Roxen WebServer 2.2

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Introduction

Welcome to the first Roxen Tutorials! This section is dedicated to all of the users of the Roxen products. The tutorials are intended for both beginners and experienced users, and we hope that all find some interesting reading and get creative ideas.

It is assumed that the reader is familiar with HTML and have some knowledge of XML, since these tutorials only focuses on their topics.

As always, if you have any suggestions, comments or complaints regarding these tutorials do not hesitate to send an email to manuals@roxen.com and if the issue is an obvious bug do not hesitate to report it to Bug Crunch, our bug tracking system.

If tags

Welcome to the Lesson about RXML If tags!

As you surely know, a typical web page consists of text and HTML tags sent over the Internet from a web server to a browser. The HTML tags tell the browser how the page should be displayed.

The **Roxen Macro Language, RXML**, offers a number of tags which are used in the same way as HTML tags, but extend the sometimes quite limited power of HTML. One group of RXML tags are the **If tags**. These tags make it possible to create dynamic pages based on conditions. You could let authenticated users only get confidential information of a page or optimize pages for different kinds of browsers. If tags also make it possible to create web applications in RXML without using any programming language.

Hopefully this brief presentation has made you curious about the powers of If tags. If so, please don't hesitate to read the following Sections of this Lesson.

This Lesson is designed so that you may move around as you please. Feel free to read only the Sections that interest you.

After reading this Lesson you will be able to program web pages using If tags and you will know some of their many useful features. As in most creations, a tutorial isn't enough to become a master. Only hard work will get you there...

Contents

The basics of if-else statements introduces the logic of if-else statements in general to beginners in programming. If you have some experience in programming, skip this Section.

The syntax of If tags introduces the syntax of the If tags, including tags, attributes and operators.

If plugins introduces the If plugins and briefly explains the usage of each plugin.

A basic example of <if> shows a very basic example of how to use `<if>` in a web page to get you started.

Combining <if> and <define> explains how to combine and use `<if>` and `<define>` to dynamically show contents of a web page.

Browser independency with <if supports> deals with the `<if supports>` plugin, used to match contents with the browser requesting the page. Also discusses the related *page* and *client* scopes.

In the *Summary* you will find the essence of this Lesson and references to further sources of knowledge.

Detailed information about If tags is found in the *Web Site Creator Manual*.

The basics of if-else statements

This section will introduce the logic of if-else statements in general to beginners in programming. If you have some experience in programming you can skip this section.

After reading this section you will have knowledge of the basics of if-else statements.

We will create a simple web page with two radiobuttons and a regular button that will let you choose to display the text "Hello World!" in different styles. The example is rather meaningless in real life but is good to introduce you to the basics of if-else statements.

The basics

When programming you often want to control the order in which the statements will be executed. This is done by using Control Flow Statements, and some of those are the if-else statements.

The if-else statements enable your program to selectively execute other statements, based on some criteria. The simplest version, the *if* statement, is shown below. The block governed by *if* (delimited with '{' and '}') is executed if the expression is true, otherwise the execution continues after the last '}'.

```
if (expressions)
{
  statement(s)
}
```

If you want to execute other statements when the expression is false, you use the *else* statement.

```
if (expression)
{
  statement(s) executed if expression is true
}
else
{
  statement(s) executed if expression is false
}
```

Another statement, *elseif*, executes statements if an earlier *if* expression was false and it's own expression is true; *elseif* is used to form chains of conditions. If expression 1 is true, the *if* block executes and then the program jumps to the last '}' of the *else* block. Expression 2 will never be evaluated. If, however, expression 1 is false, expression 2 will be evaluated and the elseif-else will work as a regular if-else as shown above.

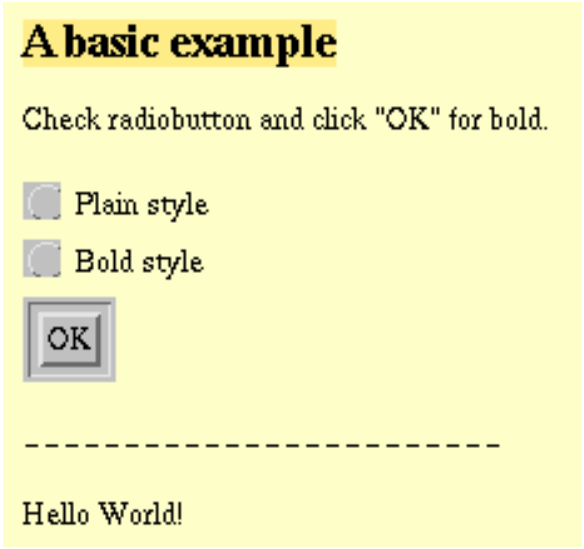
```
if (expr 1)
{
  statement(s) executed if expr 1 is true
}
elseif (expr 2)
{
  statement(s) executed if expr 1 is false and expr
 2 is true
}
else
{
```

```
  statement(s) executed if expr 1 is false and expr
 2 is false
}
```

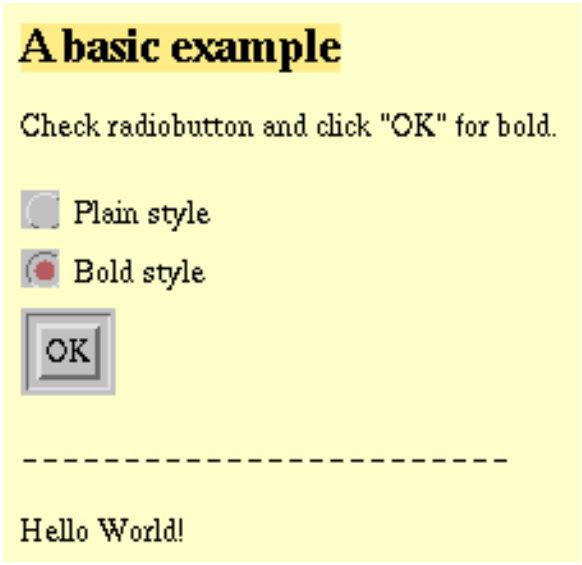
A basic example

Let's do something real to examplify what have been mentioned so far. We will create a simple HTML page containing RXML (Roxen Macro Language) that will be rather meaningless except for demonstrating the basics of *if* and *else*. The file will show the text "Hello World!" either in plain text or bold text, depending on which radiobutton is checked by the user. Here is the code followed by screenshots of the output in a browser:

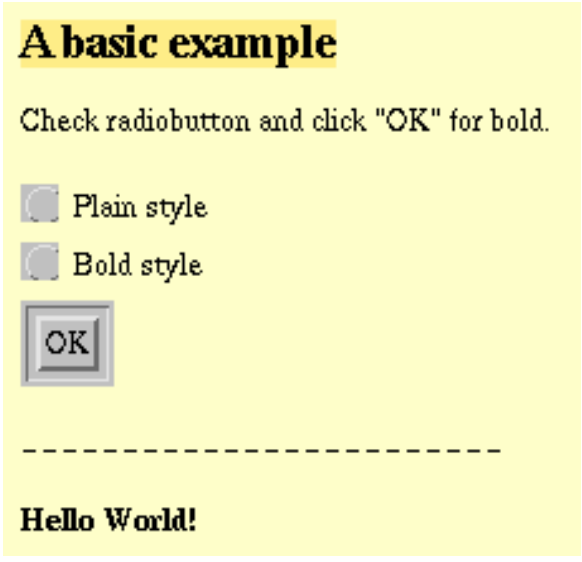
```
<html>
 <head>
  <style type='text/css'>
  <!--
    body{background-color:#FEFEC9}
    h1{background-color:#FEED87}
  -->
  </style>
 </head>

 <body>

 <!-- HTML FORM -->

 <h1>A basic example>/h1>

 <p>Check radiobutton and click &quot;OK&quot; for
bold.</p>

 <form action='hello_world.html' method='GET'>
   <input type='radio' name='style' value='plain' /
>
      Plain style <br />
   <input type='radio' name='style' value='bold' />
      Bold style <br />
   <input type='submit' value='OK' />
 </form>

 <p>------------------------</p>

 <!-- RXML CODE -->

 <if variable='form.style is bold'>
   <p><b>Hello World!</b></p>
 </if>
 <else>
   <p>Hello World!</p>
 </else>

 </body>
</html>
```



The page in the browser before any interaction.



The user chooses 'Bold style', clicks OK...



...and the text goes bold.

The interesting part of the code is the `<!-- RXML CODE -->` section. We want to check if the user chose bold or not.

When the user clicks the OK button, the variable *style* will contain either the string 'bold' or the string 'plain' (or perhaps be empty, if something goes wrong). We use an if-else statement to check which. If *style* contains 'bold', the expression *variable='form.style is bold'* will be true, the line inside *if* executes and 'Hello World!' will be bold. If *style* doesn't contain 'bold', the expression will be false and the line inside *else* will execute; 'Hello World!' will be plain text.

```
<!-- RXML CODE -->

<if variable='form.style is bold'>
  <p><b>Hello World!</b></p>
</if>
<else>
  <p>Hello World!</p>
</else>
```

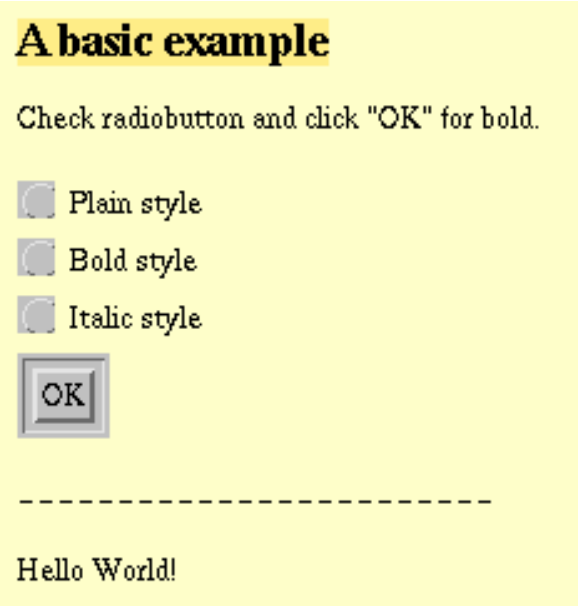
Let us add the possibility to make the text italic. We insert the lines:

```
<input type='radio' name='style' value='italic' />
  Italic style <br />
```

below the second `<input>` and rewrites the RXML part to

```
<if variable='form.style is bold'>
  <p><b>Hello World!</b></p>
</if>
<elseif variable='form.style is italic'>
  <p><i>Hello World!</i></p>
</elseif>
<else>
  <p>Hello World!</p>
</else>
```

This gives us the following result:



Now the user has three options.

As you might have guessed, this is an example of the if-elseif-else statement. If *style* contains 'bold', the *if* tag executes, if it contains 'italic', *elseif* executes and in all other cases, *else* executes.

Summary

This section has taught you the basics of the if-else statements in general. If-else statements is used to control the flow of a program. The *if* statement test a condition and if the condition is true, the *if* statement block will execute. The *else* statement will execute if an *if* condition is not true. The *elseif* statement is used to form chains of conditions.

More details about if-else statements and other control flow statements are found in any book or on any site that is teaching programming. However, the information in this Section should be enough to take you through the rest of this Lesson.

The next section, *The syntax of If tags* will introduce the RXML If tags, including tags, attributes and operators.

The syntax of If tags

This section will introduce the basics of the RXML If tags.

After reading this section you will know the proper usage of RXML If tags using attributes and operators.

If you are looking for an example, see *A basic example of <if>*.

Tags

If-statements in RXML are built up by combining the six basic tags `<if>`, `<else>`, `<elseif>`, `<then>`, `<true>` and `<false>`. With `<if>` and `<elseif>`, attributes are used to state which test(s) to do. One attribute should be one of several If plugins. Logical attributes *and*, *or* and *not* are used to further specify the test(s). We sum this up in the following general syntax (code within '[ ]' is optional):

```
<if plugin1='expr' [and|or plugin2='expr' ...] [not
]>
  if block
</if>
[<elseif plugin='expr' ...>
  elseif block
</elseif>]
[<else>
  else block
</else>]

or

<if plugin1='expr' [and|or plugin2='expr' ...] [not
] />
<then>
  if block
</then>
[...]
```

Always remember to close tags

```
<if variable='var.foo = 10' />
  or
<if variable='var.foo = 10'></if>
```

and to add values to attributes

```
<if true=''></if>
----------------------
<if variable='var.foo = 1' and='' match='&var.bar;
is bar'>
```

for proper XML syntax. This is necessary since RXML is a XML compliant language.

Let's have a look at the basic tags:

<if>

is used to conditionally show its contents; provides a framework for the If plugins.

<else>

shows its contents if the previous <if> returned false, or if there was a <false> above.

<elseif>
is the same as <if>, but will only evaluate if the previous <if> returned false.

<then>
shows its contents if the previous <if> returned true, or if there was a <true> above.

<true>
is an internal tag used to set the return value of If tags to true.

<false>
is an internal tag used to set the return value of If tags to false.

```
<set variable='var.foo' value='1' />

<if variable='var.foo = 1'>
  var.foo is 1
</if>
<else>
  var.foo is not 1
</else>


  var.foo is 1
```

A test is made if the variable *var.foo* is 1. This is true because the first line does nothing less than sets that variable to 1. Please note that the spaces around the '=' operator are mandatory.

```
<set variable='var.foo' value='1' />

<if variable='var.foo = 1' />
<then>
  var.foo is 1
</then>
<else>
  var.foo is not 1
</else>


  var.foo is 1
```

The same test using *if-then-else* instead.

```
<true />
<then>
  truth value is true
</then>
<else>
  truth value is false
</else>


  truth value is true
```

In this example the internal <true> is used to set the truth value to true so that the following <then> will be executed.

Attributes

The attributes used with <if> are:

plugin name
The If plugin that should be used to test something, e.g. <if variable>. It is mandatory to specify a plugin. See the *If plugins* Section for further information.

not
Inverts the result (true->false, false->true).

or
If any criterion is met the result is true.

and
If all criterions are met the result is true. *and* is default.

```
<set variable='var.foo' value='1' />

<if variable='var.foo = 1' not=''>
   var.foo is not 1
</if>
<else>
   var.foo is 1
</else>


   var.foo is 1
```

Here the test is logically negated with *not*.
The use of <if variable='var.foo != 1'> gives the the same result as <if variable='var.foo = 1' not=''>.
A common mistake done is when combining *and*, *or* and *not*.

```
<if user='foo' or='' not='' domain='*.foobar.com'>
  ...
</if>
```

will not work since the *not* attribute negates the whole tag, not just the *domain* attribute. If you want to negate the whole condition, add *not* at the end. If you only want to negate one of the attributes, you must rewrite the code with an *if-elseif-else* statement.

```
<if user='foo'>
</if>
<elseif domain='*.foobar.com' not=''>
  ...
</elseif>


<set variable='var.length' value='3' />
<set variable='var.string' value='foo' />

<if variable='var.length > 0' <b>and=''</
b> match='&var.string; = foo'>
   var.string is 'foo'
</if>
<else>
   Either string is empty, doesn't contain string '
foo' or both.
</else>

   var.string is "foo"
```

A multiple test with two different If plugins, *variable* and *match*.
You could be tempted to write expressions like:

```
<if variable='var.foo = 1' or='' variable='var.bar
= 1'>
  ...
</if>
```

This will not work, as you can only use the same attribute once. Here *Variable* is used twice.

Operators

Above we used the '>' operator. The operators that may be used in expressions are:

Operator	Meaning
=	equals
==	equals
is	equals
!=	not equals
<	less than
>	greater than

Note that '<=' and '>=' are not possible operators except in the *Expr* plugin. However, for the effect of `<if variable='var.foo <= 1'>` you simply use `<if variable='var.foo > 1' not=''>` instead.

Global patterns are possible to use in almost all plugin expressions. ' * ' match zero or more arbitrary characters while ' ? ' matches exactly one arbitrary character.

```
<if ip='130.236.*'>
  Your domain is liu.se
</if>
<else>
  Your domain isn't liu.se
</else>


  Your domain isn't liu
```

In this example 130.236.1 as well as 130.236.123 would be true. If the test would be `<if ip='130.236.?'>` only 130.236.0 - 9 would be true.

Regular expressions are not supported in If tags.

Summary

This section has taught you the basics of the If tags. If statements are built up by the six basic tags, `<if>`, `<else>`, `<elseif>`, `<then>`, `<true>` and `<false>`.

With `<if>` and `<elseif>` an attribute naming an If plugin must be added. The general syntax is:

```
<if plugin1='expr' [and|or plugin2='expr' ...] [not
]>
  if block
</if>
[<elseif plugin='expr' ...>
  elseif block
</elseif>]
[<else>
  else block
</else>]
```

Logical attributes, *and*, *or* and *not* adds functionality. Inside the attribute expression, the '=', '==', 'is', '!=', '<' and '>' operators are valid.

Always remember to close tags (/) and to give attributes a value (='') for proper XML syntax.

More details about If tags is found in the *Web Site Creator Manual* or by putting `<help for='if' />` in a web page.

The next section, *If plugins* will explain the usage of the If plugins.

If plugins

This section will introduce the If plugins used as attributes with `<if>` and `<elseif>`.

After reading this section you will have knowledge of the different plugin categories and the usage of the plugins.

The following sections will contain examples of how to use different plugins for creating dynamic web pages in many different ways.

The categories

The If plugins are sorted into four categories according to their function: *Eval*, *Match*, *State* and *Utils*.

EVAL	MATCH	STATE	UTILS
clientvar	accept	config	date
cookie	client	false	exists
expr	domain	pragma	group
match	ip	prestate	time
variable	language	supports	user
.	referrer	true	.
.	.	.	.

The following parts will go through these categories and the corresponding plugins. We will look at the proper way of usage and some traps you might fall into.

Eval

The *Eval* category is the one corresponding to the regular tests made in programming languages, and perhaps the most used. They evaluate expressions containing variables, enities, strings etc and are a sort of multi-use plugins. All If-tag operators and global patterns are allowed (see *The syntax of If tags*).

Plugin	Syntax
clientvar	clientvar='var[is value]'
cookie	cookie='name[is value]'
expr	expr='pattern'

Plugin	Syntax
match	match='pattern1[,pattern 2,...]'
variable	variable='name[is pattern]'

Cookie and *Variable* plugins use a similar syntax. `is` can be any valid operator and `name` is the name of any defined or undefined variable(cookie). They first check if the named variable(cookie) exists, and if it does and a pattern(value) is specified, the expression will be evaluated. *Variable* is a general plugin while *Cookie* is for testing existence and/or values of cookies.

```
<set variable='var.foo' value='10' />

<if variable='var.foo = 10'>
  true
</if>
<else>
  false
</else>

  true
```

Please note that it is the name of the variable, not the entity representing it, that should be used. Here we receive an error from the RXML parser becase we used an entity instead of a variable name. The proper way to do the test above is `<if variable='`**var.foo** `= 10'>`.

Match is used in a similar way, but there are certain differences. The syntax is `<if match="pattern">`, where pattern could be any expression. We could use `<if match='var.foo = 10'>` although this is rather meaningless, since we would check if the name of the variable *var.foo* (or the string "var.foo") was equal to the string "10", which it obviously is not. The only thing that would return true in this case is another meaningless expression: `<if match="var.foo is var.foo">`.

Instead we should always use entities with *Match*, i.e. *var.foo*. In RXML, entities are used to represent the contents of something, e.g. a variable. An entity is written as a variable name enclosed with '&' and ';'. Above the *name* of the variable is *var.foo*, the *value* is '10' and the *entity* is *var.foo*. The entity is replaced by its content when parsed to HTML, in this case '10'.

```
<set variable='var.foo' value='10' />

<if match='var.foo = 10'>
  true
</if>
<else>
  false
</else>

  true
```

Again, *variable name* goes with *Variable* and *entity* goes with *Match*.

A warning when testing patterns with whitespaces. If you want to test if the entity *var.foo* equals the string 'he is nice' and do like this...

```
<set variable='var.foo' value='he is nice' />
'&var.foo;' <br /><br />

<if match='&var.foo; is he is nice'>
  var.foo is 'he is nice'
</if>
<else>
  var.foo is not 'he is nice'
</else>

  "he is nice"

  var.foo is not "he is nice"
```

...you won't get the expected result. This is because the *Match* plugin interprets the first valid operator after a whitespace as the operator to use. In the example above the test really is if 'he' equals 'nice is he is nice', which obviously is false. Rember that the string 'is' also is a valid operator.

Expr evaluates mathematical and logical expressions. The following characters only should be used in the expression:

1, 2, 3, 4, 5, 6, 7, 8, 9, 0, ., x, a, b, c, d, e, f, X, A, B, C, D, E, F
For numbers, decimal, octal and hexadecimal. E.g. 1.23, 010 == 8, 0xA1 == 161

int, float
For type casting between integers and floats. E.g. (int)3.45 == 3, (float)3 == 3.000000

<, >, =, -, +, *, /, %, (,)
Mathematical operators. Note that '==' should be used for equality. E.g. 10 % 4 == 2 , (1 + 2) * 3 == 9

&, |
Logical operators. Note that '&&' and '||' should be used for 'and' and 'or', that '1' equals 'true' and '0' equals 'false'. E.g. 1+0 && 1

If any other character is used there will be an error in the RXML parser. Therefore entities should be used, not the variable name, in a similar way as *Match*.

```
<set variable='var.foo' value='2' />

<if expr='1+&var.foo;*3==7'>
   var.foo = 7
</if>
<else>
   var.foo = 9
</else>

   var.foo = 7
```

An example of *expr* showing that the regular rules of mathematics applies here. The expression evaluates correctly as

```
1+2*3 == 1+6 == 7
```

and not as

```
1+2*3 == 3*3 == 9
```

Note that the '==' operator must be used for 'equals', unlike the other *Eval* plugins. Also note that whitespaces around operators are not mandatory.

Clientvar extends the *Supports* plugin, see *State* below. It is used for tests of the client requesting the web page, e.g. a browser or a WAP phone. The following variables (*var*) are currently testable:

height - The presentation area height in pixels (WAP clients)

javascript - The highest version of javascript supported

robot - The name of the web robot

width - The presentation area width in pixels (WAP clients)

is can be any valid operator.

```
<if supports='javascript'>
  <if clientvar='javascript < 1.2'>
    Your browser supports older versions of javascr
ipt
  </if>
  <else>
    Your browser supports javascript
  </else>
</if>
<else>
  Your browser doesn't support javascript at all
</else>
```

The variable can be used in expressions as shown above. *Clientvar* can test the exact JavaScript version supported, unlike *Supports*, that only checks if JavaScript is supported or not.

Match

The *Match* category contains plugins that match contents of something, e.g. an IP package header, with arguments given to the plugin as a string or a list of strings.

Plugin	Syntax
accept	accept='type1[,type2,...]'
client	client='pattern'
domain	domain='pattern1[,pattern2,...]'
ip	ip='pattern1[,pattern2,...]'
language	language='language1[,language2,...]'
referrer	referrer='pattern1[,pattern2,...]'

Accept checks which content types the browser accepts as specified by it's Accept-header, e.g. 'image/jpeg' or 'text/html'.

```
<p>You are using
<if client='Mozilla*'>
  <if client='*compatible*msie*'>
    <b>Internet Explorer</b>.
  </if>
  <elseif client='*compatible*opera*'>
    <b>Opera</b>.
  </elseif>
  <else>
    <b>Netscape</b>.
  </else>
</if>
<else>
  another client.
</else>
</p>
```

Client compares the user agent string with the given pattern.

Domain and *Ip* plugins checks if the DNS name or IP address of the user's computer match any of the patterns specified. Note that domain names are resolved asynchronously, and that the first time the browser accesses a page containing `<if domain>`, the domain name might not have been resolved yet.

Language matches languages with the Accept-Language header.

Referrer checks if the Referrer header match any of the patterns.

State

State plugins check which of the possible conditions something is in, e.g. if a flag is set or not, if something is supported or not, if something is defined or not etc.

Plugin	Syntax
config	config='name'
false	false=''
pragma	pragma='string'
prestate	prestate='option1[,option2,...]'
supports	supports='feature'
true	true=''

True and *False* are plugins used in exactly the same way as `<then>` and `<else>`. Should not be confused with the `<true>` and `<false>` tags.

```
<set variable='var.foo' value='10' />

<if variable='var.foo is 10' />
<if true=''>
  var.foo is 10
</if>
<if false=''>
  var.foo is not 10
</if>

  var.foo is 10
```

Config tests if the RXML config named has been set by use of the `<aconf>` tag.

```
<if pragma='no-cache'>
  The page has been reloaded!
</if>
```

```
<else>
  Reload this page!
</else>
```

Pragma compares the HTTP header pragma with the given string.

Prestate checks if all of the specified prestate options, e.g. '(debug)', are present in the URL.

Supports tests if the client browser supports certain features such as frames, cookies, javascript, ssl among others. An example of this with a complete list of features that can be tested is found in the section *Browser independency with <if supports>*

Utils

The *Utils* category contains additional plugins, each specialized in a certain type of test.

Plugin	Syntax
date	date='yyyymmdd' [before,after] [inclusive]
exists	exists='path'
group	group='name' groupfile='path'
time	time='hhmm'' [before,after] [inclusive]
user	user='name1[,name2,...] [any]'

```
<if time='1200' before='' inclusive=''>
   ante meridiem (am)
</if>
<else>
   post meridiem (pm)
</else>
```

Date and *Time* plugins are quite similar. They check if today is the date "yyyymmdd" or if the time is "hhmm". The attributes *before*, *after* and *inclusive* may be added for wider ranges.

```
<if exists='/dir1/dir2/foo.html'>
   foo.html exists
</if>
<else>
   foo.html doesn't exist
</else>

   foo.html doesn't exist
```

Exists checks if a file path exists in a file system. If the entered path does not begin with '/', it is assumed to be a URL relative to the directory containing the page with the `<if exists>` statement.

Group checks if the current user is a member of the group according the groupfile.

A useful *Util* plugin is *User*, that tests if the user accessing a site has been authenticated as one of the users specified. The argument *any* can be given for accepting any authenticated user.

Summary

This Section has presented the If plugins that is divided into four categories, *Eval*, *Match*, *State* and *Utils*, *Utils* and *SiteBuilder*, according to their function.

Eval plugins evaluate expressions as in regular programming languages, *Match* plugins match contents with arguments given and *State* plugins check which of two possible conditions is met. *Utils* plugins perform specific tests such as present date or time.

More details about If plugins are found in the *Web Site Creator Manual*.

The next Section, *A basic example of <if>*, will show an example of a basic usage of the Match plugin.

A basic example of <if>

This section will show a simple example of how we use `<if>` in a web page.

After reading this section you will understand how to use `<if>` with the *Match* plugin.

We will create a feature on the DemoLabs Inc. site (shipped with Roxen Platform). This feature includes the possiblity to toggle between short view and long view using a button while reading a protocol in the Management Protocol Archive. The short view only displays the header of the protocol, while long view shows the full protocol.

Short/Long feature in protocols

Imagine that the protocols tend to be rather long and that someone only wants to check which persons were present and what issuses that were discussed during a meeting. Wouldn't it be nice only to view a 'header' of the protocol per default, containing these data. The whole protocol should only be displayed when the user explicitly requests that. To accomplish this we add some RXML and a button. The button will be used to toggle between viewing the whole protocol and only the 'header'.

Since we want every new protocol file to have this feature we will edit the Stationary Protocol file *protocol.html*. This is a default protocol file that is used as a foundation for creating new protocol files. At the top of this file we add the following code:

```
<!-- Page loaded first time -->
<if match='&form.request; is '>
  <form method='POST'>
    <input type='hidden' name='request' value='long
' />
    <submit-gnutton gnutton='gnutton5' align='left'
    >Long view</submit-gnutton>
    <br /><br />
  </form>
</if>

<!-- When long mode is requested -->
<elseif match='&form.request; is long'>
  <form method='POST'>
    <input type='hidden' name='request' value='shor
t' />
    <submit-gnutton gnutton='gnutton5' align='left'
    >Short view</submit-gnutton>
    <br /><br />
  </form>
</elseif>

<!-- When short mode is requested -->
<else>
```

```
  <form method='POST'>
    <input type='hidden' name='request' value='long
' />
    <submit-gnutton gnutton='gnutton5' align='left'
    >Long view</submit-gnutton>
    <br /><br />
  </form>
</else>
```

Before the line `<h1>Opening</h1>`, which is the starting header for the full view mode we add an `<if>` test. Only if the user requests long view the content between `<if>` and `</if>` will be sent to the browser. Finally we add `</if>` at the last line of the file.

```
<if match='&form.request; is '>
  <h1>Opening</h1>
    ...
</if>
```

This will result in the following button and short form of the protocol file when loaded the first time:

The text displayed in the short form protocol with button added on top.

The trick is to dynamically insert the right form depending on which view is requested. This is accomplished with an *if-elseif-else* statement. `<if>` checks for an empty *form.request*. This will only be the case the first time the page is loaded. `<elseif>` catches the case when long view is requested and `<else>` the case when short view is requested.

```
<if match='&form.request; is '>
  ...
</if>
<elseif match='&form.request; is long'>
  ...
</elseif>
<else>
  ...
</else>
```

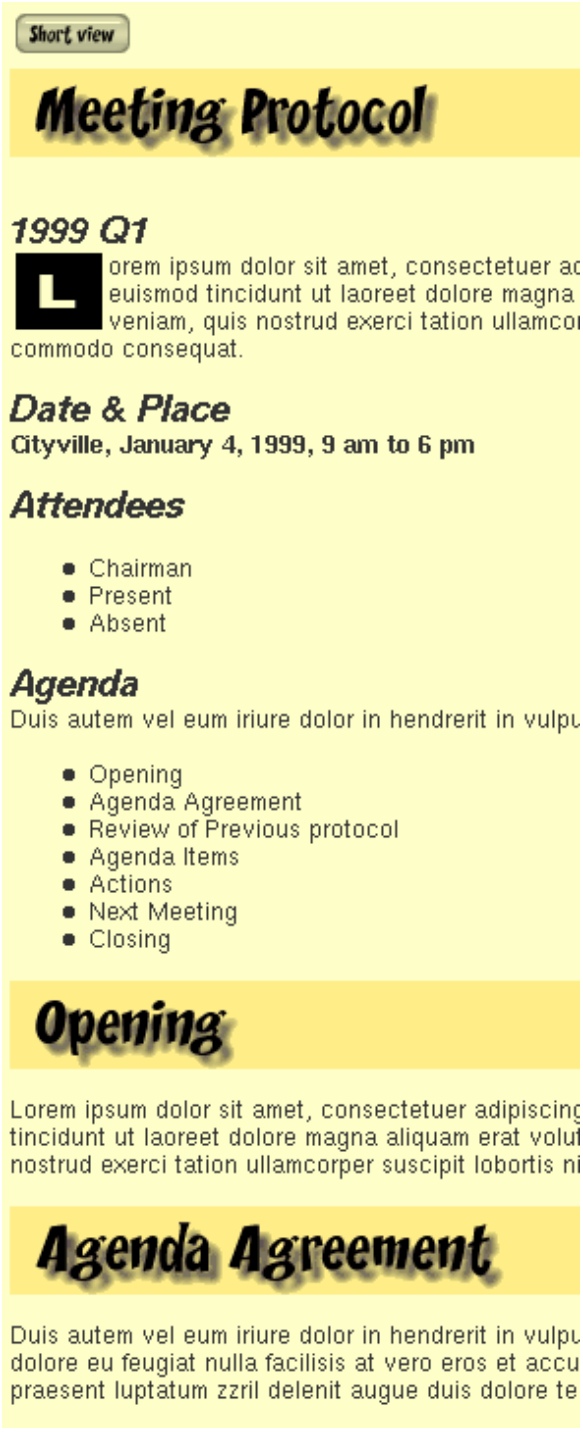
The inserted form contains a hidden field with its *request* variable set to the mode that will be requested on submit and a special XSLT defined button - `<submit-gnutton>` - with its displayed text set inside the container. XSLT is not in the scope of this Lesson, so we will leave that with telling this is used only to get a nice look-&-feel.

```
<form method='POST'>
  <input type='hidden' name='request' value='long'
/>
  <submit-gnutton gnutton='gnutton5' align='left'
  >Long view</submit-gnutton>
  <br /><br />
</form>
```

You could use an ordinary submit button as well:

```
<input type='submit' value='long' />
```

Well, there it is! Finally, let's have a look at a part of the long view version of a protocol page:



The button inserted on a long view protocol page.

Summary

This section has shown a basic example of how to use the `<if>` plugin *Match*.

More details about `<if>` and If Plugins are found in the *Web Site Creator Manual* and/or by adding `<help for='if' />` in a web page.

The next section, *Combining <if> and <define>* will teach the basics of how to use `<if>` and `<define>` to dynamically display contents in a web page.

Combining <if> and <define>

This section will show how to combine `<if>` and `<define>` to dynamically show contents of a web page.

After reading this section you will have knowledge of how to combine `<if>` and `<define>` when creating a web page. You will also know how to use `<define>` to define your own RXML macro.

We will create a web page with a HTML form requesting the name and e-mail address of a user. On submit we will check if all fields are set and if the e-mail address is valid. The page will show a response depending on the test results.

The <define> tag

A very useful tag is the *Variable* tag `<define>`. It is used for creating your own macros such as tags, containers or If-callers. The most common use is to define an 'alias' for a portion of code that will be inserted several times on a web page. We will not discuss `<define>` in depth here. See the *Web Site Creator Manual* for details.

Let's create a tag that will work as a sum of some other tags.

```
<define tag='multi-set'>
  <set variable='var.foo' value='one' />
  <set variable='var.bar' value='two' />
  <set variable='var.gazonk' value='three' />
</define>

<pre>var.foo is 'var.foo'
var.bar is 'var.bar'
var.gazonk is 'var.gazonk'
</pre>

<multi-set/>

<pre>var.foo is 'var.foo'
var.bar is 'var.bar'
var.gazonk is 'var.gazonk'
</pre>
<pre>var.foo is ""
var.bar is ""
var.gazonk is ""
</pre>

  <multi-set/>

<pre>var.foo is "one"
var.bar is "two"
var.gazonk is "three"
</pre>
```

Here `<multi-set>` is used to insert the three `<set>` tags. If we were to do this set operation in multiple places the value of `<define>` is quite obvious. We can also add values via attributes to our defined tag.

```
<define tag='hello'>
  Hello there, &_.name;!
</define>

<hello name='John Doe'/>
  Hello there, John Doe!
```

The attribute values are catched with entities and using the '_' scope, representing the current scope. Here the value of the *name* attribute is represented by the entity *_.name*. If

we want to set default values to attributes (used when the attribute is left out) we use the container <attrib>.

```
<define tag='hello'>
  <attrib name='name'>Mr Smith</attrib>
  Hello there, _.name!
</define>

<hello /><br />
<hello name='John Doe' />


  Hello there, Mr Smith!<br />
  Hello there, John Doe!
```

An interesting feature is to define a macro for an If plugin or combinations of If plugins. You simply create an alias that can be used together with <if>.

```
<define if='js'>
  <if supports='javascript' and=''
      clientvar='javascript = 1.2' />
</define>

<if js='js' />
<then>
  Your browser supports javascript 1.2
</then>
<else>
  Your browser doesn't support javascript 1.2
</else>


  Your browser supports javascript 1.2
```

Here <if js='js'> is replaced by <if supports='javascript' and='' clientvar='javascript = 1.2'> before the page is sent to the browser.

Well, that is how far we go into <define> here. In the example part below we will use the <define tag> feature to insert a HTML form with dynamic content.

Verifying an e-mail address

We are going to create a simple e-mail address checker only using HTML and RXML. The first time the page is loaded a form is presented to the user for input of name and e-mail address. A submit sends the input and when the page is loaded again, we will first check that both name and e-mail address were added, and if so, check if the e-mail address matches the form '*@*.*'. If any of the tests fail, an error message will be displayed together with the form for new input. Correct input will not be deleted. If all goes well, a nice welcome awaits the user.

The source code is found by following the link. (It might be a good idea to open the source code file in a different window, so that it is easily read parallel to this section. The code won't be displayed here to shorten the length of this section.)

First we define a RXML macro called *mail-form* that inserts a form. Four attributes are used: *nameval, mailval, status* and *mess*. We use <attrib> to set default values for *nameval* and *mailval* to the data entered in the field. This will save entered data so that the user won't have to retype it. The form will display a status message, an ordinary message and a form with two input fields and a submit button.

```
<!-- DEFINING FORM TAG -->
<define tag='mail-form'>
  <attrib name='nameval'>&form.name_;</attrib>
  <attrib name='mailval'>&form.mail_;</attrib>

  <p><b>&_.status;</b><br />&_.mess;</p>

  <form method='POST'>
    <table>
      <tr><td>Name:</td>
      <td><input type='input' size='30' name='name_
'
                 value='&_.nameval;' /></td></tr>
      <tr><td>E-mail:</td>
      <td><input type='input' size='30' name='mail_
'
                 value='&_.mailval;' /></td></tr>
      <tr><td><input type='submit' name='button'
                 value='OK' /></td></tr>
    </table>
  </form>
</define>
```

The start form

To display the page dynamically we use <if> and <else>. The first test checks if the page is loaded for the first time or if the user pushed a submit button to get there. Only if the user clicked the 'OK' button, *form.button* will represent 'OK'. The next test checks if both fields contain data. If so, *var.ok* will have the value 1. The last test checks if the e-mail address match the form '*@*.*'. This test is really not sufficient in real life, since an address like 'foo@foo@mail.gazonk' would be correct. Remember that anything goes with '*'. It is left for you to figure out a nice algorithm for a better check. Remember, practice makes the master.

```
<if match='&form.button; = OK'><!-- OK clicked -->
  ...
  <if variable='var.ok = 1'><!-- Both not empty -->
    <if variable='var.mail_ = *@*.*'><!-- Success -
->
      ...
    </if>
    <else><!-- Mail not on proper format -->
      ...
    </else>
  </if>
  <else><!-- name or e-mail empty -->
    ...
  </else>
</if>
<else><!-- First time or Again clicked -->
  ...
```

```
</else>
```

The first time the page is loaded or if the user clicked the 'Again' button we use our defined macro to display the start form.

```
<else><!-- First time or Again clicked -->
  <mail-
form status='' mess='Please state your name and
   e-mail address.' />
</else>
```

When we are sure that the user clicked the 'OK' button, we test the data entered. We use `<set>` to catch the data from the two input fields and then test if any of them where empty, `<if variable='var.name_ = '>`. If so, we use `<append>` to set *var.ok* to 0, which will give a false result in the 'Both not emtpy' test. The form will then reappear with a message telling the user to fill in both fields.

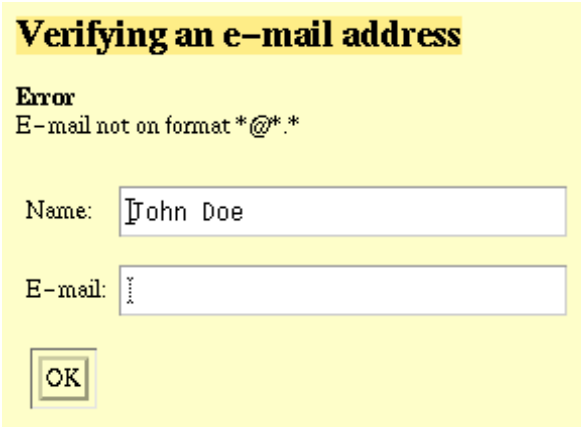
```
<set variable='var.ok' value='1' />
<set variable='var.name_' value='&form.name_;' />
<set variable='var.mail_' value='&form.mail_;' />

<if variable='var.name_ = '>
  <append variable='var.ok' value='0' />
</if>

<if variable='var.mail_ = '>
  <append variable='var.ok' value='0' />
</if>

<if variable='var.ok = 1'><!-- Both not empty -->
  ...
</if>
<else><!-- name or e-mail empty -->
  <mail-
form status='Error' mess='You must fill in both nam
e and
   e-mail address.' />
</else>
```

If any field is left empty the form reappears with an error messge

Next we check the e-mail address. We use the *Variable* plugin although it looks like a typical *Match* test. This is done to avoid the problem with whitespaces when doing a *Match*. (See *If plugins* section, *Eval* part for a discussion on this special case.)

```
<if variable='var.mail_ = *@*.*'><!-- Success -->
  ...
</if>
<else><!-- Mail not on proper format -->
  <mail-form status='Error' mess='E-
mail not on format *@*.*'
   mailval='' />
</else>
```

If the test fails the form reappears. Note that the e-mail input filed is cleared by adding `mailval=''` to `<mail-form>`.



This will be displayed if E-mail doesn't match the form '@*.*'*

Finally, if all tests pass, we display a nice welcome message and add a button that will take the user back to the start form again.

```
<if variable='var.mail_ = *@*.*'><!-- Success -->
  <p><b>E-mail address verified</b></p>
  <p>Welcome <b>&form.name_;!</b></p>
  <p>E-mail address '&form.mail_;' is OK.</p>
  <form method='POST'>
    <input type='submit' name='button' value='Again
' />
  </form>
</if>
```

If all goes well we welcome the user and display the input

Summary

This section has taught you how to combine `<if>` and `<define>` to dynamically show contents of a web page.

The `<define>` tag is used for creating your own macros such as tags, containers or If-callers. The code

```
<define if='js'>
  <if supports='javascript' and=''
      clientvar='javascript = 1.2' />
```

```
</define>
```

will create the macro 'js' that can be used as an alias for the <if> tag inside the container. You simply use it like this, <if js='js'></if>.

More details about <if> and <define> is found in the *Web Site Creator Manual* or by adding <help for='if' /> and/or <help for='define' /> in a web page.

The next section, *Browser independency with <if supports>* will teach how to use the <if supports> plugin to create dynamic pages based on what techniques the client browser supports.

Browser independency with <if supports>

This section will deal with the <if supports> plugin and the *page* and *client* scopes.

After reading this section you will know about the many features that might be checked for with <if supports> and the properties of the *page* and *client* scopes and their entities.

We will create a feature on the R&D page of Demo-Labs Inc. site (shipped with *Roxen Platform*) that dynamically uses JavaScript or HTML forms depending on the client browsers support for the JavaScript technique.

The <if supports> plugin features

Have you ever met somebody that have produced a good looking web page for one browser and later found out that another browser smashes it up totally? With RXML you can easily check which features the browser requesting a page supports and send the content corresponding to that. You simply use the <if supports> plugin. Below follows a list of the different features this If plugin is able to check.

Attributes
tests if the HTML attribute is supported inside tags. Possible features:

```
align
 backgrounds
 fontcolor
 imagealign
 mailto
 tablecolor
 tableimages
```

Client type
checks if the browser is of a certain client type, e.g. *msie* checks if the browser is an Internet Explorer. Possible features:

```
html
 msie
 phone
 robot
 unkvown
```

Graphics
is graphic related tests, i.e. if the browser supports certain image formats. Possible features:

```
gifinline
 jpeginline
 pjpeginline
 pnginline
 wbmp0
```

Tags
checks if the browser supports these HTML tags at all and/or in a proper manner. Note that *divisions* and *div* have the same function. Possible features:

```
bigsmall
 center
 divisions/div
 font
 forms
 frames
 images
 layer
 math
 noscript
 supsub
 tables
```

Techniques
tests if the browser supports a certain technique. Possible features:

```
activex
 autogunzip
 cookies
 java
 javascript
 js_image_object
 js_inner_html
 pull
 push
 ssl
 stylesheets
 vrml
 wml1.0
 wml1.1
```

The syntax for *Supports* is

```
<if supports='feature'>
```

where *feature* is replaced by one of the keywords above. The *javascript* attribute is used to test if the browser supports JavaScript or not. It will be used in the example part below.

```
<if supports='javascript'>
  <if clientvar='javascript < 1.2'>
    Your browser supports javascript versions less
than 1.2
  </if>
  <else>
    Your browser supports javascript version 1.2 or
 higher
  </else>
</if>
<else>
  Your browser doesn't support javascript at all
</else>
```

If you want a more exact test for which JavaScript version is supported, you can use <if clientvar="javascript is version">, where *is* can be replaced by any valid operator. This is not used in the example part below.

Page and client scopes

For displaying and/or getting information about the client browser the *client* scope is suitable. The following list is an extract of the many different entities available:

accept-language - The preferred language of the client, e.g. 'en'.

accept-languages - The preferred language and a list of other languages also accepted.

fullname - The full user agent string, e.g. 'Mozilla/4.7 [en] (X11; I; SunOS 5.7 i86pc)'

ip - The ip address the client is located at.

javascript - The javascript version supported by the client.

name - The name of the client, e.g. 'Mozilla/4.7'

referrer - The URL of the page on which the user followed a link to this page.

If information about a page is wanted, there is a convenient scope called *page* for such tasks. Some useful entities are:

bgcolor/fgcolor - the background/foreground color of the page

description - as specified in meta data.

filename

filesize - in bytes.

keywords - as specified in meta data.

title - as specified in meta data.

type - the content type of the file, e.g. 'text/html'.

url - the URL to this file from the web server's point of view.

For the complete list of entities of these scopes, insert

```
<insert variables='full' scope='client' />
  or
<insert variables='full' scope='page' />
```

in a web page. Let's look at some examples:

```
<if supports='msie'>
  You are using Internet Explorer
</if>
<elseif match='&client.name; is Mozilla/4.*'>
  You are using Netscape 4.*
</elseif>
<else>
  You are using &client.name;
</else>
</before>
```

A simple check for which browser is requesting this page.

```
<if supports='javascript'>
  JavaScript version: &client.javascript;
</if>
<else>
  Doesn't support JavaScript.
</else>
```

An example of the use of *javascript* attribute and entity. The *client.javascript* entity contains the actual version supported. *Clientvar* plugin can be used for narrow test for JavaScript version supported. See the *If plugins* Section, *Eval* part, for details and an example.

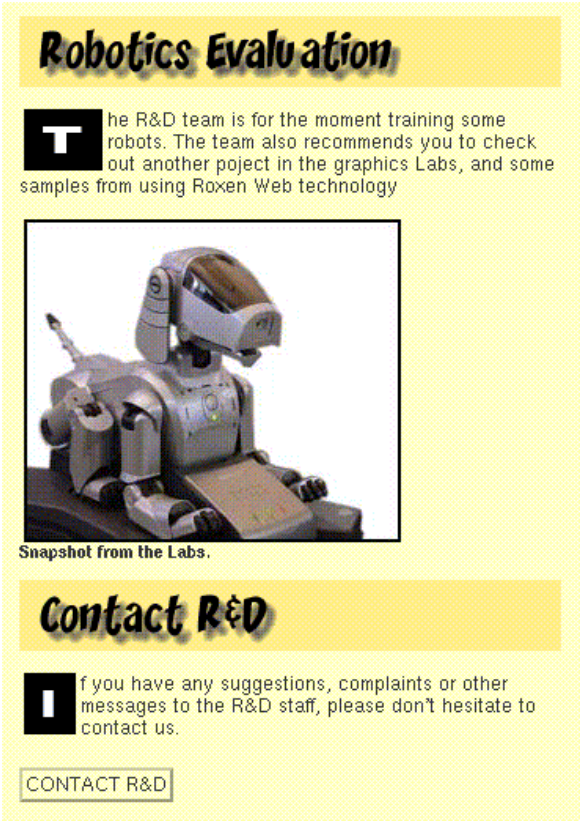
Browser JavaScript support optimizing

To demonstrate how to use the `<if supports>` plugin, we will create the possibilty to contact the R&D team of DemoLabs Inc. by submitting a message written in a form. The contact form will be displayed in a pop-up window and the message will be sent back to the parent window on submission. This is nicely done by adding some JavaScript code. However, some browsers don't support JavaScript or has it turned off. Therefore we will test if the browser supports our script, and if not, we will bring the user a pure HTML form instead.

The `<if supports='javascript'>` works like the HTML `<noscript>` tag. There is one major difference, though; `<if supports='javascript'>` doesn't catch if the browser has JavaScript turned off. On the other hand, `<if supports>` works on all browsers, also those where `<noscript>` doesn't (like Internet Explorer 2.0 and Netscape Navigator 2.0). We will show how to combine these in a very useful manner.

The source code of the files in this example is found by following the link. (It might be a good idea to open the source code file in a different window, so that it is easily read parallel to this Section. The code won't be displayed here to shorten the length of this Section.) Remember that this is a RXML tutorial. Although we use JavaScript and XSLT (Extensible StyleSheet Language Transformer) code, we won't explain that in detail here. If you aren't familiar with those techniques, don't dig into that code. We will add enough information for you to understand this Section anyway.

Ok, let's get down to work.



This is the JavaScript version of index.xml

The snapshot above shows the JavaScript version of the edited *index.xml* of the R&D directory. The 'Contact R&D' part with a button is added. Let us look how this is done.

```
<h1>Contact R&D</h1>
<p initial='initial'>If you have any suggestions,
 complaints or other messages to the R&D staff,
 please don't hesitate to

<if supports='javascript'>
  ... <!-- supported -->
  <noscript>
    ... <!-- turned off -->
  </noscript>
</if>
<else>
  ... <!-- not supported -->
</else>
```

First we add the headline, some text and an *if-else* statement that will check if JavaScript is supported and on or not. The *supported* section will contain the JavaScript version code, the *turned off* will display a message saying that this page uses JavaScript, please turn this feature on or use the HTML version. *Not supported* section will contain the HTML version code.

The <noscript> version contents added instead

```
<noscript>
  <p><b>This page uses JavaScript,
   so you should enable JavaScript in your browser
options
   and reload this page for the button above to wor
k.
   Else, <a href='message.xml'>click here</a>
   to contact R&D staff.</b></p>
</noscript>
```

The <noscript> version, sent when we know that the browser supports JavaScript but has this feature turned off, gives the user an opportunity to choose version. The link leads to the contact form in pure HTML. The <else> code, sent when the browser really doesn't support JavaScript, looks like this:

For browsers not supporting JavaScript this is added

```
<else>
  <a href='message.xml'><b>contact us</b></a>.
</else>
```

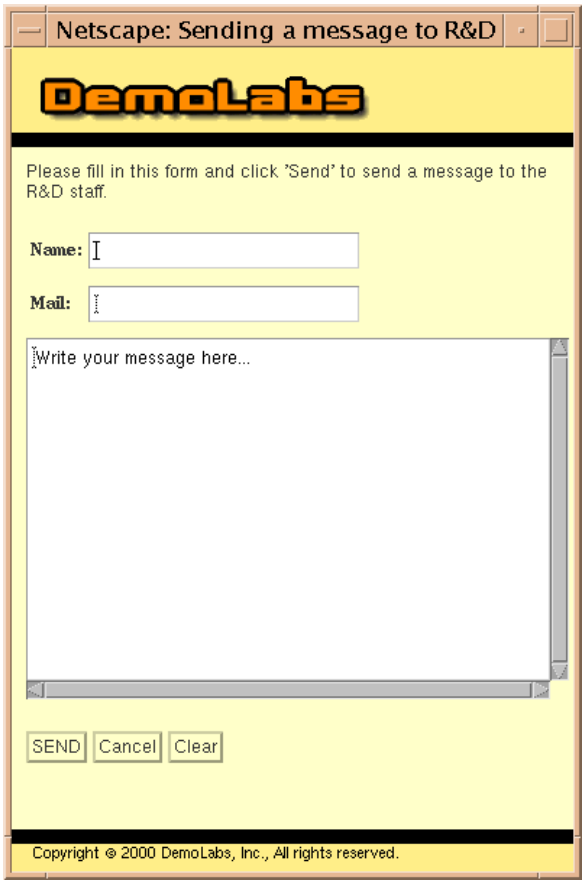
We simply insert a link leading to the message form in HTML version. It is a basic form with no tests of input or other funny stuff. (We don't comment the form here. Have a look in the source code if you are curious. The file is named *message.xml*.)

The message form in HTML version

Ok, this was (hopefully) the exceptions when users view the page. Let's consider the JavaScript version again.

```
<if supports='javascript'>
  contact us.
  <form>
    <input type='button' value='CONTACT R&D'
     onClick='openMessWin('messForm.xml')' />
  </form>

  <form name='hiddenForm' action='disp_mess.xml'>
    <input type='hidden' name='_name' />
    <input type='hidden' name='mail' />
    <input type='hidden' name='mess' />
  </form>

  <noscript>
    ...
  </noscript>
</if>
```

We insert a button that opens a new window using `onClick='openMessWin('messForm.xml')'`. The contents of that window is coded in *messForm.xml*. If you have a look at the source code you see that some features are added compared to the HTML version message form - additional buttons and some JavaScript logic checking the input. (The hidden form is added for some JavaScript magic that we won't explain here. The nice look&feel is possible by the *popup.xsl* template file, but that is another story.)



This is the pop-up window that appears when the user clicks the 'CONTACT R&D' button

The user adds name, mail address and a message, clicks 'SEND' and the pop-up window disappears and data is submitted and handled in some way by the server. In this example we simply display it in the browser. The message will be displayed the same way if the HTML form is used instead.

If_tags, Browser support optimizing, img 6

Well, that's it. This was just a simple example of the powers of `<if supports>`. As shown in the former parts, there are many features that may be checked for and dynamically handled.

Summary

This section has taught you how to check for which facilties the browser requesting the web page supports and how to adjust the sent information according to that. The *page* and *client* scopes where also discussed. The syntax for *supports* is

```
<if supports='feature'>
```

For displaying and/or getting information about the client browser the *client* scope is suitable, e.g. the *client.javascript* entity holds the JavaScript version supported by the client. The *page* scope gets information about a page, such as *page.filename* or *page.filesize*. For the complete list of entities, insert `<insert variables='full' scope='client' />` or `<insert variables='full' scope='page' />` in a web page.

More details about `<if supports>` and *client* and *page* scopes are found in the *Web Site Creator Manual* or adding `<help for="if" />` in a web page.

Summary

This lesson have been treating the Roxen Macro Language (RXML) If tags, used to create dynamic web pages based on conditions. They also make it possible to create web applications in RXML without using any programming language.

The If tags correspond to the if-else control flow statements common in regular programming languages.

If tags statements are built up by six basic tags, `<if>`, `<else>`, `<elseif>`, `<then>`, `<true>` and `<false>`. The general syntax is:

```
<if plugin1='expr' [and|or plugin2='expr' ...] [not
]>
  if block
</if>
[<elseif plugin='expr' ...>
  elseif block
</elseif>]
[<else>
  else block
</else>]
```

Mandatory attribute to `<if>` and `<elseif>` is an If plugin. Logical attributes - *and*, *or* and *not* - adds functionality. Inside the attribute expression, '=', '==', 'is', '!=', '<' and '>' operators are valid.

For proper XML, always close tags

```
<if match='&var.foo; is foo' />
  or
<if match='&var.foo; is foo'></if>
```

and give all attributes a value

```
<if true=''>.
```

The If plugins are divided into five categories, *Eval*, *Match*, *State*, *Utils* and *SiteBuilder*, according to their function. *Eval* plugins evaluate expressions as in regular programming languages, *Match* plugins match contents with arguments given and *State* plugins check which of the conditions possible is met. *Utils* plugins perform specific tests such as present date or time. *SiteBuilder* plugins require a *Roxen Platform SiteBuilder* and add test capabilities to web pages contained in a *SiteBuilder*.

```
<set variable='var.foo' value = '1' />

<if variable='var.foo = 1'>
  foo = 1
</if>
<else>
  foo is something else
</else>


  foo = 1
```

Here is an example of a simple if-else with RXML `<if>` and the *Eval* plugin *Variable*.

References

Roxen Web Site Creator Manual

Roxen Macro Language (RXML)

Roxen Administrator Manual

HTML 4.01 Specification by W3C

XML 1.0 Specification by W3C

XSL Specification by W3C

XSLT Specification by W3C

Netscape JavaScript Reference

If you have any questions, suggestions, comments or complaints about this lesson, please send an e-mail to **manuals@roxen.com**.

Database Tutorial

This section of the manual deals with how Roxen and Pike can connect to SQL databases, retrieve data and modify the data stored there. It doesn't aim at teaching SQL or how to design a database, save for very simple cases, which are not surprisingly the most common in normal Web-related programming tasks. So you won't find references to triggers, stored procedures, referential integrity or complex privileges management here: they CAN be used from Roxen or Pike, but they're more of an SQL matter, which is out of the scope of this manual.

Roxen and Pike offer an uniform layer to access all the supported databases. However such a layer does not cover anything but issuing queries and retrieving data. SQL is unfortunately another matter: it is an ANSI standard, but just about every SQL server has its own dialect, which may be a subset or a superset of the standard. You'll need to check your server of choice's documentation about its version of SQL.

This section of the manual tries to be a reference for both Roxen and Pike programmers. To do so, most examples will be available in two versions, a Pike snippet of code, and RXML code.

Note! The RXML `<sqloutput>` and `<sqltable>` have been deprecated in favour of the <emit source="sql"> container. In this manual the 'old' tags are used, but the new tag is briefly introduced on the *The emit and sqlquery Tags* page.

Contents

Introduction to MySQL

MySQL by TcX AB is a simple SQL server, very popular among web-designers. It is a relatively simple and lightweight server, which aims at being very fast, but is not fully ANSI-SQL compliant, as it doesn't support features such as triggers or sophisticated access control.

Since MySQL is so popular among web-developers, it was chosen as the reference RDBMS for Roxen. This chapter will introduce you to it, and to some of the pitfalls most easily encountered when using it. The examples shown are however as cross-platform as they could be: they should work with any SQL server which claims at least a partial degree of ANSI-SQL compliance.

- *Privileges*
- *Building a Sample Database*

Querying

Querying a server is by far the most used DB-related functionality. Almost everything (in some cases, plain everything) you'll do when interacting with an SQL server goes through specifying correctly-formed SQL queries, sending them to a server and then interpreting the results the server sends back.

RXML 2 offers two different ways to query a server, Pike too. These are needed to fit all situations; a query may yield results, or it might not, and the only way to tell the difference is by looking at the SQL code being executed by the server.

It would seem that programs (or RXML pages) accessing SQL resources are difficult and cryptic because the results queries can return are inherently dynamic in number and structure. Fortunately, very few programs need to handle the full range of possible outcomes from a query. In fact, most SQL queries are either non-interactive, or are parametric. This means they have a fixed structure where a few values (or no value if the query is non-interactive) change on each execution. This ensures that the results (or lack thereof) can be predicted accurately; if not in number, at least in structure.

It is best to see SQL statements not as a foreign plug-in into a program's execution flow, but as an integral part of it. Whenever the data storage structure changes, the program must be changed according to it (this is why database design is such an important matter: a bad database design decision might end requiring an application rewrite almost from scratch).

- *The query() function*
- *The big_query() function*
- *Quoting*

Data Extraction

In this chapter we'll introduce how to perform data-extraction queries. We'll introduce the SQL syntax for data-extraction, and provide a few examples, both in RXML and in Pike.

- *SQL Syntax*
- *Conditions*
- *Sorting*
- *Limiting*
- *Functions*
- *Features Missing from MySQL*

Data Insertion

In this chapter we'll introduce how to insert data into a database.

Notice that data insertion and modification are two different operations, using two different SQL commands.

- *Insertion Syntax*

Using RXML Features with SQL Databases

In this chapter we'll examine how to exploit some RXML features when working with SQL databases.

The examples here contained are geared towards SQL-driven data sources, but it is not of course the only use for them.

- *The tablify Container*
- *The Business Graphics Module*
- *The emit and sqlquery Tags*

Database Maintainance

Up to this point we have assumed the databases to be already present for us. But this of course isn't the case in some real-world situations.

Designing a database is a very complex task for nontrivial cases. It is also a very delicate operation: when dealing with data-storage-related applications,

usually the application is built around the data, and not the other way around. So a bad data storage design will snowball, leading to a bad application design, which is very expensive to fix, going as far as a rewrite from scratch.

So for the umpteenth time we'll remark that if an application uses non-trivially organized data, the best solution is to hire someone to design the database.

In this chapter we'll examine how to build and delete a database, how to set the tables and indices up or remove them. We'll assume that the databse structure is so simple to be self-evident (which is often the case for web-related systems), database design won't be taken into account.

Also, the examples will be in pike-only: these activities are meant to be used only once at database-creation, and are really not suited for a web-based application.

- *Database Creation*
- *Creating Tables*
- *Indices*
- *Dropping*

Privileges

A fundamental point, and a very common pitfall, in day-to-day MySQL operations is understanding how the MySQL privileges system works. This chapter is meant to provide only an overview of the basic functionalities. You may safely skip this section when you only use the internal database shipped with Roxen 2.2, since this hassle is already covered by the internal workings of Roxen. To get more details on the MySQL privileges system, please refer to the MySQL manual.

The first noteworthy aspect is that MySQL does *not* use the security features of the host system. It has its own authentication schemes, different from the system's.

This section uses the GRANT and REVOKE commands, which have been implemented in MySQL version 3.22.11. If you have an earlier version, you're suggested to upgrade.

MySQL offers four levels of access control: global, database, table and column. We'll only deal with the first two, as they are the most important. If you think your setup would require finer-grained security, you'll probably also need to hire a knowledgeable Database Administrator: data storage and retrieval is a very sensitive matter, performance- and security-wise.

To manage privileges you'll have to use the GRANT and REVOKE SQL commands. Their (simplified) syntaxes are:

```
GRANT <priv_type> [, priv_type ...] ON <*.*|databas
e.*> TO
      <user name> [IDENTIFIED BY '<password>']
      [, <user name> [IDENTIFIED BY '<password>'] ,
...]
      [WITH GRANT OPTION]

REVOKE <priv_type> ON <*.*|database.*> FROM <user n
ame>
[, <user name>, ...]
```

Where *priv_type* is a type of privilege, chosen among

```
ALL [PRIVILEGES]    FILE                RELOAD
ALTER               INDEX               SELECT
CREATE              INSERT              SHUTDOWN
DELETE              PROCESS             UPDATE
DROP                USAGE
```

"ALL" or "ALL PRIVILEGES" means (guess what?) everything. "USAGE" is the same as "no privilege".

If you use the "*.*" syntax, the altered privileges will be at the global level. If you use "database.*", you'll touch the database-level privileges.

The user name can have the form 'username@host', and can have wild-cards ('%' or '_', see later) in both the host or username parts.

If you specify the "IDENTIFIED BY..." clause, you'll set a password for the named user. Users without a password *are* legal in MySQL, but they are a very serious security hazard.

WITH GRANT OPTION means that the user is given the privilege to grant the same privileges he has to other users. It can be revoked with the syntax

```
REVOKE GRANT OPTION ON ... FROM *user name*
```

In the default MySQL setup there is an anonymous user ('%@localhost'), whose existence can cause unexpected results while authenticating other users. It is advised to remove the anonymous user. It can't be done with the GRANT syntax, but you have to do it manually as detailed the examples below.

Also, in the default MySQL setup there's an empty database named 'test', open for anonymous use. We'll use it throughout this tutorial, but it's advised to remove it ('DROP DATABASE test') after you're done, as it can be a source of denial-of-service attacks.

Note! In order to maximize the security of your site, it's always best to give each user the minimal privileges allowing him to do his work.

Create a new user named 'kinkie', having basic data access to the 'test' database.

With Pike:

```
$ pike
Pike v0.6 release 116 running Hilfe v2.0 (Increment
al Pike Frontend)
object o=Sql.sql("mysql://
root:<password>@localhost/mysql");
o-
>query("grant select,insert,update,delete on test.*
 to kinkie identified by
                '<password>');
o->query("flush privileges");
```

Or, from the MySQL monitor:

```
$ mysql -uroot -p<password> mysql
> grant select,insert,update,delete on test.* to ki
nkie identified by
  '<password>';
```

Create a new user named 'dbmanager' having full SQL access to all databases (but deny him server-related maintainance tasks):

With Pike:

```
object o=Sql.sql("mysql://
root:<password>@localhost/mysql");
o-
>query("grant select,insert,update,delete,create,dr
op,alter,index on
              *.* to dbmanager identified by '<pa
ssword>'");
```

Disable the 'nasty' user.

With Pike:

```
object o=Sql.sql("mysql://
root:<password>@localhost/mysql");
o->query("revoke all on *.* from nasty");
```

Note! This will _not_ remove the user from the authentication database, only prevent him from connecting.

To remove the user completely, you'll have to act directly on the "mysql" database; with Pike:

```
object o=Sql.sql("mysql://
root:<password>@localhost/mysql");
o->query("delete from user where user='nasty'");
```

Delete the anonymous users and the public-access entries to the test databases:

```
object o=Sql.sql("mysql://
root:<password>@localhost/mysql");
o->query("delete from user where user='');
o->query("delete from db where db like 'test%');
```

You might have noticed there are no RXML examples in this chapter. These tasks *can* be executed from RXML (provided that you connect with enough access rights), but it's not advised to have RXML code perform such critical tasks: one reload too much could make your database useless. Using the DBs tab in the server Administration Interface could prove handy, though.

Building a Sample Database

In the previous chapters we introduced how to build and install your database server. In this chapter we'll build the sample database that will be used throughout this manual.

Make sure your MySQL daemon is running and that the MySQL program files are in your PATH, then use this command line

```
$ mysqladmin -u root -p password create sample
```

The database server will create files making a database. A single database server can handle many databases: each is a data repository, completely independent from all the other databases hosted by the same server.

A database can be dumped using the "mysqldump" utility. It will create an SQL script file, that when run will re-create the structure and contents of a database. The sample database was dumped with this utility.

You'll now want to fill in the sample database. To do so, you must use the "mysql" utility, with these command lines:

```
$  mysql -u root -
p password sample <sample_db.schema
```

```
$  mysql -u root -p password sample <sample_db.data
```

The "mysql" utility is a so-called "interactive monitor", an application whose purpose is to execute arbitrary SQL statements interactively. It is a very powerful and useful tool, and it's advised to get familiar with it.

The two lines are required because I chose to dump the database structure (the so-called 'schema') and the data separately.

The sample database is a simplified excerpt of the CIA World Factbook. It only covers a few nations, and for each nation only a small amount of data.

From this moment on, we will not use the administrative user to develop the examples. Instead, we will create a user named 'user' with password 'password' and use it. Make sure you remove that user once you are done with this tutorial.

To create the user, you will need to issue this query from inside the mysql interactive monitor:

```
$ mysql -u root -p *password* sample
```

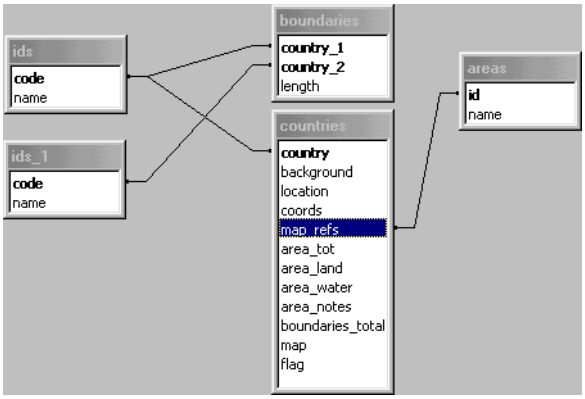
...which grants all privileges on sample.* to the user identified by 'password'.

The Sample Database Structure

The sample database consists of four tables. The first one, named 'ids' is used to tie country names to their 2-letter unique codes, which are used everywhere else. The one named 'areas' has the purpose to tie a few world areas to an unique integer identifier.

Although in theory both those tables could be not necessary (they handle a very simple association, the 2-letter country code could be very easily substituted with the country name in every place it appears), they actually serve two purposes: they make the other tables more compact and efficient (a 2-letter unique code is simpler to handle and requires less space than a variable-length name), and they formalize and restrict the domain of possible choices, allowing for a cleaner and more robust design.

The 'countries' table contains a few descriptive fields for each country, possibly in relation with other tables. The 'boundaries' table contains informations about the countries boundaries. It could be considered relationed to the 'countries' table, but it's more practical to see it as a separate entity.



The query() function

The query() method of the Sql.sql object is the "simple" query interface. It is meant to be used for those queries that return little or no data.

It's signature could look frightening:

```
array(mapping(string:string|float|int)) query
(string sql)
```

but it isn't that bad, really.

The returned value is an array, one element for every row, of mappings whose indices are the column names, and values the column contents.

So in order to access the "foo" column in the fourth returned row, you'll use

```
mixed datum = db[4]->foo;
```

If there are no results, the method will return an empty array.

Find out the country code for Italy

```
string country_code_for_italy() {
    object db=Sql.sql("mysql://
user:password@localhost/sample");
    array result=db-
>query("select code from ids where name='Italy'");
    if (sizeof(result)>0) { //
if there is any result
        return result[0]->code;
    }
    return 0; //no code found
}
```

The reason why this interface is only suited for simple queries is that it will fetch the whole results set and store it locally. It's not that big a deal for small databases, but make a small mistake in specifying the query on an HUGE database, and it will be tens or hundreds of megabytes to fetch. Talk about bloat... If you're going to retrieve potentially huge data-sets, you'll need the big_query interface instead. It's a bit more complex to use, but it will allow you fetch results on demand.

The big_query() function

The big_query() function allows programmers more control than the simpler query() function on how data is retrieved from the database server, as it allows fetching the data rows on demand. This is especially useful when you wish to do client-side computations on the fly on big datasets, that would require too much memory to be completely fetched and then processed.

The function's signature is `object(Sql.sql_result) big_query(string sql)`

The returned object is a handle to the results dataset. It offers methods allowing you to retrieve rows and get informations on the dataset itself.

int num_rows()
returns the total number of rows in the result object. Some drivers (i.e. Sybase) might not provide this functionality, and thus the only way to know how many rows there are is by explicitly querying the server (see example below).

int num_fields()
returns the number of columns for the result object. This function is usually meant for development purposes only, you shouldn't need it on production systems.

int eof()
returns true if all rows in the result object have been fetched.

array(mapping(string:mixed)) fetch_fields()
retrieves descriptions for the columns in the results set. The mappings in the returned array (one for each column) have some default fields, but they change in different drivers. See the example below to discover what fields your driver of choice provides. This function is usually used for development purposes only. You should rarely need it on production systems. Also, notice that the returned results will correspond to the server's idea of the fields, which might be different from the actual declaration.

void seek(int skip)
This method allows to skip fetching some rows (the skip argument must be a nonnegative integer).

int|array(string|int) fetch_row()
The most important function of all, this one allows you to fetch a row of data. There is one element of the array for each column, and the columns are ordered as returned by fetch_fields() and as specified in the SQL query. If 0 is returned instead, it means that there are no more rows to retrieve. An integer 0 is returned for (SQL) NULL values, while all types of stored data are returned as strings. It's up to the user to do the adequate type casts where appropriate. Type information can usually be retrieved with the fetch_fields() function.

Note! There are some restrictions on how data are retrieved with some drivers. Please check the drivers-specific section for more detailed information.

Print the name and background for all the countries in Europe.

```
object(Sql.sql) db=Sql.sql("mysql://
user:password@localhost/sample");
object(Sql.sql_result) result=db->big_query(
       "select ids.name, countries.background "
       "from ids,countries,areas "
       "where areas.name='Europe' and countries.map
_refs=areas.id and "
       "ids.code=countries.country");
array(string) row;
while (row=result->fetch_row())
{
      //
row[0] is the country name, row[1] is the backgroun
d info
      write("---"+row[0]+"\n");
      write(row[1]+"\n");
}
```

Now let's try writing a simple pikescript handling a multi-page table without resorting to the LIMIT SQL clause (see ../data_extract/limiting). The main purpose of this example is showing the usage of num_rows and seek functions, so despite being a complete example, it's a bit stretched (in real-world, this is one of the cases where the Roxen caching capabilities come handy). Also, it doesn't output formally valid HTML, and it doesn't handle exceptions. We'll show the 'ids' table contents, with ten entries per page and links to the other pages.

```
#define DBHOST "mysql://user:password@localhost/
sample"
#define QUERY "select name, code from ids order by
name"
#define ENTRIES_PER_PAGE 10
#define SEEK_IS_BROKEN

string parse (object id)
```

```
{
  string toreturn;
  object(Sql.sql) db;
  int number_of_entries, number_of_pages, page, j;
  object(Sql.sql_result) result;
  array(string) row;

  page=(int)(id->variables->page);
  toreturn="<table border=1>\n";
  db=Sql.sql(DBHOST);
   //connect
  result=db-
>big_query(QUERY);                          //query
  number_of_entries=result-
>num_rows();               //get the number of rows
#ifdef SEEK_IS_BROKEN
  //
it looks like mysql's implementation of seek() is b
roken, probably at
  //
the mysql level in my version (3.22.29). I'll do a
loop to emulate seek
  for (j=0;j<ENTRIES_PER_PAGE*page;j++)
    result->fetch_row();
#else
  result-
>seek(ENTRIES_PER_PAGE*page);                //
skip unneeded results
#endif

  for(j=0; j<10; j++) {                //
at most 10 results
    row=result->fetch_row();           //
fetch the row
    if (!row)                          //
no more data?
      break;                             //exit
    toreturn += "<tr><td>"+row[0]+"</
td><td>"+row[1]+"</td></tr>\n";
  }
                                       //
now the links section
  number_of_pages=number_of_entries/
ENTRIES_PER_PAGE;
  if (number_of_entries%ENTRIES_PER_PAGE)
    number_of_pages++;                 //
there might be an incomplete page
  toreturn+="<tr><td colspan=2>";
  for (j=0;j<number_of_pages;j++)
  {
    toreturn += "<a href='"+id-
>not_query+"?page="+j+"'>"+(j+1)+"</a> ";
  }
  toreturn +="</td></tr>";
  toreturn +="</table>";
  return toreturn;
}
```

What happens if the num_rows function is not available? The same results can be obtained via a simple SQL query, obtained modifying the actual query being executed. It is of course less efficient because two queries are issued instead of one. But it's better than nothing.

The query is obtained replacing the list of fields being fetched with the 'COUNT(*)' SQL function. It has slightly different semantics for complex queries, but for all the query types covered in this manual, it works. You might want to alias it for easier manageability (see ../data_extract/syntax).

So the previous example would have been written as:

```
#define DBHOST "mysql://user:password@localhost/
sample"
#define COUNT_QUERY "select count(*) as num from id
s"
#define QUERY "select name, code from ids order by
name"
#define ENTRIES_PER_PAGE 10
#define SEEK_IS_BROKEN

string parse (object id)
{
  string toreturn;
  object(Sql.sql) db;
  int number_of_entries, number_of_pages, page, j;
  object(Sql.sql_result) result;
  array(string) row;

  page=(int)(id->variables->page);
  toreturn="<table border=1>\n";
  db=Sql.sql(DBHOST);
   //connect
  number_of_entries=(int)(db-
>query(COUNT_QUERY)[0]->num); //(1)
  result=db-
>big_query(QUERY);                          //query
#ifdef SEEK_IS_BROKEN
  //
it looks like mysql's implementation of seek() is b
roken, probably at
  //
the mysql level in my version (3.22.29). I'll do a
loop to emulate seek
  for (j=0;j<ENTRIES_PER_PAGE*page;j++)
    result->fetch_row();
#else
  result-
>seek(ENTRIES_PER_PAGE*page);                //
skip unneeded results
#endif

  for(j=0; j<10; j++)                  //
at most 10 results
  {
    row=result->fetch_row();           //
fetch the row
    if (!row)                          //
no more data?
      break;                             //exit
    toreturn += "<tr><td>"+row[0]+"</
td><td>"+row[1]+"</td></tr>\n";
  }
                                       //
now the links section
  number_of_pages=number_of_entries/
ENTRIES_PER_PAGE;
  if (number_of_entries%ENTRIES_PER_PAGE)
    number_of_pages++;                 //
there might be an incomplete page
  toreturn+="<tr><td colspan=2>";
  for (j=0;j<number_of_pages;j++)
    toreturn += "<a href='"+id-
>not_query+"?page="+j+"'>"+(j+1)+"</a> ";
  toreturn +="</td></tr>";
  toreturn +="</table>";
  return toreturn;
}
```

(1): this line is a quick shortcut using the simpler query (see query) interface. It is appropriate in this case, because the results are tiny. We didn't make any checks on the results either, because their structure is very well-known.

The values returned by fetch_fields depend on the server you are connecting to, save for a few ones which should be always there. This is one of the reasons why you shouldn't need to use this function except during development. Let's see an example of it in action:

With Pike:

```
> object db=Sql.sql("mysql://user:password@local-
```

```
host/sample");
Result: object
> object res=db-
>big_query("select country, map_refs, flag from cou
ntries");
Result: object
> res->fetch_fields();
Result: ({ /* 3 elements */
    ([ /* 7 elements */
      "decimals":0,
      "flags":(< /* 2 elements */
            "primary_key",
            "not_null"
        >),
      "max_length":2,
      "length":2,
      "type":"string",
      "table":"countries",
      "name":"country"
    ]),
    ([ /* 7 elements */
      "decimals":0,
      "flags":(< /* 1 elements */
            "not_null"
        >),
      "max_length":1,
      "length":4,
      "type":"char",
      "table":"countries",
      "name":"map_refs"
    ]),
    ([ /* 7 elements */
      "decimals":0,
      "flags":(< /* 2 elements */
            "not_null",
            "blob"
        >),
      "max_length":13127,
      "length":65535,
      "type":"blob",
      "table":"countries",
      "name":"flag"
    ])
})
```

An array of mappings is returned, one mapping for each field. The "name" key is always present, as is the "flags" key. The other fields change depending on the server, and (as you might see) on the data type.

Quoting

As better explained in the *Conditions* page, constants (especially string constants) must be quoted in SQL. How the quoting must actually be composed will be explained later, now we'll introduce the facilities Pike and RXML offer to perform the quoting operation. The operation is server-transparent (that is, it adapts to the various servers' quoting schemes.

Pike

The Pike solution is pretty straightforward: quoting is handled via the Sql.sql->quote(string) method. It returns a string, which is the quoted argument.

It is supposed to be used when assembling a query, and is strongly encouraged to use it whenever a query is interactively built from some user's input: a malformed input could break the query by causing an SQL syntax error. It's useless to say that it could also be used maliciously, to completely alter the query structure, thus giving access to the lowlevel database contents.

Let's write a small interactive Pike application which prints the background for user-entered countries.

```
#!/usr/local/bin/pike
#define DATABASE "mysql://user:password@localhost/
sample"

//
sample program: find out some country's background
information
int main() {
  object readline=Stdio.Readline();               /
/used for interactive input
  object db=Sql.sql(DATABASE);                    /
/connect to the DB
  readline->set_prompt("Country (q to quit)> ");
  string input;
  array(mapping(string:mixed)) result;
  while (input=readline->read()) {                /
/while !eof
    if (input=="q") break;                        /
/exit on "q"
    //query-
building. I like to use sprintf to build parametric
 queries, as
    //
it shows the query structure in the source (increas
ed readability),
    //
as well as allowing easier control over the SQL sta
tement
    string query=sprintf("select background from co
untries, ids "
                         "where countries.country=i
ds.code and "
                         "name='%s'",
                         db->quote(input)         /
/notice the quoting!
                         );
    result=db->query(query);
    if (!sizeof(result)) {
      write("No such country in the database\n");
      continue;
    }
    write(result[0]->background+"\n");
  }
}
```

RXML

There are two occasions in which you'll want to do quoting in RXML when performing SQL-related operations: parametric query building and results quoting (for instance to populate a selection list). In most cases the RXML parser tries to do the "sensible" thing, but sometimes that's just not enough, and you'll need to manually override the parser's "opinion".

On production systems, any degree of freedom is a risk: on such systems it is thus recommended to always specify the encodingq, as it will lessen the probability of errors, failures or security vulnerabilities.

Parametric Queries

You can use the standard entity-syntax to build parametric queries: just use entities in your query strings. Make sure to force the sql-encoding, or you might head into trouble.

The example beneath does the same task as the above pike application using RXML. It performs both of the encoding operations: results-encoding to populate a selection list and variable encoding to perform a parametric query:

```
<form method="post" action="&page.url;">
Select a country: <select name="country">
<emit source="sql"
      query="SELECT name,code FROM ids,countries
             WHERE countries.country=ids.code
             ORDER BY name">
<option value="&_.code;">&_.name;</option></
sqloutput>
</select>
<input type="submit">
</form>

<if variable='form.country'>
<sqltable host="mysql://user:password@localhost/
sample"
  query="SELECT name,background FROM countries,ids
         WHERE countries.country=ids.code
           AND ids.code='&form.country:sql;'"/>
</if>
```

SQL Syntax

The most basic SQL syntax for a data-extraction query is:

`SELECT` *what* `FROM` *table name*`[,` *table name* `...]` `[WHERE` *conditions*`]`

what defines what you wish to get from the query. It can be a column name (more on column names later), a function to be performed on the retrieve data (more on this in the functions chapter). The special notation '*' means "all columns from all the specified tables".

In order to extract everything from a table, with RXML:

```
<sqltable border="1"
  host="mysql://user:password@localhost/sample"
  query="SELECT * FROM boundaries">
```

with Pike:

```
 string parse (object id) {
    object db=Sql.sql("mysql://user:password@local-
host/sample");
    array(mapping) results=db-
>query("select * from boundaries");
    string output="<table border=1>";
    foreach (results,mapping m) {
        output+="<tr><td>"+m->country_1+"<td>"+m-
>country_2+"<td>"+
        m->length+"</tr>\n";
    }
    output+="</table>";
    return output;'
}
```

If we wanted to get the results only for a column in that table, we would have instead

with RXML:

```
<sqltable border="1"
  host="mysql://user:password@localhost/sample"
  query="SELECT length FROM boundaries">
```

Of course you can select more than one column, simply having *what* be a comma-separated list of column names.

With RXML:

```
<sqltable border="1"
  host="mysql://user:password@localhost/sample"
  query="SELECT country_1, country_2 FROM boundarie
s">
```

Using a single table doesn't harness the power of relations. Those are not "physical" entities, but are built when a query is executed if multiple tables are specified together with conditions to explain how the data from the tables should be collated (or "the tables are joined"). Usually an equality test is used to specify those conditions, but it's not a requirement. The result of the join operation is a virtual table merging those records from every involved table that satisfy the specified conditions.

Let's print the name of the known countries and the geographic regions they belong to. The country names are in the 'ids' table, the regions are in the 'areas' table, the two are tied via the 'countries' table. The relations we'll use are two: ids.code must be equal to countries.country, and countries.map_refs must be equal to areas.id

with RXML

```
<sqltable border="1"
  host="mysql://user:password@localhost/sample"
  query="SELECT ids.name AS country, areas.name AS
region
           FROM ids, countries, areas
          WHERE ids.code=countries.country
            AND countries.map_refs=areas.id">
```

Column Names

A column can be addressed in two ways: "plain" and "dotted notation". The latter is the more complete form, and is guaranteed not to be ambiguous. The former is allowed for brevity's sake by most servers (including MySQL), but only when no confusion is possible.

Aliases for Columns

It is possible (usually to have a function result with a simpler name) to alias the names of the returned columns, simply extending the *what* parameter above with the syntax

`column_name AS` *alias*

The values will be then available in the result as "alias" column, rather than "column_name".

With RXML:

```
<sqltable border="1"
  host="mysql://user:password@localhost/sample"
  query="SELECT country_1 AS first_country,
                country_2 AS second_country FROM bo
undaries">
```

See the functions chapter to see how for an example when using functions.

Aliases for Tables

Table names can be aliased with the "as" syntax, too. This is especially important in one case, and that is when you need to cross-reference a table with itself, or if a table is involved in multiple relations with another. It's illegal in SQL to have two or more tables with the same name mentioned in the tables list of a query.

With our sample database, it's necessary to alias a table if we want to expand the country codes in the boundaries table to their names. In order to accomplish that result, we will need to:

With RXML:

```
<sqltable border="1"
  host="mysql://user:password@localhost/sample"
  query="SELECT ids_1.name AS name_1,
                ids_2.name AS name_2, length
           FROM ids AS ids_1, ids AS ids_2, boundar
ies
```

```
        WHERE ids_1.code=boundaries.country_1
          AND ids_2.code=boundaries.country_2">
```

Here we aliased two times the 'ids' table for clarity's sake, we could have aliased it only once. Also, we aliased the column names for the same reason.

No Tables Involved

It is possible to have queries which don't involve any table, simply by not specifying the "FROM" clause. Such queries are not very useful, except sometimes to perform server-assisted translations.

With Pike:

```
 > object db=Sql.sql("mysql://user:password@local-
host/sample");
Result: object;
> db->query("select now() as time")[0]->time;
Result: "2000-02-29 12:12:57"
```

The conditional part of a query is explained in the following chapter.

Conditions

The condition part of the query, as shown in the "syntax" paragraph is a boolean expression, usually arbitrarily complex (old versions of MiniSQL have heavy limitations the syntax of this portion). Only rows that satisfy it will appear in the results set. If none does, the results set will be empty.

When evaluating the condition, column names are substituted with the data they contain, and operators are evaluated according to a well-specified grammar. Constants must be quoted according to their type.

Numeric Constants

Integer and floating-point numbers are not quoted. They can be told apart because floating-point numbers have the decimal separator (.). Usually the server's parser is quite lenient though, fixing types when possible according to the context.

Column Names

These are not quoted. Since they mustn't be ambiguous this poses a bit of limitations on column names. As a general rule, legal C variable names are legal column names (unless they are reserved words of course). SQL is a bit more lenient than C, so you should get a little more leeway.

String Constants and Quoting

Strings are quoted using the apostrophe symbol ('). If a string contains the literal apostrophe character, it must be escaped. Different escaping schemes are specified, the most usual ones being doubling it (i.e. 'It''s a shame') or prepending it with a backslash (i.e. 'It\'s a shame').

Let's obtain from our sample database the total area of Italy.

With RXML:

```
<emit source="sql" host="mysql://
user:password@localhost/sample"
  query="select name, area_tot from ids, countries
    where ids.code = countries.country and ids.name
='Italy'>
&_.name;'s total surface is &_.area_tot; sq. km.
</emit>
```

Other Data Types

Other data types are usually represented as formatted string, which get interpreted by the server according to the context.

The LIKE Operator

This operator is used to do glob-like matching. It has the syntax `value` *LIKE* `PATTERN` where the value is usually a column, and the pattern a string literal, possibly containing two magic characters: '_' and '%', which act like glob characters '?' and '*', that is they match any (single) character, and any arbitrarily long sequence of any character. If what you're matching against contains the literal '_' or '%' characters, you can escape them prepending the backslash character '\'.

Let's try to find out the countries neighbouring Italy. The right way to do so would be looking in the 'boundaries' table. But a summary can be found in the countries.location text, and we'll use that.

With RXML:

```
<sqltable border=1 host="mysql://
user:password@localhost/sample"
  query="select name from ids, countries
         where countries.country=ids.code and locat
ion like '%italy%'">
```

Notice that the "column like '%something%'" syntax (with leading and tailing globs) is very inefficient, and should be avoided whenever possible.

MySQL offers the more powerful REGEXP operator, with the syntax `value` *REGEXP* `expression` where the value is usually a column name or a function result, and expression is a string-quoted regular expression.

NULL Column Values

Some columns can be empty, or (in SQL terms) be NULL. To deal with them when selecting data, you use the 'IS' syntax, which takes the form `value` *IS [NOT]* `NULL` where value can be obtained from a a column (thus be a column name) or can be a constant value (of course it would be rather dumb to evaluate a constant expression, but you can of course do that if you wish).

Sorting

Data in a result is in undefined order. To have it sorted to some other order, the *ORDER BY* clause can be used. It modifies the basic query syntax:

```
SELECT <columns> FROM <table> [, <table> ...] WHERE
 <condition>
       ORDER BY <column name> [DESC] [, <column nam
e> [DESC] ...]
```

This will sort the returned rows according to the specified columns, depending on the column type (numerically if the column type is numeric, syntactically if the column type is textual, etc.) If the *DESC* modifier is specified, the rows will be sorted in reverse (descending) order.

Limiting

It is sometimes useful not to retrieve all the rows in a query.

You can do it using SQL or (in Pike) you can do it by simply not using some of the results you fetch.

Doing it in SQL has some advantages, for instance it will reduce the load on your SQL server, your Pike application and your internal network. On the other side, the syntax for performing such an operation is not part of the SQL standard, and so every server adds its own extensions to perform this operation.

We will introduce the MySQL syntax here. For other systems, consult your server's of choice SQL reference manual.

MySQL offers limiting via an extension of the SELECT syntax, which gets changed like this:

```
SELECT <columns> FROM <tables> [WHERE <condition>]
[ORDER BY <columns>]
       [LIMIT [offset,]howmany>]
```

offset and *howmany* are two numbers. When returning rows, MySQL will skip the first *offset*, and only return *howmany*.

Fetch the 20th to 30th countries with their associated codes (sorted by country name) with the 'LIMIT' syntax, in RXML:

```
<sqltable border=1 host="mysql://
user:password@localhost/sample"
  query="select name,code from ids order by name li
mit 20,10">
```

...or with Pike, using the query() function and result selection:

```
object db;
array(mapping(string:mixed)) result;
db=Sql.sql("mysql://user:password@localhost/sam-
ple");
result=db-
>query("select name,code from ids order by name");
if (sizeof(result)>20)
    result=result[20..];
else
    result=({});
if (sizeof(result)>10)
    result=result[..10];
foreach(result,mapping m) {
    write(m->name+"\t"+m->code+"\n");
}
```

The two sizeof()-based conditionals are needed because when slicing arrays, we need to make sure that valid indexes are used, and that the required semantics are respected.

With Pike, using the big_query() function and result selection:

```
object(Sql.sql) db;
object(Sql.sql_result) result;
int j;
db=Sql.sql("mysql://user:password@localhost/sam-
ple");
result=db-
>big_query("select name,code from ids order by name
");
for(j=0;j<19 && result->fetch_row();j++)
    ; //empty body, it's all done in the condition
for(j=0;j<11;j++) {
    array row;
    if (!(row=result->fetch_row()))
        break;
    write (row[0]+"\t"+row[1]+"\n"); //
row[0] is the name, row[1] is the code
}
```

Functions

Whenever a column or a constant can be used in a query definition, a function can be used instead. Functions perform operations on the data, the usual quoting rules applying to their arguments.

The available function and their names names vary wildly from server to server, as does their syntax. We'll introduce here the most important MySQL functions. For further information, consult your server's documentation.

Arithmetic and math functions

+, -(unary or binary), / (with infix notation), *

ABS(X)

SIGN(X)

MOD(X Y)
modulo, like 'X % Y' in C

FLOOR(X)

CEILING(X)

ROUND(X)
rounding operators

LEAST(X, Y,...)
returns the smallest of its arguments

GREATEST(X, Y,...)
returns the greatest of its arguments

Comparison and logic functions

=
equality

!= or <>
dis-equality

>, >=, <, <=

IS [NOT] NULL
true if the compared value is (not) NULL

expr IN (value, ...)
true if the expression expr appears in the list

NOT or !

OR or ||

AND or &&
logic operators

String comparison and operations

value LIKE pattern

see the *Conditions* page

value REGEXP pattern
performs a regular-expression match

CONCAT(str1, str2,...)
concatenates the arguments

LENGTH(str)
returns the length of its argument

LEFT(str,len)
return the leftmost len characters

RIGHT(str,len)
return the rightmost len characters

SUBSTRING(string,start_at,length)
returns length characters starting from position start_at

TRIM([LEADING|TRAILING|BOTH] FROM string)
trims leading, trailing or both spaces from string

LOWER(string)
returns the string in lower case

UPPER(string)
returns the string in upper case

PASSWORD(string)
returns a Mysql password that checks against string

ENCRYPT(string[,salt])
same as the Unix crypt(3) function. If supplied, 'salt' should be 2 characters long. Otherwise it uses a random salt.

Control flow operators

IFNULL(expr1,expr2)
if expr1 is not null, returns it, otherwise it returns expr2

IF(expr1,expr2,expr3)
if expr1 is true, returns expr2, else expr3

Date-related functions

DAYOFWEEK(date)
returns the weekday index for date (Sunday=1...Saturday=7)

DAYOFMONTH(date)
returns the day of the month for date (1..31)

DAYOFYEAR(date)
returns the day of the year for date (1..366)

MONTH(date)
returns the month for date (1..12)

YEAR(date)
returns the year from date (1000..9999)

HOUR(time), MINUTE(time), SECOND(time)
time extraction functions

CURRENT_DATE, CURRENT_TIME, CURRENT_TIMESTAMP
'magic' variables, that are treated like functions. They contain the current date, time, and timestamp respectively.

Miscellaneous functions

LAST_INSERT_ID()
returns the last value automatically generated by an 'AUTO_INCREMENT'-type column

Special functions

These functions are somewhat 'special', in that they have different semantics when used in conjunction with the 'GROUP BY' clause (which is not covered in this manual).

COUNT([DISTINCT] expr)
if 'expr' is a column name, it returns the number of non-null rows returned for that column. If it's an asterisk '*', it gives the number of returned rows. If the DISTINCT keyword is specified, duplicate values are not counted.

AVG(expr)
Returns the average of the columns matched.

MIN(expr)
Returns the least of the columns matched.

MAX(expr)
Returns the greatest of the columns matched.

SUM(expr)
Returns the sum of the columns matched.

Show the current day of the week:

```
$ mysql -u user -p password sample
[MySQL Monitor]
> select dayofweek(now()) as day;
```

Count the number of rows in a table:

```
> select count(*) from ids;
```

Count the number of countries whose name begins by 'i':

```
> select count(*) as number from ids where ids.n
ame like 'I%'
```

Features Missing from MySQL

What's missing?

There are a few very powerful features ANSI SQL provides that we haven't mentioned, and that we won't go into detail on.

The main excu.. ahem, reason for this is that they're quite powerful and complex and thus out of scope for this manual. Furthermore, they're not supported by all SQL servers. MySQL in particular doesn't support them.

The features we're talking about here are views and sub-queries. When your SQL server of choice supports them, Pike and Roxen can use them.

Also, SQL is designed to support transactions via some special keywords. However, not all servers implement this feature. If you need transactions, you also need an experienced database administrator to optimize your SQL and your application in general, so you won't find any reference to that here. Sometimes used as a simpler scheme in place of transactions, table locking is available for instance on

MySQL. Refer to the MySQL manual for further information on the topic.

Insertion Syntax

While data extraction queries enforce the relationships between the tables in a database, data insertion queries do not. Data is always inserted into a table, never into a relation.

This fact is reflected in the SQL syntax for an insertion query. There are of course a few variations:

`INSERT INTO` *table* `VALUES (`*value* `[, `*value* `...])`

is the basic version. It only allows to specify all the values in a table row. The values' order is of course relevant: it must correspond to the order the columns were defined in when the table was created.

Sometimes it's preferrable not to specify data for all the columns: data may be unknown, automatically completed by the server (unique IDs, timestamps, ...) or the default value might be acceptable for some columns. This can be obtained with the alternate syntax:

`INSERT INTO` *table* `(`*column* `[, `*column* `...]) VALUES (`*value* `[, `*value* `...])`

A value must be supplied for each column specified in the columns-list. Unspecified columns will be assigned the default value or NULL. If no default value is specified and NULL is declared invalid for a column, an error will be thrown when trying to insert.

A particular form of subquery can be used to fill in a table (usually temporary tables). This is the only form of subquery supported by the MySQL database. The syntax is:

`INSERT INTO` *table* `[(`*column* `[, `*column* `...])] SELECT ...`

There are a few limitations for the SELECT query, check your server's of choice manual to know more about them.

An insert-type query doesn't return any results, so you should use SQLQUERY in RXML, or not expect any results if you're using Pike. Also, you have to watch out and *Quoting* quote the values you're inserting. Program errors and possible security breaches are possible of no proper quoting is used.

Insertion Query with Pike

This program was used to build the sample database, and as such it's hackishly raw. It takes the contents of a file named "country-codes.data" in the current directory. That file has one entry per row, with two tab-separated fields (country code and country name). Those same data are dumped into the sample database.

```
 int main () {
  object o=Sql.sql("mysql://user:password@local-
host/sample");
  array(string) rows=Stdio.read_file("countries-
codes.data")/"\n";
  rows-=({""});
  foreach (rows,string row) {
    array(string)fields=row/"\t";
    o-
>query("insert into ids(code,name) values ('"+field
s[0]+"','"+
      o->quote(fields[1])+"')");
  }
}
```

Insertion Query with RXML

Performing insertion queries with RXML must be considered with extreme caution: while it is a great system, it is undoubtably less flexible than the Pike programming language.

This simple RXML page will allow you to insert a new country - country code entry into the sample database:

```
<form action="&page.url; method="post">
Country name: <insert name="name"><br>
Country code: <insert name="code" maxlength=2><br>
<input type="submit"><input type="cancel">
</form>

<if variable="form.name">
<!-- we're inserting data here -->
<sqlquery host="mysql://user:password@localhost/
sample"
  query="INSERT INTO ids (code,name)
         VALUES ('&form.code:sql;','&form.name:sql;
')"/>
</if>
```

Notice that while this sample works, and can be used in a development/internal environment, it is not suited to be used in a production environment: events such as a duplicate entry will cause uncaught exceptions, which could potentially leak information such as the database's password or the implementation internals.

See <*catch*> to address these issues.

The tablify Container

This page isn't meant to be a reference for tablify, as it can be found on the <*tablify*> page.

The `<tablify>` container can be used to make (plain or nice) HTML tables out of formatted text, as well as allowing to perform some operations on the data like sorting.

Of course it is not mandatory to use it to build tables, but it can save some work, especially to build "nice" tables. The `<sqltable>` tag can be used for the same purpose too, but it doesn't have the same flexibility, and it is being slowly phased out, so support for it might be dropped in the future.

Build a table with `<emit>` to print the total area of each known nation:

```
<table border="1">
<tr><th>Country</th><th>Total area</th></tr>
<emit source="sql"
      host="mysql://user:password@localhost/sample"
     query="SELECT name,area_tot FROM ids,countries
            WHERE ids.code=countries.country">
<tr><td>&_.name;</td>
    <td>&_.area_tot;</td></tr>
</emit>
</table>
```

Doing the same with tablify:

```
<tablify nice="yes" interactive-sort="yes" size="3"
         titlecolor="white" cellseparator="|">
Country|Total Area
<emit source="sql"
      host="mysql://user:password@localhost/sample"
     query="SELECT name,area_tot FROM ids,countries
```

```
            WHERE ids.code=countries.country">
&_.name;|&_.area_tot;</emit>
</tablify>
```

Tablify expects to receive its data in a tabular form, with newline-separated rows of tab-delimited entries. In this case I chose to override the default cell separator because some editors try to translate the tab character to a sequence of spaces. Should you choose to do the same, make sure that your delimiter is a character that does not occur in your dataset.

While I shamelessly used the interactive-sort parameter to tablify, it is not recommendable to use the tablify sorting functions in general, but rather using the SQL "order by" clause for performance reasons.

The Business Graphics Module

The business graphics module (providing the diagram tag) allows Roxen to build different kind of diagrams on-the-fly. A reference chapter on the module's features (ref: the business graphics module chapter) is available.

We won't duplicate the reference specification, but instead focus on how to use a sql data-source to feed a diagram generation tag.

We'll start off with an example:

Show a graphic documenting the total areas for the known countries:

```
<diagram type=barchart horgrid name="Areas"
  namefont="franklin gothic demi" namesize=25>
<data xnames form=column xnamesvert>
<sqltable ascii host="mysql://
user:password@localhost/sample"
          query="select name,area_land,area_tot fr
om ids, countries where
                 ids.code=countries.country order
by area_tot desc">
</data>
<legend separator=|>Total area|Land area</legend>
</diagram>
```

In the example, the data are fed by columns rather than by rows (which is the default for the diagram tag) because SQL modules are better suited for that kind of layout.

The <sqltable> tag, together with the ascii parameter, is the most suited system to feed data to a <diagram> tag.

You always need to watch out for possible field separator misinterpretation problems: the default field separator (the tab character) and line separator (newline) are not usually found in SQL-obtained data-sources, especially the numeric data used to feed the diagram module. But you must not take this for granted, so make sure to check, and possibly use a different separator and the <sqloutput> tag to make sure.

The emit and sqlquery Tags

The <emit> tag is a plugin-based data management system.

Generally speaking, <emit> will iterate through all the data in a dataset such as the result of a SQL query, processing the contents of the tag for each item in the dataset. The source of the dataset is specified in the tag's arguments, along with a few source-dependent parameters. See *the chapter on emit* in the creator manual for more details. The emit tag allows to take full advantage of the Roxen variable scopes.

Applying this to the case of SQL queries, the dataset is a tabular result, and the items are the result's rows. The source to be used is named "sql", and it takes as additional arguments host (the SQL-URL of the host to be contacted) and query (the SQL query to be executed). Additionally, it accepts the same parameters as the sqloutput tag.

The example in the tablify chapter can be rendered with emit as:

```
<table border=1>
<emit source="sql" host="mysql://
user:password@localhost/sample"
  query="select name,area_tot from ids, countries w
here
  ids.code=countries.country">
<tr><td>&_.name;</td><td>&_.area_tot;</td></tr>
</emit>
</table>
```

Remember: _ is the default scope. Should it be unavailable, or should you want to use it for some other tag, you can use another scope, like this:

```
<table border=1>
<emit source="sql" host="mysql://
user:password@localhost/sample"
  scope="queryscope"
  query="select name,area_tot from ids, countries w
here
  ids.code=countries.country">
<tr><td>&queryscope.name;</
td><td>&queryscope.area_tot;</td></tr>
</emit>
</table>
```

The sqlquery tag can be rendered with an empty emit tag

```
<sqlquery host="mysql://user:password@localhost/
sample"
  query="insert into foo(bar) values ('gazonk')">
```

can thus be translated into

```
<emit source="sql" host="mysql://
user:password@localhost/sample"
  query="insert into foo(bar) values ('gazonk')" />
```

There is no builtin way to emulate the sqltable tag, you'll have to follow the syntax described for the <*tablify*> tag previously.

Database Creation

Database creation is not a part of the SQL standard, and the details are very much server-specific. The Pike SQL interface, however, offers two functions as part of the Sql.sql object that can serve for this purpose.

Create a "foo" database:

```
void create_new_database(string dbname)
{
  mixed error;
  object db = Sql.sql("mysql://admin:pass-
word@localhost/");
  error = catch {
    db->create_db("newdb");
  };
```

```
  if(error)
  {
    werror("Error: "+db->error()+"\n");
    return;
  }
}
```

Delete the "foo" database:

```
void delete_database(string dbname)
{
  object db = Sql.sql("mysql://admin:pass-
word@localhost/");
  db->drop_db("newdb");
}
```

Of course the catch {} clause in the first example is overkill here, these operations are really REALLY meant to be used interactively, and so a stack backtrace can be very descriptive and useful.

Most servers provide an SQL syntax to perform this operation. In some cases creating a database is so expensive that an external app is used to perform the operation. When your server supports it via SQL, using SQL is advised. This functions are provided mostly for MiniSQL compatibility (MiniSQL doesn't provide an SQL syntax to create a database).

Creating Tables

Tables are created via a mostly standard SQL syntax. When a table is declared, the names and types of its columns are specified, possibly along with constraints, default values and other options.

Most databases, however, allow changing a table structure at any time. Be warned that doing so without breaking any constraint might be not trivial. We won't go into details on how to modify a table structure here. You can check your server's SQL reference manual, looking for the keywords "ALTER TABLE".

Also, we won't go into details on referential integrity constraints. If you need them, you also need a skilled database administrator, and explaining them here would be out of scope.

Again, the SQL standard is not well-specified here. While the basic syntax to create a table is standardized, column types are not (except a few). Also, some servers allow defining custom types, further complicating the matter. Finally, the syntax to define constraints is heavily dialectized, save for the most basic functions. Check your server's documentation for further informations.

We'll use the MySQL syntax as reference.

The basic syntax is:

`CREATE TABLE` *name* `(`*declaration*`[,` *declaration* `...])`

The declarations can be columns, keys or indices (see the indices chapter) in various flavors. Let's take a look at a column declaration syntax first: it is

*column_name**column_type* `[NOT NULL] [DEFAULT` *value*`] [AUTO_INCREMENT] [PRIMARY KEY]`

The column name can be pretty much anything, as long as it doesn't clash with any reserved word. For simplicity's sake, using short, descriptive names is advised. Dots, spaces and other non-alphabetical characters are forbidden.

If the *NOT NULL* clause is specified, it poses a constraint on the column, namely that it must be specified (or, in other terms, it can't be NULL). An attempt to insert a row without specifying this value will result in an SQL error and a (Pike or RXML) exception.

If the *DEFAULT* clause is specified, inserting a row without specifying this column will result in inserting the default value instead. If it's not specified, NULL will be inserted instead (possibly clashing with the *NOT NULL* condition).

AUTO_INCREMENT is only meaningful for numeric types, and useful only for integer types. Its behavior is like a specialized default value: if NULL is specified as data for the column, then the actual inserted value will be the maximum present value + 1. This is useful for creating unique IDs for the rows in the table.

We'll return on the *PRIMARY KEY* argument later.

SQL Data Types

All servers should support at least the INTEGER, REAL, CHAR and VARCHAR types. Unluckily, that's about as far as it goes, and there is even no wide-accepted agreement on the semantics of CHAR and VARCHAR.

INTEGER
is what it seems, an (usually 32-bits) integer. It is signed, unless the keyword UNSIGNED (e.g. INTEGER UNSIGNED) is used.

CHAR
is a fixed-length character string. Some servers space-pad it at the end (and use the VARCHAR type for unpadded strings), others don't. MySQL doesn't pad it.

VARCHAR
is a variable-length string. Usually it differs from CHAR in terms of how it is stored on disk: while CHAR values allocate the storage space for the entire field length (and if it's shorter leave it unused), VARCHAR values are usually stored as a (length, value) pair and are packed. This means that they use less space on disk, but are somewhat slower to access. More importantly, usually VARCHAR values can't be used in indices or keys.

MySQL Data Types

Of course servers provide many more data types. Here are some details on MySQL's types:

TINYINT [UNSIGNED], SMALLINT [UNSIGNED], MEDIUMINT [UNSIGNED], INTEGER [UNSIGNED], BIGING [UNSIGNED]
are respectively 8-, 16-, 24-, 32-, 64-bit wide integers (signed, 2's complement unless the UNSIGNED clause is specified). Notice that while performing internal arithmetic all values are transformed into 64-bit signed integers, so even for BIGINT UNSIGNED (which is theoretically 64-bit wide, no more than 63 bits values should be used.

FLOAT and DOUBLE
are what you can expect them to be (single- and double-precision floating-point numbers).

NUMERIC
(length,decimal) is an unpacked floating-point number. It is stored as a string, one char per digit. If DECIMAL is 0, then the numbers are considered integer, and can't

have a decimal part. LENGTH is the size, and must be in the 0-255 range.

DATE, DATETIME, TIME
are date-related types. The legal range for them is from '1000-01-01 00:00:00' to '9999-12-31 23:59:59'. MySQL uses the "yyyy-mm-dd hh:mm:ss" syntax to display dates, but also understands others. It is however recommended to stick to the default.

TIMESTAMP
is a somewhat magic column-type. It stores a date and a time as a 32-bit UNIX datetime value, thus the legal range is from '1970-01-01 00:00:00' to sometime in 2037. It is magic in that when you perform an INSERT or UPDATE operation on a row and don't specify the value for a TIMESTAMP column, MySQL will fill it for you with the date-time of the operation. Useful for time-stamping operations (hence the name).

CHAR (length) [BINARY]
is a fixed-length string as described above. Padding spaces are not added by MySQL. Comparisons are case-insensitive unless the BINARY keyword is specified. *length* must be in the 1-255 range. Values longer than the specified length are truncated.

VARCHAR (length) [BINARY]
is a variable-length string. Same arguments as the CHAR type apply.

TINYBLOB, BLOB, MEDIUMBLOB, LONGBLOB
are amorphous storage spaces, long at most (2^8-1), (2^16-1), (2^24-1) or (2^32-1) bytes.

TINYTEXT, TEXT, MEDIUMTEXT, LONGTEXT
are the same as BLOBS, save that comparisons between values are case-insensitive.

Indices

Indices are one of the reasons why RDBMSes are fast when retrieving data: they are built from the data in user-specified columns when rows are inserted into the database and are used when data is selected or retrieved, thus avoiding in most cases the necessity to do a full table scan when performing read operations. Indices cause insertion operations to be slightly slower, but can make data extraction operations and joins orders of magnitude faster. Indices can span multiple columns, and could even include all the columns (although such an index would be of limited use). Usually DBMS allow to define more than one index per table (the maximum number might be constrained).

Keys (or unique indices) can be seen as "a stronger kind of index". A key is an index which is also constrained to be unique: having two rows with the same key in a table is forbidden, for any key defined on the table. The interpretation the various databases give to this concept varies, however. For some (including MySQL), a key is merely an alias for "index". For others, indices can be used to enforce constraints but have no impact on data organization while keys do. For further information on your server's concept of keys, consult its manual.

One key is special, and is named "primary key". The data is usually put in storage in such a way that read operations involving only the primary key are even faster than operation involving keys or indices. It is also usually very slow to update, and is not allowed to contain NULL values.

Unique indices are the way provided by SQL to avoid duplicate rows, defining one that spans all the columns you wish to maintain unique, maybe even all of them. There can be multiple constraints, that can be expressed by defining multiple indices.

The syntax to create an index varies from RDBMS to RDBMS. However, there are two main syntaxes we'll explain here. Consult your server's documentation for details on the syntax it supports.

MySQL Syntax

MySQL has indices and keys definitions inside table creation clauses. The basic syntax is:

`CREATE TABLE` *name* `(` *declaration* `[,` *declaration* `...])`

where a declaration is either a column declaration, a key declaration or an index declaration. For columns declaration, see the *Creating Tables* page.

For indices, unique indices and primary key the syntax is respectively:

`PRIMARY KEY (`*column* `[,`*column*`...])`
`UNIQUE INDEX` *index_name* `(`*column* `[,`*column*`...])`
`INDEX` *index_name* `(`*column* `[,`*column*`...])`

The names for indices (unique or not) must be unique in a table (no pun intended).

This is the defininion for the "areas" table in the sample database:

```
CREATE TABLE areas (
  id tinyint NOT NULL auto_increment,
  name char(20) NOT NULL,
  PRIMARY KEY (id),
  UNIQUE INDEX name (name)
)
```

There are two constraints: the area id must be unique, as must the area name. Joins are made on the primary key for efficiency purposes.

Postgres Syntax

With PostgreSQL and other databases indices are seen not as part of a table definition, but are "external" entities attached to a table. They are created by a CREATE clause, whose basic syntax is

`CREATE [UNIQUE] INDEX ON` *table* `(`*column* `[,` *column*`])`

Primary keys are defined using the same syntax as MySQL.

The definition above would have been with PostgreSQL:

```
CREATE SEQUENCE areas_seq

CREATE TABLE areas (
  id tinyint NOT NULL DEFAULT NEXTVAL('areas_seq'),
  name char(20) NOT NULL,
  PRIMARY KEY (id)
)

CREATE UNIQUE INDEX unique_area ON areas (name)
```

Notice that recent versions of MySQL (3.22 and later) and PostgreSQL support both syntax styles.

Single-Column Primary Keys

If your table has a primary key spanning over a single column, you can declare it simply appending the "PRIMARY KEY" keyword to the column definition:

```
CREATE TABLE areas (
       id tinyint NOT NULL auto_increment PRIMARY K
EY,
       ...
)
```

Notice that in most cases the PRIMARY KEY clause implies the NOT NULL clause.

Dropping

To delete indices, tables or databases, the DROP command is used in its variations:

To delete an index (where the CREATE INDEX syntax is used), the syntax is:

`DROP INDEX` *name*

To drop a table the syntax is:

`DROP TABLE` *name*

The table, its contents and definition will be deleted from the database irrevocably.

To drop a database altogether (where supported), you can use

`DROP DATABASE` *name*

The pike SQL-interface provides a specific-purpose function to drop a database: this is mainly for compatibility with MiniSQL where the operation of dropping a database is demanded to a specific-purpose API function, named drop_db.

Using SQL:

```
object db = Sql.sql("mysql://admin:pass@local-
host");
mixed exception;
exception = catch {
  db->query("DROP DATABASE test");
};
if(exception)
{
  werror("Error while dropping the database: "+db-
>error()+"\n");
  throw(exception);
}
```

Using the API functions:

```
object db=Sql.sql("msql://admin:pass@localhost");
mixed exception;
exception=catch {
  db->drop_db("test");
};
if(exception)
{
  werror("Error while dropping the database: "+db-
>error()+"\n");
  throw(exception);
}
```

Notice that I haven't either tried to fetch results (there's no result to fetch anyways) and the exception handling has been very limited, and for diagnostic purposes only: these operations are really meant to be used only interactively.