BSF4ooRexx

Scripting Apache OpenOffice (AOO) and LibreOffice (LO) using Universal Network Objects (UNO)

Business Programming 2

Windows GUIs (AWT)	Sockets SSL/TLS	XML SAX/DOM JSON	Scripting AOO/LO (UNO)	Rexx Script Engine	Portable GUIs (JavaFX)	Java Web Server (Tomcat)	Java Classes written in Rexx style

Prof. Rony G. Flatscher

History, 1

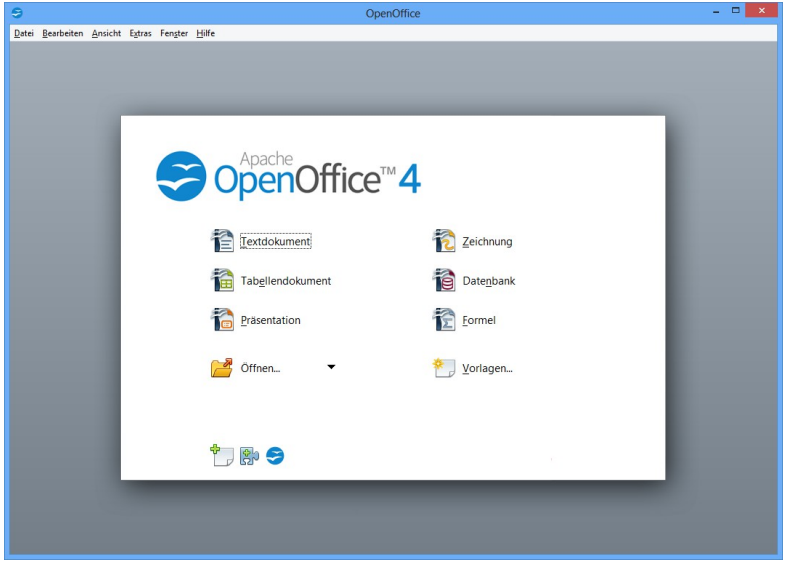
- StarOffice
  - Originates in Germany
    - StarDivision, est. 1985
  - Portable C++ class library ("Star")
    - Allow creation of a portable integrated office suite – Goal:
      - Compatibility with MS Office, 1995
      - Read and write MS Office files
  - 1990s
    - OS/2, Windows
  - Slow hardware, small bandwidths!

StarOffice 9.1.0 (Windows 7)

https://upload.wikimedia.org/wikipedia/de/3/32/StarOffice_9.png

History, 2

- StarOffice → OpenOffice
  - 1998 bought by Sun
    - StarOffice 5.1 → **O**pen**O**ffice.**o**rg 1.0 (2002)
  - 2010 bought by Oracle
    - Oracle OpenOffice
  - 2011 donated to ASF (Apache Software Foundation)
    - **A**pache **O**pen**O**ffice (AOO), incubating
    - First release of AOO 3.4 (May 2012)
    - 3.4.1 AOO graduates at ASF! (October 2012)
- As of 2022-12-11
  - OpenOffice 4.1.13
    - <https://www.openoffice.org/>

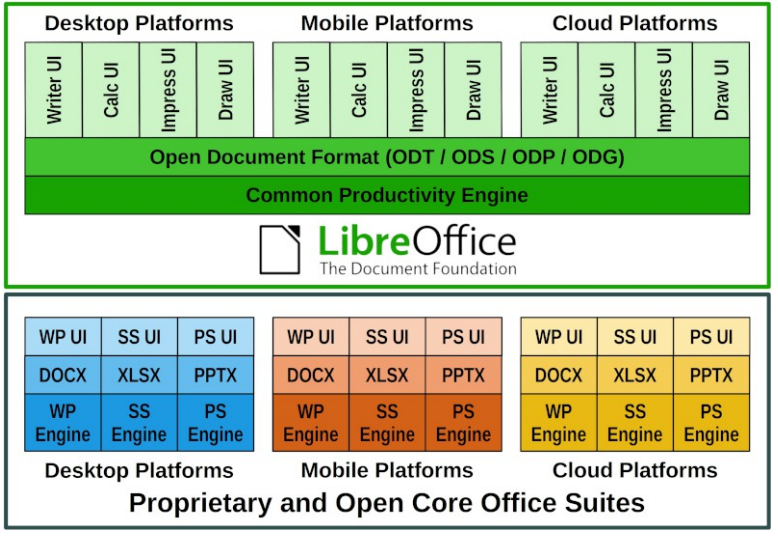


OpenOffice 4.1.13

https://upload.wikimedia.org/wikipedia/commons/e/e8/OpenOffice_4.0.png

History, 3

- OpenOffice.org → **L**ibre**O**ffice(LO)
  - 2010 forked from OpenOffice.org
    - Currently: LibreOffice 7.4
      - <https://www.libreoffice.org/> (2022-12-11)
- OpenOffice.org → NeoOffice (Mac only)
  - 2003 commercial fork of OpenOffice.org
    - Currently: NeoOffice 4.4
      - <https://www.neooffice.org/> (2022-12-11)

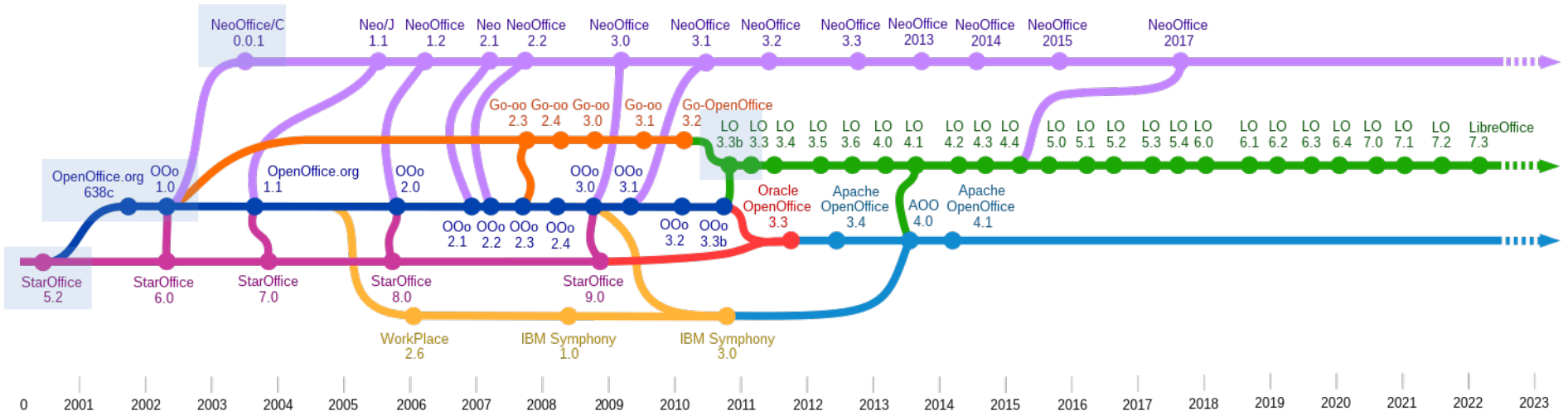


LibreOffice

https://www.libreoffice.org/assets/lo-technology.png

History, 4

- Forks
  - taking a copy of source code and start independent development project



https://en.wikipedia.org/wiki/LibreOffice#/media/File:StarOffice_major_derivatives.svg (2022-12-11)

Bird Eye's View, 1

- Set of services that may contain interfaces with attributes, other services, structs and properties
- All common functionality of all types of documents is extracted and organized as a set of interfaces that define methods and possibly attributes
  - E.g. loading, saving, printing documents, ...
- Services are created and get managed by service managers

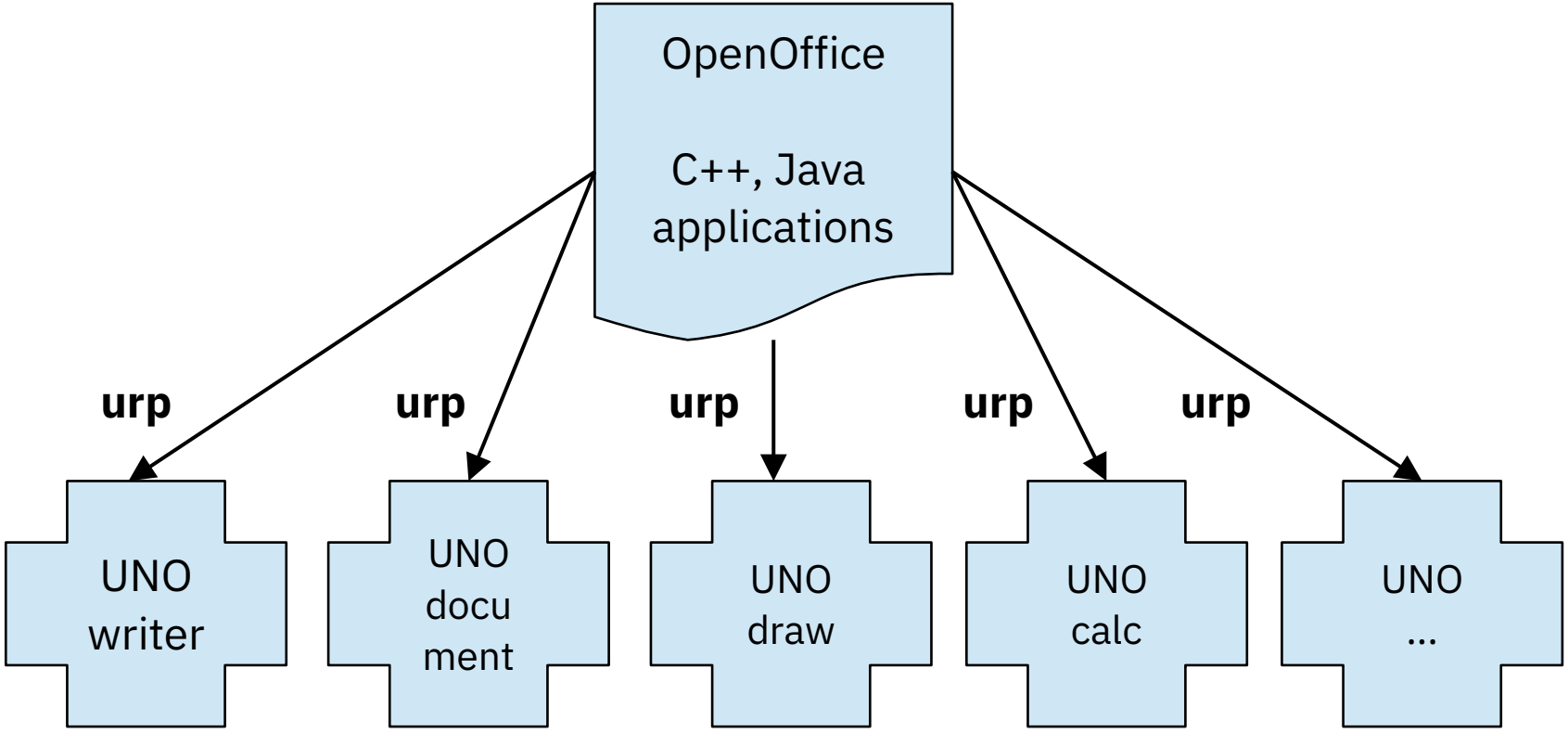
Bird Eye's View, 2

- Client-/Server-Architecture
  - Communication via TCP/IP
  - Employing distributable components (“UNO”)
    - Server can run on any computer in the world!
    - Operating systems of the server and the client are irrelevant for the purpose of communication!
  - Client may run on the same machine as the server
    - Default installation and configuration

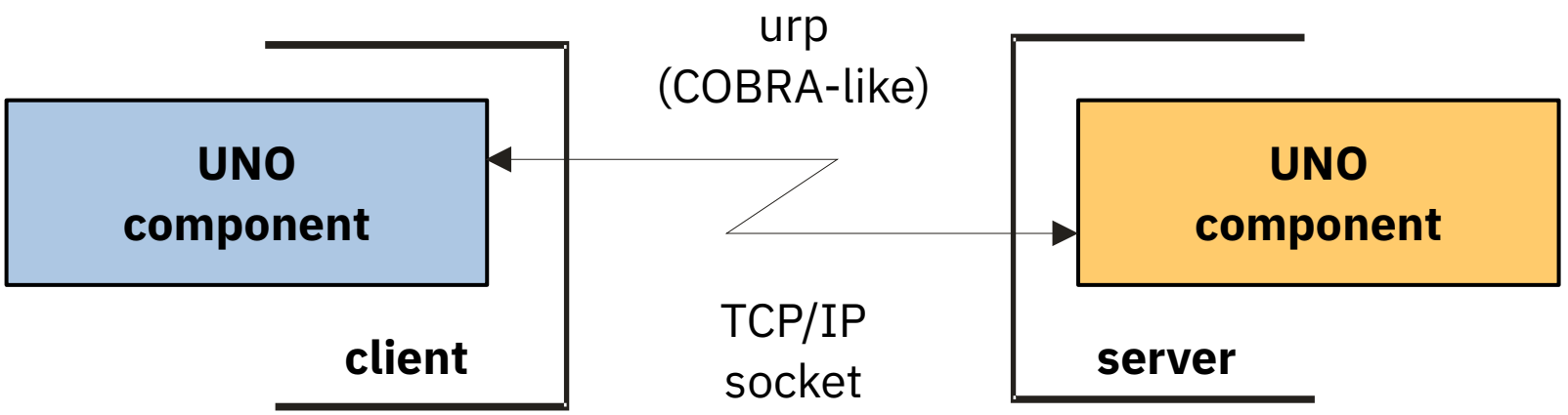
Bird Eye's View, 3

- “UNO”
  - **U**niversal **N**etwork **O**bjects
  - Distributable, interconnected infrastructure
  - All functionality is organized in the form of classes (“UNO classes”)
  - UNO classes (types) get defined in an IDL (**I**nterface **D**escription **L**anguage)
- “urp”
  - **U**NO **r**emote **p**rotocol
  - CORBA-like
    - **C**ommon **O**bject **R**equest **B**roker **A**rchitecture

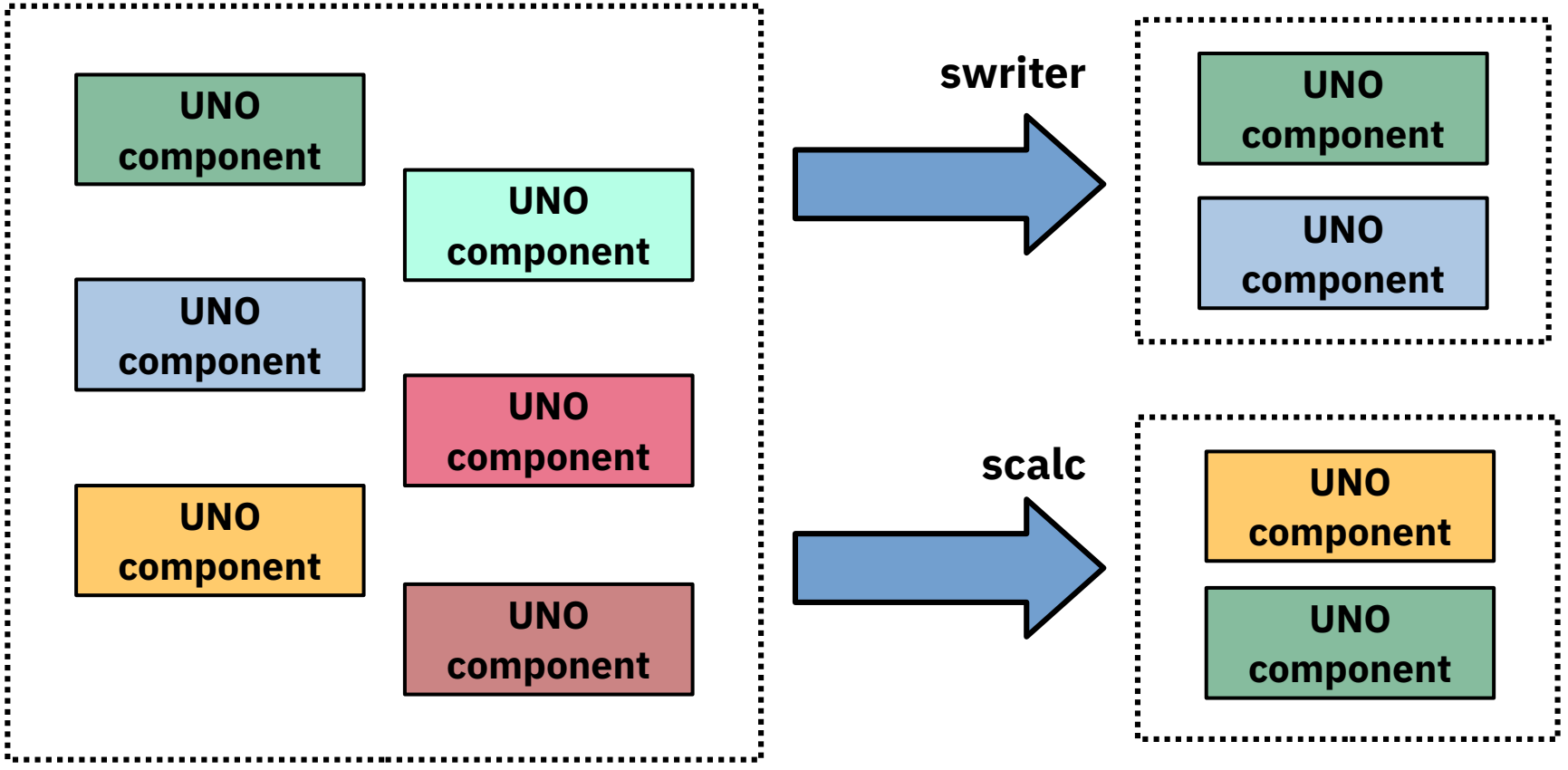
Bird Eye's View, 4



Bird Eye's View, 5

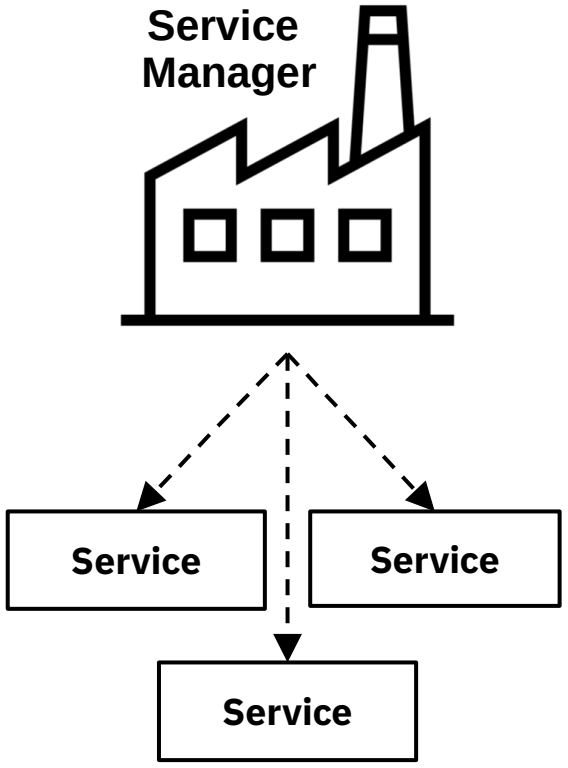


Bird Eye's View, 6



Bird Eye's View, 7

- “Service Managers” (a.k.a. “factories”)
  - Supplied by servers
    - Also cf. XComponentContext.getServiceManager()
  - Can be used to request/create services
- 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

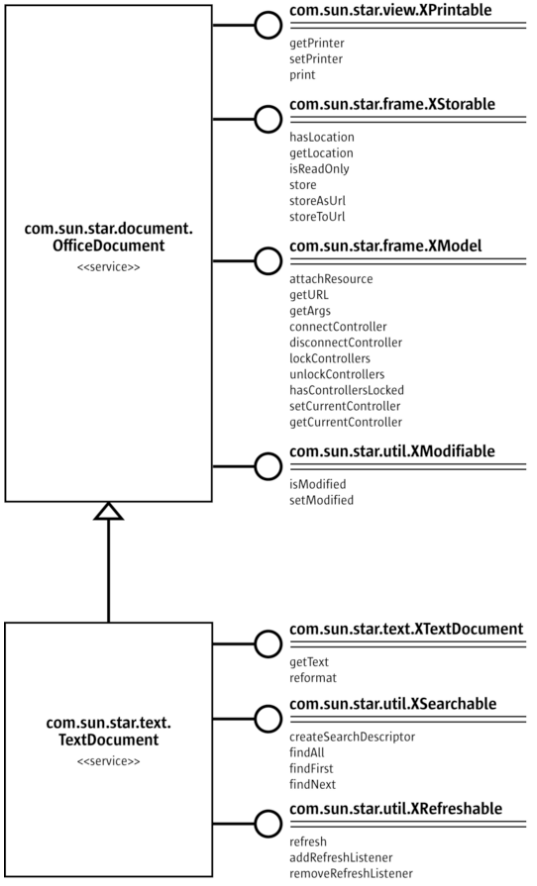


Bird Eye's View, 8

- “Services”
  - Can be comprehensive
  - May contain
    - "Interfaces" (group of methods and attributes)
    - Other "Services"
    - “properties” (com.sun.star.beans.PropertyValue)
  - Depending on the desired task you need to query (request) the appropriate interface, e.g.
    - com.sun.star.view.XPrintable
    - com.sun.star.frame.XStorable
    - com.sun.star.text.XTextDocument

Bird Eye's View, 9 – An Example

- Two services with seven interfaces
  - "OfficeDocument"
    - Four interfaces
      - com.sun.star.view.XPrintable
      - com.sun.star.frame.XStorable
      - com.sun.star.frame.XModel
      - com.sun.star.util.XModifiable
  - "TextDocument"
    - Three interfaces
      - com.sun.star.text.XTextDocument
      - com.sun.star.util.XSearchable
      - com.sun.star.util.XRefreshable



https://wiki.openoffice.org/wiki/Documentation/DevGuide/FirstSteps/Using_Services (2022-12-11)

Programming Languages

- Programming languages
  - C++ (queryInterface)
  - Java (queryInterface)
  - Basic (implicit queryInterface)
  - Python (implicit queryInterface)
- Java-based scripting framework
  - BeanShell (queryInterface)
  - JavaScript (queryInterface)
  - ooRexx (queryInterface)
  - …

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Basic UNO Datatypes

Basic UNO Datatype	Java Datatype
UNO_ANY	com.sun.star.uno.Any or java.lang.Object
UNO_VOID	void
UNO_BOOLEAN	boolean
UNO_BYTE (8-bit)	byte
UNO_CHAR (16-bit)	char
UNO_SHORT (16-bit)	short
UNO_UNSIGNED_SHORT (16-bit)	short
UNO_LONG (32-bit)	int
UNO_UNSIGNED_LONG (32-bit)	int
UNO_HYPER (64-bit)	long
UNO_UNSIGNED_HYPER (64-bit)	long
UNO_FLOAT	float
UNO_DOUBLE	double

UNO Types/Classes, 1

- IDL
  - **I**nterface **d**escription **l**anguage
  - Text based definition of UNO types
  - Can be reflected at runtime
- UNO Types/Classes (in alphabetical order)
  - *UNO Constants*, members:
    - Fields, usually of the same UNO datatype
  - *UNO Enum*, members:
    - Fields are always of type UNO_LONG (32-Bit integers)

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UNO Types/Classes, 2

- UNO Types/Classes (continued)
  - *UNO Exception*, members:
    - Fields of any datatype
  - *UNO Interface*, members:
    - UNO Methods
    - UNO Attributes
  - *UNO Module*, members:
    - Any UNO Type/Class
    - Name of the module(s) are denoted in the fully qualified name of an UNO type, e.g.
      - **com.sun.star.beans**.PropertyValue

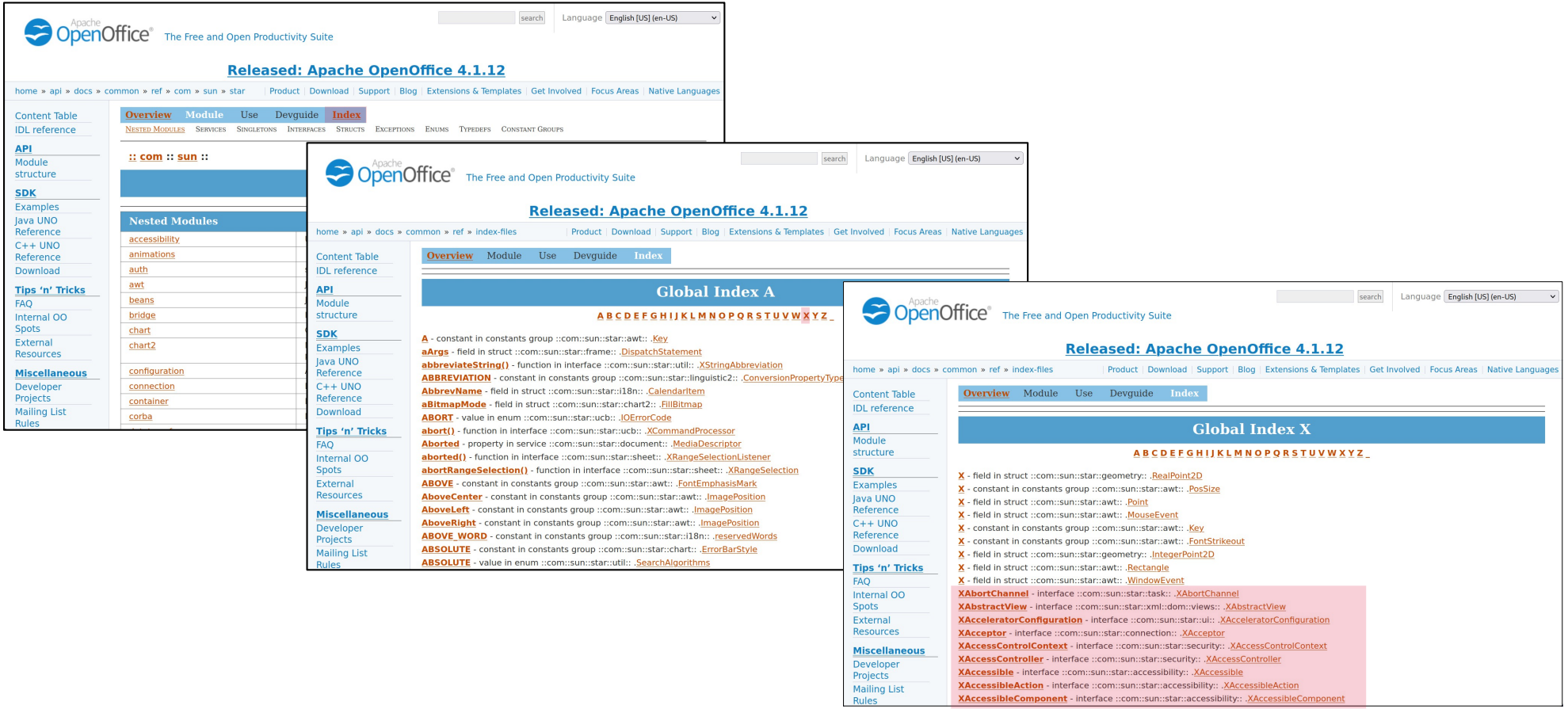
UNO Types/Classes, 3

- UNO Types/Classes (continued)
  - *UNO Service*, members:
    - *UNO Interfaces*
    - *UNO Services*
    - *UNO Properties* (com.sun.star.beans.PropertyValue)
      - Regarded as a set (com.sun.star.beans.XPropertySet)
  - *UNO Singleton*
  - *UNO Struct*, members:
    - Fields only!
  - *UNO Typedef*

Documentation, 1

- Extremely important
  - Wealth of services and interfaces
  - Created in pure German ;) engineering style
    - To miss the forest for the trees!
- AOO API documentation
  - <http://www.openoffice.org/api/> (2022-12-11)
    - Developer's guide, API wiki, UNO wiki, extensions, examples, tutorials
  - <http://www.openoffice.org/api/docs/common/ref/com/sun/star/module-ix.html> (2022-12-11)
    - Extensive, HTML-linked API reference
    - Use its Index to locate services, interfaces, etc.

Documentation, 2



Documentation, 3

- Codesnippets
  - <https://web.archive.org/web/20130530183917/http://codesnippets.services.openoffice.org/index.xml> (2022-12-11)
  - Scripts in Basic, Java, ooRexx, Python
- ooRexx' “UNO_API_info.rxo”
  - Installed with BSF4ooRexx
    - Uses reflection and generates writer/pdf documents containing the documentation , linked to the official AOO API reference documentation!
    - Can be invoked via the dispatch interface from any programming language
    - Cf.: <https://wi.wu.ac.at/rgf/rexx/misc/OOoCon/2010_Budapest/> (2022-12-11)

Documentation, 4

- WU Vienna
  - <http://wi.wu.ac.at/rgf/diplomarbeiten/> (2022-12-11)
  - Select AOO, OOo, LibreOffice and/or UNO in the keyword dropdown list
  - BSF4ooRexx samples
    - Mostly based on student's work
    - Thesis describe the frameworks and document the samples
    - Some samples installed with BSF4ooRexx in the subdirectory bsf4oorexx/samples/OOo (BSF4ooRexx 6.41: Java 6+, ooRexx 4.1+) or bsf4oorexx*850*/samples/OOo (BSF4ooRexx 8.50: Java 8+, ooRexx 5.0+)

Documentation, 5

- MRI extension
  - <http://extensions.services.openoffice.org/project/MRI> (2022-12-11)
  - Great AOO inspector written in Python
  - Code (snippet) support for Basic, Java, C++, C# CLI, Python
- AOO mailing lists
  - Consult: <http://www.openoffice.org/mail_list.html> (2022-12-11)
    - ooo-dev@openoffice.apache.org
    - ooo-api@openoffice.apache.org

Documentation, 6

- Results of analyzing the AOO Java archives
  - Types and Interfaces (AOO 3.4.1, summer 2012)

jar	Total Types	Interfaces	Share %
juh.jar	47	3	(6.4%)
ridl.jar	469	224	(47.8%)
jurt.jar	98	2	(2.0%)
unoil.jar	2 694	1 422	(52.8%)
Sum	**3 308**	**1 651**	**(49.9%)**

Querying an Interface

- queryInterface() examples
  - sDispatchHelper, a service of type com.sun.star.frame.DispatchHelper
- queryInterface() in Java

```
import com.sun.star.frame.XDispatchHelper;
// …
XDispatchHelper xDispatchHelper=(XDispatchHelper)
    UnoRuntime.queryInterface(XDispatchHelper.class, sDispatchHelper);
```

- queryInterface() in JavaScript

```
importClass(Packages.com.sun.star.frame.XDispatchHelper);
// ...
xDispatchHelper = UnoRuntime.queryInterface(XDispatchHelper, sDispatchHelper);
```

- queryInterface() in ooRexx

```
xDispatchHelper=sDispatchHelper~com.sun.star.frame.XDispatchHelper
-- or simpler:
xDispatchHelper=sDispatchHelper~XDispatchHelper
```

Scripting AOO

- Two kinds of scripting (programming)
  - **Stand-alone**
    - Need to bootstrap OpenOffice in order to initialize the AOO environment to interact with
    - Full control about addressing different AOO servers, if needed
  - Dispatched by AOO (“macro”)
    - AOO supplies a script context that allows access to the initialized AOO environment (getDesktop, getComponentContext) and to the document (getDocument) for which the dispatch occurred

Bootstrapping

Java

```
// import ...
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=8100;urp;StarOffice.ServiceManager");
// test whether we got a reference to the remote ServiceManager
if (null != rInitialObject) {
   System.out.println("initial object successfully retrieved");
} else {
   System.out.println("given initial-object name unknown at server side");
}

 … cut …
```

ooRexx

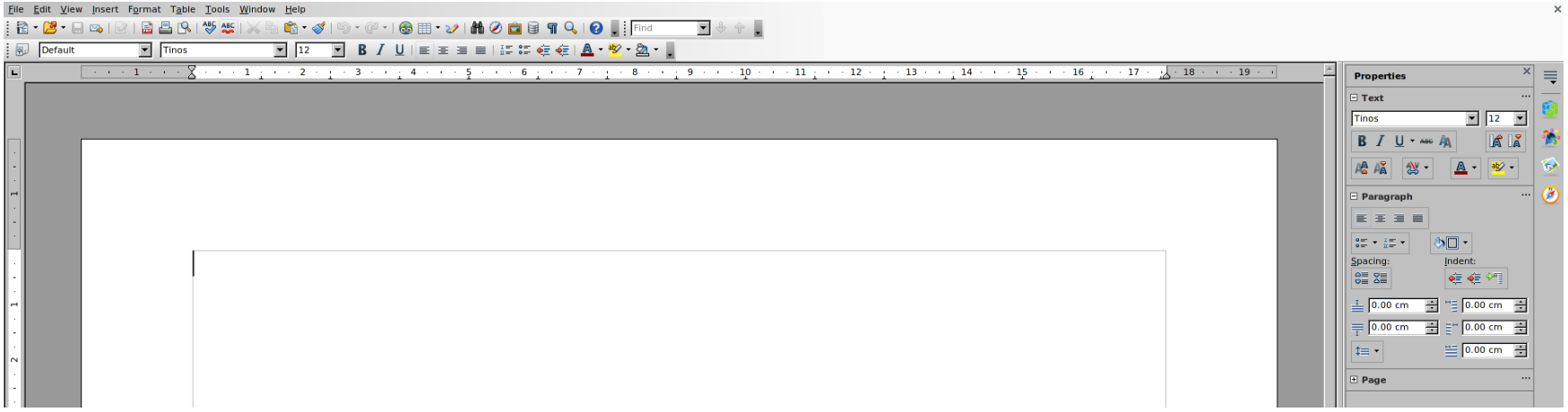
```
url="uno:socket,host=localhost,port=8100;urp;StarOffice.ServiceManager"
rInitialObject=uno.connect(url)

if rInitialObject<>.nil then
   say "initial object successfully retrieved"
else
   say "given initial-object name unknown at server side"
-- ... cut ...

::requires UNO.CLS   -- get UNO support
```

Creating/Loading Documents

```
xDesktop=uno.createDesktop()  -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader -- get XComponentLoader interface

uri="private:factory/swriter" -- new swriter document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

-- ... now do whatever you want or need to do ...

::requires UNO.CLS    -- get UNO support
```

"file:///c:/docs/aFile.odt"
"http://www.RexxLA.org/aFile.ods"

```
scalc
swriter
simpress
sdraw
```



Linux, XOrg 1.2.1.1.4, OpenOffice 4.1.13

Word Processor (“swriter”), 1

- 3 Services

  GenericTextDocument (com.sun.star.text.GenericTextDocument),
  OfficeDocument (com.sun.star.document.OfficeDocument),
  TextDocument (com.sun.star.text.TextDocument)

- 35 Interfaces (unqualified)

  XBookmarksSupplier, XChapterNumberingSupplier, XDocumentEventBroadcaster, XDocumentIndexesSupplier, XDocumentInfoSupplier, XDocumentPropertiesSupplier, XEmbeddedScripts, XEndnotesSupplier, XEventBroadcaster, XEventsSupplier, XFootnotesSupplier, XLineNumberingSupplier, XModel, XModifiable, XMultiServiceFactory, XNumberFormatsSupplier, XPagePrintable, XPrintJobBroadcaster, XPrintable, XPropertySet, XReferenceMarksSupplier, XRefreshable, XReplaceable, XSearchable, XStorable, XStyleFamiliesSupplier, **XTextDocument**, XTextEmbeddedObjectsSupplier, XTextFieldsSupplier, XTextFramesSupplier, XTextGraphicObjectsSupplier, XTextSectionsSupplier, XTextTablesSupplier, XUndoManagerSupplier, XViewDataSupplier

Word Processor (“swriter”), 2

- 37 Properties
  - ApplyFormDesignMode, ApplyWorkaroundForB6375613, AutomaticControlFocus, BasicLibraries, BuildId, CharFontCharSet, CharFontCharSetAsian, CharFontCharSetComplex, CharFontFamily, CharFontFamilyAsian, CharFontFamilyComplex, CharFontName, CharFontNameAsian, CharFontNameComplex, CharFontPitch, CharFontPitchAsian, CharFontPitchComplex, CharFontStyleName, CharFontStyleNameAsian, CharFontStyleNameComplex, CharLocale, **CharacterCount**, DialogLibraries, ForbiddenCharacters, HasValidSignatures, HideFieldTips, IndexAutoMarkFileURL, LockUpdates, ParagraphCount, RecordChanges, RedlineDisplayType, RedlineProtectionKey, RuntimeUID, ShowChanges, TwoDigitYear, WordCount, WordSeparator

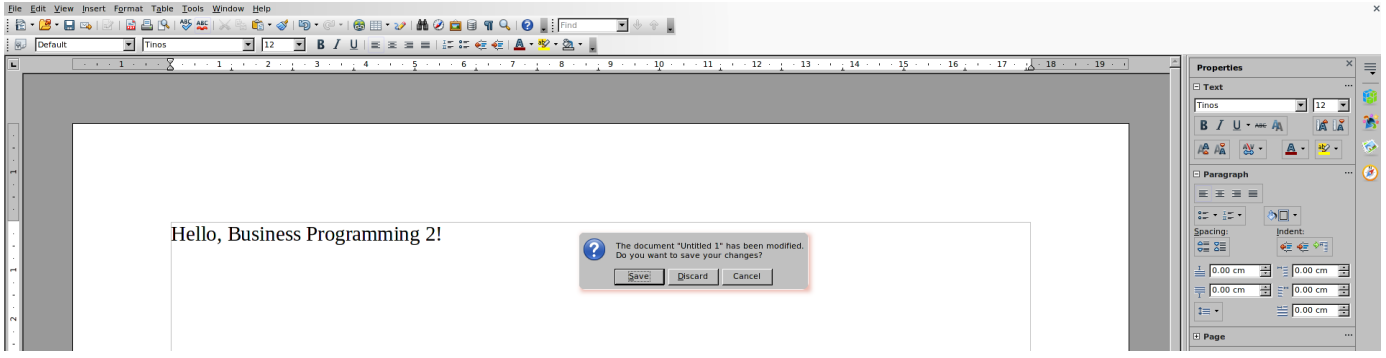
Word Processor (“swriter”), 3

- Interface com.sun.star.text.XTextDocument
  - Get access to the text object representing the text of the entire document using getText()
    - Returns XText, which is derived from XSimpleText, which is derived from XRangeText, hence the methods of all three interfaces are available!
- Concept of “cursors”, e.g.
  - Pages, Paragraphs, Sentences, Words, Characters
- Possible to also insert tables, fields, pictures, drawings, ...

Create Word Processor Document (“swriter”), 1

- Add text “Hello, Business Programming 2!”
- Closing the word processor document manually will cause the “Save”-dialog to appear

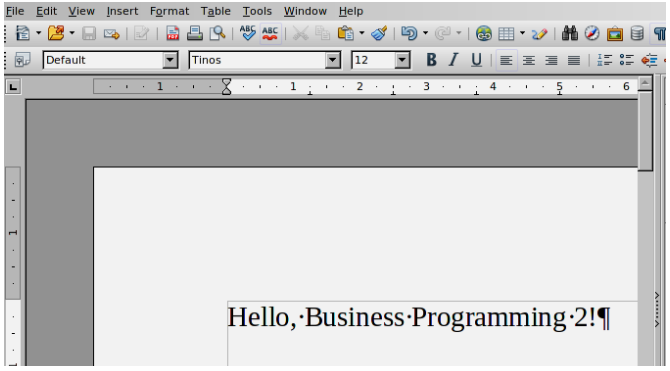
```
xDesktop=uno.createDesktop()      -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader     -- get XComponentLoader interface

uri="private:factory/swriter"     -- new swriter document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xText=doc~XTextDocument~getText   -- get text object
xText~setString("Hello, Business Programming 2!")

::requires UNO.CLS                -- get UNO support
```



Linux, X11 21.1.4, OpenOffice 4.1.13

Create Word Processor Document (“swriter”), 2

```
xDesktop=uno.createDesktop()          -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader         -- get XComponentLoader interface

uri="private:factory/swriter"         -- new swriter document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xText=doc~XTextDocument~getText       -- get text object
xText~setString("Hello, Business Programming 2!")

doc~XModifiable~setModified(.false) -- set document to unmodified
call SysSleep 5                       -- sleep 5 seconds
doc~XCloseable~close(.false)          -- close document (window)

::requires UNO.CLS                    -- get UNO support
```

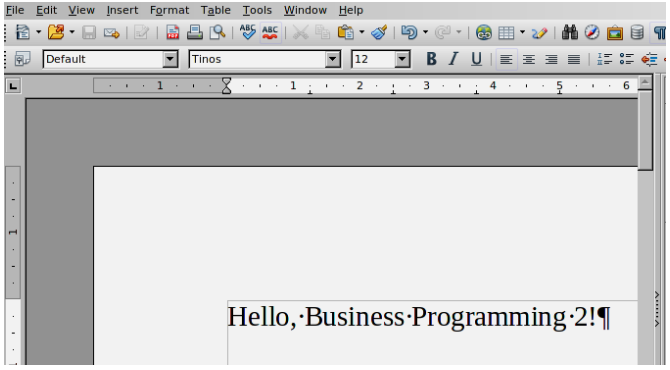


- Change state of document to “unmodified”
  - Leftover document can be closed without a save dialog
  - Using interface com.sun.star.util.XModifiable
- Sleep five seconds, then close document
  - Using interface com.sun.star.util.XCloseable

Linux, X11 21.1.4, OpenOffice 4.1.13

Create Word Processor Document (“swriter”), 3

```
xDesktop=uno.createDesktop()          -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader         -- get XComponentLoader interface
uri="private:factory/swriter"         -- new swriter document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xText=doc~XTextDocument~getText       -- get text object
xText~setString("Hello, Business Programming 2!")

xprops=doc~XPropertySet               -- get access to the properties
say "character count:" xprops~getPropertyValue("CharacterCount")

doc~XModifiable~setModified(.false) -- set document to unmodified
call SysSleep 5                       -- sleep 5 seconds
doc~XCloseable~close(.false)          -- close document (window)

::requires UNO.CLS    -- get UNO support
```



- Access and show property CharacterCount
- Change state of document to “unmodified”
  - Leftover document can be closed without a save dialog
  - Using interface com.sun.star.util.XModifiable
- Sleep five seconds, then close document
  - Using interface com.sun.star.util.XCloseable

Output:

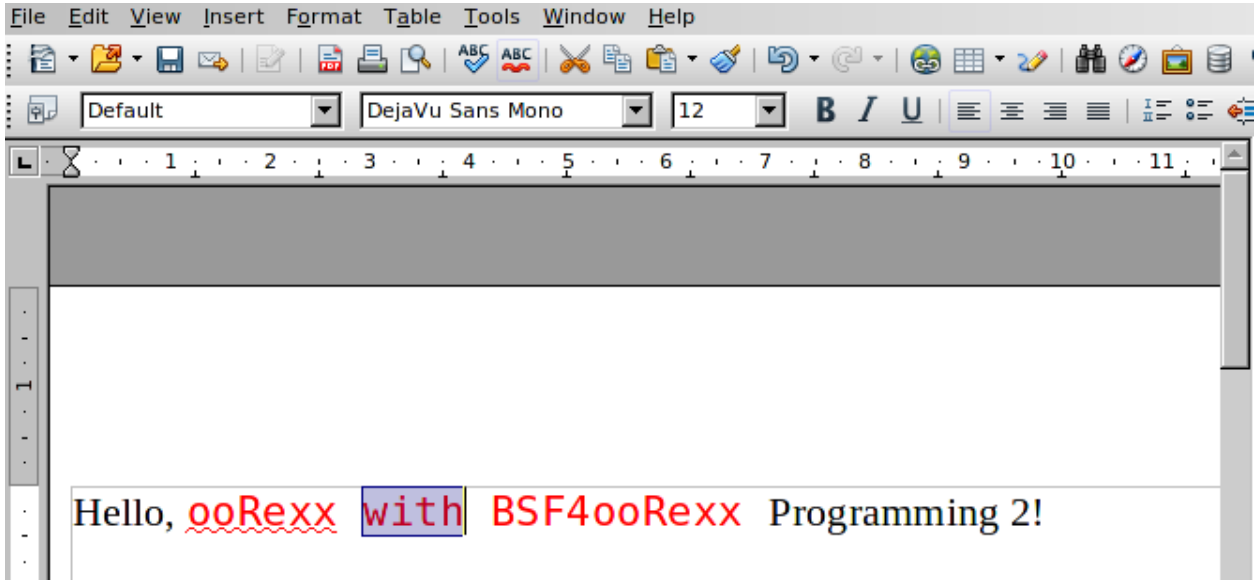
```
character count: 30
```

Create Word Processor Document (“swriter”), 4, 1

```
xDesktop=uno.createDesktop()        -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader       -- get XComponentLoader interface

uri="private:factory/swriter"       -- new swriter document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xText=doc~XTextDocument~getText     -- get text object
xText~setString("Hello, Business Programming 2!")

   -- change second word
xTextCursor=xText~createTextCursor  -- character based cursor
xTextCursor~gotoStart(.false)       -- make sure we are at start

xWordCursor=xTextCursor~XWordCursor -- get the XWordCursor interface
xWordCursor~gotoNextWord(.false)    -- XTextRange represents first word
xWordCursor~gotoNextWord(.true)     -- select second word, includes blank!
xWordCursor~setString("ooRexx with BSF4ooRexx ")  -- note trailing blank

   -- change color
red=box("int", "FF 00 00"x ~c2d)    -- color red (RGB color) as integer
xWordCursor~XPropertySet~setPropertyValue("CharColor", red)

   -- change font
fontName="DejaVu Sans Mono"
xWordCursor~XPropertySet~setPropertyValue("CharFontName", fontName)
say ppd(xWordCursor~uno.getDefinition)

::requires UNO.CLS   -- get UNO support
```

- Replace “Business” with “ooRexx with BSF4ooRexx”
- Change the color to red
- Change the font name to “DejaVus Sans Mono”
- Show textual definition of UNO object referred to with variable "xWordCursor"

Create Word Processor Document (“swriter”), 4, 2



Output:

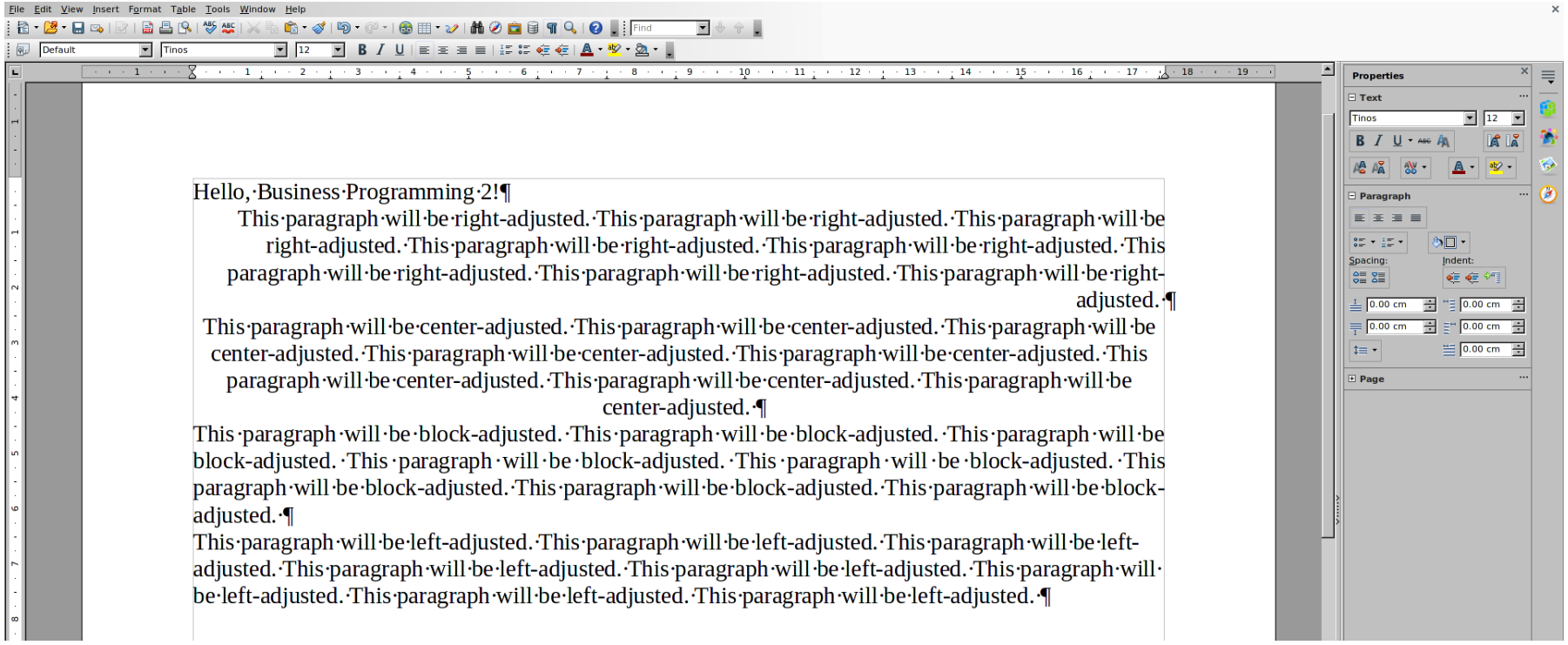
```
UNO_SERVICE|
com.sun.star.text.TextCursor+com.sun.star.style.CharacterProperties+com.sun.star.style.CharacterPropertiesAsian+com.sun.star.st
yle.CharacterPropertiesComplex+com.sun.star.style.ParagraphProperties+com.sun.star.style.ParagraphPropertiesAsian+com.sun.star.
style.ParagraphPropertiesComplex+com.sun.star.text.TextSortable|SwXTextCursor
... cut ...
```

Create Word Processor Document (“swriter”), 5, 1

```
xDesktop=uno.createDesktop()        -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader       -- get XComponentLoader interface

uri="private:factory/swriter"       -- new swriter document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xText=doc~XTextDocument~getText     -- get text object
xText~setString("Hello, Business Programming 2!")

xTextCursor=xText~createTextCursor  -- create the character based cursor
   -- make paragraph's properties accessible:
xParaProps=xTextCursor~XParagraphCursor~XPropertySet

ctlChars=.uno_constants~new("com.sun.star.text.ControlCharacter") -- UNO_CONSTANT
paraBreak=ctlChars~paragraph_break  -- get paragraph break constant

paraAdj =.uno_enum~new("com.sun.star.style.ParagraphAdjust")   -- UNO_ENUM

arr=.array~of("right", "center", "block", "left")  -- adjustments
do adj over arr   -- iterate over adjustments, create string, adjust
   xTextCursor~gotoEnd(.false)      -- position at end
   xText~insertControlCharacter(xTextCursor, paraBreak, .false)
   string=("This paragraph will be" adj"-adjusted. ")~copies(8)
   xText~insertString(xTextCursor, string, .true)
   xParaProps~setPropertyValue("ParaAdjust", paraAdj~send(adj))
end

::requires UNO.CLS   -- get UNO support
```

- Demonstrate creating and styling paragraphs
  - Get access to the paragraph properties
  - Access com.sun.star.text.ControlCharacter constants
  - Access to com.sun.star.style.ParagraphAdjust enums
  - Demonstrate adjusting paragraphs to “right”, “center”, “block”, “left” using a string that contains the adjustment verb

Create Word Processor Document (“swriter”), 5, 2



Linux, X11 21.1.4, OpenOffice 4.1.13

Spreadsheet (“scalc”), 1

- 3 Services
  - OfficeDocument (com.sun.star.document.OfficeDocument), SpreadsheetDocument (com.sun.star.sheet.SpreadsheetDocument), SpreadsheetDocumentSettings (com.sun.star.sheet.SpreadsheetDocumentSettings)
- 26 Interfaces (unqualified)
  - XActionLockable, XCalculatable, XConsolidatable, XDocumentAuditing, XDocumentEventBroadcaster, XDocumentInfoSupplier, XDocumentPropertiesSupplier, XDrawPagesSupplier, XEmbeddedScripts, XEventBroadcaster, XEventsSupplier, XGoalSeek, XLinkTargetSupplier, XModel, XModifiable, XMultiServiceFactory, XNumberFormatsSupplier, XPrintJobBroadcaster, XPrintable, XPropertySet, XProtectable, XSpreadsheetDocument, XStorable, XStyleFamiliesSupplier, XUndoManagerSupplier, XViewDataSupplier

Spreadsheet (“scalc”), 2

- 40 Properties
  - ApplyFormDesignMode, AreaLinks, AutomaticControlFocus, BasicLibraries, BuildId, CalcAsShown, CharLocale, CharLocaleAsian, CharLocaleComplex, CodeName, ColumnLabelRanges, DDELinks, DatabaseRanges, DefaultTabStop, DialogLibraries, ExternalDocLinks, ForbiddenCharacters, HasDrawPages, HasValidSignatures, IgnoreCase, IsAdjustHeightEnabled, IsChangeReadOnlyEnabled, IsExecuteLinkEnabled, IsIterationEnabled, IsLoaded, IsUndoEnabled, IterationCount, IterationEpsilon, LookUpLabels, MatchWholeCell, NamedRanges, NullDate, ReferenceDevice, RegularExpressions, RowLabelRanges, RuntimeUID, SheetLinks, SpellOnline, StandardDecimals, VBAGlobalConstantNamer

Spreadsheet (“scalc”), 3

- Interface `com.sun.star.sheet.XSpreadsheetDocument`
  - Get name access to the collection of XSpreadsheets
  - Numeric (0-based) access with XIndexAccess
- Concept of “table” consisting of a collection of rows, which each have columns
  - XCellRange (a tabular area of a spreadsheet)
  - Origin “0,0” represents upper left-hand corner
    - Offsets relative to upper left-hand corner

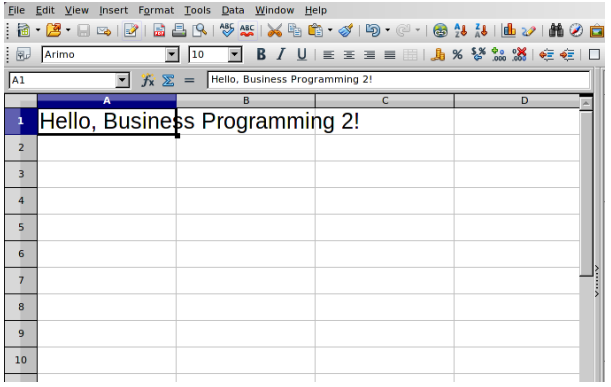
Spreadsheet (“scalc”), 4

- Addressing a cell
  - Numerically (0-based) representing offsets from origin
    - e.g. “0,1” (first column, second row)
      - getCellByPosition(columnOffset,rowOffset) returns a XCell
  - By name
    - a named range, or
    - column: a name, row: a 1-based number), e.g. “A2”
    - getCellRangeByName(Name) returns a XCellRange, then
    - getCellByPosition(0,0) returns a XCell
  - Possible to also insert charts, drawings, ...

Create Spreadsheet Document (“scalc”), 1

- Add text “Hello, Business Programming 2!”
- Demonstrate how to store a document

```
xDesktop=uno.createDesktop()        -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader       -- get XComponentLoader interface

uri="private:factory/scalc"         -- new scalc document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xSheets=doc~XSpreadSheetDocument~getSheets~XIndexAccess
xSheet =xSheets~getByIndex(0)~XSpreadSheet    -- get first spreadsheet
                                    -- add entry to "A1"
xSheet~getCellByPosition(0,0)~setFormula("Hello, Business Programming 2!")

storeURL=directory()"/scalc1.ods"   -- save document in local directory
storeURL=uno.convertToUrl(storeURL) -- change path to URL-style
doc~XStorable~storeAsURL(storeURL,.UNO~noProps) -- save document

doc~XCloseable~close(.false)        -- close document (window)

::requires UNO.CLS                  -- get UNO support
```

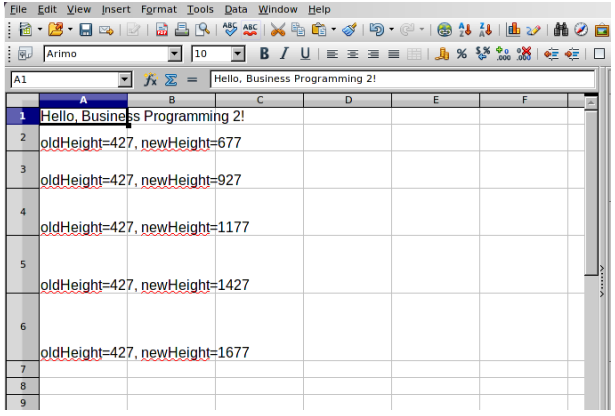


Linux, X11 21.1.4, OpenOffice 4.1.13

Create Spreadsheet Document (“scalc”), 2

- Demonstrate how to change the height of table rows

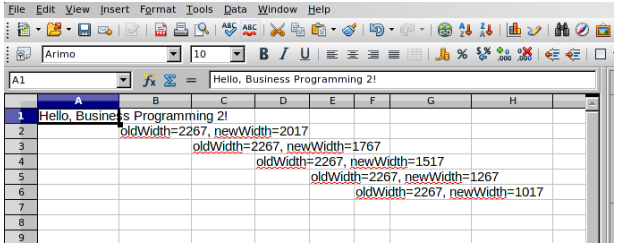
```
xDesktop=uno.createDesktop()          -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader         -- get XComponentLoader interface

uri="private:factory/scalc"           -- new scalc document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xSheets=doc~XSpreadSheetDocument~getSheets~XIndexAccess
xSheet =xSheets~getByIndex(0)~XSpreadSheet    -- get first spreadsheet
                                      -- add entry to "A1"
xSheet~getCellByPosition(0,0)~setFormula("Hello, Business Programming 2!")

xRows=xSheet~XColumnRowRange~getRows-- get XTableRows

do i=1 to 5                           -- 0-based, hence lines # 2 through # 6
   xRow=xRows~getByIndex(i)           -- fetch XRow
   props=xRow~XPropertySet            -- get access to its properties
   oldHeight=props~getPropertyValue("Height")    -- get current value
   newHeight=oldHeight+i*250          -- increase by i*0.250 cm
   props~setPropertyValue("Height", box("int",newHeight))    -- set new Height
   text="oldHeight="oldHeight", newHeight="newHeight  -- create info text
   xSheet~getCellByPosition(0,i)~setFormula(text)     -- set cell to info text
end

::requires UNO.CLS                    -- get UNO support
```



Create Spreadsheet Document (“scalc”), 3

- Demonstrate how to change the width of table columns

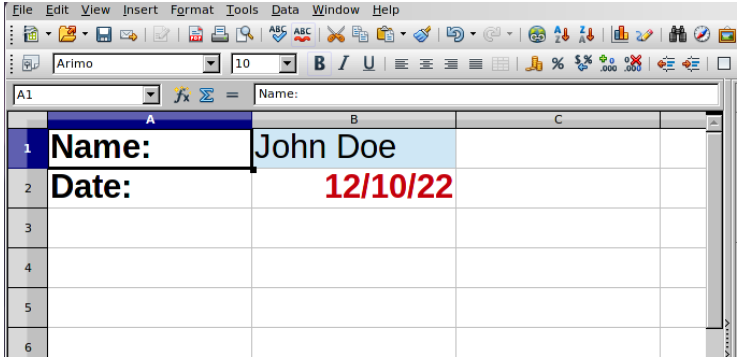
```
xDesktop=uno.createDesktop()         -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader        -- get XComponentLoader interface

uri="private:factory/scalc"          -- new scalc document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xSheets=doc~XSpreadSheetDocument~getSheets~XIndexAccess
xSheet =xSheets~getByIndex(0)~XSpreadSheet   -- get first spreadsheet
                                     -- add entry to "A1"
xSheet~getCellByPosition(0,0)~setFormula("Hello, Business Programming 2!")

xCols=xSheet~XColumnRowRange~getColumns-- get XTableColumns

do i=1 to 5                          -- 0-based, hence columns # 2 (B) through # 6 (F)
   xCol=xCols~getByIndex(i)          -- fetch xCol
   props=xCol~XPropertySet           -- get access to its properties
   oldWidth=props~getPropertyValue("Width")  -- get current value
   newWidth=oldWidth-i*250           -- decrease by i*0.250 cm
   props~setPropertyValue("Width", box("int",newWidth))  -- set new Width
   text="oldWidth="oldWidth", newWidth="newWidth  -- create info text
   xSheet~getCellByPosition(i,i)~setFormula(text) -- set cell to info text
end

::requires UNO.CLS                   -- get UNO support
```



Create Spreadsheet Document (“scalc”), 4

```
xDesktop=uno.createDesktop()        -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader       -- get XComponentLoader interface

uri="private:factory/scalc"         -- new scalc document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xSheets=doc~XSpreadSheetDocument~getSheets~XIndexAccess
xSheet =xSheets~getByIndex(0)~XSpreadSheet    -- get first spreadsheet

call uno.setCell xSheet, 0, 0, "Name:"        -- cell "A1"
call uno.setCell xSheet, "B1", "John Doe"     -- cell "B1"
call uno.setCell xSheet, "A2", "Date:"        -- cell "A2"
call uno.setCell xSheet, 1, 1, "=TODAY()"     -- cell "B2"
   -- format individual cells
xCellB1=xSheet~getCellByPosition(1, 0)        -- get access to cell "B1"
cbc=box("int", "CF E7 F5"x ~c2d)              -- define a RGB color
xCellB1~XPropertySet~setPropertyValue("CellBackColor", cbc) -- set color

xCellB2=xSheet~getCellByPosition(1, 1)        -- get access to cell "B2"
cc=box("int", "c5 00 0b"x ~c2d)               -- define a RGB color
props=xCellB2~XPropertySet
props~setPropertyValue("CharColor", cc)       -- set color
fontWeight=.uno_constants~new("com.sun.star.awt.FontWeight")
props~setPropertyValue("CharWeight", fontWeight~semiBold)

   -- format using the properties of a XCellRange for "A1:A2"
props=xSheet~XCellRange~getCellRangeByName("A1:A2")~XPropertySet
props~setPropertyValue("CharWeight", fontWeight~bold)

::requires UNO.CLS                  -- get UNO support
```

- Add text and a date
- Demonstrate how to format individual cells and a cell range



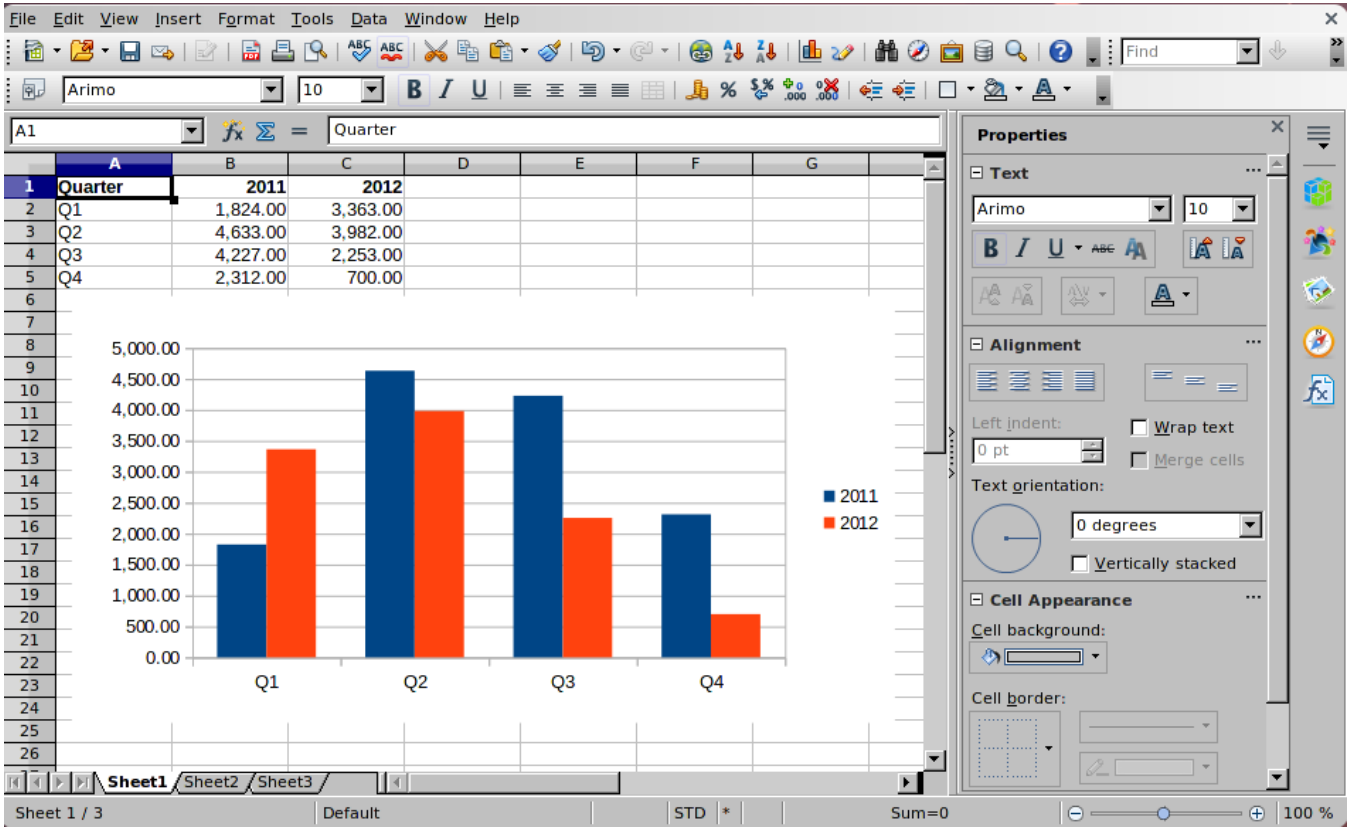
Linux, X11 21.1.4, OpenOffice 4.1.13

Create Spreadsheet Document (“scalc”), 5, 1

```
xDesktop=uno.createDesktop()        -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader       -- get XComponentLoader interface

uri="private:factory/scalc"         -- new scalc document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xSheets=doc~XSpreadSheetDocument~getSheets~XIndexAccess
xSheet =xSheets~getByIndex(0)~XSpreadSheet   -- get first spreadsheet

call uno.setCell xSheet, "A1", "Quarter"
call uno.setCell xSheet, "B1", "2011"
call uno.setCell xSheet, "C1", "2012"
do i=1 to 4
   call uno.setCell xSheet, 0, i, "Q"i
   call uno.setCell xSheet, 1, i, random(0,5000)
   call uno.setCell xSheet, 2, i, random(0,5000)
end
props=xSheet~XCellRange~getCellRangeByName("A1:C1")~XPropertySet  -- column headings
fontWeight=.uno_constants~new("com.sun.star.awt.FontWeight")
props~setPropertyValue("CharWeight", fontWeight~bold)

props=xSheet~XCellRange~getCellRangeByName("B2:C5")~XPropertySet  -- format numbers
props~setPropertyValue("NumberFormat", 4) -- predefined style, format: "#,##0.00"

structRect = .bsf~new("com.sun.star.awt.Rectangle")  -- position & size of chart
structRect~X      =   300           -- x-offset:  0.300 cm
structRect~Y      =  2250           -- y-offset:  2.250 cm
structRect~Width  = 16000           -- width:    16.000 cm
structRect~Height =  8000           -- height:    8.000 cm

xRange=xSheet~XCellRange ~getCellRangeByName("A1:C5")    -- data to be used for chart
rangeAddr = xRange~XCellRangeAddressable~getRangeAddress
arrAddr=bsf.createArrayOf(rangeAddr~getClass, rangeAddr) -- create array

xTableCharts = xSheet~XTableChartsSupplier~getCharts  -- get Chart collection & insert
xTableCharts~addNewByName("FirstChart", structRect, arrAddr, .true, .true)

::requires UNO.CLS                  -- get UNO support
```

- Generate data for four quarters for 2011 and 2012
- Format column headings
- Format numbers
- Create a chart from the generated data

Create Spreadsheet Document (“scalc”), 5, 2



Linux, X11 21.1.4, OpenOffice 4.1.13

Drawing (“sdraw”), 1

- 4 Services
  - DrawingDocument (com.sun.star.drawing.DrawingDocument), DrawingDocumentFactory (com.sun.star.drawing.DrawingDocumentFactory), GenericDrawingDocument (com.sun.star.drawing.GenericDrawingDocument), OfficeDocument (com.sun.star.document.OfficeDocument)
- 20 Interfaces (unqualified)
  - XDocumentEventBroadcaster, XDocumentInfoSupplier, XDocumentPropertiesSupplier, XDrawPageDuplicator, XDrawPagesSupplier, XEmbeddedScripts, XEventBroadcaster, XEventsSupplier, XLayerSupplier, XMasterPagesSupplier, XModel, XModifiable, XMultiServiceFactory, XPrintJobBroadcaster, XPrintable, XPropertySet, XStorable, XStyleFamiliesSupplier, XUndoManagerSupplier, XViewDataSupplier

Drawing (“sdraw”), 2

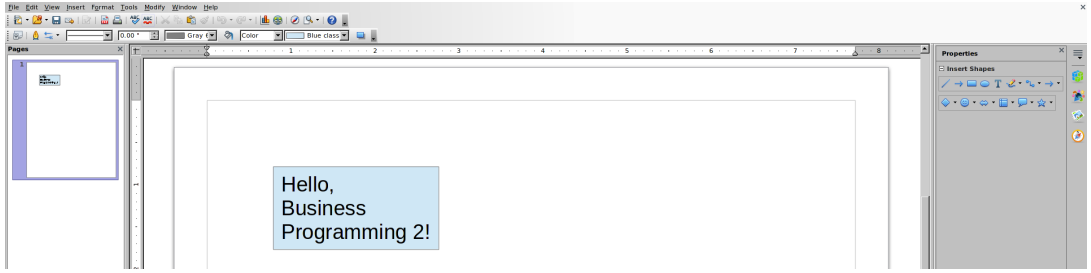
- 12 Properties
  - ApplyFormDesignMode, AutomaticControlFocus, BasicLibraries, BuildId, CharLocale, DialogLibraries, ForbiddenCharacters, HasValidSignatures, MapUnit, RuntimeUID, TabStop, VisibleArea

Drawing (“sdraw”), 3

- A collection of draw pages
- Each draw page
  - Allows any kind of drawing
  - Allows animation effects to be applied
- The draw concepts are fully reused for presentation documents!

Create Drawing Document (“scalc”), 1

```
xDesktop=uno.createDesktop()          -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader         -- get XComponentLoader interface

uri="private:factory/sdraw"           -- new sdraw document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

   -- get access to the first draw page
xDrawPage = doc~XDrawPagesSupplier~getDrawPages~getByIndex(0)~XDrawPage

xsf=doc~XMultiServiceFactory          -- get the service manager (factory)
   -- create a Rectangle shape and determine its position and size
xShape=xsf~createInstance("com.sun.star.drawing.RectangleShape") ~XShape
xShape~setPosition(.bsf~new("com.sun.star.awt.Point", 3000, 3000))
xShape~setSize(.bsf~new("com.sun.star.awt.Size", 5000, 2500))

xDrawPage~add(xShape)                 -- add new shape to first draw page
cr="0d"x                              -- ASCII carriage return char
xShape~XText~setString("Hello,"cr"Business"cr"Programming 2!")  -- now set string

::requires UNO.CLS                    -- get UNO support
```



- Fetch the drawing component's service manager
  - Used to create shapes that can be stored with the document
- Create and draw a rectangular shape, add it to the document
  - Set the shape's text to “Hello, Business Programming 2!”
  - Break up the text such that it fits into the rectangle

Presentation (“simpress”), 1

- 4 Services
  - DrawingDocumentFactory (com.sun.star.drawing.DrawingDocumentFactory), GenericDrawingDocument (com.sun.star.drawing.GenericDrawingDocument), OfficeDocument (com.sun.star.document.OfficeDocument), PresentationDocument (com.sun.star.presentation.PresentationDocument)
- 23 Interfaces (unqualified)
  - XCustomPresentationSupplier, XDocumentEventBroadcaster, XDocumentInfoSupplier, XDocumentPropertiesSupplier, XDrawPageDuplicator, XDrawPagesSupplier, XEmbeddedScripts, XEventBroadcaster, XEventsSupplier, XLayerSupplier, XLinkTargetSupplier, XMasterPagesSupplier, XModel, XModifiable, XMultiServiceFactory, XPresentationSupplier, XPrintJobBroadcaster, XPrintable, XPropertySet, XStorable, XStyleFamiliesSupplier, XUndoManagerSupplier, XViewDataSupplier

Presentation (“simpress”), 2

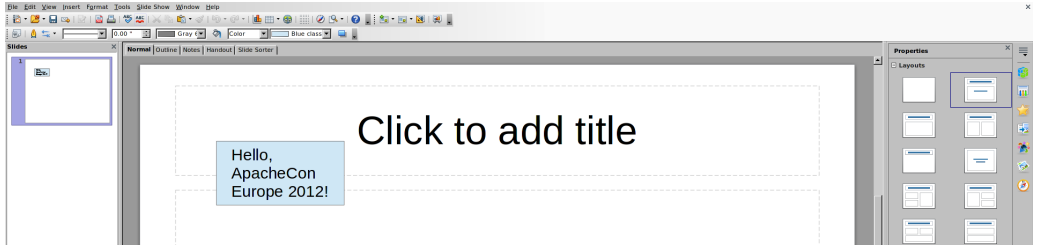
- 12 Properties
  - ApplyFormDesignMode, AutomaticControlFocus, BasicLibraries, BuildId, CharLocale, DialogLibraries, ForbiddenCharacters, HasValidSignatures, MapUnit, RuntimeUID, TabStop, VisibleArea

Presentation (“simpress”), 3

- A collection of draw pages
- Each draw page
  - Allows any kind of drawing
  - Allows animation effects to be applied
- Concept of “Master Pages”
  - Allows definition of specific layouts
- Layouts for title, listings, charts, etc.
- Presentation mode

Create Presentation Document (“simpress”), 1

```
xDesktop=uno.createDesktop()          -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader         -- get XComponentLoader interface

uri="private:factory/simpress"        -- new simpress document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xsf=doc~XMultiServiceFactory          -- get the service manager (factory)
   -- get access to the first draw page
xDrawPage = doc~XDrawPagesSupplier~getDrawPages~getByIndex(0)~XDrawPage

   -- create a Rectangle shape and determine its position and size
xShape=xsf~createInstance("com.sun.star.drawing.RectangleShape") ~XShape
xShape~setPosition(.bsf~new("com.sun.star.awt.Point", 3000, 3000))
xShape~setSize(.bsf~new("com.sun.star.awt.Size", 5000, 2500))

xDrawPage~add(xShape)                 -- add new shape to first draw page
cr="0d"x                              -- ASCII carriage return char
xShape~XText~setString("Hello,"cr"ApacheCon"cr"Europe 2012!")  -- now set string

::requires UNO.CLS                    -- get UNO support
```



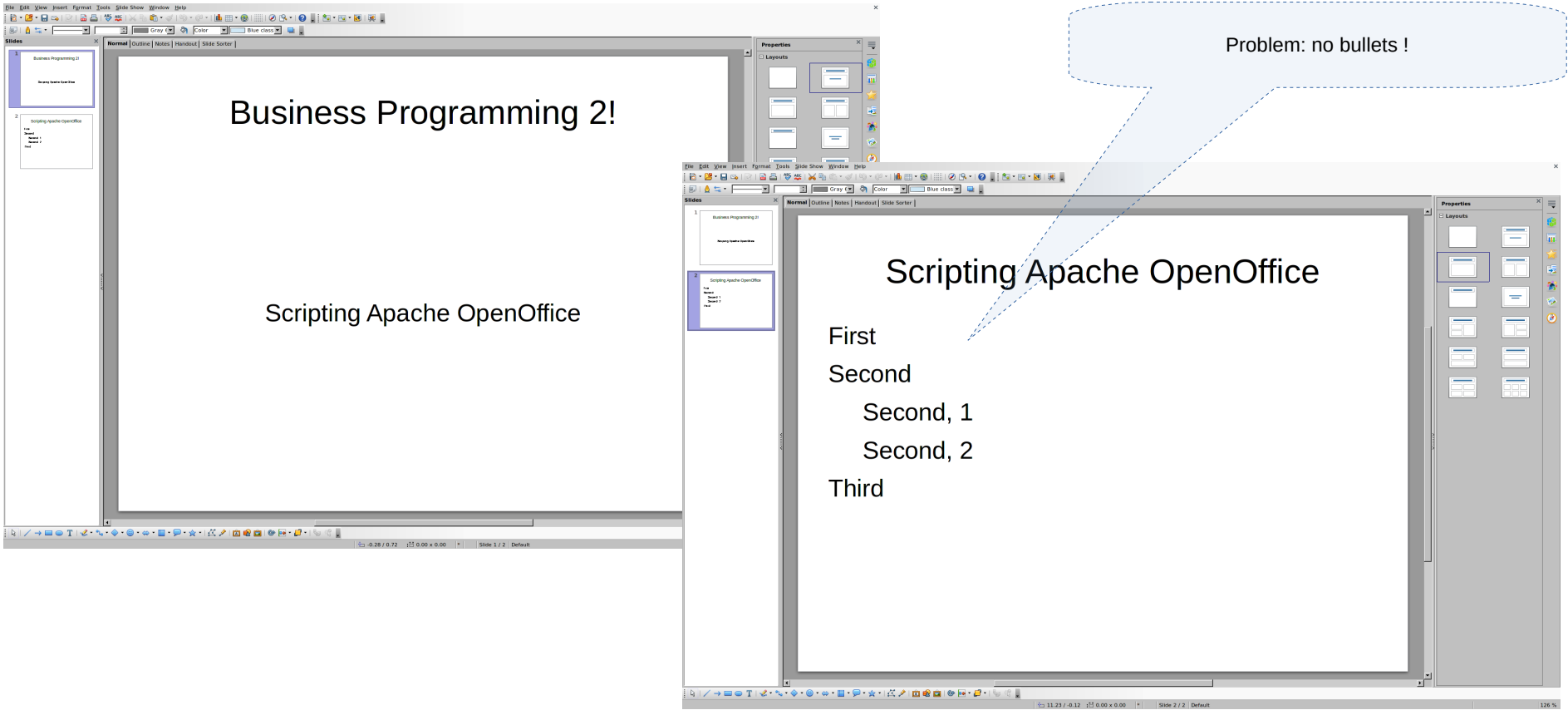
- Fetch its component's service manager
  - Used to create shapes that can be stored with the document
- Create and draw a rectangular shape, add it to the document
  - Set the shape's text to “ApacheCon Europe 2012!”
  - Break up the text such that it fits into the rectangle
- Except for the URL, the same code as for “sdraw”!

Create Presentation Document (“simpress”), 2, 1

```
xDesktop=uno.createDesktop()        -- bootstrap & get access to XDesktop
xcl=xDesktop~XComponentLoader       -- get XComponentLoader interface

uri="private:factory/simpress"      -- new simpress document
doc=xcl~loadComponentFromURL(uri,"_blank",0,.uno~noProps)

xDrawPages = doc~XDrawPagesSupplier~getDrawPages   -- get DrawPages

xDrawPage=xDrawPages~getByIndex(0)  -- get first (empty) page
xDrawPage~XPropertySet~setPropertyValue("Layout", box("short",0))  -- "Title Slide"
xShapes=xDrawPage~XShapes           -- get access to its shapes
xShapes~getByIndex(0)~XText~setString("Business Programming 2!")
xShapes~getByIndex(1)~XText~setString("Scripting Apache OpenOffice")

xDrawPage=xDrawPages~~insertNewByIndex(1)~getByIndex(1) -- insert at end, get access
xDrawPage~XPropertySet~setPropertyValue("Layout", box("short",1))  -- "Title Content"
xShapes=xDrawPage~XShapes           -- get access to its shapes
xShapes~getByIndex(0)~XText~setString("Scripting Apache OpenOffice")

lf="0a"x                            -- define line-feed character
tab="09"x                           -- define tabulator character
str="First" lf"Second" lf tab "Second, 1" lf tab "Second, 2" lf"Third"
xShapes~getByIndex(1)~XText~setString(str)

doc~XPresentationSupplier~getPresentation~bsf.dispatch("start")  -- start presentation

::requires UNO.CLS                  -- get UNO support
```

- Create two pages with different layouts
  - One “Title Slide” page, layout number: 0
  - One “Title, Content” page, layout number: 1
- Start the presentation at the end

Create Presentation Document (“simpress”), 2, 2



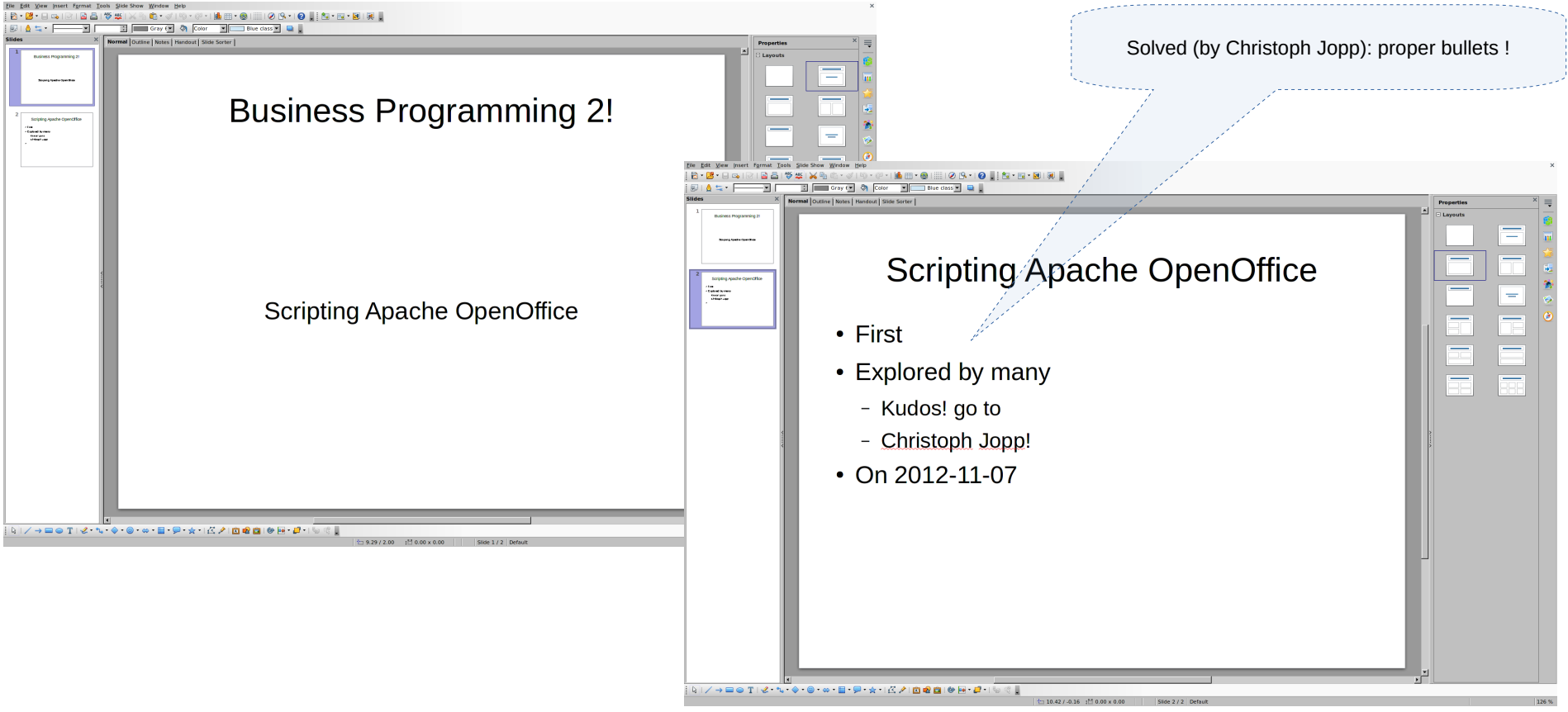
Create Presentation Document (“simpress”), 3, 1

```
…cut…
xText=xShapes~getByIndex(1)~XText    -- content's XText
call addItem xText, "First",             0  -- add string, determine level
call addItem xText, "Explored by many", 0
call addItem xText, "Kudos! go to",      1
call addItem xText, "Christoph Jopp!",   1
call addItem xText, "On 2012-11-07",     0, .false
…cut…
::routine addItem        -- adds string at the given (0-based outline) level
  use arg xText, string, level, bNewParagraph=.true

  xTR=xText~XTextRange~getEnd   -- get end, a XTextRange
  xTR~XPropertySet~setPropertyValue("NumberingLevel",level) -- set XTextRange level

  xTR~setString(string)             -- set string

  if bNewParagraph=.true then       -- add new paragraph
     xTR~getEnd~setString("0a"x)    -- add linefeed character -> new paragraph
     -- xText~insertControlCharacter(xTextCursor,0,.false) -- o.k.

::routine dumpItems                 -- show level and string from XText
  use arg xText

  enum=xText~XEnumerationAccess~createEnumeration -- enumerate paragraphs
  do i=1 while enum~hasMoreElements
    xtr=enum~nextElement~XTextRange -- we need XTextRange's string & properties
    nl=xtr~XPropertySet~getPropertyValue("NumberingLevel")
    say "     item #" i": NumberingLevel="pp(nl) pp(xtr~getString)
  end
```

Routine originally created for debugging, helpful for analyzing any enumeration in UNO, hence leaving it on the slide

- Create two pages with different layouts
  - One “Title Slide” page, layout number: 0
  - One “Title, Content” page, layout number: 1
    - Use AOO's impress outline levels!
    - Kudos to Christoph Jopp, who found the property to use!

Create Presentation Document (“simpress”), 3, 2



Linux, X11 21.1.4, OpenOffice 4.1.13

URE (UNO Runtime Environment)

- There are UNO types that can be used independently of the AOO GUI! E.g.
  - "com.sun.star.lang.Locale"
  - "com.sun.star.linguistic2.LinguServiceManager"
- Can be used by/incorporated into any other application!
- Need to bootstrap and connect to the **U**NO **r**untime **e**nvironment (URE)
  - Fetch its service manager
  - Instantiate services
    - Use services, request their interfaces

URE, Spellchecker, 1, 1

```
xContext = UNO.connect()             -- bootstrap and connect to URE
xSM = xContext~getServiceManager     -- get the service manager

serviceName="com.sun.star.linguistic2.LinguServiceManager"
lsm=xsm~createInstanceWithContext(serviceName, xContext) -- create the service
xSpellChecker = lsm~XLinguServiceManager~getSpellChecker -- get the spell checker
locales=xSpellChecker~XSupportedLocales~getLocales       -- get all supported locales

word="thru"                          -- word to spellcheck
do locale over locales               -- iterate over all available Locales
   str=locale~language"/"locale~country"/"locale~variant "-> word:" pp(word)":"
   ok=xSpellChecker~isValid(word, locale, .UNO~noProps) -- check word
   if ok then str=str "correct"
         else str=str "NOT correct! Available alternatives:"
   say str

   if \ok then                       -- not correct, get & show alternatives
   do
      alternatives=xSpellChecker~spell(word, locale, .UNO~noProps)
      if alternatives <> .nil then
      do
         do a over alternatives~getAlternatives
             say "0909"x pp(a)
         end
      end
   end
end

::requires UNO.CLS                   -- get UNO support
```

- Create a connection to URE
- Get its service manager
  - Used to create the spellchecker service using the service "com.sun.star.linguistic2.LinguServiceManager"
- Use all locales available to the spellchecker
  - In this example: some English locales
- Spellcheck the word “thru” with the different English locales
  - If not correct, list the alternatives of the locale

URE, Spellchecker, 1, 2

Output:

```
en/US/ -> word: [thru]: correct
en/GB/ -> word: [thru]: NOT correct! Available alternatives:
               [thrum]
               [thou]
               [thrush]
               [thrust]
               [truth]
               [Ruth]
en/AU/ -> word: [thru]: correct
en/CA/ -> word: [thru]: correct
en/ZA/ -> word: [thru]: NOT correct! Available alternatives:
               [thrum]
               [thou]
               [thrush]
               [thrust]
               [Thur]
               [truth]
               [through]
               [three]
```