A survey on Information Centric Networking toward IoT : Challenges and solutions of Name Resolution Service

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ABSTRACT

Information Centric Networking (ICN) has been perceived as a promising innovation for the future Internet design. The essential correspondence protest in ICN is the named information protest (NDO) and its primary objective is the proficient dispersal and recovery of the NDOs in a worldwide scale. In this respect, ICN can be a hopeful engineering in IoT condition since IoT concentrates on information and data as opposed to end-to-end interchanges. In ICN, the name recognizing the information question is area free and so Name Resolution service (NRS) Is a standout amongst the most critical outline challenges, where NRS is to make an interpretation of protest names into steering insights, for example, locators. In this paper, we talk about the inspiration and difficulties of NRS for ICN toward IoT.

Keyword - *Information-Centric Networking Name Resolution Service; IoT; challenge; architecture.*

1. INTRODUCTION

The present Internet is a host-driven systems administration, where has are particularly related to IP addresses and correspondence is conceivable between any combine of hosts. Along these lines, data in the present Internet is recognized by the name of have where the data is put away. As opposed to the host centric organizing, the essential correspondence protests in Data driven systems administration (ICN) are the named information objects (NDOs) and they are extraordinarily recognized by the area free names. In this manner, ICN intending to the productive dispersal and recovery of the NDOs in a worldwide scale has been perceived as a promising innovation for what's to come Web design to conquer the restrictions of the current Web, for example, versatility, portability, and so forth ICN likewise has been developed as a competitor engineering for IoT condition since IoT concentrates on information and data as opposed to end-to-end interchanges. What's more, the following ICN highlights are satisfying great the design necessities of IoT, for example, naming, name determination, adaptability, asset requirements, versatility, reserving, security, protection, and so on :

- Naming of information, gadgets, and administrations autonomously
- from their areas
- Distributed storing and handling
- Decoupling amongst sender and beneficiary
- Mobility bolster
- Authentication and check of substance

Since naming information freely from the present area where it is put away is an essential idea of ICN, how to find the NDO utilizing the area free name is one of the most imperative plan challenges in ICN. There are a few ventures for ICN which receive the query by-name directing conspire abusing the name determination benefit (NRS) to find the NDO utilizing the area free name, where the NRS for ICN is to make an interpretation of question names into steering indications for example, locators. In this manner, in this paper, we concentrate on talking about of the inspiration and difficulties in planning the NRS for ICN. NRS is additionally a critical test of ICN for IoT since there will be billions of items associated with the Internet in IoT condition. In this paper, we give a talk of the configuration difficulties of NRS for ICN as far as operability, security and reasonability regards. The rest of this paper is composed as takes after. We display the inspiration of NRS for ICN in Section II and give an exchange of the outline difficulties of NRS for ICN in Section III. We finish up this paper in Section IV.

2. Current Approach and related work

ICN routing is a procedure how to recover the NDO in view of its name autonomously from its system address and may include three stages: name resolution, content discovery, and content delivery. Contingent upon how these means are consolidated, ICN routing plans can be sorted as Route-By-Name Routing (RBNR), Lookup-By-Name Routing (LBNR), and Crossover Routing (HR). RBNR precludes the principal name determination step and specifically utilizes the name to course the demand to the NDO. LBNR utilizes the primary name resolution venture to make an interpretation of the name into its locator and the second substance disclosure step depends on the locator. Following section are detail about the problems

2.1 Scalable Name-Based Inter-Domain Routing for Information-Centric Networks

NIDR assumes a hierarchical inter-domain network architecture that is identical to that of the current Internet. All networks have a domain name as in the current Internet. In addition, we assume that a name-based intra-domain routing protocol such as NLSR is adopted by individual networks for propagating the reachability information of content originated inside their corresponding networks. In addition, although the basic ideas of NIDR can be applied to any ICNs with a hierarchical content naming structure, to make our discussions concrete, in this paper, we present NIDR in the framework of CCN. To ease exposition, in the following we will simply refer to an NIDR-aware ICN as an ICN, as long as there is no confusion. We will continue referring to CCN and NDN as examples of traditional ICNs that do not support NIDR.

In NIDR, Internet domain names are classified into two categories based on if their reachability information is announced and propagated in the inter-domain routing system. The first category includes all the domain names that are announced in NIDR, and we refer to such domains as routed domains (RDs). In essence, all the networks with an AS number (ASN) in the current BOP-based Internet inter-domain system can be an RD, including all ISP networks and some large enterprise networks. The reach ability information of RD names are announced and propagated in the NIDR system, and Interest packets destined to RD names can be directly routed in the NIDR system.

The second category includes all the domain names that are not announced in NIDR, and we refer to such domains as lookup domains (LDs). When an ICN node receives an Interest packet with an LD name and does not have routing information for the LD name, a name-resolution service (NRS) lookup is performed and a new Attachment Point (AP) field is populated in the Interest packet, where the AP is an RD and knows how to route the packet based on the content (domain) name. After the AP field is populated, the Interest packet is then routed based on the AP field. After the packet arrives at the AP domain (assuming the Interest packet has not been satisfied in the previous ICN nodes on the way to the AP domain), the packet is further routed based on the content (domain) name.

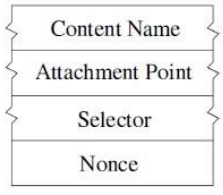

Fig -1 : Format of Interest packets in NIDR-aware ICN.

As an example, consider content with name example.com! movies/movie.mov, and assume that example.com is an LD network whose domain name is not announced in the NIDR system. Furthermore, we assume that the corresponding AP network for example.com is isp.com. When a router (or the originating machine) receives an Interest packet for the content, it first determine the AP network of the domain name example.com using NRS (assuming the node does not have the routing information for domain name example.com), and then includes the AP domain name isp.com into the attachment point field of the Interest packet. The packet can then be forwarded by the intermediate network domains based on the AP domain name. When the Interest packet arrives at isp.com, it can be further forwarded by isp.com to example.com. The mapping from an LD name to its corresponding AP is performed by a name-resolution service (NRS), for example, similar to the current DNS system.

2.2 A Flat Name Based Routing Scheme for Information-Centric Networking

Containers

A container is a space where content or information objects reside . We can imagine lots of diverse forms of containers such as file systems, databases, ID center, a server or server farms. The abstract concept can be easily extended to realistic networks such as local, regional or provider networks. Similarly, a single file can be viewed as a container that holds much other information linked via hyperlinks.

In host-centric networking, each named host takes the role of communication endpoint, whereas in ICN, the named content itself cannot participate in communication. In such a sense, we may call the named content as a "passive entity" in contrast to host as an "active entity". Thus, every passive entity must be associated with an active component to participate in communication.

Recursive Structure of Containers

A container may include nested containers and may be involved in a larger container. Thus, containers can be structured in a recursive manner such as novel/literary novel/short literary novel/short literary novel written in English/etc. Of course, a piece of content as well as a container may be involved in more than one container simultaneously, which is exactly same as multi-homing in host-centric networking. We first allow operators to structure the containers in any recursive manner so they can utilize it for their better management. When requestor wants to retrieve contents, the interest packets have to be forwarded to the containers exactly where the contents reside. Thus, they build a forest of controllers based on the recursive structure of containers for interest packet routing. We utilize bloom filters as an aggregated form of names at each controller instead of announcing the whole list of names to its peers or parents for flat name based routing. The bloom filters are in the role of forwarding table. The explicit aggregation mentioned in takes place by the use of bloom filter. We note that the forest of controllers retains the loop-free property for the use of bloom filter.

Figure 2 can be viewed that the ICN network is consisted of a forest by 3 disjoint trees. One of them may have a structure like in figure 3 (a) and the hierarchy in figure 3 (b) can be built based on its structure shown in figure 3 (a). The key components of containers for interacting with other containers are the access interface and the peering interface.

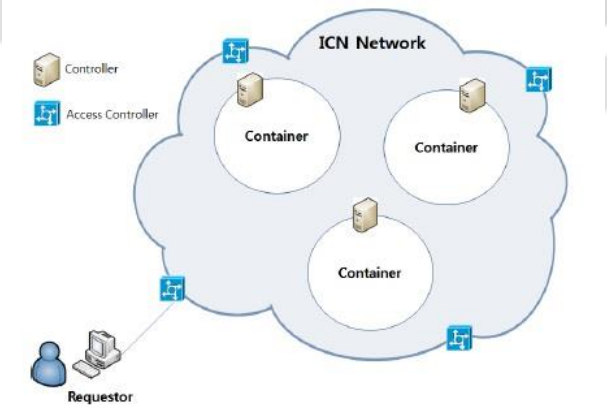

Fig -2 : Communication model

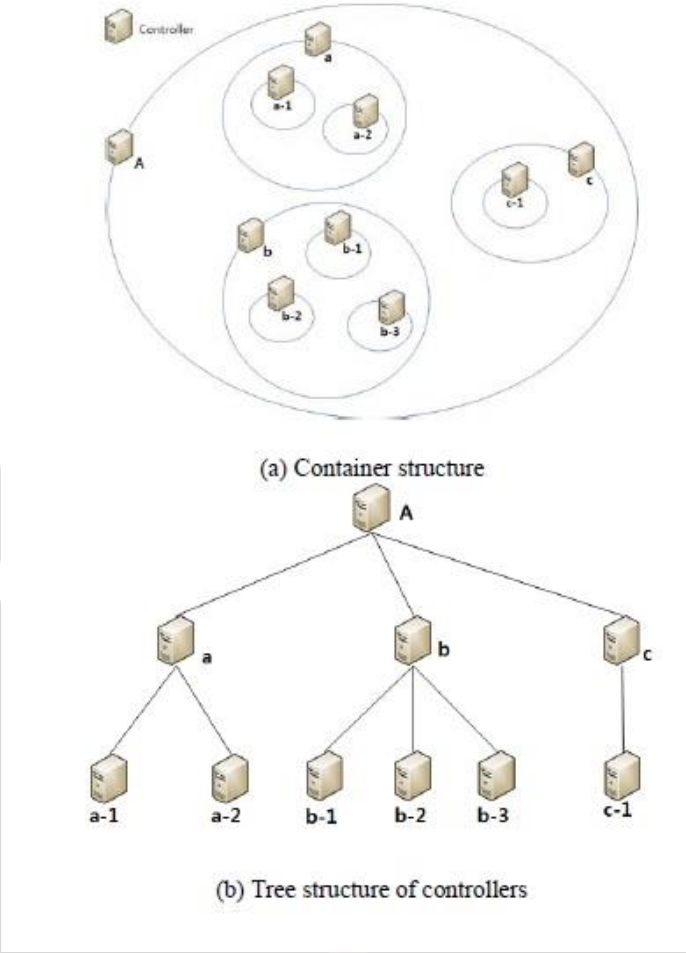

Fig -3 : Structures of container and controller

Content Registration

Here, operators are allowed to construct the container structure in any way they want and the named contents can be registered into one or more arbitrary containers since location independent flat name is assumed in this paper. Here, we emphasize that the named contents can reside in any containers they want regardless of the structure of containers. In other words, there is no constraint on registering the named content to containers. However, contents may practically reside in containers according to their structure for fast discovery.

Content Discovery

The primary role of the content discovery is generally to setup the path from a requestor to one of locators where the interest content is stored so interest packet can be forwarded along the path. However, the discovery phase in this paper is to route the interest packet by name to the container where the interest content reside.

Controllers are in the role of entry point of containers and logically build a forest of hierarchies based on the container structure. The relationships of parents and child are determined by the tier information. Controllers of their container are the roots of the hierarchies and ones of the highest tier number containers are the leaves. Each controller consists of bloom filters of its own, child, and peer and the bloom filters are in the role of forwarding table.

Content Delivery

In this paper, it is assumed that the control plane for content discovery and data plane for content delivery are separated. So, the interest content discovered in the control plane is delivered directly to the requestor through the data plane as depicted in figure 4.

Figure 5 depicts the procedures of the flow shown in figure 4, where content "C" is registered in controller b-4, bloom filter (BF) updates occur in succession, and a requestor looks for the content "C".

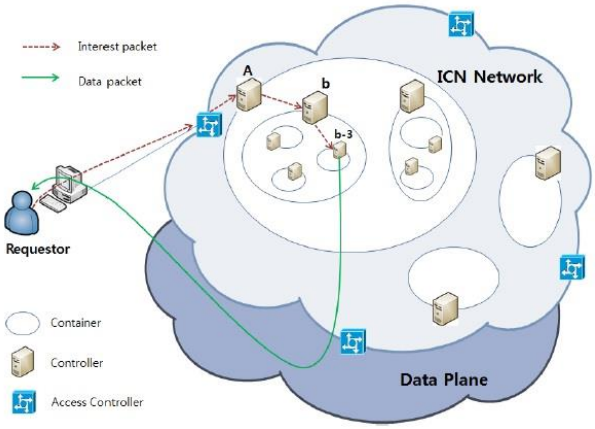

Fig – 4: Flow of interest and data packets

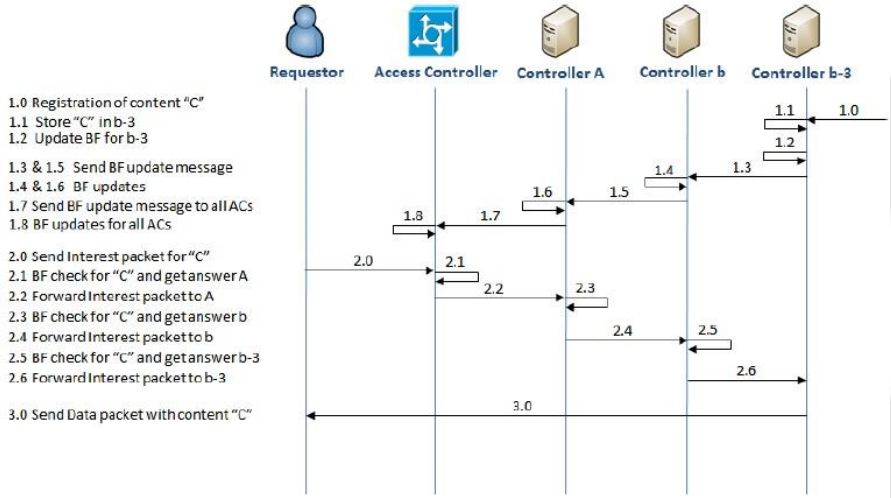

Fig – 5: Procedures of key operations

4. CONCLUSIONS

In ICN, the location independent name is used to identify the data object. So, the name resolution into routing hints such as locators is an important service in ICN. It is also important in ICN for IoT since there will be billions of data objects connected to Internet in IoT environment. In this paper, we discussed the motivation and design challenges of NRS for ICN in terms of operability, security and manageability respects.

6. REFERENCES

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