

Data Object Routing Algorithms for Data Aware Networking

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Abstract: In the era of new generation networking systems, Next generation networks, software defined networking, data aware networkings are prominent areas for researchers to develop various architectures and systems, and the concept of data aware networking was initially coined by ITU-T. Various types of data are treated as data objects and are identified either by name or identification number and the same are used for sharing of data in the World Wide Web. The request response mechanism of client and servers happens with the name of identification number of data object duly hiding the URL way of accessing the data items. This paper proposes routing algorithms for data object routing in World Wide Web.

Keywords: Data aware networking, Data Objects, World Wide Web, data sharing, Future Networks

I. INTRODUCTION

Data aware networking (DAN) is an information centric networking approach based on name based or identifier based communication^[6]. It enables the users to distribute data objects among the World Wide Web and to retrieve them in an efficient and adequate manner with suitable mechanism and routing algorithms. The data aware networking enables the name or identifier based communication of data objects by providing mechanisms to publish data objects, locate data objects regardless of its location, respond and supply of valid data objects to the user, route and process user requests, proper usage of network resources allowing the users to have higher throughput and lower latency.

DAN recommends a unique name to all data of different categories in order to enable name based communication^[4]. The users of DAN can get the required data objects not only from the Original location but also from any intermediate nodes in the network with the cached data objects. DAN also makes it sure that the users will always be provided with a latest updated copy of the data object by removing out dated objects as and when they are invalid. It also provides the user with suitable security mechanisms to maintain data integrity of data objects^[5]. Every object in DAN should be digitally signed by its publishers in order to maintain the origin and integrity of the object. The data aware networking also categorizes the data objects into different categories so that the user can be able to access the data object of required category.

DAN also keeps the history of data transfer and also makes note of the frequency of data objects so as to maintain the copies of the data in the intermediate nodes so that the users can access the required data object from a nearby location as and when required. The history of data transfer also helps the DAN to automatically send the data objects to the required users based on their usage history and frequency. For this purpose, the Data aware networking maintains different routing algorithms and uses the suitable one based on the usage history of user and also the data object. These routing algorithms are sometimes reactive and sometimes proactive.

The users of DAN need not maintain end to end connection for managing hosts thus simplifies the mobility aspects of the end terminals. The maintenance of DAN by the operators is also made simplified by providing the operators with mechanisms to minimize the resource usage and energy consumption^[7]. DAN also allows the data objects to be stored in intermediate nodes and be retransmitted by the intermediate node on behalf of the host to adapt to varying networking conditions.

DAN also supports a variety of application programming interfaces (API) for data object distribution and data object retrieval. Most popular API s of them includes put/get and publish/subscribe. In the put/get API, application can be able to request and pull a data object from its serving network^[8]. In addition to this, The publish/subscribe mechanism also allows the applications to make an advanced request of what data object is needed, so that the data objects can be sent to them as and when it is published.

The next section briefly describes the working nature of data aware networking and how data items are transformed to data objects. Section 3 deals with the header structure of data object and section 4 deals with the methodology to publish and disseminate data objects to the end users. Section 5 deals with the different approaches to serve the end user with the required data item followed by the conclusion and references used for the research work.

II. DAN SYSTEM

Next generation networking separates service systems from transport systems. Data aware networking is a networking of data objects for publication and sharing of data items at service level. The conventional way of data transfer occurs at data link layer and network layer. Data routed are packets and packets are the basic data unit in conventional routing systems^[1]. The data aware networking (DAN) is built on the top of conventional networking duly utilizing conventional networking procedures. In DAN, data objects are touted at presentation or session layer. Such routing is logical routing which in turn happen using conventional routing techniques. The data objects are maintained by the publisher of data objects and such data objects are utilized by higher level client systems. Data objects are published by publishers and such data objects are routed to the client through intermediate object managers. These object managers act as agents on behalf of publishers.

The data objects are supplied to the object managers as and when required reactively or in advance proactively. The next section describes the structure of header of data object required for data object routing.

III. HEADER OF DATA OBJECT

The properties of data objects are crucial not only for identifying the data objects but also important in the data object routing and version updations^[2]. This section represents required details of header of data objects for routing. The fields required in the header of the data object are size of header, size of actual data, data object name, data object identification number, category of data object, version number, next updation date, categories of data agents etc.,

The structure of a data object in transmits usually divided into two parts namely header part and data part^[3] as shown below:

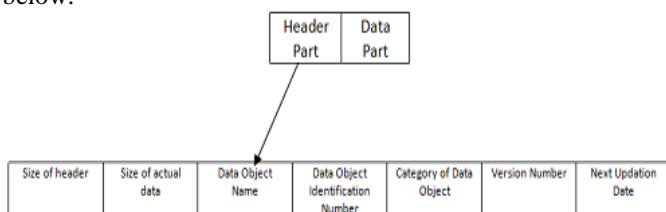


Fig.1 Structure of a Data Object in DAN

The first two fields indicate the size of the header and the actual data respectively. The third field represents the unique name of the data object and the fourth field represents the unique identification number of the data object. The category of data object is represented in the next field. The validity of the data object is represented by its version number and the next updation date fields. By using the next updation date field, a system or an end user will easily come to know whether the data object received is latest or not. If the date of accessing the file crosses the next updation date, the file is actually invalid and needs an updated file to be loaded.

The next section describes the publication process of data objects in detail.

IV. PUBLICATION OF DATA OBJECTS

In data aware networking systems, the major stakeholders are authors, publishers, clients, data object managers and data object regulating authority (DORA). The overall controlling system of data aware networking in legal aspects is maintained by DORA.

DORA frames regulations for publisher registration, object manager registration, author registration, and categorization of data objects, updation frequency of data objects, feedback systems etc., and Different categories of data objects are determined by DORA. An author can register one or more publishers to publish data objects of his own interest. The authorized authors shall make a data object and publish it through the publisher. Such published items can be made accessible through category wise agents. The published data objects are indexed among all agents. As and when requested by the client, data objects are transferred to the client through agents. While processing the client requests, frequency of data objects will be maintained by agents.

V. ROUTING ALGORITHMS

Data Aware Networking mechanism allows the sharing of data objects among the client and server using a variety of routing algorithms. However, all the routing algorithms followed by the DAN are either reactive or proactive. Reactive algorithms provide direct data transfer between the client and server while the proactive algorithms provide intermediary node transfer based on statistical analysis of data objects.

5.1 Reactive Routing: In the reactive routing algorithms, authors will make the object and get it published by the publisher. The author may choose to publish the same data object by one or more publishers. The publisher will maintain the catalog of data objects. On the other hand, the user will register themselves with the object manager. User will place request for a data object through the object

manager. The object manager then forwards the request to the publisher and the publisher responds to the object manager with the required data object after successful validation. The data object is then routed from the server to the client through intermediary nodes. The intermediary nodes based on the statistical analysis, may keep a copy of the data object.

5.2 Proactive Routing: This routing requires user history of usage of data objects. This mechanism is based on the user's and the data object's statistics. Based on the user's statistics, a user may need a data object frequently over a period of time Or A data object may be used frequently by any number of users frequently. Based on this analysis, the data object will be made available at the nearby intermediary nodes by the publisher so that the data object will be readily available to the users as and when required.

VI. CONCLUSION

Data aware networking is prominent area in the future domain of business concepts. The concept of URL may be continued for internal purpose of DAN systems. End user needs to know name and identification number of data object of his own interest for accessing.

DAN introduces data object banking system for commercial and non commercial business management. Data object publishing, routing, agent management and functioning of object managers are crucial for the success of data aware networking systems.

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