Introduction to the Kepler User Interface and Actor-Oriented Modeling

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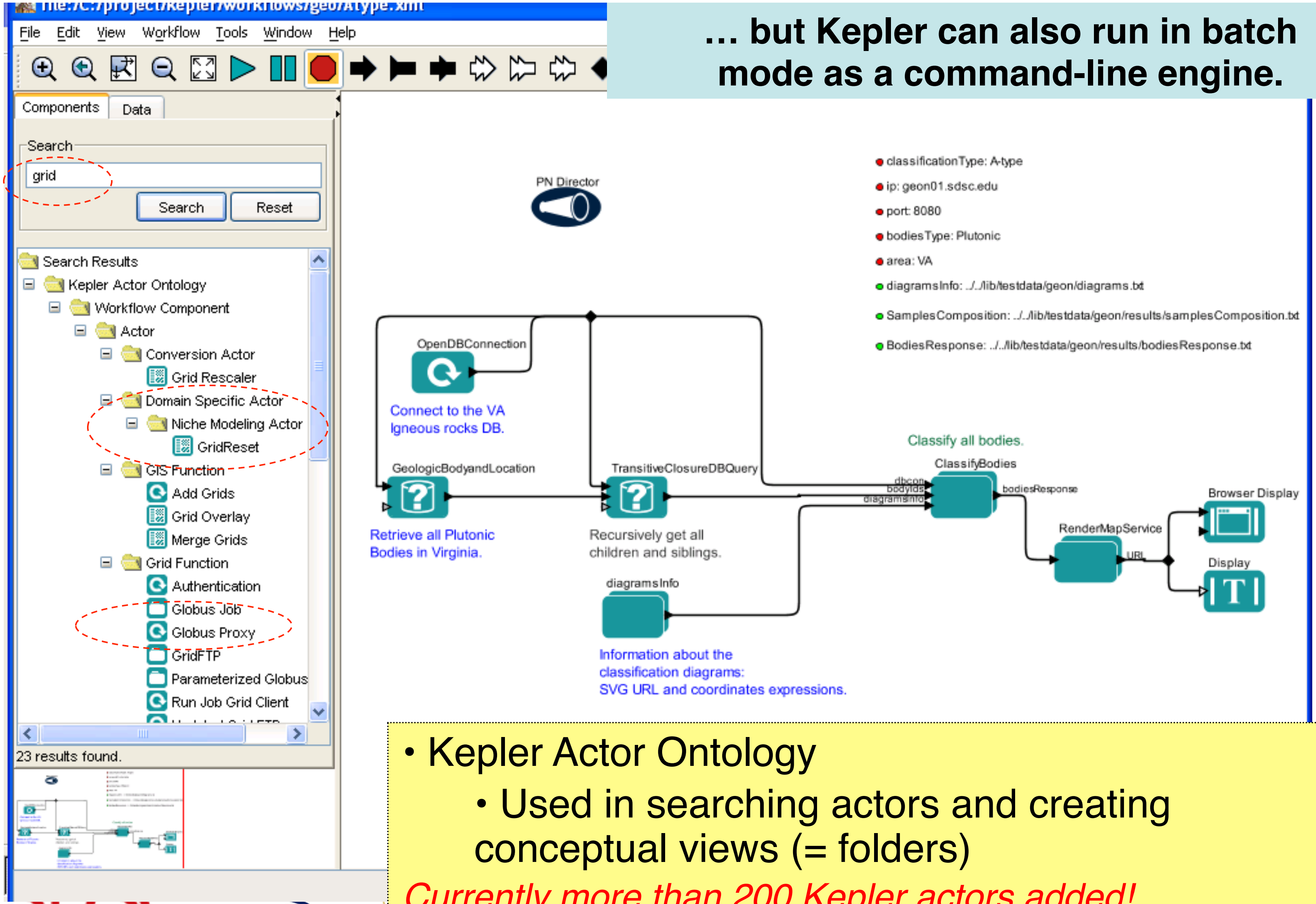
The Kepler User Interface



Search: grid

23 results found.

- classificationType: A-type
- ip: geon01.sdsc.edu
- port: 8080
- bodiesType: Plutonic
- area: VA
- diagramsInfo: ../../lib/testdata/geon/diagrams.txt
- SamplesComposition: ../../lib/testdata/geon/results/samplesComposition.txt
- BodiesResponse: ../../lib/testdata/geon/results/bodiesResponse.txt

Connect to the VA Igneous rocks DB.

Retrieve all Plutonic Bodies in Virginia.

Recursively get all children and siblings.

Classify all bodies.

Information about the classification diagrams: SVG URL and coordinates expressions.

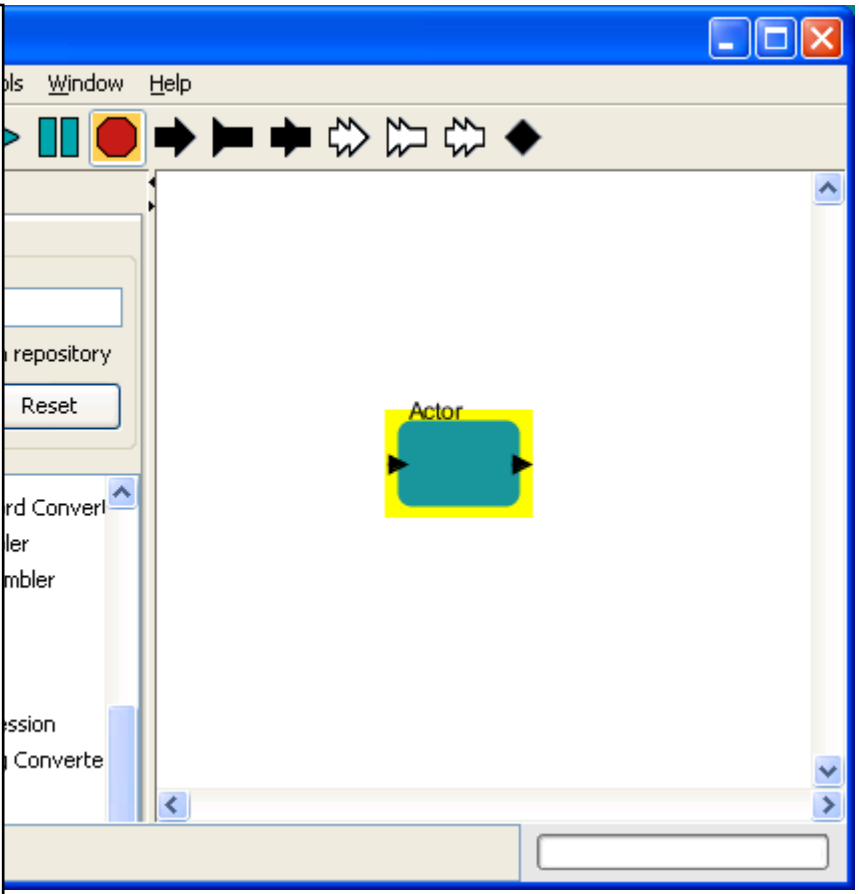
… but Kepler can also run in batch mode as a command-line engine.

- Kepler Actor Ontology
  - Used in searching actors and creating conceptual views (= folders)

Currently more than 200 Kepler actors added!

Actor-Oriented Modeling in Kepler

- Actors
  - Single component or task
  - Well-defined interface (signature)
  - Given input data, produces output data
  - Configured with parameters
  - "Composite" actor for sub-workflows
- Ports
  - Each actor has a set of input and output ports
  - Denote the actor's signature
  - Produce/consume data (a.k.a. tokens)
  - Can be semantically annotated with domain-specific concepts



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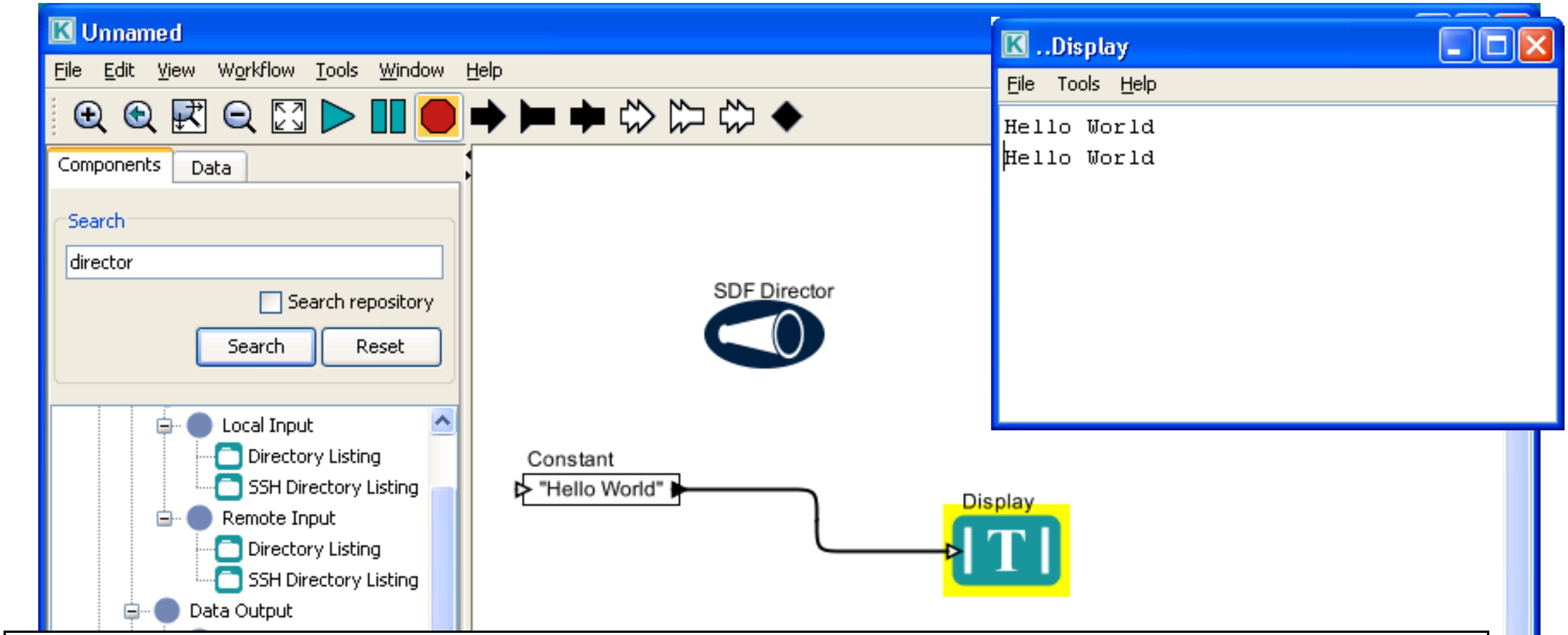

```
Hello World
Hello World
```

- Dataflow Connections
  - Actor “communication” channels
  - Directed edges
  - Connect output ports with input ports
- Directors
  - Execution models, define the execution semantics of workflow graphs
  - Executes workflow graph (some schedule)
  - Sub-workflows may have different directors

Directors Provide Execution Semantics

- Define the semantics of
  - execution of actors and workflows
  - interactions between actors
- Synchronous Dataflow (SDF)
  - Connections have queues for sending/receiving fixed numbers of tokens at each firing. Schedule is statically predetermined.
- Process Networks (PN)
  - Actors execute in separate threads with queues of unbounded size. Related to Kahn/MacQueen semantics. The workflow is executed in parallel pipeline.
- Discrete Event (DE)
  - Actors communicate through a queue of events in time. Used for instantaneous reactions in physical systems.
- Dynamic Dataflow (DDF)
  - Connections have queues for sending/receiving arbitrary numbers of tokens at each firing. Schedule is dynamically calculated.

Ptolemy and Kepler are unique in combining different execution models in heterogeneous models.

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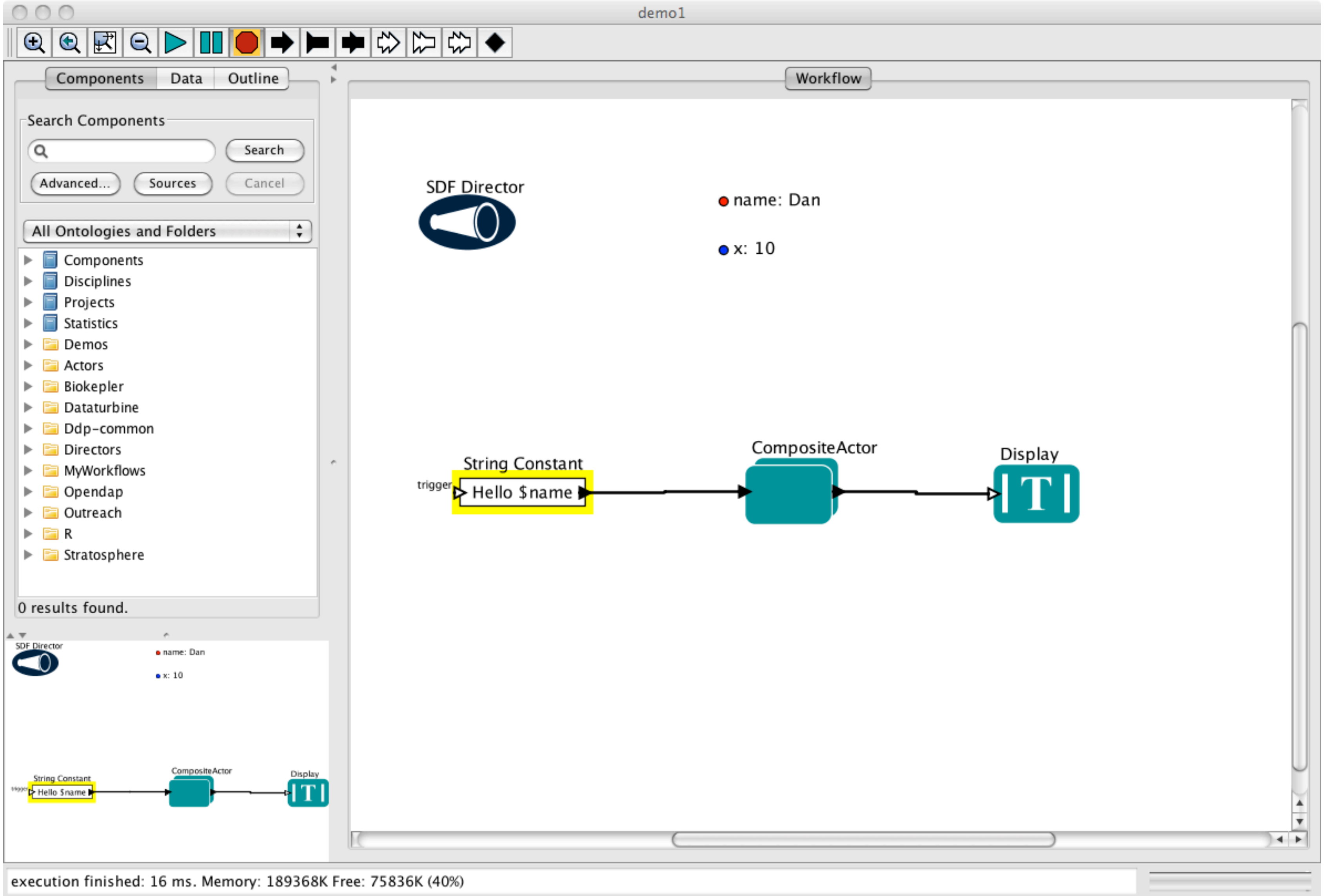
Demo: Building a Simple Workflow



execution finished: 16 ms. Memory: 189368K Free: 75836K (40%)

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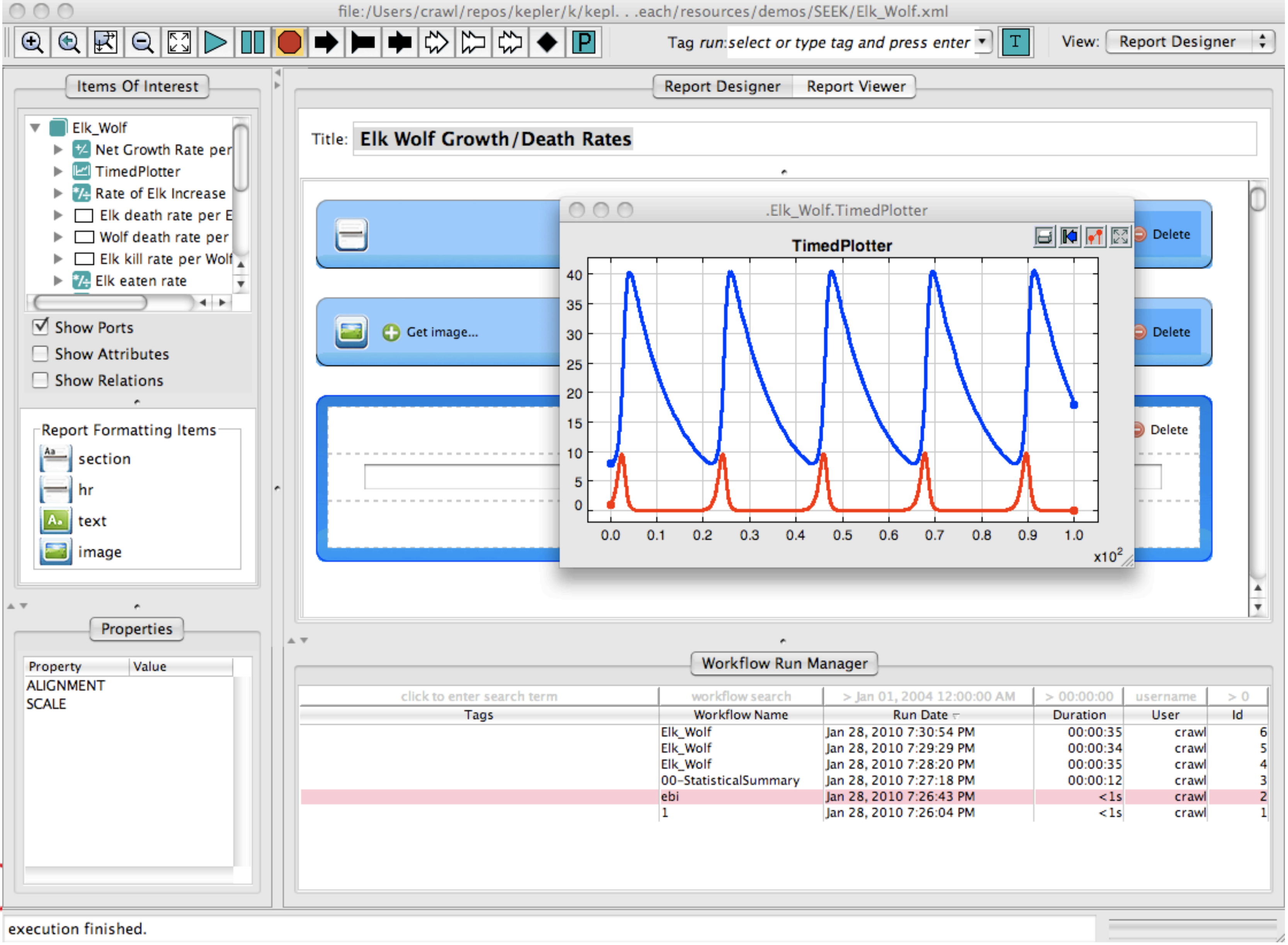
Kepler Provenance Framework

- **What** provenance is recorded:
  - Workflow Specification: actors, ports, connections, parameters, etc.
  - Workflow Evolution: parameter values that change over time, addition/removal of actors, ports, etc.
  - Workflow Execution:
    - Start/stop of workflow, individual actor executions
    - Data exchanged between actors
- **Where** provenance is recorded:
  - Modular interface supports saving to different output types.
  - Currently implemented: Text file, SQL, Ignore

Reporting and Workflow Run Manager



☑ Show Ports

□ Show Attributes

□ Show Relations

Property	Value
ALIGNMENT	
SCALE	

Title: Elk Wolf Growth/Death Rates

click to enter search term	workflow search	> Jan 01, 2004 12:00:00 AM	> 00:00:00	username	> 0
Tags	**Workflow Name**	**Run Date**	**Duration**	**User**	**Id**
	Elk_Wolf	Jan 28, 2010 7:30:54 PM	00:00:35	crawl	6
	Elk_Wolf	Jan 28, 2010 7:29:29 PM	00:00:34	crawl	5
	Elk_Wolf	Jan 28, 2010 7:28:20 PM	00:00:35	crawl	4
	00-StatisticalSummary	Jan 28, 2010 7:27:18 PM	00:00:12	crawl	3
	ebi	Jan 28, 2010 7:26:43 PM	<1s	crawl	2
	1	Jan 28, 2010 7:26:04 PM	<1s	crawl	1

execution finished.

Command-Line Execution

- Execute from command-line:

kepler.sh –runwf demo1.xml

- Set parameters:

kepler.sh –runwf –name “Kepler” –x 20 demo1.xml

NEXT:
Building a Metagenome Annotation Workflow using Kepler and bioKepler

1st Workshop on bioKepler Tools and Its Applications