Fileteller: Paying and Getting Paid for File Storage

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Abstract. FILETELLER is a credential-based network file storage system with provisions for paying for file storage and getting paid when others access files. Users get access to arbitrary amounts of storage anywhere in the network, and use a micropayments system to pay for both the initial creation of the file and any subsequent accesses. Wide-scale information sharing requires that a number of issues be addressed; these include distributed access, access control, payment, accounting, and delegation (so that information owners may allow others to access their stored content). In this paper we demonstrate how all these issues are addressed using a micropayment architecture based on a trust-management system. Utilizing the same mechanism for both access control and payment results in an elegant and scalable architecture.

Keywords: Micropayments, trust management, network storage, access control.

1 Introduction

We have set out to create an architecture for a file storage marketplace, which we have called FILETELLER. We envision that there will be Network Storage Providers (NSPs) that make available file storage and charge for it. These storage providers can be traditional ISPs, new businesses created solely for the purpose of providing large amounts of file storage, cooperating organizations, or even individuals with a fast Internet connection and spare capacity on their home systems who want to make such capacity available for a small fee.

The actual price paid for this service can be in real money, in loyalty points, or even in closed-system currency ("play-money" used only as a bookkeeping device among users of the system). We use the trust-management-based micropayments system described in [1] and summarized in Section 1.3 to handle the very small payments that would accompany use of the FILETELLER service. Furthermore, we use a trust-management system for all the access control as well, thereby integrating the payment and the access control mechanisms; access is granted

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not only on the basis of who someone is or what credentials they hold, but also on whether they can pay for it.

1.1 Motivation

Probably the most onerous operation for individual computer users is backing up their file systems. Local disks have grown tremendously in size in recent years; it is not uncommon for a home computer to have 50-100GB of disk space. At the same time, the usual backup media (tape and CD-R) have not grown much in capacity, and tape storage in particular is much more expensive relative to the price of disk than it used to be. Commercial endeavors are already offering "network drives" where, for a small monthly fee comparable to what an ISP charges for Internet access, users are entitled to some amount of network-attached storage. We believe that wide availability of such offers, paid for with fixed monthly fees or on a per-use basis at a low per-transaction cost, are going to become increasingly available in coming years. These "network drives" can simply be used as backup storage, or can even be used as the main repository of all user data (backed up by the NSP), while the file system on the user's machine acts as a file cache, much like AFS[2] does.

Off-site backup storage and provisions for disaster recovery, once the purview of large, well-funded organizations, are becoming increasingly important to smaller companies, academic institutions with limited IT budgets, and even individuals. While setting up off-site storage operations for just that purpose may be expensive, groups of similar in nature and geographically separated organizations may want to share their excess capacity. By using a system such as FILETELLER, they can do so in a straightforward way without worrying about one member abusing other members' resources, because of the implicit accounting (even if it is just "play money,") that goes with the system.

Another reason to have network-attached storage is file sharing. Today, if network users wish to make some of their files available to others on the Internet, they can place them on their Web pages and publish the corresponding URL, or in older times "put them up for anonymous FTP." Neither mechanism provides for easy access control or the possibility of financial gain for the owner of the information. Web pages can be password-protected, and FTP directories (even anonymous FTP directories) structured in such a way as to only allow authorized parties to access the information; however, the only users allowed to access the files are those that are already known to the system. This, as is the case with existing network file systems, limits access only between users in the same administration domain and requires considerable involvement of the administrator and the file owner in the access control management. When replication for availability and performance scalability purposes is taken into consideration, the management complexity increases drastically. The WebDAV system [3] solves some of these problems, but its main purpose is group manipulation of shared files, not occasional access.