# Design, Implementation, and Evaluation of a Social Networking Application Using Named Data Networking

Dorrie Tang, Zhehao Wang, Professor Jeff Burke

Center for Research in Engineering, Media, and Performance (REMAP) / University of California, Los Angeles

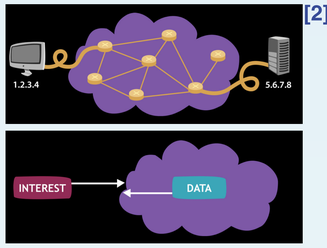
## Background

### Current Model of the Internet: IP

- Endpoints on the network are given IP addresses
- Packets are forwarded based on addresses
- Focuses on location of data

### A New Internet Architecture: NDN

- Data is given hierarchical, human-readable names
- Interests are forwarded based on names
- Focuses on content of data




[2]

## Introduction

### Motivation:

- Current social networks running on IP rely on servers owned by single companies to store and provide users' data; with this NDN application, data can be published on users' machines, allowing control over access to their data.
- The developing of this application will explore potential advantages of NDN.

### Our project:

This project developed a social networking application running on NDN to explore and demonstrate differences from similar applications on IP like Facebook and Twitter. We designed a namespace and a protocol, then implemented two browser interfaces to publish and receive data. The application was built using ndn-js, an NDN client library in Javascript, and run on the NDN testbed, an NDN network with nodes across the world.

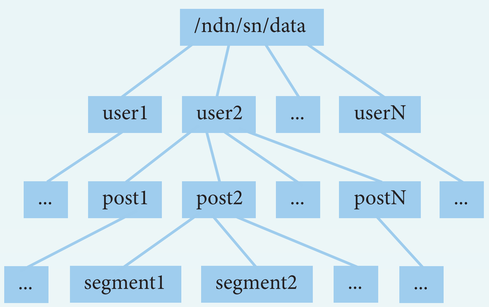
### Related Work:

A study done by B. Mathieu et al. (2012) [3] analyzed how the information-centric approach to networking works in parallel with how social networking applications allow users to easily share contents, and its advantages compared to the current IP-based delivery. This project hopes to utilize these advantages in this NDN-based social networking application.

## Namespace Design and Protocol

The **namespace** of an application running on NDN is the hierarchical way data are named when being published onto the network.

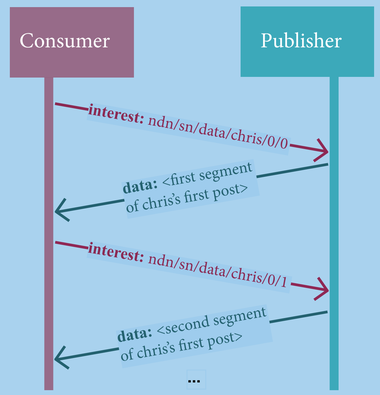
### Hierarchical View




**example:** ndn/sn/data/chris/0/0

- The namespace of the application designed in this project is human-readable and compatible with how the application is used (looks at username, then a specific post).
- Posts are broken into segments depending on how many are needed to contain the data.

### Sequence Diagram




The **consumer** is the part of the application that issues the user's interests for data in the network.

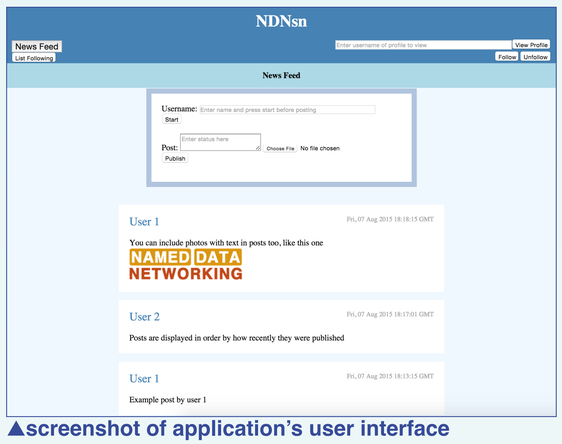
The **publisher** is the part of the application that takes in the user's input (text and/or a photo) and publishes it onto the network.

## User Interface

The user interface depicted below includes functions for both the consumer and publisher, combined in one page.

**Publisher:** (in highlighted gray box) allows user to publish text and photos

**Consumer:** (throughout the page) News Feed, View Profile buttons to view data; posts listed beneath publishing area; List Following, Follow, Unfollow buttons




▲**screenshot of application's user interface**

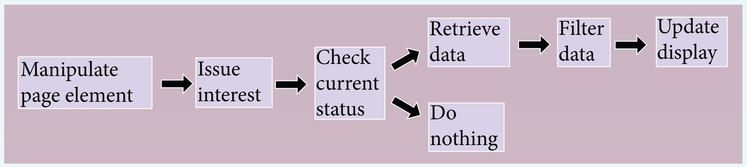
## Implementation

- Data from interests are stored in background and the consumer functions mainly show or hide page elements, allowing data to be constantly retrieved.
- We used event-based programming when separating out and writing functions because of the heavily user-dependent nature of the application.
- asynchronous consumer functions: (1) to retrieve data for interests and display them as HTML elements, (2) to decide what data to display on the user interface and to rexpress interest if there was no new data retrieved

**Publisher**

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Keychain, storage, and memory content cache are initialized, prefix is registered | Data is inputted by user, "Publish" button is clicked | Parts of name specific to data are added to initial prefix | Data packets are made and put into memory content cache |

**Consumer**




- We tested publishers and consumers separately by opening them in different tabs of a web browser and checking if functions were working as expected. They were later combined into one file to make the interface more user-friendly.
- After all the functions were working, the HTML was manipulated to make the user interface more aesthetically pleasing.

## Conclusion

### Advantages:

The design of this NDN application has a **distributed** model that eliminates the need for the centralized services that IP applications have. With this NDN application, data can be published on users' machines, allowing control over where/who can access their data. The model also allows users to obtain data from any node on the network matching their requests, not necessarily the content's publisher; this matches the use case of the user-dependent application.

[3]

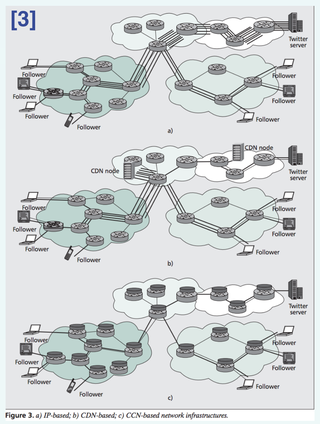



**Figure 3.** *a) IP-based; b) CDN-based; c) CCN-based network infrastructures.*

### Future features to explore:

- permanent storage on users' machines rather than just the webpage
  - -Where in machines would data be stored?
  - -What would happen to the data over time?
- the ability for publishers to delete past posts
- a search function allowing users to find each other without knowing each other's NDN usernames
  - -Where would this information be kept without use of a centralized server?
- encryption of data so users can control where their information goes and who can access it
  - -What is an appropriate model for the signing and verification of data on this applciation?
- various other aspects on the user interface

## Acknowledgments

First and foremost, I'd like to thank my Daily Lab Supervisor Zhehao Wang, my professor Jeff Burke, and the other students working in the REMAP Lab (mainly Randy, Zoe, and Peter) for hosting and helping me this summer. Special thanks to Luke Shaw for the help and feedback with HSSRP assignments such as journal club presentations or this poster, and to Will Herrera for coordinating the HSSRP program this summer. Finally, my thanks cannot be expressed enough in words to my family and the many friends I've met through this program for providing constant support and keeping me energetic all throughout the past two months.

## References

**[1]** Zhang, L, Afanasyev, A, Burke, J, Jacobson, V, claffy, kc, Crowley, P, Papadopoulos, C, Wang, L, Zhang, B, "Named Data Networking," ACM SIGCOMM Computer Communication Review 44 (2014)

**[2]** "The Mission To Save The Internet By Rewiring It From The Name Up."Motherboard. N.p., n.d. Web. 12 July 2015.

**[3]** Mathieu, B, Truong, P, You, W, Peltier, J, "Information-Centric Networking: A Natural Design for Social Network Applications," IEEE Communication Magazine (2012)

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