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An Incrementally Deployable Data Centric Architechture Using Particle Swarm Optimization Algorithm

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ABSTRACT

Today's Internet users are majorly interested in accessing data only from server i.e. interested in data networks instead of host networks. But the current Internet architectures are host centric network and it is not practically possible to deploy a pure data-centric architecture. Therefore this paper describes such architecture which is future proof DCNA for Internet which is incrementally deployable that supports both data centric and host centric services having features like multi-homing and mobility. Keywords:-Ad-hoc network, incrementally deployable, future proof.

Keywords: *Ad-hoc network, Dyanamic route guidance, future proof, incrementally deployable.*

INTRODUCTION

Data Centric Network Architecture (DCNA):-

The Internet architecture was designed in the 1970s and it is host-centric till now. The hosts in the Internet are generally named by their IP addresses; the current Internet network does not have a mechanism for directly naming data (files, streams, etc.) and services (processes that are remotely invoked by clients). Instead, both are named in association with domain names.

Today's Internet traffic is associated with applications where users are interested in the data and not in the source where the data resides. On the other side, the current Internet architecture is host-centric rather than data- centric. This motivates a new network architecture that can efficiently support both data-centric and host-centric services. This paper describes an implementation of an incrementally deployable Data- Centric Network Architecture (DCNA) for the Internet. DCNA is based on a shim layer or service binding (SB) layer between the application layer and the transport layer and the appropriate interfaces to efficiently connect these layers. In addition to being data-centric and incrementally deployable, we will also use PSO for getting expected result as per Client's demand in short time. we aim at designing a new network architecture that is both data-centric and incrementally deployable. Thus the end hosts implementing the new network architecture have to be compatible with the existing hosts in order to be incrementally deployable. From the perspective of the new and existing end hosts, it is desirable that we only need to make the minimum changes to the host stack. There are a few design choices for the Internet to move towards data centric while being incrementally deployable.

Particle Swarm Optimization (PSO):

Dynamic route guidance is an important part of the intelligent transportation system Particle Swarm Optimization (PSO) is a bionic algorithm that simulates the flying birds; it has the advantages of small individuals, simple calculation, and robustness. The effective route guidance can reduce the travel time of drivers, avoid congested road segments, and so raise road network efficiency.

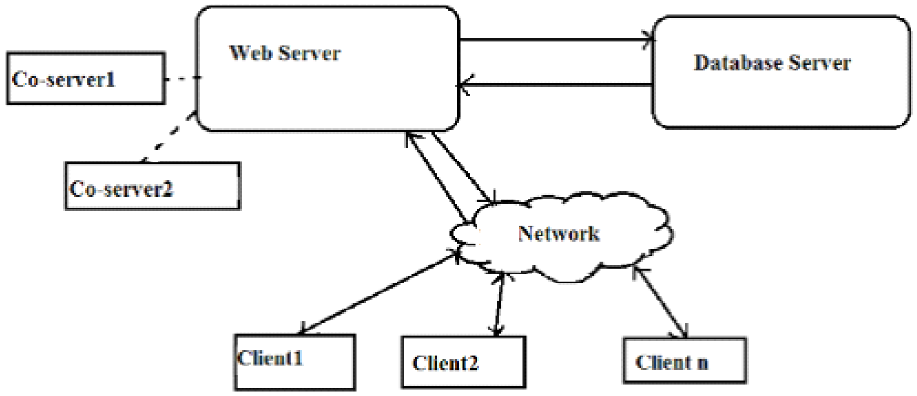

Fig 1. DCNA Architecture

BODY OF MANUSCRIPT

Existing System

To support data centric services several data-centric network architectures have been proposed in recent years: content centric networking (CCN) ,network of information (Net-Inf), data-oriented network architecture (DONA) , and publish-subscribe Internet routing paradigm (PSIRP).

The principles behind Content Centric Networks were first described in the original 17 rules of Ted Nelson's Project Xanadu in 1979.

CCN (Content -Centric Network) which converts host -centric services to data-centric services. In this network, contents of file are divided into multiple chunks and each of them assigning unique name that follows hierarchical structure.

CCN has some limitations. A first con is that it requires changes in the basic network operation, which is a big obstacle. A second con is that scalability.

In 2006, the DONA project at UC Berkeley and ICSI proposed an information centric network architecture, which improved TRIAD by authenticity and persistence in the architecture. On August 30, 2006, PARC Research Fellow Van Jacobson gave a talk titled "A new way to look at Networking" at Google.

DONA (Data Oriented Network Architecture) is slightly similar to CCN i.e it assigns an unique name for every service with public-private key pair. While content names in CCN are hierarchical but data names in DONA are flat and self-certifying. A node which is interested in the data that sends FIND packets to the resolution infrastructure, which routes FIND packets to identify the data closest to the requesting node. Once the desired data is found, it is sent to the requesting node using standard IP routing and forwarding techniques.

DONA's limitation is that it supports data-centric network approach but not host-centric network approach and is not an incrementally deployable network.

The PSIRP (Public-Subscribe Internet routing paradigm) project started on January 2008 and is expected to last until September 2010. This architecture eliminated the current Internet architectures defects such as spam mails, distributed denial of service (DDoS) attacks, inefficient mobility support.

Proposed Work

There are various alternatives for Internet to become data-centric. Among various alternatives one of them is for every application in application layer to be data-centric. For example, BitTorrent is also data centric that is user does not need to know where an expected data or services are located. But it is not purely data-centric because it interacts first with host and then data.

The most of the applications on the Internet are host-centric such as Hyper Text Transfer Protocol (HTTP) is itself host-centric but suppose if a user wants this application in data-centric approach then it is very difficult to convert it into data-centric architecture and it is inefficient.

And another application is to design transport layer protocol which supports both data-centric and host-centric network and it is also employable to all upper layer applications .But limitation to these applications to a specific transport layer protocol makes it impossible for existing applications to use the benefits of any novel transport layer protocols.

In this paper, new network architecture is introduced called DCNA (Data Centric Network Architecture) that can efficiently support both data-centric and host-centric applications. DCNA inserts a shim layer or service binding (SB) layer between the application layer and the transport layer of Internet. In the shim layer or SB layer a new algorithm is introduced that is Particle Swarm Optimization (PSO).

PSO is related to movements of flying birds i.e. a bionic algorithm and has the advantages of small individuals, simple calculation, and robustness. The effective route guidance can reduce the travel time of drivers, avoid congested road segments, which raise the road network efficiency.

We have validated the design of DCNA by implementing a simple Linux-base prototype with kernel version 2.6.28. Fig. illustrates the topology of the prototype, which comprises three routers, three ingress tunnel routers (xTRs), two mapping servers, a RH, a multi-homed server implemented with DCNA, a server with DCNA, a multi-homed host with DCNA, a mobile host implemented with DCNA, and a traditional host.

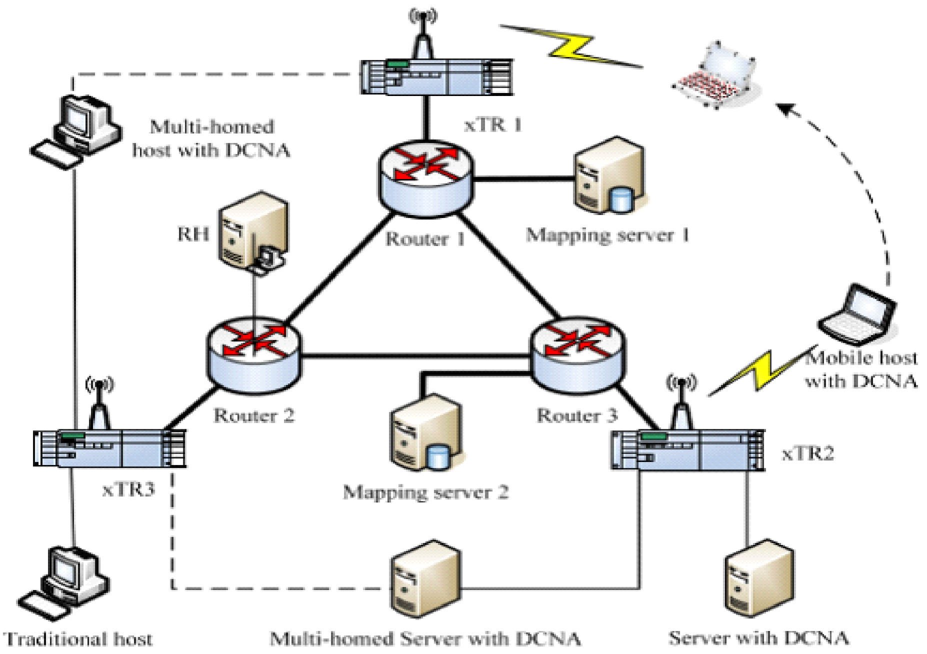

Fig 2. The Topology of Prototype [1]

The implementation of the hosts with DCNA consists of near about 22,300 lines of code and comprises the following main modules:

1. Application module:

In order to verify that DCNA can support both host-centric and data- centric model, we modified the Apache HTTP server so that it can send a request to the SB layer when we simply input an SID instead of a URL.

2. Session Binding module:

It generates CIDs for application instances, resolves IP addresses for SIDs, and manages transport layer connections used for obtaining a desired data.

Benefits of DCNA:

DCNA can provide data-centric, mobility support, multi-homing support, and is incrementally deployable. In addition, it can provide the deployment of new applications.

Data Centric:

The advantage of DCNA is it supports data-centric service. It describes in more detail using the example illustrated in Fig. 3, suppose a destination with IPdst wants to obtain a service with SID hosted by two sources, i.e., source 1 with Ipsrc and source 2 with IPsrc In order to obtain the service denoted by SID, the application layer of the destination sends a request to the SB layer of the destination.

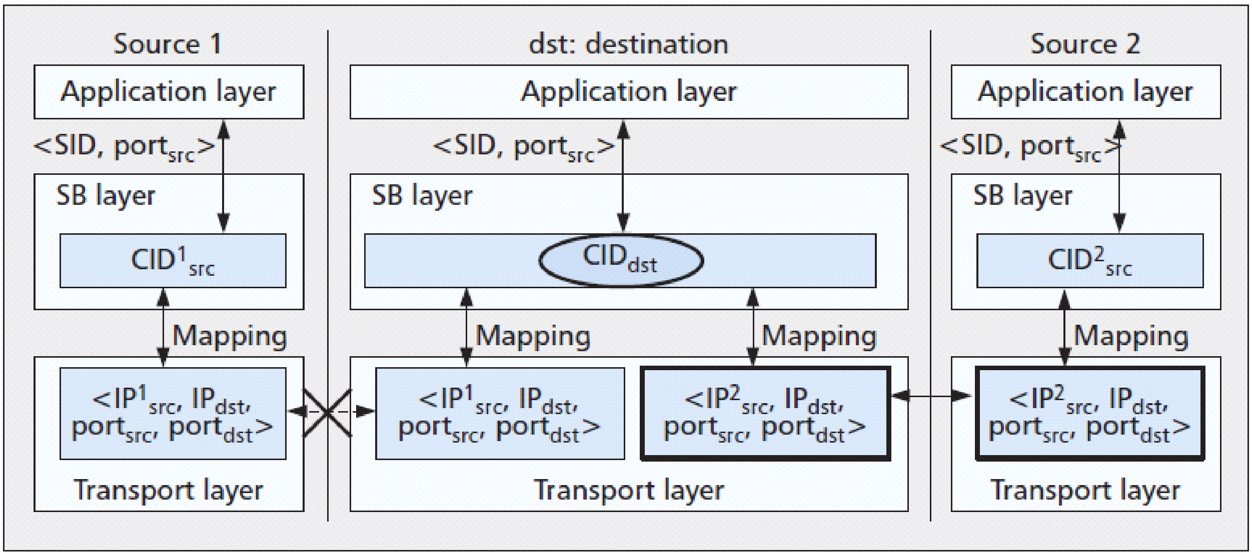

Fig. 3. Illustration of DCNA for data-centric services [1]

Incrementally Deployable:

As stated previously, DCNA is incrementally deployable. This is illustrated by Fig. 10, which shows how a node with the current Internet architecture (called "old node" for ease of presentation) communicates with another node with DCNA (designated as "new node"). Since the source cannot support SID, the destination node can only initiate a communication.

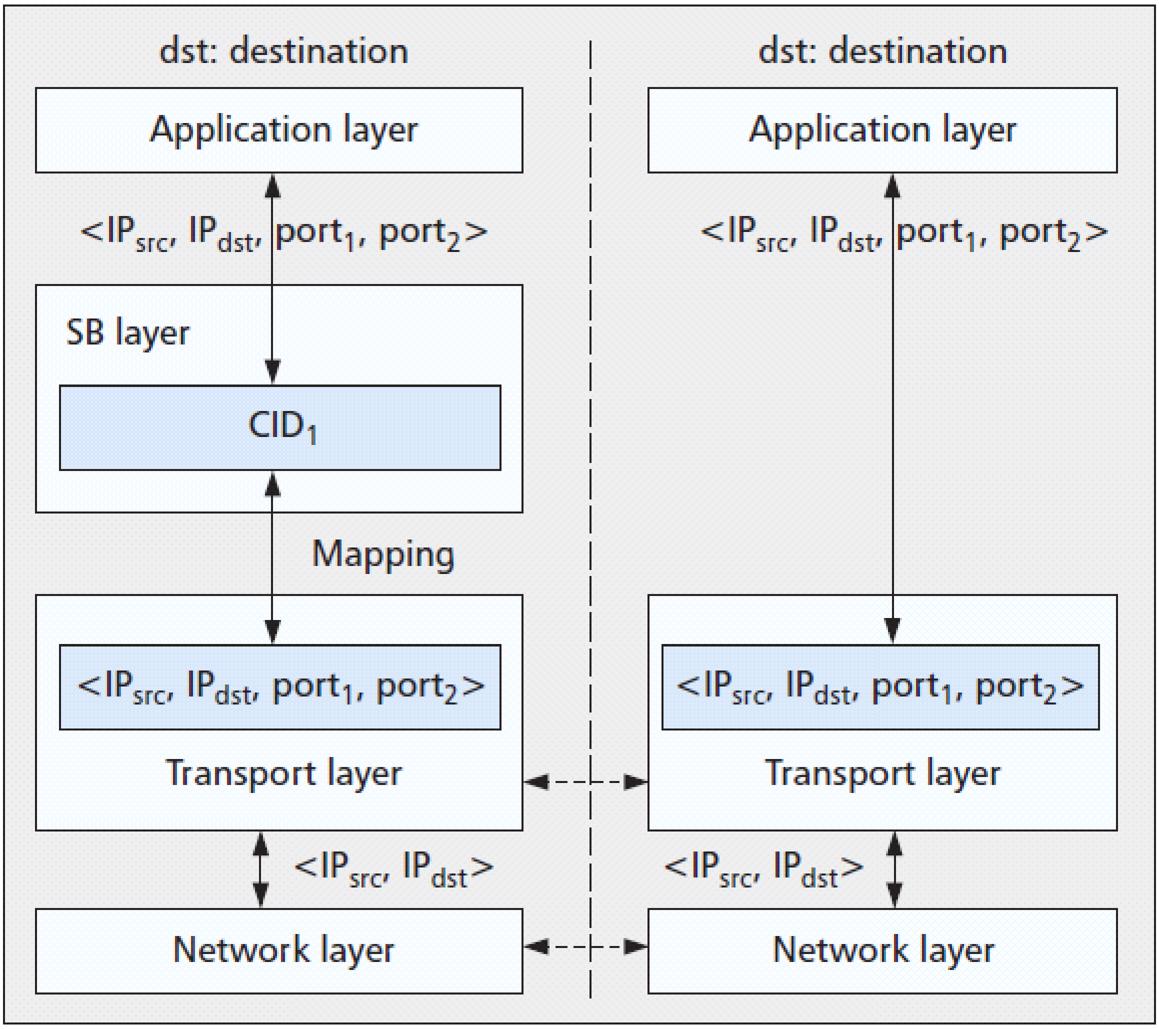

Figure 4. Illustration of communications between a node with the current Internet architecture and a node with DCNA [1]

Multi-homing:

DCNA is also capable of efficient multi-homing support. This illustrates by using the example shown in Fig. 5,suppose a destination is multi-homed to two subnets and has two IP addresses denoted by Ipdst 1 and Ipdst2 suppose that the destination wants to obtain a service denoted by SID hosted by a source denoted by Ipsrc. Fig. 5 (a) illustrates how DCNA supports multi-homing when the source and the destinations initiate a communication using the SID.

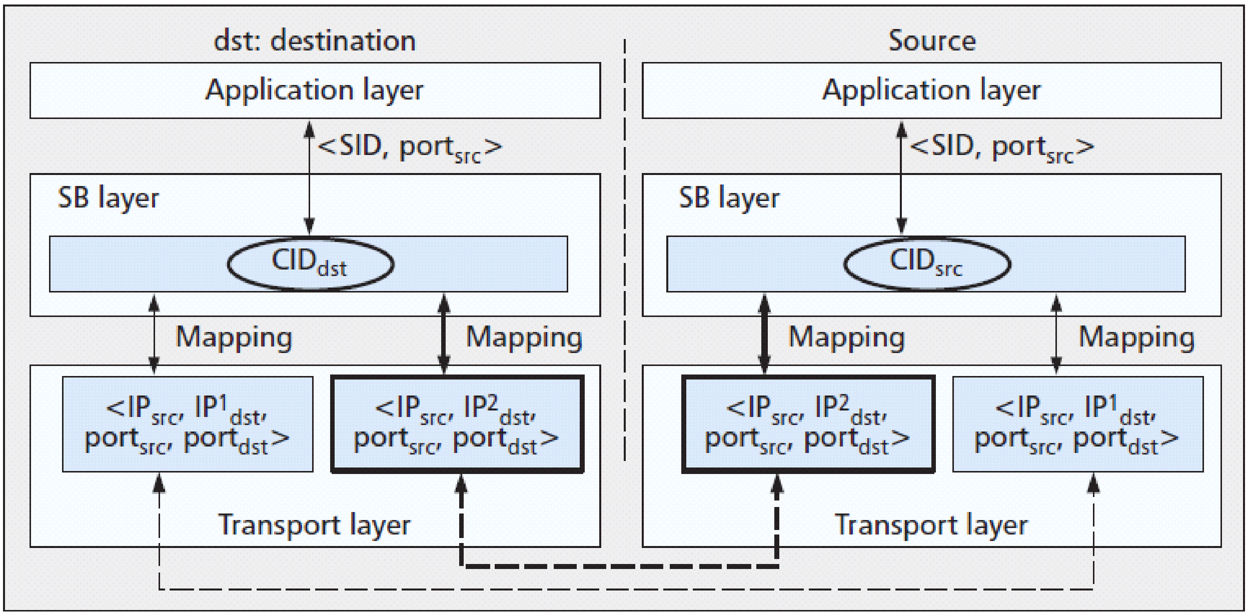

Fig. 5. Illustration of multi-homing support in DCNA[1].

Mobility support:

Another benefit of DCNA is its support for mobility, including service mobility and host mobility. Host mobility allows a device to move between IP subnets. By inverse, service mobility allows users to maintain access to their services while moving or changing devices and network service providers.

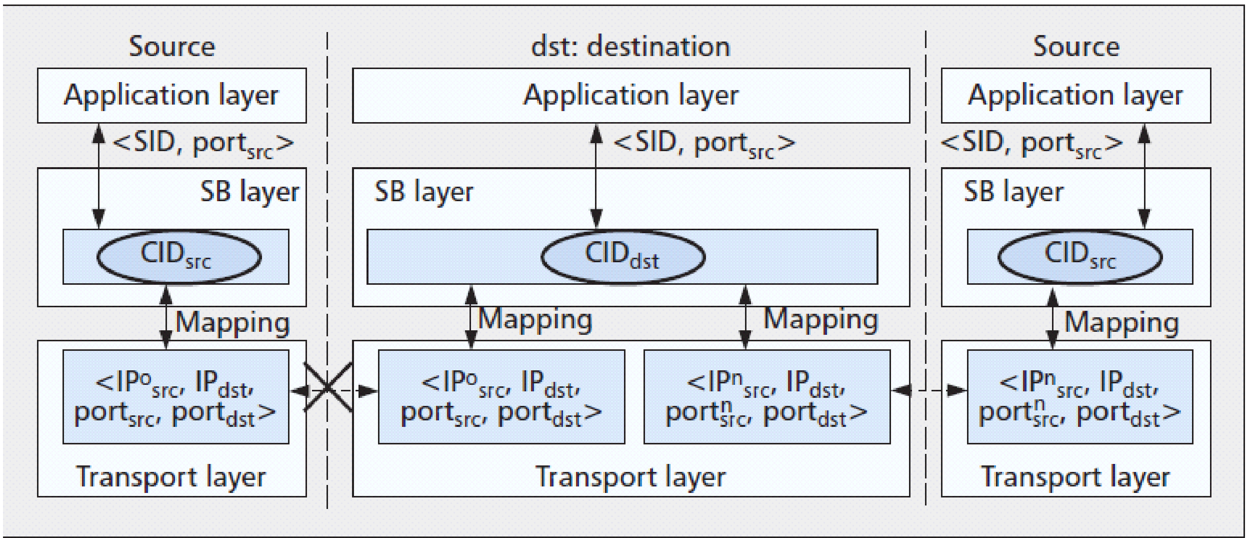

Figure 6. Illustration of mobility support in DCNA when a source and a destination initiate a communication using an SID [1]

CONCLUSIONS

In this article, we have proposed an incrementally deployable Data-Centric Network Architecture (DCNA) for the Internet. By adding a shim layer (i.e. the service binding layer) between the application and transport layers, DCNA is able to support both data-centric and host-centric service. We have built a future proof concept prototype and evaluated the feasibility of DCNA. It has been widely recognized that a future Internet should be data-centric, since users use the Internet mainly for data retrieval but are not interested about where the expected data resides. In this paper, proposed an incrementally deployable data-centric network architecture (DCNA) for the Internet.

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