Volume 4, Issue 1, January 2014 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Product Lining of Cloud Services

Divya Chadha*
M.M.I.C.T.&BM, MCA
Maharishi Markandeshwar University,Mullana, India

Narender Singh
Computer Science Department
Central University of Haryana ,Hisar, India

Abstract— Software Product line is emerging as an important paradigm and now days this concept is also implemented for various other paradigms or services to provide wide range of products with some commonality and variability feature. One of these areas is Cloud computing. With evolution of new technologies and softwares, companies are not capable to compete by buying all the services and resources on their own. So, this concept is becoming a necessity because buying software, Infrastructure and a platform service involves huge expenses that can affect financial boundaries of a project. Due to availability of large number of service providers and limited resources the concept of product lining of cloud services has been proposed to provide services of various providers with product lining under one cloud.

Keywords— Software Product Lines, Cloud Computing, Cloud services, Cloud architecture

I. INTRODUCTION

Cloud Computing is an efficient Computing Model. That has provided a backbone to the business enterprises because of its beneficial features. Cloud computing acts as a host and provides many services to customers. Today this concept is attaining a lot of attention and demand because of its economical features. The concept emerged from public and grid computing. Here user can use virtualized resources as a service in, 1980's concept of grid computing came into existence when dependability of users on internets and complexity of work started increasing. The necessity for having concept of Grid was realised when various companies began to use resources like computing, storage, bandwidth, software, data, information, knowledge etc., Grid computing then made it possible by providing distributed services in geography into a logical entirety [1]. In 90's concept of cloud computing emerged to make up defects of Grid Computing and to improve existing pattern. It laid emphasis on service pattern that carried computation. Customer utilizes services and resources provides by cloud service providers and pay for that according to terms and policies finalized between customer and cloud services providers.. The public computing service includes the hardware, the software, computation resources [2].As the cost of software and other resources are very high, companies are getting these services on rent that is proved to be economical for these companies and doesn't affects their annual Return on investment.

Providers such as Amazon, Google, Sales force, IBM, Microsoft, and Sun Microsystems are efficiently emerging in this field so that business enterprises do not spent their excessive time in installation, configuration, testing, running, security, and up gradation. To provide redundancy and to ensure reliability these service providers have established new data centers for hosting Cloud computing applications in various locations around the world. The benefit of this technology is that it requires minimal management and service provider interaction that actually consume a lot of time and other resources. Cloud computing offers a shared pool of resources that can be configured such as networks, servers, storage, applications and services. Cloud computing is such a model that enables convenient and on-demand network access to these shared resources that can be rapidly provisioned [3]. With help of cloud services users can get software infrastructure and hardware services remotely. Different companies are providing their services independently and a user has to subscribe for a particular company for getting those services like HCL, AMAZON .they all are providing services in this field. But If a user can get all these services of various companies from one host which is administrating various clouds it will be very advantageous for large enterprises. The implementation of this concept can be done like Software Product lining where a tool is used to provide various services or products with some commonalities.

Paper is organized as follows: Section 1 provides introduction to cloud computing, its services and architecture of cloud computing by various companies. Section 2 comprises of Introduction to Software Product Line, its process and Big Lever Software Gears. Section 3 presents concept of Product Lining of Cloud Services in detail. Conclusion is presented in last section of paper.

II. INTRODUCTION TO CLOUD COMPUTING

An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

A. Basic Architecture of cloud computing

The services provided by cloud computing, are shown hierarchically. This Hierarchical view includes Software-as-Service (SaaS), Infrastructure as a Service (IaaS) , Platform as a Service (PaasS) and Data Centers. These are described as follows:

The services provided by cloud computing, are shown hierarchically. This Hierarchical view includes Software-as-Service (SaaS), Infrastructure as a Service (IaaS) , Platform as a Service (PaasS) and Data Centers. These are described as follows:

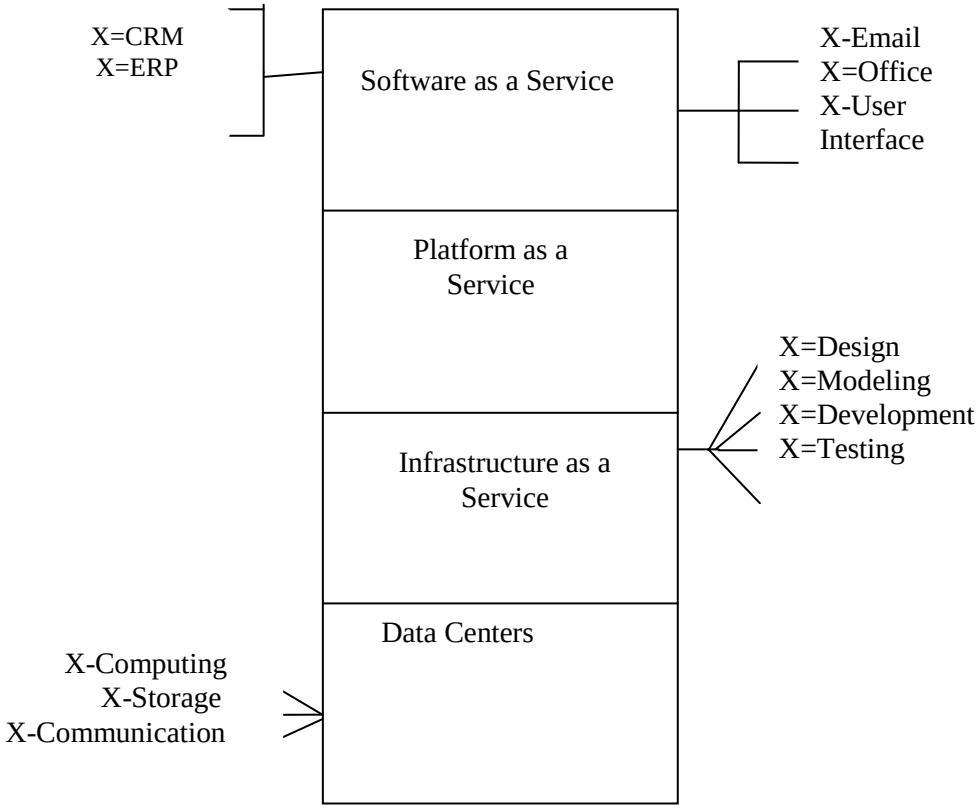

Fig 1. Hierarchical view of Cloud Computing [5]

- **Software –as-a-Service (SaaS)**
  SaaS is a software distribution model where service providers host various applications and make them available to customers over. As Service oriented architecture, Web services and development approaches are supported by technologies. SaaS is becoming an efficient and very beneficial service and much used by organizations [5].
- **Infrastructure-as-a-Services** (IaaS)
  IaaS is the service of huge computing resources like storage, network and capacity of processing. For example when user avails storage service on rent , storage location or disk is not to be paid, only a part of it is paid. Consumer gets infrastructure services without having any knowledge about the location of storage. Sometimes the IaaS is also called Hardware-as-a-Service (HaaS) [5].
- **Platform as a service (PaaS)**
  PaaS includes services like . Resource management functions for scheduling processing time, memory allocation and application integrity within environment are provided by PaaS. It is an application-development tool that enables service consumers to build cloud applications that run on the hosted platform [6].
- **Data Centers**
  Data centers provide the hardware where clouds run. This is the base of cloud computing. Data center are made up of various interconnected servers. They are built in less populated areas and with less energy rate to avoid natural disaster. [7].

B. Existing Architecture

Cloud computing services act as a shared pool of configurable resources that can be accessed on demand basis.

1) IBM cloud Architecture: IBM Cloud Architecture provides following components

Cloud Service Creator: IBM cloud services are generated by Cloud Service Creator. Service creation tools re used that runtime artefacts and management related aspects. For all services there is set tools that are used specifically for creation of that particular service.

Cloud Service Provider: Cloud Service are provided by service providers. There are two components of this module: Common Cloud Management Platform (CCMP) and Cloud Services. Cloud Services are various cloud services offered like SaaS, PaaS and IaaS. CCMP delivers instances of Cloud Services of any category to Cloud Service Consumers and allows consumers to manage those instances.

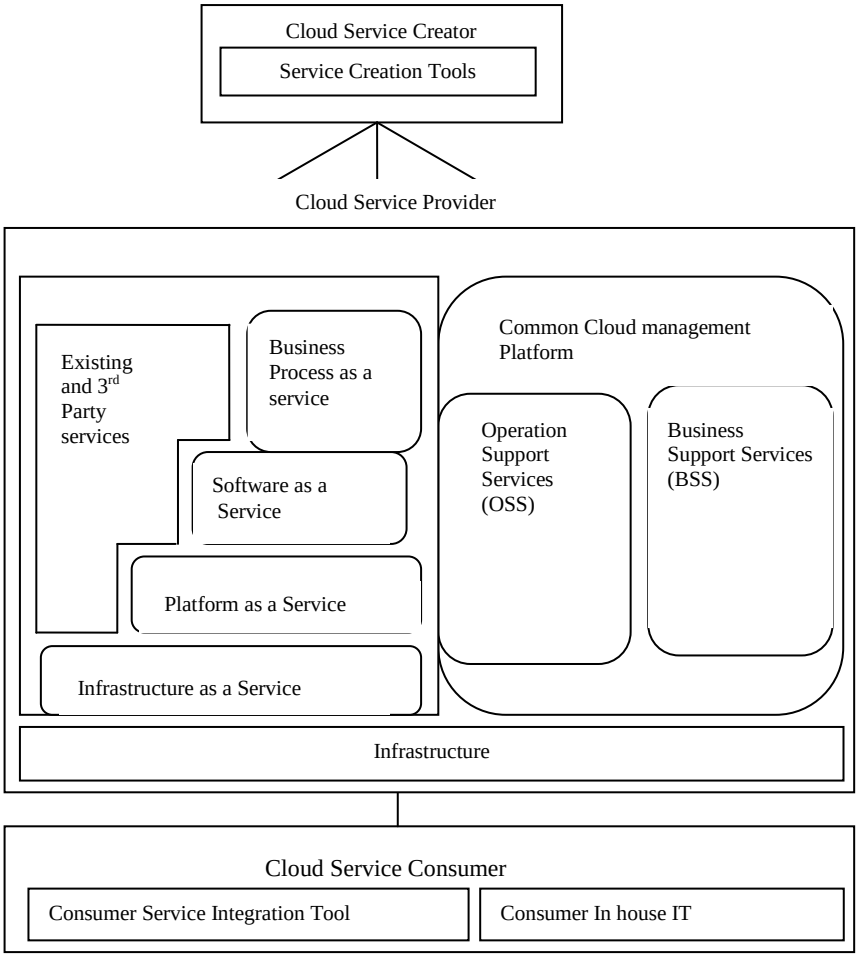

Fig 2. IBM Cloud Architecture [8]

2) Cisco Architecture: The foundation of Cisco Reference Architecture [9] framework consist of technology Architecture that contains features like network, storage and corporate. Layers are the hosts that provide services to consumers.

Security architecture: To overcome security issues is the task of this layer. Security architecture is provided to ensure security across the entire framework.

Service Orchestration architecture: It consists of configuration repository enablers that contain information like service catalogue, asset inventory and resource to service mapping.

Service management: It takes place in service delivery and management architecture. The topmost layer is the consumer-facing layer, usually exposed via a portal-like solution.

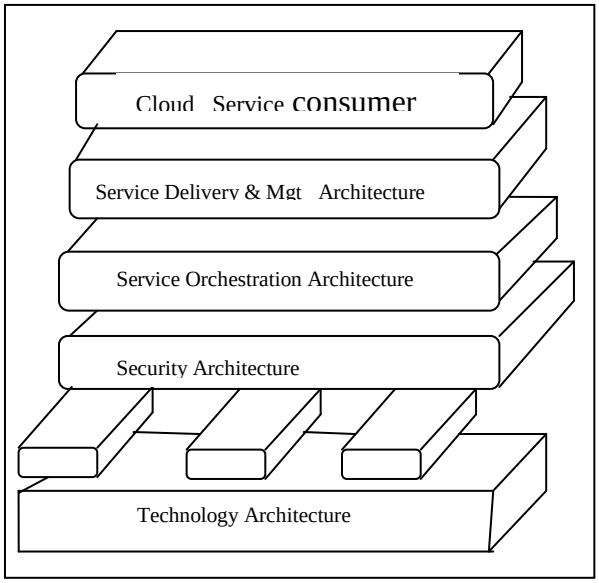

Fig 3. Cisco Cloud Architecture[9]

3) Reserviour Architecture:The RESERVOIR provides platform to service provider's architecture provides a remarkable platform to Service Providers by identifying and distinguishing the needs of users who understand the operation of particular businesses and offer suitable Service applications. It satisfies Providers, who lease computational resources in the form of a Cloud computing infrastructure

Lowest Level: The lowest layer of RESERVOIR is Virtual Execution Environment Host (VEEH). It enables the upper layer to have an interface with virtualization products. It also provides plugins for different supervisors.

Middle Level*:* The Upper Layer of architecture Virtual Execution environment Manager (VEEM),it provides abstraction for cloud computing.It interacts with VEEH and control multiple VEEHs within one site. It controls activation of virtualized operating system ,its migration, replication and deactivation.

Highest level: Last is Service managers. This is highest level of interaction. It interacts with service providers to ensure correctness of requirements. In addition to it , it also performs management task.

The key differentiator from other Cloud Computing infrastructure is RESERVOIR's ability to federate across different sites, which might be implementing different virtualization products. This is achieved by cross-site interactions between multiple different VEEMs operating on behalf of different Cloud computing providers.

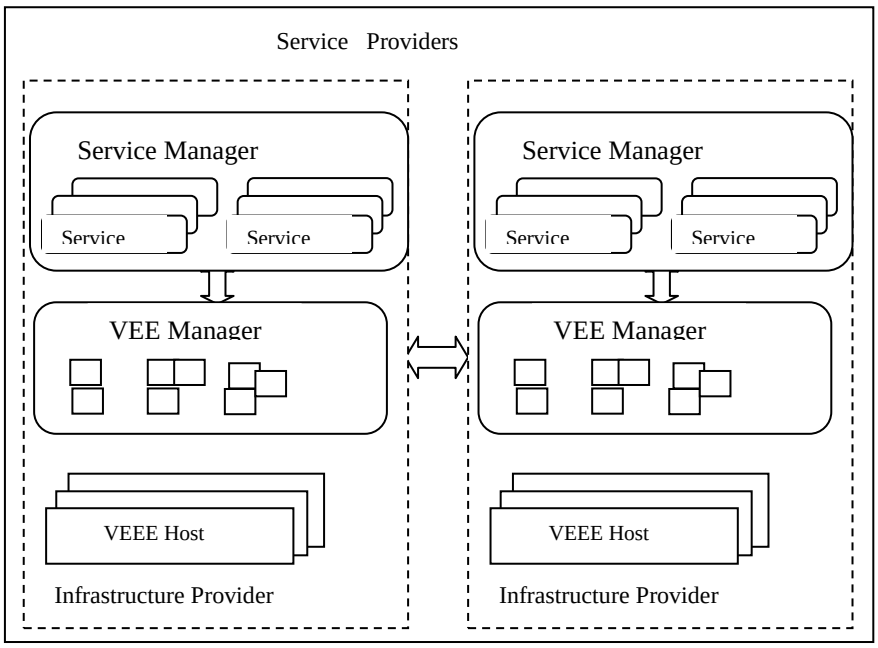

Fig.4. Reservoir Architecture [10]

These are the various services provides by different cloud service provide. But the proposed idea is to have user at the centre and he must have choice among different services of different providers not all services by an individual service provider. Users should have a choice to switch between various service providers. Providing all the services by different providers can also be done by having services at one edge and an administrator must be there who is satisfying customer needs by providing service of their own choice. Next section presents Introduction to Software product line.

III. INTRODUCTION TO SOFTWARE PRODUCT LINE

Software Product Lines (SPL) [11] refers to engineering techniques where common means of production are used to create a new system. In this system, software assets can be reused to construct new software In software product line similar type of parts or components are assembled to create product line of similar products. Here the central components are set of core assets that are the main components Fr designing of various products similar products or components are assembled or configured.. The study of software product lines includes collection of similar type of software system that has some commonality.. The individual products in the software product line are built from these core assets according to a pre-defined production plan, sometimes called a reuse guide [12]. It arises repository of common software components that create software artifacts when reuse is predicted [13] .This concept can be implemented along variability by using commonality function or by using common assets. SPL techniques can be used in various phases of software development life cycle. It can also be used in other areas to provide variable products with common assets .For example in software testing phase software product line can be used for using similar test plan components in various software development processes.

A. Process

Software product lines can be described in terms of four simple concepts that form the process of software product line, as illustrated below:

- **Core Assets**
  These assets can be composed in various ways to create products that can be configured. These software assets are the main ingredient for software product line because of their nature to be reused again. These assets are requirements,

source code components, test cases, architecture, and documentation. The main feature of these assets is commonality of architecture for various product lines. To accommodate variation among the products, variation points are included and deviations are affixed among paths.

- **Product Decisions**
  This phase describes product decision – a variable component that can be used in different forms along with commonality feature of core assets to produce outcome. These variable features can also be reused. A product decision is taken with some deviation in asset and a variable decision based on a particular requirement of user. A decision model is then made by including common component and variable decision.
- **Production process**
  This is a phase in which product decision suitable to particular requirement is chosen and used with some core asset to produce an asset and its configuration is also determined to achieve the outcome. This consists of composing and configuring products from the software asset inputs. This is a means of composing products out of assets.
- **Process Outcome**
  Process Outcome is the result of applying common core assets with variable decision . It produces wide rande of outcomes that is originated by relating the concept of commonality and variability**.** Commonality refers to core assets and Variability refers to decisions that can vary depending on a particular problem, requirement and component development. Fig 5. [14] shows the usage of Core Assets with product development. These are amalgamated under the control of management to give unique output.

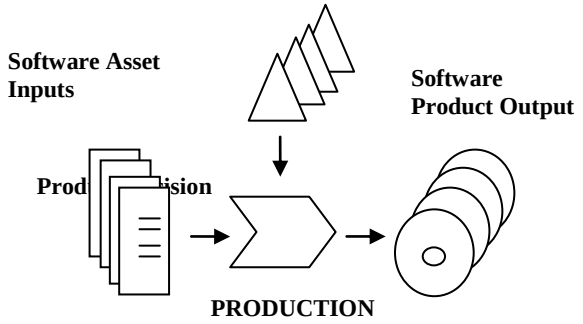

Fig 5. [14] Shows usage of Core Assets and Product Decision

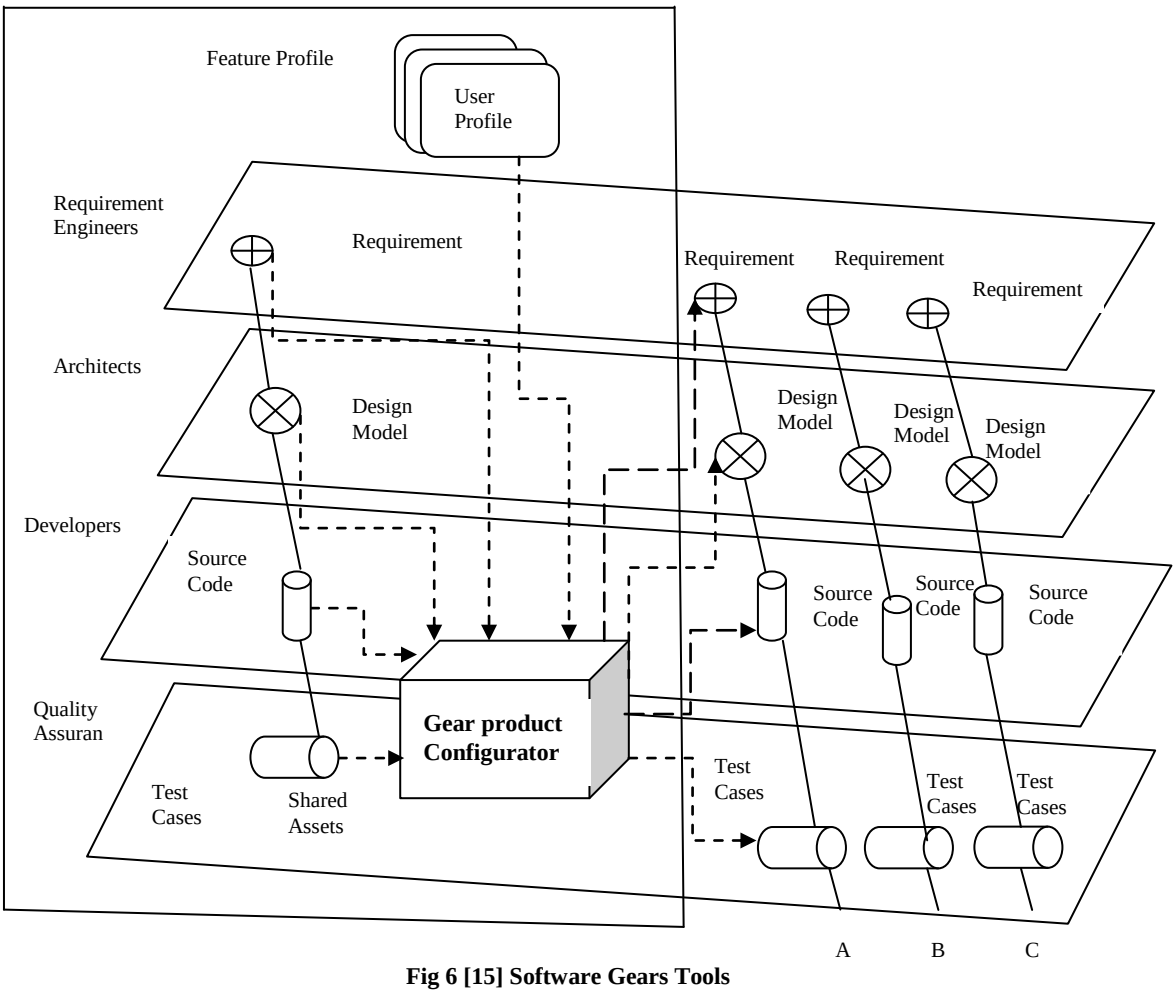

Fig 6 [15] Software Gears Tools

B. BIGLEVER SOFTWARE GEARS

Big Lever software gears is a product line tool that is capable of automatically producing the entire product related to that product line.

Production Line: Gears production lines consist of 3 elements.

Configurable Assets: These include software artifacts such as source code, requirements, models and test cases.

Feature Model: It consist of each product in terms of optional and varying features choices specified for the product line.

Product Configurator: It automatically chooses or assembles software assets to produce product as per requirement of user. Fig 6. Shows Gears configuration tool.

The solution also provides a unique console called Gears Development Environment for managing facets of systems and software development including powerful collection of browsers, views, languages, constraints , editors , dashboards, wizards and analytical tools.

IV. PRODUCT LINING OF CLOUD SERVICES

This concept can also be explained as follows. Fig 7, matrix representation shows example of Software as a Service where various software services are provided by the company by keeping some commonalities in all software services and providing different outcomes by using variable product decision. SaaS 1, SaaS 2 and so on are various services that can be outcome of common features and variable decision and this is the concept of product lining of Cloud services

	F1	F2	F3	Fn
S1	S1F1	S1F2	S1F3	S1Fn
S2	S2F1	S2F2	S2F3	S2Fn
S3	S3F1	S3F2	S3F3	S3Fn
Sn	SnF1	SnF2	SnF3	SnFn

Si where i=1 to n is number of SaaS Services
Fj where j=1 to m is number of variable features to provide various SaaS Services
SiFj=> is the combination of ith Software as a Service (Si) and jth variable feature or product decision

Fig 7. Matrix Representation

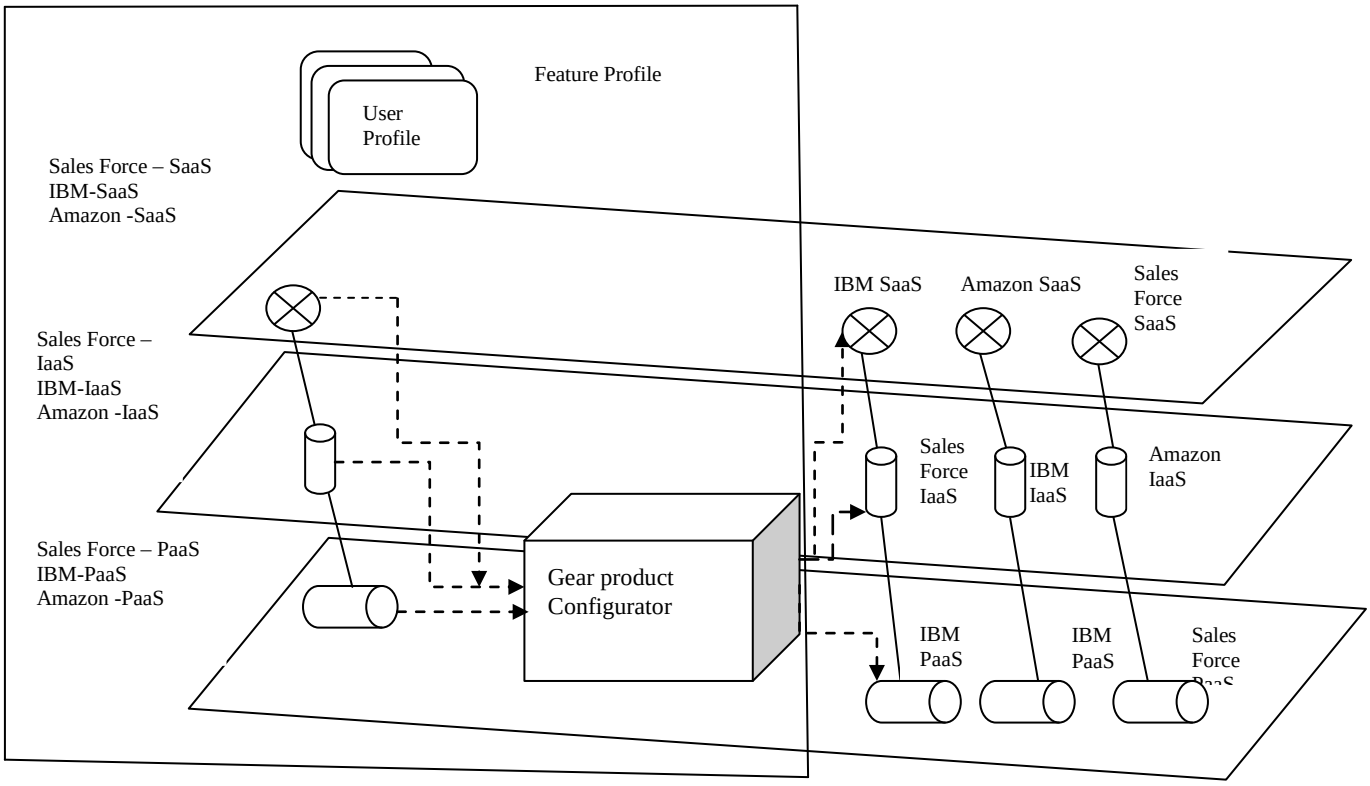

Fig 8. Product Lining of Cloud Services

The matrix shown above in Fig. 7 represent SaaS services represented as Si that is common services Fj represent variable product decision or variable features that combine with SaaS to form various SaaS services with some common services or commonality and variable features. A decision in product lining of cloud services may be combination and compatibility of various services from different providers. This concept can be illustrated by including cloud services in Software Gears self configuration Tool. Fig. 8. Shows product lining of various cloud services. It consists of three major services provided by all cloud service providers SaaS, IaaS and PaaS. It shows that it is not necessary that user A will go for all services provided by IBM. There may be requirement of SaaS from IBM, IaaS from Sales Force and PaaS from IBM as per requirements, compatibility and profitability of a user.

This self configurator tool automatically arranges and provides set of services as per requirements of all users. This self configurator tool is proposed to fulfil requirements of all users with different services under one cloud. These Software services are the outcome of varying decisions with fixed assets or common resources. This commonality attribute along with different decisions form variety of software as service.

V. CONCLUSION.

Cloud services are the backbone of big companies now days so that they can compete globally with other companies that are equipped with latest upcoming technology and resources bearing heavy cost. With availability of various providers it will be very compatible and helpful for big companies when they will have choice of their own to choose among various services of different providers. Product lining of services is good and economical where user can enjoy various services under one cloud and will prove to be beneficial for cloud service providers also.

REFERENCES

[1] Zheng, J. and Chen, L. "The Evolution Process and Economic Analysis of Cloud Computing with Its Application in Chinese University", International Conference on Challenges in Environmental Science and Computer Engineering, 2010.

[2] Zhang, S. , Zhang, S., Chen, X. and Wu, X. "Analysis and Research of Cloud Computing System Instance", Second International Conference on Future Networks,2010

[3] Mell, P. and Grance, T. "The NIST Definition of Cloud Computing, National Institute of Standards and Technology", Information Technology Laboratory, Version 15, \10-7-09,2009

[4] Taneja, K. , Taneja.H., Chadha, D., Vol. 1 Issue 1. "Cloud Computing: A Catalyst for Commercial Success of Computing Trends", International Journal of New Innovations in Engineering and Technology (IJNIET), June 2012

[5] Mathur, P. and Nishchal, N. " Cloud Computing: New challenge to the entire computer industry", 1st International Conference on Parallel, Distributed and Grid Computing (PDGC - 2010).

[6] Chong, F., Miguel, A., Hogg, J., Homann, U., Zwiefel, B., Garber,D., Joseph, J., Zimmerman, S. and Kaufman, S. . "Design Considerations for S+S and Cloud Computing",2009

[7] Tsai, W.T. , Sun, X. and Balasooriya, J. "Service-Oriented Cloud Computing Architecture", Seventh International Conference on Information Technology,2010.

[8] Behrendt, M. et. al.. "Introduction and Architecture Overview ,IBM Cloud Computing Reference Architecture 2.0" 2011.

[9] Cisco Cloud Computing -Data Center Strategy, Architecture and Solutions . Point of View White Paper for U.S. Public Sector, 1st Edition, 2009.

[10] Rochwerger B, Breitgand D, Levy E, Galis A, Nagin K, Llorente L,Montero R,Wolfsthal Y, Elmroth E, C´aceres J, Ben-Yehuda M, Emmerich W, G´alan F The RESERVOIR Model and Architecture for Open Federated Cloud Computing. IBM Systems Journal Special Edition on Internet Scale Data Centers 53(4), 2009

[11] www.softwareproductline.com

[12] Software Engineering Institute, The Product Line Practice (PLP) Initiative, Carnegie Mellon University, www.sei.cmu.edu/activities/plp/plp_init.html.

[13] Krueger, C. "Software Reuse". ACM Computing Surveys. 24, 2 (June), 131-183. 1992

[14] Chadha, D., Singh, N., "Emergence of Software Product Line,"International Conference on Recent Advances and Future Trends in Information Technology (iRAFIT2012) Proceedings published in International Journal of Computer Applications® (IJCA), 2012

[15] http://www.biglever.com/solution/product.html.

