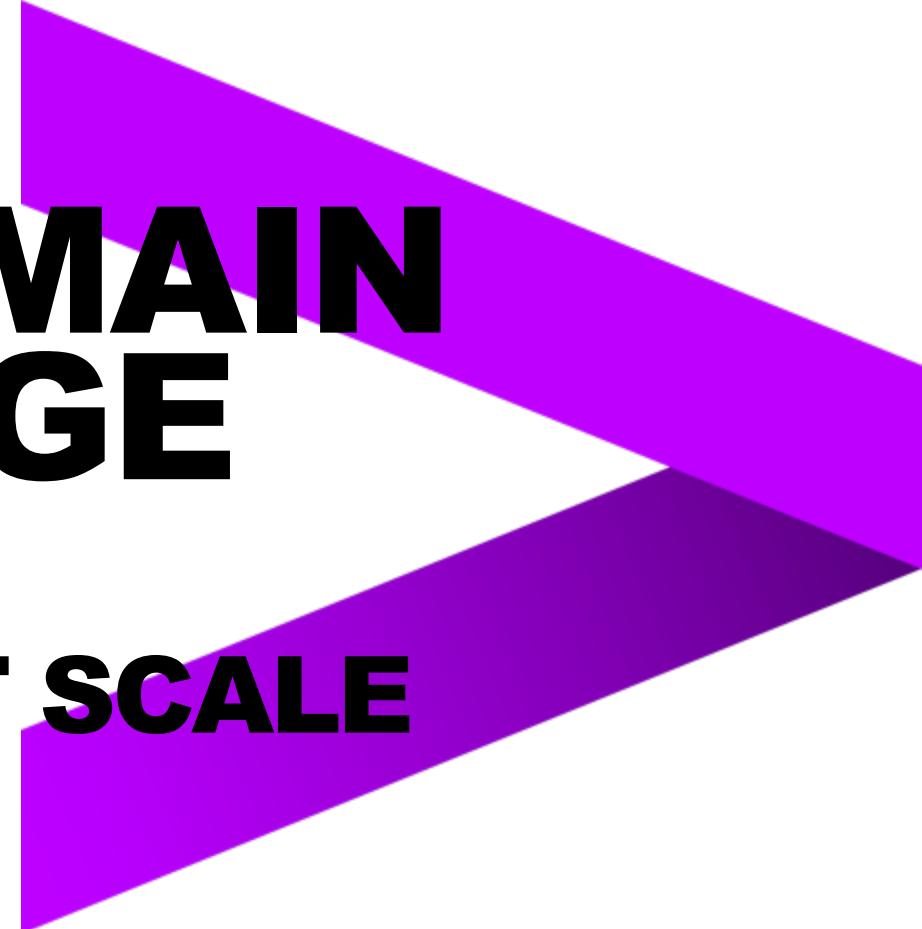
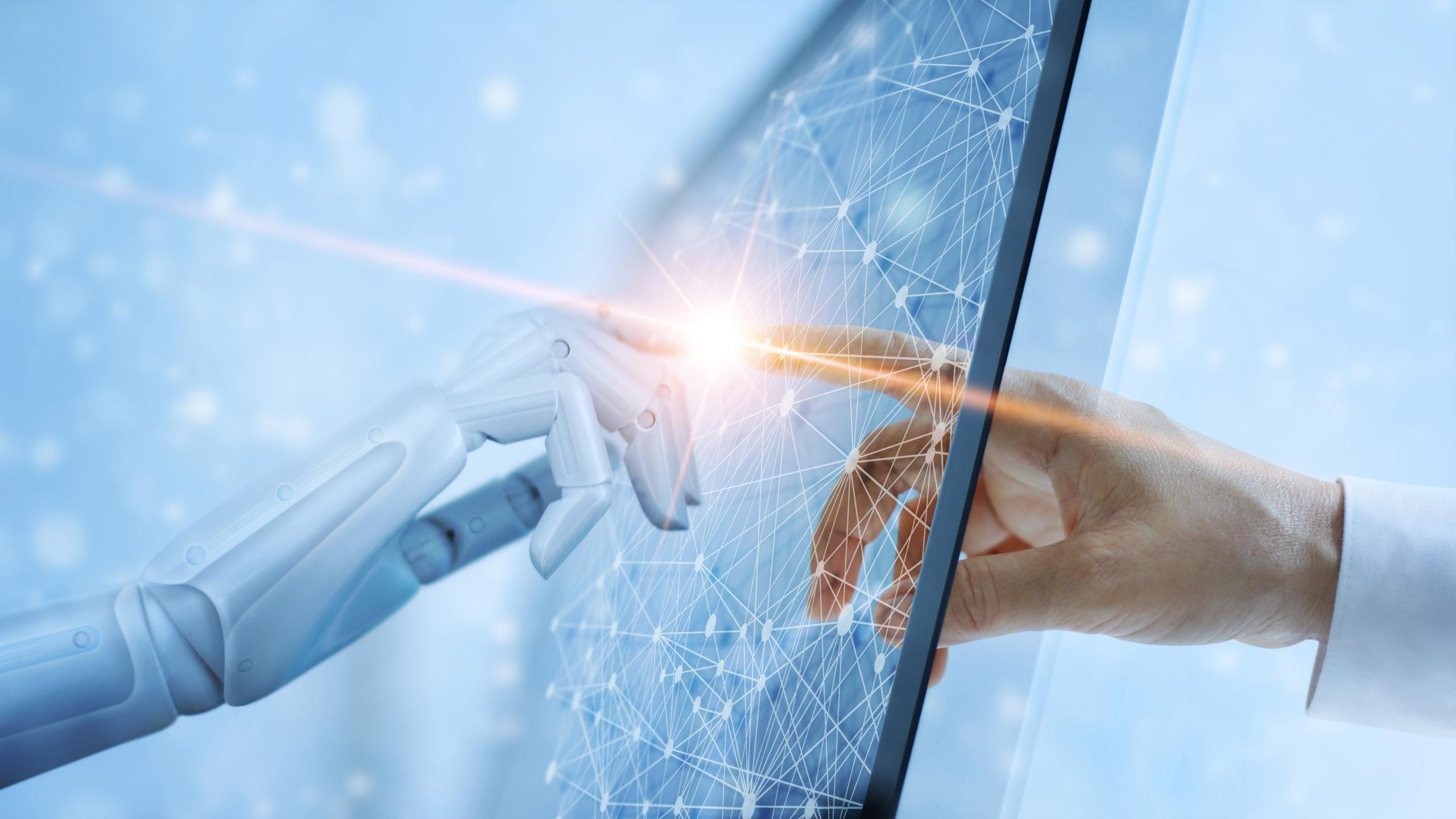




USING DOMAIN KNOWLEDGE GRAPHS TO MANAGE AI AT SCALE



**Jean-Luc Chatelain, CTO Applied Intelligence
Teresa Tung, Accenture Labs**



**LOOKING
BEHIND THE
CURTAIN**

KNOWLEDGE GRAPH BEHIND INTERNET SCALE

Extract Information

Mona Lisa - Wikipedia

https://en.wikipedia.org/wiki/Mona_Lisa ▾
The Mona Lisa is a half-length portrait painting by the Italian Renaissance artist Leonardo da Vinci that has been described as 'the best known, the most visited, ...
Year: c. 1503–06, perhaps continuing until c. 1517 Medium: Oil on poplar panel
Subject: Lisa Gherardini Location: Musée du Louvre, Paris
Lisa del Giocondo · Speculations about Mona Lisa · Lisa Mona Lisa · Mona Lisa

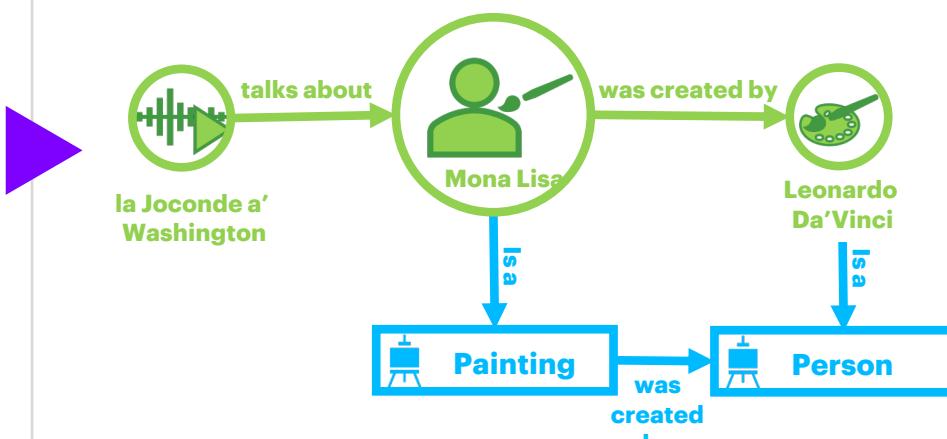
Mona Lisa | History & Facts | Britannica.com

<https://www.britannica.com/topic/Mona-Lisa-painting> ▾
Mona Lisa, oil painting on a poplar wood panel by the Italian painter, draftsman, sculptor, architect, and engineer Leonardo da Vinci, probably the world's ...

Mona Lisa – Portrait of Lisa Gherardini, wife of Francesco del ...

<https://www.louvre.fr/.../mona-lisa---portrait-lisa-gherardini-wife-francesco-del-giocondo...> ▾
This portrait was doubtless started in Florence around 1503. It is thought to be of Lisa Gherardini, wife of a Florentine cloth merchant named Francesco del ...

Contextualize Information



Assemble Information

Mona Lisa

Painting by Leonardo da Vinci



The Mona Lisa is a half-length portrait painting by the Italian Renaissance artist Leonardo da Vinci that has been described as 'the best known, the most visited, the most written about, the most sung about, the most parodied work of art in the world.' [Wikipedia](#)

Artist: Leonardo da Vinci

Dimensions: 2' 6" x 1' 9"

Location: Louvre Museum (since 1797)

Created: 1503

Period: Renaissance

Medium: Oil paint

People also search for

The Last Supper Leonardo da Vinci	Salvator Mundi Leonardo da Vinci	The Starry Night Vincent van Gogh	Lady with an Earring Leonardo da Vinci	David Michelangelo

View 15+ more

Feedback

See results about

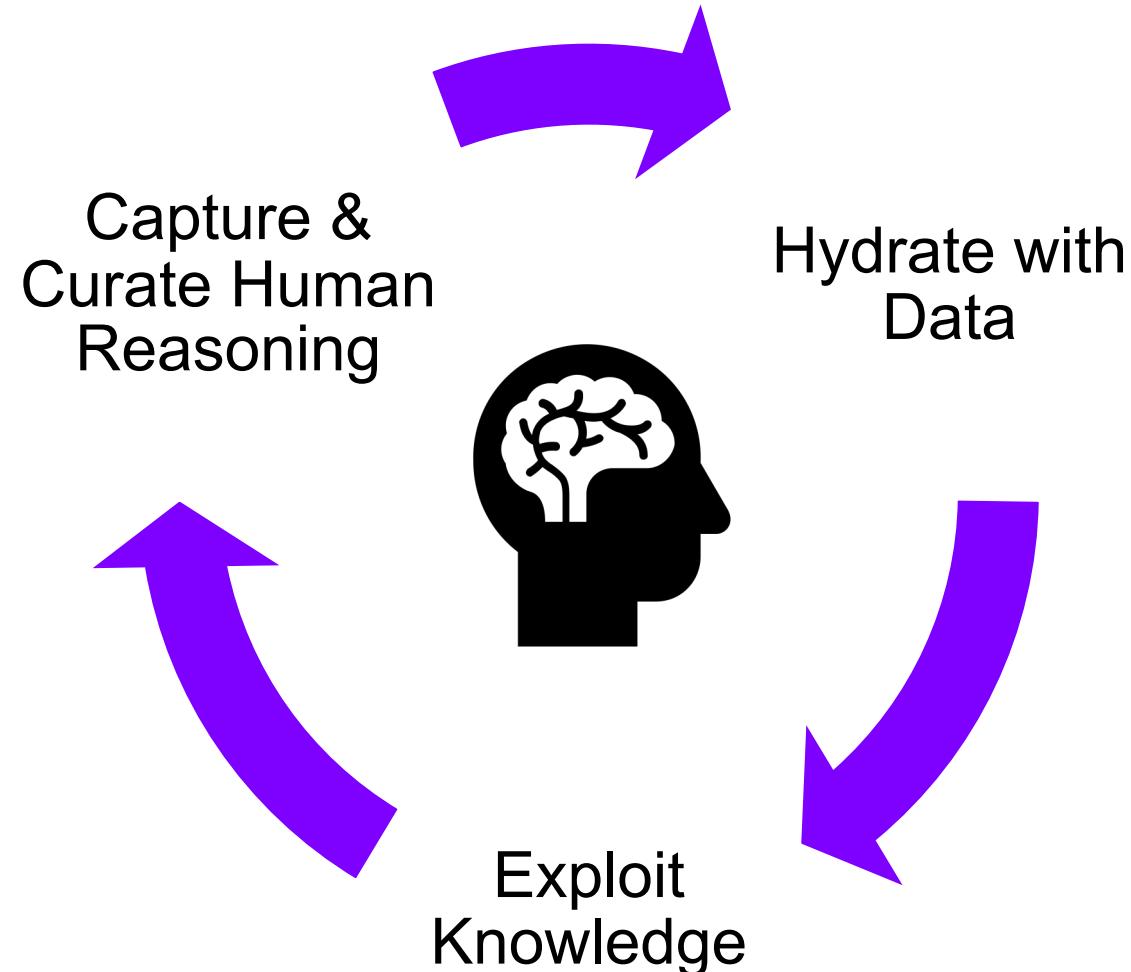
[Lisa del Giocondo \(Italian model\)](#)

Lisa del Giocondo was an Italian noblewoman and member of the Gherardini family of Florence and ...



USING A KNOWLEDGE GRAPH

CAPTURE AND APPLY KNOWLEDGE

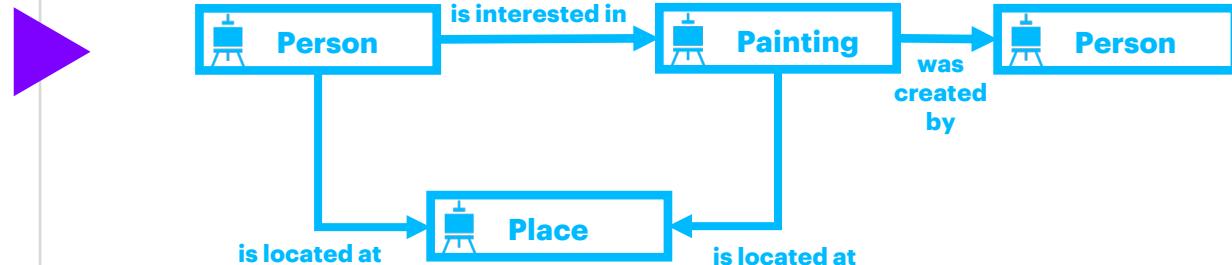


USING A KNOWLEDGE GRAPH CAPTURE HUMAN REASONING

Start with the questions

- “Where is the Mona Lisa?”
- “What is the Mona Lisa?”
- “What is the most famous painting?”
- Who is asking?
- What links did they click on?
- What else are they looking at?

Example: Model schema



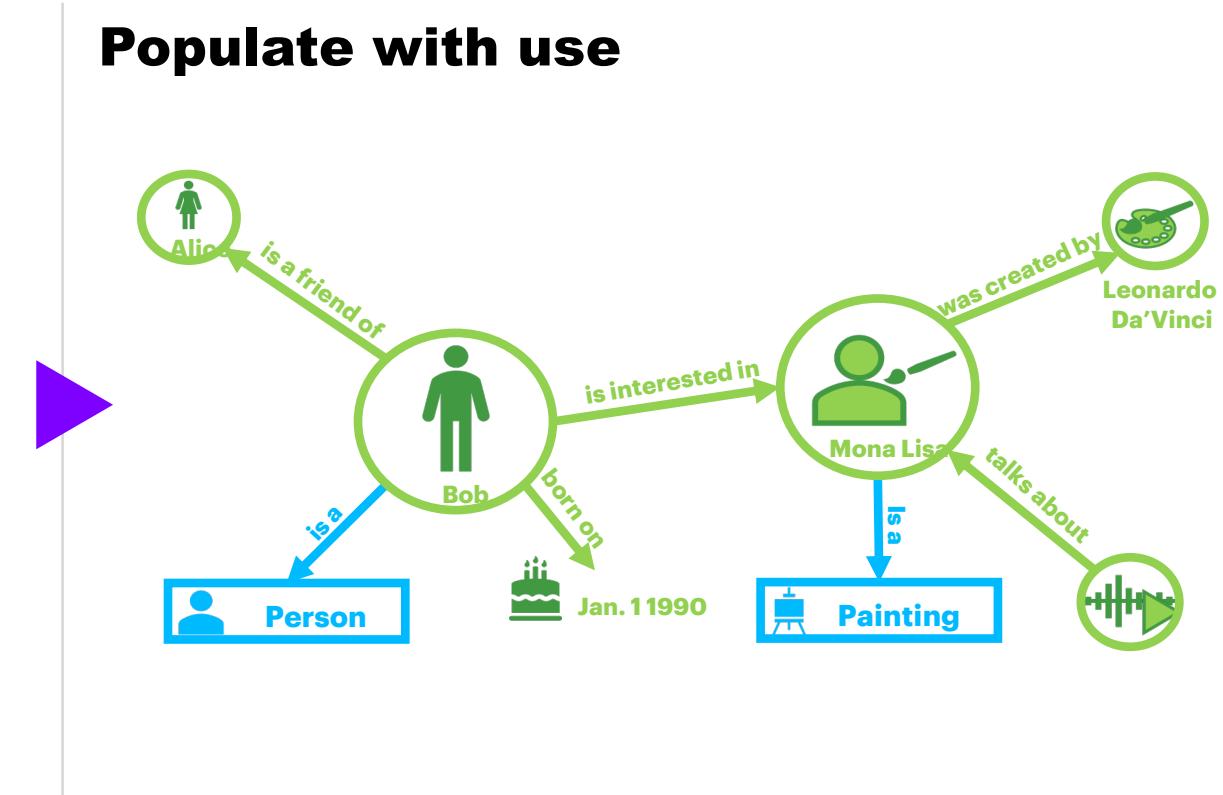
USING A KNOWLEDGE GRAPH

HYDRATE THE GRAPH

A screenshot of a Google search results page for the query "mona lisa". The results include:

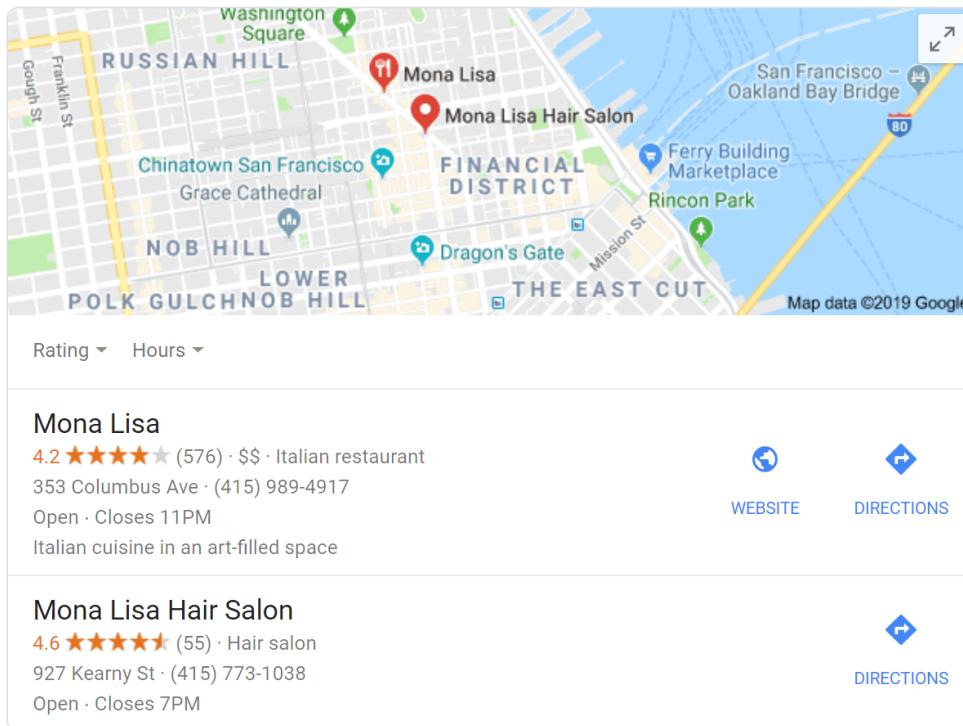
- Mona Lisa - Wikipedia**: A link to the Wikipedia page for the Mona Lisa painting.
- 10 Facts You Don't Know about The Mona Lisa by Leonardo da Vinci**: A link to a page listing interesting facts about the painting.
- Map**: A map of San Francisco showing the location of the Mona Lisa Hair Salon.
- Mona Lisa**: A detailed card with information:
 - Painting by Leonardo da Vinci**
 - Dimensions**: 2' 6" x 1' 9"
 - Location**: Louvre Museum (since 1797)
 - Created**: 1503
 - Period**: Renaissance
 - Medium**: Oil paint
- People also search for**: A list of other artworks by Leonardo da Vinci and others.
- Feedback**: A button to provide feedback on the search results.
- See results about**: A button to see more results for the query.

Populate with use

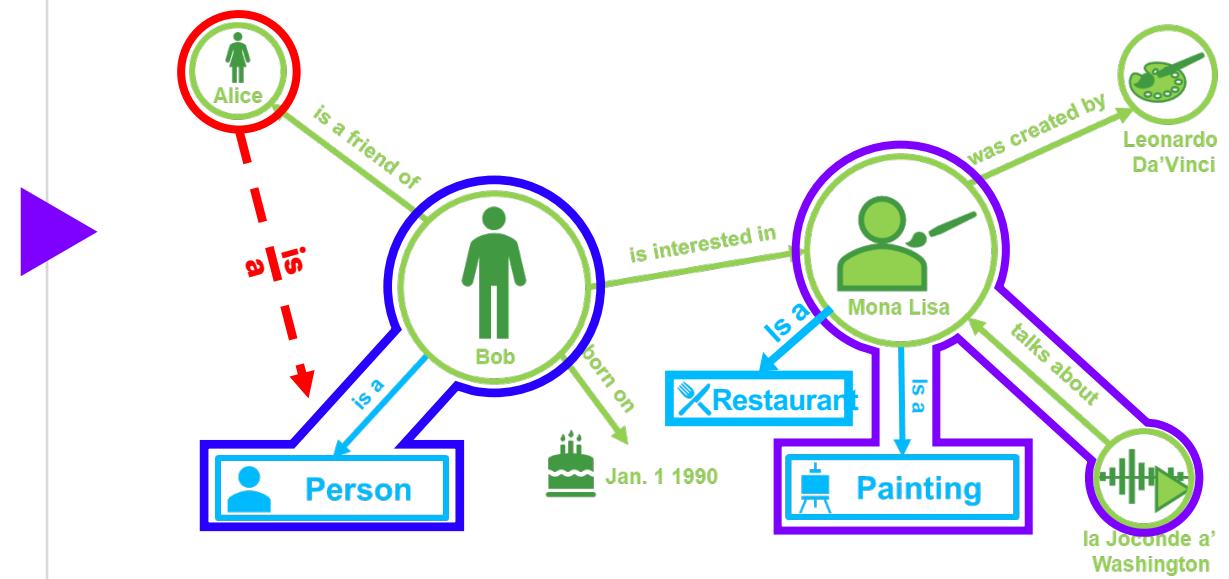


USING A KNOWLEDGE GRAPH EXPLOIT & CURATE GRAPH

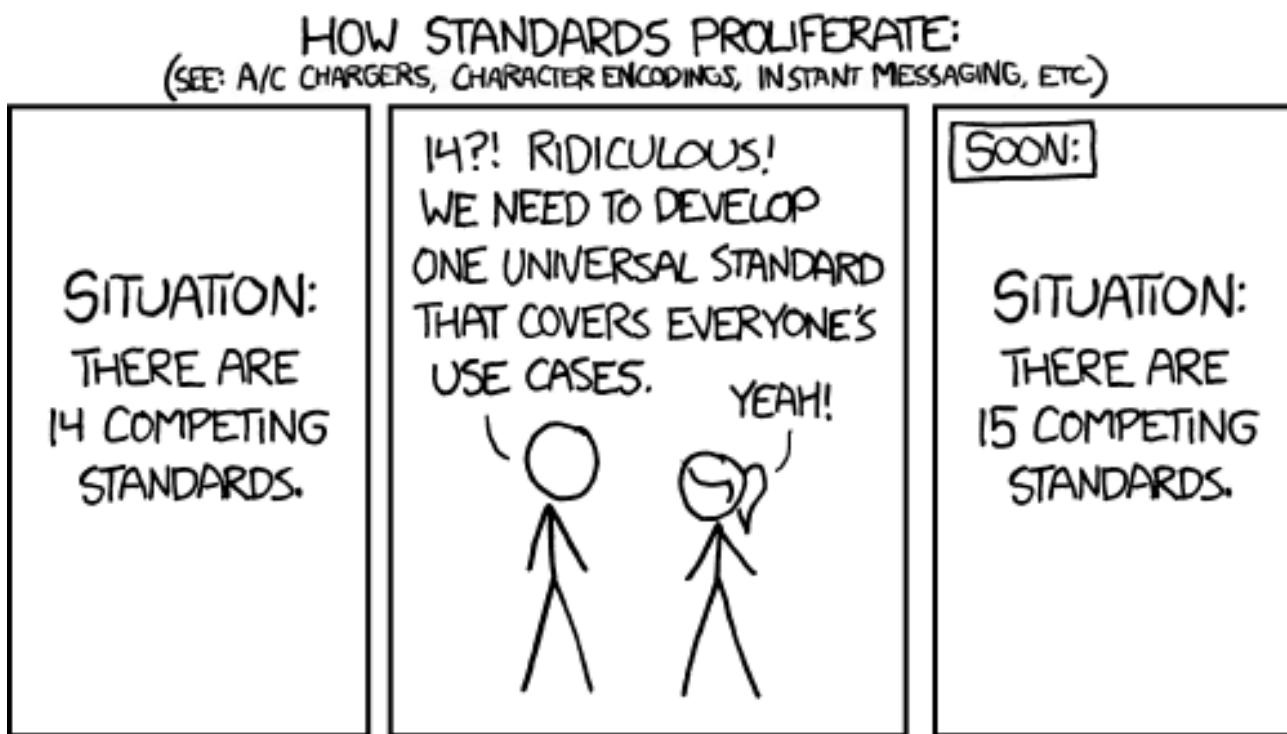
Apply based on use



Curate new relationships and concepts



NOT A STANDARD KNOWLEDGE GRAPH CAPTURES USE



Capture Data and Model Use

- Who created it?
- What did they use? Model and data pipeline components?
- Who used it?
- How did they use it? Pipeline configuration?
- What else did they look at?
- How well did it work?

Source: [HTTP://XKCD.COM/927/](http://xkcd.com/927/)

AI POWERS DATA

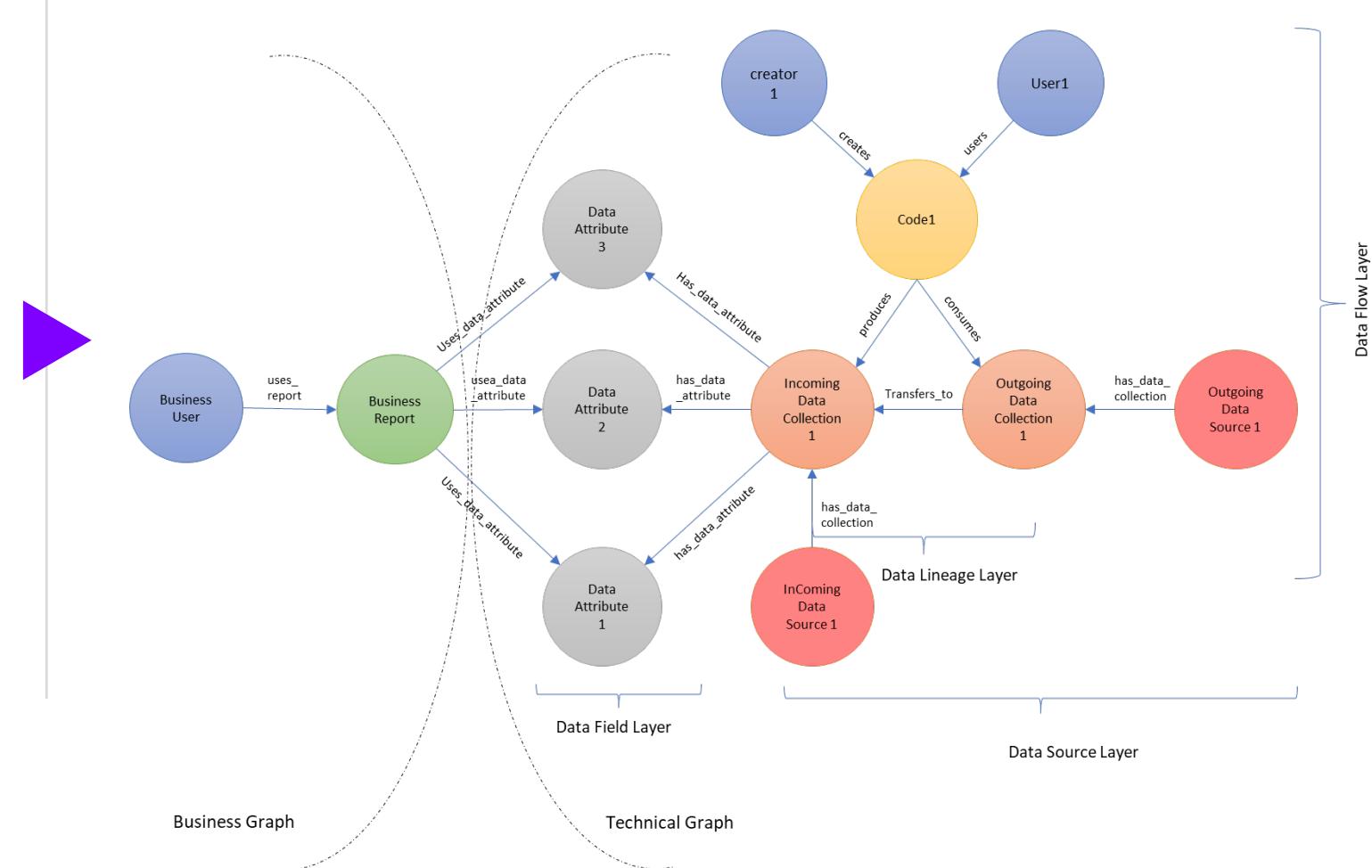
DATA SUPPLY CHAIN

CAPTURE HUMAN REASONING

Start with the questions

- “What data feeds into this financial report?”
- “Who are all the people who access financial data?”
- “I want to be notified when new customer data becomes available”
- Who created the data?
- What did they use?
- What is using the data?
- What else do they use?

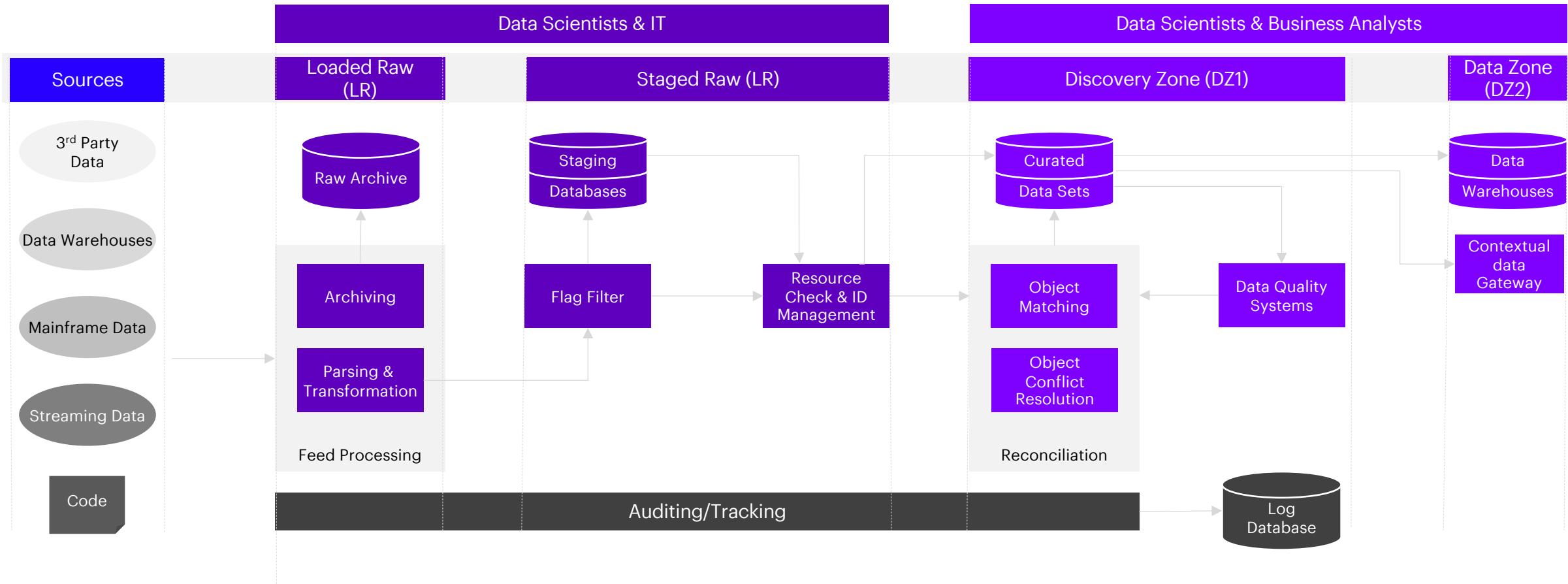
Example Model Schema



DATA SUPPLY CHAIN

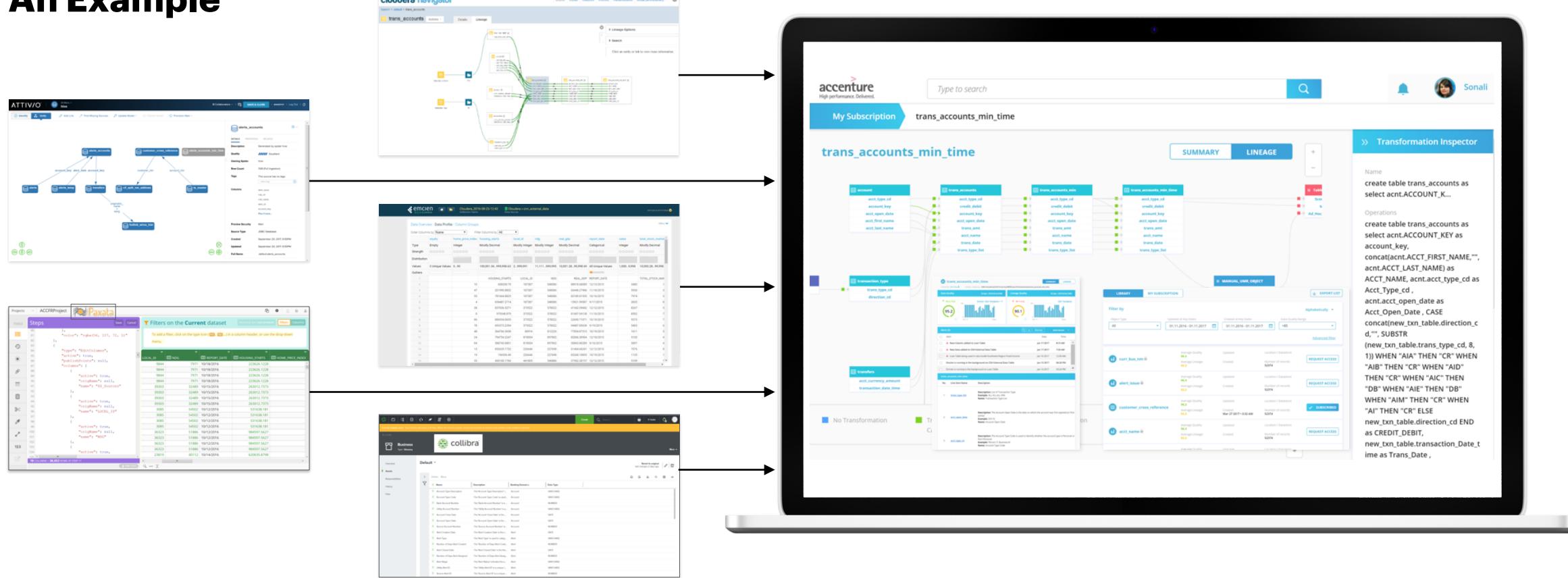
HYDRATE THE GRAPH

Example: Data Supply Chain



DATA SUPPLY CHAIN APPLY & CURATE THE GRAPH

An Example



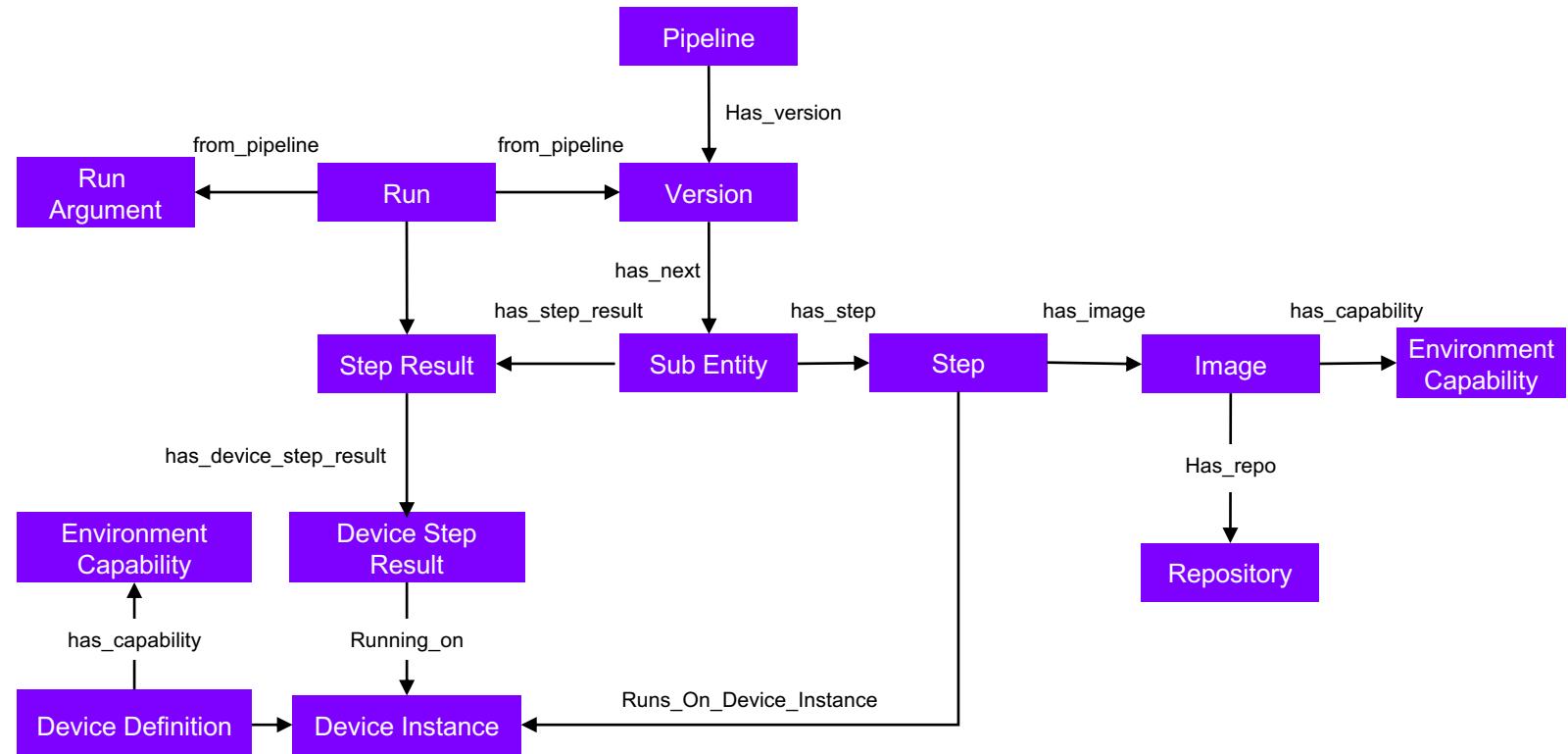
AI POWERS AI

AI PIPELINES CAPTURE HUMAN REASONING

Start with the questions

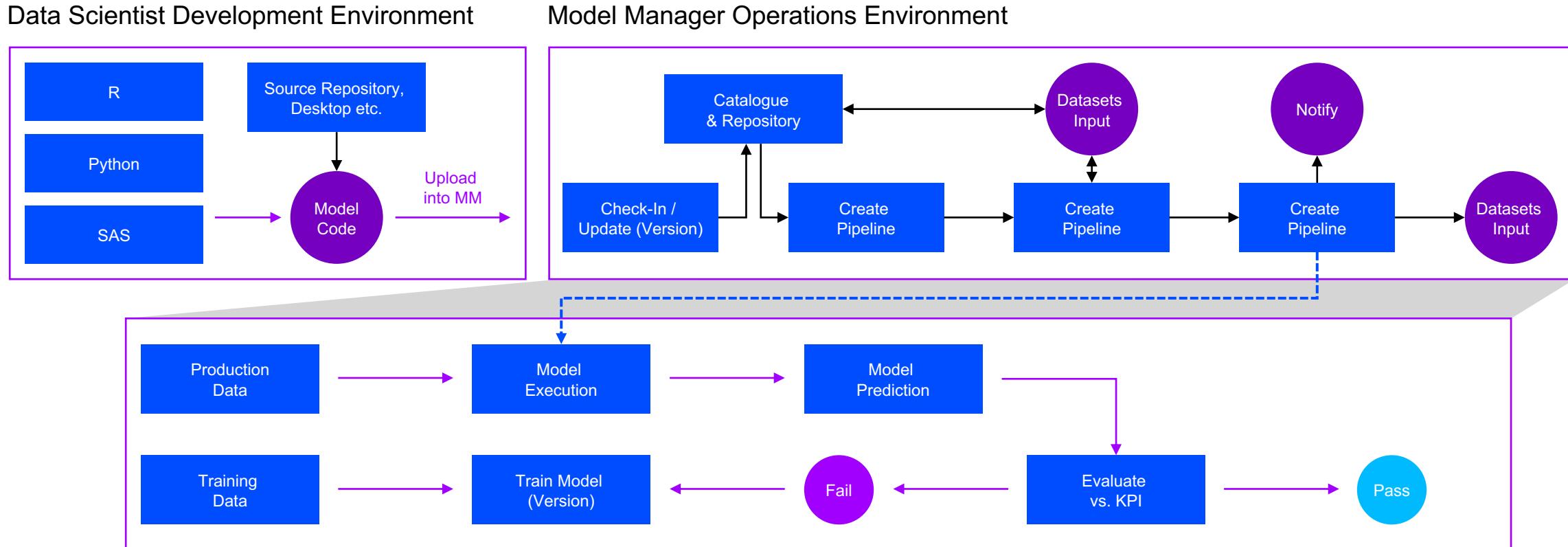
- Where is the model used?
- Who created the model?
- What does it do?
- How do we evaluate it?
- What do we do if it fails?

Example Model Schema



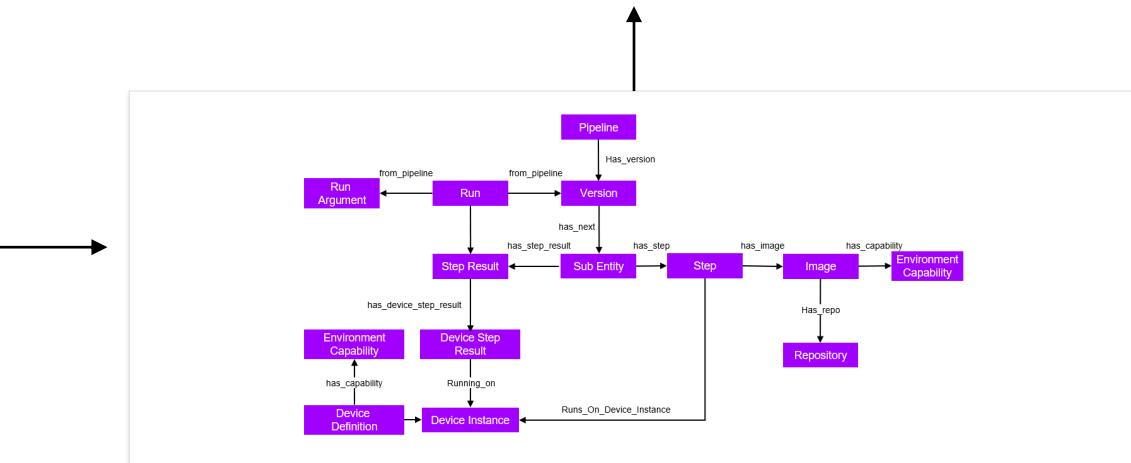
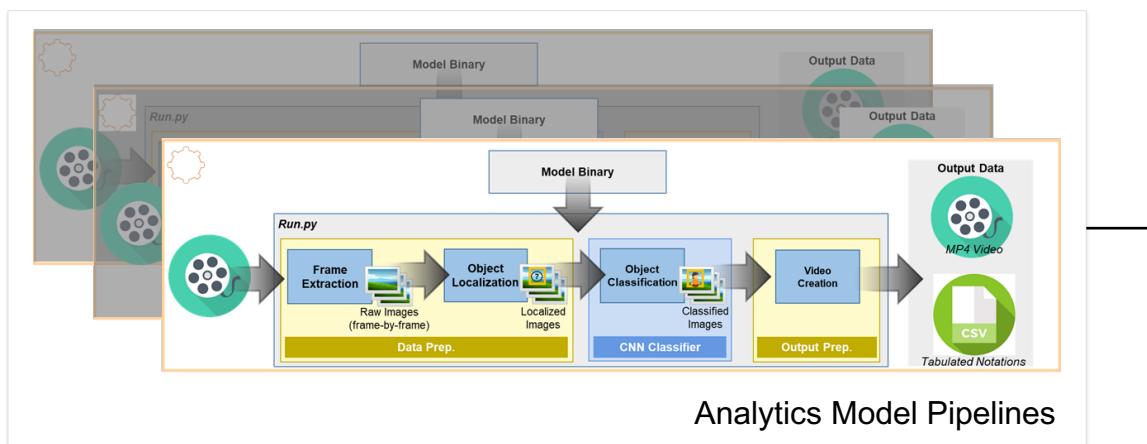
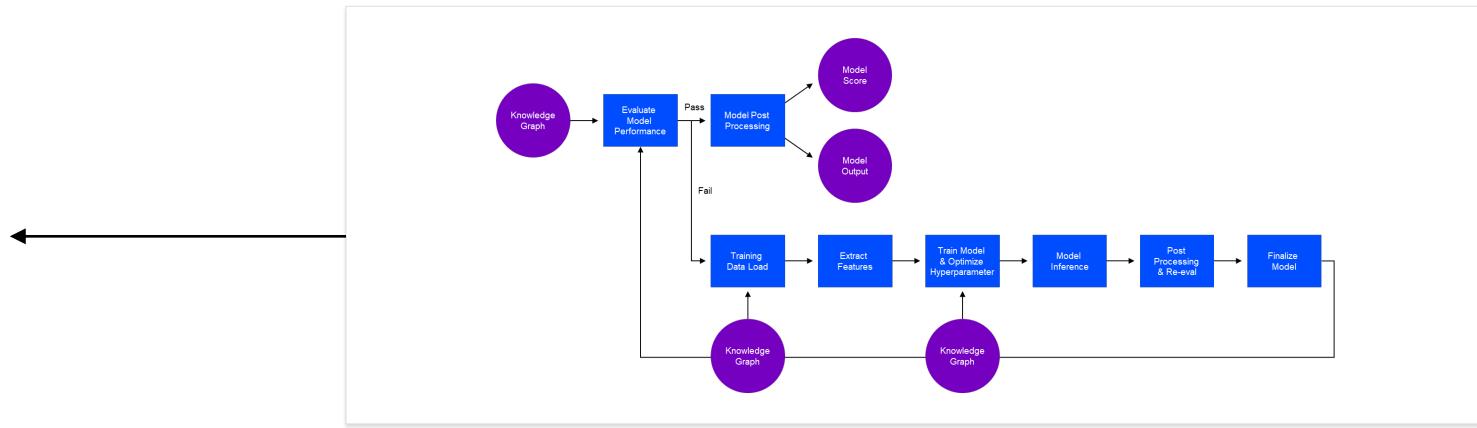
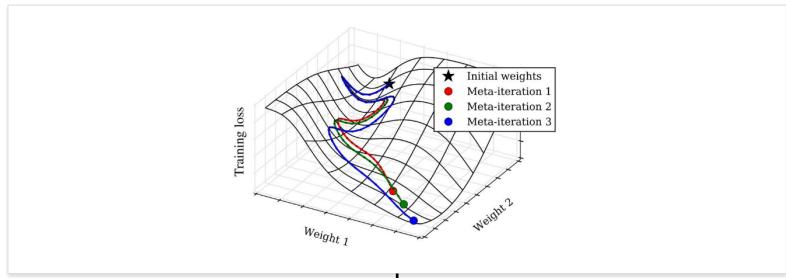
AI PIPELINES HYDRATE THE GRAPH

Example Model Management System



AI PIPELINES APPLY & CURATE THE GRAPH

An Example

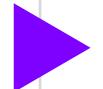


A REAL USE CASE

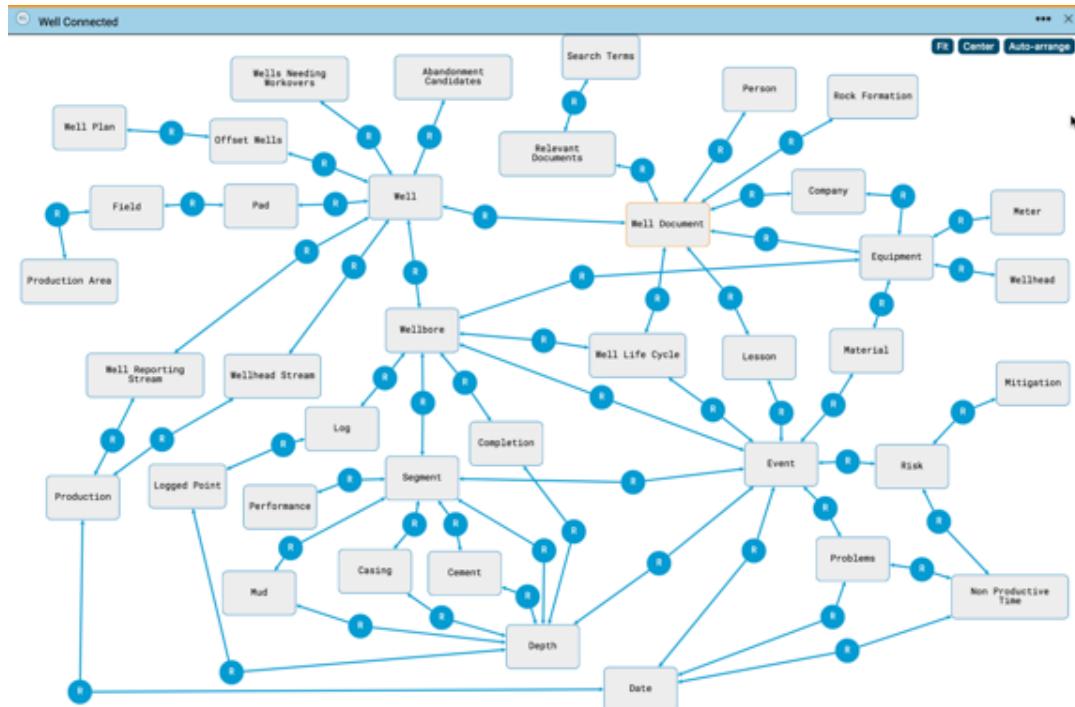
WELL ADVISOR CAPTURE HUMAN REASONING

Start with the questions

- How should we plan our next well?
- What are similar offset wells?
- What are events I should be aware of?
- What sort of impact do they have?
- How often does it happen?
- Under what conditions?



Example Model Schema



WELL ADVISOR HYDRATE THE GRAPH

Data Sources

Drilling Databases



Drilling Report

FWR	HIS Report	FDP
Bit record	NOOP & AFE	DDR
Rushmore	Mud Logs	Final DD/MWD Report
Final Geologic al Report	Post Drilling Report	Final Cement Report

Drilling Data Type

- Well Architecture (stick chart)
- Actual Mud weight ranges, cement type & quality
- Downhole related problems
- NPT data
- Lessons Learnt/After Action Review/TL Performance
- Well Depth
- Well Cost & Days
- Rig type
- Time and date of historical well
- Geological & Lithological Prognosis
- Any relevant regional info/issues
- Sidetracking method & info
- ...

Non-Exhaustive

Legend:

Structured



Unstructured

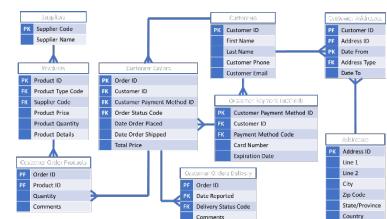
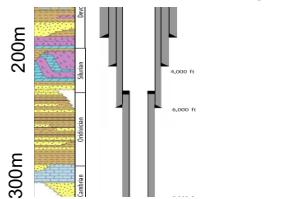


Extract from Original System

Example from Drilling Report:

Skid out cantilever 50 ft to transom aftwards, 2 ft transverse portwards to well center and secure same.

Example Well Design Schematic



Natural Language Processing

- Regular Expressions
- Dictionary-based approaches
- Pattern-based approaches
- Machine Learning
- Other combinations

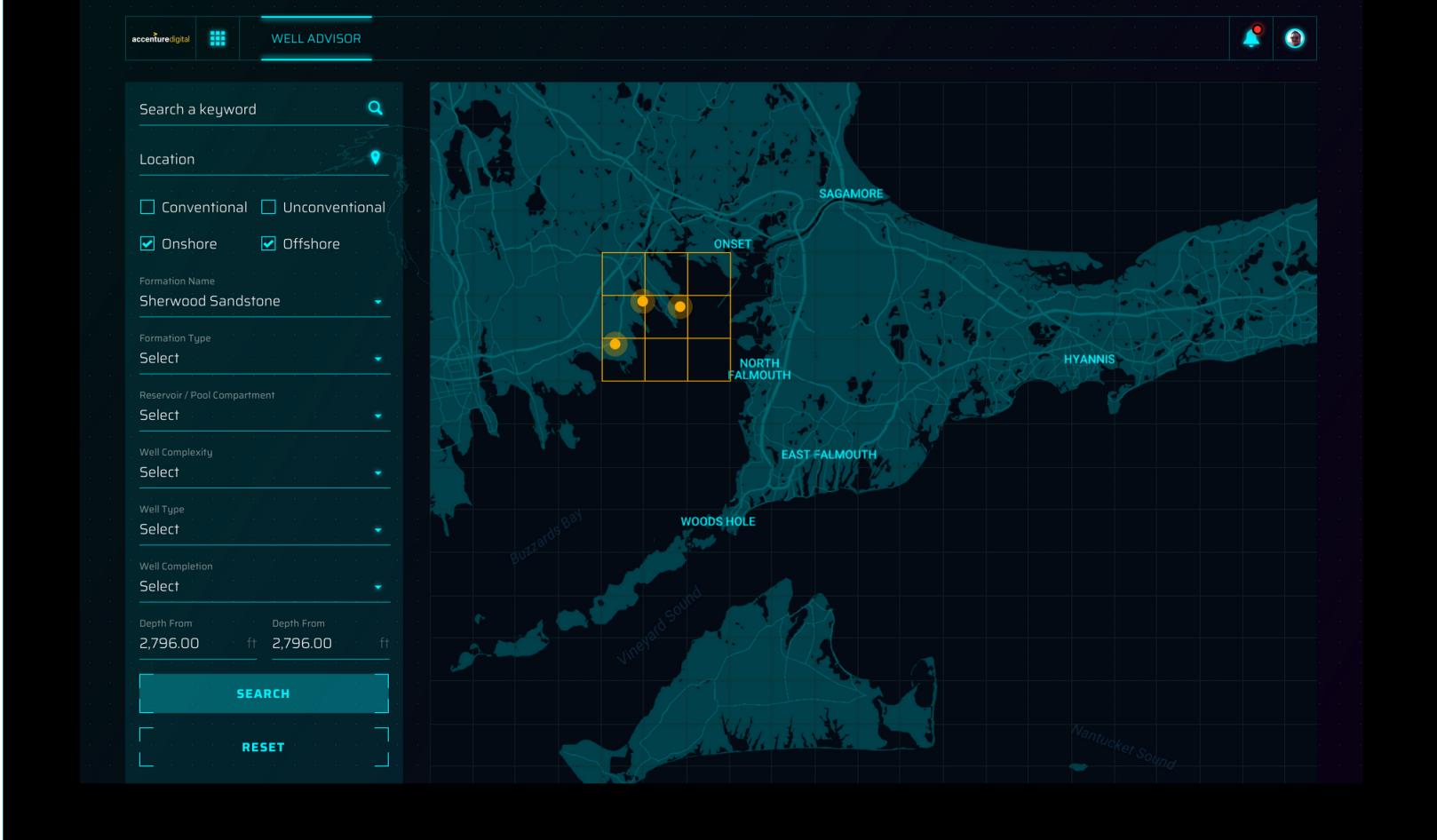
Image Processing

- Image Recognition
- Image Detection
- Image Classification
- Edge Detection
- Corner Detection

Relational Data Processing

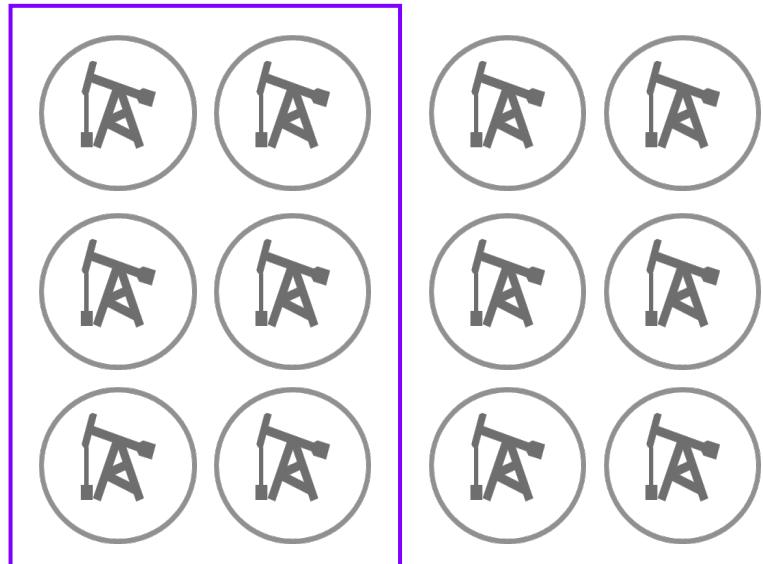
- Schema Parsing
- Entity Relationship Diagram to Hierarchy Parsing
- Data Normalization/ Denormalization

WELL ADVISOR APPLY & CURATE THE GRAPH



1

Identify population of wells that meet the search criteria

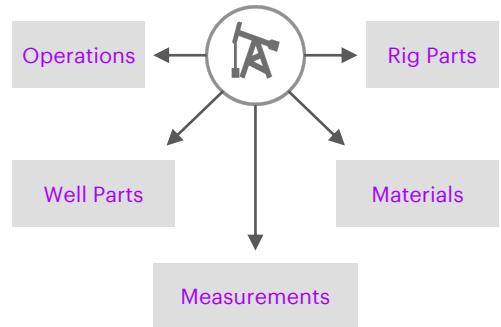


WELL ADVISOR APPLY & CURATE THE GRAPH

The screenshot shows the Well Advisor application interface. At the top, there's a navigation bar with the 'accenture digital' logo, a 'WELL ADVISOR' button, and notification icons. Below the navigation is a world map with several yellow dots representing well locations. A search bar contains the text 'mud' and a location dropdown set to 'London'. On the left, there are several filter dropdowns: 'Conventional' (unchecked), 'Unconventional' (unchecked), 'Onshore' (checked), 'Offshore' (checked), 'Formation Name' (set to 'Sherwood Sandstone'), 'Formation Type' (set to 'Select'), 'Reservoir / Pool Compartment' (set to 'Select'), 'Well Complexity' (set to 'Select'), 'Well Type' (set to 'Select'), 'Well Completion' (set to 'Select'), and depth ranges 'Depth From' (2,796.00 ft) and 'Depth To' (2,796.00 ft). A large 'UPDATE' button is at the bottom. The main area is titled 'Search Results' and shows five cards for 'Well A', 'Well B', 'Well C', 'Well D', and 'Well E', each with details like 'Location: Wytch Farm', 'Well Type: Production', and 'Formation: Clastics'. Below this is a section titled 'Suggestions' with similar cards for 'Well D' and 'Well E'. At the bottom, there's a 'Area Profile' section with six circular icons: 'AFE vs Cost', 'SPUD Date', 'Depth', 'Sections', 'NPT', and 'Incidents'.

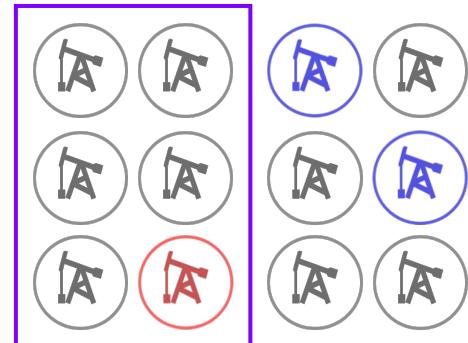
2

Generate a unique profile based on the population



3

Recommend similar wells to the profile or identify outliers



WELL ADVISOR APPLY & CURATE THE GRAPH

WELL ADVISOR

Events

Investigation

Explanation

Advisor

Workspace

LOST CIRCULATION

Loss of drilling fluid into formation detected during drilling.

0 hr ago Draft

2/4

WELL 1

NPT 28 hrs

Highly fractured zone Sherwood group

Actions taken by driller:

- Stopped drilling, POOH to shoe, switched to Trip tank, Reduced pump rate and monitor continued losses @ 8bbls
- Shut in Well and monitored - continued losses
- Reduced Mud Weight to 14.5G pumped slug - circulated BU, monitor, continued losses
- Pumped LCM - monitored - no losses
- Discussion with shore
- Reduced mud weight to 1.2SG and continued drilling

0 hr ago 1/2

WELL 1 ACTIONS

- Decrease mud weight to less than 12.5 ppg
- Assign task to review
- Assign task to review Geology

1/2

WELL 2

NPT 6 hrs

Highly fractured zone Sherwood group

Actions taken by driller:

- Observed losses, POOH to shoe, switched to Trip tank, reduced pump rate and monitored - no losses RIH slowly increase SPM and monitor no losses
- Continued drilling with reduced ROP and

0 hr ago 1/2

WELL 2 ACTIONS

- Advise drilling parameters: ROP 5-8m/hr; SPM 15 in section of hole
- Assign task to review drilling program

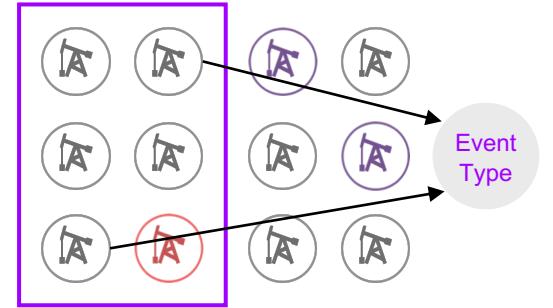
1/2

RELATED DOCUMENTS

- Well D Incident Report
- Author Zhijie Wang Last Updated 12.11.2017
- (...) circulation loss detected at Well D- Confirmed via measurements of (...)
- Field 1
- Financial Data in Field
- Last Updated 12.11.2017
- (...) Well B is contained in Field 1
- Drill Report for Well B
- Author Colin Puru Last Updated 12.11.2017
- (...) Well D is part of Field 1

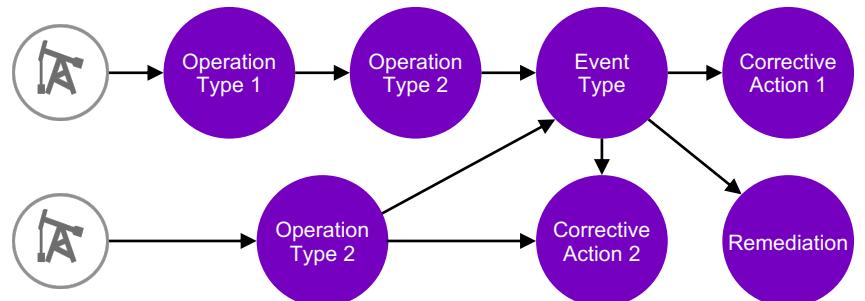
4

Identify commonalities or abnormalities in the curated population



5

Track remediation and explain consequences or commonalities.



Formula for Successful AI

Good Data +
Managed Models =
Best Outcomes

Formula for Successful AI at Scale

Good Data^{AI} +
Managed Models^{AI}
= Best Outcomes

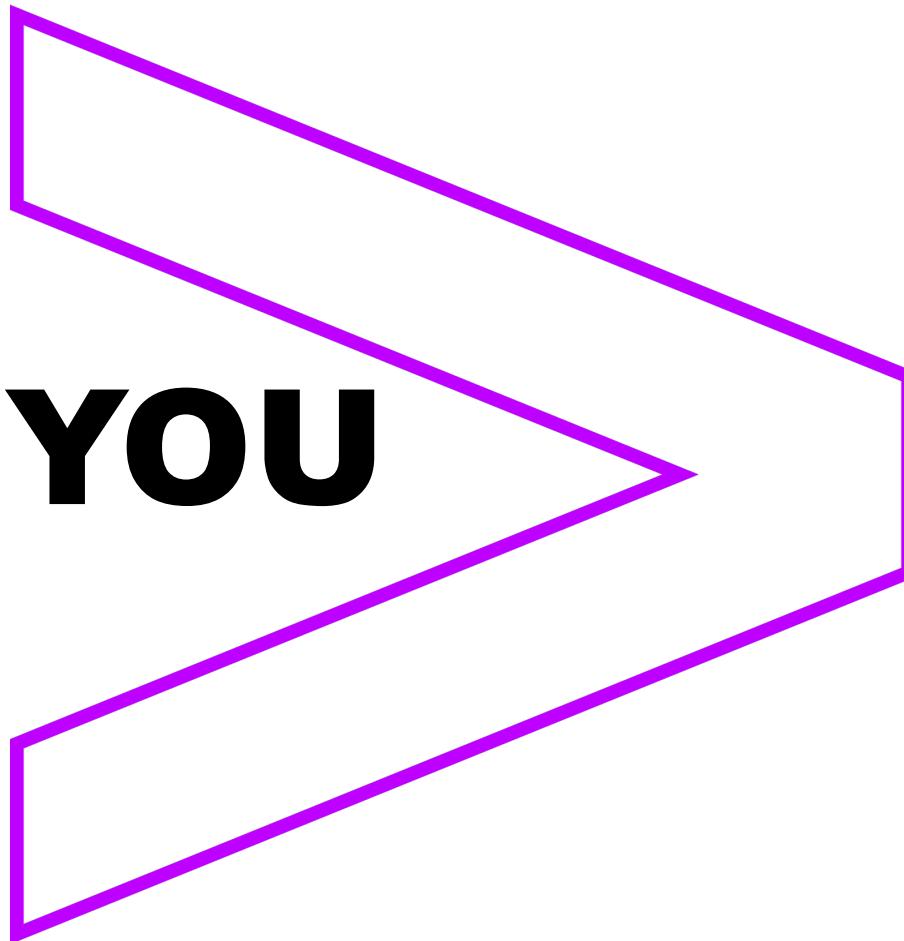
THANK YOU

LABS

TERESA.TUNG

**APPLIED
INTELLIGENCE**

JEAN-LUC.CHATELAIN



INTRODUCTION

Knowledge Graph

The screenshot shows the FutureBank Ops Risk application interface. On the left, a green sidebar displays a customer profile for 'Mellony McCoughnay' (Melanie) with details like location (Honolulu, HI), weather (78° Partly Cloudy), and status (VIP CLIENT). It also shows 'Customer Info' (Customer since May 4th, 2018), 'Language Preference' (English), and 'Authorized Users' (John McCoughnay). Below this are sections for 'Active Accounts (5)' and 'History (8)'. The main area is a ticket resolution interface for 'Ticket: A12FGX4'. It includes tabs for 'COMPLAINT' and 'RESOLUTION'. The 'COMPLAINT' tab shows a probable issue ('Points & Rewards (80% Confident)'), issue category ('Points & Rewards (80% Confident)'), issue subcategory ('Promotion Issue (90% Confident)'), relevant promotion ('Summer 2018 (90% Confident)'), relevant account ('VISA Ending 2532'), and a message from the customer. The 'RESOLUTION' tab lists verifications (Agent Verified Customer, Customer Verified Account, Customer Verified Issue checked), match criteria (Points Match, Dollar Match, Account Match, New Account Verification, Spending Verification checked), and a resolution message. At the bottom, there are 'RECOMMENDED PROMPTS' and a 'CALL TRANSCRIPT' section.

Natural Language Processing

Customer 360:

Create a view of a customer by contextualizing the aggregate data across the company.

One application is for customer service that aims to reduce the time for complaints resolution where the knowledge graph helps diagnose the issues, recommend solutions, and dynamically routing to employees with the most knowledge of a given issue at hand.

Front end GUI of the Ops Risk application where knowledge graphs are used for classification, routing of information, and inferencing while analyzing customer issues

A KNOWLEDGE GRAPH APPROACH CUSTOMIZES AND ADAPTS

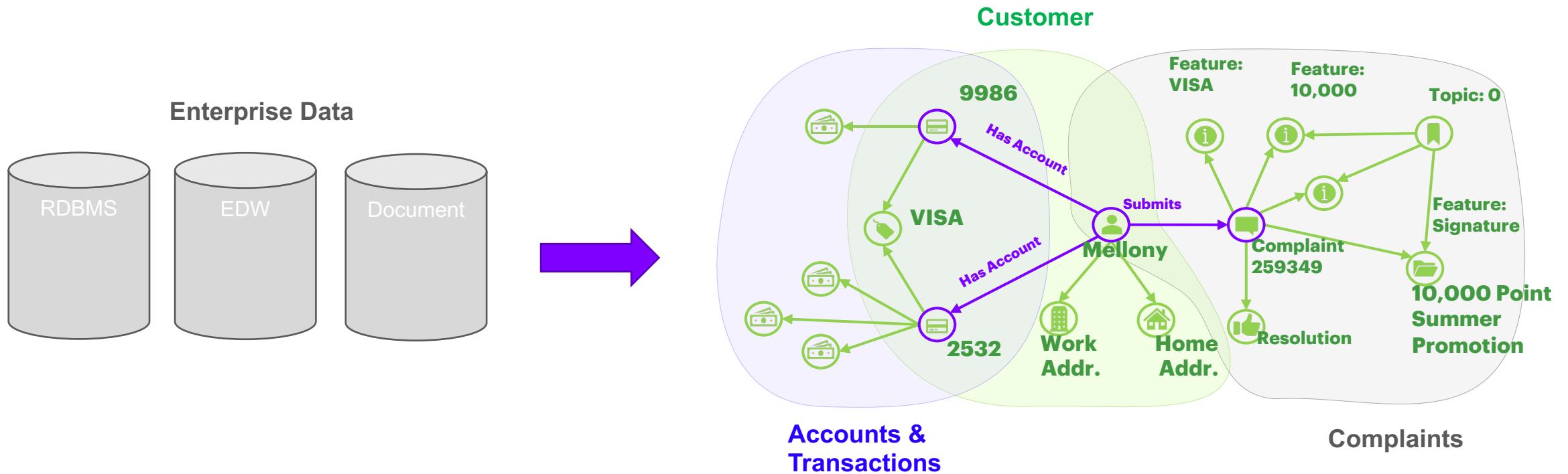
CUSTOMER INTERACTIONS

CURRENT STATE	KNOWLEDGE-ENABLED STATE
Static issue classification: Fixed rules classify issue category.	Flexible issue classification including partial matches: Classification rules dynamically updated based on dynamically learned features. Partial matches are possible and highlighted to the representative. Even classification categories are continuously updated in the background.
Static decision trees: Resolution options exist and may allow the representative to override.	Dynamic resolution guidance: Dynamic guidance highlights how the current complaint fits into the exact resolution. Representative action and resolution success are feedback immediately.
High-level matching to Customer Service Representative expertise: Complaint routing is directed to groups of representatives, but without fine-grained differentiation	Directed routing a specific Customer Service Representative's expertise: Routing to select the best resolution dynamically recomputes to take in factors like past relationships with this customer or customers like this one or complaints like this one. Determining "like" is continuously updated in the background based on successful resolution.

CATEGORIZATION USES CROSS-DOMAIN KNOWLEDGE

An knowledge model combined with enterprise data creates a contextualized view.

Example: Enterprise data across 3 domains are merged to provide a view for complaint categorization.



COMPLAINT CONTEXT GUIDES RESOLUTION

Example: The knowledge graph models how customers, credit cards, and promotions interact.

In addition, we know that Mellony has a particular Visa card ending in 2532. We know her issue revolves around a promotional offer.

As a result we can drill down to the issue very quickly and see that she should have received points after her transactions and the interaction is dynamic with respect to ACTUAL customer information



**Customer:
Mellony**



**CSR:
Matt**

Hi, I recently signed up for a VISA Signature Card that was supposed to give me 10,000 points when I spent \$1,000. I have spent \$2563 but I don't see the points. Can you please help me figure this out?

Hi Mellony, is this in reference to your account ending in 2532?

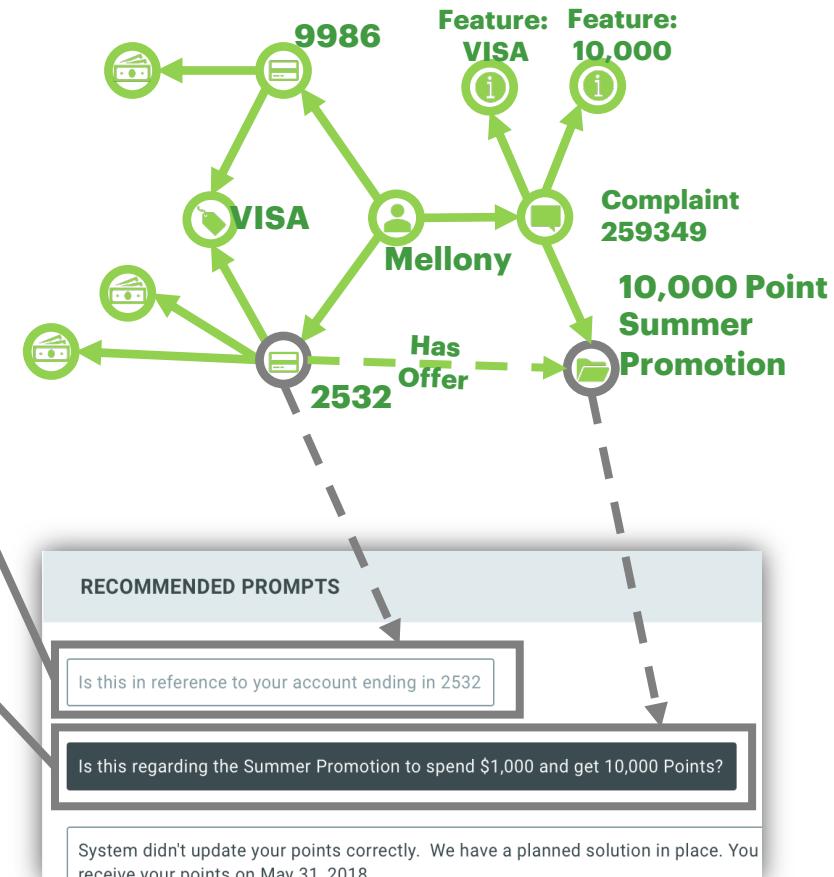
Yes!

Great! Is this regarding the Summer Promotion to spend \$1,000 and get 10,000 on any existing card?

It wasn't a summer promotion, I can't remember the exact name though.

Not a problem, I see we have a Signature Card Promotion with similar criteria.

That sounds right!



Guidance for conversations based on contextual cues from direct knowledge graph links within the view of customer and their information

INFER NEW “BEST” RESOLUTIONS

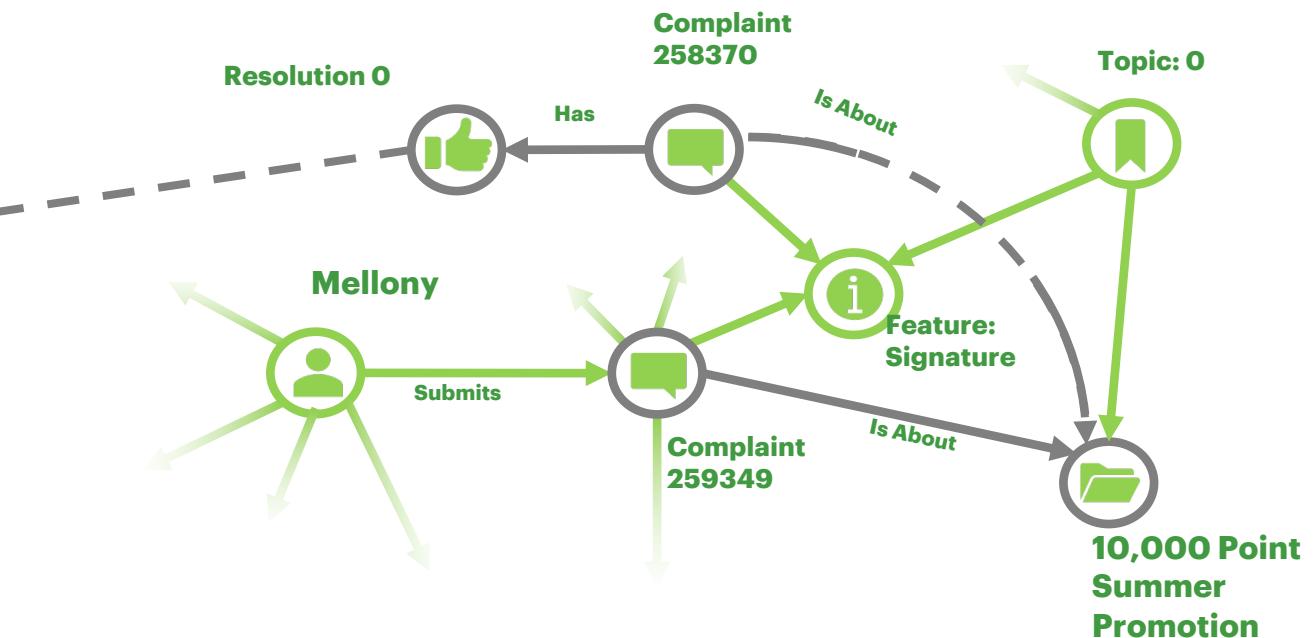
EXAMPLE: While the system cannot provide customer service representative Matt an exact pre-programmed resolution, traversing the knowledge graph discovers similar complaints with a resolution.

In this particular case, a previous customer complaint 258370 has a similar feature and a resolution that indicates a system fix will be applied card holders.

As Matt applies this resolution in the future, this resolution can be linked directly to the 10,000 Point Summer Promotion.

RESOLUTION

- System didn't update your points correctly. We have a planned solution in place. You will receive your points on May 31, 2018.
- Users billing cycle will end on May 30th, 2018. Promotion points will be applied on May 31st, 2018



Inferencing within a knowledge graph is performing a query that traverses the relationships over one or more hops