



Chapter I

The OSI Model and Switching

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In this chapter we give the motivation and basic concepts of the OSI reference model, discuss its seven-layer architecture, the communication between systems using the OSI model, and finally the relationship between the OSI model and multilayer switching.

MOTIVATION AND BASIC CONCEPTS

The Open System Interconnection (OSI) reference model is a framework for defining the conventions and tasks required for network systems to communicate with one another. The work on the OSI model began in the late 1970s, mostly independently, by the International Organization for Standardization (ISO) and the International Telegraph and Telephone Consultative Committee or CCITT (which comes from the translation of the title in French). CCITT has been succeeded by the Telecommunications Standardization Sector of the International Telecommunications Union (ITU-TS). In 1983 the work of the two organizations was combined, and a single document describing the reference model for Open Systems Interconnection was produced. The term “open systems” refers to the fact that the specifications are publicly available to everyone.

The purpose of the OSI model was to assist vendors and communications software developers to produce interoperable network systems. Although the OSI model was designed to replace all previous computer communications standards, it is no longer viewed as such a replacement. Rather, the OSI model has succeeded as a tool for describing and defining how heterogeneous network systems communicate.

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The OSI model is based on a widely accepted structuring technique called layering. According to this approach, the communications functions are partitioned into a vertical set of layers. Each layer performs a related set of functions, utilizing and enriching the services provided by the immediately lower layer. The layering approach was developed to address the following goals:

- Provide a logical decomposition of a complex communications network into smaller, more understandable and manageable parts.
- Provide standard interfaces between network functions and modules.
- Provide a standard language for describing network functions, to be used by network designers, managers, vendors, and users.

An important task in the development of the OSI model was to group similar functions into layers, while keeping each layer small enough to be manageable, and at the same time, keeping the number of layers small, since a large number of layers would increase the processing overhead. The principles used in defining the OSI layers are summarized in following list (Stallings, 1987):

1. The number of layers should not be so many as to make the task of describing and integrating the layers more difficult than necessary.
 2. Layer boundaries should be created at points where the description of services is small and the number of interactions between boundaries is minimized.
 3. Separate layers should be created in cases where manifestly different functions are performed or different technologies are involved.
 4. Similar functions should be collected into the same layer.
 5. A layer should be created where functions are easily localized. This enables the redesign of the layer to take advantage of new technologies.
 6. A layer should be created where there is a need for a different level of abstraction in the handling of data.
 7. Changes of functions or protocols of a layer should be made without affecting other layers.
 8. For each layer, boundaries with its upper and lower layers only are created.
- The application of the above principles resulted in the seven-layer OSI reference model, which we describe next.

THE SEVEN OSI LAYERS

The seven layers of the OSI reference model, are concerned with tasks ranging from how electrical signals are generated and bits are encoded, to the interface with user applications (Stallings, 1987; Tanenbaum, 1988) (Table 1).

The Lower Layers: Physical, Data Link, Network

The three lower layers of the OSI reference model are responsible for transferring the data between the end systems, hence constitute the communications portion of the model. These layers run on both end systems and intermediate nodes.

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