IMPLEMENTING REMOTE PROCEDURE CALLS

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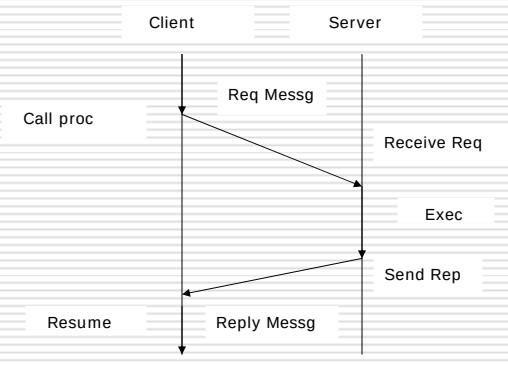
Outline

- Introduction
- RPC Binding
- Grapevine
- Simple Call, Complicated Call
- Light weight RPC
- Sun RPC

Introduction

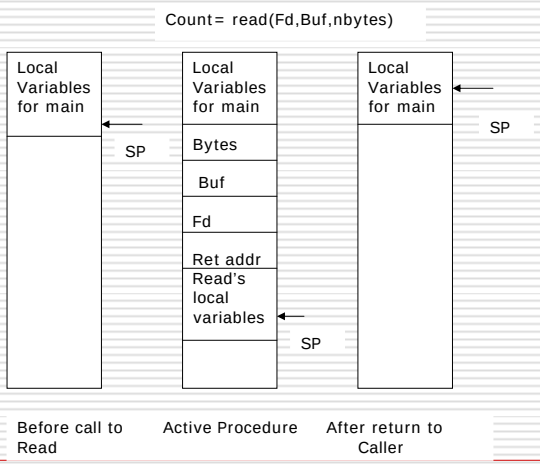
- Transfer of control and data across a communication network
- Special case of Interprocess Communication
- Issues facing implementation --- Semantics of call, addressing the callee, integration to current system, protocols for transfer, integrity and security of data

RPC Model



TYPICAL MODEL OF RPC

Example-Interprocess Communication



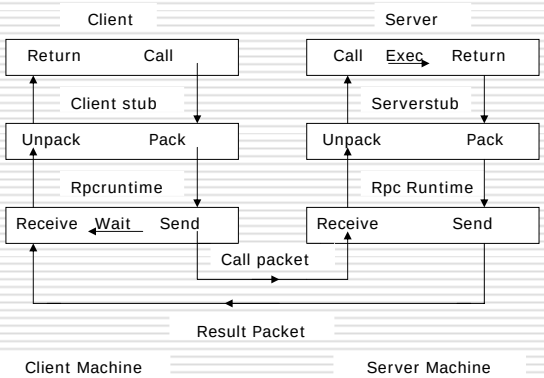
Issues

- Indistinguishable local call and remote procedure calls
- Syntactic and Semantic Transparency
- Determining the location and identity of the callee

Components

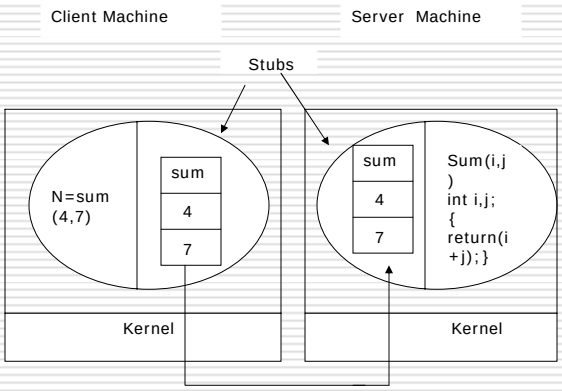
- User
- User stub
- RPC Runtime
- Server
- Server stub

Implementation



RPC IMPLEMENTATION

Parameter Passing



Computing sum(4,7) remotely;

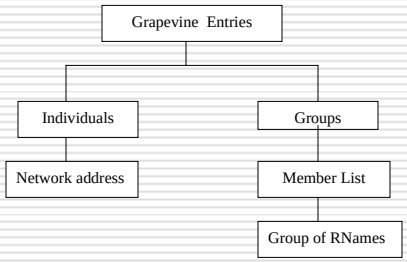
Client – Server Binding

- Interface – Type , Instance
- The interface and the services offered
- Created by user
- Locate a server- Broadcasting
- Binding agent

Grapevine

- Provides message delivery, access control and resource location
- Multiple computers communicating via the internet
- Maintains registration database- info about the users, services, machines etc
- Entry -> RName
- Replicated data

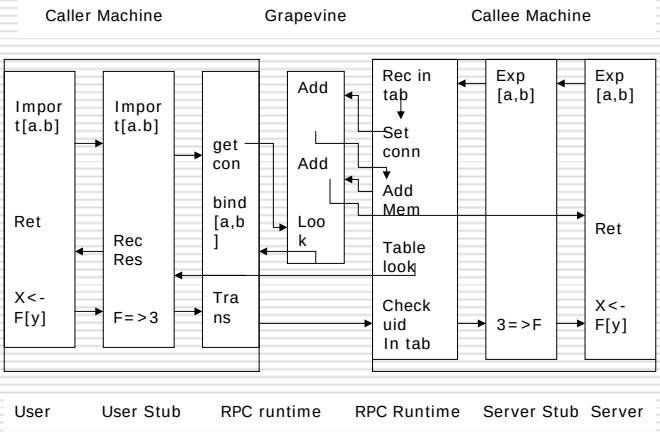
Grapevine Structure



Environment

- Cedar programming environment
- 24-bit virtual address,80 megabyte hard disk
- Uniform access across the network
- Local Ethernet
- Powerful, convenient for building programs

Event Sequence



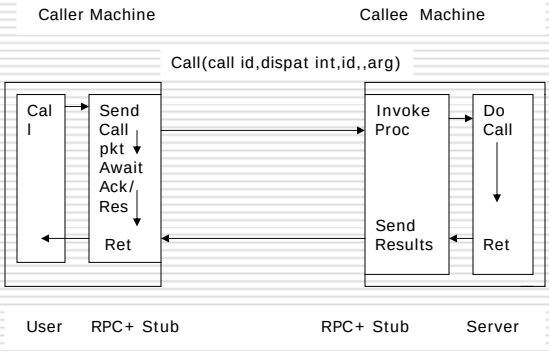
SEQUENCE OF EVENTS IN BINDING AND A SUBSEQUENT CALL

Simple Calls

- Call packet --Call identifier, data for the procedure along with the arguments
- Call identifier – Eliminates duplicate transfers
- Components of the call identifier–(machine relative identifier, sequence number) activity
- No initiation of new call until the result is obtained
- Result packet-Result and the same call identifier sent earlier

Simple Calls – Cont'd

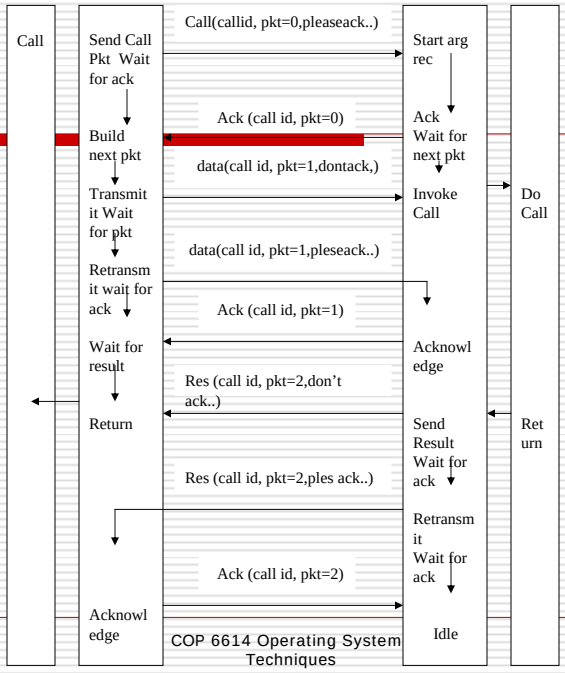
- Callee machine – table of sequence numbers



PACKETS TRANSMMITTED IN A SIMPLE CALL

Complicated Calls

- Problems faced – packet loss, long waits
- Caller sends probe packets – should be acknowledged
- Notifies the crash, failure of server, exceptions etc
- Large arguments- sent in multiple packets, last packet requires acknowledgement



Processes

- Stack-Idle server processes
- No extra process creation
- Reverts to idle state when completed
- Packets – Process identifier
- Four process swaps

Exception Handling

- Called signals
- Checks for catch phrase
- If terminated by jump, caller is notified
- Procedure activations are unwound
- Security-→End to end data encryption
- Grapevine used as authentication service

Operating Systems

- Monolithic kernel OS - Large kernel separated from user programs
- Microkernel-Small kernel with primitive operations for user level servers
- Microkernel-Programmed separately with own address space which forms a domain
- Simple, flexible

Lightweight RPC

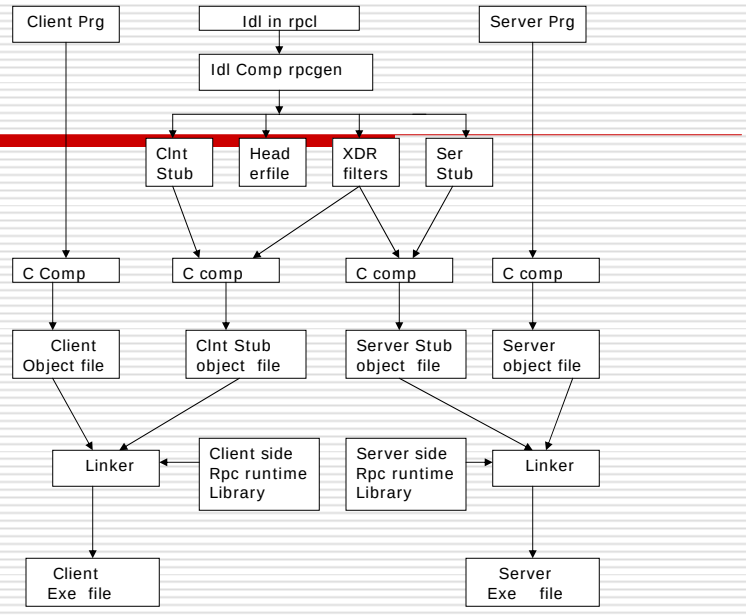
- Cross domain communication-Between domains on same machine
- Cross machine- Domains in different machines
- Lightweight – Uses optimized cross domain
- Uses special threads scheduling mechanism, hands off scheduling
- Client -> server (arg, thread)
- Server ->validates and creates a call
- Dispatches thread ,starts server

Lightweight RPC

- Fewer copies of data
- Common stack is used and accessible to both the client and server
- All procedures have a call stub in client's domain and entry stub in server's domain
- Uses shared data structures, caching the domains to idle processes
- Higher performance

Sun RPC

- Developed by Sun Microsystems
- UNIX RPC
- Interface Definition->Program number, version number, procedures, i/o parameters
- IDL complier -> rpcgen
- RPC accepts one arg and produces one result
- Local binding agent-portmapper
- Handles exceptions



RPC CREATION IN SUN RPC

Conclusions

- RPC makes distributed computing easy and efficient
- Similar to the local calls
- Reduced cost
- Better Performance

References

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