論文摘要

群播技術乃是一種應用在 Internet 上的資料傳遞技術，其特點是可允許一個來源同時對多個接收端傳遞相同的資料，群播應用散見於如多方會議、財經資訊的推播、IPTV 中的廣播電視與分散式互動模擬等。僅管群播應用發展迅速，但大多數的商用服務架構仍以電信運營商或內容提供商為群播來源，而終端用戶為接收端。本論文嘗試探討以終端用戶端為群播來源，並以此模式從資訊消費的價值鏈中探討其市場的接收度、服務部署的可行性與獲利模式，同時亦將針對目前已提供類似服務模式的業者個案作一比較，希望藉此進一步瞭解隱含其中的創新商業模式與機會。

Abstract

In current Internet communication architecture, most of the applications are built upon the unicast model which means there's a dedicate communication channel between an information source (server) and a receiver (client). One of the challenges of scaling applications based on a unicast model is that both processing overhead at source and bandwidth consumption in the network are proportional to the number of receivers that interested in the information. The advent of IP multicast is thus providing an alternative approach to address the technical issues and scale up the deployment of applications, for example, multiple-party conferencing, info-casting, IP television, grid computing, and so on.

In most of the commercial IP networks that offer IP multicasting services today are in a centralized architecture, that is, multicasting sources are provisioned by service provider or content providers, end-users (or subscribers) are receivers that passively consume the information. However, as digital contents sharing is getting popular and the business is getting market traction, there's a potential opportunity for deploying multicasting services where end-users are acting as multicast sources and share the contents with other end-users (receivers). This paper will propose a business model, or an end-user-based multicasting service, where end-user is encouraged to be a multicasting source and sharing the information with the members within a community of interest. An end-user-based multicasting service, where the end-user is acting as multicast information source, is not yet popular in the commercial networks. However, given that digital content sharing portal on Internet, including YouTube, MySpace and Joost, are gaining market momentum in terms of traffic volume, content diversity and eye-ball duration, end-users are no longer passively receiving the

information in an on-demand manner, multicast technologies allow end-user to push contents at the advantages of real-time and network bandwidth saving. Such advantages become the incentives for end-users, and even service and content providers, to embrace multicast technology as an alternative to unicast approach. Based on the observations described above, an end-user-based multicasting service would no longer exist in experimental network, but become the mainstream communication mechanism, as well as unicast, and being a source of profitability. Regarding to this model, five issues from different aspects are presented by asking the following:

1. What are the opportunities for end-user?
2. What are the opportunities for service provider?
3. What are the opportunities for content provider?
4. How to achieve a pricing scheme with fairness and incentive.
5. The strategies of market development and service deployment.

This paper will first review the industry background and related multicast technologies include:

1. IGMPv2/v3

2. PIM/SSM

3. MSDP

Furthermore, a typical architecture of multicasting network is given for a better illustration to the service deployment, and, for interests of network and service planning.

The value-chain associated to this business model includes three major members, or stakeholders:

1. End-users: the information receivers that consuming the information, and also the sources, that co-developing or re-producing the contents.

2. Service provider: the infrastructure provider where multicasting services are based on. It can be incumbent or competitive Internet service providers. A multicasting infrastructure does not only pertain to the functions from a networking perspective, but also from a service perspective, for example, offering a security infrastructure that facilitates the membership management and a admission control mechanism to manage the overall quality of service.

3. Content provider: the major contributor, other than end-user, to multicasting contents. One of the differentiations, as described in this paper, from end-user is that content provider owns a more systematic content creation process, a more strict enforcement of content protection, and a billing system to effectively track the real usages of contents.

As analyzed in this paper, each member on this value-chain has both direct and indirect influences to the success to this model whereby business opportunities are also embedded.

The innovation of the model proposed in this paper is primarily from the differentiation to current business model. There are five sources of innovation that our model is mapped and elaborated include:
1. Knowledge structure
2. Industry structure
3. Capabilities to lead the design
4. Market requirements
5. Industry cycle

To maintain the market momentum, as described in this paper, it's crucial that all members in the value-chain to share and jointly define the values, rather than the traditional way where values are solely defined by the enterprise or supplier. The essence of value joint-development can be described by the following characteristics:

1. Communication
2. Experience accessibility
3. Risk assessment
4. Transparency

The above nine dimensions are used in the analysis of case study and the findings to the first three issues presented.

To facilitate the exploration of a feasible pricing scheme, this paper will review related researches on pricing by categorizing the following as the cost drivers to a multicasting service:

1. Information stream characteristics, for example, data-rate in bits per second.

2. The placement of multicast source and receivers in a network.

3. The scale of multicasting service, single-domain, i.e. confining to single network service provider, or cross-domain.

Based on the cost drivers, relevant researches spent on approximating the cost of a multicasting network and services include:

1. Single fixed center-rooted tree.

2. Multiple fixed center-rooted tree

3. Multiple dynamic center-rooted tree

There are researches taken more factors into the consideration when approximating the cost, include network complexity, delivery delay and quality of service. This can be another interest of researches for business development. Based on the approximation outcomes, two pricing schemes that widely considered: flat-rate and usage-based. Both schemes are employed in the case study presented. The goal of developing a feasible pricing scheme, as indicated in this paper, should provide incentives to every member in the value-chain to achieve an

efficient and reasonable usage of network resource in an accountable way.

The last issue is exploring the market acceptance, elaborating the deployment strategies and opportunities of profitability based on this model. Three cases will be presented: Verizon Business, Bloomberg and Internet2/Abilene, which provide multicasting services at different market sectors: residential market, financial enterprise market and academic sector. The cases are compared by the service models, deployment strategies and business development, which is further illustrated and compared by information and cash flows.

Finally, findings are consolidated from the case studies and conclusions are drawn from these findings. Suggestions are made and further research interests are also highlighted.