User Datagram Protocol (UDP)

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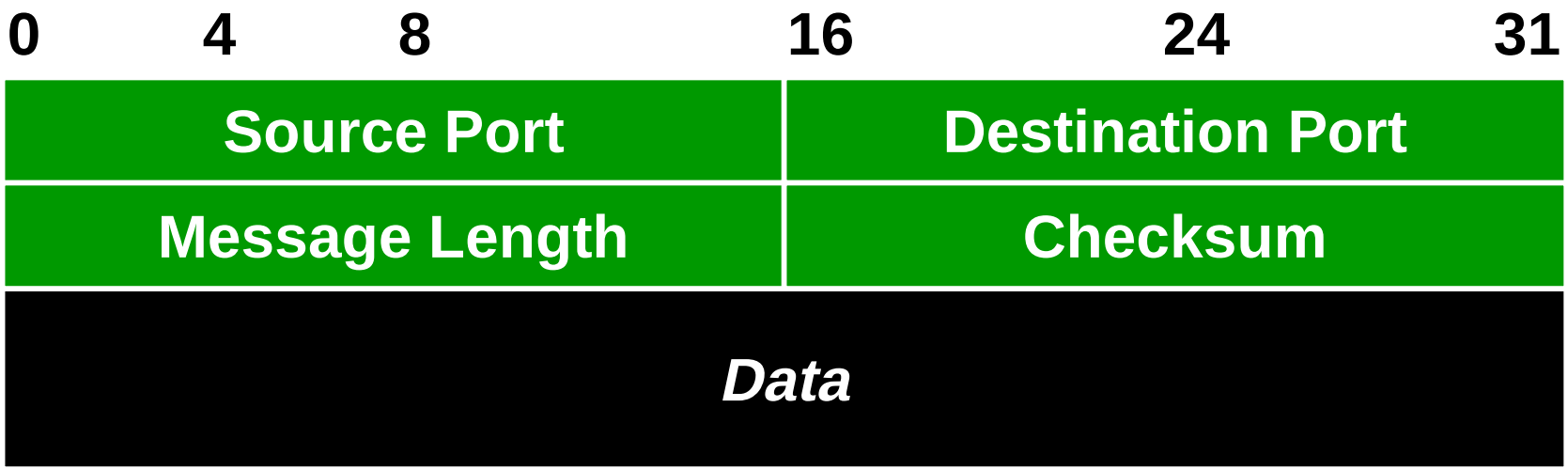
UDP: The User Datagram Protocol

- **UDP is another transport protocol in the TCP/IP suite**
- **UDP provides an unreliable datagram service**
  - **Packets may be lost or delivered out of order**
  - **Users exchange datagrams (not streams)**
  - **Connection-less**
  - **Not buffered -- UDP accepts data and transmits immediately (no buffering before transmission)**
  - **Full duplex -- concurrent transfers can take place in both directions**

UDP Datagram Format



UDP Header Fields

- ***UDP Destination Port*: identifies destination process**
- ***UDP Source Port*: optional -- identifies source process for replies, or zero**
- ***Message Length*: length of datagram in bytes, including header and data**
- ***Checksum*: optional -- 16-bit checksum over header and data, or zero**

UDP Versus TCP (1)

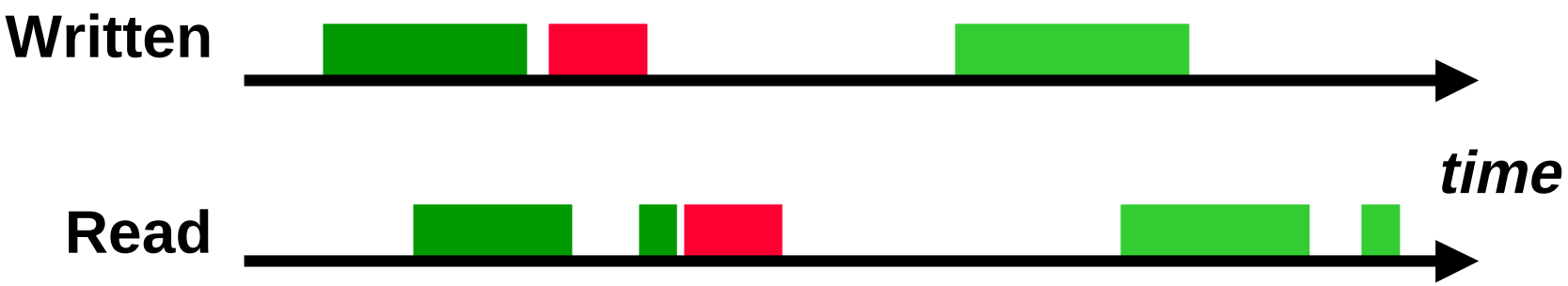
- **Choice of UDP versus TCP is based on:**
  - **Functionality**
  - **Performance**
- **Performance**
  - **TCP's window-based flow control scheme leads to bursty bulk transfers (not rate based)**
  - **TCP's "slow start" algorithm can reduce throughput**
  - **TCP has extra overhead per segment**
  - **UDP can send small, inefficient datagrams**

UDP Versus TCP (2)

- **Reliability**
  - **TCP provides reliable, in-order transfers**
  - **UDP provides unreliable service -- application must accept or deal with**
    - **Packet loss due to overflows and errors**
    - **Out-of-order datagrams**
- **Multicast and broadcast**
  - **Supported only by UDP**
  - **TCP's error control scheme does not lend itself to reliable multicast**
- **Data size**
  - **UDP datagrams limited to IP MTU (64KB)**

UDP Versus TCP (3)

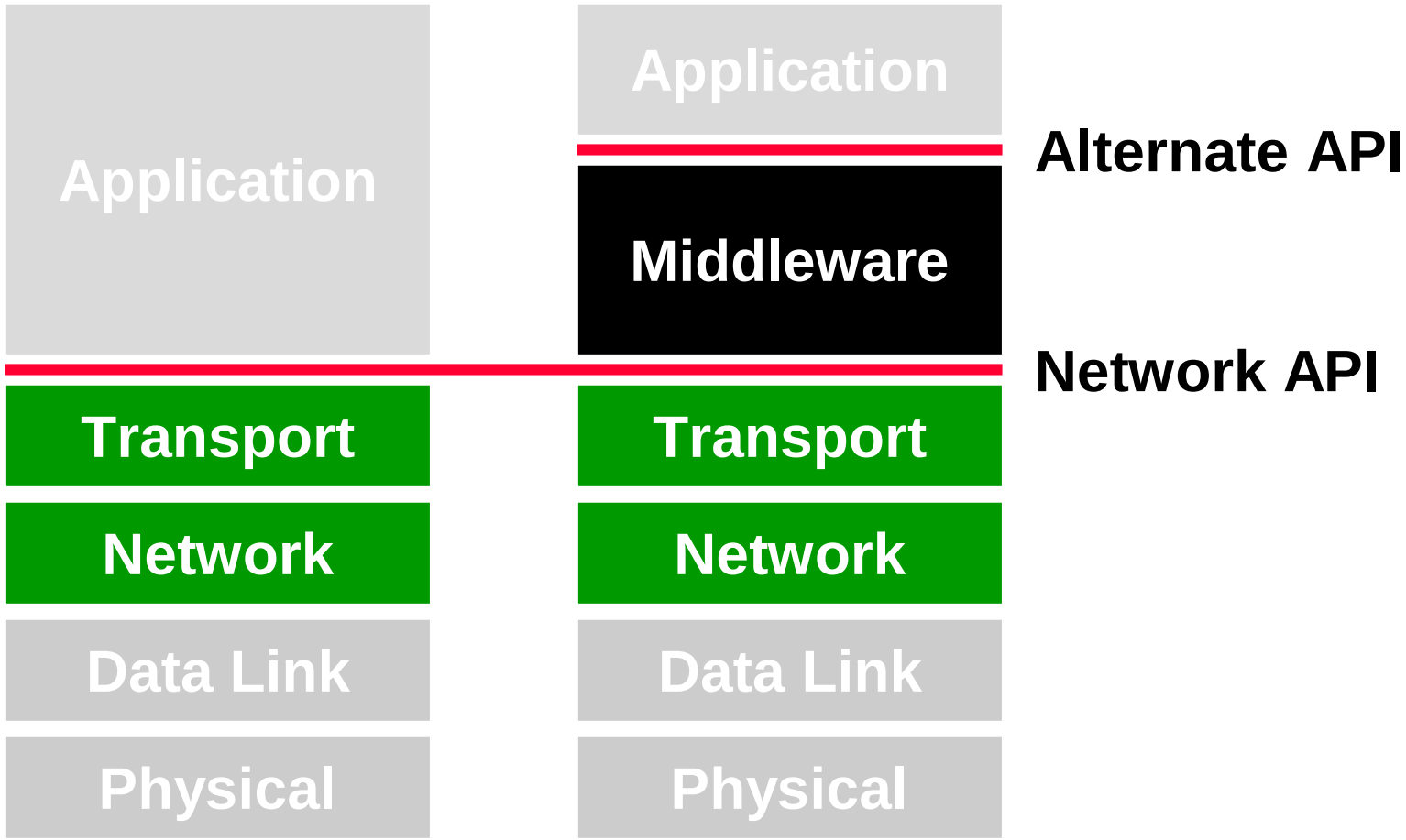
- **Application complexity**
  - **Application-level *framing* can be difficult using TCP because of the Nagle algorithm**
  - **Nagle algorithm controls when TCP segments are sent to use IP datagrams efficiently**
  - **But, data may be received and read by applications in different units than how it was sent**



UDP versus TCP (4)

- **Which is used for ...**
  - **HyperText Transfer Protocol (HTTP)?**
  - **File Transfer Protocol (FTP)?**
  - **Telnet?**
  - **Post Office Protocol (POP)?**
  - **Remote WHO (rwho)?**
  - **MBONE audio/video?**
  - **Real Player?**
  - **Network File System (NFS)?**

“Middleware” Model (1)



“Middleware” Model (2)

- **Higher-level services can be provided for application development by so called “middleware”**
  - **May be built above the operating system (and run on various operating systems)**
  - **May be part of the operating system**
- **Possible functions: messaging, distributed object management, directory services,**
  user-defined data types, composite data types, remote procedure calls (RPC), alternate communication abstractions

You should now be able to ...

- **Distinguish between services, interfaces, and implementations related to protocols**
- **Identify the relationship between the TCP/IP protocol suite and the OSI Reference Model**
- **Identify the functions of the key protocols in the TCP/IP protocol suite**
- **Identify the differences between transport services provided by TCP and UDP**
- **Match application needs to services provided by TCP and UDP**