Android Overview

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Outline

- Java network programming overview
- Android Overview
- Android Emulator Overview
- Project Overview
- Getting Started

Java Network Programming

- Java.net.* programming model
  - Blocking model, you wait until work is done, maybe forever
  - One thread required per connection
  - Socket exposes input and output stream
- Java.nio.* programming model
  - Introduced in Java 1.4, non-blocking IO
  - **New Interface: SocketChannel** (in java.nio.channels)
  - Reading/writing via **Buffer** objects rather than input/output streams
  - Select() implemented

Java.net.* Socket API

- *Part of the java.net package*
  - *import java.net.*;*
- *Provides two classes of sockets for TCP*
  - *Socket : client side of socket*
  - *ServerSocket : server side of socket*
- *Provides one socket type for UDP*
  - *DatagramSocket*

Java.net.Socket

- Making a connection

```
Socket s = new Socket("hostname", port);
```

- The constructor not only creates a socket, but makes a TCP connection.
- Socket exposes input and output stream.

```
s.getOutputStream()
s.getInputStream()
```

- Most of the time you'll chain the input/output stream to some other input/output stream or reader object to more easily handle the data.

Java.net.Socket

- Create a print stream for writing
  - `OutputStream rawOut = socket.getOutputStream();`
  - `PrintStream pout = new PrintStream(rawOut);`
- Create a data output stream for writing
  - `BufferedOutputStream buffOut = new BufferedOutputStream(rawOut);`
  - `out =new DataOutputStream(buffOut);`
- Create a data input stream for reading

```
DataInputStream din =
new DataInputStream(socket.getInputStream());
```

Java.net.ServerSocket

- Server Side socket
- To support multiple clients servers have at least one thread per client

```
ServerSocket svr = new ServerSocket(port);
while (Socket s = svr.accept())
{
  new EchoThread(s).start();
}
```

Java.net and Thread

```
class EchoThread extends Thread {

  EchoThread(Socket s) { ... }

  public void run() {
  // waits for data and reads it in until connection dies
  // readLine() blocks until the server receives a new line from client

     String s;
     while ((s = in.readLine()) != null) {
         out.println(s);
     }
  }
}
```

Reference for Java Network Programming

- http://java.sun.com/docs/books/tutorial/networking/sockets/index.html

Android

- Software platform on mobile device by **Open Handset Alliance (Google)**
- Developing language is Java
- Linux kernel (Open Source)
- Provides a development kit (SDK)
- Emulator support with some limitation

Developing Android Application

- There are four building blocks to an Android application:
  - Activity
  - Service
  - Broadcast Intent Receiver
  - Content Provider

- http://code.google.com/android/intro/anatomy.html

Developing Android Application

- Activity
  - Controls a single screen
  - Usually starts up with an app, multiple Activity(screen) is associated to an app
  - Intent is used to move from screen to screen
- Service
  - A Service is code that is long-lived and runs without a UI
  - E.g. Network I/O, playback of media files
- **Not using these components correctly can result in the system killing the application's process while it is doing important work.**

Project 1

- Description
  - Develop a file sharing application where updates get synchronized when users come across within communication range

- Checkpoint
  - Implement service discovery
  - Establish a TCP connection between every pair of nodes in range
  - Due Feb 5. 2 weeks from now.

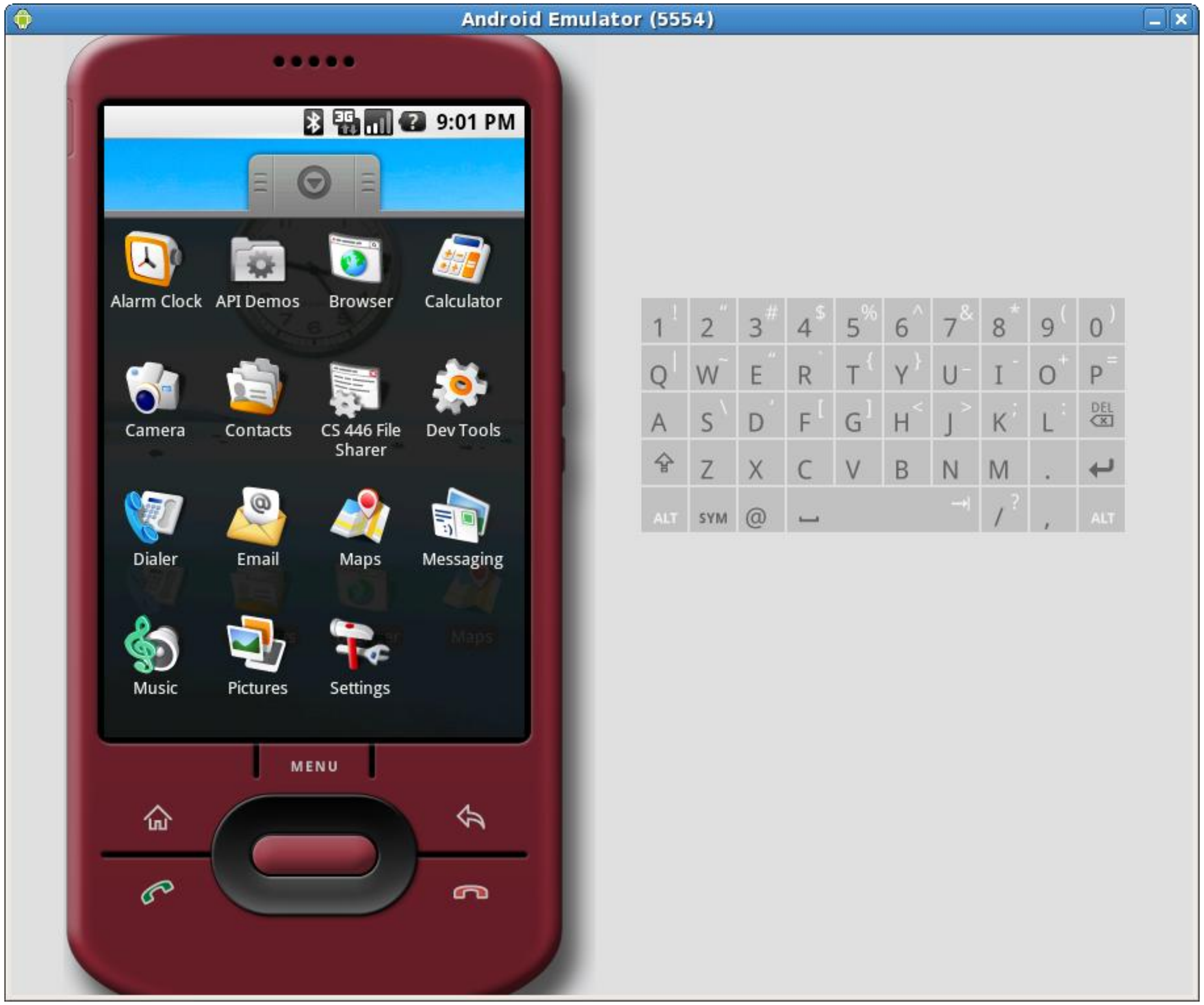
Getting Started

- Setting up the environment (Installation)
  - Section 3.1 of the project document
  - Use the pre-installed binaries on AFS
  - Copy the binaries from AFS
  - Install yourself
- Need eclipse, Java SDK 1.5/1.6, android SDK, eclipse plug-in

Getting Started

- Starting the project on Eclipse
  - Download project file
  - Open the project in Eclipse (read the documentation)
- Running the local server
  - Local server controls the connection between Android emulators
  - Implemented in Ruby binds port 10001 ~ 10010
  - Need eventmachine Ruby lib
  - `setenv  RUBYLIB /afs/cs.cmu.edu/project/cmcl-srini-4/15-446/android/eventmachine-0.12.2/lib`

Emulator


Android Emulator (5554)
9:01 PM
Alarm Clock
API Demos
Browser
Calculator
Camera
Contacts
CS 446 File Sharer
Dev Tools
Dialer
Email
Maps
Messaging
Music
Pictures
Settings
MENU

Emulator

- Running the emulator
  - Stand-alone (./emulator)
  - Eclipse Plug-in (Just ‘Run’ it as Android application)
- Binds to port 5554~5580
  - Don’t run on shared machines
- adb (Android Debugging Bridge)
  - Using adb, we can connect to android’s shell
  - Logcat (demo)

Running multiple emulators

- Manual mode will let you do this
  - Menu: Run → Run Configurations
  - Go to Android Applications on the left tab and select FileSharerActivityProject
  - Click on Target tab and select “maunal” mode
  - When you run you can specify to launch a new emulator or use existing ones to run the app
- To use adb you have to specify the emulator device name if there are multiple emulators
- #adb –s emulator-5554 shell

Configurations

- XML file defines a connectivity

```
<?xml version="1.0" encoding="UTF-8" ?>
<connectivity time="2" nodes="2">
    <connect node1="0" node2="1" at="1" />
</connectivity>
```

Project API

- Broadcast Interface
  - BroadcastReceiveCallBack
  - CS446Bcast
- Socket API (blocking IO)
  - CS446ServerSocket
  - CS446Socket
- Util
  - getMyID() returns the ID of the emulator

Broadcast Interface

- BroadcastReceiveCallBack
  - BcastMsgReceived(byte []msg, int srcID) gets called when a broadcast message is received from srcID. Msg is the byte array of the content.
- CS446Bcast
  - open() : returns CS446Bcast
  - send(byte [] msg): sends a broadcast message

Socket

- CS446ServerSocket
  - There can be only one server socket. ServerSocket always binds to port 0.
  - open(): returns a CS446ServerSocket
  - accept(): Listens for a incoming connection and returns a CS446Socket when a connection is established
  - close(): closes the socket
  - isClosed(): returns boolean

Socket

- CS446Socket
  - CS446Socket(int peerID): opens a socket and makes a connection to peerID, always use local port 1 remote port 0 when making a active connection
  - void close()
  - int getLocalPort()
  - int getPort()
  - int getPeerID()
  - int getLocalID()
  - OutputStream getOutputStream()
  - InputStream getInputStream()

2nd part of project 1

- You will be given a workload of users updating file.
- You will need to keep a version vector and synchronize the content.
- Details will be posted soon