Predictive Acceleration of Critical Section Execution with Asymmetric Multi-Core Architectures

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IDEA

Scenario

Naïve Multicore

ACS 2x

ACS 4x

ACS 8x

PACS 2x

PACS 4x

PACS 8x

Non critical region
Critical region
Blocked
Simulation results for Vanilla trace

- Environment: 4-cores, 1-Fast
- Application: 4-threads, 1-critical region

<table>
<thead>
<tr>
<th>Speed-up on Fast core</th>
<th>Wait-cycles on ACS</th>
<th>Wait-cycles on PACS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>2x</td>
<td>300</td>
<td>102</td>
</tr>
<tr>
<td>4x</td>
<td>150</td>
<td>0</td>
</tr>
</tbody>
</table>

Vanilla Trace:

```
#inst:100
#predict<CR, 100>
Lock<CR>
#inst:100
Unlock<CR>
#inst:100
#release<>
#inst:100
```
Simulation results on X264 traces

Global Cycles for One Fast Core

- **Prediction**
- **No Prediction**
Simulation results on X264 traces

Global Cycles for Two Cores

- Prediction
- No Prediction

Speed Up vs. Total Cycles graph showing comparison between prediction and no prediction for two cores.
Simulation results on X264 traces

Global Cycles for Three Cores

- **Prediction**
- **No Prediction**
Simulation results on X264 traces

Global Cycles for Four Cores

- Prediction
- No Prediction
Simulation results on X264 traces

Wait Cycles for One Fast Core

- Prediction
- No Prediction

Speed Up

Wait Cycles
Simulation results on X264 traces

Wait Cycles for Two Fast Cores

- **Prediction**
- **No Prediction**

Wait Cycles vs. Speed Up
Simulation results on X264 traces

Wait Cycles for Three Fast Cores

- Prediction
- No Prediction

The graph shows the comparison between wait cycles with prediction and without prediction as a function of speed up. The speed up is measured on the x-axis, while the wait cycles are on the y-axis.
Simulation results on X264 traces

Wait Cycles for Four Fast Cores

- **Prediction**
- **No Prediction**
Reasons for Anomalies

• Contention generated through false prediction

  WOLF !!
  WOLF !!

• ... or may be a Bug ??
Key Issues to be addressed in Milestone-3

• False predictions
  – Solution?
  – History based credibility prediction

• Late mutex identification
  – Solution?
  – History based mutex prediction