International Telecommunication Union

Beyond the Internet?

Innovations for future networks and services

THIN APPS STORE FOR SMART PHONES BASED ON PRIVATE CLOUD INFRASTRUCTURE

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INTRODUCTION

- Revolutionary growth in usage of mobile devices for sophisticated applications.

Nokia N900

iPhone 3G S

Blackberry Tour

- Required large memory, extreme graphical processing to support these applications.
- Major Constraints are energy and bandwidth constraints.
- The gap between present processing power and requirements of these applications do not seem to be closer.

DEMYSTIFYING THE SOLUTION

- Integrate the next generation cloud computing technology to support sophisticated customer mobile applications.

- *A private cloud has been designed using an open source cloud – computing framework Eucalyptus to develop a smart phone application store.*
- Assert low computational load on mobile devices through the use of cloud computing.
- Implemented on the unique cloud computing platform using virtualization to enhance scalability.

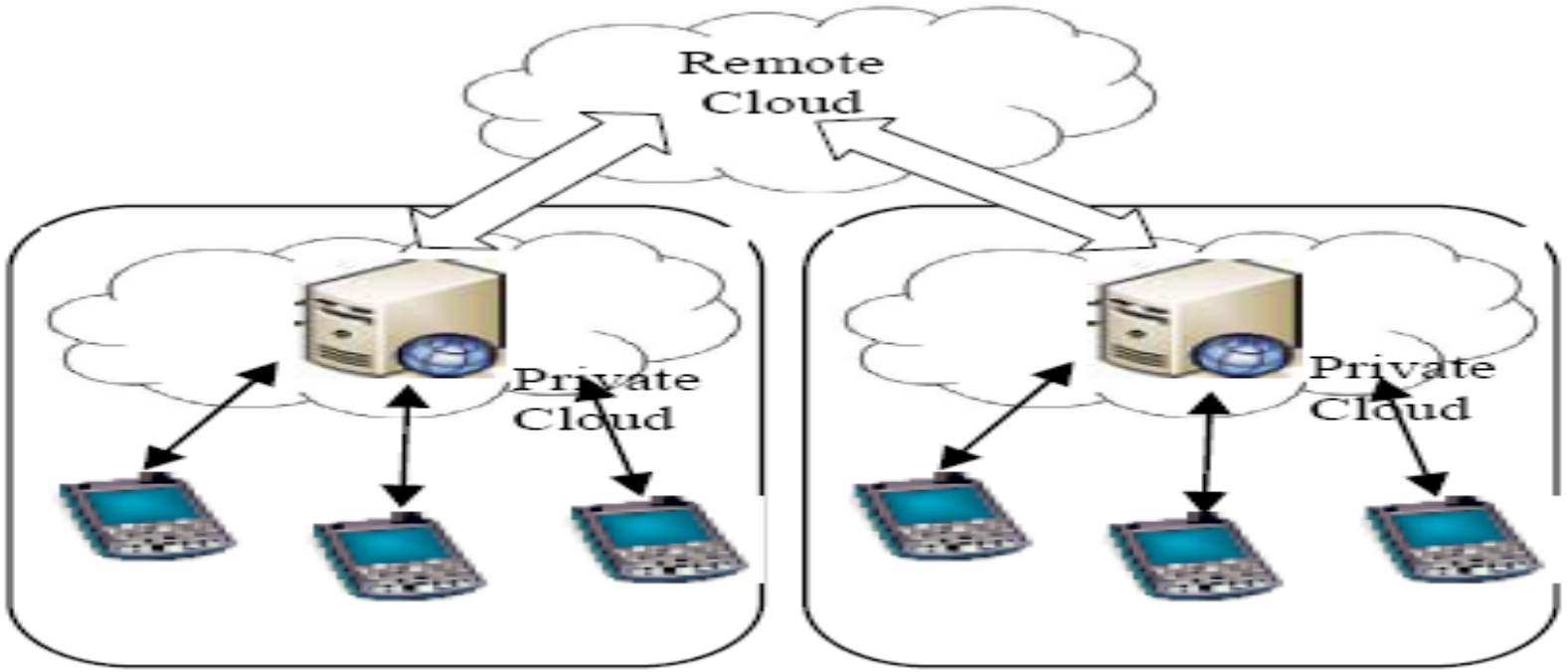
CLOUD COMPUTING STRUCTURE

- Cloud computing for mobile devices provides the key concept of transferring mobile device computation to the cloud.

- Computing resources like processor, memory are owned and managed by the cloud service provider and client (Cloud Used/ SaaS Provider) access these resources via internet.

PRIVATE CLOUD INFRASTRUCTURE-1

- Private Cloud architecture that provides required resources to a certain fixed number of clients on some payment for these services.
- How Our App-Store uses Private Cloud ?

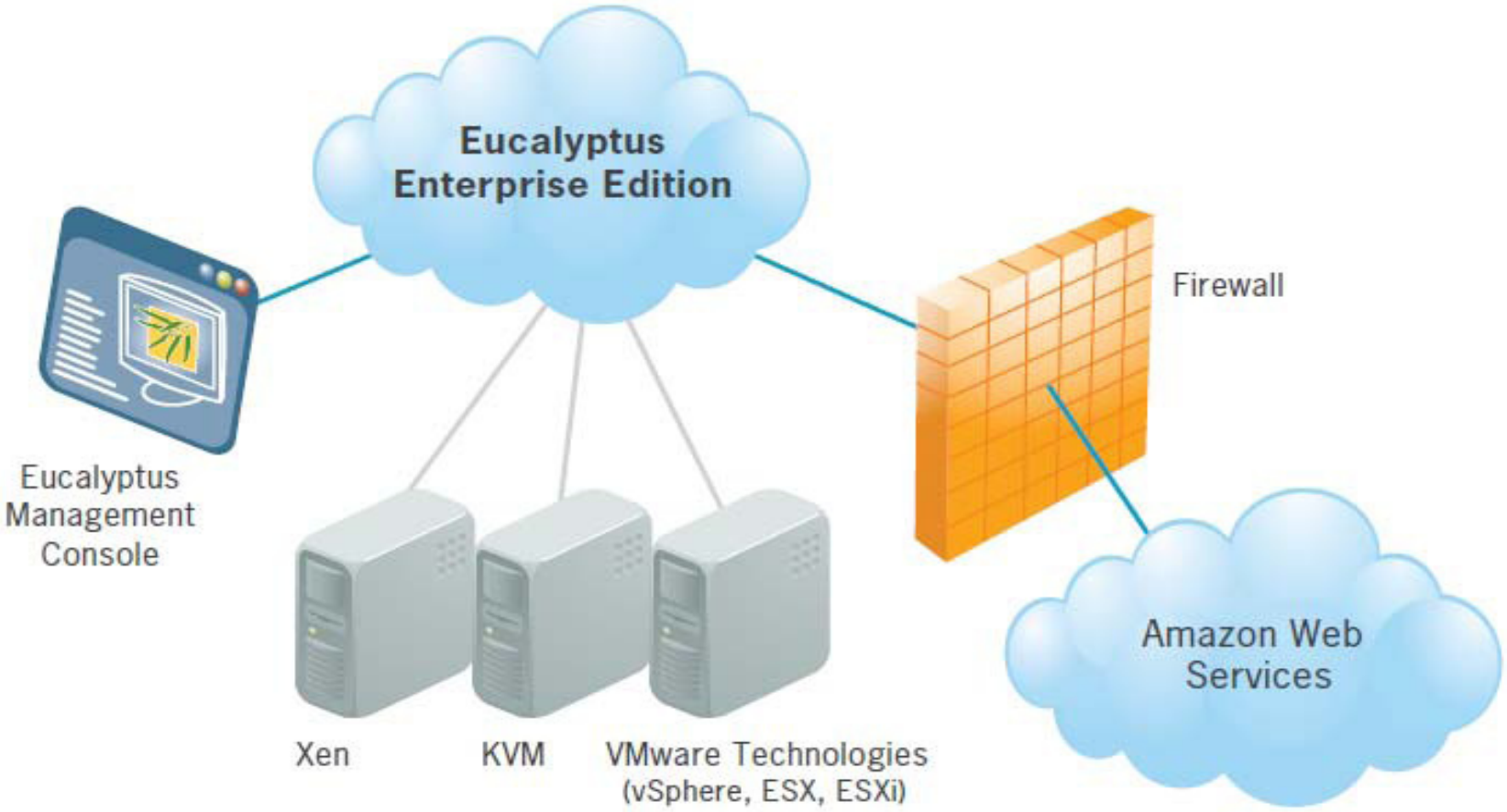


PRIVATE CLOUD INFRASTRUCTURE-2

- Mobile devices are operated under a single private cloud using the concept of cells.
- These sets of privately held clouds are connected to the remote cloud. These local cloud units further serve as a successor of remote cloud in the hierarchical structure
- The private cloud units serve as a computational as well as storage infrastructure for mobile devices.

EUCALYPTUS- THE PRIVATE CLOUD

- Eucalyptus is an open source cloud-computing framework that we are using to provide Infrastructure as Service.

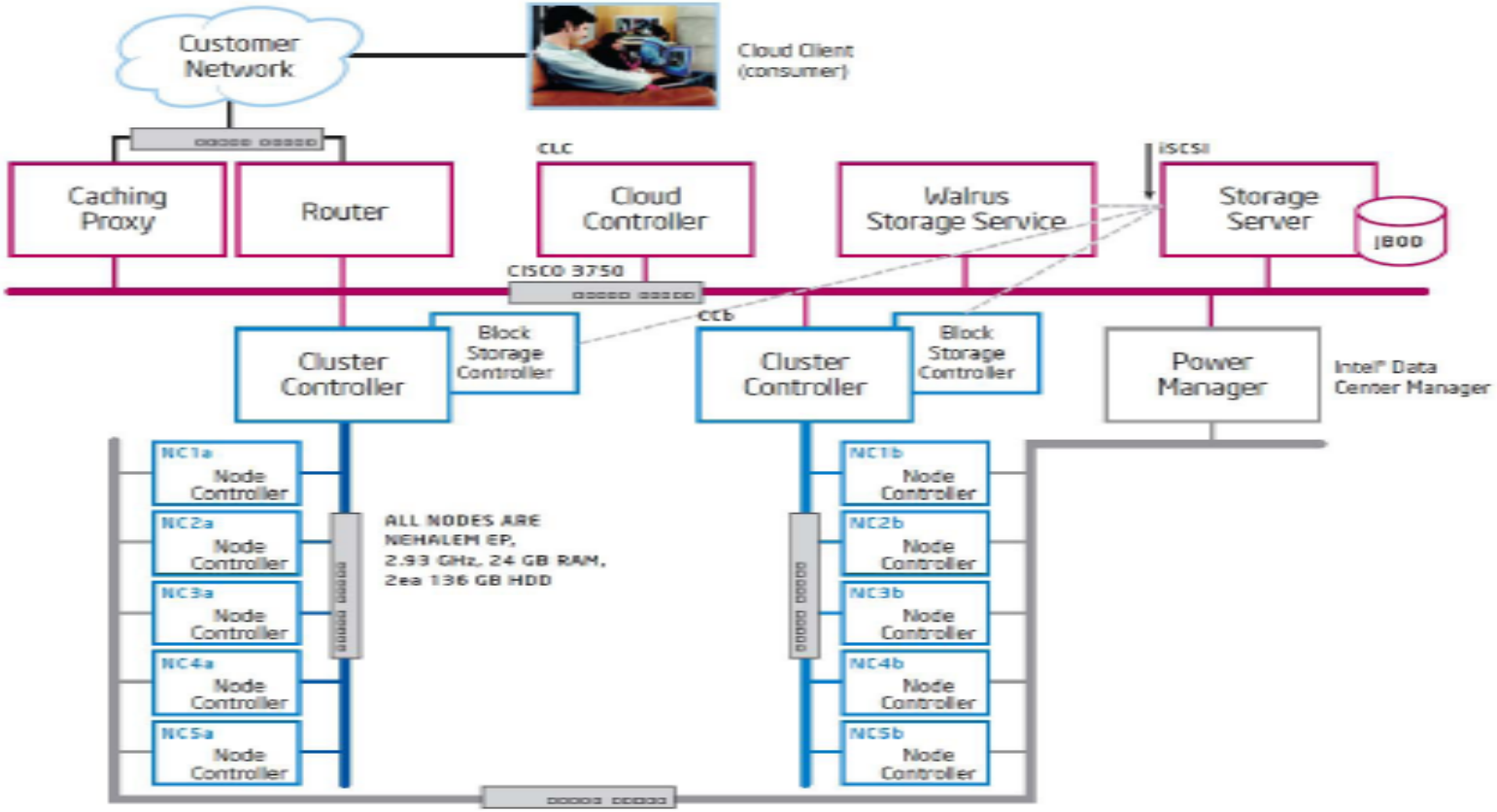


COMPONENTS OF EUCALYPTUS

Component	Function
Node Controller	Controls the execution, inspection, and terminating of VM instances on the local host
Cluster Controller	Gathers information about and schedules VM execution on specific node controllers, as well as manages virtual instance network.
Storage Controller (Walrus)	Put/get storage service that implements Amazon's S3 interface, providing a mechanism for storing and accessing virtual machine images and user data.
Cloud Controller	Entry-point into the cloud for users and administrators. It queries node managers for information about resources, makes high-level scheduling decisions, and implements them by making requests to cluster controllers.

PHYSICAL IMPLEMENTATION OF EUCALYPTUS

The physical implementation of eucalyptus include Intel Xeon processor 5500 series code named Nehalem for Node controllers, Xeon Processor X5570 for Cloud Controller (CLC), Cluster Controller (CCa & CCb), and Walrus Storage Service. Cisco's networking equipment like Routers, Cisco 3750 Switches have been used for configuring and routing the network.



CONFIGURATION OF EUCALYPTUS PRIVATE CLOUD

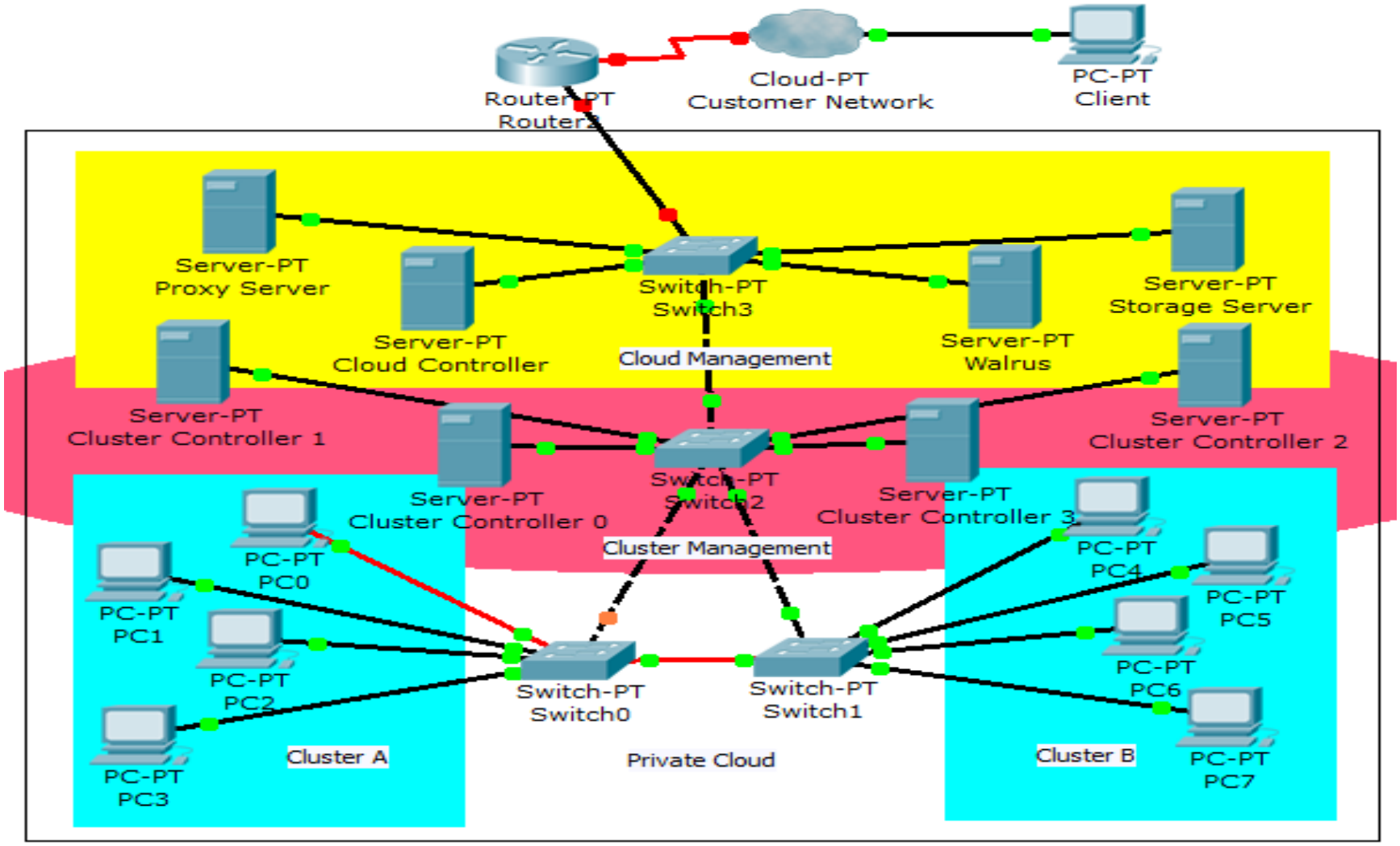
Configuration Of Intel Xeon Based Eucalyptus Private Cloud being Developed

System	Processor	Memory	Form Factor
Cloud / Cluster Controller	Intel Xeon Processor X5570	24 GB	2U Rack Mount
Node Controller	Intel Xeon Processor X5570	24 GB	1U Rack Mount
Walrus Storage Service	Intel Xeon Processor X5570	48 GB	2U Rack Mount
Storage Server	Intel Xeon Processor X5570	24 GB	5U Tower
Proxy Server	Intel Xeon Processor 5140	4 GB	1U Rack Mount

NETWORK ADDRESSING DETAILS OF THE CLOUD NETWORK

NETWORK	*IP RANGE*	*SUBNET MASK*	*BROADCAST*
CLOUD NETWORK	*192.168.16.0/20*	*255.255.240.0*	*192.168.31.255*
PRIVATE VM NETWORK	*10.0.0.0/8*	*255.0.0.0*	*10.255.255.255*
CLUSTER CONTROLLER [CCA]	*192.168.32.0/24*	*255.255.255.0*	*192.168.32.255*
CLUSTER CONTROLLER [CCB]	*192.168.33.0/24*	*255.255.255.0*	*192.168.33.255*
CCA PUBLIC IP FOR INSTANCE	*192.168.17.1/254*	*255.255.255.0*	*192.168.17.255*
CCB PUBLIC IP FOR INSTANCE	*192.168.18.1/254*	*255.255.255.0*	*192.168.18.255*

SIMULATION OF NETWORK DESIGN USING CISCO PACKET TRACER



SMART PHONE CLOUD INTEGRATION -1

- Addressing the issue of fully supporting the multimedia applications on smart phones by offloading some tasks on private cloud.
- Designed light web-applications that can take input from users, perform computational tasks on cloud, can show results back to users. This process is called augmented execution.
- Augmented execution is performed in four steps

I. A clone of the smart phone is created within the cloud
II. The state of the primary phone and the clone phone is periodically or on-demand synchronized.
III. Applications are executed in the clone, automatically or upon request. This is done by a virtual machine hosted on a node/ cluster or by a physical node.
IV. Results from clone execution are re-integrated back into the smart phone state.

SMART PHONE CLOUD INTEGRATION -2

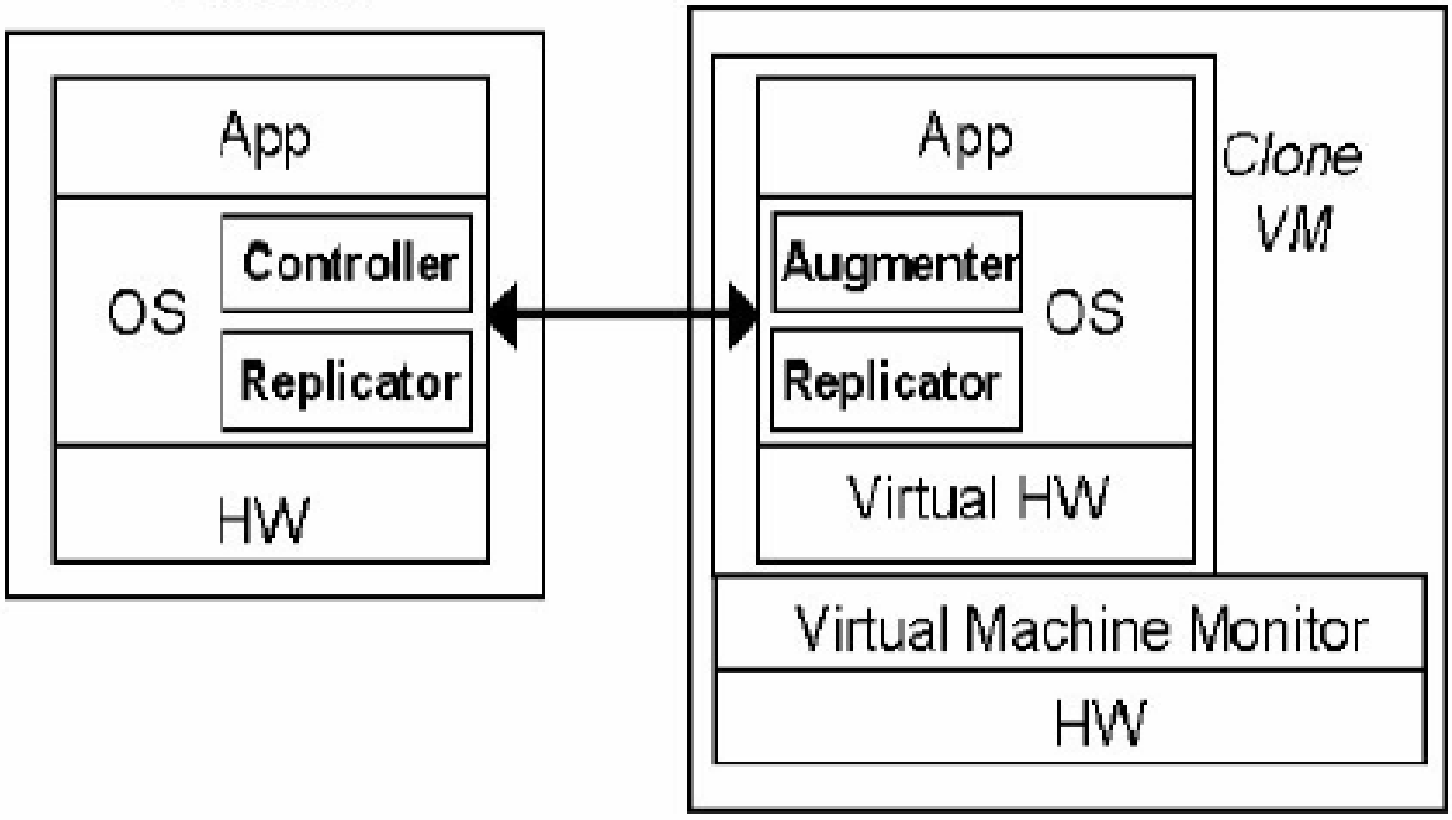
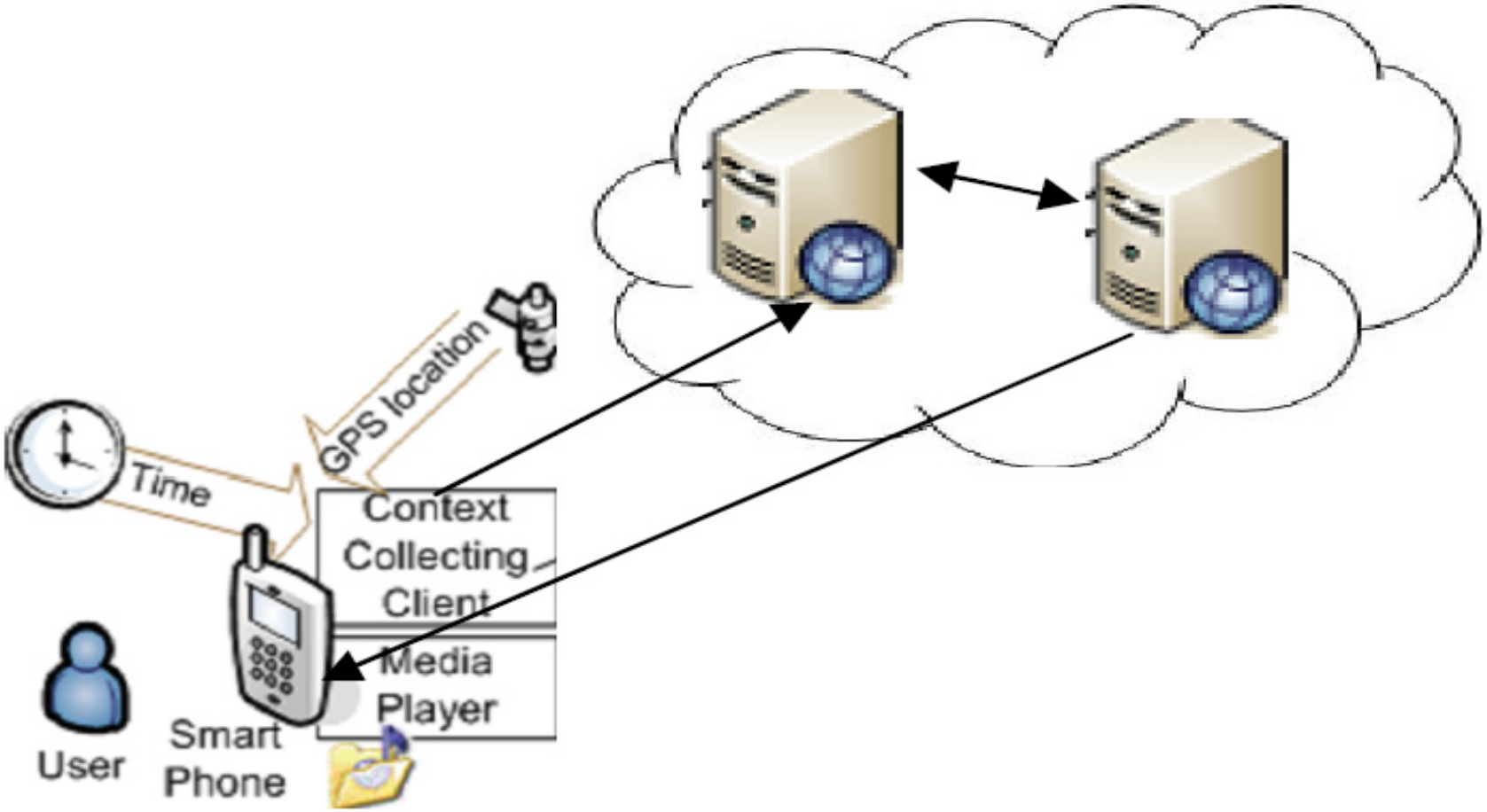


Fig 10: Smartphone and Private cloud integration

APPLICATION 1: VIRTUAL GUIDE

- Developed mobile cloud architecture based context learning smart phone application ‘virtual guide’.

APPLICATION 2: AUGMENTED VIRTUALITY BASED LEARNING



Working of Augmented Virtuality Based Learning Application

CONCLUSION

- A noble work of implementing Eucalyptus based cloud computing infrastructure for hosting mobile applications store has been presented.
- Critical details of physical implementation of cloud like servers used for different cloud components like node controller, cluster controller, storage controller and proxy server, their network assembly and IPv4 based addressing scheme have been discussed in details.
- We have also briefly discussed development of two sample applications for hosting on our Mobile Application Store.

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QUESTIONS