

# NETWORK EFFECTS: THE PRINCIPLES THAT GOVERN HOW NETWORKS EMERGE AND COMPETE

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## HOW DO MANY-TO-MANY NETWORKS EMERGE? HOW DO THEY COMPETE?

LinkedIn will IPO this year and Facebook is contemplating one. EBay is already public. And venture capital is chasing every startup that might produce the next huge collaborative network. In this article we summarize the key underlying principles that govern the emergence, growth and competition of network-driven businesses.



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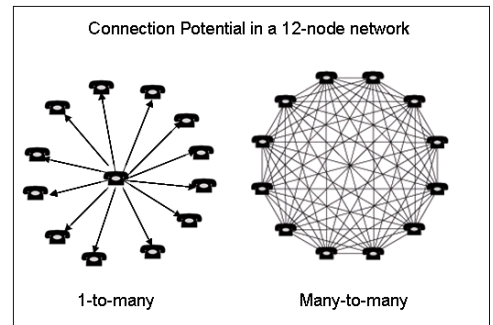
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## NETWORK EFFECTS

By Bruce Benson, Senior Managing Director, FTI Consulting

### Introduction

There are two key types of network structures. The first type is the “one-to-many” network, like a TV broadcast network, which broadcasts from the center of the network, but the individual participants cannot interact. The second type, which we call “many-to-many” networks, are ones in which consumers can interact with one another. Verizon’s cellular network is an example.



*The companies that master these network effects are the ones most likely to prosper disproportionately in today's internet economy.*

In this paper we describe the key economic rules that govern the emergence, growth and competitive behavior of many-to-many networks. These networks masquerade as social networks, exchanges, peer-to-peer sites, telephone networks, chat networks, dating sites, tweets, wikis, etc. But at the heart of them all is the key element that the network becomes more useful as more people join. Such networks at scale have extraordinary resistance to competitors because participants want the largest gathering place possible. As we write this, Facebook now has 700 million members and will probably reach a billion before the end of 2011. Today it is estimated to be worth over \$100 billion dollars. Several of these networks like LinkedIn are gearing up for their IPO. YouTube was bought by Google for \$3 billion, and eBay is the largest auction site in the world. As we write this article, the VC community is scrambling to fund any startup that exhibits these “network effects”.

On the internet it is easy to create these types of networks. Unlike their physical equivalent, such as a capital-intensive cell-phone network, these virtual internet networks can be set up in days. Economists have been studying the behavior of networks for quite some time in a field they call *network economics*. It is the study of goods and services whose usefulness is determined, in whole or in part, by the number of other consumers that use them. They say such goods and services exhibit “network effects” or network externalities. Several books such as *Information Rules*<sup>1</sup> were written during the first dot.com that brought the concept of network economics into the spotlight. However, these books did not anticipate how pervasive these many-to-many networks would become. The goal of this article is to resuscitate some of these principles, bring in some of the newer thinking from economists, and describe a few principles of our own. Indeed, it is not too much to suggest that those companies that master these new network effects are the ones most likely to prosper disproportionately in today's internet economy.

### The Behavior of Network Goods

**A Definition.** We will coin the terms *network goods* or *network-dependent goods* to mean a product or service whose usefulness is determined by the size of its network of members. Skype, eBay, faxes, telephones, and MySpace are network-dependent goods. If their users couldn't interact, they'd be useless, and the more members, the more useful they become. Note that all these types of services require a many-to-many network

<sup>1</sup> *Information Rules* by Carl Shapiro and Hal Varian, Harvard Business School Press, 1999

between their users since they have to interact. This network can be physical, like a phone company's or virtual like eBay's.

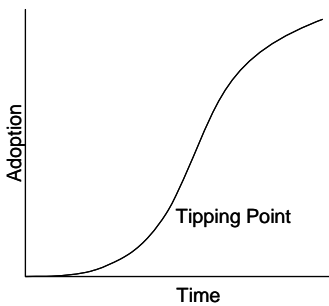
*The first dot.com era was about portal networks. We have entered the era of the many-to-many network.*

It's important to stress that just because a service is delivered through a network doesn't always mean it's a network good. Portals like Yahoo! are not network goods. Their usefulness is not dependent on the size of their network. This is because the users all come and pull information from a central Yahoo! Site; the members don't interact. This is true for TV networks as well. They are not network goods because their utility to a viewer is not a function of how many other viewers there are. In theory, consumers would receive the same broadcast whether there were 200 or 2 million viewers. These types of networks rely on one-to-many (broadcast) networks for delivery. In a sense, the first dot.com was about one-to-many "portal" networks. We have now entered the era of the many-to-many network.

With these preliminaries out of the way, let's look more closely at the behavior of network goods.

### Network size and tipping points

Network goods have an adoption pattern shaped like an S curve. Historically, network goods have taken a long time to incubate in the market before they hit a tipping point that ignites rapid adoption. This happened with fax machines. Faxes had a small market niche in filing flight plans of all things, but they only caught on for general business use when there were a sufficient number of them in the workplace.



Some network goods, of course, don't survive long enough to reach a tipping point. Video phones are a good example. Consumers didn't buy them because none of their friends and family had them, so they were not very useful. Unable to find a market niche where they could hang on until their penetration grew to spark a tipping point, they died still-born. The concept was resurrected anew with Skype Video. However, Skype first achieved network size in voice calls between computers and only then began offering video -- after their network of consumers was built.

When two similar services are launched in the market and are network-dependent, a battle ensues to build the underlying size of their networks. This is because a service's value to the customer is determined by the very size of the network it offers. The more members, the more useful it is. When AIM launched in May of 1997 it wasn't useful until a sufficient number of people joined. MSN's Messenger service was launched several months later. But once AIM's network reached sufficient size, new customers, facing a choice of which program to use, naturally opted for AIM because it had the largest network of members. This leads us to our first principle of network goods:

*Principle 1: Consumers are usually compelled to use the service with the biggest network.*

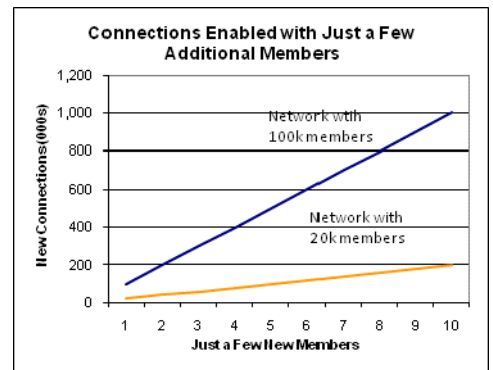
We use the word "compelled" in this principle to indicate something far more powerful than the mere size advantage of the network. The size advantage makes it *exponentially* more useful and usually dominates the consumer's decision-making process. This is because the network with the most members enables more interactivity which is what the consumers are seeking. In eBay's case this means more buyers and sellers, in YouTube's case it means more amateur video is contributed and shared, and in Skype's case it means users can call more people. Indeed, Metcalf's law regarding these types of networks says that a network of N members enables  $N^2$  connections.

A tipping point is ignited when the network good hits a critical mass of users and it moves from having niche utility to mass utility. Because the value of the network increases with its size, a positive feedback loop ensues -- more people join, it becomes more useful, and even more people join. This leads us to our second principle:

*Principle 2: Being first to market is an even bigger advantage for network goods.*

The original service that starts up in a market initially has the bigger size, and Principle 1 says this is where new members will gravitate. Since the service gets more valuable with size, it follows that the first network will usually grow faster and reaches a tipping point sooner than later arrivals.

This disproportionate advantage also shows up in the mathematics. Say AIM initially had 50,000 members versus MSN's 10,000. If they each add *just one* new member, then AIM will gain 100,000 new connections while MSN only gains 20,000<sup>2</sup>. The chart at right shows the growth in connections as both add from one to ten new members. Of course, consumers don't do this math, they simply join the one that is more likely to connect them to the most people.



We are compelled to warn that being first to market isn't a guarantee of success or popularity even for network goods. The features of the service have to be the right ones. (For an excellent elaboration on this subject, see the book *Fast Second* by Constantinos Markides and Paul Geroski<sup>3</sup>.)

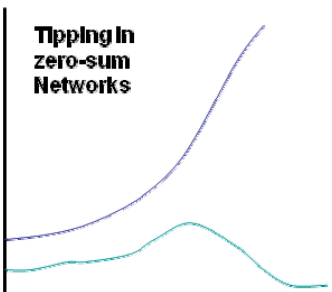
**Network goods and zero-sum games**

Networks are often incompatible, meaning that members of one can't interact with members of another. When networks are incompatible, the race for consumers is often a zero-sum game, meaning that a gain of a particular member by one service is a loss to the other. In such cases, when a tipping point is reached, one service will enjoy a positive tipping point while the other can suffer a negative one.

This has played itself out in the zero-sum competition between MySpace and Facebook. Both were early social networking sites for teens. However MySpace became very commercialized after being bought by Rupert Murdoch. This turned off consumers – an example of adopting the wrong feature set. Since teens don't need two such services, every gain by Facebook has been a loss for MySpace, and its future looks bleak. This gives us our third principle:

*Principle 3: In a zero-sum competition between network goods, the winner takes all.*

Facebook was originally smaller than MySpace and should have lost this competition, except that it initially found safe harbor with the college and high school crowd who wanted to interact privately with other students but not with the world at large. As MySpace corrupted its original user promise, Facebook became open to anyone, not just students. Facebook currently has 700 million members and is heading toward one billion. MySpace is being sold off at the moment for piece-parts.



<sup>2</sup> Metcalf's Law: An interconnected network with N members enables N<sup>2</sup> connections. With one additional member, AIM would enable 50,001<sup>2</sup> – 50,000<sup>2</sup> or 100,000 new connections.

<sup>3</sup> Josse Boss Press, Copyright Wiley and Sons, 2005.

Not all network goods are zero-sum. Today there are several illegal P2P services for sharing music and people often use several of them. They are network goods because they depend on their members to share their music and videos. Yet because not all services have the same content consumers will join several.

Negative tipping points with zero-sum products and services occur with non-network goods as well. Owning an iPod has become "cool" and the resulting bandwagon effect has made it the product of choice. Since a consumer doesn't need two such devices, the MP3 player market is a zero-sum game. Consequently sales of rival products suffered declines as the iPod exploded in popularity. However, the iPod is not a network good. The popularity it enjoys can eventually be overcome by rivals who strive to imitate its sleek design and features. This happened in the '80s with the Sony Walkman. In its day, it originally enjoyed the same cultish popularity as iPhones today. Yet, eventually competitors imitated all of the important features, and the Walkman was commoditized. But in the case of network goods, network size itself is often the dominant and most valued feature. This is much harder for rivals to overcome -- *Network size cannot be imitated in a factory; it must be hard-won in the marketplace.*

### Lock-in and Compatibility

This brings us to the issue of consumer lock-in and switching costs. Just as people will join the bigger network, they will be unwilling to leave the bigger network for a smaller one. The network's size creates a switching cost for the consumer, and the consumer is locked in. If Skype has a network with 14 million members and if Verizon had a similar service with 2 million members, most Skype members would not be tempted to join Verizon. If some Skype consumers did switch to Verizon, they would lose 12 million connections (14 million – 2 million). This is their switching cost. Hence our fourth principle:

*Principle 4: In incompatible networks goods, the bigger the network the greater the lock-in.*

Based on the foregoing four principles, it may seem the largest network always wins, and there is nothing the smaller players can do. Fortunately this isn't true, and we'll explore the general subject of network competition later. However, one key tactic in minimizing the leader's network size advantage is to become compatible with their service. Once two services are compatible, consumers are no longer locked in due to network size. For instance, in the example above, if Verizon and Skype made their services compatible, a Verizon member could call a Skype member without changing services. They would also gain access to a total of 16 million people, increasing the utility of both services. This leads to principle five:

*Principle 5: The leader's network size advantage is neutralized and consumer utility is increased when networks become compatible.*

The two services will still compete for market share in terms of quality of service, features, ease of use and price, but no longer on network size. When do two competitors decide to become compatible and why? Again, we'll discuss this later in this article.

### Only One?

It is very interesting to note that many of the network goods we have been discussing completely dominate their category: Skype for free computer-to-computer phone service, eBay for internet auctions, Facebook for social networking, YouTube for amateur video and Tweeter for tweets. This gives rise to our sixth principle, which we have to caution is more of a conjecture, but is supported by our observations:

*Principle 6: For most network-dependent services, the market only wants one.*

In the case of eBay, the consumer is better off with the largest auction marketplace possible. Sellers are better off because they can reach a huge number of bidders and they only have to put their items up for bid in one place. Equally, buyers are better off because they are more likely to find items they're looking for at the price they want in a huge market place with lots of sellers. YouTube is similar. People wanting to share their amateur creations with others find it very convenient to put their videos on one service that reaches millions rather than several smaller services. Similarly, people wanting to watch amateur video would rather go to one place where the videos have been viewed and rated by many other people.

In short, *consumer utility is maximized when there is a single service*. This is very rare in conventional economics. In conventional economics, competitors slug it out until two or three winners are left standing. Since consumers want competitors – at least to ensure there is a check on monopolistic pricing and continued innovation -- there is always room and a need for a second or third supplier.

These dominant services are very hard to dislodge by competitors. Before Google bought YouTube, it tried to launch its own video sharing site, as did Yahoo and MSN. They got no takers. The market only wanted one.

## Competition and Co-opitition in Network Goods

Barry Nalebuff from Yale and Adam Brandenburger from Harvard wrote the book *Co-opitition* in 1996<sup>4</sup>. Using results from game theory they brought to light how competitors can often maximize their position through strategic cooperation with their rivals – a concept they called “co-opitition”. We'll first discuss competition among network goods then look at co-opitition in terms of network compatibility.

### Competition

In terms of competition between networks, we want to focus on when consumers switch from one network good or service to another. In conventional economics, competition rages around benefits and price. Obviously, consumers are looking for the product with the most benefits and least price. In addition, for some goods and services, there are switching costs that make it harder to switch brands or services. Conventional economics has boiled all this down to the following relationship:

*Consumers switch to a new product when its benefits exceed its price + switching costs*

This means that when the perceived benefits of the product or service exceed its price difference against other alternatives and the consumer's other hassles of switching, the consumer is susceptible to switching. (This doesn't guarantee they will -- humans are extremely inert. In this sense the role of marketing is to overcome their inertia.) As an example, a consumer may switch to a Mac from a PC when the perceived benefits of a Mac (such as better graphics, ease of use and slicker design) exceed the additional price of the Mac and the hassle of switching all of their files from their old PC.

Network economists have added an additional variable to this switching relationship, which is the gain in network size when switching. So in network economies, consumers switch when:

*Benefits + Network Size Gain > Price + Switching Costs<sup>5</sup>*

In our previous example of Skype vs. Verizon, a person who originally joined Verizon with 2 million members might soon realize that they'd be better off joining Skype with its 14 million members, a network size gain of 12

<sup>4</sup> Published by Currency Doubleday, 1996

<sup>5</sup> Derived from Oz Shy's *The Economics of Network Industries*, Cambridge University Press, 2001.

million. Since the services are both free, there's no price issue, and because they are both very intuitive there are no switching costs. Hence the Verizon members will almost always switch to Skype. Note that if Skype's voice quality was worse (a switching cost) or Skype wasn't free, then the consumer might forestall switching.

The relationship above is more profound than it may seem. Google is currently trying to figure out how to launch a site that will steal members away from Facebook. As it does so, the battle with Facebook will be fought over every variable in this switching equation.

Often on the Web, the price of both the leader's and the competitor's service is zero, and switching costs are minimal, so the battle is all about benefits vs. network size. Since consumers won't switch from a big network to a smaller one without a very good reason, the benefits of the smaller competitor's service will have to be very significant in order to entice the consumer to switch.

This discussion about competition and switching can be summed up as a single principle:

*Principle 7: To switch consumers away from the network size leader, competitors must significantly exceed the leader in benefits while minimizing price and switching costs.*

This principle demonstrates why defeating illegal P2P music networks is so difficult for the music industry. P2P services are the network size leader in music. The number of illegal downloads per month far exceeds paid downloads. But legal competitors who want illegal consumers to switch to their service have fewer benefits to offer because legal services have fewer songs and awkward copy protection schemes. Of course prices are higher on legal networks because consumers have to pay for their songs. Switching costs are also higher because the consumer has to re-download their entire library. In short, there is no dimension in the switching equation above in which the legal network can trump the illegal network. The requirements of Principle 7 cannot be achieved. Only ramped up legal enforcement (which is a higher "cost" to the pirating consumer) can force this switch.

The best way for smaller competitors to neutralize the network size advantage of the incumbent is through compatibility, so let's now turn to co-opitition.

## Co-opitition

When and why does a market leader decide to cooperate with competitors and make their network or product compatible?

The key thing to observe about maintaining network incompatibility is that it's more expensive for the supplier than compatibility. There are four main reasons for this:

1. When a service is incompatible it has to develop and maintain its own compliments. For example, in the case of iTunes it has to maintain its own proprietary song store, its own song format, its own hardware and software. This is far more expensive than relying on open standards.
2. Incompatibility limits the size of the market for each competitor. The fact that AIM users can't converse with Windows Messenger users limits the size of AIM's network. Today, new users have to pick the one that lets them chat with the most friends or co-workers (or use both).
3. The marketing costs to explain to consumers the virtues of your incompatible system are higher, which reduces profits.
4. When services are incompatible, the underdog will undercut the prices of the leader. This forces the leader to react in kind, driving prices and profits downward. But when services are compatible there is less competition around pricing. ATM machines are an example. Banks used to have incompatible ATM networks. Rival banks would cut their fees to attract customers. It eventually became clear to the banks that fees would be higher and their customers would be happier if they made their net-

works compatible and so they did.

Since the cost of incompatibility is high, profits are lower for all competitors than they might be under compatibility. Consequently there often comes a point in the market leader's progression when they have gained as much market share as possible under incompatibility and will shift to compatibility. In doing so, they pick up probably more than their fair share of the fence-sitting customers while lowering costs and improving profits. In addition, the leader can often create this compatibility by licensing access their dominant technology or network access to others, and thereby also gain new revenue from their competitors. This gives us an eighth principle:

*Principle 8: Since compatibility is more profitable, the market leader will usually shift to compatibility after capturing his market share under incompatibility.*

### The Logic of Compliments

When content is distributed on a many-to-many network, the network and the content shared on it are compliments. They are both required to deliver the service to the consumer, and the service cannot exist without both. While co-dependent, the network distributor and the content provider are rarely equal. A large distributor like Apple has significant pricing leverage over content owners, but with smaller distributors the content owner has pricing power.

One important way to gain a price advantage when the players are complimentary is to commoditize your partners by finding several suppliers of the needed compliment. This is easy to see in the case of Yahoo News, who can commoditize its national news suppliers by making deals with Reuters, AP and even have its own journalists. This creates price competition among Yahoo's news suppliers and weakens the suppliers' pricing leverage. Equally, content owners will seek many distribution partners so that no one of them has much power over the content owner. This gives us our ninth principle:

*Principle 9: Complimentary partners in a network will attempt to commoditize each other.*

A special case arises when there is only one source of content or only one significant distribution partner. Owners of unique content like a hit movie know its distribution partners can't get it anywhere else and so they can't be commoditized. This leads to their favorite axiom that *content is king*. But this is really only true when there are multiple distribution outlets. When there's only one major distributor, content isn't king. In the case of iTunes, who owns 90% of the digital music download market, iTunes has set a uniform and low price for all songs of 99 cents. They have virtually commoditized the music labels' content. Consequently when content owners with desirable content come up against a dominant distributor, things can get fractious.

This leads to our last principle:

*Principle 10: Complimentary networks exist only when the participants' revenue models are aligned.*

This is not quite as obvious as it sounds. Of course, the participants in a delivery network won't do business with each other if they can't make money, but it's *how* they each make their money that makes the partnership possible. For example, MTV distributes its content nationally through various cable companies. The two parties have found alignment: the cable companies make money through subscription fees to the consumer, while MTV makes money through advertising within the content. (MTV also get some licensing fees from the cable operator.) This is not the case with YouTube. Both the content owners and YouTube's parent, Google, want to make money from advertising *in the content*. To date, they can't agree on a revenue sharing arrangement or who owns the customer relationship. Their business models are out of alignment.

## Conclusion

While we have exposed the key principles of network competition, knowing these principles is not in itself a competitive strategy. Conventional consumer companies must understand how they will compete with these networks. Content owners must decide how they will negotiate, how they will create leverage for themselves, and how they will co-exist. Startups and VCs must understand how they will get to market quickly, create the winning features for their members, and how they will hit a tipping point before other market entrants do. And existing network competitors like Facebook and Google must understand how they will win share away from one another by using the principles above to their best advantage.

We believe we have entered the era of the network economy. This really can't be in doubt as we watch Facebook help topple Eastern governments. Companies have to build their strategies from these principles. Failing to do so can be disastrous. Rupert Murdoch paid \$250 million for MySpace, but he failed to preserve the benefits consumers wanted in a social network (Principle 7) and MySpace is all but forgotten.

If you're concerned about your company's strategy in a networked world, give us a call, FTI is here to help. Readers should feel free to contact us at:

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