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# Sky Computing: The Future of cloud computing

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**Abstract-Sometimes, a single cloud isn't enough. Sometimes, you need the whole sky. That's why a number of researchers are developing tools to federate clouds, an architectural concept dubbed "sky computing" .The Sky Computing model allows the creation of large scale infrastructure using resources from multiple cloud providers. These infrastructures are able to run embarrassingly parallel computation with high performance.**

**Developing a way to join several cloud infrastructures together into one massive cloud would be especially useful to academic researchers who utilize open large-scale compute resources, like the Open Science Grid or the European Grid Infrastructure, together with open source cloud computing platforms such as Nimbus, in order to create their own private clouds with rather than say Amazon's EC2.**

**In this paper we talked about sky computing and differences between grid, cloud and sky computing. and various mechanics that might lead to sky computing over multiple clouds, and then that idea was picked up by many projects.**

**Keywords: grid computing, dynamic, sky computing architecture**

## 1. INTRODUCTION

The initial applications were recently built following different distributed computing approaches: (1) a Service Oriented Architecture (SOA) based training system, (2) a modular real-time data analyzer, and (3) a cluster-based simulator. But Cloud technologies are currently designed mainly for developing new applications. "Early Cloud providers were focused on developers and technology start-ups when they designed their offerings". Software architects looking to build new applications can design the components, processes and workflow for their solution according to the new Cloud related concepts. However, building new applications that are being architected from scratch for the Cloud is only slowly gaining traction, and there are only few enterprise applications that currently take real advantage of the Cloud's elasticity .Infrastructure-as-a-service(IaaS) cloud computing is revolutionizing how we approach computing. Compute resource consumers can eliminate the expense inherent in acquiring, managing, and operating IT infrastructure and instead lease resources on a pay-as-you-go basis. IT infrastructure providers can exploit economies of scale to mitigate the cost of buying and operating resources and avoid the complexity required to manage multiple customer-specific environments and applications. So, this complexity helped to arose an emerging computing pattern known as "Sky Computing".

### 1.1 What Is Sky Computing

Sky Computing is an emerging computing model where resources from multiple clouds providers are leveraged to create large scale distributed infrastructures.

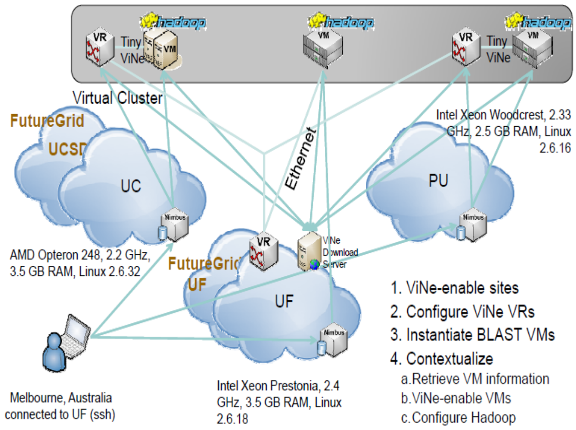



**Fig (1) Sky Computing**

### 1.2 Cloud computing vs Grid Computing vs Sky Computing

**A. Control on Resources**

*Grid Computing*- When using remote resources for regular computing assumption is done that control over resources is stays with the site, but this choice is not always useful when remote users who might need a different OS or login access.

*Cloud computing*- A cloud computing infrastructure is a complex system with a large number of shared resources. These are subject to unpredictable requests and can be affected by external events beyond our control. Cloud resource management requires complex policies and decisions for multi-objective optimization. The strategies for cloud resource management associated with the three cloud delivery models, Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), differ from one another.

*Sky computing*- Sky computing allows users to control resources on their own. So trust relationships within sky computing are the same as those within a traditional non distributed site , simplifying how remote resources interact.

**B. Scalability**

*Grid Computing*- It is hard to scale

*Cloud computing*- The ability to scale on demand is one of the biggest advantages of cloud computing. Often, when considering the range of benefits of cloud, it is difficult to conceptualize the power of scaling on-demand, but organizations of all kinds enjoy tremendous benefits when they correctly implement auto scaling.

*Sky computing*- It is dynamically scalable as resources are distributed over several cloud.

**C. Security**

*Grid Computing*- Grid systems & applications require standard security functions such as authentication, access control, integrity, privacy & non repudiation. To develop security architecture of grid system it should satisfy the following constraints like single sign on, protection of credential, interoperability with local security solutions etc. But with the development of latest security technologies like globus toolkit security models has tighten the grid security to a some extent

*Cloud computing*- In this security is not strong as users data is disclosed to unauthorized systems & sometimes hijacking of accounts is possible because of unauthorized access to intruder

*Sky computing*- When in sky computing we deploy a single appliance with a specific provider, we rely on basic security and contextualization measures this provider – specific networking & security context. So security relationships are more complex require provider-independent methods to establish a security & configuration context.

**D. Challenges**

*Grid Computing*- It distributes the resources on large geographically distributed environments & accesses the heterogeneous devices & machines. So it is major challenge to manage the administrative of the grid computing & the software, which are enabled the grid computing are less.

*Cloud computing*- The cloud services providers are faced with large, fluctuating loads that challenge the claim of cloud elasticity. In some cases, when they can predict a spike, they can provision resources in advance.

*Sky computing*-To connects the client to a trusted networking domain and configures explicit trust & relationships between them so that client securely takes ownership of customized infrastructure for an agreed time period. To achieve this is a major challenge in sky computing.

**E. Applications**

*Grid Computing*- Grid portals, Load balancing, Resource broker etc

*Cloud computing*- Big data analytics, File storage, Disaster recovery, Backup etc

*Sky computing*- Seasonal e-commerce web server, event based alert systems etc

## 2. HOW SKY COMPUTING WORKS

When a remote user leases a resource, the service provider turns control of that resource over to the user. This change was enabled when a free and efficient virtualization solution is available. To construct a sky virtual cluster using user level virtual network – Vine following steps are required.

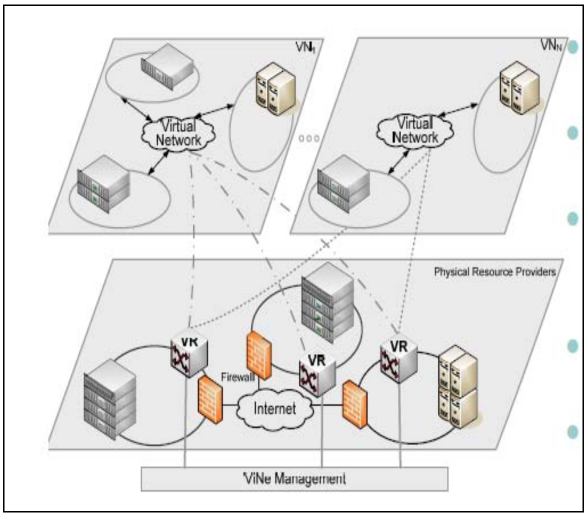



**Fig (2) A virtual cluster connected with Vine**

1. **Preparation:-**Obtain a ViNe image is available from the science cloud marketplace. This image is capable of providing and integrating context information.
2. **Deployment:** - Start a ViNe VM in each site which provides virtual routers used as gateways by nodes that do not run ViNe software**.** Start the desired number of compute VMs at each provider site. The contextualized images are configured to automatically (securely) contact the context broker to provide appropriate networking and security information and adjust network routes to use VRs to reach nodes crossing site boundaries. The configuration exchange includes VMs on different provider sites so that all VMs can behave as a single virtual cluster.
3. **Usage:-**Upload inputs and start the desired application (typically, by simply logging into the virtual cluster and using a command-line interface).

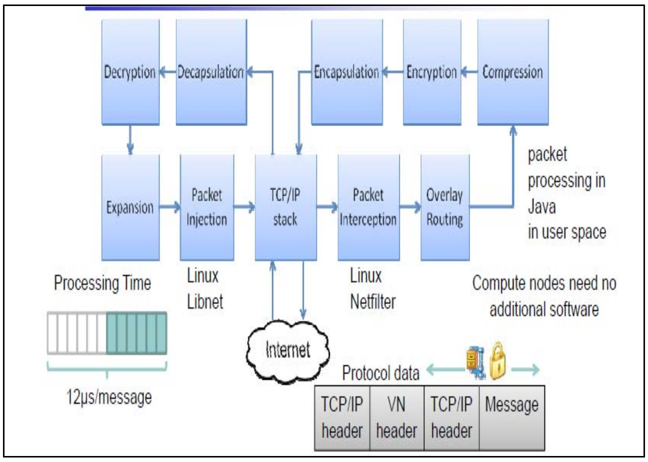
**4.Routing :-** It requires two table as a) Local network description table (LNDT) – which describes the VN membership of a node, b)Global network description table – which describes sub network for which a VR is responsible. For e.g. suppose that a VR with the following tables, received a packet from 172.16.0.10 destined to 172.16.10.90 is shown below in Fig (3) and Fig (4)

| LNDT | |
|---|---|
| Host | ViNe ID |
| 172.16.0.10 | 1 |
| 172.16.0.11 | 2 |

| GNDT – ViNe ID 1 | |
|---|---|
| Network/Mask | Destination |
| 172.16.0.0/24 | VR-a |
| 172.16.10.0/24 | VR-b |

| GNDT – ViNe ID 2 | |
|---|---|
| Network/Mask | Destination |
| 172.16.0.0/24 | VR-a |
| 172.16.20.0/24 | VR-c |

**Fig (3)**



Fig(4) ViNe Routing

The above figure describes about routing process which has been taken place in ViNe network, when a packet is moving from one source to destination. The packet processing is done in java and VN haeader is attached along with TCP/IP header to the message

### 3. TYPES OF SKY COMPUTING PROVIDERS

IaaS integrators for multiple Cloud offers: Reservoir, OpenNebula, Eucalyptus, DeltaCloud, OCCI, Nimbus, libcloud etc

PaaS integrators for multiple Cloud offers: Simple Cloud targets only PHP appls and 3 providers

CloudBroker – negotiation, configuration done manually

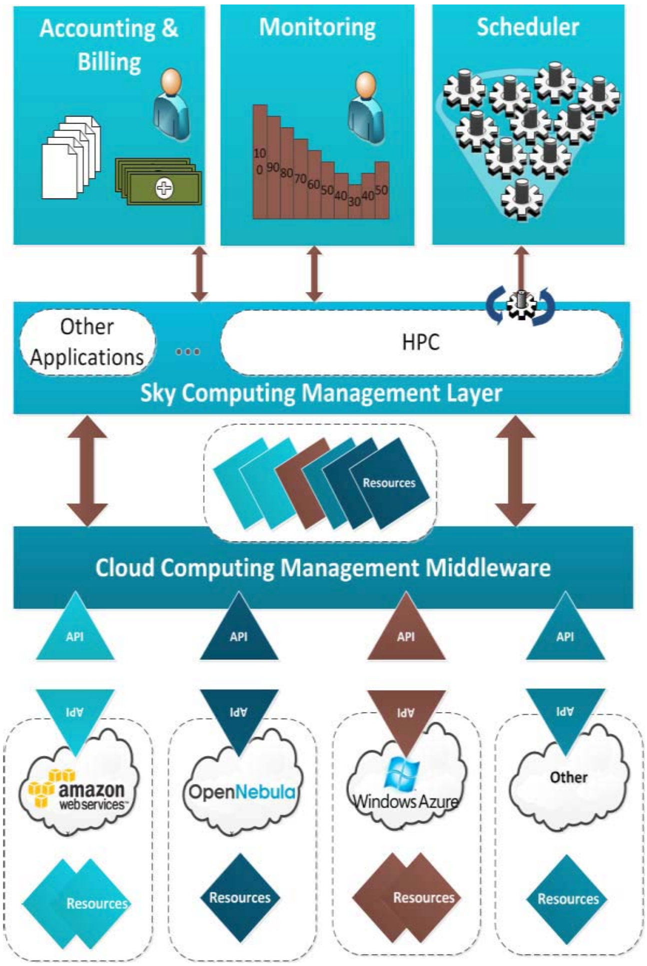
mOSAIC – not only Web appls, intend larger no. providers, adapt at run time

### 4. SKY COMPUTING ARCHITECTURE

The main idea in this paper is to create a turn-around model to enable intensive computing in Cloud networks. This is hoped to be achieved by enlarging the set of available resources in a way they overcome the problems referred before, like elevated latency between nodes. Also, it must be cross Cloud provider in order to combine resources. To achieve this, there must be a structure capable of receiving instructions, process and return results from all different underlying cloud systems. The proposed architecture [6] is represented in Fig (5).

As we can see in Fig (5), each Cloud provider has a specific API that makes available an interaction with their own resources. All these can be aggregated by a middleware layer, which allows controlling and managing resources by translating every command to the correspondent provider API. Abstraction, from bottom to top, is the key for building a consistent system. With the established middleware, it should be possible to use the available resources across any provider and seamlessly increase/decrease resources, adapting to demand.

The upper layer, Sky Computing, integrates the last level of Infrastructure as a Service and the next layer of Software as a Service. It allows scheduling and distributing resources to inputted tasks/requests made. This is a critical layer, as it must be as comprehensive as possible in features and capabilities. Here, our main focus is HPC, but is must be possible to deal with other applications too. Management, with scheduling, accounting and billing, should be well developed as well as Monitoring and Job submission.



Fig(5) Sky Computing proposed architecture

### 5. SKY COMPUTING CONCERNS

A. ***Sky Computing Benefits***

• Single networking context -All-to-all connectivity
• Single security context- Trust between all entities
• Equivalent to local cluster-Compatible with legacy code

B. ***Challenges***

• Inter-cloud resource creation & management
• Efficient inter-cloud communication
• Efficient distribution of tasks
• Fault-tolerance
• Adaptability to resource dynamicity

C. ***Resource usage estimation***

Provider perspective- can improve resource utilization, as schedulers are able to fit more requests in the same resource

Consumer perspective-to choose the most cost-effective cloud and resource configuration for a given problem

D. ***Fault modeling***

If components are cloud services, what is a component fault?

• SLA violation? User-defined condition? Unusual behavior?

• E.g. resource-exhaustion faults

_ How can the health of a sky system/app be managed?
_ What/how are concerns separated?
• E.g. virtual routers
A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable" Similar issues for security, privacy, performance

E. ***User-level overlay networks needed for intercloud Communication-Hard to deploy due to cloud-specific restrictions***
• Overcome via network-virtualization software in VMs
• It is important to keep the software simple and light

TinyViNe enables applications across clouds
• Experiments with parallel bioinformatics applications show that it efficiently enables sky computing
• Can be implemented as a service by a cloud provider, in the context broker of a sky provider or by the consumer
• Being improved to enable autonomic networking

Issues: Develop Cloud application independent from the IaaS level -Ensure best offer selection and (re)negotiation Implementations -Theoretical studies about the offer selections and billing system

## 6. Characteristics Of Virtualization In Sky Computing

Security and Trust-
In the past, site owners couldn't trust a remote resource because they had no control over its configuration.
• Now that clouds let users control remote resources, however, this concern is no longer an issue.
• Combining the ability to trust remote sites with a trusted networking environment, a virtual site can now exist over distributed resources.
Efficiency-Advances in processing, communication and systems/middleware technologies had as a result new paradigms and platforms for computing
Flexibility and Scalability – The cloud can quickly scale up to thousands of servers or services to make resources available as they are needed.
Resource management-sky Computing facilitates the Implementation and realization of Emerging technologies to deliver Better Customer Experience with improved & real-time Interaction across the business operations to maximize the value for the consumer and stakeholders where sustainability can be achieved with increased profitability and competitiveness.

## 7. Conclusion

Grid Computing: Aggregation of distributed heterogeneous resources
Sky Computing: Aggregation of distributed heterogeneous Clouds.
Sky computing is an emerging computing model where resources from multiple cloud providers are leveraged to create large scale distributed infrastructures. These infrastructures provide resources to execute computations requiring large computational power, such as scientific software. Establishing a sky computing system is challenging due to differences among providers in terms of hardware, resource management, and connectivity. Furthermore, scalability, balanced distribution of computation and measures to recover from faults are essential for applications to achieve good performance. This work shows how resources across two experimental projects: the FutureGrid experimental testbed in the United States and Grid'5000, an infrastructure for large scale parallel and distributed computing research composed of 9 sites in France, can be combined and used to support large scale, distributed experiments
Several open source technologies are integrated to address these challenges. Xen machine virtualization is used to minimize platform (hardware and operating system stack) differences. Nimbus, which offers VM provisioning and contextualization services, is used for resource and VM management. Nimbus allows turning a cluster into an Infrastructure-as-a-Service cloud.

## References

[1] José Fortes, Advanced Computing and Information Systems Laband NSF Center for Autonomic Computing
[2] KatarzynaKeahey ,MaurícioTsugawa, Andréa Matsunaga, and José A.B. Fortes – paper of nimbus 2009**.**P. Singhala, D. N. Shah, B. Patel ,*Temperature Control using Fuzzy Logic*,january 2014
[3] http://www.logicworks.net/blog/2014/10/scalability-cloud-computing-old-problems-new-solutions/
[4] Harmeet Kaur,Kamal Gupta 2013, International Journal of Scientific Research Engineering & Technology (IJSRET)
[5] Neha Mishra, RituYadavand SaurabhMaheshwari 2014, International Journal on Computational Sciences & Applications (IJCSA) Vol.4
[6] Sky computing-Exploring the aggregated Cloud resources – Part I,by André Monteiro, Joaquim Sousa Pinto,Cláudio Teixeira, Tiago Batista
[7] Sky Computing:When Multiple Clouds Become One, José Fortes,Advanced Computing and Information Systems Lab and NSF Center for Autonomic Computing
[8] Architecturing a sky computing platform ,Dana Petcu, Ciprian Craciun, Marian Neagul, Silviu Panica