SCUFL2: BECAUSE A WORKFLOW IS MORE THAN ITS DEFINITION
Taverna workflows

- A set of (local and remote) **services** to analyze or manage data
- **Nested** workflows are also services
- **Data-links** connects services
  - i.e. output from service A is input to service B and C
  - Describes the **desired dataflow** instead of process coordination
- Automatic iterations
- Can customize **list handling** and control links

Taverna 2.3 released 2011-07-14

http://www.mygrid.org.uk/

http://www.wf4ever-project.org/

http://www.taverna.org.uk/
Taverna workflow features

- Nested workflows
  - Reuse existing components
- Implicit iterations
  - With customizable list handling
- Pipelining
  - Process partial iteration results early
- Parallelisation
  - Run as soon as data is available
- Retries, failover, looping
  - For stability and conditional testing
- Plugin-extensible execution control
  - Ideas: caching, error detection, dynamic service lookup
Extensible workflow engine

- New service types/protocols
- Execution control like looping/branching/start/stop
- Service discovery at runtime
Taverna’s existing wf formats

- **Taverna 1: SCUFL 2004-2007**
  - Lightweight XML format
  - Extensions in arbitrary formats ("Put your XML element here")
  - Parsed and written by many 3rd parties

- **Taverna 2: t2flow 2007-2011**
  - Supports control and service extensions of T2
  - Annotation system
  - ‘Heavy’ XML serialisation of Java beans
  - Tricky to use by 3rd parties
SCUFL2 motivations

- Easy to use for third-parties
- **Semantic web**/linked open data compatible → *identifiers and ontology*
- **Extensible** in a controlled manner
  - Plugins should provide a minimal ‘schema’
  - But parsers should not need to know about plugin
- Bundle relevant **resources**
  - Input/output data, provenance, scripts, binaries
- **Annotations** on anything
- **Reproducible** workflow results
Research objects

- **Reusable** – used as part of new study;
- **Repurposeable** – reuse the pieces in a new (and different) study. Substitute alternative data sets, methods;
- **Repeatable** – repeat the study, possibly years later;
- **Reproducible** – a special case of repeatability with a complete set of information/results to work towards;
- **Replayable** – go back and see what happened;
- **Referenceable** – cite in publications;
- **Revealsable** – provenance and audit;
- **Re-interpretable** – crossing boundaries;
- **Respectful** – appropriate credit and attribution;
- **Retrievable** – discover and acquire.
Research Object vision

- **ROs: Aggregations** to support sharing/publication
- Incorporating *methods, data, people*
- Research Objects will allow us to conduct research in ways that are
  - **Efficient:** cheaper to borrow than recreate
  - **Effective:** larger scale through reuse
  - **Ethical:** Benefiting wider communities, not just individuals
- *Could I have a copy of your Research Object please?*
WfEver project

- Architecture/implementation for workflow preservation, sharing and reuse
- Research Object models
- Workflow Decay, Integrity and Authenticity
- Workflow Evolution and Recommendation
- Provenance
- Driven by Use Cases: Biology & Astronomy

...technological infrastructure for the preservation and efficient retrieval and reuse of scientific workflows in a range of disciplines.
What is SCUFL2?

- **File format** for *(Taverna)* workflows and data
- **Specification** *(wiki)*
- **Ontology** *(OWL)*
- **Schema** *(XSD)*
- **API** *(Java +Ruby?)*
- **Conversion Tool** *(Java)*
SCUFL2 bundles

ZIP archive

- `mimetype`
- `META-INF/manifest.xml`
- `META-INF/container.xml`
- `workflowBundle.rdf`
- `annotations/myExperiment.rdf`
- `inputs.rdf`
- `outputs.rdf`
- `run/provenance.rdf`
- `resources/script.pl`
- `inputs/data.txt`
- `outputs/result.txt`

http://www.taverna.org.uk/
http://www.mygrid.org.uk/
http://www.wf4ever-project.org/
http://example.org/binary
http://example.net/tavernaServer
http://example.com/largeData
http://myexperiment.org/workflow/1337
Bundle manifest

the-workflow-bundle.scufl2

Root file: Primary document of the bundle (ePub OCF/Adobe UCF).

Alternative representations of same workflow bundle allowed (Turtle, JSON, HTML, etc)

“Structured” zip-file (can be unpacked to be exposed on the web)

Self-documenting media type (OpenOffice ODF, ePub OCF, Adobe UCF) – for tools like file(1) and mime magic

META-INF/container.xml

```xml
<container version="1.0"
xmlns="urn:oasis:names:tc:opendocument:xmlns:xmlns:container">
<rootfiles>
  <rootfile full-path="workflowBundle.rdf" media-type="application/rdf+xml" />
  <!-- <rootfile full-path="workflowBundle.ttl" media-type="text/turtle" /> Alternative repr. -->
</rootfiles>
</container>
```
Workflow bundle

**Unique identifier** which can be used as *prefix* for all relative references in bundle

Suggests **main workflow** and **main profile**, but executor could (e.g. by parameter) run a different workflow or profile

Additional (non-executable) annotations and metadata
Technologies and standards

- OpenOffice ODF *manifest*
- ePub OCF/Adobe Universal Container Format (UCF) *container rootfile, mimetype*
- RDF/XML and OWL *structure and annotations*
- XML Schema for ‘structured’ RDF/XML
- Open Annotation Collaboration (OAC)?
- ORI-ORE? *Aggregation*
- Open Provenance Model (OPM)?
Status: Alpha

- Want people to try it out
- Open for suggestions and feedback
- Beta to be released in Autumn 2011
  - Native format for upcoming Taverna 3 in 2012
  - Load/Save plugin for Taverna 2.3 2011 Q4
- Future plans
  - Explore further research object & provenance
  - Converting to/from workflow systems like Galaxy?
Acknowledgements

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More information

- http://www.taverna.org.uk/
- http://www.wf4ever-project.org/
- http://www.mygrid.org.uk/
- http://github.com/mygrid/scufl2