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Semantics Group

Specifying and Checking Java using CSP

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Content

Semantics Group

- Why CSP?
- CSP-OZ to Java
- jassda
- Differences to CSP_M
- Conclusion and Future Work

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Why CSP?

Semantics Group

- Project ForMooS: **For**mal **M**ethods in **o**bject **o**riented **S**oftware Engineering
- base: CSP-OZ [C. Fischer 2000]
  - *Communicating Sequential Processes* [Hoare '85] +
  - *Object-Z* [Smith 2000]
- goal: UML (subset) → CSP-OZ → Java

CSP-OZ-Classes

- The three parts of a CSP-OZ-Class:
  1. Interface
  2. dynamical behaviour: CSP-Process
  3. State space and state transformation: Z-Part
- goal: map every part to the implementation

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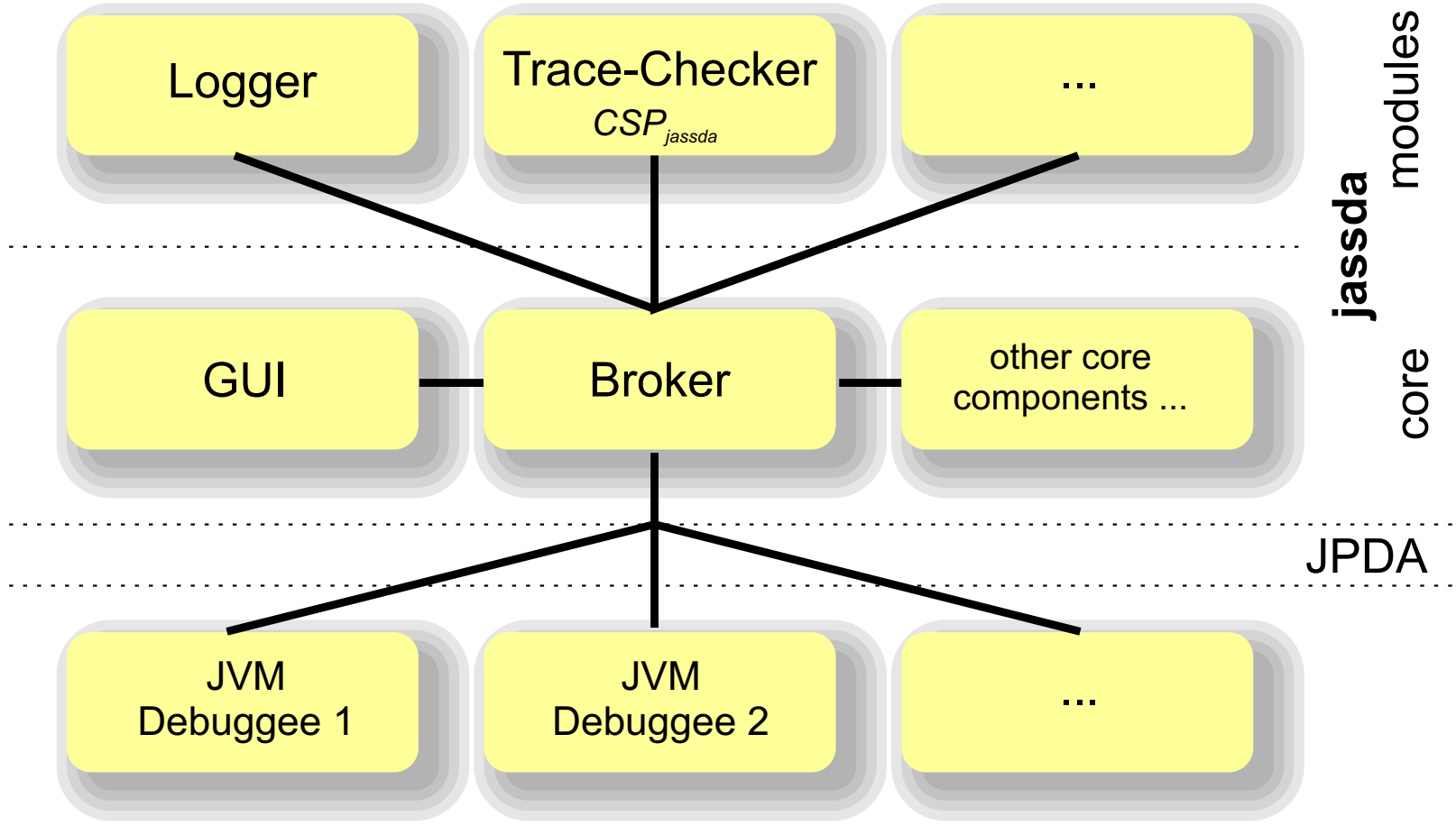
  1. Java - Interface
  2. Trace Assertions
  3. Design-by-Contract, BISL

skip CSP-OZ

jassda Overview

- Jass: **J**ava with **ass**ertions
- jassda: **Jass D**ebug **A**rchitecture
- Debug on Byte-code level
- modular structure (framework for debugging)

jassda Architecture



Serialised Event Stream

- Using JDI means getting a **serialised** stream of events.
- serialised stream = trace
- CSP trace semantics
  - check: (trace of current run) $\in$ CSP trace semantics
  - “checking operational”:
    do not expand the trace semantics
    describe further trace(s) by processes (for every step)

Events

Possible *events*: Everything that can stop the VM via JDI. CSP_{jassda} basic events: (analogous to Design by Contract clauses

- Method entry point `begin`
- Normal method termination `end`
- Exceptional method termination `exception`

Event Properties

- Virtual Machine (Debugee)
- JDI

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Event Properties

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- Virtual Machine (Debugee)
- thread
- class
- instance
- method

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Filtering of events through properties by Java classes (handler class)

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Event Sets

[[S]] Semantics Group

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eventset myset = { handler="..."
debuggee="..." thread="..." ... }
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(default property for handler and predefined event sets)

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- operations on sets: intersection, union

Binding Variables (2)

Binding event set variables similar to communication via channels in CSP_M:

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- Variable binding in CSP_{jassda}:

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main() { in?x:[arg0] -> out!x -> main() }
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Determinism (1)

- Internal Choice (CSP_M)

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- so: use trace semantics

$$traces(a \rightarrow P \sqcap b \rightarrow Q) = traces(a \rightarrow P \,\Box\, b \rightarrow Q)$$

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Hello World

```
eventset helloWorld
 { handler="jass.debugger.jdi.eventset.GenericSet",
   class  ="HelloWorld" }
eventset start { eventtype="begin" method="start"}
eventset stop  { eventtype="begin" method="stop"}

main() {
  ||x:[instance] @ helloWorldProc(x)
}
helloWorldProc(x) {
  helloWorld.start.x ->
     helloWorld.stop.x -> helloWorldProc(x)
}
```

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  - extendable through modular structure

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Many thanks to Mark Brörkens