Virginia Tech ■ ECE/CS 4570: Wireless Networks and Mobile Systems ■ Spring 2006

In-class Laboratory 14 (L14)

Part I – Objectives and Laboratory Materials

Objectives

The objectives of this laboratory are to:

- understand the role of service discovery in pervasive computing; and
- become familiar with Service Location Protocol (SLP).

After completing the assignment, you should be able to:

- understand how to utilize SLP and web services for the development of web service-based pervasive computing applications.

Hardware to be used in this laboratory assignment

Each student group needs the following hardware.

- Dell notebook computer with IEEE 802.11b card (with a fully charged battery)
- iPAQ with IEEE 802.11b card and cradle (with a fully charged battery)

The following hardware will be provided by the laboratory instructor.

- Two Intel access points
- Two Directory Agents (DAs) connected with red crossover cables to their respective Intel access points

Software to be used in this laboratory assignment

- OS: Windows XP on the notebook and Pocket PC 2002 on the iPAQ
- PocketTV mplayer
- mSLP for Service Location Protocol (SLP) implementation
- Ethereal

Part II – Pre-laboratory Assignment

This portion of the assignment must be completed *prior* to the in-class laboratory session.

Reading Assignment

- Service discovery in the future for mobile commerce, by Dipanjan Chakraborty and Harry Chen at http://www.acm.org/crossroads/xrds7-2/service.html.
- Documentation on SLP (with mesh enhancement) implementation from Columbia University http://www.cs.columbia.edu/~zwb/project/slp.
- Read all parts of this laboratory assignment.

Tasks

You are expected to perform the following tasks.

1. Verify the web server (IIS) runs well on your notebook by typing “http://localhost” in your browser.

2. Download SLP software "mslp.zip" from the class web site into the c:\wnms\labs\lab_14 folder and unzip it. It will generate all the files in the mslp folder under the current directory.
3. Download the User Agent (UA) software "mplayer.zip" from the class web site to c:\wnms\labs\lab_14 and unzip it. Copy "mplayer.exe" to your iPAQ.
4. Download at least two short video clips from Internet sites such as http://www.pocketmovies.net/ to your IIS web server directory (c:\inetpub\wwwroot by default). Calculate and note the average bandwidth requirement for real-time playback. Approximately, the playback rate of a video file can be calculated as the size of the file (in bits) divided by the duration of the playback period. As you will register these video clips with a Directory Agent program, these video clips should be accessible via their URLs. For example, if you download a video file "video1.mpeg" to your web server directory, the video file should be accessible from your browser at "http://localhost/video1.mpeg." Note that the video clip files downloaded should be suitable for playback on a Pocket PC (320 × 240 maximum display size) and should not be too big (should be smaller than 5 MB).

Part III – In-class Laboratory Assignment

You are expected to perform the following tasks. Note that the laboratory instructor will divide groups into two teams, A and B.

1. Setup the wireless network (see Figure 1).
    - Two Intel wireless gateways will be set up by the laboratory instructor.
        i. SSID1 = **WNMS4570A** (for Team A), SSID2 = **WNMS4570B** (for Team B)
        ii. WEP-enabled with key = **ABCDEF4570**
    - Two DAs will be running on the two notebooks set up by the lab instructor. DA-A's IP address is 192.0.2.116 (for Team A) and DA-B's IP address is 192.0.2.117 (for Team B).
    - Setup your notebook as a Service Agent (SA) with IP address 192.0.2.(100+group#) and network mask 255.255.255.0.
    - Setup your iPAQ as a User Agent (UA) with IP address 192.0.2.(150+group#) and network mask 255.255.255.0.
    - Verify that your notebook computer can communicate with your iPAQ through the Intel access point set up by the laboratory instructor.

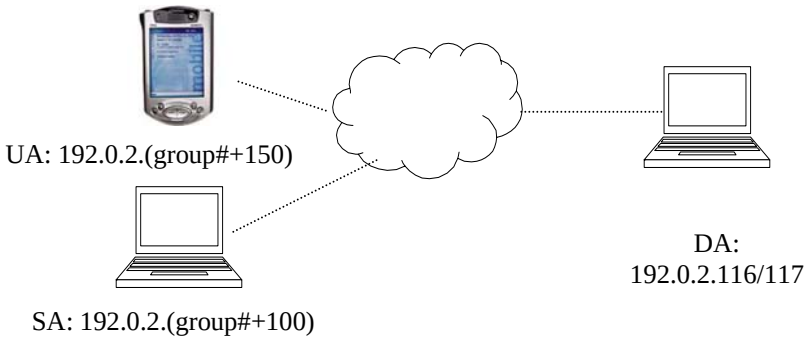

Figure 1. Network configuration.

2. Build a SA based on mSLP (an implementation of SLP using Java) using JDK 1.4.2 and run it on your notebook to register your video services with the DA.

   - Go to Start->Run and enter "cmd" to open a command line window.
   - Change directory to c:\wnms\labs\lab_14\mslp\src by typing the following command "cd c:\wnms\labs\lab_14\mslp\src" followed by <RETURN>. Then build an SA by typing the following command.

     set path=%path%; c:\j2sdk1.4.2_06\bin (this command defines the path to use javac)

     javac sa.java (this command compiles a SA)
   - Start the SA by typing the following command "java sa" followed by <RETURN>. This SA will register your video services using mSLP.
   - Register your video clips with a DA as follows.

     a. Click the **Auto DA Discovery** button to search for DAs. Your SA will send a SrvRqst (searching for directory-agent) message to the SLP multicast address 239.255.255.253 at port 2427. (Note that the original port number used by SLP v2 is 427; however, it requires you to have the root privilege to use this port. For demonstration purposes, we choose to use a port number higher than 1000.)

     b. Once your SA finds a DA running on the laboratory instructor's notebook at 192.0.2.116 or 192.0.2.117, register your video clips with the DA. On the **Message Composer** Panel, choose **Message Type** Service Registration (SrvReg) and fill out the required fields as follows.

        - Scope: The scope is used to group services by location, network or administrative categories for increasing SLP scalability. Enter "ececs4570" as the scope.
        - Service type: Enter "video" as the service type. Note that each service has a service type. For example, the service types for http://www.srvloc.org and service:lpr://thebe.nvc.cs.vt.edu are "http" and "service:lpr"(printing service), respectively.
        - URL: This is the service address. It is unique for all services. Enter the URL to access your video clips residing on your notebook. For example, if your video file name is "video1.mpeg" then enter http://your_ip_address/video1.mpeg.
        - Lifetime: A service lifetime is used to specify the registration period. A registration needs to be refreshed before its lifetime expires; otherwise, the service will be removed from the DA. Enter 30 minutes.
        - Language tag: Enter "en" for English.
        - Attribute/Predicate: An attribute/predicate can be used to refine the service or service request. For example, to register a video service with bandwidth requirement 100 Kbps, the predicate can be specified as "bw=100." To search services with bandwidth requirement less than 100 Kbps and video length less than 60 seconds, the predicate can be specified as "bw<100, length<60." Enter the bandwidth requirement of each video clip as "bw = x" where x is playback rate of the video in Kbps which you calculated during the pre-laboratory assignment.

     c. Register your video clip with its properties (e.g. URL, attribute) specified by clicking **SendMessage**. Make sure your message composer panel looks similar to the following before you register each video clip.

d. For service registration, you can choose to use UDP or TCP and Fresh SrvReg or Increamental SrvReg from the **Configuration** menu. Select **UDP** and **Fresh SrvReg**.

e. Start Ethereal to identify SrvRqst (searching for directory-agent) and SrvReg messages for better understanding the SLP operation.

3. Run the PocketTV program "mplayer.exe" on your iPAQ.

   Hint: To access the input panel in mplayer, first go to Settings->Buttons, select Button1 and assign <Input Panel>, click OK.

   - The mplayer application running on your iPAQ serves as a UA to locate video clips services maintained by a DA. On the UI interface, specify the maximum video playback rate by pressing the built-in hardware Button 1 (the leftmost button) to input the bandwidth and click the **Search** button to look for video services. By this process, mplayer will first send a SrvRqst message (searching for the directory-agent) via the SLP multicast address 239.255.255.253 to locate a DA. If successful, it will send a unicast SrvRqst UDP packet to the DA to locate video clips services that satisfy the specified bandwidth requirement.
   - All matched video services will be listed in a list-box UI from which you can choose one video clip to play.
   - By observing Ethereal data to trace service request packets, do you see any IP address trying to access the video services provided by your SA?
   - Close mplayer on your iPAQ by Tools->Exit since the close button on the UI does **not** close mplayer completely.

In-class Laboratory Results for L14

Group Members: _____

1. List the following fields of a SLP SrvRqst (searching for directory-agent) packet from SA to DA.

   Source IP:

   Source Port:

   Destination IP:

   Destination Port:

2. Fill in the fields of a SLP SrvRqst reply packet from DA to SA.

   Source IP:

   Source Port:

   Destination IP:

   Destination port:

3. Fill in the fields of a SLP SrvReg packet from SA to DA:

   Source IP:

   Source Port:

   Destination IP:

   Destination Port:

4. List the IP addresses of UAs that access your SA's video services. Give a separate list of IP addresses for each MPEG video that is advertised by your SA.