Looking for a needle in a haystack?
Use Eclipse TMF!

The Kalray MPPA® use-case

EclipseCON 2014
Agenda

- About Kalray and MPPA®
- Software trace system
- Use case #1
- Use case #2
- Use case #3
Agenda

- About Kalray and MPPA®
- Software trace system
- Use case #1
- Use case #2
- Use case #3
About Kalray and the MPPA

- **MPPA®**: Multi-Purpose Processing Array
- Best Performance / Energy Ratio Worldwide
- 16 compute clusters
  - of 16+1 cores
- 4 IO Clusters of 4 cores
- 25 GFLOPS/W
- 75 GOPS/W
MPPA®-256 Processor Hierarchical Architecture
256 Processing Engine cores + 32 Resource Management cores

Instruction Level Parallelism
Thread Level Parallelism
Process Level Parallelism
(still) Process Level Parallelism
Agenda

- About Kalray and MPPA®
- Software trace system
- Use case #1
- Use case #2
- Use case #3
Software trace system: details (1/2)

- Static code instrumentation
  - Defined at compile time
  - Output through a dedicated (HW) trace port
- Compatible with LTT-ng
  - Code compiled for x86 generates UST LTT-ng tracepoints
  - Code compiled for MPPA generates MPPA tracepoints
  - Can display both in the same viewer
- MPPA tracepoints can be (de)activated
  - Today: by patching the elf file (within Eclipse)
  - Tomorrow: on the fly, during execution
Software trace system: details (2/2)

```
Name
- hello_world_mppa.mpk
  - hello_world_io (IODR)
    - items (state=INACTIVE)
      - THREAD_PROFILING (state=INACTIVE)
        - locations
          - ..:/../..:/../c/src/..:/../cpkit/score/src/threaddispatch.c:148
        - arguments
          - pm3 (size=4, displayAs=decimal)
          - pm2 (size=4, displayAs=decimal)
          - pm1 (size=4, displayAs=decimal)
          - pm0 (size=4, displayAs=decimal)
          - conf (size=4, displayAs=decimal)
    - TERMINATE_THREAD (state=INACTIVE)
    - SYSCALL_EXIT (state=INACTIVE)
    - SYSCALL_ENTER (state=INACTIVE)
    - START_THREAD (state=INACTIVE)
    - SET_OBJECT (state=INACTIVE)
    - PRINTF (state=INACTIVE)
    - ISR_PROFILING (state=INACTIVE)
    - ISR_HANDLER_out (state=INACTIVE)
    - ISR_HANDLER_in (state=INACTIVE)
    - ISR_DISPATCH_out (state=INACTIVE)
    - ISR_DISPATCH_in (state=INACTIVE)
    - CONTEXT SWITCH (state=INACTIVE)
    - mppa_pci_queue (state=INACTIVE)
    - mppa_jpc (state=INACTIVE)
    - mppa_dnoc (state=INACTIVE)
    - mppa_cnoc (state=INACTIVE)
    - mppa (state=INACTIVE)
  - hello_world_cluster (CLUSTER)
    - nodeos (state=INACTIVE)
    - mppa_jpc (state=INACTIVE)
```
Software trace system: intrusiveness

- Typical intrusiveness
  - 1 cycle when a tracepoint is inactive (may be 0 in the future)
  - 6 cycles for a simple tracepoint
  - around +3 cycles for each additional tracepoint argument

- 80 to 100 bytes of code size overhead.
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- About Kalray and MPPA®
- Software trace system
- **Use case #1**
- Use case #2
- Use case #3
Use case #1: HEVC encoding/decoding

- CES 2014:
  - Kalray demonstrated the first low power Live Ultra HD HEVC (4K) encoder
Use case #1: HEVC encoding/decoding

<table>
<thead>
<tr>
<th>Name</th>
<th>Calls</th>
<th>Accumulated duration</th>
<th>Acc. duration (% vs parent)</th>
<th>Average duration</th>
<th>Min duration</th>
<th>Max duration</th>
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<td>node0.DSU.bin</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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</tr>
</tbody>
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Use case #1: HEVC encoding/decoding

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Use case #2: PCIe application
Use case #2: PCIe application

- PCIe driver
- PCIe
- UST trace
- LTTng trace
- MPPA traces
Use case #2: PCIe application
Agenda

- About Kalray and MPPA®
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Use case #3: SigmaC, a C-based parallel dataflow programming model
Use case #3: Dataflow-aware traces
Use case #3: Dataflow dependency tracking
Conclusion

- For MPPA and its applications, tracing is a key feature
  - Tracing must be done everywhere
    - MPPA clusters, Host kernel and user space
  - Visualizing tools must be easy to use and efficient
    - For debug, verify, profile, ...

- TMF answers to all these needs

- Future plans
  - Controlling & visualizing traces at runtime (from debugger)
  - Visualizing power consumption, CPU load, context-switch and IT metrics...
  - Instruction-level traces (produced by simulator)
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# Kalray Offices

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<tr>
<th>Headquarters  (Paris area)</th>
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<td>Tel: +81 80-4660-2122</td>
<td>Tel: +1 408-475-0550</td>
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<td>email: <a href="mailto:info@kalray.eu">info@kalray.eu</a></td>
<td>email:</td>
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</tbody>
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