A coordinated approach towards optimized autoscaling in a container environment

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Outline

- Problem Statement
- System Overview
- Prediction Algorithms
- Metrics
- Evaluation
- Division of work
- Q&A
Problem Statement

- Renewable resources

- Container adoption is happening at a very rapid pace (>81%)

- Around 30% of the virtual system environments are idle
Solution ?? Optimal Vertical Autoscaling.
System Overview

- Metric Collector
- Resource Prediction
- Resource Reallocation
Resource Demand Prediction Algorithms

- Wavelet Transform + Markov Model.
- Autoregressive integrated moving average (ARIMA).
- Idle resources = Total Allocated - Resource Demand
Metrics

- CPU:
  - cpu usage percentage

- Memory:
  - mem usage percentage
  - active_anon
  - active_file
  - heuristics based on inactive_file and inactive_anon
### Inactive vs Active

<table>
<thead>
<tr>
<th>CONTAINER</th>
<th>CPU %</th>
<th>MEM USAGE / LIMIT</th>
<th>MEM %</th>
<th>NET I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLOCK 1/0</td>
<td>0.18%</td>
<td>209.3 MiB / 23.54 GiB</td>
<td>0.57%</td>
<td></td>
</tr>
<tr>
<td>56ce5de29bc</td>
<td>0.08%</td>
<td>224.5 MiB / 23.54 GiB</td>
<td>0.93%</td>
<td></td>
</tr>
<tr>
<td>254 kB / 0 B</td>
<td>0.00%</td>
<td>10.5 MB / 19 MB</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Ba1ff8010581</td>
<td>0.00%</td>
<td>93.8 MiB / 104.9 MiB</td>
<td>88.75%</td>
<td></td>
</tr>
<tr>
<td>800 MB / 3.12 GB</td>
<td>0.00%</td>
<td>1.684 MiB / 7.852 MiB</td>
<td>21.44%</td>
<td></td>
</tr>
<tr>
<td>0 0 / 0 0</td>
<td>0.00%</td>
<td>53.89 MiB / 23.54 GiB</td>
<td>0.22%</td>
<td></td>
</tr>
<tr>
<td>47.8 MB / 2.74 MB</td>
<td>0.00%</td>
<td>1.685 MiB / 23.54 GiB</td>
<td>0.01%</td>
<td></td>
</tr>
<tr>
<td>57476bf547d</td>
<td>0.00%</td>
<td>3.602 MiB / 23.54 GiB</td>
<td>0.01%</td>
<td></td>
</tr>
<tr>
<td>1.24 MB / 0 B</td>
<td>0.00%</td>
<td>3.438 MiB / 23.54 GiB</td>
<td>0.01%</td>
<td></td>
</tr>
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<td>50e0165037e7</td>
<td>0.00%</td>
<td>4.14 MB / 0 B</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

```bash
$ cat memory.stat
```

```bash
inactive_anon 229376
inactive_file 85676032
active_file 6205440
```
Evaluation

- RUBiS +
- Docker
- Google Cloud Platform

- Time To Completion
- Scale
Division of Work

- **Evaluation Platform Setup & Memory scaling Metrics:** Subhendu S Behera

- **Prediction Algorithms:** Pardhakeswar

- **CPU scaling metrics & Benchmarking:** Tapas Mallick
Q&A