Chapter II

Through Maya Mnaizel

Architectural styles

A style is expressed as replaceable components with well-defined interfaces, connectors, exchanged data between components, and configuration.

Connector

A mechanism is a system or method that enables or makes easier the exchange of information, the organization of activities, or the collaboration between different parts or individuals that are involved in a particular process or task.

Example: facilities for remote procedure calls, messaging, or streaming

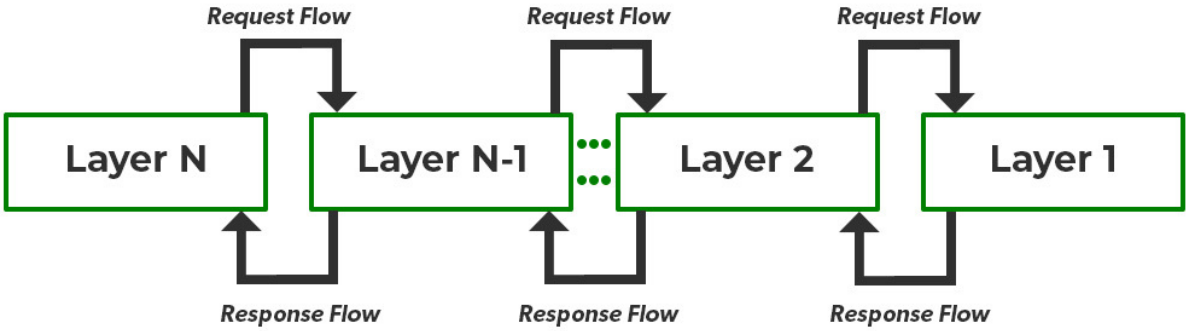
First architectural style:

Layered architecture

In a layered architecture, different components are organized in layers.

Each layer communicates with its adjacent layer by sending requests and getting responses

The Layered architecture separates components into units



Application Layering

Traditional three-layered view

- Application interface later
- Processing layer
- Data layer

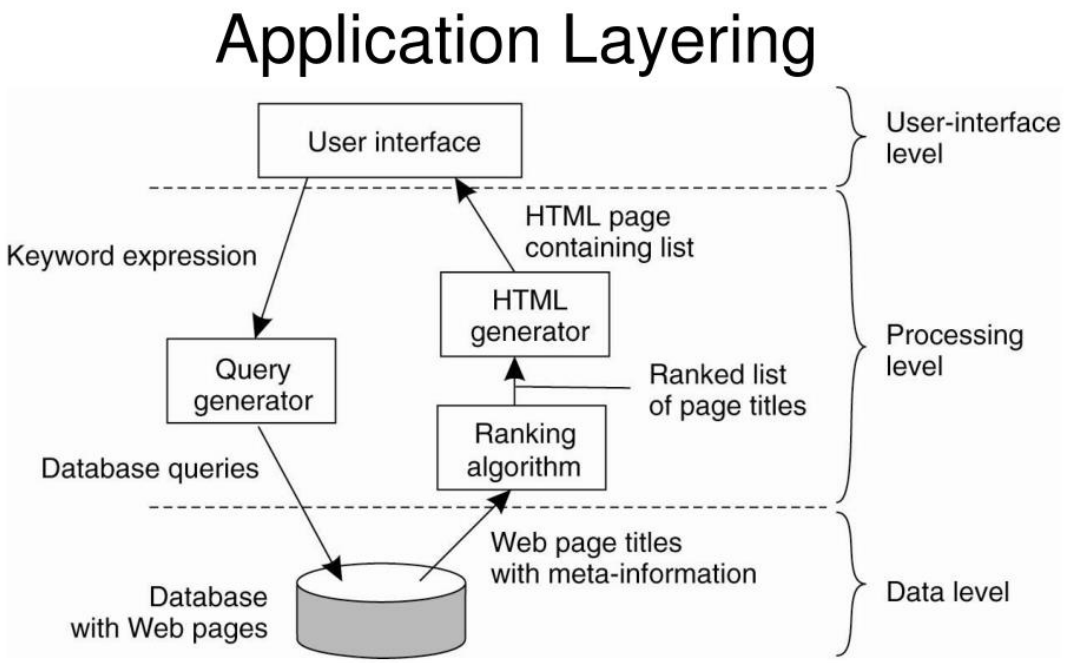


Figure 2-4. The simplified organization of an Internet search engine into three different layers.

Found in most information systems using traditional database technology, a simple search engine

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Object-Based architecture

Based on loosely coupled arrangement of objects

- Components are objects, connected through a procedure call

https://th.bing.com/th/id/OIP.BRO7jZ8edrabmJF8Wpih9wAAAA?rs=1&pid=ImgDetMain

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RESTful architecture

A software architectural style that defines the set of rules to be used for creating web service. Web services that follow the REST architectural style are known as RESTful web services. It allows requesting systems to access and manipulate web resources by using a uniform and predefined set of rules

Basic Operations

Operation	Description
PUT	Create a new resource
GET	retrieve the state of a resource
DELETE	delete a resource
POST	modify a resource by transferring a new state

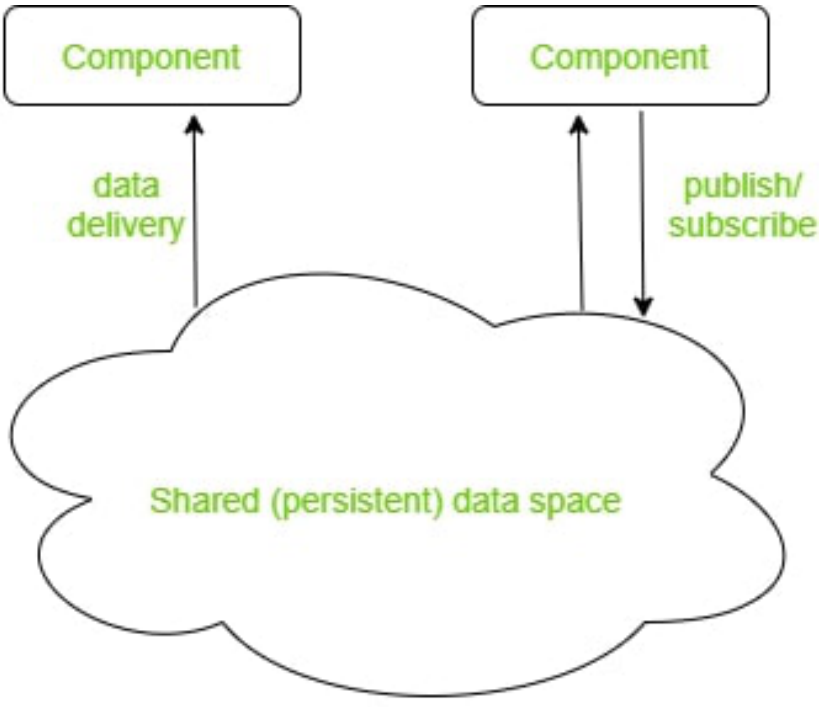
Data Center architecture (Data space)

A common data space is present at the center

It contains all the required data in one place a shared data space.

All components are connected to this data space and they follow the publish/subscribe model of communication

The central data repository at the center



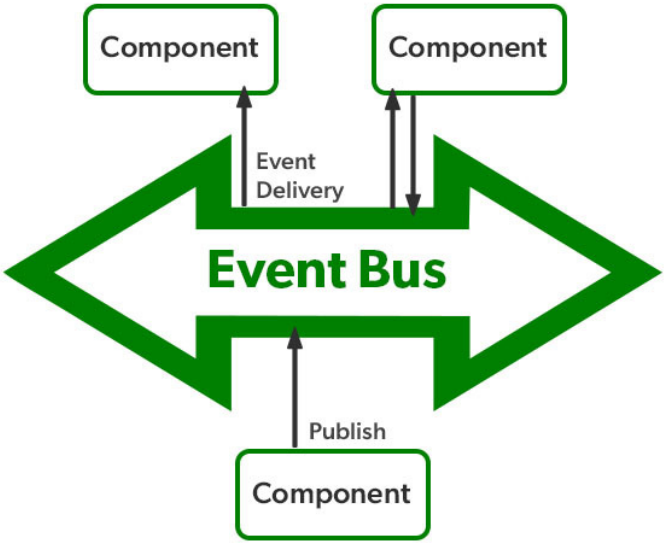
Event-based architecture

Almost similar to Data Centered Architecture the difference is these architectural events are present instead of data

Events are present at the center in the Event bus and delivered to the required component whenever needed

In this architecture, the entire communication is done through events

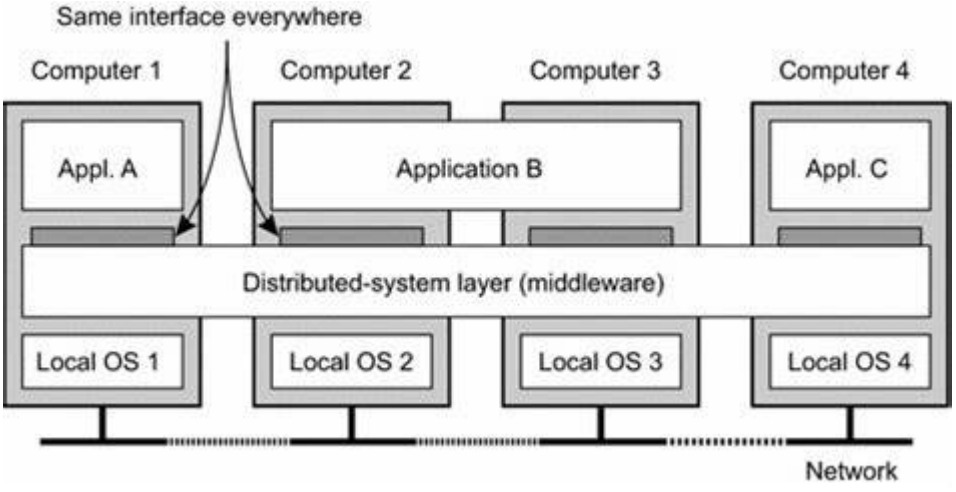
When an event occurs, the system, as well as the receiver, gets notified



Middleware

Distributed systems can achieve uniformity through a common layer to support the underlying hardware and operating systems, which is known as middleware

It provides services beyond what is already provided by OS, enhancing functionality



Using legacy to build middleware

Problem:

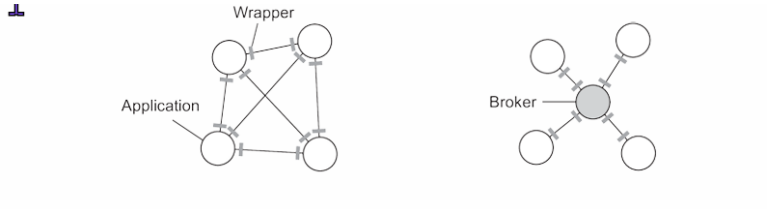
The interfaces provided by a legacy component may not be suitable for all applications.

Solution

A ***wrapper*** or ***adapter*** transforms the functions of a component into an interface that can be used by a client application.

two types of wrappers

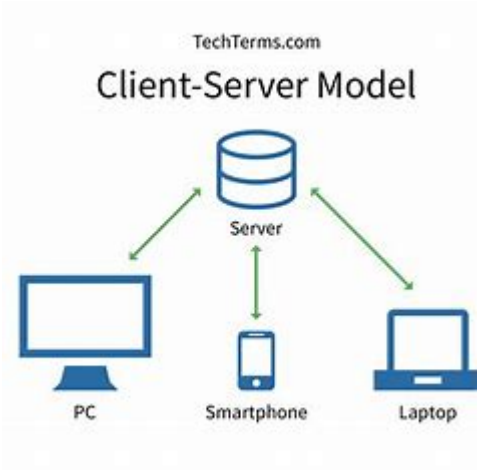
- 1-on-1
- Broker

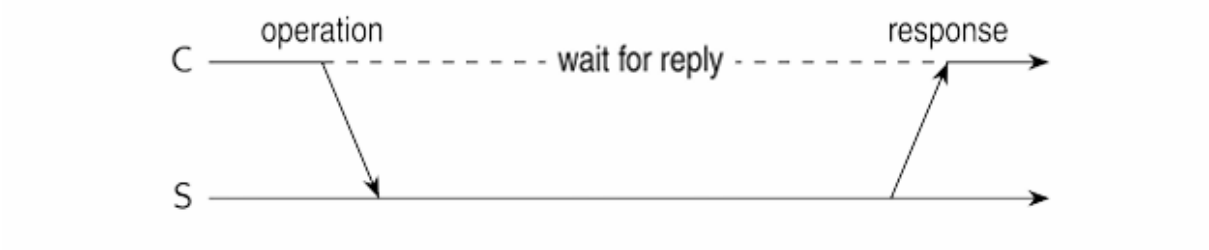


Centralized Systems

- Consists of a single-machine
- all calculations are done by a particular computer
- Its performance is low as the workload is not divided

Basic Client-Server Model

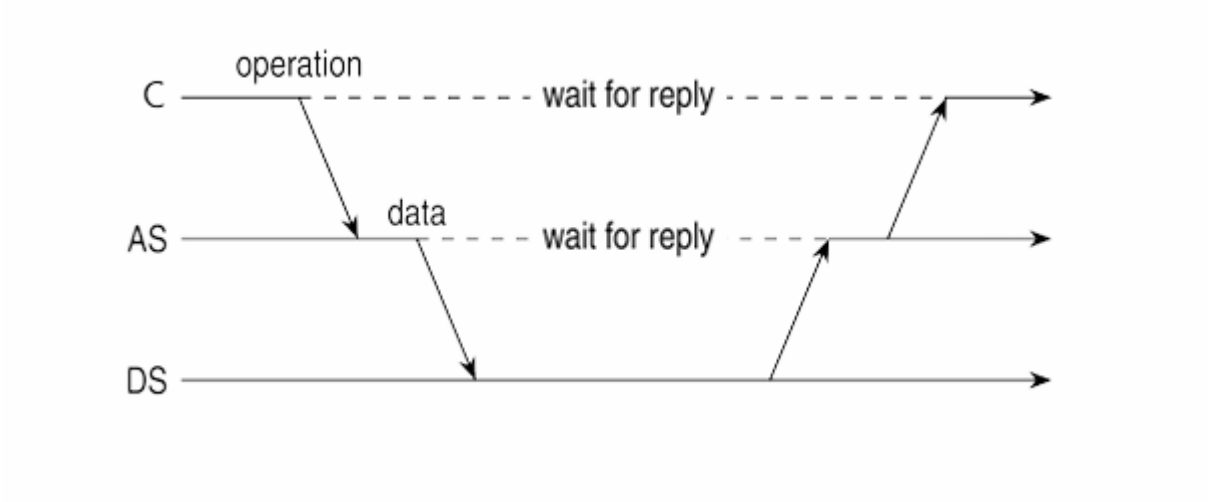




Multi-tiered Centralized Systems

- Single-tiered → dumb terminal
- Two-tiered → client/server configuration
- Three-tiered → each layer on a separate machine

Three-tier architecture



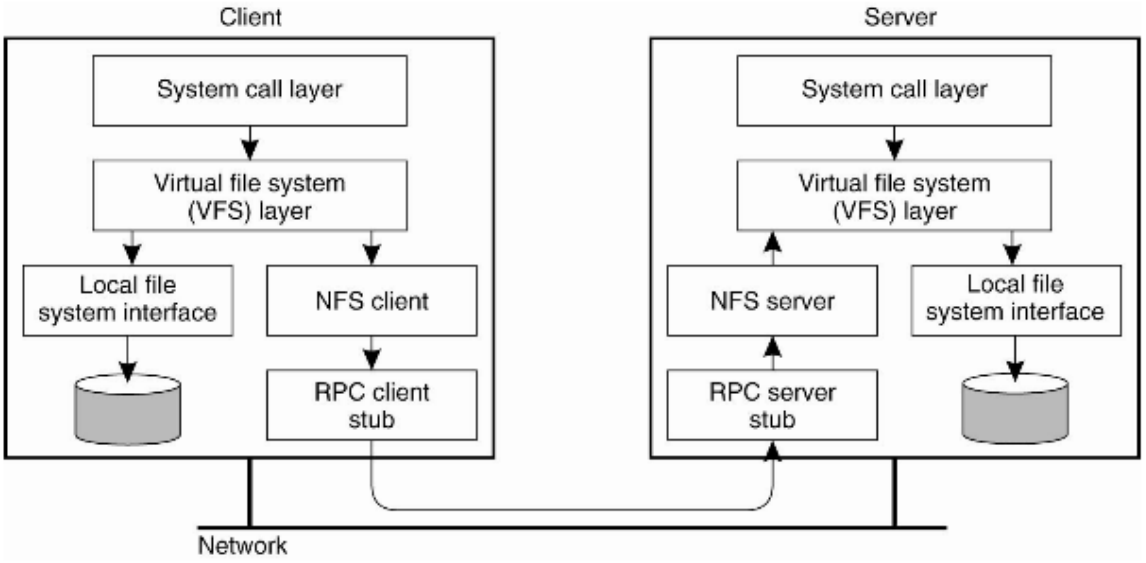
Network File System - NFS

each NFS server provides a standardized view of its local file system

File Transfer Protocol (FTP) is typical upload/download model

like Dropbox

NFS Architecture



Another Example:

Simple Web Servers

- A website was a collection of HTML files that are referred to each other by a hyperlink
- A web server needed only a hyperlink to fetch a file

Less Simple Web Servers

- A website was built around a database with content
- A webpage could still be referred to by a hyperlink
- Web server still needed only a hyperlink to fetch a file

Alternative Organizations

Vertical Distribution

Dividing a distributed application into three logical layers and running the components on separate servers.

Horizontal Distribution

A single client or server can be divided into logically equivalent parts, each operating on its subset of the complete dataset.

Peer-to-peer Architecture

Each process acts as a client and a server simultaneously.

Edge-server Architecture

Systems are deployed on the edge of the network where servers are placed. This is the boundary between enterprise networks and the Internet.

Reasons for having an edge infrastructure

- Latency and bandwidth

- Reliability
- Security and privacy

Blockchain

Blocks are arranged in an unmodifiable, chronological chain. Each block is immutable, resulting in widespread replication. However, determining who can append to the chain is the real issue.

Questions

In the RESTful style, what HTTP method is used for creating a bucket?

PUT

What are the two types of coupling in architectural styles?

- Temporal
- Referential

In which type of coupling are events used to communicate between components?

Event-based

Which architectural style uses publish/subscribe as a communication pattern?

Data Center Architecture

What is the architectural style that uses object-based components?

Object-based style

How are components connected in an object-based style?

Through procedure calls

What is encapsulation in object-based style?

Objects encapsulate data and offer methods on that data without revealing the internal implementation

What is the architectural style that views a distributed system as a collection of resources?

RESTful architecture

What are the basic operations in RESTful architectures?

PUT, GET, DELETE. POST

What is an example of a service that uses RESTful

AWS S3

What does Middleware contain?

Commonly used components and functions that need not be implemented by application separately

What is the problem with using a legacy component’s interface?

The interfaces offered by a legacy component are most likely not suitable for all application

How can the problem of incompatible interfaces be solved?

By using a wrapper or adapter that offers an interface acceptable to a client application

How can middleware be organized?

through 1-on1 or broken

Why would you want to adapt middleware’s behavior for specific applications?

Middleware contains solutions that are good for most applications, but not necessarily for all

What is the configuration of a multi-tiered centralized system?

Single-tier, two-tier, three-tier

What is the Network File System?

An example of a standardized view of a local file system

What happens when a client accesses a remote file in NFS?

The file is moved to the client and returned to the server when the client is done

What is the typical upload/download model? FTP

What is an example of a layered system architecture?

The Network File System

What did a website consist of in the old days?

A collection of HTML files

What are the two alternative organizations in symmetrically distributed systems architectures?

Vertical distribution and Horizontal distribution

What does vertical distribution involve?

Dividing distributed applications into three logical layers and running the components from each layer on a different server

What does horizontal distribution involve?

Physically splitting a client or server into logically equivalent parts, with each part operating on its share of the complete data set

What is a characteristic of peer-to-peer architecture?

Processes are all equal and act as both clients and servers

What is the purpose of the Application-interface layer in the traditional three-layered view of application layering?

Units for interfacing with users or external applications

What is the purpose of the Processing layer in traditional three-layered view of application layering?

Contains the function of an application

What is the purpose of the Data layer in traditional three-layered view of application layering?

Contains the data that a client wants to manipulate

What is the purpose of the User-interface level in object-based architectural style?

Provides the user interface

What is an architectural style?

A style formulated in terms of replaceable components with well-defined interfaces, the way that components are connected, the data exchanged between components, and how these components and connectors are jointly configured into a system

What is a connector in a distributed system?

A mechanism that mediates communication, coordination, or cooperation among components

What is layered architecture?

A different layered organization of components where each layer communicates with the layer directly above or below it. It can be simplex, duplex, or full-duplex

How does two-party communication in a distributed system work?

In two-party communication, one party acts as the server and the other as the client. The server creates a socket, listens for incoming connections, receives data from the client, processes it into a response, and sends the response back. The client creates a socket, connects to the server, sends data to the server, receives the response, and closes the connection**.**

What is the middleware often referred to as in distributed systems?

The OS of distributed systems

What is the purpose of the middleware?

To provide a commonly used interface and component for distributed systems

references

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