AI3: Application-Independent Information Infrastructure

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ABSTRACT

In the current Internet architecture, application service providers (ASPs) own users' data and social groups information, which made a handful of ASP companies growing bigger and bigger and denied small and medium companies from entering this business. We propose a new architecture, called Application Independent Information Infrastructure (AI3). The design goals of AI3 are: 1) Decoupling users' data from ASPs and users' social relations from ASPs, such that ASPs become independent from users' data and social relations. 2) Open architecture, such that different ASPs can interoperate with each other. This demo is to show a prototype of AI3. The demo has four parts: 1) ASP-independent data management in AI3; 2) ASP-independent management of users' social relations in AI3; 3) inter-domain data transport and user roaming; 4) real-time communications by using AI3. The demo video can be watched at: http://www.cs.cityu.edu.hk/~jia/AI3_DemoVideo.mp4

Categories and Subject Descriptors

C2.1 [Network Architecture and Design]: Network communications

Keywords

Internet architecture, network infrastructure, storage system

1. INTRODUCTION

Fueled up by the explosive growth of social networks in recent years, User Generated Contents (UGC), such as videos, photos, and blogs, have become a dominant source of Internet traffic. The constant efforts of developing new Internet architectures have led to several projects for information dissemination, sharing and networking. The well-known projects [1, 2, 3, 4] include Information-centric networking (ICN), Named Data Networks (NDN), and PURSUIT. However, these systems focused on efficient content discovery and data transportation by using routing and caching tech-

nologies. The issues of ownership of UGC and management of UGC have been largely overlooked and not been addressed adequately. In the current setting, application service providers (ASPs), such as Facebook, Twitter, Tencent, etc., own users' data and manage the information about users' social groups, which made a handful of ASP companies growing bigger and bigger and denied small and medium companies from entering this business. There are several major problems with this structure of ASPs: 1) The ASPs use users' data and social relations to hijack the users to go with them, leaving users with little choice. 2) Users can only publish their data within the ASP that they registered with and the data cannot be shared by friends crossing different ASPs. 3) User's social groups are fragmented by ASPs and the members of a user's social group are often scattered among several ASPs.

We propose a new architecture, called Application Independent Information Infrastructure (AI3). There are two design goals of AI3:

1) Decoupling users' data and users' social relations from ASPs, such that ASPs become independent from users' data and social relations. The ownership of users' data and information of social groups are returned back to the users and managed by the AI3 architecture. ASPs become the ordinary applications on top of AI3, which breaks down the monopoly of a few giant ASPs and provides small companies a leveled ground to compete with them in business.

2) Open architecture, such that different ASPs can interoperate with each other. Users publish information no longer with a specific ASP, they publish information to their social groups. Once a user publishes a message to a social group through an ASP, all members in this social group can receive the message no matter which ASPs they registered with. The openness of the architecture also means the interoperation among different network domains, which facilitates roaming functions of users and automatic data migration across network domains.

2. AI3 ARCHITECTURE OVERVIEW

The overview of AI3 is described in Fig.1. There are two layers in the architecture, information layer and presentation layer.

Information layer is the core of AI3, which is responsible for data storage, access control and distribution. These functions are supported by a system called versatile storage system (VSS). In VSS system, each user has his own storage to store his data and social relations. Standard APIs are provided to the presentation layer, which allows the ASPs and user applications (APPs) to operate on user's social

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Figure 1: The Architecture of AI3.

Figure 2: The Demonstration Scenario.

relations, and subscribe from and publish data to targeted social groups. To support the openness, AI3 also provides a standard inter-domain interface to allow interconnection between domains operated by different organizations. Users can move freely from one domain to another without affecting their data access experience and users from different domains can communicate seamlessly. Another design goal of AI3 is to make it as the infrastructure of data communication networks which support data transmission, inter-person real-time communication and data management. It integrates both data service and networking service into a versatile file service upon which various network applications can be built.

The presentation layer consists of the ASPs and APPs. These ASPs (or APPs) make use of the data obtained from the information layer, and provide a variety of services to the end users. Since users' data and social relations are decoupled from ASPs, all ASPs have to compete with each other to win users by providing high quality and innovative services.

3. DEMONSTRATION

Fig.2 shows the demonstration scenario. In this demo, there are three end users: Alice, Bob and Cathy, and three

ASPs: FaceBlog, SinaBlog and NetDrive. We consider two VSS domains, one in USA and the other in China. There are four parts of the demo: 1) how AI3 decouples users' social relations from ASPs; 2) how AI3 decouples users' data from ASPs; 3) how AI3 enables the VSS systems operated by different organizations to cooperate with each other; and 4) how AI3 support real-time inter-person communication.

A. ASP-Independent User Relations Management. In this part of demo, Alice in FaceBlog follows Bob who uses a different ASP, say SinaBlog. Although Bob uses a different ASP from Alice, he can still see Alice becomes his fan from his own ASP. This is because all users' social relations are managed by AI3 and decoupled from the ASPs. ASPs use standard interface provided by AI3 to operate on users' social relations.

B. ASP-Independent Data Management. In this section of demo, Cathy shares a photo to public through a file management app - NetDrive. All her followers, say Alice and Bob, can see the photo in their own ASPs, such as FaceBlog and SinaBlog, even though they do not use NetDrive. This is because all users' data are managed by AI3 and are decoupled from the ASPs. These data are solely owned and controlled by the user. Once the user deletes the data, all references of the data that were published in multiple ASPs will be completely removed throughout the entire network.

C. Inter-domain Data Transport and User Roaming. In this subsection, we demonstrate that two users registered at different VSS domains communicate with each other, and roam to the other domains seamlessly without feeling performance degradation. The inter-domain communications are handled by AI3 inter-domain interface, and they are transparent to the end users. Data pre-caching technique is employed to ensure the seamless roaming of users across domains.

D. Real-time Inter-person Communication. In this part, we demonstrate real-time inter-person communications in AI3 architecture. Two users, Alice and Bob, make a video conference call by using the app VideoChat in presentation layer of AI3. The real-time video traffic is temporally stored at and relayed by a VSS system that is close to both users. The users can also archive the streaming data into their personal storage.

4. CONCLUSION

AI3 decouples ASPs from users' data and users' social relations. With AI3 architecture, ASPs can focus on developing more innovative applications and providing better quality services to win user groups. AI3 also integrates file services with traditional networking services. This is a good structure to support user's mobility and to implement architecture-wide information security.

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