A Distributed Resource Furnishing to Offload Resource-Constrained Devices in Cyber Foraging Toward Pervasive Computing

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Abstract. Mobile devices are pursuing the succession of desktop PCs these days. Cyber Foraging is the project that investigated overcoming scarce computing resources and reducing the power consumptions of mobile devices. In this paper, we propose a framework for remote execution of mobile devices in the way of delivering user data and invoking and manipulating the software of a surrogate with VNC-style interface. This resource furnishing system has the merits of remote application execution, and automatic file transfer. Remote execution is provided via VNC-style interface that is user-friendly. Performance evaluation shows the feasibility of the resource furnishing system, for both data transfers over wired and wireless network.

Keywords: Mobile Device, Storage Server, Remote Execution, Virtual Network Computing, Cyber Foraging.

1 Introduction

The Internet is a resource pool of powerful hardware and various software sharable. Some software, specific for use in desktop PCs or requiring high processing capability are increasingly engaging faster processing speed, larger memory area and more storage space. Most of these software require powerful hardware, which has superior processing unit, huge main memory and vast auxiliary storage. These characteristics make those software unmovable, and any user who needs those software may use them through Internet.

Mobile devices are pursuing the succession of desktop PCs these days. However, mobile devices should be small and light to support mobility, so they use a small flash memory instead of a hard-disk of large data space. In the case of PDAs, these are usually equipped with RAM in size of 256~512MB. Cell-phones or smart phones permit smaller memory space. It is hard to deal with multimedia data such as mpg, and installing large software such as database engines or using database in mobile devices. Furthermore, mobile devices have low processing capability and it has been a barrier

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in applying various services of the wired environment. Cyber Foraging[1] is the project to research about the pervasive computing. It proposed a mechanism to augment the computational and storage capabilities of mobile devices. Cyber foraging realized that mobile devices forages the resources of nearby public computing facilities connected to the wired Internet through high bandwidth networks. These public computing facilities, named a *surrogate*, play the role of computing and data staging server. Actual processing and substantial data transfer is carried out by the surrogates, what is similar to the concept network computing. Cyber foraging illustrated two kinds of service. One is the data staging that mobile devices can store the data on surrogates and the other is the remote execution. The remote execution is a service that an application of mobile devices' user can utilize resources of the nearby surrogates.

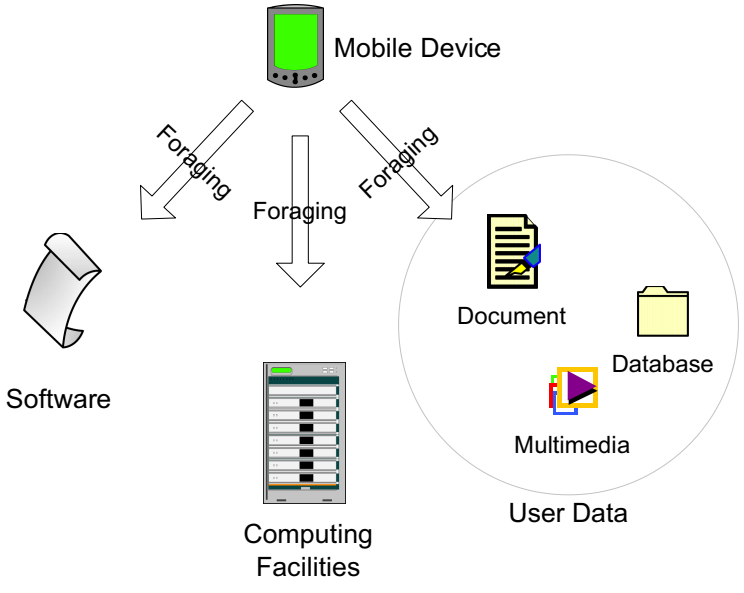

Fig. 1. Resources in Cyber Foraging for a Mobile Device

In the previous works related to cyber foraging, the software codes should be rewritten to run in distributed computing environment. However, this consumes very much effort, but even not practical for some specific software. To use those software at mobile devices, a concept of Virtual Network Computing[2] is a good candidate. The mobile device would be a thin client only receiving the screen of the software running at a computing facility over wireless network by VNC. The difficulty in adapting the concept VNC is its frequent screen refresh. For instance, PDA users can access and download packet data from networks at the maximum speed of 2.4Mbps in CDMA 2000 1x EV-DO. In maximal download speed, the application screen in size of 640x480 can be delivered as a whole once per about 1 second. This screen refresh rate seems to be too low. However a changed part of the screen is only transferred in practice, thus the actual refresh rate would be near 10 times per second.