Peer-to-Peer as an Approach for Network Management

Adriano Fiorese[*]
CISUC, University of Coimbra
Pólo II, Dep. Eng. Informática
3030-290 Coimbra, Portugal
fiorese@dei.uc.pt

Paulo Simões
CISUC, University of Coimbra
Pólo II, Dep. Eng. Informática
3030-290 Coimbra, Portugal
psimoes@dei.uc.pt

Fernando Boavida
CISUC, University of Coimbra
Pólo II, Dep. Eng. Informática
3030-290 Coimbra, Portugal
boavida@dei.uc.pt

ABSTRACT

This work presents the idea of using the P2P paradigm and its technologies applied to network management in inter-domain environments. Traditional approaches suffer from the centralized and sometimes inefficient treatment for management information discovering, publication and interaction among different administrative domains. In this work, we discuss the P2P approach, presenting it as interesting solution for the configuration management.

Categories and Subject Descriptors

C.2.3 [**Network Operations**]: Network Management—*cross-domain*; C.2.1 [**Network Architecture and Design**]: Distributed Network—*Peer-to-Peer, overlay*

Keywords

Peer-to-Peer, Network management, Cross-domain

1. INTRODUCTION

The NGI proposed user services convergence demands the different domains involved in manage their infrastructure services as well share set up responsibilities among them to offer these services in a shared way.

Currently, the administrative domain frontiers impose great obstacles for network management. Relatively good and stable solutions exist for the intra-domain management, but they are not feasible at inter-domain level due to two main reasons: 1) administrative barriers imposed by domain owners; 2) several low-level management operations cannot be performed and/or are not efficient at this level (e.g., simple SNMP-based solutions [1, 2], or even Management by Delegation (MbD) [3] solutions, at the same time the Policy-based Management [7] depends on a series of agreements and adaptation to be realized in the cross-domain).

In this respect, some researchers have begun to explore P2P-based systems for network management [5, 4,

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[*]This author have double filiation. UDESC, University of the State of Santa Catarina, Campus Universitrio Prof. Avelino Marcante s/n, Bairro Bom Retiro, 89223-100, Joinville-SC, Brasil, *fiorese@joinville.udesc.br*

6]. The potential of P2P overlays in the network management area is promising, as they lead to several immediate benefits: independence from underlying technologies and providers; domain transparency; very good level of abstraction; and, last but not least, easy support of a user-oriented quality of experience view of the services.

A first premise in our model is that the domains should know the services and/or resources they need from other domains to offer a service that will cross those domains. Some approaches such as LDAP and UDDI resolve this issue. However, they suffer from single point of failures (when they are not federated) and also may raise suspicions of data manipulation (especially when money is involved) over the domain whose service is hosted. Despite the evolving of security mechanisms, a different approach to aggregate the information about which services and resources can be managed in a shared manner is gaining strength. This approach is the P2P one.

Therefore, using the P2P abstraction each domain can exposes the services and/or resources that are available to be managed in an overlay formed by peers of every domain involved in the chain of a user service offered. The exposition and maintenance of this exposed information we call an aggregation service.

The configuration of the devices and services also represents a challenge in this cross-domain environment. The P2P approach can offer better performance when combined with the MbD, for instance. For instance, in a large scale configuration and taking into account a massive configuration data traffic a peer in a domain can select the closest peer in the target domain and send the data and the operations just once time for the whole target domain to the selected peer, saving the extra bandwidth to perform it device by device. That selected target peer will be in charge of configuring the devices based on the operations and data received. Hence, the service aggregation can be used to select the configuring peers (the ones closest the devices to be configured) in the target domains.

2. APPROACH

Our approach explores the cross-domain ability of P2P overlays to manage network resources and services. It builds on and goes beyond of related work [5, 4, 6]. In our approach every peer in the network management overlay will be able to execute some management functions. These management functions/services are able to set up the necessary aspects for a service convergence. In local domains these management functions are executed by network administrators through management tools. In the dynamic and cross-domain management envisaged by our approach these management functions can be accessed by peers belonging to different administrative domains.

2.1 The aggregation service

To accomplish the above mentioned functionality, the management peers (the ones whose management functions runs on) will advertise their services to one or more entities (aggregation-peers), which will aggregate these advertisements. The component responsible for that is called Aggregation Service (see Figure 1). It is composed of aggregation-peers belonging to the different domains involved forming the management overlay that collects the management services advertised by the management peers running and belonging in their own domains. It is expected that this component can improve the look up speed for specialized management services. High level managers use the aggregation service to search for the advertised management services in order to know which peers provide the management services and which interfaces can be used. Specialized service management providers can join the overlay in a non-deterministic way by offering their services. New management services can be deployed in the overlay in a natural way, just starting up the software.
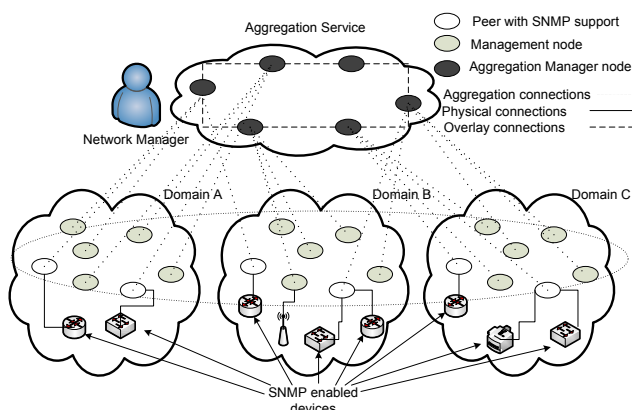

Figure 1: P2P network management approach

3. CONCLUSIONS

Some simulations facing the environment shown in Figure 1 were already made. It shows the mean path length diminish when search results are replicated in a stabilized cross-domain environment and using an overlay with circular topology and operation.

Scalability is not a problem in our approach since network management is a stable application (in the sense of churn) when compared with P2P file sharing, for instance. Thus, the simulations performed using one thousand nodes in the aggregation service and at most ten different domains showed that the number of exchanged messages and the path length for a service search can scale.

4. ACKNOWLEDGMENTS

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