This dissertation presents novel approaches in two key areas for networked services: virtual hosting systems and virtual private networks (VPNs).

In virtual hosting, the management of resources among services is a major concern. Sharing resources among services improves efficiency, whereas isolating resources improves security and privacy. Existing virtual hosting systems provide limited control for resource management. This dissertation proposes a generalized virtual hosting system based on lightweight user-level virtualization. The proposed system implements virtualization for network, process, and file system resources by intercepting system calls and modifying their arguments. The proposed network virtualization method allows using different IP addresses for different services using a single instance of the operating system kernel (see **Figure 1**). The proposed approach allows fine-grained resource control, such as sharing data at the file granularity. Moreover, additional resource management functionality can be added using user-level extension modules. This method has been applied to implement support for software updates for hosted services.

The network address ranges used in private networks frequently overlap, causing an address conflict. With existing VPN systems, it is generally not possible to connect to services on different networks at the same time in such a situation. This dissertation proposes name-based address mapping for VPNs. The proposed approach solves address conflicts among VPNs by mapping the address range of each VPN (the real addresses) to an isolated address range (the virtual addresses). Virtual addresses are assigned on name resolution based on host names. The proposed approach allows the user to access hosts on different networks at the same time, even when the real addresses of the hosts overlap (see **Figure 2**).

The approaches presented in this dissertation can be applied either individually or combined to enable novel ways for providing
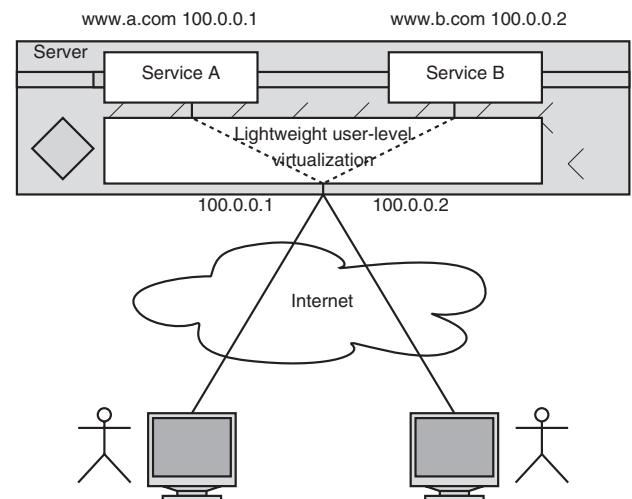

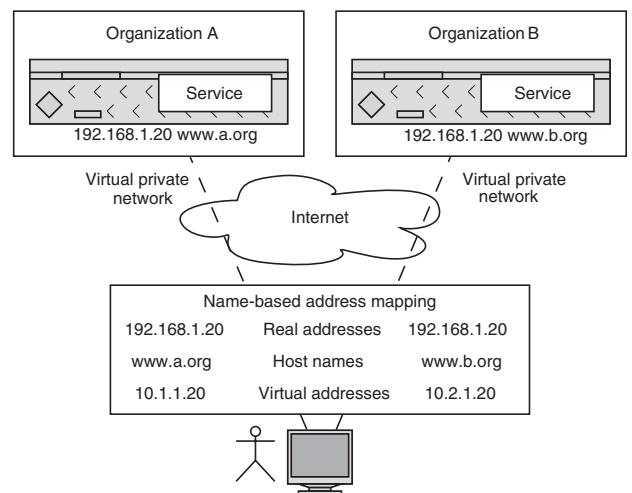Fig. 1　General virtual hosting via lightweight user-level virtualization

Fig. 2　Name-based address mapping for virtual private networks

and accessing networked services. Experimental results show that the proposed approaches are suitable for use in several practical scenarios.

<div align="right">（平成 22 年 6 月 30 日受付）</div>