- BACK-END Toolchain

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BACK-END TOOLCHAIN (GOAL = $0 COST)

AREA	COMPONENT	DEV TOOL	DESCRIPTION	EASY DESCRIPTION
LANGUAGES	**LOGIC**	Python 3.12	Primary programming language for the EchoLogz back-end. Strong in data processing, APIs, and integrations.	Where everything **THINKS** and **CALCULATES** on the server.
(single-user / Development)	**LOCAL DATABASE**	SQLite (comes w/ Python=sqlite3)	Lightweight, file-based relational database used for storing and retrieving data locally. Requires no setup or server. Simplicity, zero configuration, and portability (just one .db file).	Where everything **STORES** and **REMEMBERS** data close to home.
(multi-user / Deployment)	**CLOUD DATABASE**	PostgreSQL	Structured query language for relational database management.	Where everything **STORES** and **REMEMBERS** data.
LIBRARIES/ FRAMEWORKS	**API FRAMEWORK**	FastAPI FastAPI-GitHub	High-performance Python web framework for building RESTful APIs with automatic OpenAPI docs.	
	ORM + MIGRATION TOOL	SQLAlchemy + Alembic	ORM for managing database models and migrations - keeps code ***database-agnostic.***	Makes database work feel more **PYTHONIC** and less **PAINFUL**.
	OAUTH / API AUTH	Authlib / Spotipy	Libraries for Spotify OAuth2 authentication and API communication.	Handles Spotify **LOGIN** and **DATA FETCHING** safely.
	DATA VALIDATION	Pydantic	Data validation and schema modeling library used with FastAPI.	Keeps all the data **CLEAN**, **SAFE**, and **TYPED**.
	SERVER RUNTIME	Uvicorn (ASGI Server)	Lightweight web server that runs FastAPI apps asynchronously.	The **ENGINE** that keeps requests running smoothly.
	CACHE / SESSION STORAGE	Redis (optional)	In-memory data store for caching sessions or tokens.	Helps the back-end **REMEMBER QUICKLY**.
	MATH ENGINE	NumPy / SciPy	Vector ops (ex: cosine similarity).	Does the **MATH** fast.