Almost all of us use PCs that run Microsoft Windows. Do we simply have the same taste, or is something deeper going on? 20 years ago, Betamax was a technologically superior format to VHS. Yet we now all use VHS (which has improved markedly in the meantime). 150 years ago, hundreds of phone companies existed. But since they weren’t interconnected, the AT&T “Bell System” eventually took over almost the entire market as a government supported and regulated monopoly. The rationale behind all of these stories is what we term “network effects.” The value of the product to customers depends not only its quality but on the number of other people using the same product. There is, in essence, a network of users, and the size of the network plays a large part in its value. Thus we all use Windows-based PCs because they support the same programs and allow us to share files easily. Similarly, VHS won because once it got a large enough market share (another story), there was no reason for video stores to stock tapes in a second format. AT&T won for a similar reason: once it got a critical mass of customers, it attracted others who wanted to communicate with them.

Markets with network effects have a number of unusual features. First, there’s a tendency for the winner to claim all or most of the market, since buyers want not only a good product, but a product compatible with similar products used by others. Second, such markets are frequently subject to battles over standards, since a firm that is able to establish its own product as the standard is often in a strong competitive situation. Third, the best product need not win. An accident that gives a product a critical mass of users (an installed base) has a strong competitive position, regardless of the quality of its product. Fourth, monopoly may be the natural outcome of competition. How should antitrust authorities respond to such market power? In short, it changes the nature of competition in fundamental ways.

Network Effects

Suppose I were to tell you that I had here, in my overcoat, a brand new Panasonic cordless phone with all the bells and whistles on it, and that I would sell this telephone to you for $1. Not a bad deal, right? It’s even cheaper than a subway fare. Now suppose you knew the following information. The year is 1789, and even though I am selling the phone to you in real terms (i.e., the phone costs the 1789 equivalent of $1 dollar today), you would probably not buy it. Why? Because no one else had telephones in 1789! What would the value of owning a telephone be if you couldn’t call anyone?

Now let’s jump ahead to the early 20th century. Thanks to our friendly monopoly AT&T, more and more people are connected to the telephone network across the US.
Now you may be able to call a very small percentage of your family members or business associates. All of a sudden the phone that was worthless to you in 1789 begins to look better. Now suppose I tell you that we have traveled back to the future and we are in 2001. You can call about anyone you know in the world on the phone – not just a handful of people. This same piece of electronic equipment, which hasn’t changed one bit since I offered it to you 200 years ago, is worth a lot more. Why? The answer is network effects.

Network effects arise when each consumer’s valuation of a certain product increases with the addition of other consumers who use the product. We can extrapolate the telephone example above to many other daily applications like email and fax machines.

We call such examples direct network effects because, as we show above, it is obvious how these products’ utility increases as other people also demand them. Still another example of direct network externalities is given by software. For example, consider Microsoft Word. On one level, your valuation for this product relates to the features and functionality it provides you (for example, the spell-checker if you are a terrible typist). But in addition, suppose you insisted on using an old, DOS-based Word program that no one else uses anymore. It may be great for you if you are used to it and love it, but what if you need to email someone a document (and vice versa)? What if you need to print on a printing network that does not recognize your software? What if you are working on a group project and splitting up a paper assignment? Because millions of us use Microsoft Word together and are able to interconnect through this shared application, the value of the program increases with each additional MS Word user to the extent that we can all communicate easily and efficiently.

We also can observe indirect network effects arising from many products. One example is given by ATM machines. My banking with Chase has nothing to do (directly) with your value of using Chase directly, but the fact that we all are using Chase makes the firm more likely to build ATMs all over the city – which provides us all with increased utility. We can probably guess at this point that the value of a network good depends on the number of consumers who demand it. This point is not lost on firms, who realize that they must achieve a so-called critical mass of users in order to reap the benefits of network effects. What are these benefits? Firms like Microsoft and Chase create added inelasticity for their products, keeping consumers from switching to other products and attracting new consumers thanks to the “bandwagon” effect of demanding something that everyone around you also has.

**Critical Mass**

The logic of critical mass is as follows. Because the demand for network products increases with the expectation that there will be additional users whose presence increases the network’s value (called an externality because you, as the additional consumer, do not capture this added value that you create), the demand curve takes on an unusual humped shape instead of the normal downward sloping line. For this reason, as
price declines, a snowball effect may take place as many, many additional consumers suddenly demand the product. At this point in the demand curve we say that the installed base (the number of customers comprising the network) has attained critical mass.

We can see why firms want to attain critical mass for their network products, but this is not always easy. One confounding factor can be that of excess inertia—that is, the prevention of critical mass from being attained by some “stickiness” to a rival product or an unwillingness to adopt a new network product. A good example of this is DVD players. While firms are gradually lowering the price of DVD players as their marginal cost declines, DVDs have been slow to “explode” in the marketplace. Why? Because many consumers are unwilling to substitute DVDs for their CD players and the scores of CDs that would need to be replaced. Even though everyone may find that they prefer DVD players to CD players once they switched, this leap is not easy for the firm to induce. Thus, firms often take recourse against excess inertia by introducing new network standards that are “backwards compatible” (that is, they can be integrated with existing network goods) or by pricing at an extremely low level to offset consumers’ switching costs.

Another confounding problem for firms selling network products is that of excess momentum. In the 1980s, VHS and Betamax hit the scene around the same time, and video stores had two sections offering both types of cassettes to consumers. While it is agreed that Betamax was a better technology, we know today that VHS all but eclipsed the Betamax standard. What happened from Betamax’s point of view? Some bad decision making in terms of pricing and vendor relationships and some lucky factors for VHS led to more network adoption of the inferior VHS product; eventually as the market was “tipped” in the favor of VHS its installed base soared relative to that of Betamax. And once consumers were “stuck” on the VHS standard, there was no looking back Betamax was left in the dust.

Standards Wars

This VHS and Betamax example underscores the point that in standards wars between network products, one standard usually captures the entire market eventually due to network effects. The other standard generally is abandoned, or is relegated to a small niche of users that do not generate network externalities. Related to this, we can see that the best standard is not always the winning standard. Thus, firms must behave strategically to capture the bandwagon of consumer behavior with respect to network products whether or not their product is superior. Why? Because once they lose the ability to harness network effects, consumer demand snowballs in favor of another standard for the reasons discussed above. It is further important to note that not all outcomes in standards wars are controllable by firms, even if they are acting strategically. While it is easy to cast hindsight onto many standards wars over the years and point to why one product is victorious over another, the actual escalation of network demand is determined by a conspiracy of smaller events—some controllable by the firm, some not. Sometimes economists refer to this determinism of such events over time as “path
dependence”, which simply means that history matters in its ability to irrevocably shape the future.

An additional strategic dimension of network products and standards wars is that of the compatibility question. Why did IBM allow rival firms to “clone” its PCs? And why did Apple refuse to integrate its computing platform with IBM-compatible PCs? Firms with standards must weigh the potential costs and benefits of making their products compatible with competing products. On the positive side, allowing your products to be used with a wider number of applications, even though you are competing with those applications, creates additional demand for your products that would otherwise not exist. IBM, from above, figured that if it allowed for the number of IBM-compatible PCs to explode, its own computers—at the center of the standard—would be more demanded and other computing standards (i.e. Apple) would suffer. But on the downside, compatibility also creates risks. If you make your software compatible with that of a rival firm with superior software, you may find your installed base migrating to their products over time.

There is no clear answer to whether compatibility or incompatibility is better for a firm; it depends on the particular industry, the size of the firm, consumer behavior, and of course the competitive landscape. We can generalize a bit by saying that if product market competition is intense, then incompatibility is a superior strategy. Conversely, if competition for an eventual standard is intense—in other words, if there are two competing standards vying for critical mass and only one will survive—compatibility may be the better option.

Additional Reading

One of the best sources of information on this issue is Professor Nicholas Economides’ web site:

http://www.stern.nyu.edu/networks/

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