Case Study #5

Memi Lavi
www.memilavi.com

SkyEye

SkyEye

- Security cameras system
- Installed in factories, public places etc.
- Sends video to the cloud
- Analyzes video and notifies client for suspicious data
- Privacy extremely important

Requirements

Functional

What the system should do

1. Receive stream of photos to be analyzed
2. Look for suspicious objects (mainly persons)
3. Notify client
4. Show dashboard with past events
5. Data should be stored separately for every client
6. Allow authorized access only
7. Show central management dashboard

Non-Functional

What the system should deal with

NFR - What We Ask

1. *"How many photos per day?"*	17280 (1 in 5 sec)
2. *"How large is each photo?"*	1MB
3. "*Can we tolerate data loss?*""	Yes
4. *"What's the photos retention period?"*	6 months

Data Volume - Files

- 1 File = 1MB
- 17280 files / day = 17.3GB / day

  => ~519GB / month

  => ~3.1TB / 6 months

Requirements

Functional

What the system should do

1. Receive file to be processed
2. Validate and process the file
3. Work with various file formats
4. Performs various calculations on the file
5. Create bank payment file
6. Put the payment file in a designated folder
7. Keep log of all the activity for 7 years

Non-Functional

What the system should deal with

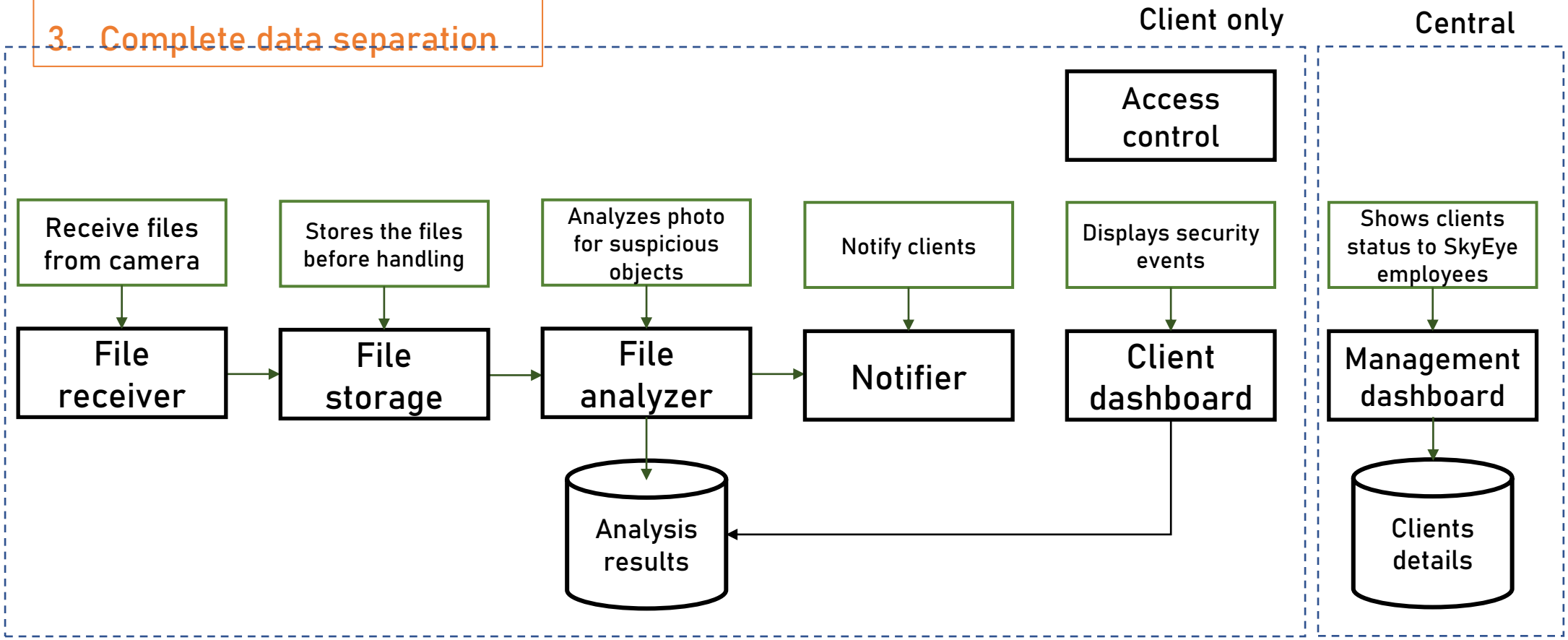
1. 17280 files / day
2. 3.1TB storage / client
3. Complete data separation

Cost Requirements

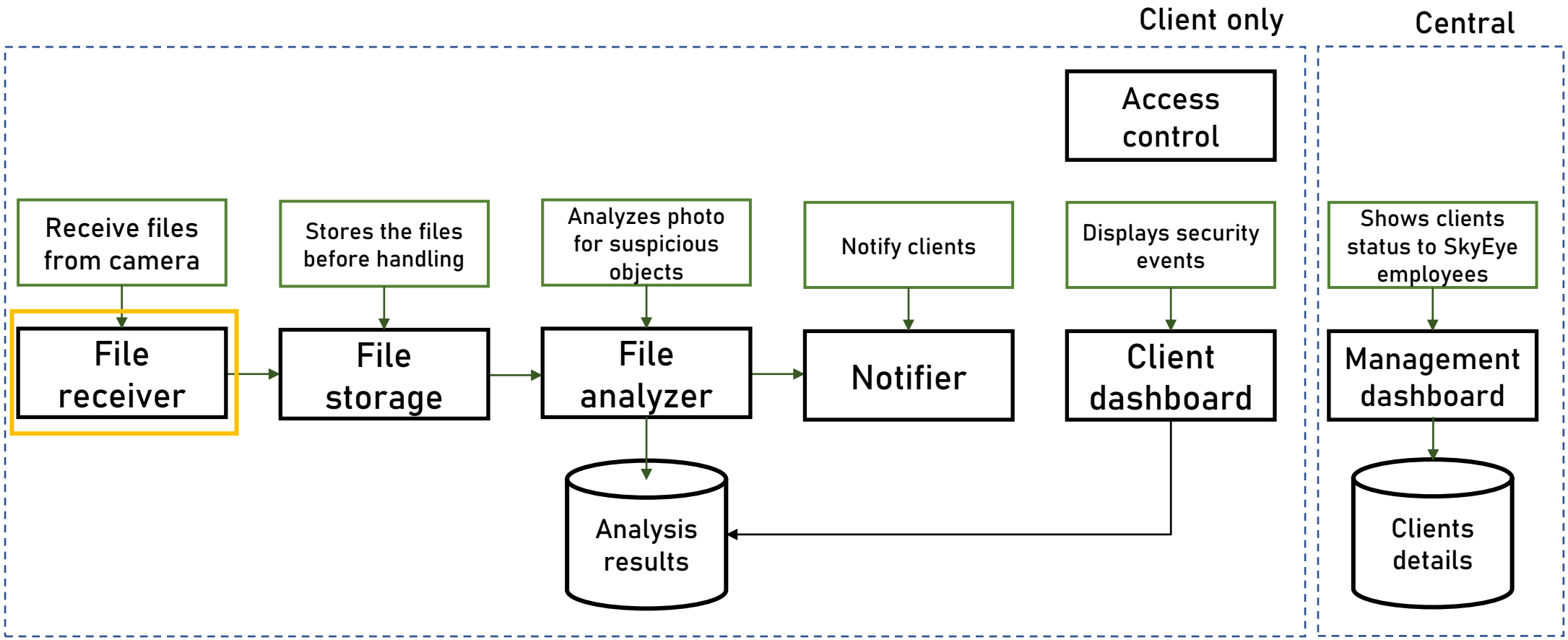
- Cost should be computed separately for:
  - The client tenant (what the client pays)
  - The company tenant (what the company pays)

Components

1. 17280 files / day
2. 3.1TB storage / client
3. Complete data separation



Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
File receiver
File storage
File analyzer
Notifier
Client dashboard
Management dashboard
Analysis results
Clients details

File Receiver

Two options:

IoT Hub

- Designed for communicating with IoT devices
- Can handle billions of devices
- Can handle a large amount of messages
- Validates the devices

Storage Account

- Dead simple to use
- Extremely cost effective
- Access control using SAS token
- Probably will be used anyway for storage…

File Receiver

Compare costs:

- Remember:
  - With IoT Hub 1 msg = 4KB
  - We'll send 17,280 files / day
  - Each file is 1MB (1000Kb)
  - So: 1000 / 4 = 250
  - Total msgs / day: 250 X 17,280 = 4,320,000

Azure IoT Hub

REGION:

West Europe

TIER:

Standard

EDITION:

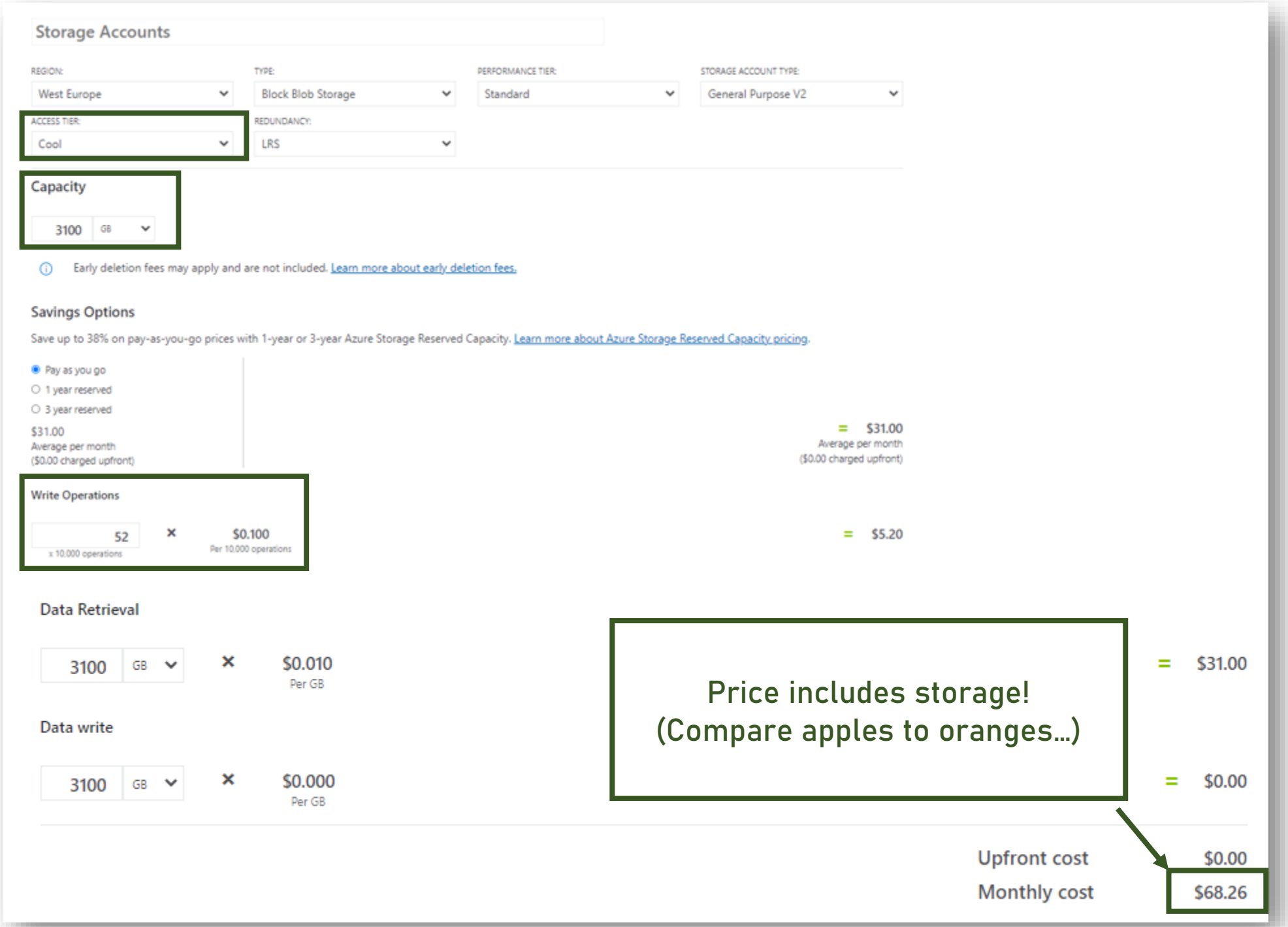
S2: Unlimited devices, 6,000,000 msgs/day, $250.00/month

ADD IOT HUB DEVICE PROVISIONING SERVICE

Features supported in Azure IoT Hub basic and standard tier differ. Learn more about the capabilities of basic and standard tier.

1	×	$250.00	=	$250.00
IoT Hub Units		Per IoT Hub unit		

Upfront cost	$0.00
Monthly cost	$250.00


Storage Accounts
REGION:
West Europe
TYPE:
Block Blob Storage
PERFORMANCE TIER:
Standard
STORAGE ACCOUNT TYPE:
General Purpose V2
ACCESS TIER:
Cool
REDUNDANCY:
LRS
Capacity
3100
GB
Early deletion fees may apply and are not included. Learn more about early deletion fees.
Savings Options
Save up to 38% on pay-as-you-go prices with 1-year or 3-year Azure Storage Reserved Capacity. Learn more about Azure Storage Reserved Capacity pricing.
Pay as you go
1 year reserved
3 year reserved
$31.00
Average per month
($0.00 charged upfront)
= $31.00
Average per month
($0.00 charged upfront)
Write Operations
52
x 10,000 operations
×
$0.100
Per 10,000 operations
= $5.20
Data Retrieval
3100
GB
×
$0.010
Per GB
= $31.00
Data write
3100
GB
×
$0.000
Per GB
= $0.00
Price includes storage!
(Compare apples to oranges…)
Upfront cost
$0.00
Monthly cost
$68.26

File Receiver

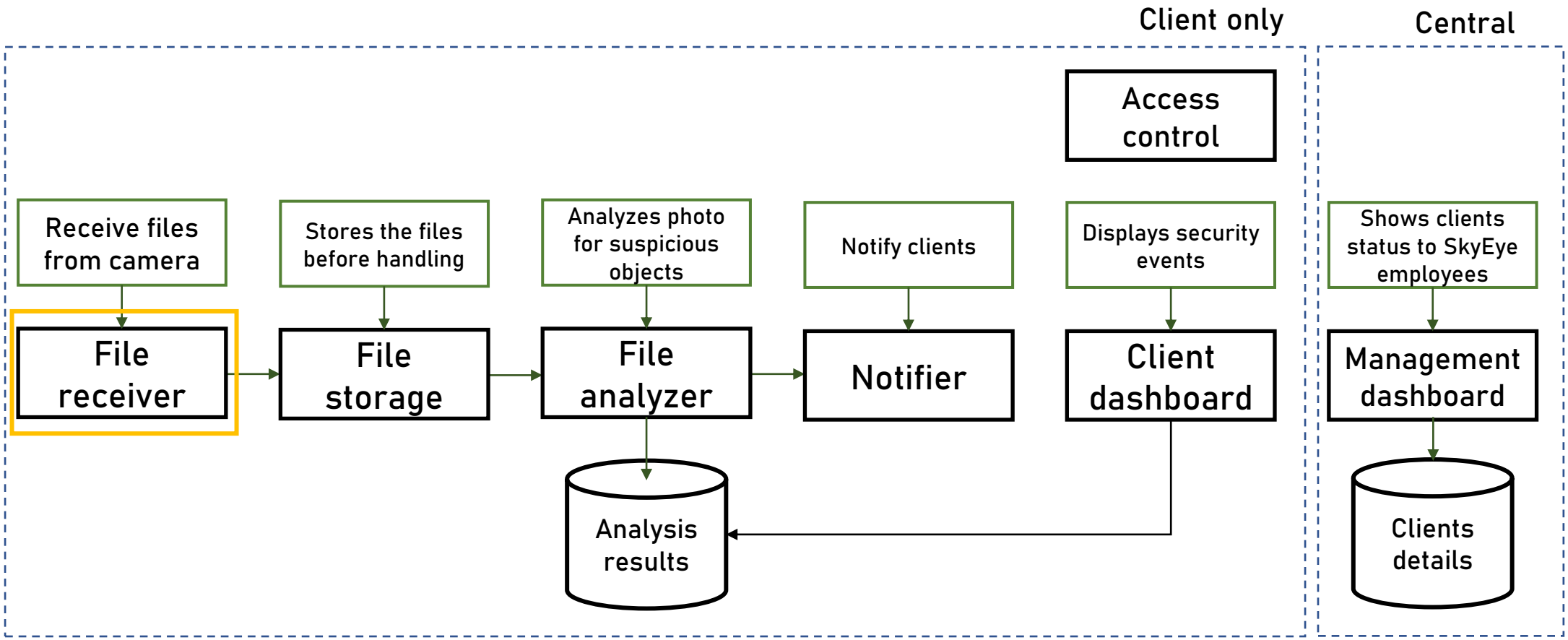
Two options:

IoT Hub

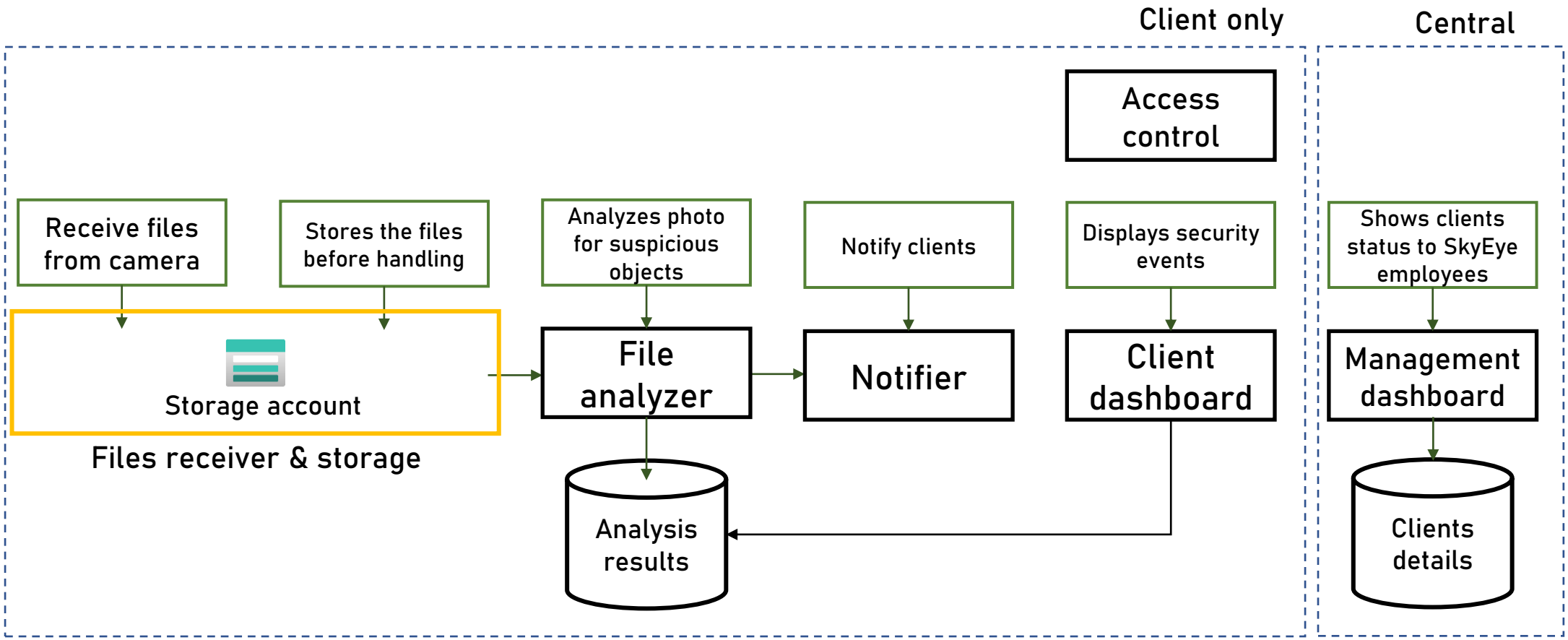
Storage Account

- No heavy load expected (1 msg / 5 sec)
- Not many devices
- Security is not a major issue
  - Worst case: A photo not belong to the system will be uploaded
- We want the customer to have as low cloud costs as possible
- So…

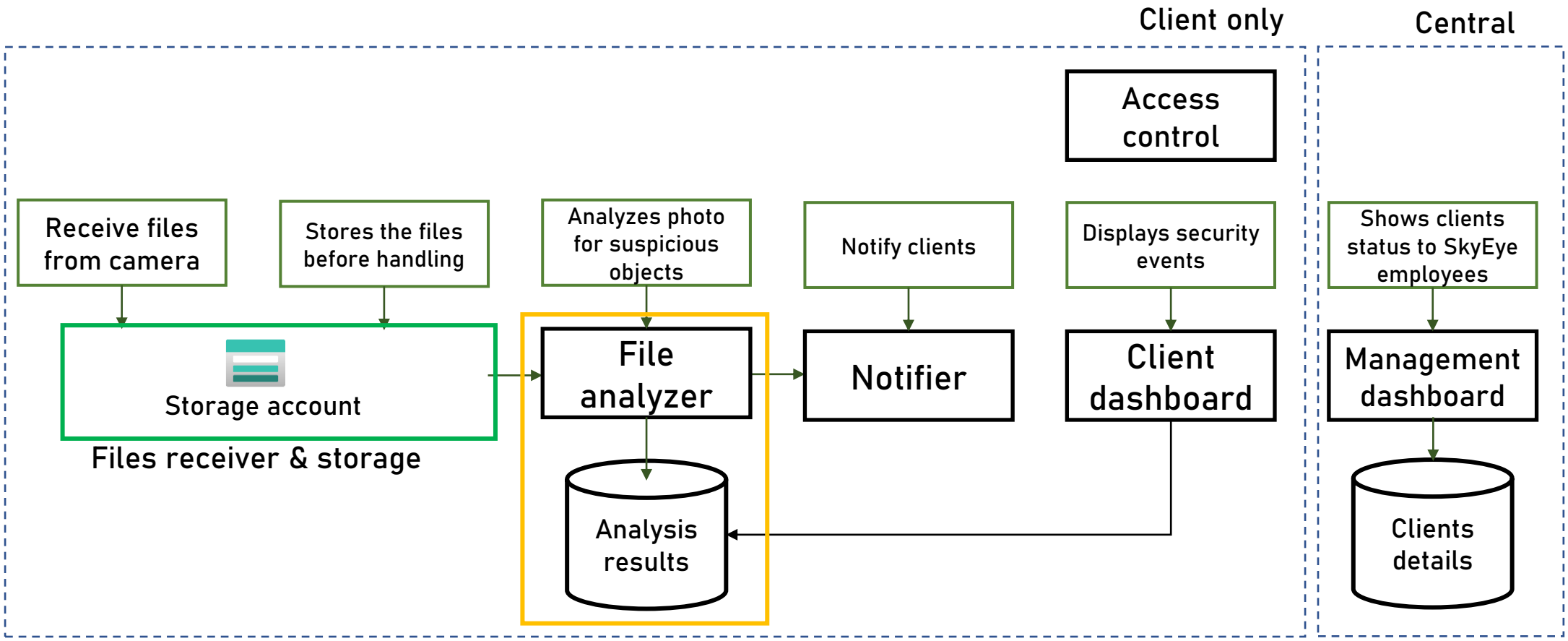
Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
File receiver
File storage
File analyzer
Notifier
Client dashboard
Management dashboard
Analysis results
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
File analyzer
Notifier
Client dashboard
Management dashboard
Files receiver & storage
Analysis results
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
File analyzer
Notifier
Client dashboard
Management dashboard
Files receiver & storage
Analysis results
Clients details

File Analyzer

What it does:

- Grabs photo from the storage account

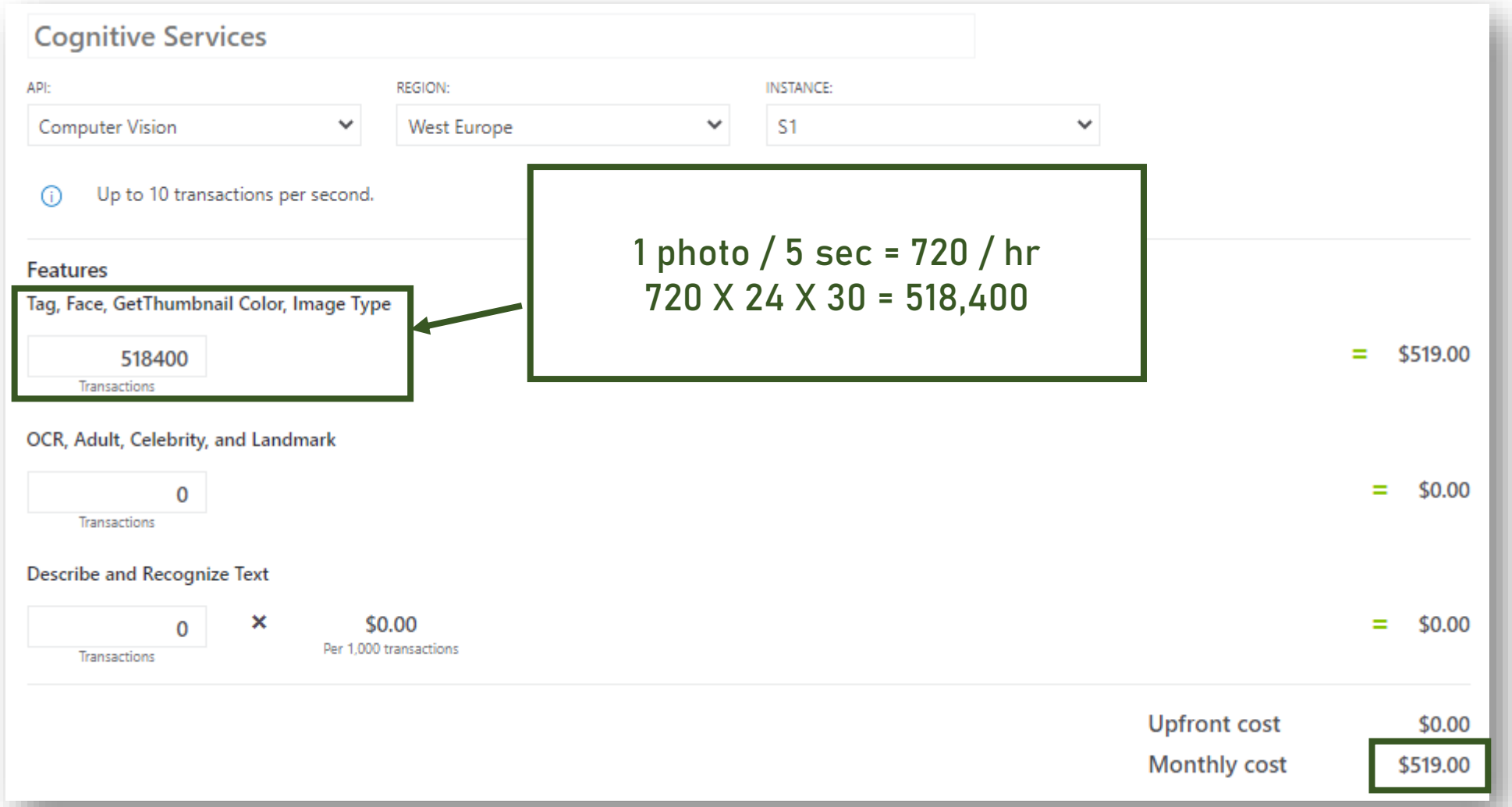
- Analyzes the photo for suspicious objects

- Stores the results in a database

File Analyzer

Cognitive Services

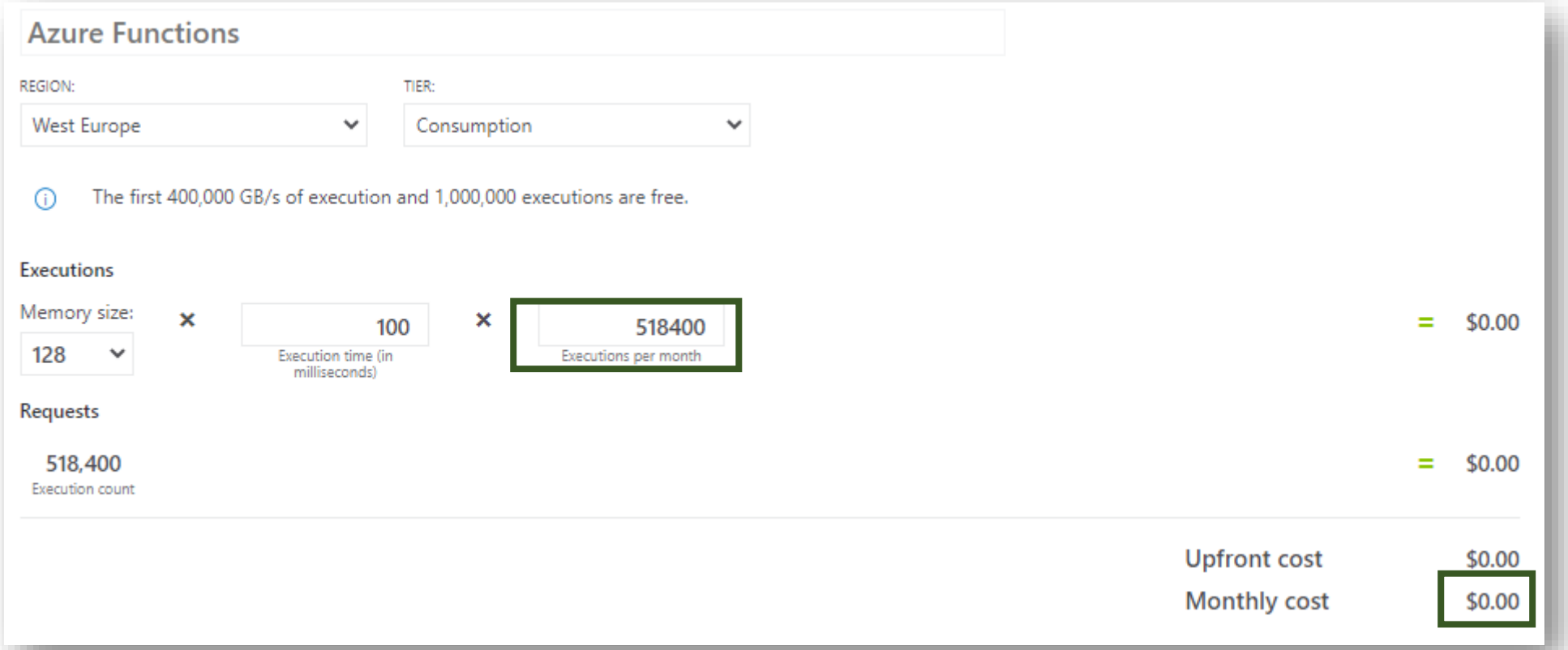
- Fully managed AI + ML functionality
- Used using an SDK or a simple REST API
- Has computer vision capabilities
- The most relevant is the Analyze Image API
- Read more here:
  https://bit.ly/2XIVTQD


Cognitive Services
API:
Computer Vision
REGION:
West Europe
INSTANCE:
S1
Up to 10 transactions per second.
1 photo / 5 sec = 720 / hr
720 X 24 X 30 = 518,400
Features
Tag, Face, GetThumbnail Color, Image Type
518400
Transactions
= $519.00
OCR, Adult, Celebrity, and Landmark
0
Transactions
= $0.00
Describe and Recognize Text
0
Transactions
×
$0.00
Per 1,000 transactions
= $0.00
Upfront cost
$0.00
Monthly cost
$519.00

File Analyzer

Function App

- Gets triggered when a new photo is added to the storage account
- Calls the Cognitive Services with the photo
- Stores the results in the database
- Practically free


Azure Functions
REGION:
West Europe
TIER:
Consumption
The first 400,000 GB/s of execution and 1,000,000 executions are free.
Executions
Memory size:
128
100
Execution time (in milliseconds)
518400
Executions per month
= $0.00
Requests
518,400
Execution count
= $0.00
Upfront cost
$0.00
Monthly cost
$0.00

File Analyzer DB

What it does:

- Stores the data about objects found in the photos
- Data include: photo reference, type of object, coordinates in the photo, etc.
- Allows querying based on various parameters
- Data is well defined
- Remember: database per client, not central

File Analyzer DB

SQL or NoSQL?

- Data is structured
- Not a lot of data
- Quite a lot of queries

SQL it is!

File Analyzer DB

Which SQL Database?

Azure SQL

Azure MySQL

Azure PostgreSQL

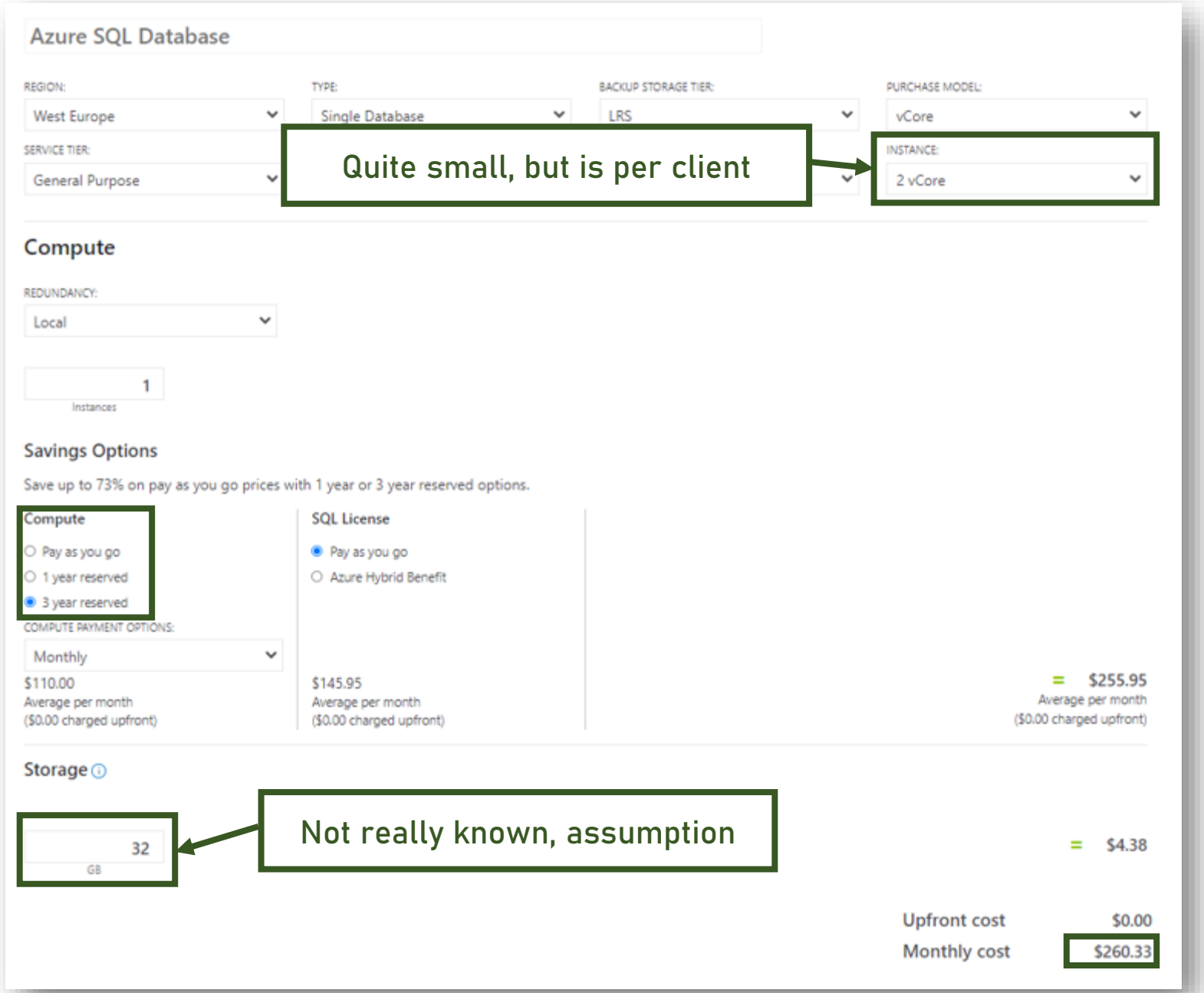
- All great databases
- Capable of handling the analyzer's data
- Decision mainly based on personal taste
- All things equal – Azure SQL offers better SLA and geo-replication capability

File Analyzer DB

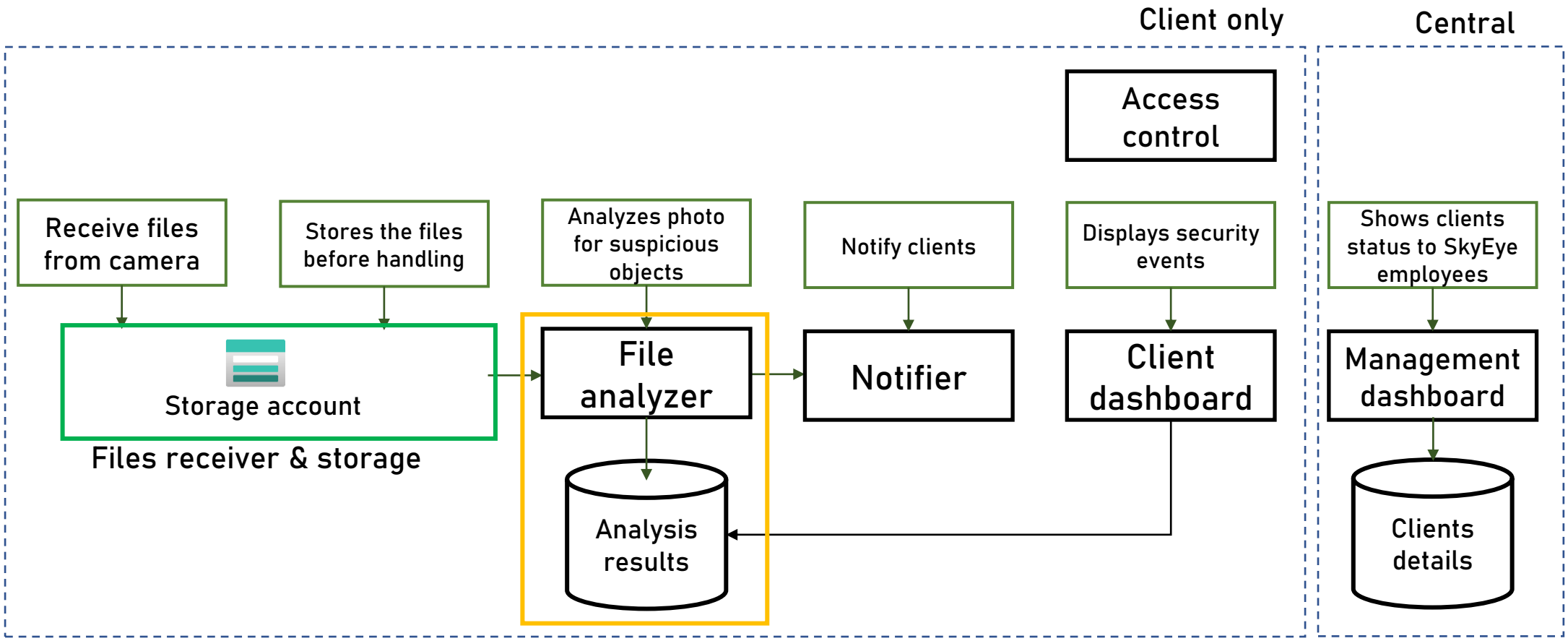
Which SQL Database?

Azure SQL

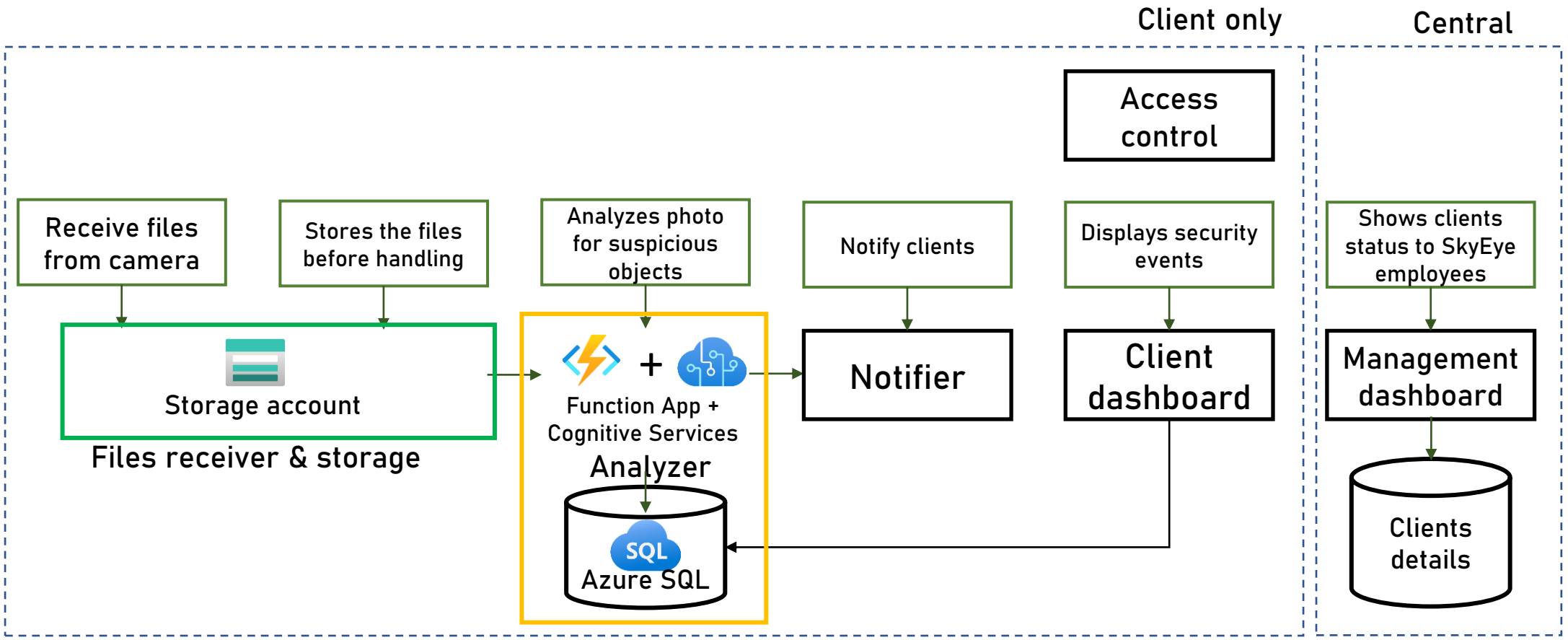
- All great databases
- Capable of handling the analyzer's data
- Decision mainly based on personal taste
- All things equal – Azure SQL offers better SLA and geo-replication capability


Azure SQL Database
REGION:
West Europe
TYPE:
Single Database
BACKUP STORAGE TIER:
LRS
PURCHASE MODEL:
vCore
SERVICE TIER:
General Purpose
INSTANCE:
2 vCore
Quite small, but is per client
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
SQL License
Pay as you go
Azure Hybrid Benefit
COMPUTE PAYMENT OPTIONS:
Monthly
$110.00
Average per month
($0.00 charged upfront)
$145.95
Average per month
($0.00 charged upfront)
= $255.95
Average per month
($0.00 charged upfront)
Storage
32
GB
Not really known, assumption
= $4.38
Upfront cost $0.00
Monthly cost $260.33

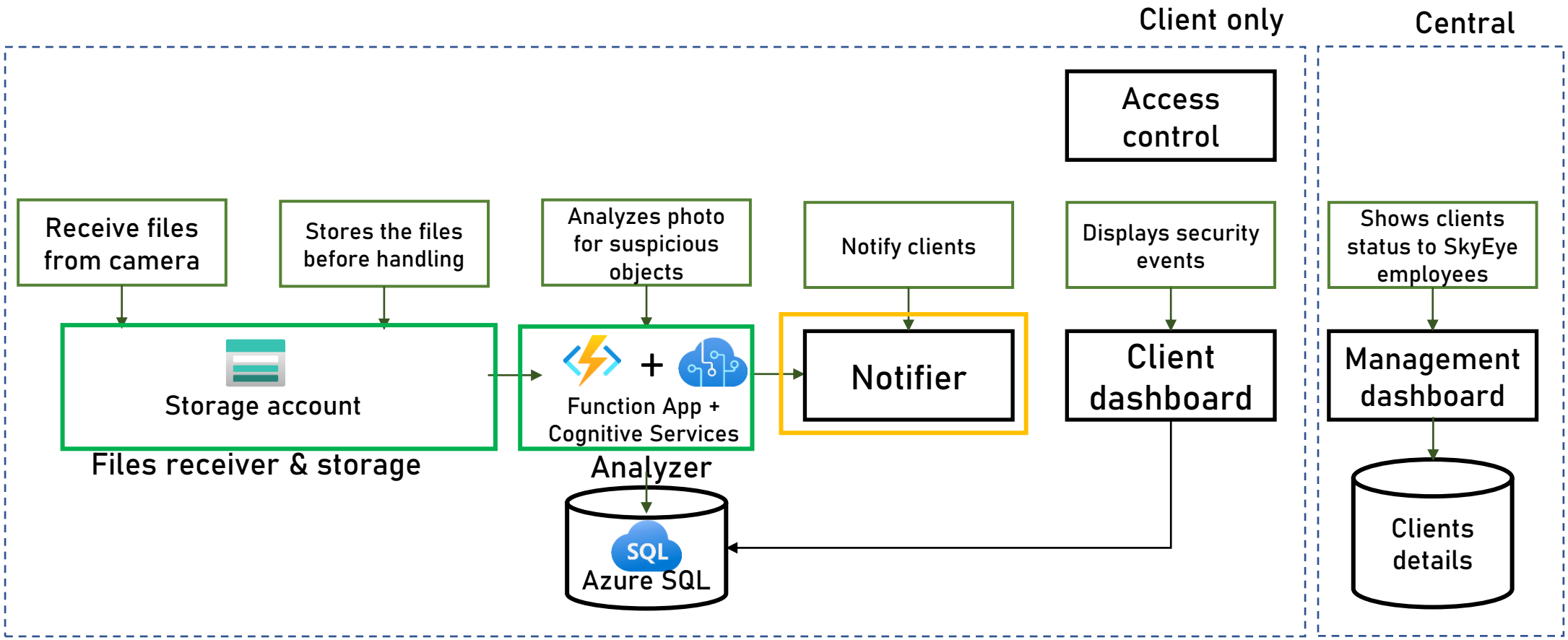
Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
File analyzer
Notifier
Client dashboard
Management dashboard
Files receiver & storage
Analysis results
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Files receiver & storage
+
Function App + Cognitive Services
Analyzer
Notifier
Client dashboard
Management dashboard
SQL
Azure SQL
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notifier
Client dashboard
Management dashboard
Files receiver & storage
Analyzer
SQL
Azure SQL
Clients details

Notifier

What it does:

- Notifies clients about suspicious activity

- Messages their mobile phone

Notifier

Notification Hub

- Fully managed push notification solution
- Cross-platform
- Handles millions of messages
- Cost effective

Notification Hubs

REGION:

West Europe

TIER:

Basic

Enough for our needs

The first 10 million pushes are included for 200,000 active devices and 10K broadcast (tag size).

Additional pushes

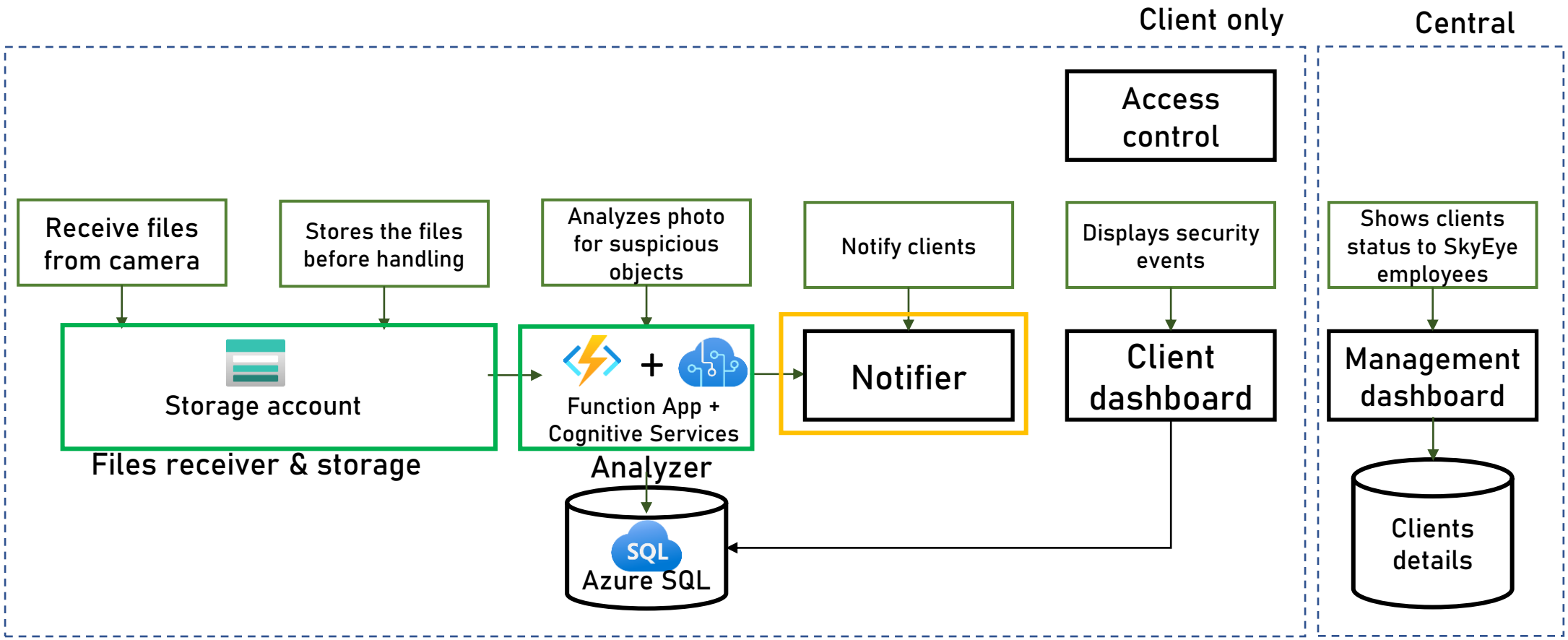
1
Millions

\+ $10.00
Per month

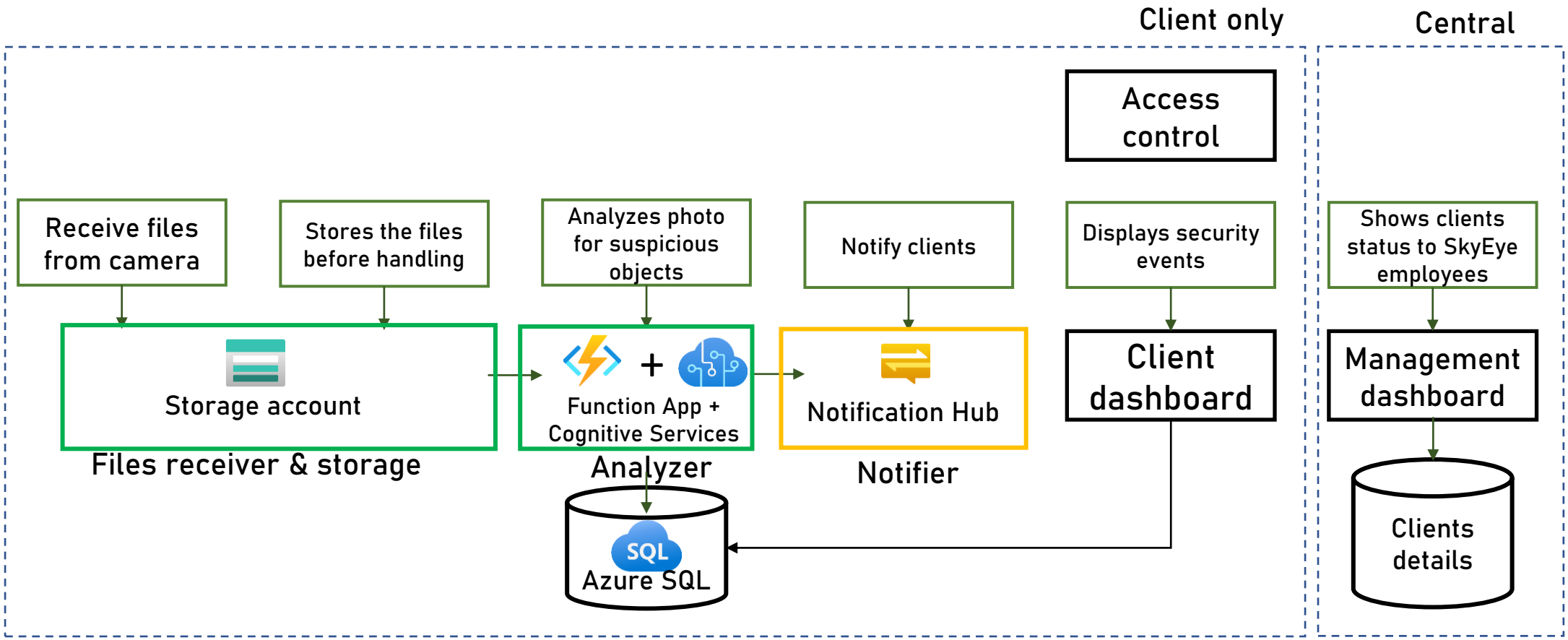
= $10.00

Upfront cost	$0.00
Monthly cost	$10.00

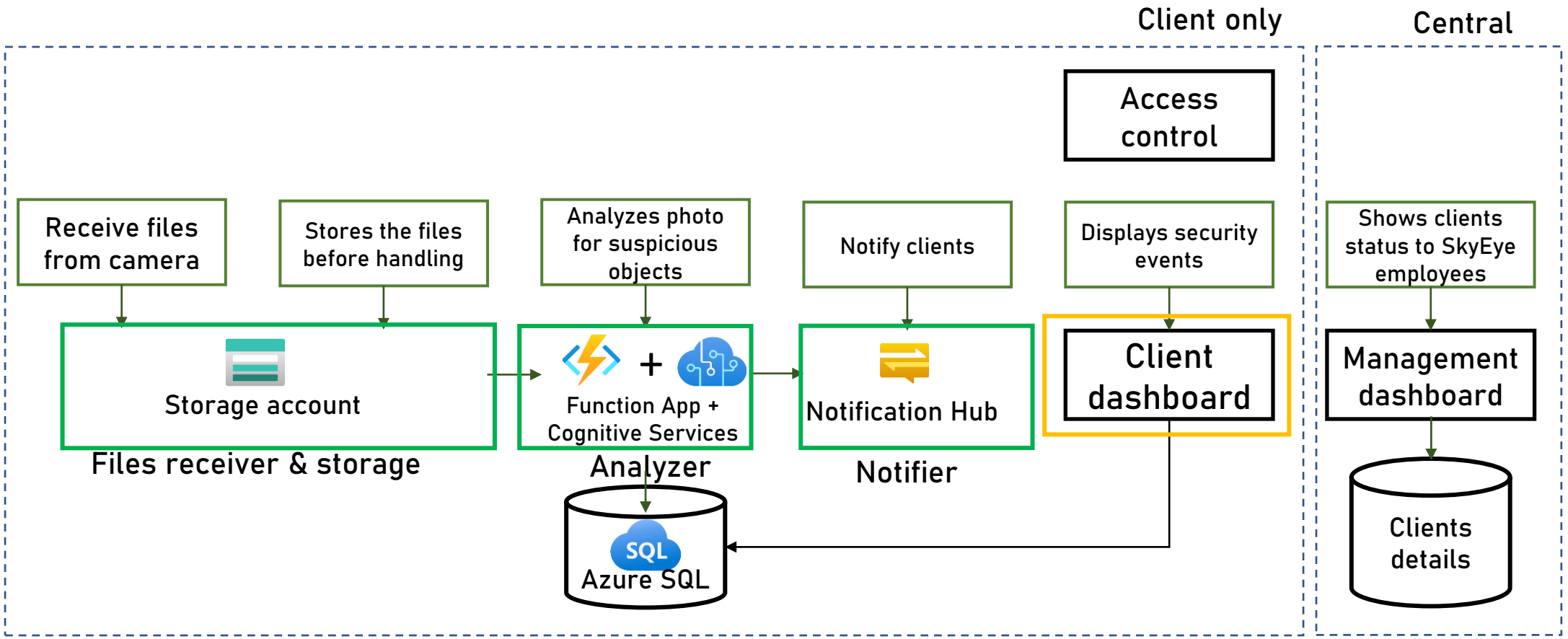
Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notifier
Client dashboard
Management dashboard
Files receiver & storage
Analyzer
SQL
Azure SQL
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
Client dashboard
Management dashboard
Files receiver & storage
Analyzer
Notifier
SQL
Azure SQL
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
Client dashboard
Management dashboard
Files receiver & storage
Analyzer
Notifier
SQL
Azure SQL
Clients details

Client Dashboard

What it does:

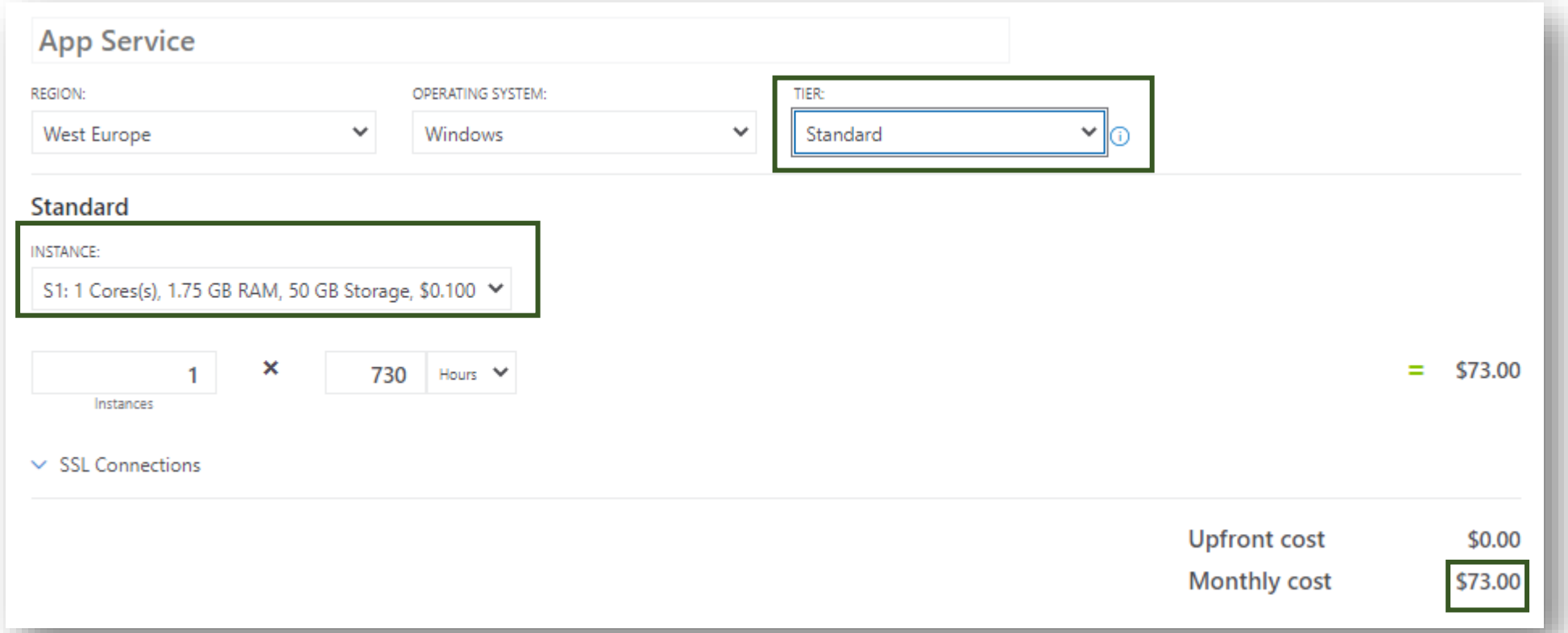
- Displays data about security events

- Allows basic querying

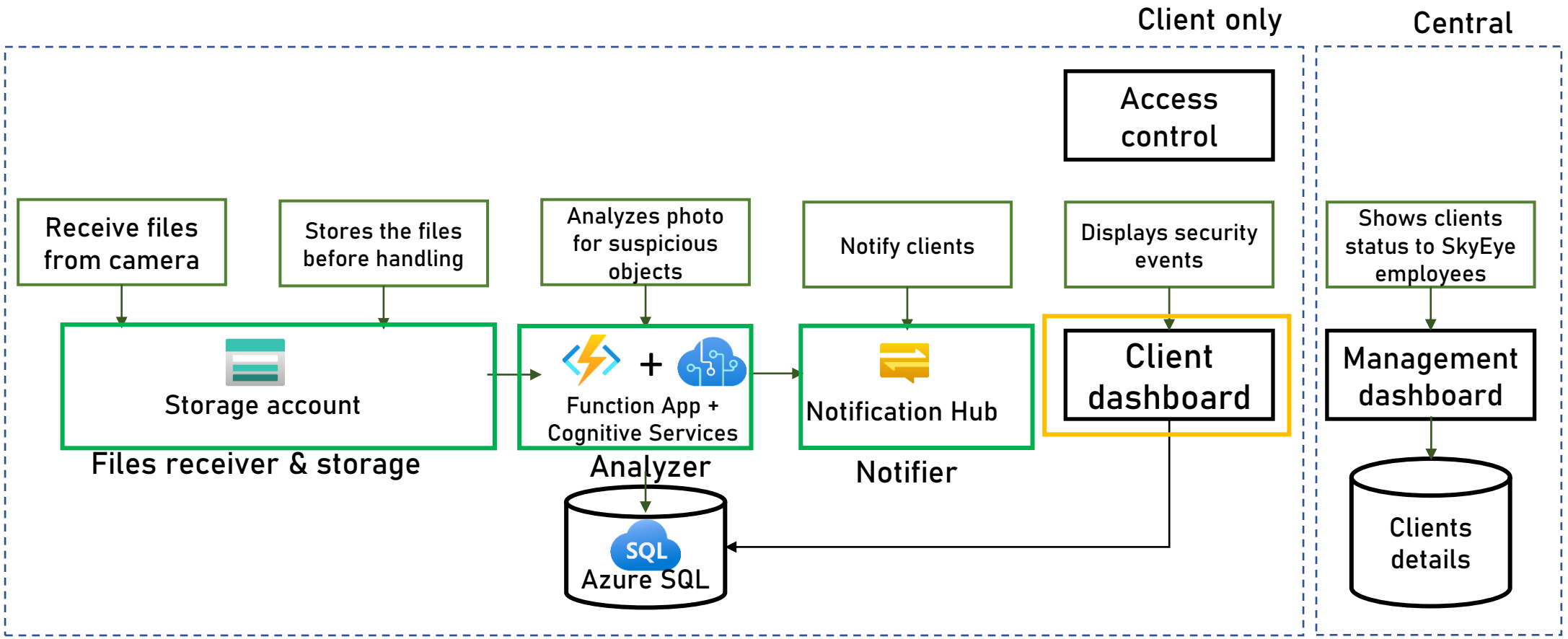
Client Dashboard

App Service

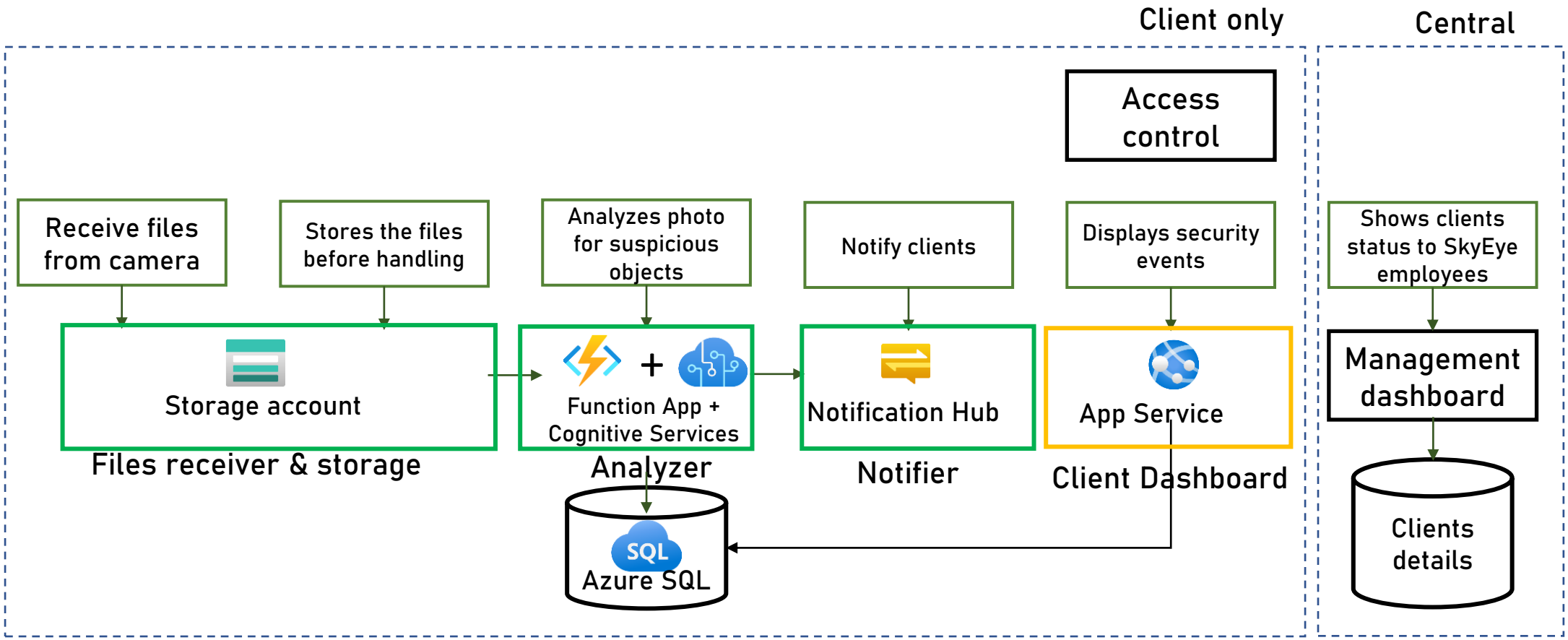
- Fully managed web app & API
- Supports many platforms
- Autoscale
- Support for WebJobs


App Service
REGION:
West Europe
OPERATING SYSTEM:
Windows
TIER:
Standard
Standard
INSTANCE:
S1: 1 Cores(s), 1.75 GB RAM, 50 GB Storage, $0.100
1
Instances
×
730
Hours
=
$73.00
SSL Connections
Upfront cost
$0.00
Monthly cost
$73.00

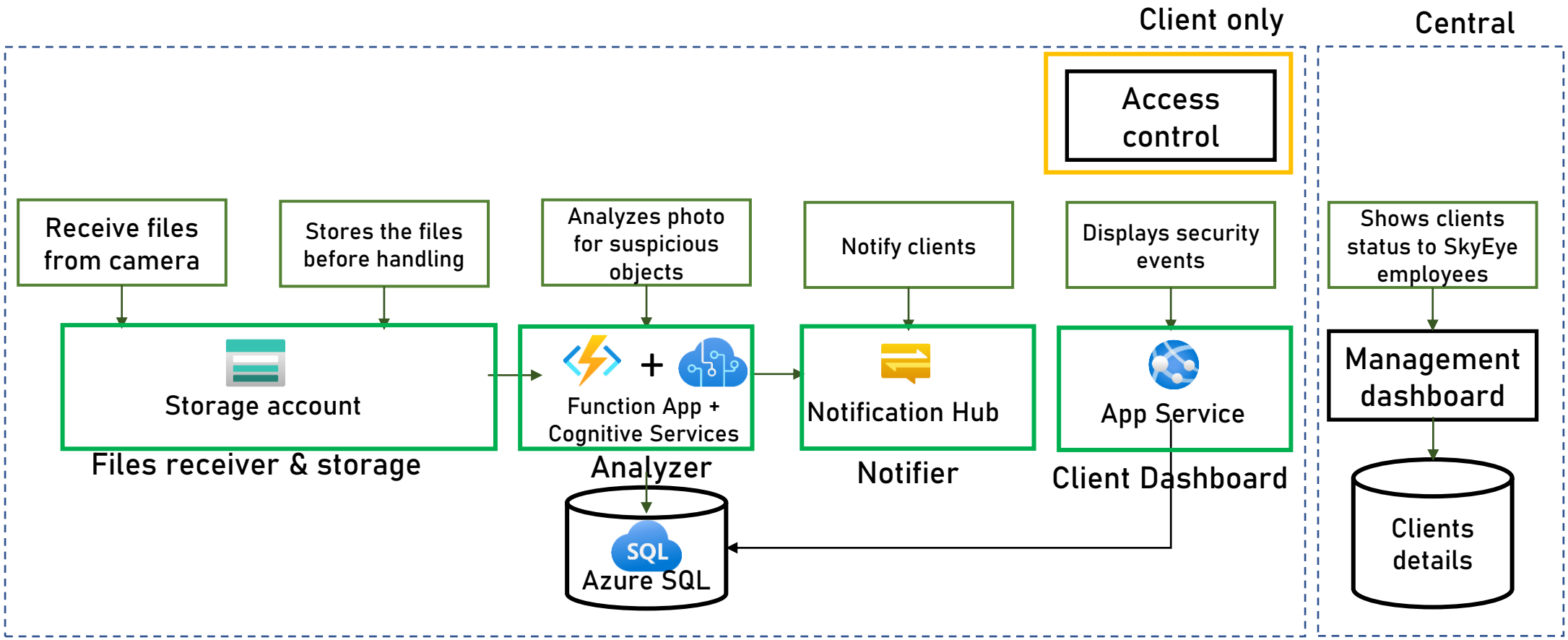
Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
Client dashboard
Management dashboard
Files receiver & storage
Analyzer
Notifier
SQL
Azure SQL
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
Management dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
Clients details

Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
Management dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
Clients details

Access Control

What it does:

- Authenticates users for accessing the client's tenant
- Provides advanced authentication techniques

Access Control

Azure AD

- Fully managed identity provider & service
- Supports advanced authentication scenarios
- Full integration with App Service

Access Control

Azure AD Cost:

- Depends on two factors:
  - Number of users
  - License (Free, P1, P2)

Access Control

	Free	Premium 1	Premium 2
Max Objects	500,000	Unlimited	Unlimited
Users & Groups	X	X	X
MFA	X (All or nothing)	X (With Conditional Access)	X (With Conditional Access)
Dynamic Groups		X	X
Conditional Access		X	X
Risk Detention			X
Risk based Conditional Access			X
Privileged Identity Management (PIM)			X
Price	Free	6$ user / month	9$ user / month

Active Directory

REGION:

West Europe

Free tier

Includes 500K Directory Objects, SSO for SaaS Apps 10 Apps/User

Premium P1

0 Users × $6.00 Per user = $0.00

Premium P2

0 Users × $9.00 Per user = $0.00

Azure Active Directory Domain Services $0.00

Upfront cost $0.00

Monthly cost $0.00

Access Control

Azure AD Tenant:

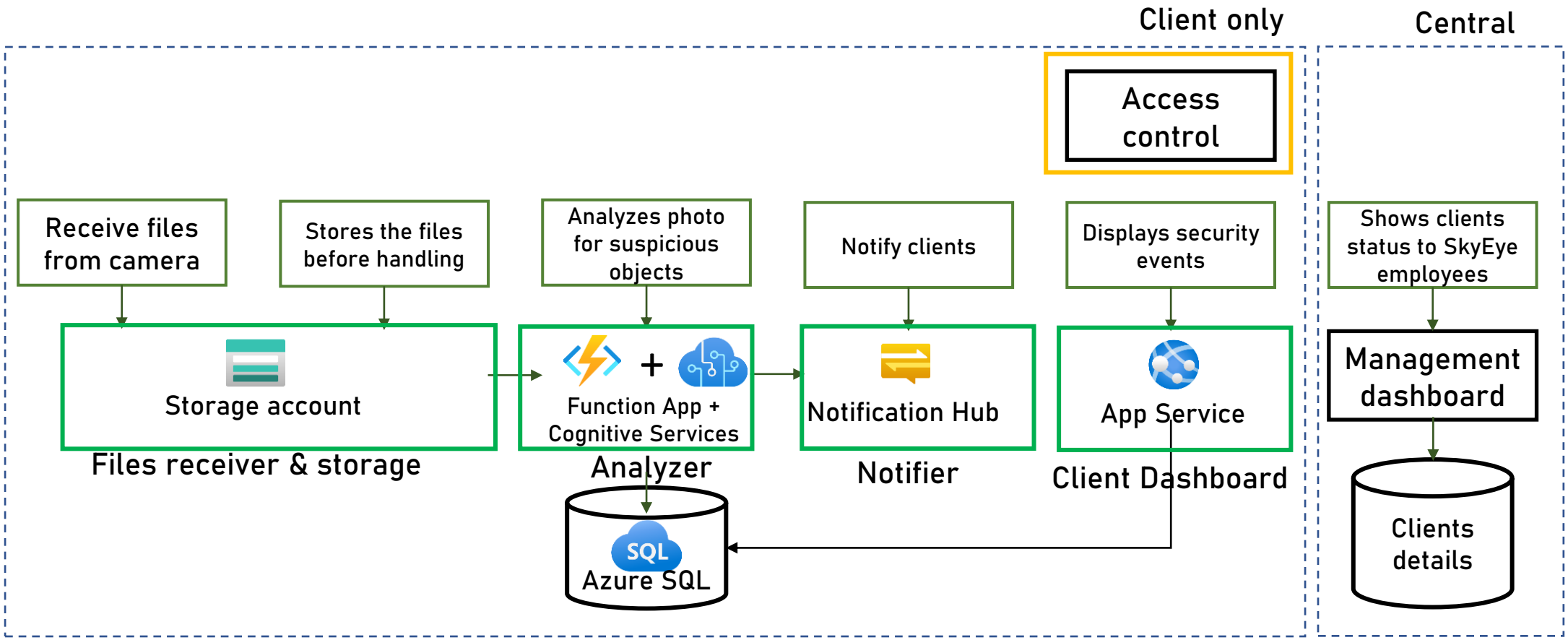
- Remember: Azure AD = Tenant

- The Tenant contains the client's subscription

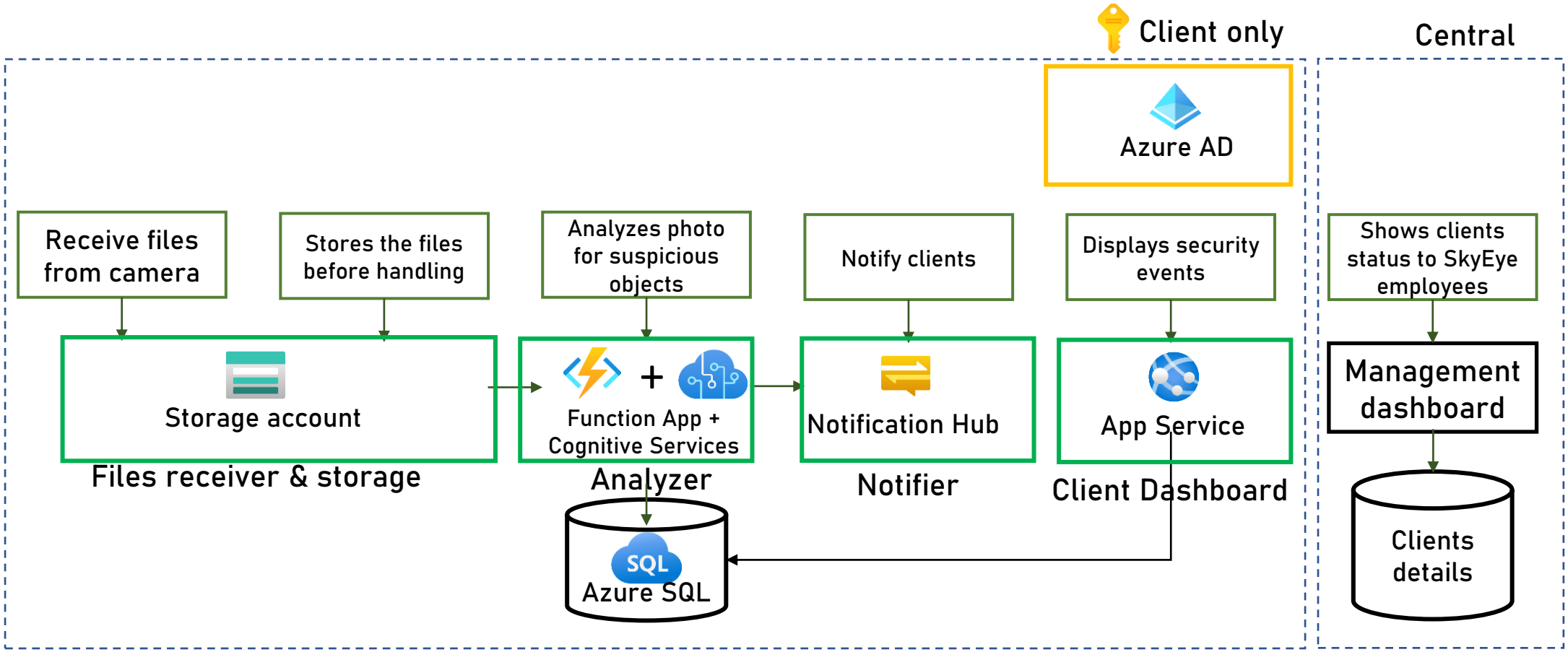
- Client's system will be in a different subscription

  than the company's subscription

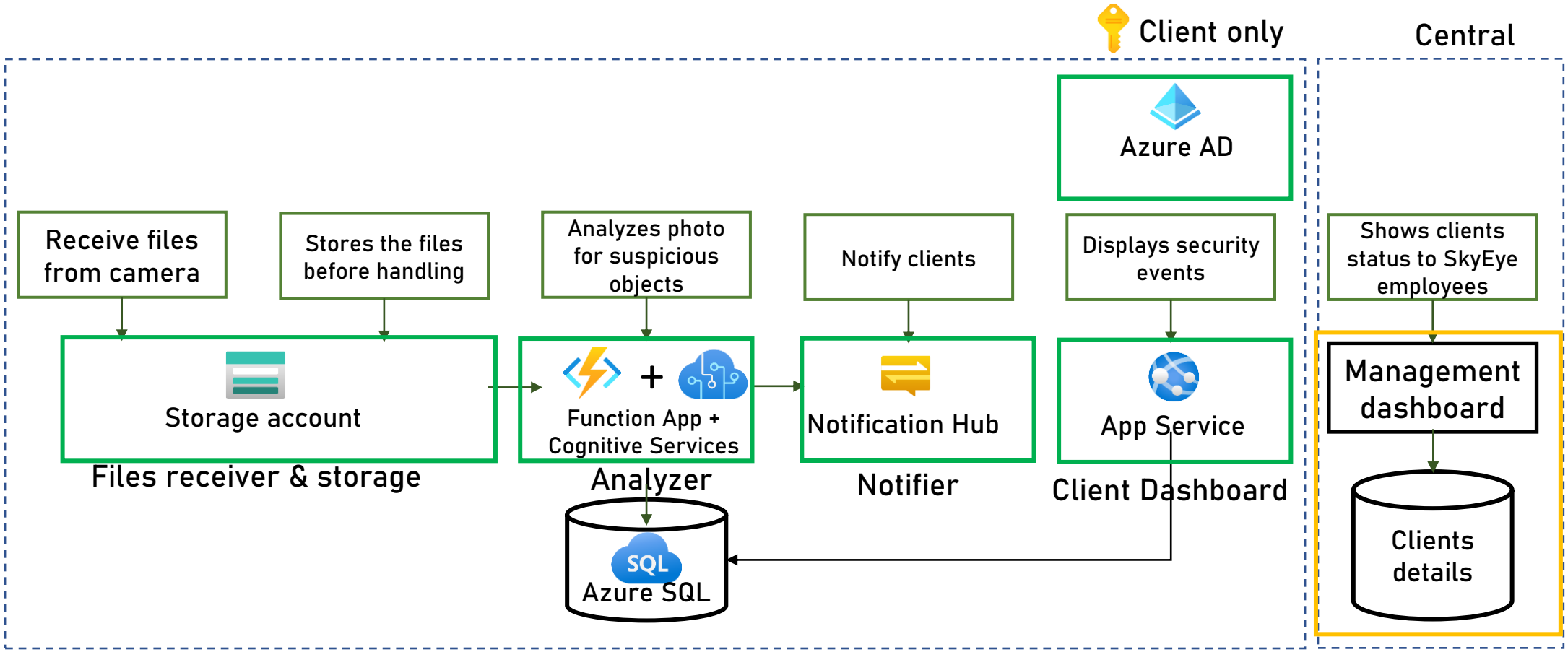
Components


Client only
Central
Access control
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
Management dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
Clients details

Components


Client only
Central
Azure AD
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
Management dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
Clients details

Components


Client only
Central
Azure AD
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
Management dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
Clients details

Management Dashboard

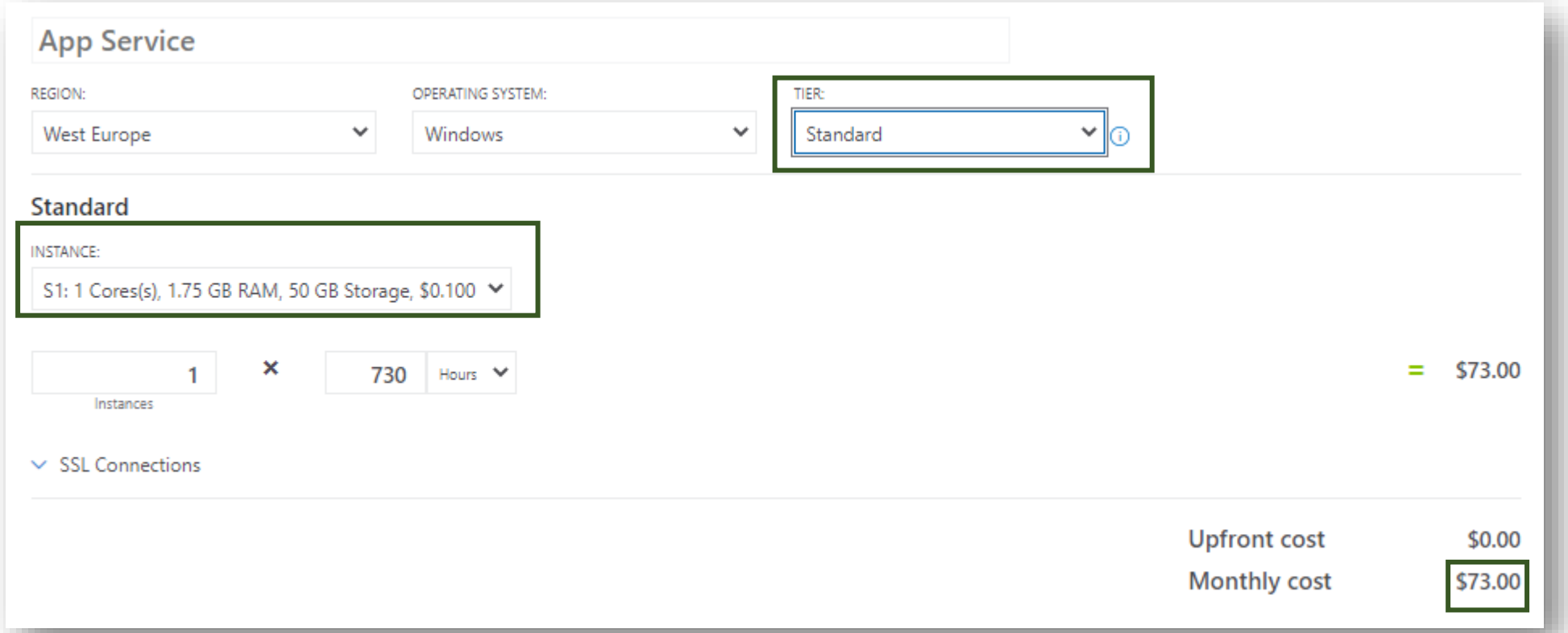
What it does:

- Shows data about clients
    - Contact details, payment info etc.
- Does not show analysis data

Management Dashboard

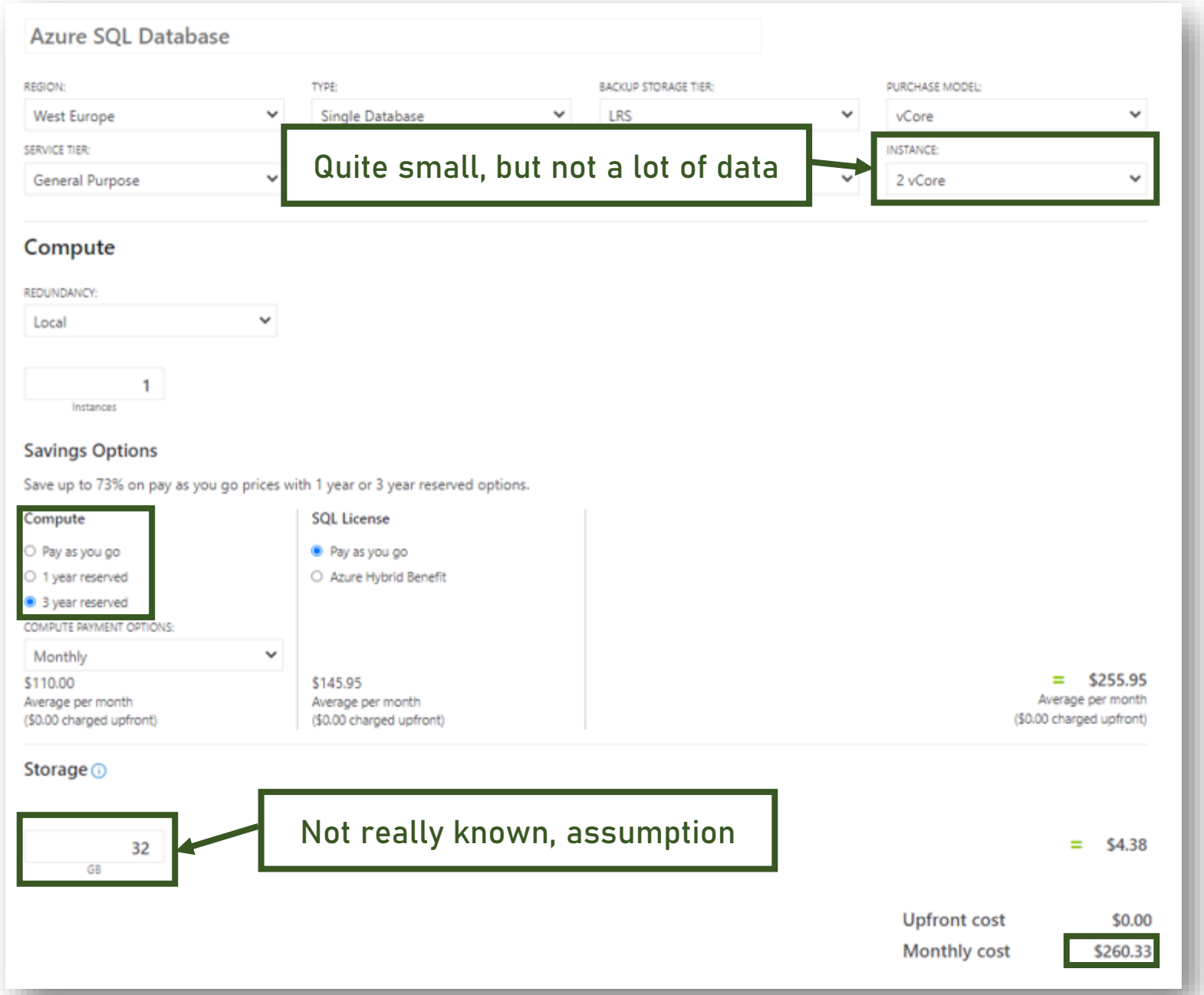
App Service

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

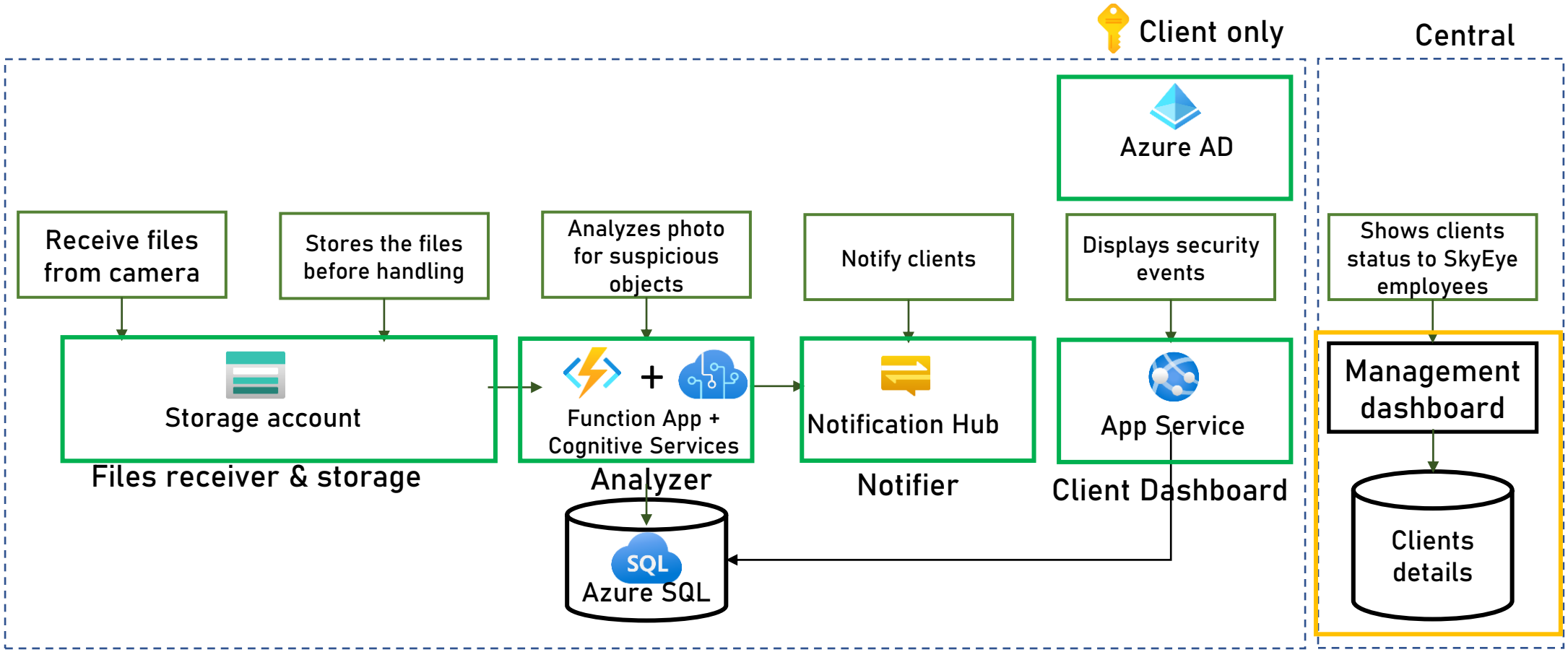

App Service
REGION:
West Europe
OPERATING SYSTEM:
Windows
TIER:
Standard
Standard
INSTANCE:
S1: 1 Cores(s), 1.75 GB RAM, 50 GB Storage, $0.100
1
Instances
×
730
Hours
=
$73.00
SSL Connections
Upfront cost
$0.00
Monthly cost
$73.00

Management Dashboard DB

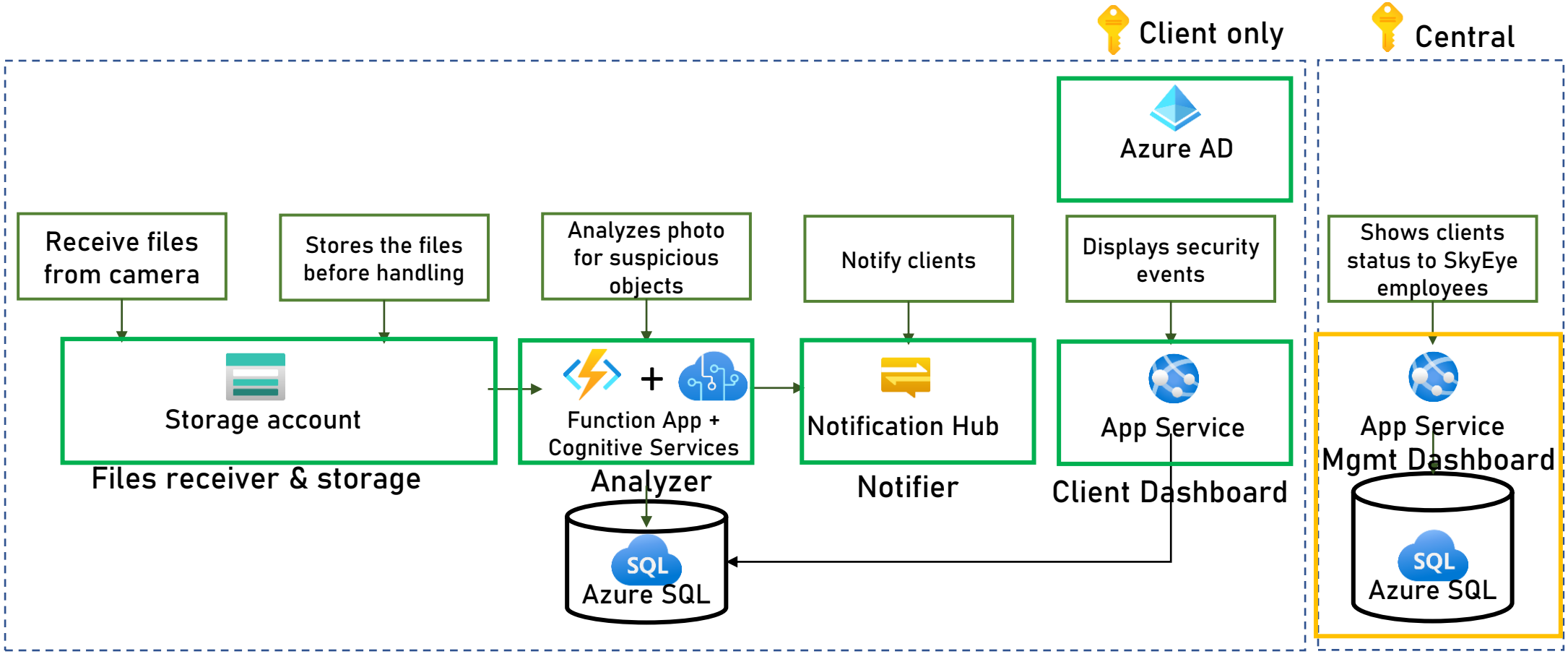
- Fully managed SQL Server in the cloud
- Allows geo-replication
- High SLA (up to 99.995%)
- We already use it…


Azure SQL Database
REGION:
West Europe
TYPE:
Single Database
BACKUP STORAGE TIER:
LRS
PURCHASE MODEL:
vCore
SERVICE TIER:
General Purpose
INSTANCE:
2 vCore
Quite small, but not a lot of data
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
32
GB
Not really known, assumption
= $4.38
Upfront cost $0.00
Monthly cost $260.33

Components


Client only
Central
Azure AD
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
Management dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
Clients details

Components


Client only
Central
Azure AD
Receive files from camera
Stores the files before handling
Analyzes photo for suspicious objects
Notify clients
Displays security events
Shows clients status to SkyEye employees
Storage account
Function App + Cognitive Services
Notification Hub
App Service
App Service Mgmt Dashboard
Files receiver & storage
Analyzer
Notifier
Client Dashboard
SQL
Azure SQL
SQL
Azure SQL

Security

- Pay attention to:
  - Data encryption
  - Access to web apps
  - Authentication

Security

- To-Do:
  - Make sure database encryption is on (should be the default)
  - Make sure Azure AD is correctly configured

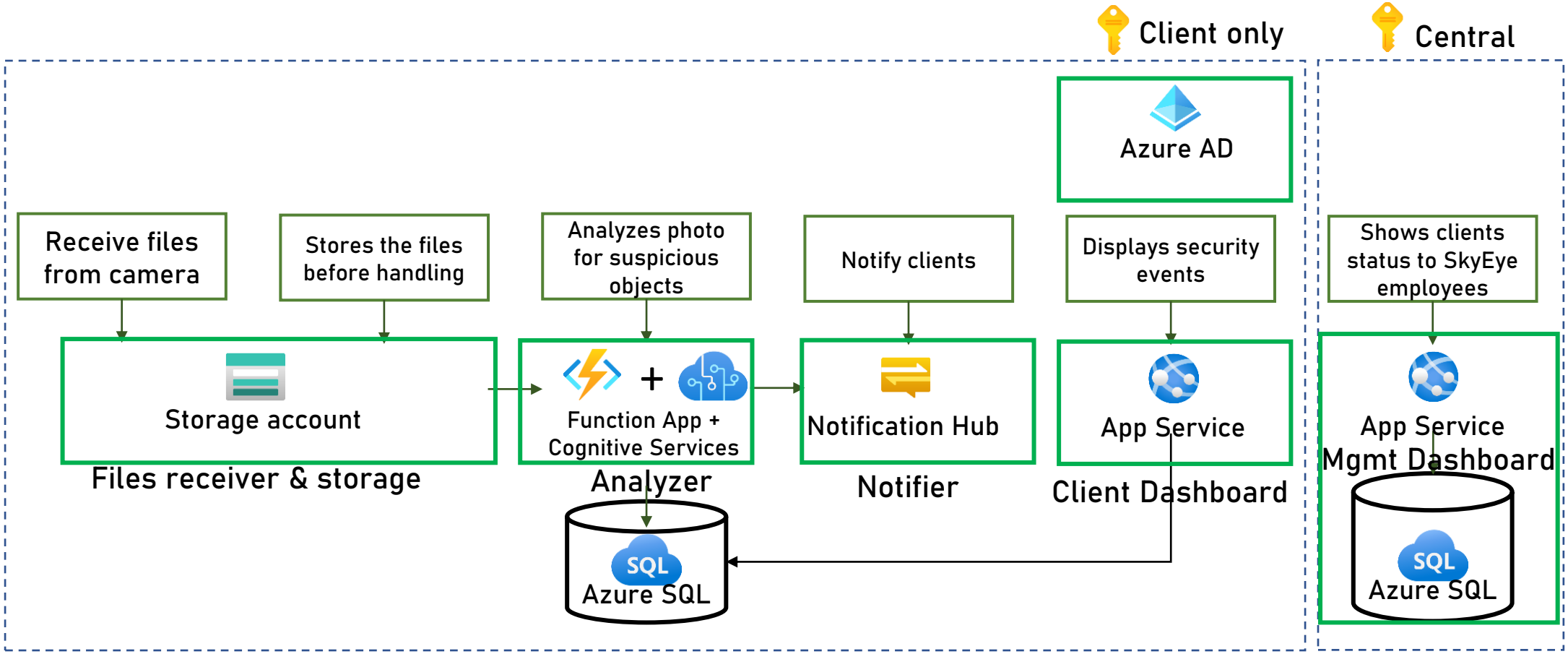
Security

- To think:
  - Should we add WAF in front of the client dashboard?
    - Apparently no need for that. Data is read only, and not used a lot.
    - Even if dashboard goes down, no long-term harm done

Security

- To think:
  - Should we add WAF in front of the management dashboard?
    - Apparently yes. Data is quite sensitive and is not read-only
    - The company decided to wait with b/c cost implications

Architecture Diagram



Cost

Client:

Estimated upfront cost	$0.00
Estimated monthly cost	$930.59

Management:

Estimated upfront cost	$0.00
Estimated monthly cost	$333.33

Download detailed cost estimations from the lecture's resources