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MOBILITY in WIRELESS NETWORK with NAMED DATA NETWORKING

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Abstract – Internet was designed as a point-to-point communication model between two hosts which requires an IP address for the connection with every networking interface they used. The connection does not guarantee the data forwarding when mobile user changes its location and there needs to repeatedly acquire an IP address. To address these problems some solutions were proposed are Mobile IP and Host Identification Protocol (HIP) but they do not support content mobility issues and the data forwarding while nodes in the network are moving. Moreover it is the challenging task with IP based mobility environment. Unless the change in IP based environment, mobile user will continue to have trouble for the connection with multiple network interfaces, increasing network overhead and less content retrieval. However, this leads to find an efficient alternative architecture to internet which is Named data Networking (NDN). NDN supports data access by Content Names (CNs) instead of IP. NDN data packets carry unique content names instead of source and destination address. The use of unique content names for data forwarding allows mobile users to have better data access as there is no need to repeatedly acquire an IP address and may continue with data forwarding which reduces network overhead. Therefore, the proposed work is intended to work with handling of mobility with Named data Networking.

Keywords – **Named Data Networking, Host Identification Protocol, Content Names, IP, Content Mobility.**

I. INTRODUCTION

Internet was designed more than 30 years ago as a packet data network where users and data servers with specific IP addresses interacting over a pre-established communication channel. This model of client-server data communication has developed now a days into a peer to-peer mode of data sharing. The applications like, YouTube, Bit Torrent, social networks have founded the idea of user generated contents. Modern users care only for specific data items irrespective of their sources of data . So, the idea of identifying servers hosting a particular content by its IP address is losing its importance. Moreover, want of IP addresses is a challenging issue to the Internet community since long time. The use of Information -centric networking platform is needed where data hosts are of less importance is , and Named Data Networking (NDN) has been proposed to address the issues related to previous IP based mobility network. NDN allows users to send a data request without having any knowledge about the hosting entity. NDN can more efficiently handle user mobility, security issues than the current Internet.

The basic design principles of NDN are based on the Internet. NDN can directly use inter-domain routing policies and IP services like, Domain Name Service (DNS). IP routing protocols like, OSPF and BGP can be inherited to NDN with slight modifications. However, NDN offers enhanced features . It uses data packets with content names (CN) instead of source and destination addresses. The use of unique content names for communication allows routers to keep track of packets states, which supports numerous functions unlike the IP routers. The data packets are selfcontained and independent from their location where they are retrieved and where they can be forwarded. These features allow in-network caching of contents for serving and fulfilling future requests and supports mobility. In NDN, all data packets are signed by its producer who sends data packet and verified by the consumer to retrieve the data, unlike IP. NDN routers support multi-path forwarding, i.e., they can forward a user request to multiple interfaces at the same time. Moreover, the use of content name for communication removes the need of continuously acquire an IP address . NDN and Internet share the same layered hourglass architecture with functional differences between corresponding layers. The OSI communication model has only Internet Protocol (IP) in the Network layer. However, it is difficult to add new functionalities to the IP and to modify the existing ones. As a future Internet paradigm, NDNs network layer must support ,security, resiliency to detect and recover from packet delivery performance , and efficiency to support multi-path forwarding and in-network caching for efficient data dissemination.

Internet was designed as a point-to-point communication between two end hosts which allowed the users to fetch data from servers. Though, the Internet has shown great resilience over the years, recently, the changes in the nature of applications, user requirements, and the usage patterns have significantly strained the traditional network. Modern users care only for specific data items irrespective of their data sources. So, the idea of using IP addresses to identify servers hosting a particular content is losing importance because it was not designed to support the newly evolving Information Centric Networking. There are the inherent limitations of the Internet with respect to support for content dissemination, user mobility, network security. Therefore, there is need of a new Internet paradigm which can address the drawbacks of the current Internet and root out the challenges with simple and efficient solutions and motivates to proposed the alternative architecture NDN over the IP based network.

By analyzing NDN characteristic ,features and several proposed techniques on various functionalities of NDN and IP in a purely objective manner for the benefit of future research key contributions are: propose a feature tree-based taxonomy that organizes NDN key features and their relationships into a framework to help understand and classify the existing work. Provide a brief overview of NDN and its characteristic features and also exploring varios system services of NDN. Provide a detailed review of existing works on different aspects of NDN as per proposed work, covering architecture and organizational structure, routing, data dissemination and retrieval strategies, and applications.Also discuss several open problems and identify directions for future research in handling the content mobility issues in existing IP based network.
The objective of proposed work

1. To address the mobility issues in IP based network using Named Data Networking.

The remainder of this paper is organized as follows. Section II presents the literature survey and taxonomy of literature survey , Section III presents proposed solution based on detailed survey and analysis of NDN system services. Finally, Section IV concludes the presented paper.

II. LITERATURE SURVEY

George Xylomenos et.al, [1] has done survey on Information Centric Networking has done the survey on Information- Centric Networking research in 2013 and said that this context, Information-Centric Net- working (ICN) has emerged as a promising candidate for the architecture of the Future Internet. Inspired by the fact that the Internet is increasingly used for information dissemination, rather than for pair-wise communication between end hosts, ICN aims to reflect current and future needs better than the existing Internet architecture. By naming information at the network layer, ICN favors the deployment of in-network caching and multicast mechanisms, thus facilitating the efficient and timely delivery of information to the users. However, there is more to ICN than information distribution, with related research initiatives employing information-awareness as the means for addressing a series of additional limitations in the current Internet architecture, for example, mobility management and security enforcement, so as to fulfill the entire spectrum of Future Internet requirements and objectives. some architectures were introduced in ICN are CCN , NDN,et

Philosophy of Information Centric Networking was introduced by Ted Nelson in 1979[2].The current Internet architecture was founded upon a host-centric communication model, which was appropriate for coping with the needs of the early Internet users. Internet usage has evolved however, with most users mainly interested in accessing information, irrespective of its physical location. This paradigm shift in the usage model of the Internet, along with the pressing needs for, among others, better security and mobility support, has led researchers into considering a radical change to the Internet architecture. In this direction, many research efforts investigating Information-Centric Networking (ICN) as a foundation upon which the Future Internet can be built.

Divya Saxena et. al, [2] has done the survey on Named data Networking provide an detailed survey by studying its architecture and various schemes proposed for its different characteristic features, like, naming, adaptive forwarding and routing, caching, security, mobility, etc. In this paper, they introduce a novel taxonomy to study NDN features in depth. We have also covered several NDN applications. also survey concludes by identifying a set of open challenges which should be addressed by researchers in due course. The basic design principles of NDN are based on the Internet .NDN can directly use major IP services like, Domain Name Service (DNS) and inter-domain routing policies. IP routing protocols like, BGP and OSPF can be adapted to NDN with little modifications. However, NDN offers certain enhanced features as explained below. It uses data packets with content names instead of source and destination addresses. The use of unique content names for communication allows routers to keep track of packets states, which supports numerous functions unlike the IP routers. The data packets are self contained and independent from where they are retrieved and where they can be forwarded. These features allow in-network caching of contents for fulfilling future requests and inherently support consumer mobility. In NDN, all data packets are signed by its producer and verified by the consumer, unlike IP. NDN routers support multi-path forwarding, i.e., they can forward a user request to multiple interfaces at the same time. Moreover, the use of content name for communication removes the need of application specific middleware too.

Yu Zhang et.al [3] has done survey on Mobility support in Named Data Networking in 2016 and stated that the initial Named Data Networking (NDN) architecture design provided consumer mobility support automatically, taking advantage of NDNs state full forwarding plane to return data to mobile consumers; at the same time, the support of data producer mobility was left unspecified. During the past few years, a number of NDN producer mobility support schemes have been proposed. This paper provides a clear definition of NDN mobility support, to enable fetching of data produced by mobile users, and then to classify the proposed solutions by their commonalities and to articulate design tradeoffs of different approaches.

M.Micheal Santha Soniya, et at. [4] has stated in 2015 on survey of Named Data Networking the comparison of the networking principles is given. In the comparison NDN provides the stateful forwarding plane. NDN's forwarding mechanism provides best performance in blockhole hijacks, network congestion and link failures handling. The IP develop- ment history shows the new architecture that provides the functional advantages and offer inferior performance. NDN is an attractive solution for wireless networking and wireless channel issued by TCP/IP based solutions. In NDN many challenges are still lie ahead like caring security, caching. This paper gives an invitation to the researchers for further examining in this new direction.

Qingxia Che, et al. [5] has done survey on Transport Control Strategies in Named Data Networking and stated a comprehensive survey and research challenges on transport control of NDN for the first of time. first had provided an introduction of NDN and its data transport process. Then, the essential differences of NDN transport control compared with IP transport control are analyzed and compared from three perspectives: users side, routers, and network provider. Next, an in-depth taxonomy and classification of NDN recent transport control proposals is given. Finally presented some research challenges and broader perspectives.

Marica Amadeo, et al. [6] has done a survey on Content Centric Networking in 2014 and said ICN has Synonym as Content-Centric Networking. Content-Centric Networking (CCN) is a candidate future Internet architecture that gives favourable promises in distributed wireless environments. The latter ones seriously call into question the capability of TCP/IP to support stable end-to-end communications, due to lack of centralized control, node mobility, dynamic topologies, intermittent connectivity. The CCN paradigm, relying on name-based forwarding and in-network data caching, has great potential to solve some of the problems encountered by IP-based protocols in wireless networks. This paper examines the applicability of CCN principles to wireless networks with distributed access control, different degrees of node mobility and resource constraints. We provide some guidelines for readers approaching research on CCN, by highlighting points of strength and weaknesses and reviewing the current state of the art.

M. Vahlenkamp [7] has given the main performance metrics to evaluate the performance of NDN routing approaches are CPU utilization , PIT count , memory, also the network network utilization , Interest re-transmission rate, and time-to-completion i.e, total time required to satisfy a content request

L. Wang, et al. [8] For supporting the name based routing in NDN, IP based routing protocol OSPF is extended to distribute name prefixes and to calculate routes for them. A name-based dynamic routing protocol OSPF for Named-data (OSPFN) is designed, OSPFN routing works in seven main steps as stated and explained. Management of these IP addresses increases overhead and limits support for NDN multi-path forwarding.

A.K.M. Hoque, et al. [9] has stated about Link State Routing protocol as it runs on the top of NDN where
each Data packet used for routing updates are signed by the producer for supporting authentication. There are four key factors of NLSR routing protocol. First is, to name the routers, links, process, data, and keys. Second is, distribution of keys and trust for them. Third is, to pull the routing updates dissemination instead of pushing updates as in OSPF. Fourth is, to rank the interfaces for supporting multi-path forwarding.

Dibenedetto, et al. [10] have argued that inter-domain routing protocol like, Border Gateway Protocol (BGP) must be considered in the future Internet architecture. Inter-domain routing protocols make routing decisions based on paths and intra-domain routing protocols like, Link State Routing (LSR) and Open Shortest Path First (OSPF) calculate the shortest path among the routers. Network operators set up and implement policies for route selection. The authors have also discussed about the different parameters like, routing, cache access, and FIB usage for inter-domain routing policies. Moreover, the authors have also focused towards NDN economic incentives for cache sharing, routingrebate, CS, and PIT policies.

Rezazad, et al. [11] has been studied using network traffic analysis, to increase the cache performance like, cache hit ratio and also introduced dynamic partitioning of CS for NDN traffics by using the cache miss equation which is used to dynamically partition database buffers. The main objective of the proposed scheme is to minimize the cache miss probability and ensure the fairness across different NDN traffics. The results show that dynamic partitioning reduces cache miss probability for edge routers.

Dai, et al. [12] have proposed two PIT placements like, output line-card, and input-output line-cards. In output line-card, segregated PIT is placed at each outgoing interface. An Interest packet makes its entry at the output line-card where it is forwarded further . In input-output line-cards, PIT is placed both at incoming and outgoing interfaces. While both the schemes have limited support for multi-path forwarding, the former does not at all support loop detection.

Varvello, et al. [13] have introduced a third-party PIT placement where PIT is placed at each input-line-card. Whenever a request arrives for content A, a third party selects the PIT through hashing. There is no need of line card at the output because same procedure is repeated for the CN of the data packet. This scheme supports multi-path forwarding, Interest aggregation and loop detection. However, it takes an extra switching for handling both interest packet and data packet.

Li, et al. [14] have used modified bloom filter and proposed a new mapping bloom filter (MBF). MBF is a data structure which supports querying and mapping of the set elements in the memory and minimizes on-chip memory cost. MaPIT performs better over NCE and hash table.and hence provide a better solution.

Massawe, et al. [15] have proposed a Bloom-filter based Scalable and Privacy Preserving Routing Protocol for providing security and privacy to NDN interest packet. Moreover, multicast key management protocol is also proposed which allows authorized users to access keywords of the content (known as multicast encryption). A content-dependent key tree is used for key distribution.

Gasti, et al. [16] have studied and explored NDN in-built security features which resists the NDN from certain attacks, such as *reflection attacks*, *bandwidth depletion*, *cache poisoning* and *black-hole prefix hijack*. In reflection attack, adversary uses another host IP to make attack which is not possible in NDN due its symmetric communication. The effect of this attack is limited in NDN because after some time requested content will be available in the intermediate routers' caches. Interests for the same content will be satisfied earlier via cached copies. The two main DoS attack that target the contents are *content/cache poisoning* and *cache pollution*. They have discussed three new NDN-specific DoS attacks, such as *interest flooding*, *content/cache poisoning* and *cache pollution* with a set of countermeasures.

Tang, et al. [17] have classified Interest flooding attack in FIB-based and Broadcast based Interest flooding. In FIB-based Interest flooding, a particular name prefix is targeted and many times requests are forwarded for same name prefix from adversary side. This does not only exhaust PIT but also, wastes FIB resources. In broadcast based Interest flooding, adversary selects a non-existent name prefix for interest packet and floods it. A two phase detection scheme has been proposed to track the normal name prefixes used in Interest flooding.

C. E. Perkins [18] has proposed the Mobile IP solution, IP-based environment, devices require an IP address (to communicate with other devices) for every networking interface they use and do not guarantee the continuation of an ongoing connection. Therefore, for mobile devices, communication is not feasible until they acquire a new IP address every time when there is a change in location.

Meisel, et al. [19] were the first to argue that current Internet architecture and its protocols are not suitable for the highly mobile environment like, Mobile Ad-hoc Network (MANET). The authors then discussed the main failing reasons of IP-routing based approach with respect to mobility. In order to solve these problems, some opportunistic IP-routing based protocols were also proposed for taking the full advantage of wireless broadcast nature. But still, IP address assignment to the mobile node and their management problems were remaining. data units are framed within bundles and allows late binding of data names to node IP address. But still, each bundle is delivered using the traditional IP addresses.hence there needs to handle mobility with Named Data Networking

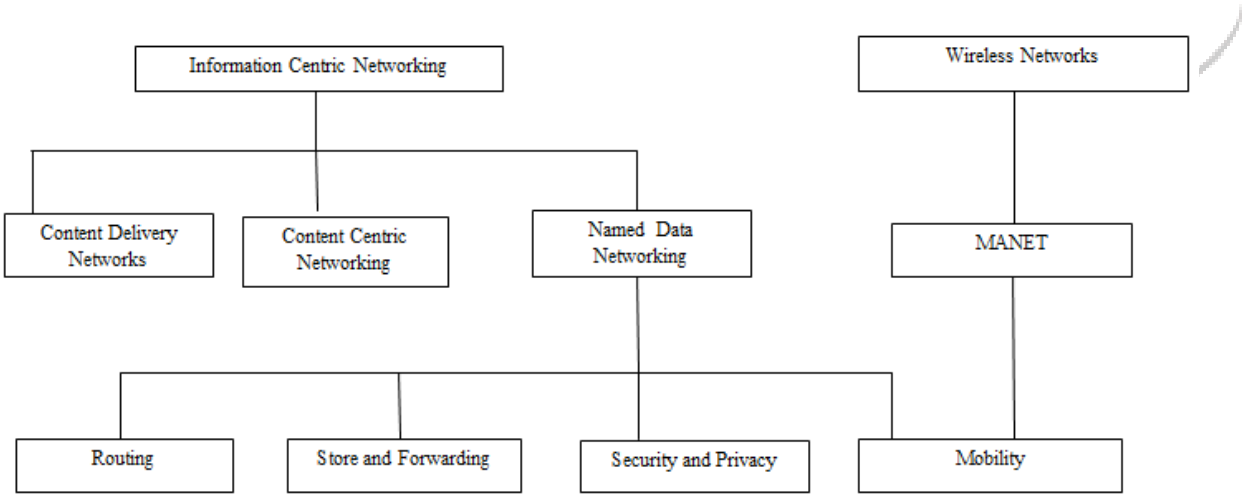

Fig1. Taxonomy of Literature Survey

III. PROPOSED SYSTEM

In IP-based environment, devices require an IP address for every networking interface they use and do not guarantee the continuation of an ongoing connection. Therefore, for mobile devices, communication is not feasible until they acquire a new IP address every time when there is a change in location. This IP-based mobility environment does not directly deal with content mobility issue. Unless we change IP-based mobility environment, mobile user will continue to have trouble for connection with multiple network interfaces, increasing overheads in large scale network and less content retrieval.

In contrast, an NDN does not bind a particular ow with a specific interface. This is because an interface is very much a location-oriented concept, which can be abstracted away from in a content re- quest/reply model. Specifically, an application only expects the network stack to reply with a unique data item, without needing information regarding which interface was used. Consequently, in an NDN, a request can easily be multiplexed over a number of different interfaces without the need for

application-level awareness. This means that applications running on a multihomed NDN node can seamlessly exploit these different interfaces without needing to understand which interface has actually been used.

However, this leads to find an efficient alternative architecture to internet which is Named data Networking (NDN).NDN supports data access by Content Names (CNs) instead of IP. NDN data packets carry unique content names instead of source and destination address. The use of unique content names for data forwarding allows mobile users to have better data access as there is no need to repeatedly acquire an IP address and may continue with data forwarding which reduces network overhead and the mobility with respect to mobiles users can be handled efficiently with NDN. Mobility in NDN has not been explored too much.

Therefore, the proposed work is intended to work with handling of mobility with Named data Networking.
Basic differences between IP-mobility and NDN mobility issue Host Multihoming Host Multi-homing Within IP, many applications and protocols make the assumption that a host is uni-homed. Over the years, this assumption has been manifested in various infrastructural and software design decisions. For instance, by definition, a HTTP GET request is received over a single TCP connection, from a single source address. As such, it is difficult to exploit multiple potential network interfaces that might be available when using HTTP. Multi-path TCP is one approach to addressing this, however, this is yet to be widely deployed.

IV. CONCLUSION

This paper provides an detailed literature survey on Mobility in wireless Network with Named Data Networking and also gives the NDN is an attractive solution for wireless networking issued by TCP/IP based solutions and is a proposed future internet architecture that attempts to adapt current internet to its current demands and usage.Also it has been studied from related work how mobility management is diffeerent in NDN from IP based mobility and has great impact on it and future works will be intended to do the efficient mobility management to merging of other networks(MANET,VANET.etc) in NDN.Therfore, the future work is intended to work with handling of mobility issues in IP based network with Named Data Networking.

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