Microsoft Ignite

Build agents with knowledge, agentic RAG and Azure AI Search

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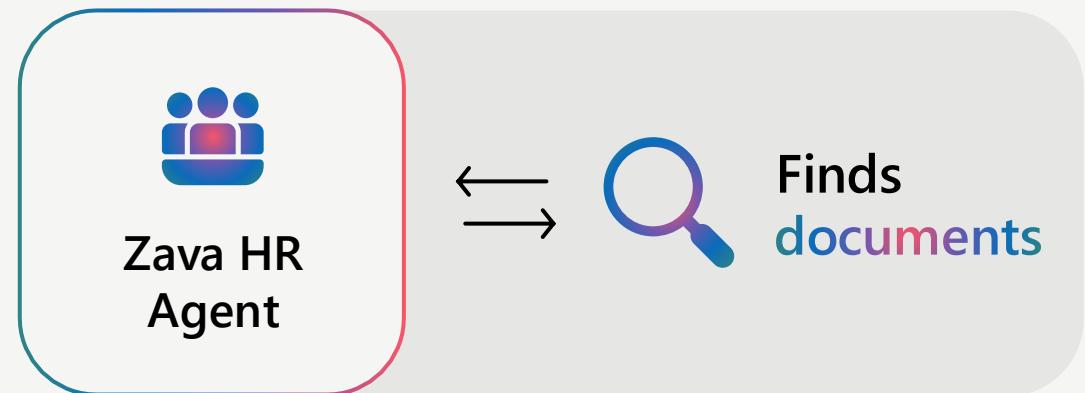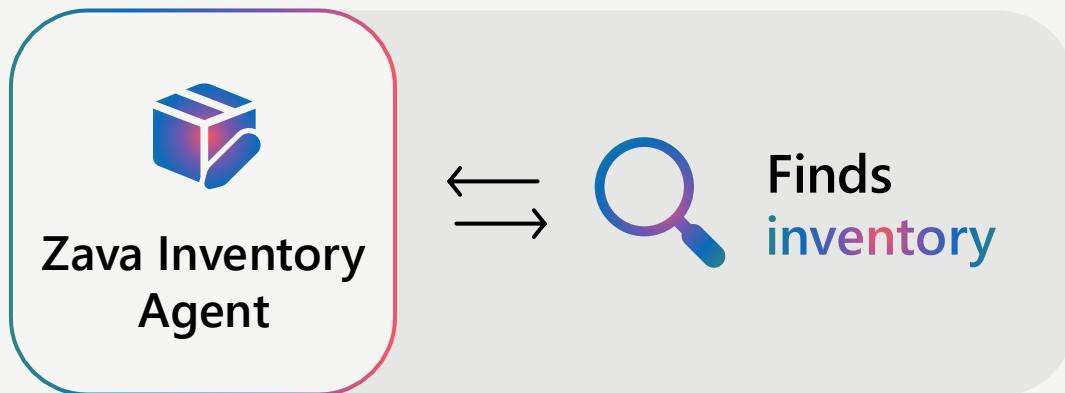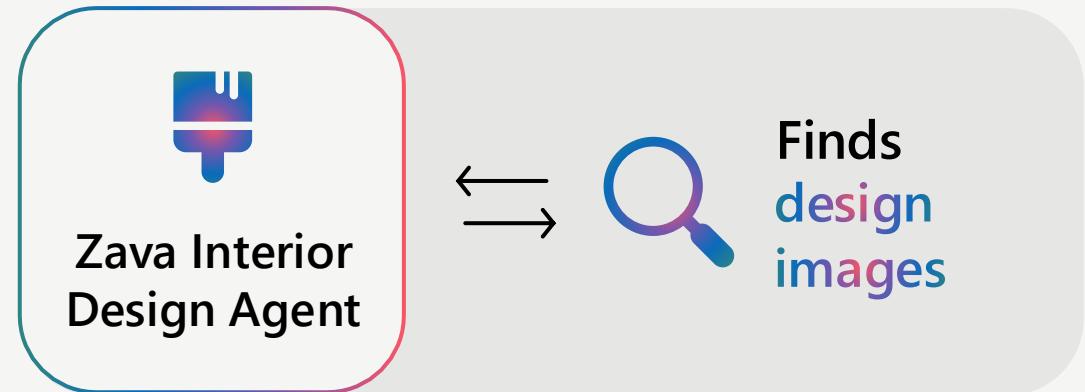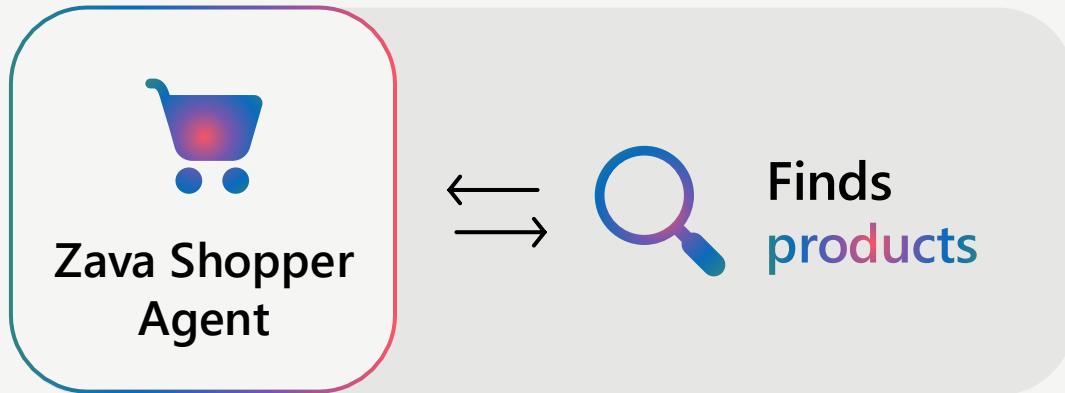
Agenda

- RAG 101
- Knowledge Bases in Azure AI Search
- Microsoft Foundry and Knowledge Bases
- Q&A

Introduction to RAG
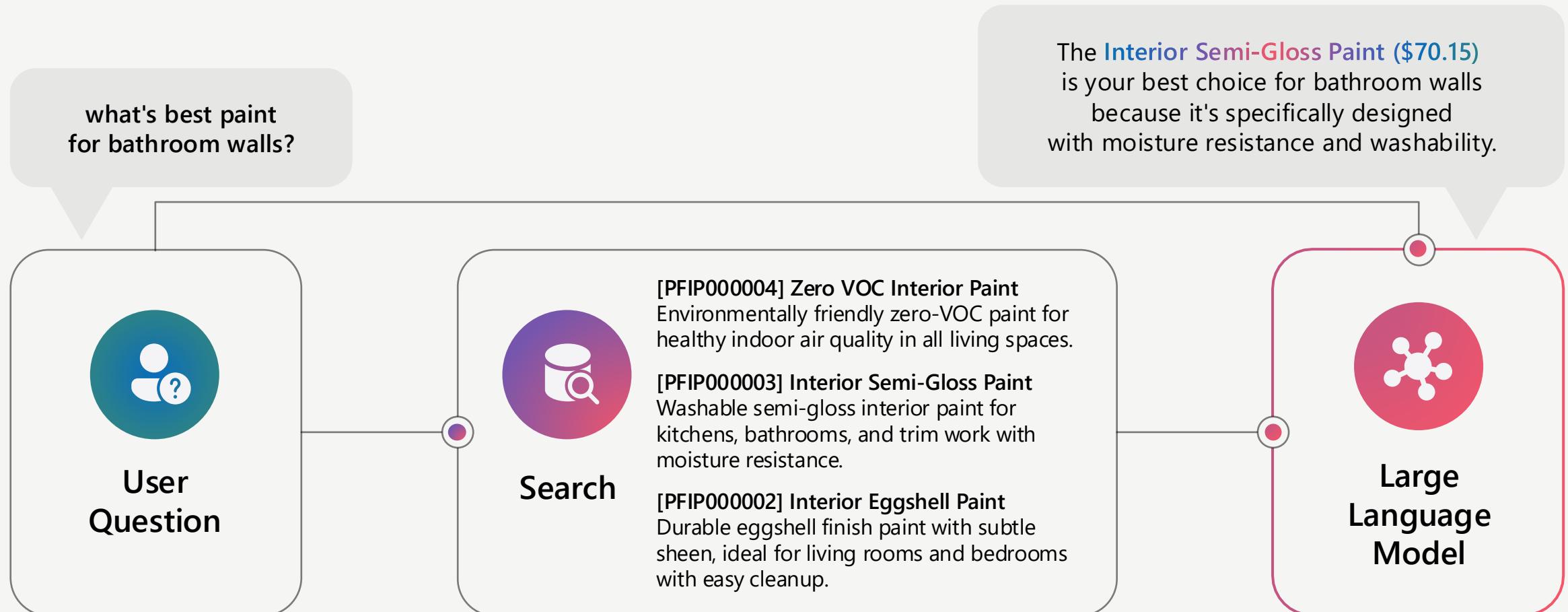
# Every domain needs agents. Every agent needs context.

Zava Shopper Agent ← → Finds **products**

Zava Interior Design Agent ← → Finds **design images**

Zava Inventory Agent ← → Finds **inventory**

Zava HR Agent ← → Finds **documents**

How do agents use context? RAG!

Retrieval-Augmented Generation (RAG) grounds
the response from an LLM in the retrieved context.

The Interior Semi-Gloss Paint ($70.15)
is your best choice for bathroom walls
because it's specifically designed
with moisture resistance and washability.

what's best paint
for bathroom walls?

**User
Question**

Search

[PFIP000004] Zero VOC Interior Paint
Environmentally friendly zero-VOC paint for
healthy indoor air quality in all living spaces.

[PFIP000003] Interior Semi-Gloss Paint
Washable semi-gloss interior paint for
kitchens, bathrooms, and trim work with
moisture resistance.

[PFIP000002] Interior Eggshell Paint
Durable eggshell finish paint with subtle
sheen, ideal for living rooms and bedrooms
with easy cleanup.

**Large
Language
Model**

Azure AI Search

State-of-the-art retrieval

| Rigorously tested retrieval | Streamlined data pipeline | Developer integrations | Enterprise-ready foundation |
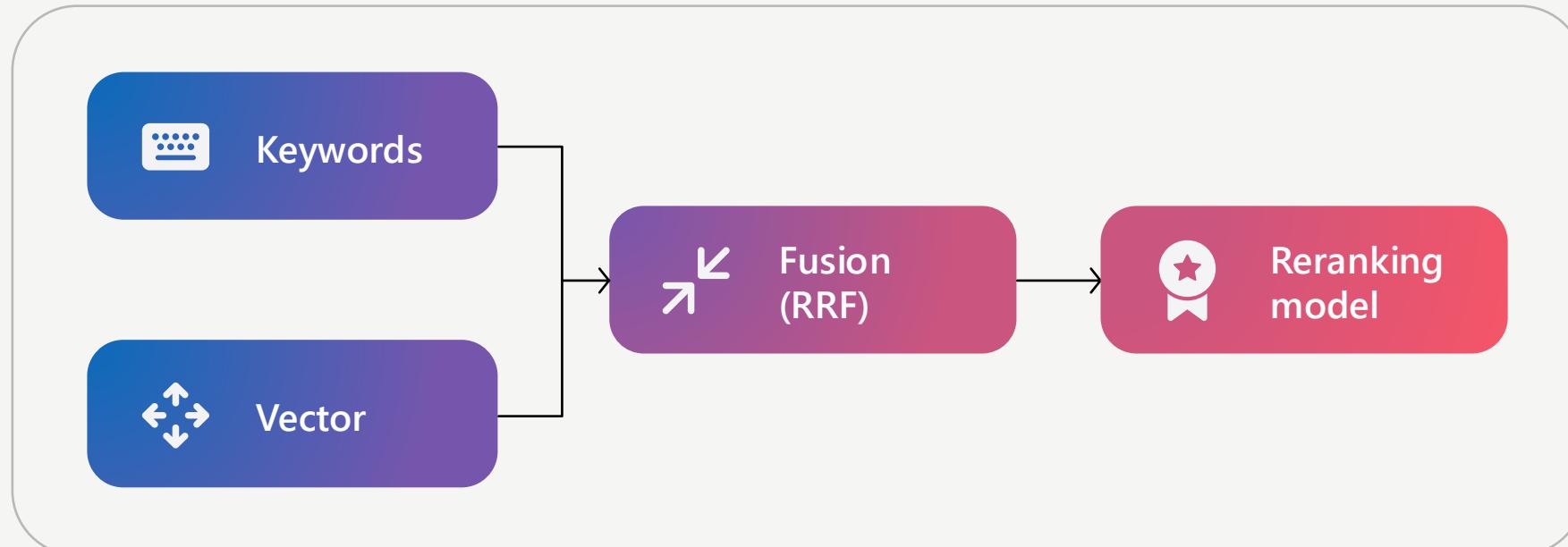
Hybrid search: Optimal retrieval strategy

Complete search stacks do better:

- Hybrid retrieval (keywords + vectors) > pure-vector or keyword
- Hybrid + Reranking > Hybrid
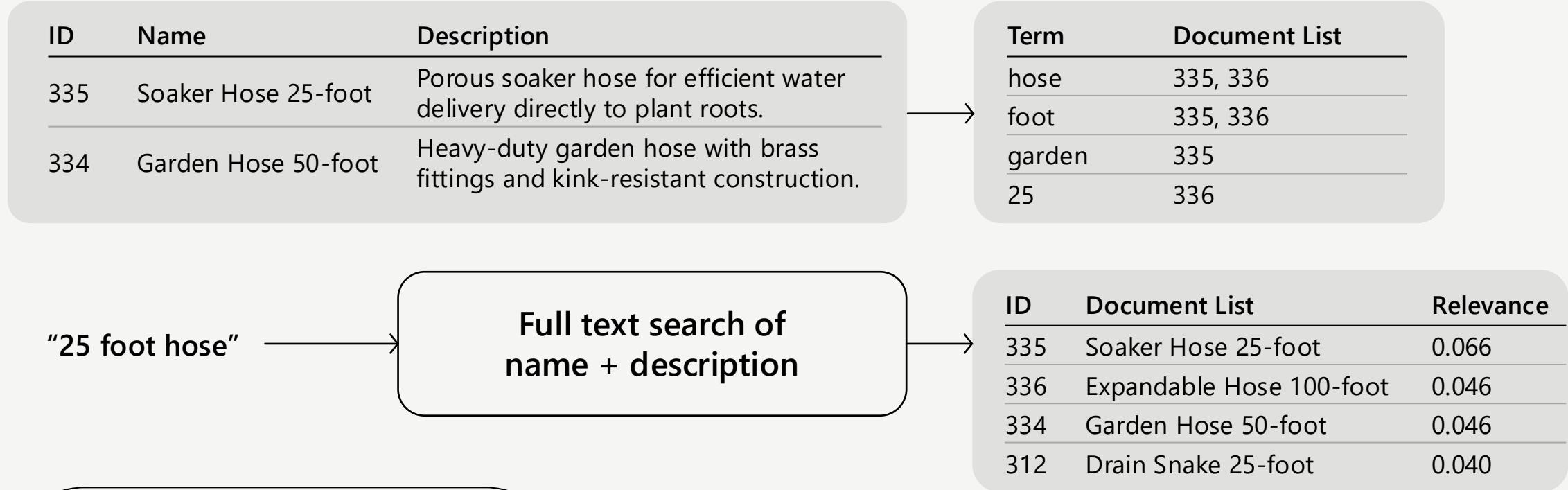
Let's break those down...

Keyword search

Documents are stored in an **inverted index** which can be queried efficiently.

ID	Name	Description
335	Soaker Hose 25-foot	Porous soaker hose for efficient water delivery directly to plant roots.
334	Garden Hose 50-foot	Heavy-duty garden hose with brass fittings and kink-resistant construction.

→

Term	Document List
hose	335, 336
foot	335, 336
garden	335
25	336

"25 foot hose" →

Full text search of name + description

→

| ID	Document List	Relevance
335	Soaker Hose 25-foot	0.066
336	Expandable Hose 100-foot	0.046
334	Garden Hose 50-foot	0.046
312	Drain Snake 25-foot	0.040

Example:
aka.ms/aisearch-examples
zava_search_keyword.py
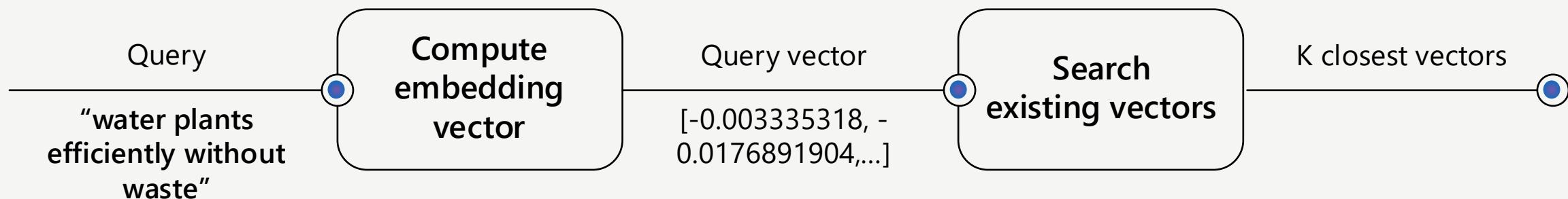
AI Search uses the **BM25** algorithm, commonly considered to be the best full-text search algorithm.

Vector search

1. **Encode queries as embeddings** (lists of floating point numbers)
2. **Find semantically similar documents by comparing embeddings**

Query → **Compute embedding vector** → Query vector → **Search existing vectors** → K closest vectors

Query: **"water plants efficiently without waste"**

Query vector: [-0.003335318, -0.0176891904,...]
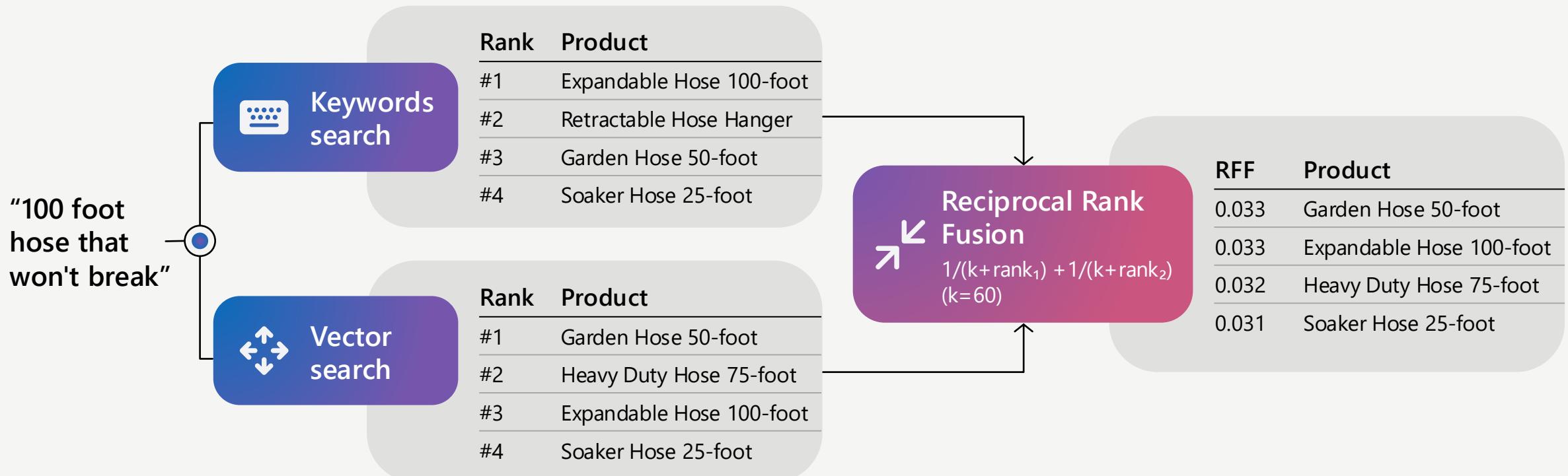
AI Search can use the **HNSW** approximation algorithm for more efficient search across massive vector indices.

Example:
aka.ms/aisearch-examples
zava_search_vector.py

| Name	Cosine Similarity
Self-Watering Planter	0.632
Misting Sprinkler	0.610
Tomato Plant Food	0.591

RRF: Reciprocal Rank Fusion
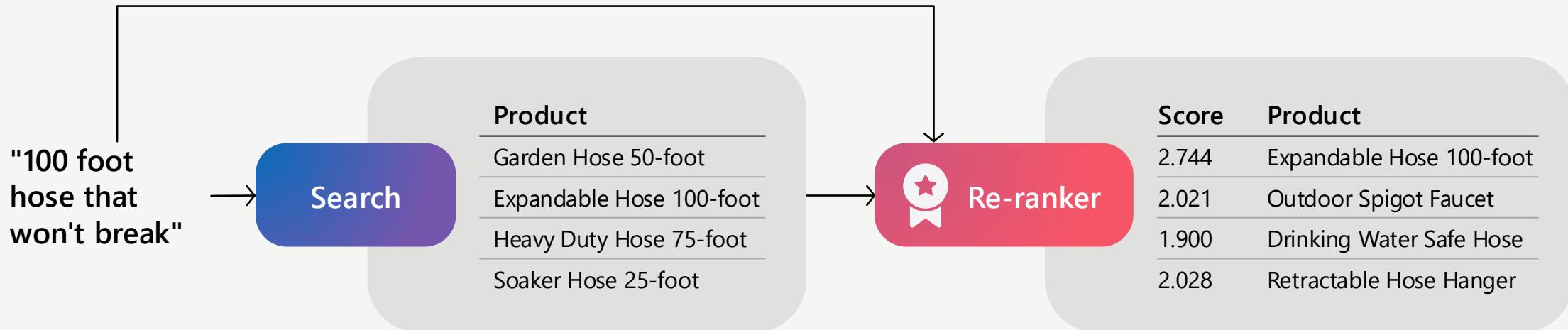
Using text **and** vector search? Merge results using RRF to rank results based off their relative ranks.

"100 foot hose that won't break"

Keywords search

Rank	Product
#1	Expandable Hose 100-foot
#2	Retractable Hose Hanger
#3	Garden Hose 50-foot
#4	Soaker Hose 25-foot

Vector search

Rank	Product
#1	Garden Hose 50-foot
#2	Heavy Duty Hose 75-foot
#3	Expandable Hose 100-foot
#4	Soaker Hose 25-foot

Reciprocal Rank Fusion

$$1/(k+rank_1) + 1/(k+rank_2)$$
$$(k=60)$$

RFF	Product
0.033	Garden Hose 50-foot
0.033	Expandable Hose 100-foot
0.032	Heavy Duty Hose 75-foot
0.031	Soaker Hose 25-foot

Example:
aka.ms/aisearch-examples
zava_search_rrf.py

Re-ranking
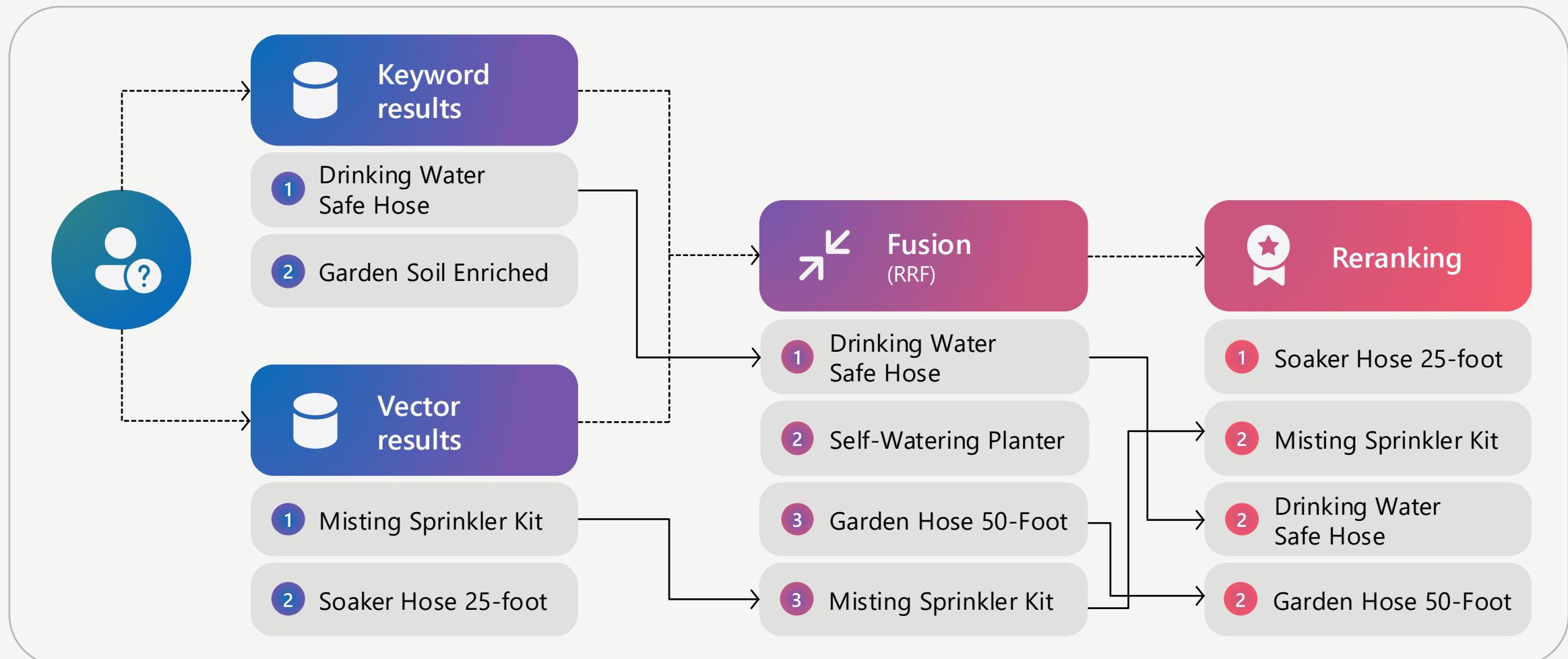
A re-ranking step assigns documents a relevance score according to the original query. AI Search uses a **cross-encoder** model for the re-ranking step, which was trained on human scores.

"100 foot hose that won't break"

Search

Product
Garden Hose 50-foot
Expandable Hose 100-foot
Heavy Duty Hose 75-foot
Soaker Hose 25-foot

Re-ranker

Score	Product
2.744	Expandable Hose 100-foot
2.021	Outdoor Spigot Faucet
1.900	Drinking Water Safe Hose
2.028	Retractable Hose Hanger

Example:
aka.ms/aisearch-examples
zava_search_reranker.py

A complete hybrid search flow

Question: "garden watering supplies"

Impact of hybrid search across query types

Query type	Keyword [NDCG@3]	Vector [NDCG@3]	Hybrid [NDCG@3]	Hybrid + Semantic ranker [NDCG@3]
Concept seeking queries	39	45.8	46.3	59.6
Fact seeking queries	37.8	49	49.1	63.4
Exact snippet search	51.1	41.5	51	60.8
Web search-like queries	41.8	46.3	50	58.9
Keyword queries	79.2	11.7	61	66.9
Low query/doc term overlap	23	36.1	35.9	49.1
Queries with misspellings	28.8	39.1	40.6	54.6
Long queries	42.7	41.6	48.1	59.4
Medium queries	38.1	44.7	46.7	59.9
Short queries	53.1	38.8	53	63.9

Source: Outperforming vector search with hybrid + reranking

When hybrid search isn't always enough...

Multiple questions in one query

What type of paint would be most suitable for a bathroom, and what is the estimated cost range for high-quality options?

Chained queries

Explain how to paint my house most efficiently. Then give me a list of the Zava products and prices for each supply

Queries requiring external knowledge

What's the best Zava sander for table corners and when do I replace my sanding pad?

Knowledge Bases in Azure AI Search

Agentic retrieval with knowledge bases
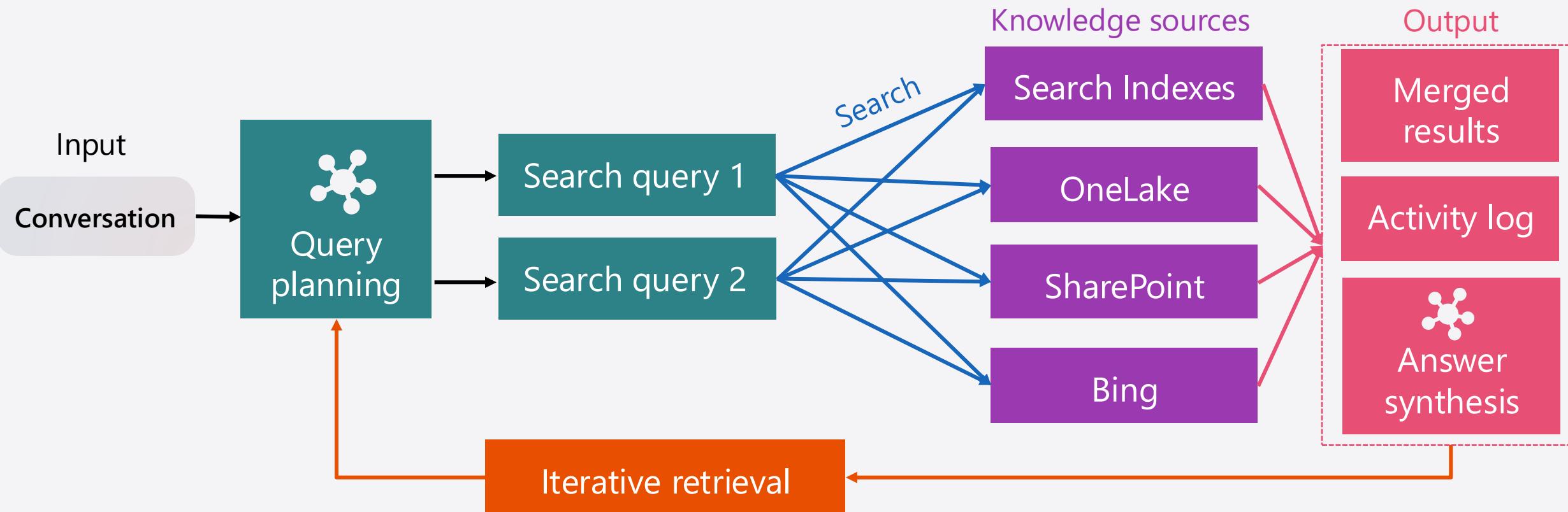
Public preview

Agentic methods applied to retrieval
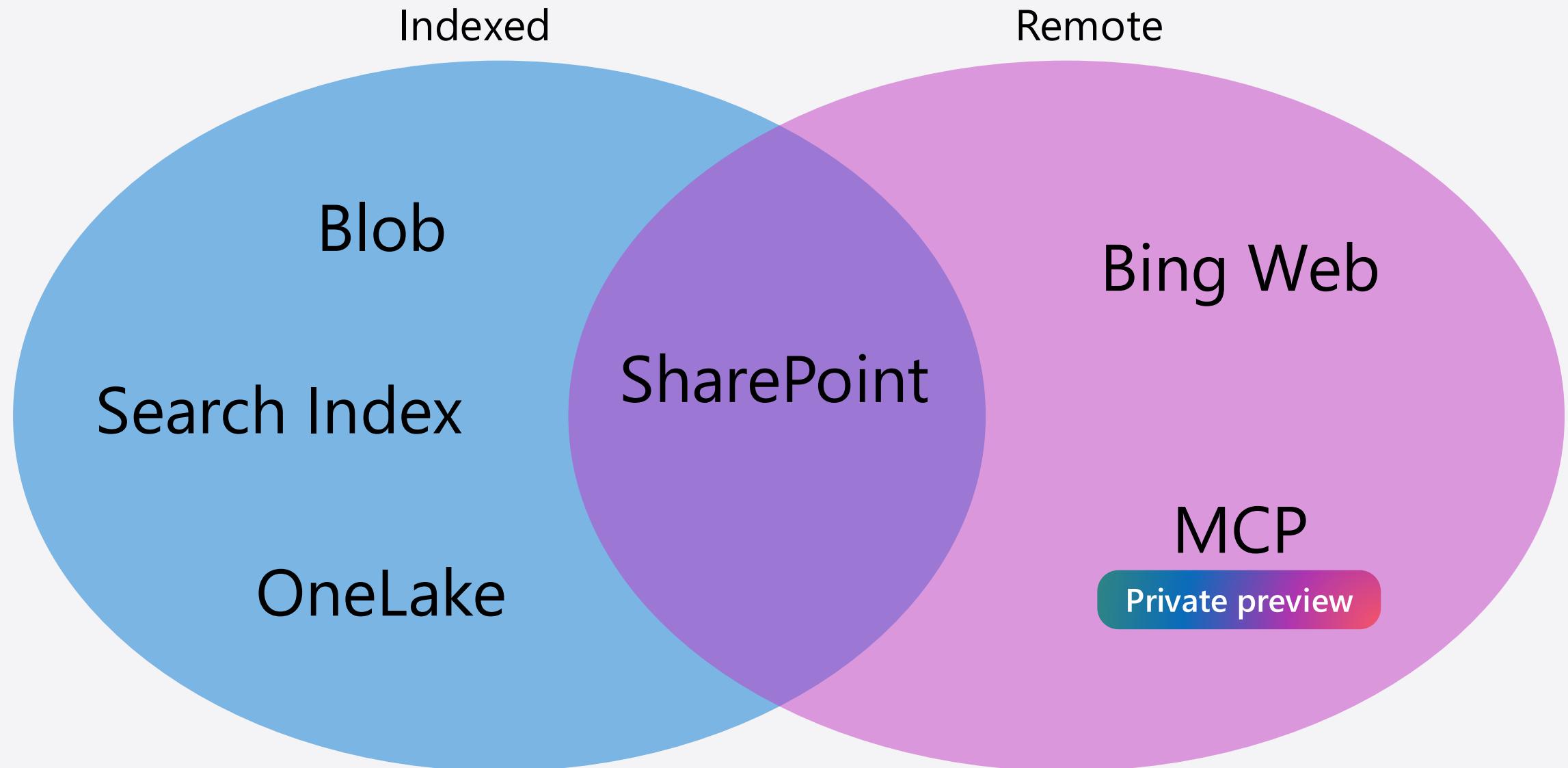
Query planning	Knowledge source selection	Results merging

Knowledge sources

Output

Input

Conversation

Query planning

Search query 1

Search query 2

Search

Search Indexes

OneLake

SharePoint

Bing

Merged results

Activity log

Answer synthesis

Iterative retrieval
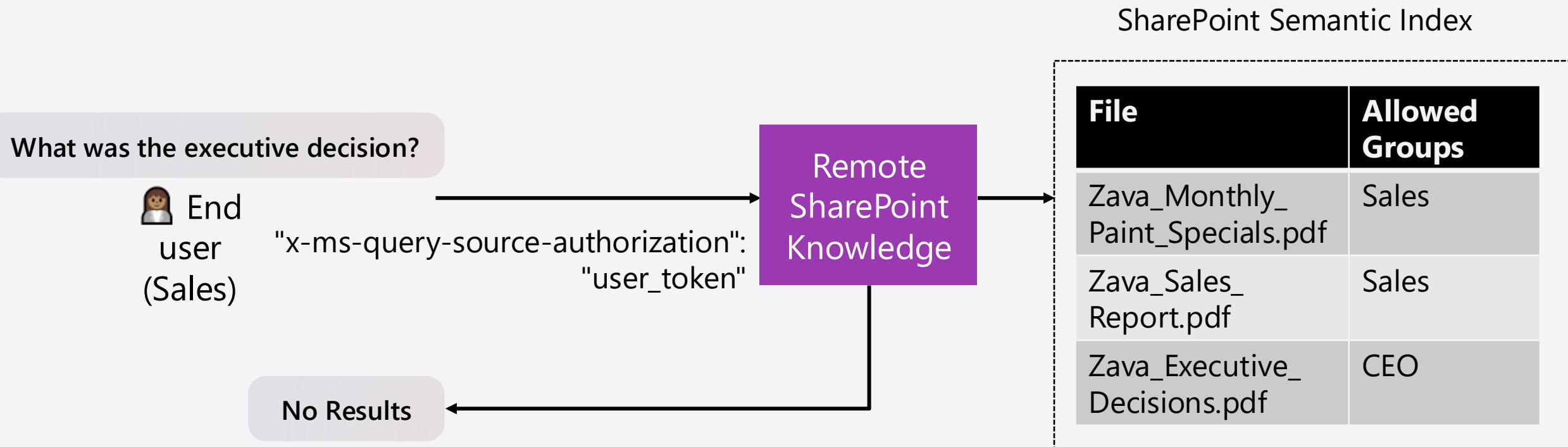
Search step uses hybrid search with semantic re-ranking when supported by the knowledge source
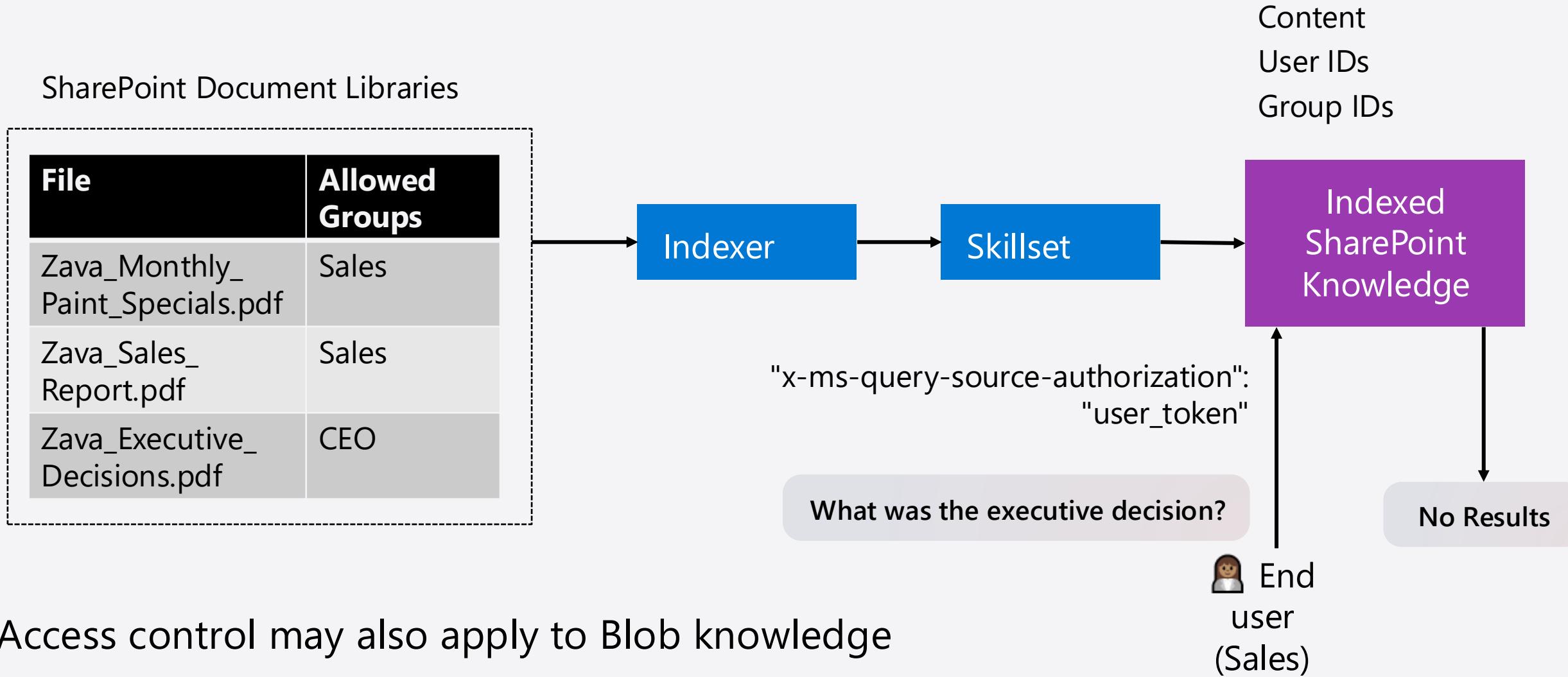
Indexed and Remote Knowledge Sources

Remote SharePoint Knowledge

What was the executive decision?

🧑🏽 End user (Sales)

"x-ms-query-source-authorization": "user_token"

Remote SharePoint Knowledge

No Results

SharePoint Semantic Index

File	Allowed Groups
Zava_Monthly_Paint_Specials.pdf	Sales
Zava_Sales_Report.pdf	Sales
Zava_Executive_Decisions.pdf	CEO

Indexed SharePoint Knowledge

SharePoint Document Libraries

Content
User IDs
Group IDs

File	Allowed Groups
Zava_Monthly_ Paint_Specials.pdf	Sales
Zava_Sales_ Report.pdf	Sales
Zava_Executive_ Decisions.pdf	CEO

Indexer → Skillset → Indexed SharePoint Knowledge

"x-ms-query-source-authorization":
"user_token"

What was the executive decision?

No Results

🧕🏽 End user (Sales)

Access control may also apply to Blob knowledge

Indexed Knowledge Ingestion

Data Repository

Blob

OneLake

SharePoint

Indexer

Skillset

Search Index

⏰ Runs on a schedule.

♻️ Change tracking to detect additions, deletions, updates.

Built-in skills:

Content Understanding

SplitSkill

Embedding Skill

Content Understanding
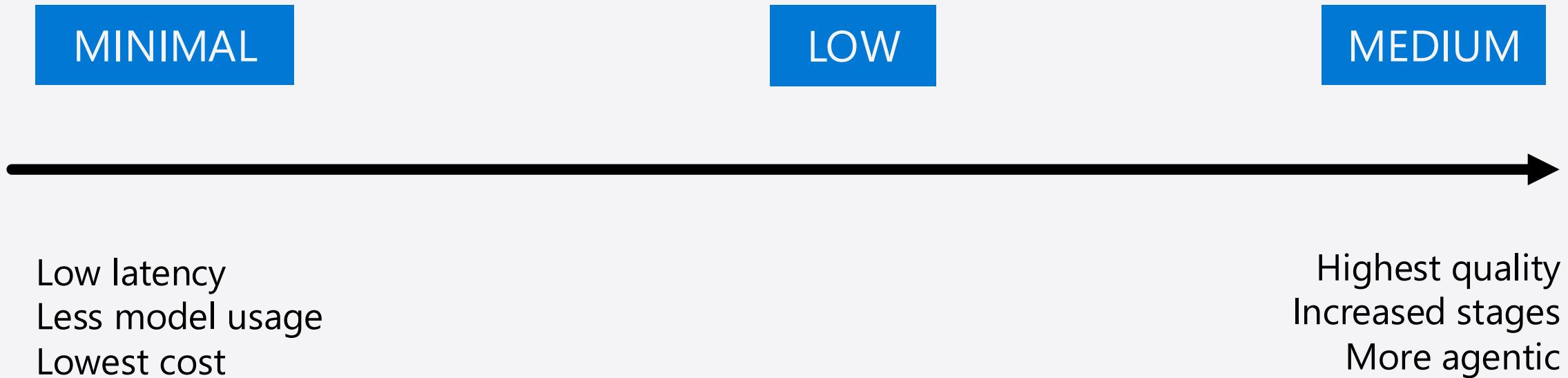
Indexed knowledge sources offers multiple parsing modes:

- **minimal**: Leverage free default parsing capability of indexers
- **standard**: Use Content Understanding to enrich extracted documents with media descriptions


```
<figure>
Decide which sander to buy
Large flat surfaces
Edges & flush sanding
Tight corners & small parts
Determine if 5 inch or 1/4 sheet
sander is better for you
Zava Orbital Sander 1/4 Sheet
PTSA000011
Zava Palm Sander
PTSA000013
Zava Random Orbit Sander 5-inch
PTSA000012
Zava Orbital Sander 1/4 Sheet
PTSA000011
</figure>
```
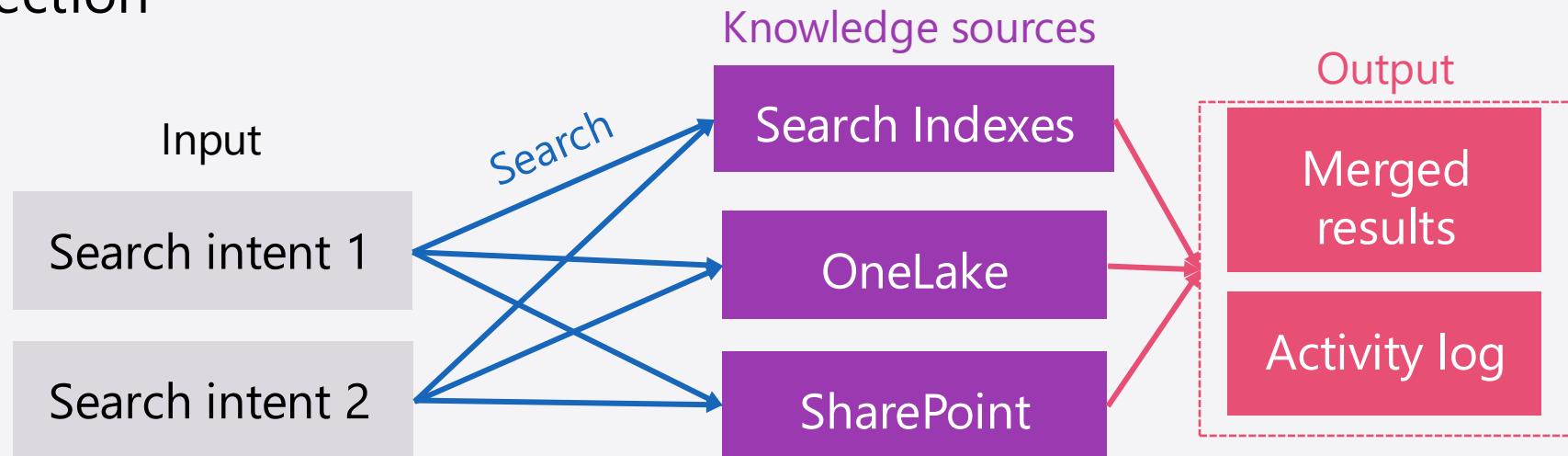
Knowledge base retrieval reasoning effort

Knowledge base with <u>minimal</u> effort

Minimal does *not* include:
- Query planning
- Knowledge source selection
- Web source
- Answer synthesis
- Iterative retrieval

Knowledge sources

Output

Input

Search

Search Indexes

OneLake

SharePoint

Search intent 1

Search intent 2

Merged results

Activity log

Search intents represent queries.

All intents are sent to *all* sources.

Example of minimal effort

"what's best Zava paint for bathroom walls?"

* You may optionally pass in *multiple* intents.

Activity log

Step	Details
Search ""what's best Zava paint for bathroom walls?"	Source: Search index Results: 8
Search ""what's best Zava paint for bathroom walls?"	Source: SharePoint Results: 2

Intent is sent to *all* sources.
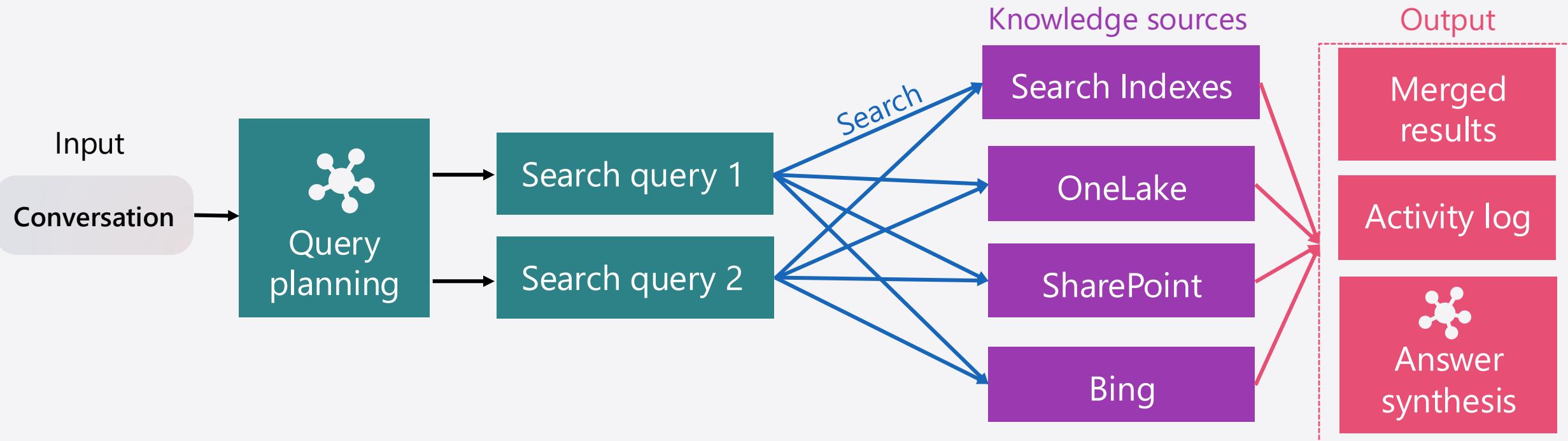
Merged results

.pdf

Interior Semi-Gloss Paint, price $47.0\r\n\r\n ## Brand\r\nZavaTech Hardware...

🏆 Re-ranker score: 2.95

ZavaBathroomPost.pdf

Refresh Your Bathroom with Confidence: Why Semi-Gloss Paint Makes All the Difference When it comes to painting projects, bathrooms are...

🏆 Re-ranker score: 3.07

Knowledge base with <u>low</u> effort

Low effort mode does *not* include:
- Iterative retrieval
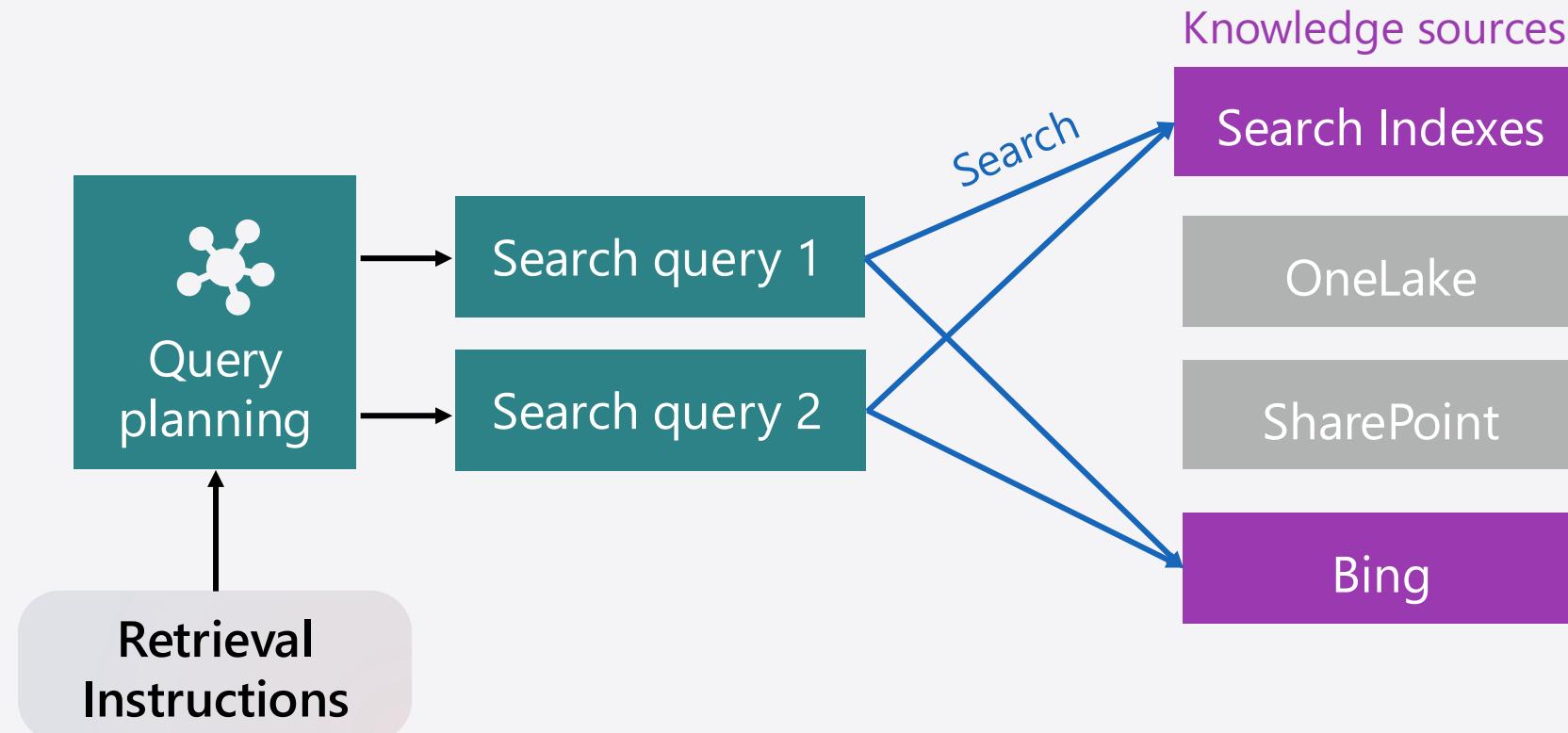
Knowledge source selection

Query planning also determines which knowledge sources are used

Example of low effort with knowledge source selection

What Zava paint can I use to paint my bathroom and how much does it cost?

Activity log

| Step	Details
Query planning	Input tokens: 2113 Output tokens: 75
Search "Zava paint suitable for bathroom use"	Source: Search index Results: 6
Search "Zava paint prices"	Source: Search index Results: 14
Agentic reasoning	Reasoning: 20K Effort: Low
Model answer synthesis	Input tokens: 7921 Output tokens: 108

Merged results

PFIP000003.pdf

Interior Semi-Gloss Paint, price $47.0\r\n\r\n ## Brand\r\nZavaTech Hardware…

🏆 Re-ranker score: 3.03

PFIP0000005.pdf

One-Coat Interior Paint, price $50.00r\n\r\n ## Brand\r\nZavaTech Hardware
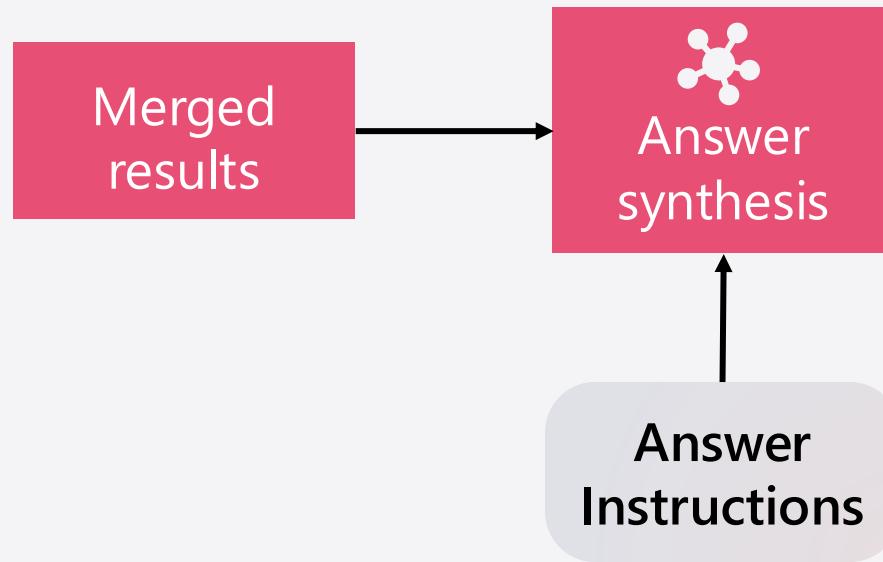
🏆 Re-ranker score: 2.95

Answer synthesis

A semi-gloss interior paint is suitable for use in a bathroom because it offers moisture resistance, is washable, and stands up well to humidity and frequent cleaning. This type of paint is specifically recommended for bathrooms, kitchens, and trim work due to its durability and ease of maintenance [ref_id:1]. The typical cost for a can of Interior Semi-Gloss Paint from ZavaTech Hardware Solutions is $47.00 [ref_id:2].

Answer synthesis is *optional*.

Answer synthesis with instructions

Merged results → Answer synthesis ← Answer Instructions
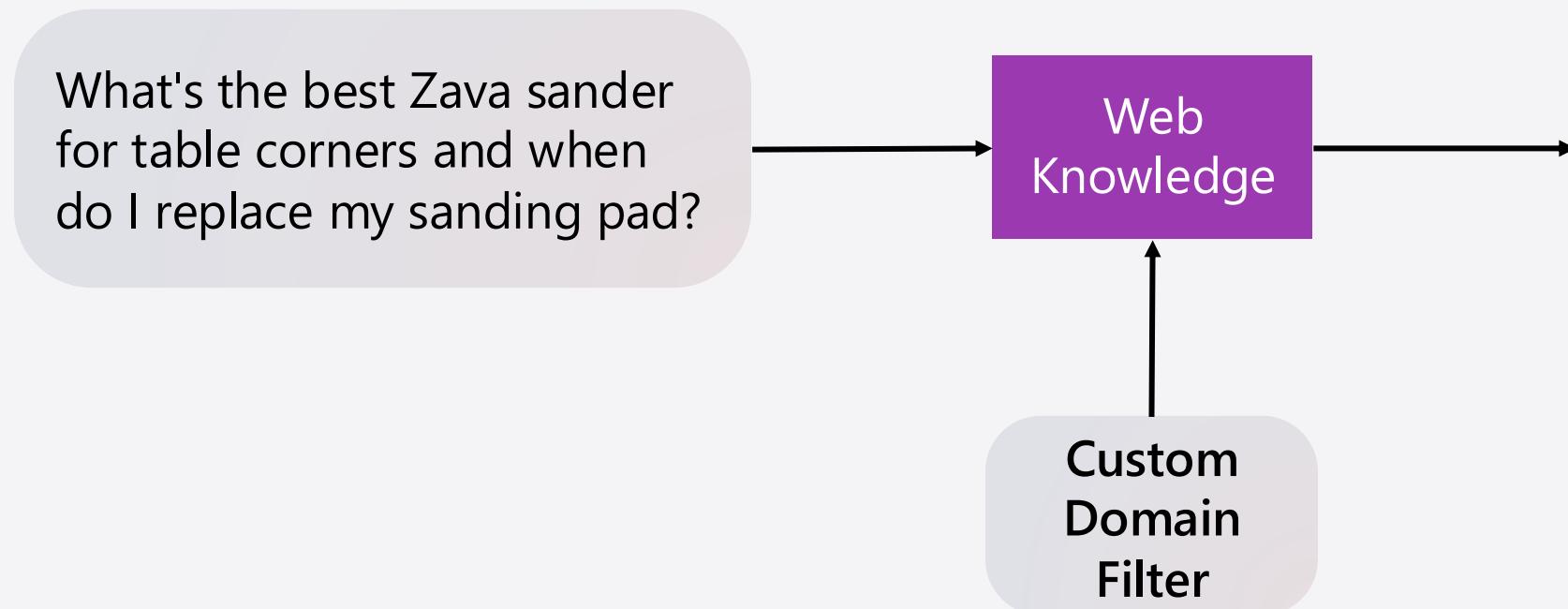
Instructions	Answer
Default (no instructions)	A semi-gloss paint is highly recommended for bathrooms due to its moisture resistance, washable surface, and ability to withstand humidity and frequent cleaning, making it ideal for bathroom walls and trim [ref_id:0][ref_id:1]. While specific price ranges are not provided, semi-gloss paints are typically available at hardware stores and online, with costs varying by brand and quality [ref_id:1]. For best results, ensure proper surface preparation and apply two thin coats for a durable, long-lasting finish [ref_id:0][ref_id:1]
"Answer with bullet points"	- Semi-gloss interior paint is recommended for bathrooms due to its moisture resistance, washability, and durability against humidity and splashes [ref_id:0][ref_id:2][ref_id:4]. - Flat or eggshell finishes are less suitable for bathrooms, as they do not handle constant humidity as well as semi-gloss [ref_id:4]. - The typical cost for a can of interior semi-gloss paint is around $47.00 [ref_id:2].
"Answer with a haiku"	Moisture in the air— Semi-gloss shines, stands strong here. Bathrooms: $47 [ref_id:2].

Bing Web Knowledge

Answer synthesis

What's the best Zava sander for table corners and when do I replace my sanding pad?

→

Web Knowledge

↑

Custom Domain Filter

→

A semi-gloss interior paint is suitable for use in a bathroom because it offers moisture resistance, is washable, and stands up well to humidity and frequent cleaning. This type of paint is specifically recommended for bathrooms, kitchens, and trim work due to its durability and ease of maintenance [ref_id:1]. The typical cost for a can of Interior Semi-Gloss Paint from ZavaTech Hardware Solutions is $47.00 [ref_id:2].

Answer synthesis is *required*.

Example of low effort with Bing web knowledge

what's best Zava paint for bathroom walls, and how does it compare to other brand paints?

Output

Activity log

Step	Details
Query planning	Input tokens: 2113 Output tokens: 75
Search "paint for bathroom"	Source: manuals Results: 13
Search "paint for bathroom"	Source: Bing Web Results: 8
Search "cost of bathroom paint"	Source: manuals Results: 14
Search "cost of bathroom paint"	Source: Bing Web Results: 0
Agentic reasoning	Reasoning: 20K Effort: Low
Model answer synthesis	Input tokens: 7921 Output tokens: 108

Merged results

PFIP000003.pdf

Interior Semi-Gloss Paint, price $47.0\r\n\r\n ## Brand\r\nZavaTech Hardware...

🏆 Re-ranker score: 2.95

coolpaints.com

Url: https://www.coolpaints.com/bathroom-moisture-paint-issues-one-weird-trick

Title: Why semi-gloss paint is the best for bathrooms
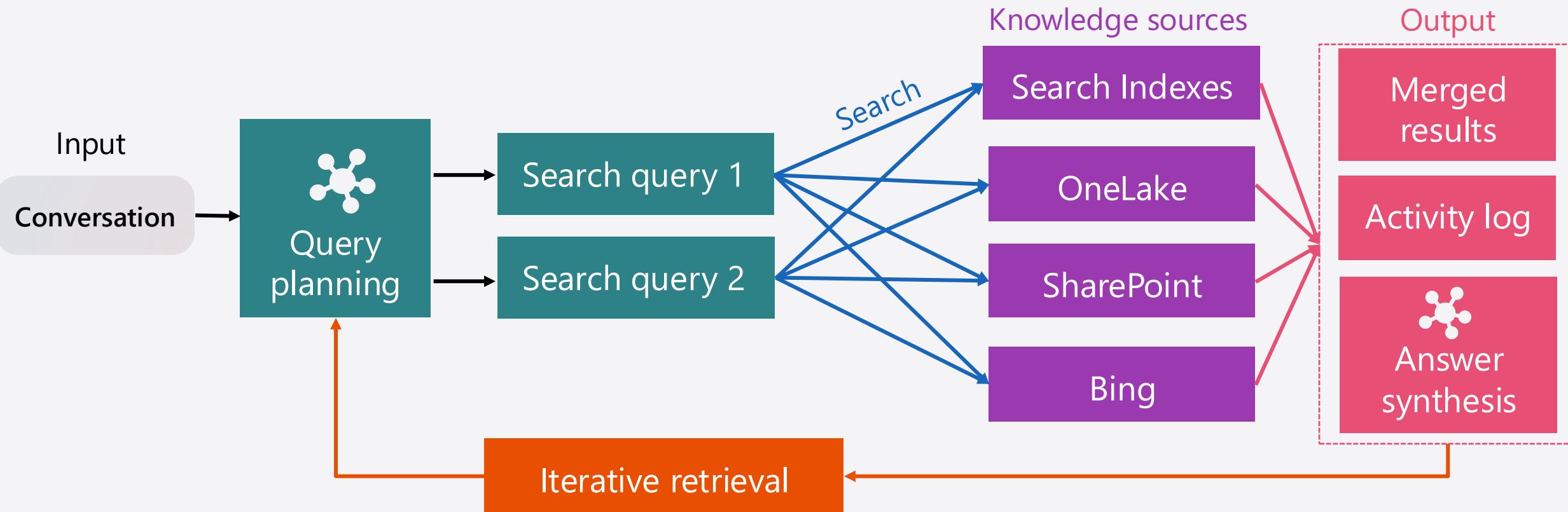
Answer synthesis

A semi-gloss interior paint is suitable for use in a bathroom because it offers moisture resistance, is washable, and stands up well to humidity and frequent cleaning. This type of paint is specifically recommended for bathrooms, kitchens, and trim work due to its durability and ease of maintenance [ref_id:1]. The typical cost for a can of Interior Semi-Gloss Paint from ZavaTech Hardware Solutions is $47.00 [ref_id:2].

Answer synthesis is *required* for web knowledge.

# Knowledge base with <u>medium</u> effort
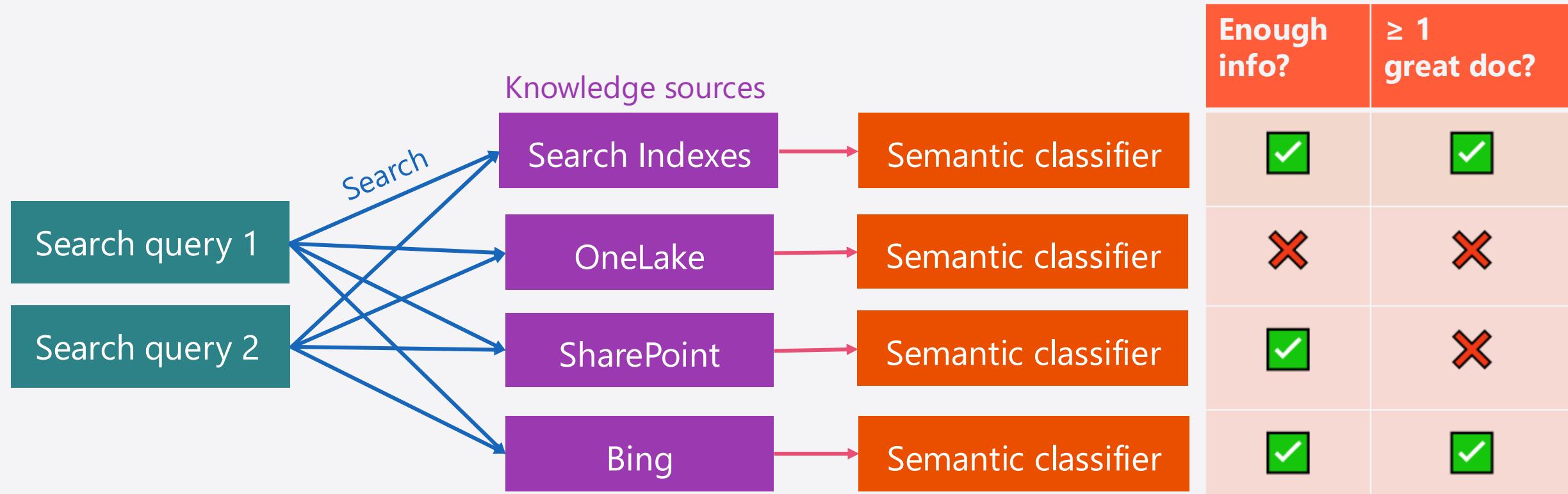
New model for results merging

Medium reasoning effort uses an additional model: **semantic classifier**

- Trained to recognize when there's enough context to answer the question
- Takes a 2nd pass at scoring documents
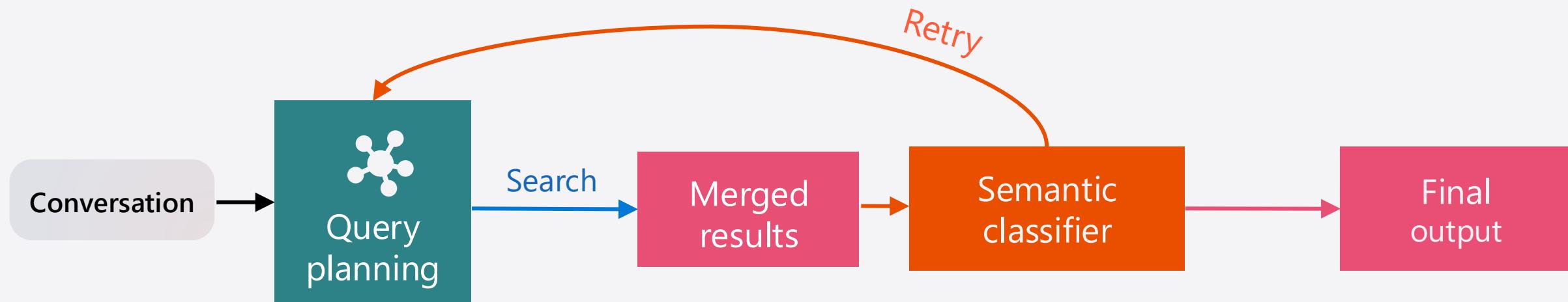
Iterative search

Retry on insufficient results

- The next try of query planning considers the previous results

Example of medium effort

Explain how to paint my house most efficiently. Then give me a list of the Zava products and prices for each supply

Output

Activity log

Step	Details
Query planning	Input tokens: 1484 Output tokens: 115
Search "efficient house painting"	Source: manuals
Search "Zava paint supplies prices"	Source: manuals
Search "efficient house painting"	Source: web
Search "Zava paint prices"	Source: web
Query planning	Input tokens: 1169 Output tokens: 249
Search "paint brushes rollers trays"	Source: manuals
Search "paint brushes rollers trays"	Source: web
Agentic reasoning	Reasoning: 65K Effort: Medium
Model answer synthesis	Input tokens: 12676 Output tokens: 196

Merged results

PFEP000007.pdf

Exterior Acrylic Paint, price $57.0\r\n\r\n## Brand\r\nZavaTech...

🏆 Re-ranker score: 2.85

francoisestmoi.com

Url: http://francoisetmoi.com/diy/top-5-ways-to-paint-more-efficiently

Title: Top 5 Ways to Paint More Efficiently

qualitypreferred.com

Url: https://www.qualitypreferred.com/choosing-the-right-method-the-best-way-to-paint-a-house

Title: The Best Way to Paint a House

Answer synthesis

The most efficient way to paint a house is to work from the top down: start by prepping all surfaces, then paint ceilings first, followed by trim and baseboards, and finish with the walls, using rollers for large areas and brushes or pads for detail work to minimize drips and touch-ups [ref_id:5][ref_id:3][ref_id:4]. For exterior painting, clean and repair surfaces, prime exposed areas, and always paint from high to low, finishing with doors and trim [ref_id:5][ref_id:6].

Below is a list of Zava paint supplies:
* Exterior Acrylic Paint: $57.0 [ref_id:1]

Start today: Open source solution with Knowledge Bases

Code:
aka.ms/ragchat

Docs:
aka.ms/ragchat/knowledgebase
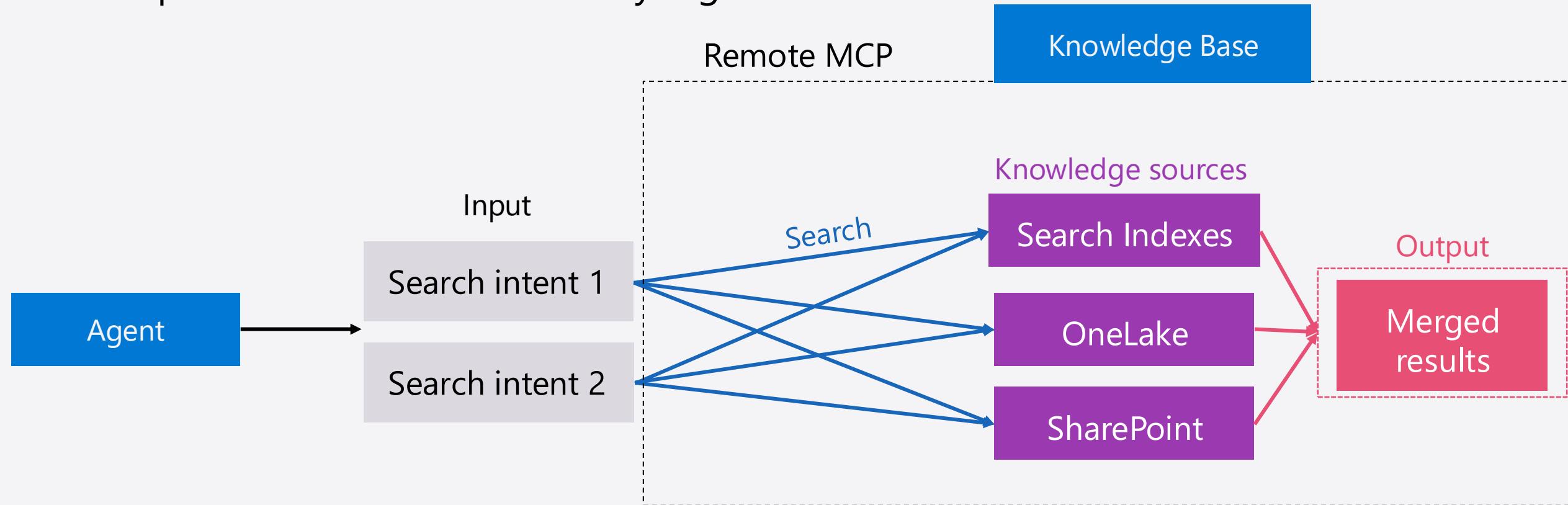
Foundry IQ

The knowledge layer for agents

aka.ms/FoundryIQ

Foundry IQ and Knowledge Bases

- Similar to minimal effort mode
- Output does not include activity log

Conclusion

Resources and next steps

Get Started with Azure AI Search
aka.ms/AISearch-new

Foundry IQ Public Preview
aka.ms/FoundryIQ

GitHub Sample – Quickstart
aka.ms/AISearch-ar-pyn

GitHub Sample – Agent Service Integration
aka.ms/AISearch-ar-agent

Take the Azure AI Learn Courses
aka.ms/CreateAgenticAISolutions

Sign up for the MCP Private Preview
aka.ms/KR-MCPSource

How did we do?

Tell us your thoughts about our sessions and complete the event survey

Go to aka.ms/ignite/sessions/evals or scan the QR code