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CONNECTIONS AND CONNECTIONLESS

One of the most basic concepts of network architecture is the distinction between the connection and connectionless models of communication. The connection model is based on the establishment and maintenance of "state information" that is held in common by the communicating parties and the underlying service provider; the state information establishes a context within which the parties interact with the service provider and communicate with each other. The connectionless model is based on individually self-contained units of communication (often called "datagrams"), which are exchanged independently without reference to any shared state (that is, there is no "connection" between the communication parties). In the connection model, each individual unit of communication is interpreted by reference to the shared state of the connection, which captures information such as the identity of the communicating parties, the current status of flow-control variables, the way in which data have been encoded for transmission, and the sequence numbers of data units that have not yet been mutually acknowledged). In the connectionless model, each unit of communication carries within itself all the information that each party needs to interpret it, since there is no shared state to refer to.



The OSI reference model terms connection-oriented and connectionless, describing virtual circuit and datagram modes of operation, were coined by Lyman Chapin and John Gurzick during the production of the first draft of the connectionless addendum to the OSI reference model on the roof of the Pointe resort in Phoenix, Arizona, in 1981. Sometime between 1983 and 1987, the connection-oriented "X.25 crowd," who were not about to hyphenate the noun connection (to create an adjective) without attaching a similarly demeaning shackle to the rival connectionless, succeeded in changing the "official" term to connectionless-mode –an injury to English grammar that at least had the dubious virtue of leaving everyone equally dissatisfied. A few reminders of the original terms persist; the standard acronym for the "connection-mode network service," for example, is CONS, not CMNS, and the title of ISO/IEC 8073 is "Connection-oriented Transport Protocol."

A common mistake is to assume that either the connection model or the connectionless model must be used uniformly throughout a network architecture; that is, if one layer is defined using the connection model, then all the other layers must also use the connection model. In fact, the two models are complementary: it is appropriate to use the connection model to define a protocol in one layer (e.g.,

the transport layer) and the connectionless model to define a protocol in a different layer (e.g., the network layer), the combination of which can be used to provide a connection-oriented (transport) service to a higher layer.

The TCP/IP and OSI architectures employ both models in all layers, with one important exception: in TCP/IP, only the connectionless model is used to define the services and protocols of the internet layer. The Internet architecture refers to the two models as simply “connections” and “datagrams.” The OSI reference model, with its penchant for “precise” terminology, uses the terms *connection-mode* and *connection-oriented* for the connection model and the term *connectionless-mode* for connectionless model.

Communication using a connection proceeds through three distinct phases:

1. *Connection establishment*, during which the parties that intend to communicate negotiate and agree on the terms of their interaction and perform any necessary “setup” functions (such as the allocation of buffers, the establishment of underlying communication links, and the initialization of state variables).
2. *Data transfer*, during which information is exchanged according to the rules established during connection establishment.
3. *Connection release*, during which the context established for communication is dismantled (buffers freed, underlying links torn down, state data structures deallocated).

Connection-mode operation is based on the familiar model of a telephone conversation:

1. Dial the phone.
2. Talk to the party at the other end.
3. Hang up.

In contrast, connectionless communication has just one phase of operation: transmission of a single, self-contained unit of data in a package that contains all relevant information. It is based on the equally familiar model of the basic postal mail service: put all necessary information (address, return address, postage, “airmail” label, etc.) on the envelope and drop it in the mailbox slot.