Virtualization on Grid’5000

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Grid’5000

- French infrastructure for research on large-scale distributed systems
- Funding: INRIA (ADT Aladdin-G5K), CNRS, regions and universities
- 9 sites, 1500 machines, 6000 cores
- Highly reconfigurable, controllable and monitorable
  Experiments on all layers: network, OS, middleware, applications
Virtualization on Grid’5000

- Used for most of the services required to run the platform
- 32 dom0, 149 domU managed by the support staff
- Currently migrating to using Puppet
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- Not used by default on the user nodes
  - Not the right thing for experiments
    Resource sharing; overhead of the virtualization layer
  - Power to the users: can re-install nodes using KaDeploy
    RIaaS: Real Infrastructure as a Service?
KaDeploy

http://kadeploy3.gforge.inria.fr/

• Fast and scalable deployment tool
  Re-install 300 machines in 10 minutes

• Underlying technologies : PXE, efficient broadcast, Grub

• Usually used to deploy Linux systems

• Can also deploy FreeBSD, Xen, …
  *dd*-based images, *chainloading* of disk partition to boot
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  Similar to a cloud/virtualization provisioning tool
  but works on real machines!

Choose your virtualization solution and deploy it on Grid’5000
Supporting Virtualization Experiments

- System images
- Network
Supporting Virtualization Experiments: Images

- Pre-built images for Xen
  - Debian Etch – Xen 3.0.3
  - Debian Lenny – Xen 3.2

Work in progress:
- Newer images
- More documentation of the image creation process
- Help users create their own images

Open question: broadcast of domU environments to nodes
- Chain-based (Kastafior)?
- P2P-based (BitTorrent)?
- GridFTP-like?
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Grid’5000 uses routing (level 3) between sites

Routerable (inside Grid’5000) IP addresses for virtual machines

/14 (262142 addresses) per site
Example: Lille – 10.136.0.0 - 10.139.255.255
Reservation of virtual addresses

- Several users might use virtualization simultaneously
  ⇒ Need to avoid conflicts

- Need reservation scheme for both IP and MAC addresses

- Several co-existing solutions (on different /16 IP ranges):
  - *Fingers crossing* : do not use any reservation tool
    User hopes that nobody else is using the addresses
  - In-house address reservation solution
Grid’5000 Address reservation solution

- Work by Cyril Constantin then Philippe Robert
- Uses DHCP to allocate IP addresses
- `xenlist` script on dom0:
  - Gives allocated IP
  - Configures DNS
Address reservation solution : shortcomings

- Random allocation (the DHCP way)
- Cannot restrict to IP ranges (required by clouds)
- MAC of domU depends on the node
  Corner cases during experiments with migration
- Xen-specific
- Doesn’t integrate with cloud solutions
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Ongoing discussions to improve the situation
Ideas & feedback welcomed!
Network virtualization

Goal: ensure isolation between experiments
- Run your own DHCP, malicious code, etc
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Inside a Grid’5000 site: KaVLAN
- Dynamic configuration of VLANs on switches and routers
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Between Grid’5000 sites: KaVLAN + QinQ

- IEEE 802.1QinQ to propagate VLANs over the inter-site network
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Both are eagerly waiting for beta-testers!
Other possible uses of virtualization on Grid’5000
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(Due to lack of resources, most of those are not being pursued currently)
Increase the number of available nodes

- Virtualization not suitable for general use
- But during exp. preparation, no need to run on real hardware
- Could help prepare experiments on a large number of nodes without being too disruptive
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But :
- Open research question (projects : Hipcal/Hipernet, Entropy)
- Still high availability of resources, not really needed
Transform Grid’5000 into Cloud infrastructure

- Cloud’5000 : virtualization everywhere
- "Grid" no longer hype, "Cloud" is
- Easier to sell Grid’5000 that way
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But :

- Not the Right Thing to do
  Access to real hardware is invaluable
  .. And required for virtualization research!
- Some (old) nodes do not support hardware virtualization
Provide a Cloud API on Grid’5000

OK, but which one?

We already have the Grid’5000 API:
https://api.grid5000.fr/

Different kind of reservations
Job scheduling, walltime specified at beginning of job

Possible solution: build cloud API over Grid’5000 API
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Provide virtual machines for specific experiments

- Some experiments require infrastructure
- Large scale campaigns of best-effort jobs
- Idea: provide virtual machines to users

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But:
- Not clear if most needs can be satisfied using VM
  Specific needs: fast storage, etc
- So far allocated manually when needed
  Not clear if infrastructure to automate that necessary
Conclusion

- Grid’5000: great platform for research on virtualization
- Provides direct access to hardware
- Possible to work, at a large scale, on:
  - Comparative studies between virtualisation solutions
  - Various hypervisor improvements (inter-site migrations)
  - Developing and deploying clouds on hundreds of nodes
Discussion

- Which platform are you using for your virtualization studies?
- Are you using Grid’5000? Did it work for your virtualization work?
- Not using it? Why? Would it be useful for you? What’s missing?