CCN BASED DISASTER INFORMATION SERVICE

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1. Introduction

Content-Centric Networking (CCN) as one of the Next Generation Network (NGN) technologies provides merits in terms of mobility, security, power consumption and bandwidth efficiency. However, most of network services depend on client-server mode. When a large scale disaster strikes, the connections between clients and servers might be unstable, because of the damages, congestions, and power failure of the network systems. The network service could not maximize the efficiency of CCN if it over-dependence on central server. Therefore, the content-oriented and decentralized network service could improve the survivability and efficiency in disaster.

In this paper, we proposed a decentralized CCN based network service to provide disaster information service between terminals and CCN nodes.

2. CCN Based Disaster Information Service

There are two message types in CCN, Interest and Content. Both messages have name element. A CCN node has three main functions. The Content Store (CS), a content cache which organized for retrieval by prefix match lookup on names. The Forwarding Information Base (FIB), a table of outbound faces used to forward Interest messages toward potential sources of matching data. The Pending Interest Table (PIT) is a table of sources for unsatisfied Interest, it keeps track of Interests forwarded upstream toward content source, and the data could be sent downstream to its subscriber. The CCN nodes could forward and cache the Contents in response to Interests. Thus, we present an information service that terminals could publish the information as Contents to nearest CCN node and retrieve the information by sending Interests.

2.1 Naming Strategy

In this section, we present a unified naming strategy for disaster information service. Each terminal could use the same naming strategy to retrieve or publish the disaster information to the nearest CCN node.

2.1.1 Publish Disaster Information

The terminal could publish the disaster information to the nearest CCN node (such as CCN router). Disaster information should consist of picture, text message, video, audio and etc. Disaster information will be packaging in Content Objects. Publishing the disaster information is uploading the Contents to CCN node.

The naming strategy of publishing disaster information should be organized like following:

…	Name Prefix	…	Content
…	/Dinfo/%city%/%district%/%machi%/#latitude/#longitude/	…	…
	/Dinfo/tokyo/shinjuku/nishiwaseda/35.42.32/139.43.03/		

Form 1, Disaster Information Contents

The name of disaster information should be expressed by geographic information. The name components of city, district and machi depend on the value of latitude and longitude should be the unique value. For example, the name of coordinate N35º42"53' E139º43"05' should be /Dinfo/tokyo/shinjuku/nishiwaseda/35.42.53/139.43.05.

2.1.2 Retrieve Disaster Information

According to the unified naming strategy, terminal could send several interests to retrieve the information.

The terminal should enumerate the entire possible names within a given coordinate range.

Name Prefix	…	…
/Dinfo/%city%/%district%/%machi%/#latitude-range/#longitude-range/	…	…
/Dinfo/tokyo/shinjuku/nishiwaseda/ [35.42.99/139.43.00 ↑ 35.42.00/139.43.00] [35.42.99/139.43.99 ↗ → 35.42.00/139.43.99]		

Form 2, Interests for Retrieving Contents

The terminal will receive the matching Contents and plot them on a local map.

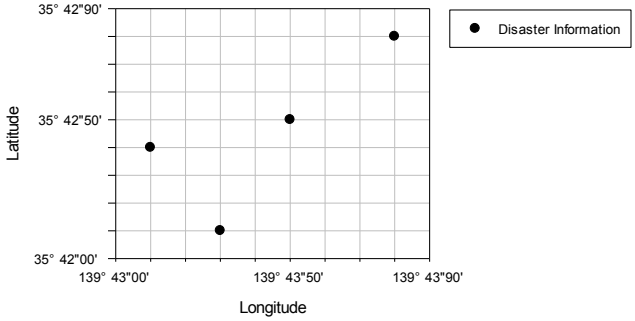

Figure 1, Plotting Disaster Information

3. Feasibility Evaluation

The minimum unit of coordinate value in naming strategy determines the maximum disaster information within a given area. The distance between two coordinates could be calculated by Spherical Law of Cosines.

$$D = acos(sin(\varphi_1) \cdot sin(\varphi_2) + cos(\varphi_1) \cdot cos(\varphi_2) \cdot cos(\Delta\lambda)) \cdot R$$

The earth radius R is 6371km. Thus, one second of coordinate is approximately 30m in Tokyo. If we use the Second as the minimum unit of location in naming strategy, the minimum unit of area is 30m^2. The disaster information service coverage area should be:

$$\text{Area}_{Disaster\ Service} = Sum_{Caching\ Capacity} \times Unit_{Minimum}$$

Hence, for providing disaster information service in $1\ \text{km}^2$ area, we need to store 33,334 disaster information contents on a single or multiple CCN nodes.

4. Future Work and Acknowledgement

The terminal could get disaster information with the shortest path and utilize disaster information service without accessing fixed central servers. It could reduce data forwarding times. It was proved that the CCN could improve energy efficiency [3]. The green network service would play important roles in disaster.

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References

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