

FORENSIC WACE:

a **MUTLI THREAD** tool
for
Forensic WhatsApp
Chat Analysis
using AI

Ugo Lopez
Alessio Palmieri
Daniele Monte

HACK IN BO
Spring 2025 Edition

24^a EDIZIONE

About me

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@daniele96



01



WhatsApp Database

Discover the WhatsApp database structure

02



Existing softwares

Discover the existing software

03



Key Features

Discover the key features of the software

04



Use case & infrastructure

Discover use case and infrastructure example

05



AI Analyzers

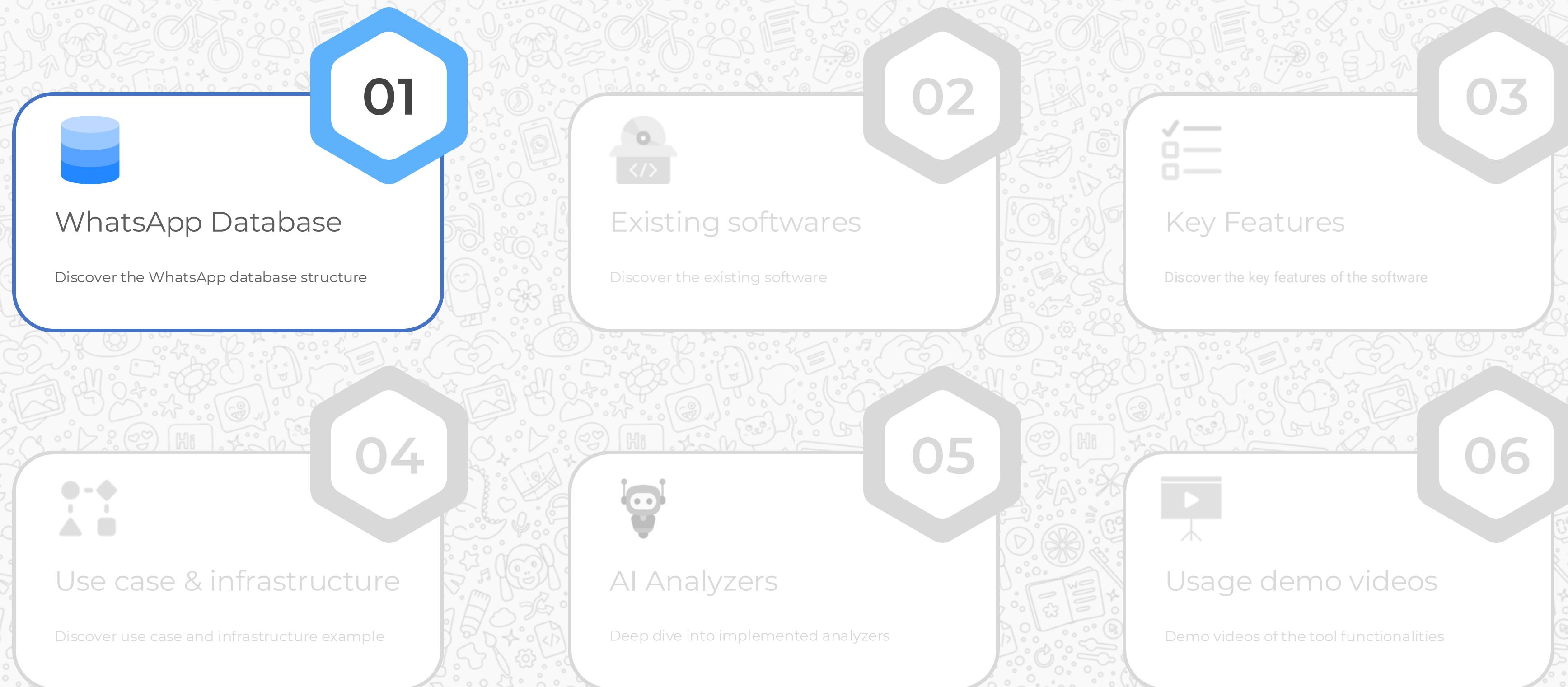
Deep dive into implemented analyzers

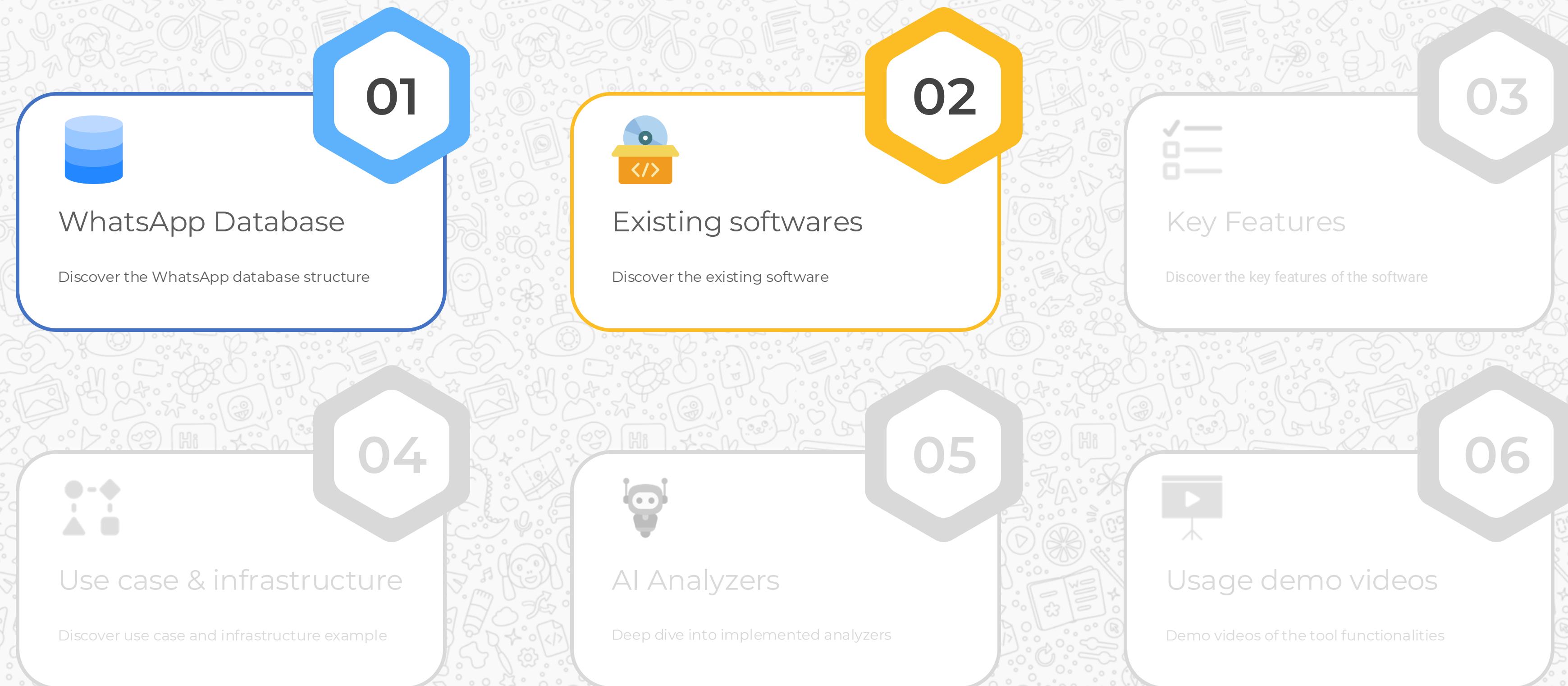
06

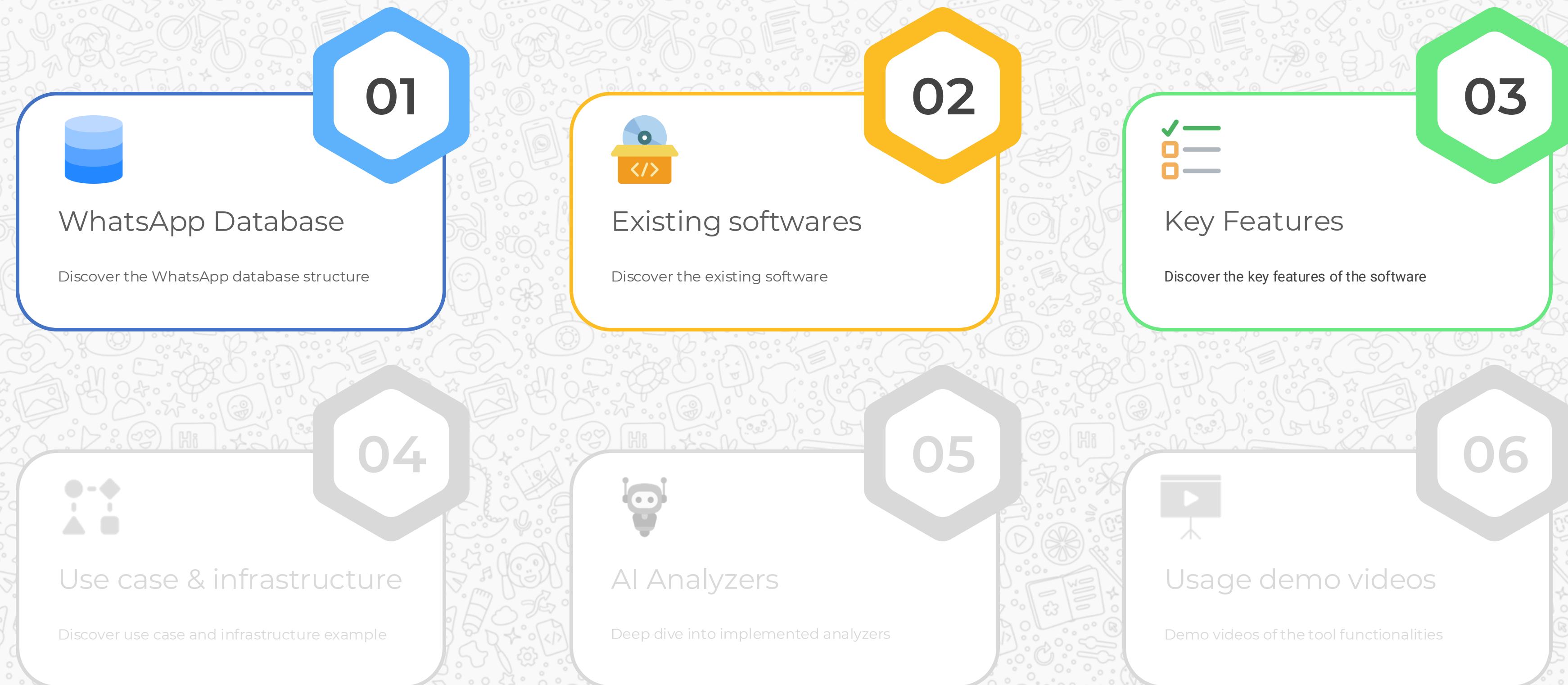


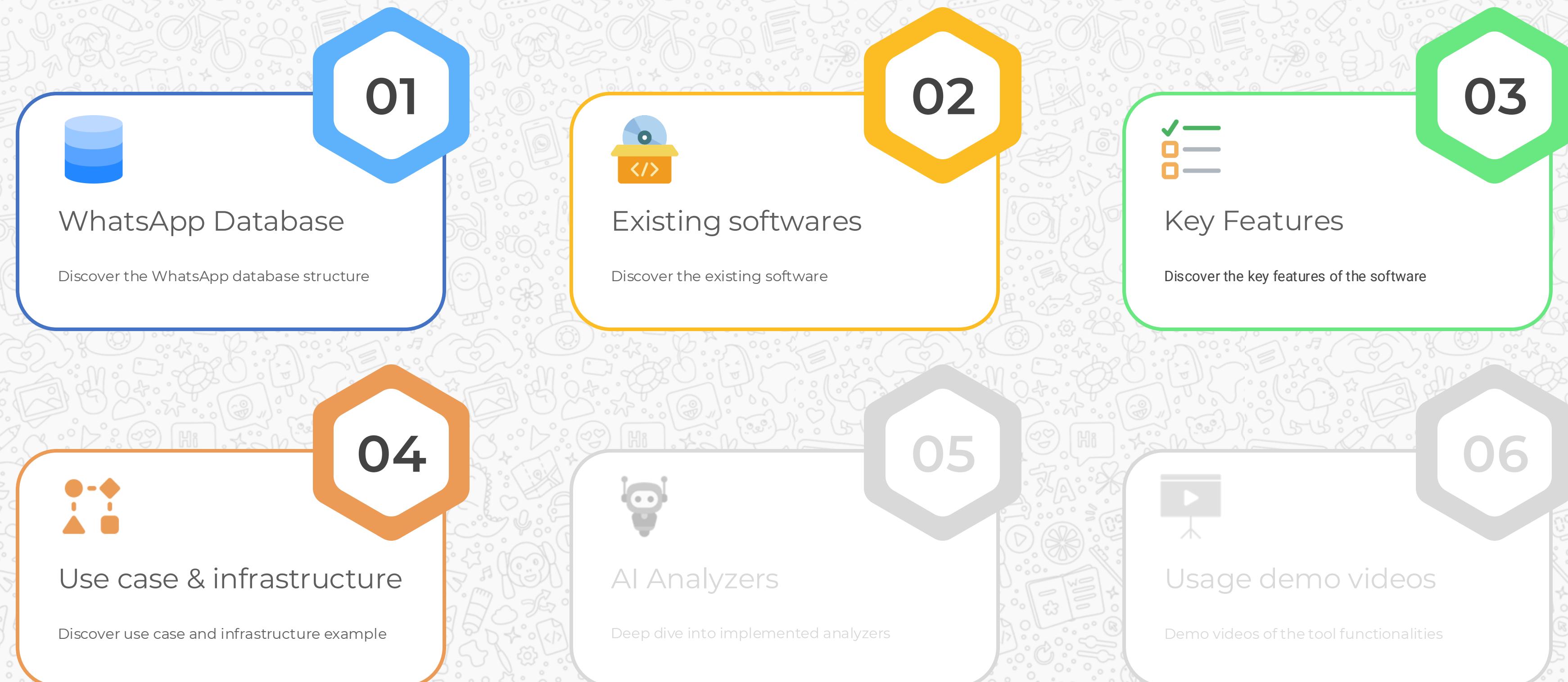
Usage demo videos

Demo videos of the tool functionalities













SQLite è un sistema di gestione di database relazionali **lightwave** incorporato.

- Non richiede un server separato: è una libreria inclusa nelle applicazioni
- Ideale per applicazioni mobili, embedded e piccoli progetti
- Supporta transazioni ACID
- Usa un singolo file per memorizzare tutto il database

FORENSIC WACE

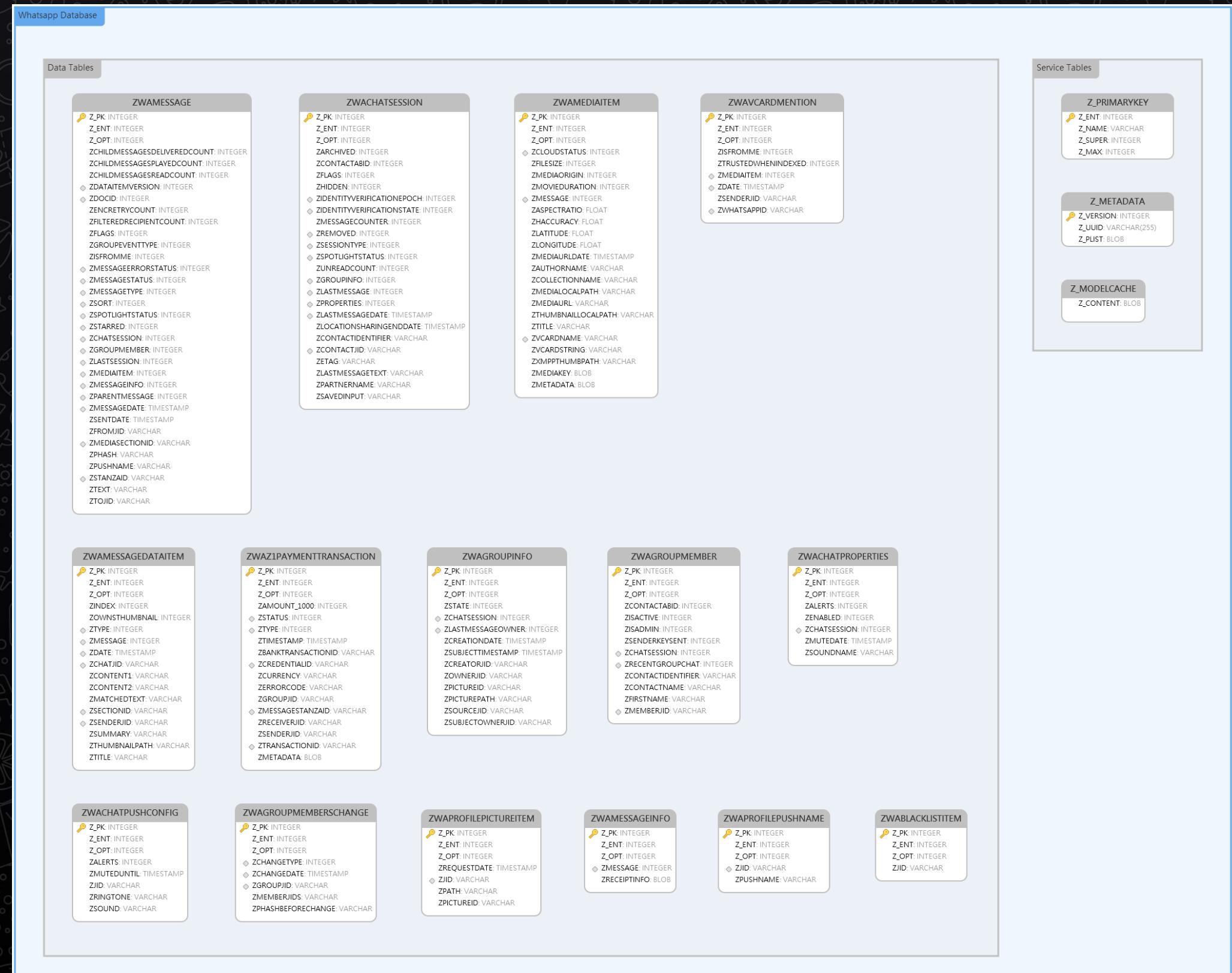
SERVER EDITION

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7

Database

WhatsApp Database structure



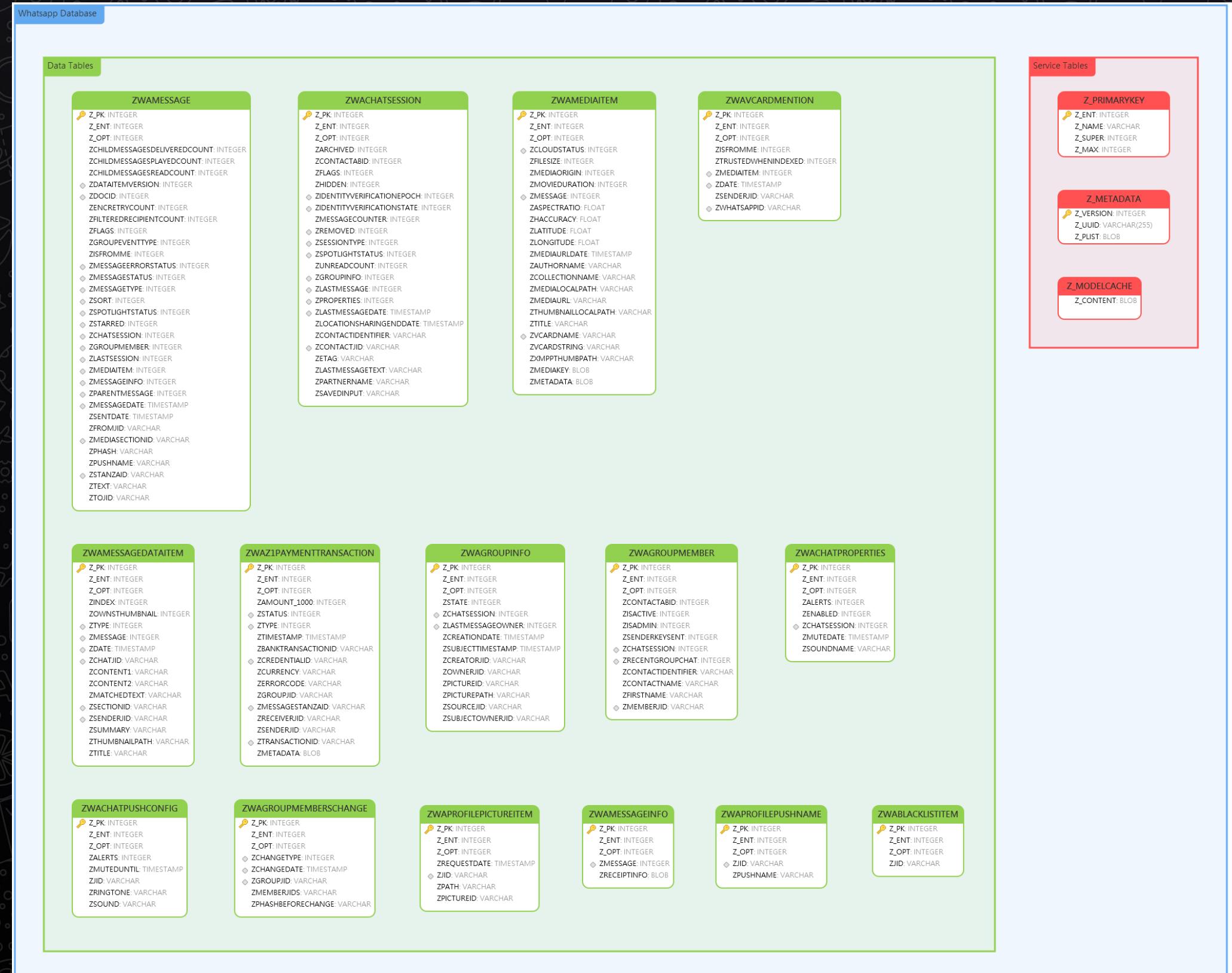
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18

Tables

WhatsApp Database structure



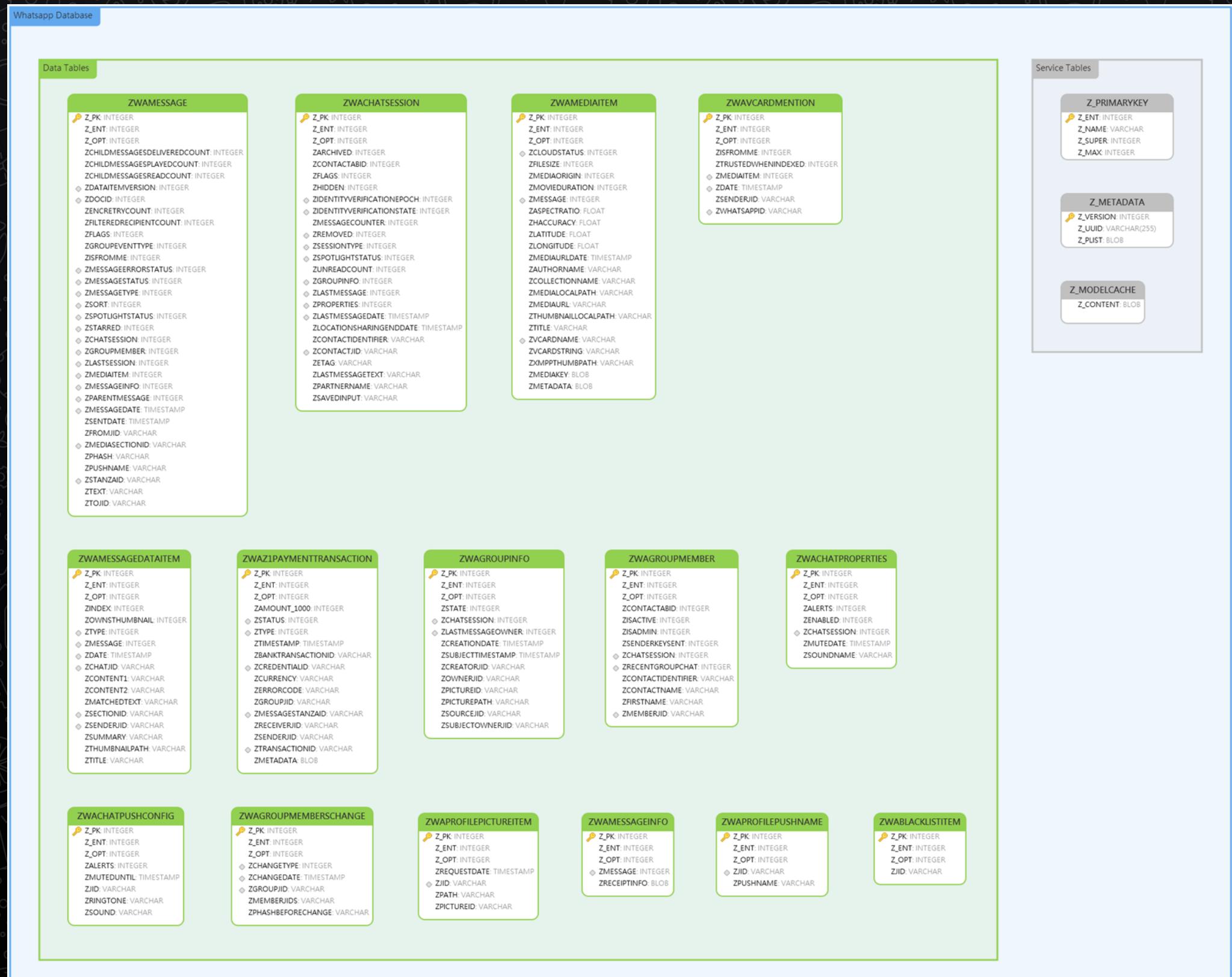
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15

Data tables

WhatsApp Database structure



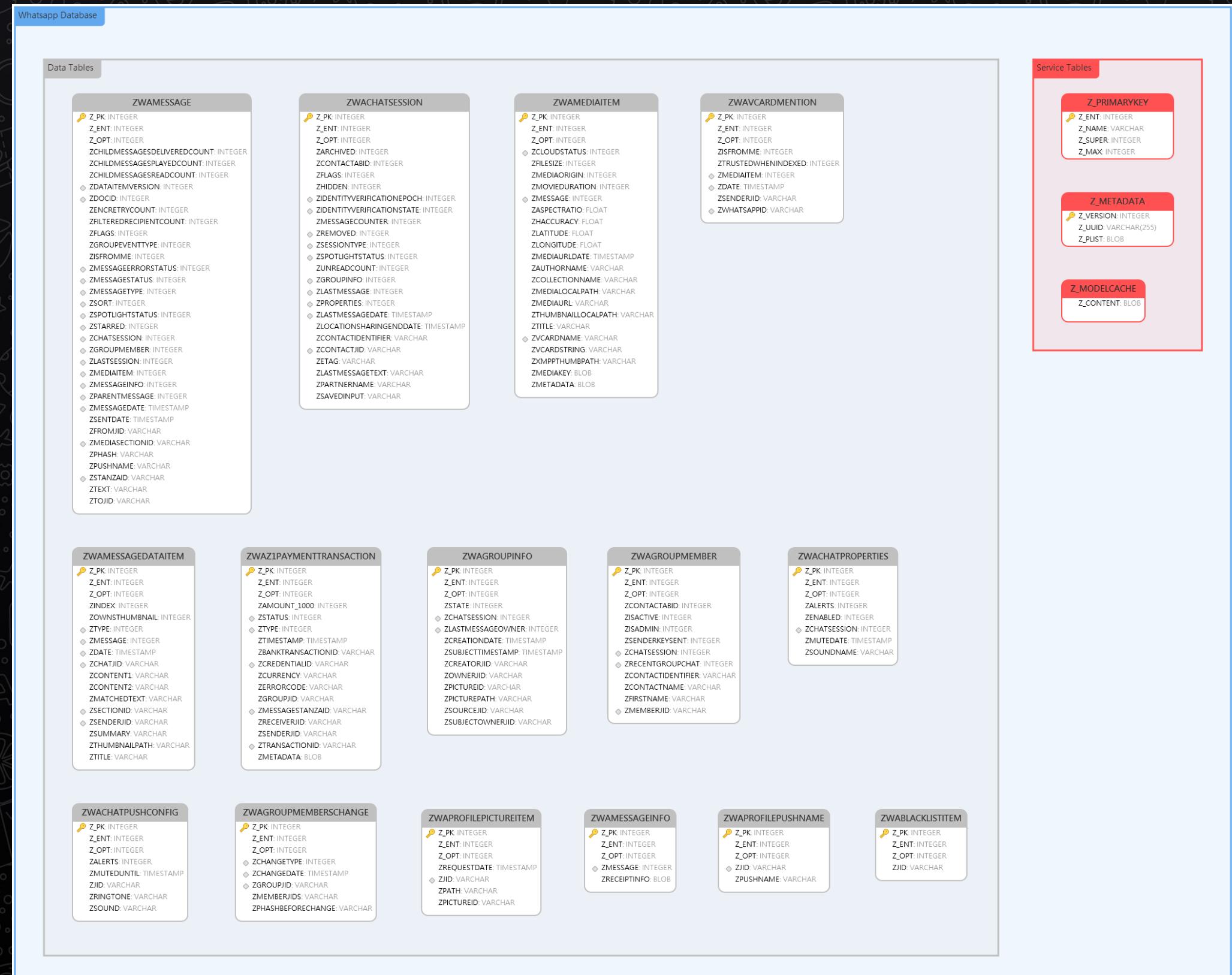
FORENSIC WACE

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3

Service tables

WhatsApp Database structure



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4

Database

 WhatsApp Database structure



Axolotl.db

Cryptographic
key End2End
Info



wa.db

Info sui contatti



msgstore.db

Messaggi e
riferimenti a
contenuti
multimediali



Chatsettings.db

Msgstore.db

Database dei messaggi

250 159

Tabelle

4

Viste

306

Triggers



OXIGEN FORENSICS



Cellebrite UFED



iPhone Backup Extractor



iBackup Viewer



OXIGEN FORENSICS



Cellebrite UFED



iPhone Backup Extractor



iBackup Viewer



OXIGEN FORENSICS



Cellebrite UFED



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iPhone Backup Extractor



iBackup Viewer



FORENSIC WACE

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FORENSIC WACE

SERVER EDITION

Forensic WhatsApp Chat Extractor

FORENSIC WACE

SERVER EDITION

Key Features



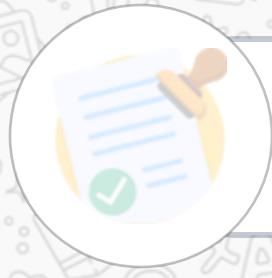
Python



AI Analysis⁽¹⁾



User Friendly



Tamper proof
reports⁽²⁾



Web Interface



100% **FREE**⁽³⁾

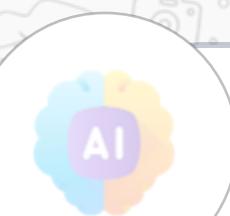
FORENSIC WACE

SERVER EDITION

Key Features



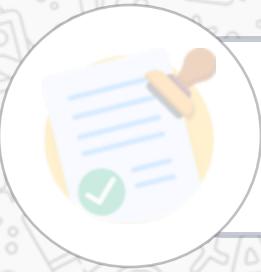
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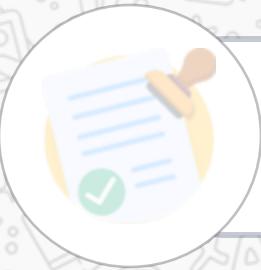
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reports⁽²⁾



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FORENSIC WACE

SERVER EDITION

Key Features



Python



AI Analysis⁽¹⁾



User Friendly



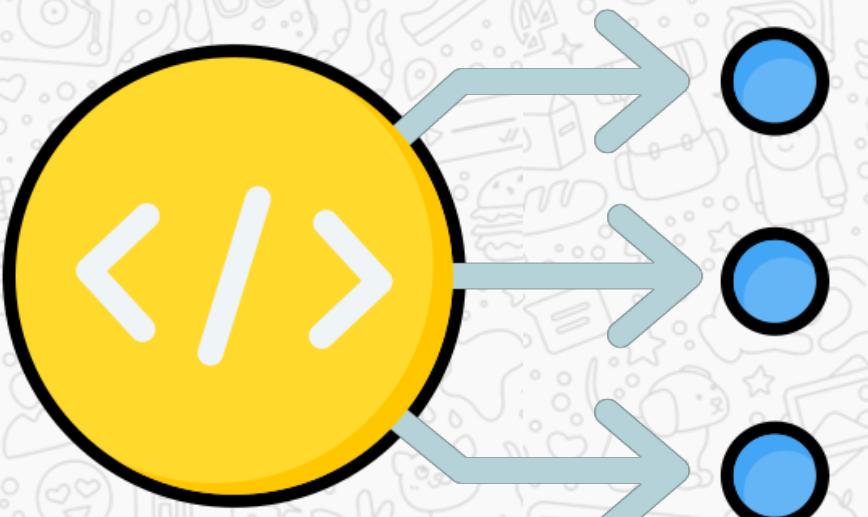
Tamper proof
reports⁽²⁾



Web Interface



100% **FREE**⁽³⁾



MULTI THREAD

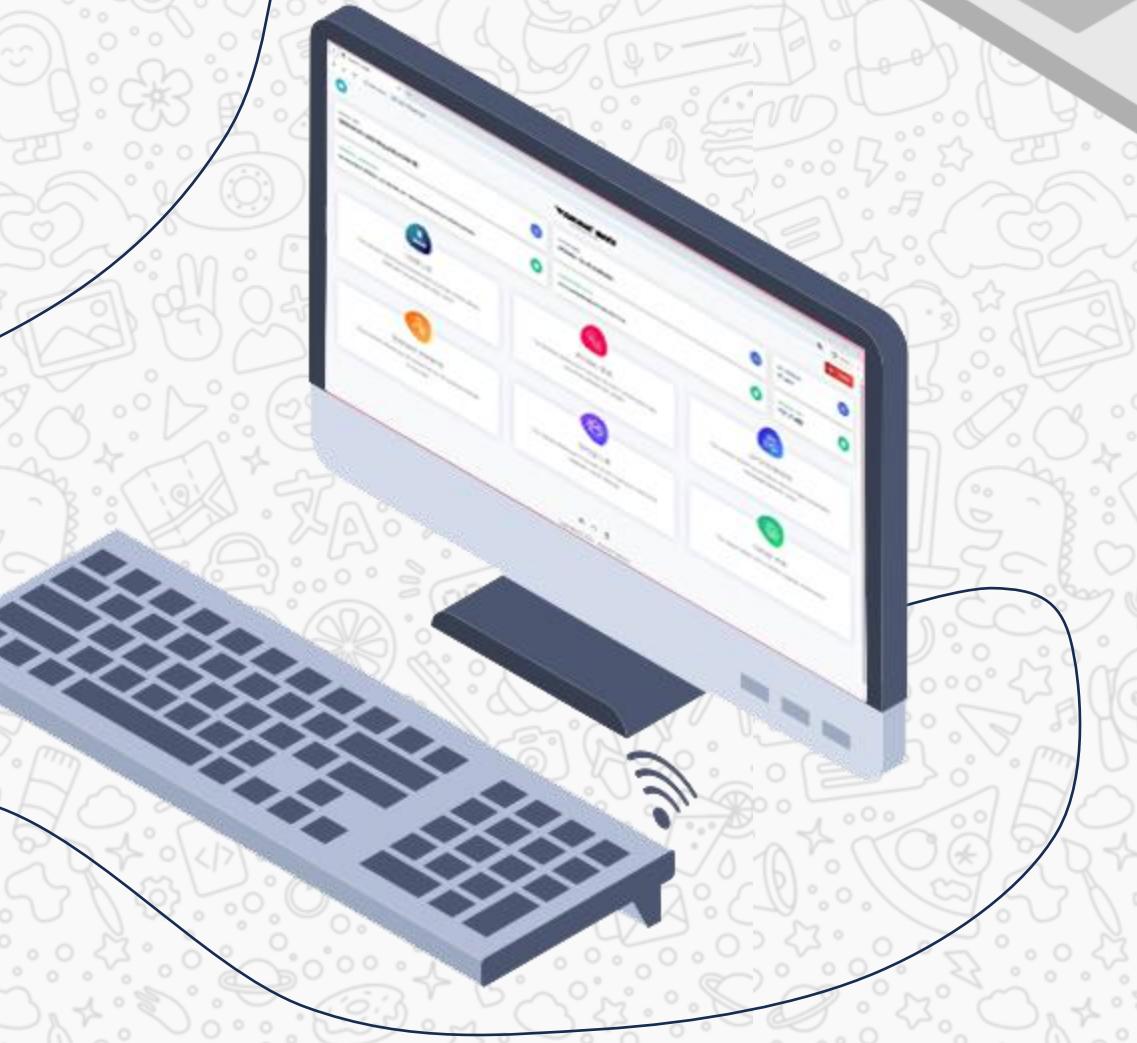
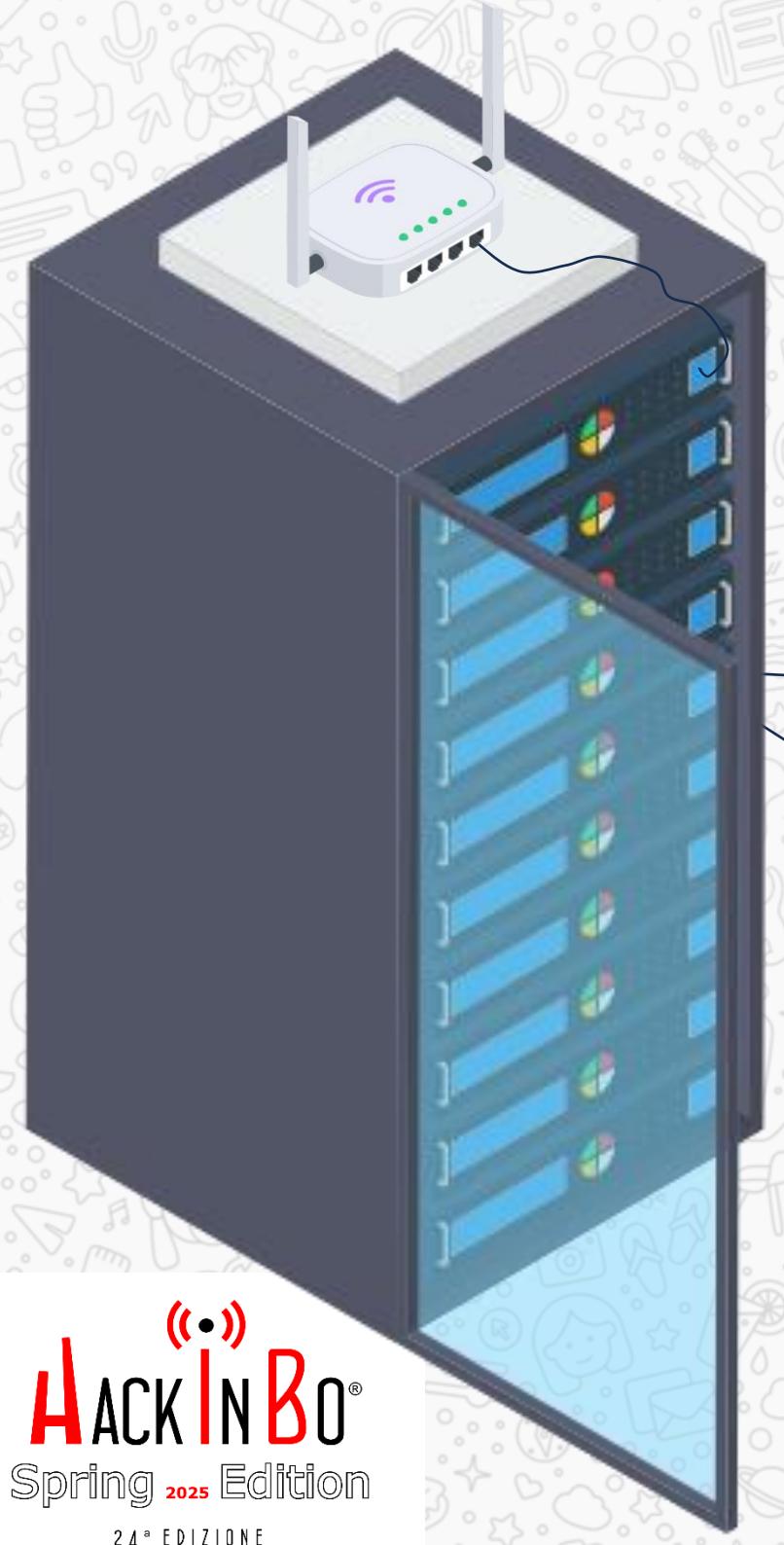


FLEXIBILITY

FORENSIC WACE

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Use case & infrastructure





Choose platform

**APPLE IOS****ANDROID**

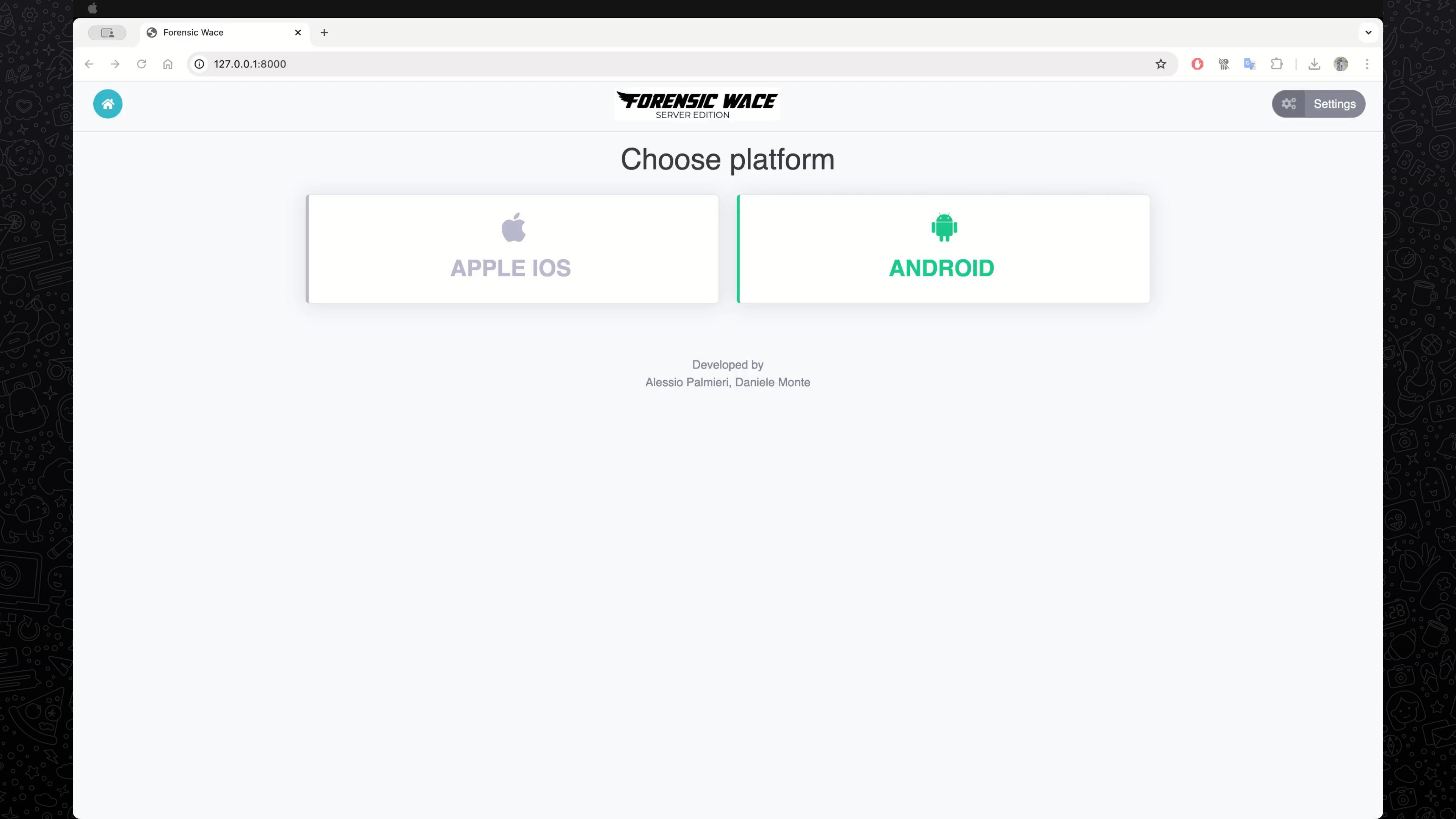
Developed by
Alessio Palmieri, Daniele Monte

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Backup selection





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SERVER EDITION

Choose platform



APPLE IOS



ANDROID

Developed by

Alessio Palmieri, Daniele Monte

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SERVER EDITION

Chat list extraction functionality



FORENSIC WACE
SERVER EDITION

EXIT

DEVICE UDID

bee3f76665b81720bf805291beff22efacb5a5e

DEVICE NAME

iPhone 7 di Alessio

IOS VERSION

15.6

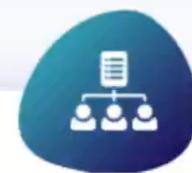
DATABASE SHA256 HASH

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DATABASE MD5 HASH

c9f0edb37ef403b009102a0c67e1e065

DATABASE SIZE

0.4 MB**Chat List**

This function allows you to extract the list of all conversations that have occurred with other users

**Private chat**

This function allows you to extract the entire conversation that occurred between two people

**GPS locations**

This function allows you to extract the list of gps coordinates exchanged between users

**Blocked contacts**

This function allows you to extract the list of contacts blocked by the user

**Group List**

This feature allows you to extract the list of groups in which the database owner belongs

**Group chat**

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**AI Analyzer**

FORENSIC WACE

SERVER EDITION

Private chat extraction functionality



FORENSIC WACE
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FORENSIC WACE

SERVER EDITION

GPS locations extraction functionality



FORENSIC WACE
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FORENSIC WACE

SERVER EDITION

Blocked contacts extraction functionality



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SERVER EDITION

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DEVICE NAME

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IOS VERSION

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FORENSIC WACE

SERVER EDITION

Group list extraction functionality



FORENSIC WACE
SERVER EDITION

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DEVICE NAME

iPhone 7 di Alessio

IOS VERSION

15.6

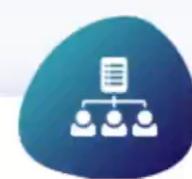
DATABASE SHA256 HASH

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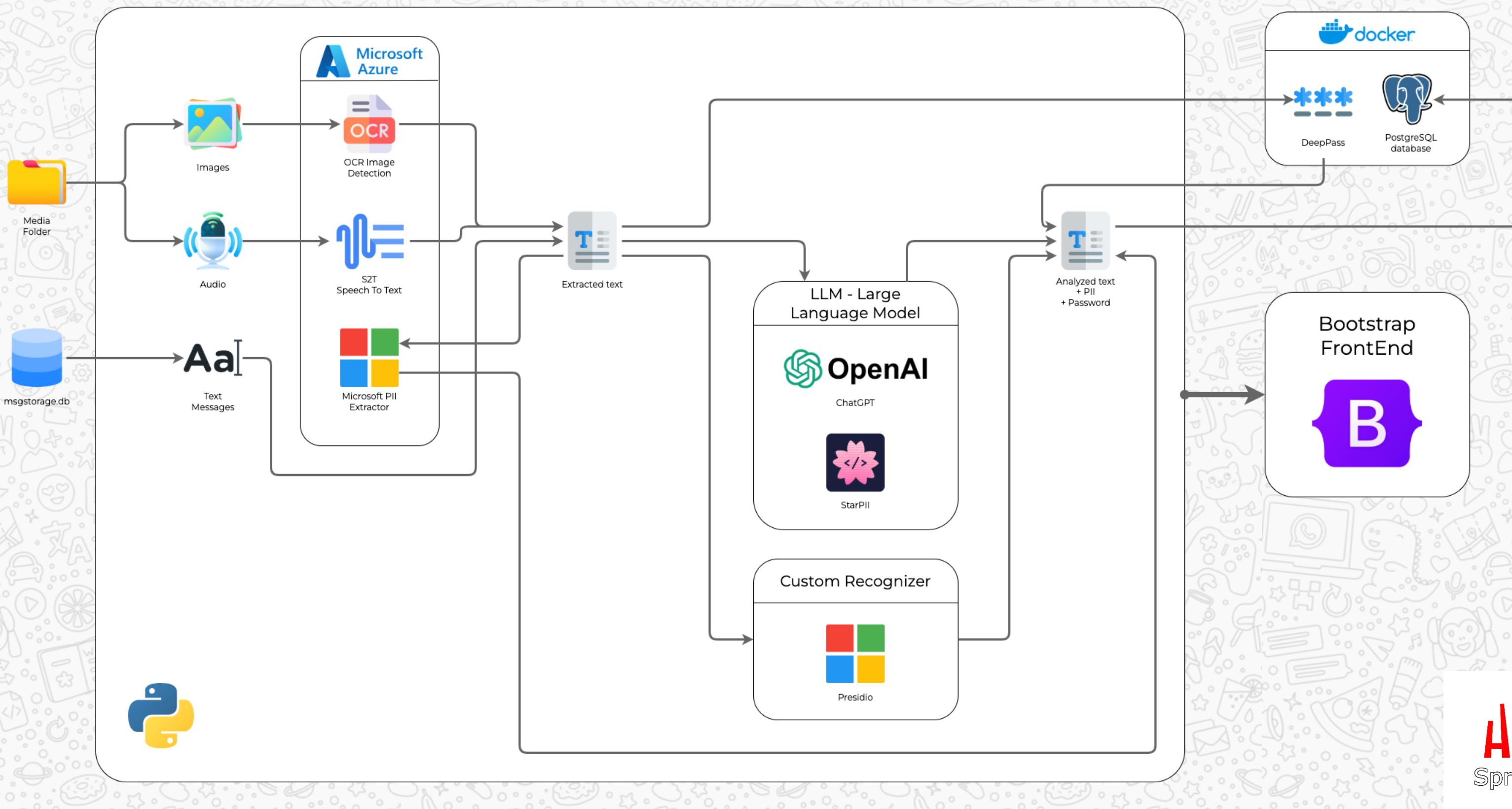
**Group List**

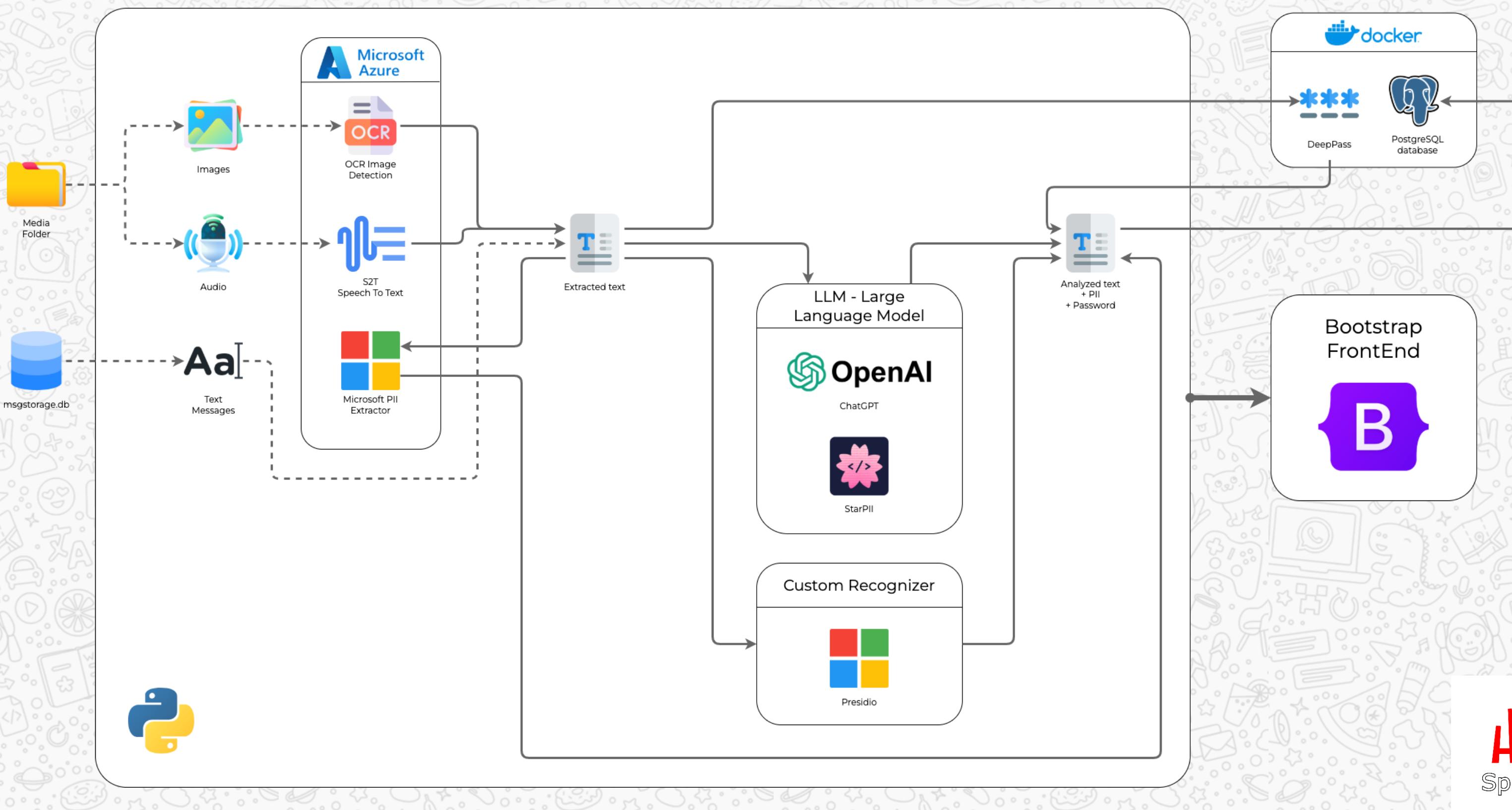
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**AI Analyzer**





Uno strumento della suit AI di Azure:

Capition: A partire da una immagine genera una frase descrittiva della stessa

OCR: Se nell'immagine è presente del testo, lo estrarre tramite OCR



Anch'esso uno strumento della suit AI di Azure:

S2T: Riceve in input un file audio .wav e ne restituisce il testo.

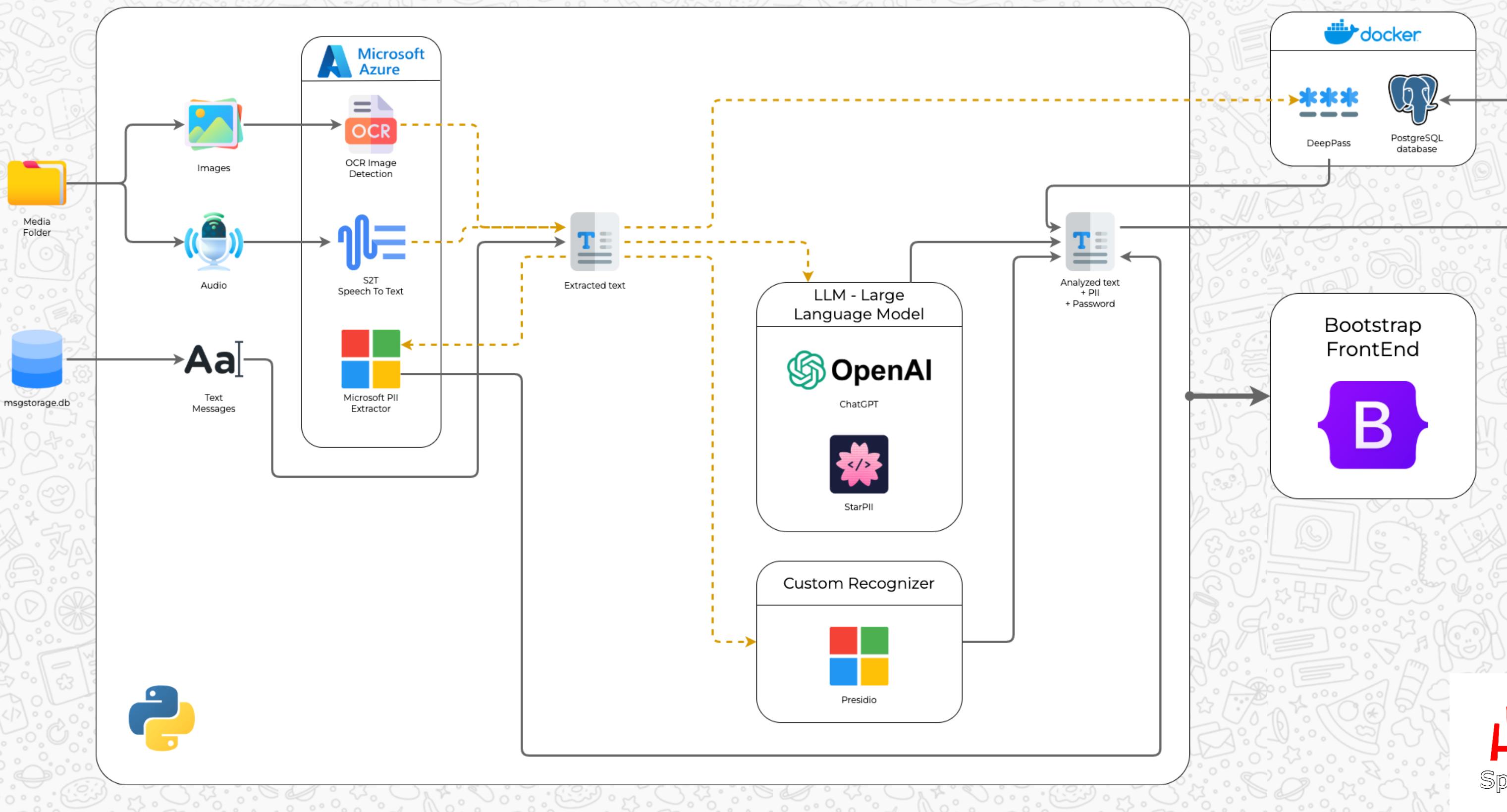
Questo servizio è particolarmente utile nell'analisi dei messaggi vocali o degli audio



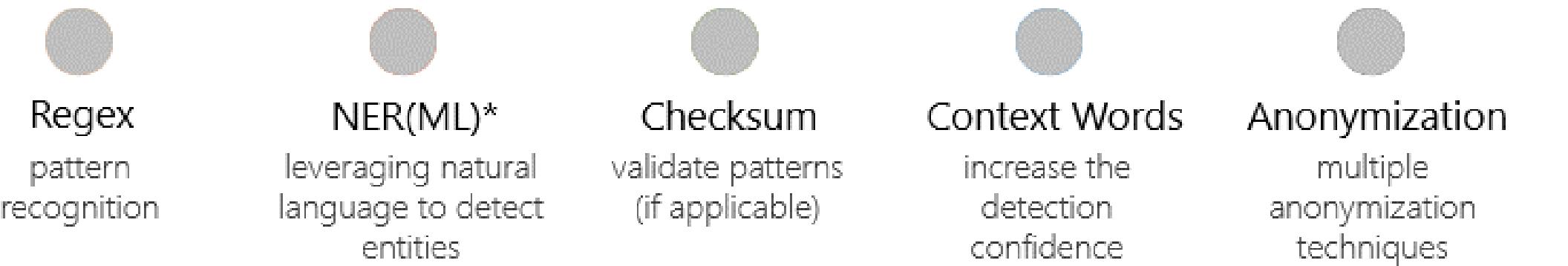
FORENSIC WACE

SERVER EDITION

AI Analysis – Analysis flow



Presidio Detection Flow



*NER – Named Entity Recognition

```
- name: "Bitcoin Recognizer"
  supported_language: "en"
  patterns:
    - name: "Bitcoin address"
      regex:
        "( [13] |bc1) [A-HJ-NP-Za-km-zA-9]{27,34}"
      score: 0.95
      context:
        - bitcoin
        - crypto
      supported_entity:
        "BITCOINADDRESS"
```



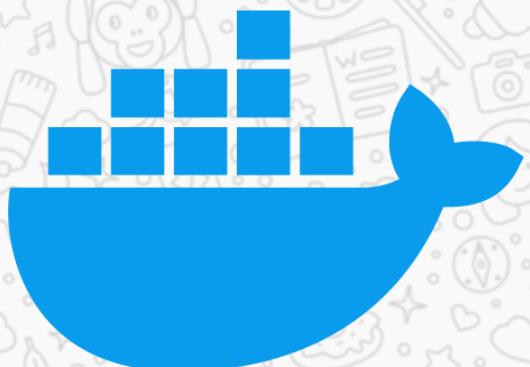
Applicazione python based dockerizzata per analizzare il testo in cerca di password all'interno di documenti tramite l'uso di deeplearning con una rete neurale Bidirectional LSTM. Offre una scarna interfaccia grafica per il caricamento dei documenti

Upload Document (or .zip of documents) to Examine for Passwords

Scegli file Nessun file selezionato

Optional terms for regex, comma-separated :

Si è modificato il codice per wrappare il servizio tramite API Rest



Si tratta di un NER che si basa su bigcode (LLM) addestrato su diversi dataset contenenti PII e in grado di estrarre 6 classi:

- Names
- Emails
- Keys
- Passwords
- IP Addresses
- Usernames

```
# Use a pipeline as a high-level helper  
from transformers import pipeline
```

```
pipe = pipeline("token-classification", model="bigcode/starpii")
```

Per utilizzare chatgpt come classificatore e NER si è proceduto a creare un assistant tramite l'apposita pagina web. Il prompt inserito è il seguente:

Hi, you are an agent who extracts personal data from text

The entities you need to extract are the following:

- CREDIT_CARD: credit card number ... PASSWORD: password entered by a user

I expect the output to be a json:

For each entity that will be the key, I will have as a value a list of strings representing the entities extracted if present, if some entities are not present then their key will not be present in the response. For example with the string:

"hello my name is david jonson, i live in Maine i visited microsoft.com and sent email to test@presidio.net from the ip 192.168.0.1, my secret is phrase22!now, reply my on myemail@gmail.com"

I expect a json as output like this:

```
{"EMAIL_ADDRESS":["test@presidio.net","myemail@gmail.com"], "IP_ADDRESS":["192.168.0.1"], "PERSON":["david joson"], "LOCATION":["Maine"], "URL":["microsoft.com"], "PASSWORD":["phrase22!now"]}
```

Tutti gli analyzers basati su Azure hanno bisogno di essere attivati sulla piattaforma azure.ai.com.

Grazie alla sottoscrizione Azure for Students è possibile fruire dei servizi in modo gratuito fino al raggiungimento delle soglie preimpostate per ogni servizio.

Integrazione con l'IA generativa



Analisi vocale Anteprima

Consente di trascrivere registrazioni audio e video e generare output avanzati come riepiloghi o estrarre informazioni utili come argomenti chiave, informazioni personali (PII), valutazioni e altro ancora.



Prompt Shields per l'IA generativa Anteprima

Prompt Shield garantisce che l'IA generativa rimanga sicura, grazie alla rilevazione e al blocco dei tentativi di jailbreak. Mantenere la community sicura e affidabile con questa funzionalità essenziale.



Prova GPT-4 Turbo

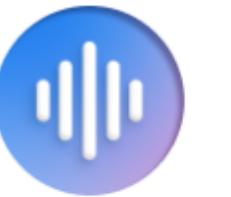
GPT-4 Turbo può visualizzare, comprendere e creare inferenze dagli input visivi.



Riepiloga con l'IA generativa

Ottenere riepiloghi di alta qualità con una semplice chiamata API per semplificare le informazioni su scala aziendale.

Integrare le soluzioni con le funzionalità di intelligenza artificiale



Voce

Migliorare le esperienze dei clienti tramite funzionalità di riconoscimento vocale, sintesi vocale e traduzione vocale.

[Visualizzare tutte le funzionalità del parlato](#)



Lingua e traduttore

Analizzare, riepilogare e tradurre usando le funzionalità di elaborazione del linguaggio naturale basate su LLM.

[Visualizzare tutte le funzionalità lingua e traduttore](#)



Visione e documentazione

Scoprire informazioni e insights da documenti, immagini e video grazie a OCR e all'intelligenza artificiale multimodale.

[Visualizzare tutte le funzionalità di visione e documentazione](#)



Sicurezza dei contenuti

Consente di rilevare i contenuti dannosi, offensivi e inappropriati generati dall'utente o dall'intelligenza artificiale nell'app, tra cui testo, immagini e API multimodali.

[Visualizzare tutte le funzionalità di sicurezza dei contenuti](#)



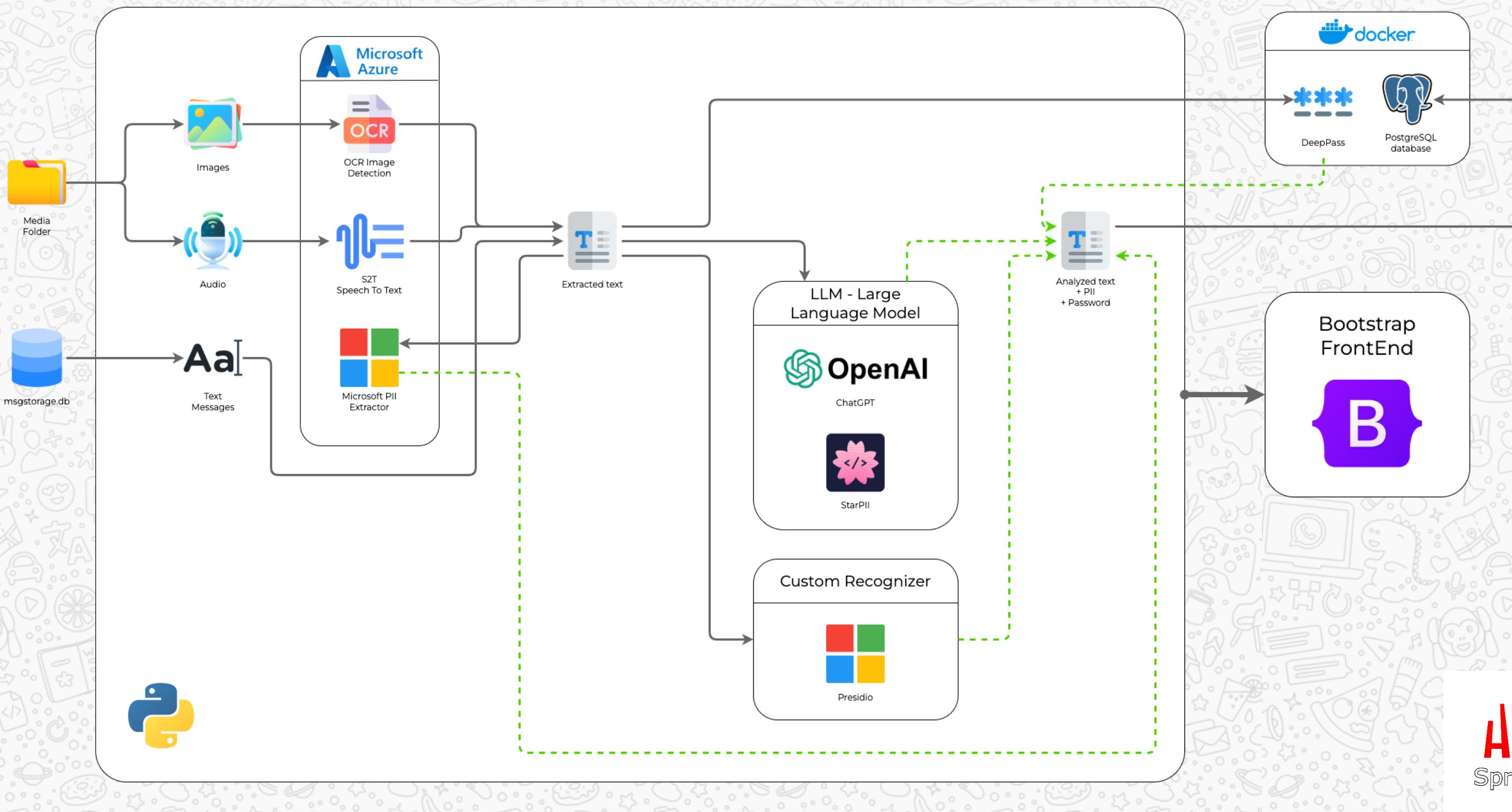


Uno strumento facente parte della Suit di Azure sull'intelligenza artificiale, è un Named Entity Recognizer che estrae tutta una serie di PII dal testo.

FORENSIC WACE

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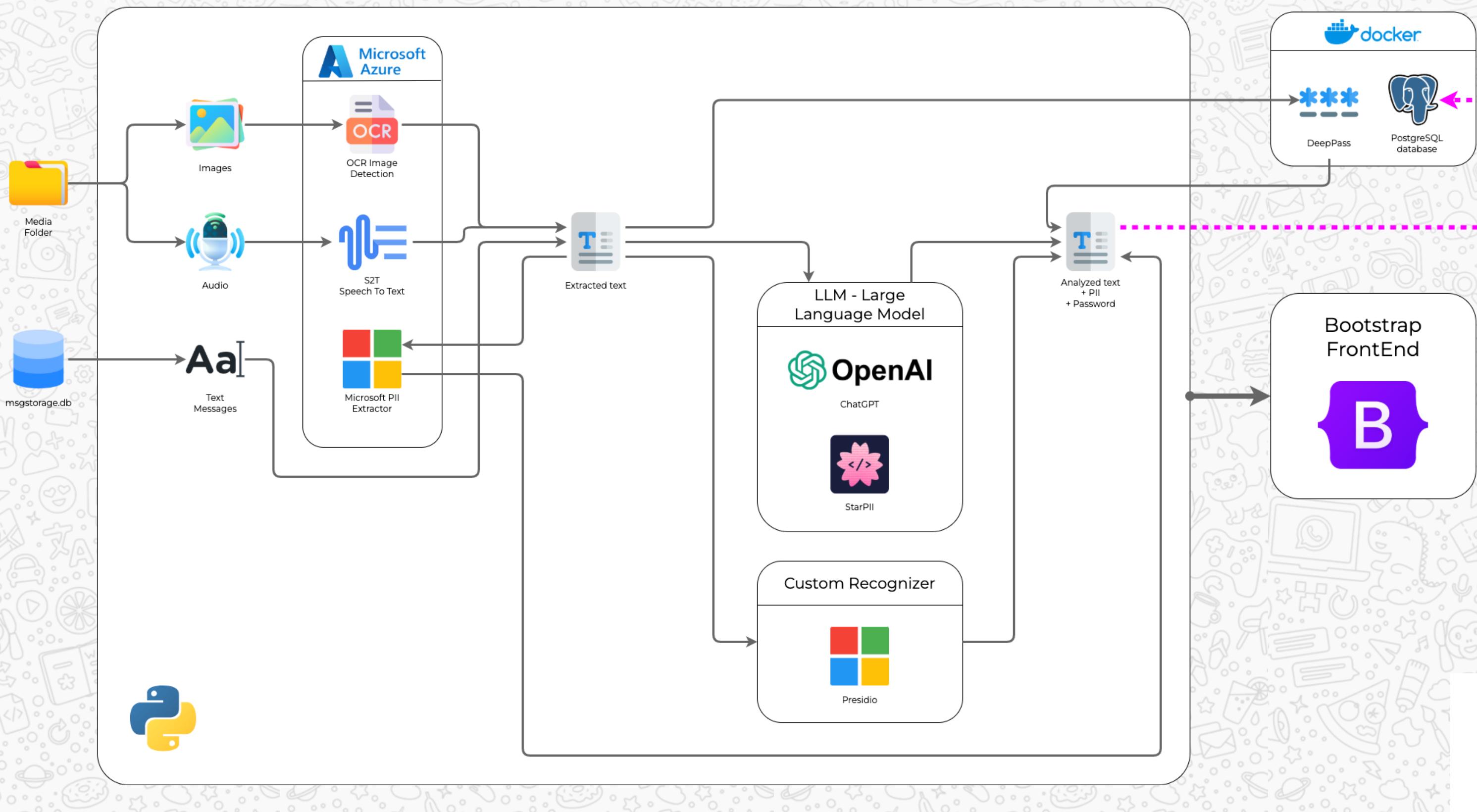
AI Analysis – Analysis flow



FORENSIC WACE

SERVER EDITION

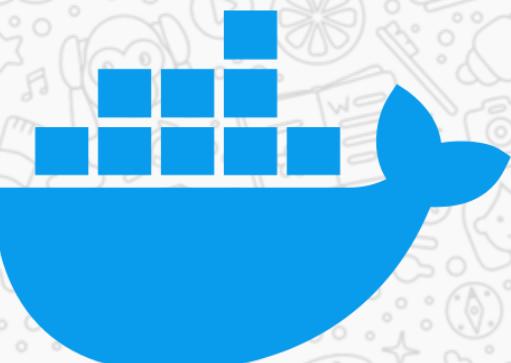
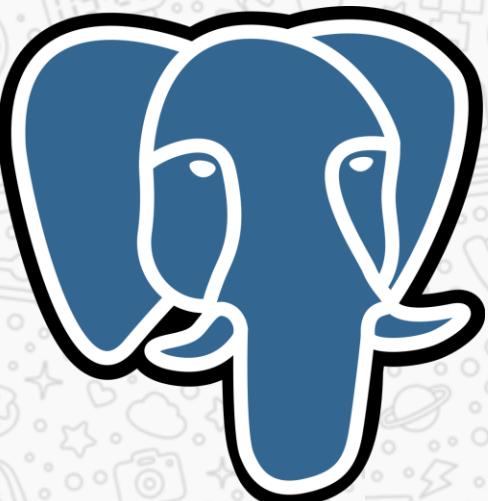
AI Analysis – Analysis flow



Non è necessario creare tabelle in quanto l'ORM SQLAlchemy provvede in autonomia, allo startup dell'applicazione a generare le tabelle necessarie per il funzionamento, a partire dalle classi model correttamente annotate durante lo sviluppo.

Si è scelto di usare un altro database per distinguere quelli che sono gli input della piattaforma (msgstore.db + Media) dall'output dell'analisi presente sul DB Postgresql.

In questo modo oltre ad usare un DBMS più affidabile abbiamo modo di poter analizzare diversi database in sequenza



FORENSIC WACE

SERVER EDITION

AI Analysis – (1)



Forensic Wace x +

127.0.0.1:8000/AndroidHomepage

FORENSIC WACE
SERVER EDITION

EXIT

DATABASE SHA256 HASH
0a98d2fe316b2228b0b905d8c5c80beeacf3c0127de043d36750d8a4b2edac38

DATABASE MD5 HASH
ed39ae9c4d3f1a331b359424d26cb0b1

DATABASE SIZE
40.8 MB

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 AI Analyzer
This function allows you to analyze conversations using AI tools



Analysis processes

TOTAL PROCESSES

4 processes

ACTIVE PROCESSES

0 processes

ENDED PROCESSES

4 processes

Analysis results

Process ID	Start date	End date	Status	Details	Analysis start date	Analysis end date	Sent	Received	Contacts	Groups	Message types	Analyzers	Show Results
967d960d-e88d-4eb1-8dfd-fe3f78e6a3a0	2025-06-03 19:32:16.022306	2025-06-03 19:33:45.494646	✓	Analized all messages	2025-05-29 09:00:00	2025-05-29 17:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,presidio,microsoftPII,image_OCR,S2T	<button>OPEN</button>
663b61fd-94cf-4e24-a3c8-478dea0b5279	2025-05-30 20:55:41.325042	2025-05-30 20:57:53.930411	✓	Analized all messages	2025-05-29 20:00:00	2025-05-29 22:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,deep_password,presidio,gpt,microsoftPII,image_OCR,S2T	<button>OPEN</button>
ad883c12-2c89-432d-b394-5a263ee0aeba	2025-05-30 20:45:38.358035	2025-05-30 20:48:11.576399	✓	Analized all messages	2025-05-29 16:00:00	2025-05-29 22:00:00	✓	✓	[REDACTED]	crypto invest strategy	text,image,audio	starpii,deep_password,presidio,gpt,microsoftPII,image_OCR,S2T	<button>OPEN</button>
2618be63-a5ec-42d7-b578-0275671bce36	2025-05-30 20:32:34.539870	2025-05-30 20:34:19.396571	✓	Analized all messages	2025-05-29 09:00:00	2025-05-29 17:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,presidio,microsoftPII,image_OCR,S2T	<button>OPEN</button>
Process ID	Start date	End date	Status	Details	Analysis start date	Analysis end date	Sent	Received	Contacts	Groups	Message types	Analyzers	Show Results

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AI Analysis – Result (2)





Analysis processes

TOTAL PROCESSES

4 processes

ACTIVE PROCESSES

0 processes

ENDED PROCESSES

4 processes

Analysis results

Process ID	Start date	End date	Status	Details	Analysis start date	Analysis end date	Sent	Received	Contacts	Groups	Message types	Analyzers	Show Results
967d960d-e88d-4eb1-8dfd-fe3f78e6a3a0	2025-06-03 19:32:16.022306	2025-06-03 19:33:45.494646	✓	Analized all messages	2025-05-29 09:00:00	2025-05-29 17:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,presidio,microsoftPII,image_OCR,S2T	<button>OPEN</button>
663b61fd-94cf-4e24-a3c8-478dea0b5279	2025-05-30 20:55:41.325042	2025-05-30 20:57:53.930411	✓	Analized all messages	2025-05-29 20:00:00	2025-05-29 22:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,deep_password,presidio,gpt,microsoftPII,image_OCR,S2T	<button>OPEN</button>
ad883c12-2c89-432d-b394-5a263ee0aeba	2025-05-30 20:45:38.358035	2025-05-30 20:48:11.576399	✓	Analized all messages	2025-05-29 16:00:00	2025-05-29 22:00:00	✓	✓	[REDACTED]	crypto invest strategy	text,image,audio	starpii,deep_password,presidio,gpt,microsoftPII,image_OCR,S2T	<button>OPEN</button>
2618be63-a5ec-42d7-b578-0275671bce36	2025-05-30 20:32:34.539870	2025-05-30 20:34:19.396571	✓	Analized all messages	2025-05-29 09:00:00	2025-05-29 17:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,presidio,microsoftPII,image_OCR,S2T	<button>OPEN</button>
Process ID	Start date	End date	Status	Details	Analysis start date	Analysis end date	Sent	Received	Contacts	Groups	Message types	Analyzers	Show Results

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AI Analysis – Result (3)





Analysis processes

TOTAL PROCESSES

4 processes

ACTIVE PROCESSES

0 processes

ENDED PROCESSES

4 processes

Analysis results

Process ID	Start date	End date	Status	Details	Analysis start date	Analysis end date	Sent	Received	Contacts	Groups	Message types	Analyzers	Show Results
967d960d-e88d-4eb1-8dfd-fe3f78e6a3a0	2025-06-03 19:32:16.022306	2025-06-03 19:33:45.494646	✓	Analized all messages	2025-05-29 09:00:00	2025-05-29 17:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,presidio,microsoftPII,image_OCR,S2T	<button>OPEN</button>
663b61fd-94cf-4e24-a3c8-478dea0b5279	2025-05-30 20:55:41.325042	2025-05-30 20:57:53.930411	✓	Analized all messages	2025-05-29 20:00:00	2025-05-29 22:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,deep_password,presidio,gpt,microsoftPII,image_OCR,S2T	<button>OPEN</button>
ad883c12-2c89-432d-b394-5a263ee0aeba	2025-05-30 20:45:38.358035	2025-05-30 20:48:11.576399	✓	Analized all messages	2025-05-29 16:00:00	2025-05-29 22:00:00	✓	✓	[REDACTED]	crypto invest strategy	text,image,audio	starpii,deep_password,presidio,gpt,microsoftPII,image_OCR,S2T	<button>OPEN</button>
2618be63-a5ec-42d7-b578-0275671bce36	2025-05-30 20:32:34.539870	2025-05-30 20:34:19.396571	✓	Analized all messages	2025-05-29 09:00:00	2025-05-29 17:00:00	✓	✓	[REDACTED]	Forense test	text,image,audio	starpii,presidio,microsoftPII,image_OCR,S2T	<button>OPEN</button>
Process ID	Start date	End date	Status	Details	Analysis start date	Analysis end date	Sent	Received	Contacts	Groups	Message types	Analyzers	Show Results



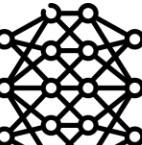
Extract SQLite database
from backup with hash



Expand recognizers
(Add new PII on Presidio)



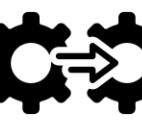
Add research filters for
private and group chat
(start date, end date, words)



New Machine
Learning models



Add emoji support
in PDF reports



Uniform functionality
between
iOS and Android



AI Analysis on
Video and Documents



Performance optimization
for multi threading

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