Lecture #1

WSMT
Spring 2024

Introduction to Web Services

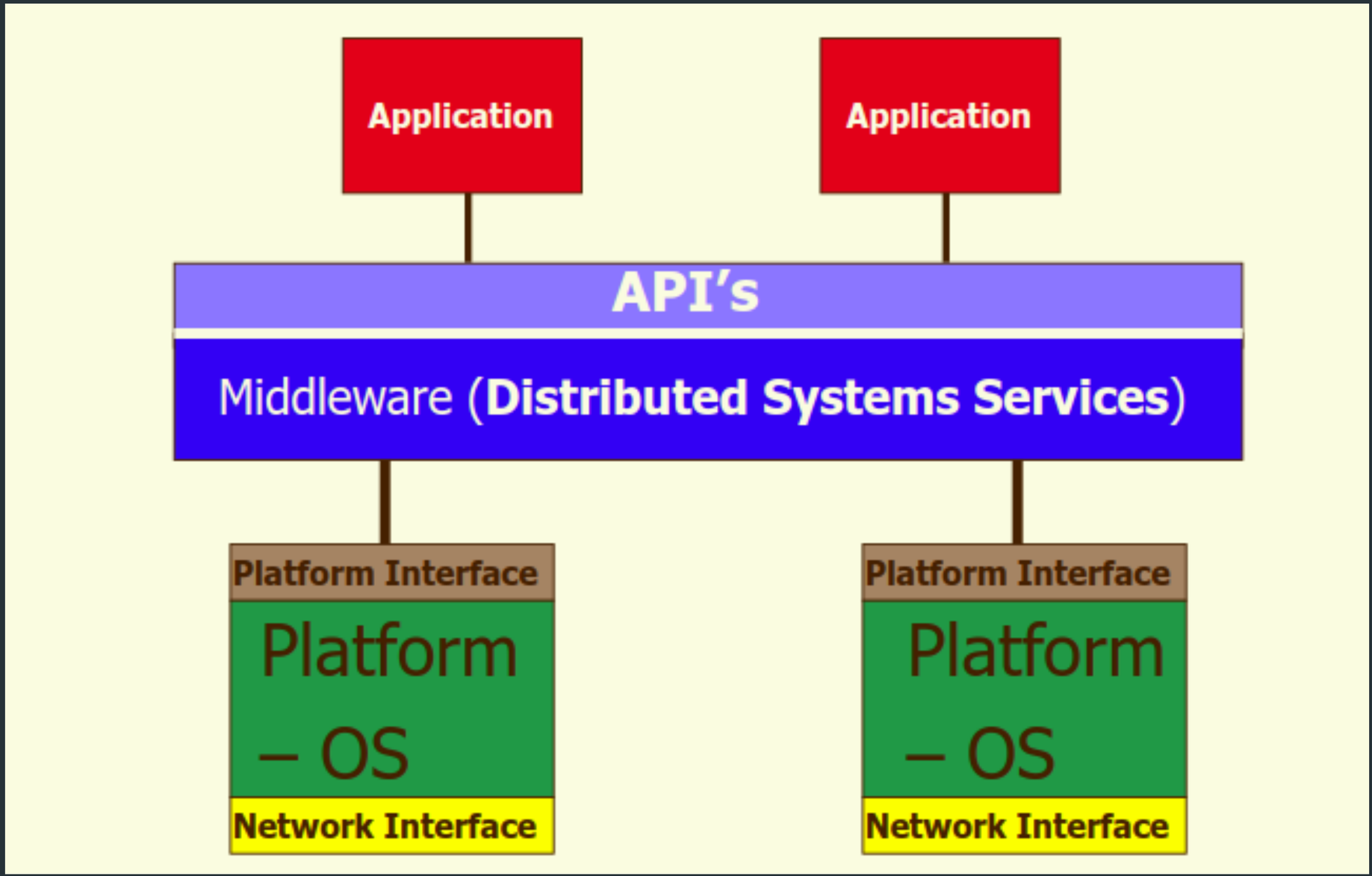
What are Web Services?

What is Web Services?

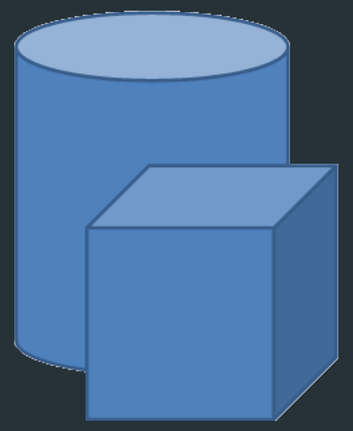
www.educba.com

Introduction to Middleware Technologies

What is Middleware?

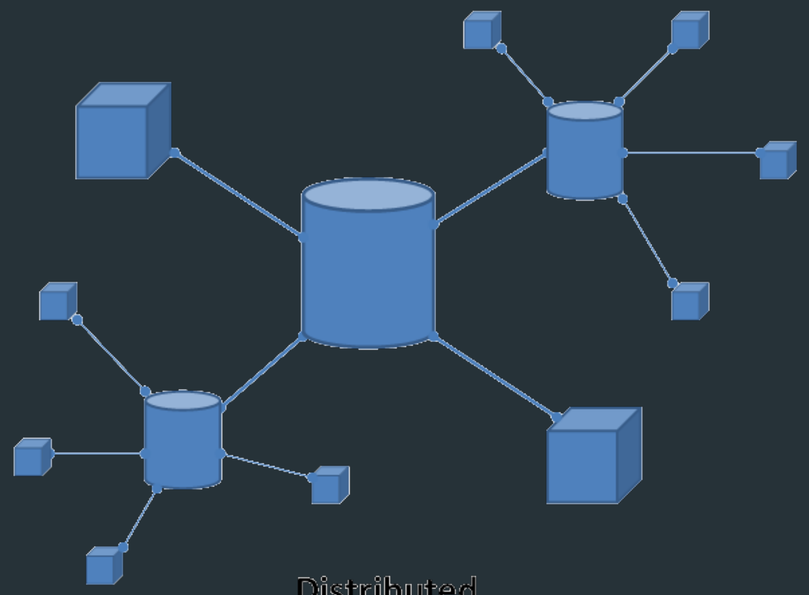

Application
Application
API's
Middleware (Distributed Systems Services)
Platform Interface
Platform – OS
Network Interface
Platform Interface
Platform – OS
Network Interface

Distributed Systems



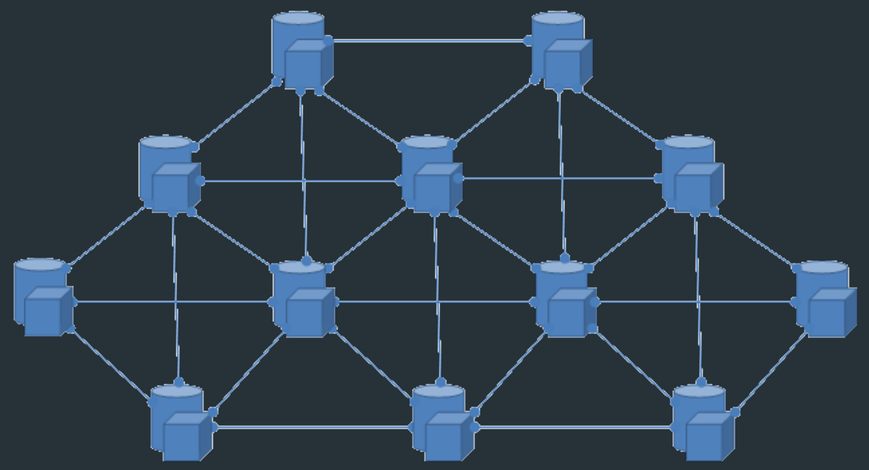
Centralized

one node does everything



Distributed

nodes distribute work to sub-nodes



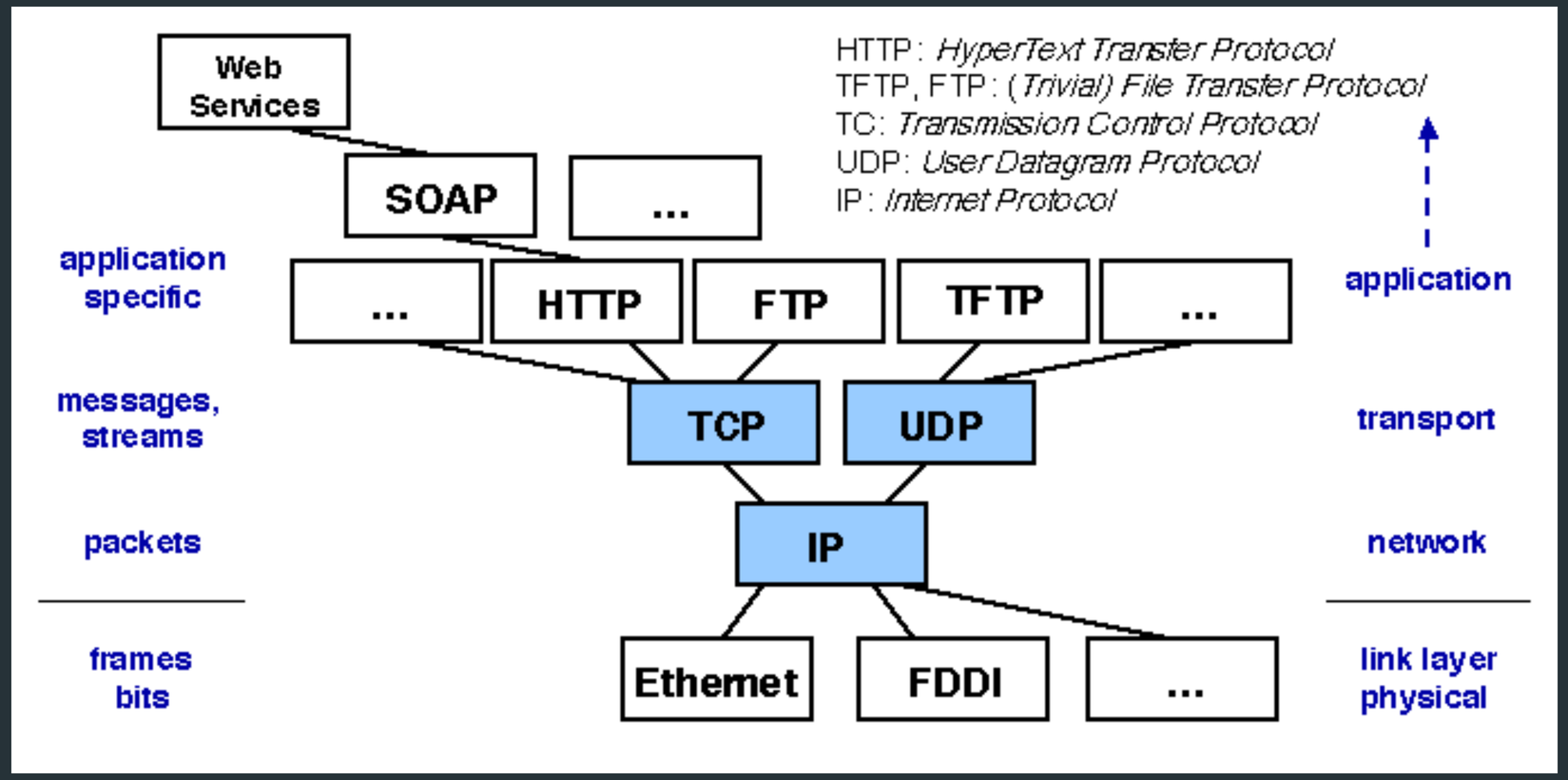
Decentralized

nodes are only connected to peers

Distributed Systems

Understanding Middleware for Distributed Systems

Communication Protocols Used in Middleware

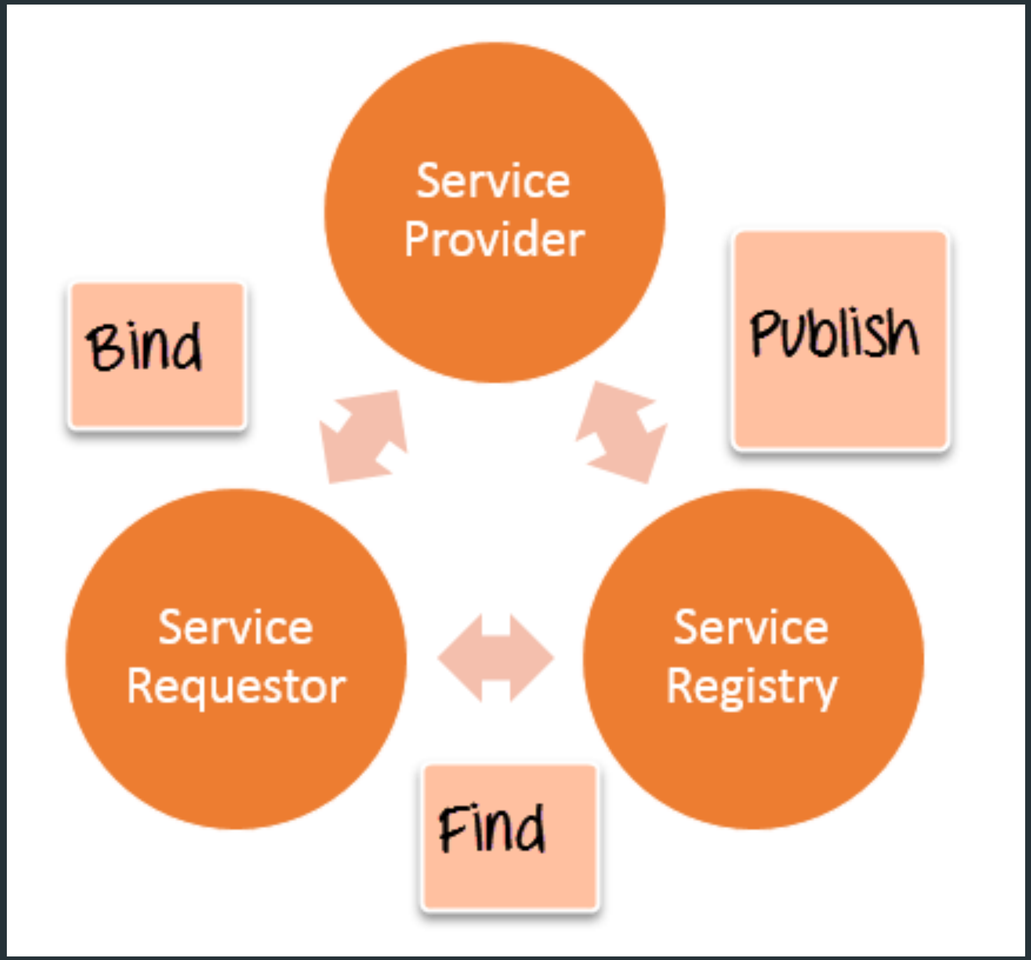


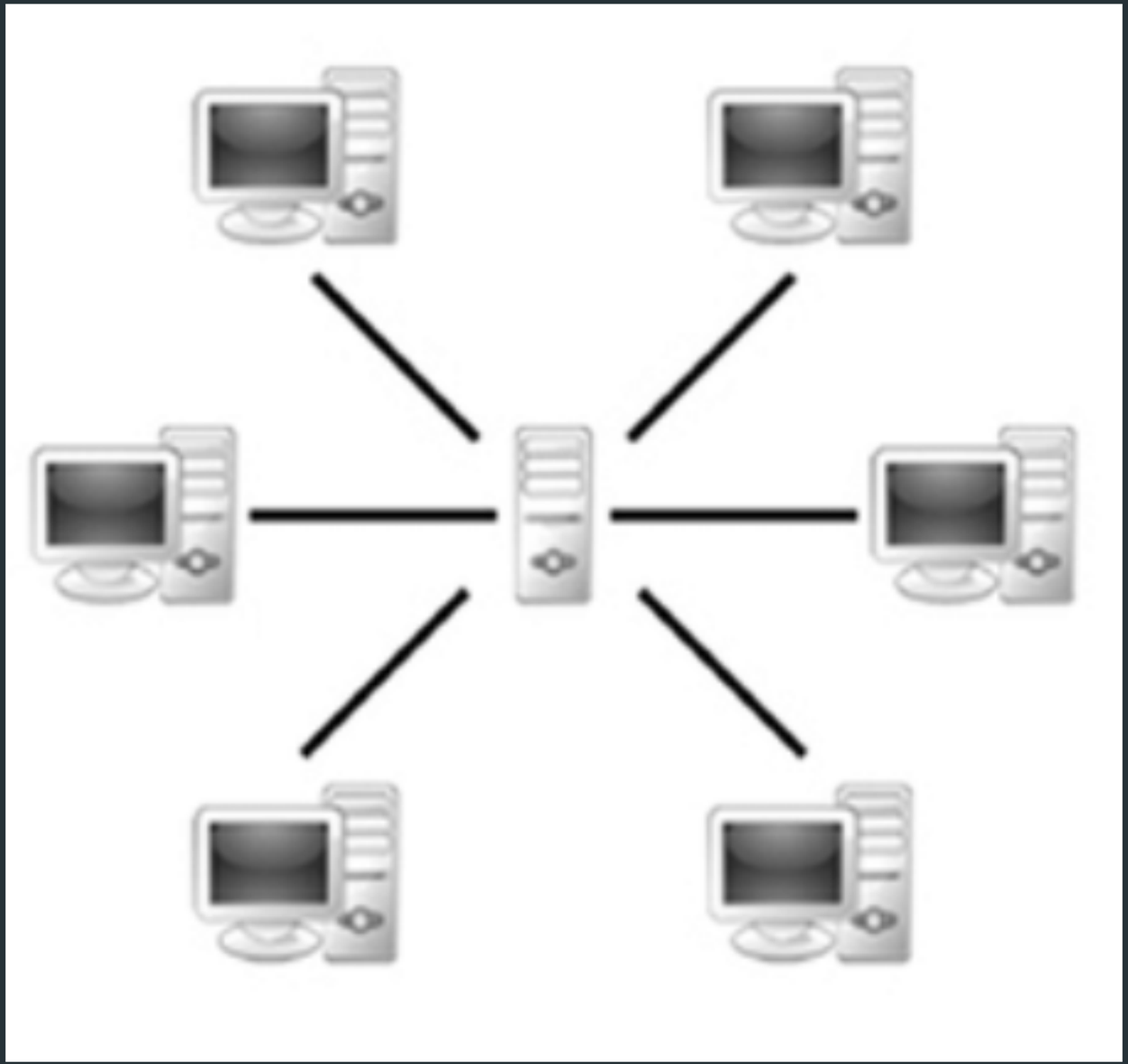
Commonly Used Communication Protocols in Middleware

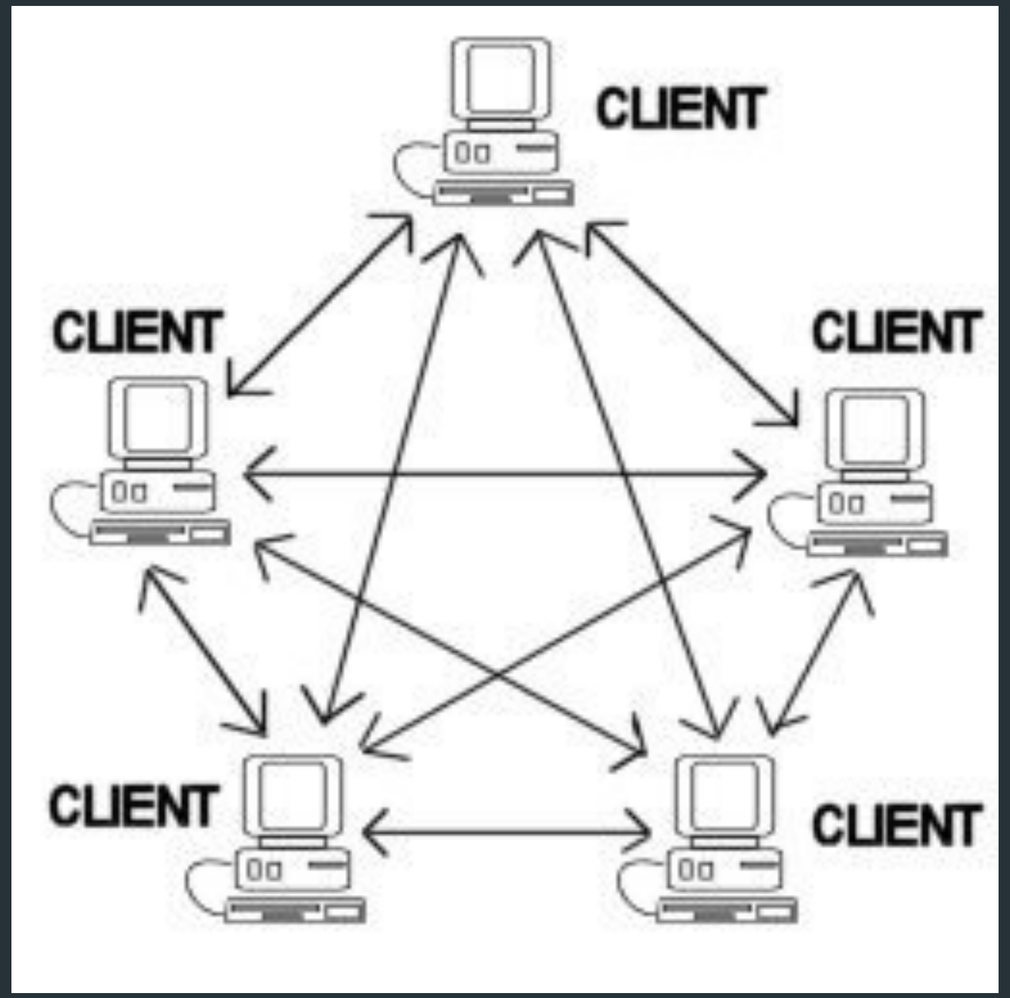
Commonly Used Communication Protocols in Middleware

- HTTP
- TCP
- AMQP
- MQTT

Web Service Architectures


Service Provider
Publish
Bind
Service Requestor
Service Registry
Find




CLIENT
CLIENT
CLIENT
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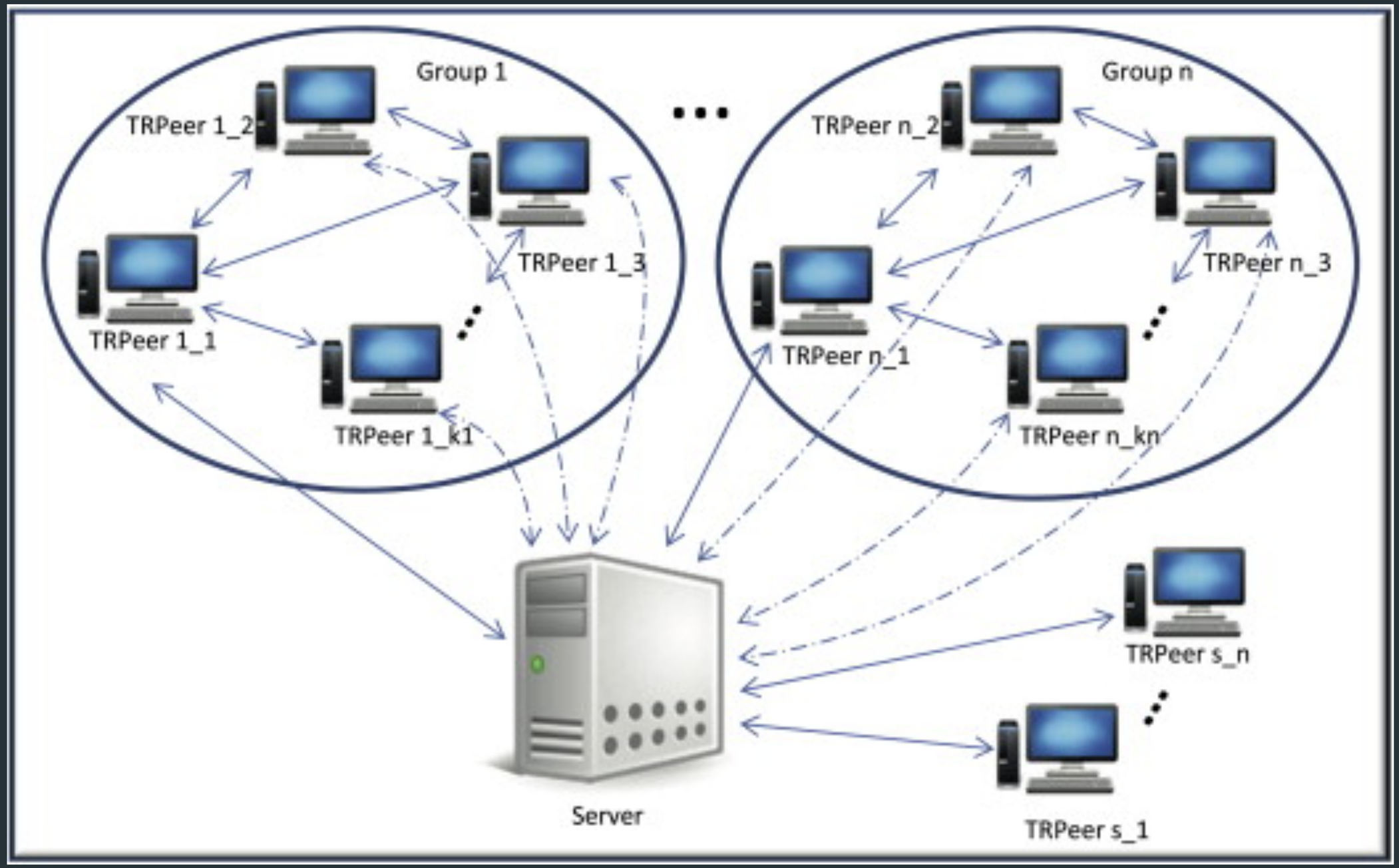
Group 1
TRPeer 1_2
TRPeer 1_3
TRPeer 1_1
TRPeer 1_k1
Group n
TRPeer n_2
TRPeer n_3
TRPeer n_1
TRPeer n_kn
TRPeer s_n
TRPeer s_1
Server

Types of Web Services

Types of Web Services

thriftly.io protocol comparison	First released	Formatting type	Key strength
SOAP	Late 1990s	XML	Widely used and established
REST	2000	JSON, XML, and others	Flexible data formatting
JSON-RPC	mid-2000s	JSON	Simplicity of implementation
gRPC	2015	Protocol buffers by default; can be used with JSON & others also	Ability to define any type of function
GraphQL	2015	JSON	Flexible data structuring
Thrift	2007	JSON or Binary	Adaptable to many use cases

SOAP (Simple Object Access Protocol)

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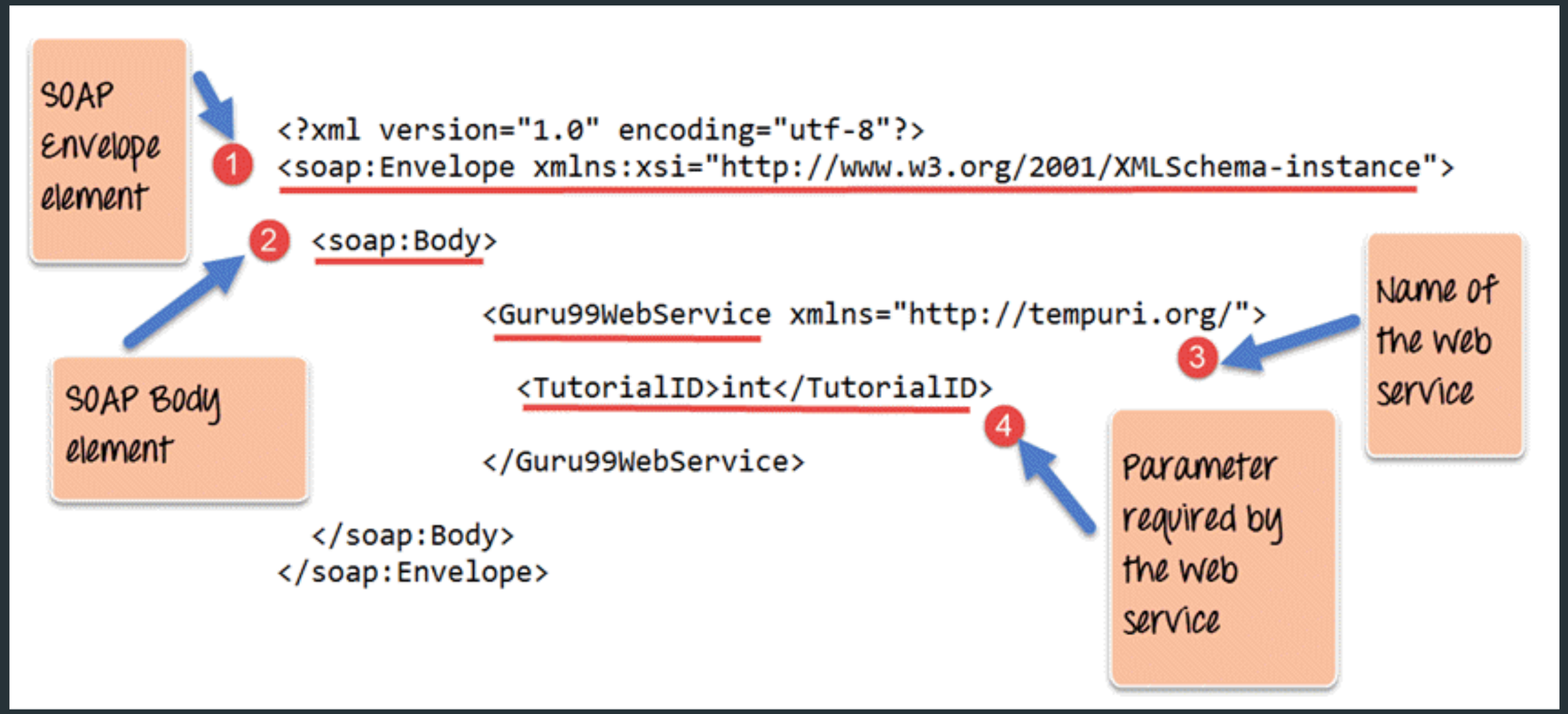

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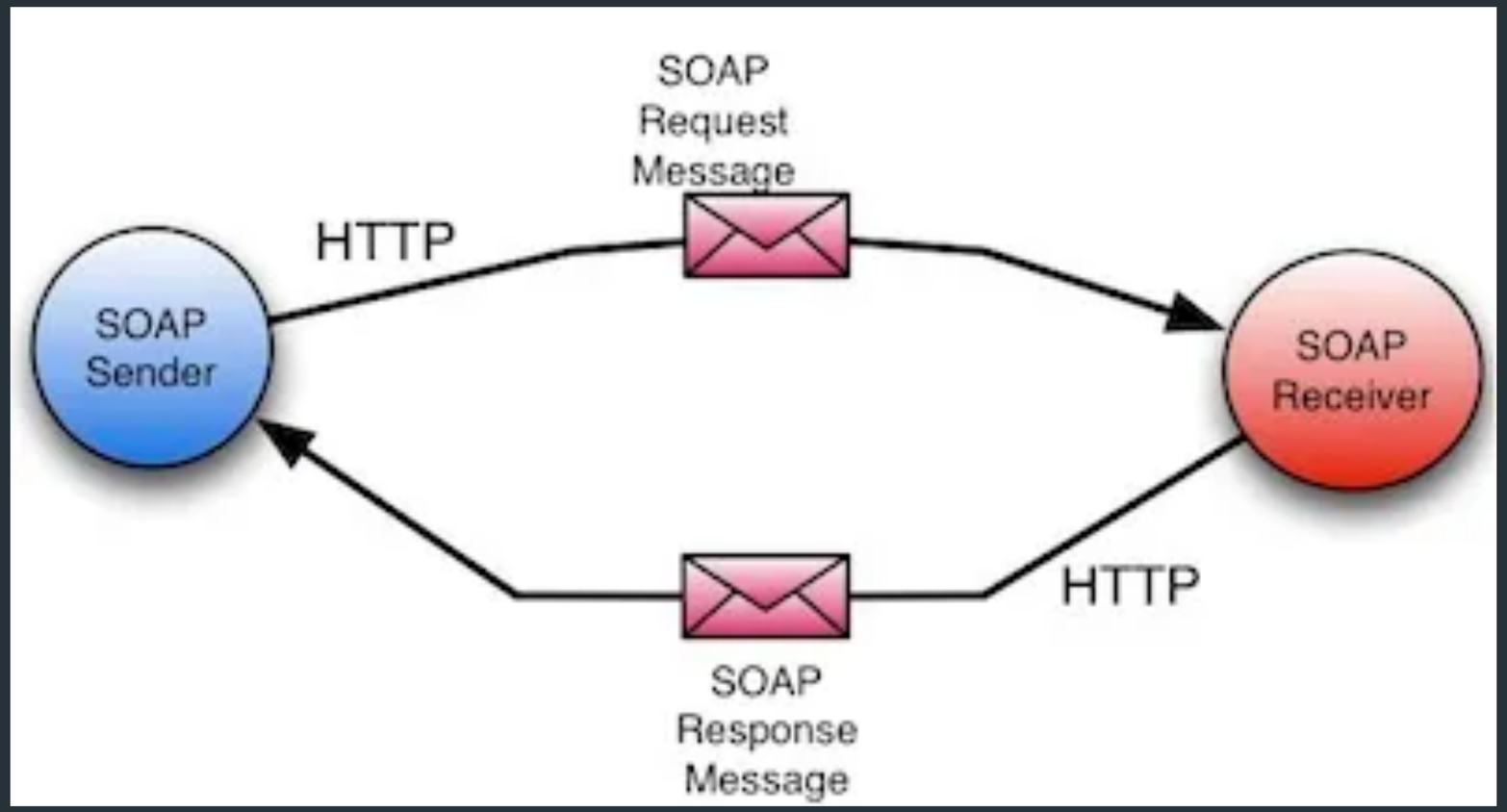

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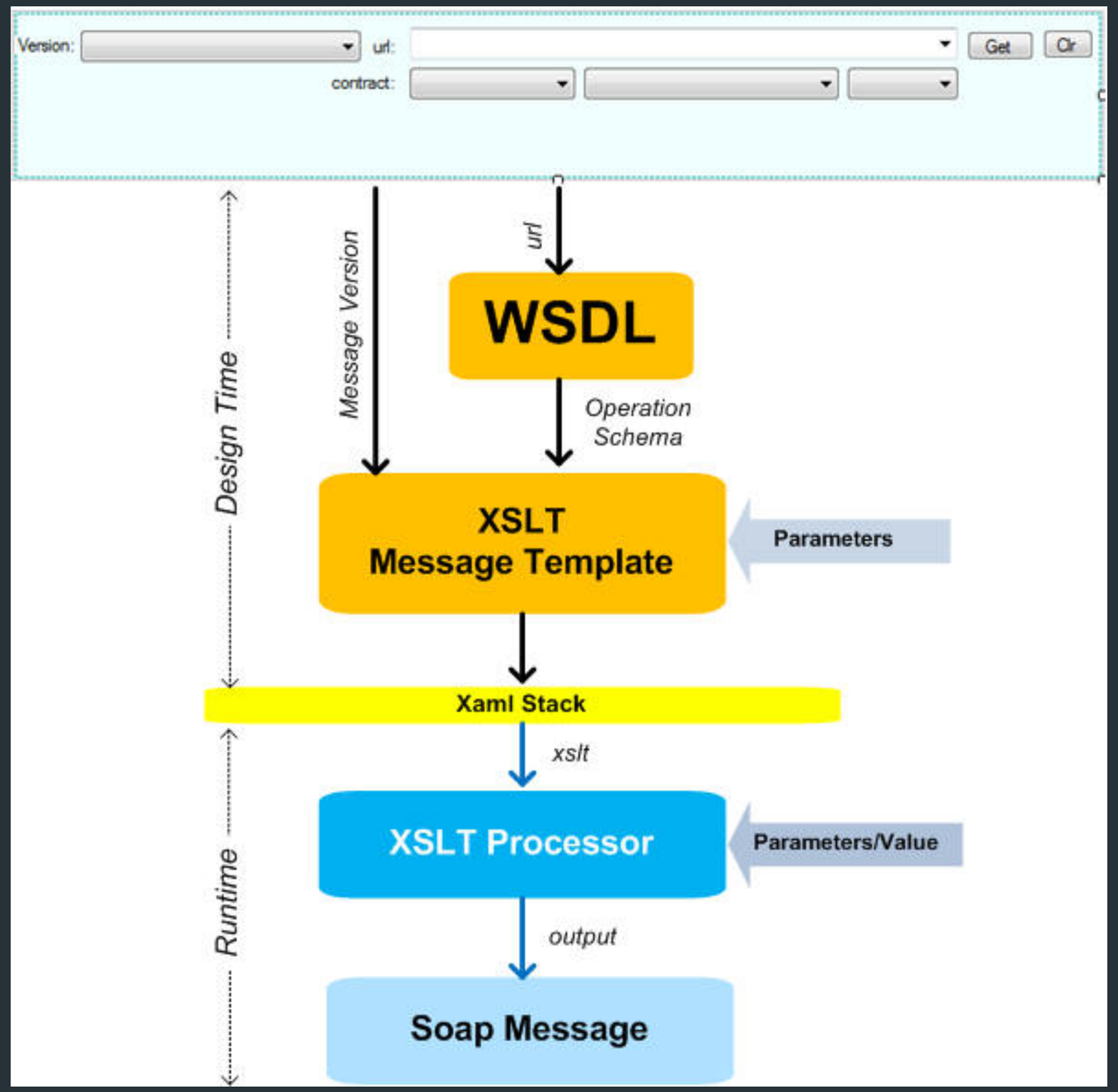

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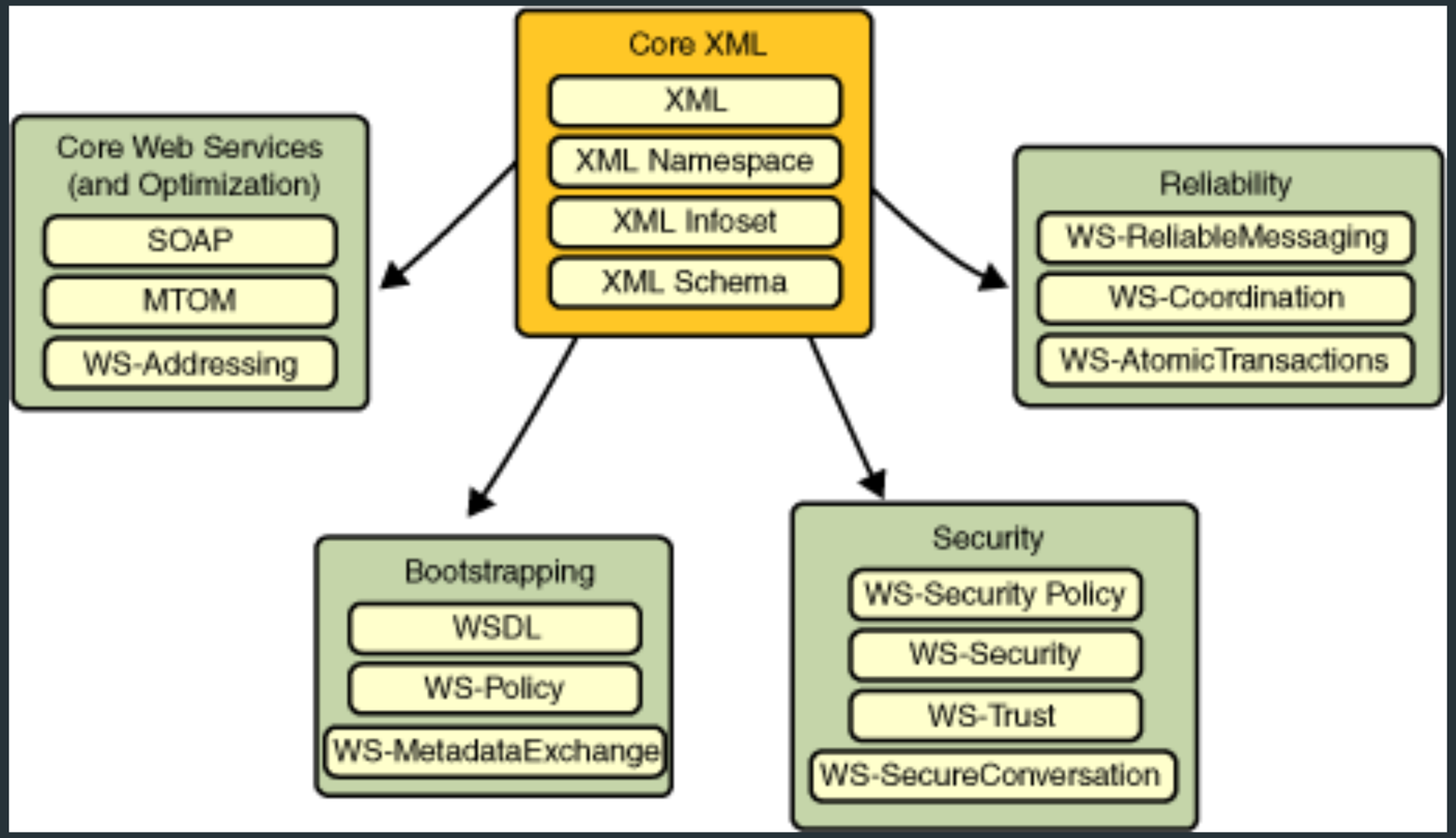

RESTful Web Services

REST (Representational State Transfer)

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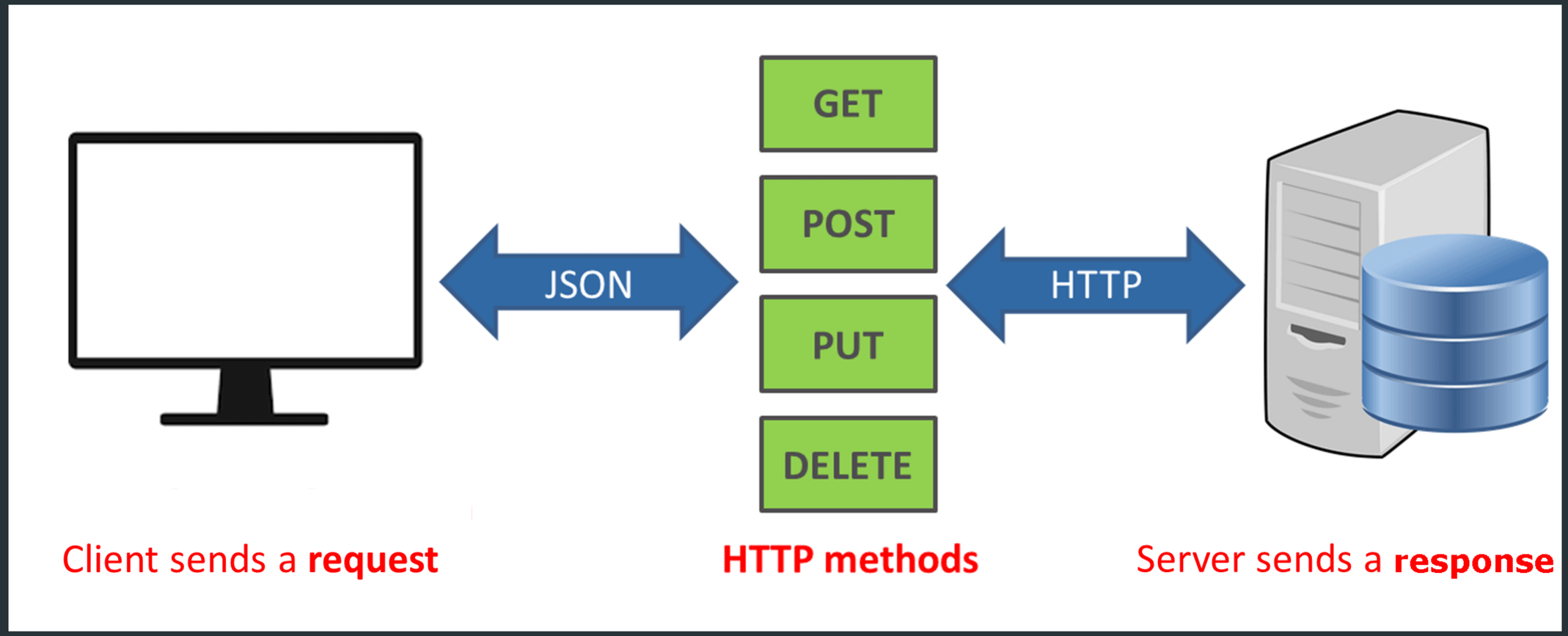
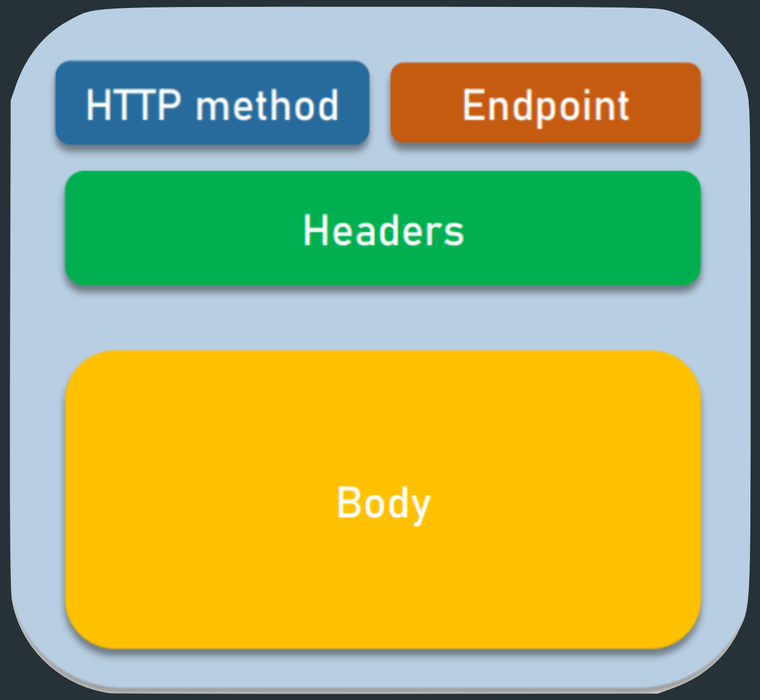


REST (Representational State Transfer)

```
POST /api/2.2/sites/9a8b7c6d-5e4f-3a2b-1c0d-9e8f7a6b5c4d/users HTTP/1.1
HOST: my-server
X-Tableau-Auth: 12ab34cd56ef78ab90cd12ef34ab56cd
Content-Type: application/json

{
  "user": {
    "name": "NewUser1",
    "siteRole":  "Publisher"
  }
}
```



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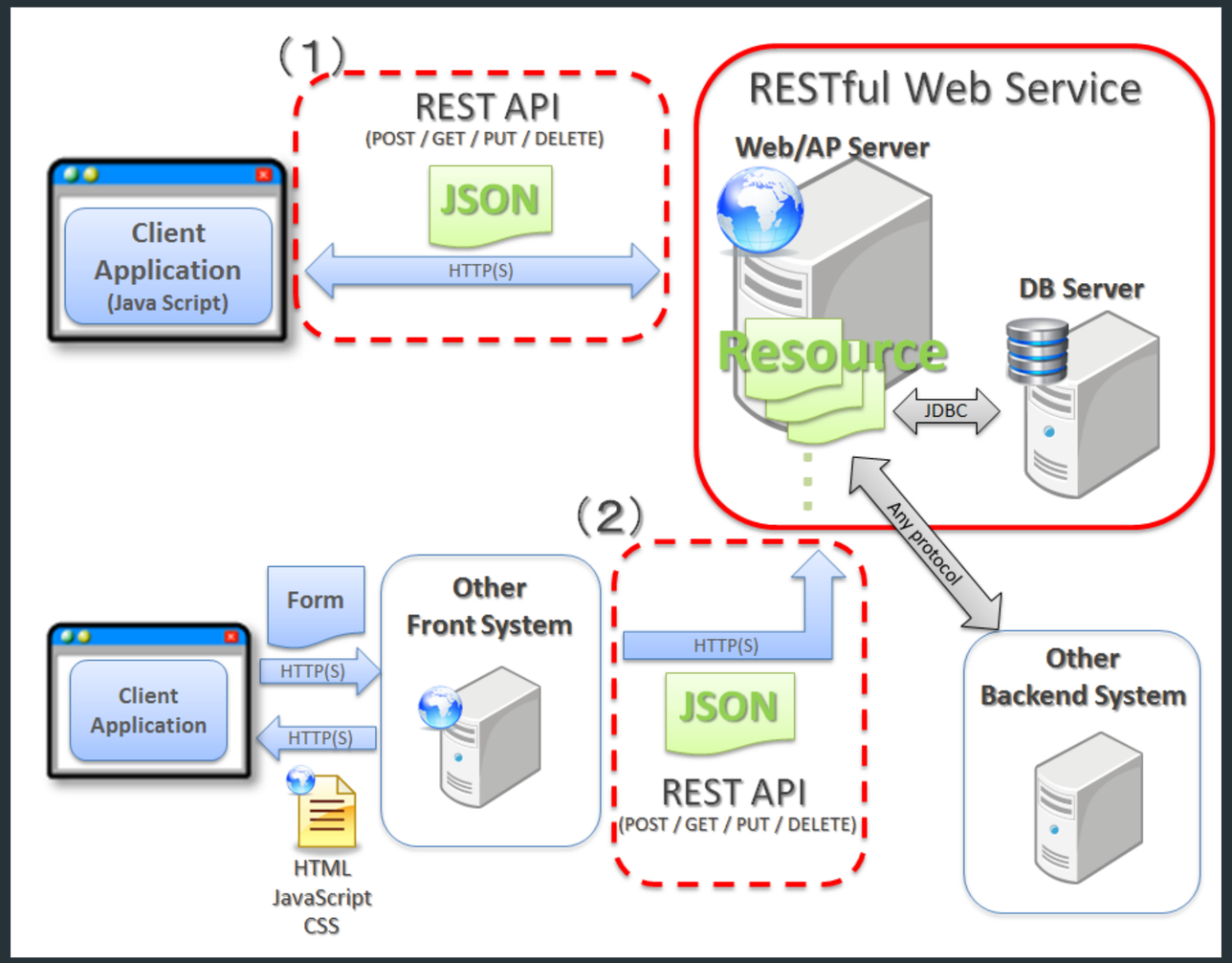
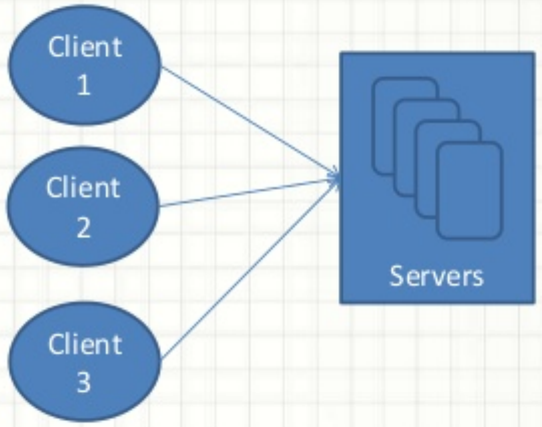


REST (Representational State Transfer)

Stateless

- No client state at server.
- Any State is maintained at Client side.
- Each request has all the information to process the request.



XML-RPC Web Services

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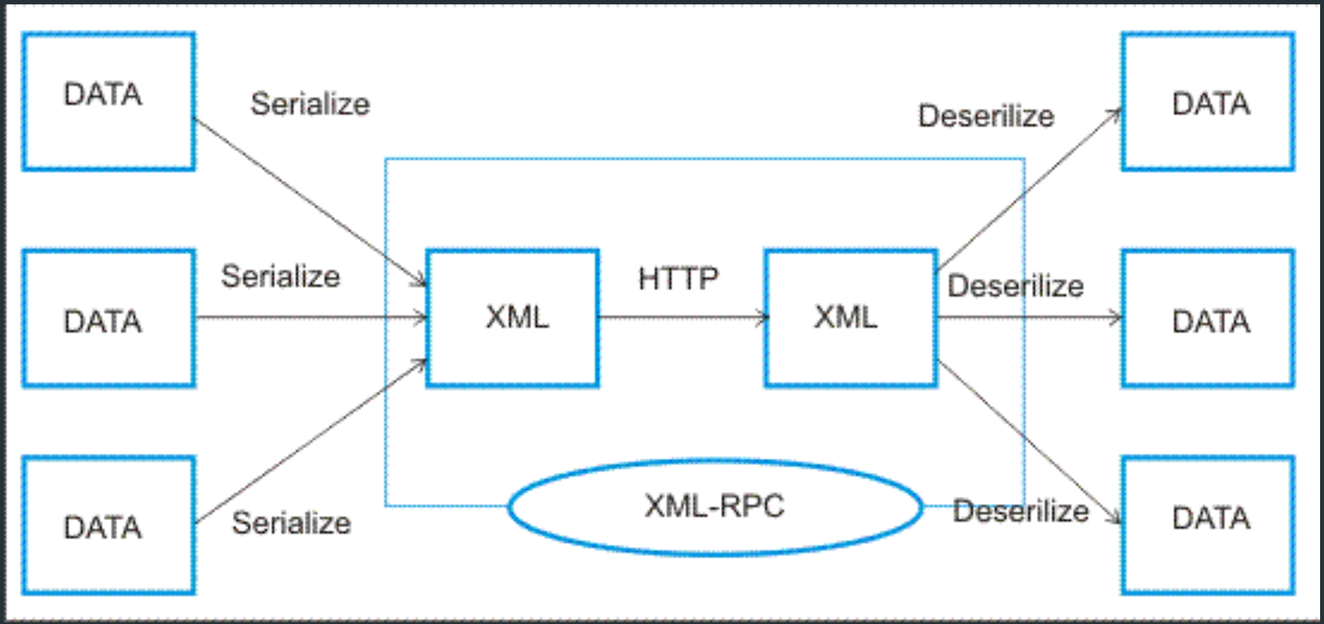

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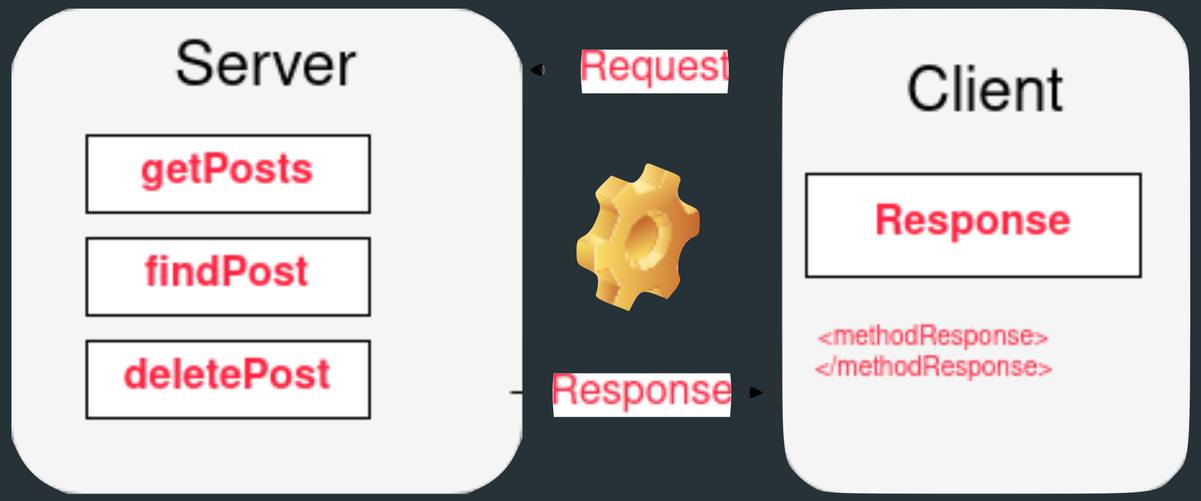

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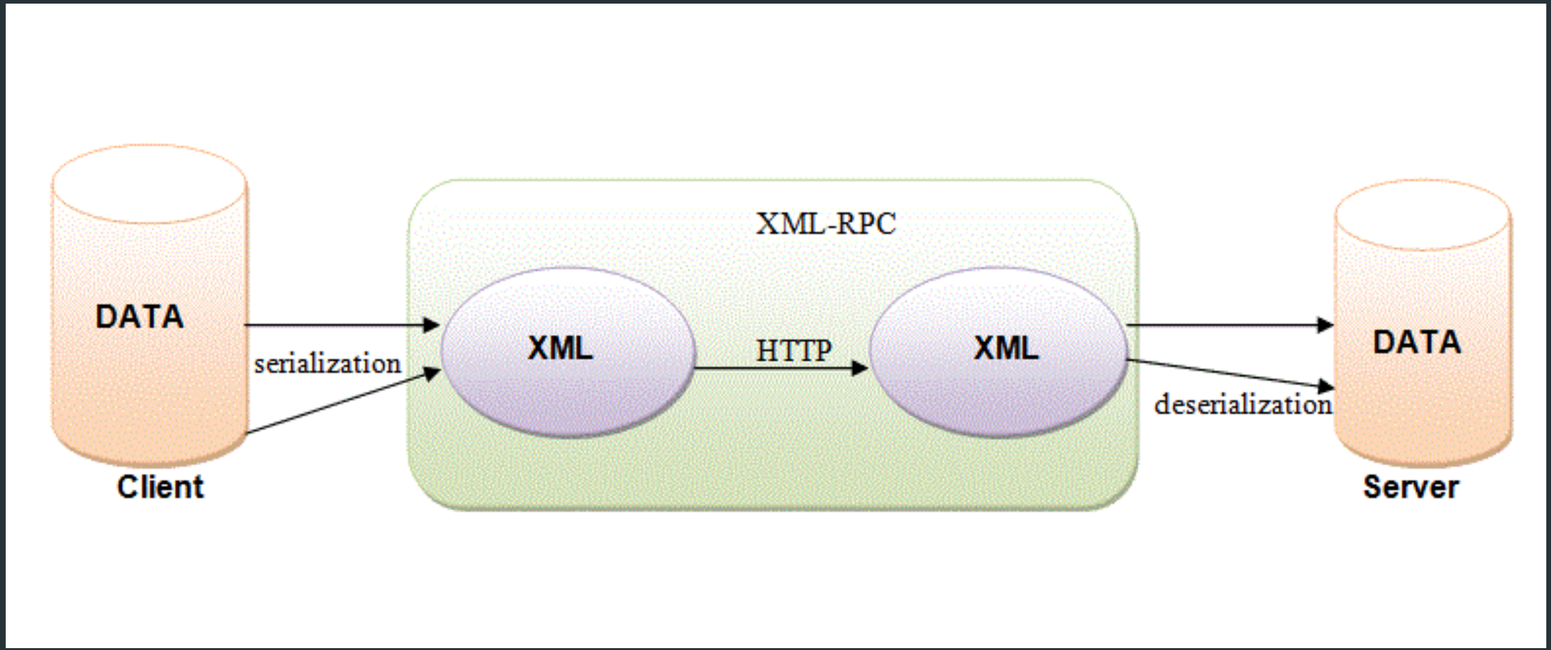


XML-RPC Web Services

SOAP vs XML-RPC

- Similarities
  - Use XML for messaging
  - Messages are usually embedded into HTTP header
  - Use request/response mechanism
  - Mainly use in remote procedure call
  - Platform independent
  - Language independent
- Differences
  - SOAP messages are more complicated than XML-RPC
  - Make use of XML namespaces and XML Schemas
  - Hence give a standard way for data encoding and RPC
  - Thus allow automatic method invocation on the Web

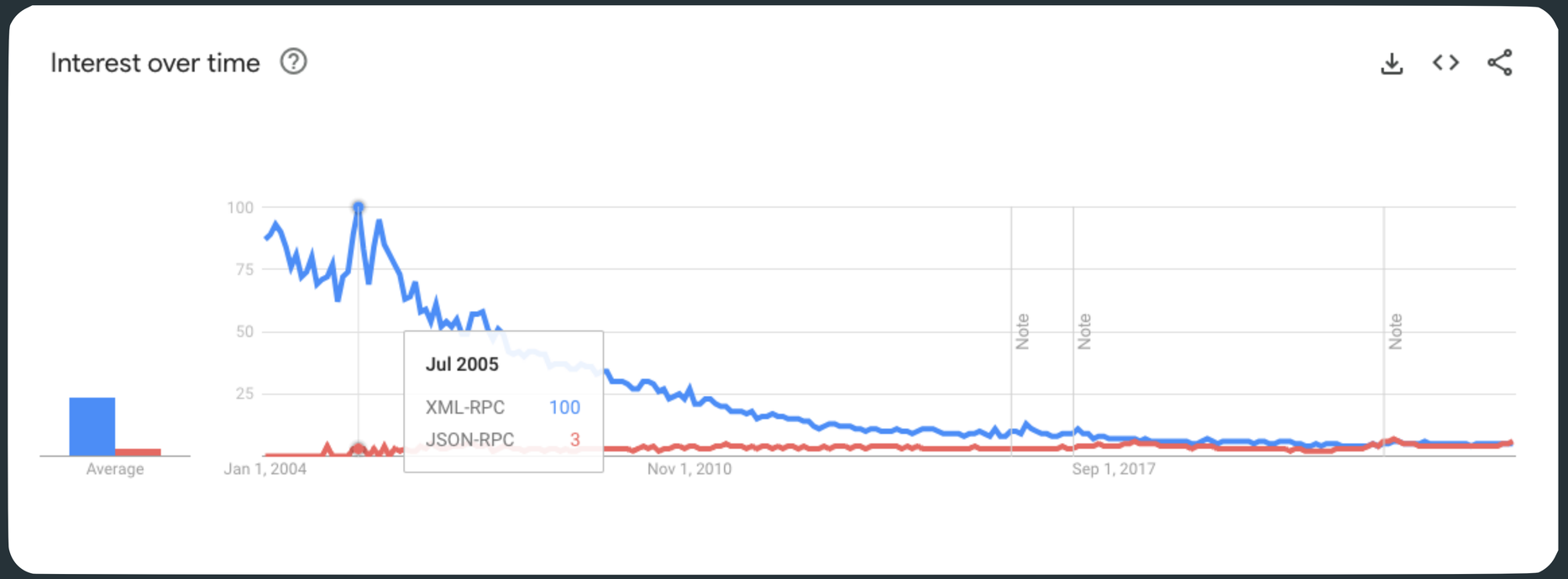
JSON-RPC Web Services

JSON-RPC Web Services

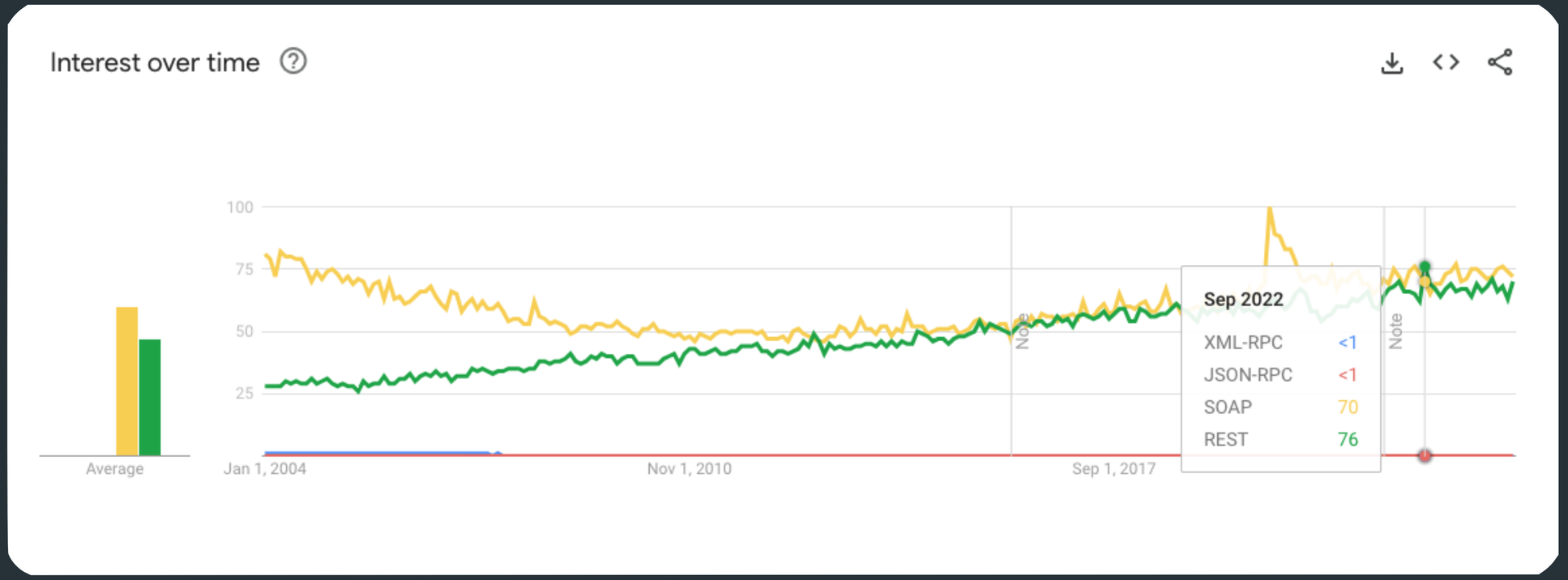
JSON-RPC Web Services

```
{
    "jsonrpc": "2.0",
    "method": "user.get",
    "params": {
        "output": "extend"
    },
    "auth": "038e1d7b1735c6a5436ee9eae095879e",
    "id": 1
}
```

JSON-RPC Web Services



Interest over Time



Message-oriented Middleware (MOM)

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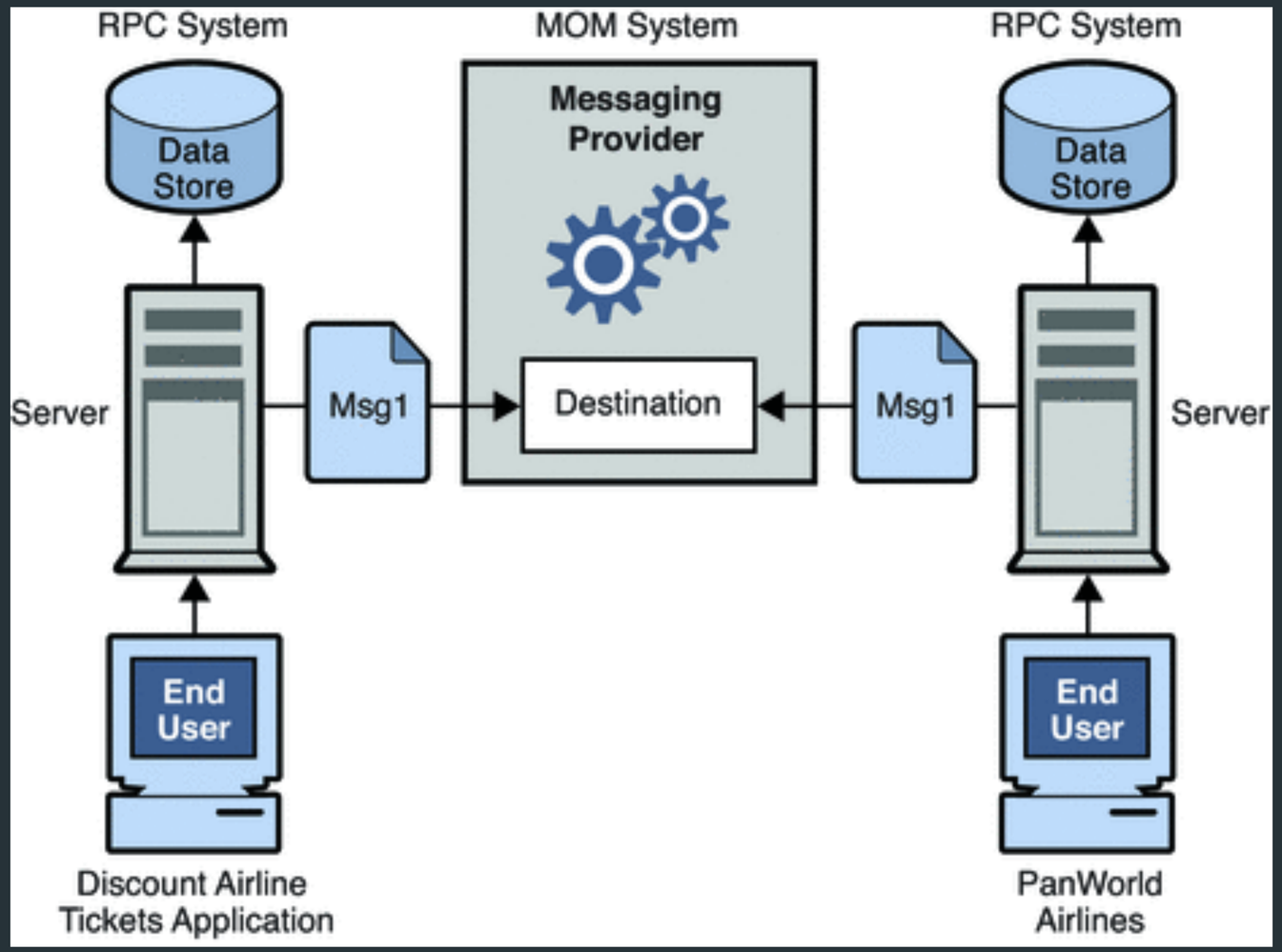

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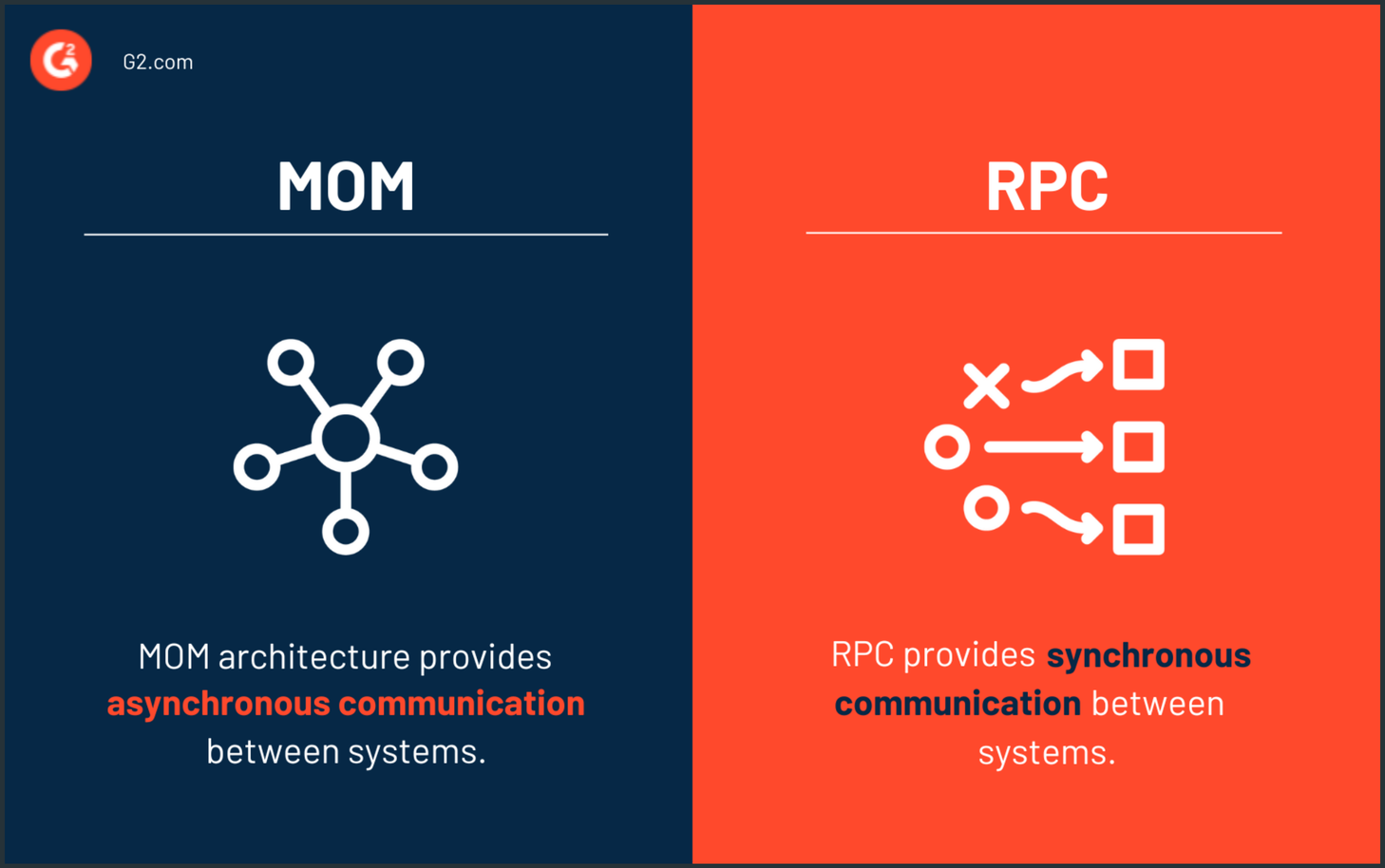

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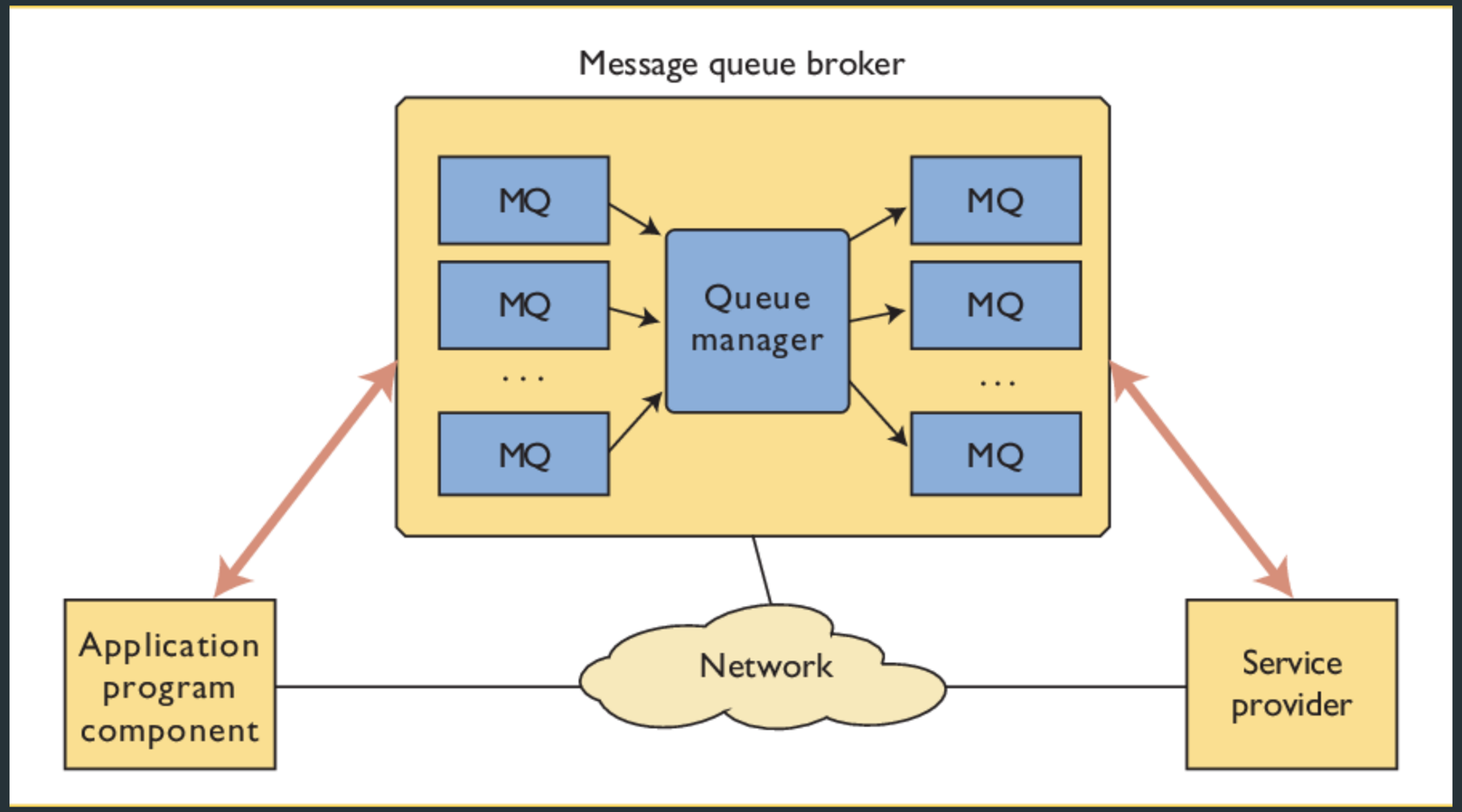

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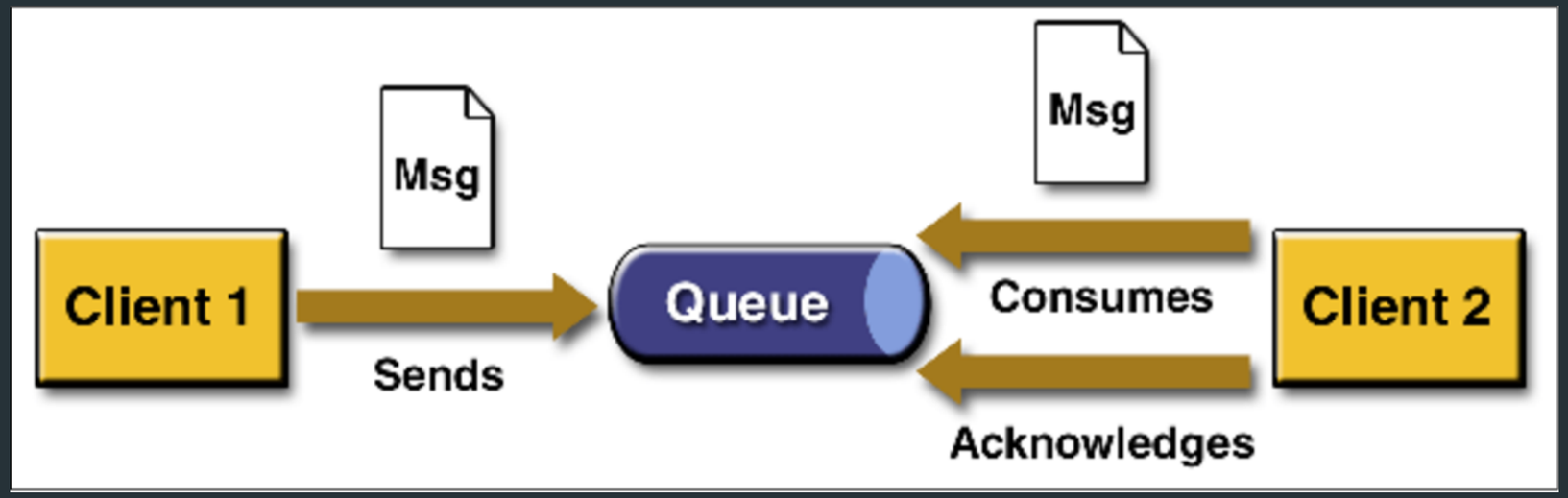

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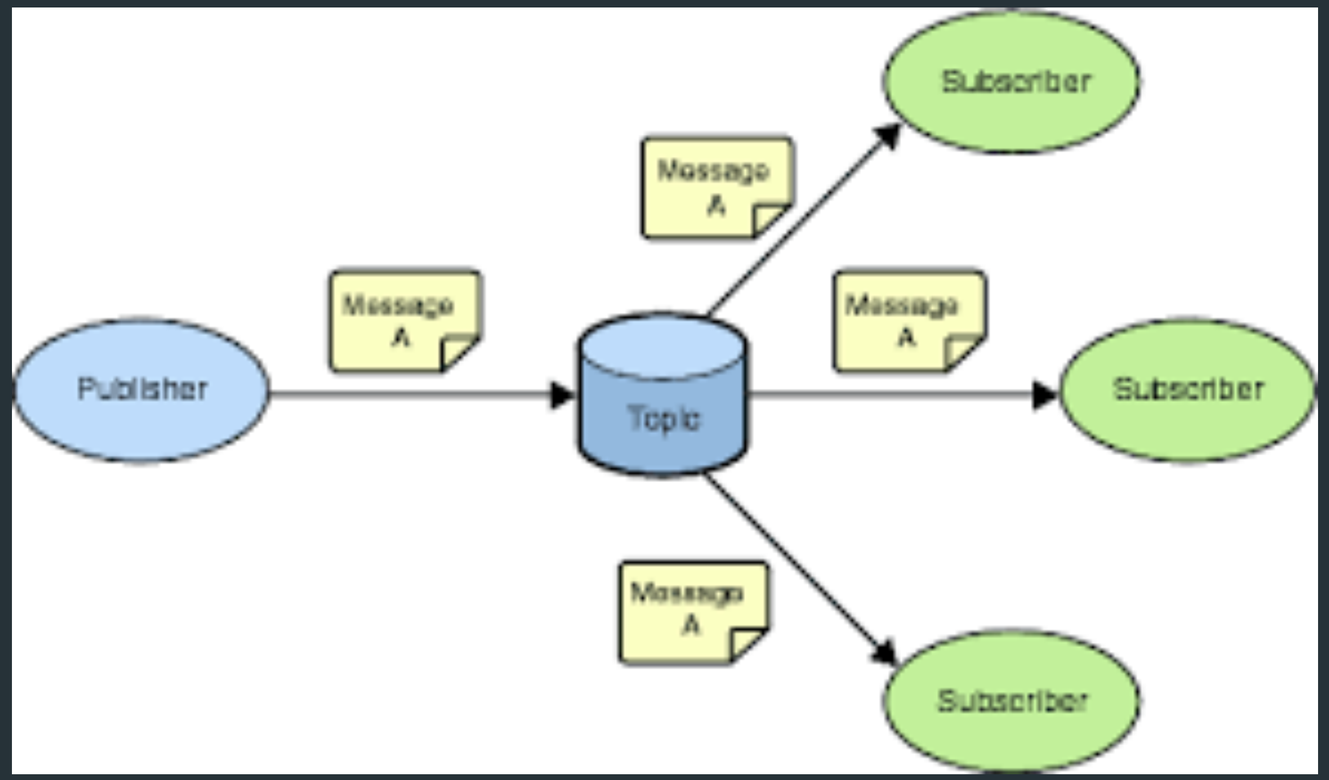

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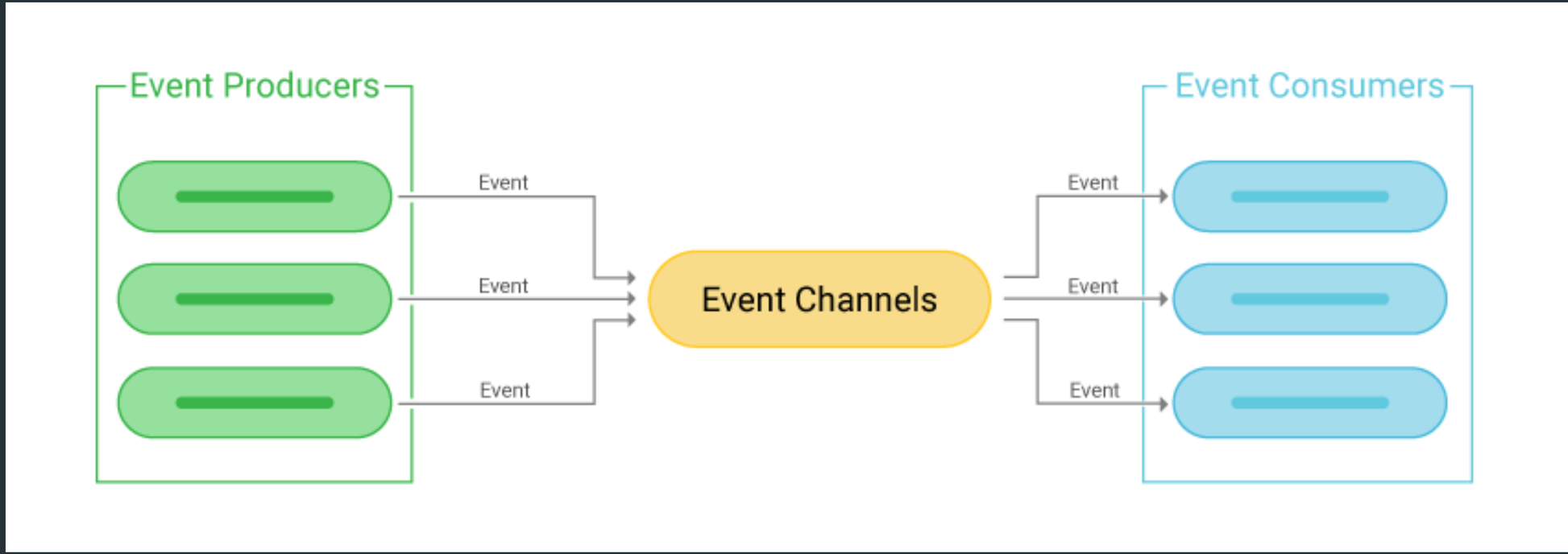

Service Oriented Architecture (SOA)

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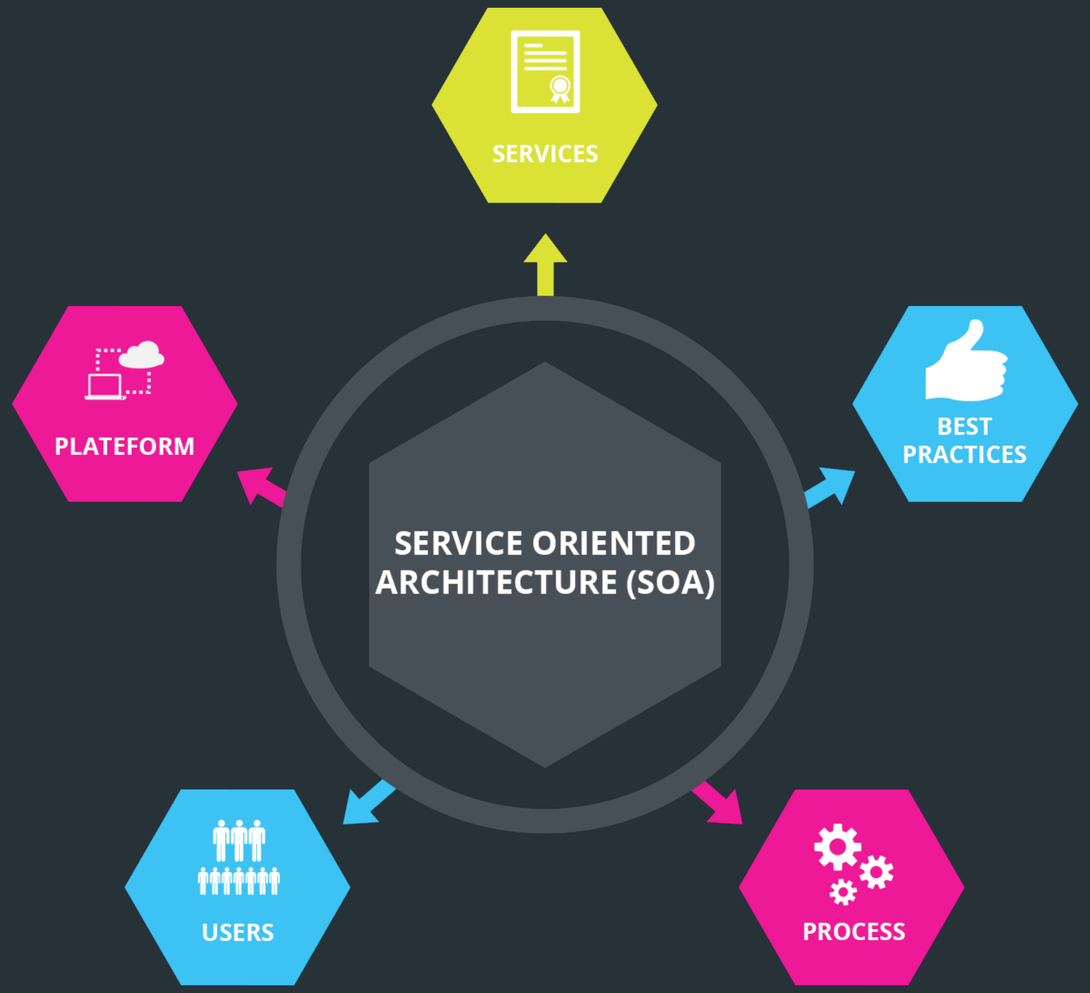
SOA Key Features

- Service contract
- Service description
- Service discovery
- Service composition
- Service security



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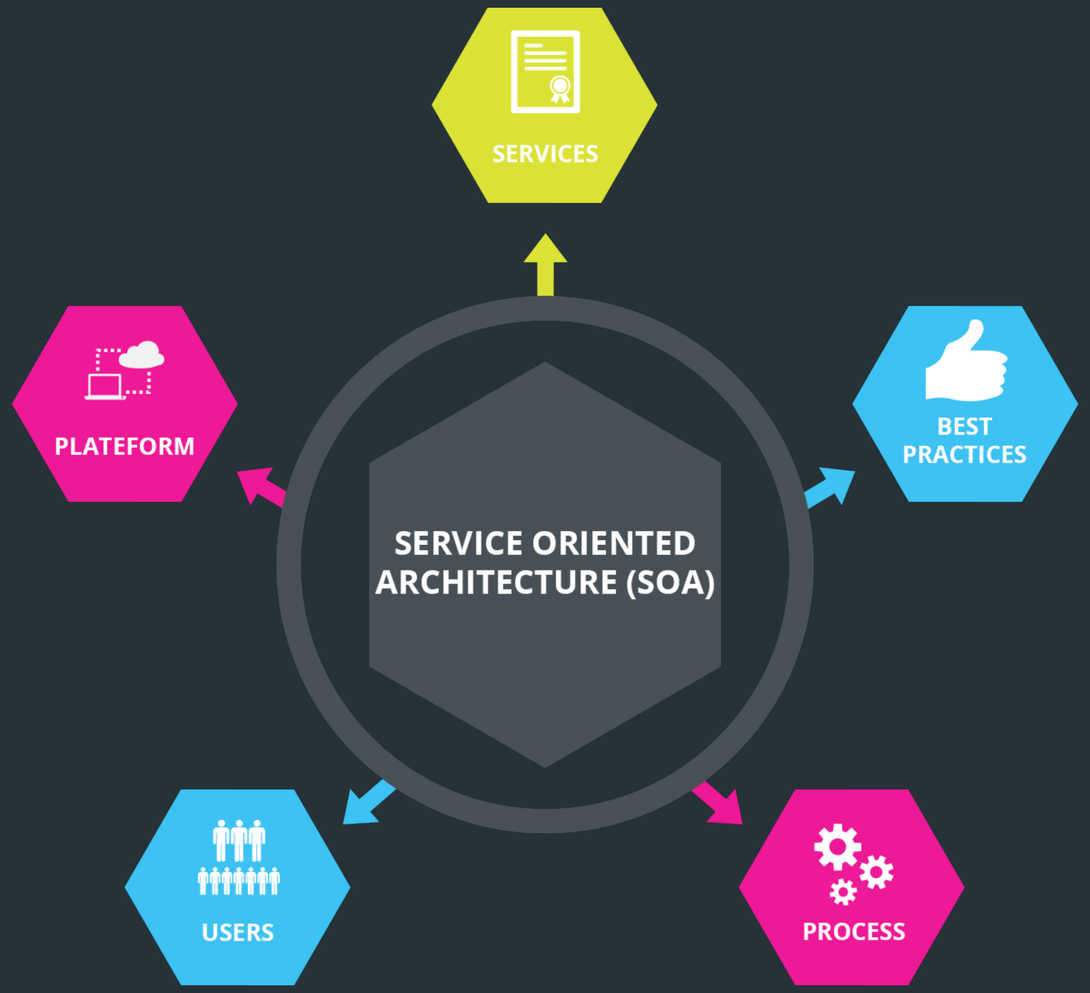

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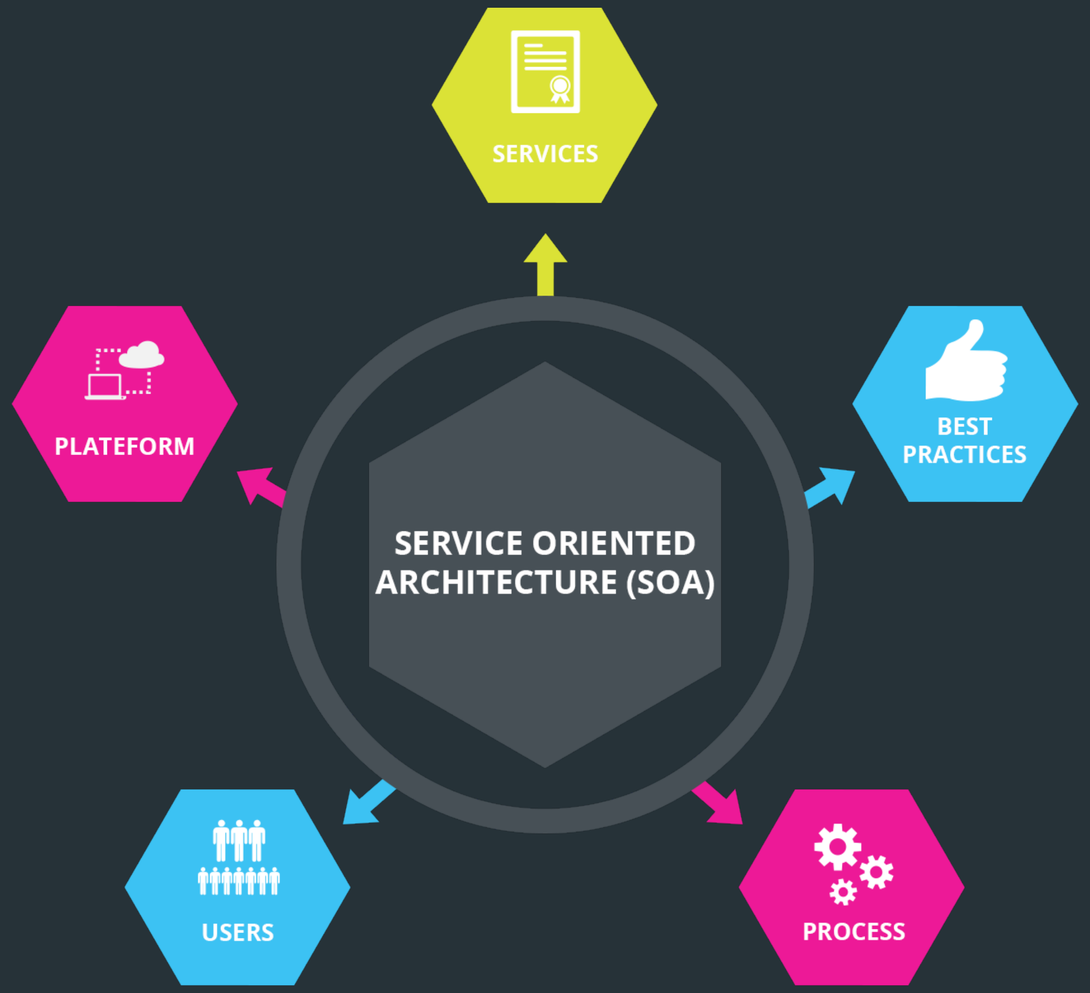

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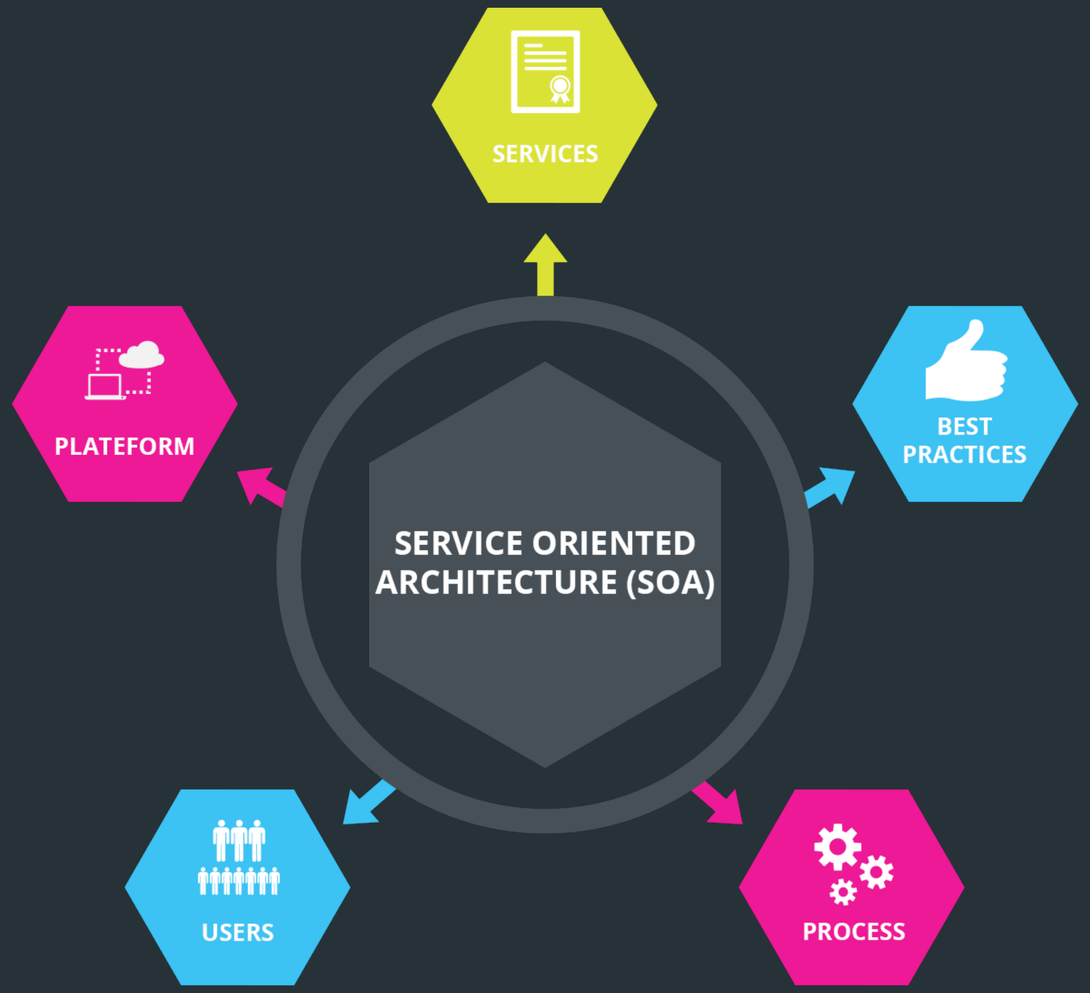

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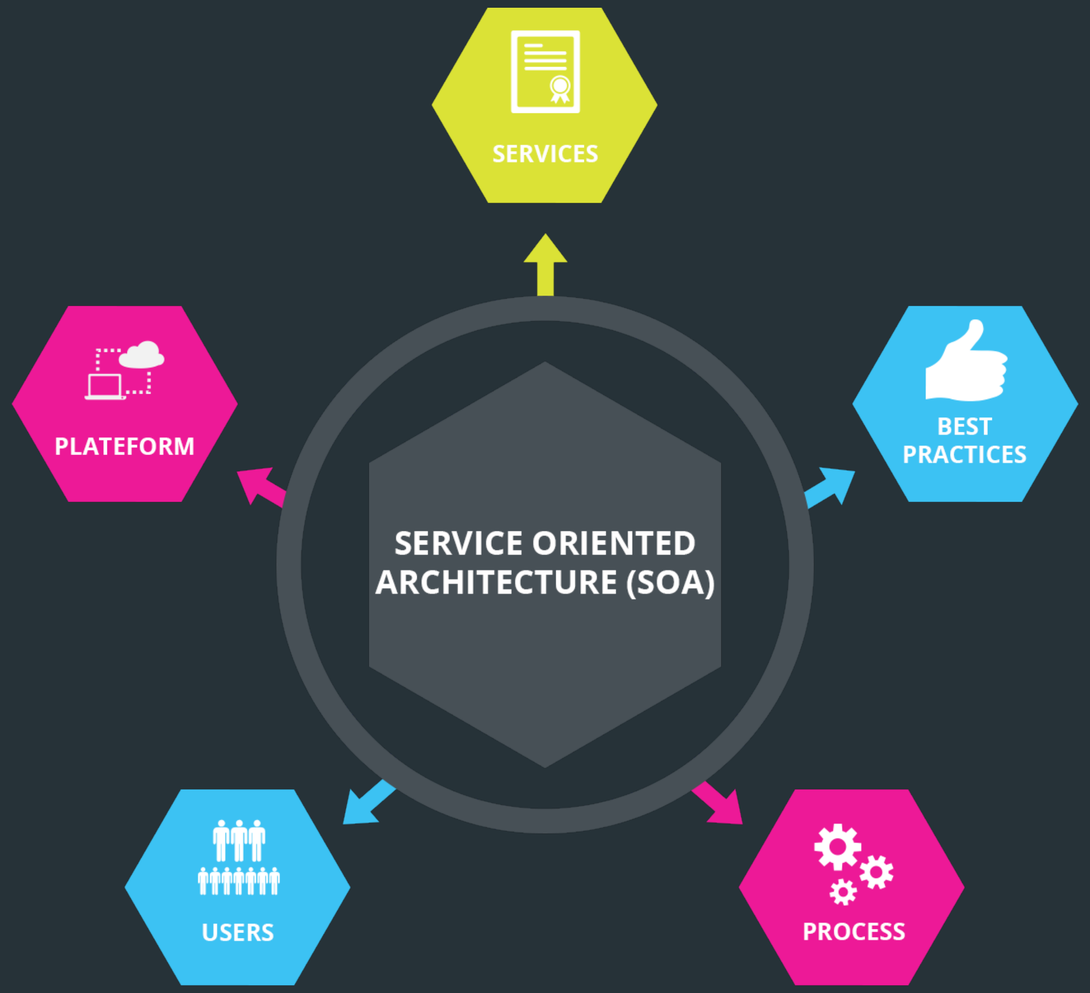

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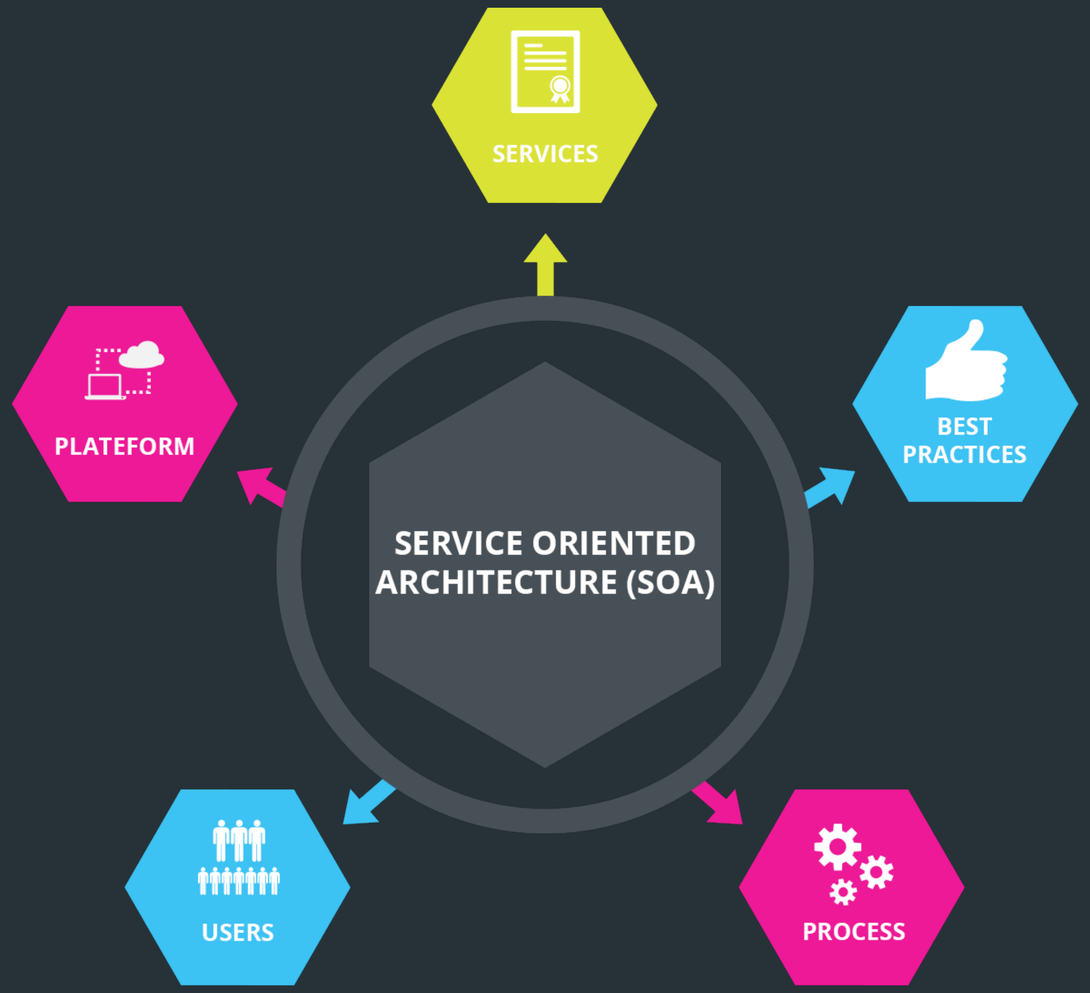

Microservices Architecture

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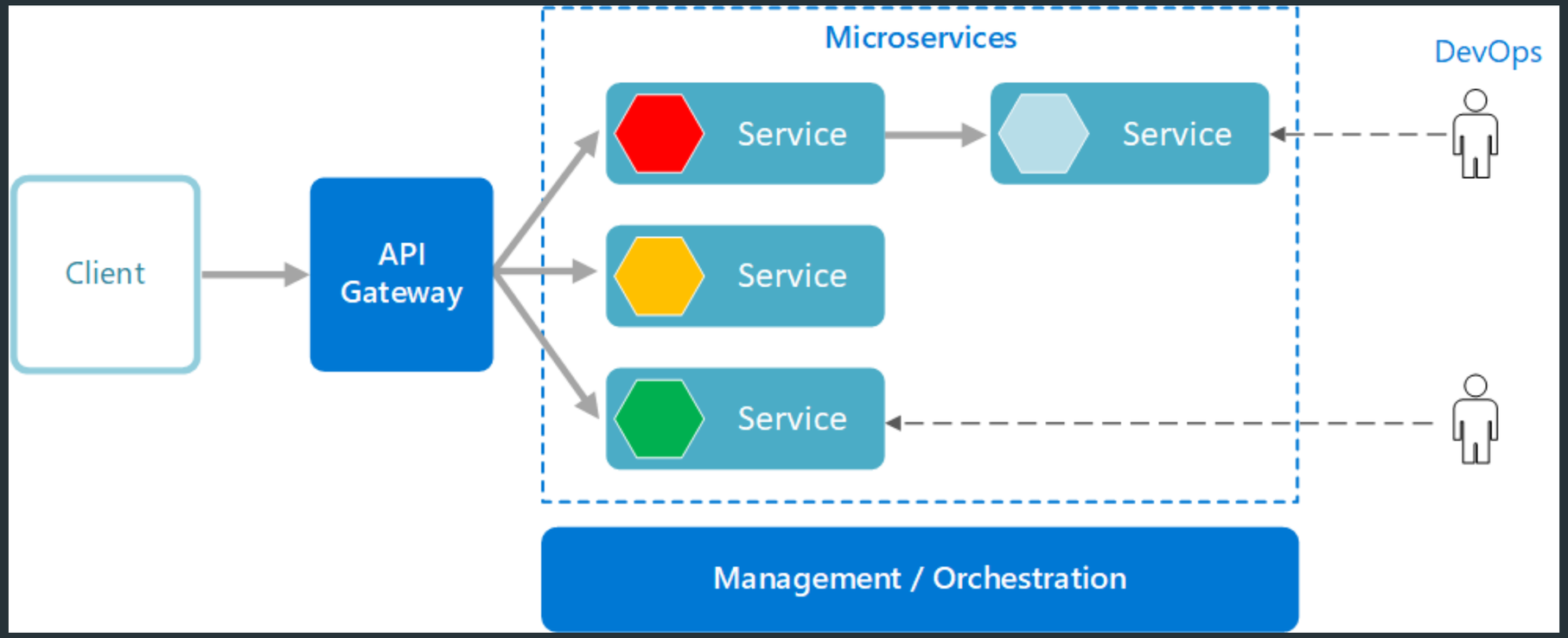

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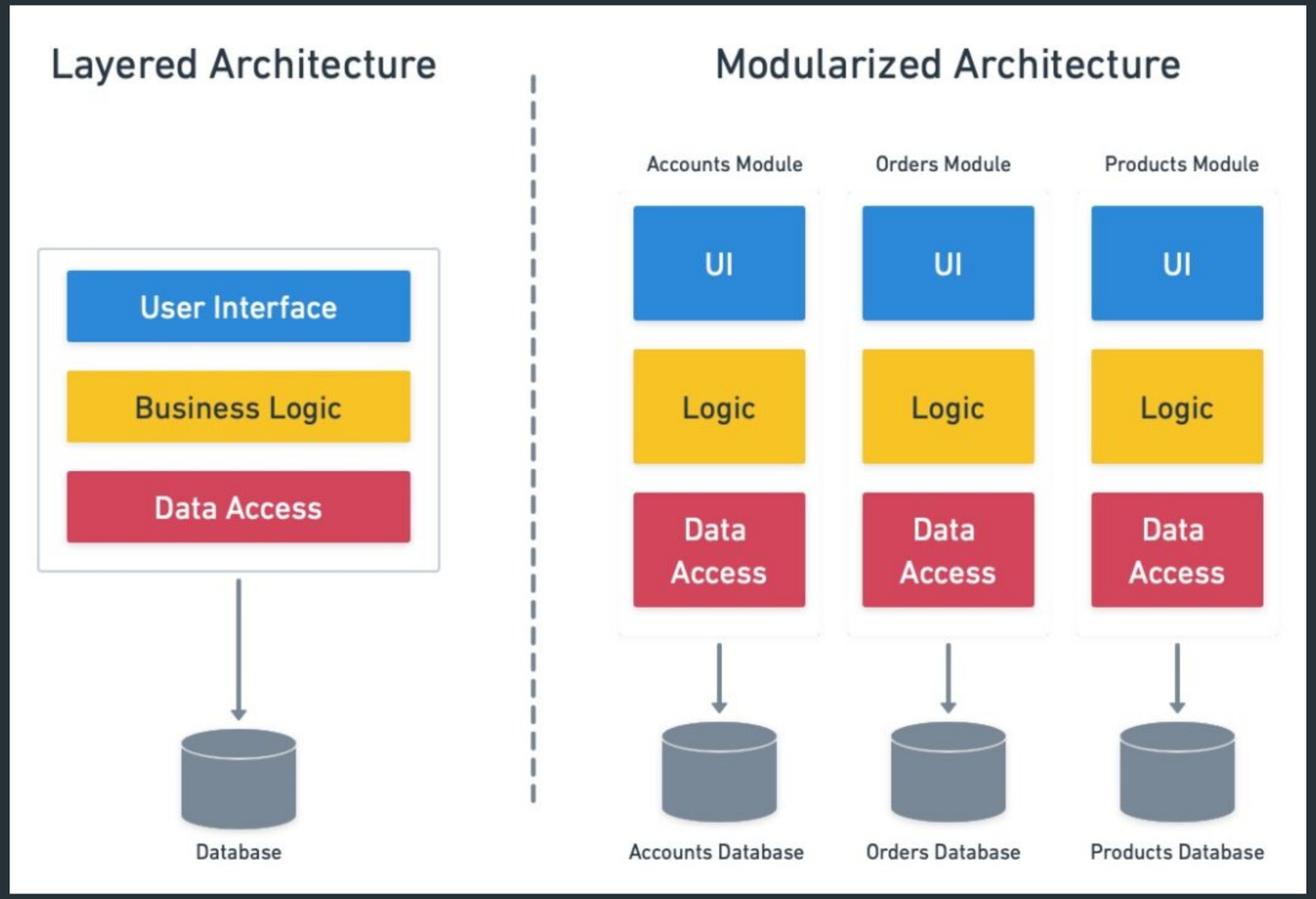

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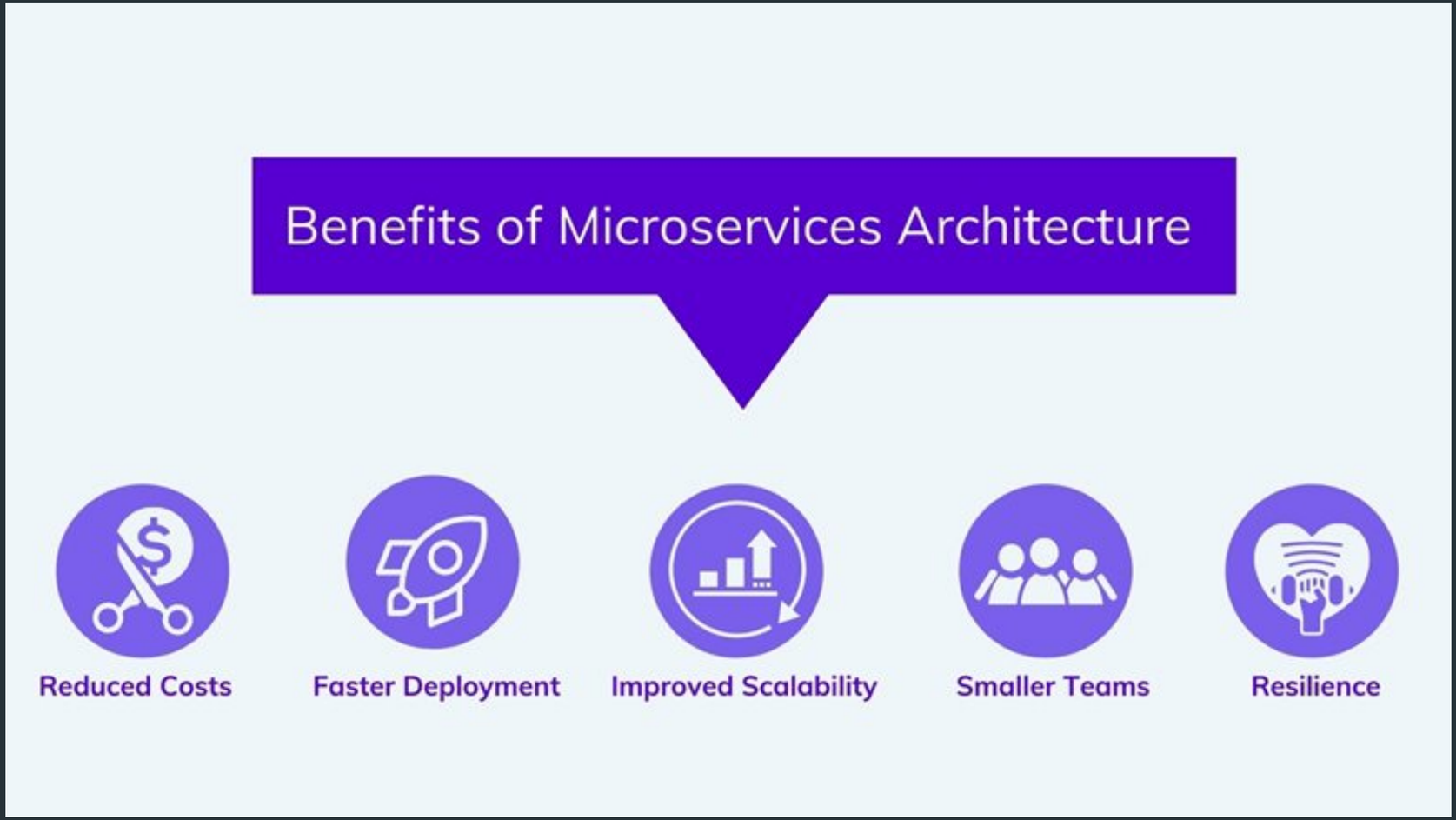
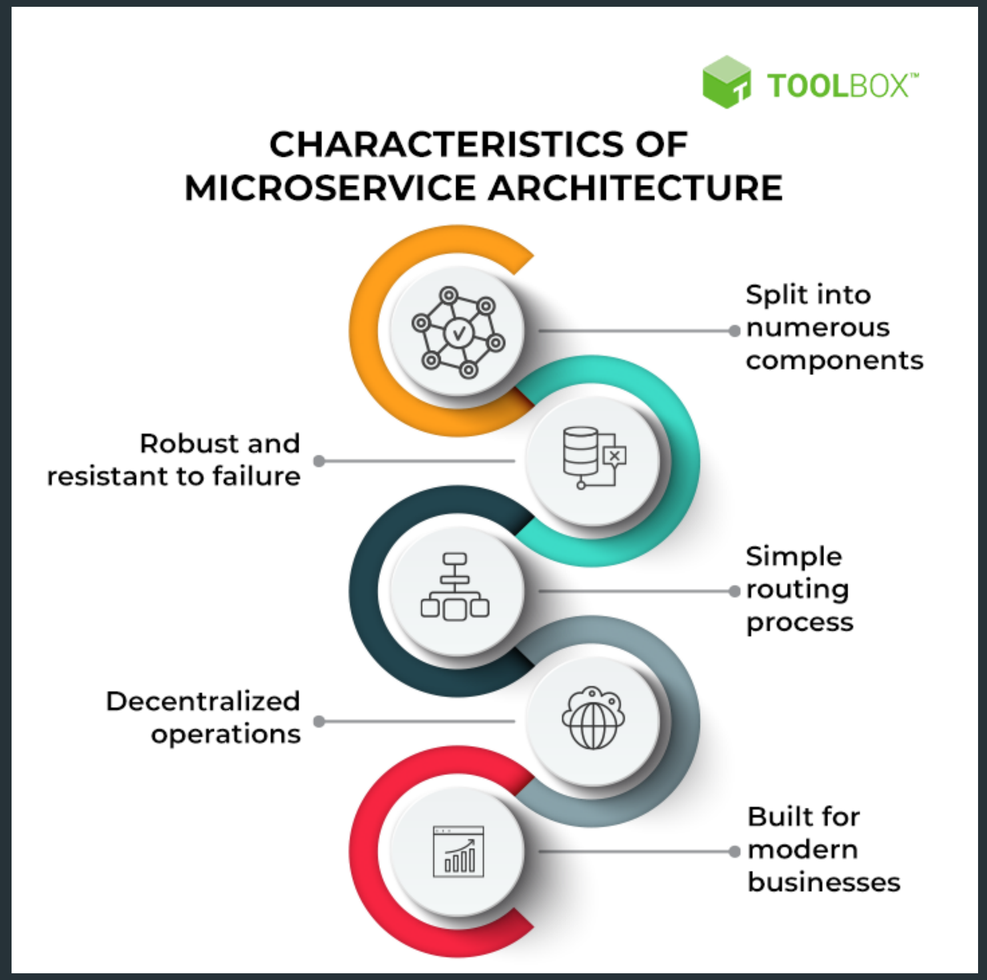


Microservices Key Concepts

- Service boundaries
- API-first design
- Decentralized governance
- Continuous integration and deployment
- Resilience and fault-tolerance



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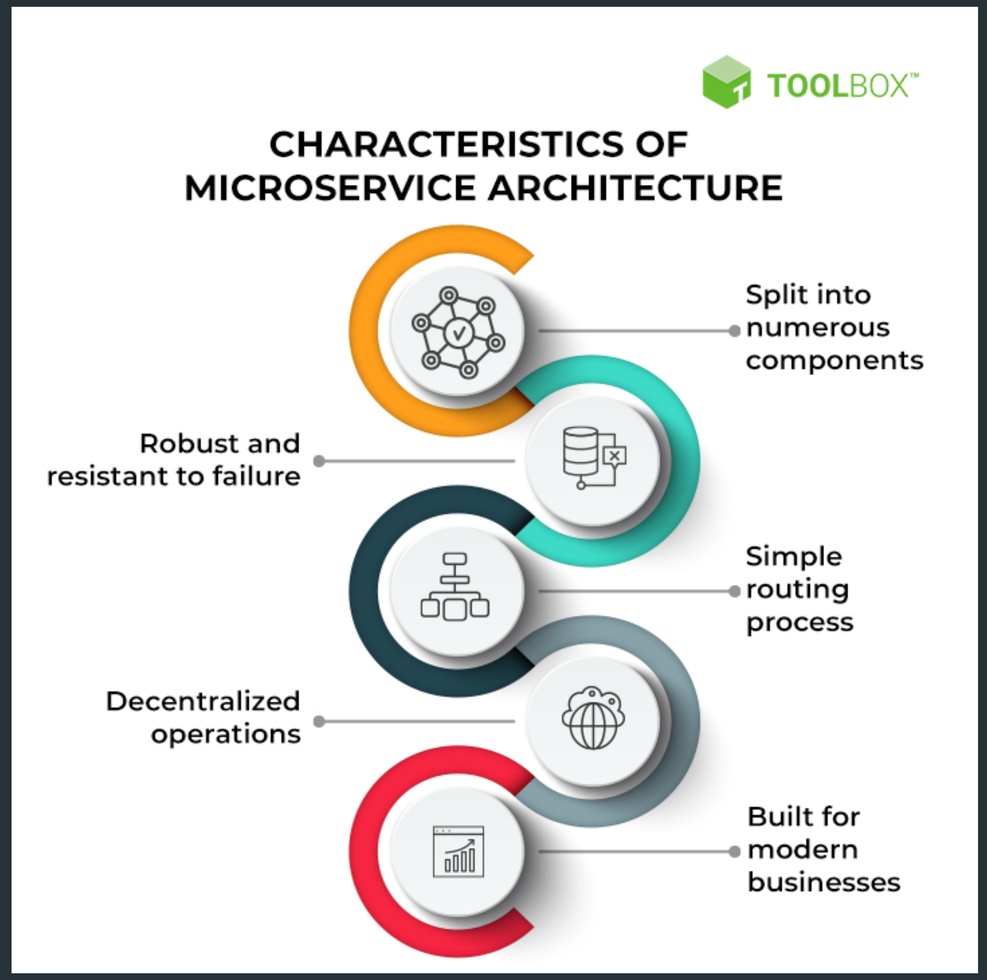

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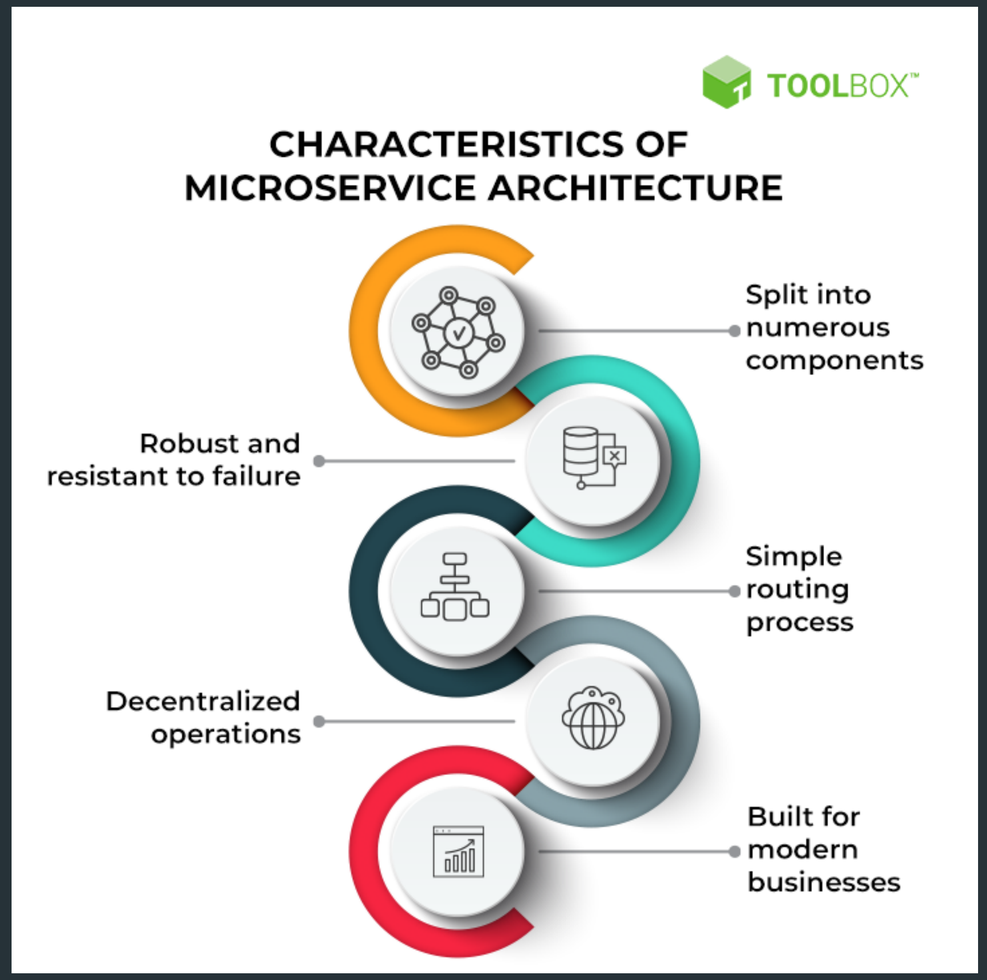

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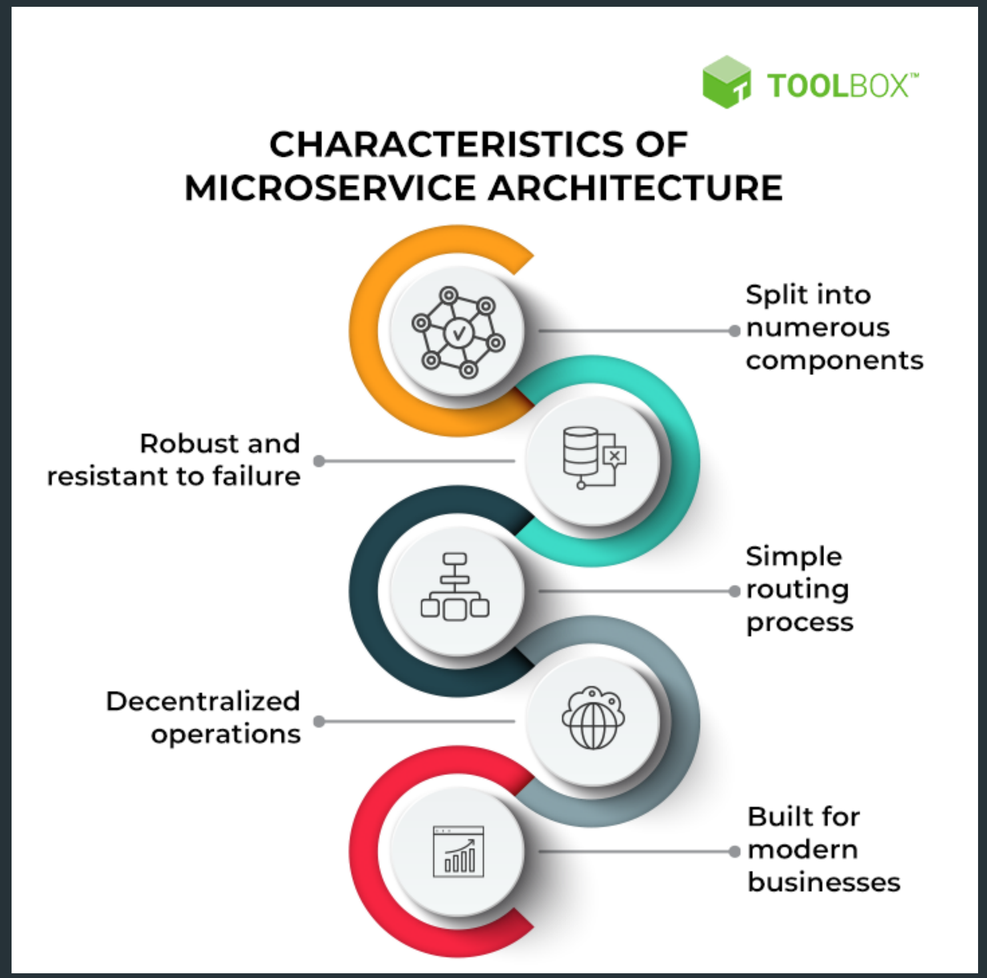

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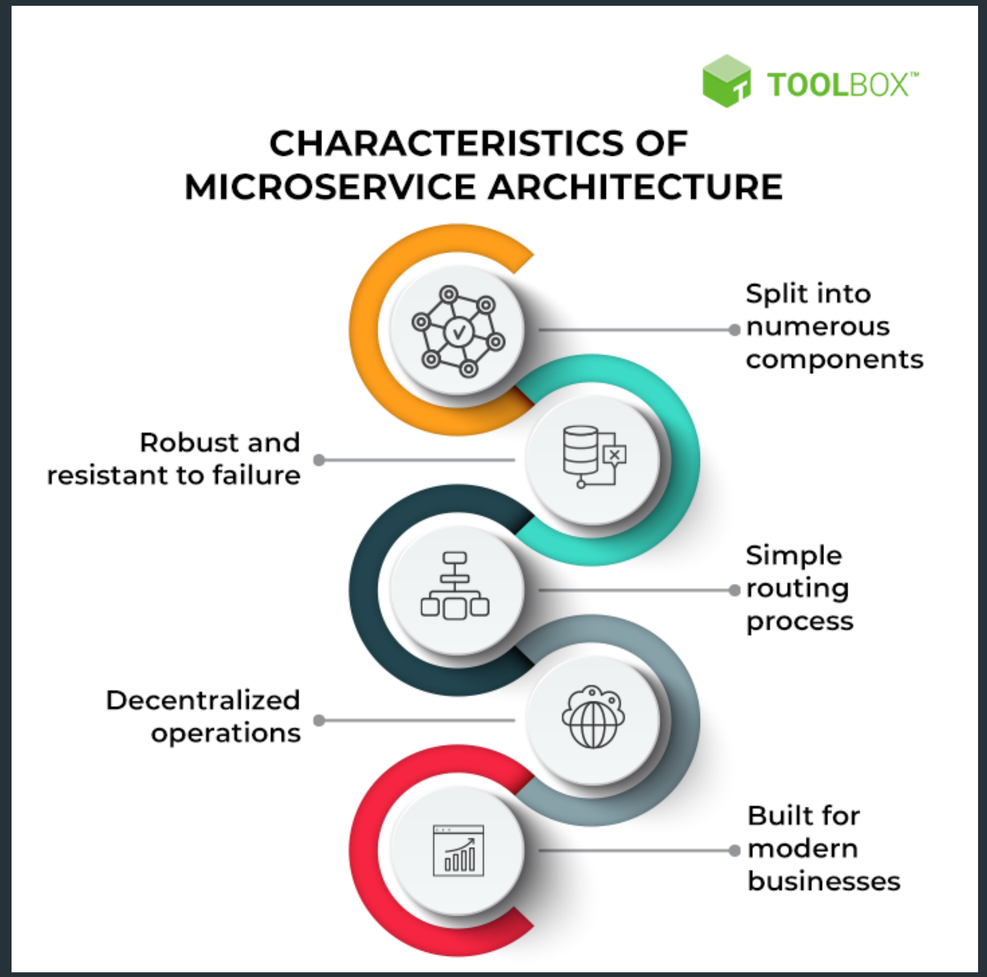

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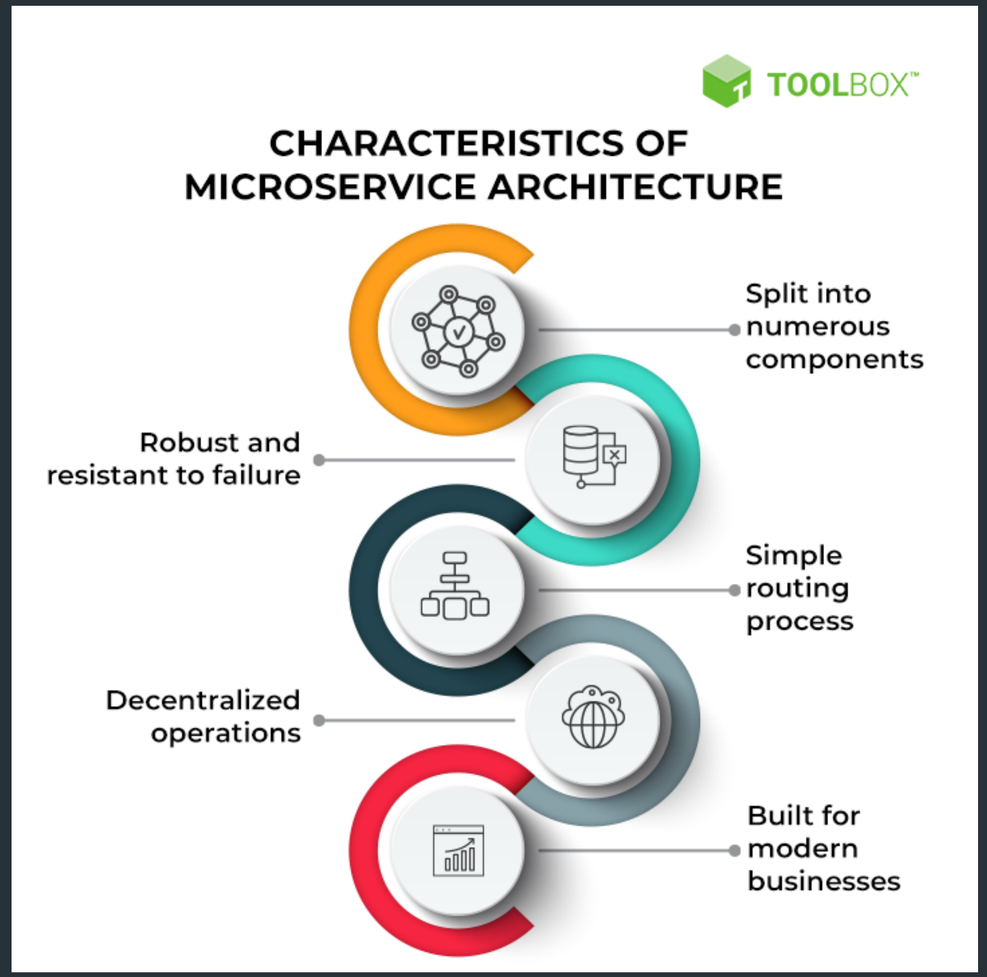

Serverless Computing

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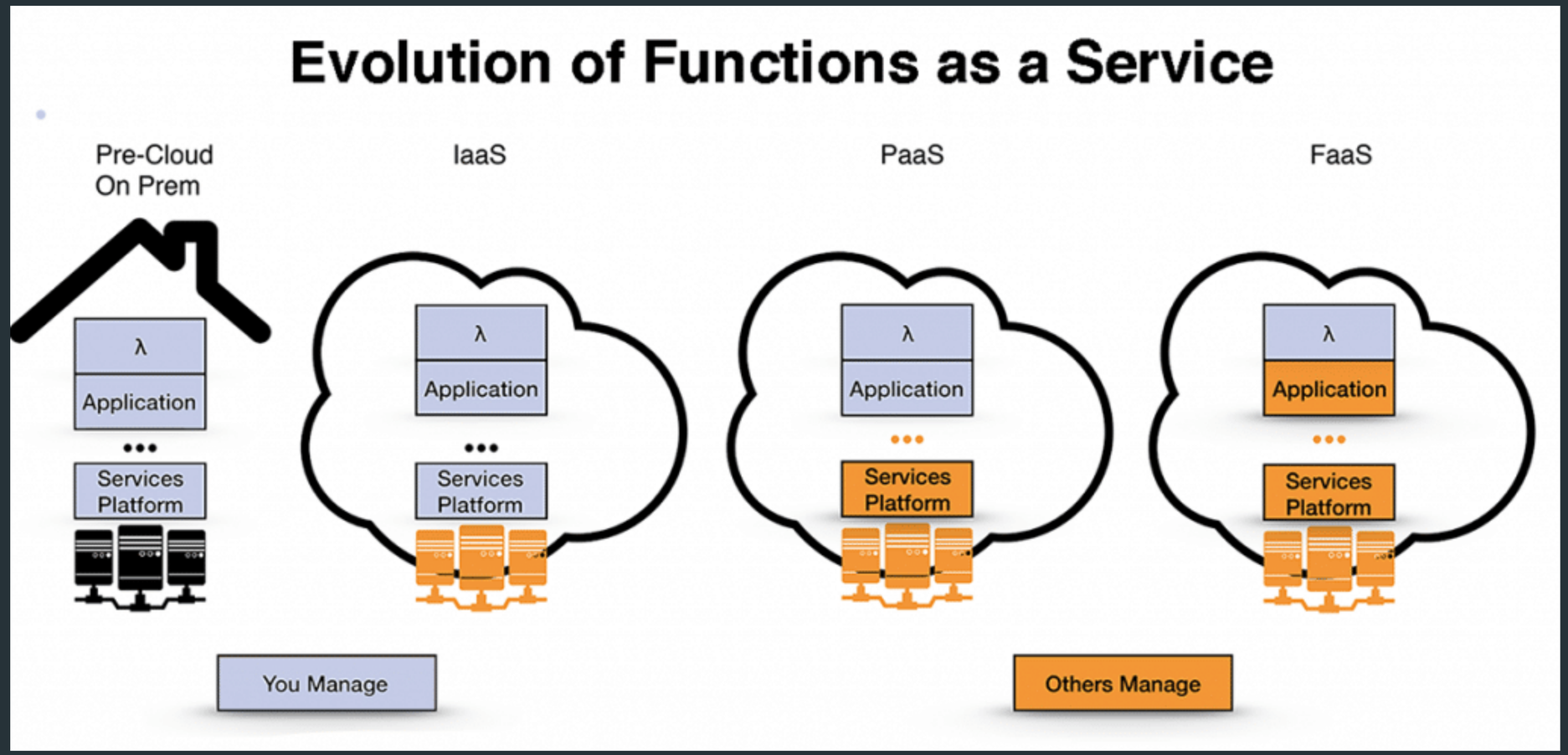

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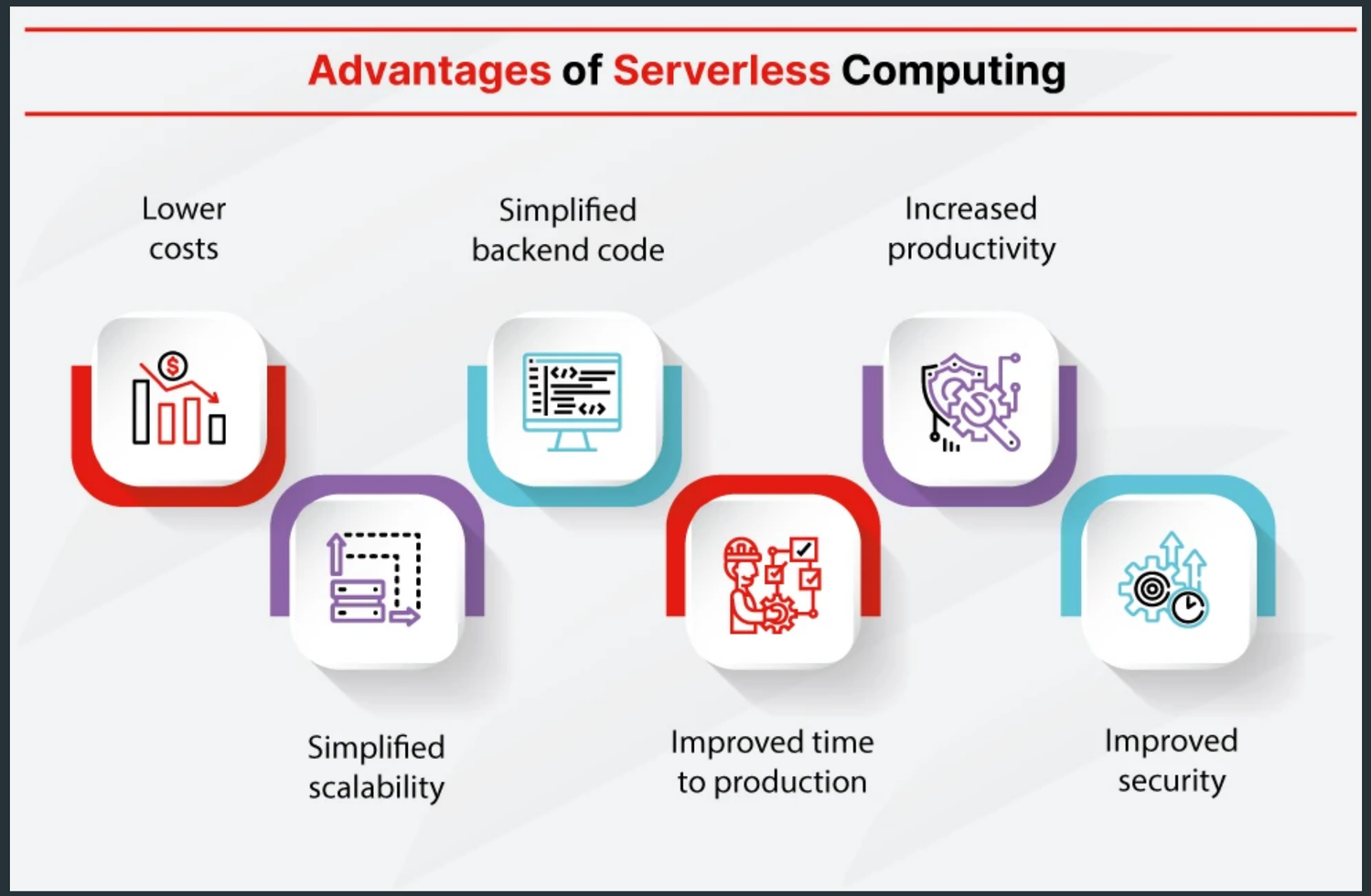

Serverless Key Concepts

- Event-driven architecture
- Stateless functions
- Pay-per-use billing
- Third-party services
- Cold start latency

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- Stateless functions
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- **Cold start latency**

Plan

Homework Plan

- Short essay (> 500 words) explaining the basic concepts of web services.
- Simple RESTful web service.
- Design and implement a message-oriented middleware system.

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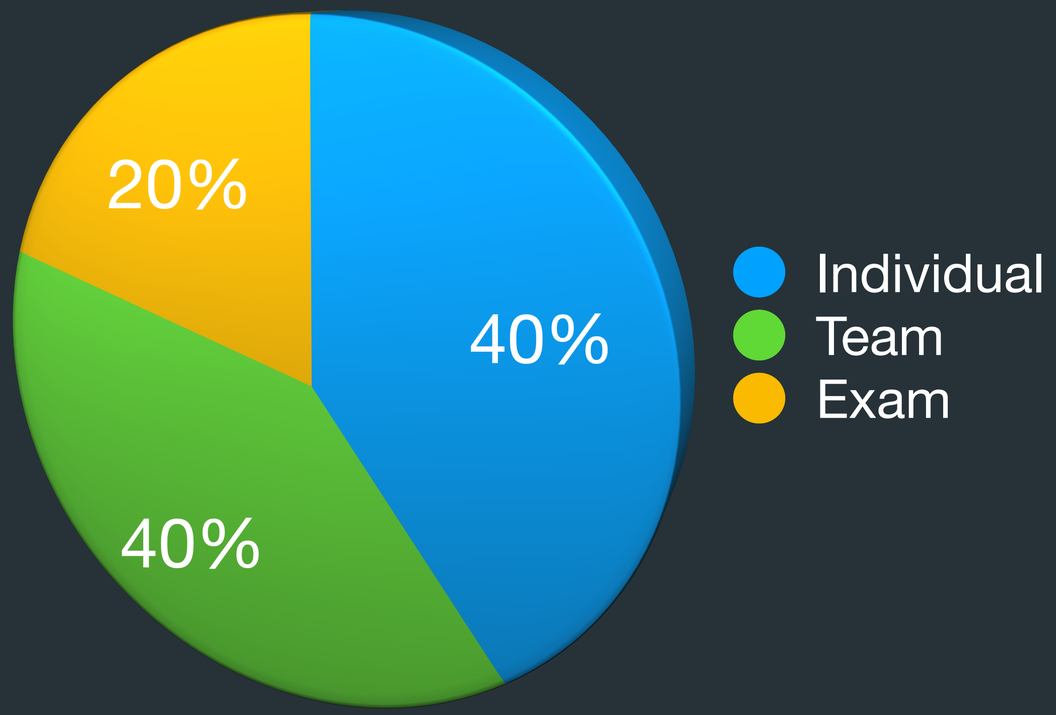
Individual

Team of Two

Homework Plan

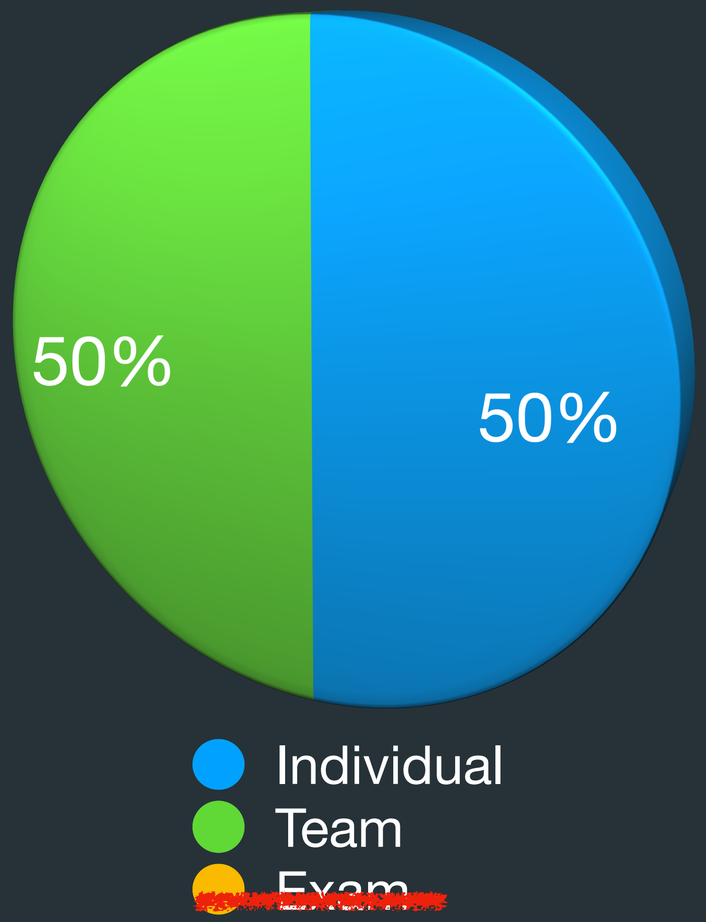
- Everything should be submitted on GitHub Classroom repository.
- To receive a grade the homework should be presented in class.

Grades



Grades

Done before April 15th



Done before May 27th

Lecture outcomes

- Web services & middleware - essential for distributed systems
- Various architectures & technologies - different benefits & trade-offs
- SOA, Microservices, Serverless - different architectures for web services
- MOM - important for asynchronous communication
- Plan - the course plan.