Improving Agility and Elasticity in Bare-metal Clouds

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Bare-metal Clouds
An IaaS for high performance and device functionality

OS Deployment Problem
Long wait time sacrifices agility and elasticity

(1) Image Copy
(Tens of minutes)
(2) Reboot from Local Disk
(A few minutes)

Existing Solutions

(1) OS Streaming Deployment [Clerc et al. IPCCC’10]
(2) Conventional VMMs [VMware’01, Xen’03, KVM’07]

OS Deployment with a Special-purpose VMM
(1) Streaming deployment with VMM
(2) Seamless de-virtualization

Evaluation (Deploying 32GB Linux image)

<table>
<thead>
<tr>
<th>OS-Startup Time</th>
<th>Proposed</th>
<th>NFSRoot</th>
<th>KVM/NFS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Copy</td>
<td>370</td>
<td>145</td>
<td>29</td>
</tr>
<tr>
<td>Proposed</td>
<td>5+58</td>
<td>30+42</td>
<td></td>
</tr>
</tbody>
</table>

Quick start up (8.6 times faster)

Cassandra Throughput

Eventual bare-metal performance

Seamless de-virt.

OS-transparent

Performance / Device functionality

Continuous virtualization overhead

Streaming deployment with VMM

Exposed physical interface

Device interface-level I/O mediation

I/O interpretation to understand I/O context

I/O redirection to perform network booting

I/O multiplexing to perform background install

Device Driver

VMM

OS

Device Mediator

VMM

OS

No virtual interface

MPICH Latency (10-nodes cluster)

Almost bare-metal performance

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