



JUBE

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

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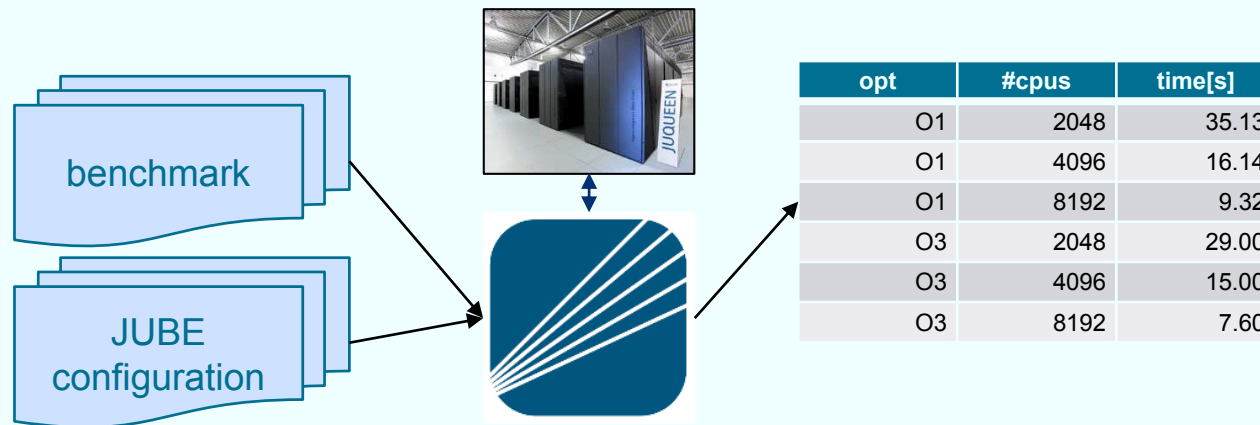
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Jülich Supercomputing Centre


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What is JUBE?

- Environment to run, monitor and analyse benchmarks (command line based)
- Motivation: objective comparison of computer architectures
- Use cases: procurements, monitoring the effects of system and configuration changes



JUBE history

- Development started in 2004
- JUBE version 1  ← not part of this presentation
 - 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: 2.0.2

! JUBE 1 file format  JUBE 2 file format !

Why JUBE?

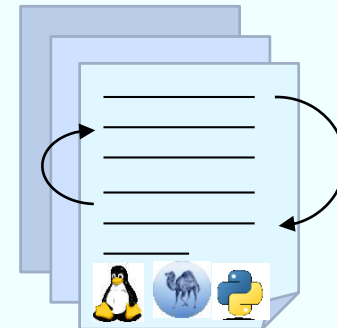
Alternatives:

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

Why should I spend time writing additional configuration files?

Can you run your benchmark every day, using ten different parameterizations?

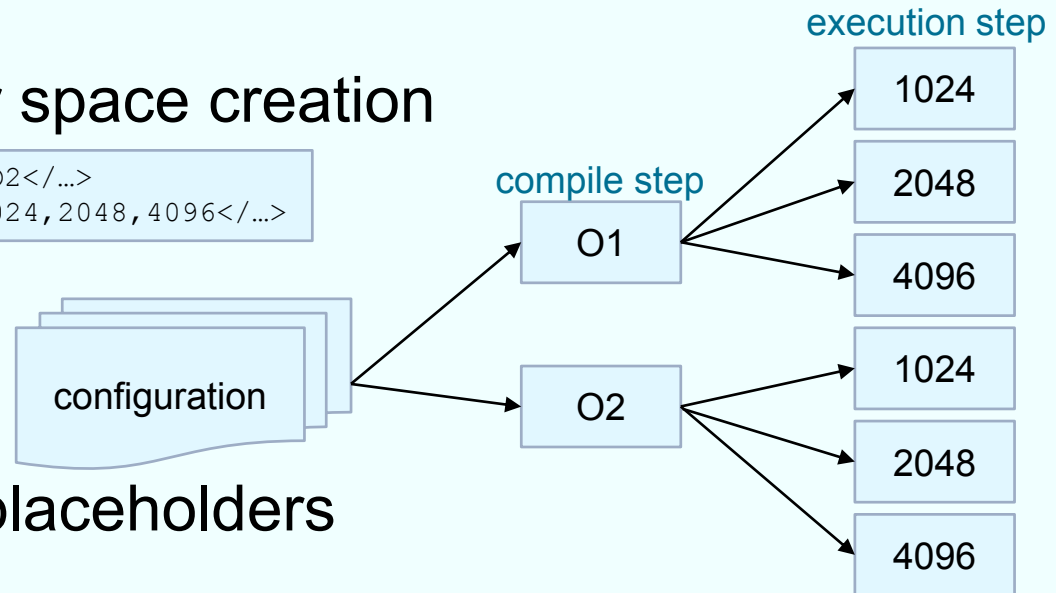
Was the last run for optimization level three? ...



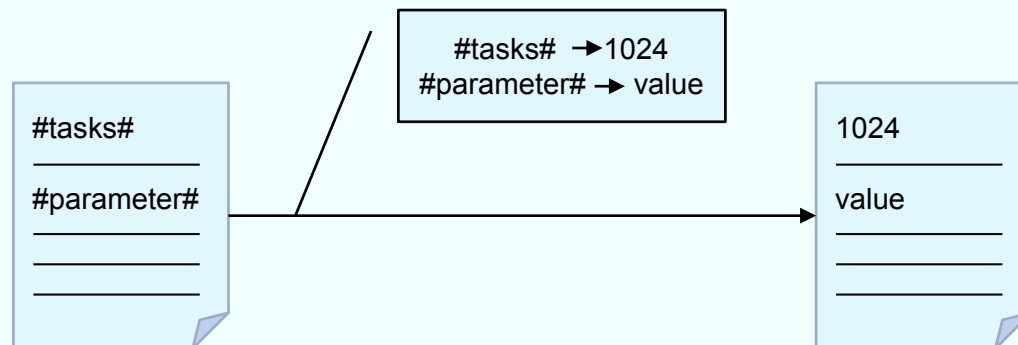
Main concepts

- Easy parameter space creation

```
<parameter name="opt">O1,O2</...>
<parameter name="tasks">1024,2048,4096</...>
```



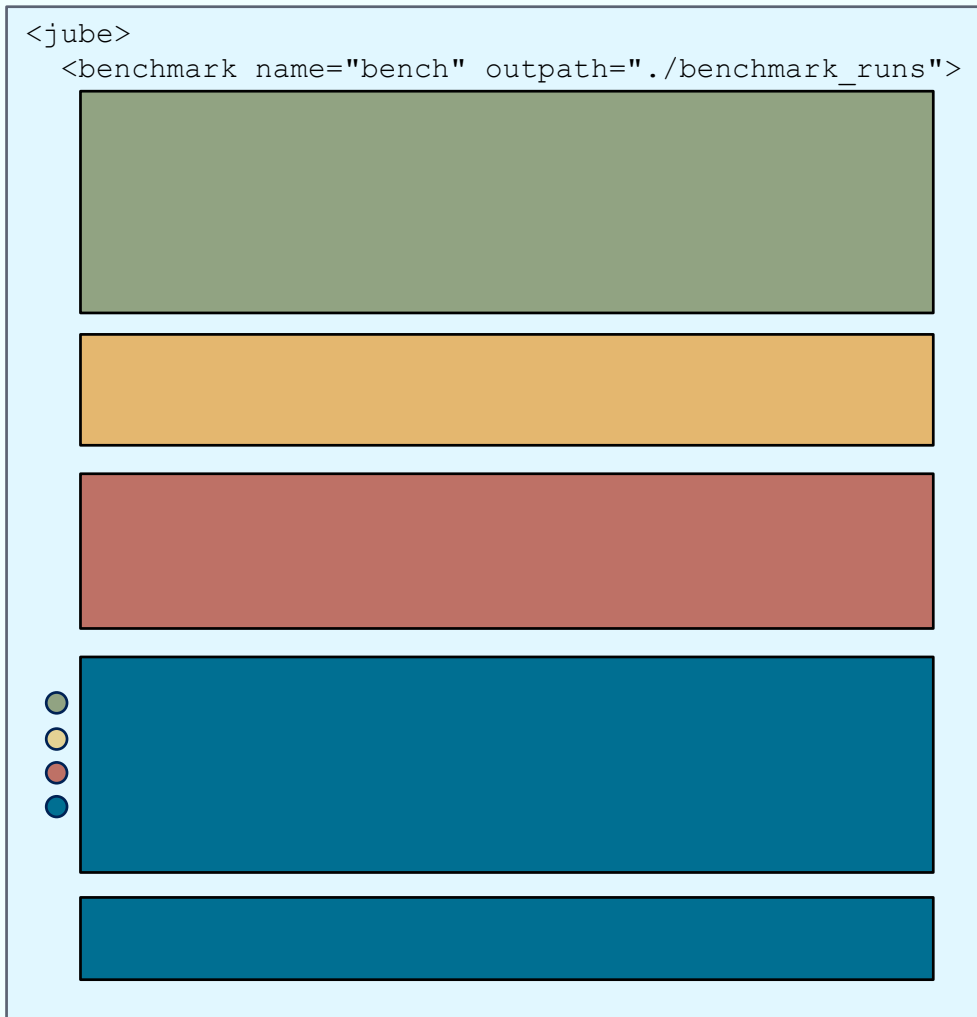
- Substitution of placeholders



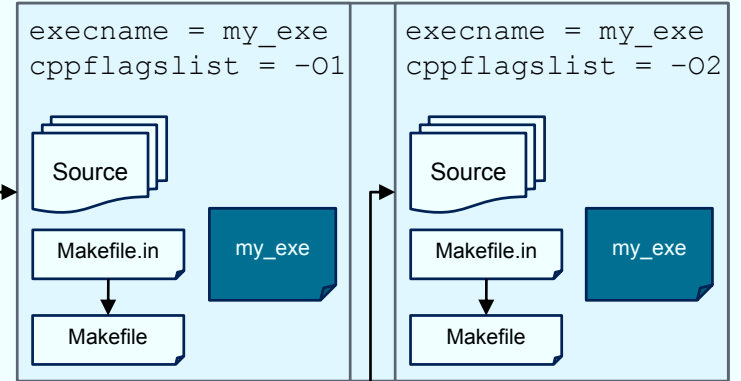
XML input file format

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

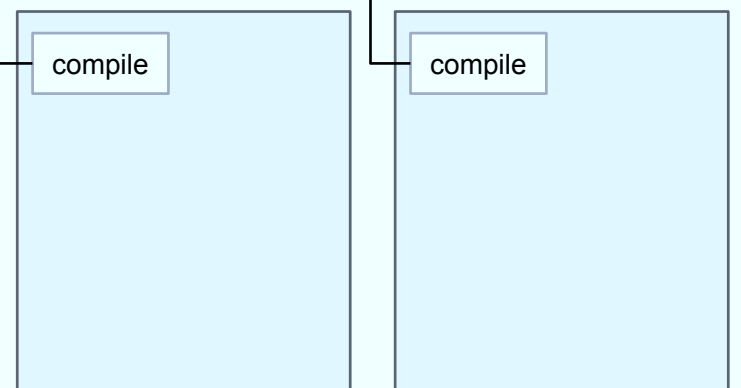
Workflow



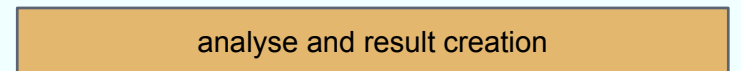
compile



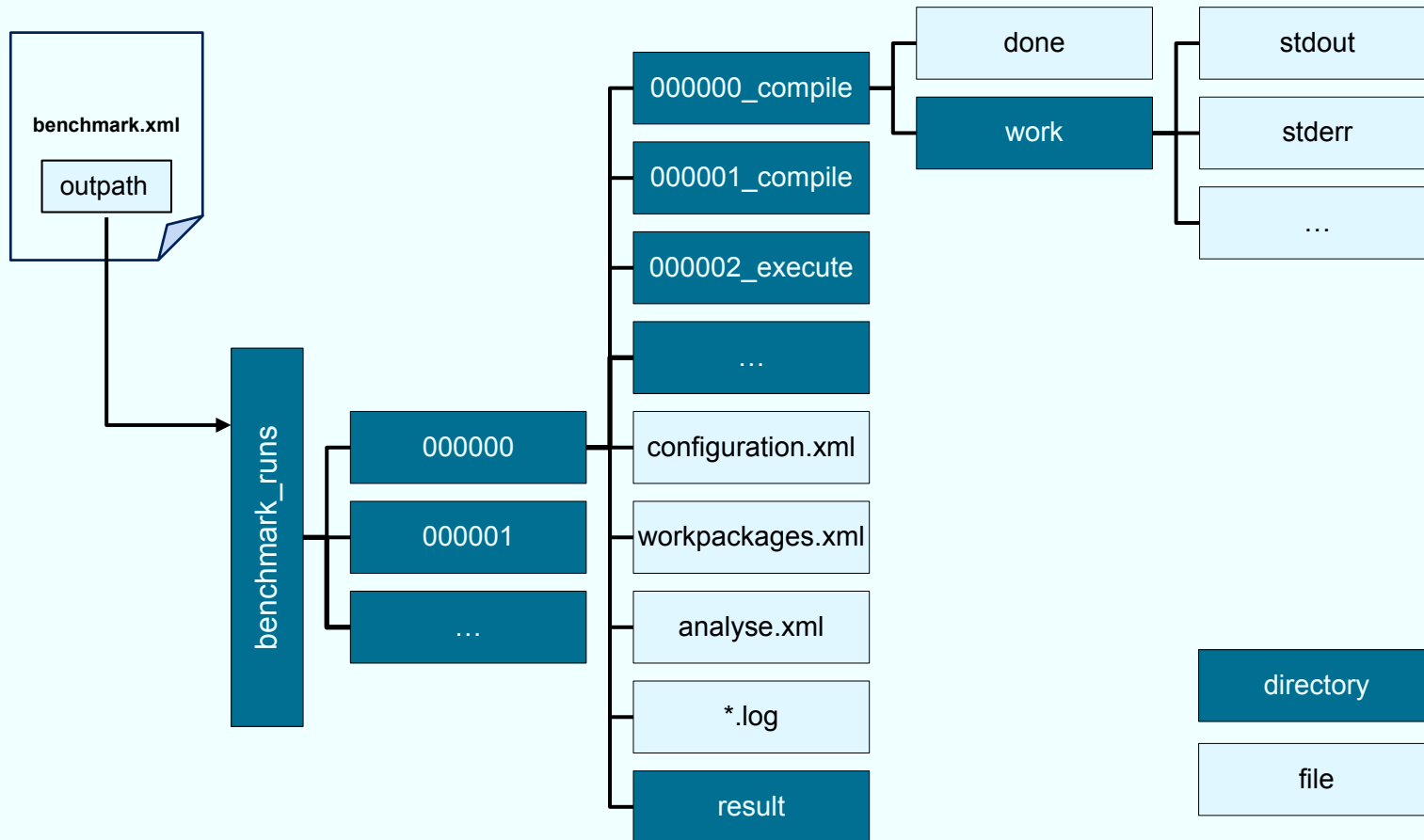
execute



...



Directory structure



Command line access



1. Start a new benchmark run

- `jube run benchmark.xml`

2. Continue an existing benchmark run

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

3. Analyse the benchmark data

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

4. Create and show result representation

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

Help?!



1. Online documentation and tutorial

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

2. Info mode

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

3. Command line accessible glossary

- `jube help <keyword>`

4. Logs

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

5. Debug mode

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

Platform independent benchmarking

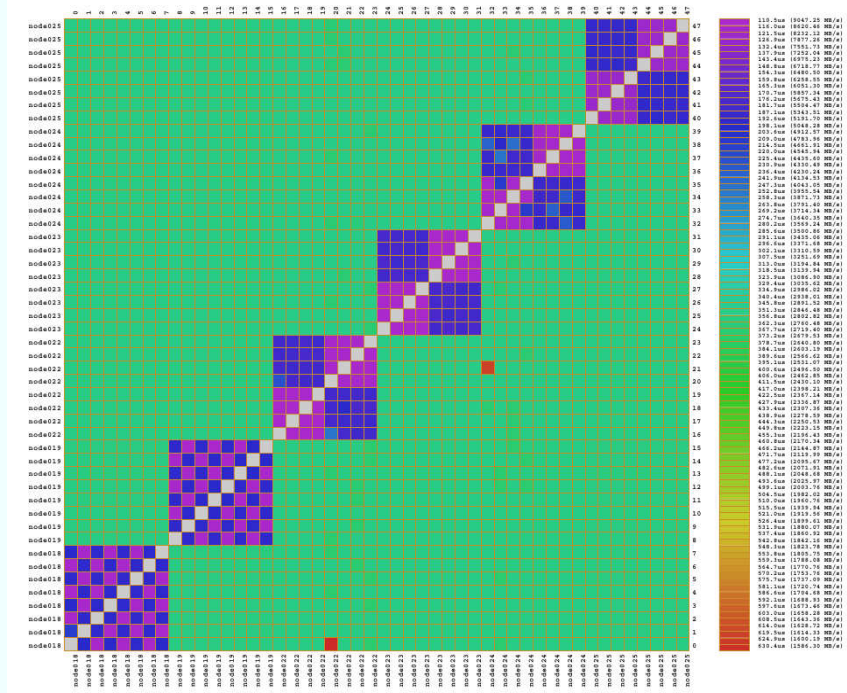


Example JUBE Linktest implementation

```
<?xml version="1.0" encoding="UTF-8"?>
<jube>
  <benchmark name="linktest" outpath="benchmark_runs">
    <comment>A linktest JUBE benchmark</comment>
    ...
  </benchmark>
</jube>
```

Linktest:

- Parallel ping-pong test between all possible MPI connections of a machine
- www.fz-juelich.de/jsc/linktest



Example JUBE Linktest implementation

compile

```

<?xml version="1.0" encoding="UTF-8"?>
<jube>
  <benchmark name="linktest" outpath="benchmark_runs">
    <comment>A linktest JUBE benchmark</comment>

    <!-- ===== compile ===== -->
    <fileset name="source">
      <link>fzjlinktest-1.1p5.tar.gz</link>
      <prepare>tar -xf fzjlinktest-1.1p5.tar.gz</prepare>
    </fileset>

    <step name="compile" export="true">
      <use>source</use>
      <do>module load intel-para</do>
      <do>module load SIONlib</do>
      <do work_dir="fzjlinktest/src">make -f Makefile_LINUX SIONLIB_INST=$$EBROOTSIONLIB</do>
    </step>

    ...
  </benchmark>
</jube>

```

link files to work directory

load modules and run make

Example JUBE Linktest implementation

execute

```

...
<benchmark name="linktest" outpath="benchmark_runs">
  ...
  <!-- ===== execute ===== -->
  <parameterset name="systemParameter" init_with="platform.xml">
    <parameter name="nodes" type="int">1,2,4</parameter>
    <parameter name="executable">mpilinktest</parameter>
    <parameter name="mail">s.luehrs@fz-juelich.de</parameter>
    <parameter name="taskspernode" type="int">28</parameter>
    <parameter name="timelimit">00:15:00</parameter>
    <parameter name="args_exec">-k $msg_size</parameter>
  </parameterset>
  <parameterset name="linktestParameter">
    <parameter name="msg_size" type="int">128,1024,10240</parameter>
  </parameterset>
  <fileset name="binaries">
    <link rel_path_ref="internal"
          directory="compile/fzjlinktest/src">mpilinktest,pingponganalysis</link>
  </fileset>
  <step name="execute" depend="compile">
    <use from="platform.xml">executeset</use>
    <use from="platform.xml">executesub</use>
    <use from="platform.xml">jobfiles</use>
    <use>systemParameter</use>
    <use>binaries</use>
    <use>linktestParameter</use>
    <do done_file="$done_file">$submit $submit_script</do>
  </step>

```

platform specific parameters

linktest specific parameters

create internal file link

submit job

Example JUBE Linktest implementation

postprocess

```
...  
<benchmark name="linktest" outpath="benchmark_runs">  
  ...  
  
  <!-- ===== postprocess ===== -->  
  <step name="postprocess" depend="compile,execute">  
    <use>binaries</use>  
    <do>./pingponganalysis -p execute/pingpong_results_bin.sion</do> ← create report  
  </step>  
  ...
```

Example JUBE Linktest implementation

analyse

```

...
<benchmark name="linktest" outpath="benchmark_runs">
  ...
  <!-- ===== analyse ===== -->
  <patternset name="pattern">
    <pattern name="min_time" unit="us">RESULT: Min Time Stest:\s*$jube_pat_fp</pattern>
    <pattern name="max_time" unit="us">RESULT: Max Time Stest:\s*$jube_pat_fp</pattern>
    <pattern name="avg_time" unit="us">RESULT: Avg Time Stest:\s*$jube_pat_fp</pattern>
  </patternset>

  <analyzer name="analyse">
    <use>pattern</use>
    <analyse step="execute"><file>stdout</file></analyse>
  </analyzer>

  <result>
    <use>analyse</use>
    <table name="result" style="pretty" sort="nodes,msg_size">
      <column>nodes</column>
      <column title="msg_size[kB]">msg_size</column>
      <column format=".3f">min_time</column>
      <column format=".3f">max_time</column>
      <column format=".3f">avg_time</column>
    </table>
  </result>
...

```

regular expressions

files to analyse

create a result table

Example JUBE Linktest implementation

Result:

nodes	msg_size[kB]	min_time[us]	max_time[us]	avg_time[us]
1	128	30.319	35.842	32.858
1	1024	227.849	261.505	244.477
1	10240	230.352	315.825	243.127
2	128	27.339	33.339	30.144
2	1024	174.165	179.529	176.697
2	10240	174.522	180.999	177.264
4	128	26.504	33.816	29.742
4	1024	173.330	181.675	176.864
4	10240	172.814	181.834	176.962

Available JUBE (v. 1) benchmarks

DEISA benchmark suite: (eDeisa, Deisa2)

- GADGET, Ramses, Fenfloss, IFS, NEMO, NAMD, IQCS, CPMD, Quantum_ESPRESSO, GENE, PEPC, BQCD, SU3_Ahiggs

PABS: PRACE application benchmark suite (PRACE-PP/1IP)

- Code_Saturne, CP2K, CPMD, EUTERPE, GADGET, GROMACS, NAMD, NEMO, NS3D, QCD, Quantum_ESPRESSO, WRF, ALYA, AVBP, ELMER, GPAW, HELIUM, OCTOPUS, PEPC, SPECFEM3D, TRIPOLI_4
- Synthetic codes: bonnie, euroben, hpcc, ior, psnap, selfish, skampi, smb, stream2

PUABS: PRACE Unified Application benchmark suite (PRACE-2IP)

- ALYA, CP2K, Code_Saturne, GADGET, GENE, GPAW, GROMACS, NAMD, NEMO, QCD, Quantum_ESPRESSO, SPECFEM3D

Available JUBE (v. 2) benchmarks

- mdtest: Metadata test benchmark
- IOR: (InterleavedOrRandom) I/O benchmark
- HPL: High-Performance Linpack Benchmark
- LinkTest: Parallel MPI PingPong Test

Where to start?

Website (download and tutorials):

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



Versions:

- **1.x** older JUBE release, Perl based
- **2.x** new release, Python based
- **1.x** to **2.x** converter included in JUBE v. 2

Prerequisites:

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

* `argparse` module needed

Installation:

- `python setup.py --user`  **install into** `$HOME/.local`

Development and upcoming features

- Reusing steps
 - E.g. reuse existing binaries
- More flexible parameter creation
 - Create new parameter while running the benchmark
- High-level job submission API
 - Instead of generic <do>

Contact

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Thank you for your attention!