"Automating OpenOffice with ooRexx: Architecture, Gluing to Rexx Using BSF4Rexx"

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Agenda

- "**O**pen**O**ffice.**o**rg" ("**OOo**")
  - Overview Architecture
  - "UNO", "urp"
- BSF, BSF4Rexx
  - Architecture
- Making ends meet
  - Gluing of OOo with ooRexx
- Roundup and Outlook

Sources of figures, examples and hints

- From the excellent OOo "Developer's Guide", cf. http://www.OpenOffice.org
- Mr. Augustin's paper "Erweiterung der Skriptfähigkeit von OpenOffice.org durch BSF und JSR-223" at the "WU Wien", cf. http://www.matt.at/oo_examples
- From the excellent book, "OpenOffice.org Macros Explained" by Mr. Pitonyak, cf. http://www.HetzenWerke.com

OpenOffice.org Brief History, 1

- StarOffice
  - Originates in Germany
  - Portable C++ class library ("Star")
    - Allow creation of a portable integrated office suite
    - Goal: compatibility to MS Office
  - 90'ies
    - OS/2
    - Windows
    - Explored Macintosh, Unix

OpenOffice.org Brief History, 2

- StarOffice, continued
  - Bought by Sun
    - Development transferred to the U.S.A.
  - Solaris
    - Allowed MS Office compatible office suite
  - Opensource
    - In parallel to commercial version "StarOffice"
    - "OpenOffice.org" (OOo)
      - Linux, Macintosh, OS/2, Solaris, Windows, …

OpenOffice.org
Developer's Bird Eye's View, 1

- Set of services to create and maintain documents
- All common functionality of all types of documents is extracted and organized as a set of interfaces
  - E.g. Loading, saving, printing documents
- For each type of document the specific functionality is extracted and organized as a specialized set of interfaces
    - E.g. TextCursors ("write"), Cell-Manipulation ("calc")

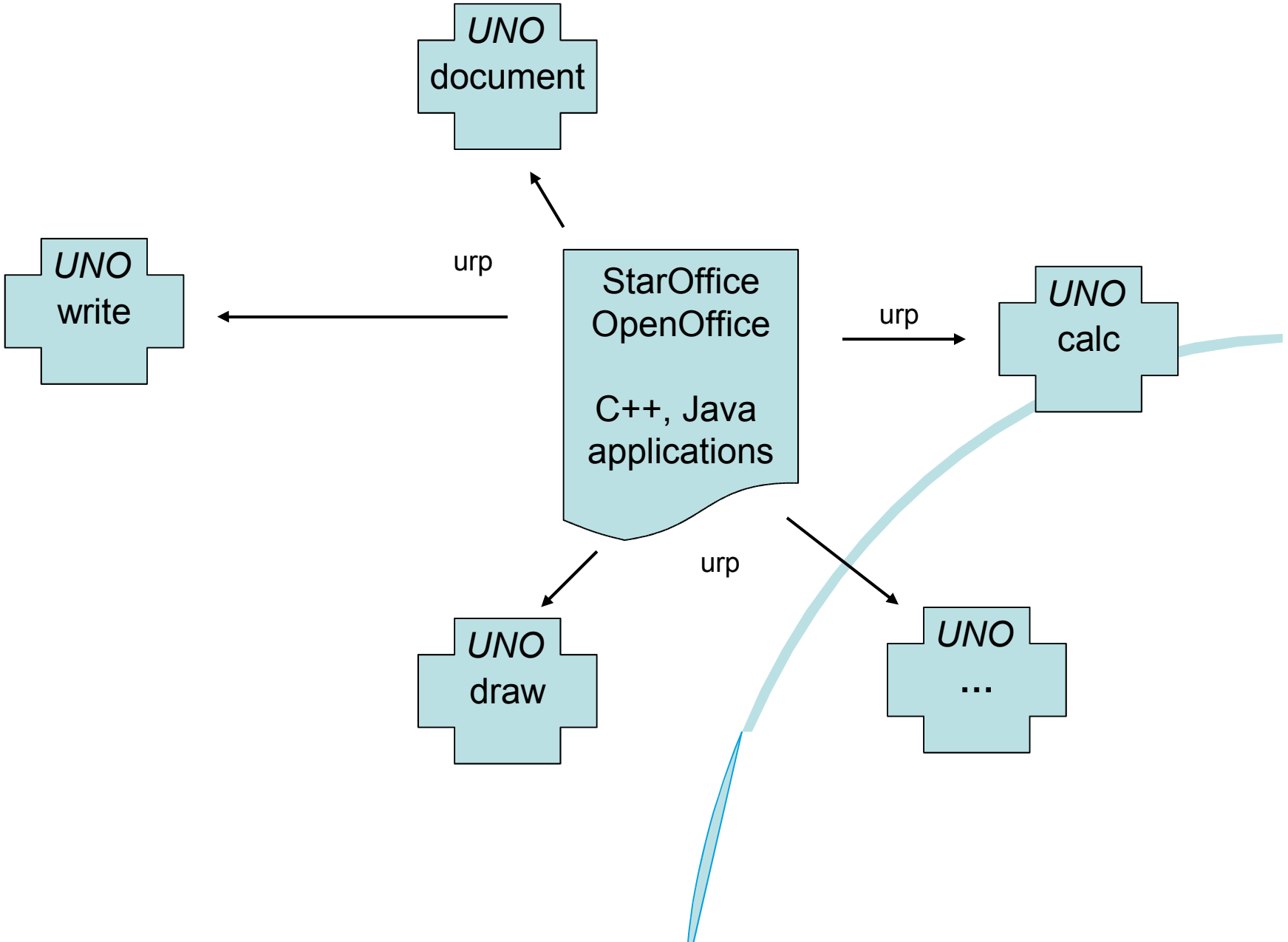
OpenOffice.org Developer's Bird Eye's View, 2

- Client/Server Architecture
  - Employing distributable components ("UNO")
    - Server can run on any computer in the world!
    - Operating system of server as well as that of the client is irrelevant!
  - Communication
    - TCP/IP sockets
    - Named pipes, if available
  - Client can run on the same machine as the server

OpenOffice.org Building Blocks, 1

- "UNO"
  - **U**niversal **N**etwork **O**bjects
  - Distributable, interconnectible infrastructure
  - All functionality is organzied in the form of classes
    - "UNO classes"
- "urp"
  - "UNO remote protocol"
    - CORBA-like protocol

OpenOffice.org Building Blocks, 2



OpenOffice.org Building Blocks, 3

- "Service Managers"
  - Supplied by servers
  - Can be used to request services from the server
  - Returned service allows access to a part of the "office" functionality, E.g.
    - *com.sun.star.frame.Desktop*
    - *com.sun.star.configuration.ConfigurationProvider*
    - *com.sun.star.sdb.DatabaseContext*

OpenOffice.org Building Blocks, 4

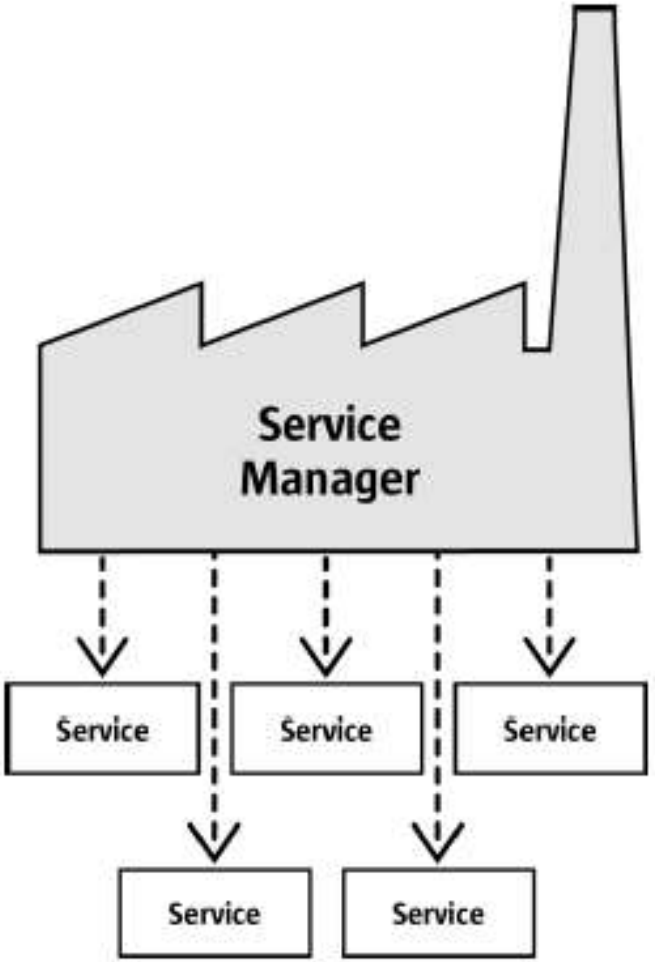


Illustration 2.1: Service manager

OpenOffice.org Building Blocks, 5

- "Services"
  - Can be comprehensive
  - Are organized in partitions named
    - "Interfaces" (group of functions/methods) and
    - "structs" (group of related properties only)
  - Depending on the desired task you need to request the appropriate interface, e.g.
    - com.sun.star.view.**X**Printable
    - com.sun.star.frame.**X**Storable
    - com.sun.star.text.**X**TextDocument

OpenOffice.org Building Blocks, 6

- An example
  - Two services with seven interfaces exposed
    - There are more available
  - "OfficeDocument"
    - Four interfaces
  - "TextDocument"
    - Three interfaces

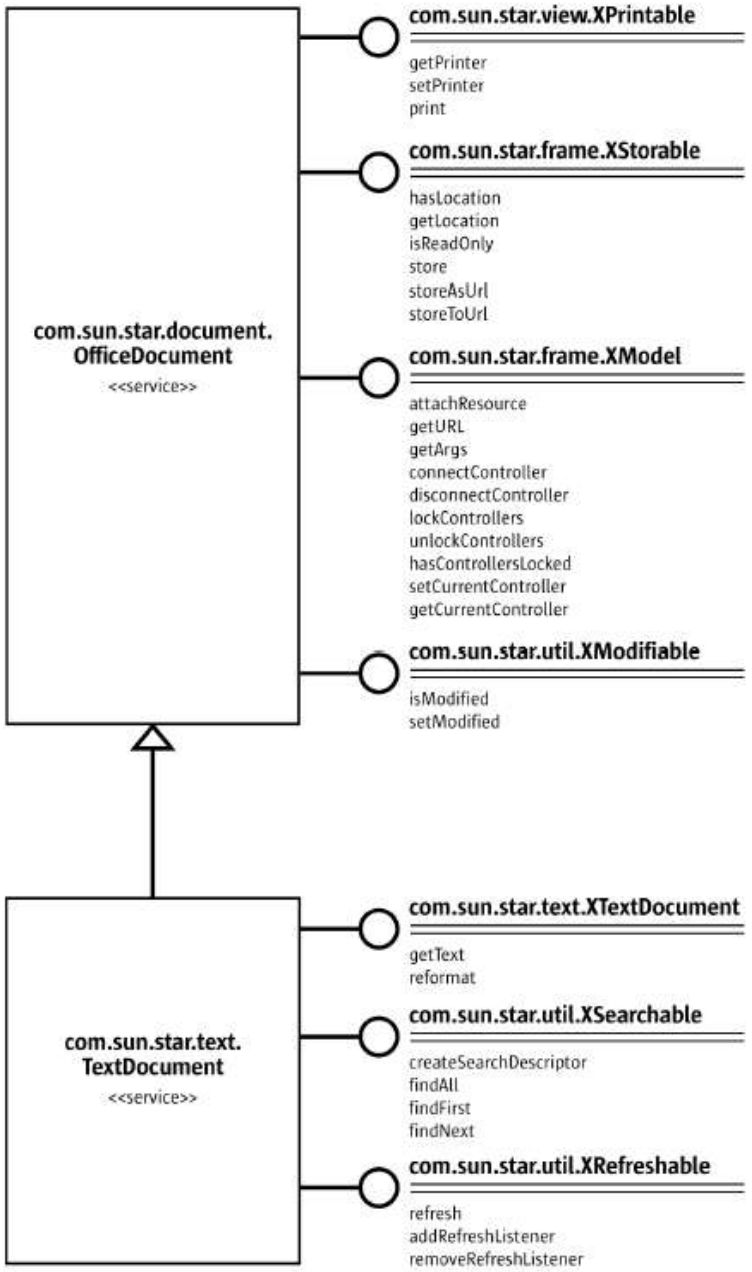


Illustration 2.3: Text Document

OpenOffice.org Building Blocks, 7

- Client needs to get in touch with the server
  - URL-style connection string
  - Server creates an object to interact with and returns a handle for it to the client

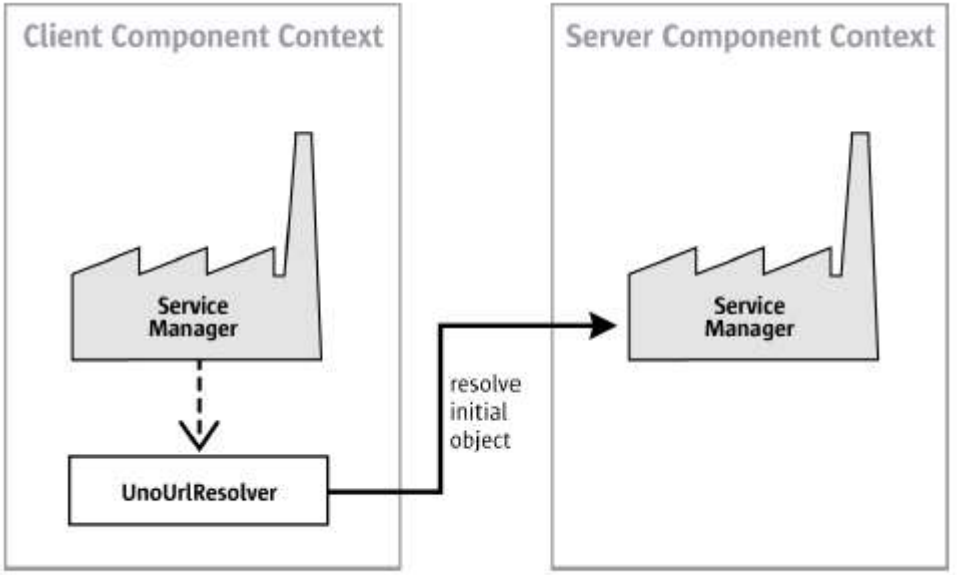


Illustration 2.2: UnoUrlResolver gets Remote ServiceManager

OpenOffice.org Programming languages

- OOo version 1.1
  - C++
  - StarBasic
    - Scripting language
  - **Java**
  - Python
- Upcoming OOo version 2 in addition
  - BeanShell (interpretable Java)
  - JavaScript

OpenOffice.org

Java, 1

- Full implementation for UNO
  - "Java UNO"
- Every UNO component/class can be directly used by Java
- UNO components can also be developed in Java
- C++ UNO and Java UNO are fully interoperable!

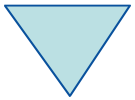
OpenOffice.org – Create a Connection Java, 2

```
XComponentContext xLocalContext =
com.sun.star.comp.helper.Bootstrap.createInitialComponentContext(null);
// initial serviceManager
XMultiComponentFactory xLocalServiceManager = xLocalContext.getServiceManager();
// create a URL resolver
Object urlResolver = xLocalServiceManager.createInstanceWithContext(
"com.sun.star.bridge.UnoUrlResolver", xLocalContext);
// query for the XUnoUrlResolver interface
XUnoUrlResolver xUrlResolver =
(XUnoUrlResolver) UnoRuntime.queryInterface(XUnoUrlResolver.class, urlResolver);
// Import the object
Object rInitialObject = xUrlResolver.resolve(
"uno:socket,host=localhost,port=2002;urp;StarOffice.ServiceManager");
// XComponentContext
if (null != rInitialObject) {
     System.out.println("initial object successfully retrieved");
} else {
     System.out.println("given initial-object name unknown at server side");
}
```

OOo and ooRexx ?

- No direct support for ooRexx in OOo
- No external Rexx functions available for OOo
- BUT
  - **If** there was a way to bridge ooRexx with Java and then use Java to bridge to UNO, **then** it would be **possible** to team OOo with ooRexx!
  - … and there **is** a means available for that:

    BSF4Rexx !



BSF

- Bean Scripting Framework
  - A Java framework, making it easy for Java to invoke scripts in non-Java scripting languages
    - E.g. JavaScript, NetRexx
  - Originally developed by IBM as open source
    - Part of IBM's WebSphere to allow scripts to be deployed within Java Server Pages (JSP)
  - Fall 2003 handed over to **jakarta.apache.org**
    - Used e.g. in **ant**, **xerces**

BSF4Rexx

- BSF with a Rexx engine
  - Allows the usage of Rexx from BSF
    - Any Java program can invoke Rexx
    - Rexx scripts are able to communicate with Java objects, if made available by the Java program
  - Allows Java to be used as a huge Rexx function library
    - The public methods and public fields of every Java object and Java class object can be used by Rexx
    - If necessary, Java can be started up by Rexx

BSF4Rexx, Example
Rexx Using Java

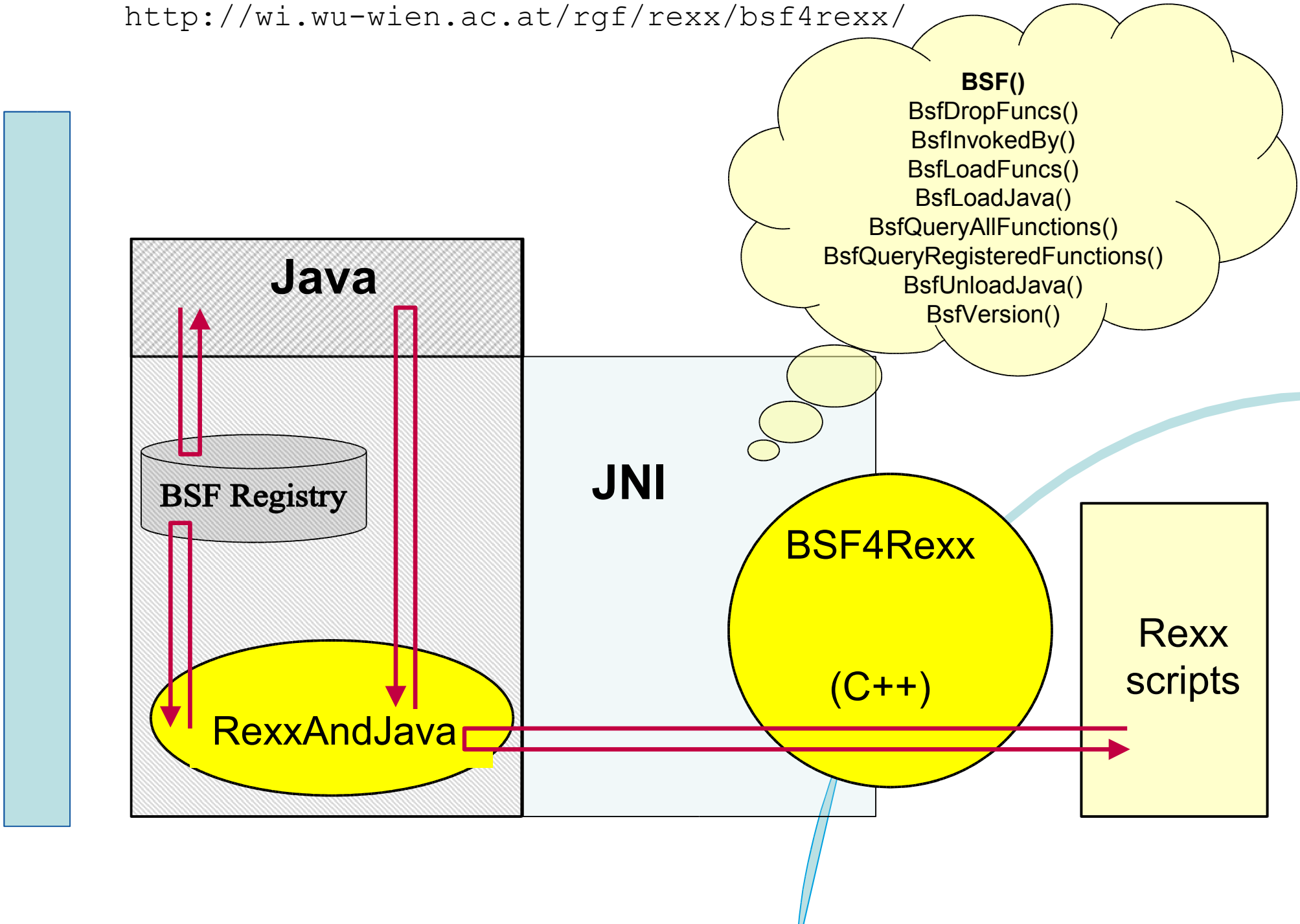
```
/* classic Rexx version, querying the installed Java version */

     /* load the BSF4Rexx functions and start a JVM, if necessary */
if rxFuncQuery("BSF") = 1 then   /* BSF() support not loaded yet ? */
do
  call rxFuncAdd "BsfLoadFuncs", "BSF4Rexx", "BsfLoadFuncs"
  call BsfLoadFuncs /* registers all remaining BSF functions */
  call BsfLoadJava  /* loads Java */
end

say "java.version:" bsf('invoke', 'System.class', 'getProperty',
'java.version')
```

Yields, e.g.:

```
java.version: 1.4.2
```

BSF4Rexx Architecture

http://wi.wu-wien.ac.at/rgf/rexx/bsf4rexx/



BSF4Rexx, Typing Issue, 1 "Strict"

- A newer version than the "Augsburg" version of BSF4Rexx
  - Will be named "Vienna" or "WU", still under development
  - Beta version can be downloaded from

    `http://wi.wu-wien.ac.at/rgf/rexx/bsf4rexx/`
  - Allows to omit type information usually needed for Java
    - Java is a strongly typed programming language, Rexx is not!
  - "strict" allows to supply explicit type information
    - Needed under rare circumstances where Java methods of the same name and same number of arguments exis, but differ in the type of their arguments only

BSF4Rexx, Typing Issue, 2 "Strict"

- "Type indicators" preceed the argument in BSF()-subfunctions containing the word "Strict"
- "Type indicators" are one of the following strings
  - **BO**olean, **BY**te, **C**har, **D**ouble, **F**loat, **I**nt, **L**ong, **O**bject, **SH**ort, **S**tring
    - Only bold and uppercase letters need to be given
    - Java type information is given in the HTML documentation
    - "BOolean", "Byte", "Char", "Double", "Float", "Int", "Long", "SHort", "String" are the Java "primitive" data types
    - "Object" is *any* Java object

Camouflaging Java, 1

BSF.cls

- "**BSF.cls**"
  - An ooRexx package
  - Defines routines, classes and methods which hide the procedural interface from ooRexx programs
  - Wraps all BSF()-subfunctions into ooRexx Methods
  - Allows to import Java classes explicitly into ooRexx in the form of ooRexx proxy classes
  - Allows to create ooRexx proxy objects which interact with the appropriate Java objects

Camouflaging Java, 2

BSF.cls

- "**BSF.cls**"
  - Supports Java array objects as ooRexx array proxies
    - Allows using Java array objects as if they were ooRexx array objects
    - Hence indexing of proxy arrays starts with 1 (and not 0)!

BSF4Rexx, Example ooRexx Using Java

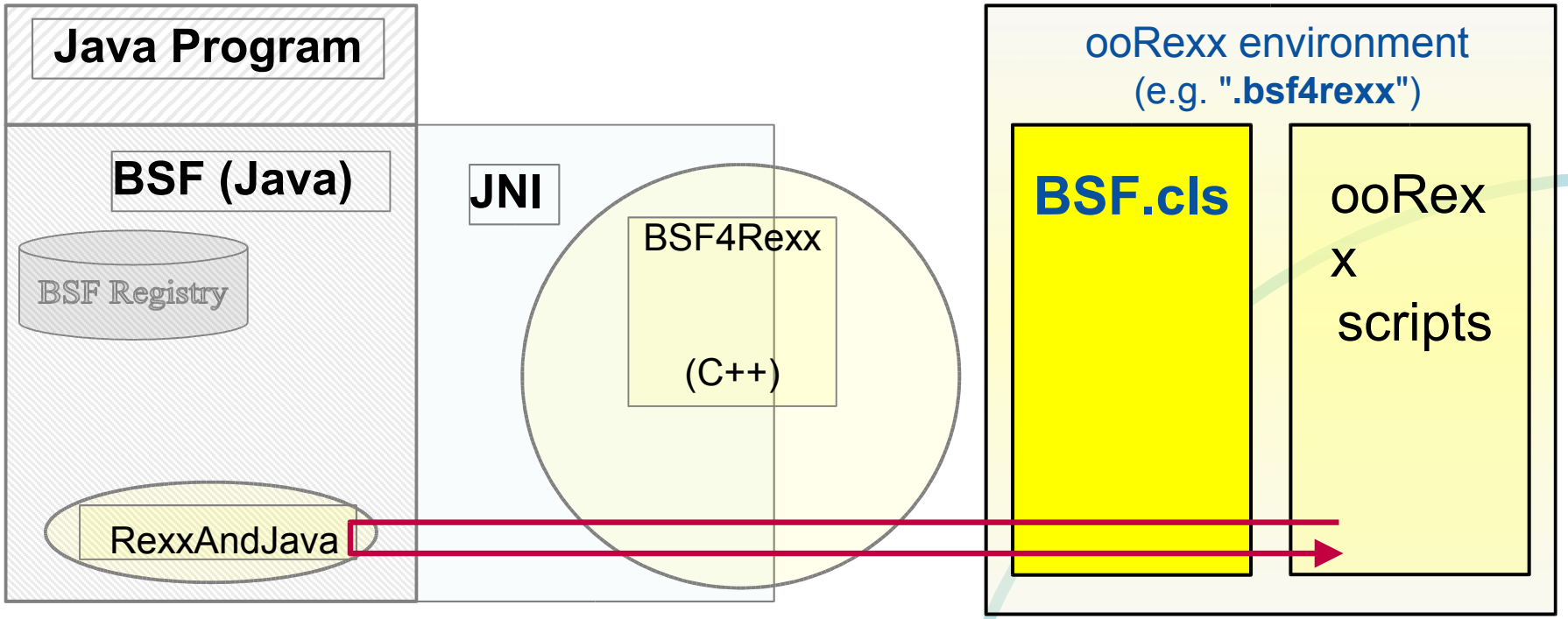
```
/* ooRexx version */

say "java.version:" .bsf4rexx~system.class ~getProperty('java.version')

::requires "BSF.cls" -- loads the ooRexx (camouflaging) support
```

Yields, e.g.:

```
java.version: 1.4.2
```

Camouflaging Java, 3

Architecture



BSF.cls, 1

Pre-register Fundamental Java Class Objects

- ooRexx directory "**.BSF4Rexx**"

1) .bsf4rexx~Class.class
2) .bsf4rexx~Object.class
3) .bsf4rexx~Method.class
4) .bsf4rexx~Array.class
5) .bsf4rexx~String.class
6) .bsf4rexx~System.class
7) .bsf4rexx~Boolean.class
8) *.bsf4rexx~**boolean***
9) .bsf4rexx~Byte.class
10) *.bsf4rexx~**byte***
11) .bsf4rexx~Character.class
12) *.bsf4rexx~**char***

1) .bsf4rexx~Double.class
2) *.bsf4rexx~**double***
3) .bsf4rexx~Integer.class
4) *.bsf4rexx~**int***
5) .bsf4rexx~Long.class
6) *.bsf4rexx~**long***
7) .bsf4rexx~Float.class
8) *.bsf4rexx~**float***
9) .bsf4rexx~Short.class
10) *.bsf4rexx~**short***
11) .bsf4rexx~Void.class
12) *.bsf4rexx~**void***

BSF.cls, 2
Proxy Class **BSF**

- Execute "BSF.cls" either with **call** or **::requires**

```
call "BSF.cls"
::requires "BSF.cls"
```

- Allows to import Java classes and interact with them as if they were ooRexx classes

```
.bsf~import(rexxName, javaName)
.bsf~import("javaFrame", "java.awt.Frame")
f=.javaFrame~new("hi!")~~show~~toFront~~setSize(200,100)
```

- Allows to create Java objects

```
.bsf~import("javaFrame", "java.awt.Frame")
f1=.javaFrame~new("hi!") -- using an imported Java class
-- or directly via class .BSF
f2=.BSF~new("java.awt.Frame", "hi!") - using .BSF directly
```

BSF.cls, 4
Proxy Class **BSF**

- Procedural BSF()-subfunctions available as (mangled) instance methods:
  - (1) bsf.addEventListener
  - (2) bsf.exit
  - (3) bsf.invoke
  - *(4) bsf.invoke**Strict***
  - (5) bsf.getFieldValue
  - (6) bsf.setFieldValue
  - *(7) bsf.setFieldValue**Strict***
  - (8) bsf.getPropertyValue
  - (9) bsf.setPropertyValue
  - *(10) bsf.setPropertyValue**Strict***
- Procedural BSF()-subfunctions available as class methods:
  - (1) exit
  - (2) sleep
  - (3) lookupBean
  - (4) pollEventText
  - (5) getStaticValue
  - (6) postEventText
  - (7) wrapArray
  - (8) createArray
  - (9) wrapEnumeration
  - (10) setRexxNullString

BSF.cls – Some Remarks, 2
Creating and Using Java Arrays

```
-- create a two-dimensional (5x10) Java Array of type String
arr=.bsf~createArray(.bsf4rexx~string.class, 5, 10)

arr[1,1]="First Element in Java array."       -- place an element
arr~put("Last Element in Java array.", 5, 10) -- place another one

do i over arr      -- loop over elements in array, ooRexx style!
   say i
end
```

Yields:

```
First Element in Java array.
Last Element in Java array.
```

Making Ends Meet
Setting Up, 1

- Install BSF4Rexx
  - Follow the instructions coming with BSF4Rexx
  - Run the supplied test/nutshell programs
- Configure the OOo Java archives
  - Make sure OOo is enabled for Java
    - Check "Tools → Options… → Security → OpenOffice.org → Java → Enable"
  - Add the following OOo "jar"-files (in …\program\classes) to the environment variable "CLASSPATH"
    - jurt.jar, jut.jar, javaunohelper.jar, ridl.jar, classes.jar, sandbox.jar
    - juh.jar, unoil.jar

Making Ends Meet
Setting Up, 2

- Either
  - Start OOo ("soffice.exe") with the following command line

```
soffice -accept=socket,host=localhost,port=8100;urp;
```

- Or
  - Configure OOo to always listen on the given socket and communicating with 'urp' as explained in the OOo Developers Guide, p. 31ff
  - Start one instance of OOo
    - Possible to start an explicit server instance of OOo!

Making Ends Meet
Get the Ball Rolling, 1

- Get in contact with the server and request access to OOo using Java UNO
  - Create a local (client-side) OOo context and get its ServiceManager from it
    - Get a URLResolver service from the local ServiceManager
    - Use the URLResolver service to establish a connection to the server returning the RemoteContext
    - Request the remote ServiceManager from the received RemoteContext

Making Ends Meet
Get the Ball Rolling, 2

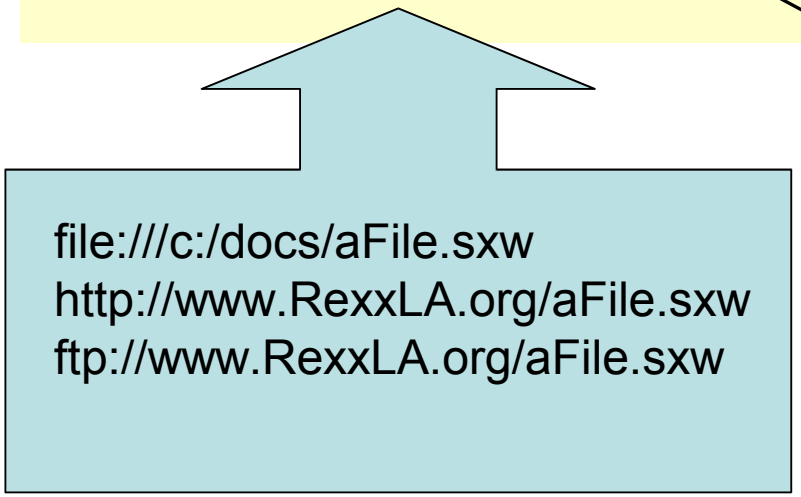
- With the help of the remote ServiceManager request the "Desktop" service on the server
  - Of all of the interfaces defined for the "Desktop" service, request the interface "XComponentLoader" allowing the loading (creation) of components (documents)
  - Use the functionality of the XComponentLoader to load (create) an empty text document

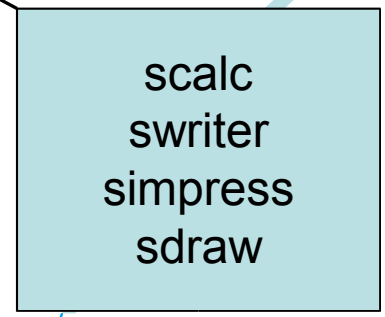
Making Ends Meet, An Example, 1

```
/* initialize connection to server, get its Desktop-service and XComponentLoader interface */
CALL "BSF.cls"                                    /* get full access to Java using BSF4Rexx */
xComponentContext = .bsf~new("com.sun.star.comp.helper.Bootstrap") -
     ~createInitialComponentContext(.nil)
xUrlResolver = xComponentContext~getServiceManager() -
     ~createInstanceWithContext("com.sun.star.bridge.UnoUrlResolver", xComponentContext)

unoResolverName = .bsf4rexx~Class.class~forName("com.sun.star.bridge.XUnoUrlResolver")
unoRuntime = .bsf~new("com.sun.star.uno.UnoRuntime")
urlResolver = unoRuntime~queryInterface(unoResolverName, xUrlResolver)

unoUrl = "uno:socket,host=localhost,port=8100;urp;StarOffice.NamingService"
rInitialObject = urlResolver~resolve(unoUrl)
namingServiceName = .bsf4rexx~Class.class~forName("com.sun.star.uno.XNamingService")
rName = unoRuntime~queryInterface(namingServiceName, rInitialObject)

rXsmgr = rName~getRegisteredObject("StarOffice.ServiceManager")
msfName = .bsf4rexx~Class.class~forName("com.sun.star.lang.XMultiServiceFactory")
xMsf = unoRuntime~queryInterface(msfName, rXsmgr)

-- Retrieve the Desktop object, we need its XComponentLoader interface
-- to load a new document
aDesktop = xMsf~createInstance("com.sun.star.frame.Desktop")
xDesktop = .bsf4rexx~Class.class~forName("com.sun.star.frame.XDesktop")
oDesktop = unoRuntime~queryInterface(xDesktop, aDesktop)
xComponentLoaderName = .bsf4rexx~Class.class~forName("com.sun.star.frame.XComponentLoader")
xComponentLoader = unoRuntime~queryInterface(xComponentLoaderName, oDesktop)
```

Making Ends Meet, An Example, 2

```
-- … continued …

/* Open a blank text document   */

/* No properties needed         */
propertyValueName = .bsf4rexx~Class.class~forName("com.sun.star.beans.PropertyValue")
loadProps = .bsf~createArray(propertyValueName, 0) /* 0=no elements, i.e. empty Java array */

/* load an empty text document */
xWriterComponent = xComponentLoader~loadComponentFromURL(   -
          "private:factory/swriter", "_blank", 0, loadProps)
```





Roundup and Outlook, 1

- OOo
  - Opensource, openplatform
  - UNO, urp
    - C++, Java
  - Client/server architecture
- ooRexx
  - BSF4Rexx as bridge
- Full openplatform control by ooRexx
  - Not restricted to C++, Java, StarBasic or Python!

Roundup and Outlook, 2

- Creating an ooRexx package
  - Simplifying recurring tasks, like establishing a connection with a server
  - Simplifying access to components, e.g. making it easier to manipulate cells of the spreadsheet
- With the advent of OOo 2.0
  - Devise a plug-in for BSF4Rexx, allowing ooRexx to be dispatched from within OOo
  - Will make it possible to use ooRexx wherever StarBasic is used!