Optimization of Electronic Design Automation (EDA) Infrastructure with UniCloud and Virtualization

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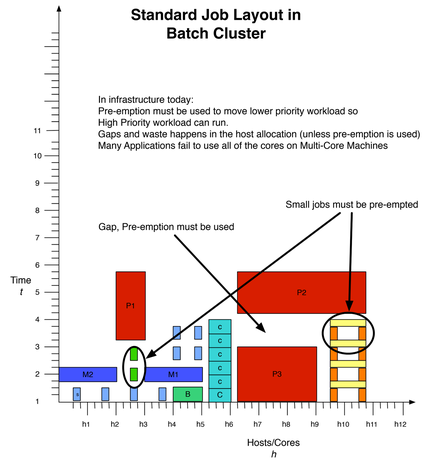
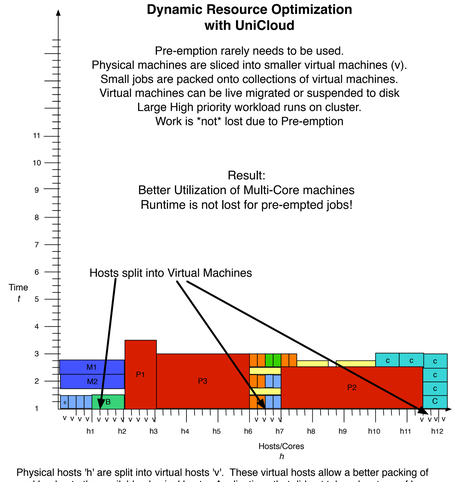
- **EDA environments are concerned with optimizing License usage and overall cluster throughput.**
- **Current schedulers cannot optimize license usage without pre-emption and re-running workload from the beginning.**
- **UniCloud + Virtualization can live migrate or suspend to disk entire machines running applications.**
- **Applications are not killed so very little CPU cycles are wasted.**
- **Virtualization overhead is in the range of 2-4%.**
- **Project and Customer specific virtual clusters can be created on demand to ensure compute resources meet project deadlines and goals.**
- **Virtualization allows for better use of multi and many core machines by running multiple applications in small virtual machines.**
- **UniCloud + Virtualization can 'pack' more applications onto the existing compute resources ensuring maximum usage of software licenses and cpu hardware.**
- **Running applications in Virtual Machines provides *Mobility* for the entire application. Similar to a checkpoint but far more robust.**

Standard Job Layout in Batch Cluster



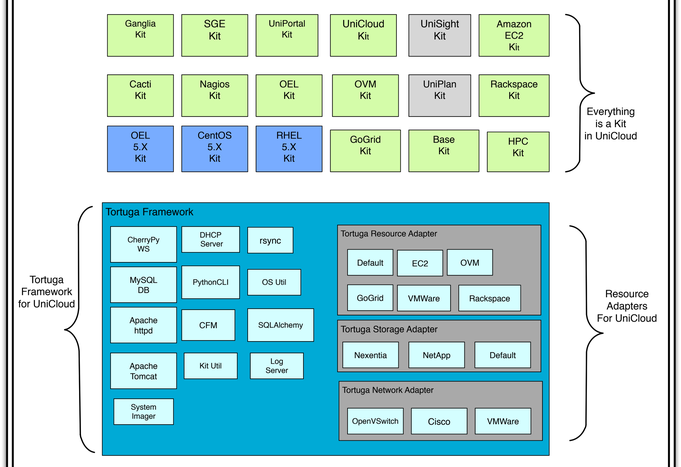
Pre-empted jobs are 'run from the beginning' so computation is lost. Suspending jobs rarely works since high priority jobs need the memory on the machine. Multi-core machines are under utilized.

Dynamic Resource Optimization with UniCloud

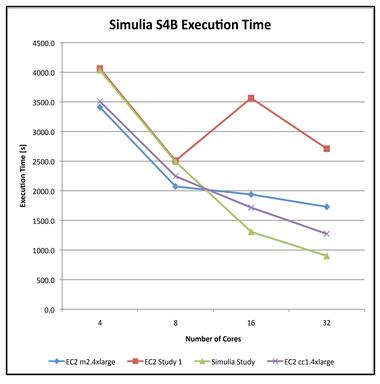


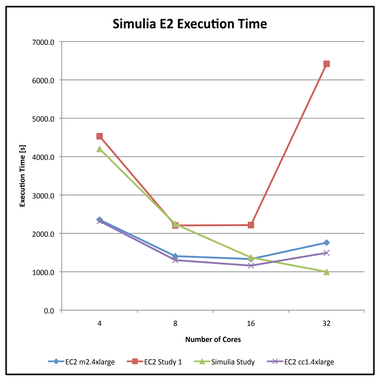
Physical hosts 'h' are split into virtual hosts 'v'. These virtual hosts allow a better packing of workload onto the available physical hosts. Applications that did not take advantage of larger memory and cores on modern machines can be split into multiple Virtual Machines and smaller jobs run on those machines. All those cores you bought can now be used!!

UniCloud 2.1 Architecture



Simulia Benchmark Amazon EC2





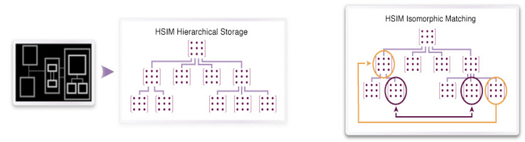
Compute Node Type	CPU	CPU Cores	Memory [GB]	Swap [GB]	Interconnect
EC2 - m2.4xlarge	Intel Xeon X5550 @ 2.67GHz, 8MB Cache	8	68.4	0	1Gbps Ethernet
EC2 - cc1.4xlarge	Intel Xeon X5570 @ 2.93GHz, 8MB Cache	16	22	10	10Gbps Ethernet
Simulia Intel Xeon Woodcrest	Intel Xeon X5160 @ 3.0 GHz, 4MB Cache	4	16	Unknown	Infiniband

Benchmark Results for Common EDA Applications In Virtual Machines

HSIM

Application	Bare Metal	VM (CPU Affinity)	Slowdown	VM (No Affinity)	Slowdown
Hsim					
1 job	28.78	28.21	-2.02%	28.4	-1.34%
2 jobs	28.48	28.95	1.62%	28.32	-0.56%
4 jobs	29.1	29.11	0.03%	31.03	6.22%
6 jobs	31.78	32.31	1.64%	32.19	1.27%
8 jobs	34.31	34.67	1.04%	34.99	1.94%

Synopsys® HSIM: Hierarchical Full-chip Circuit Simulation and Analysis



Design Compiler

Bare Metal	VM	Slowdown
1172	1126	-4.09%

PrimeTime

Golden Timing SignOff Solution and Environment

Bare Metal	VM	Slowdown
5663	5774	1.92%

MAGMA

Bare Metal	VM	Slowdown
53,263	53,670	0.76%

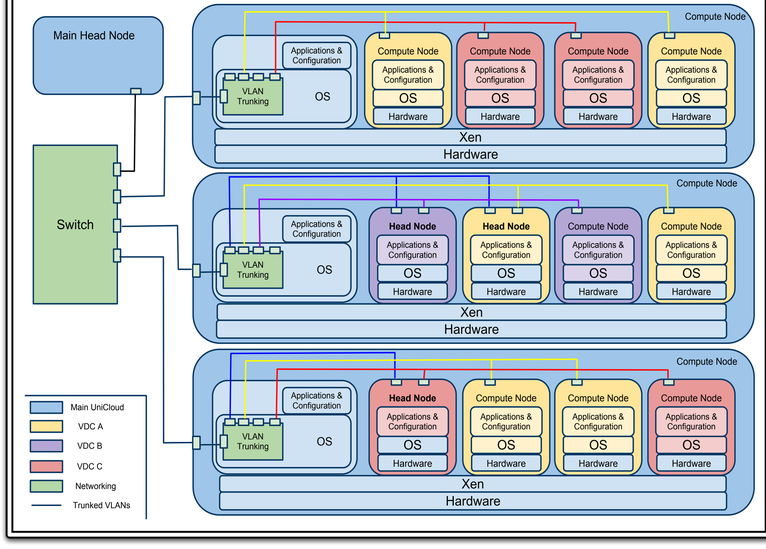
Virtuoso UltraSim Full-Chip Simulator

Bare Metal	VM	Slowdown
151	153	1.31%

Capacity, accuracy and speed in FastSPICE simulation

A Negative slow down indicates that the application ran slightly faster in a virtual machine than on physical hardware.

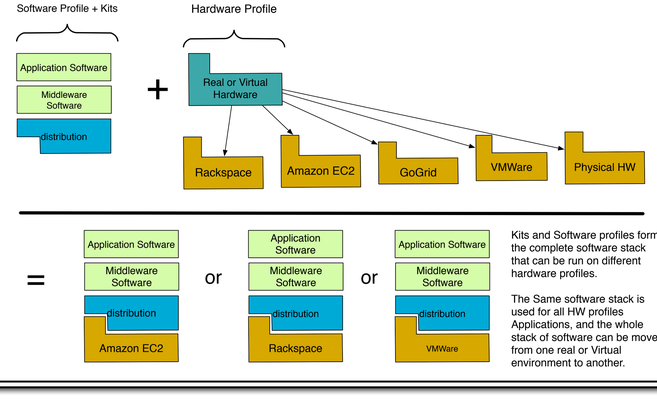
EDA Cluster Configuration with Virtualization



- UniCloud Provides a framework for packaging software into 'Kits'.
- Kits can be automatically installed and configured onto physical nodes
- virtual nodes and even cloud instances in public cloud infrastructures.
- Kits are 'Meta-RPMs' and contain the software, meta-data describing the software,
- scripts for installing and configuring the software.

- UniCloud automates many typical installation and configuration tasks in a cluster environment including Storage, Networking and Node configuration.
- UniCloud can be used to create Virtual Data Centers on the same physical compute infrastructure.
- Each VDC is isolated from the other using VLANs.
- Users can request their own cluster environment and UniCloud can automatically create that environment.

Kits, Software & Hardware Profiles



Kits and Software profiles form the complete software stack that can be run on different hardware profiles.

The Same software stack is used for all HW profiles Applications, and the whole stack of software can be moved from one real or Virtual environment to another.

Application Packaging into Kits