



Publishing Data Objects in Data Aware Networking

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Abstract. In the era of digital world everyday huge amount data is generating in the form of audio, video, image, spread sheets, documents etc. Handling such huge data with existing conventional networks is critical and a major issue. International Telecommunication Union–Technology (ITU-T) identified relevant issues and proposed characteristics and capabilities of future networks. One such system is Data Aware Networking which ought to provide effective and efficient information system to the users with most updated data. ITU-T stated that data object is a unit of information in Data Aware Networking. Data objects are identified either by a unique ID. The information sharing is done by the way of publishing Named Data Objects (NDO) and delivering to the clients [10]. In the context of DAN, the unit of information will be called as a Data Object. In order to provide authentic and most updated data, there is a need to maintain DAN data in a database system. This paper proposes a structured model of storing the NDOs in a relational model for efficient maintenance of data objects and for effective routing of NDOs between clients, publishers and DAN agents.

Keywords: Data aware networking · Named data objects · Data driven networking

1 Introduction to Data Aware Networking

Information systems play a key role in most of the contextual and digital systems now a days [1]. World Wide Web generates huge amount of data from several domains. All such information available on web domains is accessible to the public. Consistency, correctness and legality are the some of the issues with this information. In a conventional web domain several persons may involve in hosting the data. The responsibility and credibility of such persons are lacking in these systems. Also, the maintenance of correlation between information, collecting consolidated information is difficult.

ITU-T identified such issues and proposed the concept of Data Aware Networking [6, 8] to handle huge amount of data. Subsequently ITU also released its recommendation to have Data Aware Networking (DAN) with data object as primary data unit [2, 3]. The proposed architecture of DAN is shown in Fig. 1.

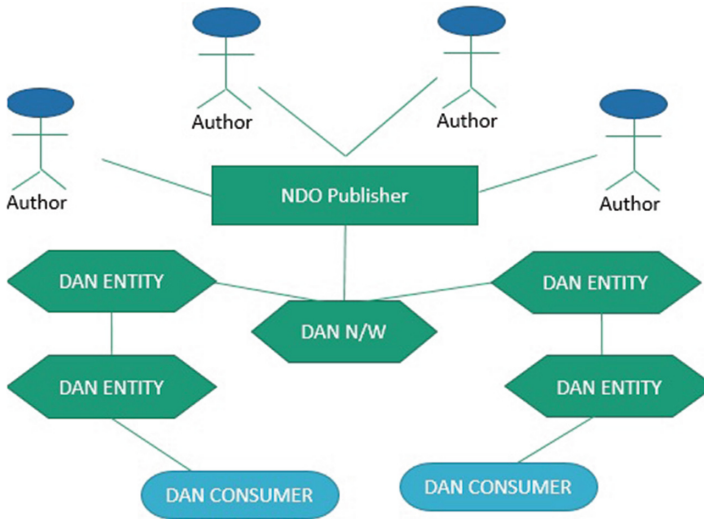


Fig. 1. DAN Architecture

The major functional units of DAN are NDO Publisher, NDO Client and DAN Agents. Every data object will be allotted a unique ID and name. Such named entities are called as Named Data Objects (NDOs). Any author or person willing to publish information, such information shall be sending to the authorized NDO Publisher of DAN. The NDO Publisher get all other required information from the author and generate NDO with name and ID. The generated NDO contains a header and actual information. The details of such Named Data Objects updated to all the Data Agents in the DAN.

NDO publisher gather required details of data item to be published from the author and build NDO and Publish the NDO. The steps in NDO publishing are preparing of header of NDO, building of NDO and publishing of NDO. The Sect. 2 describes entities of DAN system. Section 3 describes about header of NDO. Building of NDO explained in Sect. 4 and Sect. 5 describes about publication of NDO.

2 Major Components in DAN System

DAN system is networking of authors, publishers, agents and clients. Authors have to register themselves with available list of publishers to host their information. The author shall submit all personal and official details for registration. The publishers are responsible to publish information of author in a systematic way. Publishers also maintain a catalogue of published articles by different authors. Agents are middle layer in the

DAN system. Agents maintain catalogue of articles published by almost all authors and respective publishers. Agents also maintain a partial bank of articles which may be prominent articles to the nearby clients. Clients are end users of articles. This section briefly describes entities of the DAN system.

1. **Author**

Author is the primary source of information. Author may be an individual person, a group of persons, society, organization, Government or any author authority authorized to release information to the public.

2. **Named Data Object (NDO)**

NDOs are the actual data objects published by the author through publisher. A Data object is any information either for public or private purpose. Data Objects are maintained as files in database. Information to be published is encrypted and attached to document header for publication of data objects. These data objects will acquire a unique styled name and id before they are published for use.

3. **NDO Publisher**

NDO Publisher will hold the responsibility to publish the articles of the author. NDO Publisher is a Server which is full pledged computing and database system in DAN. NDO Publisher is responsible to register authors, verifying articles of author, maintaining of digital catalogue of published items, preparation header for new articles of author and preparing of NDO.

4. **NDO Client**

NDO Client is actual user of data objects in DAN system. NDO Client may be any electronic gadget attached to the DAN as leaf item in the topology DAN system. These gadgets are portable computing systems capable sending and receiving information to and from DAN network.

5. **DAN Agent**

DAN Agent is an intermediate node in the DAN system. DAN Agents acts as router for NDOs to route NDOs from NDO Publishers to NDO Clients. DAN Agents can also route requests of DAN Clients to the concerned NDO Publisher. DAN Agents also acts as mini servers to provide NDOs to NDO clients. DAN Agent maintains a database of prominent probabilistic NDOs of various Authors.

3 Header of a Named Data Object

Header is preamble of Data Object. Each data object is attached with header containing the details of Data Object. The attributes of header are Header_Size,

Data_Item_Size, NDO_Name, NDO_Id, Category, Country, Author_Id, Publisher_Id, Time_of_publishing, Volume_No, Journal_No, Data_format, Security_code, Confidentiality_code, Legal_rights_code, Price, Currency, Agent_group_code, Life_time, Update_Frequency and Reserved_bytes. Author will send all the values of these attributes to the publisher along with data item for preparation of NDO. Header itself is enough to identify a data object uniquely and ID is generated in such a way that itself is self-descriptive of the data object. Figure 1 shows structure of header of NDO. Header is prepared using UTF-8-character set.

Header_Size	Data Item_size	NDO Name	NDO_Id
Category	Country	Author_Id	Publisher_Id
Time_of_Publishing	Volume_No	Journal_No	Data_Format
Security_Code	Confidentiality_Code	Legal_rights_Code	Price
Currency	Agent_Group_Code	Life_Time	Update_Frequency
Reserved_Bytes			

Fig. 2. Proposed Structure of NDO Header

The attributes of Structure of NDO are uses UTF- Character Set. The size of attributes of header NDO is given in Fig. 2. Except *Category* and *Data format* all other attributes are self-explanatory. *Category* represents type of data object. There are several categories of data objects like word, pdf, image, spreadsheet etc....., will be published viz., Government orders, statutory documents, legal documents, centuries documents, news articles, entertainment articles, text books, novels, and so on. One can address in this issue. Each data item will be identified by using a unique Item_id irrespective of the category of the object.

4 Building a Named Data Object

Named data objects are the main entities in Data aware networking. Maintenance of these objects is a challenging issue [5]. The copies of published Data items (NDOs) are cached in several Data Agents. Keeping consistence, correctness and versions are some of the related issues. One can address these issues by maintenance of proper structure of header of NDO, building of NDO, and proper database systems at NDO Publisher and Data Agents.

The actual information is converted in encrypted form and header is prepared as per the structural of header as shown in Fig. 2. The encrypted data item is in binary form is attached to the header [4]. The structure NDO is shown in Fig. 3.



Fig. 3. Proposed Final Structure of NDO

5 Publishing a Named Data Object

The NDO Publisher builds NDOs and publishes in DAN system. Every NDO Publisher maintain a full pledged database containing the details all self-published NDOs, details of all DAN Agents in DAN system, each publication wise prominent probabilistic DAN agents, particulars other NDO Publishers, details all registered authors, details categories of data objects, publication policies, legal constraints, particulars of backend database servers etc. (Table 1).

Table 1. The size of attributes of header NDO

Description of fields of header of NDO (UTF-8 character set)		
S No	Field	No of bytes
1	<i>Header_Size</i>	4
2	<i>Data_Item_Size</i>	4
3	<i>NDO_Name</i>	200
4	<i>NDO_Id</i>	4
5	<i>Category</i>	4
6	<i>Country</i>	4
7	<i>Author_ID</i>	4
8	<i>Publisher_ID</i>	4
9	<i>Time_of_publishing</i>	78
10	<i>Volume_No</i>	4
11	<i>Journal_No</i>	4
12	<i>Data_format</i>	4
13	<i>Security_limits_code</i>	4
14	<i>Confidentiality_code</i>	4
15	<i>Legal_rights_code</i>	4
16	<i>Price</i>	4
17	<i>Currency</i>	4
18	<i>Agent_group_code</i>	4
19	<i>Life_time</i>	78

(continued)

Table 1. (continued)

Description of fields of header of NDO (UTF-8 character set)		
S No	Field	No of bytes
20	<i>Update_Frequency</i>	78
21	<i>Reserved_bytes</i>	118
<i>Total size</i>		600

The database of NDO publisher is updated immediately after an update is available from the author which will be update with all access points of DAN Network.

6 Conclusion

Named Data Objects (NDOs) are primary data units in DAN system. Building NDO is significant stage in success of DAN system. Critical items in building of NDO are encrypting of original data object of author, preparation of header and attaching encrypted data object to header. As demand of century's information is high, such data objects also to be included in publisher's database.

One can design DAN system on top of existing conventional web domain client server system hiding the details. Conventional routers are different from DAN Agents (DAN Routers). DAN Agents are purely software routers build on top conventional network. One can address issues such as security issues that arise a part of integrating DAN with conventional network layers [7].

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