Motivation

- 3G cellular networks are currently overloaded and offloading cellular traffic through opportunistic communications is a promising solution.
- The idea is to inject content to some users through the cellular network and let them opportunistically spread this content (e.g., via WLAN or Bluetooth) to other interested users upon meeting them.
- Delay tolerance allows applications to trade-off completion time for 3G usage.
- The vision of HyCloud project is to design and implement a hybrid architecture where content dissemination through opportunistic communication among several clients is controlled by the online cloud.

Opportunistic Communication Principles

- The cloud service injects content to some users through the cellular network.
- When two mobile devices are within the transmission range of each other, they exchange the content by opportunistic communications.
- Since power consumption is a principal issue in our design, the devices should search for neighboring devices periodically. Length of this period should be chosen to compromise between battery usage and cellular network offloading.
- This process is done without intervention of the user. Therefore he is unaware if the content has been received by cellular network or from neighboring devices.
- Longer transmission range increases the chance that a user meets another interested user, hence more traffic is offloaded through opportunistic communication.

HyCloud Architecture

- In HyCloud, the content scheduler runs in Windows Azure Cloud Services while authentication, data storage and notification service are provided by Windows Azure Mobile Services.

Flowchart

- Each device registers to subscription channels of its interest (such as popular news feed or video streams) and expects to receive the latest content stored in the online cloud.
- When the scheduler decides to send a content to a device, it communicates with the Microsoft Push Notification Service (MPNS), which notifies the device to download the content from Blob tables stored in Windows Azure SQL Database.
- Those mobile devices which own the latest data content take advantage of WLAN or Bluetooth interface to opportunistically disseminate the data to other subscribed devices in communication range.
- When the deadline for receiving the latest data content becomes close, each device which has not yet received the data content through either cellular network or opportunistic communication, pulls the content via cellular infrastructure.

Implementation Notes

- Due to longer communication range and higher throughput of WiFi-Direct, we prefer it over Bluetooth for device to device communication. However, WiFi-Direct is not supported by Windows Phone platform yet.
- Porting the HyCloud mobile application to Android and iOS is possible. Moreover, Windows Azure Mobile Services provides interfaces for these two mobile platforms.
- Background execution of applications is not supported by Windows Phone 8. Therefore, the demo application should be kept on foreground. However, it works as a proof of concept.