Monitoring Testbed Experiments with MonEx
Abdulqawi Saif, Alexandre Merlin, Lucas Nussbaum, Ye-Qiong Song

To cite this version:
Abdulqawi Saif, Alexandre Merlin, Lucas Nussbaum, Ye-Qiong Song. Monitoring Testbed Experiments with MonEx. Grid5000-FIT Spring School, SILECS project, INRIA, Apr 2018, Sophia Antipolis, France. hal-01793507

HAL Id: hal-01793507
https://inria.hal.science/hal-01793507
Submitted on 16 May 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
Monitoring Testbed Experiments with \textit{MonEx}

Abdulqawi Saif\textsuperscript{1,2}  Alexandre Merlin\textsuperscript{1}  Lucas Nussbaum\textsuperscript{1}  Ye-Qiong Song\textsuperscript{1}

\textsuperscript{1}Université de Lorraine, CNRS, Inria, LORIA, F-54000 Nancy, France
\textsuperscript{2}Qwant Entreprise, Épinal, France

April 04, 2018
1\textsuperscript{st} \textit{Grid’5000-FIT} School - Sophia Antipolis, France
Context

Computer system experiments

- Diversity of environments
- Variety of contexts
- Many kinds of outputs
Context

**Computer system experiments**

- Diversity of environments
- Variety of contexts
- Many kinds of outputs

Experiments’ data is often collected via:

- Ad-hoc solutions (*e.g.* combining multiple scripts)
- Manual actions (*e.g.* manipulating some missed values)
- Portability and reproducibility aware-less methods
Context

**Computer system experiments**
- Diversity of environments
- Variety of contexts
- Many kinds of outputs

*Experiments’ data is often collected via:*
- Ad-hoc solutions (*e.g. combining multiple scripts*)
- Manual actions (*e.g. manipulating some missed values*)
- Portability and reproducibility aware-less methods

How to overcome these challenges?
Our aim: having an Experiment Monitoring Framework

- Monitoring?, Yes!, but from experimenters perspective
- Easily collection of experiments’ data
- Reducing experimenters effort during experimentation (e.g. facilitating analysis by drawing figures)
- Permit to repeat experiment analysis and comparisons

Open questions:

- What should be targeted by EMFs?
- What needed to build an EMF?
- Do we need to build EMFs from scratch?
Our aim: having an Experiment Monitoring Framework

- Monitoring?, Yes!, but from experimenters perspective
- Easily collection of experiments’ data
- Reducing experimenters effort during experimentation e.g. facilitating analysis by drawing figures
- Permit to repeat experiment analysis and comparisons

Open questions:

- What should be targeted by EMFs?
- What needed to build an EMF?
- Do we need to build EMFs from scratch?
- EMF requirements
- EMF requirements Vs related work
- MonEx EMF design
- Use case experiments of MonEx
- Grid’5000 and MonEx
- Conclusions
**Motivation experiment**

- Target: torrent completion
- 100 peers & one seeder
- Dynamic growth of network → adding a peer after $n$ sec
- Emulated bandwidth of peers
**Motivation experiment**

- Target: torrent completion
- 100 peers & one seeder
- Dynamic growth of network → adding a peer after \( n \) sec
- Emulated bandwidth of peers
EMF requirements

**Motivation experiment**

- Target: torrent completion
- 100 peers & one seeder
- Dynamic growth of network → adding a peer after \( n \) sec
- Emulated bandwidth of peers
EMF requirements

Motivation experiment

- Target: torrent completion
- 100 peers & one seeder
- Dynamic growth of network → adding a peer after $n$ sec
- Emulated bandwidth of peers
EMF requirements

Motivation experiment

- Target: torrent completion
- 100 peers & one seeder
- Dynamic growth of network → adding a peer after $n$ sec
- Emulated bandwidth of peers

Experiment Monitoring Framework (EMF) requirements

- Experiment-focused
- Independent of experiments
- Independent of testbed services and man. frameworks
- Scalable
- Low impact
- Controllable by users
- Real-time monitoring
- Publishable figures
- Archival of experiments data
EMF requirements vs related works

<table>
<thead>
<tr>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
</table>

EMF requirements vs related works

<table>
<thead>
<tr>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Vendetta $\rightarrow$ code modification is necessary
OML $\rightarrow$ def. of measurement points, compilation with OML code,

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

Vendetta → also a management tool

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

**EMF requirements vs related works**

Inf. mon. → typical for 5-10 m measurements

Vendetta → no info. about the measurement frequency

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>+ -</td>
<td>+</td>
<td>+ -</td>
<td>+</td>
</tr>
</tbody>
</table>

EMF requirements vs related works

Inf. mon. → some with heavy nature (threads, …)
Vendetta → parsing events in-place

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>+ -</td>
<td>+</td>
<td>+ -</td>
<td>+</td>
</tr>
<tr>
<td>Low impact</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

EMF requirements vs related works

Testbed-provided services → specific infrastructure

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Scalability</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Low impact</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

**EMF requirements vs related works**

Inf. mon. & Testbed-provided services → only by infrastructure operators

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Low impact</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Controllable</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

### EMF requirements vs related works

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>+ -</td>
<td>+</td>
<td>+ -</td>
<td>+</td>
</tr>
<tr>
<td>Low impact</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Controllable</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Real-time monitoring</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**EMF requirements vs related works**

Inf. mon. & Testbed-provided services $\rightarrow$ RRDtool

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Low impact</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Controllable</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Real-time monitoring</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producing publication-quality figures</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>


## EMF requirements vs related works

<table>
<thead>
<tr>
<th>Feature</th>
<th>Infrastructure monitoring tools e.g. Munin</th>
<th>Testbed-provided measurement services</th>
<th>Vendetta[1]</th>
<th>OML[2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Low impact</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Controllable</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Real-time monitoring</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producing publication-quality figures</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Archival of data</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

**MonEx EMF (Monitoring Experiments)**

Experiments running on a testbed

MonEx: Experiment Monitoring Framework

- Data collectors:
  - Prometheus
  - InfluxDB

MonEx figures creator

- Grafana (Real-time visualization)

Start or end Exp_A

Get Exp_A

Draw Exp_B

An experimenter

<table>
<thead>
<tr>
<th>MonEx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
</tr>
<tr>
<td>Independent of experiments</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
</tr>
<tr>
<td>Scalability</td>
</tr>
<tr>
<td>Low impact</td>
</tr>
<tr>
<td>Easy deployment</td>
</tr>
<tr>
<td>Controllable</td>
</tr>
<tr>
<td>Real-time monitoring</td>
</tr>
<tr>
<td>Producing publication-quality figures</td>
</tr>
<tr>
<td>Archival of data</td>
</tr>
</tbody>
</table>
MonEx EMF (Monitoring Experiments)

Experiments running on a testbed

MonEx: Experiment Monitoring Framework

Data collectors

- Prometheus
  - Up-to 1 sec as a polling interval 😊
  - A lot of data exporters
e.g. node spec, specific app.
  - Fixed-interval polling 😞
- InfluxDB
  - Suitable for pushing data 😊
  - Varied interval measurements 😊

MonEx

- Experiment-focused
- Independent of experiments
- Independent of testbeds services
- Scalability
- Low impact
- Easy deployment
- Controllable
- Real-time monitoring
- Producing publication-quality figures
- Archival of data
**MonEx EMF** *(Monitoring Experiments)*

Experiments running on a testbed

Collects data

Push or Pull

---

**MonEx: Experiment Monitoring Framework**

Data collectors

- Prometheus
  - metrics

- InfluxDB
  - metrics

OR

Grafana

*(Real-time visualization)*

---

An experimenter

---

<table>
<thead>
<tr>
<th>MonEx</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
<td>+</td>
</tr>
<tr>
<td>Independent of experiments</td>
<td>+</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
<td>+</td>
</tr>
<tr>
<td>✓ Scalability</td>
<td>+</td>
</tr>
<tr>
<td>✓ Low impact</td>
<td>+</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>+</td>
</tr>
<tr>
<td>Controllable</td>
<td>+</td>
</tr>
<tr>
<td>✓ Real-time monitoring</td>
<td>+</td>
</tr>
<tr>
<td>Producing publication-quality figures</td>
<td>+</td>
</tr>
<tr>
<td>✓ Archival of data</td>
<td>+</td>
</tr>
</tbody>
</table>
MonEx (Monitoring Experiments)

Experiments running on a testbed

Data collectors
- Prometheus
  - metrics
- InfluxDB
  - metrics

MonEx figures creator

Grafana
(Real-time visualization)

Start or end Exp_A
Get Exp_A
Draw Exp_B

An experimenter

Experiments running on a testbed

Collects data
Push or Pull

- Create figures that respect publication aspects e.g. X-Y figures, Y-figures, multiple Y-figures, stack figures, ...

<table>
<thead>
<tr>
<th>MonEx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-focused</td>
</tr>
<tr>
<td>Independent of experiments</td>
</tr>
<tr>
<td>Independent of testbeds services</td>
</tr>
<tr>
<td>✓ Scalability</td>
</tr>
<tr>
<td>✓ Low impact</td>
</tr>
<tr>
<td>Easy deployment</td>
</tr>
<tr>
<td>Controllable</td>
</tr>
<tr>
<td>✓ Real-time monitoring</td>
</tr>
<tr>
<td>✓ Producing publication-quality figures</td>
</tr>
<tr>
<td>✓ Archival of data</td>
</tr>
</tbody>
</table>
**MonEx EMF** *(Monitoring Experiments)*

**MonEx:** Experiment Monitoring Framework

- **Prometheus**
- **InfluxDB**
- **Grafana** *(Real-time visualization)*

- Handle experiments **by name**
- Specify experiment **time boundaries**
- Allow interacting with experiments **metrics**

<table>
<thead>
<tr>
<th>MonEx Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Experiment-focused</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Independent of experiments</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Independent of testbeds services</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Scalability</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Low impact</td>
<td>✓</td>
</tr>
<tr>
<td>Easy deployment</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Controllable</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Real-time monitoring</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Producing publication-quality figures</td>
<td>✓</td>
</tr>
<tr>
<td>✓ Archival of data</td>
<td>✓</td>
</tr>
</tbody>
</table>
MonEx EMF (Monitoring Experiments)

Experiments running on a testbed

Data collectors

- Prometheus
  - metrics
  - Collects data
  - Push or Pull

- InfluxDB
  - metrics

OR

MonEx server

MonEx figures creator

Grafana
(Real-time visualization)

Start or end Exp_A
Get Exp_A
Draw Exp_B

An experimenter

MonEx

- Experiment-focused
- Independent of experiments
- Independent of testbeds services
- Scalability
- Low impact
- Easy deployment
- Controllable
- Real-time monitoring
- Producing publication-quality figures
- Archival of data
MonEx EMF (Monitoring Experiments)

Experiments running on a testbed

MonEx: Experiment Monitoring Framework

- Prometheus
- InfluxDB
- MonEx server
- MonEx figures creator
- Grafana (Real-time visualization)

Data collectors

Push or Pull

Collects data

Start or end Exp_A

Get Exp_A

Draw Exp_B

An experimenter

Experimenter responsibilities:

1. Make a usual experiment deployment
2. Communicate data with MonEx → Expose it for Prom. or push it into InfluxDB
   → Use or write your own exporter(s)

<table>
<thead>
<tr>
<th>MonEx</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>Experiment-focused</td>
</tr>
<tr>
<td>✓</td>
<td>Independent of experiments</td>
</tr>
<tr>
<td>✓</td>
<td>Independent of testbeds services</td>
</tr>
<tr>
<td>✓</td>
<td>Scalability</td>
</tr>
<tr>
<td>✓</td>
<td>Low impact</td>
</tr>
<tr>
<td>✓</td>
<td>Easy deployment</td>
</tr>
<tr>
<td>✓</td>
<td>Controllable</td>
</tr>
<tr>
<td>✓</td>
<td>Real-time monitoring</td>
</tr>
<tr>
<td>✓</td>
<td>Producing publication-quality figures</td>
</tr>
<tr>
<td>✓</td>
<td>Archival of data</td>
</tr>
</tbody>
</table>
Use case experiments

Three different experiments
- Highlighting MonEx ability to cover EMF requirements
- Performed on the Grid’5000 testbed

First Experiment: many-nodes Bittorrent Download
- One seeder & 100 peers
- Transmission as torrent client
- Distem for emulating slow peers (30KB/s)
- Dedicated VLAN for monitoring traffic
- Prometheus as a MonEx data collector
- We use our own exporter\(^1\) (tens LOC)

First Experiment: workflow
First Experiment: workflow

Make a usual deployment and install *MonEx*
Use case experiments

First Experiment: workflow

```
curl -X POST MonEx_IP:5000/exp/Exp_A
```
First Experiment: workflow

Run experiments’ workload
First Experiment: workflow

curl -X PUT MonEx_IP:5000/exp/Exp_A
Use case experiments

First Experiment: workflow

Bittorrent experiment

MonEx: Experiment Monitoring Framework

Data collectors

Prometheus

metrics

MonEx server

MonEx figures creator

Grafana
(Real-time visualization)

Pull monitoring

./monex-draw -S M_IP:5000 -exp "Exp_A" -metric "completion" -type "duration" -t "Torrent ..." -y "Completion (%)", -x "Time (sec)" -n

Torrent completion of a 500MBytes file over time on a 30 kBytes/s network

Monitoring Testbed Experiments with MonEx
Use case experiments

Second Experiment: metrics diversity

- Metrics: HDD Util & power of a MongoDB cluster
- Three-shard nodes & 80 GB of total data
- Prometheus as a data collector & Grafana for visualization
- Two default node-exporters of Prometheus
  ⇒ node-exporter → nodes spec.
  ⇒ SNMP-exporter → PDUs data

Monitoring Testbed Experiments with MonEx
Third Experiment: time-dependent & heavy-measurement

- Metric: file offsets vs sequences of I/O requests
- High-frequency measurement (thousands of I/O) → pushing data to InfluxDB
- Generate I/O traces using an eBPF tool
- Fio benchmark generates rand. read workload

Third Experiment: results

- Get data
  
curl -X GET 127.1:5000/exp/accessPattern -H "Content-Type: application/json" -d 
"measurement":"ebpf","server":"influx", "database":"monex","type":"sample"’ > d.csv

- Draw-it!
  
./monex-draw -F d.csv -x "I/O request (sample)" -y "Offset (bytes)" -p -r "random"
MonEx leverages several features of Grid’5000:

- Monitoring traffic on separate LAN or another NIC
  - Targeting scalable experiments
    e.g. torrent experiment
- Up-to-date docs and rich API
  e.g. We automated the power experiment thanks to a Grid’5000 wiki page
- Co-operating easily with outside environment
  e.g. placing MonEx outside the testbed
- Deploying customized images with root privileges
  e.g. with built-in node-exporters
Conclusions:

- We defined the minimal requirements of EMFs
- Absence of related work with full coverage of requirements
- We designed MonEx EMF on top of Prometheus and InfluxDB monitoring systems
  - Usable on various experimentations’ context
  - Efficient for analysis repetition and metrics comparisons
  - First step to unifying experiments’ data collection methods
  - Towards experiments portability and reproducibility

Future prospects:

- MonEx maturity?
- Monitoring experiments on federated testbeds

Any Questions?
Conclusions:

- We defined the **minimal requirements of EMFs**
- **Absence** of related work with full coverage of requirements
- We designed **MonEx EMF** on top of Prometheus and InfluxDB monitoring systems
  - Usable on various experimentations’ context
  - Efficient for analysis repetition and metrics comparisons
  - First step to **unifying** experiments’ data collection methods
  - Towards **experiments portability** and reproducibility

Future prospects:

- MonEx maturity?
- Monitoring experiments on federated testbeds

Any Questions?