



Denodo

Taking a Logical - Data Mesh Approach to Data Integration & Secure Data Sharing

U.S. Defense Information Systems Agency (DISA)

Emerging Technology Directorate (EM)

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Denodo – Key Growth Metrics

The Leader in Data Virtualization



LEADERSHIP

- Longest continuous focus on data virtualization – since 1999
- Leader – Gartner Data Integration MQ 2022
- Leader in Forrester 2020-2023 Wave – Ent. Data Fabric
- Leader in Forrester 2024 Wave – Data Virtualization
- Customers Choice for Gartner Peer Insights for Data Integration Tools 2023
- Winner of numerous awards



DENODO OFFICES and EMPLOYEES

- 25 offices across 20 countries
- New offices in 2021 – S. Korea, Netherlands, Belgium & Sweden
- ~ 20% growth in employees in 2021

CUSTOMERS and PARTNERS

- 1000+ customers
- 250+ active and engaged partners

FINANCIALS

- Backed by \$4B+ private equity firm; \$0 debt
- ~ 50% annual growth; Profitable.

Energy	
Technology	
Manufacturing	
Financial Services	
Insurance	
Healthcare	
Public Sector	
Telecommunications	
Retail	
Pharma / Biotech	

Data Challenges in the News Now!

FCW The Business of Federal Technology

PEOPLE IT MODERNIZATION DIGITAL GOVERNMENT SECURITY

TRENDING // IT MODERNIZATION // CYBERSECURITY // COVID 19 // CLOUD AND INFRASTRUCTURE // THE LECTERN // SP

The Navy's plan to crack down on data duplication



GCN The Technology that Drives Government IT

EMERGING TECH STATE & LOCAL DATA & ANALYTICS CLOUD & I

TRENDING // AI AND AUTOMATION // COVID 19 // ELECTIONS AND VOTING // BIOMETRICS

Army data fabric to unify tactical, enterprise networks



Nextgov CYBERSECURITY EMERGING TECH ARTIFICIAL INTELLIGENCE I

TRENDING // RANSOMWARE // CLOUD // WORKFORCE // SPONSORED: THE CYBERSECURITY EXECUT

SPONSOR CONTENT ? WHAT'S THIS?

Harnessing a Data Fabric to Accelerate Digital Transformation in the Public Sector

Denodo DoD Use Case Examples & ATOs

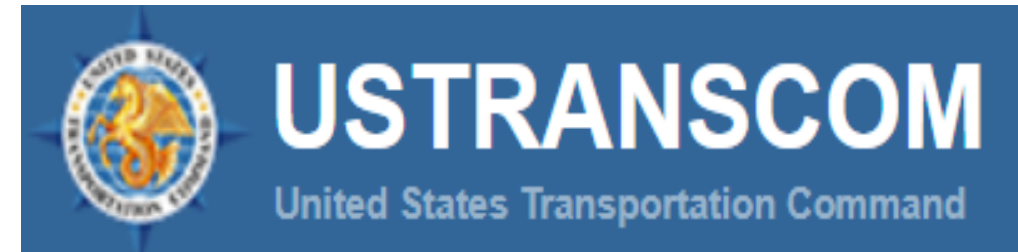
CASE STUDY —

The Authorization to Operate (ATO) process is aimed at minimizing and managing risk responsibility in government.

Department of Defense (DoD) Impact Level 4 (IL4), Impact Level 5 (IL5), and Impact Level 6 (IL6)



- **Centralized data dependency manager** enabling visibility per application on data sources,
- Insulates the consumers from the disruption caused by evolving data schemas by **maintaining data model integrity**,
- Provides scheduling and data access features that **reduce development time frames**.



- Mobility Air Force (MAF) - **Global Decision Support System (GDSS)** – Command and Control,
- **Aircraft Maintenance Tracking** - repair/inspection (IMDS – Oracle database), parts and part cost used for the repair (ILSS – XML file),
- **Maintenance Staff Visibility** - Information about the staff that performed the repair, their skill level and hourly rate \$ (PDF file).



- **Automated metadata management**, discovery, search, updates. Reducing difficulty when users need to access a “blended data element”,
- Custom connectors for metadata management, **Automated Categorization** of attributes and data sources,
- **Trusted Digital Thread** - manufacturing world, web interfaces for engineers to track manufacturing and design over their life cycle and web interface.

Air Force Envision – Denodo

The Data



Envision has connections to 100+ data sources from across DAF, DoD, and USG agencies. New connections are continually added to support Lines of Effort. Envision works with each source system to tailor the data connection to meet system-specific requirements and to ensure minimal impact to data sources.

ABS	AROWS	D035C -Discovery	Data Discovery	LDMS	PIEE WAWF
ADLS	AROWS_R	D042A -Discovery	Defense.gov	Leaveweb	PMRT
ADSS	ASIMIS	D043 -Discovery	FPDS	LOGMOD	RAMPOD
ADVANA	ASIMS	D200A -Discovery	FSDM	M4S	RAMPOD_Discovery
AFFMSII	Air Force MTF Locations	D200C -Discovery	FYDP	MABSM	REMIS
AFGET	Air Force Manual PPE imports	D200N -Discovery	Fleet Posture	MPES	REMIS_CFO
AFID	C2IMERA	DCAPES	G054 -Discovery	MilPDS	REMIS_Discovery
AFTOC	CAF Aviation SIPT	DCAPES_Static	G081	MilPDS_AT	REPOL
AF_COVID_Reporting	CAMIS_Cadet	DCPDS	GAFS_BL_VAULT	MilPDS_RI	RMS
AF_Vaccination_Status_Entry	CAMS_FM -Discovery	DDS	GDSS (UDL)	MilXtrac	SCS -Discovery
AF Weather	CAV-AF	DDS Survey Data	GDSS (Denodo)	MyFitness	SLCMS
ALIS Discovery	COGNOS	DEAMS	GTIMS	MyLearning	SharePoint Online
AMREP	CAVAF_Discovery	DMAPS	ICE	MyVector	STARS
APACS	CEMS	DMSI	IGC	NOTAMS	TBA
ARIS	CIPS	DPAS -Discovery	ILS-S	OA	TICMS
ARMS	CMOS	DPAS EQUIP -Discovery	IMDS	OTA	Tiberius
ARMS_LC	CSWS-DE	DRILS	JDRS	PEX_Langley	VAULT_PROD
	D002A -Discovery	DRRS-S	JMAR	PEX_Tinker	WSMIS -Discovery
		DTS	JRAMS	PIEE EDA	UDL

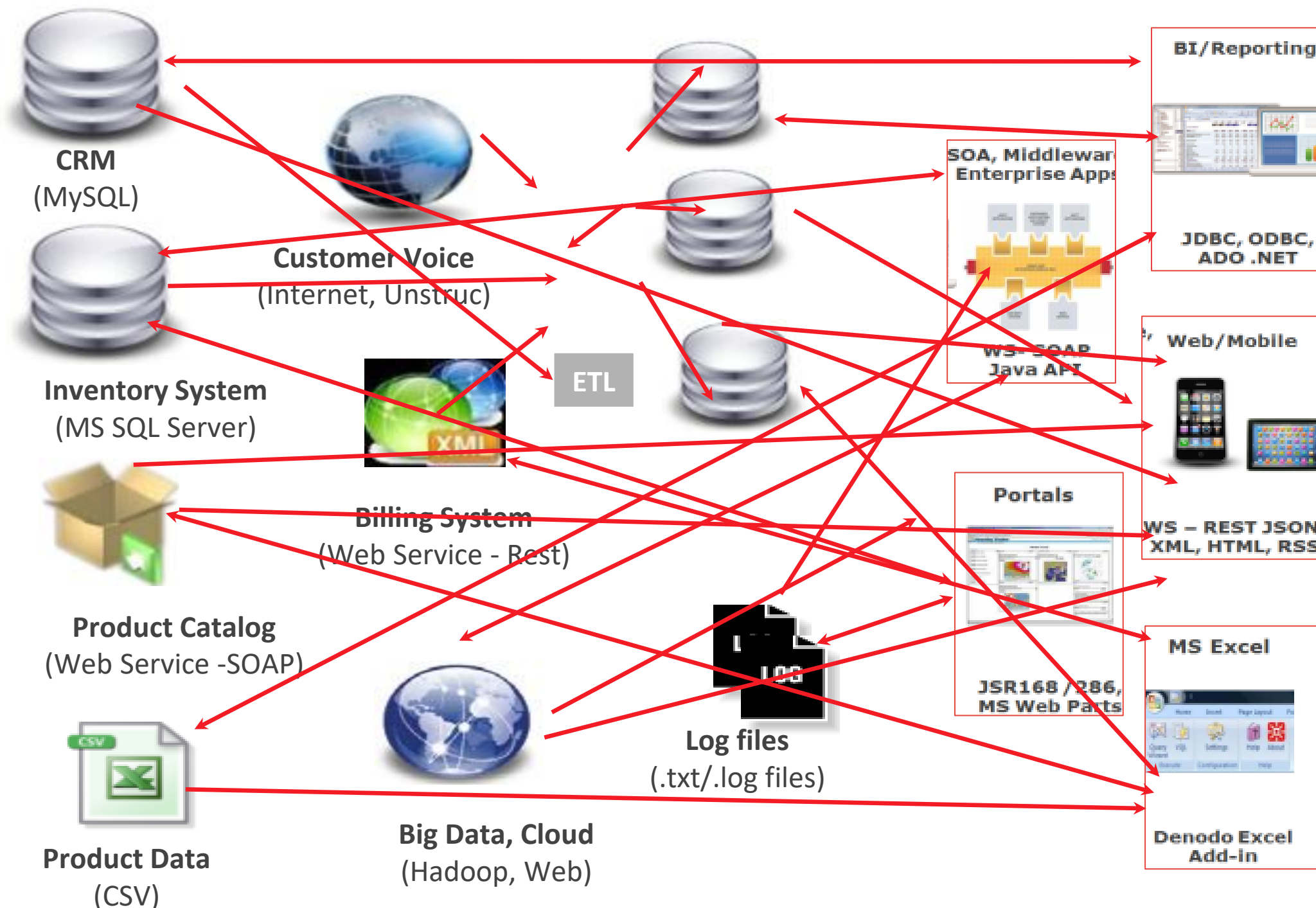
For more details on individual data sources, visit [Envision's Data Sources](#). To request a data source to be added, visit [Envision's Data Request Form](#).

UNCLASSIFIED

Traditional Data Replication & Point-to-Point Integration

No one is focused on Data Delivery

Unmanageable, brittle, duplicate data, security risks, high cost



IT Focus:
Data
Collection &
Storage

Business Focus:
Data Analysis &
Insights

This Is Why Data Management Has Been Elevated as a Top Business Priority

AI, ML & Analytics, Operational



Logistics



Research



Operations



Finance

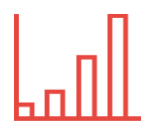


HR



Citizen
Services

Business Data Layer



Data Discovery and Data
Self-Service



Data Preparation,
Sharing & Delivery



Data Governance &
Security



Data Ecosystem
Monitoring & FinOps

Data Storage & Compute



KEY QUESTIONS

How to enable data exploration and preparation across multiple systems?

How to minimize data replication and data movement?

How to increase data sharing?

How to create and provision composite business data sets with agility?

How to minimize data computing costs in cloud?

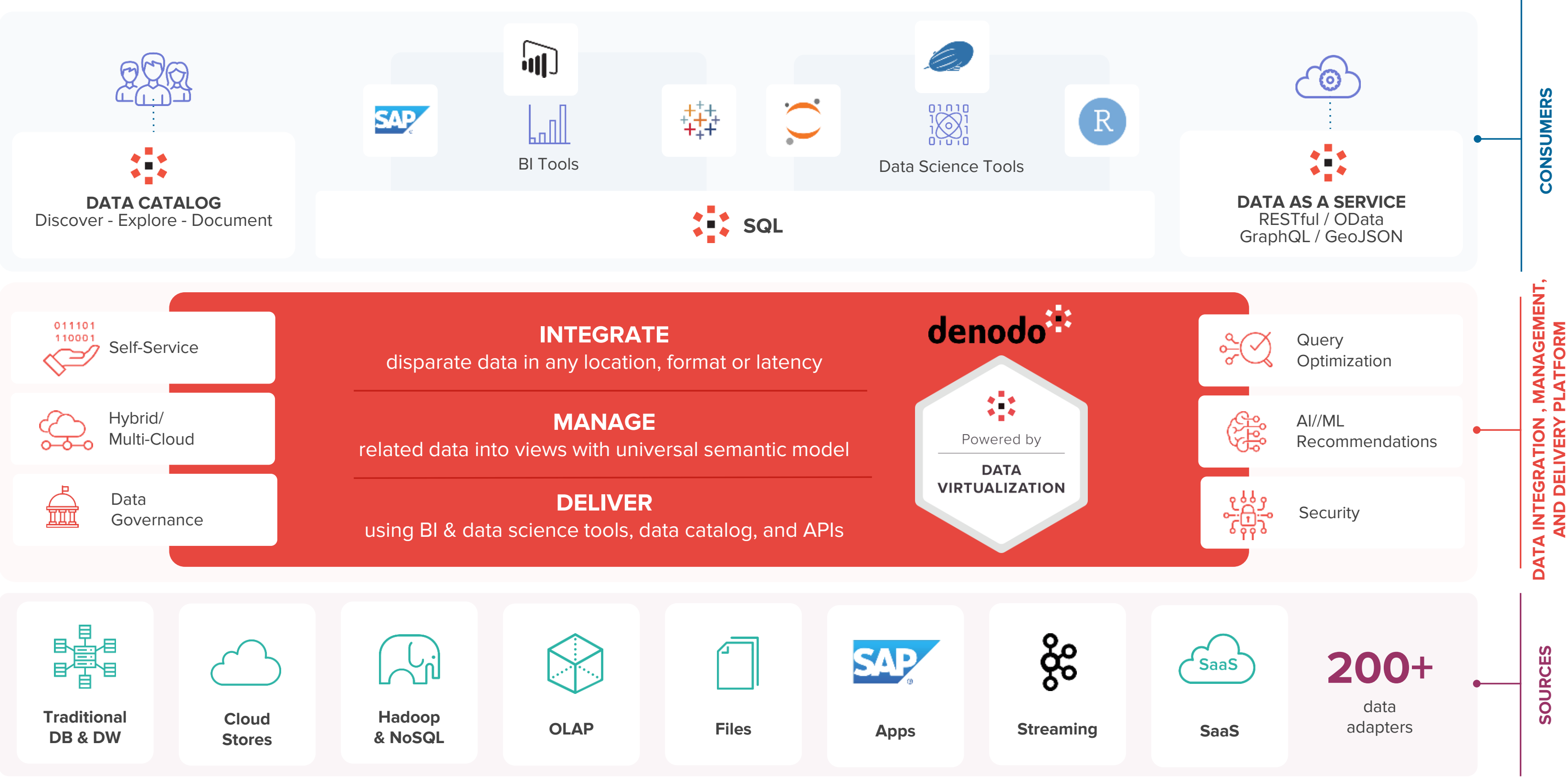
How to help increase data usage by all constituencies?

How to integrate the informational and operational data ecosystems?

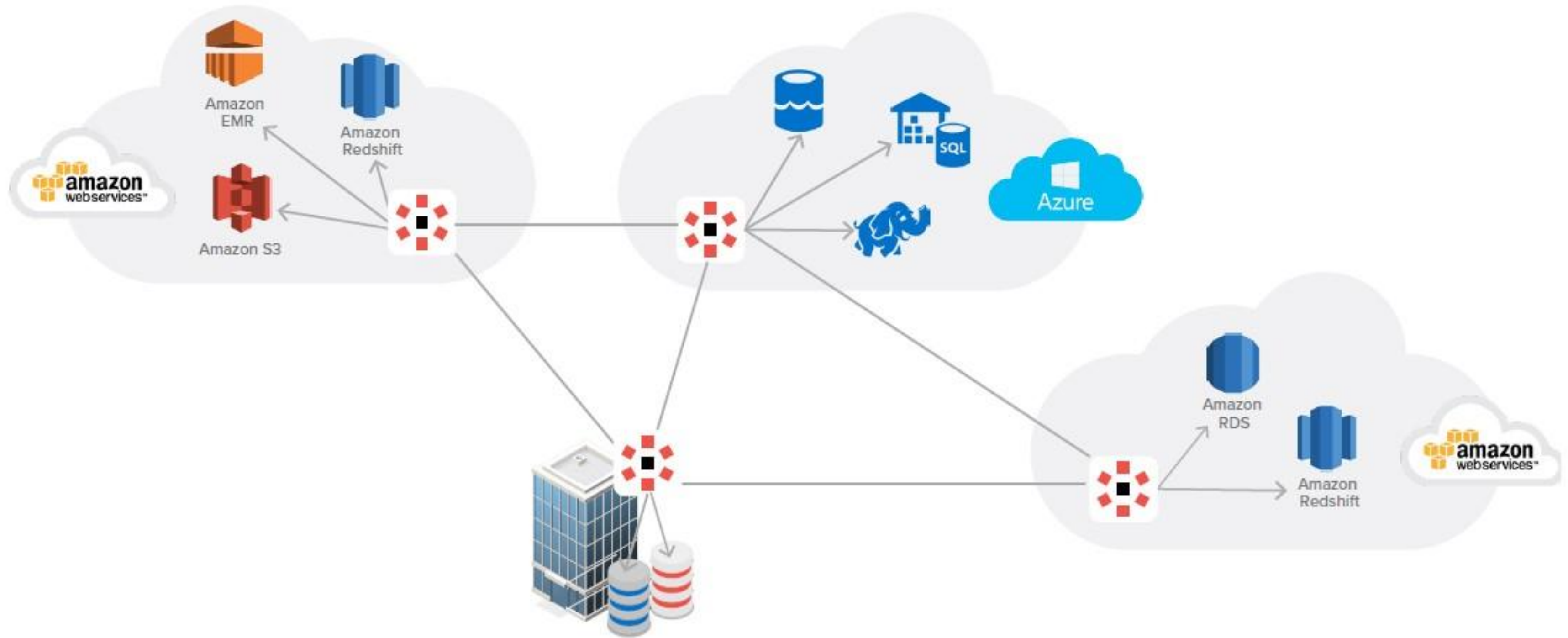
How to meet privacy and compliance requirements?

How to fully monitor and audit the corporate data ecosystem?

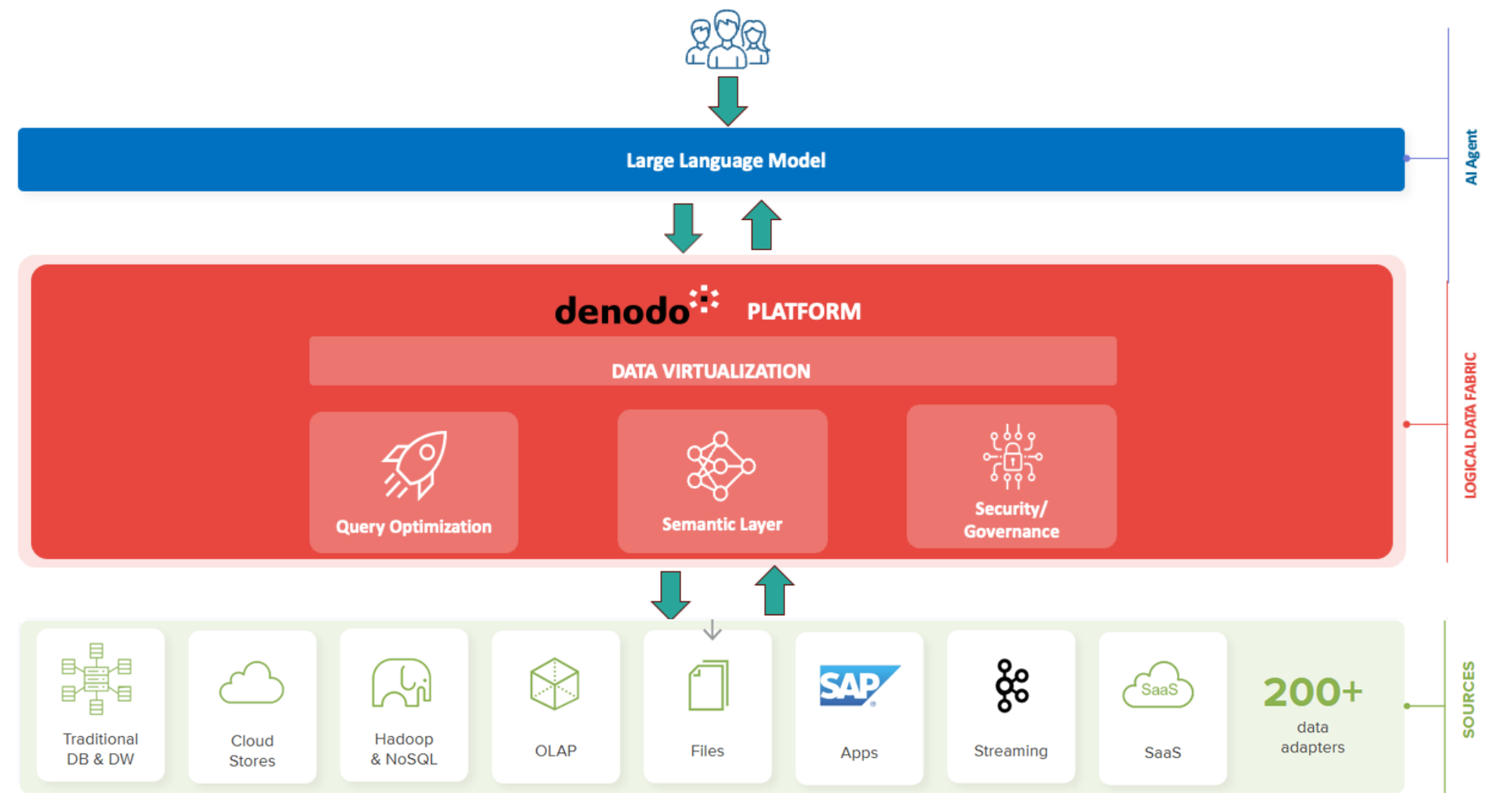
Denodo Platform Architecture



Denodo in a Multi-location Multi-Cloud Architecture

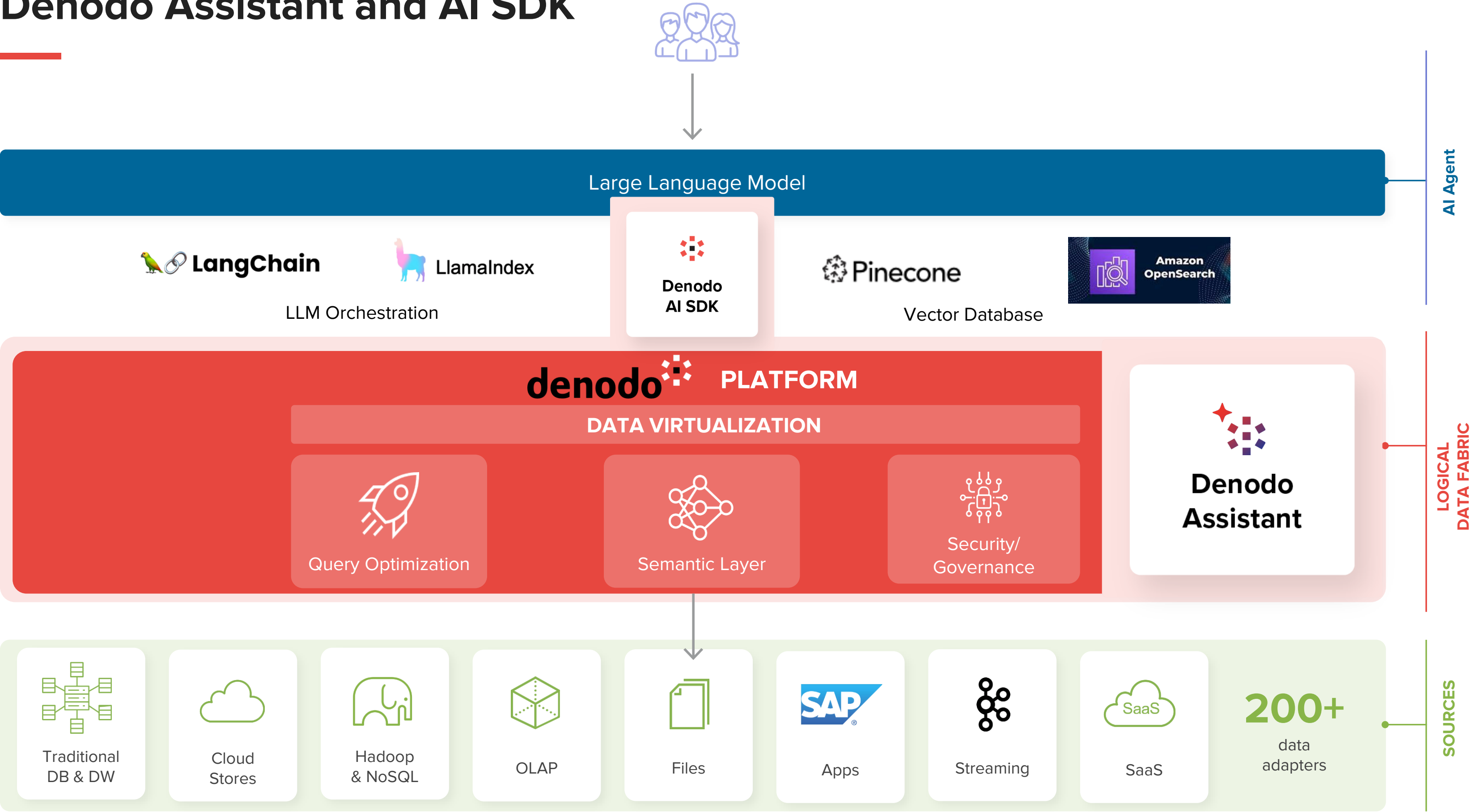


Denodo Provides a Trusted Data Foundation for Gen AI



- A unified, secure access point for LLMs to interact with and query all enterprise data
- A rich semantic layer, providing LLMs with the needed business context and knowledge
- Quick delivery of LLM-friendly data views that are de-coupled and abstracted from the underlying technical complexity
- Built-in query optimization for LLM workloads

Denodo Assistant and AI SDK



Denodo Assistant

By leveraging internal algorithms developed by Denodo and integrating with LLMs offered by the industry leaders, Denodo Assistant helps developers and users throughout the data product life cycle by intelligently answering questions, offering suggestions, and recommending optimal solutions.



Denodo Assistant – Intelligent/Automation Features

Intelligent autocomplete in VQL Shell based on usage activity

Automatic recommendations of datasets in the Data Catalog

Automatic Summary Recommendations

Query Wizard Recommendations

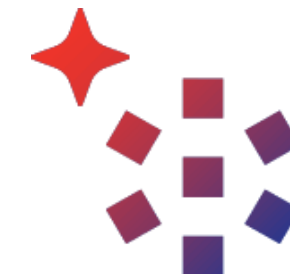
Data Prep Recommendations

Assisted Query

*View description suggestions

*Column name/description suggestions

Powered by Denodo
Assistant



Denodo Assistant in Modeling Wizards

* Server configuration

admin.bv_marketing

admin.bv_areas

SUMMARY

EDIT

OPTIONS

VQL

Save

Clear Changes

Source Refresh

Drop

?

View Schema

Metadata

View name

bv_mark

Field name		Field type
promotionid_0		int
description		text
startdate_0		text
enddate_0		text
product		int
area		text
type		text
discount		double
channel		text

Denodo Assistant: Suggested Field Descriptions

Click Ok to save the changes. Only the fields with selected check boxes will be saved.

<input checked="" type="checkbox"/> Field Name	Description	
<input type="text"/>		
<input checked="" type="checkbox"/> promotionid_0	The field 'promotionid_0' holds an integer identifier for a promotion, but it is not a primary key and its value can be nullable.	
<input checked="" type="checkbox"/> description	The 'description' field contains text describing a promotion. This field can accommodate nullable entries.	
<input checked="" type="checkbox"/> startdate_0	'startdate_0' is a text field indicating the starting date of a promotion. This field can contain nullable values.	
<input checked="" type="checkbox"/> enddate_0	The field 'enddate_0' contains text representing the end date of a promotion and may include nullable entries.	
<input checked="" type="checkbox"/> product	The 'product' field is an integer identifier linking to a specific product involved in a promotion, and it can have nullable values.	
<input checked="" type="checkbox"/> area	The 'area' field contains text specifying the geographical or organizational area of the promotion's application. This field can be nullable.	
<input checked="" type="checkbox"/> type	'type' is a text field describing the type of promotion being offered, and it can have nullable values.	
<input checked="" type="checkbox"/> discount	The 'discount' field stores a double precision number representing the discount percentage or amount offered in the promotion, and it can be nullable.	
<input checked="" type="checkbox"/> channel	'channel' is a text field that identifies the medium through which the promotion is offered (e.g., online, in-store), and this field can also be nullable.	

Discard

Accept

Denodo Assistant in VQL Shell

The screenshot displays the Denodo VQL Shell interface. The main editor shows a SQL query:

```
1 SELECT identificador_cliente_1,  
2        identificador_cliente_2,  
3        demo_actual_cliente,  
4        demo_hogar_actual_cliente,  
5        identificador_cliente_3,  
6        fecha_primera_envio,  
7        fecha_primera_venta,  
8        saludo,  
9        nombre,  
10       apellido,  
11       preferido,  
12       dia_nacimiento,  
13       mes_nacimiento,  
14       ano_nacimiento,  
15       pais_nacimiento,  
16       inicio_sesion,  
17       correo_electronico,  
18       fecha_ultima_revision  
19 FROM admin.customer_test_2;
```

Below the query editor are tabs for "Output" and "Execution Logs". A "Copy to Clipboard" button is visible at the bottom right of the editor area.

The "Denodo Assistant" panel on the right provides a welcome message and offers two main actions:

- Explain a query** (with a "Preview" button)
- Diagnose query** (with a "Preview" button)

Below these buttons, it states: "Denodo Assistant uses AI.Check for mistakes."

The "Explain a query" section shows a preview of the query being explained:

```
1 SELECT identificador_cliente_1,  
2        identificador_cliente_2,  
3        demo_actual_cliente,  
4        demo_hogar_actual_cliente,  
5        identificador_cliente_3,  
6        fecha_primera_envio,  
7        fecha_primera_venta,  
8        saludo,  
9        nombre,
```

The "Denodo Assistant" section provides a detailed explanation:

The query selects various fields from the admin.customer_test_2 view, including unique customer identifiers, demographic information, contact details, and important dates. This query retrieves specific data about customers stored in the customer_test_2 view.

- **Explain:** business purpose of a SQL query
- **Diagnose:** automatically detect and fix typos, syntax and grammar errors

Calling the LLM in SQL: ENRICH_AI () function

- Leverage the power of LLMs via SQL execution with access to table data
- Customizable prompt
- Role-based usage control
- Supports multiple use cases
 - Content Generation
 - Summarization
 - Entity Extraction
 - Classification
 - Sentiment analysis

The screenshot shows a SQL query editor with the following query:

```
1 select enrich_AI('Classify in "LOW" - "MEDIUM" "HIGH" the levels of cholesterol in the blood given this laboratory test in mg/dL. Answer just with "LOW" "MEDIUM" "HIGH" ' || tcho_0) from laboratory where tcho_0 IS NOT NULL limit 10
```

Below the query editor, there are tabs for Output, Execution Logs, and Query Results. The Query Results tab is active, showing the following results:

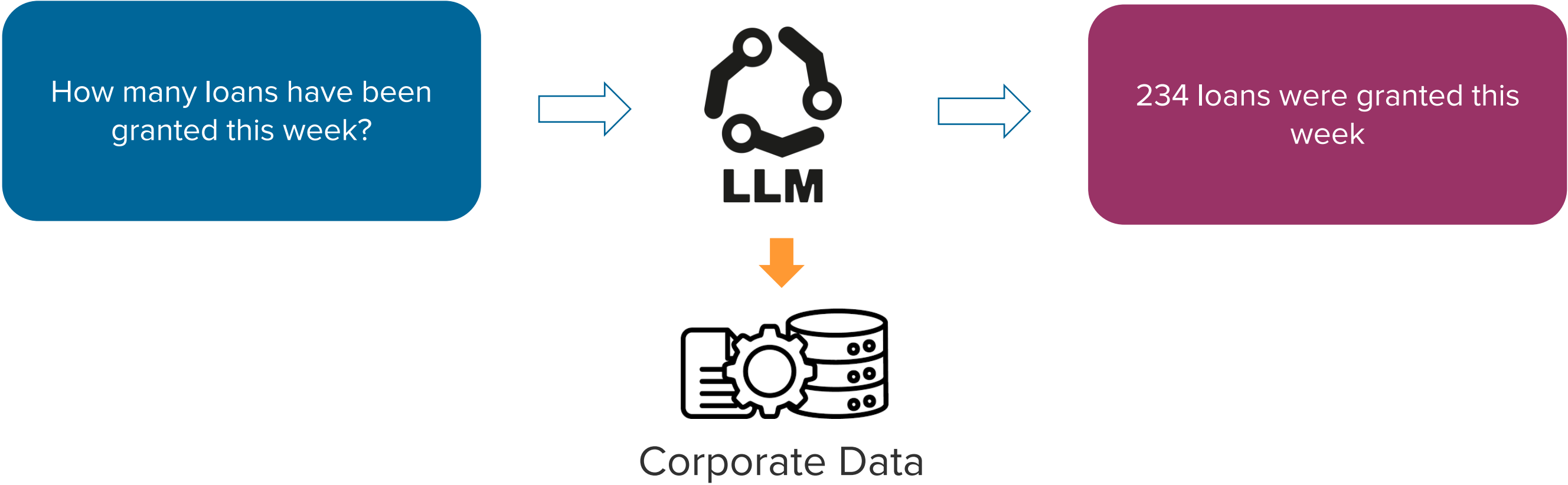
enrich_ai
MEDIUM
MEDIUM
MEDIUM
MEDIUM
LOW
MEDIUM

At the bottom of the results section, there are links for Refresh, Copy displayed results to clipboard, Save trace, and Copy trace to clipboard.

The Challenge for GenAI adoption



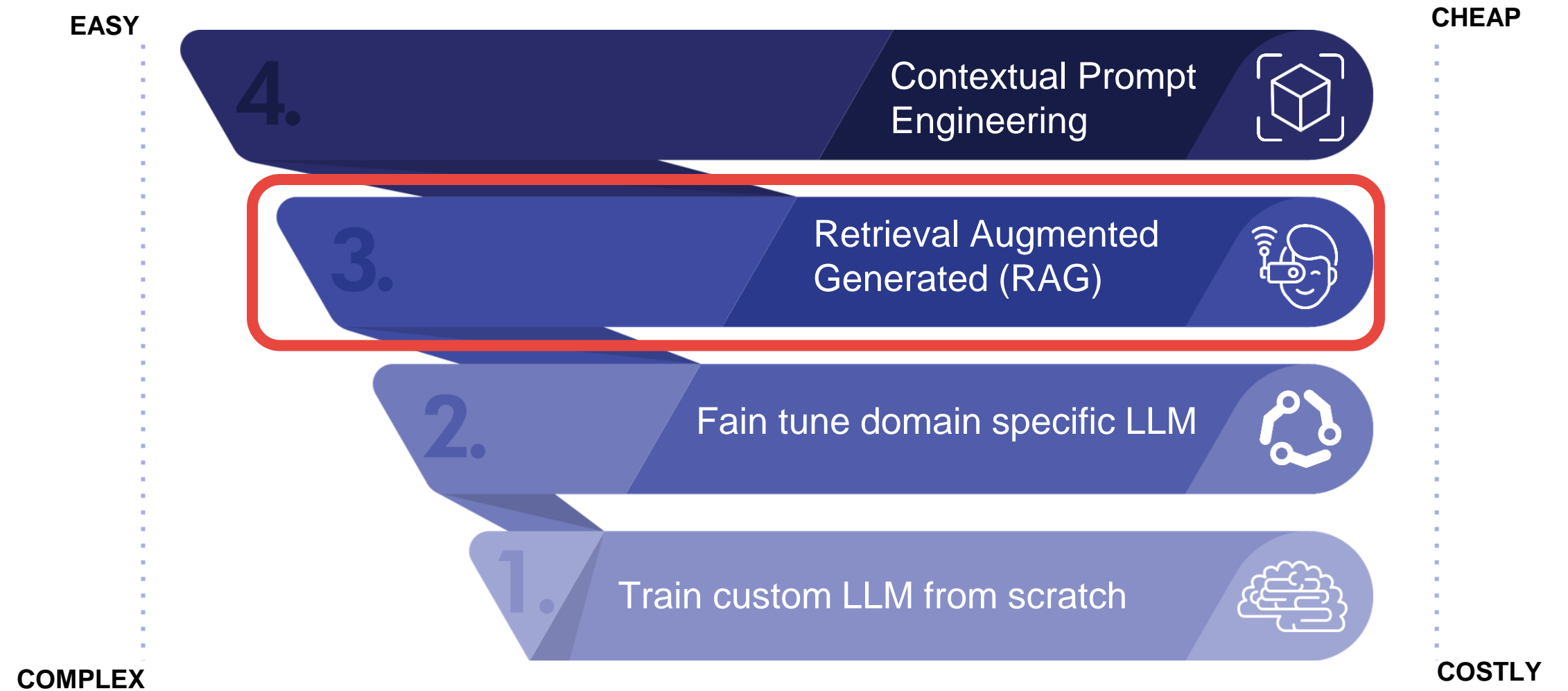
Augment LLM with Corporate Data and Knowledge



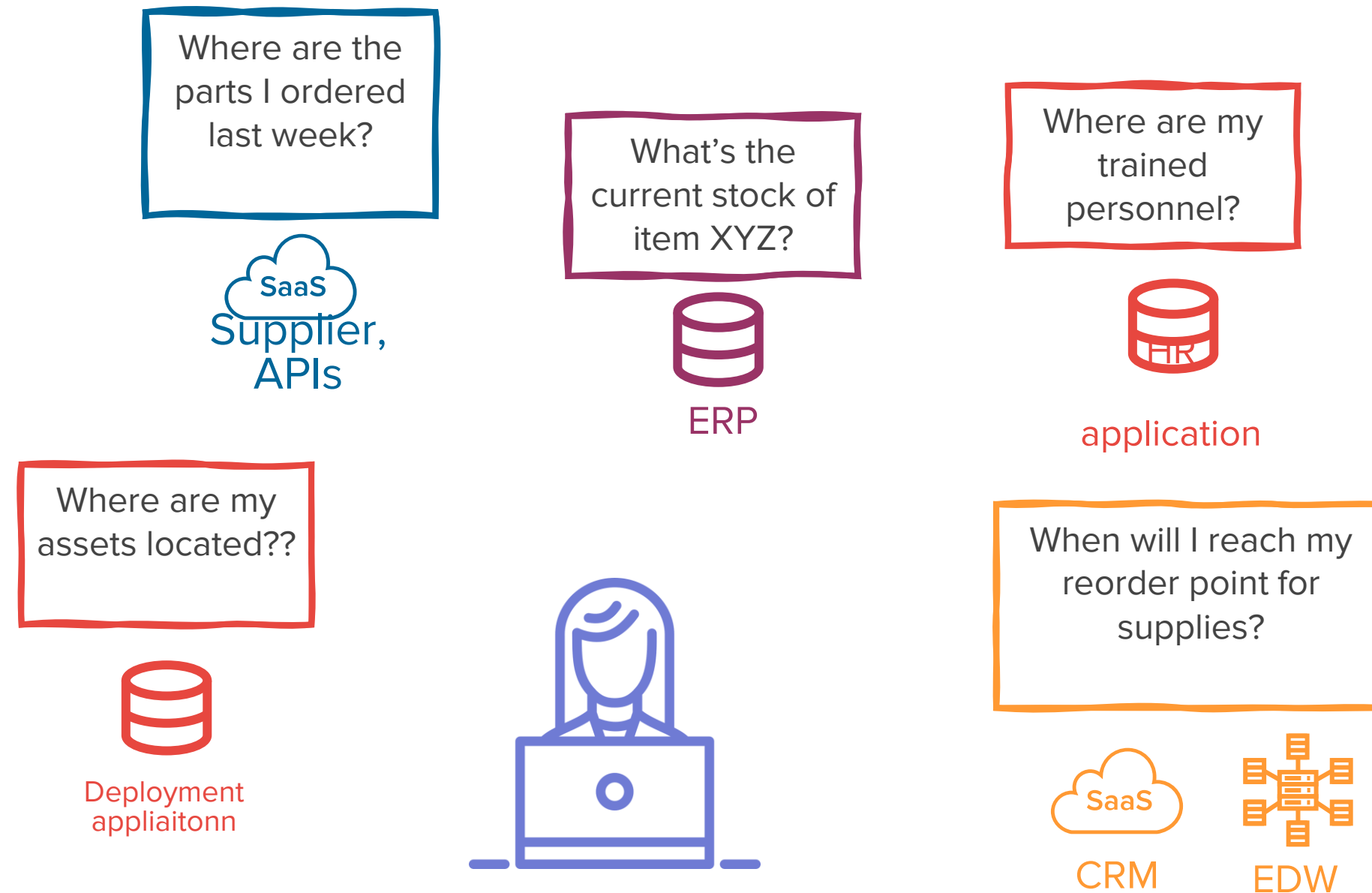
Building Smart Apps with GenAI

RAG is emerging as the standard for building Smart Apps with GenAI, integrating data retrieval for accurate, context-rich responses.

- **Enhances AI Accuracy:** Incorporates real-time, relevant enterprise data to reduce hallucinations and deliver precise, trustworthy outputs.
- **Contextual Intelligence:** Leverages domain-specific knowledge to create smarter, more personalized user interactions and decision-making.
- **Scalable Innovation:** Supports diverse applications, from chatbots to AI agents, empowering organizations to accelerate GenAI-driven initiatives.

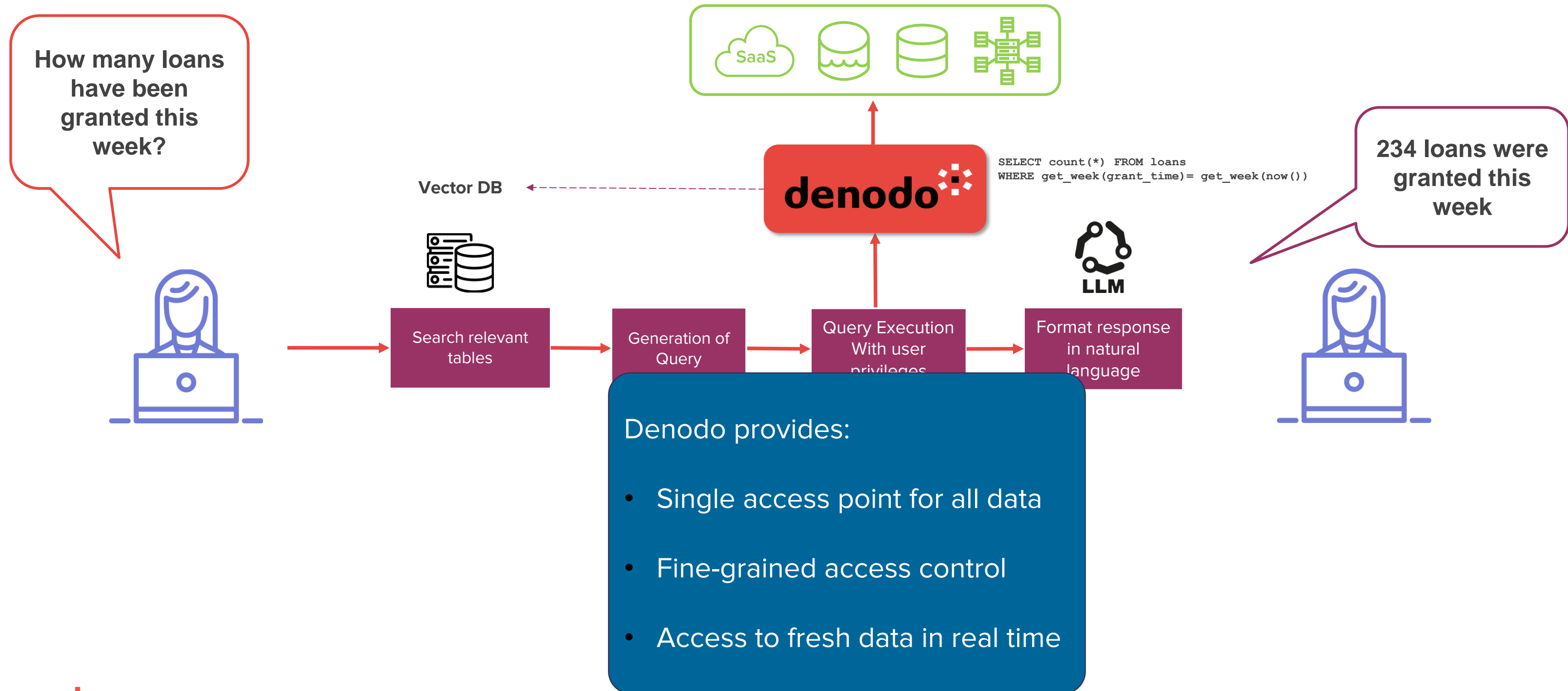


The Complexity of Conversing with your Data with genAI apps

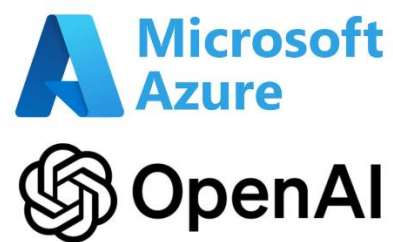
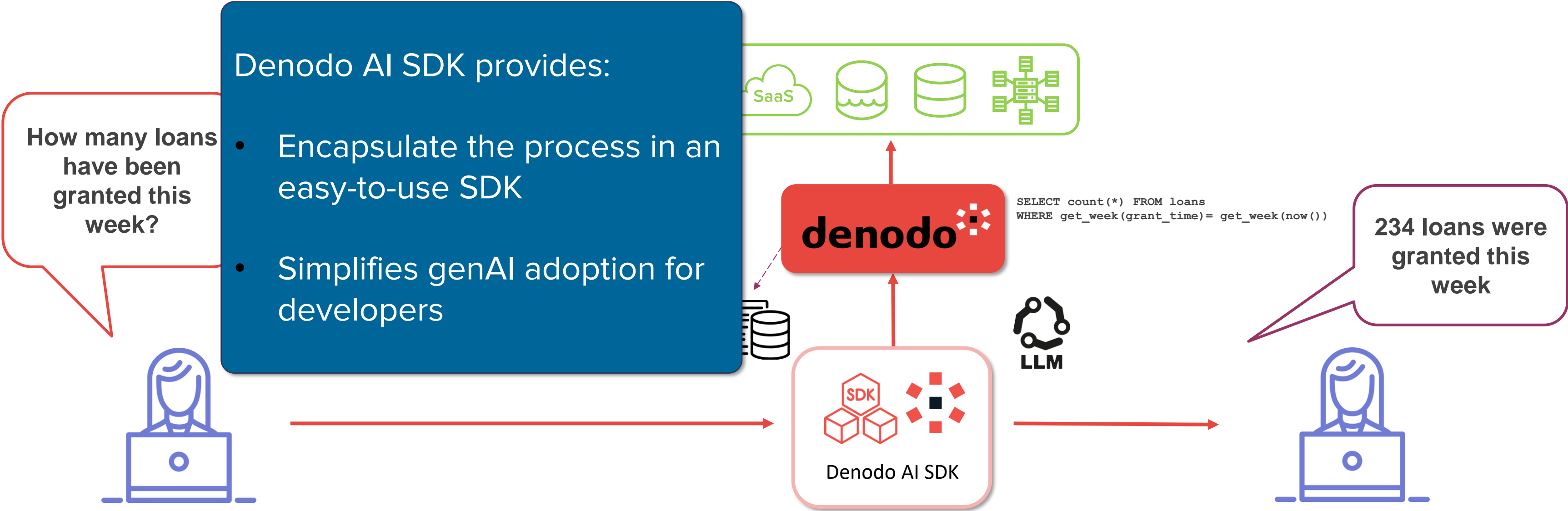


Information for these kind of genAI applications is often scattered in a variety of operational and analytical systems, both external and internal

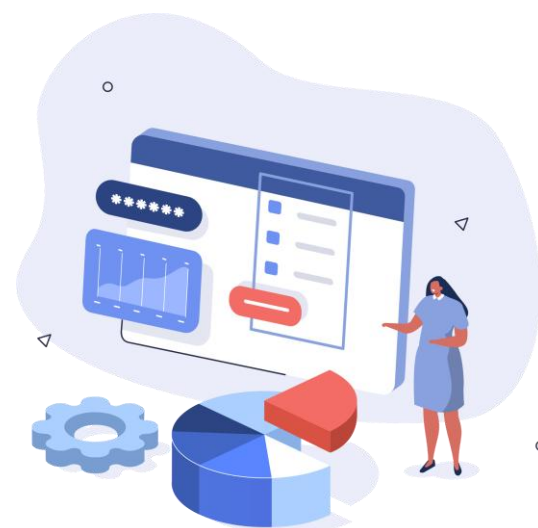
Denodo is Uniquely Equipped to Solve those Challenges!



Introducing Denodo AI SDK

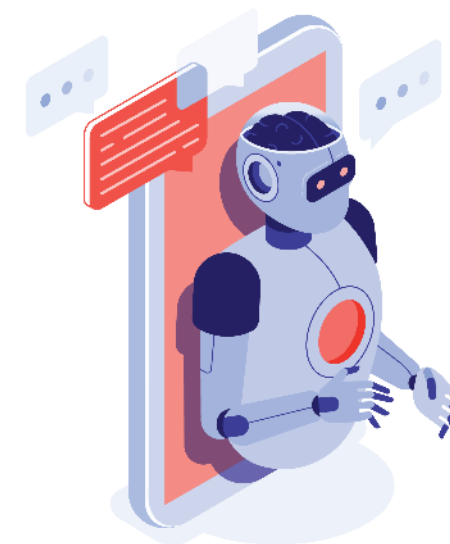


There Are Two Main Component of the AI SDK



REST API

- Pre-built orchestrations simplifying common GenAI patterns
- Simplifies the development so, companies can quickly bring new Chatbots or Agents to market quickly
- Offers both **metadata** and **data** query capabilities in natural language



Sample Chatbot App

- With some configuration you can have a chatbot up and running
- Available as open source, allowing you to see, review, and customize
- **Talk to your data, in minutes!**

Denodo AI SDK REST APIs

Denodo AI SDK API 0.3 OAS 3.1




















[/openapi.json](#)

Be fearless.

Authorize 

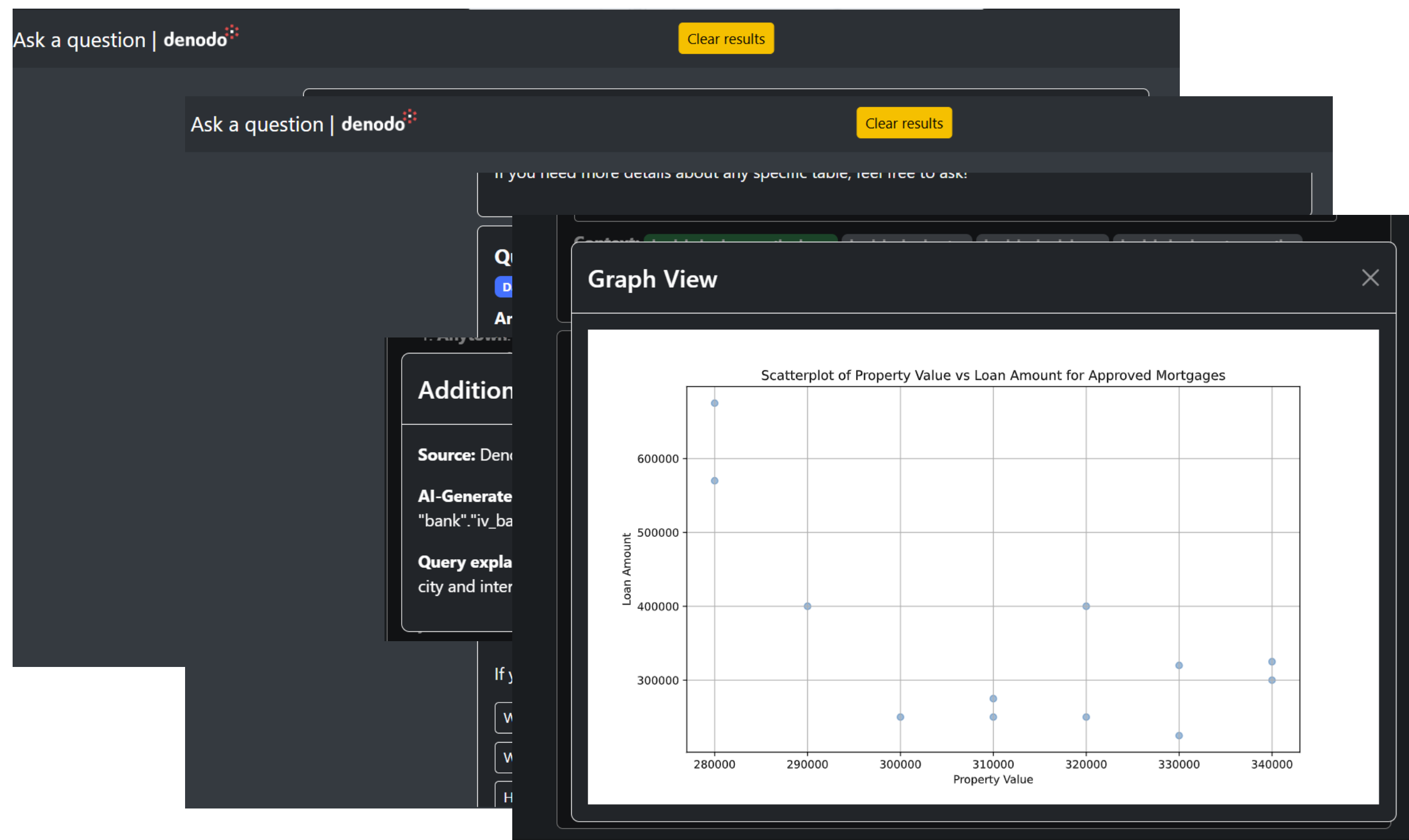
default



GET	/getMetadata	Getmetadata			
GET	/getConcepts	Getconcepts			
GET	/similaritySearch	Similaritysearch			
GET	/streamAnswerQuestion	Streamanswerquestion			
GET	/streamAnswerQuestionUsingViews	Streamanswerquestionusingviews			
GET	/answerQuestion	Answerquestion			
GET	/answerDataQuestion	Answerdataquestion			
GET	/answerMetadataQuestion	Answermetadataquestion			
GET	/answerQuestionUsingViews	Answerquestionusingviews			

Denodo AI SDK Example Chatbot

- Written in Python and Langchain
- Uses the Denodo AI SDK APIs
- Quick and easy deployment for pilots and project acceleration
- Open source and fully customizable



Build Third-Party Integrations in Minutes



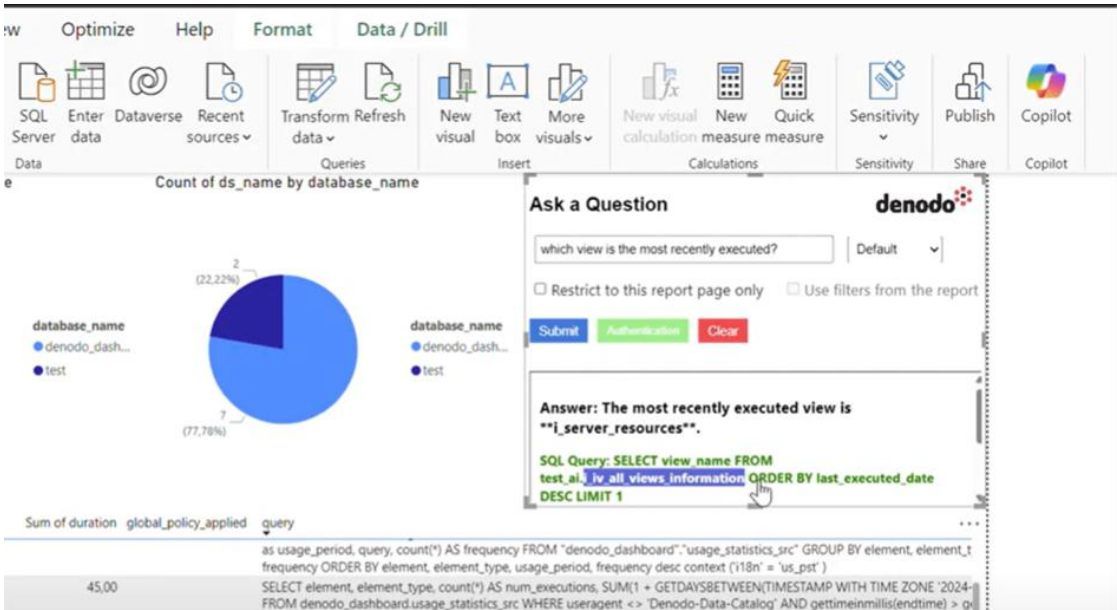
Powerful app | 1:24 PM

Powerful app: can you show me the top 10 most expensive loans and the corresponding loan officer that issued them?

Powerful app: Here are the top 10 most expensive loans along with the corresponding loan officers:

Loan ID	Loan Amount	Interest Rate	Term	Loan Officer Name	Loan Officer Email	Loan Officer Phone Number
9	\$675,000.00	4.0%	20	Michael Brown	michael.brown@example.com	555-345-6789
3	\$570,000.00	4.0%	20	Carlos Perez	carlos.perez@example.com	555-123-4567
11	\$400,000.00	3.5%	10	Carlos Perez	carlos.perez@example.com	555-123-4567
22	\$400,000.00	3.75%	15	Martha Vargas	martha.vargas@example.com	555-234-5678
17	\$400,000.00	3.5%	10	Karen Diaz	karen.diaz@example.com	555-789-0123
16	\$400,000.00	3.5%	10	Jennifer Lopez	jennifer.lopez@example.com	555-678-9012
16	\$350,000.00	4.25%	25	Nancy Flores	nancy.flores@example.com	555-678-9012
4	\$350,000.00	4.25%	25	Sarah Davis	sarah.davis@example.com	555-456-7890
7	\$325,000.00	3.75%	15	Robert Garcia	robert.garcia@example.com	555-789-0123
10	\$320,000.00	3.75%	15	Laura Gonzalez	laura.gonzalez@example.com	555-012-3456

SELECT loan_id, loan_amount, interest_rate, term, CONCAT(j.first_name, ' ', o.last_name) AS "Loan Officer Name", o.email AS
FROM bank.bank_loans l
JOIN bank.bank_loanofficers o ON loan_officer_id = o.loan_officer_id
ORDER BY loan_amount DESC
LIMIT 10;



Intrigued about the possibilities of Denodo's AI SDK? Try it yourself!

Follow these steps to get started!

1. Download [Denodo Express](#) if you don't have Enterprise Plus yet
 2. Read the step-by-step tutorial [Building an AI Chatbot with Denodo in Minutes](#)
 3. Review the documentation [Denodo AI SDK Guide](#)
 4. Dive into the open-source code of [Denodo AI SDK](#) in Github
- Curious about more advance uses of the technology? Check out these KB articles:
 - [Adding session memory to your Denodo AI SDK chatbot](#)
 - [Integrating the Denodo AI SDK in a Slack bot](#)
 - [Integrating the Denodo AI SDK in a MS Teams bot](#)



The Denodo Platform enables RAG

Metadata

- Provides Gen AI Apps with the information they need
- Data schemas, business names, field descriptions with contextual information.

Semantic layer

- Makes data stored in the canonical data platforms accessible with one consistent and secure interface for GenAI Applications

Exposes 'AI-friendly' views to Gen AI

- Basic LLMs struggles with complex queries involving many JOINS
- Denodo can simplify the automatic generation of SQL by LLMs

Key Take-Aways

- **By 2026, 80% of businesses will adopt Gen AI (Gartner).** There are hundreds of possible use cases
- Generative AI enables the use of Natural Language for **data management**, and will automate data preparation and enrichment
- Denodo makes Gen AI better: Denodo provides **Foundation of Trusted Data** to unleash the full potential of Gen AI applications.



Data Management



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Thanks!



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