = i2b2.hive.communicatorFactory ("ONT");

// create namespaces to store the communicator's msg templates and parsers
i2b2.ONT.cfg.msgs = {};
i2b2.ONT.cfg.parsers = {};
```

Definition of XML Message

Now the individual XML message templates need to be created. These templates are simply strings saved into the **msgs** namespace. Best practice is to save them using a name that is the same as the i2b2 Hive RPC call.

```
i2b2.ONT.cfg.msgs.GetSchemes =
'<?xml version="1.0" encoding="UTF-8" standalone="yes"?>\n'
'<ns3:request xmlns:ns3="http://www.i2b2.org/xsd/hive/mghs/1.1."
  xmlns:ns4="http://www.i2b2.org/xsd/cell/ont/1.1/"
  xmlns:ns2="http://www.i2b2.org/xsd/hive/plugin/">\n'
'  <message_header>\n'
'    {proxy_info}\n'
'    <i2b2_version_compatible>1.1</i2b2_version_compatible>\n'
'    <hl7_version_compatible>2.4</hl7_version_compatible>\n'
'    <receiving_facility>\n'
'      <facility_name>i2b2 Hive</facility_name>\n'
'    </receiving_facility>\n'
'    <datetime_of_message>{header_msg_datetime}</datetime_of_message>\n'
'    <security>\n'
'      <domain>{sec_domain}</domain>\n'
'      <username>{sec_user}</username>\n'
'      {sec_pass_node}\n'
'    </security>\n'
'    <message_control_id>\n'
'      <message_num>{header_msg_id}</message_num>\n'
'      <instance_num>0</instance_num>\n'
'    </message_control_id>\n'
'    <processing_id>\n'
'      <processing_id>P</processing_id>\n'
'      <processing_mode>I</processing_mode>\n'
'    </processing_id>\n'
'    <accept_acknowledgement_type>AL</accept_acknowledgement_type>\n'
'    <application_acknowledgement_type>AL</application_acknowledgement_type>\n'
'
'    <country_code>US</country_code>\n'
'    <project_id>{sec_project}</project_id>\n'
'  </message_header>\n'
'  <request_header>\n'
'    <result_waittime_ms>{result_wait_time}000</result_waittime_ms>\n'
'  </request_header>\n'
'  <message_body>\n'
'    <ns4:get_schemes type="default"/>\n'
'  </message_body>\n'
'</ns3:request>;
```

Placeholder tags starting, and ending, with three curly brackets ("{" and "}") are contained throughout this message string. Between the tag's curly brackets is its non-space containing name used to identify the tag. These tags are replaced with values passed in the call parameters when the communication method is invoked.

Reserved Tag Names

There are a number of reserved tag names that are automatically defined by the i2b2 web client framework. You may (and most like will) use these tags in your message.

**Warning**
Undefined behavior (and potential web client instability) will occur if you attempt to assign a value to these tags when invoking any communication methods

Tag Name	Example Value	Description
{proxy_info}	<proxy> <redirect_url> http://services.i2b2.org/i2b2/rest/PMService/getServices </redirect_url>	Information used by the Web Client's proxy server
{sec_domain}	HarvardDemo	Domain of current project
{sec_project}	Demo	Code of current project
{sec_user}	demo	User currently logged in
{sec_pass_node}	<password token_ms_timeout='1800000' is_token='true'> SessionKey:ewlalmaQCnWuhAh5mooW </password>	See Documentation on Hive Project Management Cell
{header_msg_id}	mQgJaD4z12dd2vLWWzY64	Runtime generated GUID
{header_msg_datetime }	2010-05-19T13:24:35-04:00	Current datetime in ISO8601
{result_wait_time}	180	Max query time in seconds

Message Parser Creation

You may create a message parser to simplify your own code and to allow other developers to more easily integrate with your standardized cell communicator. When your parser is invoked its **this** variable references the standard *Communicator Results Object* ("CRO") that is returned by the communicator subsystem.

```
i2b2.ONT.cfg.parsers.GetSchemes = function(){
  if (!this.error){
    this.model = [];
    // extract records from XML msg
    var c = this.refXML.getElementsByTagName('concept');
    for (var i=0; i < 1 * c.length; i++) {
      var o = new Object;
      o.xmlOrig = c[i];
      o.level = i2b2.h.getXNodeVal(c[i], 'level');
      o.key = i2b2.h.getXNodeVal(c[i], 'key');
      o.name = i2b2.h.getXNodeVal(c[i], 'name');
      o.total_num = i2b2.h.getXNodeVal(c[i], '&totalnum');
      // save extracted info
      this.model.push(o);
    }
  } else {
    this.model = false;
    console.error("[GetSchemes] Could not parse() data!");
  }
  return this;
};
```



Be Careful

Very specific behavior is expected from your parser function! Your parser is expected to create an array called **this.model** containing a list of values or JavaScript objects representing data from the XML message. If an error occurs, your parser is expected to set **this.model = false**. Your parser routine must always return the reference to its **this** variable

Creating Communication Methods

The generic communicator object returned by calling the **i2b2.hive.communicatorFactory()** function consist of several private use functions and data structures. The **_addFunctionCall()** function is to be used by your initialization routine to create communicator methods that are to be called by non-framework code, such as the code in your cell / plug-in. To continue with this section's example and create the ONT cell's **GetSchemes** communication method the following code is executed:

```
i2b2.ONT.ajax._addFunctionCall("GetSchemes",
    "{URL}getSchemes",
    i2b2.ONT.cfg.msgs.GetSchemes,
    null,
    i2b2.ONT.cfg.parsers.GetSchemes);
```

The required first parameter of the **_addFunctionCall()** determines the name of the communicator function that will be added to the base communicator object. In this example, the communicator method **i2b2.ONT.ajax.GetSchemes()** is created.

The required second parameter is a string used to define the URL used to access the webservice on the i2b2 hive back-end. The special **{URL}** tag is replaced with the base URL of the Cell's hive webservice retrieved during the login process. The highlighted line below shows where this URL value is found in the results of the **getUserAuth** message from the PM Cell.

```
<div id="ExampTabs-mainDiv">
<cell_datas>
  <cell_data id="ONT">
    <name>Ontology Cell</name>
    <url>http://webservices.i2b2.org/i2b2/rest/OntologyService/</url>

    <project_path></project_path>
    <method>REST</method>
    <can_override>true</can_override>
  </cell_data>
</cell_datas>
```

The required third parameter is a reference to the XML message template that is to be sent to the i2b2 hive back-end when the **i2b2.ONT.ajax.GetSchemes()** communicator method is called. The message always has its special tags replaced with the values passed to the communicator method. The optional fourth parameter is an array containing the names of tags used in the XML message template that should NOT be escaped. For example, if a specific message tag is supposed to be interpreted as additional XML elements you will want to make sure that it is not escaped automatically by the communicator subsystem. If you are not using this parameter you can omit it from the function parameter list unless you are passing a 5th parameter, in which case you should set the 4th parameter to be **null**. An example of passing values using the optional 4th parameter is as follows:

```
i2b2.CRC.ajax._addFunctionCall("runQueryInstance_fromQueryDefinition",
    "{URL}request",
    i2b2.CRC.cfg.msgs.runQueryInstance_fromQueryDefinition,
    ["psm_result_output", ["psm_query_definition", ["shrine_topic"]]);
```

The optional fifth parameter is a reference to a special parser function that is used to extract information from the XML message returned from the i2b2 Hive back-end. If you are not using a parser then you can omit it from the function parameter list. The parser function that is passed to create a communication method via the **_addFunctionCall** function is said to be the "default message parser".



Be Careful

To ensure stability of your Web Client deployment, do not change the default message parser of any cell or plug-in this is not owned in-house. If a cell / plug-in does not extract all the information you need from its XML message you can copy the code to your own namespace, modify it, and pass its references as a parameter to the Communication Data Objects **parse()** function. Doing this will override usage of the default message parser in a way that will allow code updates without stability issues related to version mismatches or applying custom patches.

Using the Communicator

Standard Communication Method Parameters

All communication methods created using the **_addFunctionCall()** function of a communicator instance operate in exactly the same way and consume the same parameters. Below is a list of all parameters of a standard communications method:

Parameter	Required	Description
originName	N	String that is used to identify and group all messages using the message sniffer subsystem.
tagValues	N	A JavaScript object using tagname / value pairs. An example would be: { ont_synonym_records: "N", ont_hidden_records: "N", ont_search_strategy: "contains", ont_search_string: "asthma" }
scopedCallback	Y	A scopedCallback object or regular function used to enable asynchronous AJAX calls. If omitted, synchronous calls are used instead.
transportOptions	Y	Transport options passed directly to Prototype's AJAX object. See http://api.prototypejs.org/ajax/request/ for more information.

Synchronous Call Example

A code example showing how to perform a synchronous request on a standard communicator method:

```
// create the object containing tag/value pairs to be used by the XML msg template
var tagValues = { ont_synonym_records: "N",
                  ont_hidden_records: "N",
                  ont_search_strategy: "contains",
                  ont_search_string: "asthma",
                };
// use synchronous call to request results from the i2b2 Hive back-end
var results_cdo = i2b2.ONT.ajax.GetNameInfo ("originated by test", tagValues);

// dump the Communication Data Object variable (Firefox w/Firebug only)
console.dir (results_cdo);

// dump the sent xml (Firefox w/Firebug only)
console.debug (results_cdo.msgRequest);

// dump the returned xml (Firefox w/Firebug only)
console.debug (results_cdo.msgResponse);
```

Asynchronous Call Example

Here is a code example showing how to perform an asynchronous request on a standard communicator method:

```
// create the object containing tag/value pairs to be used by the XML msg template

var tagValues = { ont_synonym_records" "N",
                  ont_hidden_records" "N",
                  ont_search_strategy" "contains",
                  ont_search_string" "asthma",
                  };

// define a simple function to allow asynchronous call to the i2b2 Hive back-end
var simpAsyncCallback = function (results_cdo) {
// dump the Communication Data Object variable (Firefox w/Firebug only)
console.dir (results_cdo);
// dump the sent xml (Firefox w/Firebug only)
console.debug (results_cdo.msgRequest);
// dump the returned xml (Firefox w/Firebug only)
console.debug (results_cdo.msgResponse);
{color:#333333}};

// use asynchronous call to request results from the i2b2 Hive back-end
i2b2.ONT.ajax.GetNameInfo ("originated by test", tagValues, simpAsyncCallback);
```

Here is a code example that executes a callback function asynchronously within the scope of Firebug's console object:

```
// create the object containing tag/value pairs to be used by the XML msg template
var tagValues = { ont_synonym_records" "N",
                  ont_hidden_records" "N",
                  ont_search_strategy" "contains",
                  ont_search_string" "asthma",
                  };

// define a simple function to allow asynchronous call to the i2b2 Hive back-end
var complexAsyncCallback = function (results_cdo) {
// dump the Communication Data Object variable (Firefox w/Firebug only)
this.dir (results_cdo);
// dump the sent xml (Firefox w/Firebug only)
this.debug (results_cdo.msgRequest);
// dump the returned xml (Firefox w/Firebug only)
this.debug (results_cdo.msgResponse);
};

// create scoped-callback object (attaches execution scope to complexAsynchCallback)

var scopedCB = new i2b2_scopedCallback (complexAsyncCallback, window.console) ;

// use asynchronous call to request results from the i2b2 Hive back-end
i2b2.ONT.ajax.GetNameInfo ("originated by test", tagValues, simpAsyncCallback);
```

Alternatively, you can define a scoped callback object in the following way, which may make your code more readable:

```
// create scoped-callback object (attaches execution scope to complexAsynchCallback)

var scopedCB = new i2b2_scopedCallback () ;
scopedCB.scope = window.console;
scopedCB.callback =complexAsyncCallback;
```

Communication Data Object ("CDO")

All standardized communication method calls, regardless of synchronous or asynchronous execution, return a standard results object known as a Communication Data Object which contains details of the messages passed back and forth between the web client and the i2b2 Hive back-end.

Attribute Name	Type	Description
Result.error	Boolean	Information used by to Web Client's proxy server
Result.msgRequest	String	The message that was sent to the proxy server (and thus the i2b2 Hive web service)
Result. msgResponse	String	Code of current project

Result.msgUrl	String	The URL used to access the i2b2 Hive web service call.
Result.msgUrlProxy	String	The URL of the proxy that the web client sent the message to.
Result.refXML	XMLDOM	A reference to a XMLDOM object containing the response message.
Result.parse()	Function	A function called by a developer's code to automatically parse the XMLDOM and save the results in Result.model attribute.
Result.model	Null or Array	This attribute is created after calling the parse() function.

Message Parser Examples

The following code shows how to use the default parser function on a returned Communication Data Object:

```
// executing from Firebug console window, run synchronous GetSchemes webservice

// call with a debug title of "testing" and empty template vars denoted with {}
var testing = i2b2.ONT.ajax.GetSchemes ("test msg", {});
console.dir (testing) ;

// run the default GetSchemes parser and populate the "model" attribute of the CDO
testing.parse () ;

// dump the first record from the "model" attribute of the CDO
console.dir (testing.model[0]) ;
```

The results will be output as so:

