A New Approach for Distributed Cache Management in Information Centric Networks

Vivek Kumar Chaturvedi
Department of Computer Science
Oriental Institute of Science & Technology
Bhopal, India
vivekchaturvedibe2008@gmail.com

Asst. Prof. Sandeep Pratap Singh
Department of Computer Science
Oriental Institute of Science & Technology
Bhopal, India

Abstract— The Internet is a success due to its clear utility to regular people. At the similar time, the fruition of mobile communications and devices allows to get the capability of sensing the world, store information, and exchange it between us in an opportunistic way. However, the Internet end-to-end communication model based upon the location of devices is not in line with users' solely interest in information and not on its location. Here in this paper an efficient technique is implemented here for the information centralized network using ant colony optimization. The proposed methodology planned here provides efficient % Utilization and less computational time and virtual machine migrations.

Index Terms— Information-Centric Networking, host-to-host, host-to-content.

I. INTRODUCTION

With the evolution and growth of the internet, the world is becoming more and more connected by networks. There are numerous unusual types of networks that serve dissimilar purposes ranging from personal home procedure to company practice to public convention. It is no disclosure, then, that numerous ways of managing these networks have been developed. The current information-centric networks have separate recompense with regard to securing sensitive material as an importance of their novel come within reach of administration data in potential prospect internet architectures research attempts in the district of Information-Centric Networking (ICN) architectures is to optimize the distribution of in sequence within momentary communication associations of endpoints [6]. These kinds of systems, because of their data-centric standpoint make available the chance to implant guiding principle-centric content management components that can address looming problems in information allocation that both corporation and national agencies are beginning to face with respect to sensitive substance. This information centricity makes easy the request of security techniques that are very difficult and in some cases impracticable to be appropriate in conventional packetized networks.

Content in Information-Centric Networking is identified by a given name; for that reason content applications are basically concentrate on to the content name. Network entities use this name to route content requests towards one of the machine that hosts an authorized copy of the desired content. It follows that Information-Centric Networking will hold some appearance of name-based steering and forwarding, where a packet is addressed to content given name to a certain extent than a geographic position e.g., the IP address. Similarly to current CDNs, the assortment of the explicit host or separation of hosts where the demand message is forwarded may depend on several factors, e.g., the detachment from the appealing customer, the offered server load, and the traffic load in the network.

Content authentication and security is an additional key characteristic make available by the largest part ICN solutions. In the Internet, most of the effort in the security area has been assumed validating sender and receiver and protecting the connection between them. Such approach has demonstrated strong limits. Conversely, in Information-Centric networking s the content is authenticated so to be protected against alteration or eavesdropping. Accordingly, an Information-Centric network only permits the circulation of genuine copies of the content.

Finally, Information-Centric Networking provides in-network caching; Information-Centric Networking routers are anticipated to be prepared with a cache wherever they can store part of the content they relay. Upon reception of ask for communication routers confirm in their cache whether a copy of the desired content is available. If this is the case, they bring to an end propagating the request message and throw the desired content to the requesting user. Information-Centric Networking are building with a much more data-centric perspective, focusing on routing information rather than just ones and zeros. This is not a refutation of end-to-end arguments however. Rather, it is an affirmation that some services must be included into the fabrics of these kinds of systems reflecting the ubiquitous need for those functions [1].

To overcome the friction caused by the dissimilarity among the content delivery problem and the host-to-host communication representation the investigating society has only just focused on Information-Centric Networking (ICN) [2], [3], narrative networking example that put together substance liberation as a resident network characteristic. The rationale is to architect a network that automatically understands procedures and distributes substance information independently of its location. The communication shift is understood by swapping host addresses with content given names. Named data is exchanged upon user demand, and can be stored by several networks constituent as well as routers prepared with storage.

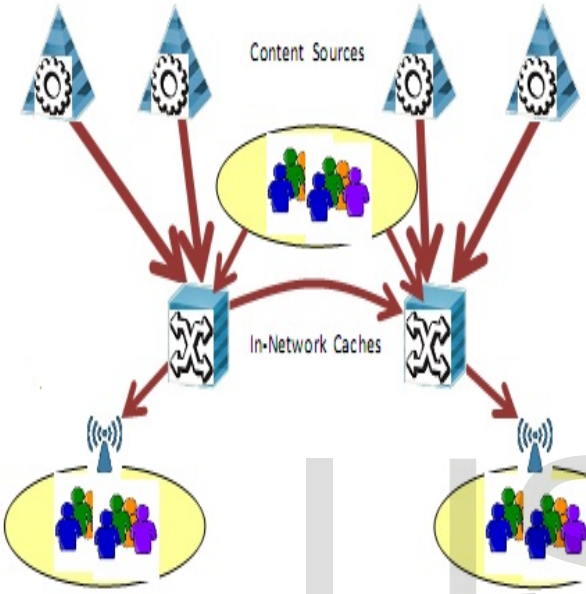


Figure 1: Basic Architecture of information-centric networking.

Expanding autonomic administration from entity devices to the collective self-management of networks of such devices consequences in autonomic networking and there have been significant efforts in this area over the last five years. At the same time as an amount of advances have been recommended associated to autonomic network management, most of them are generic high-level architectures [4]-[5] and design of infrastructures focusing only partially on the key research issues.

II. Literature Survey

In this paper [6], author has proposed autonomic cache management architecture for Information-Centric Networking that changing re-assigns information items to caches. For example, the distinguish popularity and neighborhood of requests and not on inactive off-line predictions. Distributed managers make substance item regenerating decisions, based on the detected item demand patterns, such as their status and district, in sort to diminish the overall network traffic cost enforced by the user requests. Fundamentally they proposed four distributed on-line cache management algorithms necessitate different levels of group action among the autonomic managers and they analyze them in terms of their execution, complexness, message overhead and convergence time. They also compute a lower bound of the overall network traffic cost for a definite class of network topologies and show that the proposed cache management algorithms execute approximate to the derived lower bound and final result provide evidence that network wide knowledge and cooperation give significant performance advantages and decrease the time to meeting at the expenditure of extra message replaces and computational attempt.

To provide these autonomic cache management planning for Information-Centric Networking that dynamically relocates in sequence items to caches. Here scattered managers make in sequence item put backend results, based on the examined item appeal patterns, for example their popularity and locality with the purpose of reduce the overall network traffic cost enforced by the user requests. Here they originate four distributed on-line intra-domain cache management algorithms, classify them according to the level of collaboration required and evaluate them in expressions of presentation, complication, message operating cost and convergence time.

In this paper [7] author has described a new move toward to network resource management in information-centric networks: data packets are allocated with an existence that is utilized as an origin for scheduling and reserve organization in the network, and for congestion control and retransmission logic at the end hosts, leveraging packet durations. This comes within reach of makes the network management self-governing of round-trip time amount, which are valuable assets in environments where RTT quantity is complicated, for instance information-centric networks.

Even though this effort was based on information-centric networks, deadline-based network operations may be valuable also in other circumstances with confronted RTT measurement. Such as, buffer bloat has been acknowledged as an important confront for the resource management in IP networks, because of the showing a discrepancy packet delays. Related problem has also been examined on wireless links, where undependable link technology and link-layer consistency methods origin high discrepancy in packet transmission delays. We will maintain to examine this possibility additional, together with a more systematic performance assessment and additional expansion of scheduling algorithms for information-centric networks. Here they offered a scheduling algorithm that formulates utilize of the packet lifetimes, difficult to make sure that packets are distributed within their allocated lifetimes, and evaluated it with unusual scheduling algorithms based on ns-3 simulations.
In this paper [8] they suggest an age-based supportive cache scheme and designed two algorithms to realize it aiming at reducing system delay and publisher load for ICN network. To the most excellent of our information, this is the first effort to the learning and estimation of such type of policy in existence of multiple contents sharing the equivalent ICN infrastructure.

Here they focus on light-weight collaboration methods that increase well-liked substances to the network edge despite the fact that all together fully make use of the storage capacity of intermediate nodes. We estimate the efficiency of our method under authentic traces and reasonable network topology. The results signify that their method accomplishes considerable concert increases. They also performed widespread simulation under authentic traces and realistic network topology. Experimental results demonstrate the advantages deriving from our method, with network delay and the publisher load decreased extensively. They are arrangement to additional get better the method through theoretical analysis and execution to recognize difficulties in the plan and estimate concerts at different scales.

In this paper [9], author has concentrate on the issue of scalable protocols for extensive region Web cache distribution. Here in this paper they primary enumerate the transparency of the ICP protocol by successively a set of proxy standards. In this paper they also show the advantages of cache allocation determine the visual projection of the subsisting protocols, and recommend a novel protocol called "summary cache." In this novel protocol, each proxy maintains a summary of the cache address list of each contributing proxy and ensures these outlines for prospective hits before sending any uncertainty. Two issues add to our protocol's short visual projection: the summaries are bringing up to date only occasionally and the directory illustrations are very inexpensive as little as 8 bits per entrance. Using trace determined simulations and a prototype performance they evaluated to existing protocols for instance the internet cache protocol (ICP), summary cache decreases the number of inter-cache protocol communications by a issue of 25 to 60, shrinks the bandwidth utilization by over 50%, removes 30% to 95% of the protocol CPU visual projection, all while sustaining approximately the equivalent cache hit ratio as ICP. For this reason summary cache scales to a big number of proxies.

III. Proposed Methodology

Ant based Clustering is first proposed by Deneubourget. Al. and according to him the ants can walk randomly on the workspace by picking and dropping of data from one place to another, but the as soon as they move from one place to another a chemical named Pheromone is deposited which attracts other ants to move at the same place. Here we proposed an efficient technique of applying ant based clustering for the Optimization of VM Scheduling in the Cloud Computing Environment.

T={t1,t2….tn} represents the tasks waiting to be scheduled per unit of time, n is the number of tasks.

N={n1,n2,n3…nm} represents the set of nodes in the cloud system, assuming that the cloud system has m nodes. For the cloud computing system, ni represents the computing resources on the ni; For the Cloud Storage System, ni represents the data on a ni.

V=[v1,v2…vn] represents the task scheduling vectors or a scheduling scheme. For Cloud storage system, *i v* represents the i-th task of data is provided by resources nodes that represented by *i v* value, and the length of the vector is the total amount of scheduling tasks per unit time.

For example, a task scheduling vector [5, 1, 3, 2, 1, 6], the length of this vector is 6, and represents needs to schedule task number is 6 per unit of time. The value based on the position of No. 1 is 5, represent the data of the task 1 is provided by the system node 5. So, the data of task 2 and 5 are provided by the node 1; the data of task 3 is provided by the node 3; the data of task 4 is provided by the node 2; the data of task 6 is provided by the node 6. For cloud computing system, it is on behalf of a task placed in a node.

The Probability of Pick it up can be given by the following function:

$$P_{pick} = \left(\frac{K^{+}}{K^{+} + f}\right)^{2}$$

Where, 'f' is an estimation of the fraction of nearby hosts occupied by objects of the same type, and is a constant. The Probability thus decreases with 'f', from 1 (when f=0) to ¼ (when f=),

The Probability of Drop can be given by the following function;

$$P_{drop} = \left(\frac{f}{K^{-} + f}\right)^{2}$$

Where , 'f' is same and is also constant.

Initial pheromone laying

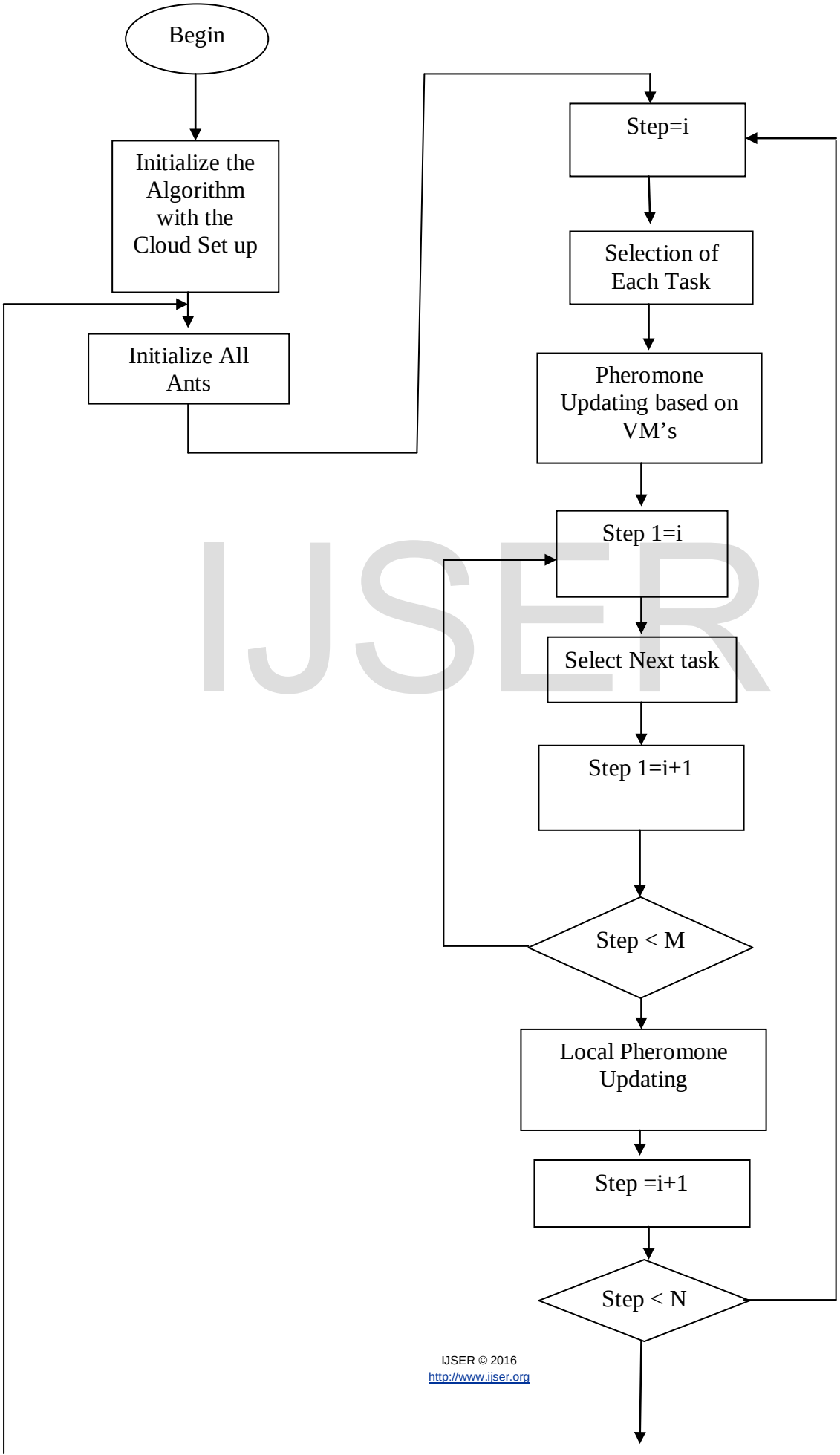
This is initialization step. Every location (i, j) with an object on the grid will be assigned a pheromone τij based on the surrounding. Let Δτ be the amount of pheromone change. The presence of similar objects in the surroundings increases the pheromone trail on the location by Δτ and a dissimilar object decreases the trail by Δτ.

Cluster construction

Ants move randomly on the grid. If an unloaded ant meets an object and finds pheromone on that location below the threshold value, it picks it up. If loaded ant comes to a location with pheromone value greater than the threshold and its load matches with the object on that location, it drops in neighborhood of location with probability.

Pheromone updation

On a pick/drop action, the pheromone on that location and the surrounding location will be updated. On Pickup, =0 and pheromone in the surrounding cells containing the similar object will be decreased and containing dissimilar objects will be increased. On Drop, and pheromone in the surrounding cells containing the similar object will be increased and containing dissimilar objects will be decreased.


Begin
Initialize the Algorithm with the Cloud Set up
Initialize All Ants
Step=i
Selection of Each Task
Pheromone Updating based on VM's
Step 1=i
Select Next task
Step 1=i+1
Step < M
Local Pheromone Updating
Step =i+1
Step < N

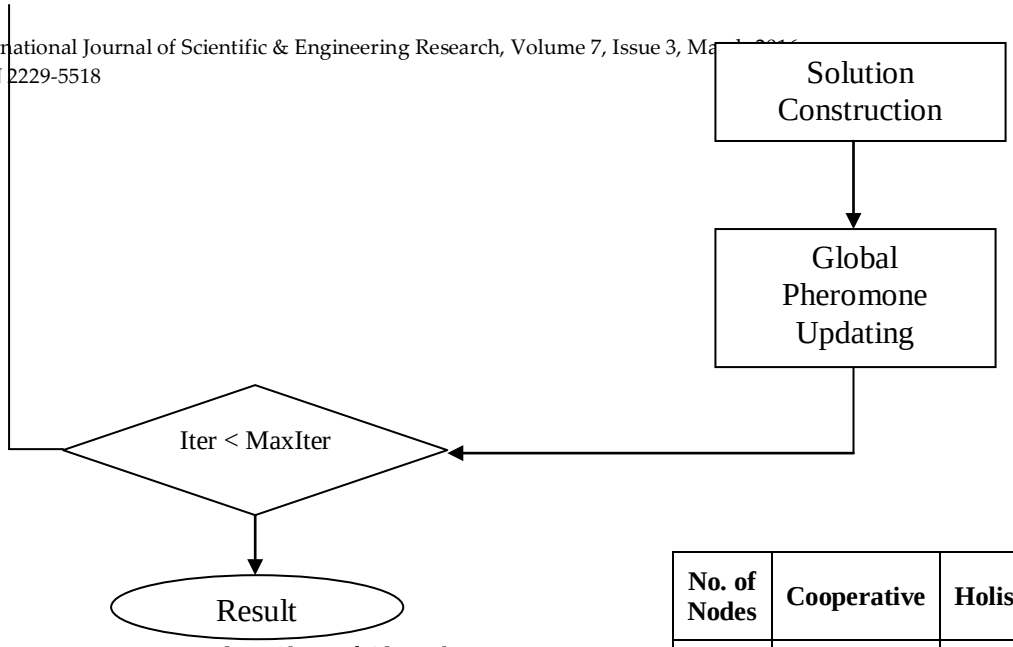


Figure 2. Flow Chart of Algorithm

IV. Result Analysis

Algorithm	Comm. for Initialization	Comm. Per iter. Per node	Comp. per iter. Per node
Cooperative	O (V2M)	O (V)	O (VM)
Holistic	O (V2M)	O (V)	O (VM)
Holistic-All	O (V2M)	O (VM)	O (VM)
Myopic	0	O (V)	O (M)
Proposed	0	O (V)	O (M)

Table 1. Complexity of Various Algorithms

Nodes	Cooperative	Holistic	Holistic-All	Myopic	Proposed
0	0	0	0	0	0
50	26	15	15	17	50
100	100	46	46	48	135
150	160	65	65	67	178
200	190	75	75	77	203

Table 2. Comparison of Performance of Various Algorithms

No. of Nodes	Cooperative	Holistics	Holistics-All	Myopic	Proposed
0	0	0	0	0	0
50	53	55	60	67	69
100	42	45	55	62	70
150	53	52	63	67	74
200	47	50	64	65	68

Table 3. Cache Replacement performance of Various Algorithms

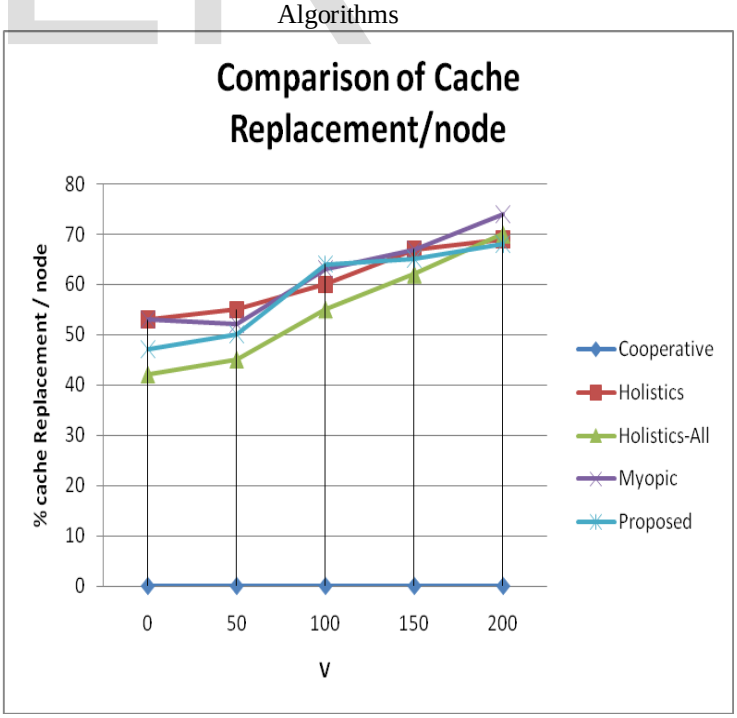


Figure 3. Cache Replacement performance of Various Algorithms

V. Conclusion

Information-Centric Networking (ICN), a novel networking paradigm that integrates content delivery as a native network feature, promises to overcome most of the described limitations. The design of simple and effective resource management mechanisms is another fundamental technical challenge for ICN. Resource management translates into the need for efficient transport protocols and storage management mechanisms, namely flow and congestion control, load balancing, cache replacement and coordination policies.

The experimental results show that the proposed methodology is efficient in terms of utilization of memory management and computational time. Also the proposed methodology provides efficient information centric network.

References

[1] Marjory S. Blumenthal and David D. Clark. Rethinking the design of the internet: the end-to-end arguments vs. the brave new world" ACM Trans. Internet Technol., 1:70–109, August 2001.

[2] V. Jacobson, D. Smetters, J. Thornton, M. Plass, N. Briggs, and R. Braynard. Networking named content. In Proc. of ACM CoNEXT 2009, December 2009

[3] T. Koponen, M. Chawla, B.-G. Chun, A. Ermolinskiy, K. H. Kim, S. Shenker, and I. Stoica. A data-oriented (and beyond)

[4] network architecture. In Proc. Of ACM SigComm 2007, pages 181 -192, August 2007.

[5] B. Jennings, S. van der Meer, S. Balasubramaniam, D. Botvich, M.O. Foghlu, W. Donnelly and J. Strassner, "Towards Autonomic Management of Communications Networks," IEEE Communications Magazine,Vol. 45, No. 10, pp. 112-121, 2007.

[6] N. Tcholtchev, M. Grajzer and B. Vidalenc, 'Towards a Unified Architecture for Resilience, Survivability and Autonomic Fault-Management for Self-managing Networks," In ICSOC/ServiceWaveWorkshops, 2009

[7] Vasilis Sourlas, Lazaros Gkatzikis, Paris Flegkas, and Leandros Tassiulas "Distributed Cache Management in Information-Centric Networks" IEEE TRANSACTIONS ON NETWORK AND SERVICE MANAGEMENT, VOL. 10, NO. 3, SEPTEMBER 2013.

[8] Somaya Arianfar, Pasi Sarolahti, Jörg Ott , "Deadline-based Resource Management for Iformation-Centric Networks" ICN'13, August 12, 2013.

[9] Zhongxing Ming, Mingwei Xu, Dan Wang, "Age-based Cooperative Caching in Information-Centric Networks" 2011.

[10] Li Fan, Pei Cao, Jussara Almeida, and Andrei Z. Broder, "Summary Cache: A Scalable Wide-Area Web Cache Sharing Protocol" IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 8, NO. 3, JUNE 2000.