Ministry of Human Resource and Development
Government of India,
Department of Higher Education
Technical Coordination Division, Shastri Bhavan
New Delhi – 110001

Project Proposal
for
Establishing Centre for Cloud Computing

1 Name and full postal address with pin code of the Institution

Kalasalingam University
Kalasalingam Academy of Research and Education)
Anand Nagar, Krishnankoil-626190
Virudhunagar District, Tamil Nadu.

2 Project Title with a brief summary

Title: Centre for Cloud Computing

Establishment of Internet accessible infrastructure (e.g. data storage and computing hardware) which is hidden from users, to provide extremely low cost computing solutions for users with data and computation intensive problem through integration of virtualization of computing infrastructure and internet technology.

3 Is it a network/coordinated project with other institute, industry, National Lab?

Yes, We have proposed to interact with the other Universities such as Indian Institute of Information Technology, Bangalore, Institute of Technology, Banaras Hindu University, Oklahoma university, U.S.A. and Ball State university, U.S.A. for collaborative research work. We are also interacting with leading industries such as Sun Micro Systems, IBM, Intel for joint research work in the area of cloud computing.

4 Total Cost of the project

Phase I (First three years)	12.94 Crores
Phase II (Fourth and Fifth Year)	04.82 Crores
Total	**17.76 Crores**

5 Project Summary

a) Project Objective.

1. Develop dynamic, secure and automated infrastructure for Cloud Computing.
2. To address the technical challenges such as user interaction interface, services catalogue, system management, provisioning, monitoring and metering in cloud computing.
3. Design and development of multi-data center, open source testbed for research on the software, data center management and hardware issues associated with the cloud computing
4. Extend access to high end educational resources to the academic community through cloud computing
5. Development of Business Applications by examining cloud adoption challenges in every business environment and proper penetration of cloud into service areas.

b) Methodology to be adopted to achieve the Objectives

1. To develop technologies for highly automated, secured, dynamic, instantiation and management of cloud computing infrastructures and services. The research focus will be on service life cycle management, infrastructure life cycle management.
2. Research will focus on how users of cloud interface with the cloud, services a user can request, select the systems from the cloud to deliver on the requested service, tracking the usage of the cloud.
3. Creation of global, multi data centre, open source testbed for the cloud computing research and education. This will promote collaboration among industry, academic institution, research labs. This cloud computing testbed will encourage research on software, data centre management and hardware issues. With this testbed researchers can test applications at internet scale.
4. To extend the access to advanced education resources such as high end software including MATLAB, Solid works, SAS, Lab view, Adobe products, SPSS etc. to the academic community through establishment of Virtual Computing lab for cloud computing.
5. Making successful cloud business applications by proper penetration of cloud into service areas. The innovative business ideas to build cloud based services can be created through collaboration, rapid deployment of lower costs private cloud. Business establishment can access to needed, standardized IT resources from a third party provider that can enable to deploy new applications, services, or computing resources rapidly without having to have an infrastructure at all with the help of cloud computing. A

set of core services or building blocks that can be rapidly assembled into higher level business services for quick deployment with the advancement of cloud computing. Small scale IT companies can purchase cloud based services to augment or replace their existing infrastructure.

c) Self assessment reflecting specific competence for undertaking the project

Kalasalingam University (formerly Arulmigu Kalasalingam College of Engineering) has successfully executed many funded projects including prestigious TIFAC CORE in Network Engineering project. The university have excellent infrastructure in the field of computing, networking and grid computing. Project team consists of senior academicians and active researchers who are currently working in the area of grid computing, computer networks, network security etc. The university has international collaborations and signed MoUs with many leading universities including Carnegie Mellon university USA, RWTH Aachen university, Germany, Oklahoma university, USA, Ball State university USA, East Tennessee university USA, etc. The university has excellent interaction with leading industries and signed MoUs with them. This includes Sun Micro Systems, Nortel Networks, Intel Ltd., Infosys, IBM, etc. Based on the above, the proposed project can be successfully carried out at Kalasalingam University

d) Stipulated period of completion

Phase I (first three years)
Phase II (Fourth and Fifth years)

6 Introduction

a) *Present State of art:*

Cloud Computing is a common metaphor for an Internet accessible infrastructure (e.g. data storage and computing hardware) which is hidden from users. Cloud Computing makes data truly mobile and a user can simply access a chosen cloud with any internet accessible device. In Cloud Computing, IT-related capabilities are provided as services, accessible without requiring detailed knowledge of the underlying technology.

Recently Cloud Computing has attracted lots of attention both from the research community and from industry. The Cloud Computing paradigm has evolved over the years from a basic IT infrastructure (data centers) to platform as a service (PaaS), and then from software as a service (SaaS) to complete service enablement on a hosted infrastructure. At the same time, virtualization has emerged as a key enabler for the cloud computing paradigm. Several challenges arise in the design, implementation, and deployment of virtualized

clouds. These challenges include but are not limited to automated service provisioning, service monitoring and management, resource elasticity, cloud programming models, economic models, charging and accounting, and, finally, virtualization-specific issues such as image management and virtual appliance-based service creation.

Current International Status

Presently IBM, Amazon, Google, Microsoft, Yahoo, and Level 3 Communications are the leaders in the cloud computing.

On Feb. 24, 2009 a new research organization called *Cloud Computing Futures* (CCF) was established, focusing on reducing the operational costs of data centers and increasing their adaptability and resilience to failure. The group will strive to lower hardware costs, power consumption, and the environmental impact of such facilities. *Cloud Computing Futures* is a new initiative to improve the efficiency of the scalable computing hardware and software infrastructure needed to deliver cloud services. Data centers and their services have grown in size and importance as Microsoft has shifted to a software-plus-services model in which an increasing number of new applications run in part, or entirely, in the "cloud" and are delivered to clients via the Internet.

Microsoft's business now depends on an ever-expanding network of massive data centers: hundreds of thousands of servers, petabytes of data, hundreds of megawatts of power, and billions of dollars in capital and operational expenses. Because these data centers are being built with hardware and software technologies not designed for deployment at such massive scale, many of today's data centers are expensive to build, costly to operate, and unable to provide all the services needed for emerging applications—resilience, geo-distribution, composability, and graceful recovery. The goal of the CCF project is to identify, create, and evaluate new, potentially disruptive innovations that can enable new software and application capabilities while also reducing the cost of building and operating cloud services. The CCF project started with a key concept: treat the data center as an integrated system—a holistic entity—and optimize all aspects of hardware and software. As a result of this work, Microsoft will be able to deliver a wider range of new, innovative services more efficiently.

Recently on April 9, 2009 Yahoo has expanded its partnerships with top U.S. universities to advance cloud computing research. The University of California at Berkeley, Cornell University and the University of Massachusetts at Amherst will join Carnegie Mellon University in using Yahoo's cloud computing cluster to conduct large-scale systems software research and explore new applications that analyze Internet-scale data sets, ranging from voting records to online news sources.

Till date, academic researchers have had limited access to Internet-scale supercomputers for conducting systems and applications research. To help alleviate this obstacle, Yahoo is granting these four universities access to the Yahoo! cloud computing cluster. The Yahoo cluster, also known as M45, has been operational since November 2007 and in use by Carnegie Mellon for more than a year. The cluster has approximately 4,000 processor-cores and 1.5 petabytes of disks.

In July 2008, Yahoo! joined forces with HP, Intel, the University of Illinois at Urbana-Champaign, the Infocomm Development Authority (IDA) in Singapore, and the Karlsruhe Institute of Technology (KIT) in Germany to create Open Cirrus™, a global, multi-data center, open source testbed for advancing cloud computing research and education. The partnership with Illinois also includes the National Science Foundation, creating a cloud computing cluster at Illinois that is made available to the entire reach of the NSF academic community. The international partnership promotes open collaboration among industry, academia and governments by removing the financial and logistical barriers to research in data-intensive, Internet-scale computing. As the Yahoo! M45 cluster is part of the Open Cirrus™ cloud computing testbed, the above universities will also gain access to and be part of the Open Cirrus™ community.

Both Google and IBM recognize that they bring two sets of expertise to the table that can make the project succeed. IBM's experience in running data centers, combined with Google's obvious experience in running web apps on giant clusters, complement each other. These two companies have partnered to offer millions of dollars in resources to universities in order to promote cloud computing projects. The companies say that the goal is to improve students' knowledge of parallel computing practices and better prepare them for increasingly popular large-scale computing that takes place in the "real world," such as search engines, social networking sites, and scientific computational needs.

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers. Amazon EC2’s simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon’s proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate themselves from common failure scenarios.

National Status

In India cloud computing research and development has yet to take active role despite of huge potential in terms both human power and marketing final product. It has remarkable relevance in India given the fact that cloud computing provides sharing of common resources at multiple locations in a very economical way.

Indian Institute of Technology, Kanpur is the first to use IBM lab. The Indian clients such as mid-market vendors, universities, telecommunication companies and government bodies will be able to access the access the center for the resource they need to pilot cloud infrastructure and application to their customer. Many Indian Industries including Infosys, IBM India, Accenture etc. have shown keen interest in promoting research in cloud computing.

Many mature technologies Grid architecture, Load balancing, Optimal deploy configuration, Consistency models, Virtualization technologies, Middleware frameworks, Software as a Service (SaaS), Hardware as a Service (HaaS), Data grid & Semantic web, Web services, Security and Risk, Fault tolerance and reliability, Auditing, monitoring and scheduling, Utility computing, High-performance computing, Peer to peer computing are used as components in Cloud Computing, but still there are many unresolved and open problems.

This emerging field will benefit from close interaction between researchers and industry practitioners so that the research can inform current deployments. It is great answer to bring in innovation at affordable cost.

Cloud is the only way to support the dramatic increase in computing needs that will allow for massive scalability while providing energy efficient and resilient infrastructure

Man Power Requirement

For making the cloud computing into a reality needs collaborative research between academic institution and industries. Many research scientists have to work in close interaction in order to achieve multi-objective goal. Once the technology is realized there will be lot of scope for lot many applications. So the cloud computing technology would bring drastic revolution the field future computing era and fetch huge employment opportunities for engineers.

b) Level of Infrastructure available with reference to technology under considerations

Kalasalingam University has excellent facilities for computing and

network research computing infrastructure includes enterprise level Sun server 4800, IBM blade servers (8Nos.) midrange servers from Sun, IBM and Wipro, Entry level servers from IBM, Wipro, HCL etc., Workstations from Sun Micro Systems, IBM etc., and more than 1000 computing nodes. Network infrastructure includes Cisco Layer 3 switches, Cisco layer 2 switches, Enterprise level routers, network management software such IBM Tivoli, Cisco LAN works, Security devices such as Nortel firewall, VPN, Web switch, SSL accelerator etc. The campus is networked with fibre and WiFi enabled. At present the university has 24 Mbps Internet bandwidth and it is in the process of expansion. The University has advanced labs in Multicore Architecture supported by Intel, Network Processor Lab supported by Intel and Wireless Sensor Networks Lab. Besides we have more than 100 postgraduate students working in this area and nearly 1000 undergraduate students studying in Computer science and IT related areas. They can be involved in developing small modules and testing

Nature of ongoing activities pertaining to project under submission in the institution:

Research work is in progress in the areas of grid computing, network technologies, network security and applications of grid computing. Many Ph.D. scholars are also working in the above mentioned areas. The university offers M.Tech. programs in the fields in i) Computer Science and Engineering, ii) Network Engineering, iii) Information Assurance and Network Security. Many of these students are doing their dissertation in the areas related to proposed project.

d) List of research publications

List of Publication

1 Foster, I. Yong Zhao Raicu, I. Lu, S. , "Cloud Computing and Grid Computing 360-Degree Compared", Grid Computing Environments Workshop, 2008. GCE '08, 12-16 Nov. 2008.

2 Mika, P. Tummarello, G., "Web Semantics in the Clouds", Intelligent Systems, IEEE, 82 – 87, Volume: 23 , Issue: 5, Sept.-Oct. 2008.

3 Hewitt, C., "ORGs for Scalable, Robust, Privacy-Friendly Client Cloud Computing", Internet Computing, IEEE, 96 – 99, Volume: 12 , Issue: 5 , Sept.-Oct. 2008.

4 Erdogmus, Hakan, "Cloud Computing: Does Nirvana Hide behind the Nebula?", Software,IEEE , 4 – 6, Volume: 26 , Issue: 2, March-April 2009.

5 Leavitt, N. ," Is Cloud Computing Really Ready for Prime Time?", Computer, IEEE, 15 - 20 , Volume: 42 , Issue: 1 , Jan. 2009.

6 Lawton, G., "Moving the OS to the Web", Computer, IEEE, 16 - 19 ,

Volume: 41 , Issue: 3 , March 2008

7 Milojicic, Dejan , “Cloud Computing: Interview with Russ Daniels and Franco Travostino”, Internet Computing, IEEE , 7 – 9, Volume: 12 , Issue: 5 , Sept.-Oct. 2008.

8 Wu Chou , “Web Services: Software-as-a-Service (SaaS), Communication, and Beyond” , Congress on Services Part II, 2008. SERVICES-2. IEEE , 1 – 1, 23-26 Sept. 2008 .

9 Ross, P.E. , “Cloud Computing's Killer App: Gaming”, Spectrum, IEEE , 14 – 14 , Volume: 46 , Issue: 3, March 2009.

10 Wenyi Zhao Nister, D. Hsu, S., “Alignment of continuous video onto 3D point clouds”, Pattern Analysis and Machine Intelligence, IEEE Transactions on , 1305 – 1318, Volume: 27 , Issue: 8 , Aug. 2005.

11 Lin, Geng Dasmalchi, Glenn Zhu, Jinzy , “Cloud Computing and IT as a Service: Opportunities and Challenges”, Congress on Services Part II, 2008. SERVICES-2. IEEE, 6 – 7, 23-26 Sept. 2008.

12 Wilkins-Diehr, N. Gannon, D. Klimeck, G. Oster, S. Pamidighantam, S. ,” TeraGrid Science Gateways and Their Impact on Science”, Computer, IEEE, 32 – 41, Volume: 41 , Issue: 11, Nov. 2008.

13 Sullivan, Francis ,” I wandered Lonely as a Cloud”, Computing in Science & Engineering , IEEE, 88 – 88, Volume: 10 , Issue: 3, May-June 2008.

14 Abawajy J H. and Dandamudi S P, “Parallel Job Scheduling Policy for Workstation Cluster Environments” In the proceedings of the IEEE International Conference on Cluster Computing (CLUSTER’00), 2000.

15 Abraham A et al, “Genetic Algorithm based Schedulers for Grid Computing System”, International Journal of ICICI, 2007.

16 Abraham A et al, “Nature’s heuristics for scheduling jobs on computational grids”, In the proceedings of the 8th IEEE International Conference on Advanced Computing and Communications, India, 2000.

17 Akshay Luther et al, ”Alchemi: A .NET-based Grid Computing Framework and its Integration into Global grids”, In the Proceedings of 6th International Conference on Internet Computing (ICOMP), Las Vegas, USA, pp. 27-30, 2005.

18 Andrew J. Page and Thomas J. Naughton, “Dynamic task scheduling using genetic algorithms for heterogeneous distributed computing”, In the proceedings of 19th IEEE IPDPS 2005.

19 Anthony Sulistio et al, “A Toolkit for Modelling and Simulating Data Grids: An Extension to GridSim”, Concurrency and Computation: Practice and Experience (CCPE), Online ISSN: 1532-0634, Printed ISSN: 1532-0626, 20(13): 1591-1609, Wiley Press, New York, USA,

Sep. 2008.

20 Avery. P et al, “Policy based scheduling for simple quality of service in grid computing”, In the proceedings of 18th International Parallel and Distributed Processing Symposium, 2004.

21 Belabbas Yagoubi and Meriem Medebber ” A Load Balancing Model for Grid Environment” In the proceedings of IEEE International Symposium on Computer and Information Sciences, 2007. ISCIS 2007 Volume, Issue, 7-9 Nov. 2007.

22 Buyya Rajkumar et al, “A Deadline and Budget Constrained Cost-Time Optimization Algorithm for Scheduling Task Farming Applications on Global Grids”, The 2002 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'02), Las Vegas, Nevada, USA, June 2002.

23 Doulamis, N.D et al, “Fair Scheduling Algorithms in Grids” IEEE Transactions on Parallel and Distributed Systems, Volume 18, Issue 11, Nov. 2007 pp.1630 – 1648.

24 Hiroyuki Ohsaki et al, “On Dynamic Resource Management Mechanism using Control Theoretic Approach for Wide-Area Grid Computing” , In the proceedings of IEEE Conference on Control Applications, 2005. (CCA 2005), pp. 891 – 897.

25 Hong Linh Troung et al, “Towards a Framework for Monitoring and Analysing QoS metrics and Grid Servives”, In the proceedings of the Second IEEE International Conference on e-Science and Grid Computing, pp. 65, 2006.

26 Hong Zhang Shan et al,”Job Super Scheduler Architecture and Performance in Computational Grid Environment”, ACM: Version, pp. 15-21, 2003.

27 Javier Carretero et al, “Genetic Algorithm based Schedulers for Grid Computing System”, International Journal of ICICI, Volume 3, Number 6, December 2007.

28 Jiaquan Gao “A parallel hybrid genetic algorithm for solving a kind of non-identical parallel machine scheduling problems”, In the proceedings of the Eighth International Conference on High-Performance Computing in Asia-Pacific Region (HPCASIA’05) 2005.

29 Jingjing Wu et al, “Application of the Hybrid Genetic Algorithm to Combinatorial Optimization Problems in Flow-shop Scheduling”, In the proceedings of the IEEE International Conference on Mechatronics and Automation, August 5 - 8, 2007, Harbin, China.

30 Kamrul Hasan S.M and Ruhul Sarker, “Hybrid Genetic Algorithm for Solving Job-Shop Scheduling Problem”, In the proceedings 6th IEEE/ACIS International Conference on Computer and Information

Science, (ICIS 2007).

31 Krauter K et al, “A taxonomy and survey of Grid resource management systems for distributed computing”, Software Pract. Exp. 2 (2002) 135–164.

32 Li Chunlin and Li Layuan, “ Fabric Level and Application Level QoS Guarantees in Grid Computing”, Institute of Mathematics and Informatics, Vilnius, Vol 18, No. 4, 569-584, 2007.

33 Li Chunlin and Li Layuan, ”Optimal Multiple QoS Resource Scheduling In Grid Computing”, In the proceedings of the 20th International Conference on Advanced Information Networking and Applications (AINA’06)-06.

34 Lin Liu and Yugeng Xi “A Hybrid Genetic Algorithm for Job Shop Scheduling Problem to Minimize Makespan”, In the proceedings of the 6th World Congress on Intelligent Control and Automation, June 21 - 23, 2006, Dalian, China.

35 Lior Amar et al, ”An On-line Algorithm for Fair-Share Node Allocations in a Cluster”, In the Proceedings of Seventh IEEE International Symposium on Cluster Computing and the Grid- 2007.

36 Mitrani I and Palmer J,” Dynamic Server Allocation Heterogenous Clusters “, In the proceedings of 1st International working conference on Heterogeneous Networks, Ilkley, UK, 2003.

37 Moreno, R. and Alonso-Conde A.B, “Job Scheduling and Resource Management Techniques in Dynamic Grid Environments”, Across Grids 2003, Volume 2970 of Lecture Notes in computer science, Springer, pp. 25 - 32, 2004.

38 Rajkumar Buyya et al, “Nimrod/G- An Architecture for a Resource management and Scheduling Systems in a Global Computational Grid”, In the proceedings of the 4th International Conference on High Performance Computing in Asia- Pacific Region, Beijing, China, IEEE Computer Society Press, USA, 2002.

39 Ranganathan K and I.Foster, “Decoupling Computation and Data Scheduling in Data Intensive Applications”, In the proceedings of 11th International Symposium on High performance Distributed Computing, Edinburgh, 2002.

40 Sathish S. Vadhiyar and Jack J. Dongarra, “A metascheduler for the grid”, In Proceedings of the 11th IEEE Symposium on High-Performance Distributed Computing, pp. 343-351, 2002.

41 Vijay Subramani et al, “Distributed Job Scheduling on Computational Grids using Multiple Simultaneous Requests”, In Proceedings of the 11th International Symposium on High Performance Distributed Computing, 2002.

42 Xiong Li et al, ” Concurrent Negotiation For Agent-Based Grid Computing”, In the Proceedings 5th IEEE International Conference on Cognitive Informatics (ICCI'06),2006.

43 Yi-Wen Zhong et al, “A Hybrid Genetic Algorithm For Tasks Scheduling In Heterogeneous Computing Systems”, In the proceedings of the Third International Conference on Machine Learning and Cybernetics, Shanghai, 26-29 August 2004.

44 Yuan-Shun Dai and Gregory Levitin “Optimal Resource Allocation for Maximizing Performance and Reliability in Tree-Structured Grid Services” IEEE Transactions on Reliability Volume 56, Issue 3, Sept. 2007 pp.444 – 453.

45 Yuan-Shun Dai et al, “Availability Modeling and Cost Optimization for the Grid Resource Management System” IEEE Transactions on Systems, Man and Cybernetics, Part A Volume 38, Issue 1, Jan. 2008 pp.170 - 179.

46 Javier Carretero, Fatos Xhafa and Ajith Abraham, “Genetic Algorithm based Schedulers for Grid Computing Systems” International Journal of InnovativeComputing, Information and Control, Volume 3, Number 6, December 2007

47 Carsten Franke, Joachim Lepping, and Uwe Schwiegelshohn, “On Advantages of Scheduling using Genetic Fuzzy Systems” University of Dortmund, Dept. of Computer Science, Dortmund, Germany, Technical Report, ISSN 1433-3325 June 2006.

48 Ehsan Ullah Munir, Jianzhong Li and Shengfei Shi, “QoS Suferage Heuristic for Independent Task Scheduling in Grid” Information Technology Journal, Volume 6 Number 8, pp: 1166-1170, ISSN 1812-5638, 2007

49 Sugree Phatanapherom and Putchong Uthayopas, “Unified Economic Deadline Scheduling Algorithm for Computational Grid”, International Journal of Information Technology, Vol. 11 No. 4.

50 Maryline Silly-Chetto and Audrey Marchand, ”Dynamic Scheduling of Skippable Periodic Tasks: Issues and Proposals” Journal of Software, vol. 2, no. 5, November 2007.

51 Gregory Levitin, Yuan Shun Dai, and Hanoch Ben-Haim, “Reliability and Performance of Star Topology Grid Service with Precedence Constraints on Subtask Execution”, IEEE Transaction on Reliability, Vol.55, No.3, September 2006.

52 Vandy Berten, Joel Goossens and Emmanuel Jeannot, “On the Distribution of Sequential Jobs in Random Brokering for Heterogeneous Computational Grids” IEEE Transaction on Parallel and Distributed Systems, Vol.17 No.2 February 2006.

7 Budget

a) Non – Recurring Expenditure:

Sl. No.	Equipment Details	Qty.	Unit Price	Total Cost
1.	Blade servers: Quad Core Intel, processors with chassis and accessories	100	Rs.2,00,000	Rs.2,00,00,000
2.	Software: Virtualization software (Sun/VMWare)	1	Rs.25,00,000	Rs.25,00,000
3.	Storage Component: 200 TB. Storage with RAID Options	1	Rs.75,00,000	Rs.75,00,000
4.	Workstations: Intel dual core processor based Work stations	200	Rs.30,000	Rs.60,00,000
5.	Networking and accessories (1GB / 10GB ports).Switches and cabling	20	Rs.1,00,000	Rs.20,00,000
6.	System Software and Application Software with academic licenses: (minimum of 60 – 100 users) Windows, Linux Database, Visual Programming, Data mining Engineering Software: Matlab / VLSI design, Mechanical design, (Ideas, ProE, Solid works) Civil Engineering software, Electrical Engineering software, IBM Tivoli network management, Web sphere.	1 set	Rs.2,00,00,000	Rs.2,00,00,000
7.	Network security devices, multiple level, Unified Threat Managements, VPN, firewall, IDS etc.	2 sets	Rs.30,00,000	Rs.30,00,000
8.	UPS and other power management system (24/7 support)	2 sets	Rs.50,00,000	Rs.50,00,000
	Total			**Rs.6,60,00,000**

b) Recurring Expenditure:

1	Internet bandwidth (64Mbps dedicated)	Rs.50 lakhs / year.
2	Electricity and other maintenance charges	Rs.15 lakhs
3	Maintenance charges for equipments (Applicable for 4th and 5th year)	Rs.30,00,000
4	**Salary component**:	

For Individual Group

Sl. No.	Post	Nos.	Annual salary	Total Expenditure
1.	Professor	1 No.	Rs.9,00,000 / year	Rs.9,00,000
2.	Assistant Professor	1 No.	Rs.6,00,000 / year	Rs.6,00,000
3.	Lecturer	2 Nos.	Rs.3,60,000 / year	Rs.7,20,000
4.	JRF / SRF	8 Nos.	Rs.1,80,000 / year	Rs.14,40,000
			Sub. Total	**Rs.36,60,000**

No. of Project groups 4 x Rs. 36,60,000	Rs.1,46,40,000

Total recurring expenditure per year (for first 3 years)	**Rs.2,11,40,000**
Total recurring expenditure per year (for IV and V years)	**Rs.2,41,40,000**

TOTAL BUDGET

Sl. No.	Details of Expenditure	Total (in Rs.)
1.	Non-recurring expenditure	6,60,00,000
2.	Recurring expenditure for first three years	6,34,20,000
3.	Recurring expenditure for IV and V year	4,82,80,000
	Total	**17,77,00,000**

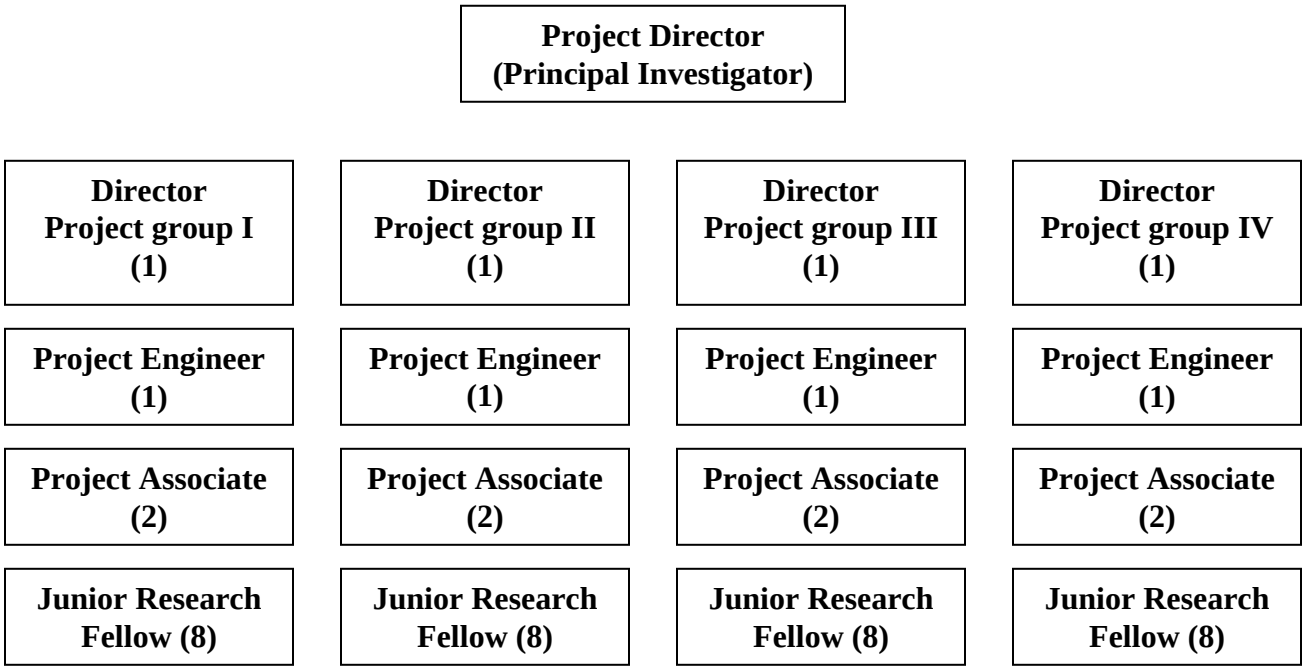
8 Plan of execution of project under consideration:

a) Organizational setup:

The main head of the project will be the Project Director (Principal investigator at senior professor rank with AGP 12,000/-) who will be coordinating the overall functioning of the project. There will be four research group directors who will be directly responsible for implementation of individual research group activities. Each research group consist of one Group director(head of the group)at professor rank, one project engineer at assistant

professor level and two project associates at lecturer level and four junior/senior research fellows. The research project activities of the four groups are

i. **Project Group I:** Developing and automating Infrastructure for cloud computing such as setting up virtual computing lab, developing middleware, etc.
ii. **Project Group II:** Design and development of system software for meeting all technical issues related to cloud computing such as security aspect, provisioning etc
iii. **Project Group III:** Developing testbeds for experimentation for different cloud computing applications
iv. **Project Group IV:** Exploring all aspects for providing educational software as a service, computing platform as a service, etc and few business applications



b) **Principal Investigator with designation (responsible for execution of project under reference)**

Dr.S.Radhakrishnan
Senior Professor
Dept. of Computer Science and Engineering
Kalasalingam University
Krishnankoil -626 190
Tamilnadu

c) **Name of the faculty members and others involved**

Sl. No.	Name	Designation	Specialization
1.	Dr. S. Radhakrishnan	Senior Professor	Network Engineering
2.	Dr. S. Karthikeyan	Senior Professor	Algorithms, Soft Computing
3.	Dr. V. Vasudevan	Senior Professor	Grid Computing
4.	Dr. K. Vimala Devi	Associate Professor	Computer Networks
5.	Mr. K. Somasundaram	Associate Professor	Grid Computing
6.	Mr. R. Ravi	Associate Professor	Network Security
7.	Mr. J. Amutharaj	Assistant Professor	Peer to Peer Networks
8.	Mrs. P. Deepalakshmi	Assistant Professor	Computer Networks
9.	Mrs. R. Ramalakshmi	Assistant Professor	Computer Networks
10.	Mr. V. Thiruppathy Kesavan	Assistant Professor	Sensor Networks
11.	Mrs. S. Sivaranjani	Assistant Professor	Sensor Networks
12.	Mr. S. Sankara Narayanan	Assistant Professor	Network Security
13.	Mr. B. Pitchai Manickam	Assistant Professor	Network Security
14	Mr.M.Gomathinayagam	Assistant Professor	Grid Security

d) **Suggested plan of action for development of infrastructure:**

1. Proposed to set up the entire infrastructure in phase I (mainly in first 2 years).
2. Will approach the major industries like IBM, Sun Micro Systems etc. to assist in setting up the infrastructure and train the man power.
3. Will interact with universities having similar facilities to share their experience in establishing the infrastructure (eg.: North Carolina State University, USA).

e) **Plan for internal monitoring and evaluation of progress implementation, (if approved).**

We will appoint a project monitoring committee consists of experts from leading academic institutions and industries, research labs to meet once in 6 months to monitor the progress of the project and fix the mile stone for every six months.

9 Existing facilities concerned with the project under reference

a) **Main equipment already available**: Routers, Switches, Network security devices, Network Management software

b) **Library facilities**: Central and department library with more than 40,000 books with access to all IEEE, IEE, Science Direct journals.

c) **Library facilities**: Central and department library with more than 40,000 books with access to all IEEE, IEE, Science Direct journals.

d) **Workshop facilities**: Well equipped work shop is available.

e) **Computational facilities**: Excellent computing facilities including Sun Enterprise level server, IBM server, Wipro, HCL servers, many Systems and Application software including engineering applications software are available. Computing facilities also include 50 Sun workstations, 20 IBM workstations and nearly 1000

nodes.

10 Any linkage with sister institutions, research laboratories, industry and other agencies

Our university has signed MoU with following universities.

1. ***Carnegie Mellon University, USA.***
2. ***RWTH Aachen University of Technology, Germany.***
3. ***Oklahoma University, USA.***
4. ***Ball State university, USA.***
5. ***East Tennessee University, USA.***
6. ***Multimedia university, Malaysia.***

Our university also signed MoUs with following leading industries.

1. ***Sun Micro Systems.***
2. ***Nortel Networks.***
3. ***Tyco Electronics.***
4. ***Fluke Networks.***
5. ***Society of Electronic Transactions and Security.***
6. ***Intel.***
7. ***Alcatel.***
8. ***Slash support.***

11 Is it inter-disciplinary project? If yes, name the participating departments

Yes, currently the core faculties are from Computer Science and Engineering and Information Technology. In the later stage we will be involving other departments for using the cloud computing facilities.

Name & Signature of
Principal Investigator

Signature
(Head of the Institution)