DEAPspace: Transient Ad-Hoc Networking of Pervasive Devices

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1 Project Goals

The aim of IBM Research's DEAPspace project is to connect mobile and pervasive devices in transient ad hoc networks to allow available resources to be utilized and coordinated towards more useful applications than any one of the component devices would be capable of supporting. DEAPspace addresses peer-to-peer networking of pervasive devices instead of client-server networking.

Example applications of DEAPspace that we envision are:

- If you receive a phone call while wearing a headset and an electronic wrist watch, your cellular phone should alert you to the call using your wrist watch, and the call should automatically be connected with your headset.
- If you are composing a GSM SMS message and a computer terminal is nearby you should be offered the option of using its keyboard instead of the cellular phone's keypad.

Our research increases the value of pervasive computing devices by allowing them to communicate via a wireless network, and share hardware resources and software services. The key physical technology that we exploit is a short-range (3 meter) wireless communication medium. In our approach, we are not limited to any particular hardware, instead DEAPspace is appropriate for any broadcast capable medium. The range of devices that we consider for DEAPspace is very broad, going from laser printers to car stereos to PDAs to wrist watch displays and to many other devices that we encounter in our environment.

2 Challenges

The challenges in achieving this scenario, broadly stated, lie with identifying the presence and capabilities of devices, and with matching complex services, such as a telephone call, with device abilities, such as voice-quality audio I/O, telephone number input, call-terminate button, etc. The former question requires both a means of specifying device capabilities, and a protocol for sharing this information with as few transmissions as possible (to preserve battery life) while at the same time provide for fast and prompt worldview updates.

Two important aspects of DEAPspace are its extensibility to future devices, and its adaptability to changing resource availability. This flexibility means that it is useful in case only a couple of devices are enabled, but increasingly so as DEAPspace becomes more pervasive—without requiring any modifications to the devices already in use.

Thus, in essence our emphasis is on transient ad-hoc, proximity-based peer-to-peer networking of PvC clients. Part of our research work is validation of our concepts and protocols through implementation: the Tuareg framework in its C and Java incarnations.

3 Status

We have developed already a very efficient and prompt service announcement and discovery algorithm that, in contrast to conventional service discovery algorithms, uses a push model instead of a pull model. Results with our RF test bed and also simulations on our DEAPspace network simulator demonstrate rather drastically that the DEAPspace service announcement and discovery algorithm performs much better than other pull-model based approaches.

We currently are preparing a version 1.0 release of the DEAPspace framework and also are working on applications of DEAPspace.

Taking DEAPspace further we want to investigate issues such as security (e.g., trust, information sharing, intrusion detection), configuration and management, and multi device applications (i.e., relayed applications, choired applications).