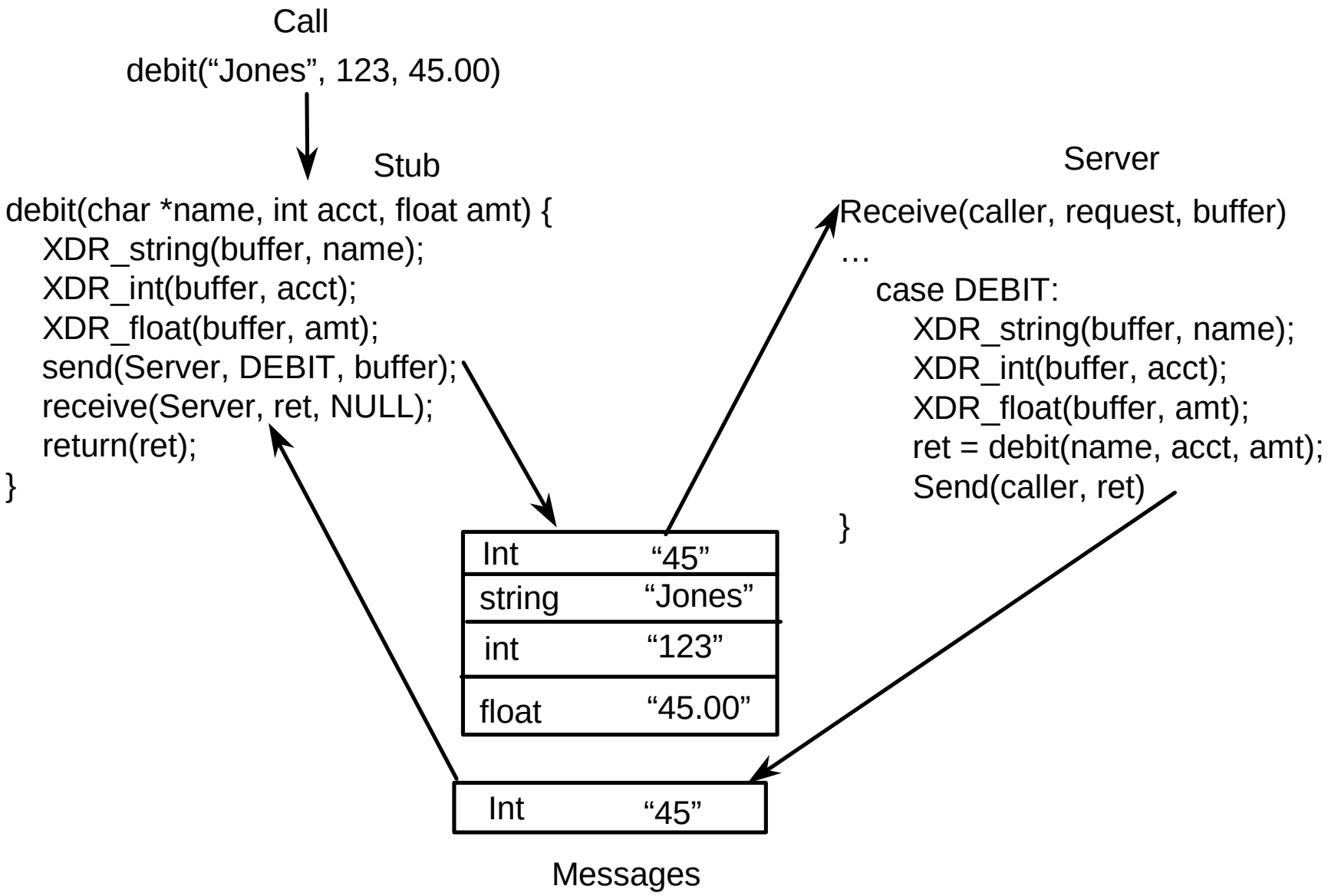
Announcements

- Reading Chapter 17 (skip 17.6.1 and 17.6.4)
  - problems: 17.1, 17.3, 17.4
- Last day for Midterm #2 re-grades is Thursday

Remote Procedure Calls

- Provide a way to access remotes services
- Look like “normal” procedure calls
- Issues:
  - binding functions to services
    - can use static binding (like kernel trap #’s)
    - can use a nameserver
  - data format
    - different machine may have different formats
    - translation is called *marshalling*
      - pick a common way to encode info (e.g. XDR)
      - always send in this common format
  - failures
    - what if a host dies while and RPC is active?

RPC Example



RPC Generators

- Given a list of functions to make into RPC
- Generate the code for:
  - RPC stubs (for clients to call)
    - marshalling code for each parameter
    - utility routines to marshal structures/records
    - code to send messages and wait for responces
  - Server code
    - case statement for each RPC type
    - un-marshal parameters
    - call local routine
  - detecting errors
  - checking version numbers between client/server

Failures

- Fail Stop
  - system either produces the correct answer or no answer
  - hard to know “what” failed
    - local network card
    - network link
    - remote network card
    - remote system
    - remote software
- Byzantine Failure
  - systems can “lie” and produce wrong answers
    - a message shows up but some of the data is wrong
  - can use check sums to detect this failure mode
    - does not deal with malicious failure
  - considered a “hard” problem

Distributed Filesystems

- Provide the same semantics as a local filesystem
  - data is stored at various locations in the system
    - often stored in central fileservers
    - can be stored in serverless fileservers
- Naming
  - location transparency
    - filenames don't imply information about location
  - location independence
    - can move the file without changing names
  - naming files
    - host:local-name
      - not transparent
    - global-name
      - transparent, requires something to coordinate names

DFS Performance Issues

- "normal" filesystem issues
  - disk parameters: seeks time, rotational latency
  - filesystem time: directory structure, fat/inodes
- distributed system issues
  - network:
    - latency (time for small requests)
    - bandwidth (time to move entire disk blocks)
  - coordination
    - time to access servers
      - namespace server
      - fileserver

Caching

- To improve performance, cache DFS information
  - goal: improve response times for overall DFS
- Local Cache
  - memory cache
    - data is stored in memory of local system
  - disk cache
    - data is stored on the disk of the local system
- Server Cache
  - memory
    - can put lots of memory here so most “popular” files are in memory

Caching (cont)

- Need to maintain consistency
  - Client initiated caching
    - client contacts the server “Is this still OK?”
  - Server initiated caching
    - server calls back to the client “dispose of those stale bits”
- What happens on write?
  - write-though caching
    - slow for writes
  - delayed writes
    - faster for writes
    - what happens when a failure occurs?