



TheServerSide  
JAVA SYMPOSIUM

## Which way do the messages flow?

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## A picture says more than 1000 words

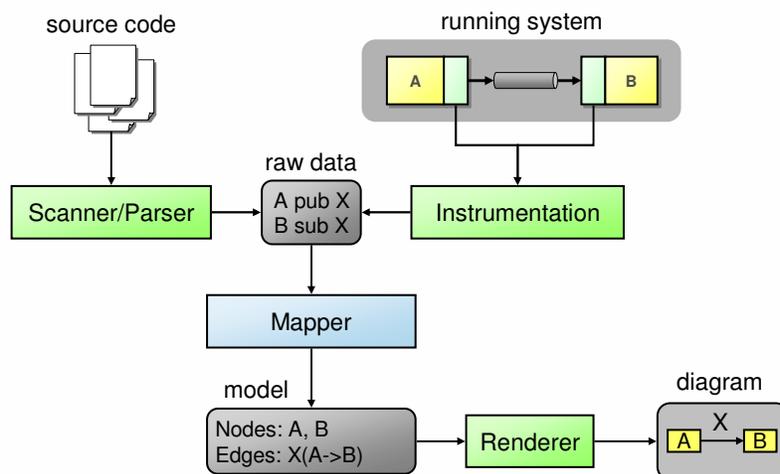
- The amount of information in current systems is beyond what we can handle (understand?)
- Often we are only interested in a specific angle
  - Relationship between classes – not the entire source
  - Number of messages flowing – not the message content
- We're good at spotting patterns in images...

Being able to control large-scale systems is an illusion.  
But we can observe what is happening...

## Where do we get the picture from?

- **Models created upfront convey a vision but usually don't reflect reality**
- **Generating a complete model for large systems is nearly impossible**
- **Systems evolve locally, often uncontrolled**
  - Particularly true for loosely coupled, dynamic systems (SOA)
- **The best picture very much depends on the question you are trying to answer**
  - We need tools that make it easy to create ad-hoc models

## Visualizing Software



## Five Steps

1. **Select Meta-model**
2. **Inspection / Instrumentation**
3. **Mapping to Model**
4. **Visualization / Output**
5. **Validation / Analysis**

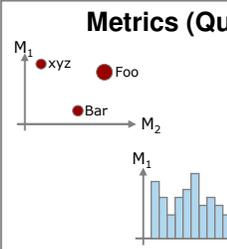
## 1. Select Meta-model

- **“A model that describes a model”**
  - The elements a model can be composed of
  - How to combine these elements
- **Example: meta-model for a class diagram**
  - A class is a box with name, methods, fields,...
  - Available connectors: association, inheritance, aggregation...
  - Rules: no circles in inheritance etc.
- **Sounds more scientific than it really is**
- **Usually pick from a few popular candidates**

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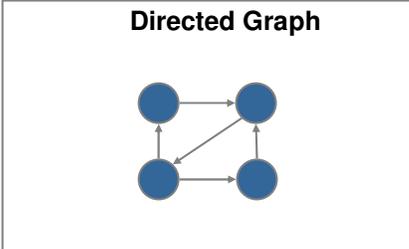
## Common Metamodels

### Metrics (Quantitative)

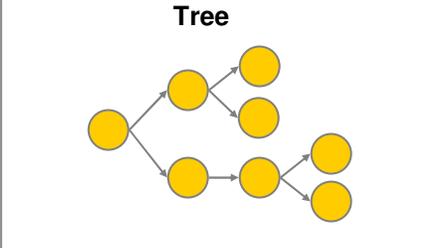


Class	M1	M2	M3
Foo	3.4	3.8	6.5
Bar	5.0	0.0	10.0
...	...	...	...

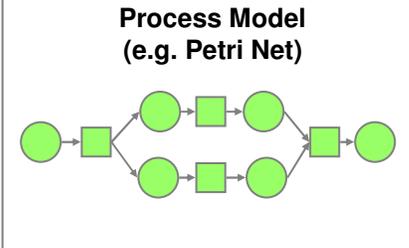
### Directed Graph



### Tree



### Process Model (e.g. Petri Net)



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## 2. Inspection / Instrumentation

### Static Analysis

- Inspect System Design
- Source code
- Configuration repository
- Scan / Parse into intermediate format

### Dynamic Analysis

- Inspect Running System
- Profiling
- Listen to messages
- Log files
- Network sniffer
- Compiler decorator

### 3. Mapping to Model

- **Map the gathered data onto the meta-model**

Senders		Receivers	
Comp.	Channel	Comp.	Channel
A	X	C	X
B	Y	C	Y

- **Example: Messaging System**

- Capture send / receive actions
- Map onto directed graph

Mapper

Nodes: A, B, C  
Edges: X(A→C)  
Y(B→C)

Graph Model

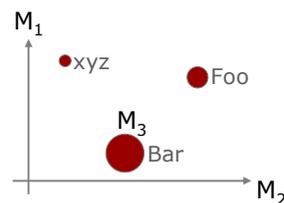
### 4. Visualization / Output

- **Example: GraphViz Dot**

- Automated graph layout tool
- Takes textual input, produces many graphics formats
- Developed by AT&T, Common Public License

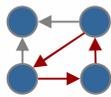
- **Example: Codecrawler**

- Object-Oriented reverse engineering
- Polymetric views of metrics
- Hotspots, complexity, inheritance, data storage, etc.
- All views are interactive

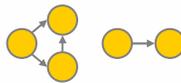


## 5. Validation / Analysis

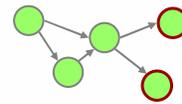
- **A model is useful for more than pretty pictures**
- **Can apply rules against the model**
- **Example: Directed Graph**



Identify circles



Identify islands  
(in domain models)



Identify leaf nodes  
(in dependency graphs)

## Example: Object Dependencies

- **Static analysis: Spring bean configuration**
- **SpringViz, a small XSLT sheet, maps bean configuration to input for GraphViz Dot**
- **Mapping and format hard-coded in style sheet**
- **Really simple but really useful**

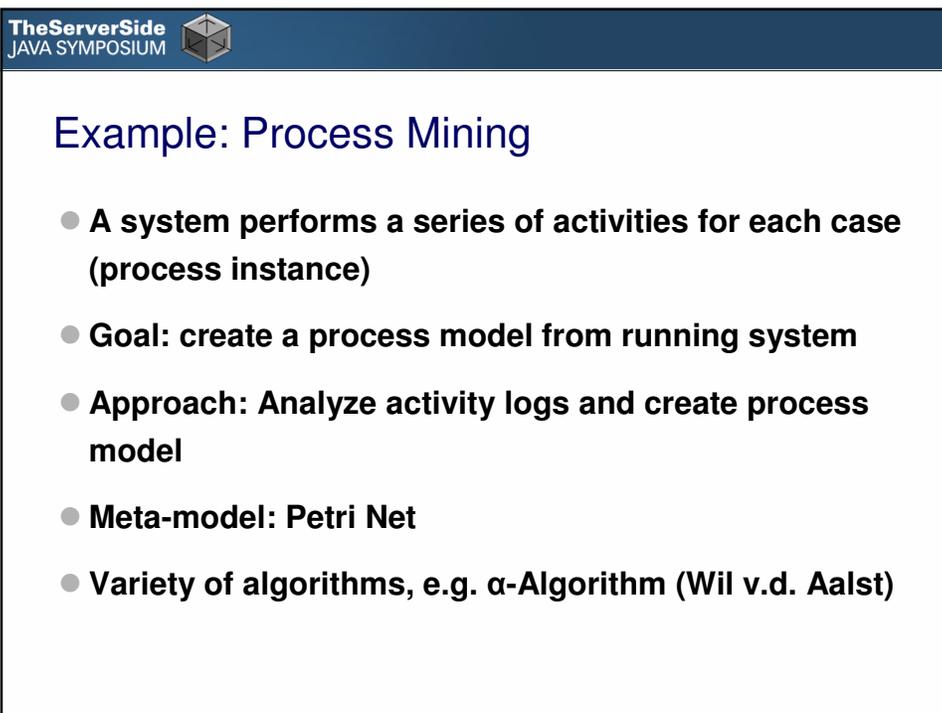
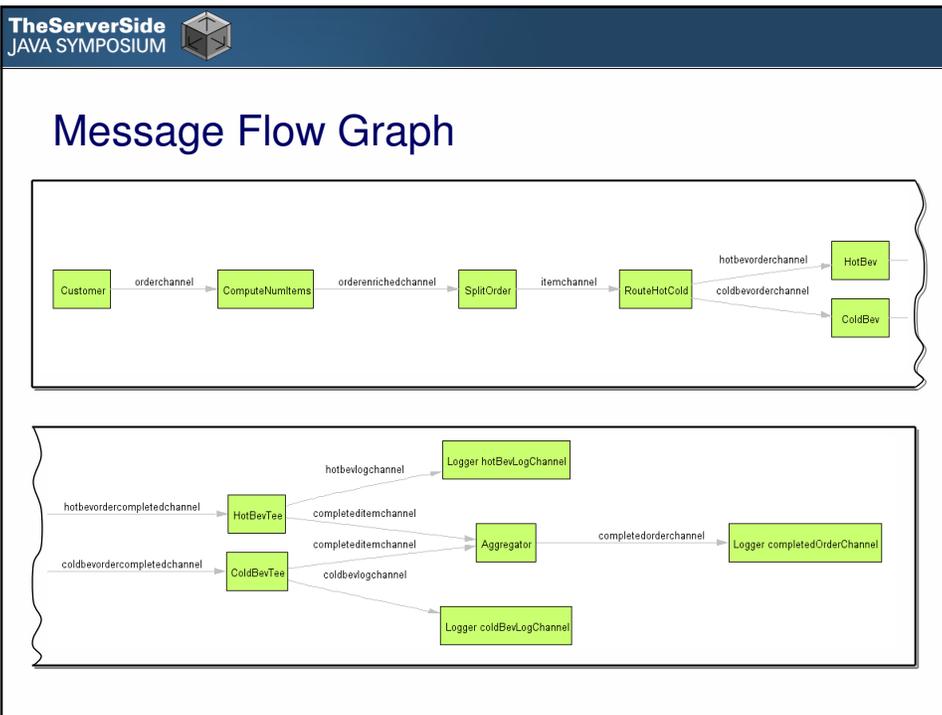
## Example: Component Dependencies

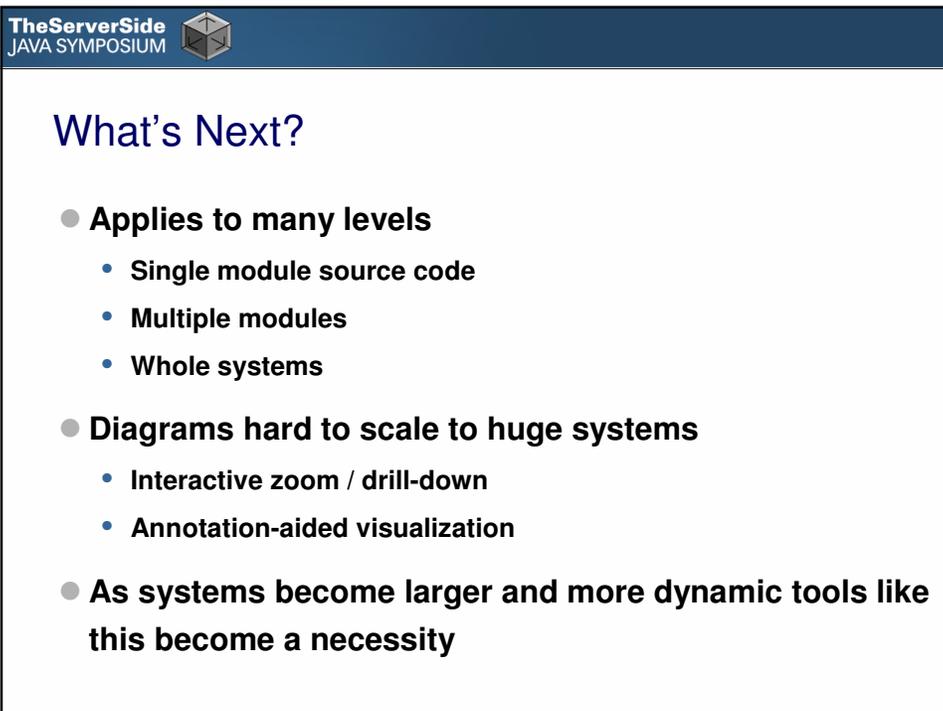
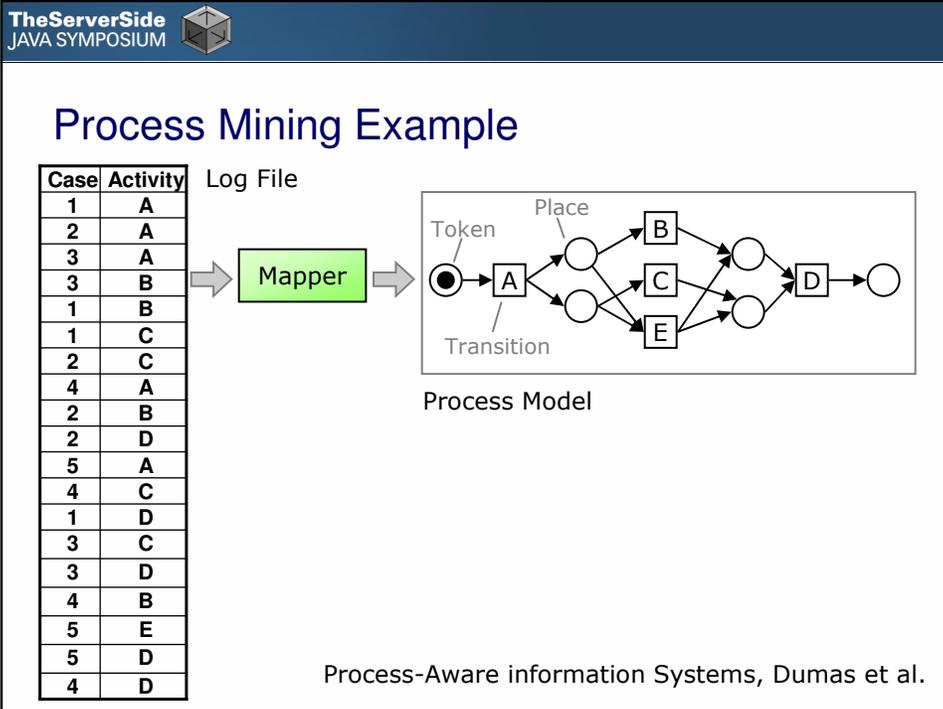
- **Dynamic Analysis: JAR references**
- **Decorate compiler with custom Ant task to get dependencies on a JAR level**
- **Map to a Directed Graph**
- **Render with GraphViz Dot as clickable SVG**
- **Navigate through model**

## Example: Code Crawler, System Complexity

- **Static analysis: Source code analysis**
- **Code Crawler imports XMI and calculates metrics**
  - NOA, NOM, WLOC
- **Renders polymetric System Complexity view**
  - Width, height, color used for metrics
  - Position used for tree layout of inheritance
- **Goal of this view is to classify inheritance hierarchies**
  - Subsystems
  - Large stand-alone classes
- **Can use other views to understand inner workings of specific hierarchies**







## Resources

- **Tools**
  - <http://www.graphviz.org> (Dot)
  - <http://www.samoht.com/wiki/wiki.pl?SpringViz>
  - <http://www.eaipatterns.com> (Messaging visualization)
- **Wil v.d. Aalst: Process Aware Information Systems, Wiley, 2005**
  - [www.processmining.org](http://www.processmining.org) (Process Mining Tool)
- **Michele Lanza's work (CodeCrawler)**
  - <http://www.inf.unisi.ch/faculty/lanza>

Questions  
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