

BIRB: Distributed Social Media Application over NDN-ICN

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Abstract Name Data Networking(NDN)[1][11] – Information Centric Architecture (ICN)[12] is a emerging network architecture which is fundamentally different[14] than TCP/IP, the current networking architecture. There are several synchronization protocols such as ChronoSync[4] and PSync[8] developed for NDN. However, there exist a very few applications using these protocols. Specifically, there is no social media application using NDN, the main focus of this project.

This proposal discusses on developing a distributed social media application called BIRB – a twitter like application using NDN. It aims to demonstrate the usability of distributed communication over NDN using the above mentioned synchronization protocol ChronoSync and PSync.

1 Introduction

Name Data Networking is a data-centric internet architecture which uses the concept of naming a content rather than naming a host (e.g. 192.168.5.75) as done by the current IP based internet architecture. Similar to the client and server in TCP/IP, it uses the concept data producer and data consumer. Producer is the one who produce the data e.g. *The Newyork Times* , while the readers can be considered as the data consumers. Every single data released by the data producer in the network is a named content e.g. */memphis/operating system/project/birb.pdf*. To fetch this data, interested consumer can send an interest packet with a name exactly matching the data name over the network. Interest packet is similar but not equivalent to a request in TCP/IP network. Once the interest is received in the network by a node i.e. routers, it will check its cache - content store (CS) for the availability of the data corresponding to the interest received. If found in CS, the data is sent back to the consumer immediate on the reversed path followed by the interest packet. Otherwise, the interest packet is forwarded to the next node and so on. If the data is not found on any of intermediate nodes, interest will ultimately reach the data producer and hence the data will be served. The path to the data producer is stored in forwarding information base (FIB) of name-data forwarding daemon (NFD). More about NDN architecture can be found on the reference section [1].

1.1 Description

BIRB is a distributed desktop-based Twitter-like social media application. It aims to demonstrate the capabilities and usability of NDN and several of its protocols developed for the communication and data transfer over NDN. Unlike most of the other social media platform, in terms of published data, BIRB is purely a distributed application as all of the data shared across the network are stored only on the local devices of the users.

"All the followers are consumers, all the followee are producers, both follower and followee can be a producer or consumer and vice-versa"

An estimated sequence diagram of the application is shown in the figure 1. Here, first, a user will send a follow request to some other user already registered to the application. The application(BIRB) will provide a search feature to find new friends. The search feature will be achieved by storing a list of all the users

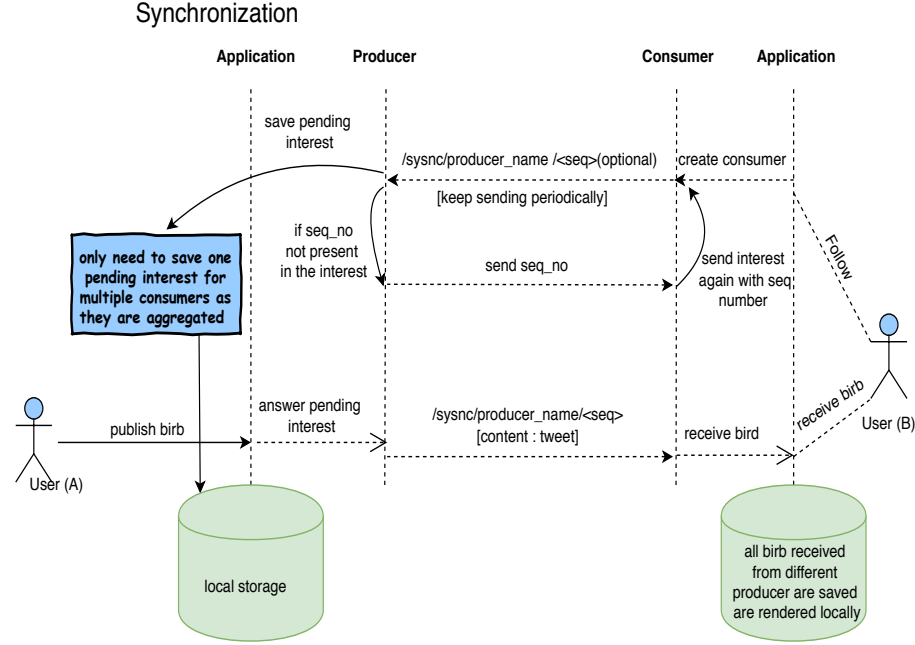


Figure 1: Figure: Sequence Diagram - BIRB

registered to the application in an intermediate server. Once a user follows another user, it will send a synchronization (sync) interest to that user. Receiving a sync interest, the application running on the other side will either send a list of all the sequence numbers of the bird (technically data) it has published till date or will store the request in its pending table (PT). The pending table is a simple database used for storing the received pending interests. The main purpose of PT is to serve pending interests received from all the followers. Basically, this interest can be viewed as a request asking for the data that followee will produce in the future. Unlike TCP/IP - push-based system, NDN is a pull-based system. Here, data consumer will have to pull the data published at the producer's end.

On the follower side, upon receiving the latest sequence number or list of them, it will pull all the data corresponding to each sequence number and subsequently store them in a local database. These stored data will be rendered by the application(BIRB) running locally on the desktop. The interest from the data consumer towards the producer is periodic in nature i.e. they are sent frequently in a certain interval. This regular interest is to synchronize between the follower and the followee whenever a new data is produced.

2 Challenges

However, even the application seems promising and simple in nature, it should overcome several challenges commonly faced in ICN architectures including some implementation challenges. Challenges such as the evolving nature of NDN libraries and synchronization algorithms, few and inconsistent NDN testbed[13] nodes, complicated certification process for a new user in order to perform remote communication and so on. Certification is a crucial part of security in NDN communication. For any user to publish or receive data to and from the network, it should be signed using a key received from the trust anchor. Currently, NDN testbed trust anchor lies on a server at UCLA. Any application aiming to use the testbed should first obtain a trust key from UCLA node.

Despite these several challenges, completion of this project will demonstrate several capabilities of NDN such as data synchronization mechanism, the usability of NDN testbed, security with the trust anchor, and finally a distributed social media application. Additionally, it will also provide an example for the real world application development over NDN.

3 Related Works

Few applications are developed in the past similar to BIRB that uses NDN architecture. Some of these application are SnapChat – a file sharing application, ChronoShare[10] - a distributed chat application , ChronoChat[6], nTorrent[5] – peer to peer file sharing application, similar to BitTorrent. In contrast to these applications, BIRB mostly concerns with sharing status – similar to tweet in the twitter – and synchronizing other’s status by maintaining a locally synchronized database between the follower and the followee. Also, none of the above-mentioned application facilitates a remote communication between the users, neither they use the NDN testbed. Thus, BIRB aims to overcome these challenges and shortcoming. The detail on the previously developed similar application can be found on the reference section.

4 Revisions

The project proposal has been approved. I have started working on it as per the milestone. I have completed first two task as mentioned on the milestone and the third task is on progress.

5 Requirements

A desktop capable of running NDN i.e. ubuntu, mac or android. The proposed application will have following features.

1. By the end of the project, a complete distributed twitter like application called BIRB will be developed. In this application, registers user can receive data from followee, as well as can published data.
2. A desktop based application with a local database storing following information.
 - List of user followed and a certain amount of birb(data) published by these users. Storing number of birbs per user can be configured from the application itself.
 - A pending table (PT) storing all the pending interest from different subscriber. These interest are used to server back the data published in the future.
3. An intermediate application server storing a list of all the registered user using the application. This is a global list and will be used to provide a search capability to find friends.
4. User should be able to sign the data before publishing it and the receiver should be able to verify the data after receiving it.
5. A user should be in sync with the followee receiving all the freshly published data.

6 Rationals

This project has several notable benefits. As mentioned earlier, NDN is a new internet architecture where the concept of IP address is completely dropped. It has several libraries and protocols developed to facilitate the communication. Despite their existence, only a few applications are available that exploits the true capabilities of NDN. However, it’s the popularity and usability is growing day by day. Several API is developed to encourage new application developers and the users. There is a 42 node testbed[13] currently deployed connecting several nodes across the globe. This testbed provides several high-level API for the app developers and the users to communicate over NDN. Upon successful completion of this application (BIRB), probably, we will have a first distributed social media application demonstrating the usability of NDN and the testbed. This application will also demonstrate the strength of data synchronization library ChronoSync and PSync along with their API. It also aims to inspire other developers to come across the NDN and develop a real-world application using it. Currently, there exists very a few application developed over NDN.

For the completion of this project following physical resources will be used. A raspberry PI as an application server storing the list of the users. A few computers capable of running NDN. And finally, the NDN testbed.

Timeline: Assuming my involvement in the NDN research from the past one and half year, and my knowledge in developing application over NDN, this project will meet the goal in two month period time.

Note: This application will be developed in a Javascript framework called electron-js, thus the user's machine should support javascript on the client side to use it.

7 Milestones

Task	Estimated Time	Status
Requirement gathering and analysis	1 Week	Completed
Installation and environment setup	1 Week	Completed
Project Implementation	4 Weeks	In progress
Testing and report writing	1 Week	
Final Submission	2 Weeks	

8 Status Report

As per the project milestone, the progress is right on track and on time. I have completed the first two tasks i.e. requirement gathering and environment setup. For the requirement gathering and environment setup, I looked into the NDN libraries such as ndn-cxx, NFD, NLSR, ndn-tools, and ndn-js – most of these libraries are mentioned in reference section. I have setup two vagrant virtual machine and have set up NDN in those machines. These machines are successfully talking with each other. This is a very first setup of requirement gathering and project initiation. Also, I looked into few resource such as Let the World Reach Your NFD” - by Junxiao Shi and NDN-JS: A JavaScript client library for Named Data Networking. These two document helps to connect NDN libraries to the testbed and set up a web socket for remote communication. The next step is the project implementation – developing the real application i.e. birb.

9 Evaluation

Since the project is right on scheduled, I believe it can be completed on time. However, I have faced some complication while establishing certification process to register app on the NDN testbed. However, I am in constant communication with the NDN development team to get dimensional insight on this and I hope to get success pretty soon. I am almost prepare for the next phase i.e. application development.

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