Case Study #1

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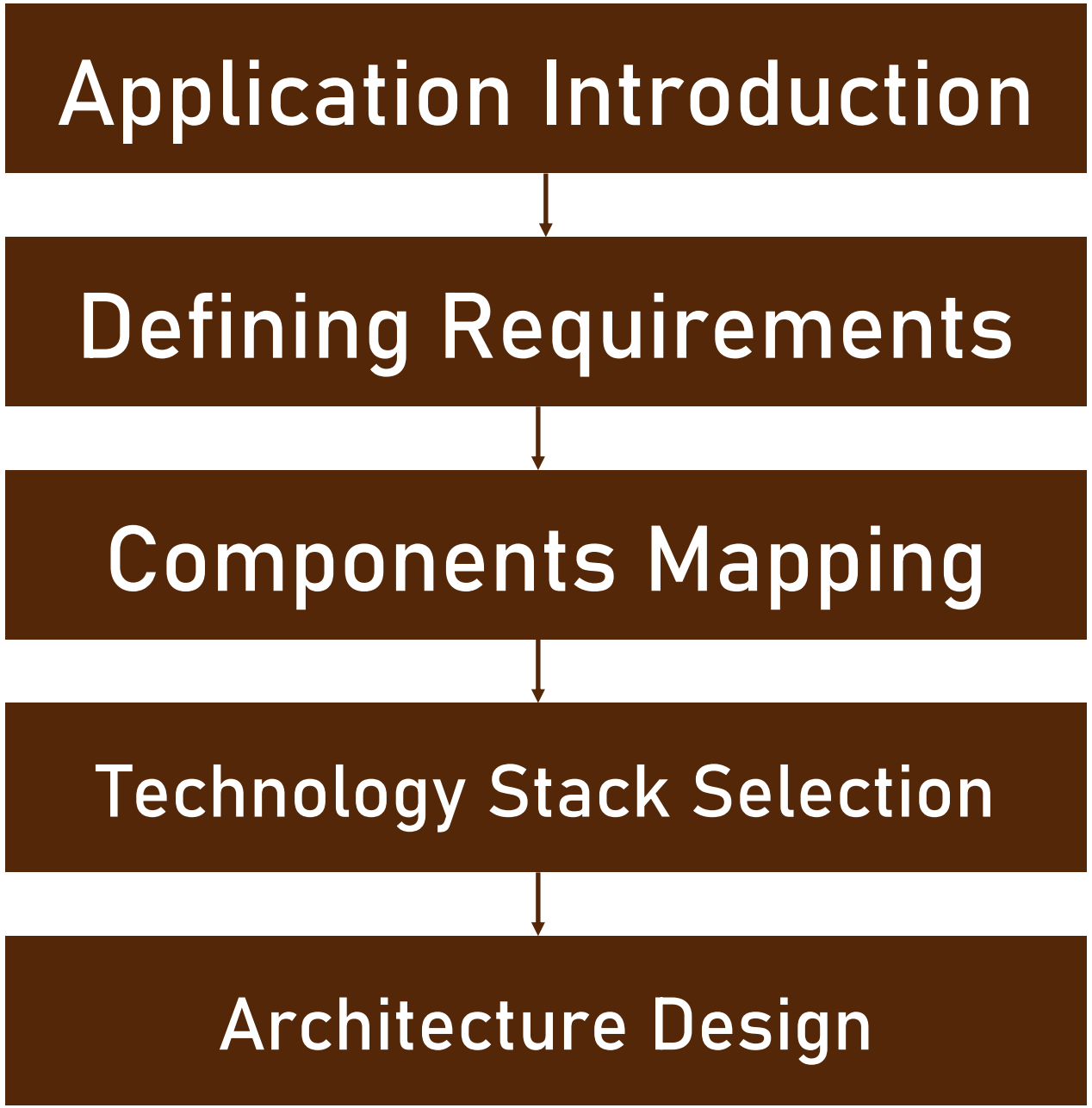
A Real World Application


Application Introduction
Defining Requirements
Components Mapping
Technology Stack Selection
Architecture Design

Dunderly

Your Paper Source

Dunderly

- Sells Paper Supplies
  - Printer paper, Envelopes, etc.
- Needs a new HR system
- Managing employees, salaries, vacations, payments

Dunderly

Requirements

Functional

What the system should do

1. Web Based
2. Perform CRUD operations on employees
3. Manage Salaries:
    1. Allow manager to ask for employee's salary change
    2. Allow HR manager to approve / reject request
4. Manage vacation days
5. Use external payment system

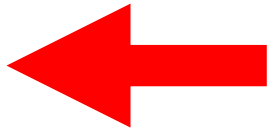
Non-Functional

What the system should deal with

Dunderly

NFR - What We Know

1. Classic Information System
2. Not a lot of users
3. Not a lot of data
4. Interface to external system



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NFR - What We Ask

1. *"How many expected concurrent users?"* 10
2. *"How many employees?"* 250
3. "*What do we know about the external Payment system?"*

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Payment System

- Legacy system, written in C++
- Hosted in the company's servers farm
- Input – only files ☹
- File received once a month

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Data Volume

- 1 Employee = ~1MB in data
- Each employee has ~10 scanned documents (contract, reviews etc.)
- 1 Scanned Document =~5MB
- Total storage for 1 employee = ~51MB

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Data Volume – Cont.

- Company expects to grow to 500 employees in 5 years
- Total storage: 51MB X 500 employees = 25.5GB
- Not a lot, but:
  - Need to consider document storage

Dunderly

SLA

4. "How critical is the system?" Not Very Critical

Dunderly

Requirements

Functional

What the system should do

1. Web Based
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    1. Allow manager to ask for employee's salary change
    2. Allow HR manager to approve / reject request
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5. Use external payment system

Non-Functional

What the system should deal with

1. 10 Concurrent users
2. Manages 500 users
3. Data volume forecast: 25.5GB
    1. Relational & Unstructured
4. Not mission critical
5. HTTP-based interface

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Components

Based on requirements:

1. Entities: Employees, Vacation, Salary
2. Interface to the Payment System

Employees Service → Performs CRUD Operations on Employees

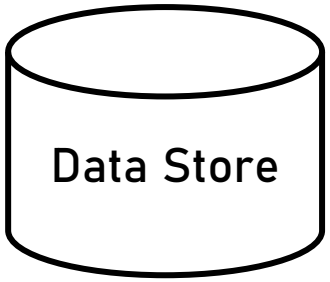
Salary Service → Salary approval workflow

Vacation Service → Employee's Vacation Management

View Service → Returns static files to the browser (HTML, CSS, JS)

Payment System

Payment Interface → Sends payment data to payment system



Logging

Q: Single or Per Service Data Store?

A: Data is shared between services, so a Single Data Store is better

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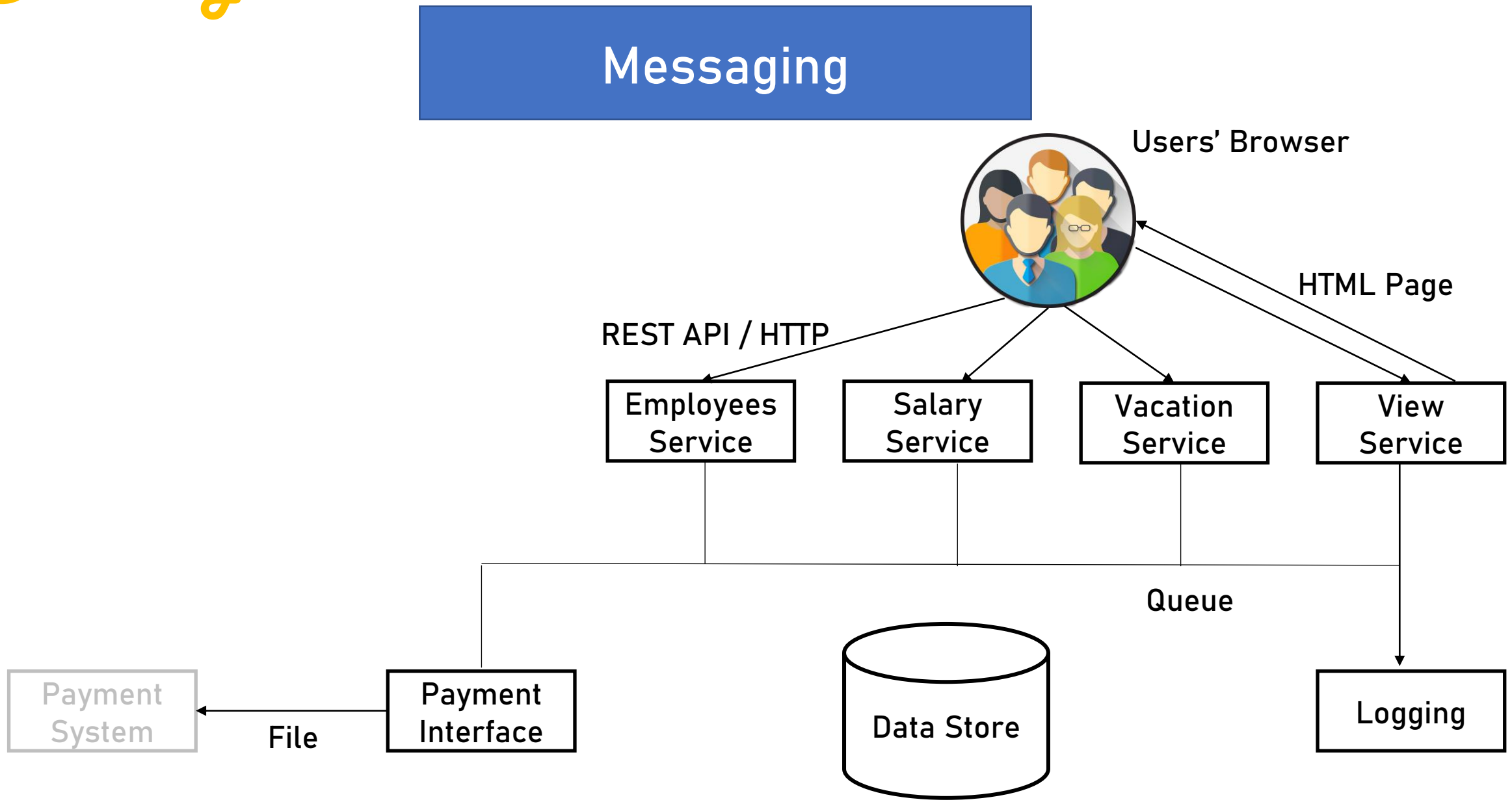
Messaging



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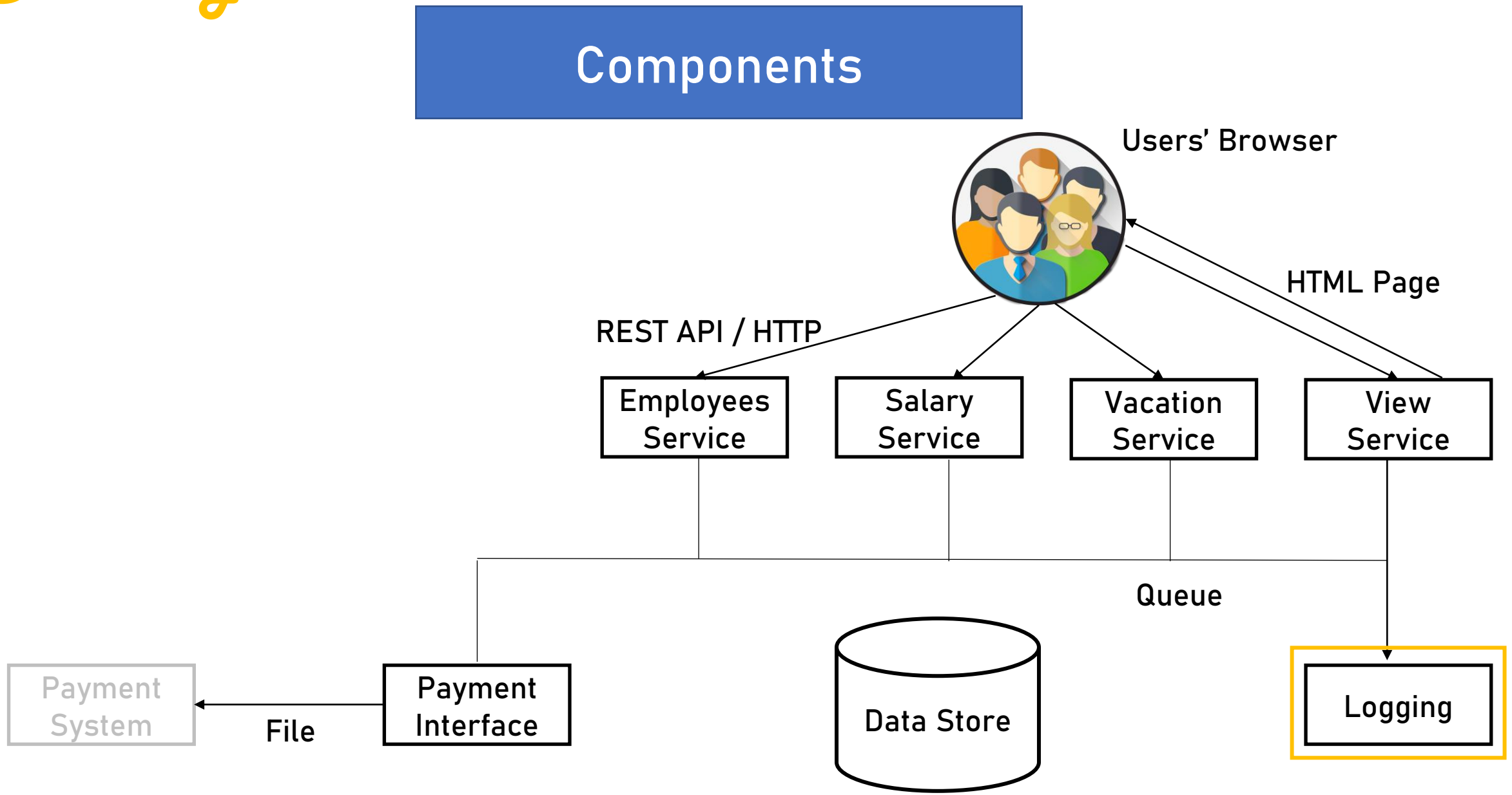
Components



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Logging Service

- Very Important

- Other services use it

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Logging - Questions

1. Is there an existing logging mechanism used by the company in the cloud?

   No

2. Develop our own or use 3rd party?

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Logging in Azure

- Azure log analytics 
  - Part of Azure Monitor
  - Great integration with a lot of services
  - Handles huge amounts of data
  - Offers query language for analysis
  - Can be streamed to log analytics tools (Power BI etc.)

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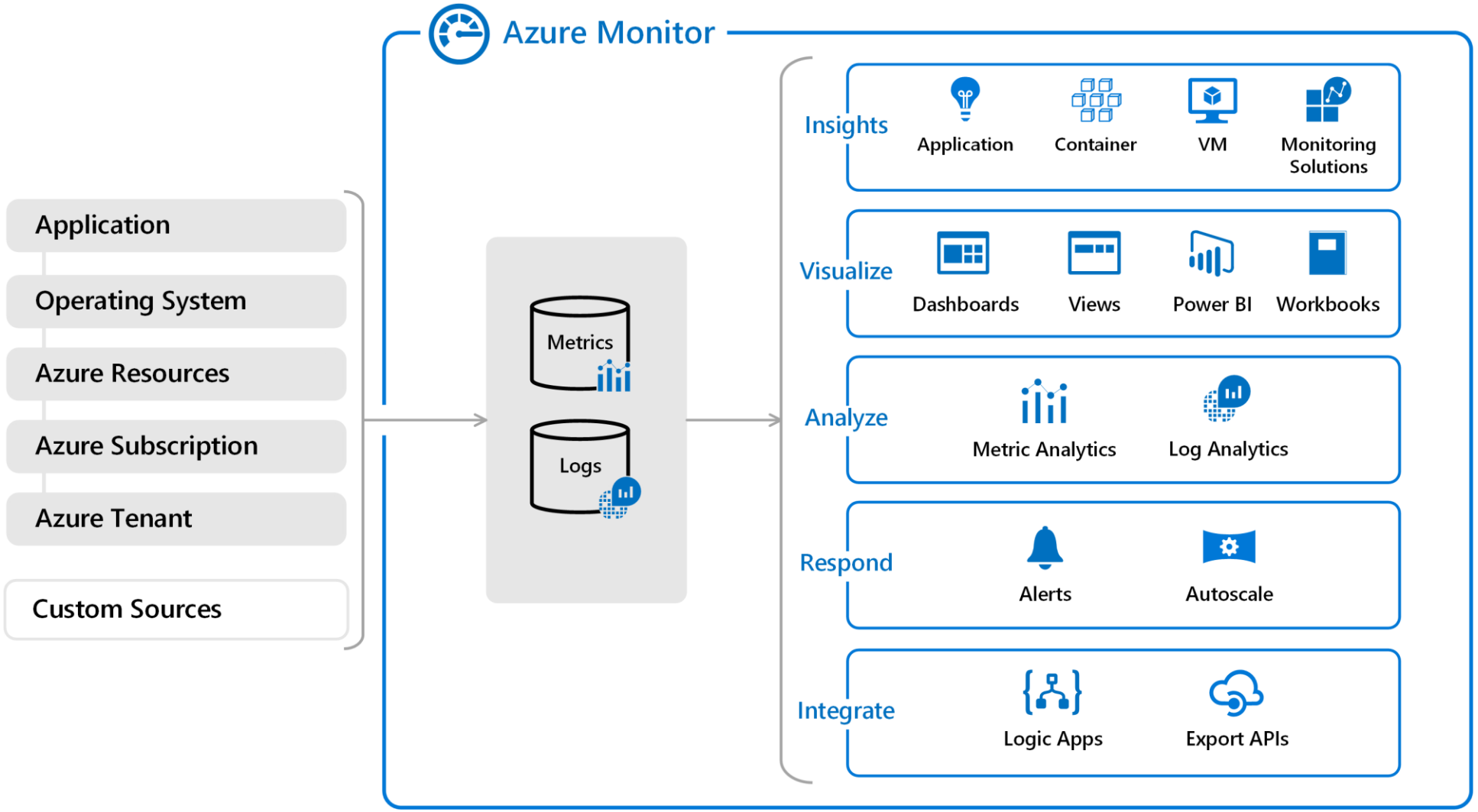
Logging in Azure



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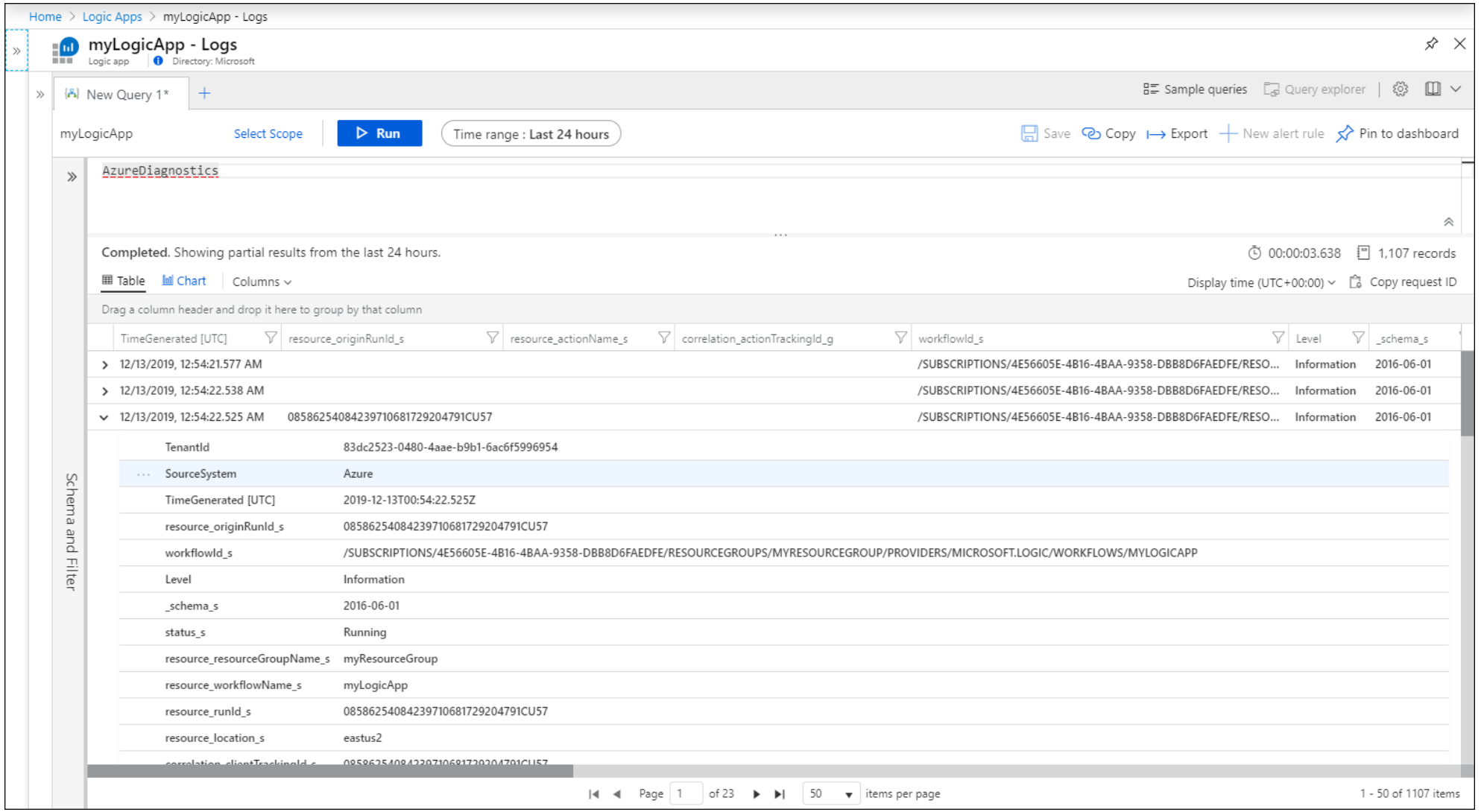
Logging in Azure



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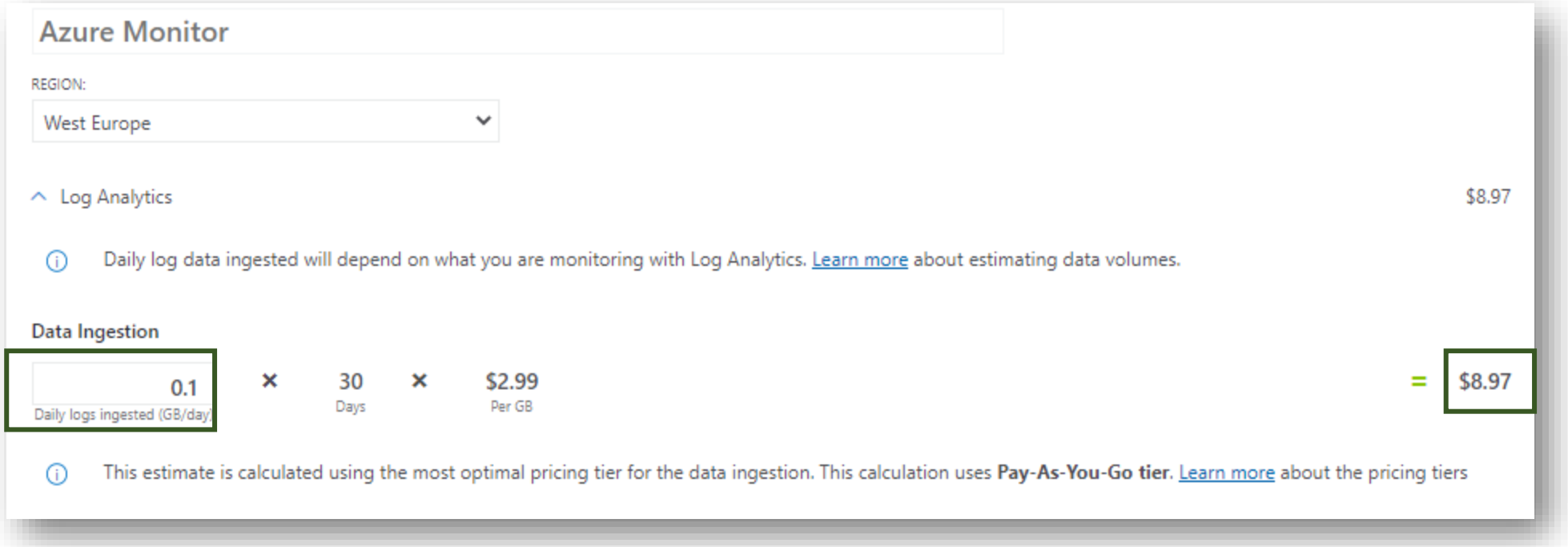
Cost of Log Analytics



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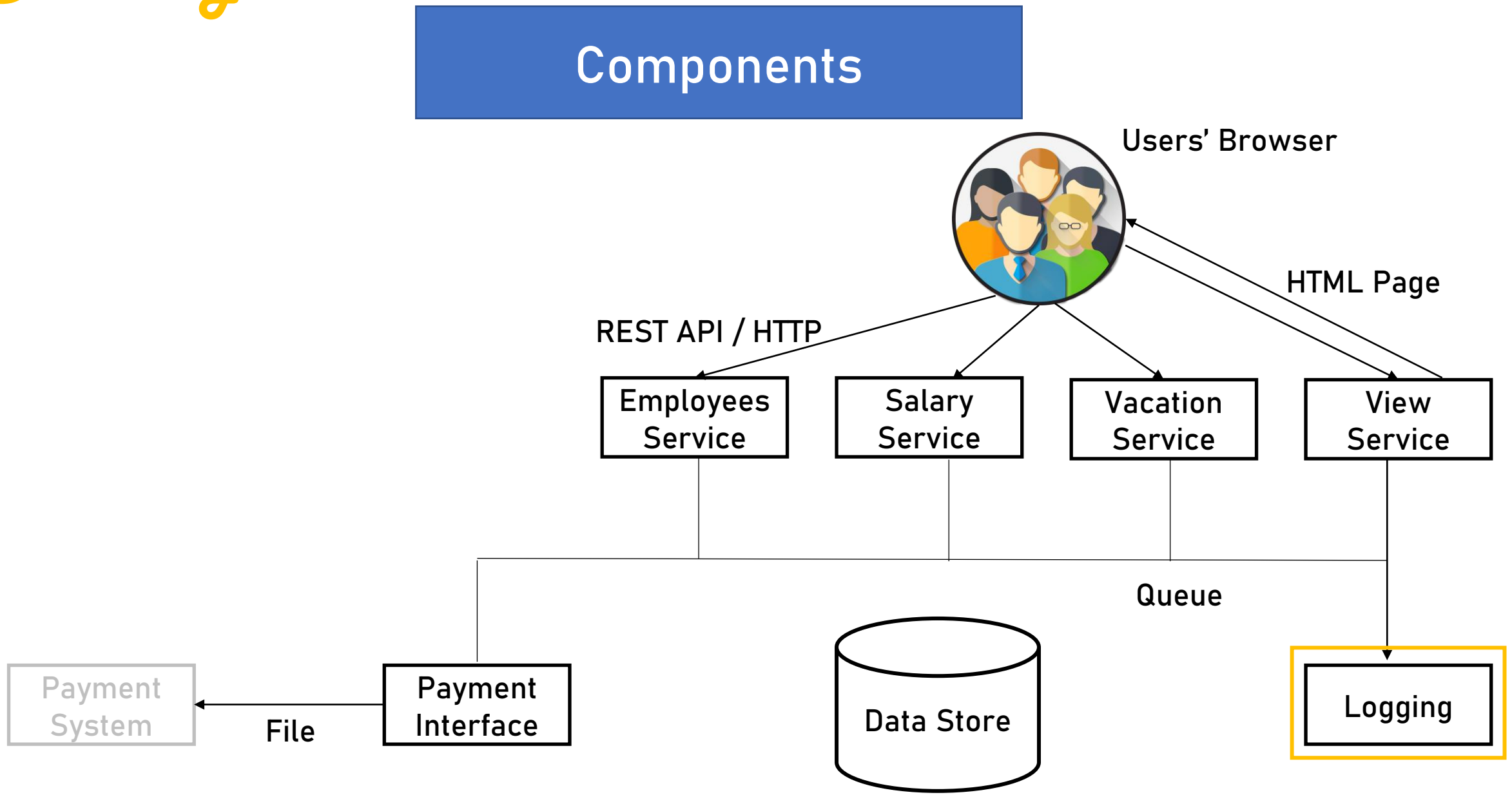

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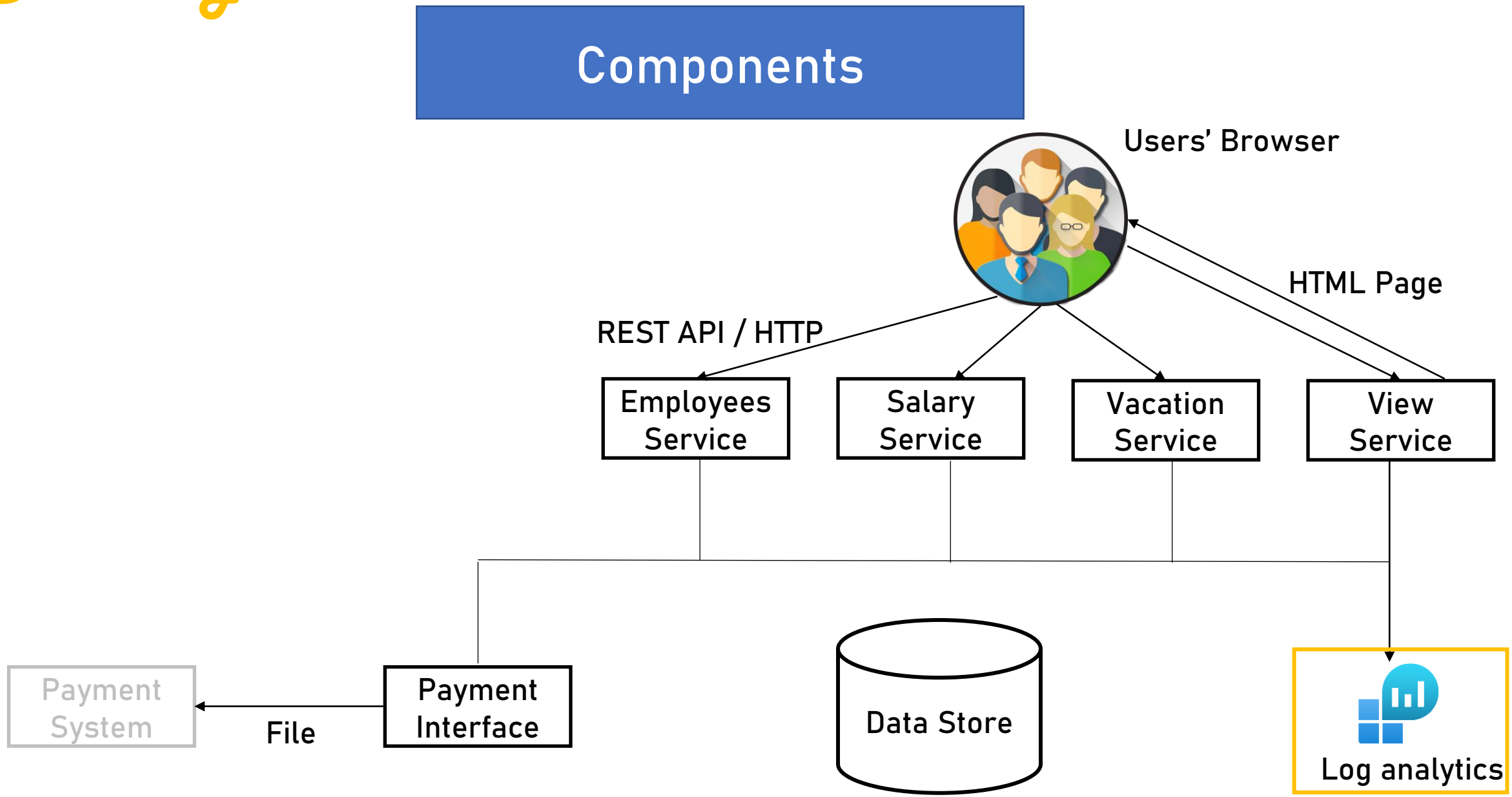

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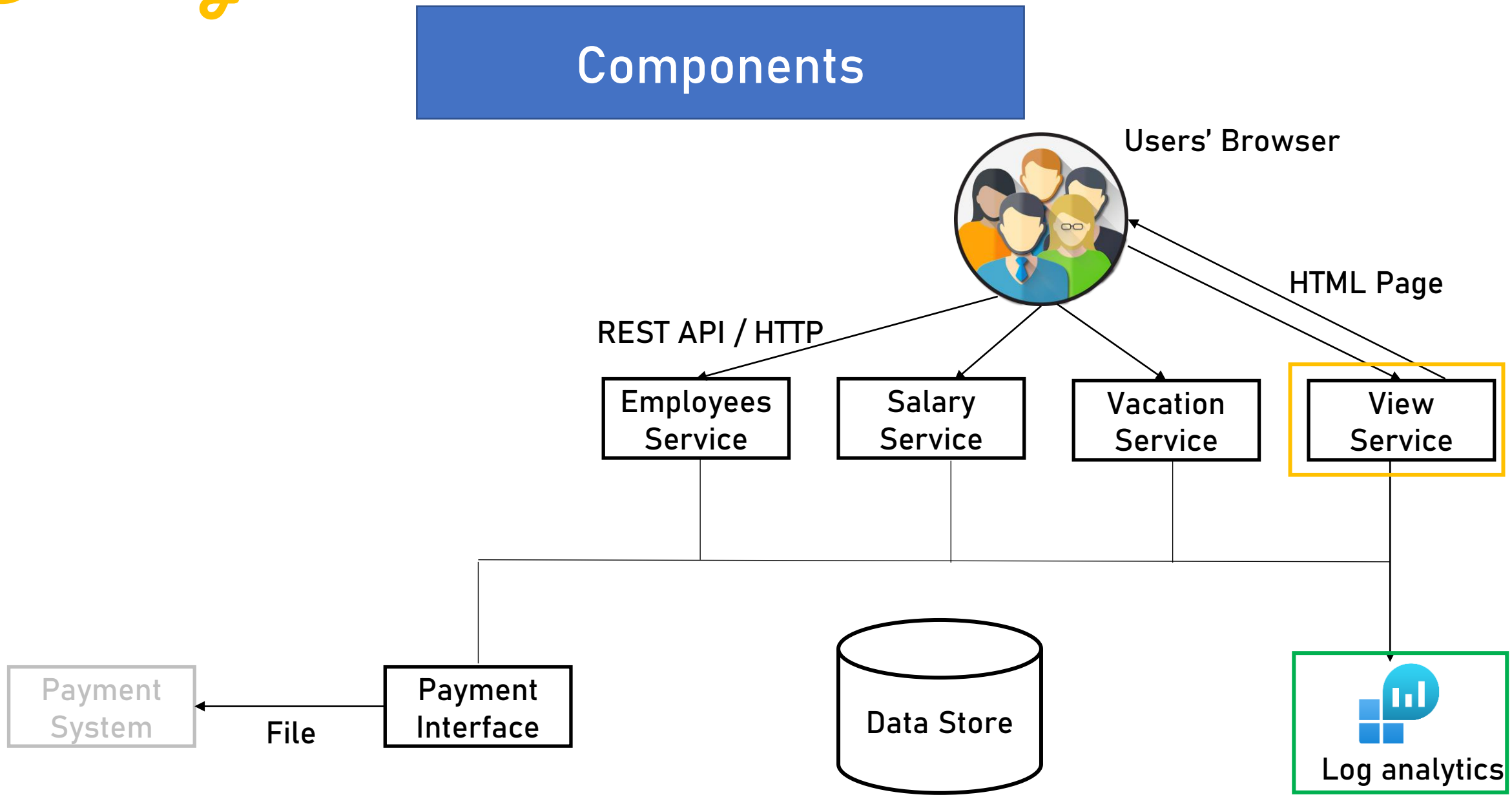

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View Service

What it does:

- Get requests from the end users' browsers

- Returns static files (HTML / CSS / JS)

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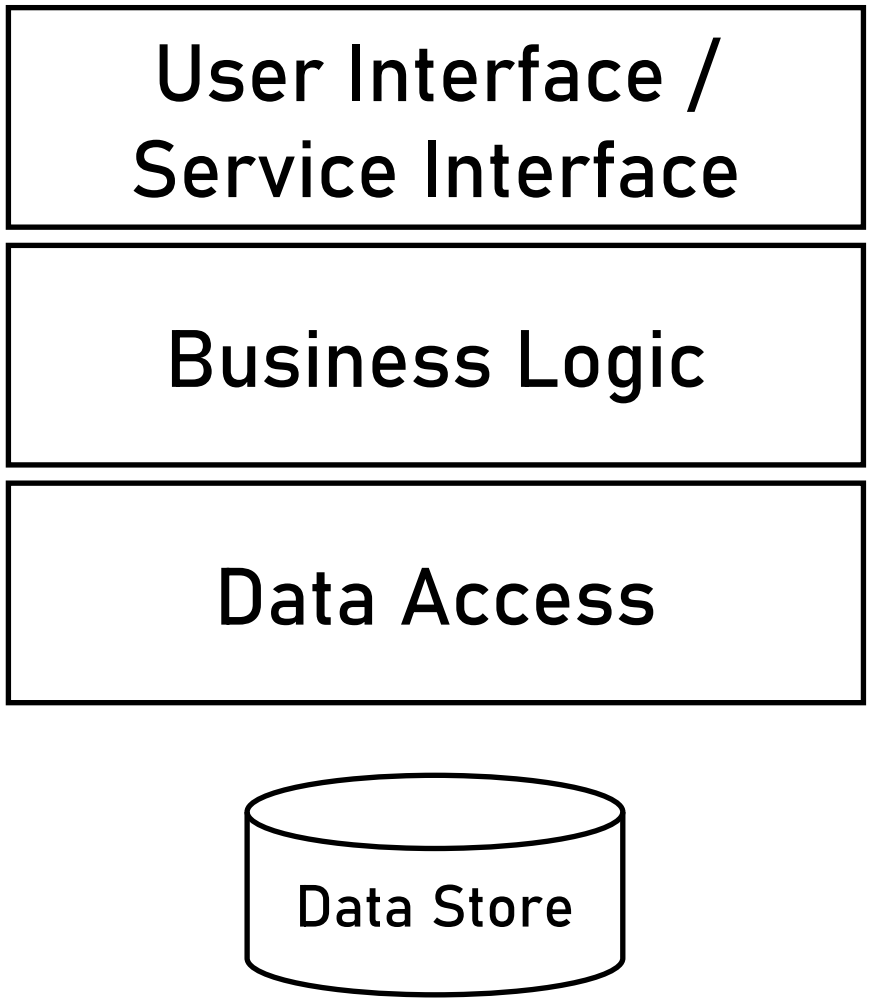
Application Type

- Web App & Web API 
- Mobile App 
- Console 
- Service 
- Desktop App 

Architecture



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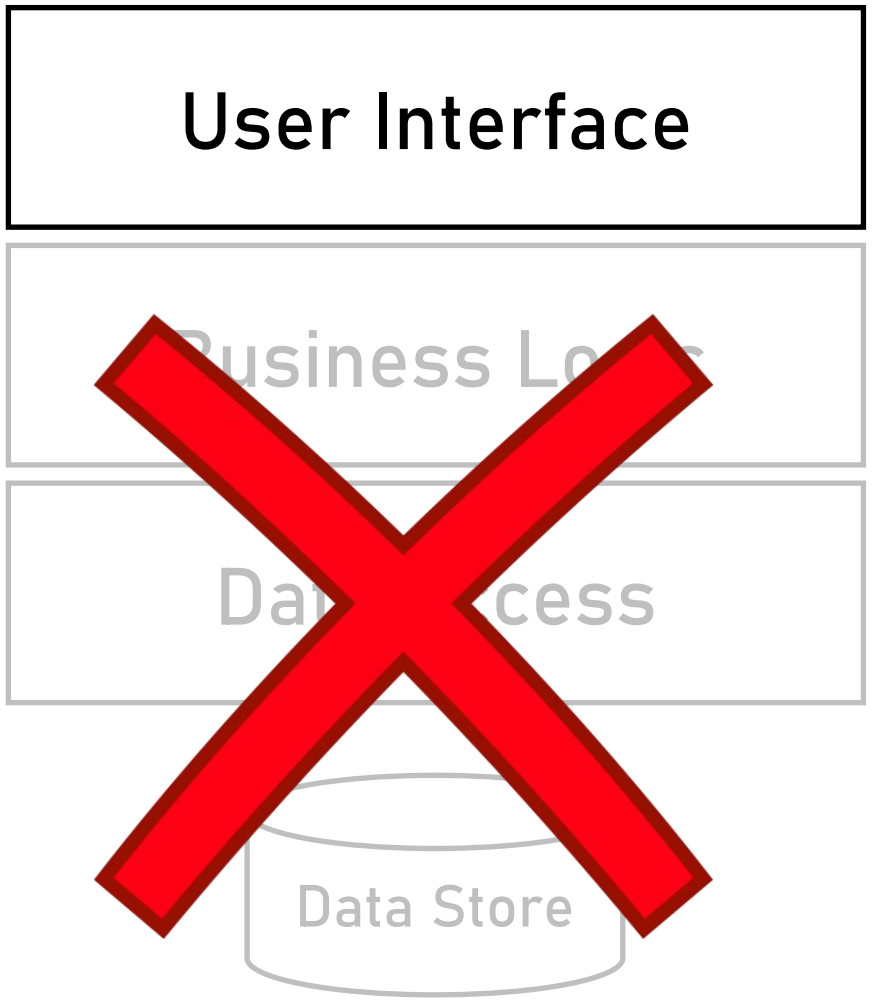
Architecture



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Static web sites in Azure

App Service

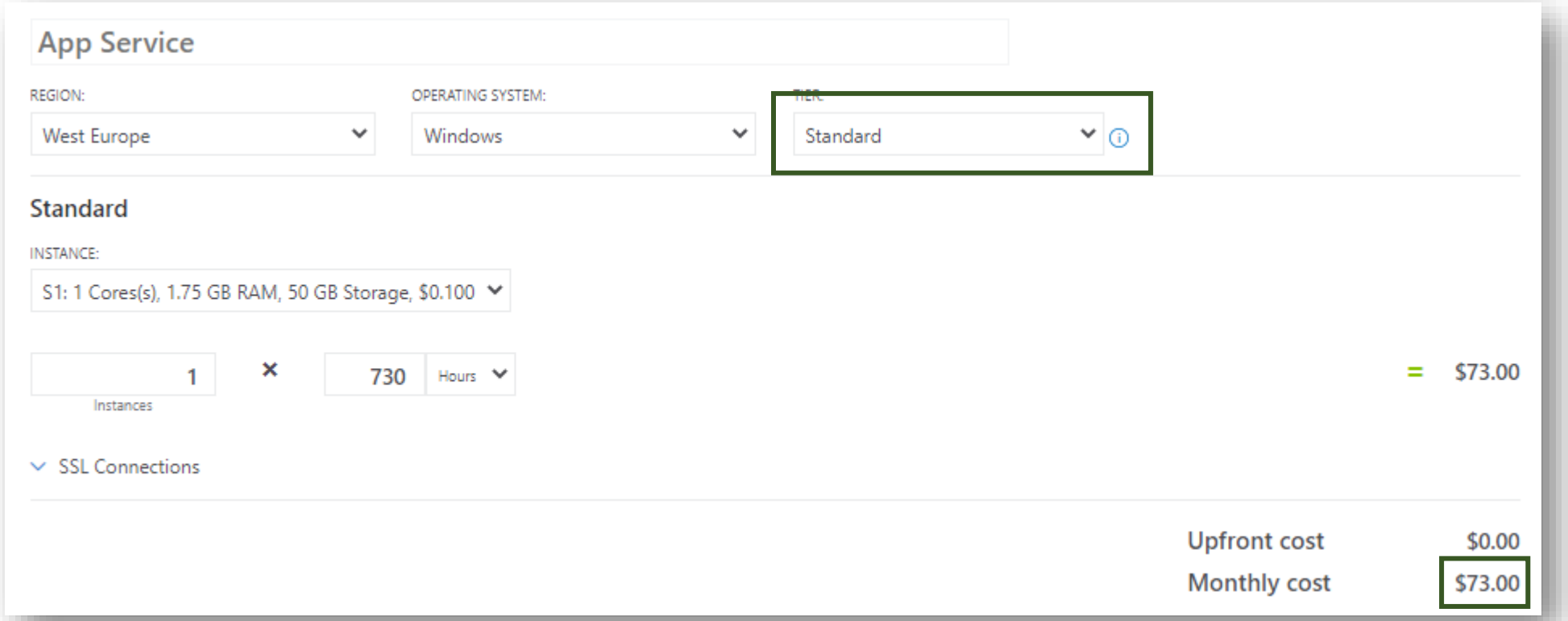
- Fully managed web app & API
- Supports many platforms
- Autoscale
- Support for WebJobs

Static Web Apps

- Fully managed static web site
- Complete integration with source controls (Git, Azure DevOps etc.)
- Extremely cost effective

Dunderly

Static web sites in Azure



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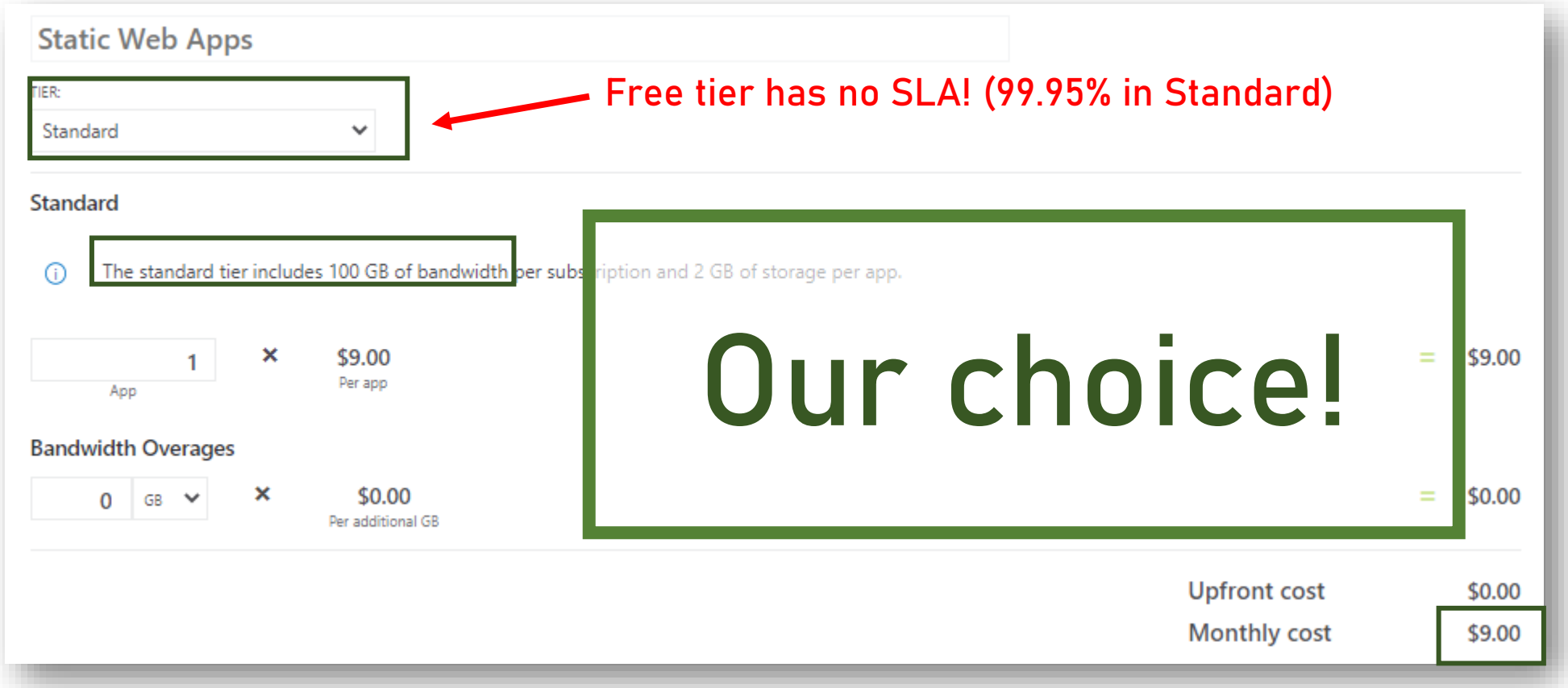
Static web sites in Azure



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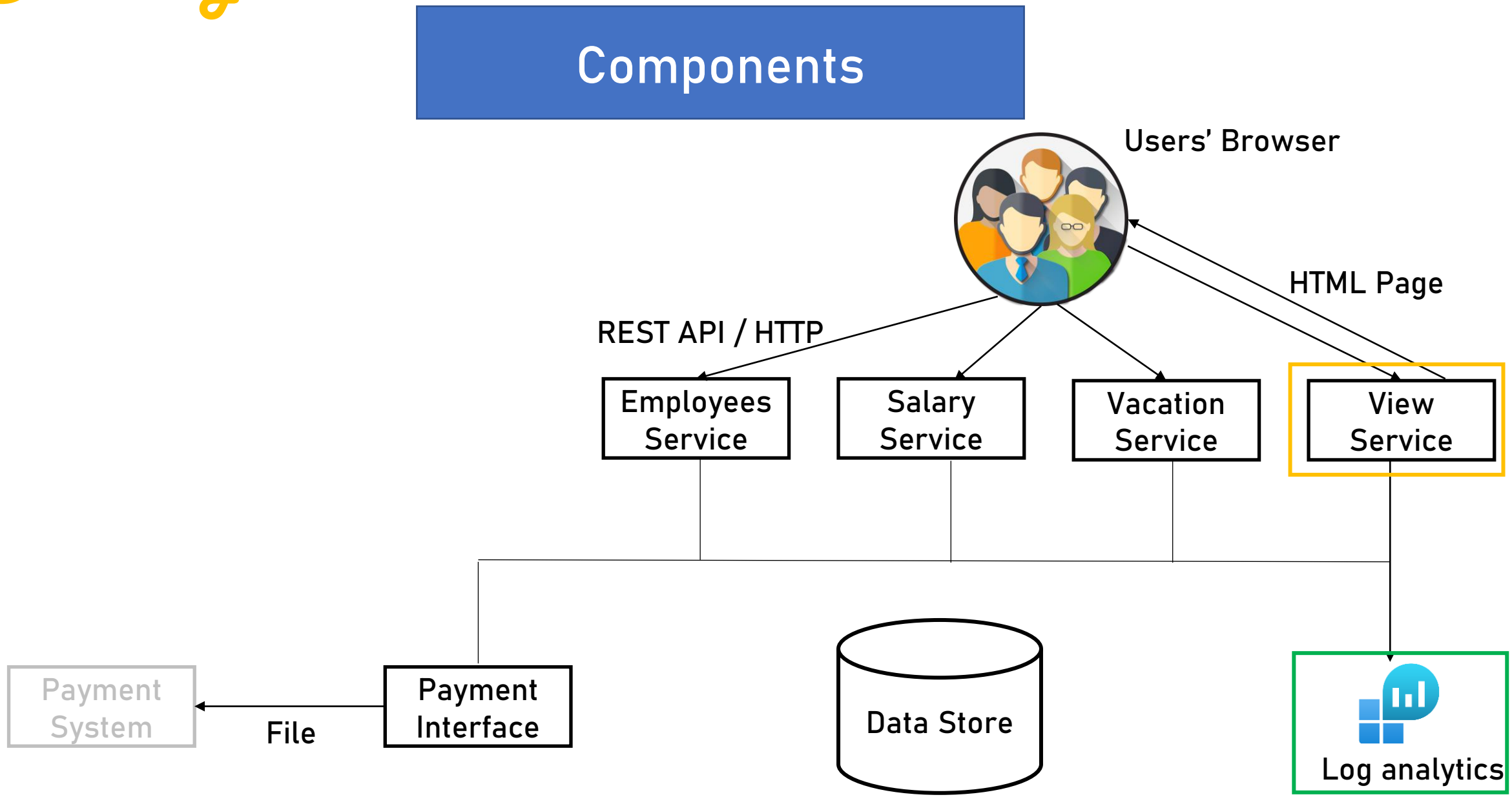

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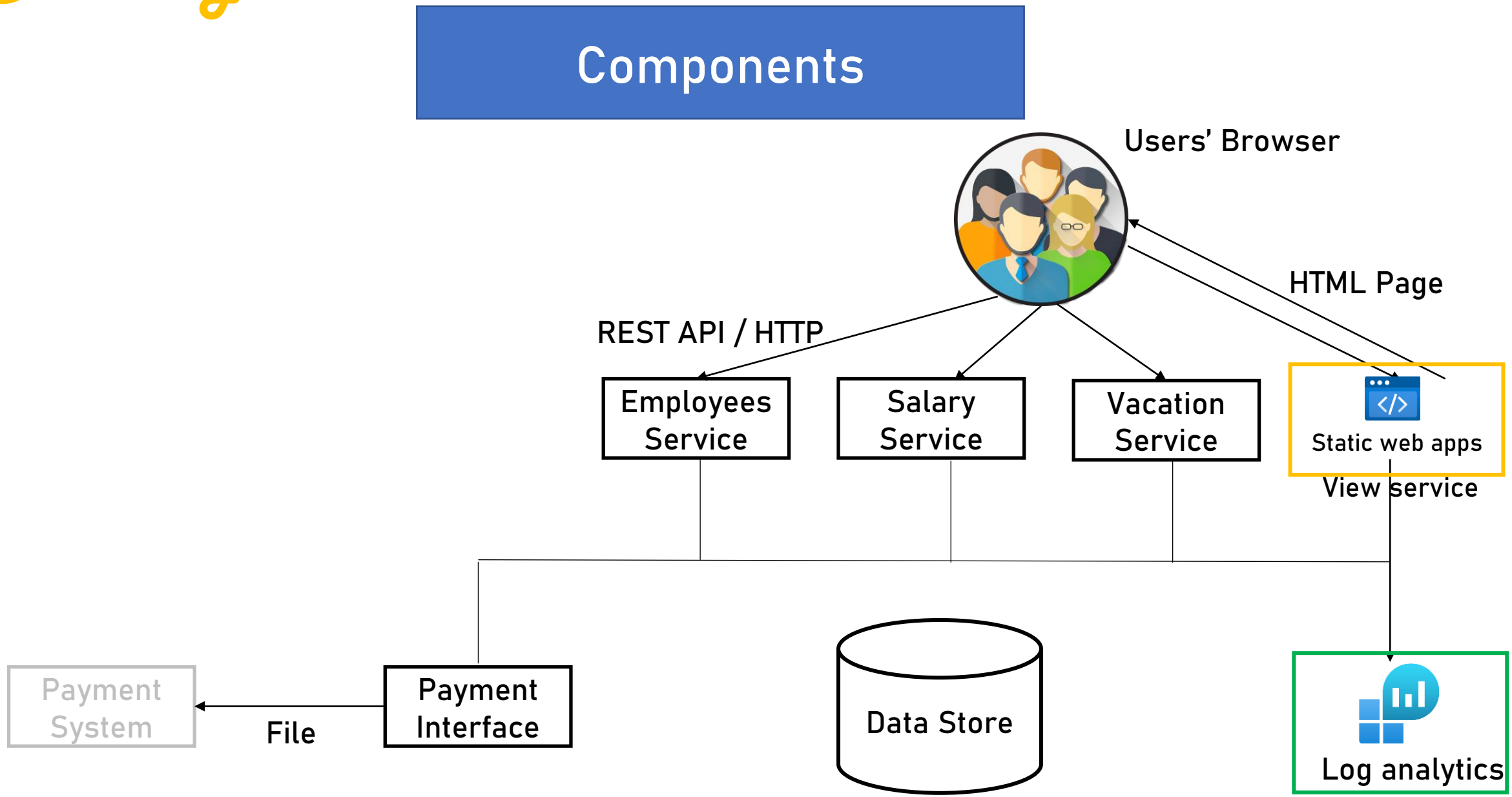

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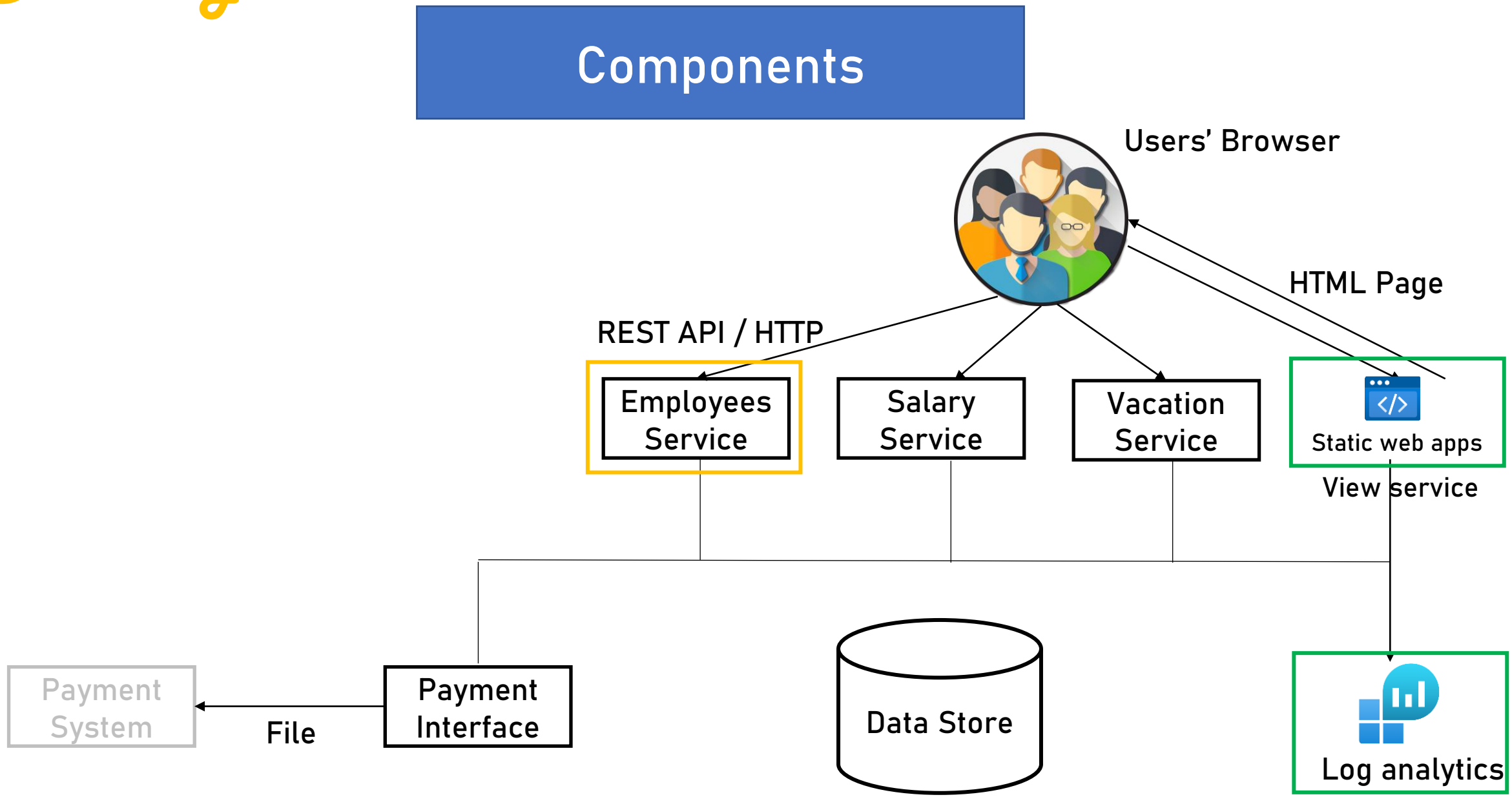

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Employees Service

What it does:

- Allows end users to query employees' data

- Allows performing actions on data (CUD)

What it doesn't:

- Displays the data

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Application Type

- Web App & Web API 
- Mobile App 
- Console 
- Service 
- Desktop App 

Dunderly

Technology Stack – Dev Platform

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Azure Web API

Let's choose:

- Azure Functions are for lightweight actions
- The API does some heavy lifting
  - Updates, docs etc.
- App services support these actions

App

- Fully manage
- Supports ma
- Autoscale
- Support for WebJobs

ctions

- Integration with cloud services
- Extremely cost effective

Dunderly

Azure Web API

App Service

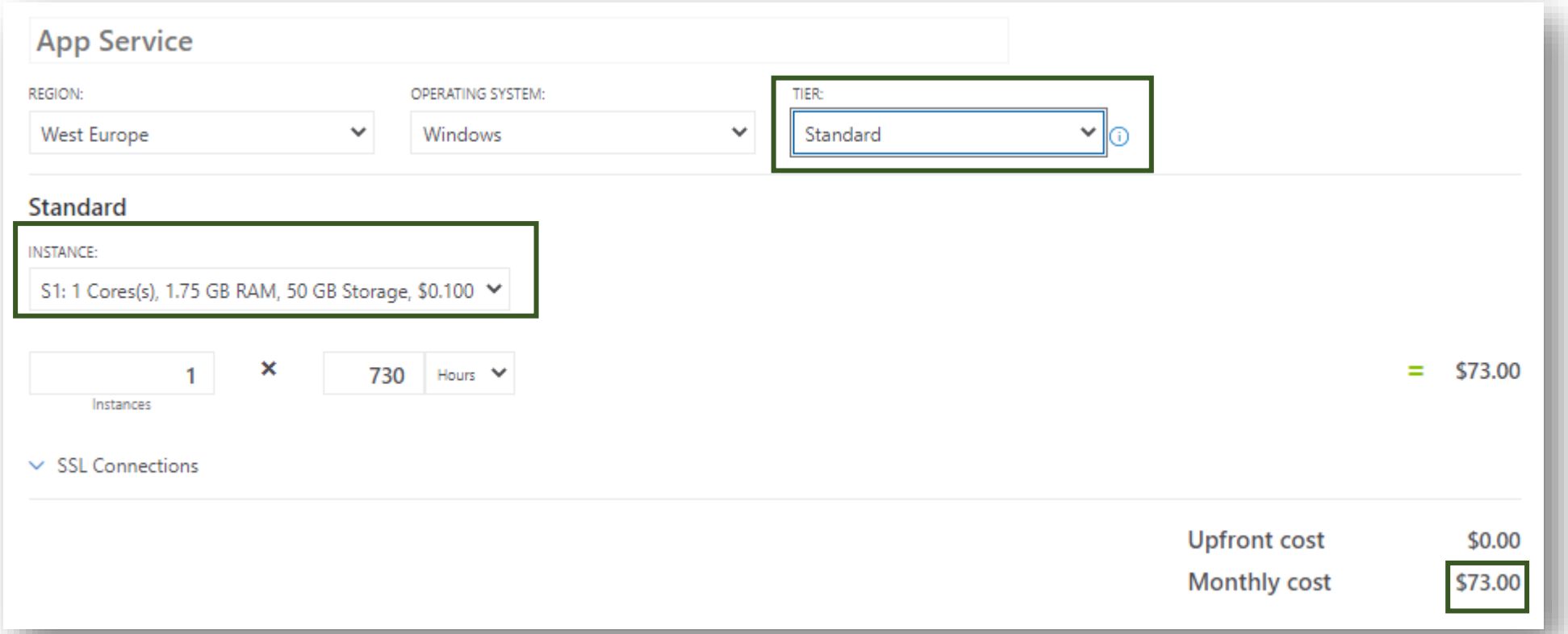
- Fully managed web app & API
- Supports many platforms
- Autoscale
- Support for WebJobs

Function Apps

- Fully managed cloud functions
- Lightweight
- Autoscale
- Integration with cloud services
- Extremely cost effective

Dunderly

Azure Web API



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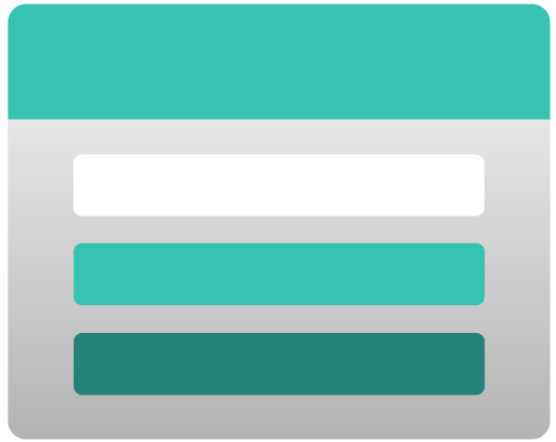
Technology Stack – Database

Employee Data (Relational)

Azure SQL

Documents



Storage Account

Dunderly

Azure SQL Database

REGION: West Europe

TYPE: Single Database

BACKUP STORAGE TIER: LRS

PURCHASE MODEL: vCore

SERVICE TIER: General Purpose

COMPUTE TIER: Provisioned

HARDWARE TYPE: Gen 5

INSTANCE: 2 vCore

Compute

REDUNDANCY: Local

1
Instances

Savings Options

Save up to 73% on pay as you go prices with 1 year or 3 year reserved options.

Compute

- ○ Pay as you go
- ○ 1 year reserved
- ◉ 3 year reserved

COMPUTE PAYMENT OPTIONS: Monthly

$110.00
Average per month
($0.00 charged upfront)

SQL License

- ◉ Pay as you go
- ○ Azure Hybrid Benefit

$145.95
Average per month
($0.00 charged upfront)

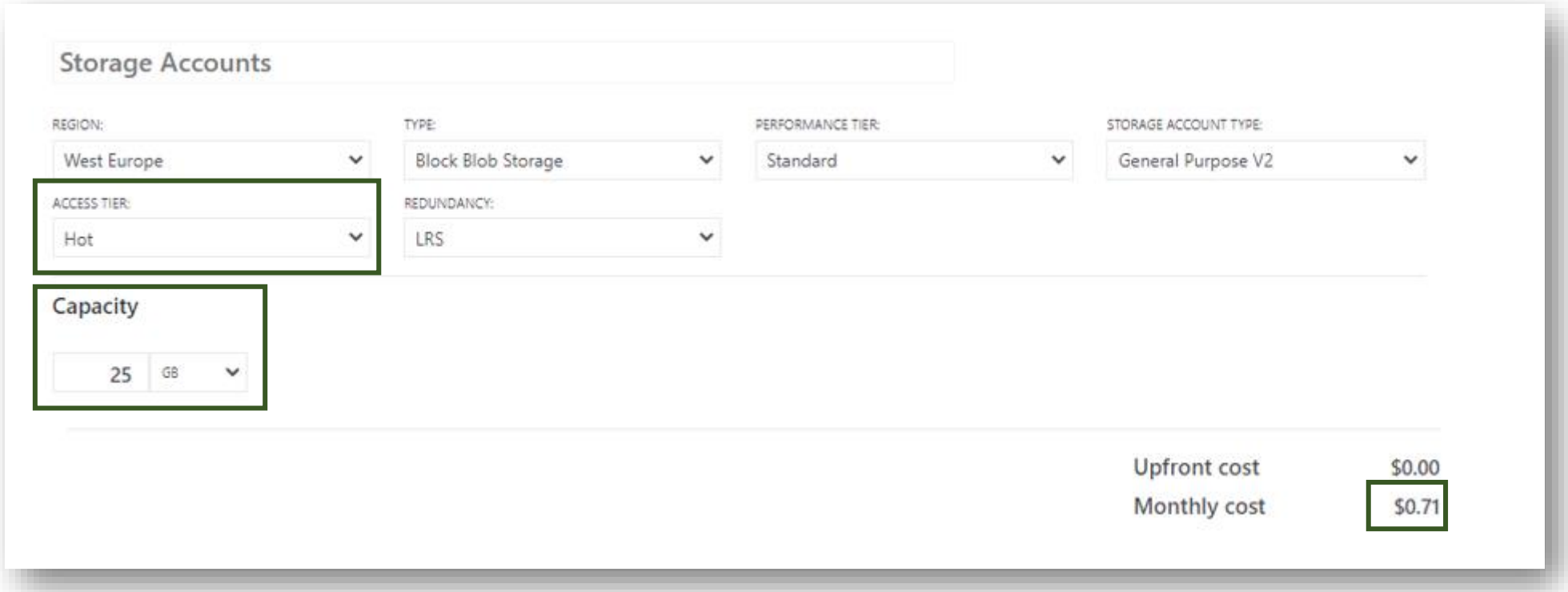
= $255.95
Average per month
($0.00 charged upfront)

Storage

5
GB

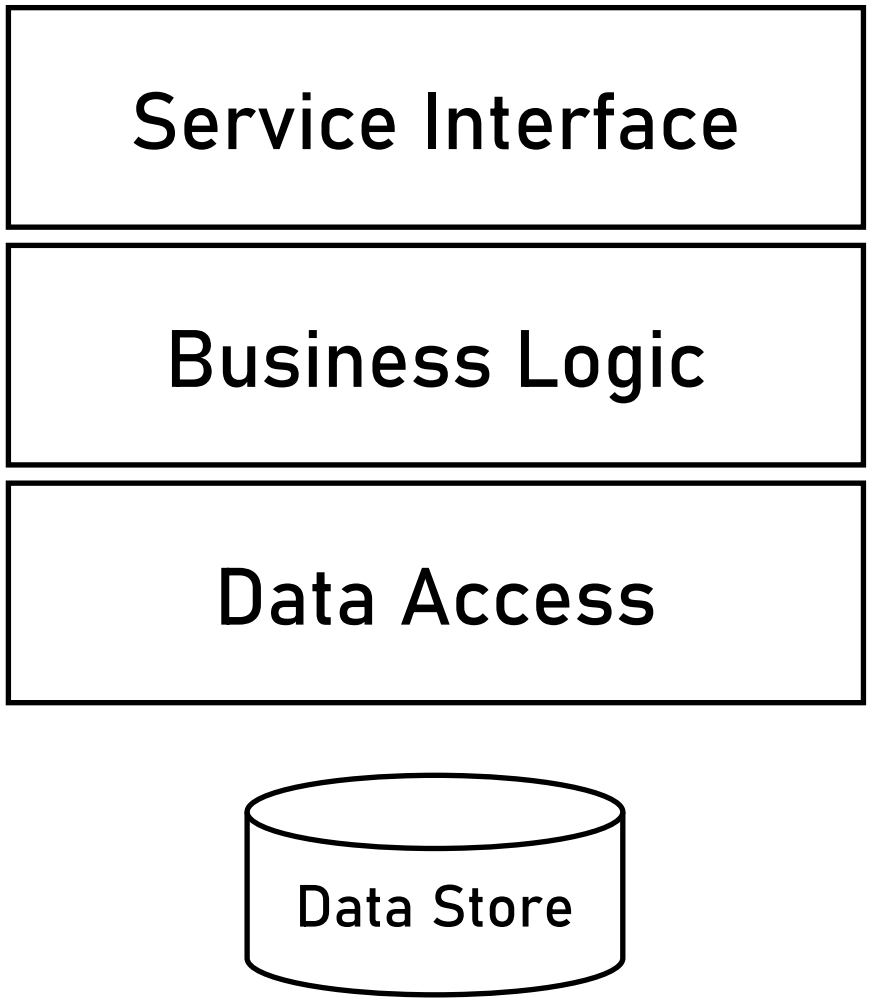
= $0.68

Dunderly


Storage Accounts
REGION:
West Europe
TYPE:
Block Blob Storage
PERFORMANCE TIER:
Standard
STORAGE ACCOUNT TYPE:
General Purpose V2
ACCESS TIER:
Hot
REDUNDANCY:
LRS
Capacity
25
GB
Upfront cost
$0.00
Monthly cost
$0.71

Dunderly

Architecture



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API

- Get full employee details by ID
- List of employees by parameters
- Add employee
- Update employee details
- Remove employee

Not physical delete!

Dunderly

API – Cont.

- Add document
- Remove document
- Get document
- Retrieve documents by parameters

Q: Do we need a separate Document Handler service?

A: Since only the Employee entity requires docs, then no.

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API

Functionality	Path	Return Codes
Get employee details by ID	`GET /api/v1/employee/{id}`	`200 OK` `404 Not Found`
List employees by parameters	`GET /api/v1/employees?name=…&birthdate=…`	`200 OK` `400 Bad Request`
Add employee	`POST /api/v1/employee`	`201 Created` `400 Bad Request`

Update employee details	`PUT /api/v1/employee/{id}`	`200 OK`
		`400 Bad Request`
		`404 Not Found`

Remove employee	`DELETE /api/v1/employee/{id}`	`200 OK` `404 Not Found`

Dunderly

API

Functionality	Path	Return Codes
Add document	`POST /api/v1/employee/{id}/document`	`201 Created` `404 Not Found`
Remove document	`DELETE` `/api/v1/employees/{id}/document/{docid}`	`200 OK` `404 Not Found`
Get document	`GET /api/v1/employees/{id}/document/{docid}`	`200 OK` `404 Not Found`
Retrieve documents for employee	`GET /api/v1/employees/{id}/documents`	`200 OK` `404 Not Found`

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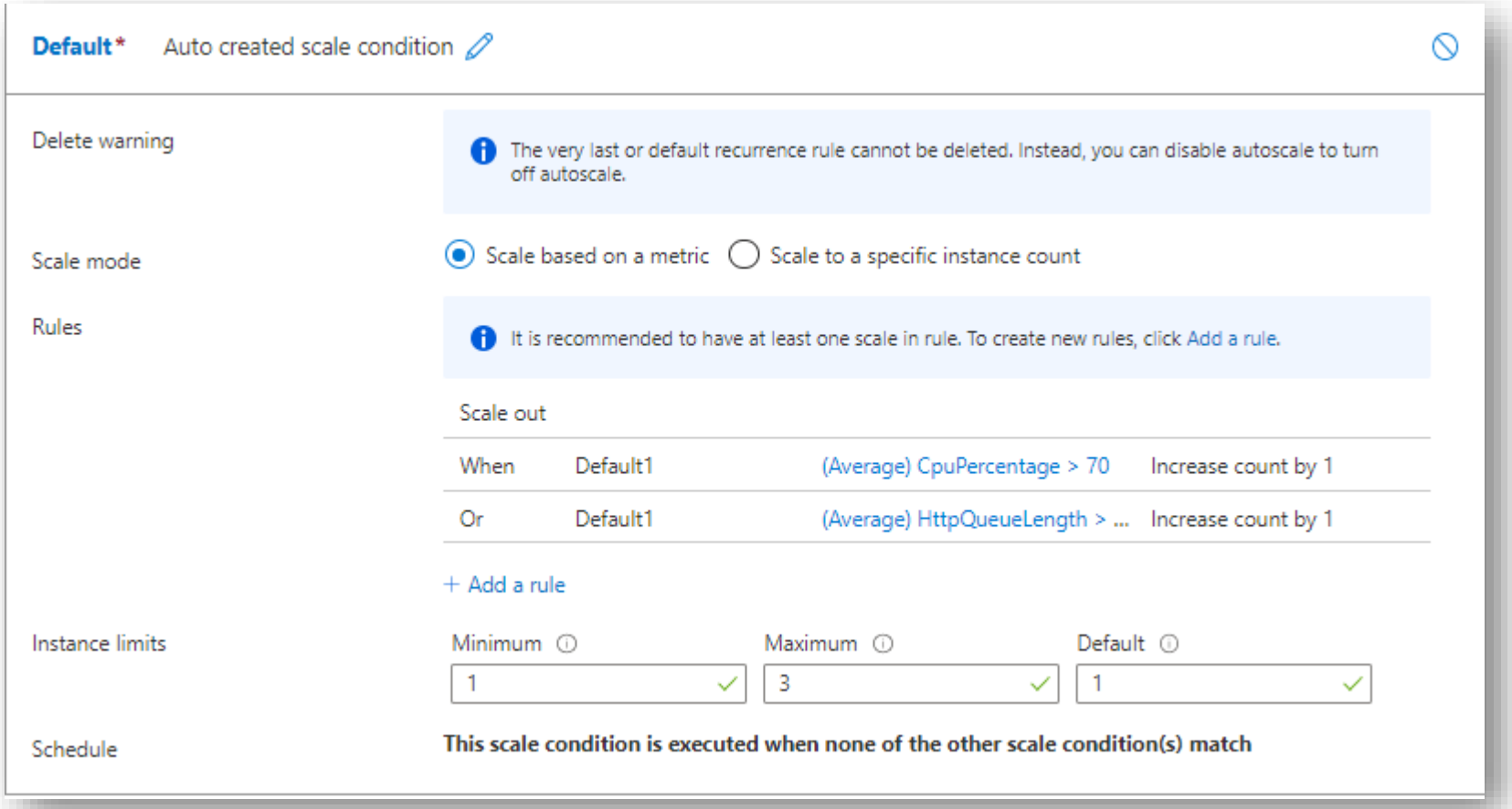
Employee Service Redundancy

App service auto scale



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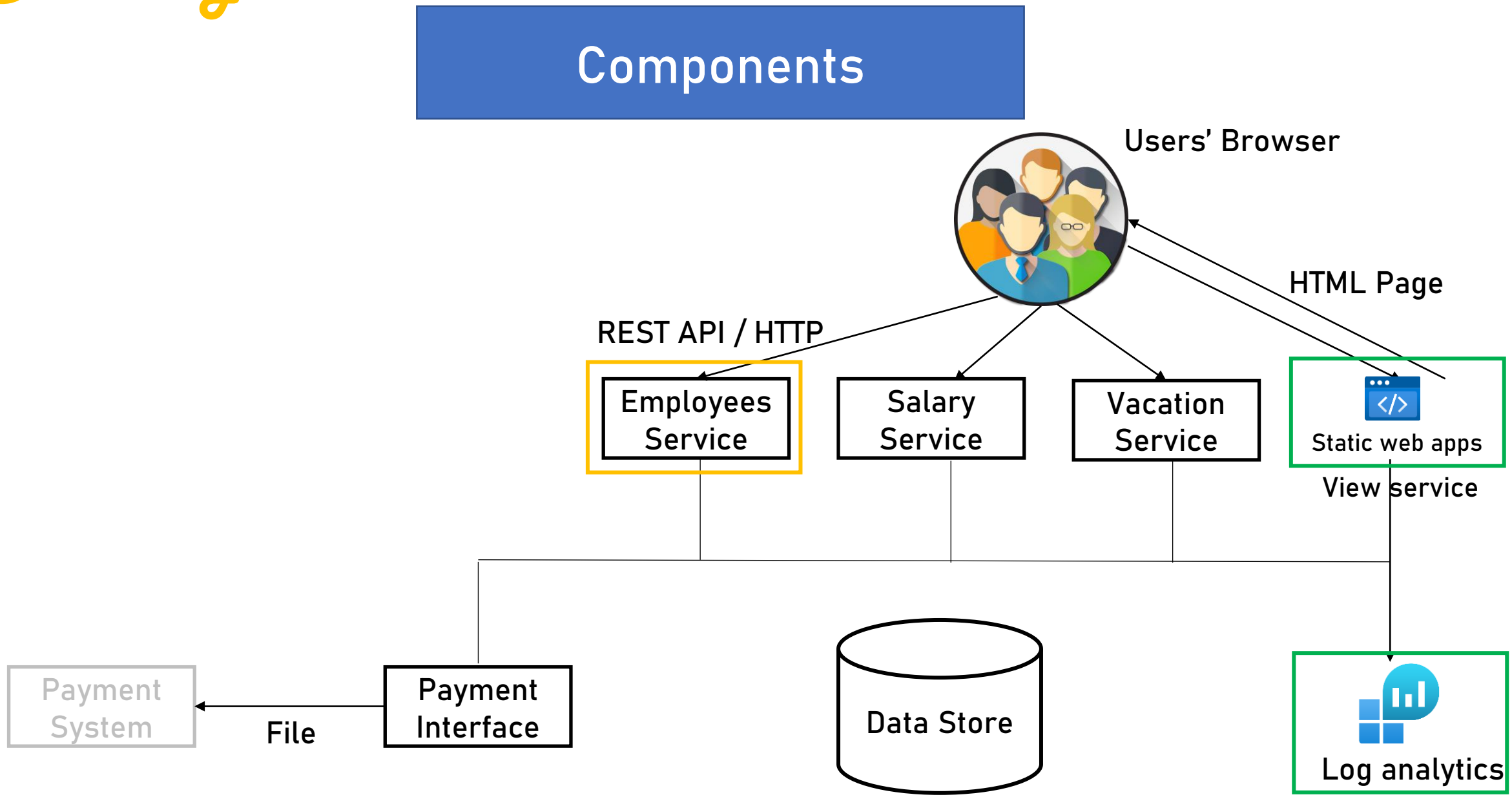
Components



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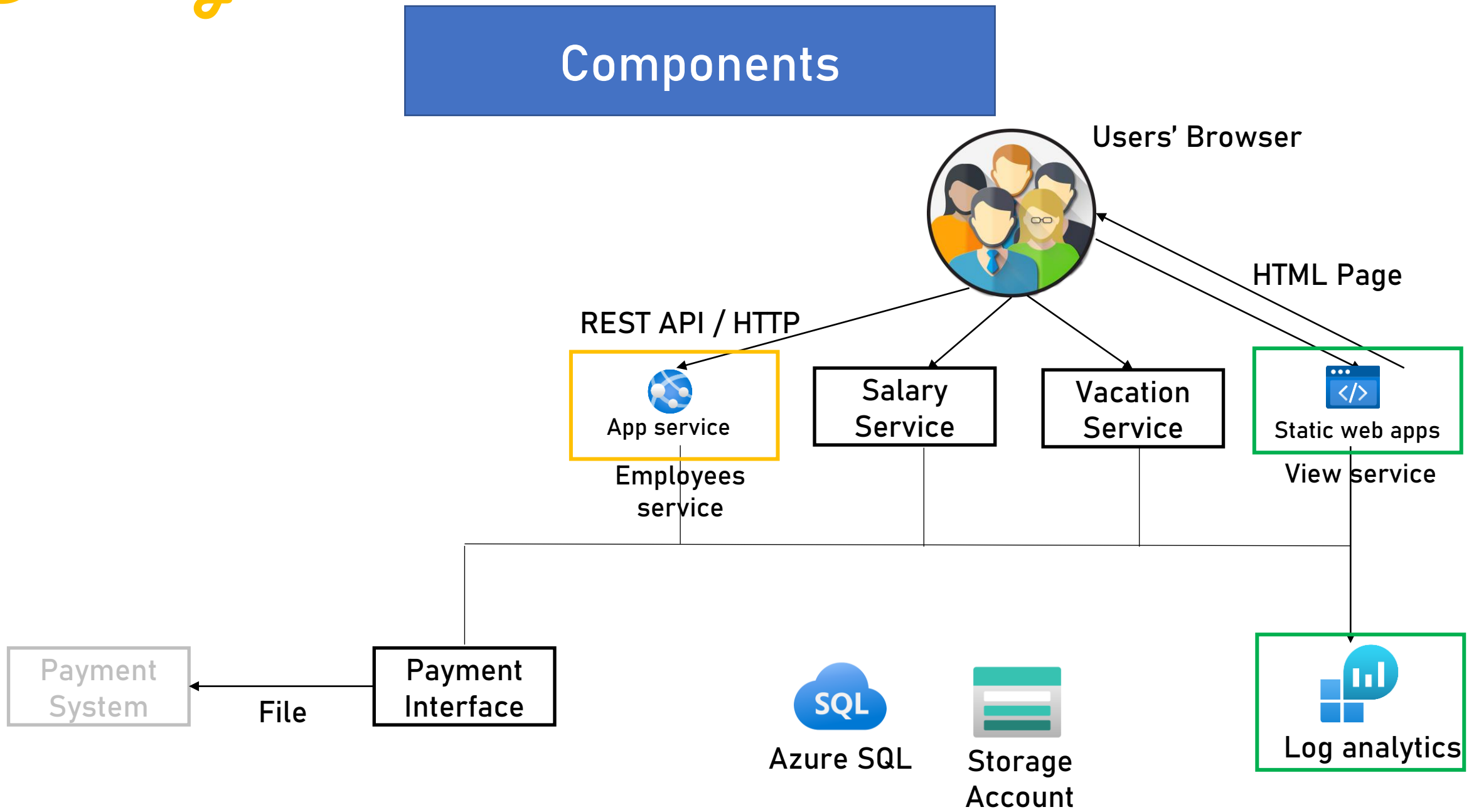

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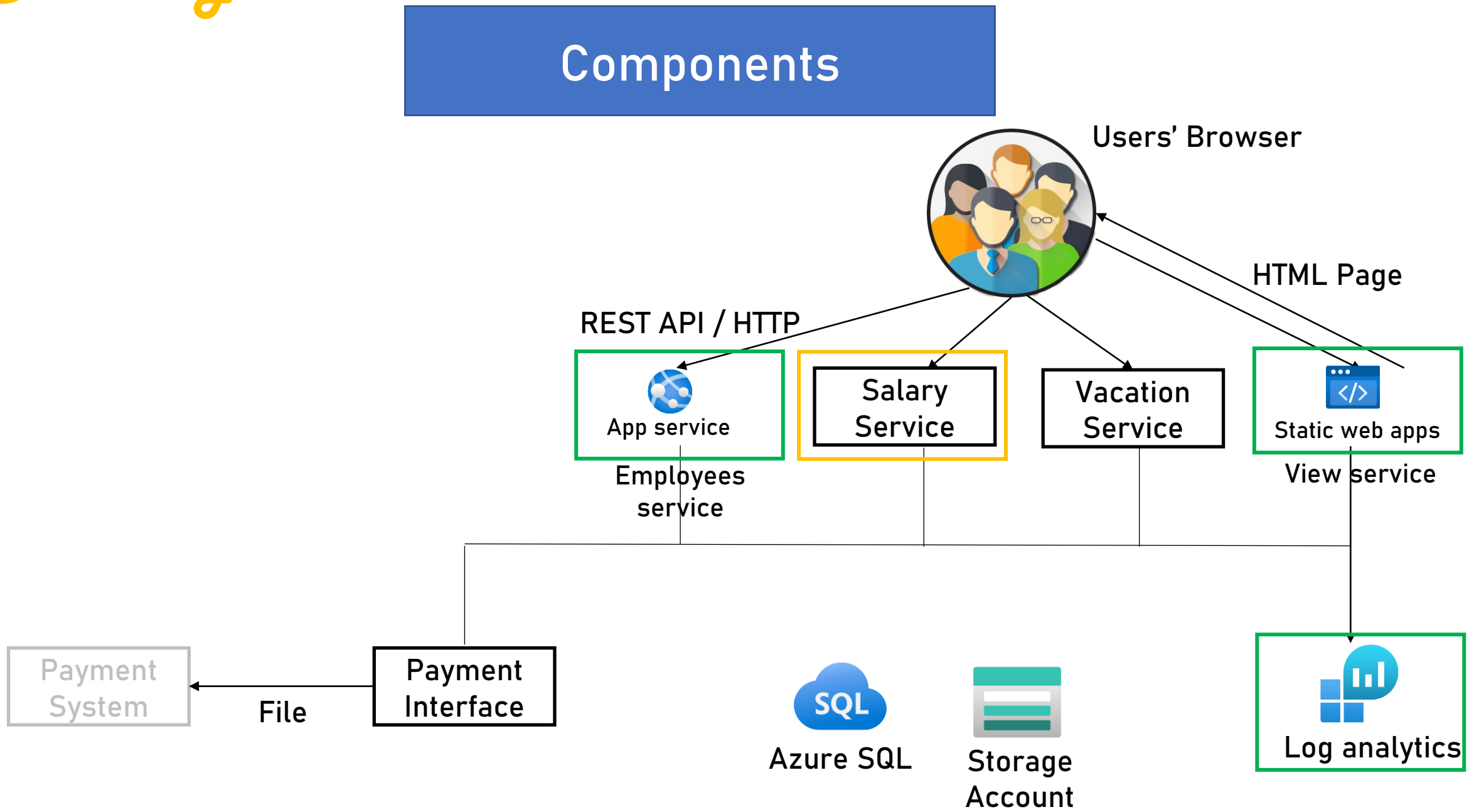

Dunderly

Salary Service

What it does:

- Allows managers to ask for an employee's salary change

- Allows HR representative to approve / reject the request

Dunderly

Application Type

- Web App & Web API 
- Mobile App 
- Console 
- Service 
- Desktop App 

Dunderly

Technology Stack

Dunderly

Azure Web API

Let's choose:

- Azure Functions are for lightweight actions
- The API does some heavy lifting
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App Se

- Fully managed w
- Supports many p
- Autoscale
- Support for WebJobs
- Integration with cloud services
- Extremely cost effective

Dunderly

Azure Web API

App Service

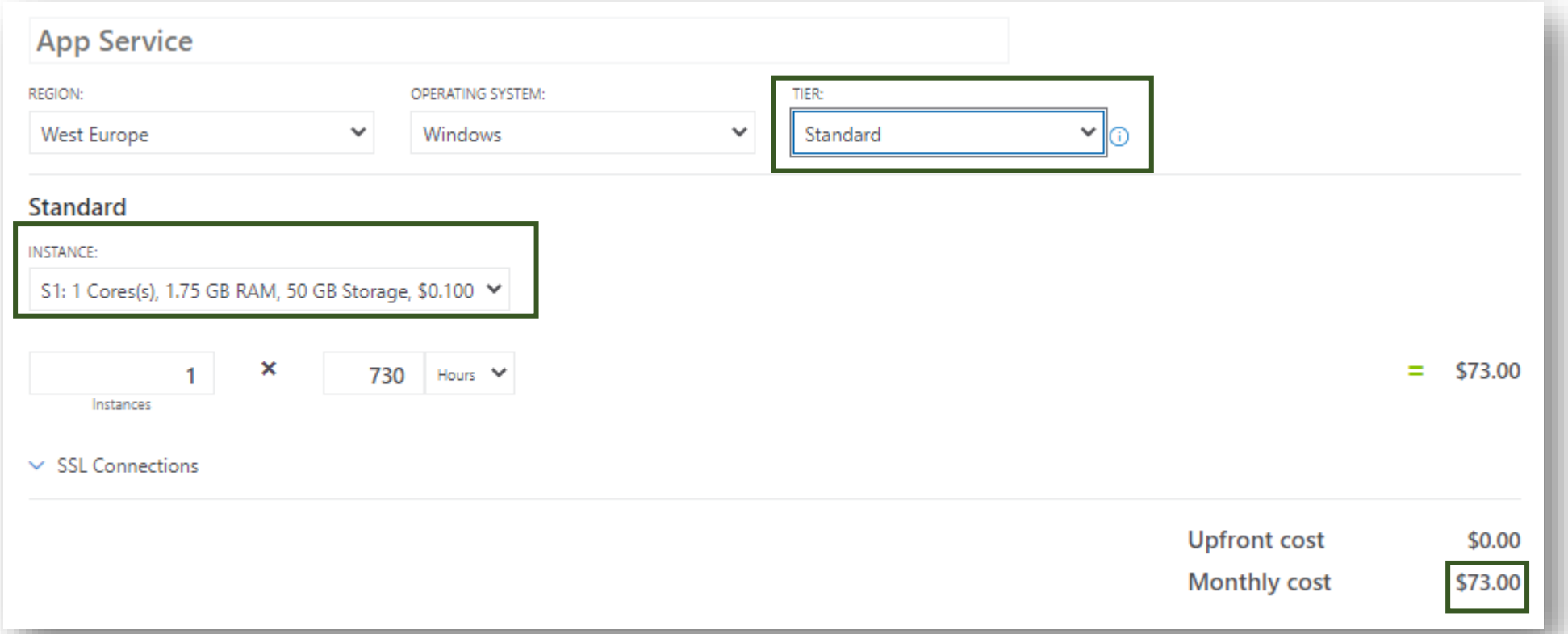
- Fully managed web app & API
- Supports many platforms
- Autoscale
- Support for WebJobs

Function Apps

- Fully managed cloud functions
- Lightweight
- Autoscale
- Integration with cloud services
- Extremely cost effective

Dunderly

Azure Web API



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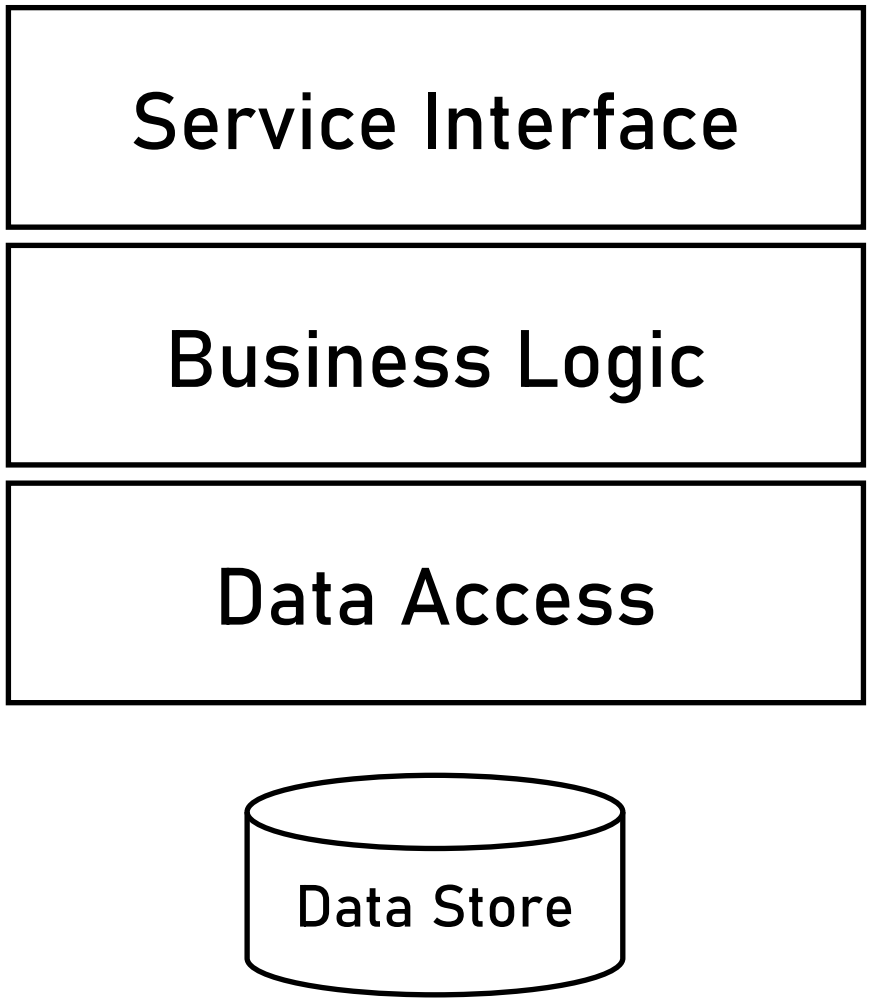
Architecture



Dunderly

API

- Add salary request
- Remove salary request
- Get salary requests
- Approve salary request
- Reject salary request

Dunderly

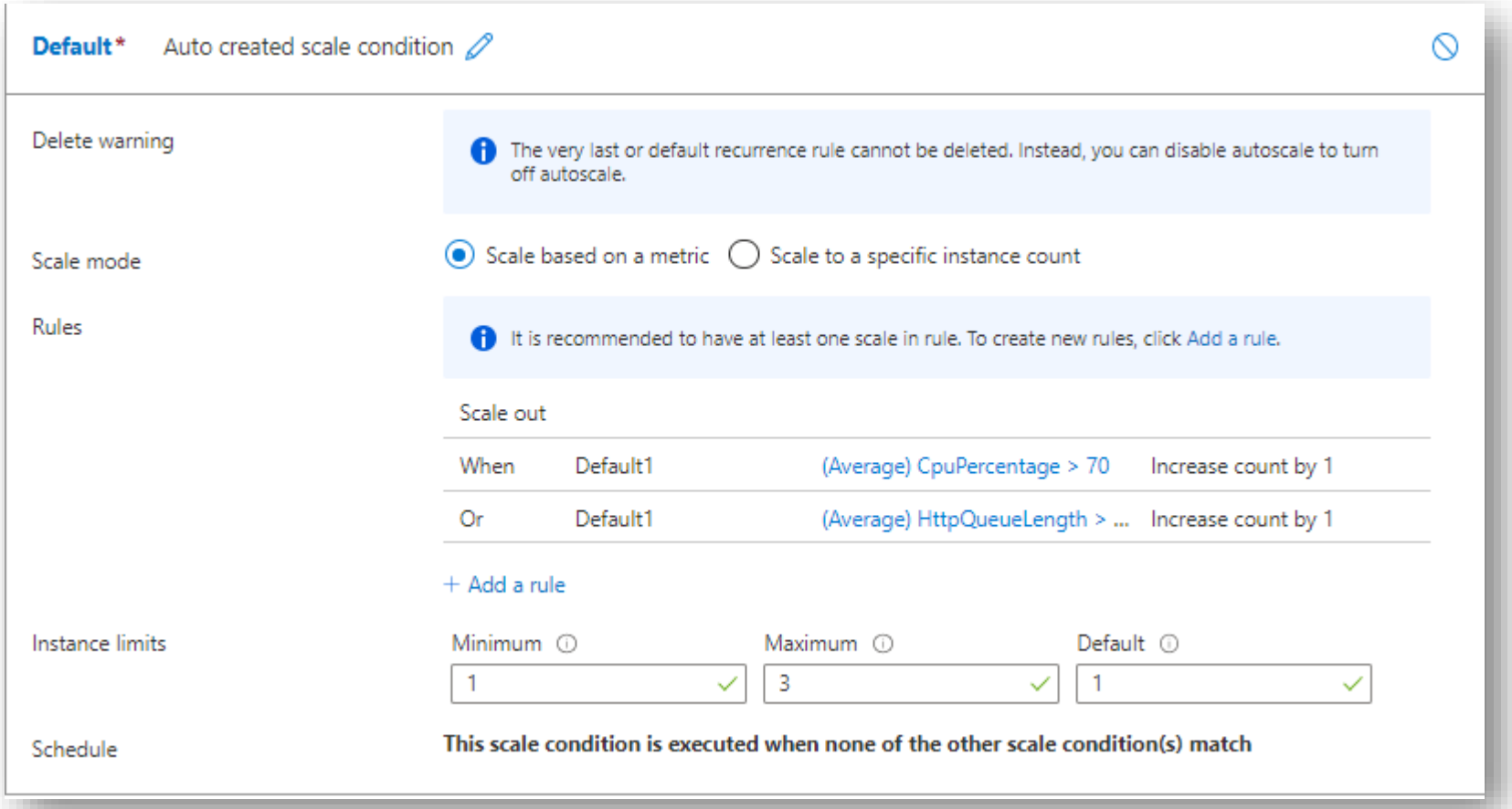
API

Functionality	Path	Return Codes
Add salary request	`POST /api/v1/salaryRequest/`	`200 OK` `400 Bad Request`
Remove salary request	`DELETE /api/v1/salaryRequest/{id}`	`200 OK` `404 Not Found`
Get salary requests	`GET /api/v1/salaryRequests`	`200 OK`
Approve salary request	`POST /api/v1/salaryRequest/{id}/approval`	`200 OK` `404 Not Found`
Reject salary request	`POST /api/v1/salaryRequest/{id}/rejection`	`200 OK` `404 Not Found`

Dunderly

Salary Service Redundancy

App service auto scale



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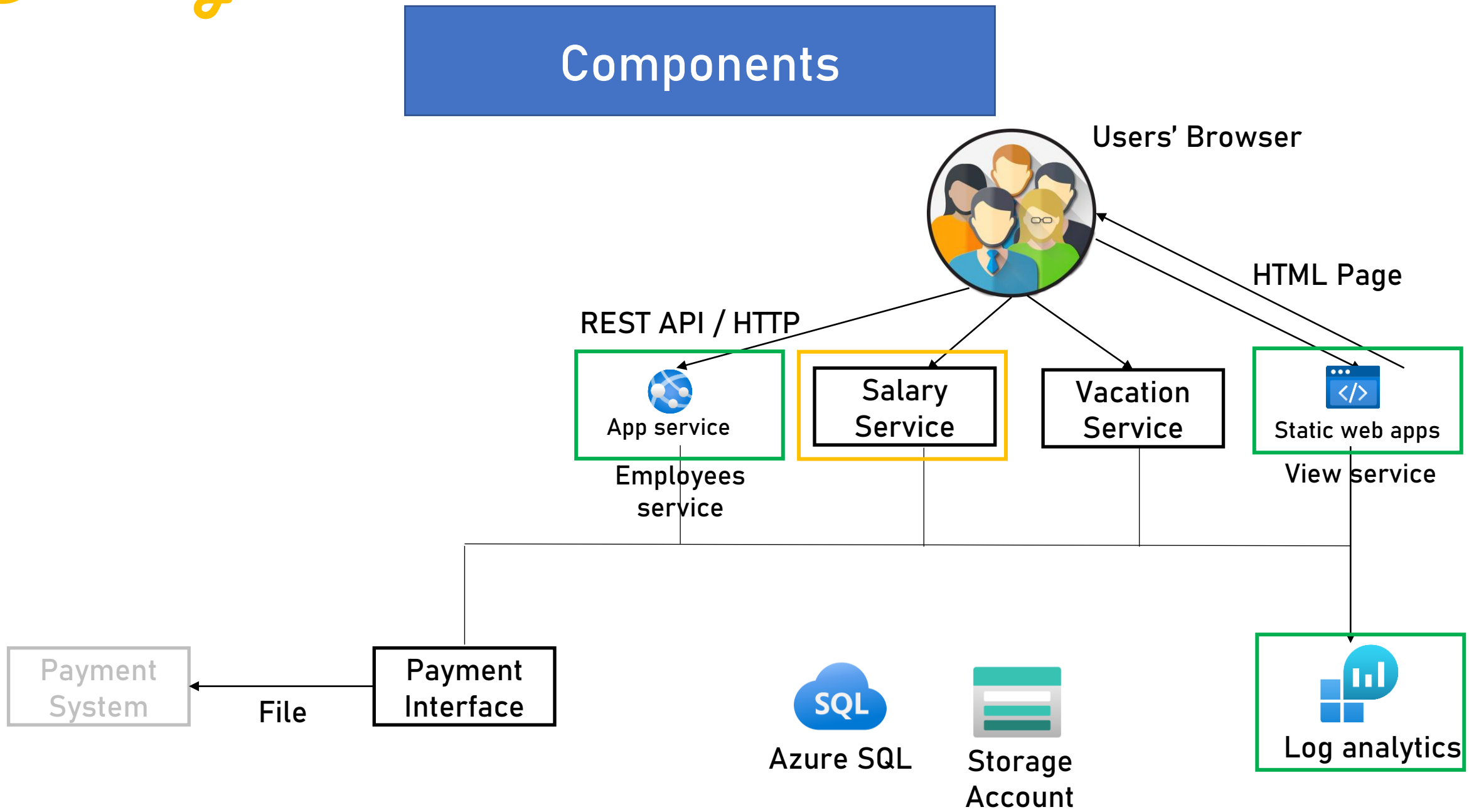

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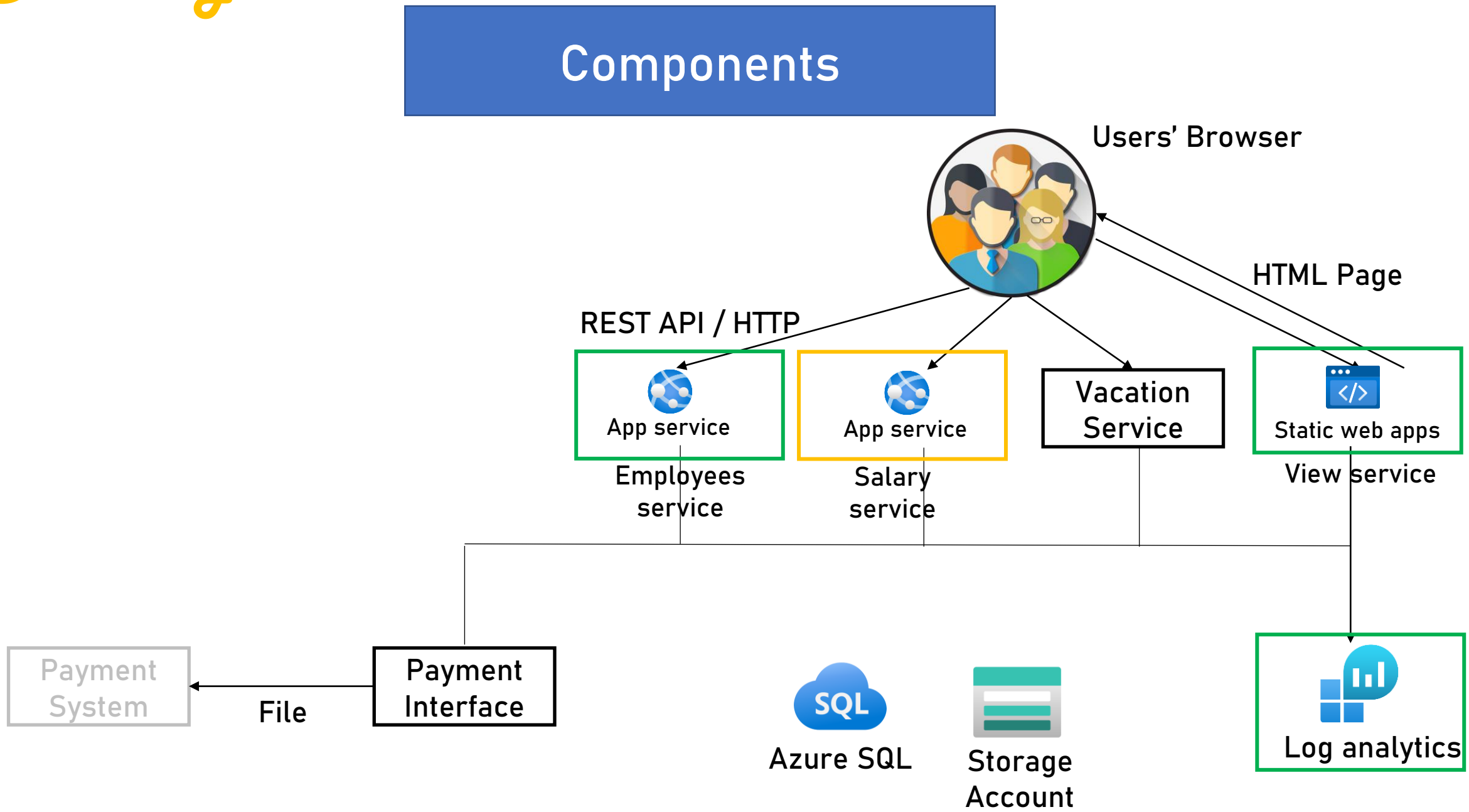

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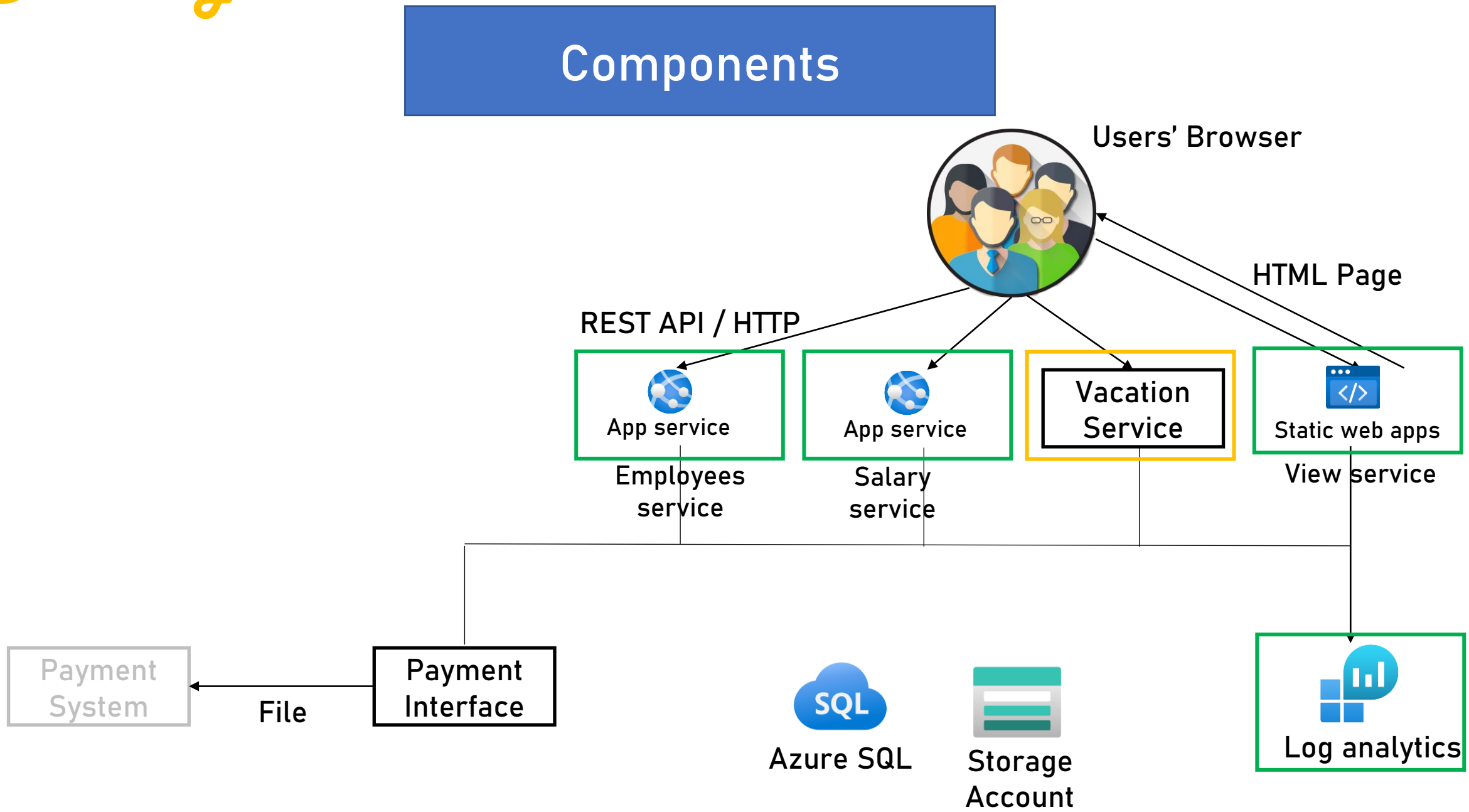
Components



Dunderly

Vacation Service

What it does:

- Allows employees to manage their vacation days
- Allows HR to set available vacation days for employees

Dunderly

Application Type

- Web App & Web API 
- Mobile App 
- Console 
- Service 
- Desktop App 

Dunderly

Technology Stack

Dunderly

Azure Web API

- Fully managed web app & API
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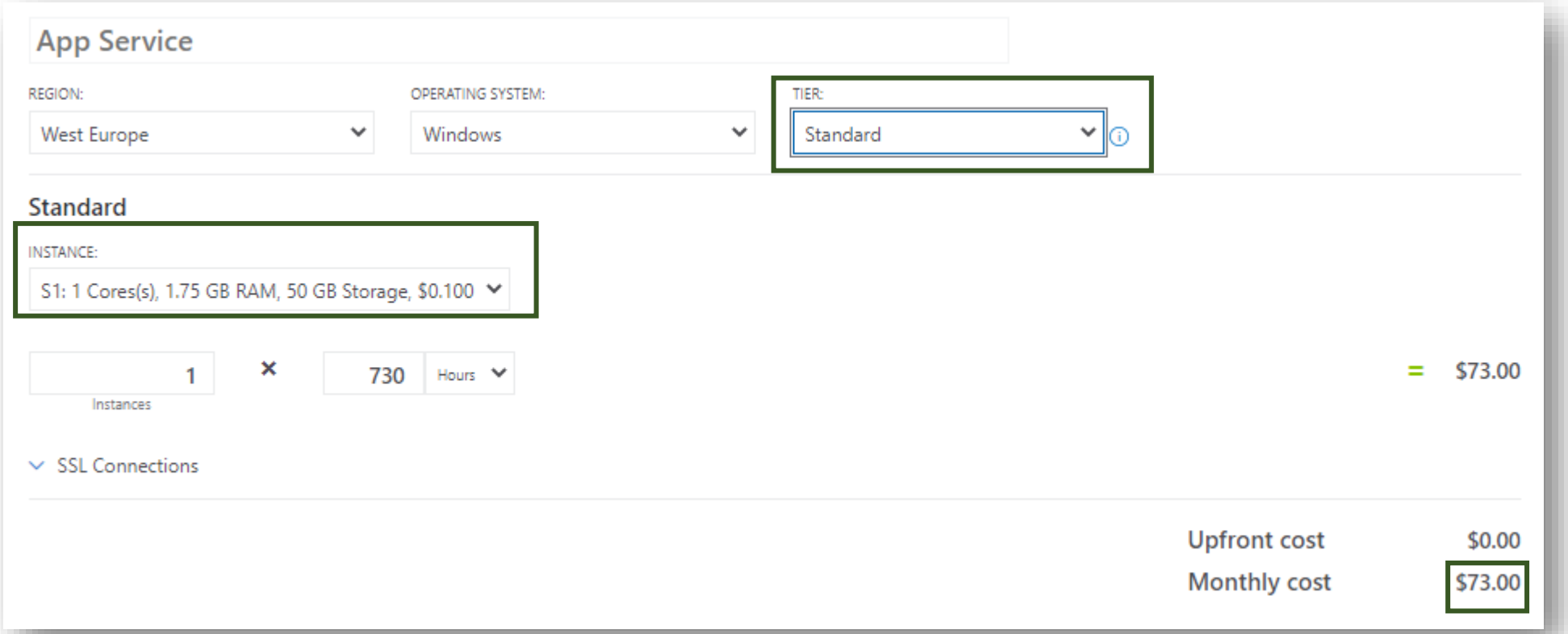
Dunderly

Azure Web API



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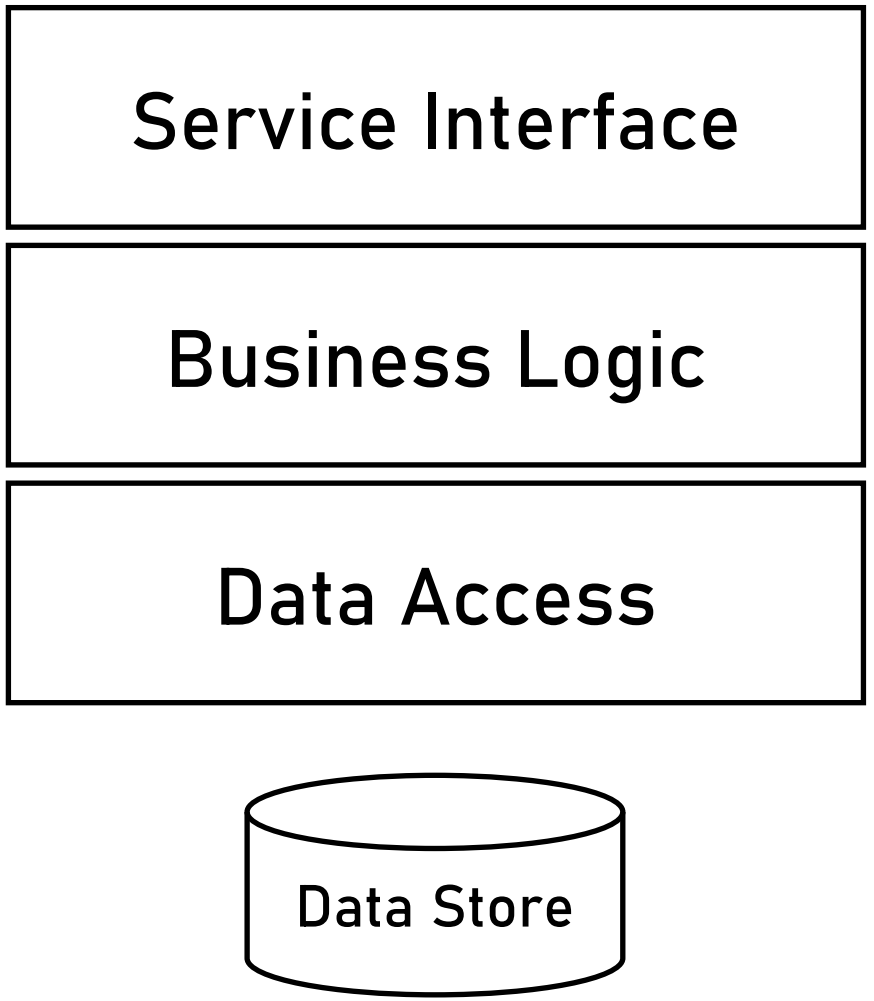
Architecture



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API

- Set available vacation days (by HR)
- Get available vacation days
- Reduce vacation days (by employees)

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API

Functionality	Path	Return Codes
Set available vacation days	`PUT /api/v1/vacation/{empid}`	`200 OK` `404 Not Found`
Get available vacation days	`GET /api/v1/vacation/{empid}`	`200 OK` `404 Not Found`
Reduce vacation days	`POST /api/v1/vacation/{empid}/reduction`	`200 OK`

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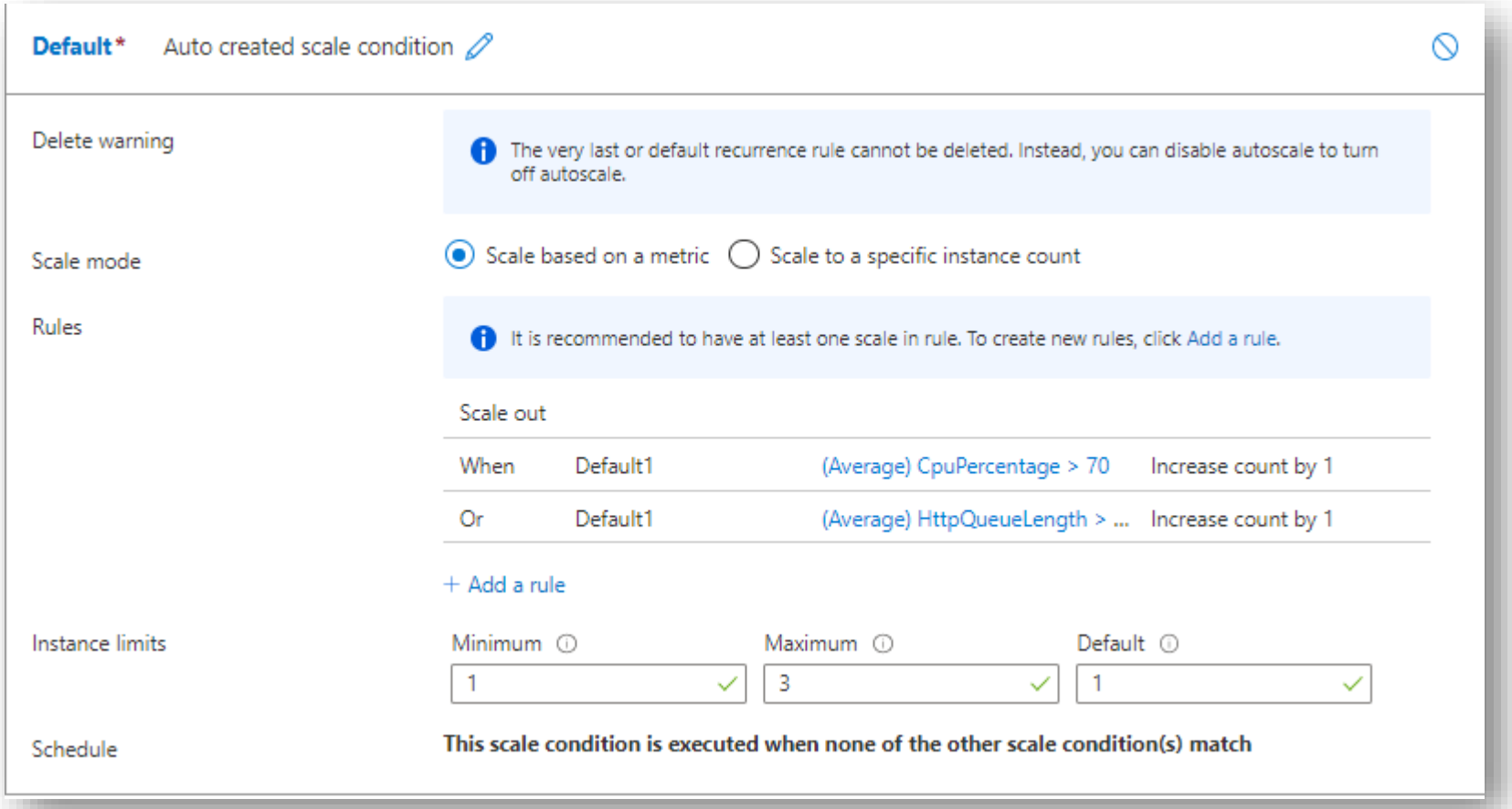
Vacation Service Redundancy

App service auto scale



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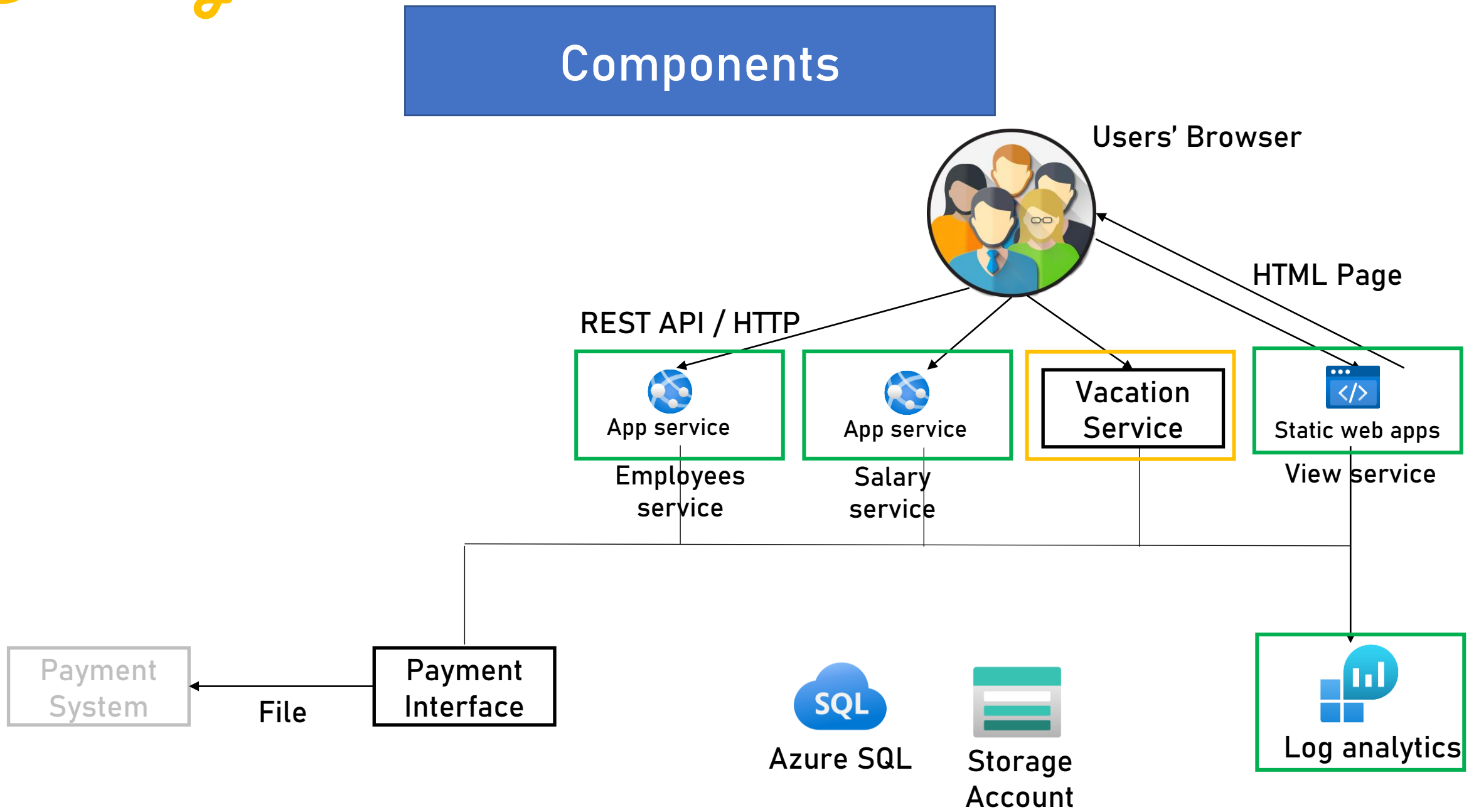
Components



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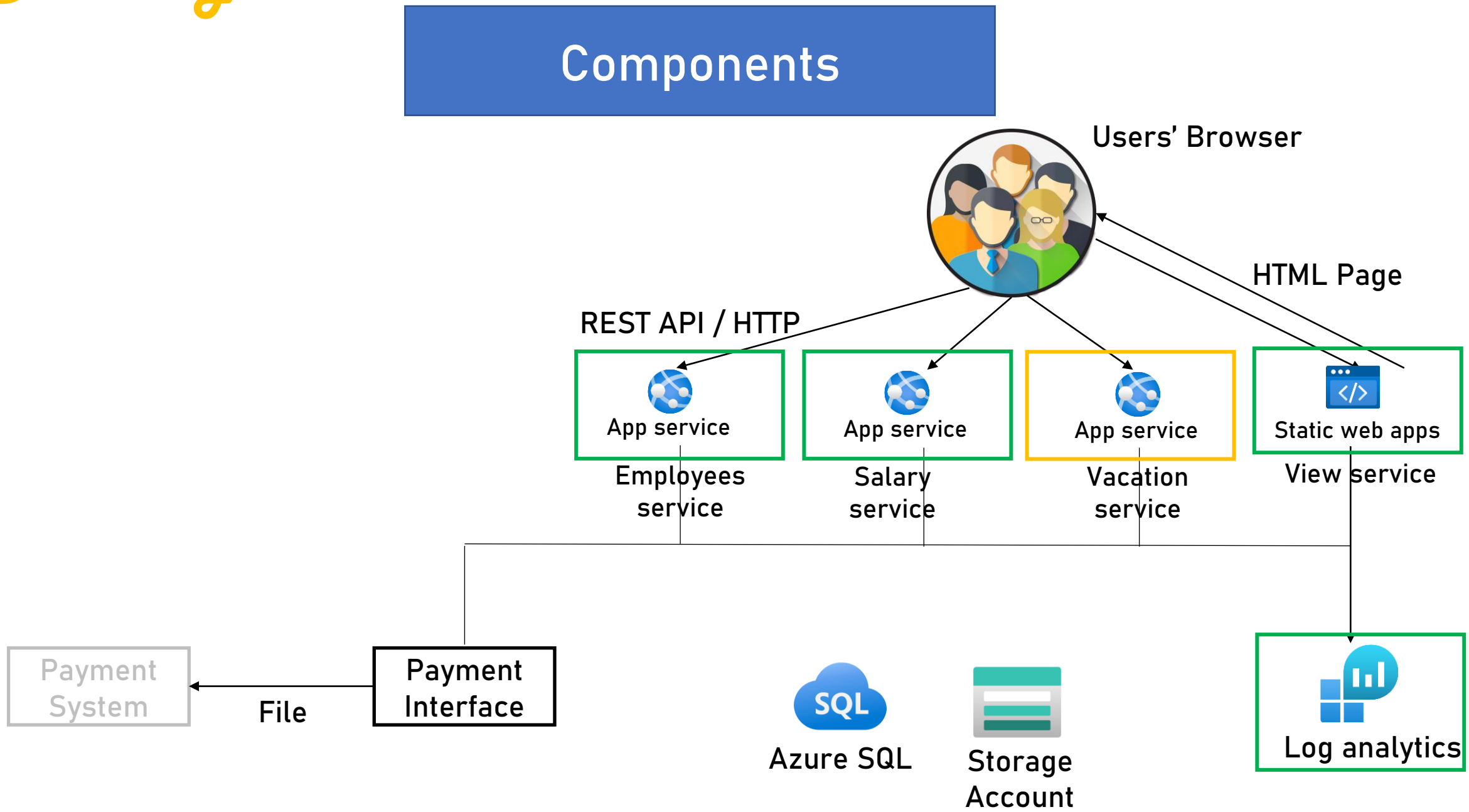
Components



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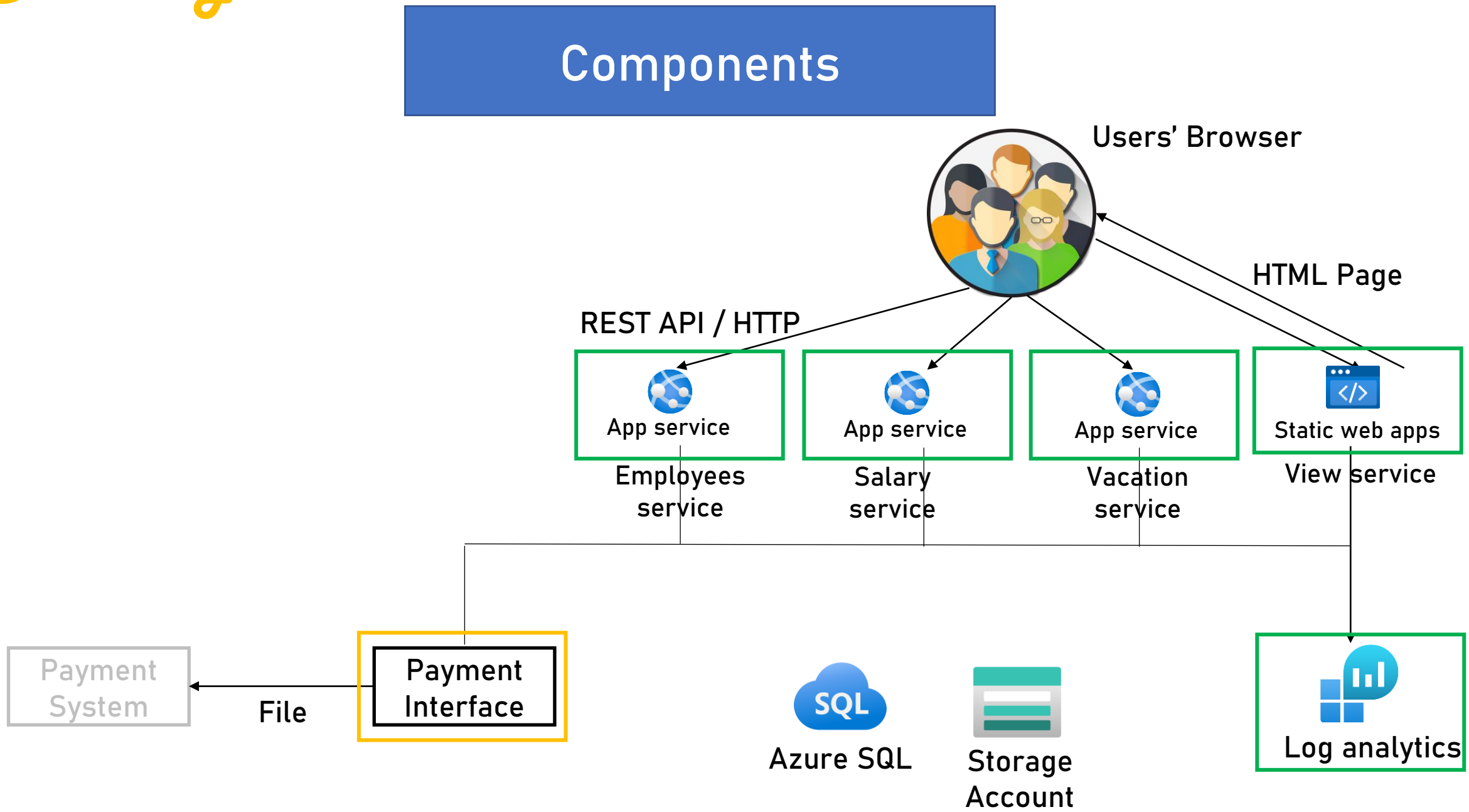
Components



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Payment Interface

What it does:

- Queries the database once a month for salary data
- Passes payment data to the external payment system

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Application Type

- Web App & Web API 
- Mobile App 
- Console 
- Service 
- Desktop App 

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Technology Stack

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Azure batch process

Let's choose:

- Azure Functions are for lightweight actions
- Have great monitoring
- The export can take a lot of time

App Se

- Runs on schedul
- Part of the App s
- No additional cos

- Integration with cloud services
- Extremely cost effective

Dunderly

Azure batch process

App Service WebJob

- Runs on schedule
- Part of the App service
- No additional cost

Function Apps

- Fully managed cloud functions
- Lightweight
- Autoscale
- Integration with cloud services
- Extremely cost effective

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Azure batch process

App Service WebJob

- Runs on schedule
- Part of the App service
- No additional cost

Other alternatives

VM

- Requires a lot of manual maintenance
- Expensive

Logic app

- Too complex for this specific job

Azure batch

- Used for huge processes, this is not the case

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Payment Interface Redundancy

- No built-in redundancy for WebJobs
- Not critical – runs once a month
- Add monitoring for catching failures

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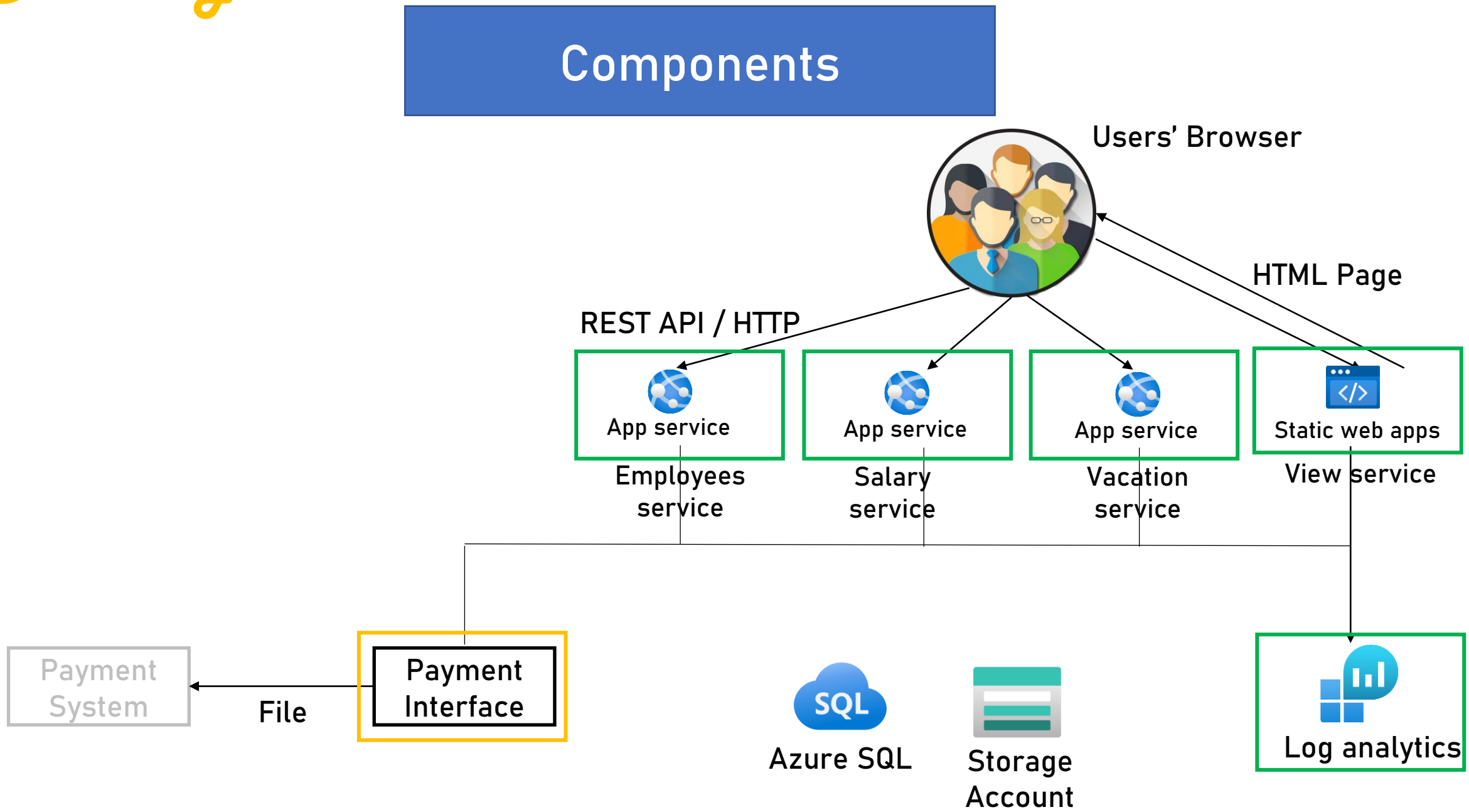
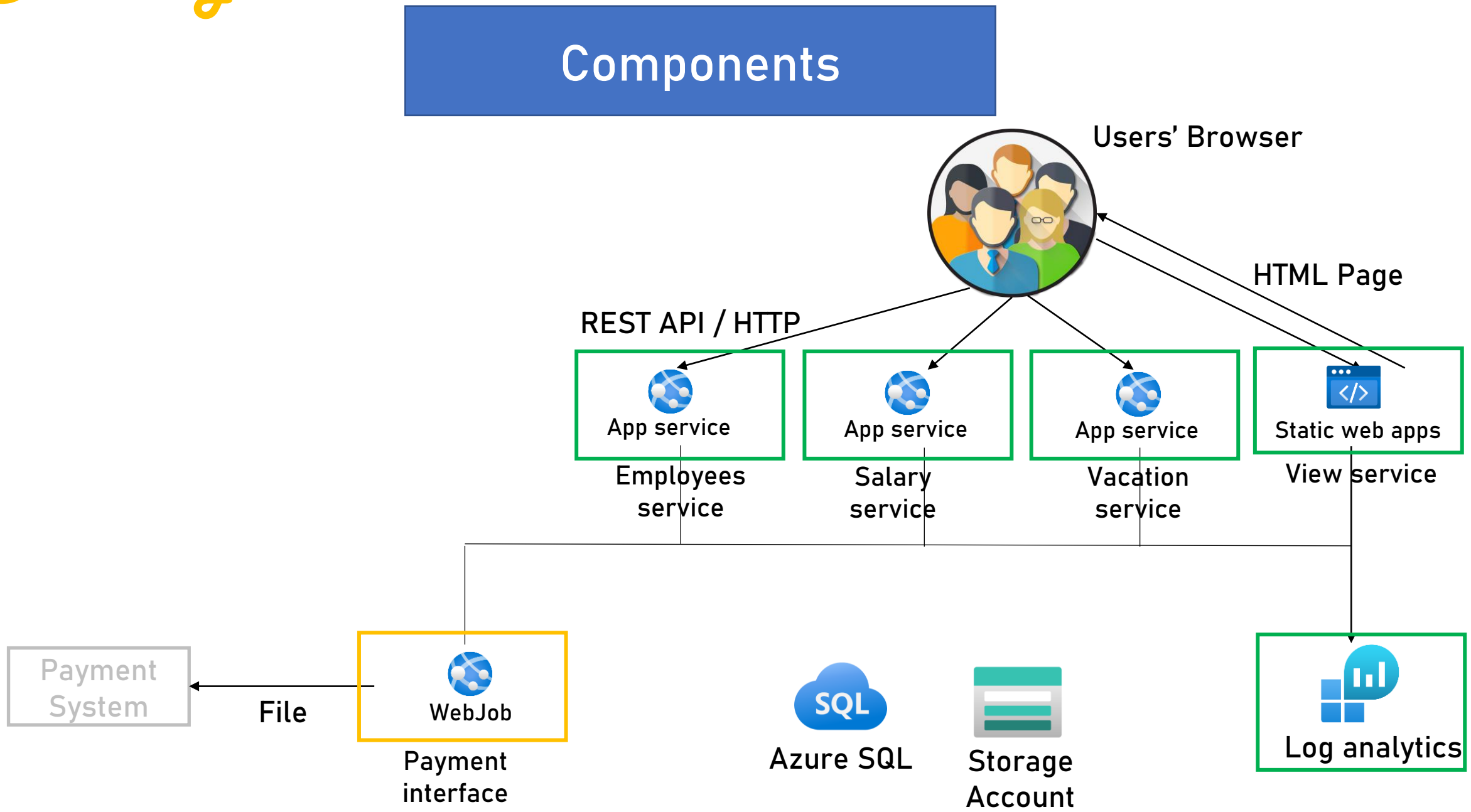
Components



Dunderly

Components



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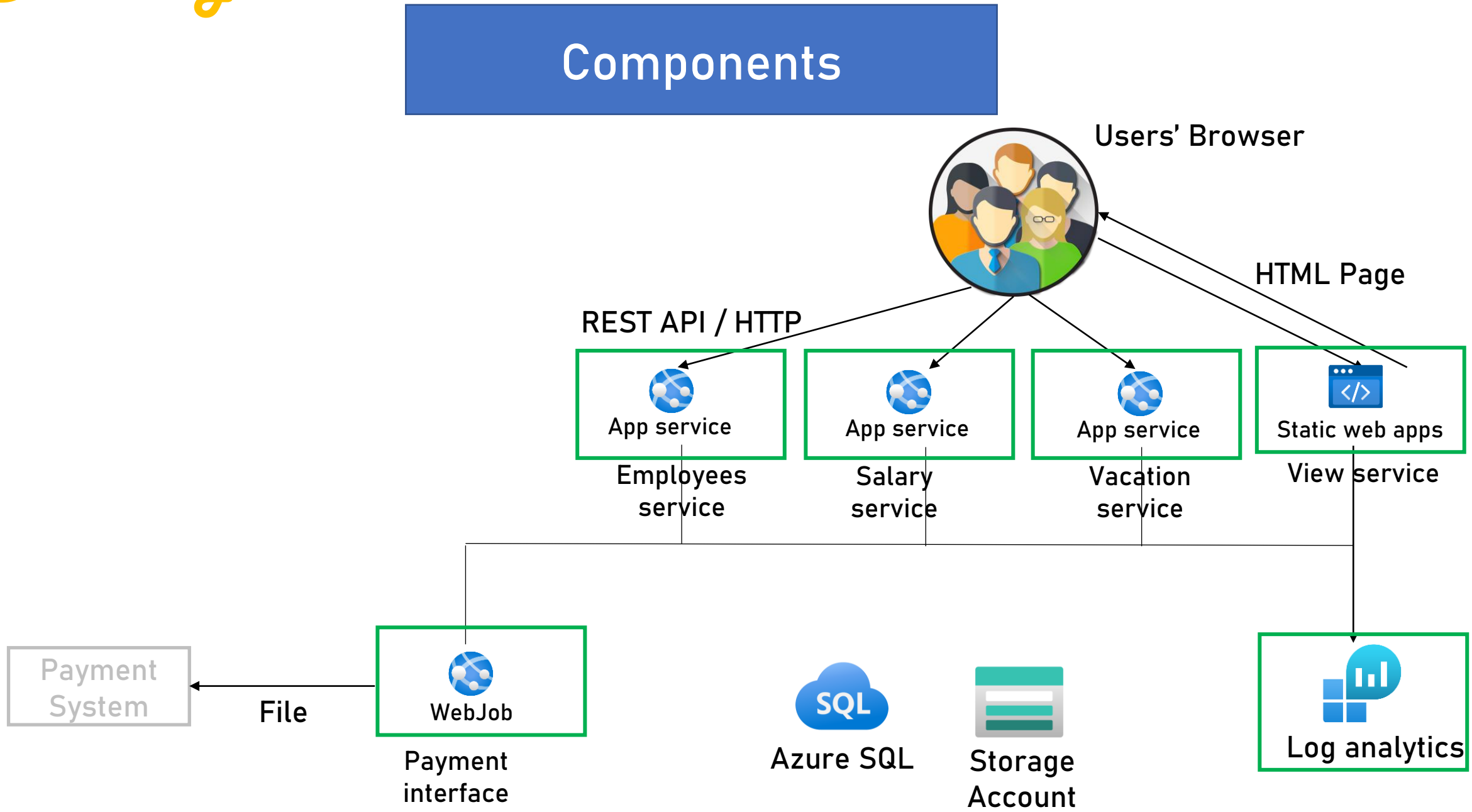
Components



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Security

- Data encryption
- Network security
- Access restrictions

Dunderly

Data Encryption

- Data in Azure Storage account is encrypted by default
  - Using 256-bit AES encryption
- Traffic to Storage Account is encrypted using TLS

Dunderly

Data Encryption

- Data in Azure SQL is encrypted by default
  - Using 256-bit AES encryption
- Traffic to Azure SQL is encrypted using TLS

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Network Security

- Currently all app services are exposed to the internet
- No protection whatsoever
- Need to add Web Application Firewall (WAF)

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Application Gateway + WAF

- Load balancer
- Web Application Firewall
- Autoscale
- Sophisticated routing

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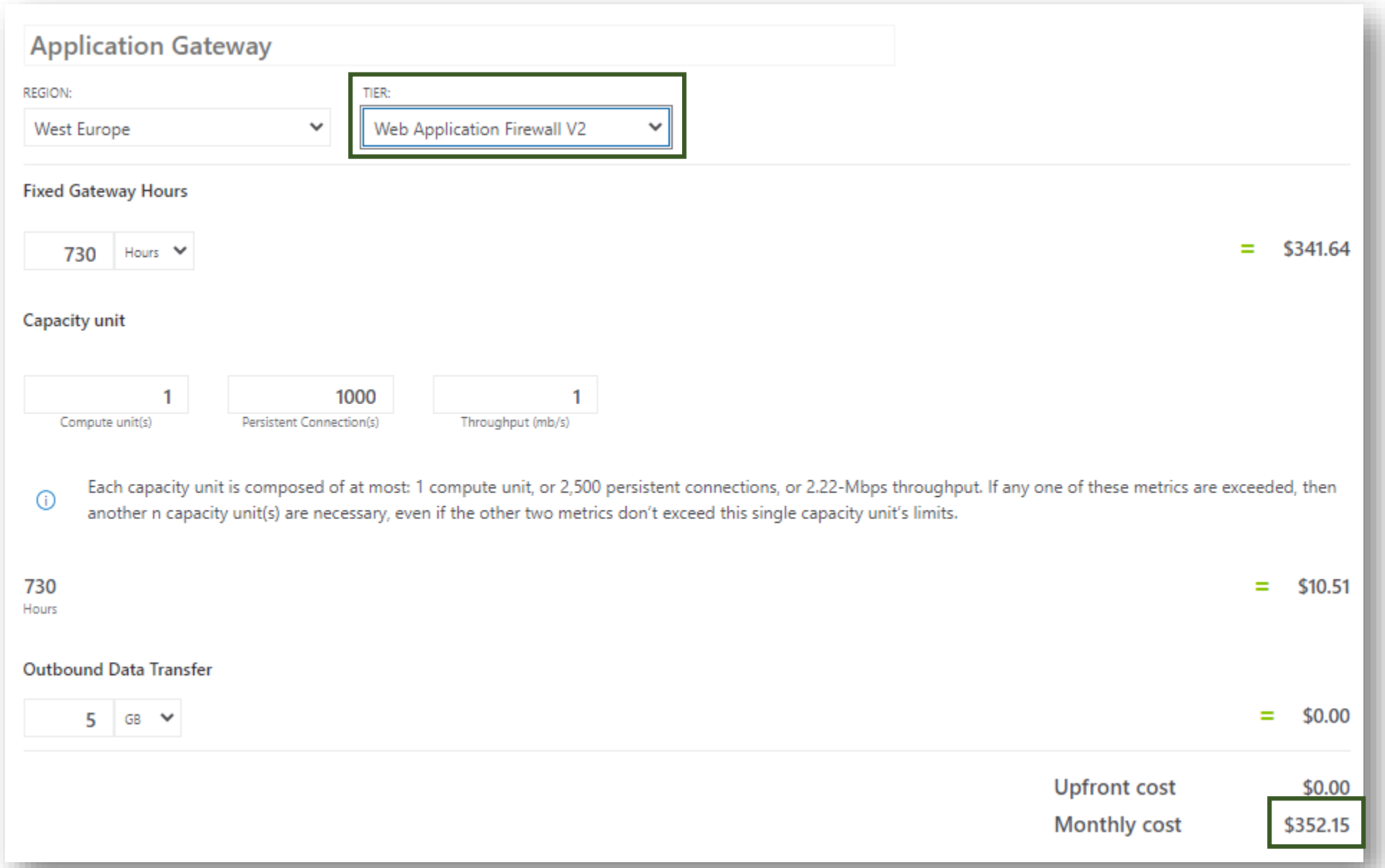
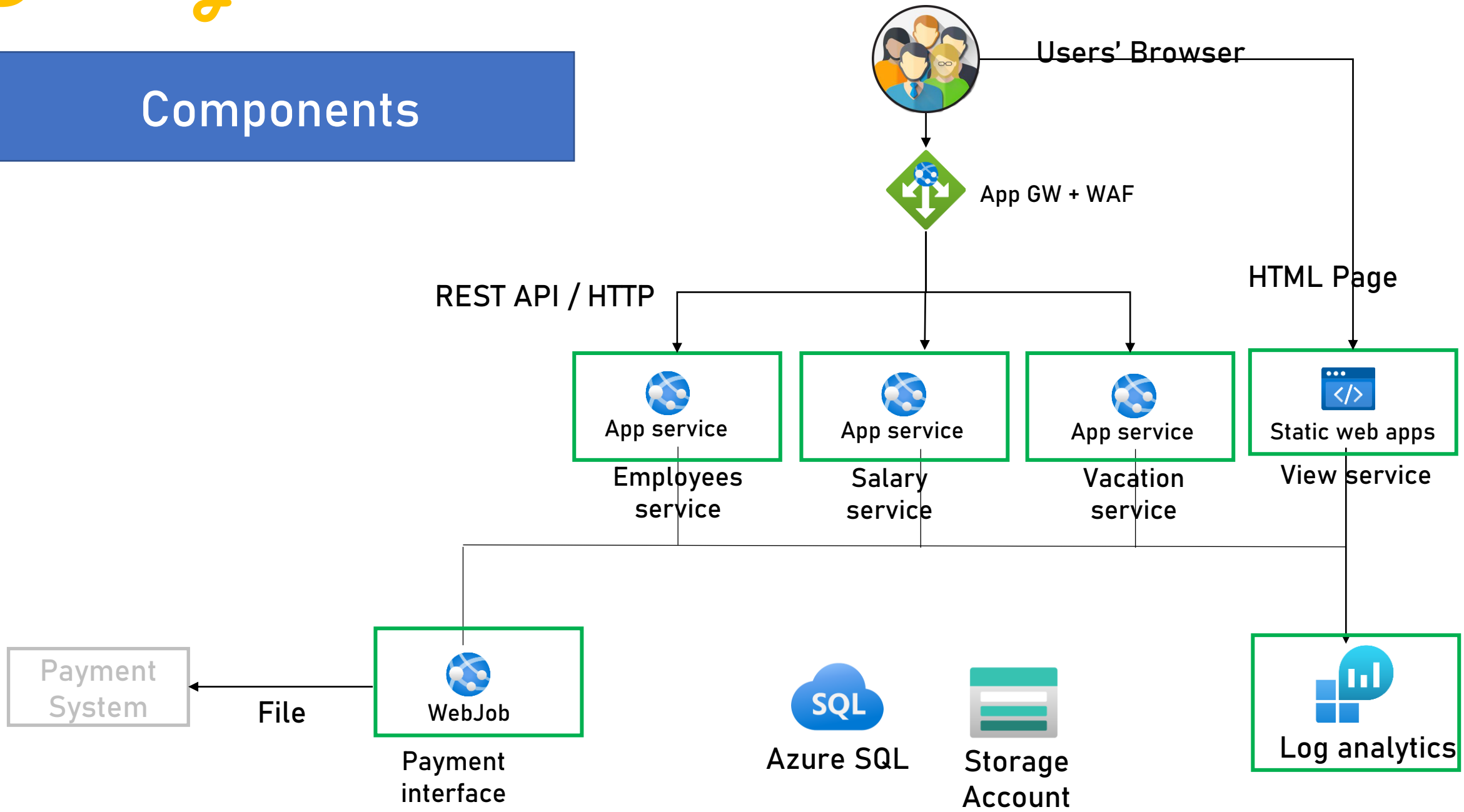

Application Gateway
REGION:
West Europe
TIER:
Web Application Firewall V2
Fixed Gateway Hours
730
Hours
= $341.64
Capacity unit
1
Compute unit(s)
1000
Persistent Connection(s)
1
Throughput (mb/s)
Each capacity unit is composed of at most: 1 compute unit, or 2,500 persistent connections, or 2.22-Mbps throughput. If any one of these metrics are exceeded, then another n capacity unit(s) are necessary, even if the other two metrics don't exceed this single capacity unit's limits.
730
Hours
= $10.51
Outbound Data Transfer
5
GB
= $0.00
Upfront cost
$0.00
Monthly cost
$352.15

Dunderly

Components



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Access Restrictions

- Access to resources should be limited to allowed resources only

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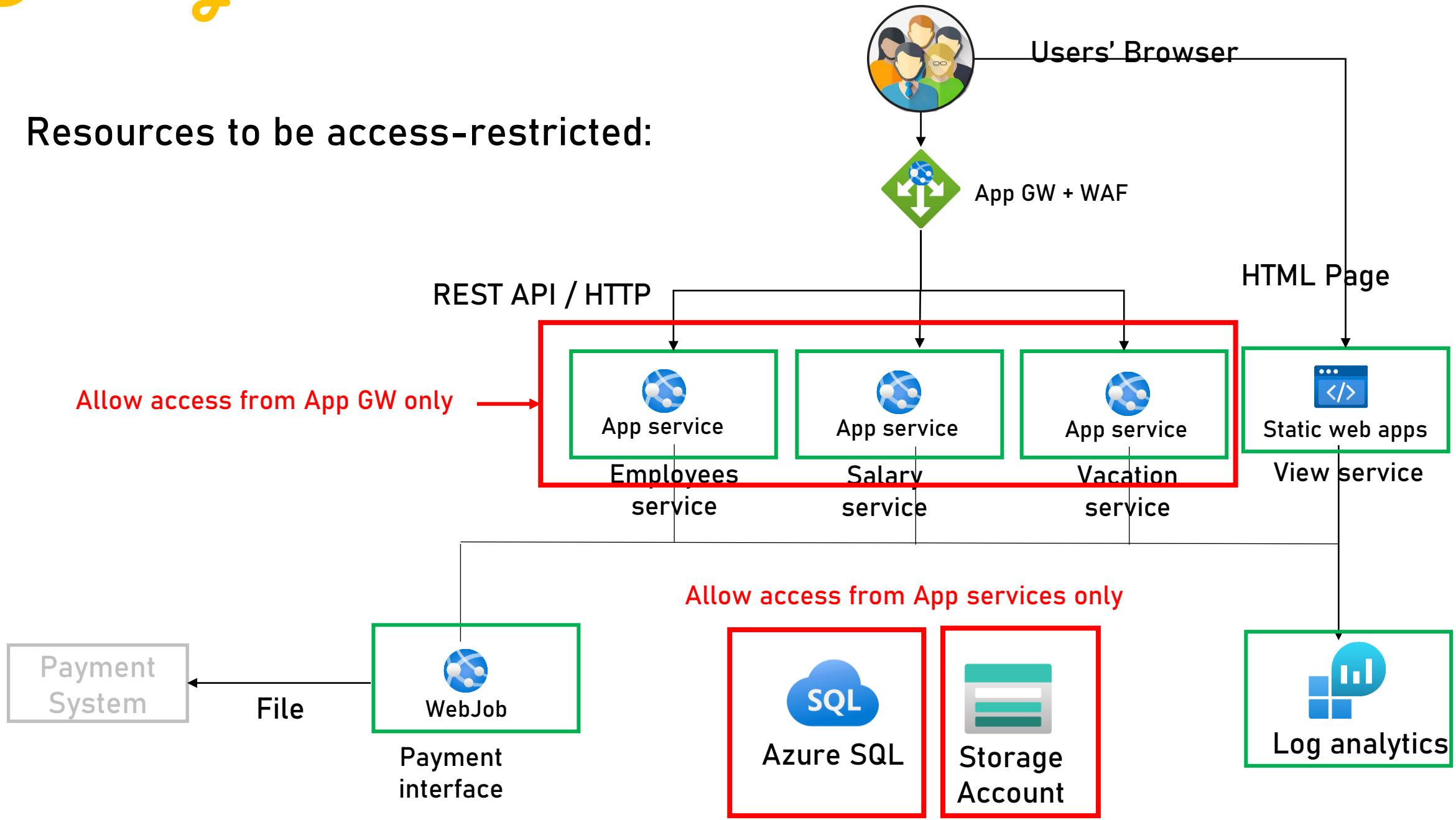
Resources to be access-restricted:



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Restrict access to App service

Add NSG rule to allow traffic from the App GW's VNET

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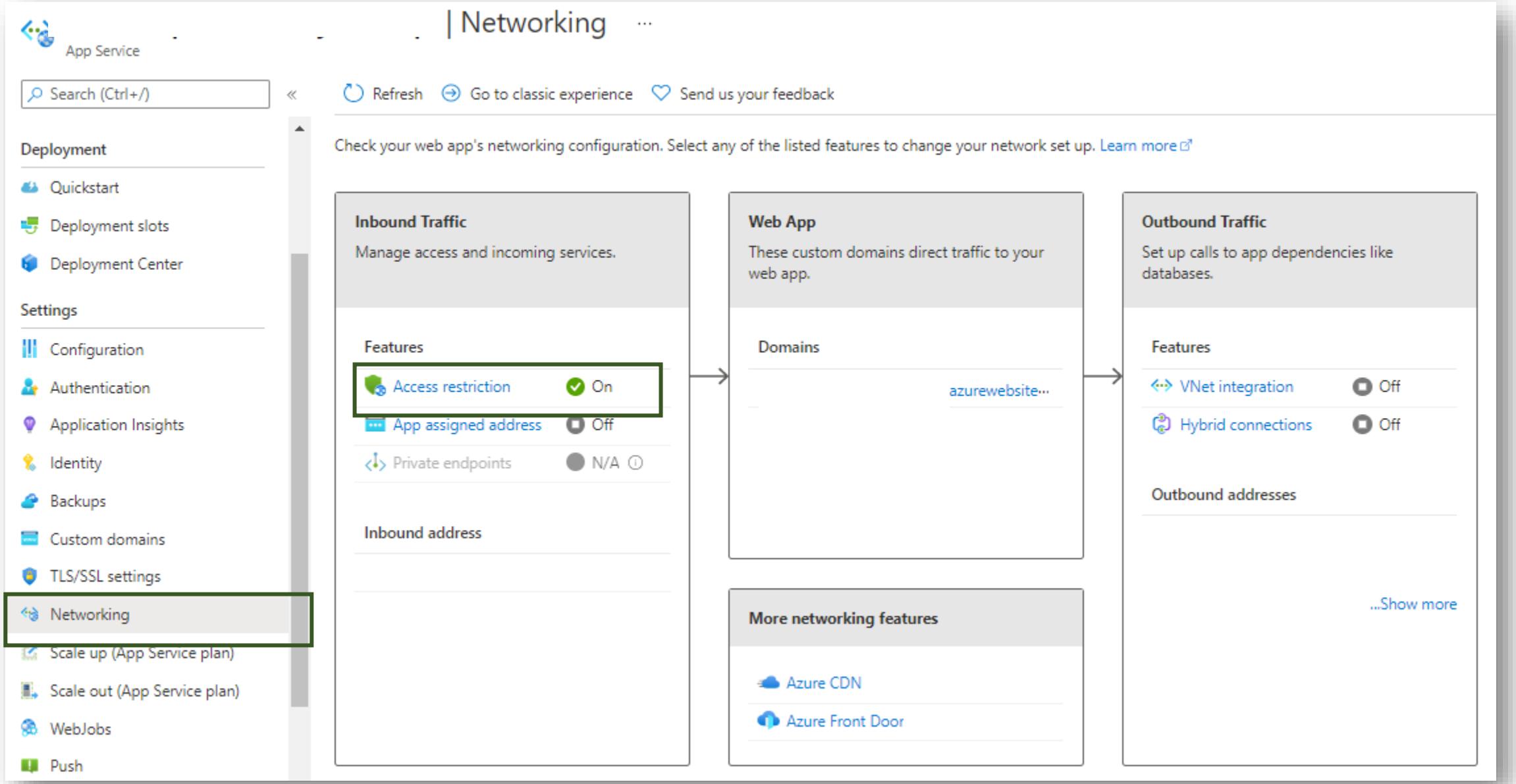
App Service
| Networking
Search (Ctrl+/)
Refresh
Go to classic experience
Send us your feedback
Deployment
Quickstart
Deployment slots
Deployment Center
Settings
Configuration
Authentication
Application Insights
Identity
Backups
Custom domains
TLS/SSL settings
Networking
Scale up (App Service plan)
Scale out (App Service plan)
WebJobs
Push
Check your web app's networking configuration. Select any of the listed features to change your network set up. Learn more
Inbound Traffic
Manage access and incoming services.
Features
Access restriction
On
App assigned address
Off
Private endpoints
N/A
Inbound address
Web App
These custom domains direct traffic to your web app.
Domains
azurewebsite...
More networking features
Azure CDN
Azure Front Door
Outbound Traffic
Set up calls to app dependencies like databases.
Features
VNet integration
Off
Hybrid connections
Off
Outbound addresses
...Show more

Dunderly

Access Restrictions

Remove Refresh

Access Restrictions

Access restrictions allow you to define lists of allow/deny rules to control traffic to your app. Rules are evaluated in priority order. If there are no rules defined then your app will accept traffic from any address. Learn more

Add rule

Priority	Name	Source	Endpoint status	HTTP headers	Action
100	API Mgmt			Not configured	Allow
2147483647	Deny all	Any		Not configured	Deny

General settings

Name

Enter name for the IpAddress rule

Action

Allow Deny

Priority *

Ex. 300

Description

Source settings

Type

Virtual Network

Subscription *

Subscription

Virtual Network *

Subnet *

default

HTTP headers filter settings

X-Forwarded-Host

Ex. exampleOne.com, exampleTwo.com

X-Forwarded-For

Enter IPv4 or IPv6 CIDR addresses.

X-Azure-FDID

Enter Front Door or reverse proxies ids.

X-FD-HealthProbe

Ex. 1

Add rule

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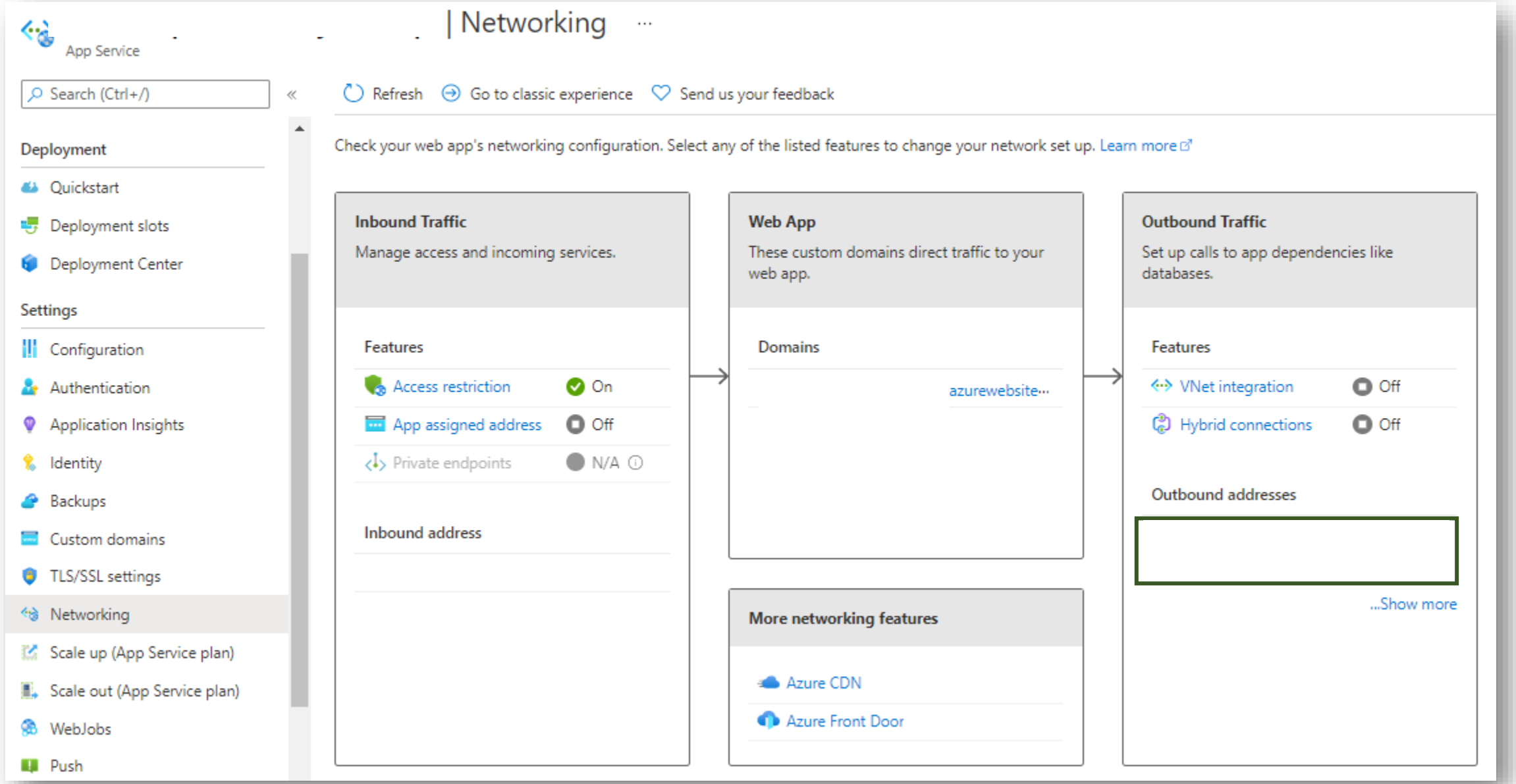
Restrict access to Azure SQL

1. Get outbound IP of the App service
2. Add firewall rule to the Azure SQL

Dunderly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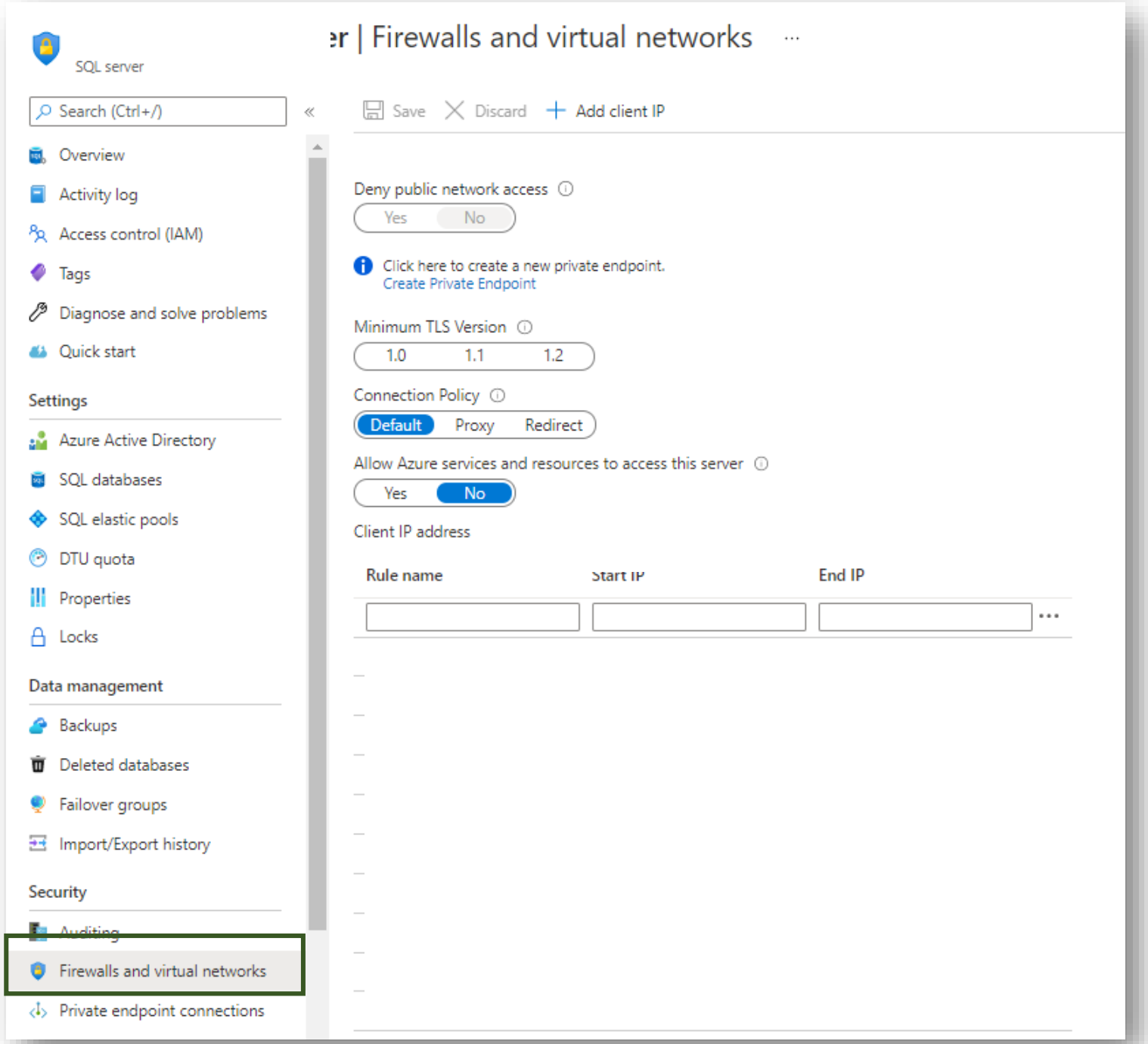
...Show more

Dunderly

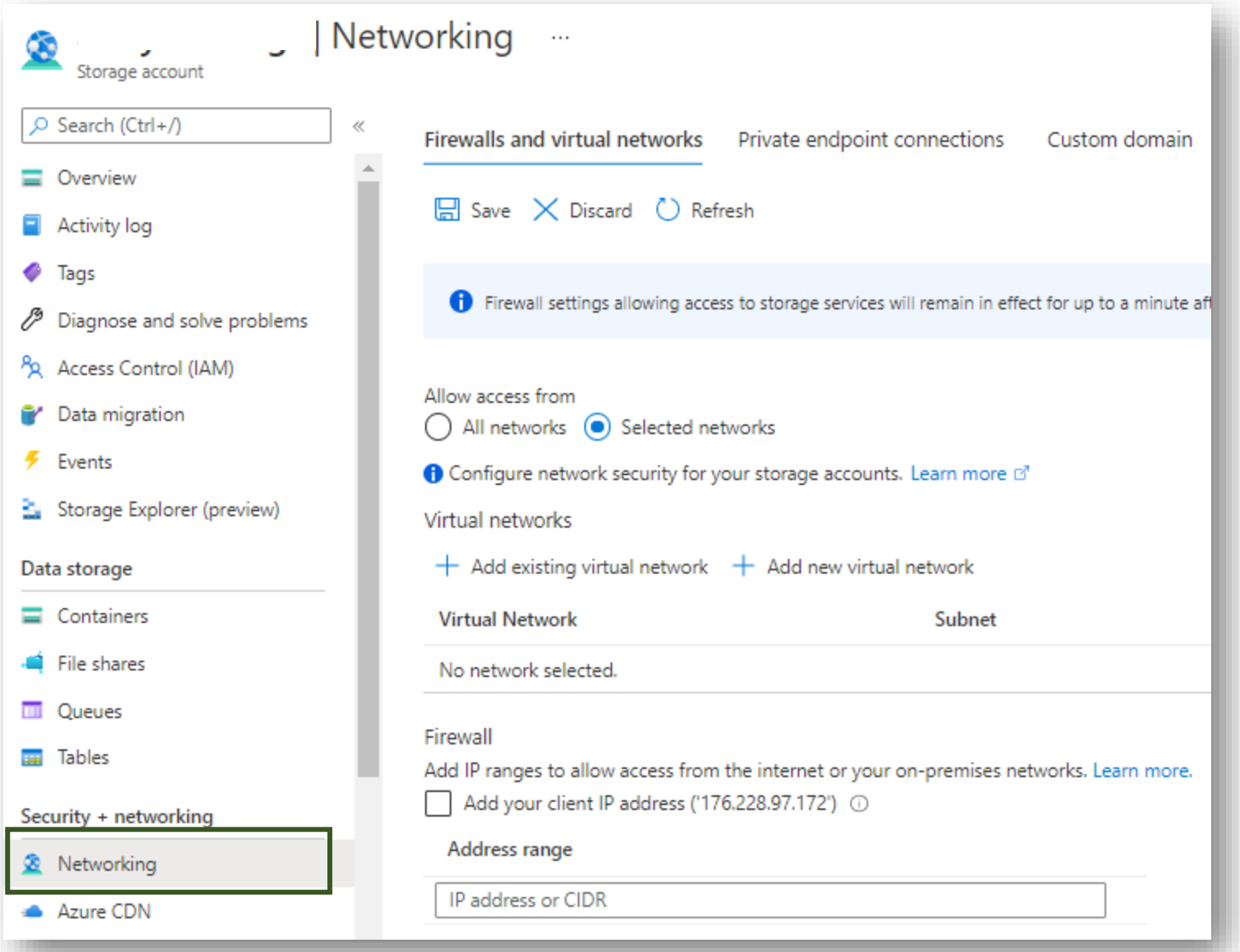

er | Firewalls and virtual networks
SQL server
Search (Ctrl+/)
Save
Discard
Add client IP
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Quick start
Settings
Azure Active Directory
SQL databases
SQL elastic pools
DTU quota
Properties
Locks
Data management
Backups
Deleted databases
Failover groups
Import/Export history
Security
Auditing
Firewalls and virtual networks
Private endpoint connections
Deny public network access
Yes
No
Click here to create a new private endpoint.
Create Private Endpoint
Minimum TLS Version
1.0
1.1
1.2
Connection Policy
Default
Proxy
Redirect
Allow Azure services and resources to access this server
Yes
No
Client IP address
Rule name
Start IP
End IP

Dunderly

Restrict access to Storage Account

1. Get outbound IP of the App service
2. Add firewall rule to the Storage Account

Dunderly


| Networking
Storage account
Search (Ctrl+/)
Overview
Activity log
Tags
Diagnose and solve problems
Access Control (IAM)
Data migration
Events
Storage Explorer (preview)
Data storage
Containers
File shares
Queues
Tables
Security + networking
Networking
Azure CDN
Firewalls and virtual networks
Private endpoint connections
Custom domain
Save
Discard
Refresh
Firewall settings allowing access to storage services will remain in effect for up to a minute af
Allow access from
All networks
Selected networks
Configure network security for your storage accounts. Learn more
Virtual networks
Add existing virtual network
Add new virtual network
Virtual Network
Subnet
No network selected.
Firewall
Add IP ranges to allow access from the internet or your on-premises networks. Learn more.
Add your client IP address ('176.228.97.172')
Address range
IP address or CIDR

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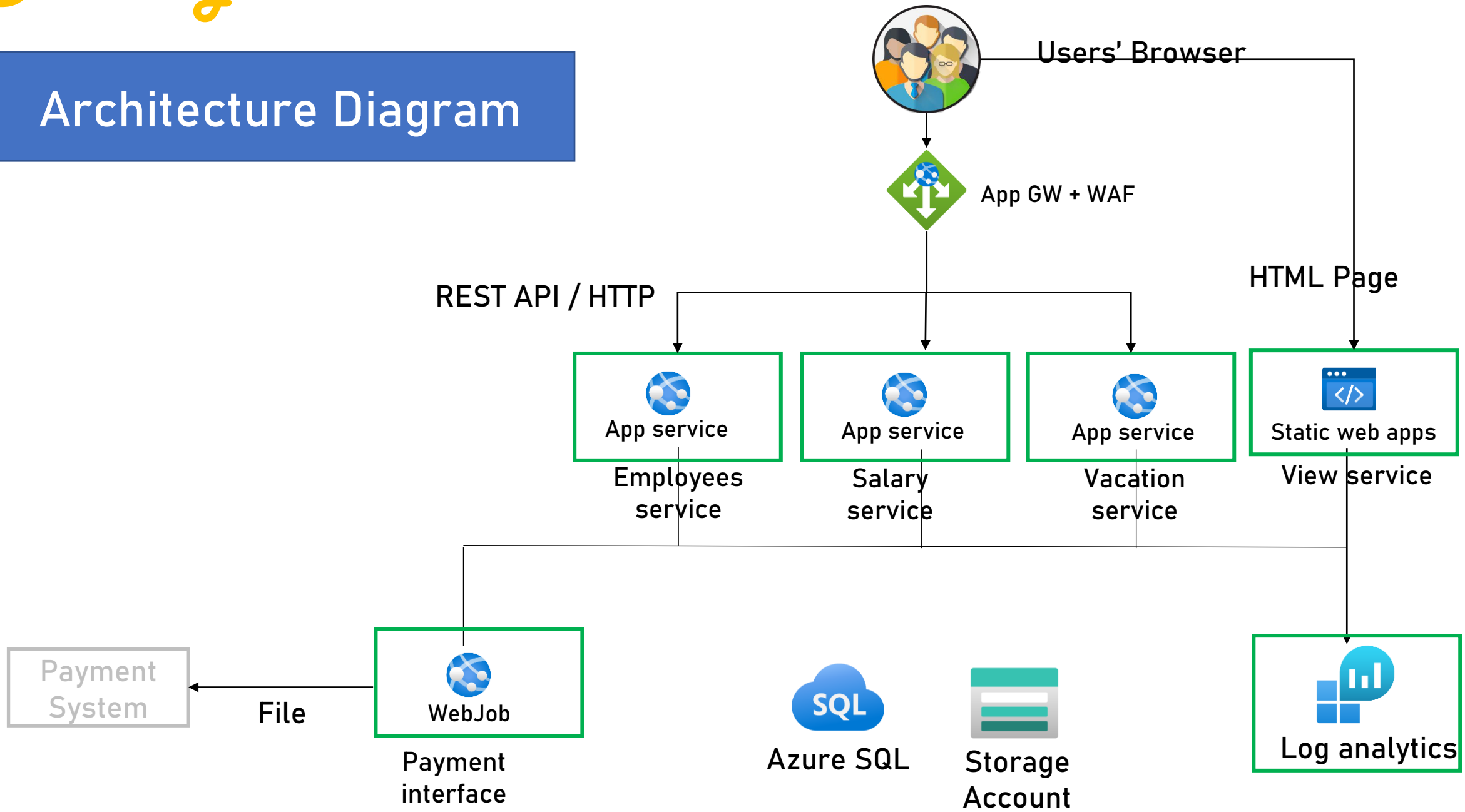
Architecture Diagram



Dunderly

Cost

Estimated upfront cost	$0.00
Estimated monthly cost	$848.07

Download detailed cost estimation from the lecture's resources