VMI-PL: A Monitoring Language for Virtual Platforms Using Virtual Machine Introspection

By

Florian Westphal, Stefan Axelsson, Christian Neuhaus and Andreas Polze

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VMI-PL: A monitoring language for virtual platforms using virtual machine introspection

Florian Westphal [1,2] Stefan Axelsson [1] Christian Neuhaus [2]
Andreas Polze [2]

[1]Blekinge Institute of Technology
Karlskrona, Sweden

[2]Hasso Plattner Institute
Potsdam, Germany

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Outline

Virtual Machine Introspection (VMI)

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- Semantic gap problem [Chen et al., 2001]

VMI Techniques

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Data-based techniques:

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VMI-PL - Overview I

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- Filters
- Reconfiguration instructions

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- Data probes
- Event probes
- Stream probes
- Filters
- Reconfiguration instructions
- Configuration

VMI-PL - Overview II

```
1  Configuration{
2      <configuration-item>
3  }
4  <event-probe>(<parameters>){
5      <data-probe>(<parameters>)
6      <filter>(<parameters>){
7          <data-probe>(<parameters>)
8      }
9  }
10 <stream-probe>(<parameters>)
```

VMI-PL - Language Constructs I

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Data Probes:

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- `CRWrite(<number>)`

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- `Syscall([<syscall number> | -])`

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- `CaptureNetwork(<mac address>, [<file-path> | <stream-id>])`

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- `CRWrite(<number>)`
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Stream Probes:

- `CaptureNetwork(<mac address>, [<file-path> | <stream-id>])`
- `CaptureKeyboardInput([<file-path> | <stream-id>])`

VMI-PL - Language Constructs II

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Filters:

- `RegisterHasValue(<register>, <value>)`

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Reconfiguration Instructions:

- `Pause`

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Filters:

- `RegisterHasValue(<register>, <value>)`

Reconfiguration Instructions:

- `Pause`
- `Reconfigure(<event probe id>)`

VMI-PL - Demo I

```
1   Configuration{
2       ProcessListHead: 0xc17cdfe0
3       TasksOffset: 440
4       PIDOffset: 520
5       ProcessNameOffset: 744
6       MMStructOffset: 468
7       ExeFileOffset: 444
8       DEntryOffset: 12
9       ParentOffset: 16
10      DNameOffset: 28
11      PGDOffset: 40
12  }
13  CRWrite(3){
14      ReadRegister(CR3, #demo)
15  }
16  ExecuteAt(0xc104f060){
17      ProcessList(PID, NAME, PATH, PGDP, #demo)
18      ReadRegister(CR3, #demo)
19  }
20  CaptureNetwork(00:16:35:AF:94:4B, #demo)
```

VMI-PL - Demo II

Demo

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Evaluation - Measurement Scenarios

- Without monitoring support

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- Monitoring support enabled (*VMI-PL*, *VProbes*)

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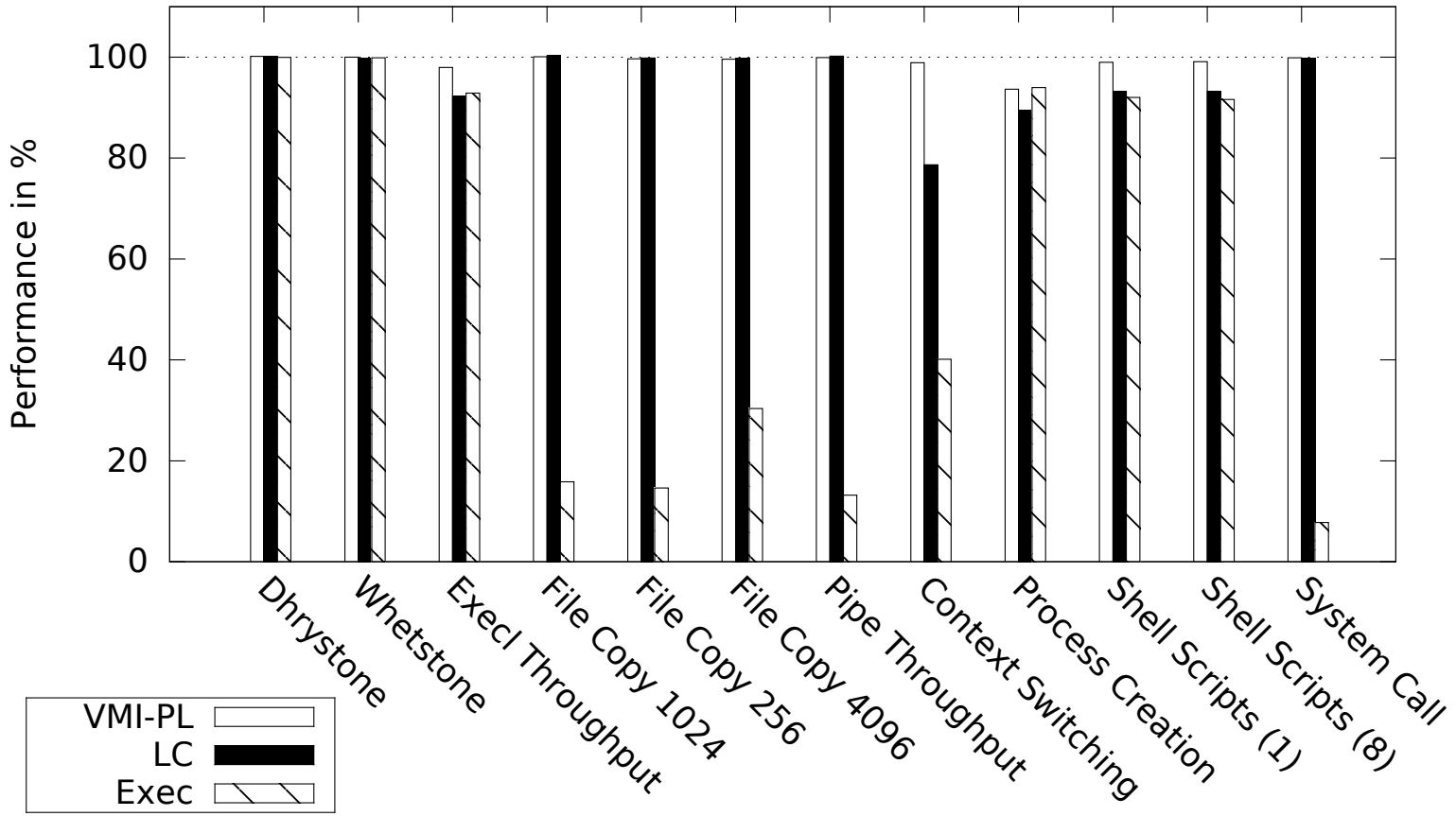
- Monitoring support enabled (*VMI-PL*, *VProbes*)
- Process life cycle monitoring (*LC*)
- Process execution monitoring (*Exec*)

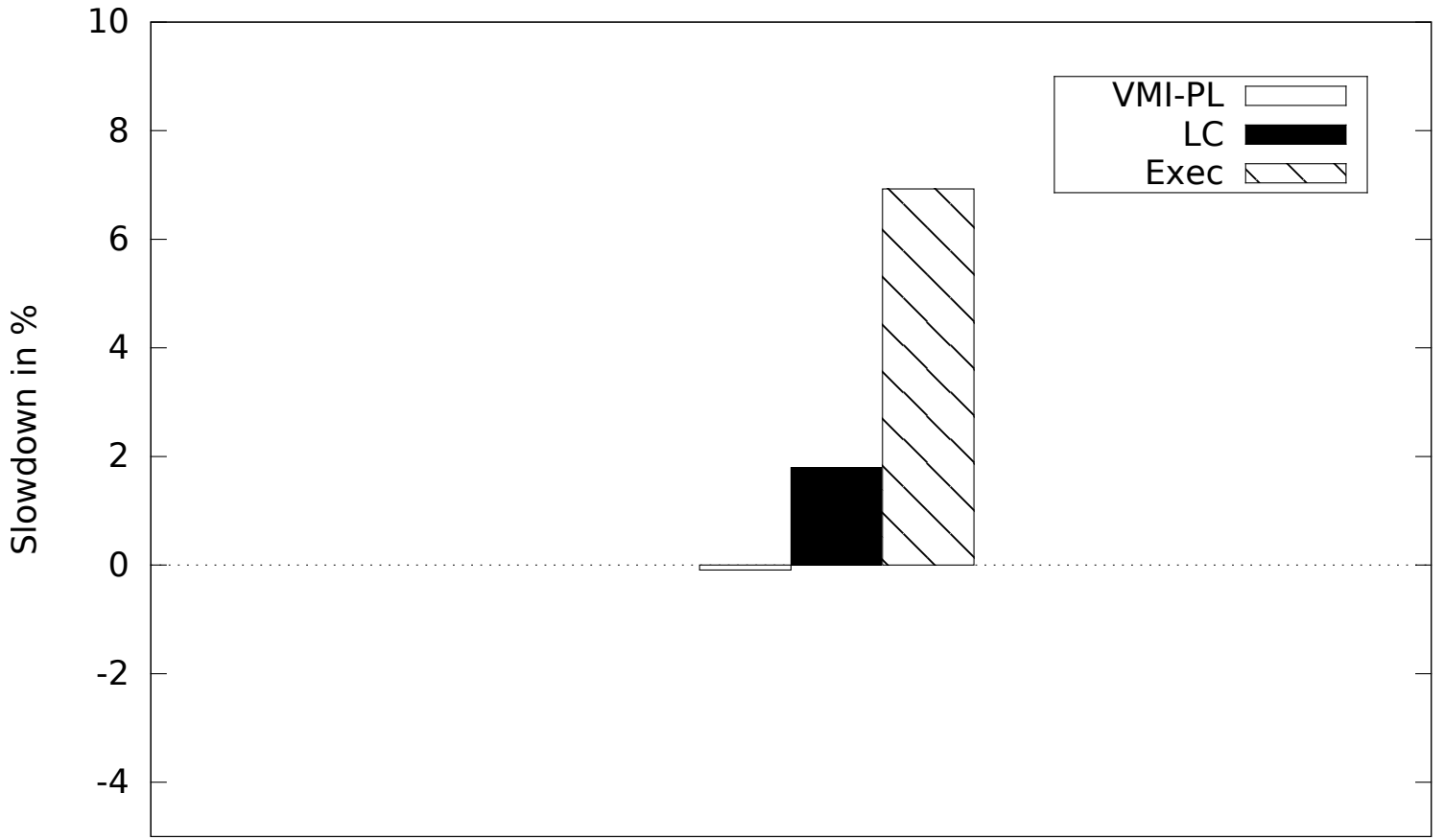
Evaluation - VMI-PL Performance I

UnixBench Benchmark



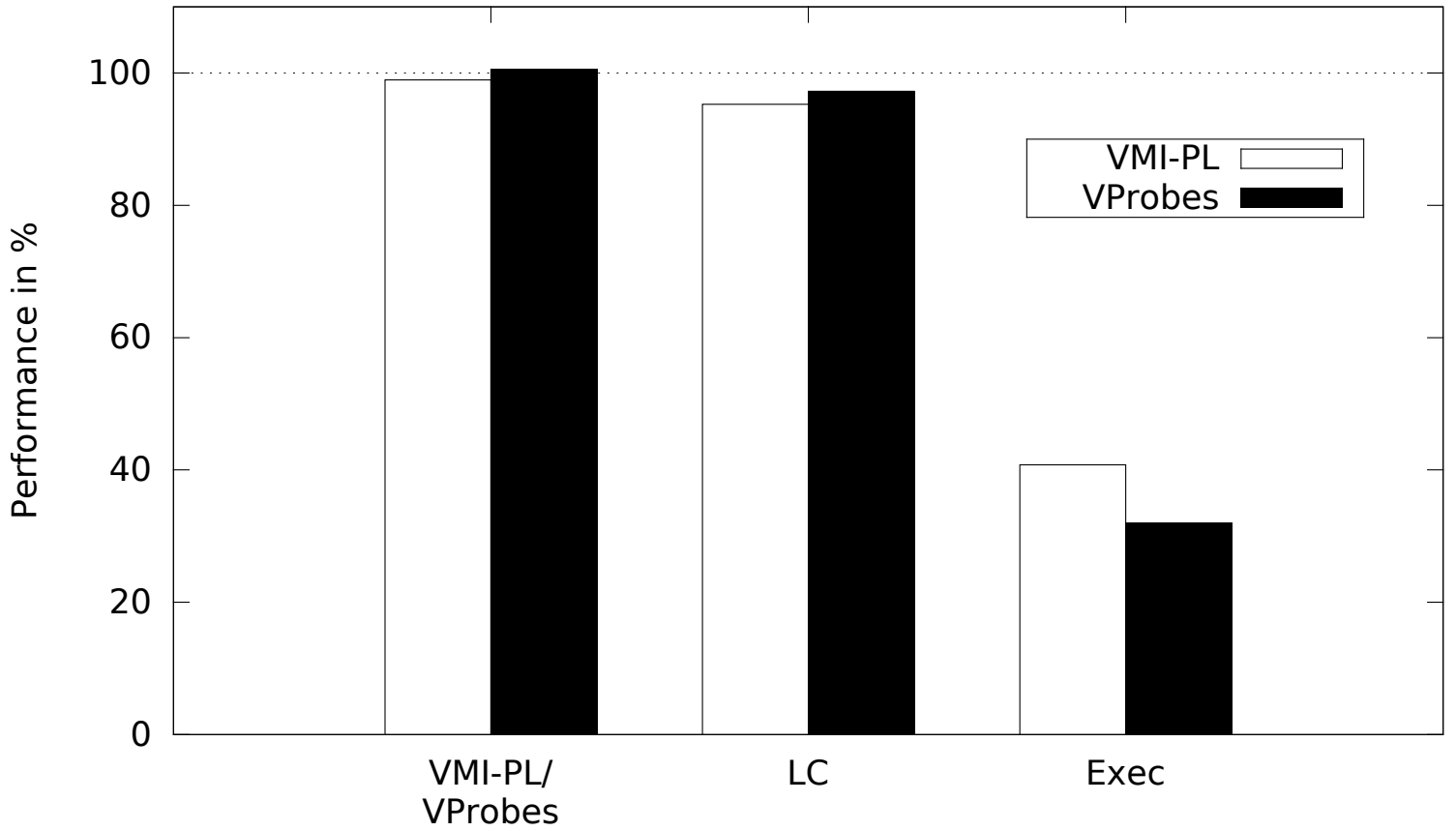
Evaluation - VMI-PL Performance II

VMI-PL Apache Build Slowdown



Evaluation - Comparison

UnixBench Benchmark



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- Classification scheme for VMI techniques
- Simple description language for VMI
  - Support for data, event, and stream-based techniques
  - Support for VM state manipulation
  - Support for retrieving operating system level information
- Prototype for KVM
  - Available at `https://github.com/FlorianWestphal/VMI-PL`

References

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