BtrPlace
A Flexible Consolidation Manager for Highly Available Applications

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N-Tiers applications

Users are looking for:
• performance
• reliability
• isolation
• ...

Where to place the VMs?
Datacenter management

Operators are looking for:
- manageability
- security
- efficient resource usage
- ...

Diagram showing network topology with giga-ethernet and fiber channel links.
Placing VMs?

- Little flexibility for the application administrator
- Solutions are provider specific
- Current algorithms are not extensible by design
Challenges in designing a flexible consolidation manager

Issues:

- Numerous specific placement constraints
- Conflicting placement constraints
- Constraints expressed by non-expert users
- Scalability:
  - Thousands of applications/VMs/Hosts
BtrPlace

- Configuration scripts:
  - Application manager
  - Datacenter administrator
- Extensible library of high-level placement constraints
- VM core model
  - Memory and CPU consumption
  - Migration, instantiation, shutdown costs
- Scalable and modular constraint solver
  - VM core model + script constraints
Configuration scripts

```plaintext
define namespace datacenter;

$ servers = @N[1..12];
$racks = { @ N[1..4], @ N[5..8], @ N[9..12] };
export $ racks to *;

namespace sysadmin;
import datacenter;
import client.*;

vmBtrplace: large;
fence(vmBtrplace, @ N1);
lonely(vmBtrplace);
ban($clients, @ N 5);

```
Data center administration

The reconfiguration plan:

- 0:00 to 0:02: relocate(VM2, N2)
- 0:00 to 0:04: relocate(VM6, N2)
- 0:02 to 0:05: relocate(VM4, N1)
- 0:04 to 0:08: shutdown(N4)
- 0:05 to 0:06: allocate(VM1, 'cpu', 3)

spread({VM3, VM2});
preserve({VM1}, 'ucpu', 3);
offline(@N4);
BtrPlace in practice

- Model Merging
  - user scripts
- Plan
  - CSP
  - CP solver
- High-level Constraints Library
- Monitoring
  - current configuration
  - statistics
- Execution
  - reconfiguration plan
  - actions

Datacenter

VM1 VM2 VM3 VM4 VM5
VMM Server N1 VMM Server N2 VMM Server N3
Scalability

- Simulated datacenter:
  - 5,000 servers
  - up to 1,700 3-tiers appliances (30,000 VMs)
  - a resource usage up to 73%

- 2 scenarios:
  - Load Increase (LI): 10% of the applications ask for 30% more uCPU
  - Network Rewiring (NR): 5% of the servers are turned off for a network maintenance
Performance evaluation

Solving duration

Reconfiguration duration
Partitioning

- the number of nodes to solve sub-RPs limits the scalability
- no impact on the quality of the reconfiguration plans
- too small partitions may alter the solvability
About BtrPlace

Online demo :
http://btrp.inria.fr/sandbox

Publications :
http://sites.google.com/site/hermenierfabien/publications