#01 Client/Server Computing

240-311 DISTRIBUTED COMPUTERS AND WEB TECHNOLOGIES (3-0-6)

Distinct characteristics of C/S

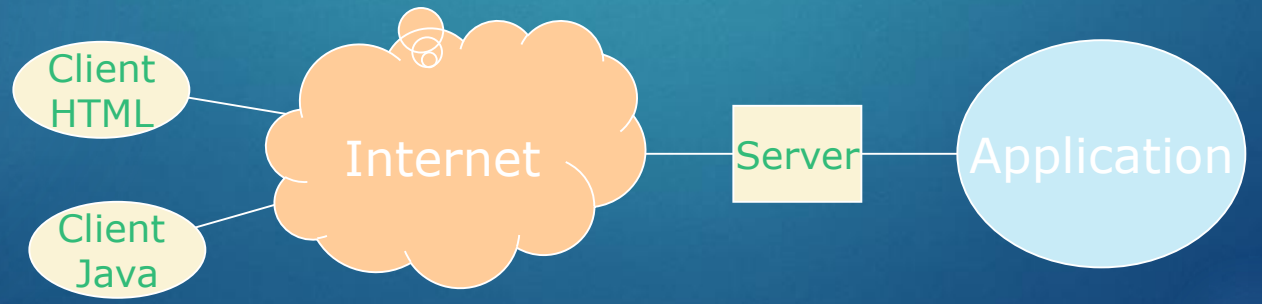
- Client-server is a computing architecture which separates a client from a server
- It is almost always implemented over a computer network
- The most basic type of client-server architecture employs only two types of nodes: clients and servers.
  - This type of architecture is sometimes referred to as *two-tier*.
  - It allows devices to share files and resources.
- Server provides the service
- Client is considered as the customer requesting the service

Distinct characteristics of C/S

- The server service can be shared among a number of clients
- Clients must request or initiate the service
- The location of the server in the network is transparent to clients
- Transaction between C/S is message-passing based
- C/S architecture is scalable
  - horizontally (more clients can added)
  - Vertically (more servers can be added)
- The server is centrally maintained where as clients are independent of each other

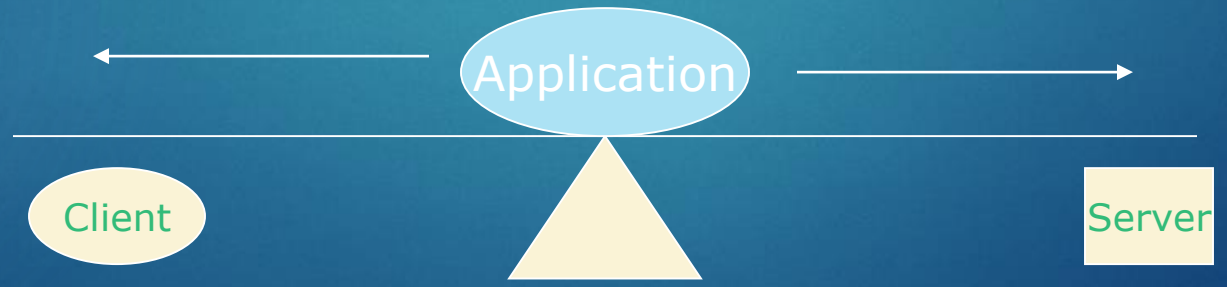
Systems with C/S Architecture

- **File servers**
  - File sharing and file processing
- **Database servers**
  - Passing file results
  - Example: Query in *DBMS server*
  - Typically one single request/reply
- **Transaction servers**
  - Transaction server includes DBMS and transaction monitoring
  - Server has remote procedures run online by the client
- **Web servers**
  - Super-fat servers and thin clients
  - Uses HTTP protocol



Client/Server Models

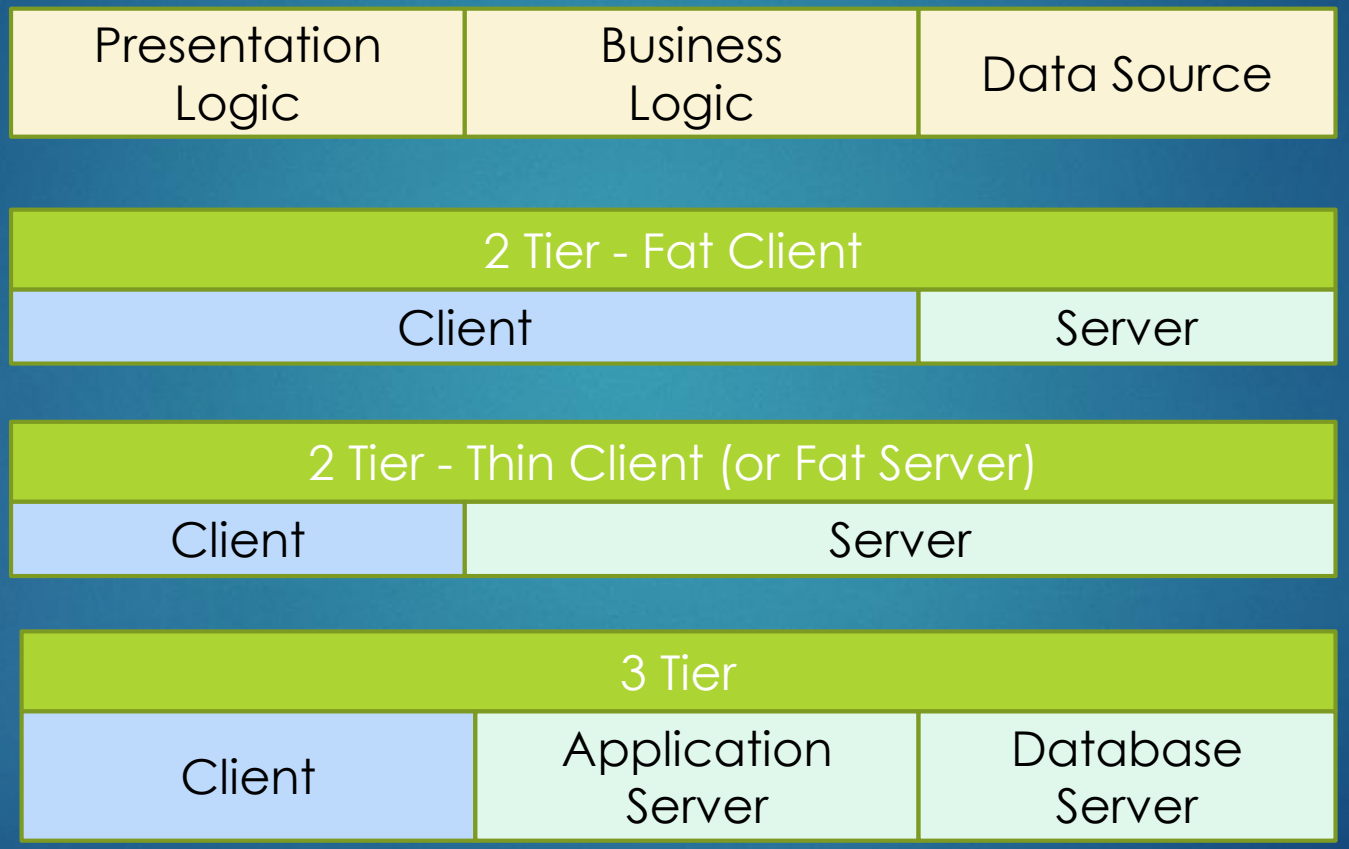
- Where to push the application to
- Fat clients
  - The bulk of the application is running on the client
  - The client knows how the data is organized and where it is
  - Different clients access the same applications different ways
- Fat servers
  - The server more complicated
  - The clients are less complex
  - More of the code runs on the server
  - The network interaction is minimized



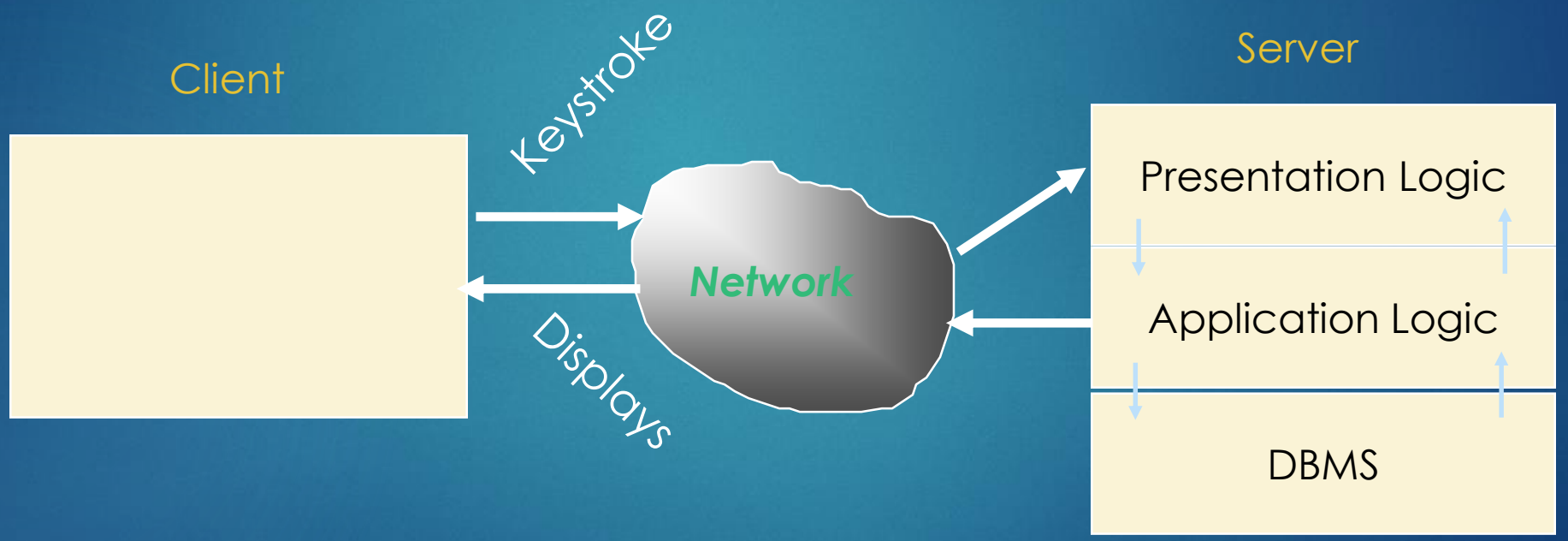
Two-Tier vs. Three-Tier

- Same basic idea as fat-client versus fat-server
- Depends on how the application is divided between the server and the client
- Two-tier servers
  - Examples: file servers and database server
  - In this case the process (application logic) is buried within the client or server (or both)
- Three-tier servers
  - Examples: Web and distributed objects
  - In this case the process is run on the middle-tier – separated from the user and data interface
  - They can integrate the data from multiple sources
  - More robust and more scalable

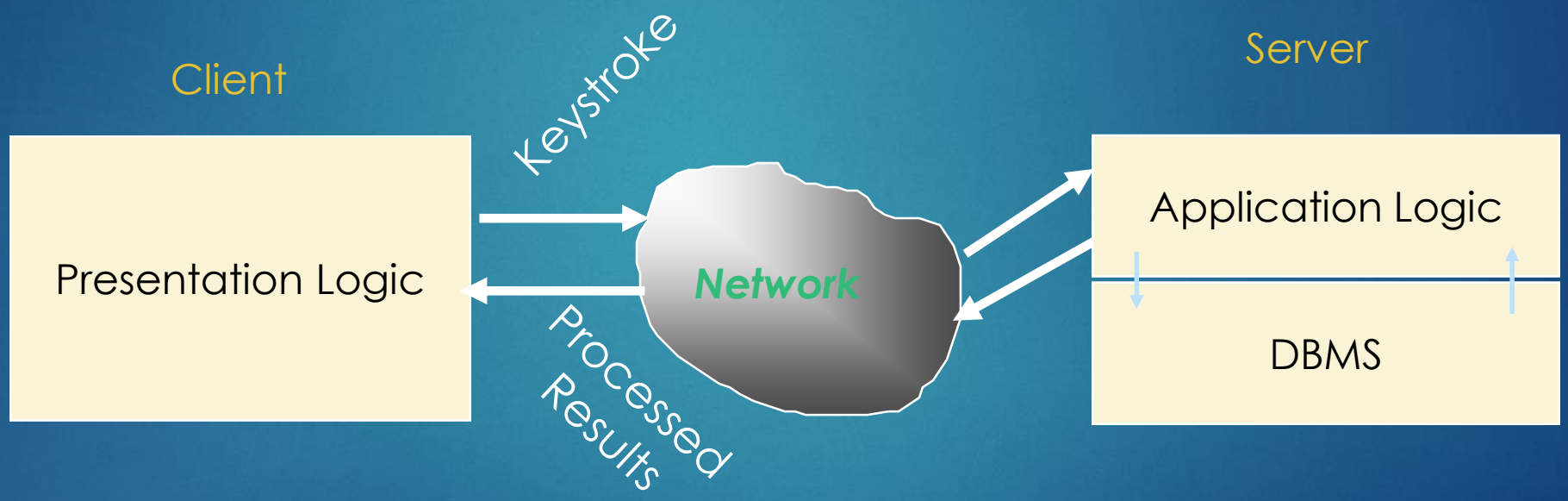
Tier Architecture



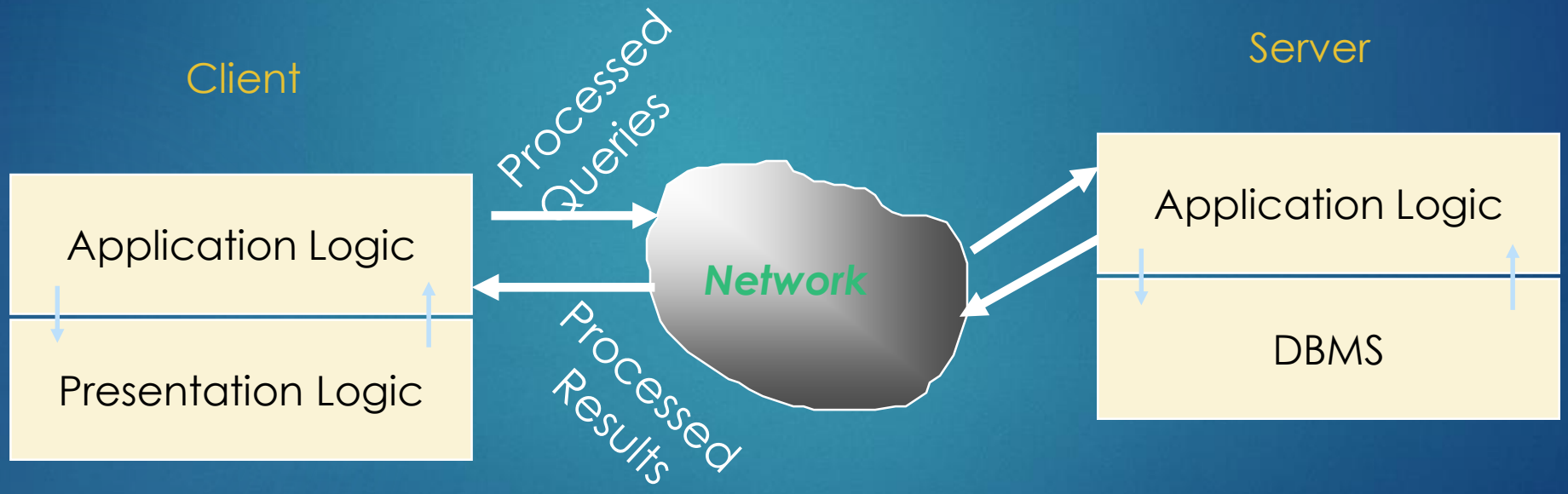
Client (dumb) - Server Model



True Client-Server Model



Distributed Client-Server Model



Client/Server Computing

- Logical extension of modular programming
  - with assumption that separation of a huge program into modules can create
    - the possibility for further modification
    - easier development
    - better maintainability.
- All large modules need not all be executed within the same memory space.
  - the calling module becomes the client(requesting service)
  - the called module becomes the server (providing service).

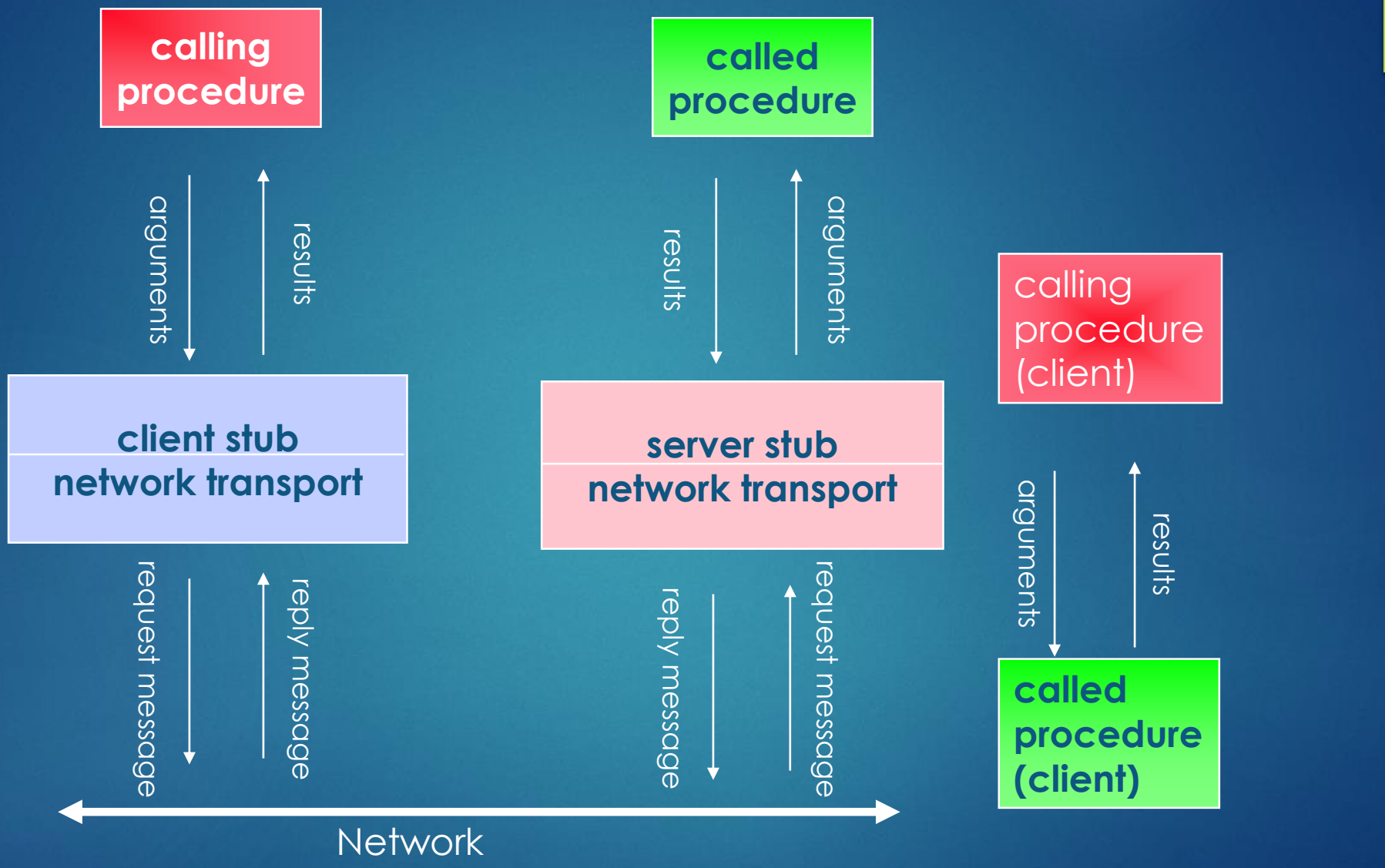
Client/Server Computing

- Clients and Servers are running separately on appropriate hardware and software platforms for their functions.
  - For example, database management system servers running on platforms specially designed and configured to perform queries, or file servers running on platforms with special elements for managing files.
- Components in Client-Server Computing
  - Client
  - Server
  - Middleware

In client-server computing major focus is on SOFTWARE

Middleware Software

- It is the (/) between client and server which glues them together
  - Allowing the client request for a service and the server providing it
- Middleware can also be between server/server
- Two broad classes
  - General
    - LAN servers, TCP/IP, Communication stacks, Queuing services, etc.
  - Application specific
    - Used to accomplish a specific task
    - Groupware specific: SMTP
    - Internet specific: HTTP
    - Database specific: SQL



Remote Procedure Call

Local Procedure Call

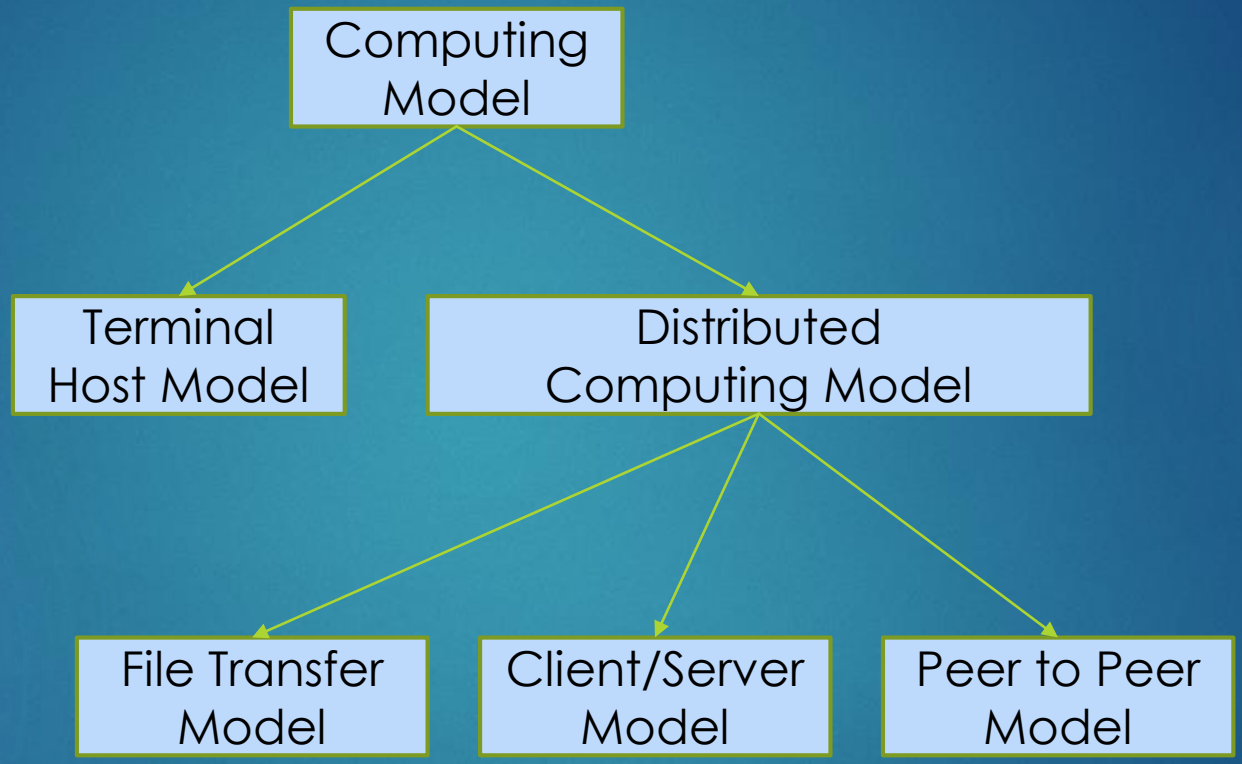
Six types of middleware

1. Asynchronous Remote Procedure Calls (RPC)
   - client makes calls to procedures running on remote computers but does not wait for a response
   - If connection is lost, client must re-establish the connection and send request again.
   - High scalability but low recovery, largely replaced by type 2
2. Synchronous RPC
   - distributed program may call services on different computers
   - makes it possible to achieve this without detailed coding (e.g. RMI in Java)
3. Publish/Subscribe (often called push technology)
   - server monitors activity and sends information to client when available.
   - It is asynchronous, the clients (subscribers) perform other activities between notifications from the server.
   - Useful for monitoring situations where actions need to be taken when particular events occur.

Six types of middleware

4. Message-Oriented Middleware (MOM)
   - asynchronous – sends messages that are collected and stored until they are acted upon, while the client continues with other processing.
5. Object Request Broker (ORB)
   - object-oriented management of communications between clients and servers.
   - ORB tracks the location of each object and routes requests to each object.
6. SQL-oriented Data Access
   - middleware between applications and database servers.
   - Has the capability to translate generic SQL into the SQL specific to the database

Computing Model



References

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- Rajkumar Buyya, "Client/Server Computing (the wave of the future)"
- Albert Yau, "Client Server Computing", http://www.doc.ic.ac.uk/~nd/surprise_95/journal/vol1/wcy/article1.html