The Need for a Protocol Architecture

When computers, terminals, and/or other data processing devices exchange data, the procedures involved can be quite complex. Consider, for example, the transfer of a file between two computers. There must be a data path between the two computers, either directly or via a communication network. But more is needed. Typical tasks to be performed:

1. The source system must either activate the direct data communication path or inform the communication network of the identity of the desired destination system.

2. The source system must ascertain that the destination system is prepared to receive data.

3. The file transfer application on the source system must ascertain that the file management program on the destination system is prepared to accept and store the file for this particular user.

4. If the file formats used on the two systems are different, one or the other system must perform a format translation function

It is clear that there must be a high degree of cooperation between the two computer systems. Instead of implementing the logic for this as a single module, the task is broken up into subtasks, each of which is implemented separately. In a protocol architecture, the modules are arranged in a vertical stack. Each layer in the stack performs a related subset of the functions required to communicate with another system. It relies on the next lower layer to perform more primitive functions and to conceal the details of those functions. It provides services to the next higher layer. Ideally, layers should be defined so that changes in one layer do not require changes in other layers.

Of course, it takes two to communicate, so the same set of layered functions must exist in two systems. Communication is achieved by having the corresponding, or peer, layers in two systems communicate. The peer layers communicate by means of formatted blocks of data that obey a set of rules or conventions known as a protocol. The key features of a protocol are as follows:

• **Syntax:** Concerns the format of the data blocks

• **Semantics:** Includes control information for coordination and error handling

• **Timing:** Includes speed matching and sequencing