CPE348: Introduction to Computer Networks

Lecture #19: Chapter 5.4

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Alternatives to TCP

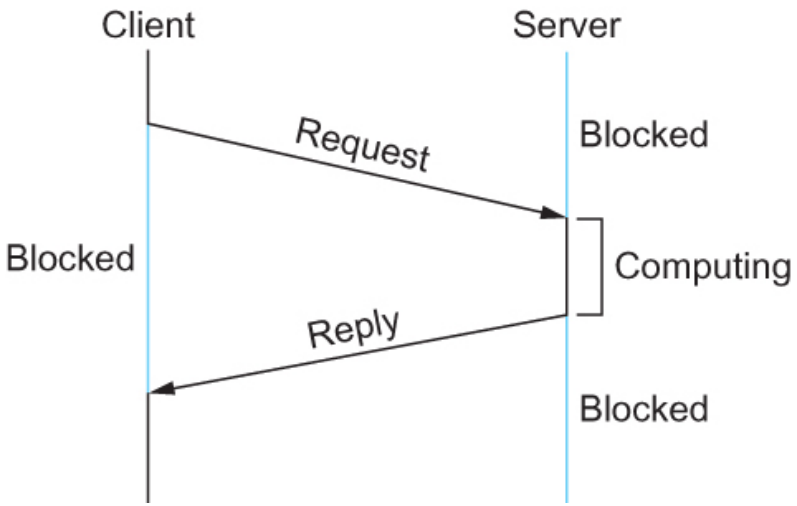
- Two classes of transport protocols
  - Stream (byte) oriented (TCP)
    - Reliable (TCP)
    - Unreliable(UDP)
  - Request/Reply (RPC) – message oriented

TCP Characteristics Review

- TCP has explicit setup and tear down phases
  - Gives the receiver a chance to deny the connection
  - Tear down allows applications to keep a connection open for long periods of time without the need to send “keep alive” messages
- TCP window based protocol
  - Advertised window can be used with the RTT to determine a rate based design if necessary
- A lot more …

Remote Procedure Call (RPC)

- Request/Reply Protocol
- Type of protocol not a standard like TCP
- RPC protocols vary in the functions performed

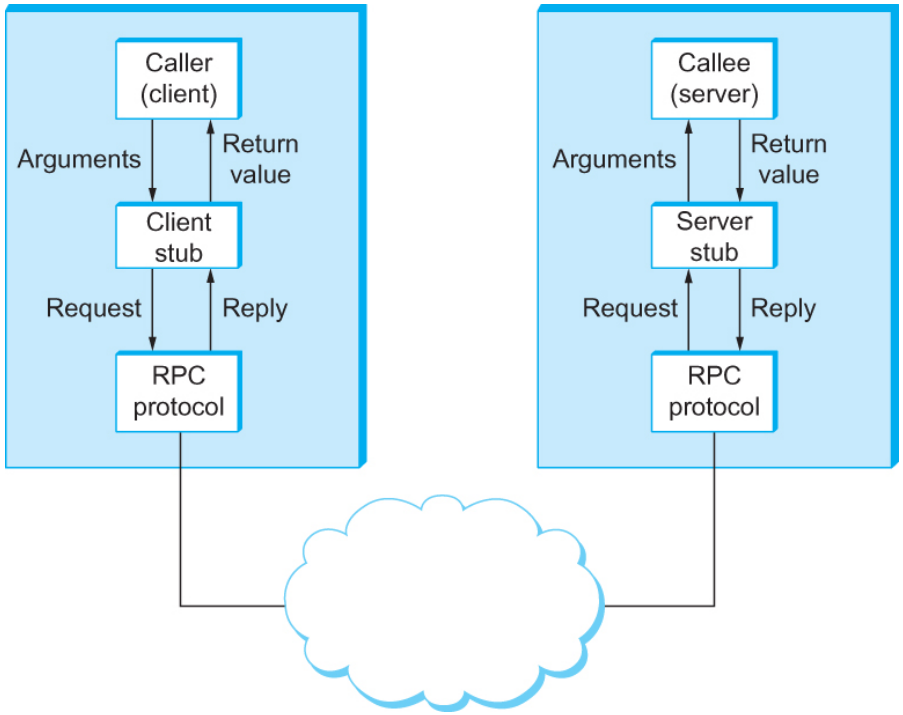


Remote Procedure Call (RPC)

- Applications make a call for a procedure
  - Procedure may be local or
  - Procedure may be remote
- Remote procedure calls are more complicated than local procedure calls
  - Network has more complex properties than a local computer
  - Computers involved may be of different architecture and data representations

Remote Procedure Call (RPC)

- Two major components
  - A protocol for handling messages send/receive – deals with network issues
  - Programming and compiler support

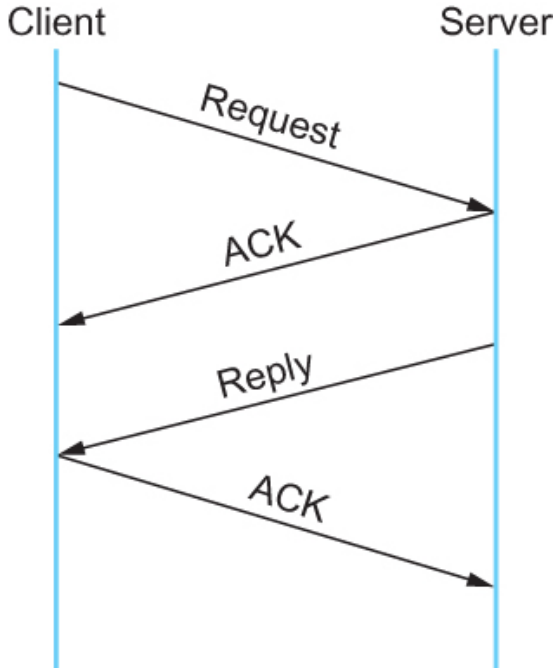


Remote Procedure Call (RPC)

- Two functions performed by any RPC protocol
  - Provide a name space to uniquely identify the procedure
    - Hierarchical approach naming structure;
    - Unique name.
  - Match each reply message to the request message
    - A message ID: Request and Reply IDs are the same;
    - Calling is blocked until a reply is received.

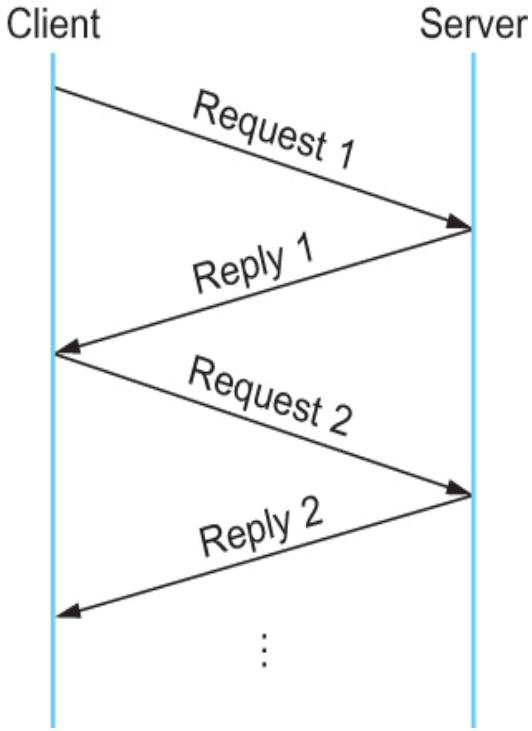
RPC – Optional Design

- RPC protocols perform additional functions
  - Provide reliable message delivery
    - Use ACKs and timeouts
    - Server ACKs the request
    - Client ACKs the reply
  - Support large packets through fragmentation and reassembly



RPC – Optional Design

- Implicit Acknowledgement
  - Caller receives a reply – this ACKs that the server received the request
  - Server receives the next request indicates that the client received the reply

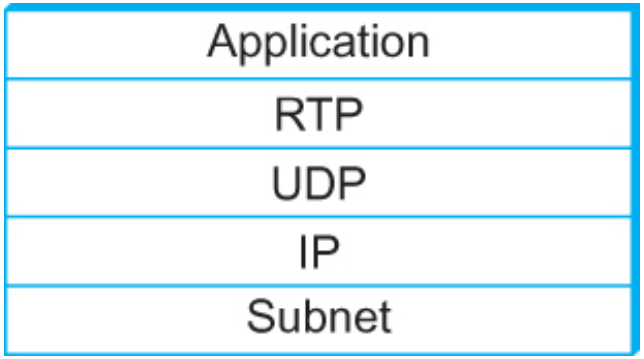


Transport for Real-Time Applications (RTP)

- Real Time applications
  - VoIP – human to human interaction
  - Multimedia – involves video, audio and data
    - Interactive applications – telephony, conferencing
    - Streaming applications – YouTube – lack human to human interaction – not as stringent as interactive applications
- Real time transport protocol concerns
  - Not too much reliability but continuity!

Transport for Real-Time Applications (RTP)

- Real Time Transport Protocol (RTP) can run over many lower-layer protocols
- RTP and UDP are both transport layer protocols
- RTP uses UDP to handle the demultiplexing (ports) of information



Protocol stack for RTP

Transport for Real-Time Applications (RTP)

- Requirements
  - Synchronization of audio and video streams
  - Indication of packet loss –
    - Application needs to deal with missing packets
    - Application needs to know that packets are missing
    - Packet loss is indication of congestion – receiver needs to convey this information to the sender
  - Frame boundary indication – different for different applications
  - A more user-friendly identifier of senders – instead of ip address, use user@domain.com

Transport for Real-Time Applications (RTP)

- Requirements, cont'
  - Make reasonably efficient use of bandwidth
    - Don't want a long header
    - Reduce number of extra bits required
    - For voice, packets are short and long headers reduce the capacity for useful data

Transport for Real-Time Applications (RTP)

- RTP Design uses a pair of protocols
  - RTP
  - RTCP – Real-Time Transport Control Protocol
    - Used for passing control information about the data stream
- RTP and RTCP use consecutive port numbers
- RTCP provides three main functions
    - Feedback on the condition of the app. and the network
    - A way to synchronize different media streams
    - A way to provide the ID of the sender for display

Summary

- Discussed how to convert host-to-host packet delivery service to process-to-process communication channel.
  - We have discussed UDP
  - We have discussed TCP
  - We have discussed TCP congestion control/avoidance
- Transport layer protocol alternatives: Remote Procedure Call (RPC) and Real-time Transport Protocol (RTP)