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Compatibility and the Creation of Shared Networks

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Many networks start out as self-contained private (or proprietary) networks. It is often the case that over time private networks link up to form shared networks. However, this does not always happen. Until Citicorp joined the nationwide Cirrus system in early 1991, both outcomes could be seen in different automatic teller networks in the New York City area. Citicorp's extensive network of automatic teller machines (ATMs) was private and essentially restricted to use by Citicorp's customers only, while the New York Cash Exchange (NYCE) network was a shared joint-venture network of a number of banks. In this chapter, I develop an economic model to explore the incentives for private networks to form shared networks. The model has broader applications to product systems generally. More specifically, this chapter explores the incentives for private networks to adopt compatible specifications so that transactions across networks are feasible and at no extra cost due to incompatibilities.

A private network can vary its degree of compatibility with another private network. In general, an adapter is required for transactions across networks, and each private network contributes to the cost of the adapter through its choice of specifications. It is shown that, even in the absence of binding agreements, full compatibility (zero adapter cost) will emerge at equilibrium provided that the demands for each of the potential transactions are of the same size. Various degrees of incompatibility and limitations of access across private networks will emerge when this condition does not hold. In particular, when demand for hybrid (across networks) transactions is small, all private networks prefer to have incompatibility and restrict access across the networks. If only one private network has a large demand (because of good reputation or high

quality of service) then it will opt for incompatibility while the smaller private network desires compatibility.

The next section introduces the terminology and analytical framework required to examine the incentives for compatibility. An example is presented that captures the intuition underlying the formal analysis and illustrates the primary findings of the formal analysis developed in the remainder of the chapter. The formal model is introduced in its simplest form in the third section. In the following sections, I discuss the symmetric case, where the demand for (hybrid) transactions across the private networks is equal to their internal transactions demands, followed by the asymmetric case, where the demand for hybrid transactions falls short of the demand for transactions within the private networks. The model is elaborated to allow for the bundling of services within private networks and the possibility that different adapters are required for different hybrid transactions. I conclude the formal analysis by showing that the conclusions of the previous analyses extend to a model that allows for sequential decisions, with the decisions on specifications taken at an earlier stage than the decisions on prices.

BASIC FRAMEWORK

Many complex goods are composed of simpler *elementary goods*, which in many cases are sold separately. For example, the good "phone call from X to Y" requires use of phone appliances at X and at Y as well as the use of a network that allows the transmission of signals from X to Y. This network may include the local networks of locations X and Y plus a long-distance network. Note that each of the elementary goods is complementary with the other, since their combination allows the consumer to purchase the *composite good* that he desires, the phone call from X to Y.

The elementary goods can be thought of as *components* and the composite goods as *systems*. For example, consider a personal computer that is composed of a central processing unit (CPU), a video monitor, and a keyboard. Each of these three elementary goods can be considered a component and their combination is a system.

In general there will be a number of elementary goods of each type. Elementary goods of the same type are obviously substitutes. The different combinations of elementary goods create systems that are also seen by the consumers as substitutes. IBM and Compaq CPUs are substitutes. So are IBM and Compaq monitors. And the four systems (pure IBM, pure Compaq, and the two hybrids) are also substitutes for each other.

The ability of all elementary goods (or components) to be combined costlessly with all elementary goods of a different type to produce functioning composite goods (or systems) is defined as *full compatibility*. Compatible elementary goods can be thought of as constituting a *network*. Consider the composite good "cash withdrawal through an ATM." It is composed of at least