Ant Based Distributed Information Centric Network for Effective Management of Resources

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Abstract— Due to access use of Internet and t the same time, the evolution 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. 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.

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

I. INTRODUCTION

The current Internet architecture focuses on communicating entities, leaving aside the exchanged information. Information-centric networking (ICN) is a new approach to internet-scale networks that shows promise with respect to decentralized, content-centric usage management, addressing scale and availability issues with current systems. In general, it takes extensive advantage of data locality; caches data aggressively, decouples information providers from consumers, and uses a content-centric perspective in network design. The overriding goals of this approach include providing higher information availability through better network resilience and implementing systems that more closely reflect today's use, focusing on heterogeneous systems with requirements ranging from mobile to static access [1]. Four of the leading projects implementing these ideas are Data-Oriented Network Architecture (DONA) [2], Content distribution in the Internet places content providers in a dominant position, with delivery happening directly between two end-points, that is, from content providers to consumers. This model is driven by the underlying Internet routing paradigm, namely that of transferring datagrams from one routable endpoint to another. This location-centric model limits the ability to fully utilize resources that are available along the route from the provider to the consumer(s), such as storage (e.g., for caching) or computing (e.g., for re-encoding). Information-Centrism has been proposed as a paradigm shift from the host-to-host Internet to a host-to-content one, or in other words from an end-to-end communication system to a native distribution network. This trend has attracted the attention of the research community, which has argued that content, instead of end-points, must be at the center stage of attention. Our main goal is to investigate and develop key network management functions for information-centric approaches related to route and cache management. Particularly, we have developed mechanisms that manage the routing processes by influencing the forwarding of interest/subscription packets and make caching decisions about where and which item to cache as well as influence the cache replacement policies.

However, trends, as shown in Figure 1 show that what is exchanged is becoming more important than who are exchanging it. As a result, the Internet is effectively moving from interconnecting machines to interconnecting information.

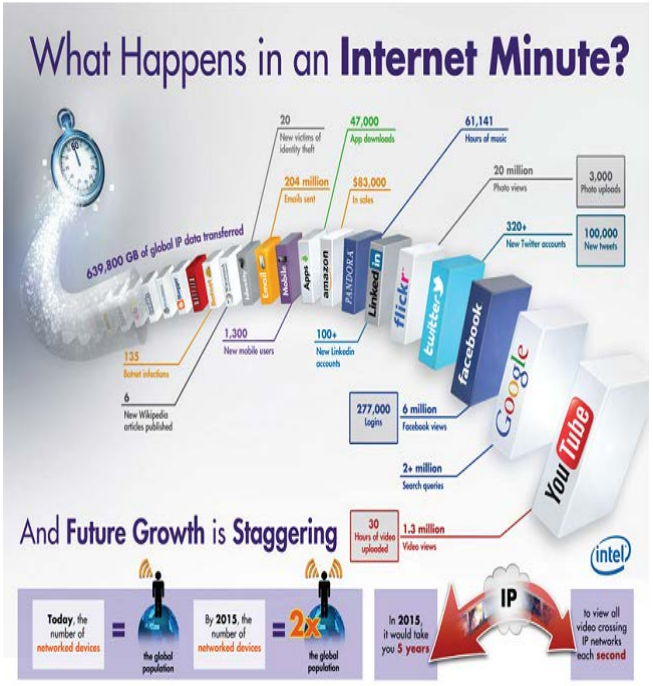

Figure 1: Internet Routing Traffic Information.

Moreover, the location-centric model used by the underlying Internet routing paradigm, transferring of datagrams from one routable endpoint to another, limits the ability to fully utilize resources that are available along the route from the provider to the consumer(s), such as storage (e.g., for caching). Information-Centric Networking (ICN) has been proposed as a paradigm shift from the host-to-host Internet to a host-to-content one, or in other words from an end-to-end communication system to a native distribution network. This trend has attracted the attention of the research community, which has argued that content, instead of end-points, must be at the centre stage of attention. Information-Centrism model shifted from the host-to-host Internet to a host-to-content one, or in other words from an end-to-end communication system to a native distribution network. This trend has attracted the attention of the research community, which has argued that content, instead of end-points, must be at the center stage of attention. These efforts promise, among other things, more flexibility in adapting to new services, efficiency improvements on lower layers, and native multicast support.

II. Literature Survey

In this paper [3], 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 request patterns, such as their popularity and locality, in order to decrease 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 convergence at the rate of additional message exchanges and computational effort.

In particular, this proposed mutual algorithm gives the most excellent concert on the topic of on the whole network traffic, but necessitates a high intensity of collaboration among the administrators and hence is of very high computational and communication complication. Alternatively, the two holistic algorithms execute secure to the mutual but join in a fraction of the iterations need by the two-way. In more features, our novel holistic-all come within reach of needs extensively a smaller amount iterations to meet, at a minor presentation loss (< 1%) and with to some extent additional communication transparency than the holistic. Consequently [3], holistic-all robust ideally to extremely dynamic situations, where transforms in the demand rate pattern are very common. As a final point, the myopic algorithm necessitates the least collaboration and for this reason is suitable for larger network systems, but its presentation is considerably not as good as than the break.

Information Centric Networking is one of the major themes driving research challenges in the Future Media Networks over the next decade. Here author has proliferation [4] of user-generated content accessible over the Internet and the developing need for disconnection of the substance from its location has commenced a novel characteristic for the propose of the Future Internet: the alteration from a host-centric to an information-centric network standard. On the other hand, information-centric network is unmoving a very novel study neighborhood and for itself there are an amount of limitations in subsisting plans. This paper presents its most important design concerns and creates some values and move towards that might allow an easier and faster migration for the information-centric networking pattern.

Initially, the interoperability of ICN with subsisting content infrastructure will be complicated, for the reason that the mainstream of ICN infrastructure suggestions and protocols needs in cooperation provider-side and consumer-side alterations. The organize facility can also be an important concern think about that the cost of re-engineering subsisting purposes to use a content-centric is high. In addition, with enhanced personalization of content comes a considerable enhance in prospective loss of confidentiality. Eventually, ICN need to be capable of sustaining elastic business models based in an unlock situation that give confidences modernization and contribution of multiple stakeholders. The establishment of some design [4] principles and approaches are fundamental for an easier and faster migration for ICN. In a first illustration, ICN architectures should be analyzed in expressions of scalability, accessibility

and consistency. Another essential standard is the assurance of network management straightforwardness and enhanced manageability that could be accomplished approving loose coupling methods. ICN also needs to sustain of a content-centric routing, entirely independent of the network topology. The content should be easily accomplished and ICN should also put into practice privacy and QoS policies. At last, the ICN example commence major transforms in expressions of existing business responsibilities, specifically for Content Distributors, Network Operators, Access ISP and Cache Owners.

In this paper [5] they show that there is a trade-off among two common caching metrics, byte hit rate and footprint decline and demonstrate that a collaboration rule can regulate this trade-off. Here they modeled cache cooperation by its exploration radius and acceptance of replacements through collaboration rule with only two constraints – search radius r and number of copies in the network K. These two parameters correspond to the variety of collaboration and tolerance of duplicates. Here they demonstrate how cooperation policy blows content sharing and additional demonstrates the relation between content attractiveness and topological properties.

In this paper [5], experimental result shows that presented their proposed work thorough numerical analysis and showed that collaboration strategy move forwards system presentation to its Pareto frontier, and how it couples content with topology. Their work leads many suggestions on how to take benefit of topological properties in in-network caching strategy plan in a way to calculate impact of topology on system performance should be taken into explanation in in-network caching strategy design.

In this paper [6] author has described a new approach to network resource management in information-centric networks: data packets are allocated with an existence that is utilized as a origin for scheduling and resource management in the network and for congestion manage 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 a 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. Information-Centric Networking (ICN) provides substantial flexibility for users to obtain information. One of the largest part essential commonalities of ICN designs is the universal caching. It is widely accepted that the in-network caching would get better presentation. On the other hand, there has been no consensus on how to design an efficient caching scheme in ICN network. In this paper [7] they propose an age-based cooperative cache scheme and designed two algorithms to realize it aiming at reducing network 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 Information-Centric Networking communications.

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.

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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:

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

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;

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

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.

IV. Result Analysis

The Table shown below is the analysis and comparison of various Information Centric Algorithm on the basis of their Complexity. The Proposed methodology implemented here provides much efficient complexity as compared to other Information Centric Algorithms.

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

The Table shown below is the analysis and comparison of various Information Centric Algorithm on the basis of their Performance with number of nodes taken. The Proposed methodology implemented here provides much efficient Performance as compared to other Information Centric Algorithms.

Nodes	Cooperative	Holistic	Holistic-All	Myopic	Proposed
0	0	0	0	0	0
50	26	15	15	17	45
100	100	46	46	48	130
150	160	65	65	67	173
200	190	75	75	77	197

Table 2. Comparison of Performance of Various Algorithms

The Table shown below is the analysis and comparison of various Information Centric Algorithm on the basis of their Cache Replacement. The Proposed methodology implemented here provides much efficient Cache Replacement as compared to other Information Centric Algorithms.

No. of Nodes	Cooperative	Holistics	Holistics-All	Myopic	Proposed
0	0	0	0	0	0
50	53	55	60	67	63
100	42	45	55	62	68
150	53	52	63	67	71

200	47	50	64	65	63

Table 3. Cache Replacement performance of Various Algorithms

The Figure shown below is the analysis and comparison of various Information Centric Algorithm on the basis of their Cache Replacement. The Proposed methodology implemented here provides much efficient Cache Replacement as compared to other Information Centric Algorithms.

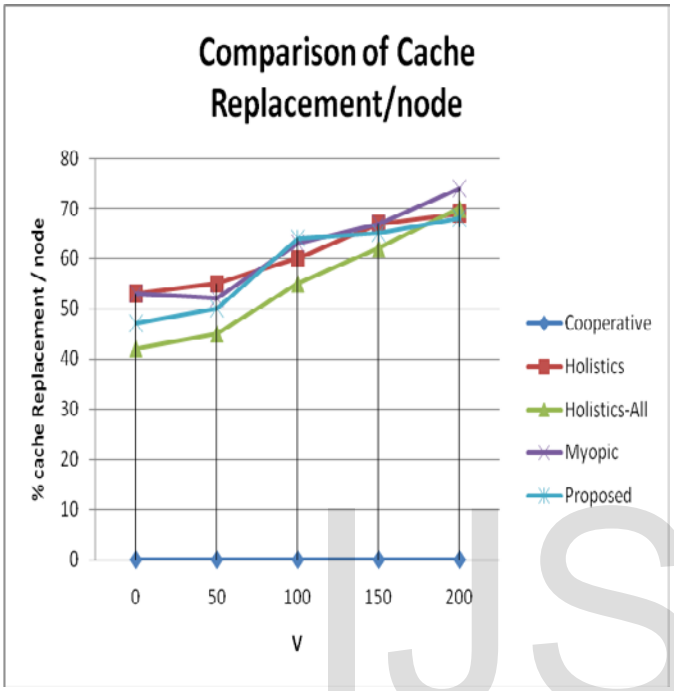

Figure 3. Cache Replacement performance of Various Algorithms

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] B. Ahlgren, C. Dannewitz, C. Imbrenda, D. Kutscher, and B. Ohlman. A survey of information-centric networking" Communications Magazine, IEEE, 50(7):26 –36, july 2012.

[2] Teemu Koponen, Mohit Chawla, Byung-Gon Chun, Andrey Ermolinskiy, Kye Hyun Kim, Scott Shenker, and Ion Stoica, "A data-oriented (and beyond) network architecture" SIGCOMM Comput. Commun. Rev., 37(4):181–192, August 2007.

[3] 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.

[4] Fernando Almeida, Justino Lourenço, "Information Centric Networks – Design Issues, Principles and Approaches" International Journal of Latest Trends in Computing IJLTC, E-ISSN: 2045-5364 Vol-3No.3 September 2012.

[5] Liang Wang, Suzan Bayhan, Jussi Kangasharju , "Effects of Cooperation Policy and Network Topology on Performance of In-Network Caching" arXiv:1312.0133v1 [cs.NI] 30 Nov 2013.

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

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

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