JÜLICH
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JUBE - A Flexible, Application- and Platform-Independent Environment for Benchmarking

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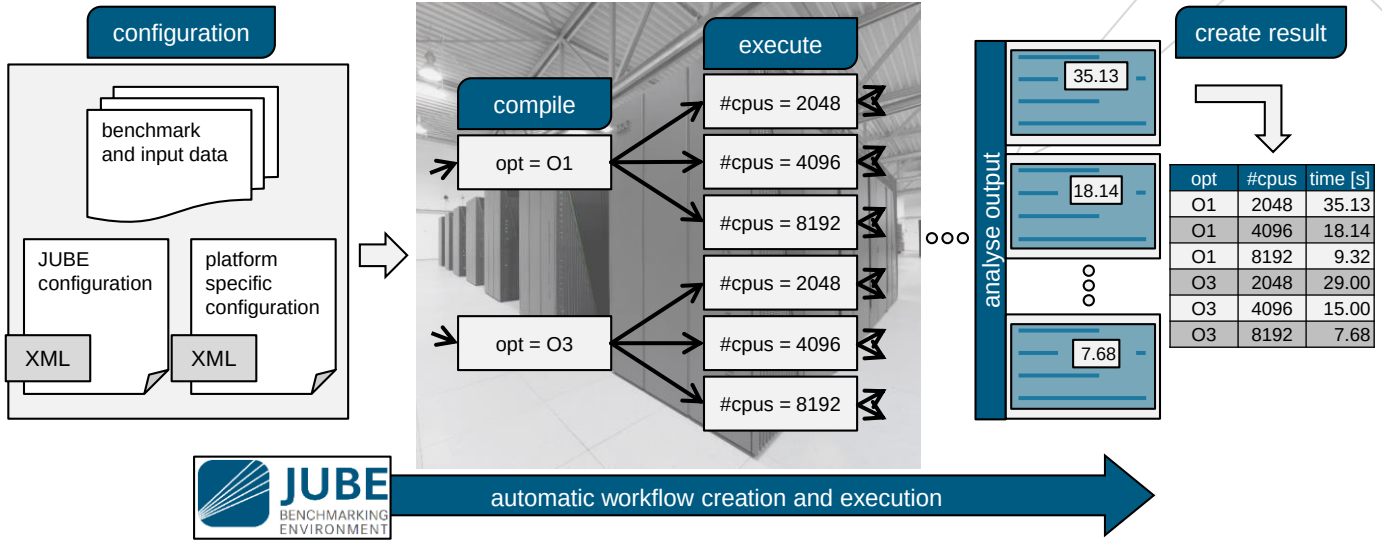
8th - 11th December 2015 – EoCoE - PoP Workshop – Jülich

Horizon 2020
European Union funding
for Research & Innovation

What is JUBE?

- Generic, configurable environment to run, monitor and analyse benchmarks in a systematic way
- Developed 2008, redesigned 2014
- Also usable for testing or production scenarios



JUBE history

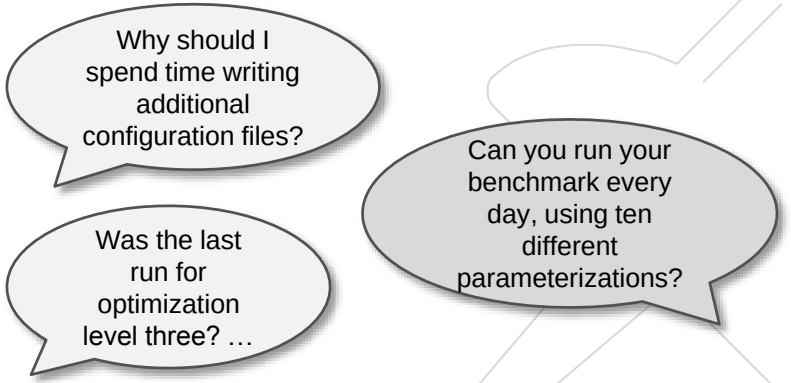
- Development started in 2004
- JUBE version 1
  - Perl based 
  - Used in many European projects like DEISA and PRACE
- 2014 complete new release: JUBE version 2
  - Python based 
  - New, more flexible input file layout
  - New command line options
  - Current version: 2.1.0

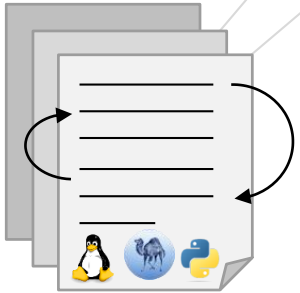
! JUBE 1 file format  JUBE 2 file format !

Why JUBE?

Alternatives:

- Manual benchmarking:
  - Easy to use
  - Time-consuming
  - Very error-prone
- Benchmark specific script solution:
  - Optimized
  - Changes can be time-consuming
  - Portability problems

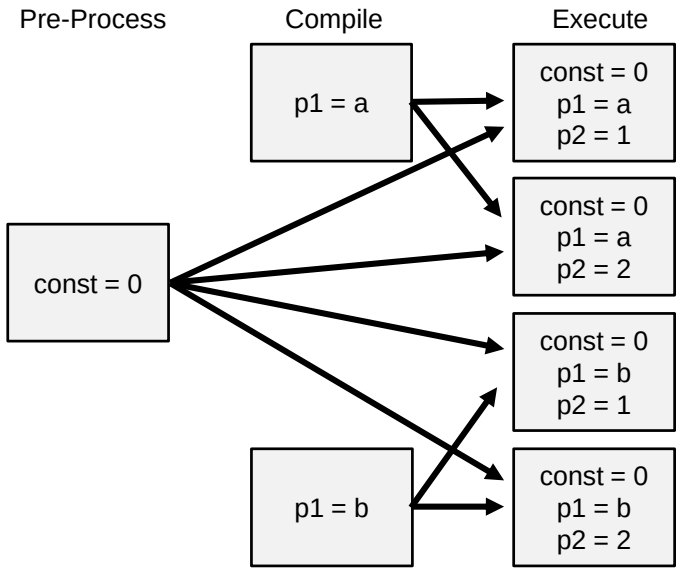




JUBE provides a generic workflow and parameter handling environment, but also supports more flexible and specialised approaches.

Key Concept: Workflow creation

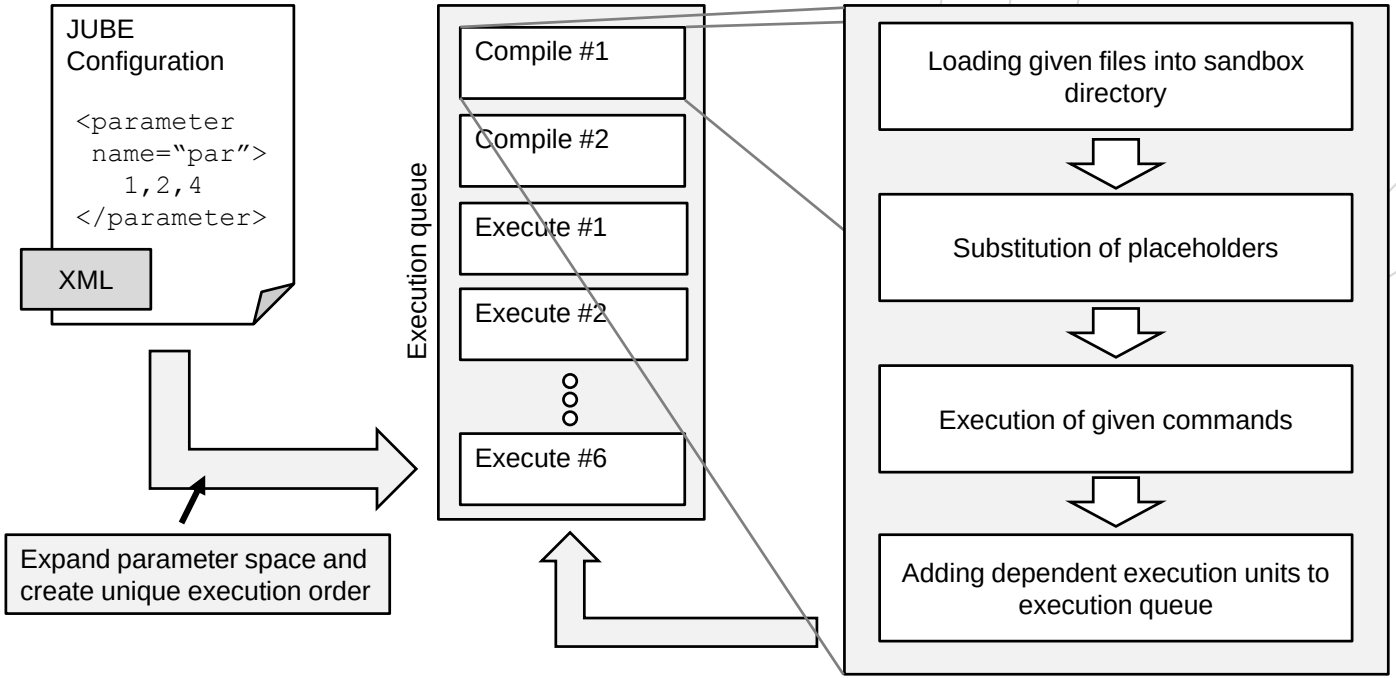
- Dependency driven step structure
- Parameter based expansion of steps




```
<parameterset name="preset">
  <parameter name="const">0</parameter>
</parameterset>
<parameterset name="compset">
  <parameter name="p1">a,b</parameter>
</parameterset>
<parameterset name="execset">
  <parameter name="p2">1,2</parameter>
</parameterset>

<step name="preprocess">
  <use>preset</use>
</step>
<step name="compile">
  <use>compset</use>
</step>
<step name="execute"
 depend="preprocess,combile">
  <use>execset</use>
</step>
```

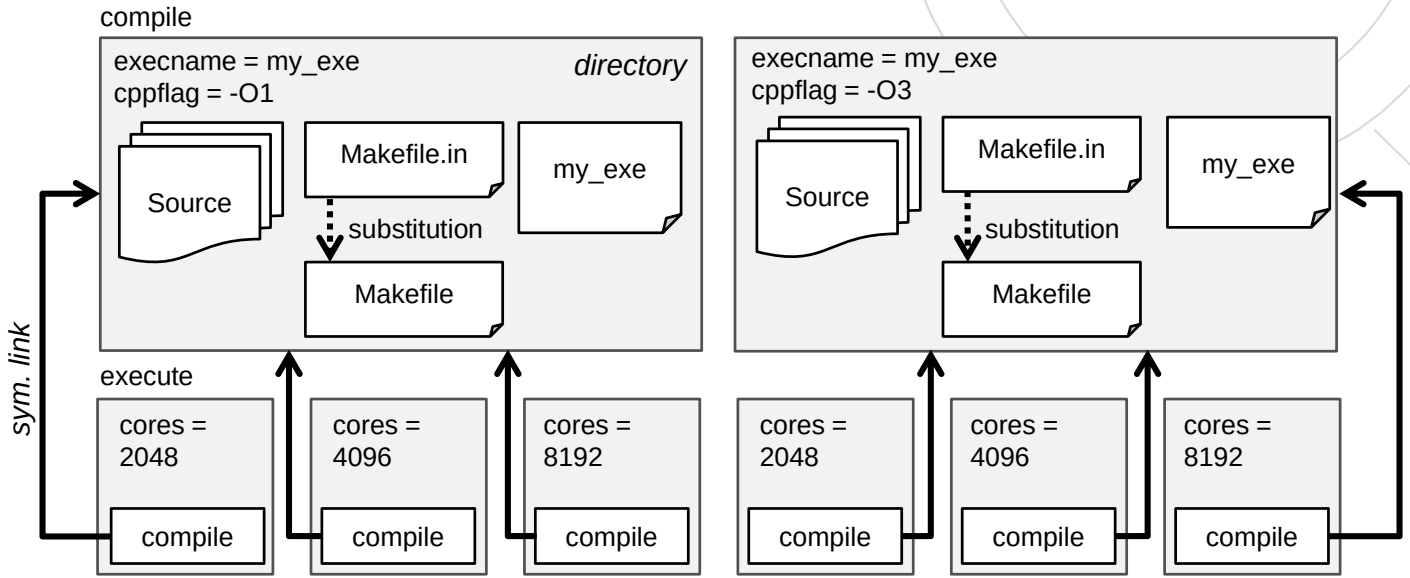
Execution order

- Internal execution queue creates unique execution order



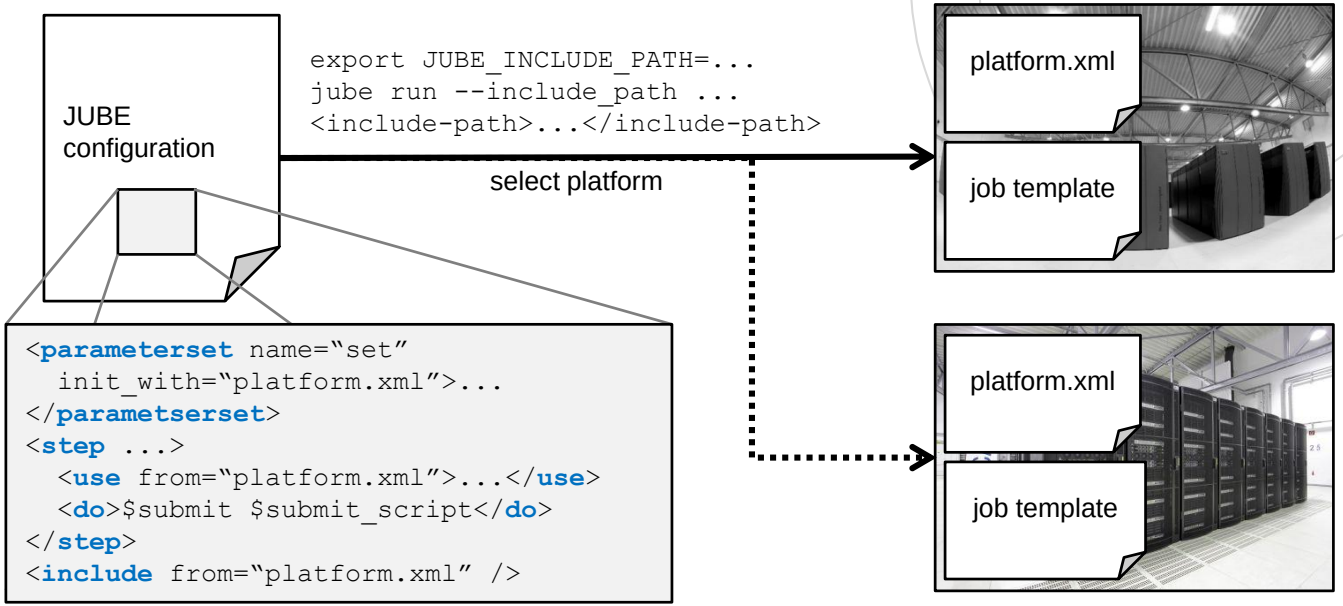
Key Concept: Directory and data handling

- Each parameter/step combination runs in a separate sandbox directory
- Dependent steps can be accessed using sym. links



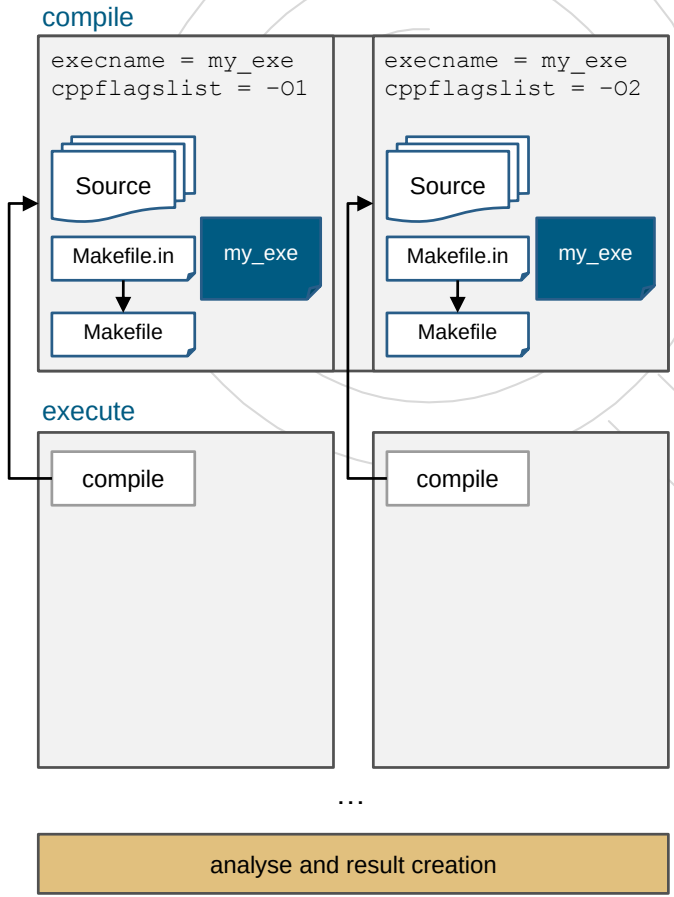
Key Concept: Platform independence

- Separation of platform dependent and independent configuration options

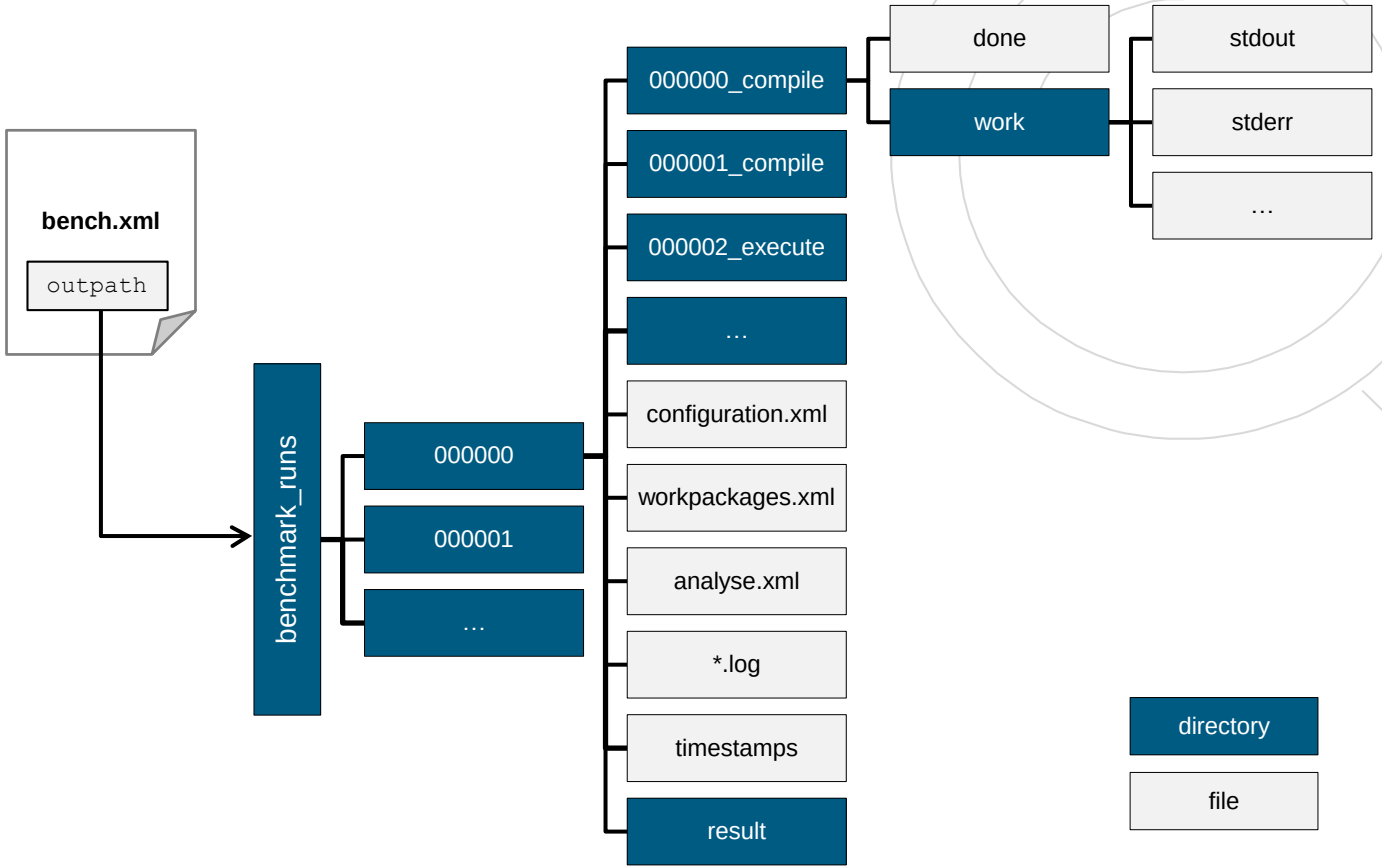


JUBE general workflow

```
<jube>
  <benchmark name="bench" outpath="./benchmark_runs">
    <parameterset name="compileset">
      <parameter name="execname">my_exe</parameter>
      <parameter name="cppflagslist">
        -O1,-O2
      </parameter>
    </parameterset>

    <fileset name="sources">
      <copy>src/*</copy>
    </fileset>

    <substituteset name="compilesub">
      <iofile in="Makefile.in" out="Makefile" />
      <sub source="#PROGNAME#" dest="$execname" />
    </substituteset>

    <step name="compile">
      <use>compileset</use>
      <use>sources</use>
      <use>compilesub</use>
      <do>make OPT=$cppflagslist</do>
    </step>

    <step name="execute" depend="compile">
      …
```



Directory structure



XML input file format

- XML must be well formed:
  - Only one root element: `<jube>`
  - `<a><b>…</a></b>` not allowed
  - Every tag must be closed (`<a>…</a>` or `<a/>`)
  - `<a attr1="…" attr1="…"/>` not allowed
  - `<a attr=… />` not allowed (missing `""`)
- Normal XML comment syntax can be used:
  - `<!-- … -->`
- JUBE tags can be validated using available DTD, schema, or RELAX NG file

Command line access

Start a new benchmark run

- `jube run benchmark.xml`

Continue an existing benchmark run

- `jube continue benchmark_dir [--id <id>]`

Analyse the benchmark data

- `jube analyse benchmark_dir [--id <id>]`

Create and show result representation

- `jube result benchmark_dir [--id <id>]`

Help?!

Online documentation and tutorial

- `www.fz-juelich.de/jsc/jube`

Info mode

- `jube info benchmark_dir [--id <id>] [--step <stepname>]`

Command line accessible glossary

- `jube help <keyword>`

Logs

- `jube log benchmark_dir [--id <id>] [--command <cmd>]`

Debug mode

- `jube --debug run|continue|analyse|result …`

Verbose mode

- `jube -v[vv] run …`

HowTo: General file layout

```
<?xml version="1.0" encoding="UTF-8" ?>
<jube>
  <benchmark name="…" outpath="…">
    <parameterset/>
    <fileset/>
    <substituteset/>
    <patternset/>

    <step/>

    <analyse/>
    <result/>
  </benchmark>
</jube>
```

- XML header line
- JUBE root tag
- benchmark area
- set definitions
- steps and commands
- file analysers
- result output creation

```
>> jube help general_structure
```

HowTo: Sets

- Main JUBE information storage technique
- Four different types of sets are available
  - `<parameterset>` Parameter storage
  - `<fileset>` Define all available files
  - `<substituteset>` Define file substitution
  - `<patternset>` Define the analyse pattern
- Set names must be unique
- Can be initialised by using an additional configuration file
- Available `<parameterset>`, `<fileset>` and `<substituteset>` are used and combined within a `<step>`
- Available `<patternset>` are used within `<analyse>`

```
>> jube help <setname>_tag
```

HowTo: Command execution

- `<do>…</do>` holds the executable commands
- All commands must use SHELL syntax (they will be executed by using `/bin/sh`)
- JUBE parameter can be used by using `$parametername`
- Parameter will be expanded in a pre-processing step
- Environment parameter can also be used
- JUBE stops execution if the command's return code fails
- Commands will only be executed once
- All `<do>` within the same `<step>` shares the same environment

HowTo: Command execution

```
<step name="…" depend="…">
  <use>…</use>
  <use>…</use>
  <do>…</do>
  <do>…</do>
</step>
```

name and dependencies

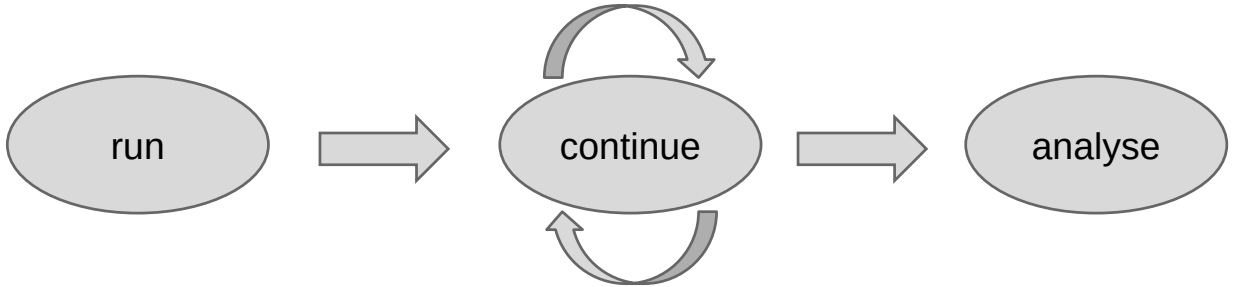
used sets

Shell commands

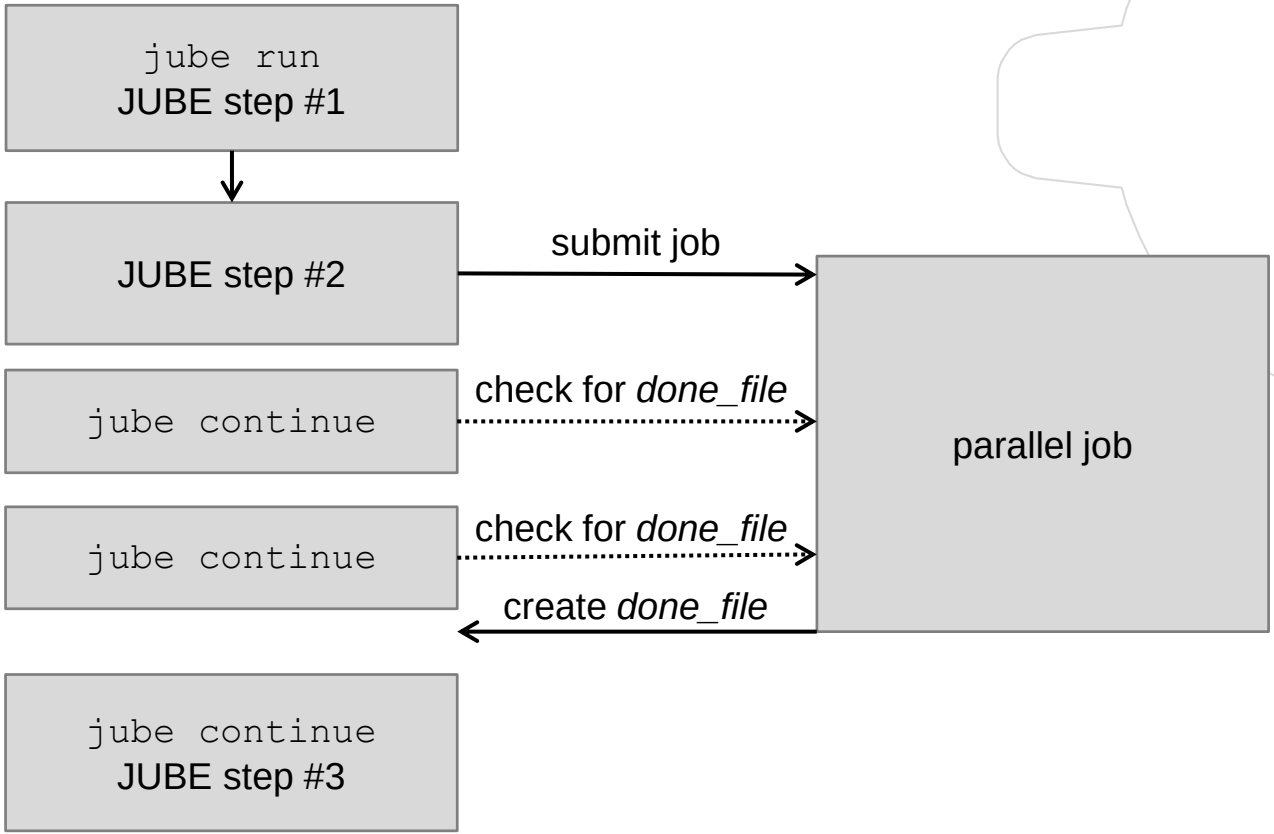
```
>> jube help step_tag
  >> jube help do_tag
```

HowTo: Job submission

- A job template and substitution can be used to generalize the job submission process
- `<do>…</do>` is used to submit the job
- `<do>` returns immediately after the job was submitted. To wait for its execution use: `<do done_file=„…“>`
- The marker file, given by `done_file`, must be generated by the job script after the parallel part was executed
- `continue` triggers JUBE to check all available marker files



HowTo: Job submission



HowTo: Analyse

- Files will be analysed by using regular expressions which are defined by the given patterns
- Multiple occurrences of the same pattern create statistical values (average, minimum, maximum etc.)

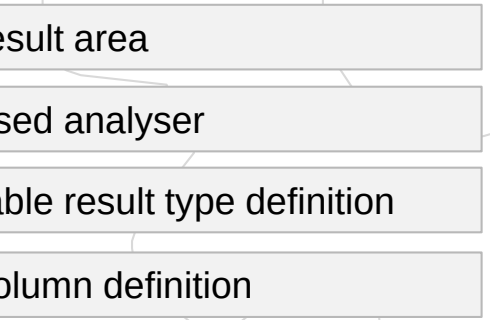
```
<analyser name="...">
  <use>…</use>
  <analyse step="…">
    <file>…</file>
  </analyse>
</analyser>
```

- analyser area
- used patternset
- step which should be analysed
- list of files

```
>> jube help analyser_tag
```

HowTo: Result creation

```
<result>
  <use>…</use>
  <table name="…">
    <column>…<column>
  </table>
</result>
```




```
>> jube help result_tag
 >> jube help table_tag
```

Example Benchmark Configurations

- **HPL**: High-Performance Linpack Benchmark
  `www.netlib.org/benchmark/hpl`
- **IOR**: (InterleavedOrRandom) I/O benchmark
  `sourceforge.net/projects/ior-sio`
- **mdtest**: Metadata test benchmark
  `sourceforge.net/projects/mdtest`

Publicly available and extensible JUBE configuration file repository:

`https://github.com/FZJ-JSC/jube-configs`

Outlook and upcoming Features

- Extend job system interaction
  - Allow JUBE to monitor submitted jobs more easily
- Add another configuration file input format
  - Not everyone likes writing XML files by hand

Where to start?

Download and Tutorials:

- **`www.fz-juelich.de/jsc/jube`**
- Open Source (GPLv3)

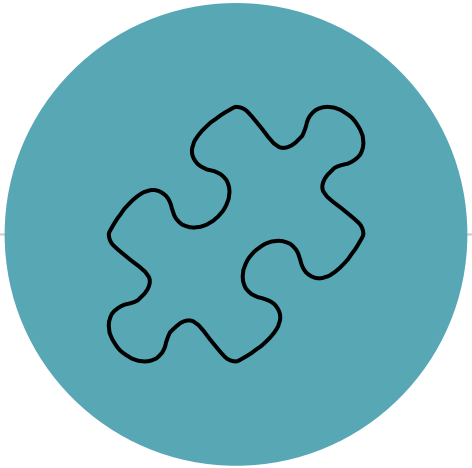
Prerequisites:

- OS: Linux
- Python 2.6, Python 2.7, Python 3.2 (or a more recent version)

Contact:

- `jube.jsc@fz-juelich.de`

These slides are a modified version of free templates found at:
http://www.slidescarnival.com/



DEMO