# Aarhus # 2015 CONFERENCE



#### Upcoming PyUNO improvements in LibreOffice 5.1

Matthew Francis





## Introduction

The state of PyUNO as of LibreOffice 5.0

Implemented near the dawn of Python, barely changed since

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- Very little syntactic sugar
- Generally a lot like writing Java
- Slower than it should be especially from a remote process
- What I hope to achieve with the new changes for 5.1
  - Make working with UNO in Python feel more Pythonic
    - $\rightarrow$  Less verbose make use of available Python syntax
  - Make it faster than before
  - Personal goal make PyUNO more appropriate as a base to build automated UI tests on





#### New features in PyUNO for 5.1







## **Collection interfaces**

- Indexed array interfaces
  - com::sun::star::container::XIndexAccess
  - com::sun::star::container::XIndexReplace
  - com::sun::star::container::XIndexContainer
- What's changed?
  - UNO objects implementing these interfaces now behave like Python lists

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#### **Collection interfaces**

Whenever you see method calls like the following, there is a simpler way to do it:

- **<** count = obj.getCount()
- \Value = obj.getByIndex(0)
- obj.replaceByIndex(0, value)
- obj.insertByIndex(0, value)
- obj.removeByIndex(0)

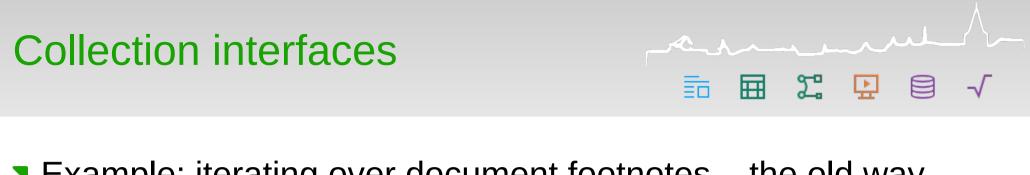
⇒ count = **len(**obj)

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- ⇒ value = obj[0]
- ⇒ obj[0] = value
- → obj[0:0] = value
- → del obj[0]
- Iteration and testing value presence also works:
  - **¬ for** value **in** obj: …
  - **¬ if** value **in** obj: …
    - ...but the if in syntax is probably useful only rarely for indexed collections (and not efficient)





Example: iterating over document footnotes – the old way

- doc = ... # load a text document
- count = doc.Footnotes.getCount()
- for i in range(count):

footnote = doc.Footnotes.getByIndex(i)

print(footnote.String)





# Example: iterating over document footnotes — the new way doc = ... # load a text document count = len(doc.Footnotes) for i in range(len): print(doc.Footnotes[i].String)

#### Or even better, if the index isn't important:

doc = ... # load a text document
for footnote in doc.Footnotes:
 print(footnote.String)







- Other examples of XIndex\*
  - Text document
    - Redlines
    - Endnotes
  - Spreadsheet
    - Charts
    - NamedRanges





## **Collection interfaces**

- Associative array interfaces
  - com::sun::star::container::XNameAccess
  - com::sun::star::container::XNameReplace
  - com::sun::star::container::XNameContainer
- What's changed?
  - UNO objects implementing these interfaces now behave like Python dicts

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## **Collection interfaces**

- Whenever you see method calls like the following, there is a simpler way to do it:
  - Value = obj.getByName(key)
  - ◀ if obj.hasByName(key): …
  - obj.replaceByName(key, value)
  - obj.insertByName(key, value)
  - ◀ obj.removeByName(key)

⇒ value = obj[key]

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- ⇒ if key **in** obj: …
- → obj[key] = value
- → obj[key] = value
- ⇒ del obj[key]
- Iteration and testing value presence also works for keys:
  - **¬ for** key **in** obj: …
  - **¬ if** key **in** obj: …
    - Different from indexed collections the for and in operators tests for keys, not values





- Example: Navigate elements of a spreadsheet the old way
  - spr = ... # load a spreadsheet
  - sheet = spr.Sheets.getByName('Sheet1')
  - range = sheet.NamedRanges.getByName('MyRange')





Example: Navigate elements of a spreadsheet – the new way

- spr = ... # load a spreadsheet
- sheet = spr.Sheets['Sheet1']
- range = sheet.NamedRanges['MyRange']







- What if an object supports both XIndex\* and XName\* ?
  - You can access it using both obj[0] and obj['Name']
  - However, iterating yields keys rather than values
    - Like a Python dict
- Examples:
  - Text document
    - TextTables
    - EmbeddedObjects
    - GraphicObjects



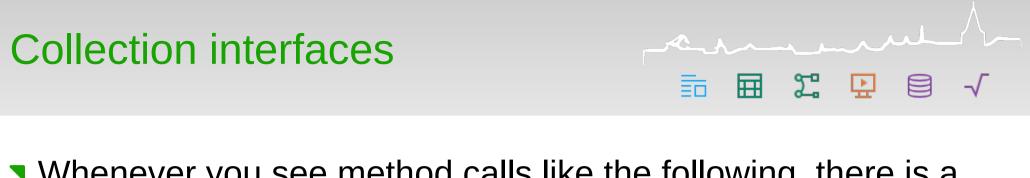
## **Collection interfaces**



#### Enumerations

- com::sun::star::container::XEnumerationAccess
- com::sun::star::container::XEnumeration
- What's changed
  - You can iterate over UNO enumerations the Python way





Whenever you see method calls like the following, there is a quicker way to do it:

```
enm = obj.createEnumeration()
while enm.hasMoreElements():
  value = enm.nextElement()
  ...
```

```
Instead, do:
```

```
for value in obj:
```

. . .







Example: iterating over document paragraphs – the old way

- doc = ... # Load a text document
- enm = doc.Text.createEnumeration()
- while enm.hasMoreElements():
  - paragraph = enm.nextElement()
  - print(paragraph.String)







Example: iterating over document paragraphs — the new way doc = … # Load a text document for paragraph in doc.Text: print(paragraph.String)

Or use a Python style explicit iterator:

```
doc = ... # Load a text document
itr = iter(doc.Text)
paragraph = next(itr)
print(paragraph.String)
```

#### Or flatten the text so it can be accessed by index:

```
doc = ... # Load a text document
paragraphs = list(doc.Text)
print(paragraphs[0].String)
```

Obviously this can be inefficient for a large document – but extremely convenient in the context of e.g. a short test when there are only a few paragraphs



## **Elimination of explicit Any**

Certain method calls need to be passed an Any with a sequence of a specific type

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- Most commonly this occurs with collection interfaces
- The syntax to deal with this in PyUNO was obscure and annoying
  - Example: creating a document index doc = ... # Load a text document index = doc.createInstance("com.sun.star.text.ContentIndex"); uno.invoke(index.LevelParagraphStyles, \ "replaceByIndex", (0, uno.Any("[]string", ('Caption',))))
- PyUNO can now infer the type required by the collection automatically index.LevelParagraphStyles[0] = ('Caption',)



## List and iterator arguments

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- Wherever a UNO API expects a sequence, a Python list or iterator can now be passed.
- This enables the use of list comprehensions and generator expressions for method calls and property assignments.

```
Example: Populate a text table
doc = ... # Load a text document
tbl = doc.createInstance('com.sun.star.text.TextTable')
tbl.initialize(10,10)
doc.Text.insertTextContent(doc.CurrentController.ViewCursor, tbl, False)
# Assign numbers 0..99 to the cells using a generator expression
tbl.Data = ((y for y in range(10*x,10*x + 10)) for x in range(10))
```



#### List and iterator arguments

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## **Tolerant struct initialisation**

Initialising a UNO struct previously required all members to be set, or none

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- Example: PropertyValue frequently, only name and value are needed
  from com.sun.star.beans import PropertyValue
  prop1 = PropertyValue()
  prop1.Name = 'foo'
  prop1.Value = 'bar'
  prop2 = PropertyValue('foo', 0, 'bar', 0)
  prop3 = PropertyValue(Name='foo', Handle=0, Value='bar', State=0)
- This requirement is now relaxed when all arguments are named prop4 = PropertyValue(Name='foo', Value='bar')







A custom behaviour is applied to cell range objects

- com::sun::star::table::XCellRange
- This is different to the other changes the collection interfaces are generic, this is a higher level API
  - However, it's one that is widely used and could benefit from some syntactic sugar

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- Applies to:
  - Sheets in Calc spreadsheets
  - Writer text tables
  - Subset cell ranges created on these





#### Cell ranges

#### Existing syntax

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- cell = cellrange.getCellByPosition(col, row)
- rng = cellrange.getCellRangeByPosition(left, top, right, bottom)
- rng = cellrange.getCellRangeByName(name)

#### New syntax – access like a two dimensional array

- cell = cellrange[0,0]
- rng = cellrange[0,1:2]
- rng = cellrange[1:2,0]

- # Access cell by indices
- # Access cell range by index,slice

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- # Access cell range by slice, index
- rng = cellrange[0:1,2:3] # Access cell range by slices
- rng = cellrange['A1:B2'] # Access cell range by descriptor
- rng = cellrange['Name'] # Access cell range by name



Note that the indices used are in Python/C order
 These pairs are equivalent:

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```
# row r, column c
cell = cellrange[r,c]
cell = cellrange.getCellByPosition(c,r)
# rows t to b, columns l to r
rng = cellrange[t:b,l:r]
rng = cellrange[t:b,l:r]
```







Objects which also implement com::sun::star::table::XColumnRowRange support negative indices (from-end indexing) and the below syntax for referencing whole rows and columns

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- Calc spreadsheet sheets and cell ranges created upon these support this interface
- Writer text tables unfortunately don't

```
rng = cellrange[0]  # Access cell range by row index
rng = cellrange[0,:]  # Access cell range by row index
rng = cellrange[:,0]  # Access cell range by column index
```





#### Import constants by group name

Previously, UNO constants had to be imported individually

#### Example

from com.sun.star.accessibility.AccessibleRole import MENU\_BAR
from com.sun.star.accessibility.AccessibleRole import DIALOG
from com.sun.star.accessibility.AccessibleRole import PUSH\_BUTTON

#### Constant groups can now be imported as a whole

from com.sun.star.accessibility import AccessibleRole
# Now you can reference AccessibleRole.MENU\_BAR etc.





#### **Object hashability**

- UNO objects should now have stable hash values
  - This allows them to be safely used as keys for collections
     s = set()
     s[obj] = 1
    - . . .

# Later, we get the same object from UNO again
# This only works if the object has a stable hash
del s[obj]

- What's that "should" doing there?
  - Handle with care, don't rely on this if possible
  - Cases where this is useful should be rare



## **Performance improvements**

Every time a UNO object is passed to PyUNO, we have to perform introspection on it to find out information about its methods and properties

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- In the case of remote (out of process) PyUNO, this means making interprocess calls
- Inter-process calls are slow, so the fewer the better
- We can't avoid making at least a few calls
- Up to LibreOffice 5.0 there was a bug which meant there were up to 50 inter-process calls for each object
  - Predictably this wasn't very fast
- Further optimisations made to eliminate unnecessary calls and make some others lazy (only when actually needed, not for every object)
- Now it's much faster remotely and a little faster locally







A major aim of these changes was not to break existing code

- Successful? Almost
  - Caused an issue with LibreLogo commit 181a7b27acf29a2728be5a0eb3696796bc7df3da
  - Now that some PyUNO objects behave like proper Python collections, they have truth values that depend on whether or not they're empty

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- The LibreLogo code used a variable that was either 0 or a PyUNO object, and expected the two choices to be always False or True respectively
  - Mea culpa didn't expect that
  - Unfortunately no easy way to work around





## **Questions?**



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## Thank you



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