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A COMPARATIVE STUDY OF ICN ROUTING PROTOCOLS

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Abstract

Information delivery such as P2P or video streaming over the internet has invited the redesigning of routing protocols to be of the information centric in nature. A new kind of communication network with a massive emphasis on information distribution is evolving presently, known as ICN (Information Centric Network). Name prefix propagation utilizing the content name is the primary objective of ICN routing architecture. In contrast to the host IP address used to route data in customary internet architecture, ICN recognizes contents using their names, because the calculation of said IP address at every intervening node introduces unwanted delays. Most part of ICN routing relies on the flooding or multicasting of the contents. With an aspiration to explore numerous proposed ICN routing mechanisms various prevailing ICN routing protocols along with their offered features are presented in the subsequent sections.

Keywords:ICNP2PVideo streamingName prefixContent name

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1. Introduction

In recent times a paradigm shift of few-to-numerous content distribution architecture has been observed in the application of Internet which was originally conceived for e-mailing or messaging and few-to-few data sharing, since the era when IP was deliberated to facilitate many clients to access plenty of overlapping data. Internet architecture is supposed to forward every piece of same content through the whole routing path from sender to requester every time it desired. Therefore, running a content distribution system on top of the host-to-host architecture perceived as remarkably inefficient. As a result, same bits of data will repeatedly needlessly traverse through the same connections and routers. The said bottlenecks in host-to-host framework lead to the production/implementation of ICN [1].

Several routing proposals have been keenly researched to address the issue of effective data sharing and distribution [2] and to replace the present internet. Table-1 represents some of the said frameworks [3]:

Table1.ICN recommended frameworks

Name	Year	Forwarding Method	Underlying Dependency
TRAID	1999	WRAP using HTTP URLs	IPv4, NAT
DONA	2007	Name based, organized as **P:L** (Where P is the cryptographic hash of principal's Public Key and L is a label chosen by principal)	FIND (P:L), REGISTER (P:L)
NetInf	2008	NIN (NetInf Node), ILS (Identifier Lookup Service), IOLS (IO Lookup Service)	NNM(NetInf API)

Typical users extensively use their gadgets to produce and view multimedia contents and increase a great amount of traffic to the internet. Route-by-name Content Centric Networking (CCN) is noticeably most vibrant exploration in ICN area. CCN engineering proved to be the most prevalent implementation of ICN model with the prime objective of route-by-name mechanism. Content is searched and retrieved by its name in CCN. In the content retrieval process, name-based routing takes the benefit of network cache deployment [4].

Named Data Networking (NDN) is another vibrant approach to meet the purpose. Communication is initiated by requester known as data consumers in NDN, the process primarily consist of exchanging two types of packets namely Interest and Data. To identify a piece of data which may be carried in one Data packet both types of packets carry a name [5]. NDN and its execution CCNx offer a capable worldwide deployable ICN.

2. Routing in ICN

NDN and CCN primarily rely upon two messages, Interest and Data. Both NDN and CCN router maintains three tables, i.e., Forwarding Information Base (FIB), Content Store (CS) and Pending Interest Table (PIT). The FIB is relatively parallel to routing table of IP based routing protocols, the destination field is transformed to the content name prefix. Routing process is requester driven which is further administers the interest packet routing. Prefix name of the desired content is contained in Interest packet. Router searches to find the requested content that might be available in CS upon reception of an interest packet. In response, the desired data packet is produced. The said data packet is transmitted back to the requester along the reverse path of the concerned interest packet when a matching content is found. In other case Router probes its PIT if there is any trace of the interest packet requesting same content has been transmitted. In this case the prevailing PIT entry is altered to add the entrance face of the interest packet, in other case new entry is appended to the PIT table and to conclude about the interest packet transmission FIB is further consulted. When the transmitted interest packet meets its desired content, relevant data packet traverses along the reverse path to the requester router depending upon the logged entrance faces in the PITs. On the basis of caching decision and cache replacement policies, content in a data packet is stored in the CS of each ICN router it traverses [6].

FIB can contain more than one interfaces of any particular name prefix. Interfaces in a FIB entry are ranked to facilitate the forwarding plan in terms of selection of the best interface(s). Initially, Router ranks the interfaces based on routing preference for any newly learned name prefix as no forwarding performance was observed thus far. Forwarding policy adjusts the interface ranking considering both types of information when information about forwarding performance is available. For example, smaller RTT will raise the ranking of any interface. Furthermore, to facilitate routing of each Interest packet every NDN router contains a strategy module. To make routing decisions of adaptive nature depending upon network conditions, a router's strategy module determines when and which interface may be used to forward an Interest, is subject to the information stored in PIT and FIB [7].

3. Comparisons

Table 2. Comparisons of various ICN routing protocols

Protocol	**Environment**	**Proposed Technique**	**Site naming requisition**	**Offered Features**
Content Activity based Short-Cut Routing [8]	CCN, NDN	Shortcut routing tables	Requires careful considerations	1. Near abroad notifications 2. Optimal content source selection 3. Router Caching 4. Content Notifications
Cooperative Routing [9]	CCN	FIB reconstruction based on Content retrieval statistics	Not Specified	1. Improved cache hit rate 2. Reduced server load 3. Reduced content retrieval time
NLSR [10]	NDN	LSA	Requires careful considerations	1. LSDB 2. Multipath 3. Failure and Recovery detection 4. Security
OCEAN [11]	CCN, NDN	DART	Adaptive	1. Interest Loop Prevention 2. ONT 3. DNT
SRSC [12]	SDN based CCN	SDN Controller based CS	Adaptive	1. No network flooding 2. Node cache 3. Boot strapping

4. Conclusion

A comparison of several ICN routing protocols along with their offered features has been presented in this paper. By learning various routing protocols of ICN support different deployment environments, it was observed that further analysis is required to validate the various features of a routing protocol. The realm of ICN routing protocols along with their relevant analysis is quiet in evolutionary stages. Before their definite deployments, the limited real-world executable choices under entirely diverse ventures are rigorously simulation based.

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