

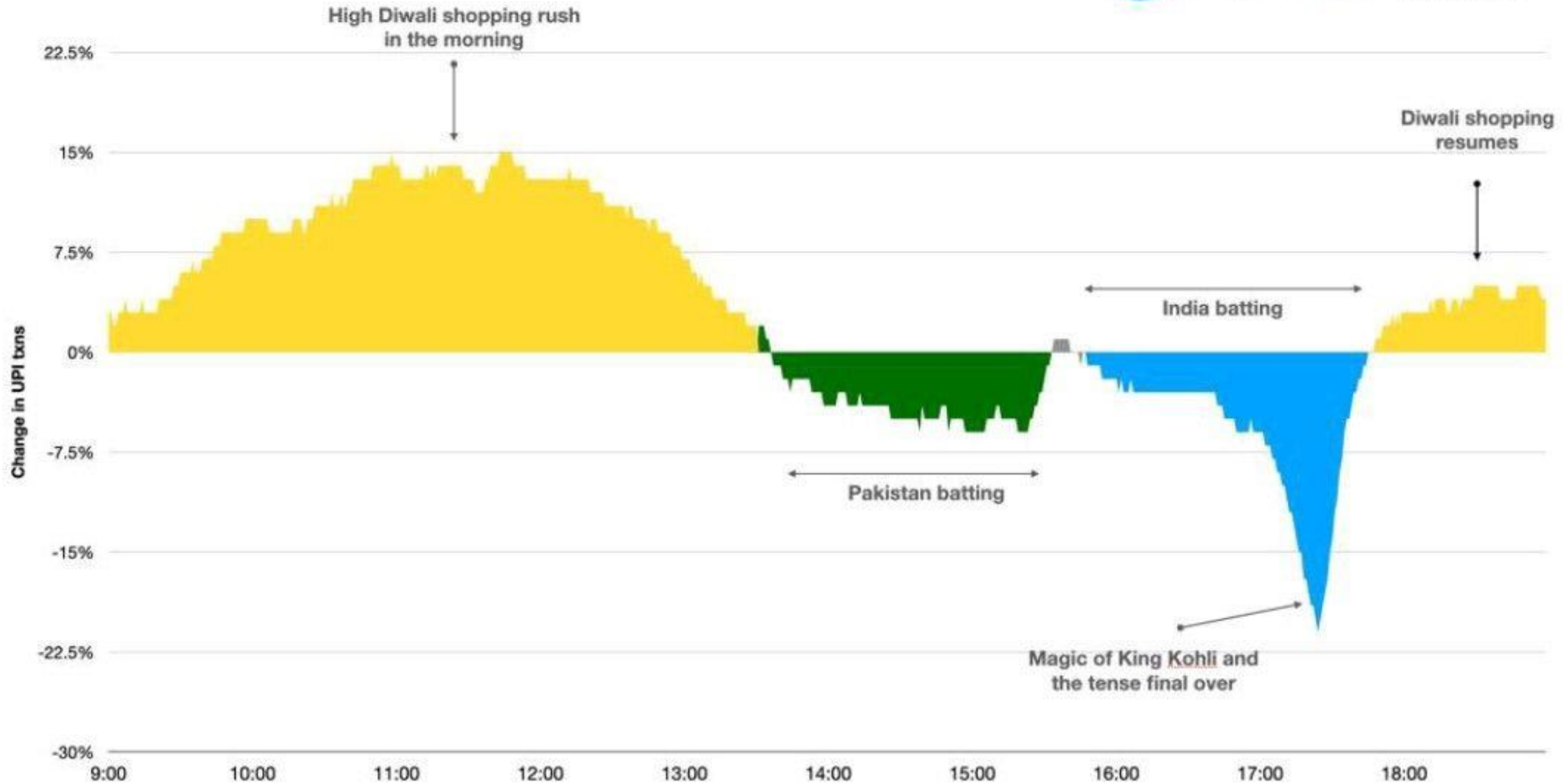
Software System Design

PG – Monsoon 2022



Software Engineering Research Centre
IIIT Hyderabad, India







Building Blocks of a Software System

Servers: Hosting, Load Balancing, CDN, DNS

Access Protocols: HTTPS-SSL/TLS, Proxy, Reverse-Proxy

Data: Relational, Warehouse, Data Cube, Data Lake, Unstructured

Messages: SMTP, POP3, Push Notifications, Message Queues

API Gateways: SOAP, REST API, ODATA, Micro-Services, WebHook

File Transfer: FTP, SFTP-SSH

Authentication: SSO/SAML/LDAP

Authorization: OAuth with Grant Type: CC/AC/RP/DC/RT/PKCE

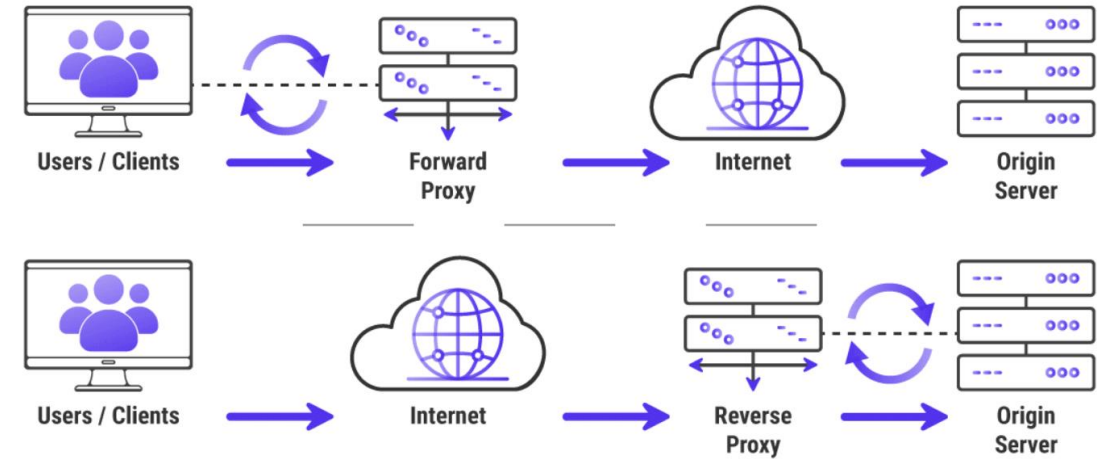
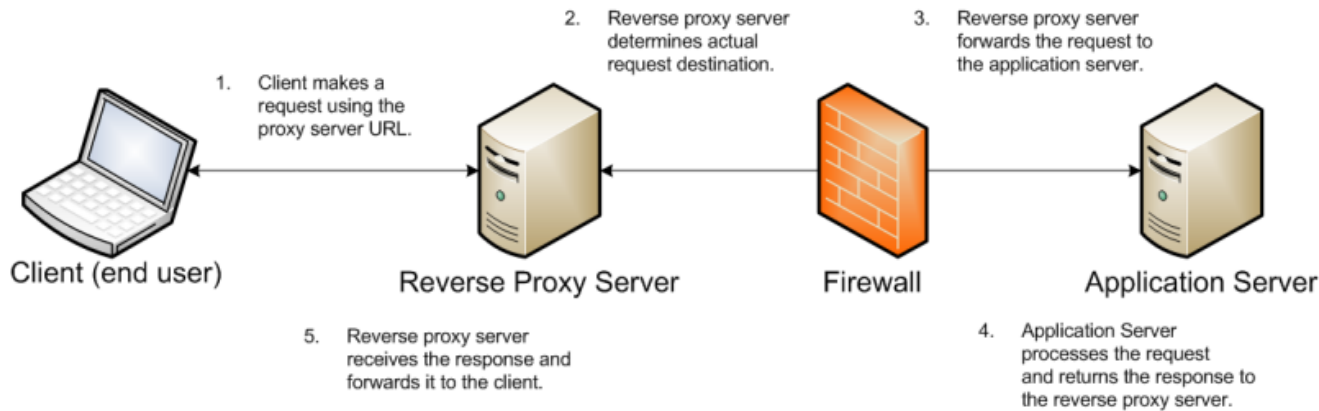
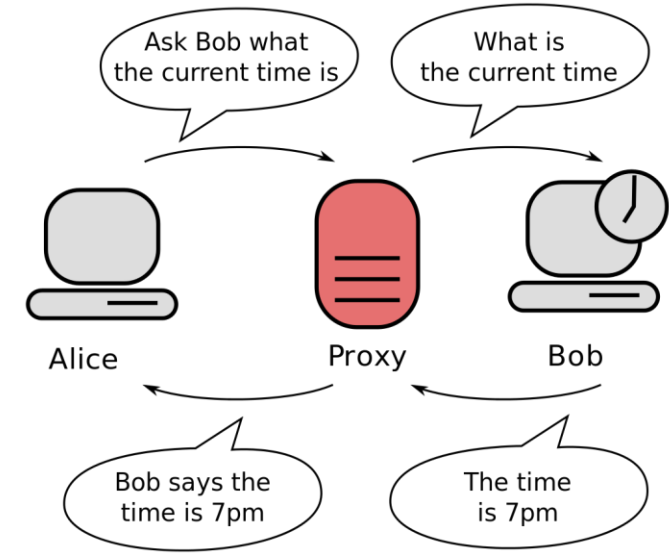
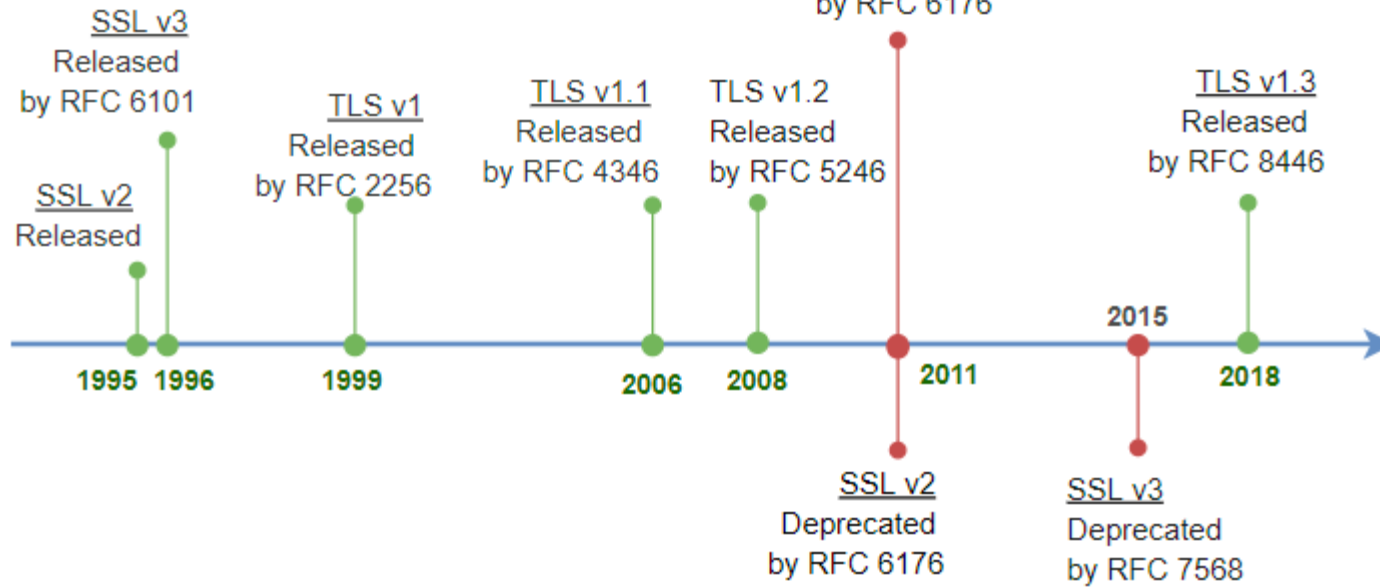
Deployment Style: IaaS, PaaS, SaaS, Hosted, On-Premise

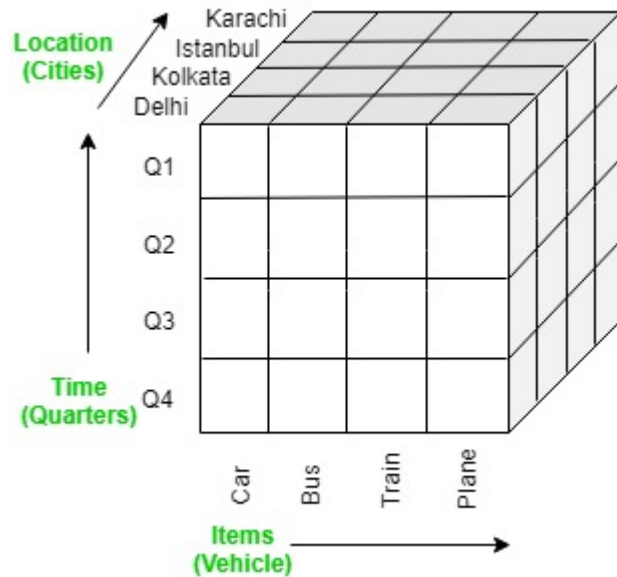
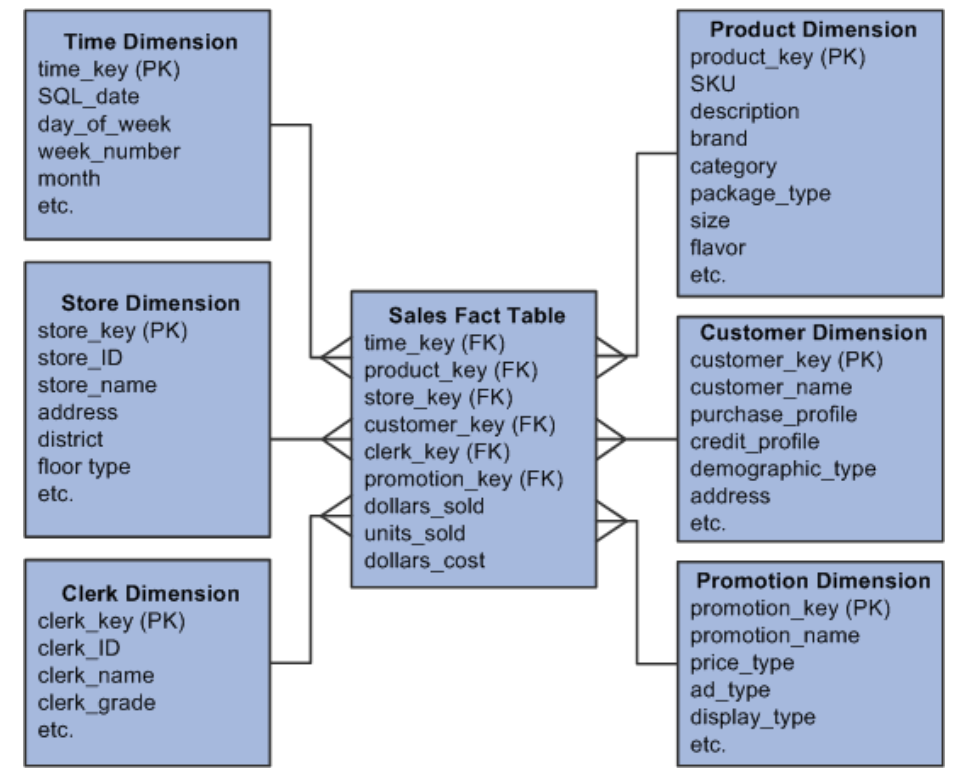
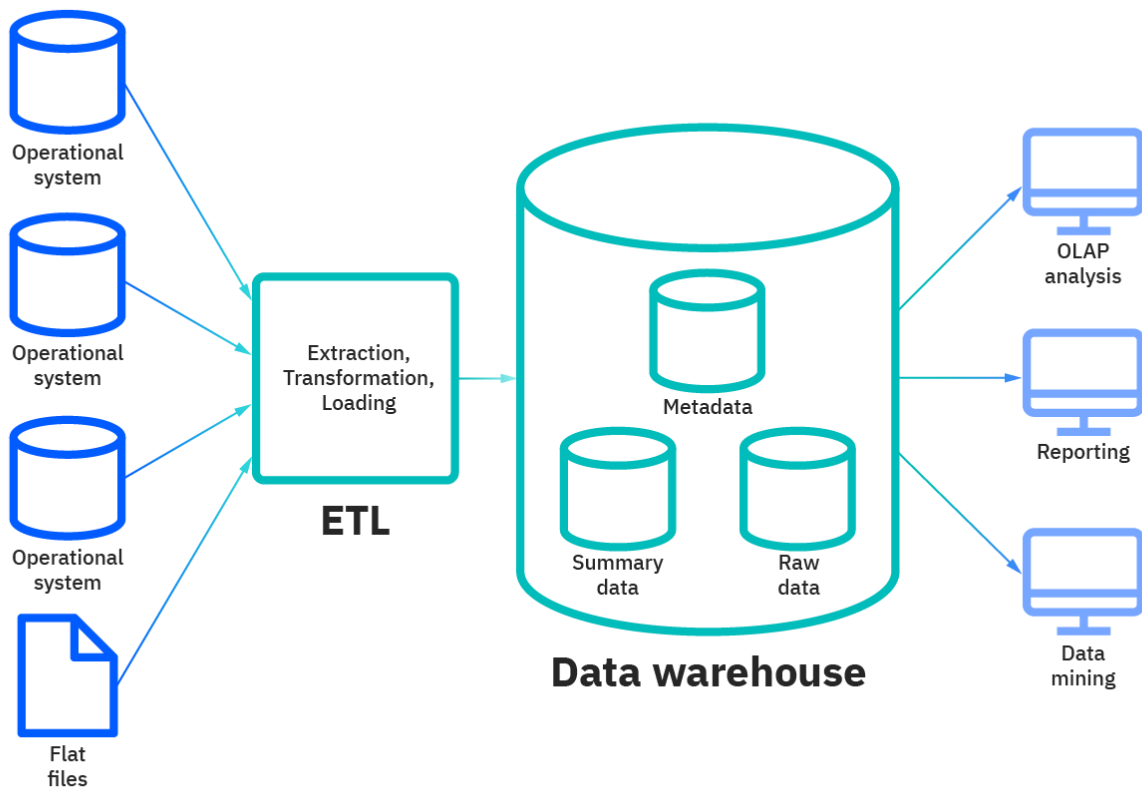
Release Management: In-place, Installer, Orchestration

Reporting & Logging: In-App, Out-App, Plugins

Framework: CMS, CRM, Full-Pack Ecosystems, In-house Custom

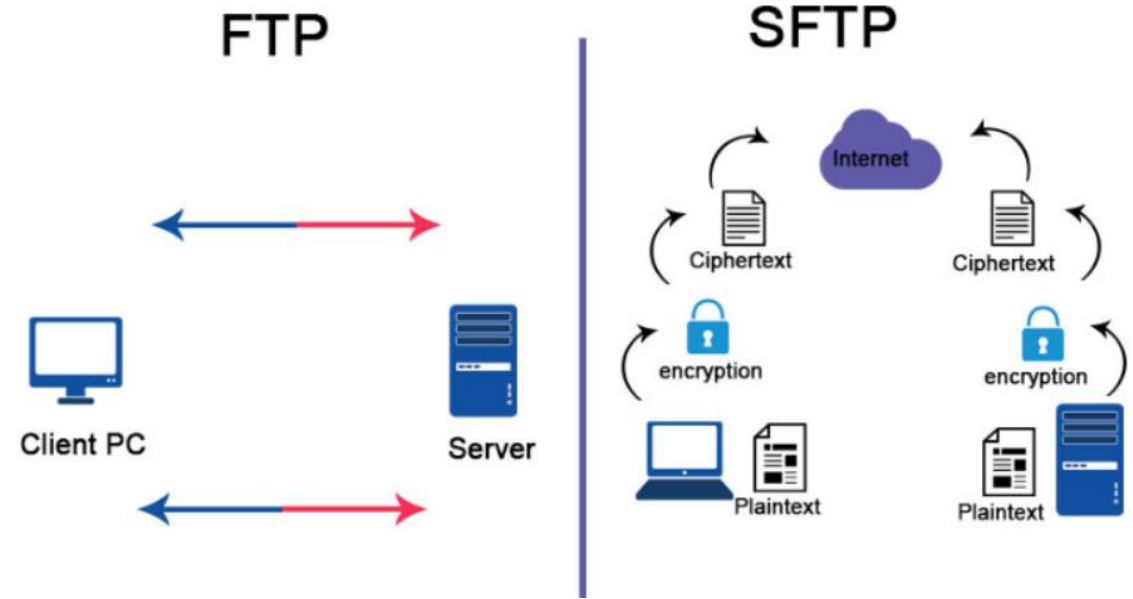
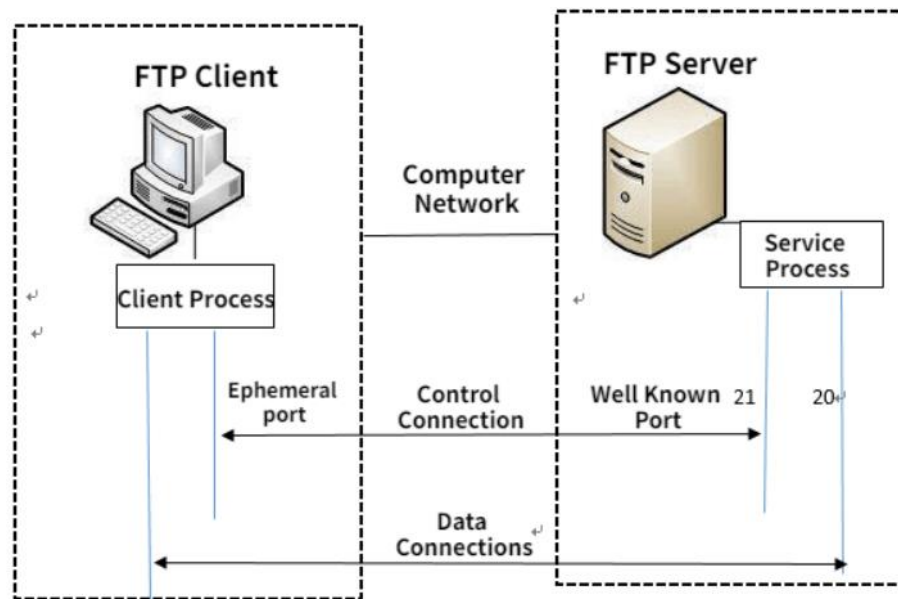
Backward compatibility with SSL
removed from all TLS versions
by RFC 6176



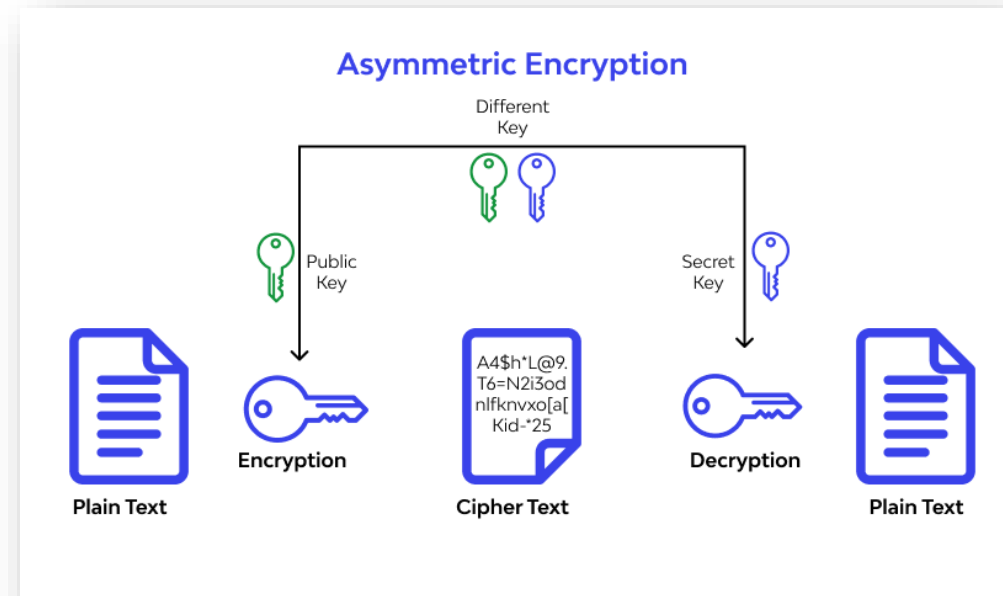
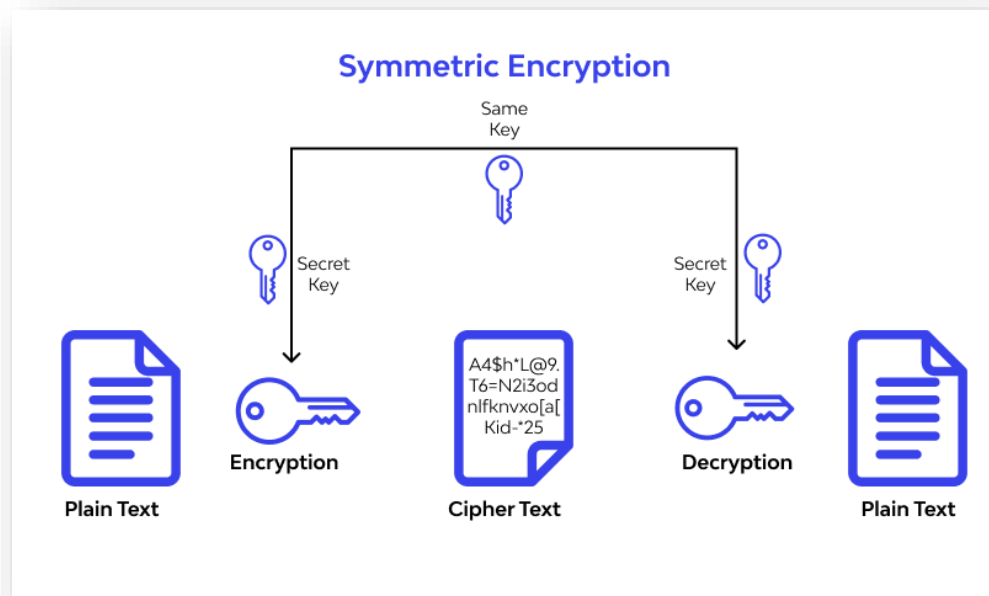


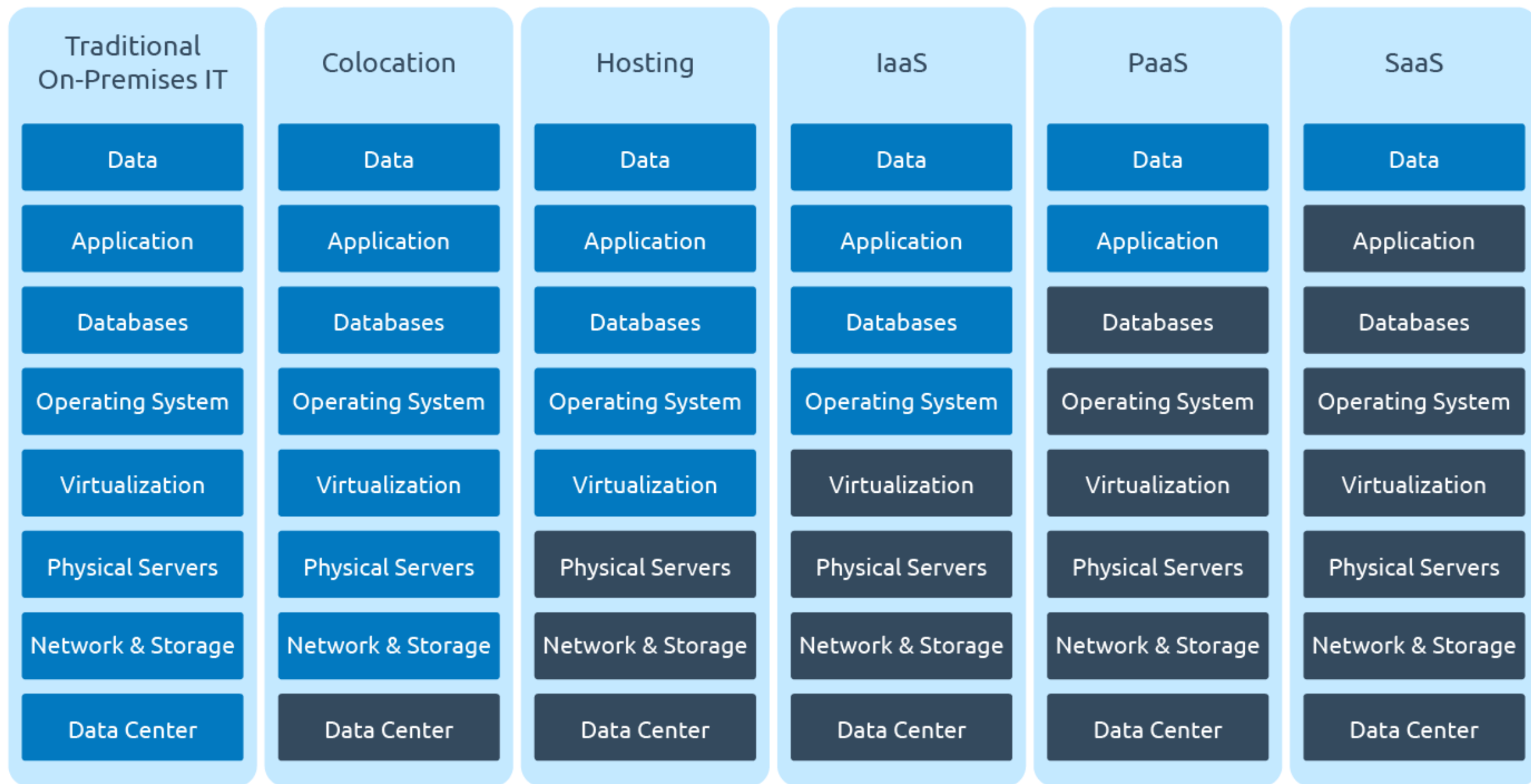
Replication – Publisher [Distributor] Subscriber
Change Data Capture * Change Tracking

Some Types: Transactional – Snapshot – Peer2Peer



SSH – Secure Shell Protocol

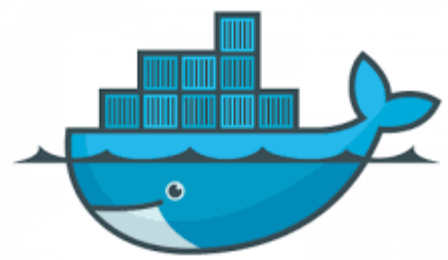
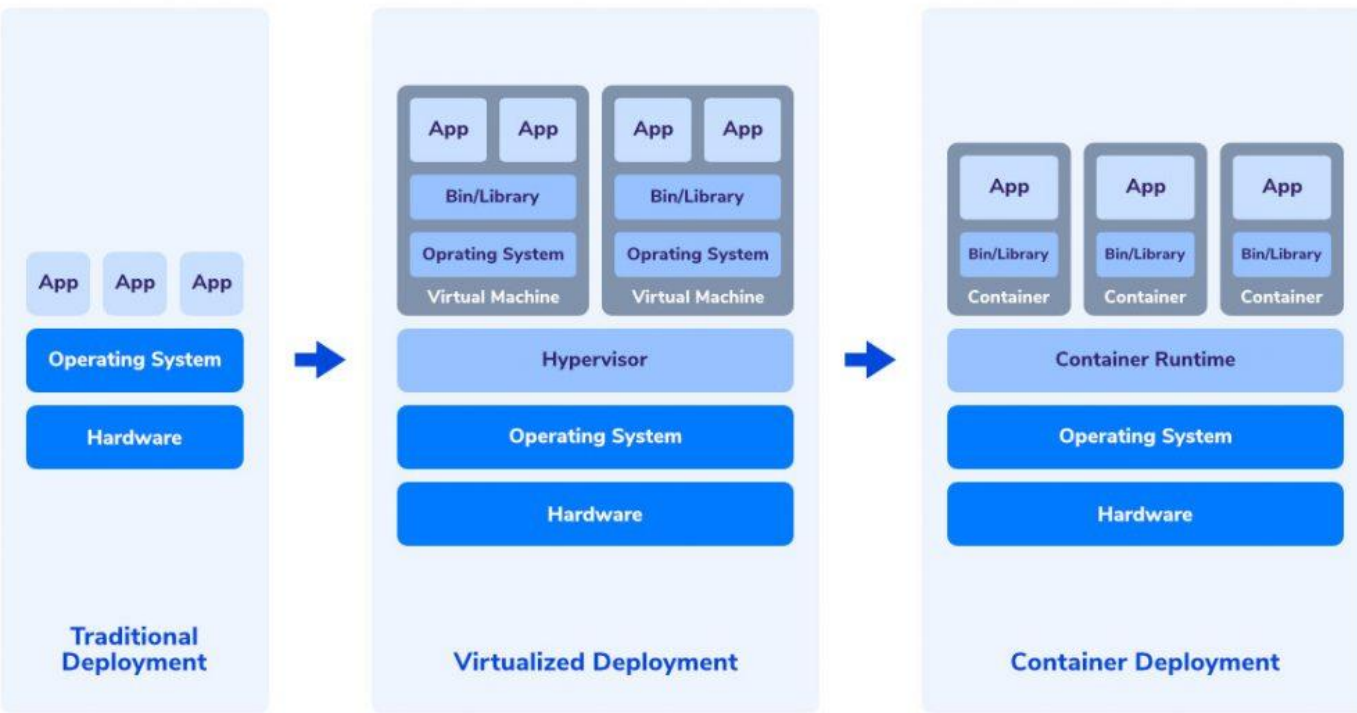




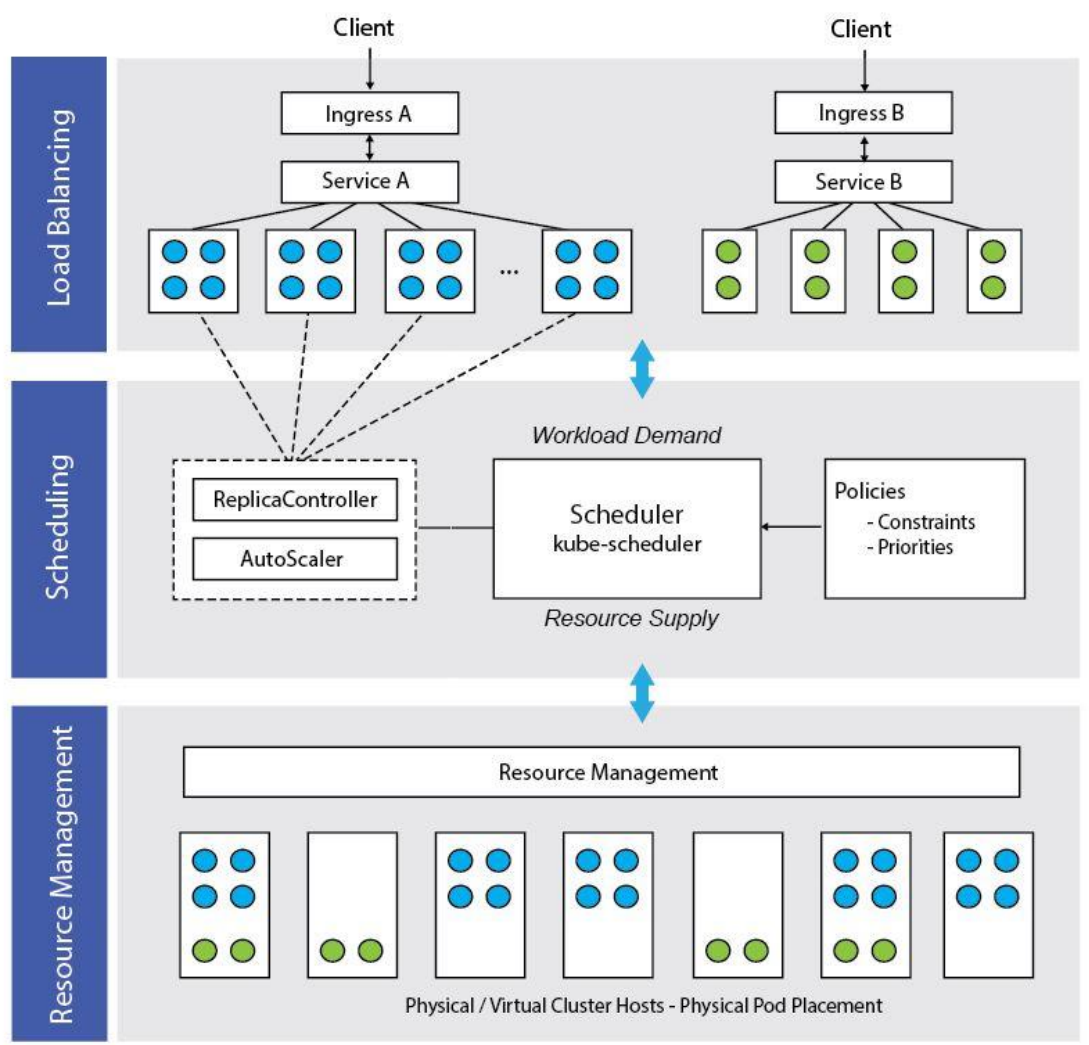
Provider-Supplied



Self-Managed



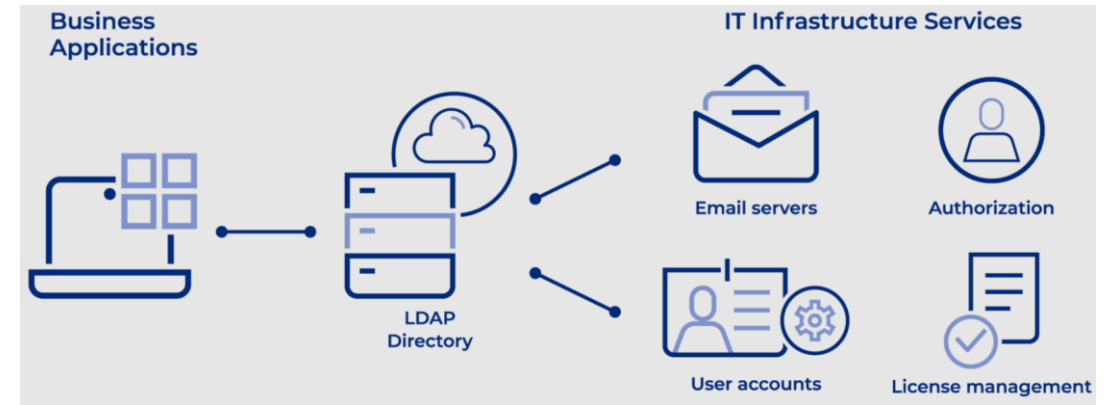
docker



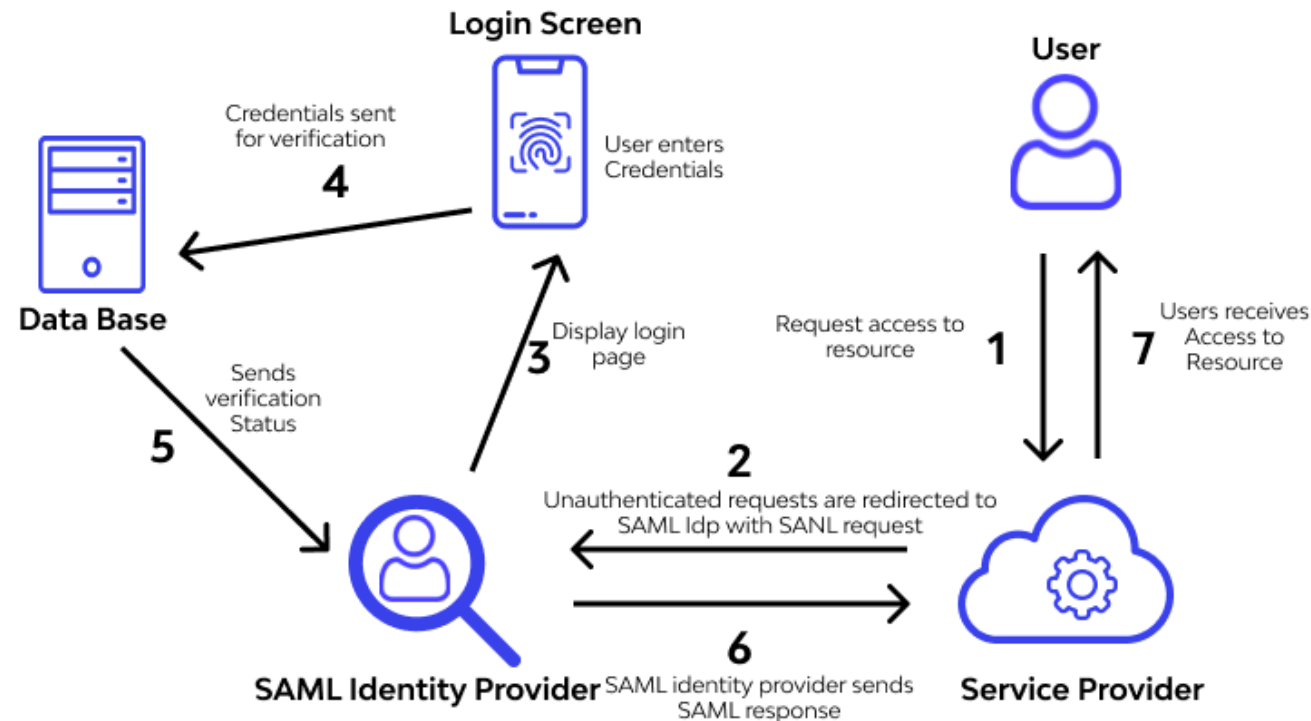
Tenant << Node << Cluster

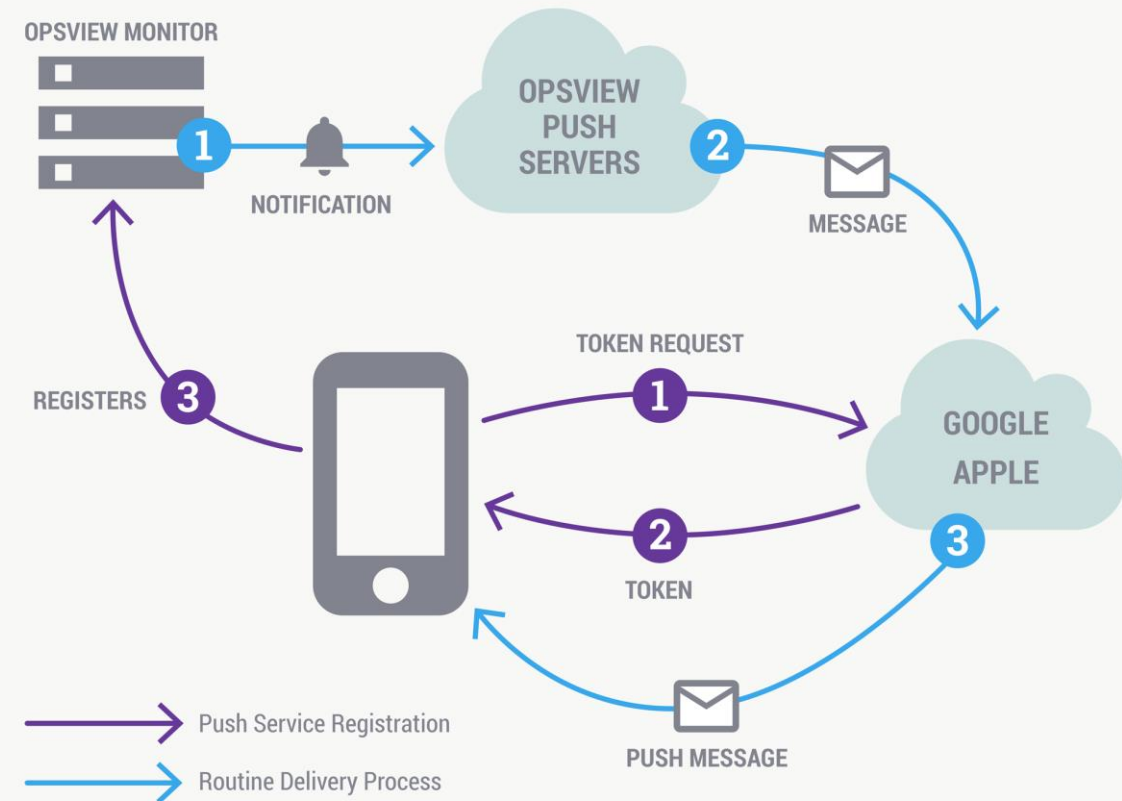
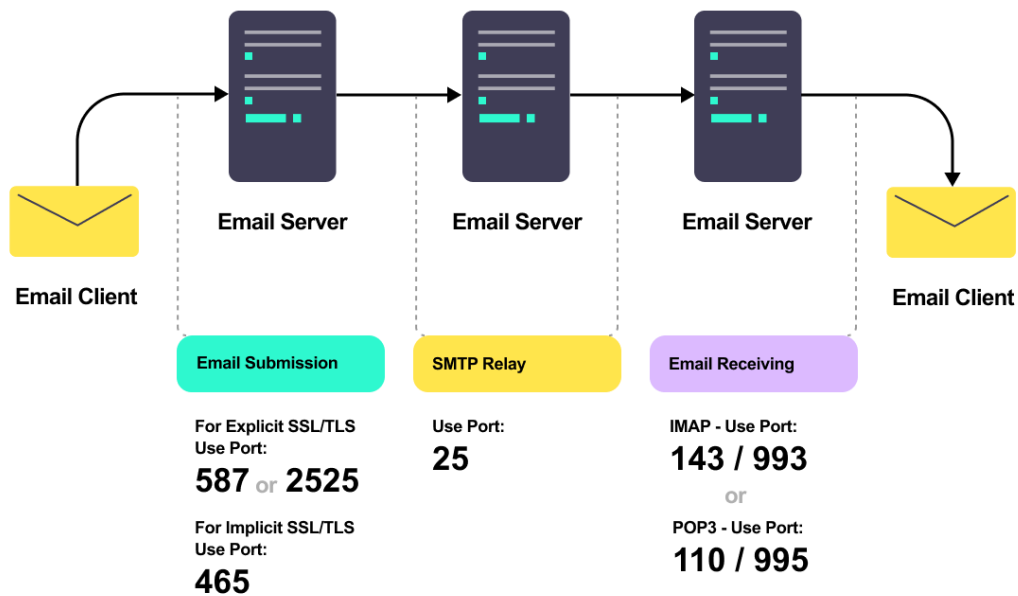
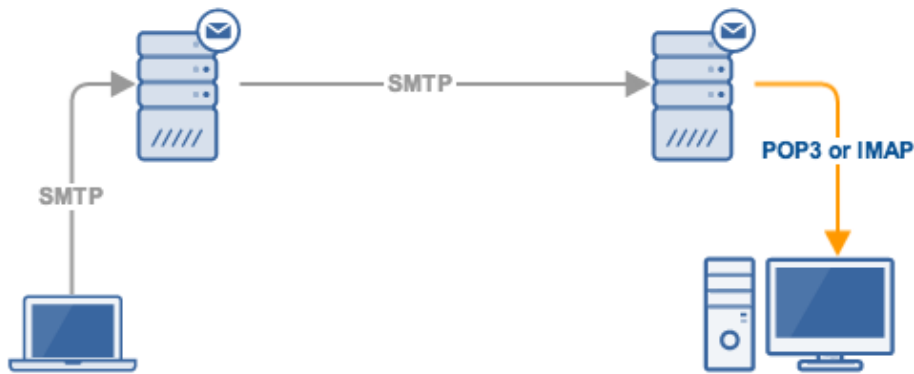


Lightweight Directory Access Protocol

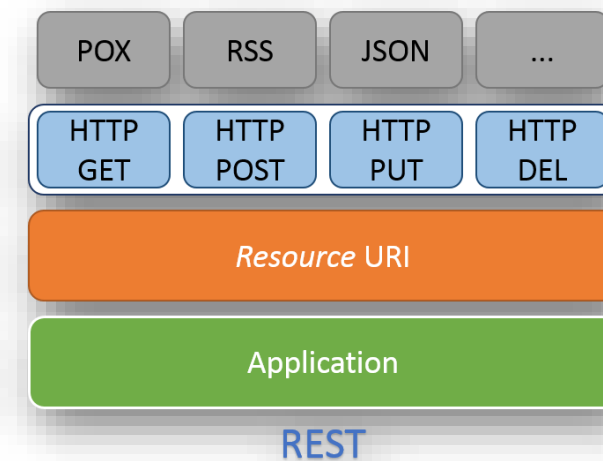
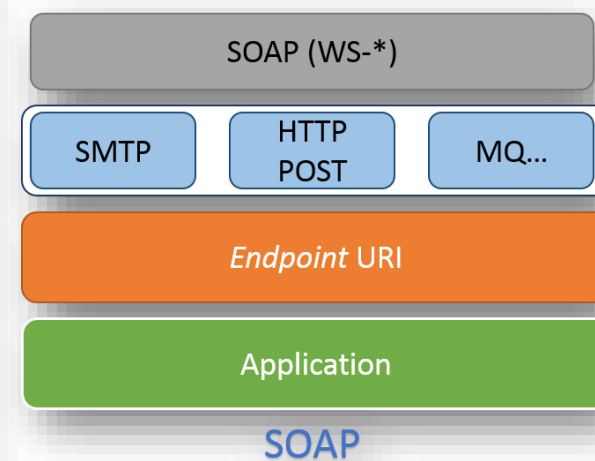
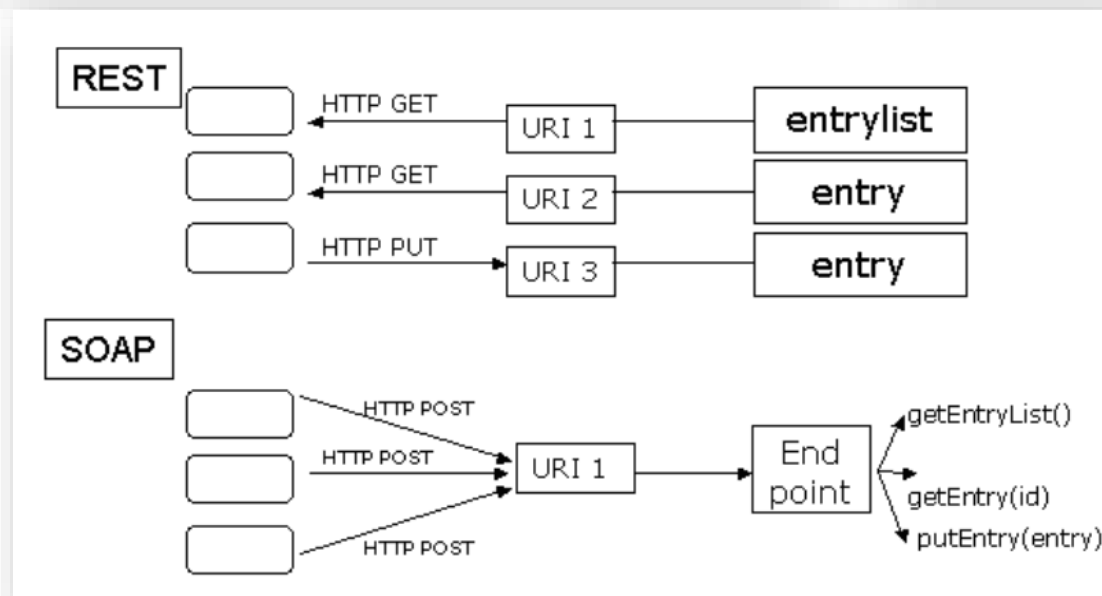
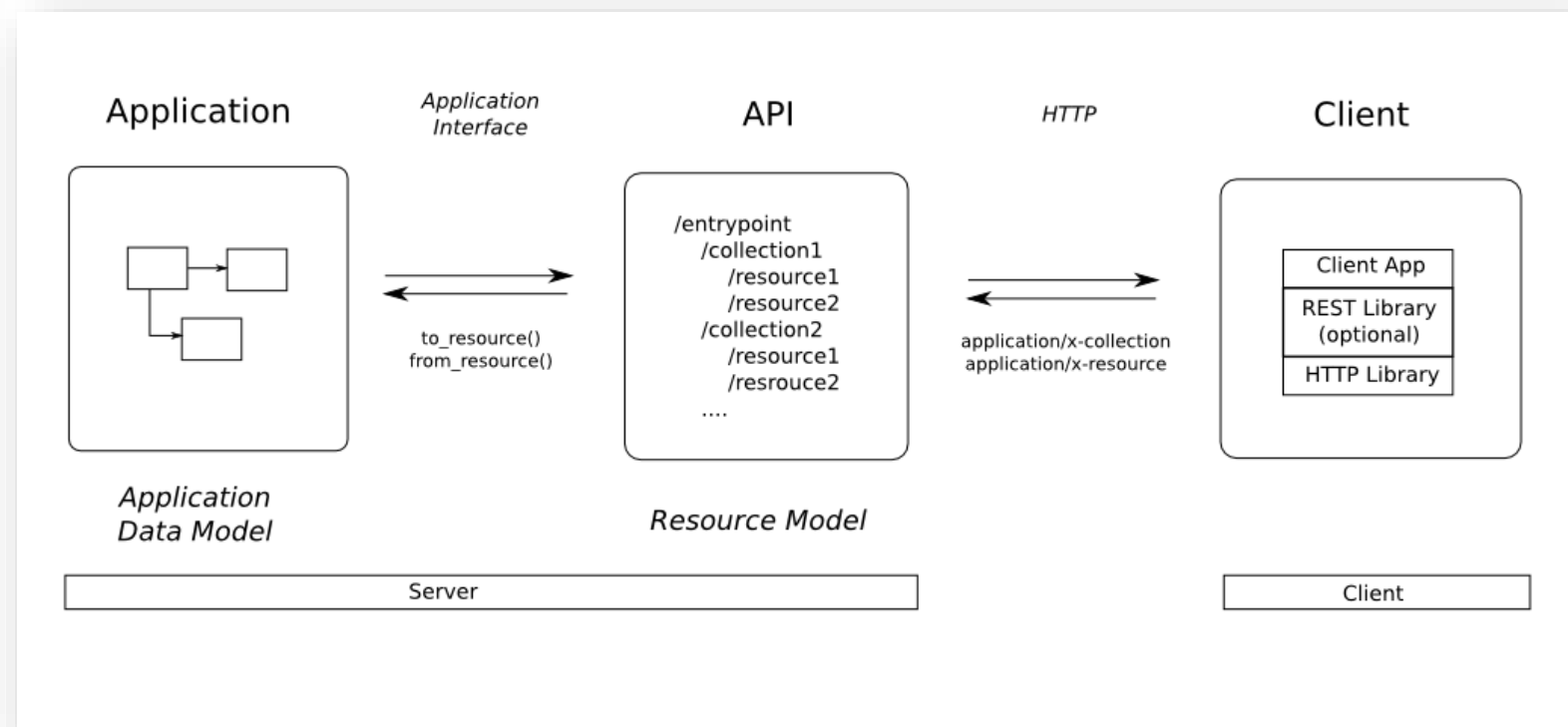
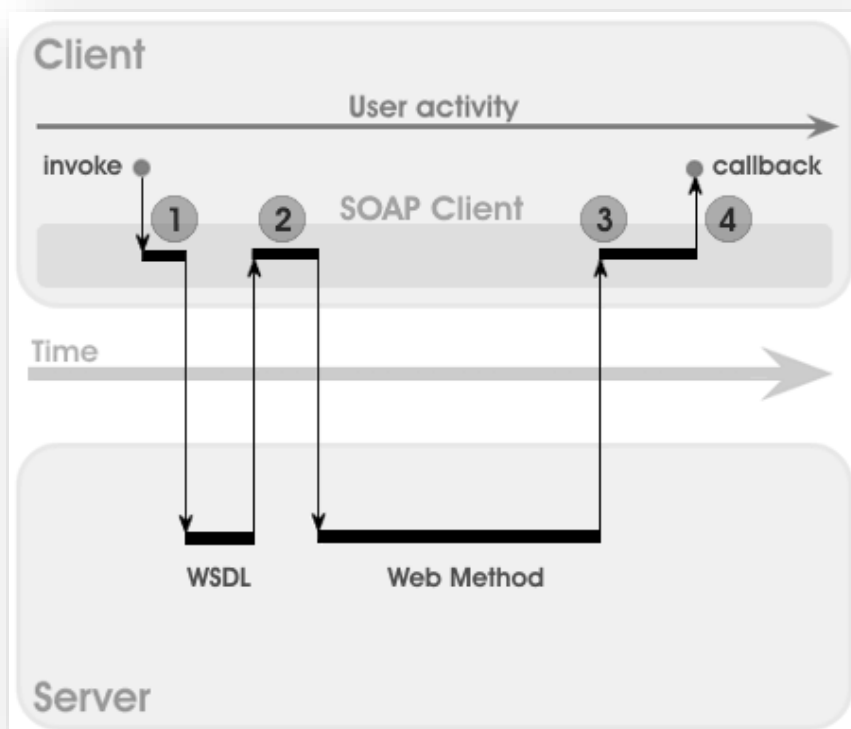


Security Assertion Markup Language (SAML) Authentication Process





Simple Mail Transfer
Post Office Protocol (POP3)
Internet Messaging Access Protocol





HTTP BASIC AUTHENTICATION

The simplest way to handle authentication is through the use of HTTP, where the username and password are sent alongside every API call.



API KEY AUTHENTICATION

This method creates unique keys for developers and passes them alongside every request. The API generates a secret key that is a long, difficult-to-guess string of numbers.



OAuth AUTHENTICATION

This framework can orchestrate approvals automatically between the API owner and the service, or you can also authorize developers to obtain access on their own.



OR... NO AUTHENTICATION

There's always the option of applying no authentication at all. This approach is commonly used in internal APIs hosted on-premise but is not a recommended practice.

Application Client

1. Authorization Request

2. Authorization Grant

3. Authorization Grant

4. Access Token

5. Access Token

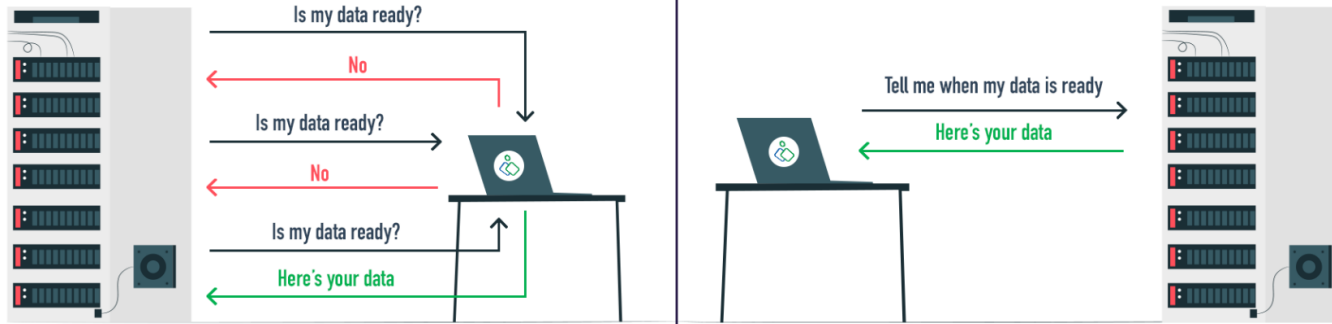
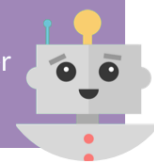
6. Protected Resource

User
Resource Owner



Service API
Authorization Server

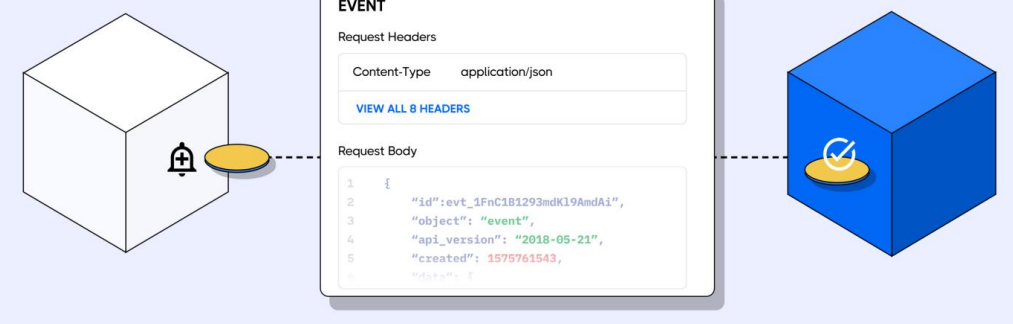
Service API
Resource Server



Polling

Webhooks

Webhooks



Event Triggering

Request with Payload

Event Processing

EVENT

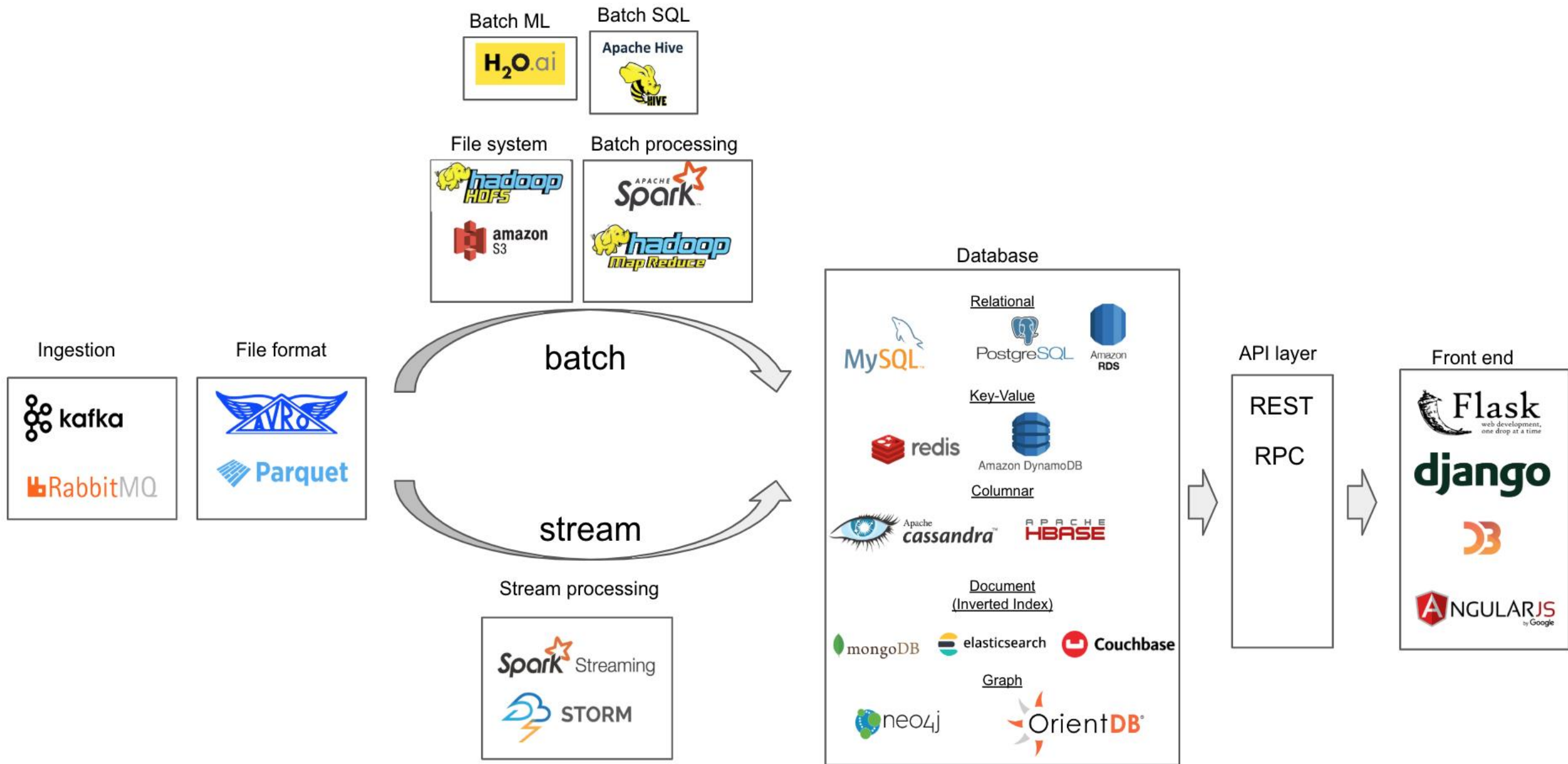
Request Headers

Content-Type	application/json
--------------	------------------

[VIEW ALL 8 HEADERS](#)

Request Body

```
1 {
2   "id": "evt_1FnC181293mdKl9AmdA1",
3   "object": "event",
4   "api_version": "2018-05-21",
5   "created": 1575761543,
6   "data": {}
7 }
```



Content Management System



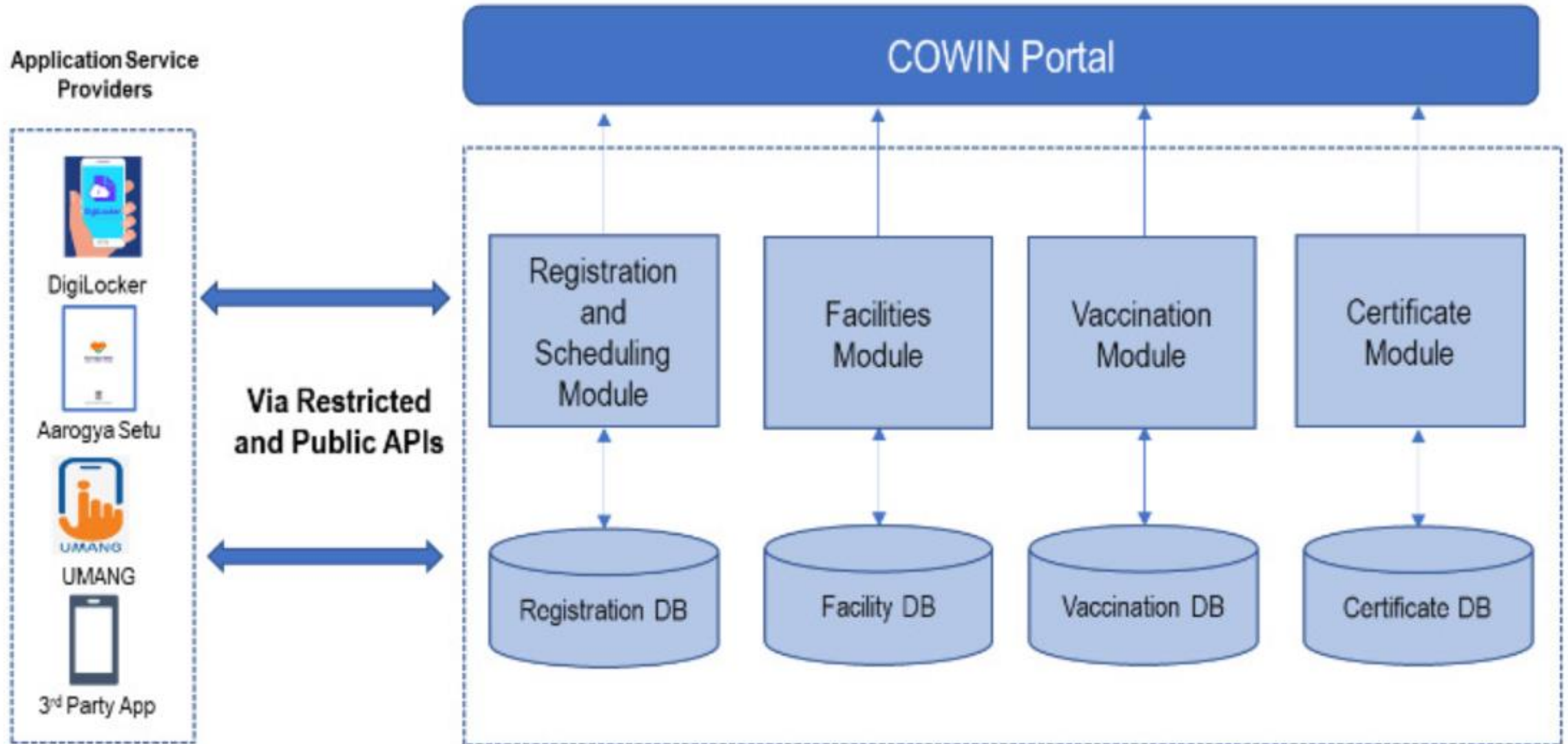
Customer Relationship Management



Full Pack Suite

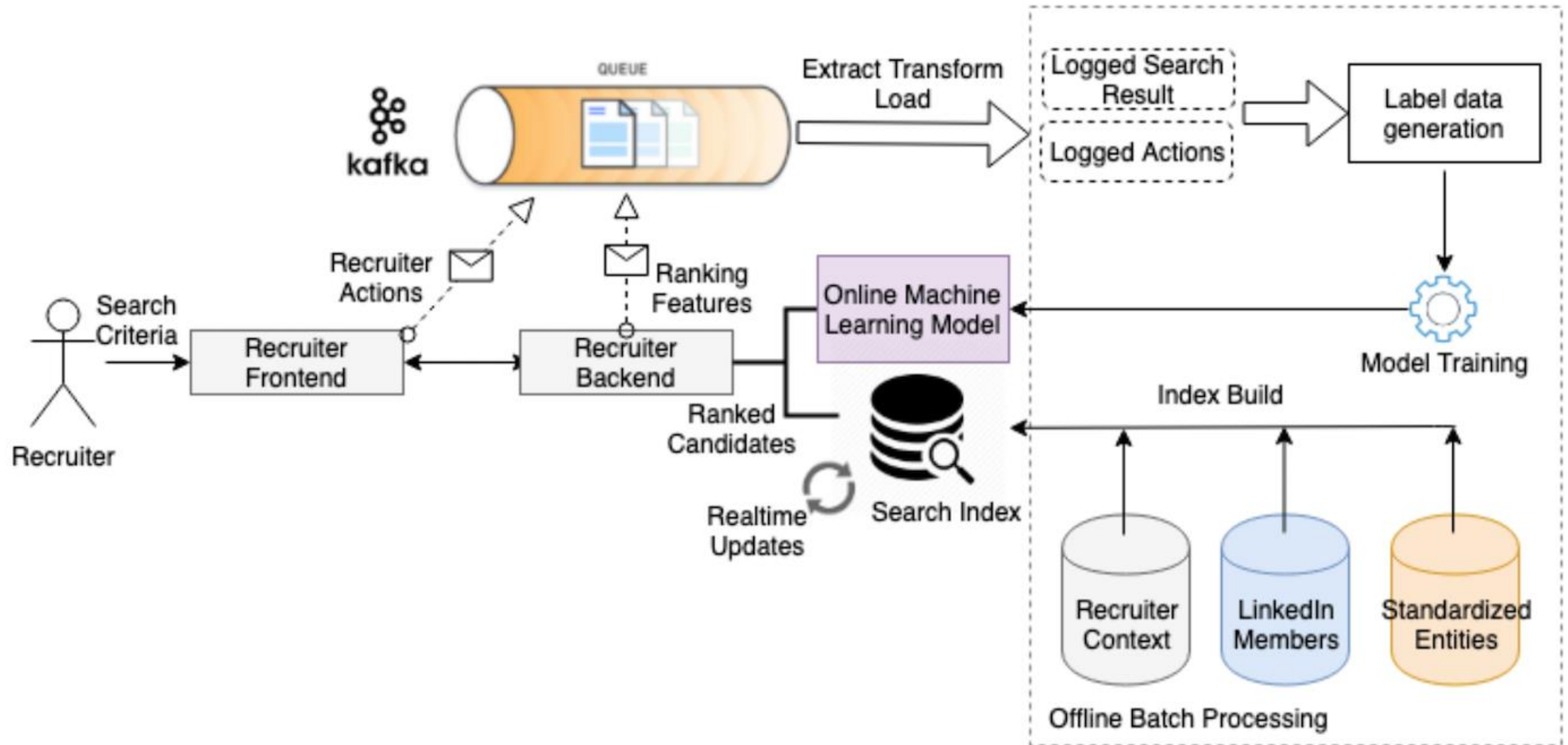


COWIN – Mass Vaccination – India Stack

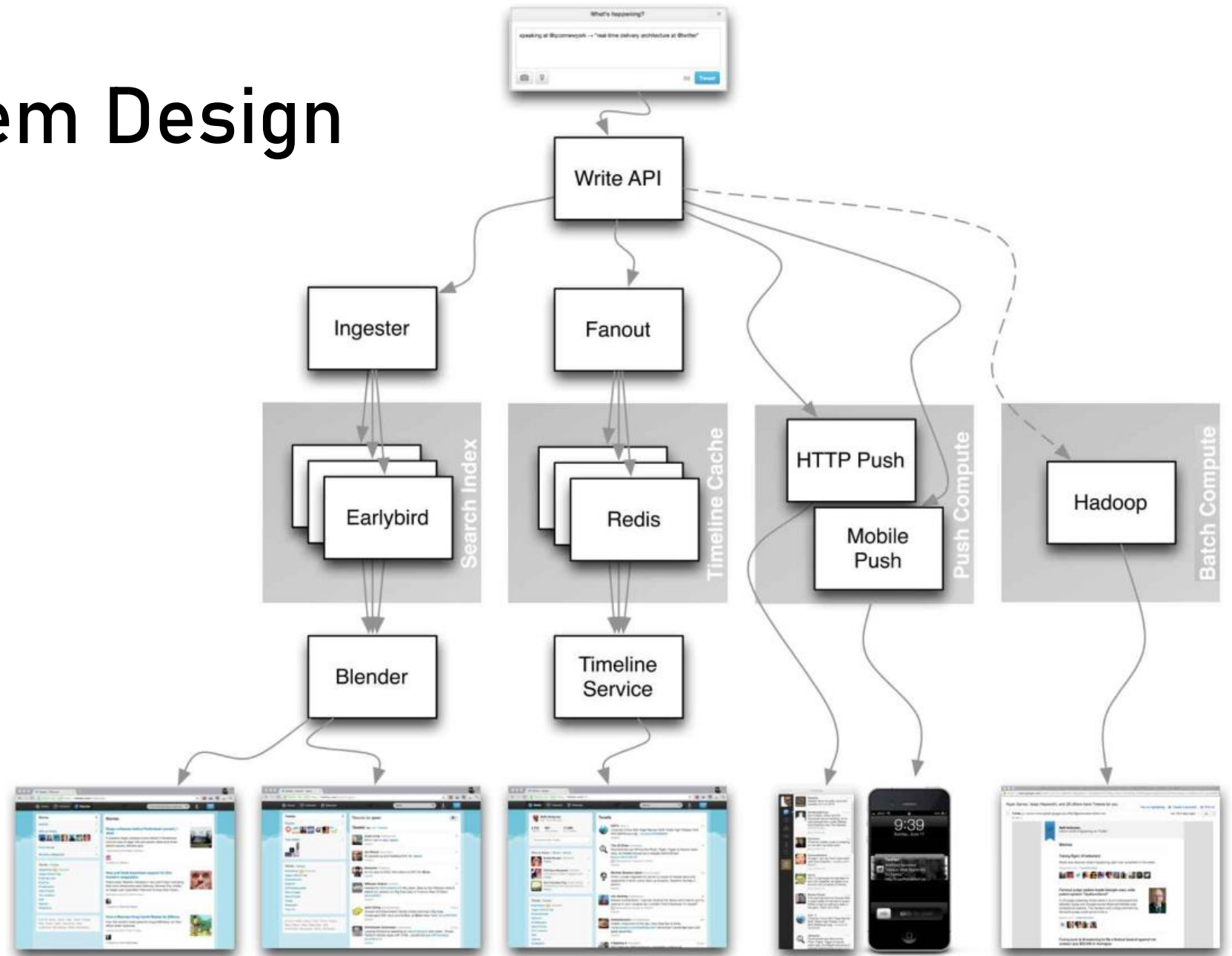


Source: <https://apisetu.gov.in/document-central/cowin/Co-WIN%20API%20Guidelines.html>

LinkedIn Recruiting Module



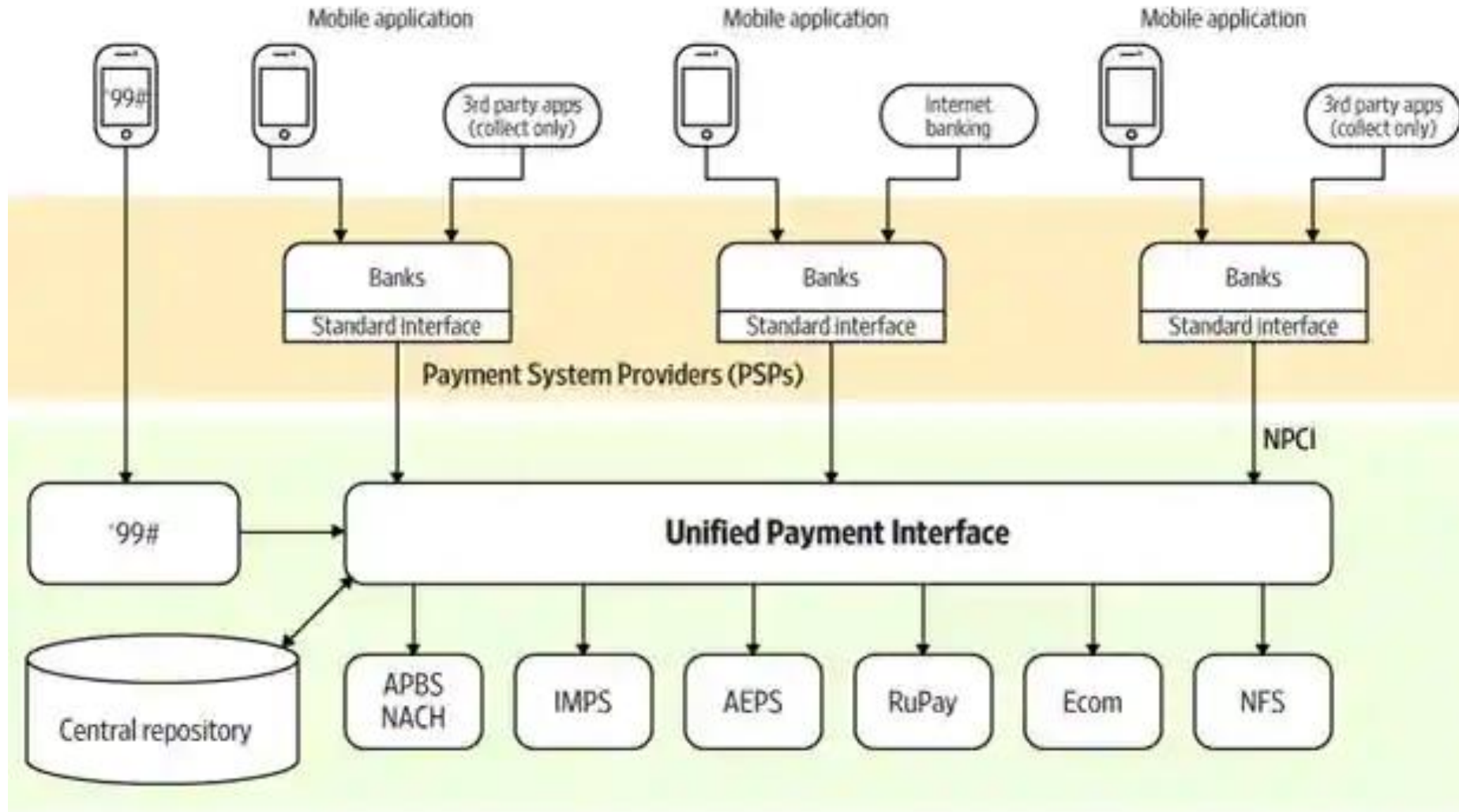
Twitter – System Design



Source: <https://www.infoq.com/presentations/Twitter-Timeline-Scalability>

UPI Payment Gateway – India Stack

THE ARCHITECTURE OF UPI



*99#: NPCI USSD service code to access banking service via phone

Source: NPCI