

快速建立強大的虛擬數據中台

Denodo 虛擬數據中台以資料不落地的獨特技術，協助企業實現資料的快速整合與高效利用。通過虛擬數據中台，打破數據孤島，加速業務洞察。



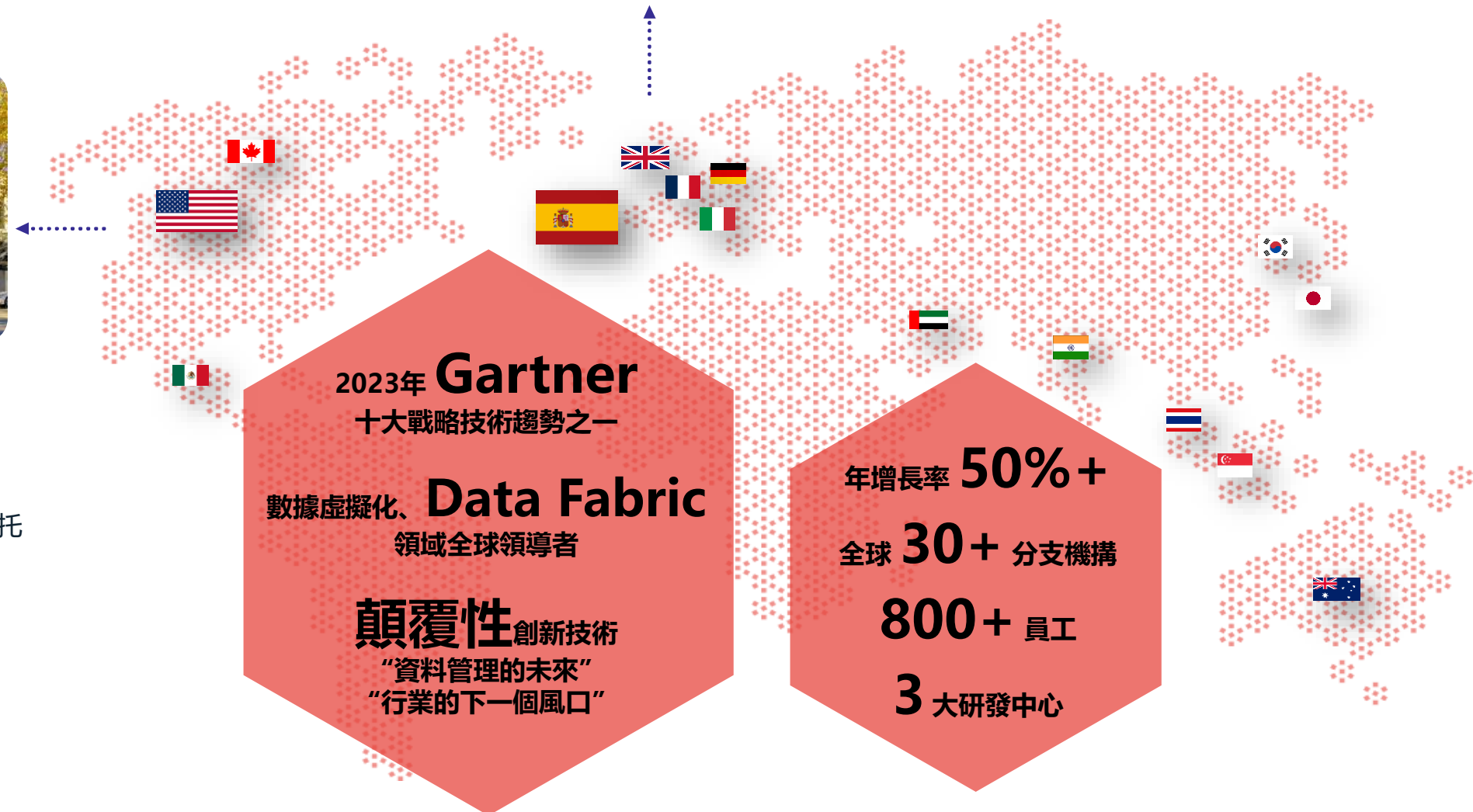
Denodo: 資料管理領域的全球領導者



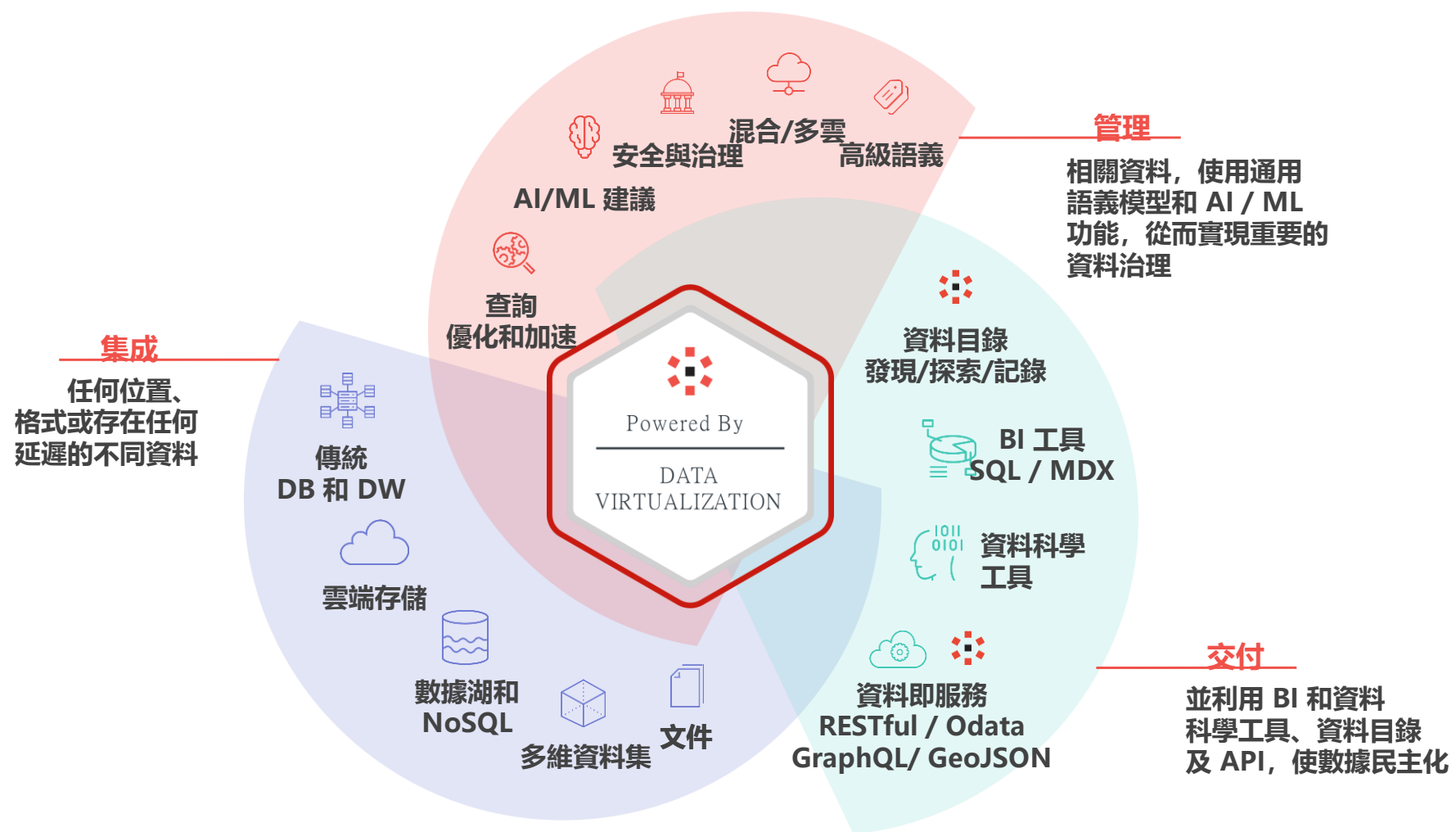
- 1999年于西班牙成立
- 新一代歐洲科技獨角獸
- 全球總部: 西班牙, 拉科魯尼亞 (朝聖之路終點)
- Denodo: 加利西亞語 "勇氣、決心"



- 2005年入駐矽谷
- 全球第二總部: 美國, 帕羅奧托



Denodo 平台：所有資料的一站式邏輯平台



- 減少 65% 的交付時間 (與 ETL 相比)
- 減少 67% 的資料準備工作
- 縮短 83% 的獲利時效

關鍵差異化優勢



易於使用



查詢回應快速



集成的主動資料目錄



通用連接



現代資料服務 API 層



動態資料脫敏



自動化雲管理

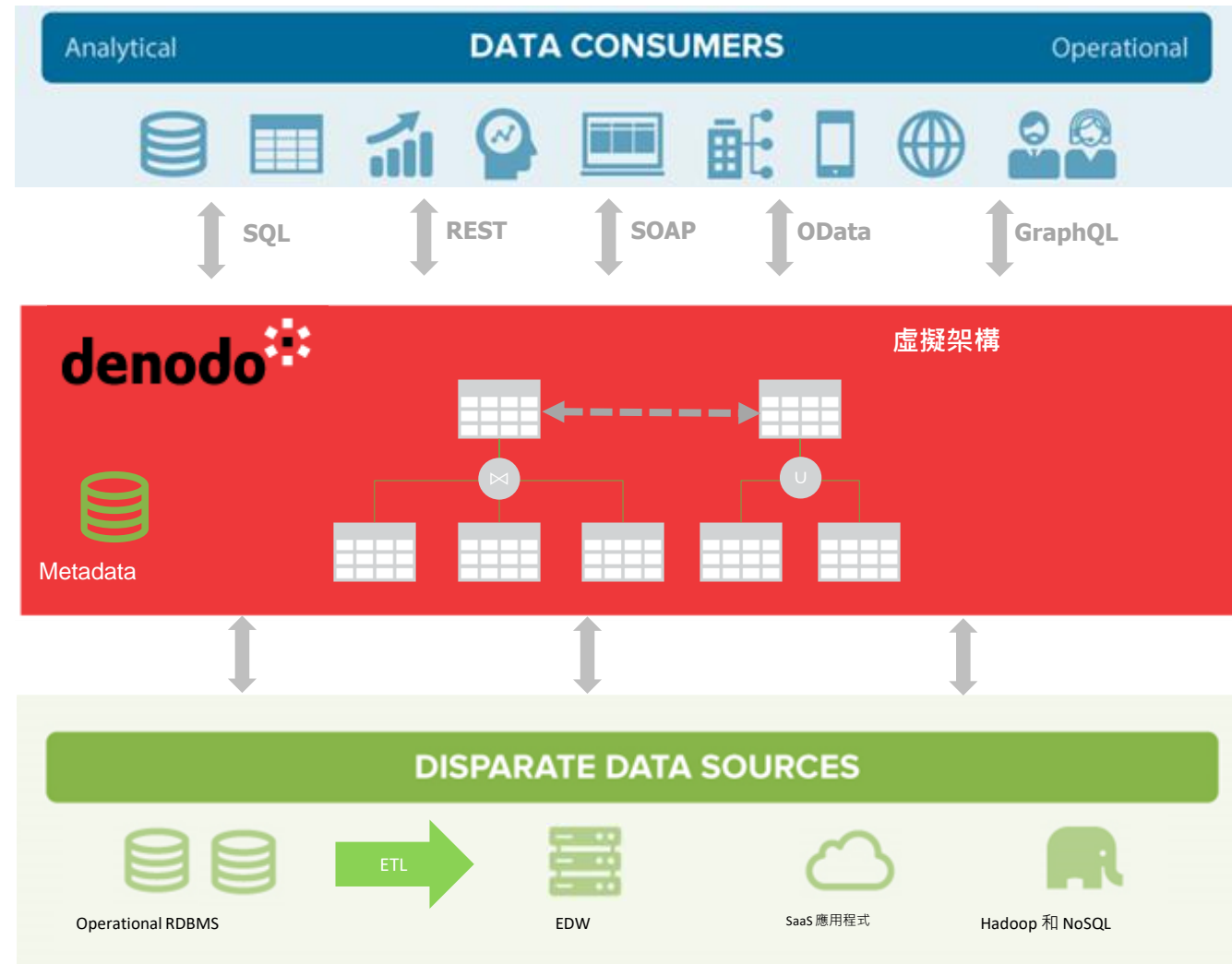
實體數據中台：常見問題

1. 資料即時性不足
2. 查詢效能不佳
3. 資料整合困難
4. 擴充性不佳
5. 資料存取權限管理不易

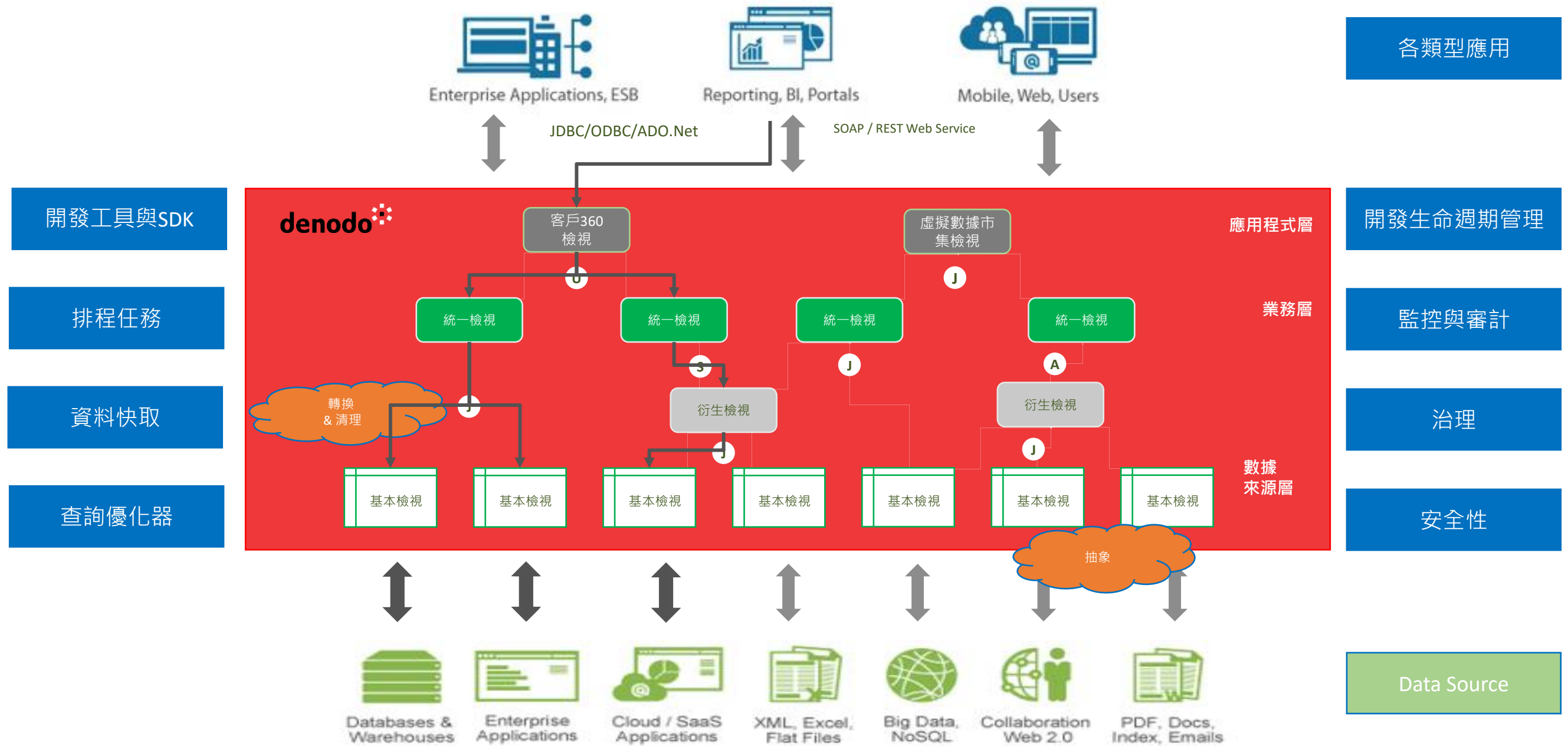
Denodo 架構簡介



Denodo 虛擬架構

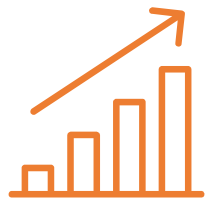


它是如何運作的？



資料開放共用 - 支援多種訪問方式

構建統一的資料服務平臺： 提供多種資料共用方式，多種SQL訪問、各種API服務、跨平臺的資料目錄等。靈活的支援不同業務、不同形式、不同場景下的資料訪問，並且可以自由變換。業務部門可以用習慣的工具訪問統一的資料模型。



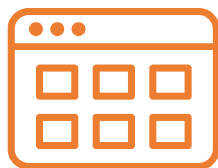
基於 SQL 訪問

- JDBC、ODBC 和 ADO.NET
 - 與報告工具集成Tableau、MicroStrategy、PowerBI、BO、Cognos、Looker、OBIEE等
 - 定制應用程式



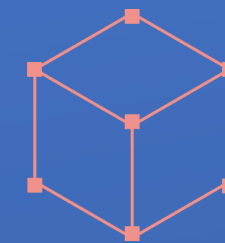
各種API 服務

- 多種格式
 - RESTful、OData 4.0、SOAP、GraphQL
- 符合現代標準：OAuth、JWT、SAML、OpenAPI

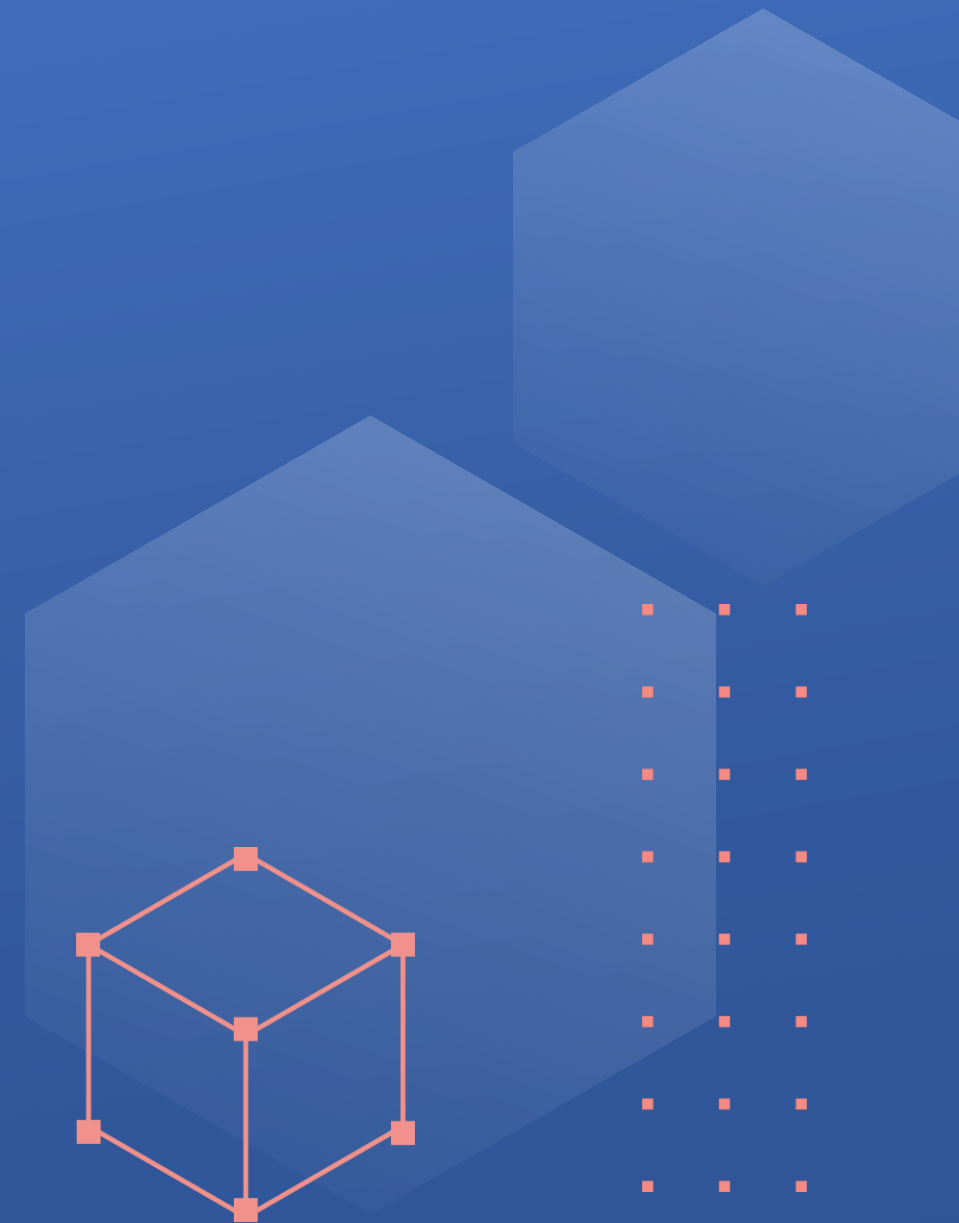
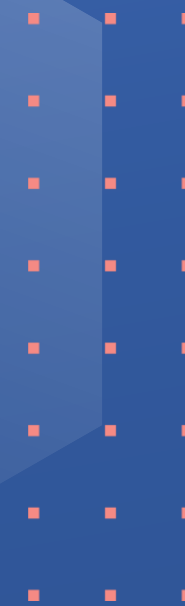
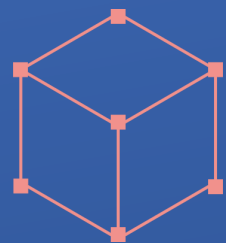


跨平臺的數據目錄

- 供業務用戶使用的基於 Web 的探索和發現工具



性能優化策略



Denodo Platform – 針對性能優化有哪些特定策略

- 四層性能優化

1. 查詢重寫

- 將處理推送到資料所在位置，最大限度地減少通過網路的資料量

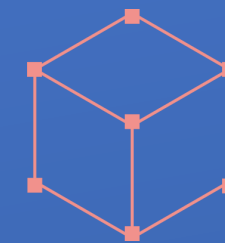
2. MPP查詢加速

- 卸載處理到同一位置的MPP集群

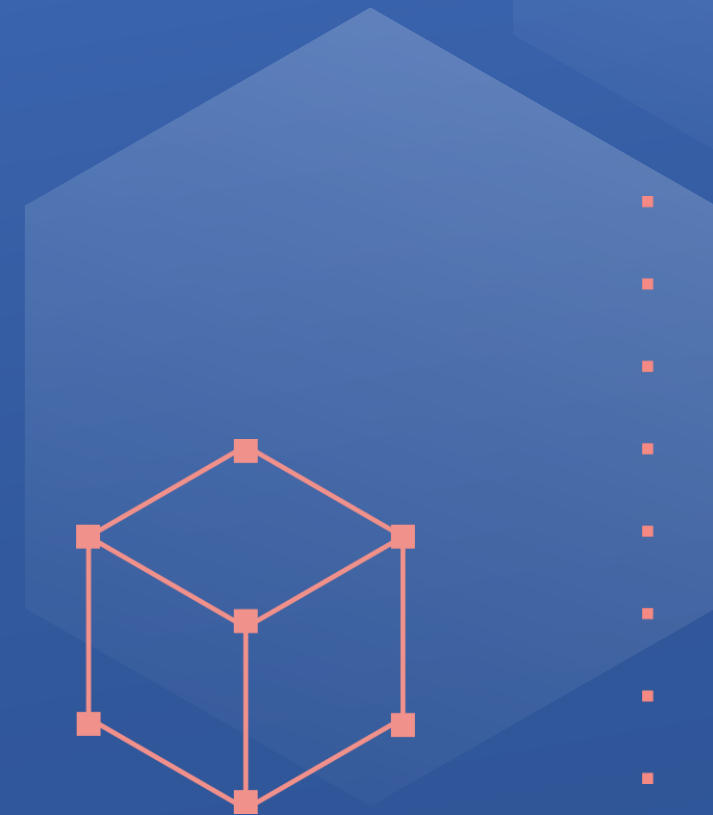
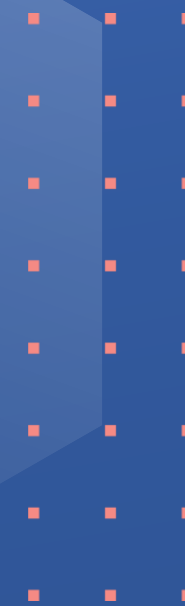
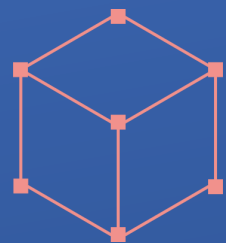
3. 智慧查詢加速（匯總資料）

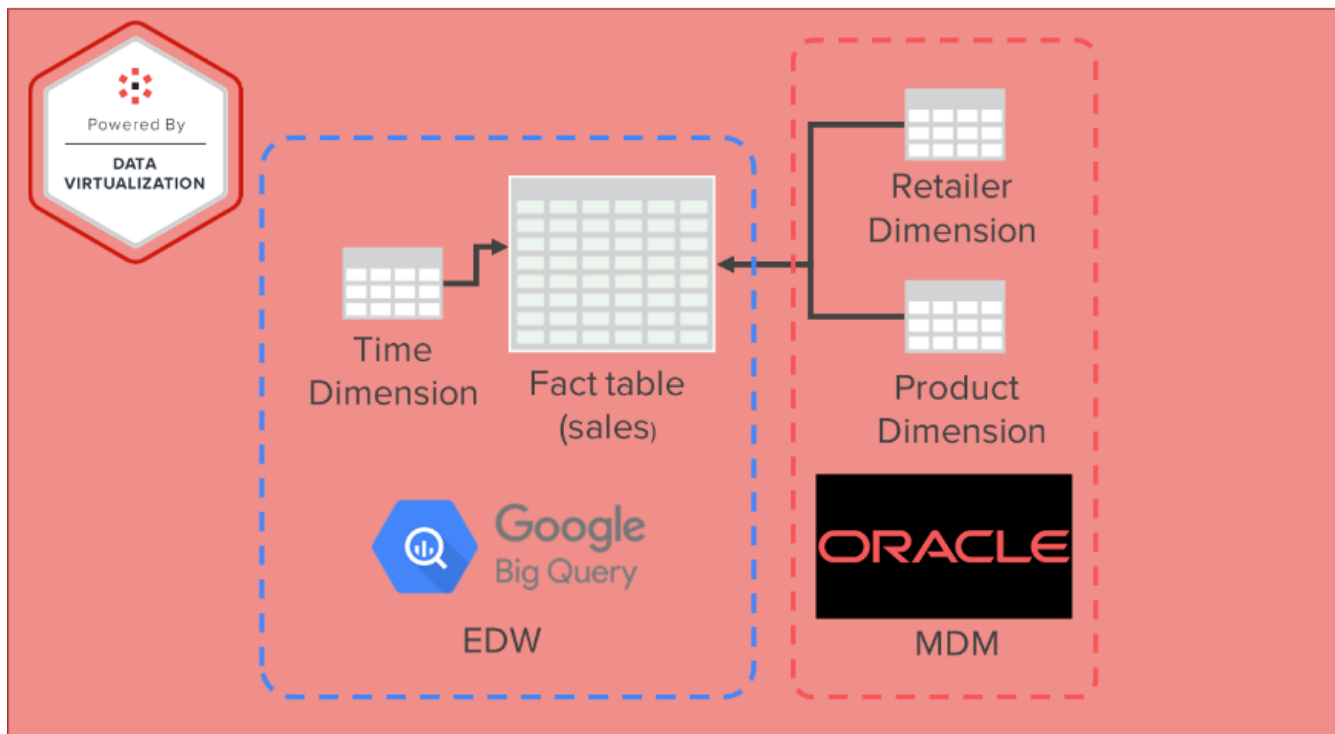
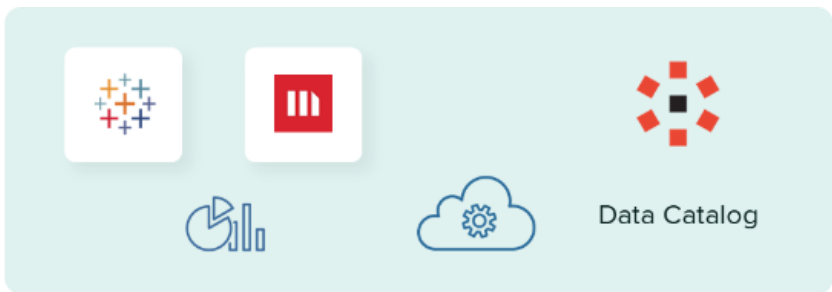
4. 快取

- 將資料快取在本地快取中以提高性能



查詢重寫





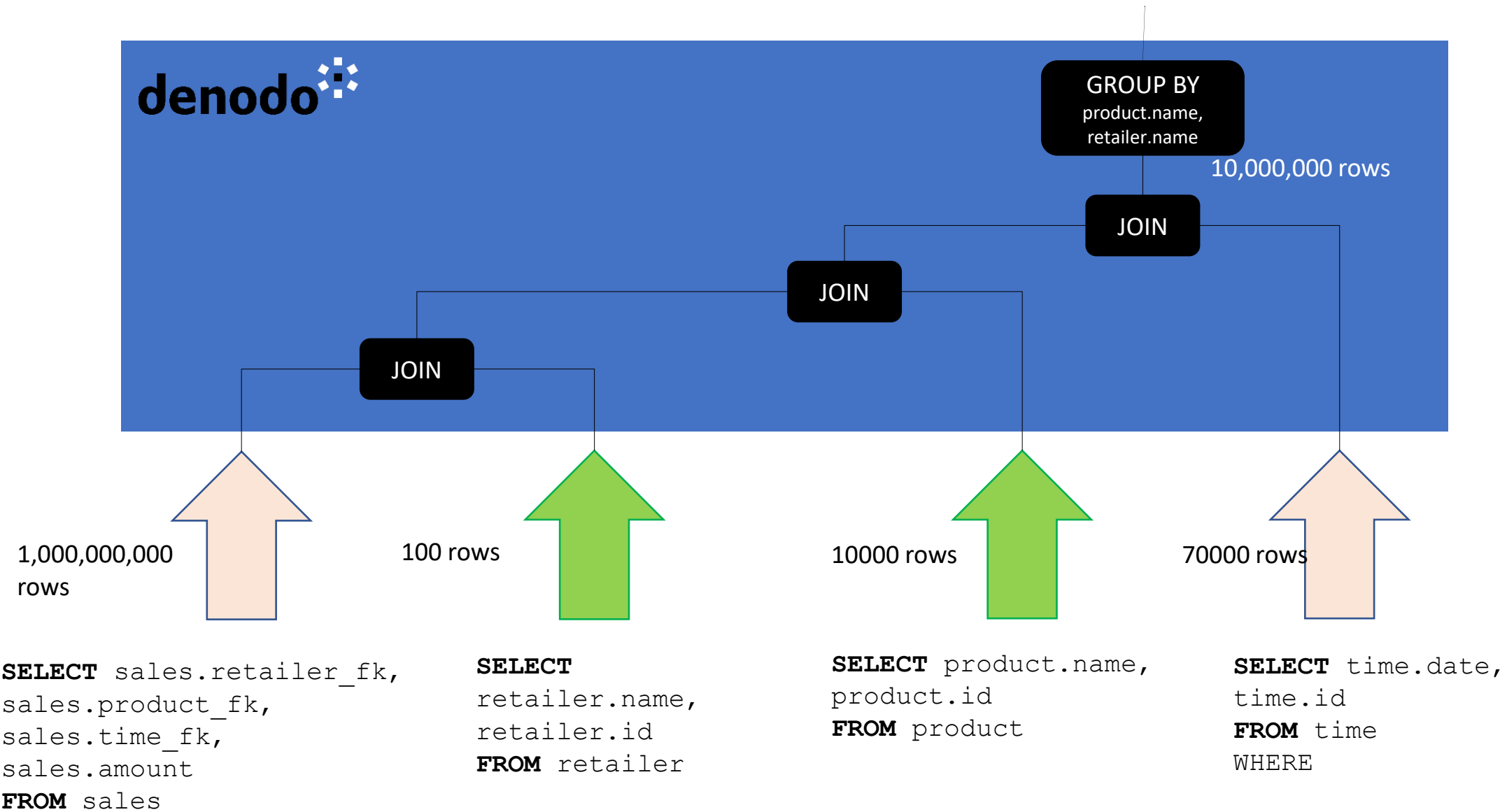
```

SELECT retailer.name,
product.name,
SUM(sales.amount)
FROM
sales JOIN retailer ON
sales.retailer_fk = retailer.id
JOIN product ON sales.product_fk =
product.id
JOIN time ON sales.time_fk = time.id
WHERE time.date < ADDMONTH(NOW(),-1)
AND product.brand = 'ACME'
GROUP BY product.name, retailer.name

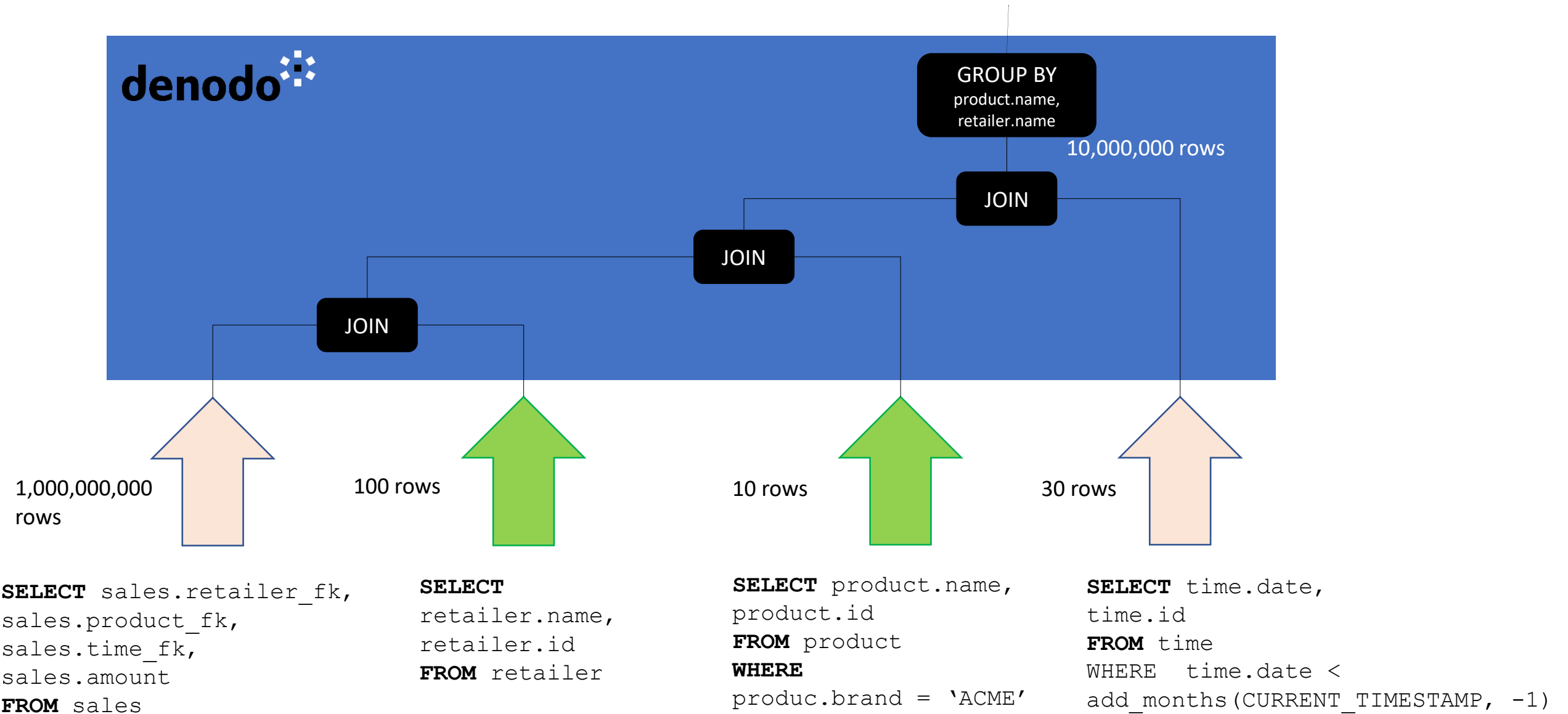
```

ACME 品牌上個月按零售商和產品劃分的總銷售額

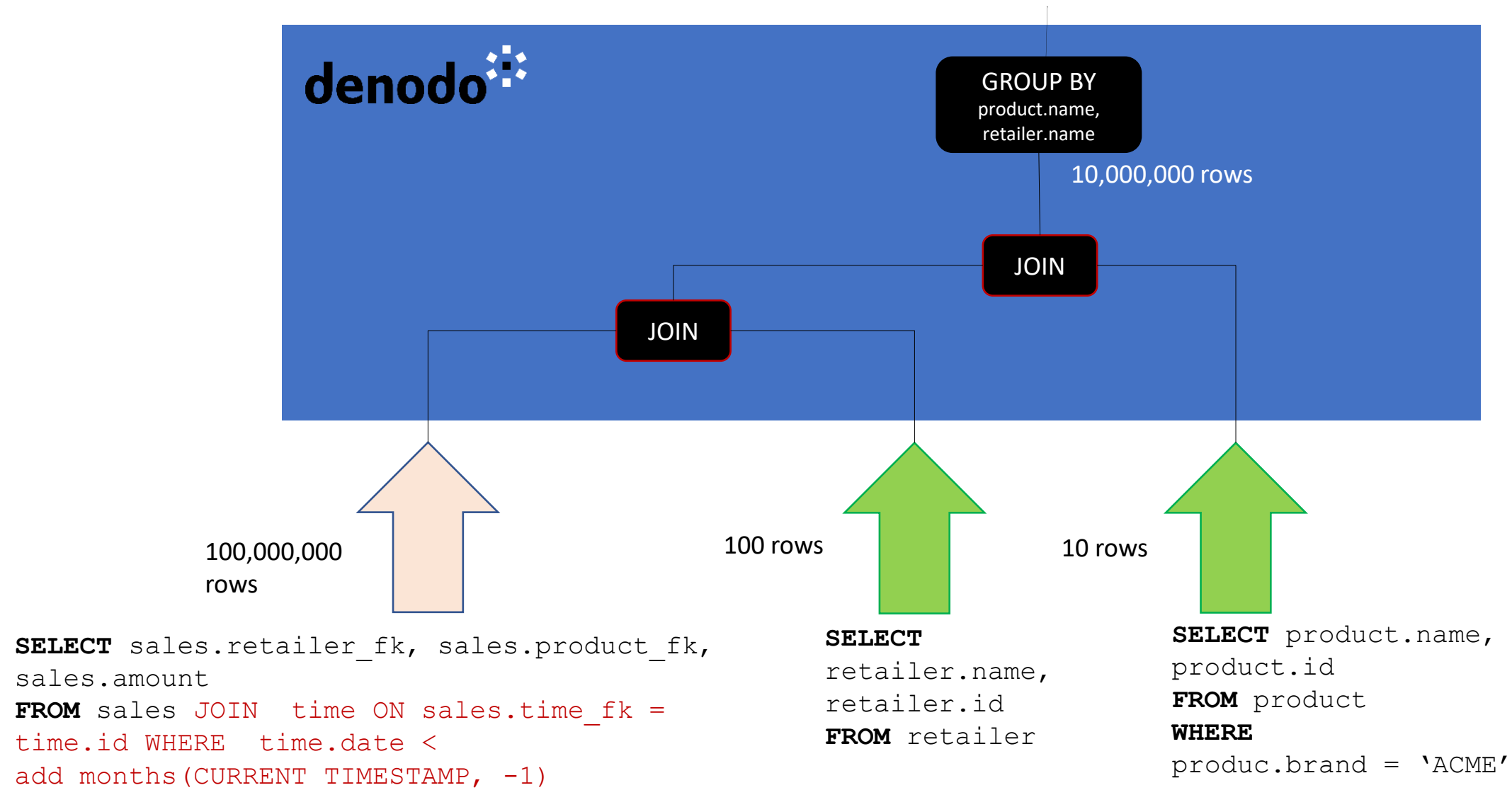
優化前



優化步驟 1 - 應用篩檢程式



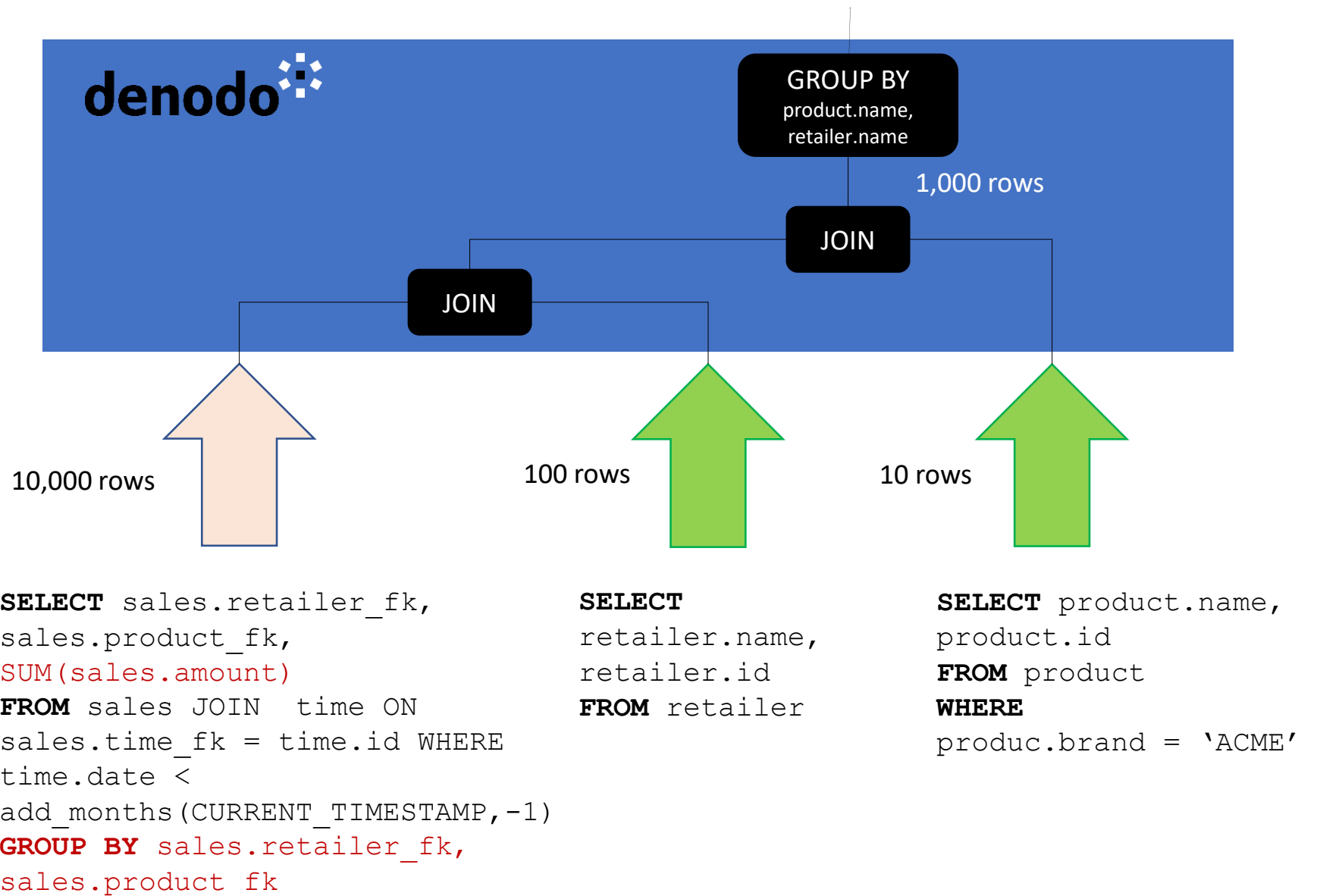
優化步驟2 – JOIN 重新排序以最大化委派



優化步驟3 - 部分聚合下推

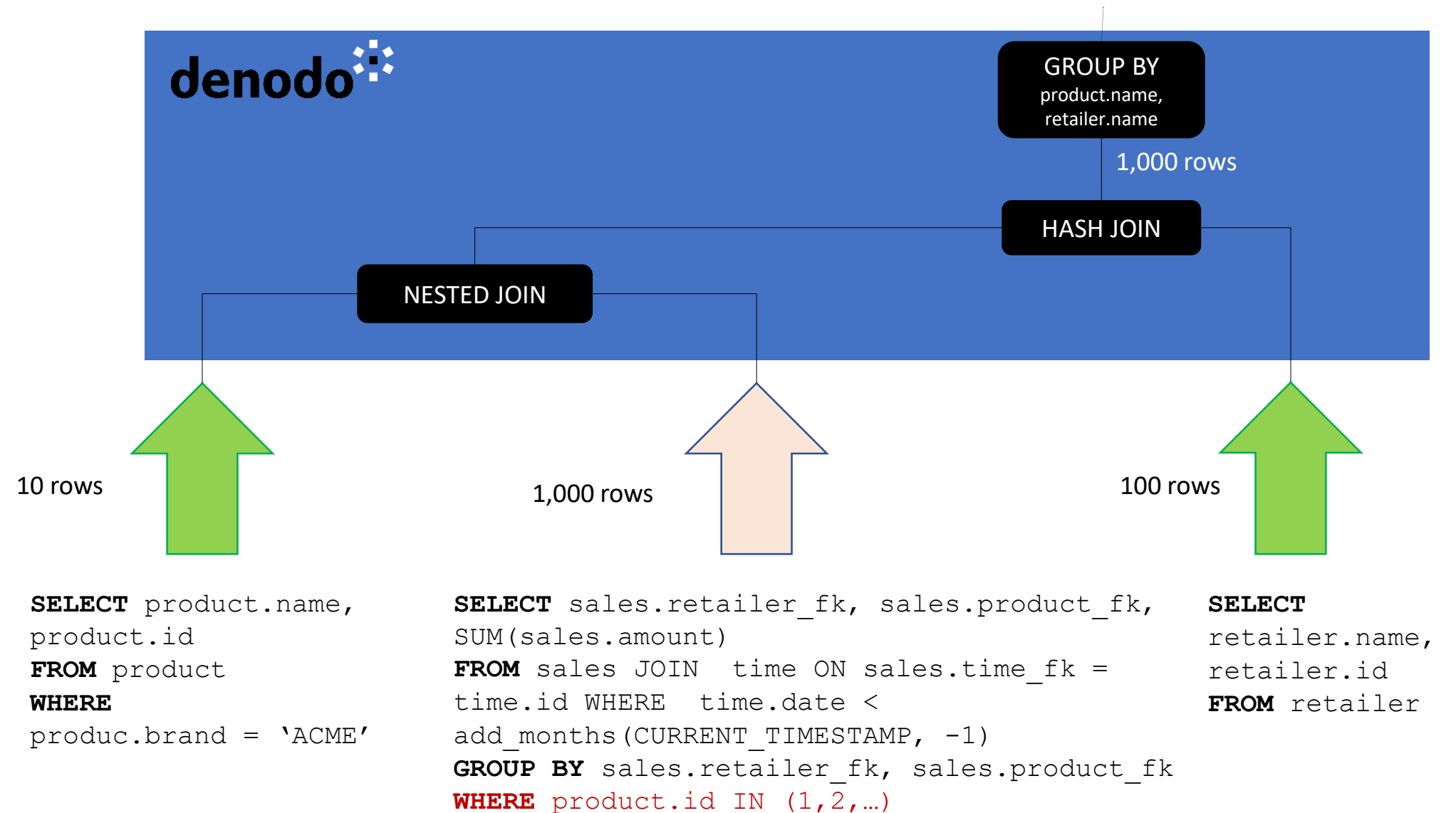
The JOIN is on foreign keys (1-to-many) and the GROUP BY is on attributes from the dimensions.

- Partial aggregation push-down optimization applied.



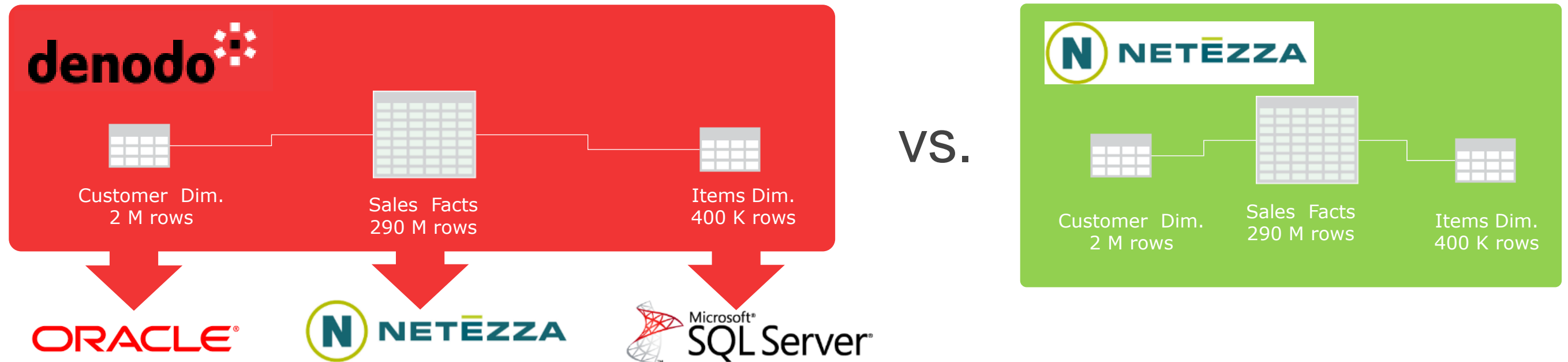
優化步驟4 – Choose Best JOIN Methods

Selects the right JOIN strategy based on costs for data volume estimations.



性能比較

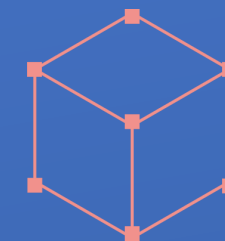
- 使用來廣泛的測試標準TPC-DS的查詢進行測試。
- 將Denodo的方法與MPP系統的性能進行比較，在MPP系統中，所有資料都已通過ETL複製。



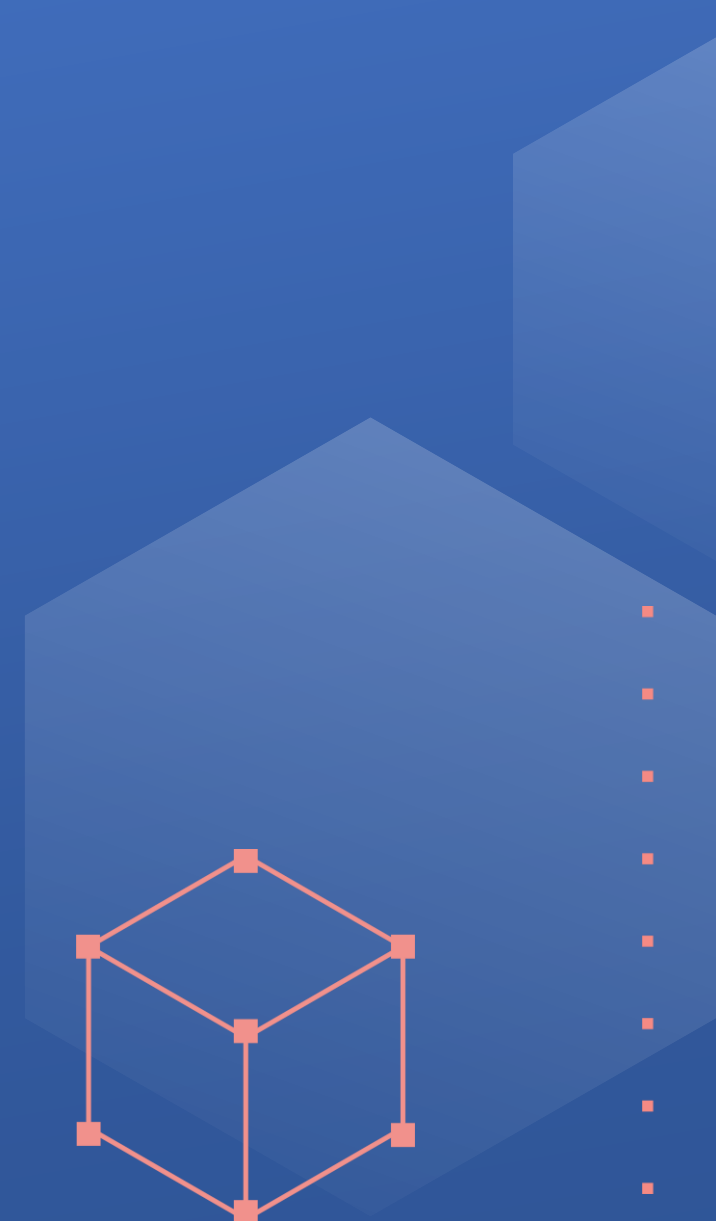
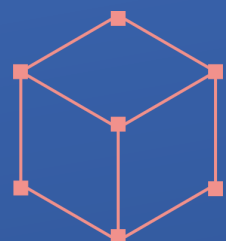
* TPC-DS是事實上的行業標準基準，用於測量決策支援解決方案（包括大資料系統）的性能

性能比較結果

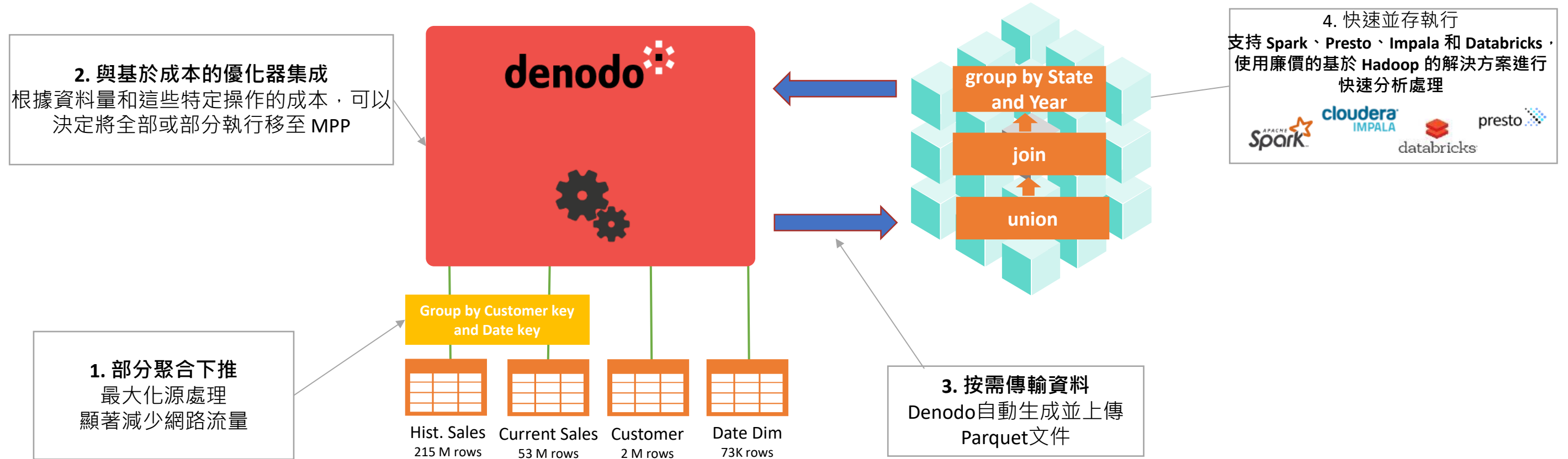
查詢說明	返回的行	執行時間Netezza	執行時間 (Federated Oracle, Netezza & SQL Server)	優化技術 (自動選擇)
Total sales by customer	1,99 M	20.9 sec.	21.4 sec.	Full aggregation push-down
Total sales by customer and year between 2000 and 2004	5,51 M	52.3 sec.	59.0 sec	Full aggregation push-down
Total sales by item brand	31,35 K	4.7 sec.	5.0 sec.	Partial aggregation push-down
Total sales by item where sale price less than current list price	17,05 K	3.5 sec.	5.2 sec	On the fly data movement



MPP查詢加速

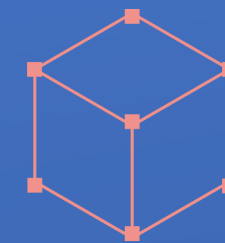


大規模並行處理

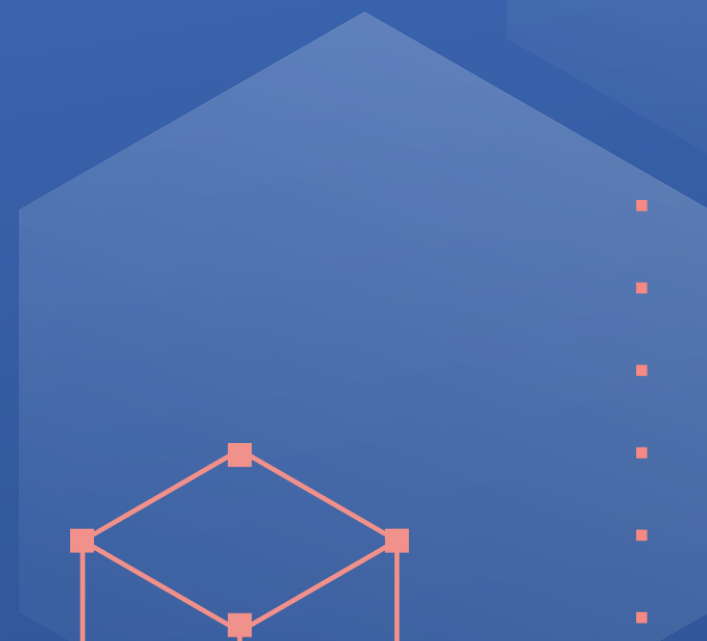
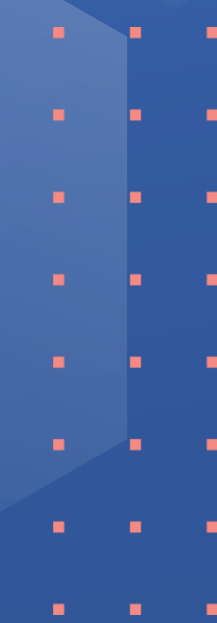
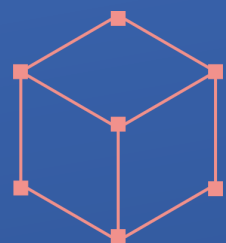


System	Execution Time	Optimization Techniques
Others	~ 38 min	
No MPP	3.6 min	聚合下推
With MPP	39.3 sec	聚合下推 + MPP 集成 (Impala 8 節點)

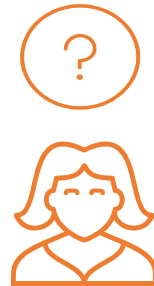




智慧查詢加速



分析的智能查詢加速



“ 總銷售
按商店和年份？
(包括商店名稱和城市)



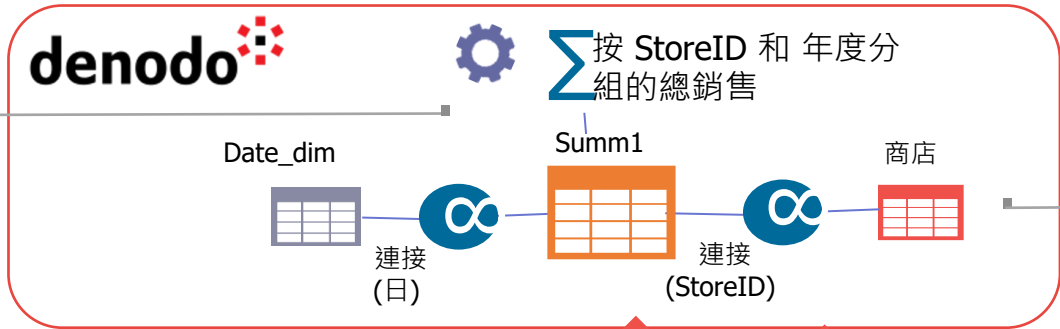
系統	執行時間
其他系統	> 500 sg
Denodo (動態查詢優化)	~ 13 秒
Denodo (動態查詢優化 + 摘要)	~ 1.4 秒

3

2

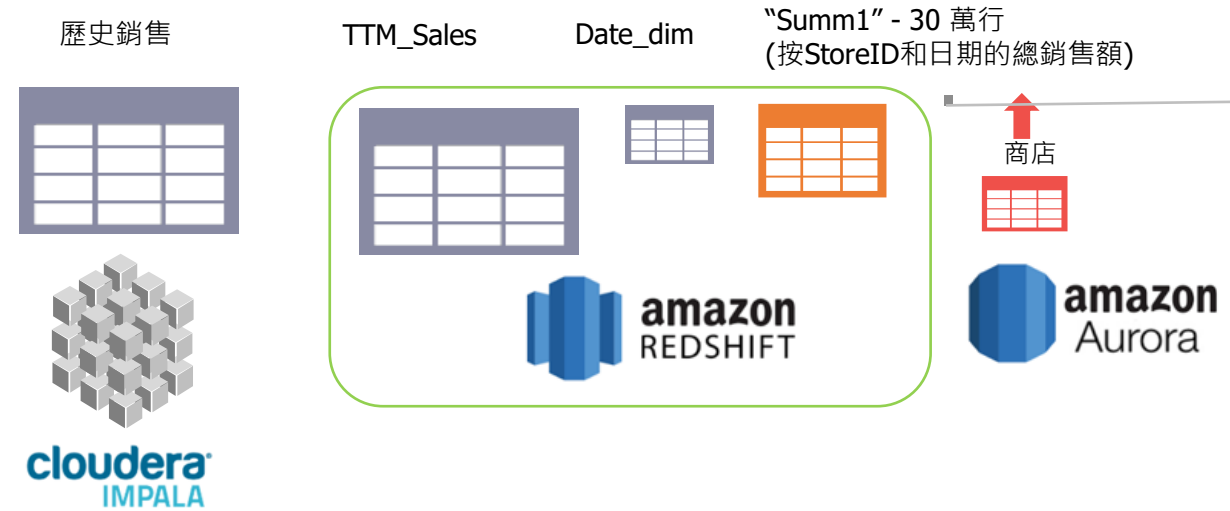
1

按商店名稱和年度 (分組) 使用摘要 (僅 300K 行，相較於原始 2.88 億行數據集，它包括商店名稱和城市，將結果返回給用戶)



連接摘要 "Summ1" 與 "商店" 和 "Date_dim" 以完成 "商店名稱" 和 "城市" 缺失欄位 (連接欄位 = StoreID 和 日)

- "歷史銷售" - 事實表 · **220M** 行
- "TTM_Sales" - 最近十二個月銷售 - 事實表 **68M** 行
- "Date_dim" - 維度表 - **73K** 行
- "商店" - 維度表 - 包含 StoreID、商店名稱和城市
- "Summ 1" - 摘要 · **300K** 行，通過 "按商店 ID 總銷售" 獲得 "按商店和日期" 查詢，存儲在 Redshift 中



Denodo 查詢優化器在成本基礎優化後識別智能查詢加速為最佳查詢執行策略，它從 AWS Redshift 讀取摘要 1 (摘要也可以存儲在 Denodo 緩存中)

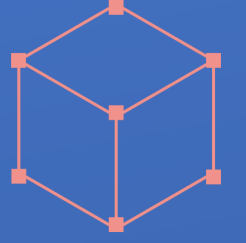


用於分析的智慧查詢加速

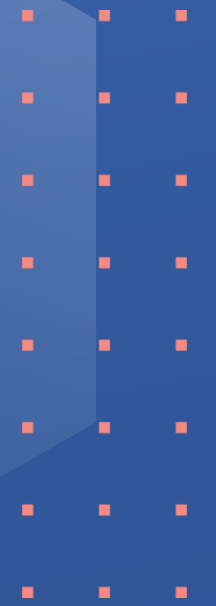
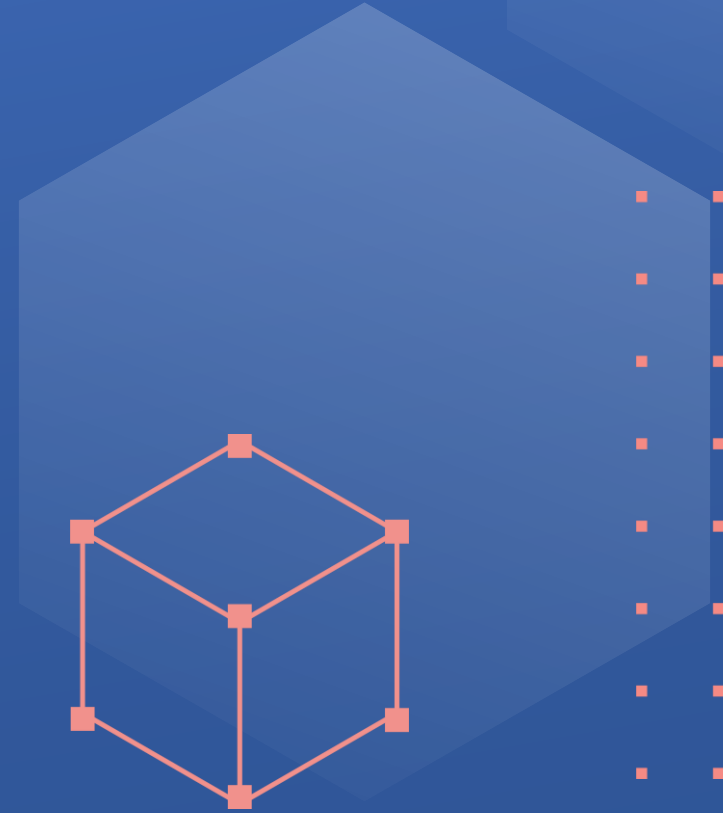
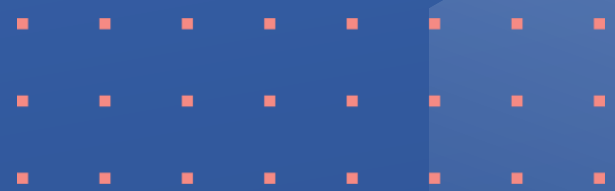
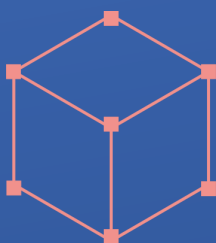
- TPCS-DS 數據：
 - 分佈在3個不同的系統中
 - 數億行的表
- 摘要：按商店 ID、sold_date_id 列出的總銷售額



Query	Execution Time (no acceleration)	Execution Time (with acceleration)	Performance Gain	Summary used
Total sales by year	15.45 s	2.38 s	6.5 x	summary_total_by_store_day
Total sales by quarter, store name and city	22.49 s	2.62 s	8.57 x	summary_total_by_store_day
Total sales by store and city for last quarter	14.71 s	0.47 s	31.1 x	summary_total_by_store_day
Total sales in a specific store	14.36 s	2.66 s	5.39 x	summary_total_by_store_day
Total sales in a specific store and year	14.32 s	3.18 s	4.0 x	summary_total_by_store_day

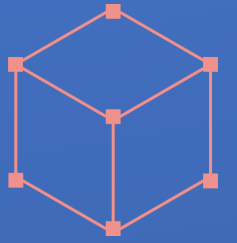


快取



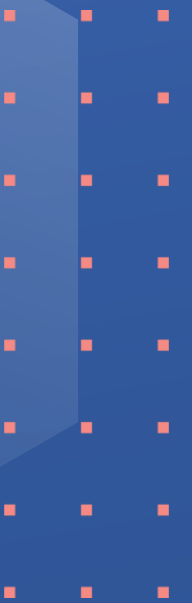
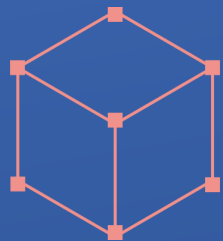
快取的工作原理

- 快取資料存儲在客戶選擇的關係引擎上
 - 關聯式資料庫、記憶體資料庫、MPP 引擎或雲端資料庫
- Denodo快取模式
 - 部分查詢快取
 - 數據完全複製



Denodo 資料目錄

架起 IT 與業務之間的橋樑



資料目錄：簡介

1. Metadata描述

- 用描述、資料分析資訊等為資料集提供背景

2. 搜尋

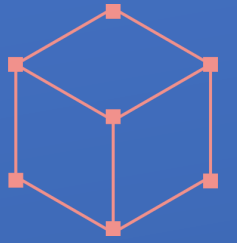
- 搜尋資料和Metadata，瀏覽類別和標籤

3. 自定義資料

- 為業務用戶提供查詢和資料準備

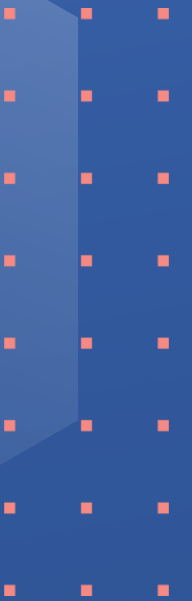
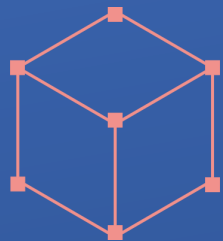
4. 資料存取

- 通過任何介面連接，使用不同的工具



Metadata描述

用描述、資料分析資訊等為資料集提供背景



資料目錄：每個欄位的Metadata描述

使用Metadata描述為每個欄位提供資料的背景

The screenshot shows the Denodo Data Catalog interface for the 'customer_dim' table. The 'Schema' tab is active, displaying a table of metadata for each field. The table includes columns for PK, Field name, Type, Field description, and Nullable. A search bar is present at the top of the table.

PK	Field name	Type	Field description	Nullable
	customer_sk	decimal	Customer Primary Key (PK)	
	customer_id	text	Customer ID (UK)	
	current_cdemo_sk	decimal	Current FK to Customer_Demographics_Dim	✓
	current_hdemo_sk	decimal	Current FK to Household_Demographics_Dim	✓
	current_addr_sk	decimal	Current FK to Customer_Address_Dim	✓
	first_shipto_date_sk	decimal	First Ship to Date FK to Date	✓
	first_sales_date_sk	decimal	First Sales Date FK to Date	✓
	salutation	text	Salutation of Customer	✓
	first_name	text	First Name	✓
	last_name	text	Last Name	✓
	preferred_cust_flag	text	Preferred Customer Flag	✓
	birth_day	decimal	Birth Day	✓
	birth_month	decimal	Birth Month	✓
	birth_year	decimal	Birth Year	✓
	birth_country	text	Birth Country	✓
	login	text	Customer Login	✓
	email_address	text	Email Address	✓
	last_review_date_sk	decimal	Last Review Date FK to Date	✓

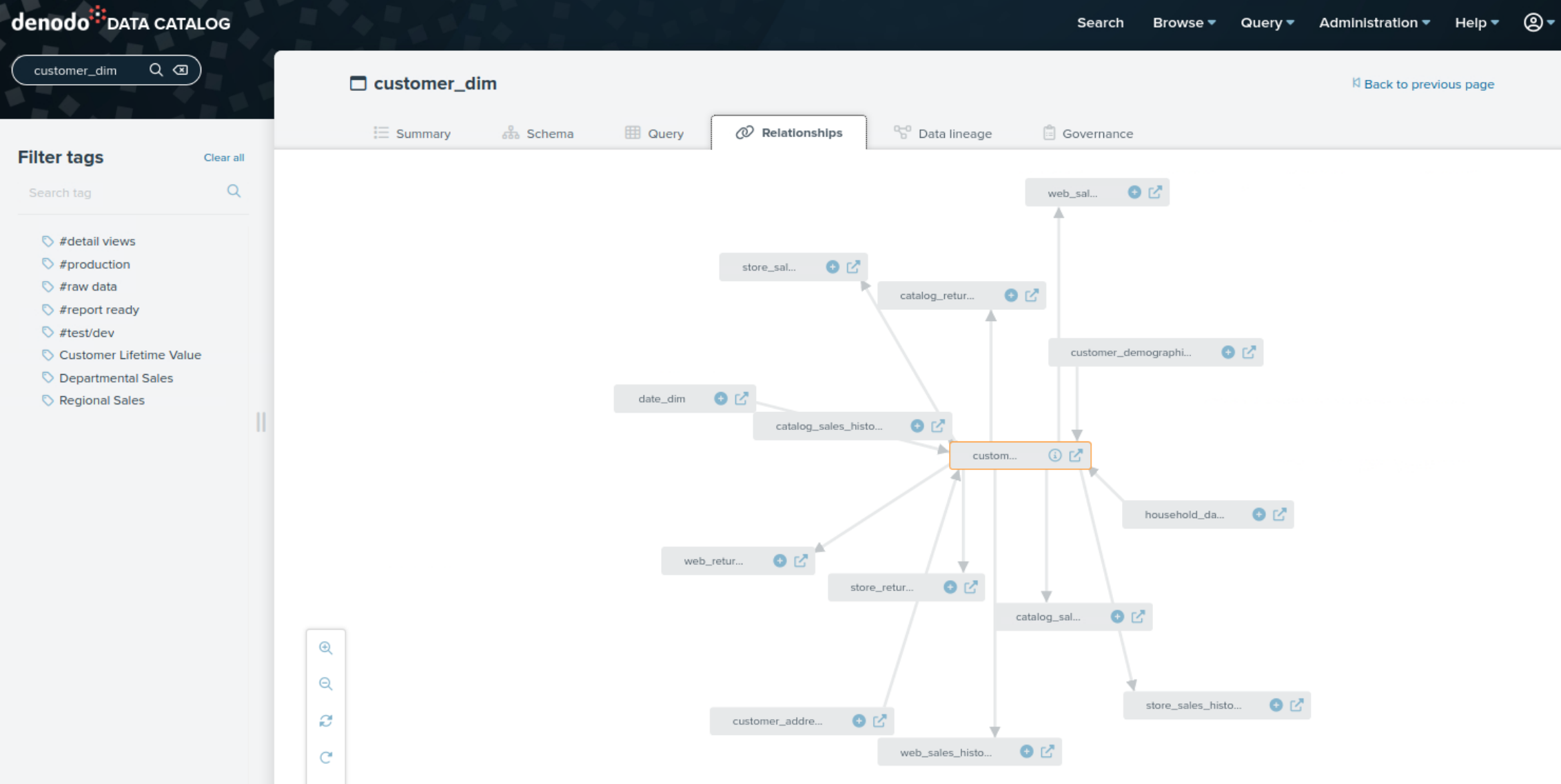
資料目錄：協作功能

協作功能：贊同、警告、棄用註解

The screenshot displays the Denodo Data Catalog interface for a 'film' entity. The top navigation bar includes 'film', 'Back to previous page', and tabs for 'Summary', 'Schema', 'Query', 'Relationships', 'Data lineage', and 'Search'. Below this, there are buttons for 'Add Tag', 'Add Category', 'Collaboration', 'Connection URLs', and 'Tableau'. The main content area shows the 'Database sakila' and 'Categories' (1960s, 1970s, 1980s). The 'Tags' section includes 'Documented', 'Production', and 'Verified'. The 'Endorsed by (2)' section lists 'admin' and 'john_smith'. The 'Warnings by (1)' section lists 'admin'. The 'Data quality' and 'Description' sections are also visible. The 'Description' text reads: 'This is the canonical view for the film entity.' followed by a list of details: 'Manager: coyote@acme.com', 'Last revision: 2020/06/20', and 'Version: 5.1'. An 'Endorsements' modal is open on the right, showing two entries: one from 'admin' (5/19/2021 3:26 PM) stating 'Version 1.0 of the film view has been released. It is ready to use in a production environment.', and one from 'john_smith' (5/19/2021 8:08 PM) stating 'The film view is a key component in our model. It provides a unified view for all the information retrieved from 100+ data sources.' The modal has a 'Close' button at the bottom right.

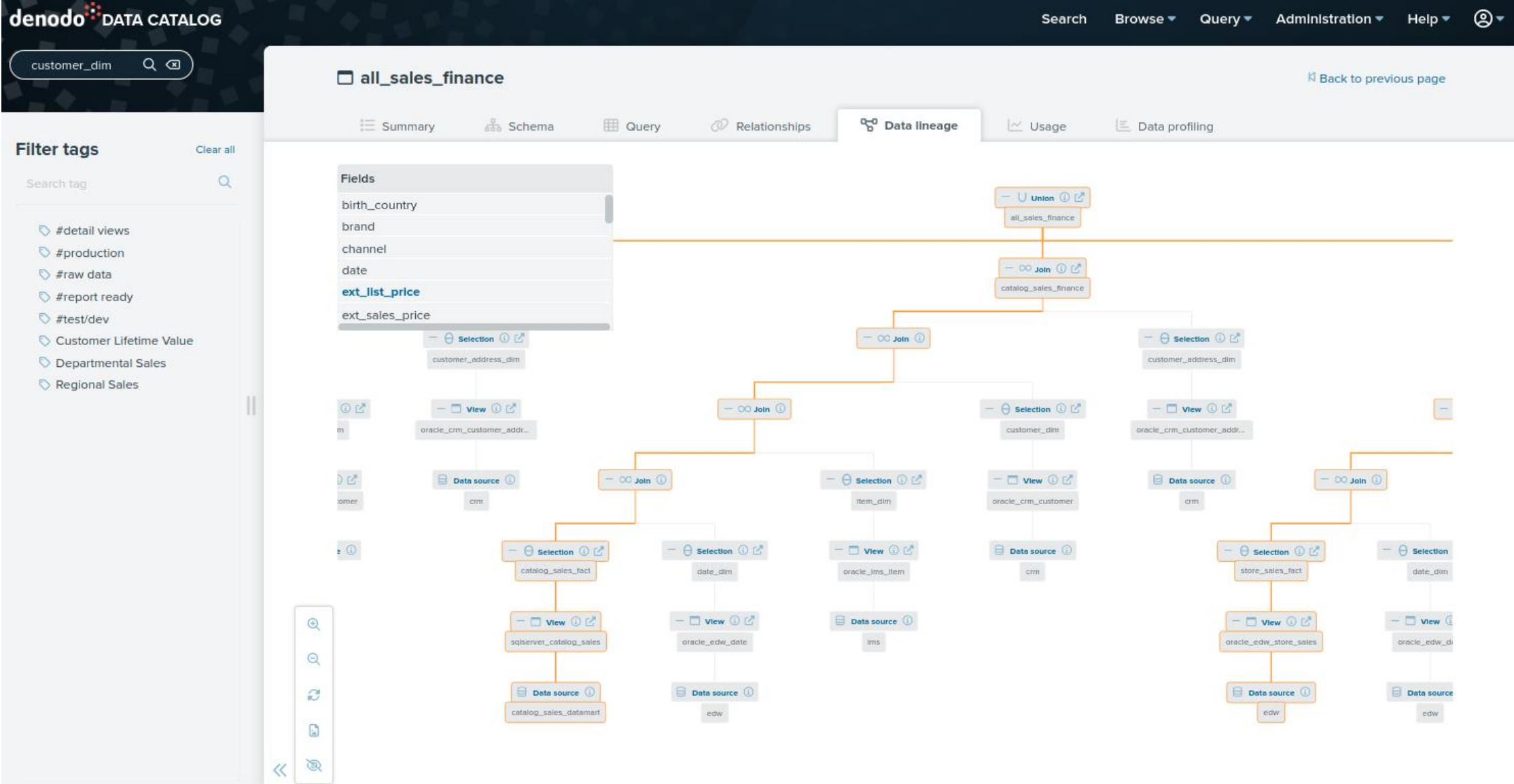
資料目錄：資料關聯圖

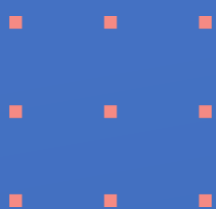
關於數據資產之間的關聯



資料目錄：完整的資料族譜以幫助驗證資料集

圖形族譜細節針對每個欄位從資料來源到最終視圖

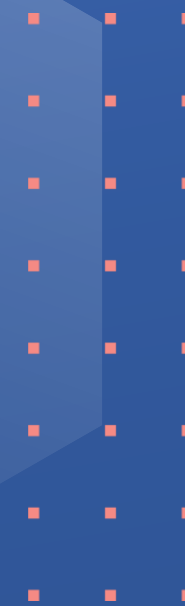
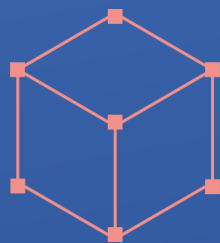




搜尋



搜尋資料和Metadata，瀏覽類別和標籤，訪問建議推薦



資料目錄：瀏覽業務類別

數據資產被分類為業務類別

The screenshot displays the Denodo Data Catalog interface. At the top, the navigation bar includes the Denodo logo, 'DATA CATALOG', and menu items for Search, Browse, Query, Administration, and Help. A search bar on the left contains the text 'customer_dim'. The main content area shows a folder view for 'Customer360' with tabs for Summary, Views, and Web services. A left sidebar titled 'Filter categories' lists various categories like Development, Finance, Marketing, Customer360, and Supply Chain. The central pane displays a grid of data assets, each with a name, description, and associated tags. The assets include:

- customer_address_dim**: Dimension for customer address details. Tags: slim, Dimensions, Customer360, #test/dev.
- customer_demographics_dim**: Dimension for customer demographic d... Tags: slim, Dimensions, Customer360, #test/dev.
- customer_details**: Combination of customer and customer... Tags: slim, Customer360, #report ready.
- customer_details_w_sales**: Combination of customer and customer... Tags: slim, Marketing, Customer360, #production, #report ready.
- customer_dim**: Dimension for customer details. Tags: slim, Dimensions, Customer360, #test/dev.
- customer_dim**: Dimension for customer details. Tags: integrated_demo, Customer360, Customer Lifetime V...

資料目錄：瀏覽標籤

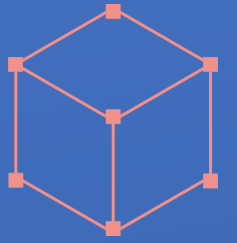
數據資產可以被分配語義標籤以進行分類、驗證等。

The screenshot displays the Denodo Data Catalog interface. At the top, the header includes the Denodo logo and 'DATA CATALOG', along with navigation links for Search, Browse, Query, Administration, and Help. A search bar on the left contains the text 'customer_dim'. The main content area is titled '#report ready' and features a 'Back to previous page' link. Below the title, there are tabs for 'Summary', 'Views', and 'Web services', with 'Views' currently selected. The interface shows a grid of data asset cards, each representing a different view. Each card includes a title, a brief description, a 'slim' icon, a folder icon labeled 'Finance', and a list of tags including '#production' and '#report ready'. The cards are arranged in a 2x3 grid. The first row contains three cards: 'all_sales_by_product_channel_qtr', 'all_sales_by_region_channel_qtr', and 'all_sales_by_region_channel_year'. The second row contains three cards: 'all_sales_campaign_management', 'all_sales_finance', and 'catalog_sales_by_region_channel...'. Each card also indicates 'Fields with search tags: 0'.

資料目錄：目錄中的Metadata搜索

在Metadata進行搜索

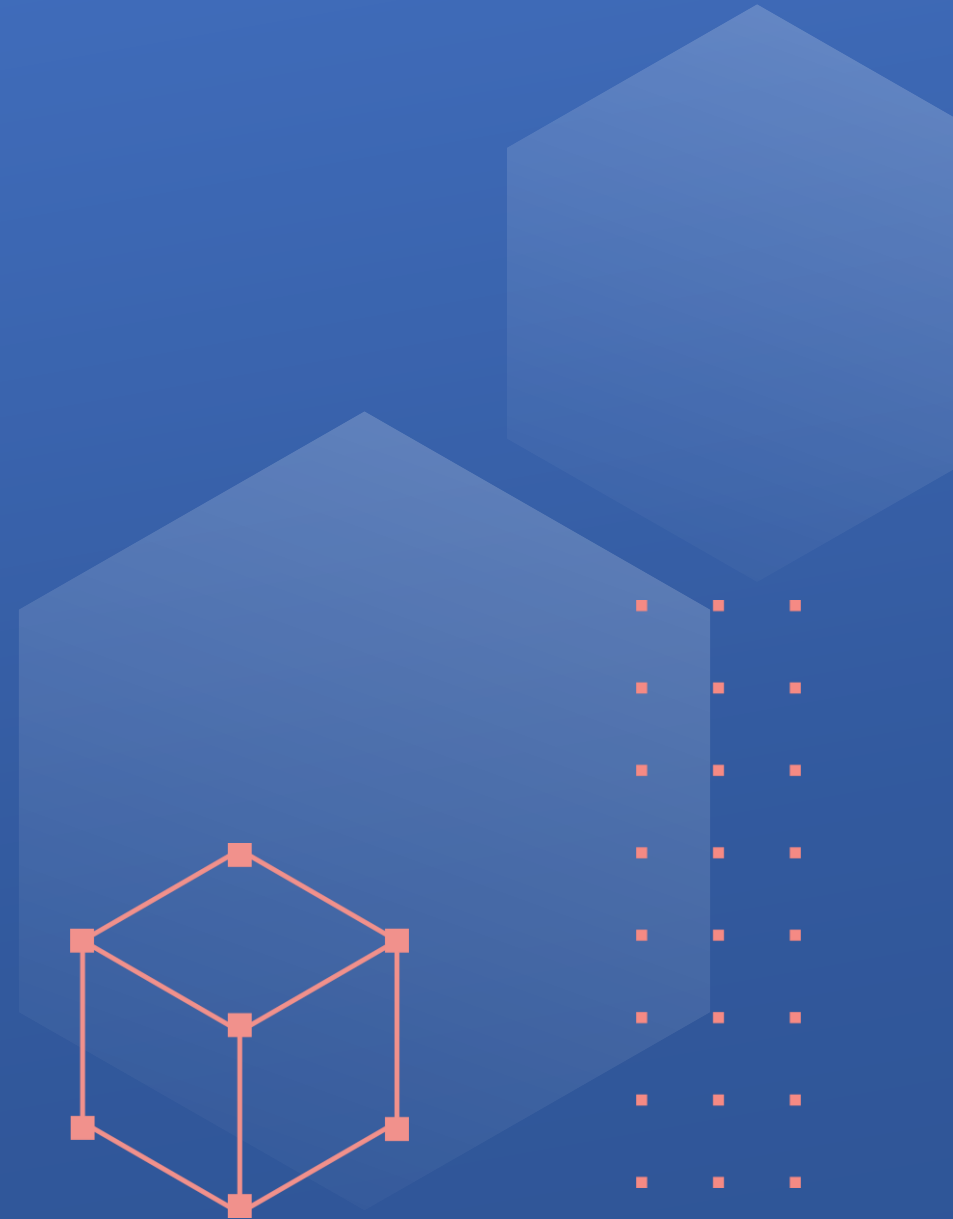
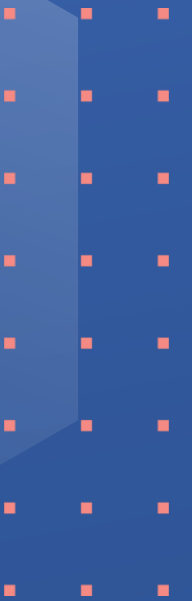
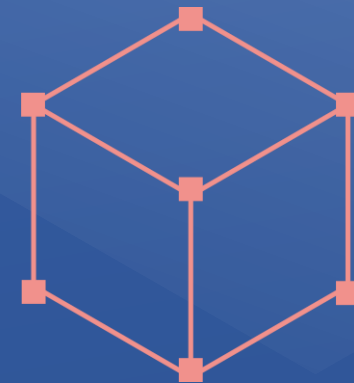
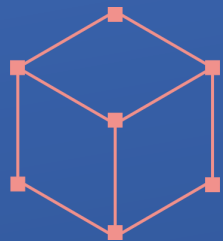
The screenshot displays the Denodo Data Catalog interface. At the top, the navigation bar includes 'Search', 'Browse', 'Query', 'Administration', and 'Help'. A search bar on the left contains the term 'customer'. Below the search bar, a 'Filters results' sidebar is visible, with 'Metadata' selected. The main content area shows a grid of search results for 'customer' under the 'VIEWS' tab. Each result card includes the view name, a brief description, associated metadata (like 'integrated_demo' or 'slim'), tags (such as 'Marketing', 'Customer360', '#production', '#report ready'), and a 'Customer Lifetime V...' tag. At the bottom left of the interface, the Denodo logo is present.



自定義資料



為業務用戶提供查詢和資料準備



資料目錄：業務用戶的查詢精靈

使用Denodo函數、過濾器、聚合、排序等。

The screenshot displays the Denodo Data Catalog interface for configuring a query on the 'all_sales_finance' table. The interface includes a search bar at the top left with 'customer_dim' entered, and a navigation menu at the top right with options like Search, Browse, Query, Administration, and Help. The main area is divided into several panels:

- Filter tags:** A sidebar on the left with a search bar and a list of tags including #detail views, #production, #raw data, #report ready, #test/dev, Customer Lifetime Value, Departmental Sales, and Regional Sales.
- Query Configuration:** A central panel with tabs for Summary, Schema, Query (selected), Relationships, Data lineage, Usage, and Data profiling. It features a 'DEFINITION' tab and a 'RESULTS' tab. Action buttons for Execute, Export, Cancel, VQL, and Save are visible.
- Fields:** A list of fields from the 'all_sales_finance' table, with checkboxes for selection. Selected fields include date, fy_year, quarter_name, month, order_number, quantity, ext_sales_price, and ext_list_price.
- Output columns:** A list of columns to be included in the query output, including ext_list_price, ext_sales_price, quantity, order_number, quarter_name, month, fy_year, and date.
- Filters:** A section for defining filters, currently showing 'month='April''.
- Order by:** A section for defining the order of results, with a hand icon and the instruction 'Define the order by dragging fields here'.

資料目錄：將查詢結果導出到文件

導出到CSV、HTML、Excel、Tableau (.tde)、Tableau (.hyper)

The screenshot shows the Denodo Query Editor interface. At the top, there's a breadcrumb 'film' and a 'Back to previous page' link. Below that is a navigation bar with 'Summary', 'Schema', 'Query' (selected), 'Relationships', 'Data lineage', and 'Search'. Underneath, there are tabs for 'DEFINITION' and 'RESULTS' (selected). A toolbar contains 'Execute', 'Export' (highlighted with a mouse cursor), 'Cancel', 'VQL', and 'Save'. The main area displays '5 rows' of data in a table:

rating	current_language/name	AVG_rental_rate	AVG_replaceme
PG-13	English	3.034843	20.402556
NC-17	English	2.970952	20.137619
R	English	2.938718	20.231026
PG	English	3.051856	18.959072
G	English	2.888876	20.124831

An 'Export query' dialog box is open, showing options for export format: CSV (selected), HTML, Excel, Tableau (.tde), and Tableau (.hyper). It also has options for 'Number of results to export': All results, Only visible results, and Only the first 100 (selected). There is a checked 'Export header' option. 'Cancel' and 'Ok' buttons are at the bottom right.

資料目錄：進階用戶的 VQL Shell

進階用戶可以使用VQL Shell來定義複雜查詢並具備自動完成功能

The screenshot displays the Denodo Data Catalog interface for the 'all_sales_finance' table. The 'Query' tab is active, showing a VQL Shell editor with the following query:

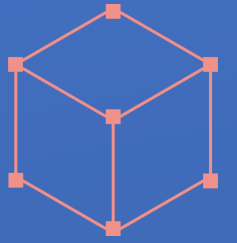
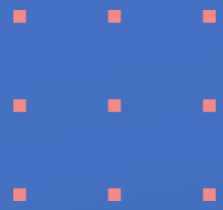
```
1 select * from all_sales_finance where month='April'
```

The interface includes a 'Fields' list on the left with the following items:

- Select all
- date
- fy_year
- quarter_name
- month
- fy_quarter_seq
- fy_week_seq
- item_sk
- order_number
- quantity
- wholesale_cost
- list_price
- sales_price
- ext_sales_price
- ext_list_price
- ext_tax
- net_paid
- net_profit

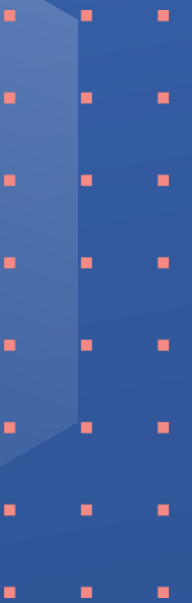
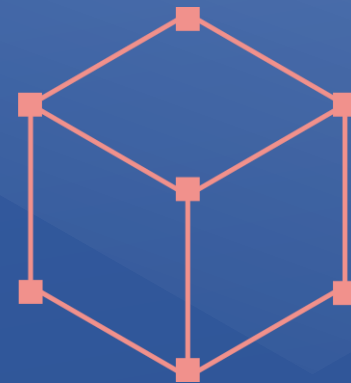
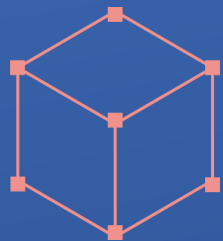
The VQL Shell editor also shows a dropdown menu for the 'CASE' statement with the following options:

- CASE expression switch WHEN expression value THEN ...
- CASE WHEN boolean condition THEN expression return...
- f(*)acos(double angle) : double
- f(*)addhour(timestamp input, Int increment) : timestamp
- f(*)addhour(Intervaldaysecond input, Int increment) : ...
- f(*)addhour(time input, Int increment) : time



資料存取

通過任何介面連接，使用不同的工具



資料目錄：通過所有可用API連接的URLs

連接URLs以連接到視圖/資料庫通過JDBC、ODBC、REST、OData和GraphQL

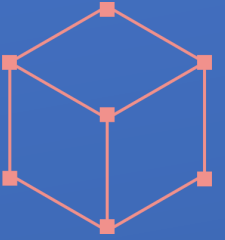
The screenshot displays the Denodo interface for the 'film' entity. The main navigation bar includes 'Summary', 'Schema', 'Query', 'Relationships', 'Data lineage', and 'Search'. Below this, there are options for 'Add Tag', 'Add Category', 'Collaboration', 'Connection URLs', and 'Tableau'. The left sidebar shows the 'Database sakila' and various filters for 'Categories' (1960s, 1970s, 1980s), 'Tags' (Documented, Production, Verified), 'Endorsed by' (admin, john_smith), and 'Warnings by' (admin). The main content area shows the 'Description' for the 'film' entity, stating it is the canonical view and listing details like Manager (coyote@acme.com), Last revision (2020/06/20), and Version (5.1). A 'Connection URLs' modal window is open, providing a table of connection strings for different protocols.

Protocol	Connection URL	Action
JDBC	<code>jdbc:vdb://localhost:9999/sakila?user=admin&password=<Your_Password_Here></code>	Copy
ODBC 32-bit	<code>DRIVER={DenodoODBC Unicode};DATABASE=sakila;SERVER=localhost;PORT=9996;UID=<Your_UID_Here>;PWD=<Your_Password_Here></code>	Copy
ODBC 64-bit	<code>DRIVER={DenodoODBC Unicode(x64)};DATABASE=sakila;SERVER=localhost;PORT=9996;UID=<Your_UID_Here>;PWD=<Your_Password_Here></code>	Copy
REST	<code>http://localhost:9090/denodo-restfulws/sakila/views/film</code>	Copy
OData	<code>http://localhost:9090/denodo-odata4-service/denodo-odata.svc/sakila/film</code>	Copy
GraphQL	<code>http://localhost:9090/denodo-graphql-service/graphql/sakila</code>	Copy

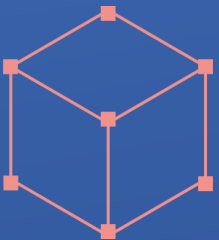
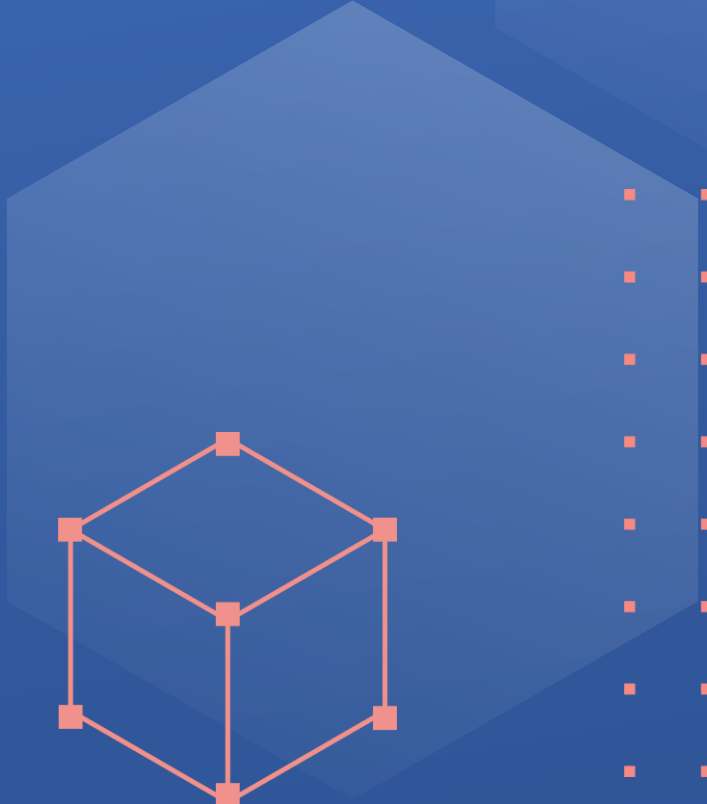
資料目錄：直接連結工具存取資料

直接連結到PowerBI和Tableau

The screenshot displays the Denodo Data Catalog interface. The top navigation bar includes 'denodo DATA CATALOG', 'Search', 'Browse', 'Query', 'Administration', and 'Help'. A search bar on the left contains 'customer_dim'. The main content area shows the 'all_sales_finance' dataset page, which includes tabs for 'Summary', 'Schema', 'Query', 'Relationships', 'Data lineage', 'Usage', and 'Data profiling'. The 'Summary' tab is active, displaying metadata such as 'Database: slim', 'Categories: Finance', and 'Tags: #production, #report ready'. A dropdown menu 'Open in' is open, showing options for 'Power BI' and 'Tableau'. A 'Filter tags' sidebar is visible on the left, listing various tags like '#detail views', '#production', and '#raw data'.



Denodo 平臺安全架構



安全架構



身份驗證

- 標準 JDBC/ODBC/ADO.Net 安全性 (用戶/密碼)
- JDBC、ODBC、ADO.Net、VDP 管理工具的 Kerberos
- JDBC/ODBC 的 OAuth 2.0
- 網路服務安全性 (HTTPS、HTTP 基本/摘要、SAML 2.0、OAuth 2.0、SPNEGO、WS 安全性)
- 多因素身份驗證 (已發布的 WS、Web 應用程式) – 身份提供者 (OAuth2/SAML)
- 使用 Kerberos、OAuth、OpenID 和 SAML 的單一登入 (SSO)

運行中的數據

- SSL/TLS 1.3



LDAP
Active Directory



身份提供者 (OAuth2,
SAML)



金鑰保管庫



統一安全管理



元數據

基於用戶/角色的授權 (RBAC)
(訪客、員工、企業)
動態屬性基礎授權 (ABAC)

架構範圍的權限

視圖級別權限
數據特定權限
(行、列級別、遮罩)
全球安全政策 (政策引擎)
自定義視圖政策

denodo



靜態加密數據

- 快取
- 交換

身份驗證

- 標準 JDBC/ODBC 安全性 (用戶/密碼)
- Kerberos 和 Windows 單一登入 (SSO)
- OAuth 1.0a 和 2.0、SPNEGO、SAML2
- 服務帳戶
- 通過身份驗證
- 與金鑰保管庫的整合

運行中的數據

- SSL/TLS 1.3



Thanks!

