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Emerging Cloud based Content Delivery Networks

V.Suresh[1*], B.Venkatesh[2], A.Anjaneyulu[3]

[1*]Department of Computer Science and Engineering, JNTU Kakinada University
[2]Department of Computer Science and Engineering, JNTU Kakinada University
[3]Department of Computer Science and Engineering, JNTU Kakinada University
Vignan's Institute of Information Technology, Duvvada, Visakhapatnam-530049,A.P. India

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Abstract— **A content delivery network or content distribution network (CDN) using cloud resources such as storage and compute have started to emerge. Unlike traditional CDNs hosted on private data centers, cloud-based CDNs take advantage of the geographical availability and the pay-as-you-go model of cloud platforms. The Cloud-based CDNs (CCDNs) promote content-delivery-as-a-service cloud model. Though CDNs and CCDNs share similar functionalities, introduction of cloud impose additional challenges that have to be addressed for a successful CCDN deployment. Several papers have tried to address the issues and challenges around CDN with varying degree of success. However, to the best of our knowledge, there is no clear articulation of issues and challenge problems within the context of cloud-based CDNs. Hence, this paper aims to identify the open challenges in cloud-based CDNs. In this regard, we present an overview of cloud-based CDN followed by a detailed discussion on open challenges and research dimensions.**

Keywords- Content delivery networks, Cloud, Cloud-based CDN, pay-as-you-go model, content-delivery-as-a-service

1. Introduction

The digital universe is doubling in size every two years. It is expected that the data we create and copy will reach 44 zeta bytes by 2020. The global internet video traffic alone will comprise 79 percent of all Internet traffic in 2016, up from 66 percent in 2013. In our current Internet-driven world, consumers expect fast, always-on data access from anywhere and any device. As a result, content providers are expected to confront with the challenge of delivering optimized and streaming content to application running on devices, including tablets and smart-phones while ensuring high-speed access and superior performance. The major challenges that the emerging applications bring to the future internet include the requirements of: 1) higher scalability, 2) higher capability, 3) higher quality of service (QoS), 4) stronger interactivity, 5) dealing with heterogeneity (e.g., device, network and application) and 6) security. Content delivery networks (CDNs)[1] are often required to face the data deluge to efficiently and securely distribute content to a large number of online users. The growth of related technologies such as accelerated web performance, rich media content streaming, IPTV, management and delivery of user generated content over the last decade has led to the significant adoption of CDNs. Cisco has estimated that over half of the internet traffic generated will be carried out by content delivery networks by 2018 [19].

A CDN is a distributed network of servers and file storage devices that replicates content/services (e.g. files, video, audio etc) on a large number of surrogate systems placed at various locations, distributed across the globe. CDNs are highly flexible and aims to improve the quality and scalability of the services offered over the Internet by reducing the latency and efficiency of delivering content to clients. The CDN maximizes the bandwidth for accessing to data from clients throughout the network by strategically placing content replica(s) at geographically distributed locations. The concept of a CDN was conceived during the early days of the Internet. By the end of 1990‟s before CDNs from Akamai[20] and other commercial providers managed to deliver Web content (i.e., web pages, text, graphics, URLs and scripts) anywhere in the world, and at the same time meet the high availability and quality expected by their end users. Today, Akamai delivers between fifteen to thirty percent of all Web traffic, reaching more than 4 terabits per second [20].

In today's dynamic Internet landscape, it is more important than ever for content and service providers to understand the requirements and demands of users. For instance, consider a video distribution services such as Netflix, YouTube and Quickflix. When delivering video content to geographically distributed subscribers, the video experience can vary depending on the delivery path to the subscriber. Studies show that, the sensitivity of subscribers to video quality issues can greatly impact the subscriptions to the services offered by the video distribution service providers [17].

Cloud computing is an emerging computing model where a myriad of virtualized ICT resources are exposed as web utilities, which can be invoked and released in an on-demand fashion. The concept of cloud computing is an immediate extension of many well researched domains such as virtualization, distributed, utility, cluster, and grid computing. Cloud computing is defined as "A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". A number of public cloud providers, including Amazon Web Services (AWS), Microsoft Azure, Salesforce.com and Google App Engine have been emerged to be very successful in the recent past. The beginning of virtualization has led to the transformation of traditional data centers into flexible cloud infrastructure [3].

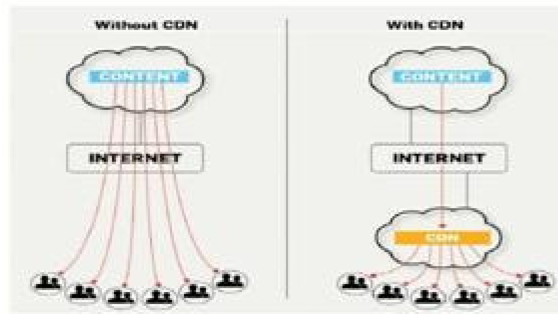
In the days before cloud, the main way to address issues regarding performance, availability and scale in CDN was for companies to physically repeat existing infrastructure in other geographical locations in order to decrease the physical distance between the end user and content servers. For example, deploy servers close to ISP gateways. This approach was not only expensive, but companies had to determine the best replicate and server placement strategy. The cloud model offers companies an alternative and less expensive way to expand infrastructure, in particular the ability to virtually scale across unlimited resources on demand without the need to buy expensive hardware. The cloud and CDN have both evolved to be complimentary utility platforms. The cloud provides virtually unlimited access to computational resources (processing, storage and network infrastructure) via an array of physical servers deployed globally. On the other hand, CDN provides an optimized repeatable delivery of content from servers to end users (one-to-many). Using the cloud and CDN together can deliver a holistic agile system that meets CDN demands and is economically viable. A cloud-based CDN architecture can provide the following advantages:

An elastic platform with the ability to dynamically and easily scale capacity up and down Hides the infrastructure complexity from CDN applications and content provides Enable a QoS driven performance management Open standard approach to tap into the capabilities of public clouds to scale during peak demand. In the past, authors have investigated CDN presenting an overview and technical challenges in designing and implementing effective CDNs. Most of the work has focused on commercial CDNs that work over private data centers.

2. Content Delivery Network and Cloud computing

2.1 Content Delivery Network

A Content Delivery Network (CDN) is a globally distributed network of web servers whose purpose is to provide faster delivery, and highly available content. The content is replicated throughout the CDN so it exists in many places all at once. A client accesses a copy of the data near to the client, as opposed to all clients accessing the same central server, in order to avoid bottlenecks near that server [7].



An overview of a typical CDN architecture is presented in Fig. 1. Depending on application and content type the architecture of CDNs may vary However, all CDN architectures mainly comprise of an origin server, a request redirecting mechanism and a large number of surrogate cache servers namely Point of Presence (POP).

Fig-1. The Architecture of a Content Delivery network

1. **Origin server***:* It is a powerful storage system that contains all the content and/or the metadata of all the content. To achieve high performance of the whole CDN, the content on the origin server are pushed to the POP servers (surrogate servers) that are located at different geographical locations across the globe.

2. **POP servers**: Pop servers are distributed in a large numbers at diverse areas in a CDN. The main function of pop server is to offer the content based on user request. When the content is not available locally, the pop server should pull it from the origin server and store it for the next probable requirement; as it might be possible that the same/other user(s) in the region will require the content. Pre-fetching is another important functionality provided by the POP server where it fetches the content that clients may be interested in from the origin server, thereby reducing the chance of traffic congestion especially during the high demand. It is evident that this kind of pre-fetching techniques may require, statistical data mining algorithms to determine what content

to pre-fetch.

3. **Request Redirecting mechanism**: One of the functions of a CDN is to dynamically redirect clients to the most optimal servers based on several QoS parameters such as server load, latency, network congestion, client access networks, and proximity, etc. There are a variety of methods that can be used to implement this mechanism as presented in Table 1.

Table 1. CDN Request Redirecting Mechanisms

Global Server Load Balancing	Global awareness
	Smart authoritative DNS
DNS-based request routing	
HTTP redirection	
URL rewriting	URL modification
	Automation through scripts
Anycasting	IP anycast
	Application level anycast
CDN Peering	Centralized directory model
	Distributed Hash Table
	Flooded request model
	Document routing model

In a distributed hash table, peers are indexed through hashing keys and are found through complex queries within a distributed system. This approach is good in performing load balancing and offloading loads to less-loaded peers. The flooded request model is simple, but scales poorly. When a node wants to find a resource on the network, which may be on a node it does not know about, it could simply broadcast its search query to its immediate neighbors. If the neighbors do not have the resource, it then asks its neighbors to forward the query. This is repeated until the resource is found or all the nodes have been contacted, or perhaps a network-imposed hop limit is reached.

2.2 Cloud Computing:

Cloud computing assembles large networks of virtualized ICT services such as hardware resources (such as CPU, storage, and network), software resources (such as databases, application servers, and web servers) and applications. The advent of virtualization has led to the transformation of traditional data centre into flexible cloud infrastructure. With the benefit of virtualization, data centre gradually provide flexible online application service hosting such as: web hosting, search, e-mails, and gaming. Largely, virtualization provides the opportunity to achieve high availability of applications in data centre at reduced costs. In industry, these services are referred to as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Cloud computing services are hosted in large data centre, often referred to as data farms, operated by companies such as Amazon, Apple, Google, and Microsoft. Cloud computing gives developers the ability to marshal virtually infinite computing and storage based on the amount of data to be processed and stored; and number of people to be notified in real time. Cloud-based ICT resources can be acquired under pay-per-use models and as needed, instead of requiring upfront investments in resources that may never be used optimally. As defined by the National Institute of Standards and Technology, the five essential characteristics of cloud computing are:

- On-demand self-service
- Broad network access
- Resource pooling,
- Rapid elasticity
- Measured service

Another important characteristic of cloud computing that is gaining significant momentum is Quality of Service (QoS) driven service delivery. For reliable and efficient management of application performance hosted on the *aaS layers, system administrators have to be fully aware of the compute, storage, networking resources, application performance and their respective quality of service (QoS). QoS parameters (e.g., latency, renting cost, throughput, etc.) play an important role in maintaining the grade of services delivered to the application consumer and administrator as specified and agreed upon in the Service Level Agreement (SLA) document. The SLA guarantees scope and nature of an agreed QoS performance objective (also referred to as the QoS targets) that the cloud application consumer and administrators can expect from cloud service provider(s) [23].

Though the notion of virtually unlimited resources is true in many aspects, there are practical limitations to the realization of this concept. For example, how to automatically provision new resources as the demand for the service increases. Previous work on resource provisioning in distributed computing environments enables its users to manually modify the hardware resources of their running job flows [6].

2.3 Comparison between CDN and Cloud Computing:

When your internet business grows up you will need higher hosting solutions. The most popular choice today is **cloud hosting** server or **CDN service** for maximum online availability. Both cloud hosting and CDN are good options, depends on your actual website requirements [22].

About Cloud Hosting

Cloud hosting or cloud computing is powered by a large number of servers that are connected through a real-time communication network. With cloud hosting service, your website data will be supported by multiple servers so if there's a single server failure, the rest will take over the work and ensure your website is always online. Cloud server hosting is very similar to the cluster server service. A typical cloud hosting service is always provided as paid as you use.

About CDN Service

CDN means Content Delivery Network. It's a large system where servers are deployed in multiple data centers across the Internet. A typical CDN service relies on a group of data center and serves your target audience via the most nearby nodes. In this way, your website will be displayed to your clients via the most possible fast speed.

2.3.1. Cloud vs. CDN – Technologies:

Cloud server and CDN service are setup in different ways. Cloud hosting service is cloud computing based where you can add unlimited resource to the system such as space or RAM and thus enable website growth. Cloud servers are typically created/managed by some leading solutions like VMware and Open stack etc.

The CDN service focuses more on the network while a cloud hosting is mainly on hardware configuration. The CDN service can be setup via unlimited datacenter service, the provider just needs to rent server space from data centers and then connect to it via CDN software. The decent CDN service has extremely high requirements for networking since it will deliver lots of data to each network location [21].

2.3.2. Cloud vs. CDN – Performance:

Cloud hosting service is the next generation hosting solution and is the development direction for all hosting providers. Cloud hosting is scalable for all computing services because you can add/remove resources on the fly. Because each service is powered by different equipments in the cloud system, the maximum performance is guaranteed. Problem fixing and trouble shooting is pretty straight and easy. The pay by use feature greatly reduced your initial investment and you have full control about usage statistics, this will help with your future internet plans making.

On the other hand, CDN service will only deliver your static web contents to different network locations to serve the nearby visitors. The CDN is not installed for any web services, but just for storage only, means when a web request occurs, it will still communicate with the source web server and database server. It will just put out the files from nearby networks. The overall website performance will completely depend on the source web server not CDN service.

2.3.3. Cloud vs. CDN – Reliability:

Cloud hosting reliability is better than CDN either from logic or actual user experience. Cloud hosting providers have full access to both hardware and networking and are able to configure services in real time. The powerful scalability of this platform makes everything possible. For large and heavy traffic web applications, cloud hosting service is the best choice.

In most of the cases, CDN is mainly used by traditional shared hosting websites, means if the shared server is down, your website will not be available either. A shared hosting server resource is very limited and there're hundreds of other websites hosted in the same space. CDN service will deliver your static contents to multiple other networks, but still highly relies on the source server performance. Especially when you're hosting video/audio files on server, CDN will not work anymore [14].

2.3.4. Cloud vs. CDN – Costs

Cloud hosting is much more expensive than CDN based the leading technologies and investment. However, unlike all other type services that are billed monthly, quarterly or yearly, you just pay for the amount you used to cloud hosting service but don't have to pay any extra. All service usage can be monitored on the fly so you're billed clearly for the service.

CDN service is pretty cheap compared to cloud hosting. If you have a heavy traffic web application, cloud hosting will be your best choice. A sole CDN service can be used if you have a small website but want to serve your audience better from different locations [8].

3. Cloud CDNs

CDNs have made a significant impact on how content is delivered via the Internet to the end-users. Traditionally content providers have relied on third-party CDNs to deliver their content to end-users. With the ever changing landscape of content types, e.g. moving for standard definition video to high definition to full high definition, it is a challenge for content providers who either supplement their existing delivery networks with third-party providers or completely rely on them to understand and monitor the performance of their service. Moreover, the performance of the CDN is impacted by the geographical availability of the third-party infrastructure. A cloud CDN (CCDN) provides a flexible solution allowing content providers to intelligently match and place content on one or more cloud storage servers based on coverage, budget and QoS preferences. The key implication is economies of scale and the benefits delivered by the pay-as-you-go model. Using clouds the content providers have more quickness in managing situations such as flash crowds, avoiding the need to invest in infrastructure development.

As stated previously, clouds provide the end users with a virtually infinite pool of computing and storage resources with no capital investment in terms of hardware and software. Therefore, CCDN systems can be very valuable in data processing and delivery of content over the Internet. The main advantage of such a system would be that they provide a cheaper means of hosting and deploying multi-tiered applications that can scale based on the usage demands. Further clouds offer not only cheap content storage and distribution functionality, but also compute functionality such that applications and data processing can also be performed on clouds. Lastly,movement from traditional client/server based CDNs to cloud computing model is a major transformation that introduces great opportunities [5].

3.1 Content Creation

Traditional CDNs are not designed to manage content (e.g., find and play high definition movies). This is typically done by CDN applications. For example, CDNs does not provide services that allow an individual to create a streaming music video service combining music videos from an existing content source on the Internet (e.g., YouTube), his/her personal collection, and from live performances he/she attends using his/her smart phone to capture such content. This can only be done by an application managing where and when the CDN will deliver the video component of his/her music program. With CCDN, the end-user will act as both content creator and consumer. CCDN needs to support this feature inherently. User-generated content distribution is emerging as one of the dominant forms in the global media market [2].

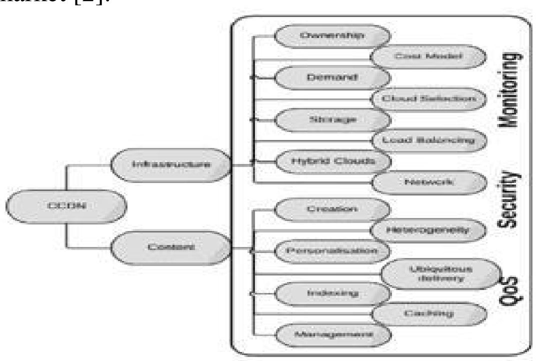


Fig- 2. Classification of CCDN Challenges and Issues

3.2 Content Heterogeneity

Existing Web 2.0 technologies currently support the authoring of structured multimedia content (e.g., web pages linking images, sounds, videos, and animations). The CCDNs will need to extend and broaden existing Web 2.0 strengths with a new environment aimed at supporting the creation and consumption of interactive multimedia content (e.g., interactive audio and video), as well as other novel forms of multimedia content (e.g., virtual and augmented reality) that are currently not supported by existing Web 2.0 technologies and tools.

3.3 CCDN Ownership

Cloud CDN service providers either own all the services they use to run their CDN services or they outsource this to a single cloud provider. A specialized legal and technical relationship is required to make the CDN work in the latter case [9]..

3.4 CCDN Personalization

CDNs do not support content personalization. For example, if the subscriber's behavior and usage pattern can be observed, a better estimation on the traffic demand can be achieved. The performance of content delivery is moving from speed and latency to on-demand delivery of relevant content matching end-user's interest and context [16].

3.5 Cost models for Cloud CDNs

The cloud cost model works well as long as the network consumption is predictable for both service provider and end-user. However, such predictions become very challenging with distributed cloud CDNs.

3.6 Security

CDNs also impose security challenges due to the introduction public clouds to store, share and route content. The use of multi vendor public clouds further complicates this problem. Security is the protection of content against unauthorized usage, modification, tampering and protection against illegal use, hack attacks, viruses and other unwanted intrusions. Further, security also plays an important role while accessing and delivering content to relevant users.

3.7 Hybrid Clouds

The integration of cloud and CDN will also allow the development of hybrid CCDN that can control on a combination and private and public cloud providers. E.g. the content provider can use a combination of cloud service platforms offered by Microsoft Azure and Amazon AWS to host their content. Depending on the pay-as-you go model, the content provider can also move from one cloud provider to another. However, achieving a hybrid model is very challenging due to various CCDN ownership issues and QoS issues[24].

3.8 CCDN Monitoring

The CCDNs can deliver end-to-end QoS monitoring by tracking the overall service availability and pinpoint issues. Clouds can also provide additional tools for monitoring specific content e.g. video quality monitoring. However, developing a CCDN monitoring framework is always a challenge.

3.9 CCDN QoS

With the notion of virtually unlimited resources offered by the cloud, quality of service plays a key role in CCDNs to maintain a balance between service delivery quality and cost. Defining appropriate SLAs to enforce QoS and guarantee service quality is very important and is also challenging. Further, the notion of hybrid clouds further complicates CCDN QoS challenges due to the involvement of multiple cloud providers with varying SLAs. CCDNs must accommodate highly transient, unpredictable user's behavior (arrival patterns, service time distributions, I/O system behaviors, user profile, network usage, etc.) and activities (streaming, searching, editing, and downloading).

3.10 CCDN Demand Prediction

It is critical that CCDNs are able to predict the demands and behaviors of hosted applications, so that it can manage the cloud resources optimally.

Concrete prediction or forecasting models must be built before the demands and behaviors of CDN applications can be predicted accurately. The hardest challenge is to accurately identify and continuously learn the most important behaviors and accurately compute statistical prediction functions based on the observed demands and behaviors such as request arrival pattern, service time distributions, I/O system behaviors, user profile, and network usage.

3.11 CCDN Cloud Selection

The diversity of offering by Cloud providers makes cloud section to host CDN components a complex task. For example, how does a CDN application engineer compare the cost/performance features of CPU, storage, and network resources offered by Amazon EC2, Microsoft Azure, Go-Grid, Flexi-Scale, Terre-Mark, and Rack-Space. For instance, a low-end CPU resource of Microsoft Azure is 30% more expensive than the comparable Amazon EC2 CPU resource, but it can process CDN application workload twice as quickly. Similarly, a CDN application engineer may choose one provider for storage intensive applications and another for computation intensive CDN applications. Hence, there is need to develop a novel decision making framework that can analyze existing cloud providers to help CDN service engineers in making optimal selection decisions [18].

3.12 Ubiquitous content delivery

Content delivery services will interact with the network and appropriately adjust its QoS as needed to deliver content to a specific user based on content and user requirements for maintaining its integrity, the device the user is using, his/her location, and the service contracts. This is a requirement for CCDNs with the growing complexity in media types, end-user access devices and intermediate network architectures[13].

3.13 Flexible content storage, compression, and indexing

Cloud storage resources allow content producers to store content on virtualized disks and access them anytime from any point on the Internet. These storage resources are different from the local storage (for example, the local hard drive) in each CPU resource (e.g., Amazon EC2 instance types), which is temporary or non-persistent and cannot be directly accessed by other instances of CPU resources. Multiple storage resource types are available for building content orchestrator. Naturally, the choice of a particular storage resource type stems from the format (e.g., structured vs. unstructured) of the content. For instance, Azure Blob (https://azure.microsoft.com/en-us/) and Amazon S3 (http://aws.amazon.com/) storage resources can hold video, audio, photos, archived email messages, or anything else, and allow applications to store and access content in a very flexible way. In contrast, No SQL (Not Only SQL) storage resources have recently emerged to complement traditional database systems [40]. Amazon Simple DB, Microsoft Azure Table Storage, Google App Engine Data store, Mongo DB, and Cassandra are some of the popular offerings in this category.

Though cloud environments are decentralized by nature, existing CDN application architecture tends to be designed based on centralized network models. It is worth noting that none of the existing cloud storage resources expose content indexing APIs. It is up to the CDN application designer to come-up with an efficient indexing structure that can scale to large content sizes to help end-users find and retrieve relevant content effectively and efficiently. To facilitate new and better ways of content delivery using CCDNs, advanced distributed algorithms need to be developed for indexing, browsing, filtering, searching and updating the vast amount of information [4] [11].

3.14 Other Challenges

Apart from the above CCDN specific challenges, there are also several important factors specific to the CDN in a CCDN that affect the performance of service within the cloud infrastructure. These include:

- *Network proximity*: It reduces the response time for improving the customer's experience about the services offered via the CDN.
- *Load balancing*: It improves the capability of the whole network by decreasing the flash crowd situation, i.e., it distributes the load to different nodes in a network such that response times and system throughput improve.
- *Local caching*: It fetches the content for the customer from the origin server and stores it in a local server closer to the customer. This technique helps in significantly reducing the response time.
- *Request redirecting*: It plays a very essential role in the performance of a CDN service as it redirects the customer's request to the nearest cache server [10] [12] [15].

4. Conclusion

Cloud-based CDNs have gained significant importance due to the wide-spread availability and adoption of cloud computing platforms. The integration of Cloud and CDN has mutual benefits, allowing content to be efficiently and effectively distributed in the Internet using a pay-as-you-go model promoting the content-as-a-service model. We identified the key challenges and research dimensions that need to be addressed in the cloud-based CDN space.

Our findings show that current cloud CDN providers are mostly based on one cloud platform and lacks support for the emerging form of content distribution namely dynamic user-generated content. Since, the solutions are based on a single cloud provider, the services lack consideration for cost models when taking advantage of cloud content storage spanning multiple cloud providers. Further, most commercial and few academic solutions do not support personalization at user level. We believe, the future of CCDN will be based around the need to support user created content and the ability to support hybrid cloud platforms and addressing the challenges such as QoS, SLA, costing introduced by hybrid clouds.

REFERENCES

[1] IDC, "Data Growth, Business Opportunities, and IT Imperatives". Available: http://www.emc.com/leadership/digital-universe/2014iview/executive-summary.htm. Accessed: 10/09/2014.

[2]. Akamai, "The Importance of Delivering A Great Online Video Experience". Available: http://www.akamai.com/dl/reports/jupiter_onlinevideoexp.pdf. Accessed: 10/09/2014.

[3] IneoQuest, "The Case for Leveraging the Cloud for Video Service Assurance". Available: http://www.ineoquest.com/wpcontent/uploads/2013/10/Whitepaper_Cloud_Services.pdf. Accessed: 10/09/2014

[4] Big Data & CDN, Available: http://www.slideshare.net/pavlobaron/bigdata-cdnoop2011-pavlo-baron, Accessed: 03/07/2014

[5]. Wang L, Kunze M, Tao J, Laszewski G (2011) "Towards building a cloud for scientific applications". Adv Eng Softw 42(9):714–722

[6] Wang L, Fu C (2010), "Research advances in modern cyber infrastructure". New GenerComput 28(2):111–112

[7] P. Mell and T. Grance, "The NIST definition of cloud computing (draft)," NIST special publication, vol. 800, p. 145, 2011.

[8] Mastin. P; "Is the Cloud a CDN Killer", Available: http://cloudcomputing.sys-con.com/node/2628667. Accessed: 03/07/2014.

[9] Compton. K; "Marching towards cloudCDN" Available: http://blogs.cisco.com/sp/marching-towards-cloud-cdn/. Accessed: 03/07/2014.

[10] Hao Yin; Xuening Liu; Geyong Min; Chuang Lin, "Content delivery networks: a bridge between emerging applications and future IP networks," Network, IEEE , vol.24, no.4, pp.52,56, July-August 2010

[11] Li Ling; Ma Xiaozhen; Huang Yulan, "CDN cloud: A novel scheme for combining CDN and cloud computing," Measurement, Information and Control (ICMIC), 2013 International Conference on , vol.01, no., pp.687,690, 16-18 Aug. 2013.

[12] Lizhe Wang, Dan Chen, Jiaqi Zhao, Jie Tao:Resource management of distributed virtual machines. IJAHUC 10(2): 96-111 (2012) .

[13] Lizhe Wang, Dan Chen, Yangyang Hu, Yan Ma, Jian Wang: Towards enabling Cyberinfrastructure as a Service in Clouds. Computers & Electrical Engineering 39(1): 3-14 (2013).

[14] Microsoft Azure Cloud Services: http://www.windows.azure.com.Accessed: 10/09/2014 .

[15]AmazonCloudFront.http://aws.amazon.com/cloudfront/, Accessed: 10/09/2014

[16]. P. Mell and T. Grance, "The NIST definition of cloud computing (draft)," NIST special publication, vol. 800, p. 145, 2011.

[17]. K. Krauter, R. Buyya, et al., "A Taxonomy and Survey of Grid Resource Management Systems for Distributed Computing," Software: Practice and Experience (SPE), vol. 32, pp. 135-164, February 2002.

[18] L. Hui, "Realistic Workload Modeling and Its Performance Impacts in Large-Scale eScience Grids," IEEE Transactions on Parallel and Distributed Systems, vol. 21, pp. 480-493, 06/15 2010.

[19] IneoQuest, "The Case for Leveraging the Cloud for Video Service Assurance". Available: http://www.ineoquest.com/wp-content/uploads/2013/10/Whitepaper_Cloud_Services.pdf. Accessed: 10/09/2014

[20] Akamai Technologies, Inc., www.akamai.com, 2014

[21]. Li. H; Zhong. L; Liu. J; Li. B; Xu. B, "Cost-Effective Partial Migration of VoD Services to Content Clouds," Cloud Computing (CLOUD), 2011 IEEE International Conference on, vol., no., pp.203,210, 4-9 July 2011

[22]. Zhang. X; Du. H; Chen. J-Q; Lin. Y; Zeng. L-J, "Ensure Data Security in Cloud Storage," Network Computing and Information Security (NCIS), 2011 International Conference on, vol.1, no., pp.284,287, 14-15 May 2011

[23]. No SQL, http://nosql-database.org/, Accessed: 8/06/2014 Wang. L, Pai. V and Peterson. L, "The Effectiveness of Request Redirection on CDN Robustness",web.cs.wpi.edu/~rek/DCS/D04/CDN_Redirection.ppt, accessed: 10/09/2014

[24] Shivlal Mewada, Umesh Kumar Singh and Pradeep Sharma, "Security Enhancement in Cloud Computing (CC)", ISROSET-International Journal of Scientific Research in Computer Science and Engineering, Vol.-01, Issue-01, pp (31-37), Jan -Feb 2013.

Authors Profile

Mr. V.Suresh pursued Bachelor of Engineering from University of Madras,Tamilnadu in 1989 and Master of Technology from Andhra University, Visakhapatnam,Andhra Pradesh in year 2002. He is currently submitted his Ph.D.Thesis and currently working as Assistant Professor, CSE/ECM Department in Vignan's Institute of Information Technology,Duvvada,Visakhapatnam,Andhra Pradesh India since

2015. He is a LIFE Member of Computer Society of India (CSI) (00174296), Institute of Electronics and Telecommunications Engineers (IETE) (M155602) and Associate Member in Institute of Engineers (IEI) (AM0915397). His main research work focuses on NLP, Network Security, Soft Computing,Cloud Security and Privacy, Big Data Analytics,Signal Processing, IoT and Computational Intelligence based education. He has 18 years of teaching experience and 4 years of Industrial Experience.

Mr. B.Venkateh pursued Bachelor of Technology from JNTU, Hyderabad, Andhra Pradesh in 2006 and the M.Tech Degree in Computer Science and Engineering from JNTU, Kakinada, and Andhra Pradesh, India in 2013. His specializations are Data Mining, Computer Networks, Network Security and Cryptography, Soft Computing, Cloud Computing and Big Data. Presently, he is an Assistant Professor, CSE/ ECM Department in Vignan's Institute of Information Technology, Visakhapatnam, and Andhra Pradesh, India. He had 11 years of teaching experience. He is a LIFE Member (LM53957) of ISTE (Indian Society for Technical Education).

Mr. A.Anjaneyulu received his B.Tech Degree in Computer Science and Engineering from Andhra University in 2013 and the M.Tech Degree in Computer Science and Technology from Andhra University, Andhra Pradesh. India in 2015. His specializations are Computer Networks, Network Security and Cryptography, Image Processing and Soft Computing. Presently, he is an Assistant Professor, CSE/ ECM Department in Vignan's Institute of Information Technology, Visakhapatnam, Andhra Pradesh, India

