Mobile ICN Applications for an Event with Large Crowds

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1. INTRODUCTION

Large crowds often gather for a limited duration of time due to a popular event such as a sports event or outdoor festival. When operators dimension cellular networks, the design is based on regular demands and load on the network during peak hours. There is however a limit to how much capacity can be allocated to a single location, and operators do not want to spend more than is typically needed. Large crowds gathering in small areas for relatively short periods of time create high loads on the cellular network.

Common for these events is that they gather a large crowd wanting to access data from the network. This creates a higher demand on the network than what the infrastructure was dimensioned for, causing deteriorated user experience. As the people in the crowd are there for the same event, interests that drive their data access patterns are likely to be similar (e.g., at a football match, most of the crowd want to view a replay of a goal). Thus, there is great potential for using the Information-Centric Networking (ICN) paradigm to improve performance as named data objects (NDOs) can be cached close to users, but also in the mobile nodes themselves, reducing the load of the network. Additionally, user-generated content can be distributed via local peer-to-peer communication to minimize a mobile node's outbound bandwidth consumption. The use of ICN technology will improve user experience by *reducing latency* and *increase robustness* when using weak or overloaded infrastructure. Furthermore, for operators, it will *reduce resource usage and system load* and *increase efficiency*.

In this demo, we show the use of the NetInf [1] ICN architecture in this scenario, with a network consisting of both infrastructure and mobile nodes, and demonstrate that it provides benefits over traditional IP networks. We show this through some sample NetInf-enabled applications for Android devices, combined with a backend NetInf infrastructure. The NetInf software for Android will be available so that demo session participants can install it on their own device and test the network themselves.

2. SYSTEM OVERVIEW

The NetInf architecture was developed jointly within the EU FP7 project SAIL, and the system components in this demo have been developed in different organizations as part of a distributed effort, but are all compliant with the NetInf protocol [2]. Figure 1a) shows a simplified overview of the system and its different components. This section will explain the different components of that system.

NetInf Protocol Implementation and API for Android

An Android service that provides the NetInf API through a user-space library that allows third-party applications to connect and use NetInf communication primitives. Applications can publish and get NDOs over both the infrastructure network and in the local wireless neighborhood through Bluetooth.

NiProxy Name Resolution Service and Content Store
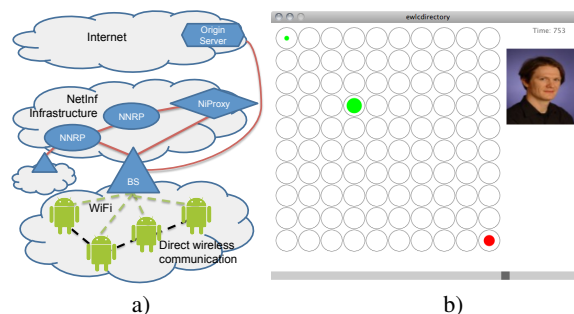

Figure 1: a) System overview. b) Visual Content Directory

Provides name resolution as well as a content store. Publishers can publish NDOs to NiProxy and either upload the NDO to NiProxy, or only register the locator of the NDO. Clients use NiProxy to resolve NetInf names and either get the NDO from NiProxy or get locators to where the NDO can be retrieved.

NNRP NetInf Router

Modular NetInf enabled router. Performs on-path caching and forwarding of NDOs according to routing information and configuration. For the purpose of this demo, a static routing setup will be used, but more complex routing can be used for larger networks.

3. MOBILE NETINF APPLICATIONS

This section describes the user applications that are available on the Android devices in the demo to access the NetInf network.

Photo Publish and Visual Content Directory

The application shown in Figure 1b) is specially designed for a stadium-based event. It allows users to publish locally generated content (photos) to the NetInf system. Other users can then use the visual content directory to scan through the recent past and see at what point in time different nodes (based on their location in the stadium seating chart) have published some content (e.g., in order to find photos that were taken from a certain angle at the time a goal was scored). The NetInf system can then be used to retrieve and display those images, either from caches in the infrastructure, or directly from the mobile node over Bluetooth if within range.

Web Browser with Local Sharing

The mobile nodes have a NetInf enabled web browser. When a web page is requested, the node tries to find it in the NiProxy name resolution server. If found, it is retrieved from a cache or from a mobile peer. If it was not found in the NetInf system, it is retrieved using regular HTTP, and subsequently an NDO is created from the web page, which is then published in the NetInf system and registered with NiProxy. This allows subsequent requests for the same web page to be served by NetInf locally, reducing the global bandwidth usage. The web browser contains indicators that show the user from what type of source a web page is being retrieved.

4. REFERENCES

[1] D. Kutscher et al. (D.3.2) Content Delivery and Operations. Deliverable, SAIL 7th FP EU-funded project, May 2012.

[2] D. Kutscher et al. The NetInf protocol. Technical Report draft-kutscher-icnrg-netinf-proto-00, IRTF, Oct. 2012.