Managing Network Services

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Abstract

Service organizations as diverse as MasterCard and Facebook represent a growing category of business activity, namely firms that offer a network platform that connects people, groups or businesses. MasterCard connects consumers with merchants while Facebook connects friends with other friends. Connection services are characterized by network externalities and high levels of value co-creation. Thus network services present unique managerial challenges and offer interesting research opportunities. Our approach to these challenges combines network theory and service dominance logic in order to describe the emerging value creation and related business models.

Introduction

A growing category of enterprise consists of businesses that make connections on behalf of individuals, groups or other businesses. While providing a connection is clearly a service, this category has been largely ignored by service marketers despite its growing importance. To make the category more explicit, we can look at the credit card offered by MasterCard that enables financial connections between consumers and merchants. Similarly, Sony's PLAYSTATION serves as a platform that connects game developers middleware providers and game players. Mall owners connect shoppers with retailers. Other examples are Google that connects content providers, consumers and advertisers or Apple iTunes/iPod connecting music labels (content publishers) and consumers. A final example should suffice to illustrate the size and scope of this category and its overall importance in the economy: the NASDAQ exchange connects those who would buy a stock with those who would sell it.

Clearly connection services play an important and large role in the modern economy. In an important sense, however, the above list does not tell the full story. In our networked world the ability to connect people or groups is rapidly increasing. We therefore see a host of new firms that use electronic networks and software to offer connection services. For now, we limit ourselves to a pair of online examples. Facebook allows users to connect with each other as might occur when I discover a friend from school who is using the service. Monster.com allows would-be employees and employers to connect. Of course connections are a key feature of networks. For this reason we describe this type of business activity as providing a network service.

The purpose of this paper is to initiate and encourage the study of network services from the point of view of services management and services marketing. We believe that our conceptual approach reveals similarities between service businesses that previously have been thought of as distinct and unrelated but which in fact are highly similar. This analysis will thereby suggest research questions fundamentally important to a large and growing set of service organizations. Likewise, our approach brings into relief real differences within network services that should inform managerial decision-making. We offer a conceptual overview that will allow us to categorize such services and present managerial challenges and research opportunities. The main contribution of this paper is therefore to address this void in the literature by defining different types of network services and exploring how value is created and managed in a network context.

In the next section we describe and define this sector in terms of the nature of the benefit flow across networks. Next, we present a categorization scheme, highlighting differences among the various categories. We finish with a section on managerial and research implications of this work.

Network Services

We can extract some common features from all of the examples presented in the first section. All the example firms provide connectivity, but while this basic service enables the network, other participants in the network generate key benefits. The mall owner provides the physical building, but merchants play a major role in drawing shoppers to that building and of course shoppers provide a key benefit to the merchants.

In network services, the flow of benefits and therefore the perception of value is more complex than is the case in other sectors where the exchange process is simpler. In our view it is productive to conceptualize this benefit flow using the terminology of network theory (Newman, 2003; Moody, McFarland and Bender-deMoll, 2005). As such we associate the clients of network services with nodes, and the connections among clients with arcs. Network approaches have been shown to be a particularly effective means in describing the structure and dynamics of socioeconomic networks (Brandes, Raab and Wagner, 2001) and we adopt it to visualize network services.

Nodes

In a network service, a node consists of a combination of the client who is a consumer of the service, and attributes provided by the network platform. The client of course brings a set of characteristics including attitudes, experience, preferences and capabilities. The platform may contribute additional capabilities such as the ability to store, retrieve, search, filter, or display information about the focal node or other nodes, and network arcs. Nodes can be homogeneous or heterogeneous, stationary or time-varying.

Arcs

The arcs serve as a conduit for the flow of benefits, and in some cases of costs, through the network. The arcs on the NASDAQ exchange allow financial settlement to move from buyer to seller and title to securities to move from seller to buyer. The specific ability of the network to transmit different types of benefits is critical in understanding the opportunities that arise in managing that network. The capability of a network to transmit benefits depends on its *topology*. The topology of a network (Powell, White, Koput and Owen-Smith 2005) refers to the geometric properties of arcs that are possible and the nature of the flow occurring along them. A traditional analog or digital broadcast network has a star topology meaning that client arcs are limited to connecting to a single node, that belonging to the broadcaster. Other network services, such as the phone network, offer a fully connected topology where any pair of nodes can connect. Other topologies include ring, chain and bus structures, among others.

In addition to the pattern of possible mappings, arcs vary in terms of their symmetry or directedness. In a *directed network* benefit flow occurs unidirectionally over arcs while in an undirected network the benefit flow will be symmetric. The broadcast example is directed in the sense that communication flow occurs in one direction only while the phone network allows for undirected or symmetric arcs.

Arcs vary also in terms of the cost of arc formation. An important question concerns who bears the fixed cost of link establishment and the implications for the network service. It is also important to consider the nature of the benefits that the arcs are capable of transmitting. Arcs vary in terms of the bandwidth (speed) of the flow of benefits, as well as the qualitative nature of the benefit flow. Arcs may enable a relatively rich or poor medium, transmitting a large or small scope of sensory information, or formats, physical goods, money, and so forth.

Insert Table 1 and Figure 1 about Here

Categories of Network services

Below we proceed to analyze four common types of network services.

Chain Networks

The classic supply chain generally involves the flow of goods and services in one direction while information and money flow in the other direction. Likewise a value chain (Porter, 1985) can be defined as a map of the entire set of competencies, investments, and activities required to create, produce, deliver, maintain, and reap the proceeds from a product or service, and the relationships among those investments and activities. Such linear networks have been extensively explored in marketing, operations and other academic literatures.

Broadcast Networks

The broadcast network exhibits a simple geometry first realized early in the twentieth century by David Sarnoff who created the RCA radio network. In such a network we see a star topology (Figure 1) with directed arcs. The directed arcs mean that the benefit flow is unidirectional. Often there are no externalities present We note that a retail store is the center of a kind of star network as the retailer takes title to the goods and pushes them along its outbound arcs to individual customers.

Peer Networks

Peer networks can also be called one-sided networks. A simple example is provided by a telephone network. These networks exhibit a fully connected topology with homogeneous nodes, at least when considering medium to long term time periods; everyone makes calls and everyone receives calls. Users change over time from one role to another variously sending and receiving calls. Arcs can be thought of as undirected, or at the least we note that the number of incoming arcs (in-degree) and number of outgoing arcs (out-degree) are often highly correlated in peer networks.

Examples of such networks are quite common: NASDAQ, eBay, file sharing, telephone, help forums, World of Warcraft online games, Betfair, Spotscout (for finding parking in Manhattan), messaging systems, academic journals (writers and readers), Facebook, Wikis and file sharing networks like Flickr.

Externalities in a peer network are widely believed to follow Metcalf's Law. The law states that the total value V of a network is proportional n*(n-1) where n is the number of nodes capable of creating benefits. It is likely that Metcalf's Law is an oversimplification (Briscoe, Odlyzko and Tilly 2006), but it is certainly true that externalities are more complex than in the broadcast case. The presence of non-negative externalities can create a winner-take-all outcome (economic terminology) or a giant component (network science terminology). In either case there is a strong pressure for all nodes to be reachable from all other nodes.

Multi-Sided Networks

In multi-sided networks nodes are heterogeneous and fall into different categories. Simple examples of nodes in multi-sided networks include audience and advertiser (*Corriere della Sera*), MasterCard (shoppers and merchants) and DoCoMo i-mode (online content providers, application developers, handset makers, and consumers). There is a growing economics literature on multi-sided networks mostly concerned with pricing in the two-sided case (e. g. Eisenman, Parker, and van Alstyne 2006). We use a definition of two-sidednesss from Roson (2004, p. 142) who states, "A market is two-sided if platforms serve two groups of agents, such that the participation of at least one group raises the value of participating for the other group." We note that a peer network with directed links and imperfectly correlated in- and out-degree is formally equivalent to a two-sided network. In network terminology two-sidedness is referred to as a bipartite topology.

Additional examples of two-sided networks include monster.com, eHarmony, search engines, credit cards, Adobe (PDF-Acrobat), shopping malls, gmail, Innocentive, blogger.com (assuming that most people do not and will not ever blog), Zazzle (tee-shirt designers and buyers). Examples of three-sided networks might include NBC (producers, viewers, advertisers), YouTube (users, professional content producers, advertisers), or Windows Vista (hardware manufacturers, application developers, users).

As noted in the definition cited above, two-sided networks exhibit cross-side externalities. For example on monster.com the more job seekers there are, the happier employers are, and vice versa. On the other hand, same-externalities tend to be negative. The more job seekers there are, the more competition there is for each job seeker and similarly for employers. In some cases cross-side externalities can be negative, as might be the case where one of the sides consists of advertisers.

Analogously to Metcalf's Law, we note that the overall value of a two-sided network approximately follows an n_a x n_b rule where n_a is the number of participants on side A and n_b is defined analogously for side B.

Consumer Behavioral Issues

In classic non-network services, consumer heterogeneity is considered highly important for marketing. In network services, node heterogeneity is even more critical since it changes the manner in which the network functions and the nature of the benefit derived from other clients. To put this in a different way, since nodes produce the benefits as well as consume those benefits, node heterogeneity implies variability in the product offering.

We illustrate this point by highlighting the distinction between a peer and two-sided network in the case where the variable that distinguishes the two groups moderates the relationship between platform characteristics and a market response. Assume on a social network site that there are two groups: profile producers and profile readers. If management sets up the rules for platform interaction so as to satisfy one of the groups, or is not aware that there are two groups, it could easily make one of the groups unhappy. Yet profile producers might derive cross-group benefits from a large number of profile readers, and vice versa. In fact, Pagani, Hofacker and Goldsmith (2009) have demonstrated that psychological variable self-identity expressiveness differentially impacts content consumption and content production of a social network site.

Externalities have been modeled from an economic perspective for many decades (Dhebar and Oren 1985), but far less is known about how externalities function from the point of view of the consumer. How is the presence of others perceived? How and when do users sense critical mass (Markus 1987)? How do groups form?

Another question of interest to behavioral researchers concerns the typical pricing trajectory of network services. Many firms begin life with a goal to leverage a pioneer advantage in the presence of the above-discussed externalities. Given externalities in the service system, the firm that gets bigger first can have a relatively permanent value advantage. To get big first, price skimming is often used where the service is inexpensive or free. Current examples of this situation include service platforms offered by Facebook, Twitter and Tinyurl. At some point these firms will need to monetize use, and at that point consumer perceptions of value will become highly important

Firm Value Creation Issues

To speak to value creation, we will utilize the example of the Amazon Kindle electronic book reader. This example is ideal from the point of view of illustrating the intersection of service networks and service dominant logic. It is also a good example of turning a tangible good into a service. The Kindle allows for reading and utilizes a wireless network to allow remote purchase and delivery of books, newspapers or magazines.

In a network service model we distinguish three potential players: (1) end user peers (nodes in our terminology), (2) transport peers (arcs) and (3) platforms/aggregators (network enablers). End user peers are able to interact ("real time" communication; asymmetrically or symmetrically), take part in social networking (i.e. Facebook, gaming environments), consume content (either pushed or pulled content, i.e. downloads, broadcast, or on demand), publish content (as individual end users or for profit) and advertise. The transport peers (ISPs, carriers, application developers) provide the "pipes" that enable utility or consumption to flow between nodes. These two potential players are linked by a platform or aggregator, who provides the environment that supports end-user benefits, usually using transport networks. In the Kindle example, Amazon is both a transport peer and aggregator.

Another example is illustrative. Google has updated the model for advertising, which formerly functioned in broadcast networks, to the interactive networks that are becoming more prevalent today. Here we highlight Google's pricing model that takes into account the topology of today's Internet in an important way. Advertisers bid to place ads on search engine results, but one does not win with higher bids alone. Google charges by the click and the Google AdRank algorithm is based on expected revenue, which has two factors:

$$ER = Bid \times Pr(Click) \qquad (1)$$

Even high bids will not win if the click through probability of the ad is low. Advertisers are thereby incentivized to produce ads that consumers wish to click on. In effect, Google takes both sides of the two-sided network into account, treating the system as a more complex ecology as compared to traditional mass media.

We see a need for service science models that use node formation, i.e. transactions, or weighted node formation, i.e. dollar volume, as objective functions. Other network metrics might prove useful to model as well. Another interesting potential topic is how we can model customer equity in two-sided markets. In effect, there are two customer sets.

The “monetization” problem discussed in the previous section is also a good candidate for a service science model. We might ask what the dynamics of a service network are in the face of added customer costs over time.

As seen previously, Multi Sided Platforms can vary from having two sides (eBay, Visa), three sides (Windows, Google), four sides (i-mode, Brightcove), or theoretically more. However, the more sides, the higher the degree of complexity and the greater the strategic challenge of balancing the interests of all sides (other things being equal).

The choice of which side to target can have an immense impact on the structure and the success of an multi-sided business. You Tube seeks to build multi-sided platform but it focuses on the “consumer” side of its business. By providing a bare-bones service that allows users to share their own online videos, YouTube not only drew traffic to its site in large numbers, but also tapped into a new source of publisher content. Since Google bought YouTube, the site has moved to monetize its traffic and its content through advertising and revenue sharing models.

Governance patterns vary from platform to platform. Some multi-sided platform managers retain a high degree of control over actions by all sides of their platform, because they conclude that centralized control is necessary for the platform to function and because they have the market power to do so. Apple, for example, in almost all cases mandates a single, across-the-board pricing structure on the iTunes music store. Other platform companies allow participants broad latitude in their activity, setting minimum rules that will enable and encourage the platform to function smoothly and profitably. Thus, eBay lets sellers decide minimum bid amounts, auction duration, and so on. Microsoft places no restrictions whatsoever over who can sell applications for Windows and how.

Conclusions

In multi-sided networks there are cost and revenue equations on each side. The platform incurs costs in serving all groups and can collect revenue from each, although one side is often subsidized. In order to analyze these emerging business models it is fundamental to understand consumer affect, thinking and behavior and how value is created in different types of networks.

We offer two main insights that we think future researchers ought to consider. First, we identify a very large class of businesses that heretofore has been ignored by service scholars, the network service. Second, we tie the flow of benefits to network arcs.

This article initiates and encourages the study of network services from the point of view of services management and marketing. Distinguishing four categories of network services and then summarizing a set of consumer behavioural issues and firm value creation issues, our analysis suggests a set of research questions fundamentally important to a large and growing swathe of service organizations. We bring into relief real differences within network services that should inform managerial decision-making. The study offers a first conceptual overview that will allow us to categorize such services and present managerial challenges and research opportunities.

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Table 1

	Chain	Broadcast	Peer	Multi-Sided
Topology	Chain	Star	Mesh	Tripartite
Node	Heterogeneous	Homogeneous	Homogeneous	Heterogeneous
Arcs	Directed	Directed	Undirected	Directed

Figure 1

Four different network topologies – a chain, a broadcast network, a mesh and a two-sided network.