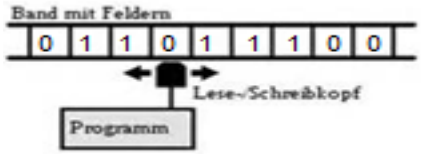
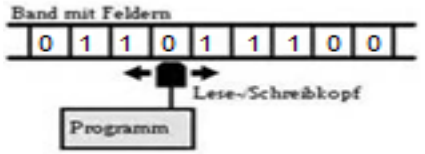


Software Architecture

Software architecture



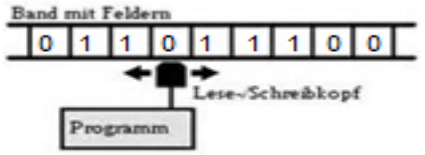
… is the set of structures needed to define a software system.

… is the discipline of creating such structures and systems.

… designs the infrastructure within which application functionality can be realized such that the functionality is best provided

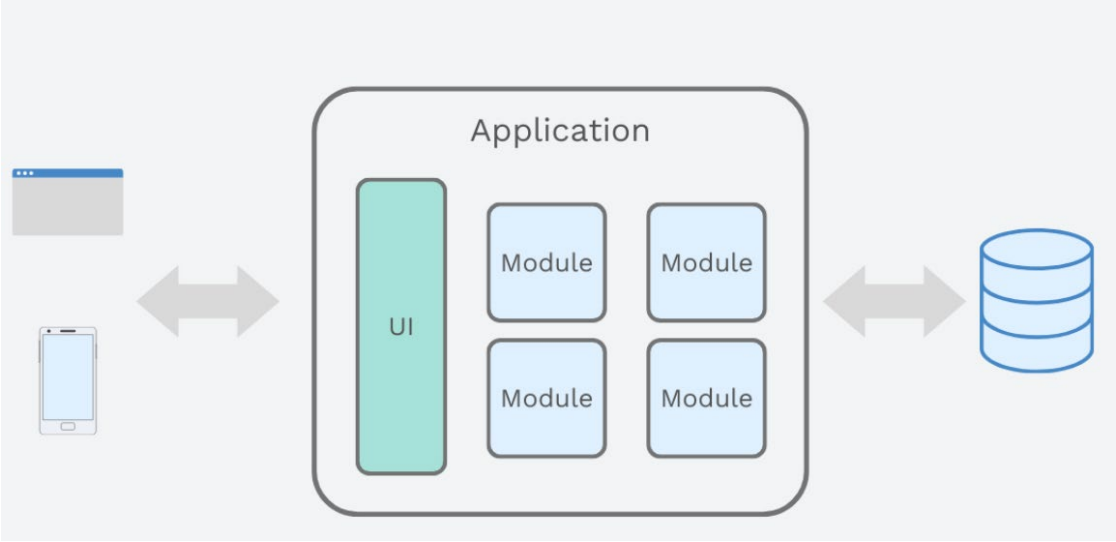
- Each software architecture structure comprises software elements, relations among them, and properties of both elements and relations.

Monolithic architecture

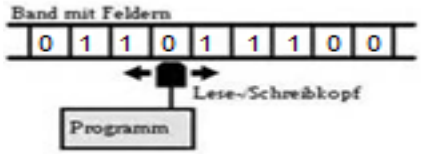


… combines all application components into a single unit.

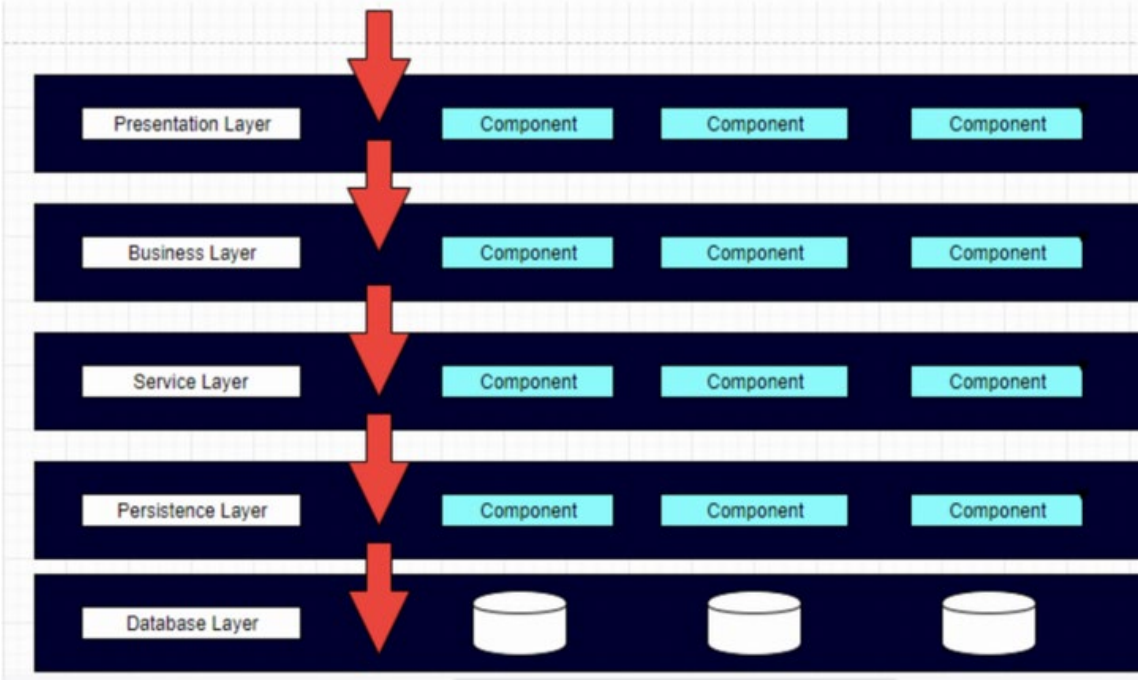
- The user interface, business logic, and data access layers are all created and maintained as one, unified unit.
- Best suited for simple, small applications.



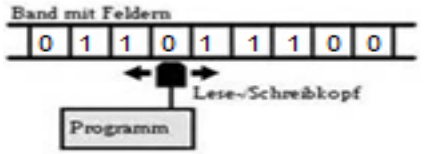
Layered Architecture (Multitier)



- In a layered architecture the components are organized in horizontal layers.
- All components are interconnected but do not depend on each other.
- All request go from top to bottom
- Best suited for larger, more complex applications



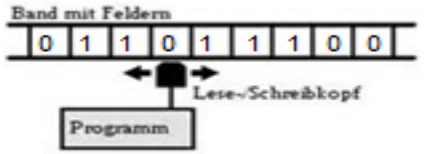
Characteristics of a Layered Architecture

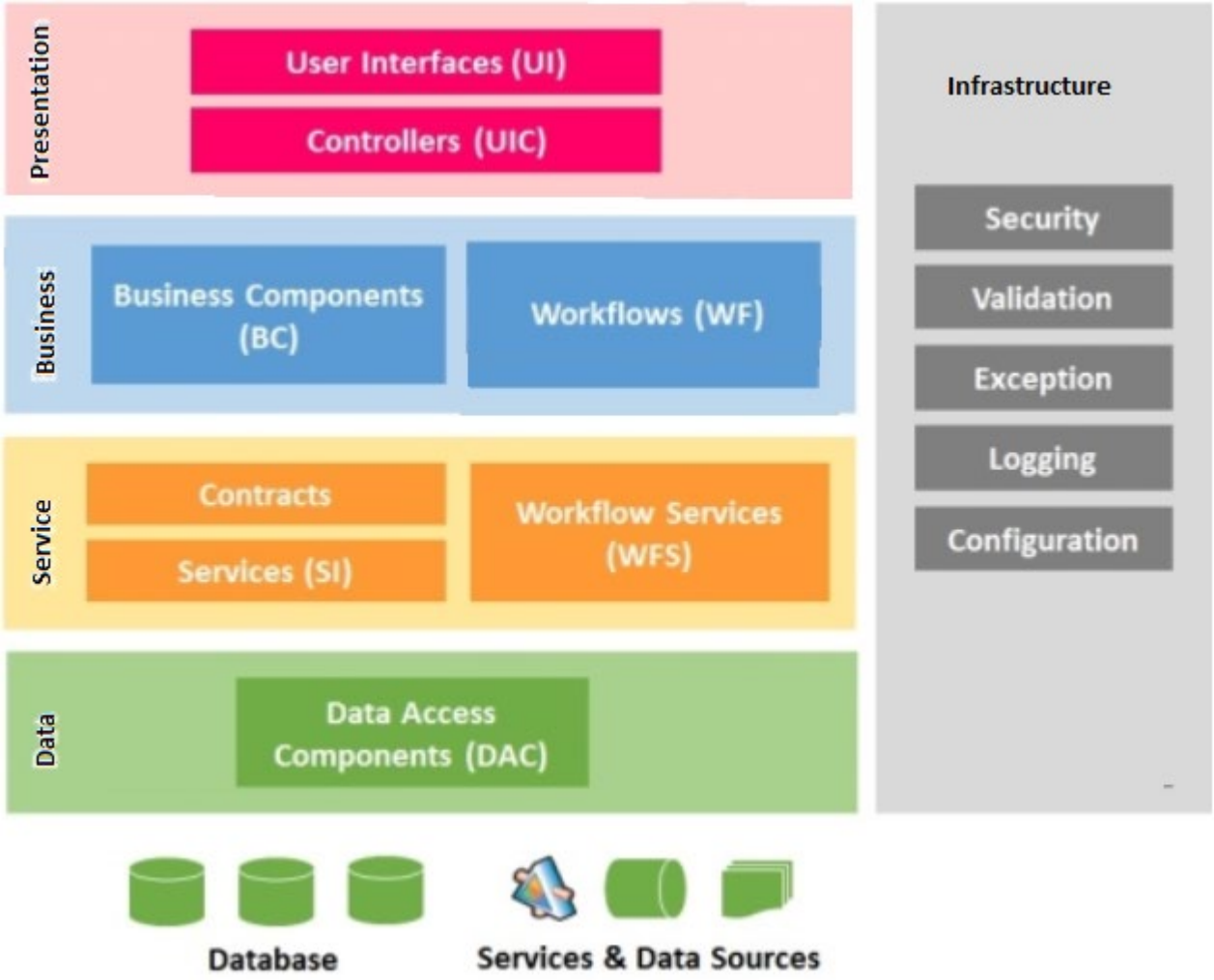


- Similar types of components are collected in one layer helps gather similar programming code together in one location.
- The layers are independent from one another.
- Clear definitions of responsibilities and interfaces help that changes in one layer have no impact to any other layers.
- Every layer can be tested separately.

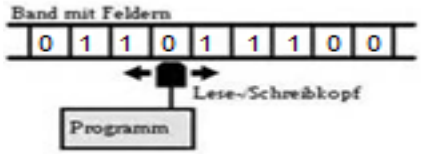
→ Has become the usual architecture for most (complex) software systems.

Layered Architecture Example

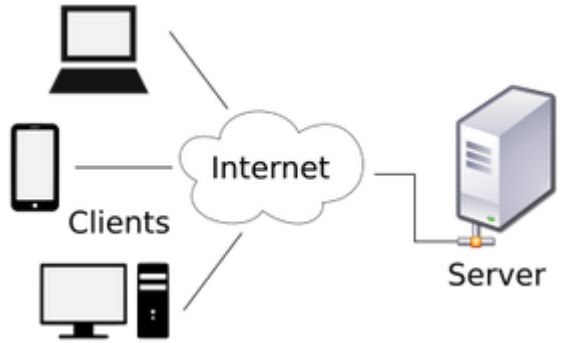




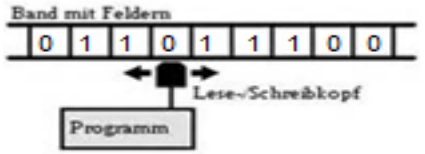
Client Server Architecture



- The term client server describes the relationship between two applications.
- The client requests a service from the server. The server fulfills the request.
- The client server paradigm can also be used by programs within a single computer
- On a network, the client-server model is a proven way to connect distributed applications or systems.

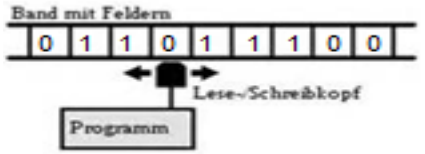


Characteristics of the Client Server model



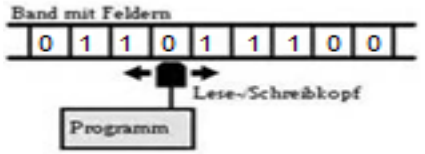
- The tasks are distributed between client and server.
- One server provides different services for many clients.
- Clients request for a service from a server.
- The communication and exchange of information works via predefined protocols (e.g. TCP/IP)
- Server and client functions or tasks are not tied to a physical hardware.
- Physical computers can perform as both client or server.
- The origin of the interaction is always at the client.

Client-Server Application Examples



Application	Client	Server
WWW, Browsing in the Internet	Firefox, Chrom, Internet Explorer, …	Web-Server (Apache, Microsoft, …)
E-Mail (read/write)	Thunderbird, Outlook, …	MS-Exchange, Zimbra, Eudora, …
File (read/write)	Operating System	File-Server, local or remote
Print a document	Operation System, Device driver	Print Server
Find a service and forward a request	Operating System	Proxy Server

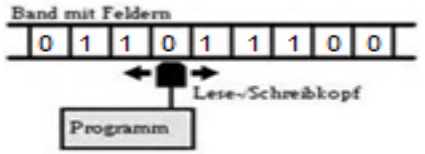
Peer to Peer (P2P)



A P2P network is computer network

- in which all computers in the network work together as peers.
- each computer or server can offer functions and services to the others
- each computer can use functions, resources, services and files offered by other computers.
- The data is distributed over many computers.

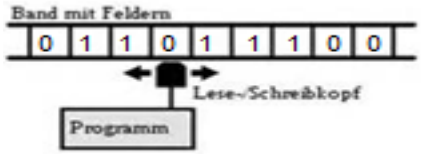
Peer to Peer (P2P)



- P2P is decentralized concept, with no central server.
- Each computer can be connected to several other computers.
- Each node provides data or resources.
- Unstructured P2P networks organize themselves.
- Since only the target system has information about the stored data, searches are made via flooding.

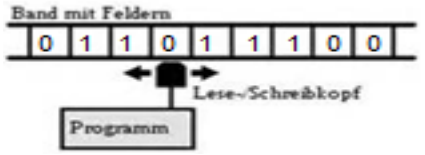
- In structured peer-to-peer networks, the routes to specific data on individual devices is stored (on specific nodes).

P2P Application Examples

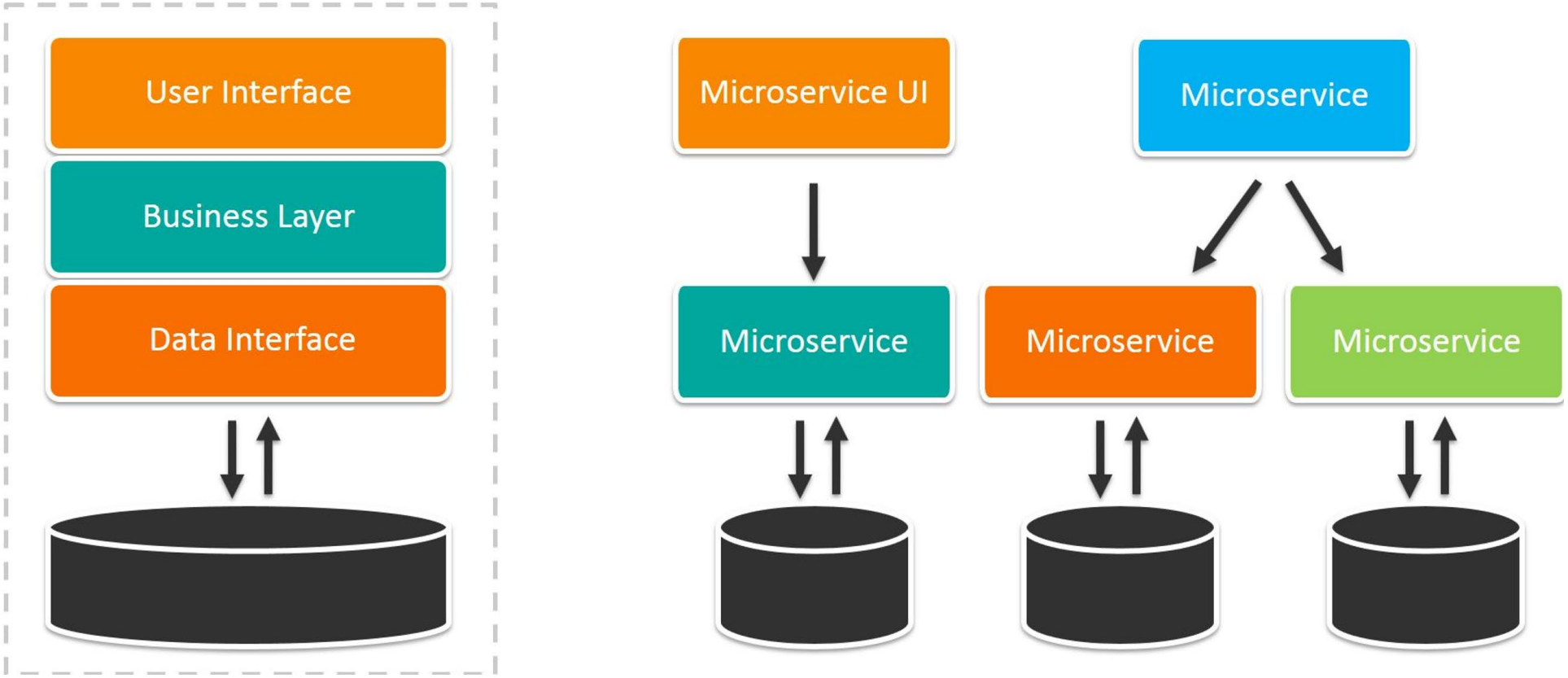


Application	Client
Apache Cassandra	Distributed Database (DDBMS)
Blockchain	Distributed Accounts (Internet of Values)
Skype	Internet telephony
BitTorrent	Distributed Filesharing (e.g. videos, …)
Napster	Ehem. Streaming and download service (mp3)

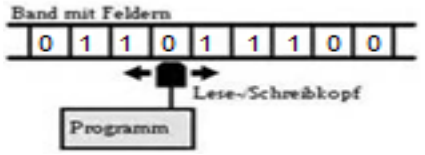
Microservice Architecture

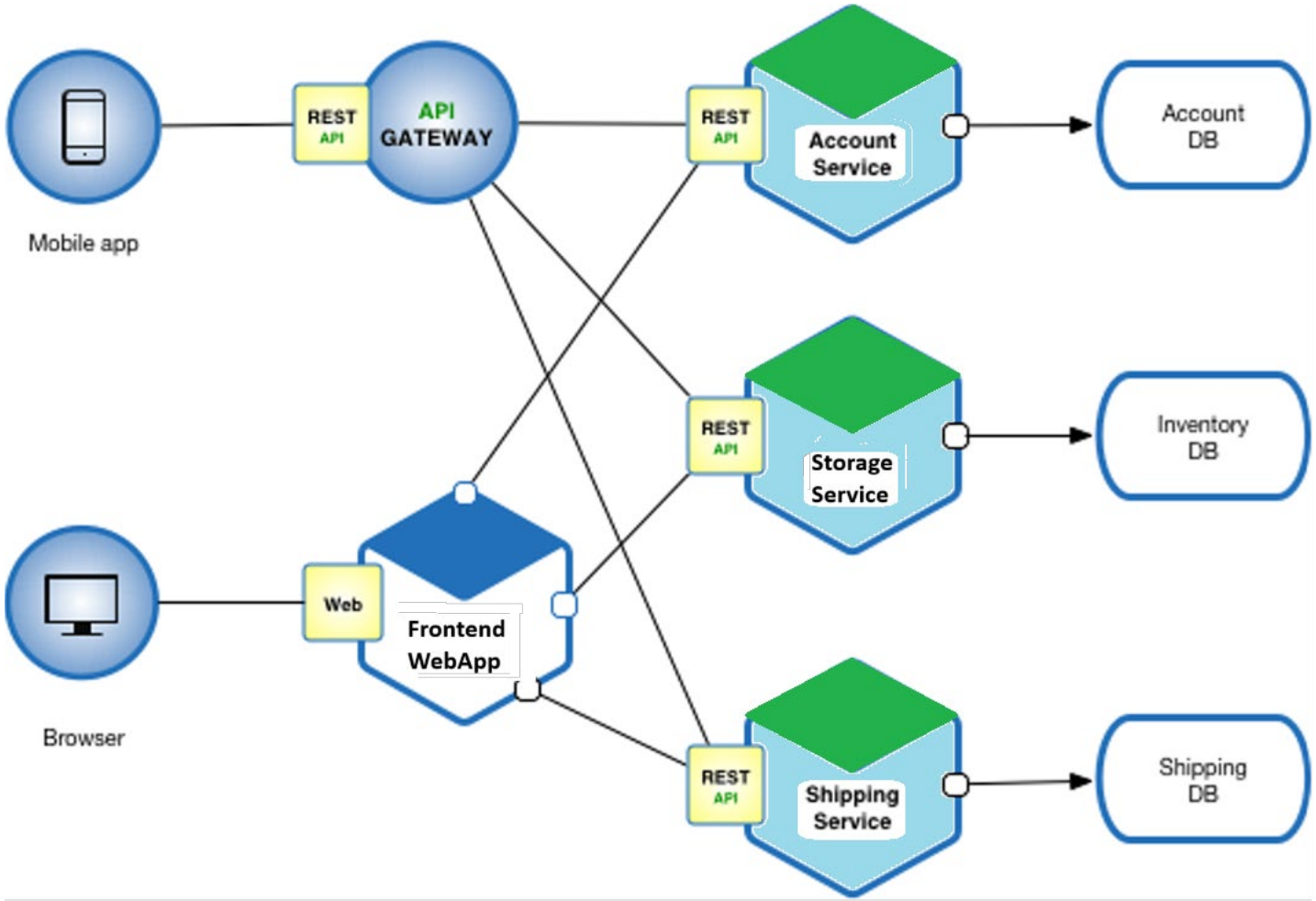


Layers ← → Microservices

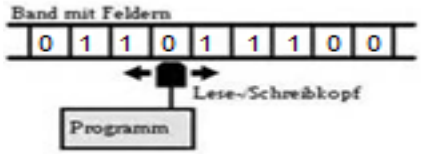


Example Microservice Architecture





Well known Microservice Applications



- Amazon
  - Online retailer and cloud service provider
- Netflix
  - Video on demand streaming service
- Uber
  - Transportation and ride-sharing company
- Etsy
  - Global marketplace for special items