Is Virtualization Killing SSI Research?

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Kerrighed
Linux clusters made easy

PARIS
Project Team

XtreemOS
Enabling Linux for the Grid

IRISA
Rennes

INRIA
Outline

Context
- Virtualization / SSI

Combining Virtualization and SSI

Conclusion
- Lessons learnt
- Perspectives
Virtualization Technologies

virtualized machines running on the compute node

compute node
SSI Technologies

virtualized an SMP machine running on compute nodes

SSI

compute nodes
Our approach

Make several combinations between SSI and Container, typeI and typeII virtualization
Combining Container and SSI
Container on the top of SSI

Allow containers to get advantage of the global ressources provided by the SSI
Combining Virtualization and SSI

Type II - Virtualization upon SSI 1/2

Allow VMs to get advantage of the global resources provided by the SSI
Combining Virtualization and SSI
SSI upon Typell-Virtualization 2/2

Allow the SSI to be run on the top of several hardware architecture
Combining Virtualization and SSI
Three layers of flexibilities

Possibility to run a windows application on a linux SSI cluster running upon MACOS X systems
Combining Virtualization and SSI
TypeI-Virtualization upon SSI 1/2

Part1 of SSI:
hide the distributed aspect of the cluster
Does ScaleMP should be a SSI Part1?

Part2 of SSI:
give tools like checkpoint, migration...
Combining Virtualization and SSI
SSI upon TypeI-Virtualization 2/2

Same as already seen
Containers on top of single system image clusters

The SSI system combines all the advantages enabled by containers on a real SMP machine in a cluster environment
Virtual Machines on top of SSI clusters

- Virtualization solves application portability issues
- Example:
  - Possibility to run an application developed for process technology A and OS B on top of computers running SSI OS based on OS C and developed for architecture processor D.
SSI on top of VMs

- VM migration and suspend functionalities provide:
  - Flexible, simple and "On Demand" resource allocation mechanisms for the applications
  - Transparent adaptation mechanisms in case of hardware changes (for instance, node additions / removals).
Lessons Learnt 4/4

➔ Virtualization and SSI complement each other

➔ SSI abstracts resources
➔ Virtualization adds another level of hardware flexibility
Conclusion

- Performance evaluation:
- Work in progress

- Combining VM/SSI setup:
  - Very attractive
  - Installation and use are quite simple (evaluated with TypeII)

- Migrate an SSI cluster from Rennes to Sophia
References

Experimentations to do
SSI upon type1-virtualization

→ Kerrighed upon XEN
  • Does it work?
  • LiveMigration?
  • Performance?

Advantages:
+ Isolation
+ server consolidation
+ Suspend/restart
+ Application portability

Disadvantage:
- VM portability
Experimentations to do SSI upon typell-virtualization

→ Performance evaluations
Make comparison between clusters with:
  → Windows OS / VM / Kerrighed / Apps
  → Linux / VM / Kerrighed / Apps
  → Kerrighed / Apps

VM:
  - Vmware (virtualization only)
  - QEMU (emulation)

Apps:
  - MrBayes in MPI (CPU intensive)
  - "make" kernel
  - Apache
Experimentations to do
SSI upon type II with multi-host OS

→ Kerrighed upon Windows and Linux clusters
→ Performance evaluations

Advantages:
+ Application portability
+ Isolation
+ server consolidation
+ Suspend/restart
+ VM portability
Experimentations to do typeII upon SSI

- VMs upon de Kerrighed
  - LiveMigration OK?
  - Kerrighed_migration OK?
- What is the most interesting?

Advantages:
+ Isolation
+ server consolidation
+ Suspend/restart
+ Application portability

Disadvantages:
- VM portability
Experimentations to do
Three layers of flexibilities

It seems that it's not possible to run VMware upon Vmware

Why this limitation?

It seems it is possible to run QEMU upon VMware
Internship subject

➔ Automatic deployment VM/Kerrighed

➔ Extension of the work of Nicolas Aupetit
  ➔ system able to deploy VMs upon grid5000
  ➔ system able deploy Kerrighed upon nodes (work of Nicolas Aupetit)

➔ For instance:
  ➔ start_kerrighed -vm Vmware -nbvm 6 -nbnode 3
Experimentations

First results
Combining container and SSI
SSI on the top of Container 2/2

Architecture irrelevant:
The same kernel is shared
between all containers
(they have not their own kernel)
Combining Virtualization and SSI Isolation of Two Distinct SSIs

Possibility to run several SSIs on the same cluster.
Future Works 1/2

 › Extend the Goldberg's classification to present in a uniform way:
   › The hardware,
   › The emulated hardware,
   › The OS and SSI,
   › The different kinds of virtualization techniques,
   › The containers.
Future Works 2/2

➔ Investigate SSI scheduler and hypervisor scheduler:
  ➔ does the SSI scheduler directly manage VMs?

➔ Extend to the Grid: interests of such hybrid approaches (VM/SSI) in XtreemOS

➔ What about ScaleMP?
VMs vs SSI

Is virtualization killing system image research?

What's about combining both approaches?