ABSTRACT
Content delivery in Delay and disruption tolerant network is a hot topic now a day. Big challenges are small buffer capacity and intermittent or slow connectivity of the infostations located in the remote or disrupted area. To overcome those challenges we have been looking for an approach. Time driven subscriptions of contents could be a solution. Aim is to store contents for a period of time according subscriptions and then delete those contents from buffer to accommodate new contents. Remote areas where internet connectivity is absent, will be benefited by implemented this approach. In urban areas, service providers could make some money by allocating time slots to the advertising companies. We have found an application which has used this approach and succeeded.

Keywords
Delay tolerant network, content based dissemination, infostations, buffer management.

1. INTRODUCTION
The use of temporal utility of subscriptions and events in content based dissemination is a new concept. The idea is that contents are stored for a specific time period and then will be deleted according to some policies. Temporal utility makes the routing of the events to the right infestation. This action ensures unnecessary information transfer on slow links and proper use of the storage capacity. We have seen many challenges related to content routing and storing in DTN. Infostations with limited resources and connected to the internet intermittently via slow links. Another problem is to choose the right content for the right infestation. An infostation near to the railway station should contain information related trains and buses time table for specific time periods. Infostations where are located in remote areas, have a different problem. Those infostations have no connection with internet. They must rely on regular mobile infestation such as route buses, which are carrying pre selected contents for the remote areas.

2. CONTENT DELIVERY MODELS
Traditionally a content distribution network (CDN) is used for content distribution where servers containing information and CDN are placed at many points in a network to make sure the maximum uses of bandwidth by the subscribers to access the contents from CDNs. CDNs are generally transmitting data over TCP and UDP. To reduce latency and packet loss, CDNs are positioned near to the edge networks to reduce delay or packet loss of any requested contents by subscribers. To ensure more reliability, CDNs are deployed in multiple locations over multiple backbones. CDN nodes are cooperating with each other to satisfy content requests by the subscribers.

Always a subscriber accesses contents from a nearby CDN instead of fetching contents from central server, which reduces the possibility of network bottleneck. Content types are web objects, audio, video, applications, documents etc. We are going discuss different content distribution models in the following chapter.

2.1 Traditional source to destination distribution model
In traditional end to end model, a user has direct connection with the CDN with options of uploading or downloading contents to or from CDN.

2.2 Old one to many distribution model
In early days, United States Postal Service (USPS) delivered mails or news letters to the village chief or the old well known man to dispatch those as they knew other villagers well. Common people got their mails or other information from the old man. This scenario has a great impact in our current one to many distribution model in delay tolerant networks.
2.3 One to many distribution model

In this case, user needs to be registered to the infostation for getting any content. After the registration, user can asked for any content, for example, weather reports from the infostation.

Infostation will search the requested content from it’s local storage and will send it to the end user. If that content is unavailable at local storage, infostation will ask it from CDN and then provide it to the end user.

3. NETWORK TOPOLOGY

Considering an opportunistic network which is a mixer of fixed infostations, subscriber nodes and, mobile infestations.

Fixed infostations are connected to the internet backbone. Infostations fetch contents from internet backbone and temporarily stored those in memory. The subscriber nodes are intermittently connected to the fixed infostations. Mobile infostations are moving from one place to another on a regular basis and carrying contents to the remote areas. So the problem is that this kind of infostations or subscriber nodes have limited buffer to store information and often have intermittent or limited connectivity.

4. BUSINESS CASES

Advertising is one of the new business concepts in opportunistic type networks. We can use infostations as content providers for this kind of business concepts. As network connections in remote areas are slow or no connectivity, local business houses can advertise their business promotions by using infostations which are located near the highways. Travelers passing by the infostations will receive ads related to nearby restaurants including happy hours information. In 2008, Kotipizza, a Finnish chain restaurant located in a remote but tourist area in Oulu earned the highest amount of revenue among other same brand restaurants in all over Finland. This chain restaurant had targeted tourists who were traveling through Oulu tourist spots.

We have found another business case for service providers. People, who are coming to city centers regularly to work, may register themselves to receive information related to travel news of some routes and also restaurants discount information during lunchtime. Their subscription time should be for a certain period of time. Infostations, located in city centers but have slow internet connection, register the subscription and fetch related information in the buffer for quick response to the subscriber. The requested information will be in the buffer for specific time period based on subscription information and will be deleted by the management console from the buffer according subscription. Service providers could use this opportunity by selling specific time slots to interested companies according to the content interests of the users seen in the past in those places at those times. The billing of the service depends on the number of advertising delivered to the subscriber.

Other business case can be providing business related information to remote villagers. Day to day stock values or market prices for goods will be interesting news for villagers. Infostations can be used for this purpose. As infostation’s memory is reasonably limited and the network link to it is quite slow, it makes sense to have techniques to selectively store only the information which is going to be relevant in the village both in terms of content and on timing.

5. APPLICATION USING TEMPORAL UTILITY

There are some popular applications for content dissemination in intermittent or slow networks. These applications have good performance record in fixed infrastructure. Our interest is to a system which can store and delete information for a period of time. We have found a time-ware content (TACO) based dissemination system which can fulfill our requirements. We are going to analyze the TACO system in following sections. The system has two main components, one is subscription and another one is event.

5.1 Subscriptions of a content

Subscribers need to register to the infostations to get their requested content. The subscription fields contains SID= subscription identification number, topic= the type of content, ms(t)= subscription temporal function describing the time validity of subscription, TTL= expiration time of the subscription. The interesting field, which is subscription temporal function, is expressed as a discrete function, allowing to define periodic time intervals as well as validity in the past and in the future within a given temporal range. Temporal validity defined in ms(t) has temporal group membership. ms(t) value is to be 1 if any topic is subscribed, otherwise 0.
The subscription period can be in the past or in the future or both. Subscriber may be interested to receive content published in recent past, or will be published soon. The TTL value is very interesting here. TTL value is only added delay for the receivable events.

5.2 Events of a content
Event fields are PID= event identification number, topic= content type, data= actual content, v(t)= event temporal function, TTL= expiration time for the event. Like the subscription temporal function, event temporal function v(t) is 1 for a valid publication, otherwise 0.

5.3 Event Matching
Mobile node registers the subscriber interest when it is near to the infestation. Infostations stored subscription data of the particular node and sends the matching events to the node. It is only matching when subscription temporal function and event temporal function both are 1.

5.4 Temporal Profiles
Temporal profiles in infestations are updated by the subscription information send by the subscriber. Popular topics are rated according to subscription of the topic. Expired subscription is deleted by subtracting the temporal function from the temporal function the corresponding profile. Profiles in fixed infostation are updated when a mobile infestation comes near to it.

5.5 Event Routing
Routing right information to the right infestations is one of the important factors in the network. Servers in CDNs are generating events and then sending those to the infostations. Temporal profiles in infostations are responsible for events routing to the internet.

5.6 Buffer Management
Events which are more likely to be requested in the near future will be kept in the buffer. It can be done by assigning double weight to the future instant than the past instant. System can then decide to store future events by seeing the weights of the events. Utilities of the events are checked time to time for ensuring the presence of latest events. If there is a situation where buffer is full but need to add an event, then need to check which utility in the buffer has lowest value. This utility will be replaced by the new one.

6. CONCLUSIONS
This paper has described periodic content dissemination in delay and disruption tolerant. Infostations are used for building temporal profiles and sending contents according to the information stored in temporal profile. It has been found that buffer management and content routing are done efficiently by temporal profiles.

7. REFERENCES


