Notes from the NetKernel4 Frontier:
Porting PoiNK to NK4

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About the Speaker

- Masters degrees in Computer Science..
  - Software Engineering & Language implementation
- ..and Cognitive Science
  - Computational Linguistics
- 29 years of software development experience
  - Wide variety of applications (info dissemination)
  - Using Java since 1997 (more Groovy now)
- Keeping an eye on NetKernel for several years
  - Developed several NetKernel3 modules
- Available for systems consulting, design, development, and training

Outline

- Introduction to PoiNK
- Resource Models
- The PoiNK Resource Model
- PoiNK: NK3 to NK4
- New Documentation System
- New Unit Test Framework
- Additional Resources

Introduction

- What is PoiNK?
  - A NetKernel module to read Excel spreadsheets
    - Provides access to spreadsheet "parts"
  - An example of a NK Resource Model
- Built on the Apache POI project
  - Open source project to..
    - "Develop pure Java ports of file formats based on Microsoft's OLE 2 Compound Document Format"
  - PoiNK using only the HSSF (Excel format) library
  - http://poi.apache.org/
- PoiNK uses the Apache License 2.0.

Outline

- Introduction to PoiNK
  - Quick Demo - (circumstances permitting)
- Resource Models
- The PoiNK Resource Model
- PoiNK: NK3 to NK4
- New Documentation System
- New Unit Test Framework
- Additional Resources

Examples

- http://localhost:1060/rowXML.groovy

```
- <row row="18" sheet="1">
  - <cell col="A" formatCode="0" row="18" sheet="1" type="S">
      <value>2.3.3.a.2.1</value>
    </cell>
  - <cell col="B" formatCode="0" row="18" sheet="1" type="S">
      <value>Identify constraints</value>
    </cell>
  - <cell col="C" formatCode="a4" row="18" sheet="1" type="F">
      <formula>G18/8/I18</formula>
      <value>0.3333333333333333</value>
    </cell>
  - <cell col="D" formatCode="a7" row="18" sheet="1" type="D">
      <value>04/10/06</value>
    </cell>
  - <cell col="F" formatCode="0" row="18" sheet="1" type="S">
      <value>sp,th,cs</value>
    </cell>
  - <cell col="G" formatCode="a4" row="18" sheet="1" type="N">
      <value>8.0</value>
    </cell>
  - <cell col="I" formatCode="0" row="18" sheet="1" type="N">
      <value>3.0</value>
    </cell>
</row>
```

Examples

- http://localhost:1060/colXML.idoc

```
- <column col="B" sheet="2">
  - <cell col="B" formatCode="0" row="1" sheet="2" type="S">
      <value>Test Cells: DO NOT CHANGE:</value>
    </cell>
  - <cell col="B" formatCode="0" row="2" sheet="2" type="B">
      <value>true</value>
    </cell>
  - <cell col="B" formatCode="0" row="3" sheet="2" type="b">
      <value/>
    </cell>
  - <cell col="B" formatCode="0" row="4" sheet="2" type="F">
      <formula>1/0</formula>
    - <value>
        <error>Spreadsheet formula evaluation error 7</error>
      </value>
    </cell>
  - <cell col="B" formatCode="0" row="5" sheet="2" type="F">
      <formula>1+1</formula>
      <value>2.0</value>
    </cell>
  - <cell col="B" formatCode="0" row="6" sheet="2" type="N">
      <value>92.0</value>
    </cell>
  - <cell col="B" formatCode="e" row="7" sheet="2" type="D">
      <value>11/14/07</value>
    </cell>
  - <cell col="B" formatCode="0" row="8" sheet="2" type="S">
      <value>String</value>
    </cell>
</column>
```

Examples

- http://localhost:1060/cellXML.bsh

```
- <cell col="B" formatCode="0" row="9" sheet="1" type="S">
    <value>Web Technology</value>
  </cell>
```

- http://localhost:1060/cellVS.bsh

```
System Engineering
```

- ...and also XML for Sheets and entire Workbooks

- Note: these scripts are calling PoiNK Accessors:
  - active:cellXML
    +wb@res:/data/tasks.xls+address@wbAddr:1!B9

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Resource Models

- Central to Resource Oriented Computing paradigm
- ROC analog to the Object Models of OO paradigm
  - models relevant properties of an application domain
  - defines Information Types
    - set of values having a particular meaning or purpose
  - defines Services
    - which operate on the information types
  - independent of various physical implementations
- Netkernel has many built-in resource models
  - XML, JSON, PiNKY, Image, etc.

Resource Models - Abstract

- A Resource Model is comprised of:
  - Abstract Information Types
    - which characterize resource instances in the model
  - Model-specific Addressing Scheme
    - (optional) a way to identify resources in the model
    - Often have a domain-specific addressing grammar
  - Services
    - Operate on resources of the model's types

Resource Models - Concrete

- Realization of Resource Models:
  - Abstract Information Type
    - Implemented by a Representation
  - Model-specific Addressing Scheme
    - Implemented as a "mini" resource model
  - Services
    - Operate on physical representations of resources
    - Operate on each other (composition)
  - Transreptors (transrepresentors)
    - Transform between physical representations
    - Do not change the information, only its form
    - Ideally, lossless and bi-directional

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The PoiNK Resource Model - (1)

- Abstract Information Types
  - Workbook
    - Sheets
    - Rows
    - Columns
    - Cells
  - Workbook Address
- Addressing Scheme
  - Workbook Address
    - really a "mini" resource model
    - defines a syntax for identifying parts of a Workbook
    - examples: 1!B9, H4, 2!AC24, 3!A

The PoiNK Resource Model - (2)

- Services
  - get a Cell's value as a String
  - get a Cell's value as XML
  - get Column values as XML
  - get Row values as XML
  - get Sheet values as XML
  - get Workbook values as XML
- PoiNK is a limited Resource Model
  - Could define many other services within the model
    - services which manipulate the entities of the model
    - services which change values within the model

The PoiNK Resource Model - (3)

- Transreptors
  - Excel file --> Workbook*
  - WorkbookAddress --> String
  - String --> Workbook Address
  - WorkbookAddress --> XML
  - XML --> WorkbookAddress
  - Workbook --> XML

* not lossless nor bi-directional

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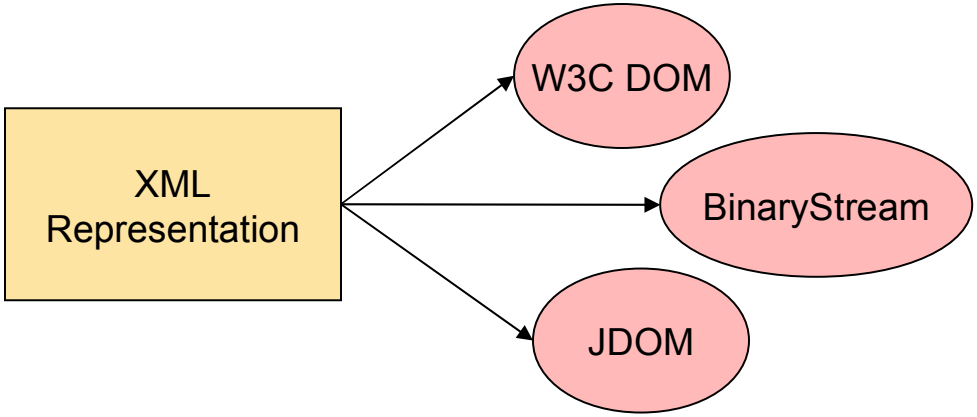
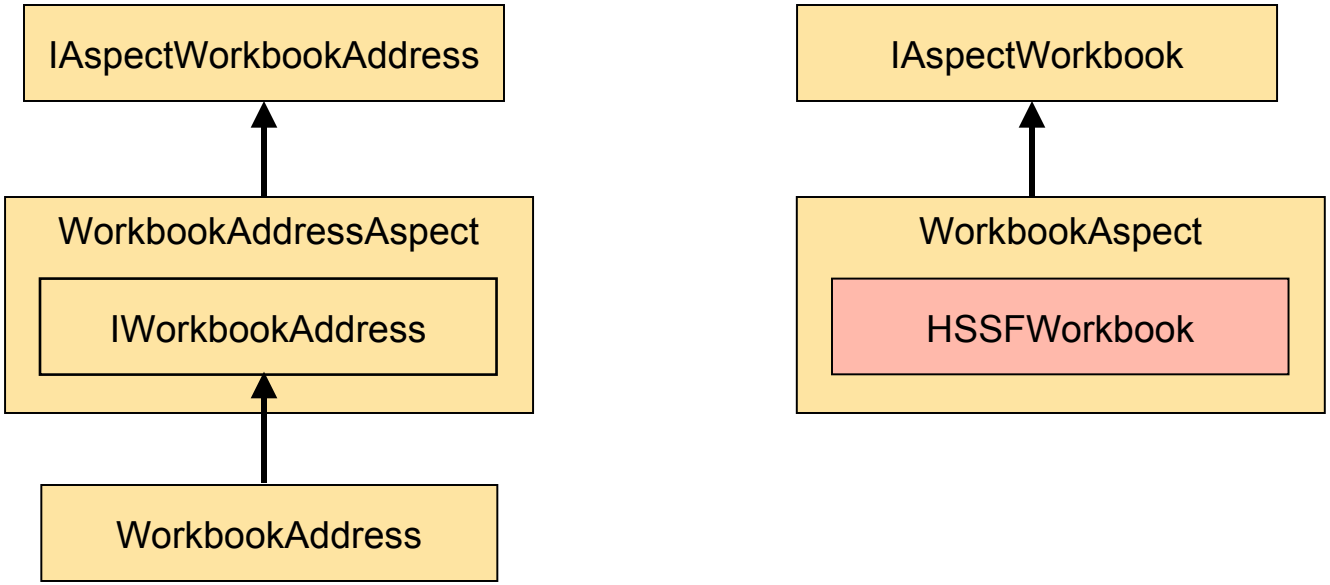
NetKernel3 - Aspects

- Representations (of Abstract Information Types)
  - In NK3 each Representation has 1 or more Aspects
    - Alternate form (realization) of the Representation
    - Each Aspect is a different concrete data type
      - Often just a wrapper around an implementation object
    - Aspects used throughout the NK API



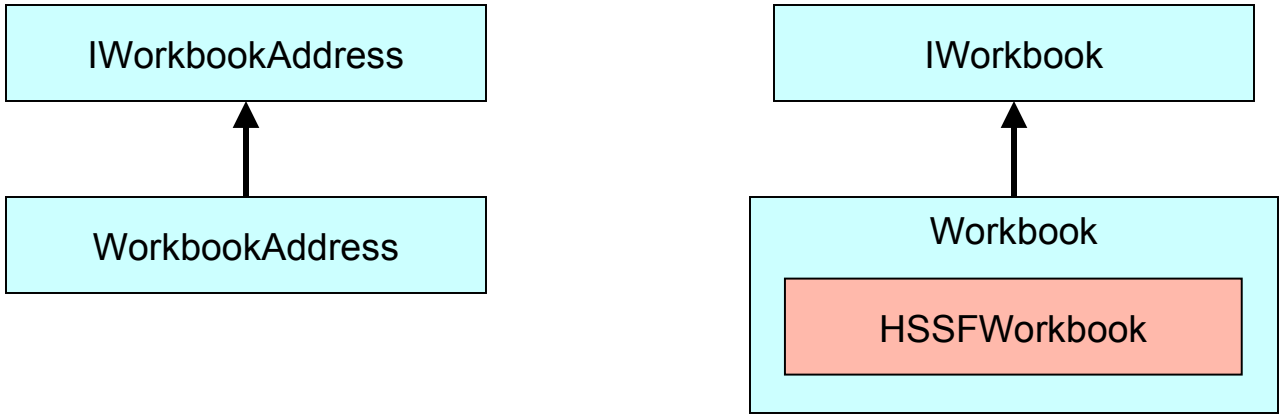
PoiNK in NK3 - Aspects

- Aspects required to wrap domain classes
  - Sometimes creates an unnecessary layer
- WorkbookAddress aspect & Workbook aspect:



PoiNK in NK4 - No Aspects

- Aspects gone: subsumed into Representations
  - Less code: smaller and cleaner
- WorkbookAddress & Workbook representations:



◇ PoiNK in NK4 - No Aspects

- Services Simplified:

```
IAspectWorkbook wbAspect = (IAspectWorkbook)
  context.sourceAspect("this:param:wb", IAspectWorkbook.class);

IAspectWorkbookAddress address = (IAspectWorkbookAddress)
  context.sourceAspect("this:param:address", IAspectWorkbookAddress.class);

// extract workbook and address of desired workbook component:
HSSFWorkbook wb = wbAspect.getWorkbookReadOnly();
IWorkbookAddress wbAddress = address.getWorkbookAddress();

//....use the extracted domain objects in the service code....
```

```
// get workbook and address of desired workbook component:
IWorkbook wb = (IWorkbook) context.source("arg:wb", IWorkbook.class);

IWorkbookAddress wbAddress = (IWorkbookAddress)
  context.source("arg:address", IWorkbookAddress.class);

//....use the domain objects in the service code....
```

NetKernel4 - Endpoints

- Everything is an Endpoint (well...almost)
  - All logical addresses resolve to an Endpoint
  - Endpoints can be categorized by function:
    - Transports
    - Transreptors
    - Accessors:
      - SOURCEs, SINKs, Translators, etc...
      - Terminology: Killers and Existentialists (?)
    - Space manipulators:
      - Fileset, Import, Mapper, Overlay, Private, Rewrite

◇ NetKernel4 - Endpoints

- NK API provides hierarchy of Endpoint classes:

```
EndpointImpl (org.netkernel.layer0.urii)
  NKFEndpointImpl (org.netkernel.layer0.nkf.impl)
    StandardEndpointImpl (org.netkernel.layer0.module.standard.endpoint)
      StandardMonoEndpointImpl (org.netkernel.layer0.module.standard.endpoint)
        StandardAccessorImpl      (org.netkernel.layer0.module.standard.endpoint)
        StandardTransportImpl     (org.netkernel.layer0.module.standard.endpoint)
        StandardTransreptorImpl   (org.netkernel.layer0.module.standard.endpoint)
-->       YourOwnTransreptorImpl (com.yourcompany.endpoint)
```

- Eases implementation of your own endpoints
- Allows implemention of multi-purpose endpoints
  - An "Accessor-Transport", for example

◇ PoiNK in NK4 - Endpoint Example

- Simple Transreptor: Workbook Address to XML

```
public class WorkbookAddressToXML extends StandardTransreptorImpl {

  public WorkbookAddressToXML () {
    // method inherited from EndpointImpl:
    declareThreadSafe();
    // methods inherited from StandardTransreptorImpl:
    declareDescription("Transrept a Workbook Address to XML representation.");
    declareFromRepresentation(IWorkbookAddress.class);
    declareToRepresentation(DOMXDA.class);
  }

  // implement abstract method inherited from StandardTransreptorImpl
  public void onTransrept (INKFRequestContext context) throws Exception {
    IWorkbookAddress wba =
      (IWorkbookAddress) context.sourcePrimary(IWorkbookAddress.class);
    String xmlStr = wba.toXMLString();
    Document doc = XMLUtils.parse(new StringReader(xmlStr));
    DOMXDA xml = new DOMXDA(doc);
    context.createResponseFrom(xml);
  }
}
```

PoiNK in NK4 - Addressing Scheme

- Workbook Address Scheme
  - really a "mini" resource model
    - Has own representation, endpoint, & transreptors
  - defines a syntax for identifying parts of a Workbook
    - Accessor endpoint declared in module.xml file
    - Grammar argument defines base URI syntax:

```
// accessor endpoint declaration in module.xml file:
...
<accessor>
  <id>WorkbookAddressScheme</id>
  <description>The PoiNK Workbook Address Scheme accessor</description>
  <class>com.tohono.poink.endpoint.WorkbookAddressScheme</class>
  <grammar>wbAddr:<group name="addr"><regex type="anything"/></group></grammar>
</accessor>
...
```

PoiNK in NK4 - Addressing Scheme

- Workbook Address Scheme
  - Endpoint implementation is simple
    - Just constructs new WorkbookAddress from argument:

```
public class WorkbookAddressScheme extends StandardAccessorImpl {

  public WorkbookAddressScheme () {
    declareThreadSafe();
    declareDescription("Implements wbAddr: scheme.");
  }

  public void onSource (INKFRequestContext context) throws Exception {
    String addr = context.getThisRequest().getArgumentValue("addr");
    IWorkbookAddress wbAddr = new WorkbookAddress(addr);
    context.createResponseFrom(wbAddr);
  }
}
```

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PoiNK in NK4 - New Documentation System

- Module documentation automatically discovered
- Configured by XML files in <MOD>/etc/system
- Built on a Wiki-interpreter engine
  - Speaks MediaWiki, Textile, Confluence, TracWiki
  - Supports HTML tables:
  - Supports extensible macro engines
  - 4 built-in macros: {xml}, {java}, {literal}, {svg}

PoiNK in NK4 - New Documentation System

- Configured by XML files in <MOD>/etc/system
  - Docs.xml - defines individual documents:

```
<docs>
  <!-- PoiNK4 Application Guide -->
  <doc>
    <id>doc:com:tohono:poink:mod:docs:guide</id>
    <title>PoiNK4 Guide</title>
    <desc>Documentation for the POI for NetKernel4 Application</desc>
    <uri>res:/docs/guide/title.mw</uri>
    <keywords>PoiNK,guide</keywords>
  </doc>
...
 <!-- endpoints -->
 <doc>
    <id>doc:com:tohono:poink:mod:docs:guide:cellxml</id>
    <title>CellXML</title>
    <desc>CellXML endpoint</desc>
    <uri>res:/docs/guide/endpoints/cellxml.mw</uri>
    <keywords>PoiNK,guide,endpoints</keywords>
  </doc>
<docs>
```

PoiNK in NK4 - New Documentation System

- Configured by XML files in <MOD>/etc/system
  - Books.xml - groups documents into books:

```
<books>
  <book>
    <id>book:com:tohono:poink:mod:docs:guide</id>
    <title>PoiNK4 Guide</title>
    <desc>Guide to the "POI for NetKernel4" Module</desc>
    <author>Tom Hicks</author>
    <publisher>Tohono Consulting LLC</publisher>
    <date>9/14/2008</date>
    <icon>res:/docs/doc-icon-violet.png</icon>
    <keywords></keywords>
    <toc>
      <item id="doc:com:tohono:poink:mod:docs:guide">
        <item id="doc:com:tohono:poink:mod:docs:guide:overview"/>
        <item id="doc:com:tohono:poink:mod:docs:guide:license"/>
        <item id="doc:com:tohono:poink:mod:docs:guide:reps">
          <item id="doc:com:tohono:poink:mod:docs:guide:wb"/>
          <item id="doc:com:tohono:poink:mod:docs:guide:wba"/>
        </item>
      </item>
    </toc>
  </book>
</books>
```

PoiNK in NK4 - New Documentation System

- Built on a Wiki-interpreter engine
  - Speaks MediaWiki, Textile, Confluence, TracWiki

```
=CellXML=

<blockquote>
The cell is selected by the required <code>'''address'''</code> argument,
which is a Workbook Address resource.
</blockquote>

<blockquote>
For more information on the Workbook Address Scheme,see the
[[doc:com:tohono:poink:mod:docs:guide:wbas|Workbook Address Scheme]] endpoint.
</blockquote>

==Module==

:'''urn:com:tohono:poink:mod'''

==Syntax==

===URI:===
:'''active:cellXML'''
```

PoiNK in NK4 - New Documentation System

- Supports HTML tables:

```
===Arguments:===
<blockquote>
<table border="1" cellpadding="5">
<tr bgcolor="#E0D7FF">
<td align="center">'''Argument'''</td>
<td align="center">'''Rules'''</td>
<td align="center">'''Description'''</td>
</tr>
<tr>
<td>wb</td>
<td><font color="red">mandatory</font></td>
<td>A Workbook resource</td>
</tr>
<tr>
<td>address</td>
<td><font color="red">mandatory</font></td>
<td>A Workbook Address resource which selects a single cell</td>
</tr>
</table>
</blockquote>
```

PoiNK in NK4 - New Documentation System

- Supports extensible macro engines
  - You can create your own formatting macros
- 4 built-in macros: {xml}, {java}, {literal}, {image}

```
==Example Usage==

===DPML:===

{xml}
<closure>
  <request assignment="response">
    <base>active:cellXML</base>
    <argument name="wb">res:/data/tasks.xls</argument>
    <argument name="address">wbAddr:1!B9</argument>
  </request>
</closure>
{/xml}
```

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PoiNK in NK4 - New Unit Test Framework

- Module tests automatically discovered
- Configured by XML file in <MOD>/etc/system
- XUnit test engine supports:
  - Tests and Testlists (suites)
  - Setup and Teardown code
  - User-defined Assertions
  - A set of built-in Assertions

PoiNK in NK4 - New Unit Test Framework

- Configured by XML file in <MOD>/etc/system
  - Tests.xml - defines Tests and Testlists
    - Example: PoiNK4 Tests.xml file with 1 top-level testlist:

```
<tests>
  <test>
    <id>tests:com:tohono:poink:test:xunit</id>
    <name>PoiNK4 XUnit Tests</name>
    <desc>XUnit tests for the PoiNK4 Module</desc>
    <uri>res:/xunit/Testlist.xml</uri>
    <icon></icon>
  </test>
</tests>
```

◇ PoiNK in NK4 - New Unit Test Framework

- XUnit test engine supports:
  - Tests and Testlists
    - Example: PoiNK4 top-level testlist:

```
<testlist title="PoiNK XUnit Tests">
  <desc>
    <div>
      This is a suite of XUnit tests for the PoiNK Library.
    </div>
  </desc>

  <group title="CellXML Accessor Tests">
    <uri>res:/xunit/CellXML.xml</uri>
  </group>
...
  <group title="Example Scripts">
    <uri>res:/xunit/ExampleScripts.xml</uri>
  </group>

</testlist>
```

PoiNK in NK4 - New Unit Test Framework

- XUnit test engine supports:
  - Tests and Testlists (suites)
    - Example: Test included from top-level testlist:

◇ PoiNK in NK4 - New Unit Test Framework

```
<testlist  title="Cell Accessor XUnit Tests">
... <!-- important details omitted (which allow this testlist to really work) -->
  <test>
    <request>
    <base>active:cellValueString+wb@res:/data/tasks.xls+address@wbAddr:2!A1</base>
    </request>
    <assert>
      <class>java.lang.String</class>
      <stringEquals>The first cell</stringEquals>
    </assert>
  </test>

  <test>
    <request>
      <base>active:cellXML+wb@res:/data/tasks.xls+address@wbAddr:1!B9</base>
    </request>
    <assert>
      <xpath>count(/cell)=1</xpath>
      <xpath>/cell/@col='B'</xpath>
      <xpath>/cell/@row='9'</xpath>
      <xpath>/cell/@type='S'</xpath>
      <xpath>/cell/@formatCode='0'</xpath>
      <xpath>/cell/value/text()='Web Technology'</xpath>
    </assert>
  </test>
</testlist>
```

PoiNK in NK4 - New Unit Test Framework

- XUnit test engine supports:
  - User-defined Assertions
    - Example: Assertion definition omitted from previous:

```
<testlist  title="Cell Accessor XUnit Tests">
...
  <!-- load assertion definitions used in this test -->
  <group title="include xpath Assertion">
    <uri>res:/xunit/assertions/xpath_AD.xml</uri>
  </group>
...
</testlist>
```

```
<!-- user-defined assertion definition, externally defined to share -->
<assertDefinition name="xpath">
  <endpoint>GroovyRuntime</endpoint>
    <argument name="operator">res:/xunit/assertions/xpath.groovy</argument>
    <argument name="result">arg:test:result</argument>
    <argument name="xpath">arg:test:tagRef</argument>  // or arg:test:tagValue
  </assertDefinition>
```

PoiNK in NK4 - New Unit Test Framework

- XUnit test engine supports:
  - User-defined Assertions
    - Example: Groovy implementation of Assertion:

```
// A custom assertion: test an xpath expression against an XML result
import org.netkernel.layer0.nkf.*
import org.ten60.netkernel.xml.xda.*

// Use the following if the tag argument is passed by-value:
// String xpath = context.source('arg:xpath', String.class)
String xpath = context.getThisRequest().getArgumentValue('xpath')
xda = context.source('arg:result').getRepresentation()
if (!(IXDAReadOnly.class).isInstance(xda)) {
  throw new IllegalArgumentException(
    'xpath assertion can only test results compatible with type IXDAReadOnly')
}
Boolean xeval = new Boolean(xda.eval(xpath))
INKFResponse resp = context.createResponseFrom(xeval)
resp.setExpiry(org.netkernel.layer0.nkf.INKFResponse.EXPIRY_ALWAYS)
```

PoiNK in NK4 - New Unit Test Framework

- Framework provides a set of built-in Assertions:
  - maxTime - request must not exceed this time
  - minTime - request must exceed this time
  - class - representation must be instanceof the class
  - mimetype - response must have this mimetype
  - expired - response must be expired
  - notExpired - response must not be expired
  - minTotalCost - response total cost, including all sub-request costs, must exceed this cost
  - maxTotalCost - response total cost, including all sub-request costs, must not exceed this cost
  - minLocalCost - response total cost, excluding any sub-request costs, must exceed this cost
  - maxLocalCost - response total cost, excluding any sub-request costs, must not exceed this cost
  - scope - response must have this scope depth
  - exception - response must be an exception and has this id

PoiNK in NK4 - New Unit Test Framework

- XUnit test engine supports:
  - A set of built-in Assertions
    - Example: Test using built-in Assertions:

```
<test>
  <request>
    <base>active:sheetXML+wb@file:/tmp/wb.xls+address@wbAddr:2!</base>
  </request>
  <assert>
    <minTime>0</minTime>
    <maxTime>50</maxTime>
    <class>org.ten60.netkernel.xml.xda.DOMXDA</class>
    <mimetype>application/xml</mimetype>
  </assert>
</test>
```

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Resources

- NetKernel Sites and Forum:
  - http://www.1060.org/ and http://www.1060research.com/
  - http://www.1060.org/forum/
- Apache POI Project
  - http://poi.apache.org/
- TheServerSide.com Articles:
  - http://www.theserverside.com/tt/articles/article.tss?l=ARESTfulCorePart1
  - http://www.theserverside.com/tt/articles/article.tss?l=ARESTfulCorePart2
  - http://www.theserverside.com/tt/articles/article.tss?l=ARESTfulCorePart3
  - http://www.theserverside.com/tt/articles/article.tss?l=ARESTfulCorePart4

Questions

- Is there any time left for Questions?
  - There's always time for questions, cheeky monkeys
    - (apologies to Craig)
- Available for systems consulting, design, development, and training
- Feedback: hickst@tohono.com

◇ EXTRA SLIDES

PoiNK in NK3 - Aspect Example

- WorkbookAspect in NK3:

```
public class WorkbookAspect implements IAspectWorkbook {

  /** The underlying POI HSSF Workbook. */
  private HSSFWorkbook workbook;

  /** Constructor to create a new instance of Workbook Aspect. */
  public WorkbookAspect (HSSFWorkbook workbook) {
    this.workbook = workbook;
  }

  /**
   * Return the underlying POI HSSF Workbook, which must not be written to!
   * @see <tt>org.apache.poi.hssf.usermodel.HSSFWorkbook</tt>
   */
  public HSSFWorkbook getWorkbookReadOnly () throws Exception {
    return workbook;
  }
}
```

◇ PoiNK in NK3 - Aspect Example

- WorkbookAddressAspect in NK3:

```
public class WorkbookAddressAspect implements IAspectWorkbookAddress {

  /** The underlying address. */
  private IWorkbookAddress wbAddress;

  /**
   * Constructor to create a new instance of the workbook address Aspect.
   */
  public WorkbookAddressAspect (IWorkbookAddress wbAddress) {
    this.wbAddress = wbAddress;
  }

  /**
   * Return the underlying address, which must not be written to!
   *
   * @see <tt>com.tohono.poink.util.IWorkbookAddress</tt>
   */
  public IWorkbookAddress getWorkbookAddressReadOnly () throws Exception {
    return wbAddress;
  }
```