

Data and Computer Communications

Chapter 2 – Protocol Architecture, TCP/IP, and Internet-Based Applications

8th Edition

by William Stallings

Protocol Architecture, TCP/IP, and Internet-Based Applications

To destroy communication completely, there must be no rules in common between transmitter and receiver—neither of alphabet nor of syntax.



—On Human Communication,
Colin Cherry

The Need For Protocol Architecture

1.) the source must activate communications path or inform network of destination

2.) the source must make sure that destination is prepared to receive data

To transfer data several tasks must be performed:

3.) the file transfer application on source must confirm file management program at destination is prepared to accept and store file

4.) a format translation function may need to be performed if the formats on systems are different


Functions of Protocol Architecture

- breaks logic into subtask modules which are implemented separately
- modules are arranged in a vertical stack
 - each layer in the stack performs a subset of functions
 - relies on next lower layer for primitive functions
 - changes in one layer should not require changes in other layers

Key Features of a Protocol

A protocol is a set of rules or conventions that allow peer layers to communicate.

The key features of a protocol are:



Syntax	<ul style="list-style-type: none">• format of data blocks
Semantics	<ul style="list-style-type: none">• control information for coordination and error handling
Timing	<ul style="list-style-type: none">• speed matching and sequencing

A Simple Protocol

agents involved:

- applications
- computers
- networks



examples of applications include file transfer and electronic mail

these execute on computers that support multiple simultaneous applications



Communication Layers

- communication tasks are organized into three relatively independent layers:
 - Network access layer
 - concerned with the exchange of data
 - Transport layer
 - provides reliable data transfer
 - Application layer
 - Contains logic to support applications

Network Access Layer

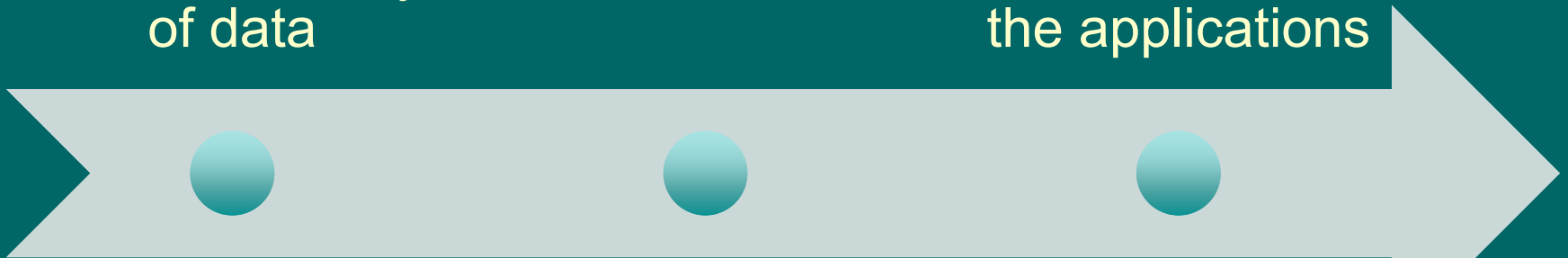
- covers the exchange of data between an end system and the network that it is attached to
- concerned with issues like :
 - destination address provision
 - invoking specific services like priority
 - access to & routing data across a network for two end systems attached to the same network



Transport Layer

concerned with
providing
reliable delivery
of data

essentially
independent of
the nature of
the applications



common layer
shared by all
applications

Application Layer

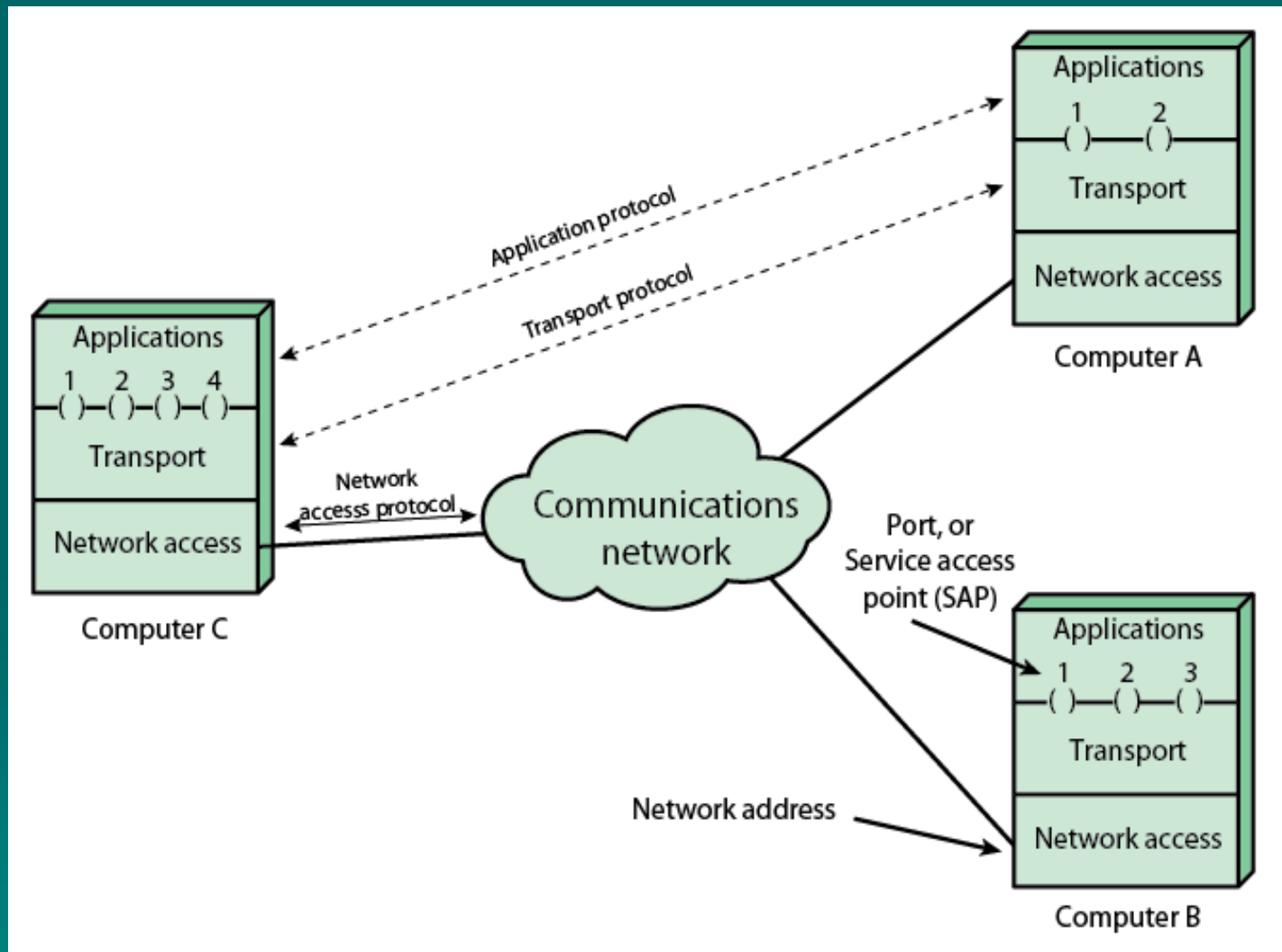


The diagram features two large, light-blue arrows pointing towards each other, meeting at a central point. The left arrow points right and contains the text 'contains the logic needed to support user applications'. The right arrow points left and contains the text 'separate module is needed for each type of application'. The background is a dark teal color with faint, concentric circular patterns at the bottom.

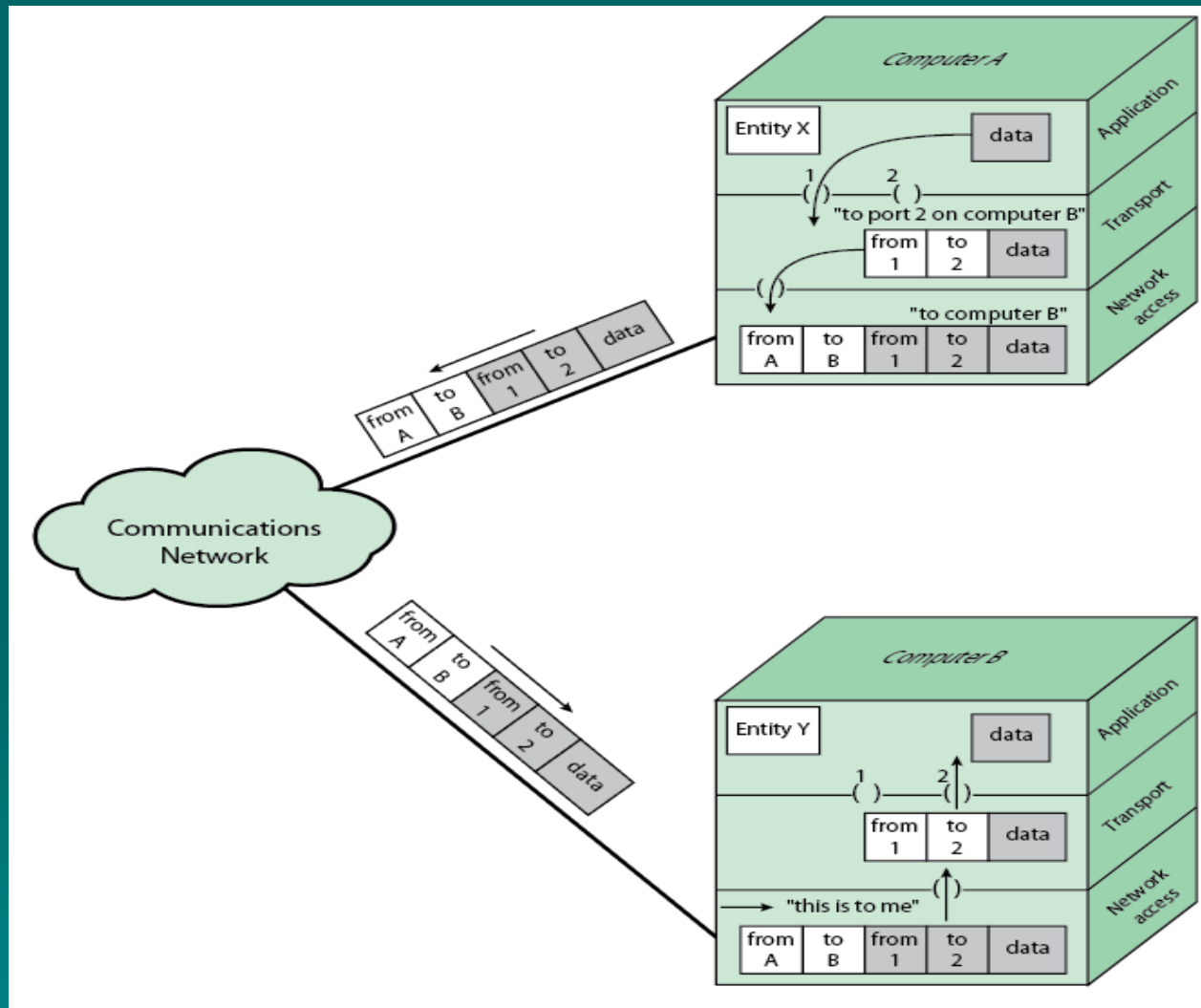
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Protocol Architecture and Networks



Protocols in a Simplified Architecture



Addressing

Two levels of addressing are needed:

each computer on the network has a unique network address

each application has an address that is unique with that computer (SAPs)

Protocol Data Unit (PDU)

- the combination of data and control information is a protocol data unit (PDU)
- typically control information is contained in a PDU header
 - control information is used by the peer transport protocol at computer B
- headers may include:
 - source port, destination port, sequence number, and error-detection code

Network Access Protocol

- after receiving segment from transport layer, the network access protocol must request transmission over the network
 - the network access protocol creates a network access PDU (packet) with control information
- header includes:
 - source computer address
 - destination computer address
 - facilities requests

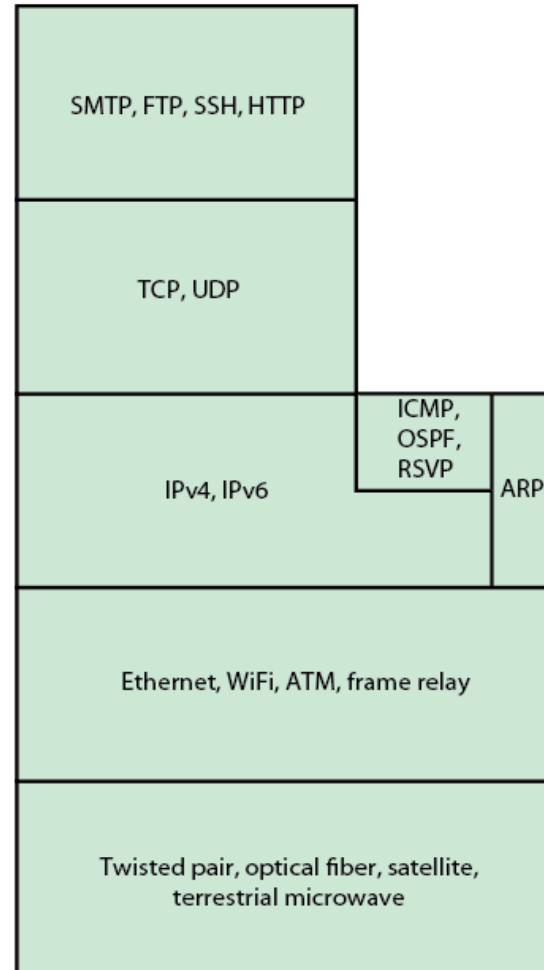
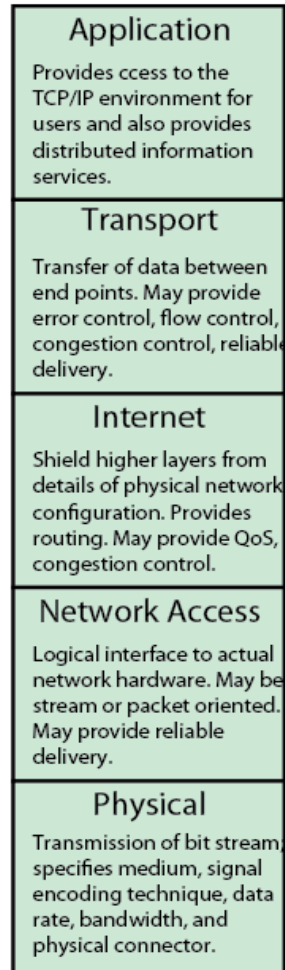
TCP/IP Protocol Architecture

Result of
protocol
research and
development
conducted on
ARPANET

Referred to
as TCP/IP
protocol suite

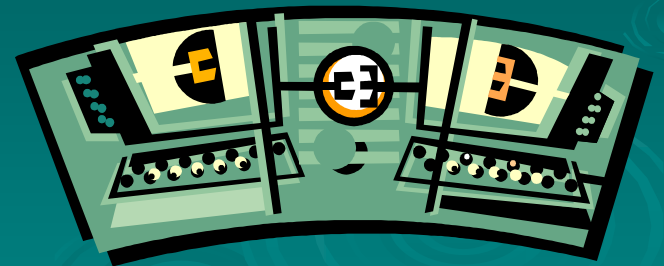
TCP/IP
comprises a
large
collection of
protocols that
are Internet
standards

TCP/IP Layers and Example Protocols



Physical Layer

- covers the physical interface between computer and network
- concerned with issues like:
 - characteristics of transmission medium
 - nature of the signals
 - data rates



Network Access Layer

- covers the exchange of data between an end system and the network that it is attached to
- concerned with issues like :
 - destination address provision
 - invoking specific services like priority
 - access to & routing data across a network for two end systems attached to the same network

Internet Layer

**implements procedures
needed to allow data to
travel across multiple
interconnected networks**

**uses the Internet Protocol
(IP) to provide routing
function**

**implemented in end
systems and routers**