Mobile Data Transport Enabling Mobile Timetable Recharging in Rural and Remote Areas

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ABSTRACT

We are using this poster to illustrate our work on exploring the boundaries of ubiquitous computing in rural and remote areas. In large and sparsely populated countries like Australia, network coverage by WiFi or GSM services is fairly limited. We are exploring how Mobile Data Transport can enable limited Mobile Data Recharging in rural and remote areas lacking network coverage. We illustrate the approach by example of providing electronic timetables at bus stops lacking network coverage. We envision this approach could be extended to peer-to-peer based transport of tourism-related information in areas far from network coverage.

INTRODUCTION

"Mobile Data Recharging" (MDR) has emerged as a topic of interest among researchers investigating mobile technology. Data recharging is about "developing a service and corresponding infrastructure that permits a mobile device of any kind to plug into the Internet at any location for any amount of time and as a result, end up with more useful data than it had before" [CFZ01].

We are interested in enabling a limited notion of MDR in areas lacking suitable network coverage, such as coverage by GSM or WiFi services. In large and sparsely populated countries like Australia, network coverage is fairly limited as network maintainers focus on covering metropolitan areas, such as Sydney and Melbourne, as well as regional hubs, such as Alice Springs. Mobile phone network coverage (except mobile satellite services) often ceases a few kilometers outside town boundaries. Installing mobile satellite services is technically possible even at the remotest locations but can generally be assumed too expensive.

Being situated in an area lacking network coverage does *not* mean, however, that networked devices, such as mobile phones or personal digital assistants, are not carried around. Tourists exploring remote areas [5], for example, may carry them as part of their equipment. They may use mobile devices for travel-related purposes (e.g., electronic maps or guides) or simply as electronic diaries, generating content to be emailed to friends and family [1] once back in a connected area. Local residents may carry devices while commuting from rural/remote areas to metropolitan areas for work or leisure purposes.

We are exploring Mobile Data Transport (MDT) which is a term we are using to denote that data can be transported "physically" to locations beyond network coverage. There, the data can be used to "recharge" via wireless protocols, such as WiFi or Bluetooth. Respective networking capabilities are increasingly built into mobile phones, PDAs and similar mobile information systems. Due to the lack of network coverage, MDR would be limited to downloading specific information though.

MOBILE DATA TRANSPORT

Mobile Data Transport (MDT) resembles reviving the tradition of physical data transport as it was omnipresent before high-speed network connections became (almost) ubiquitous. A major enhancement is the use of wireless connectivity for easy data transfer between units. Assuming a single source of information (e.g., officially released information), MDT requires a base station (providing the data to be distributed), data packages (used to physically transport the data) and recharge stations (offering the data for downloading). Implementing basic MDT requires three different types of inter-connected components:

1. One "base station" installed at a depot (one per depot). A depot can be a bus station providing electronic timetables or a tourist resort providing "special offers"
2. One or more mobile "data packages" installed on carriers, such as buses, cars or even people (one per carrier). Other mobile devices are acting as carriers in the case of peer-to-peer based data transport.
3. One or more "recharge stations" which can be stationary (e.g., a bus stop) or non-stationary (mobile devices). Stationary devices should be self-managed, support external and internal power supply and provide wireless remote administration and configuration.

Data "travel" is organized as follows:

The base station provides the information to be distributed. Upon departure, carriers download the information onto the data packages they carry. The data is transferred to the data package via WLAN 802.11b, installed at the base station. Upon arrival at target destinations, the recharge data is uploaded using wireless data connections to the local "recharge station". Transferring data can occur fully automated ("download the latest bus schedule" or "download all tourist information the other traveler is offering") and does not necessarily require human intervention.

- Technically, data recharging could be accomplished by using Bluetooth-enabled devices, such as certain mobile phones, WiFi-enabled devices, such as high end PDAs and laptops, or even IrDA (Infra Red Connection), e.g., low end PDAs and laptops.

In what follows, we illustrate the concept by example of distributing electronic bus schedules to locations lacking network coverage.

APPLICATION SCENARIO: MOBILE DATA TRANSPORT ENABLING MOBILE TIMETABLE RECHARGING AT REMOTE BUS STOPS

It is a common experience among bus riders that bus stops do not provide accurate timetable information. Timetables might be out-dated, unusable or simply missing.

Being able to download (recharge) electronic timetables at bus stops would ease some of the problems as electronic timetables would not suffer from environmental impacts, such as humidity (Darwin which is located at Australia's tropical top end enjoys up to 100% relative humidity during the wet season) and resulting mould, or vandalism, such as graffiti. Prospective or actual riders interested in the latest timetable could recharge their mobile devices at any participating bus stop or while riding the bus, simply by downloading the data. Updating electronic timetables can be automated, thus easing the maintenance problems associated with printed timetables.

MDR enabling mobile timetable recharging means we are looking at the following components:

1. One stationary "base station" installed at the bus depot (one per depot).
2. One or more mobile "data packages" installed on buses (one per bus).
3. Several stationary "recharge stations" built into or attached to solid bus stop components, such as poles or shelters (one per bus stop).

Data "travel" is organized as follows:

1. The "base station" located at the bus depot maintains the most recent version of the bus schedule (e.g., regularly updated from back office servers).
2. Upon departure, buses download the most recent version of "their" timetable onto the data packages they carry. Buses and associated timetables are easily identified by route number. Recharge data is also available for download to riders traveling on the bus.
3. Upon arrival at a participating bus stop, the recharge data is uploaded using wireless data connections to the bus stop's "recharge station".

Due to technical constraints, mobile data recharging at rural and remote bus stops would be limited to downloading timetable information and possibly other useful information, such as scheduled modifications to timetables, road construction in the near future or information relating to the bus stop's physical location (nearby attractions, etc.).

Wireless access points embedded into bus stops could not only beacon timetable information but also their coordinates and other helpful information, such as information regarding nearby attractions. Such additional information could be used to contribute to grassroots mobile infrastructure projects like the PlaceLab initiative [6]. Moreover, beacons embedded in solid poles would be well protected against vandalism.

RELATED WORK

"Emails on Wheels" [3] aims in a similar direction but pursues more specific objectives while using a different technological approach. year. In Paris, Mobitex installed a wireless system providing real time information about bus arrival times [7].

CONCLUSIONS AND FUTURE RESEARCH

We have illustrated Mobile Data Transport as a way to enable Mobile Data Recharging using mobile devices at locations that would not normally be covered by communication networks, such as WiFi or GSM. As discussed earlier, it is important to note that being situated in an area lacking network coverage does *not* mean networked devices were useless. Accordingly, we consider Mobile Data Transport as a way to provide additional benefit especially in large and sparsely populated countries like Australia. We have shown that technical requirements and implementation costs were reasonable. We are working on implementing a proof-of-concept version of the Mobile Data Transport concept exploring the timetable scenario.

We see peer-to-peer data transport among travelers as an interesting area for future research with enormous potential in advertising and "viral marketing" (see also [4]).

References

1. Brown, B. & Chalmers, M. (2003). Tourism and mobile technology. *Proceedings ECSCW 2003*, pp. 335-354. Kluwer Academic Publishers.

2. Cherniack, M., Franklin, M. J. and Zdonik, S. (2001). Expressing User Profiles for Data Recharging. *IEEE Personal Communication* August 2001.

3. D'Monte, D. (2003). Email on wheels. IslamOnline.net.

4. Heinemann, A., Kangasharju, J., Lyardet, F., Mühlhäuser, M. (2003). Ad hoc collaboration and information services using information clouds. *Proc. ASWN 2003*, pp. 233-242.

5. Loker-Murphy, L. & Pearce, P.L. (1995). Young budget travelers: backpackers in Australia. *Annals of Tourism Research*, Vol. 22, No. 4, pp. 819-843.

6. Schilit, B.; LaMarca, A.; Borriello, G.; Griswold, W.; McDonald, D.; Lazowska, E.; Balachandran, A.; Hong, J.; Iverson, V. (2003). Ubiquitous location-aware computing and the "Place Lab" initiative. *First ACM Workshop on Wireless Mobile App. and Services on WLAN*, 2003.

7. http://www.mobitex.com/pdf/Successtory_RATP.pdf