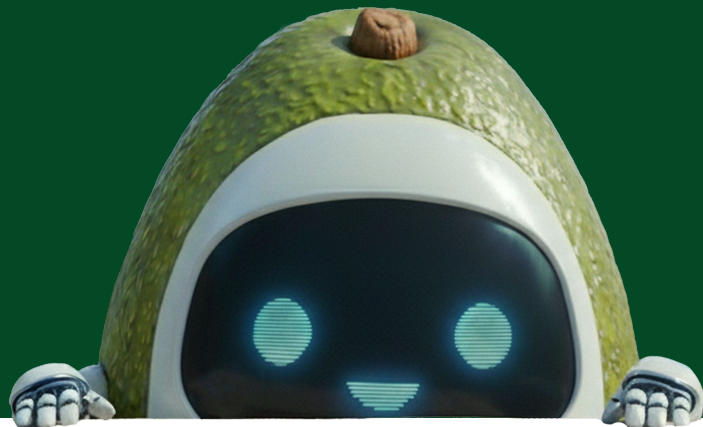




Risk Intelligence

Arango AI



Ryan Coger, Director of Sales
Arthur Keen - Senior Solutions Architect
01 29, 2026

Agenda

Risk Intelligence

Computing Transitive Risk (demo)

Computing Ultimate Beneficial Owner (demo queries)



Why is Risk Intelligence Important?

Arthur Keen - Senior Solution Architect
01 28, 2025



Who are you doing business with?



The Strategic Imperative

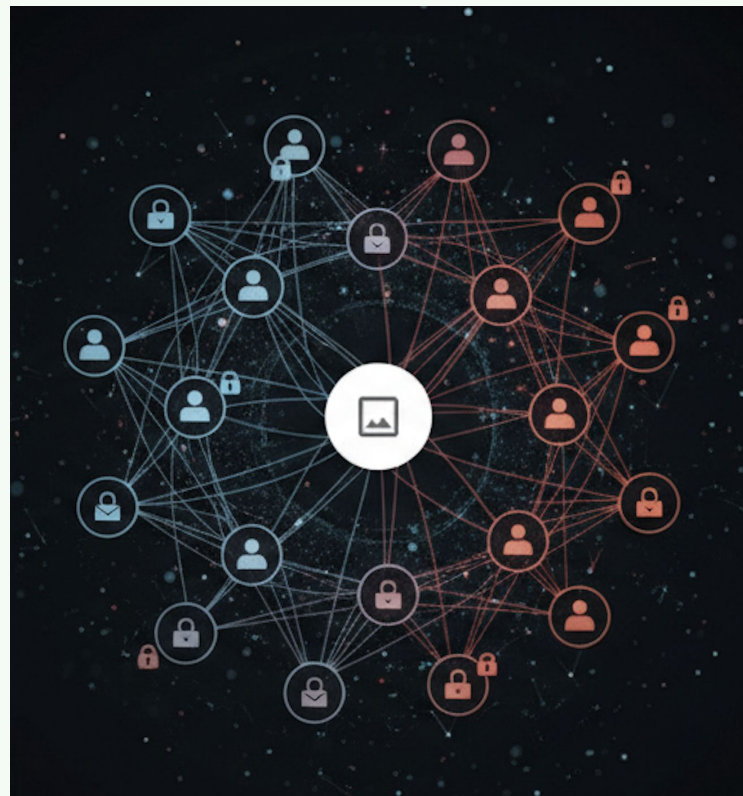
From Reactive Detection to Proactive Intelligence

Risk is no longer linear; it is **transitive and convergent**. In a globalized economy, a minor regulatory breach in a subsidiary or a change in a distant beneficial owner can trigger systemic failure or national security threats.

Business Resilience: Enterprises must map **Transitive Risk Propagation**—understanding how the failure or corruption of a third-tier supplier or partner impacts the core.

National Security Sovereignty: Modern threats are "Convergent." Adversaries use complex corporate ownership webs to bypass sanctions, infiltrate critical infrastructure, and influence dual-use technology development.

The Bottom Line: Identifying fraudulent patterns in corporate ownership isn't just about compliance; it's about **protecting the integrity of the global supply chain** and ensuring long-term operational continuity.



The Complexity Crisis

Why Traditional Systems Fail the Risk Mission

The primary barrier to effective Risk Intelligence is not a lack of data, but the **inability to harmonize and trust it at scale**.

- **Data Fragmentation:** Risk signals are scattered across thousands of PAI (Publicly Available Information) sources, internal silos, and multi-language feeds.
- **The Entity Resolution Paradox:** Identifying that "J. Smith Corp," "Smith & Co," and "Smith Holding LLC" are the same high-risk actor requires more than fuzzy matching; it requires deep relational context.
- **The Veracity Gap:** In an era of AI-generated misinformation, determining the "ground truth" of a corporate entity's ultimate beneficial owner (UBO) is a multi-hop challenge that exhausts traditional relational databases.
- **Computational Bottlenecks:** Manual investigation of "transitive risks" ($\text{Risk A} \rightarrow \text{B} \rightarrow \text{C}$) creates an **85% administrative burden**, leaving analysts reactive rather than strategic.

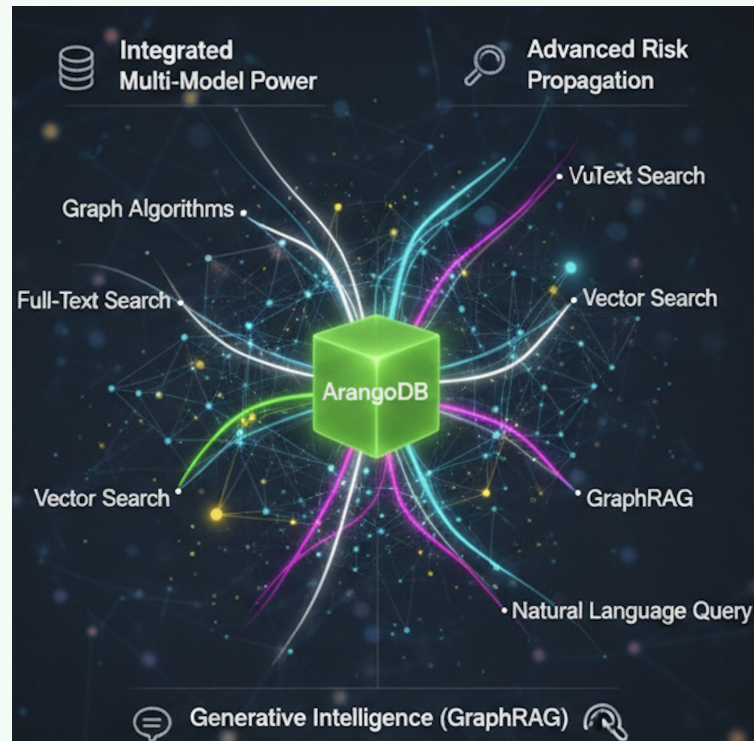


Arango – The Contextual-AI Advantage

The Ultimate Engine for Risk Propagation & Detection

ArangoDB is uniquely engineered to bridge the gap between raw data and high-fidelity risk intelligence, providing the scale and analytical depth required.

- **Integrated Multi-Model Power:** Unlike "pure" graph databases, ArangoDB combines **Graph, Document, and Search** in one engine. This allows for seamless entity resolution: full-text search to find, documents to store, and graphs to connect.
- **Advanced Risk Propagation:** Our native **Graph Algorithms** (like PageRank and Shortest Path) identify central points of failure and hidden fraudulent patterns in corporate ownership that SQL-based systems simply cannot see.
- **Generative Intelligence (GraphRAG):** We go beyond "Vector Search." Our **GraphRAG** capability allows analysts to use Natural Language Queries to explore complex networks, reducing "hallucinations" by grounding AI in the factual structure of the graph.
- **Scale & Performance:** Designed for the petabyte era, ArangoDB handles millions of "multi-hop" traversals in milliseconds, enabling real-time detection of risk as data streams in from global sources.



Relevant Libraries and Demos

Repositories Containing Reference Architectures

ArangoDB has a number of reference architecture / demonstrations that will accelerate development of Risk Intelligence Solutions

- **Risk Management**: Risk Intelligence Knowledge Graph containing OFAC sanction data. Leverages ArangoRDF.
- **Graph Analytics AI**: Agentic AI architecture for automating graph analytics. Use Cases to Actionable Intelligence
- **Arango Entity Resolution**: Harmonize disparate data. Entity Resolution Library containing multiple ER techniques leveraging full text search, vector search, and graph traversal.
- **Arango RDF**: Use Ontologies and RDF in Arango to create semantic layers and it can generate Arango physical graph schemas. We used it in the risk management repo. See [Arango-RDF-FOAF-Demo](#) to learn how to do this.
- **Hardware Design Knowledge Graph**: Shows you how to build semantic bridges between GraphRAG imported unstructured data and structured data. Leverages the Arango Entity Resolution Library. In Risk Intelligence, the unstructured data would comprise sources like news feeds and intelligence reports and the structured would comprise data sets like OFAC and data services.
- **Graph Time Travel**: Reference architecture for time travelling graphs. Use it to learn how to build temporal risk intelligence knowledge graphs, so you can understand how transitive risk changes over time.

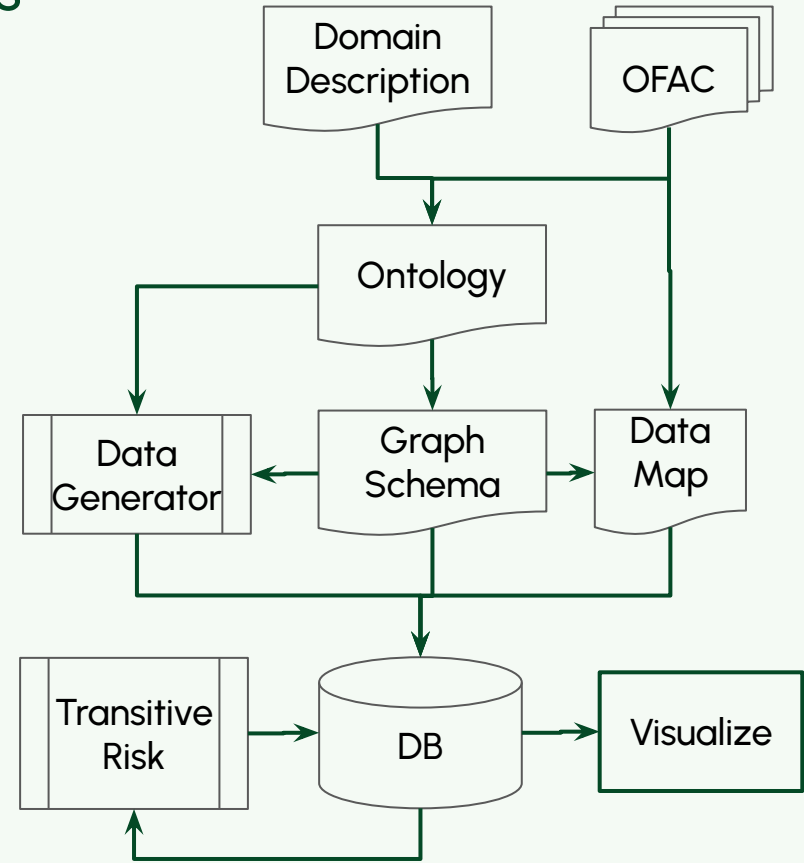


Risk Intelligence Development Process

Ontology → Transitive Risk Visualization

ArangoDB has a number of reference architecture / demonstrations that will accelerate development of Risk Intelligence Solutions

- **Ontology** - Ontology generated from risk intelligence domain description and OFAC data using AI. Ontology stored in database using ArangoRDF
- **Graph Schema**: Generated the Arango physical graph schema from the Ontology using Arango-RDF library
- **Data Prep**: Flattened the OFAC XML to CSV.
- **Data Map**: Mapped OFAC CSV and generated ArangoImport Ingest scripts, and imported into the graph
- **Data Generator**: Generate Organization/Individual synthetic Graph connected to the OFAC graph. We considered using 10 years of Fortune 1000 data and other open source data.
- **Transitive Risk**: Modified our BOM/UBO query to compute transitive risk. This query was executed on the graph to compute the transitive risk on organizations and persons
- **Visualization**: Visualizations are configured from the codebase with themes for Ontology, Data Graph, and Knowledge Graph including a risk heat map





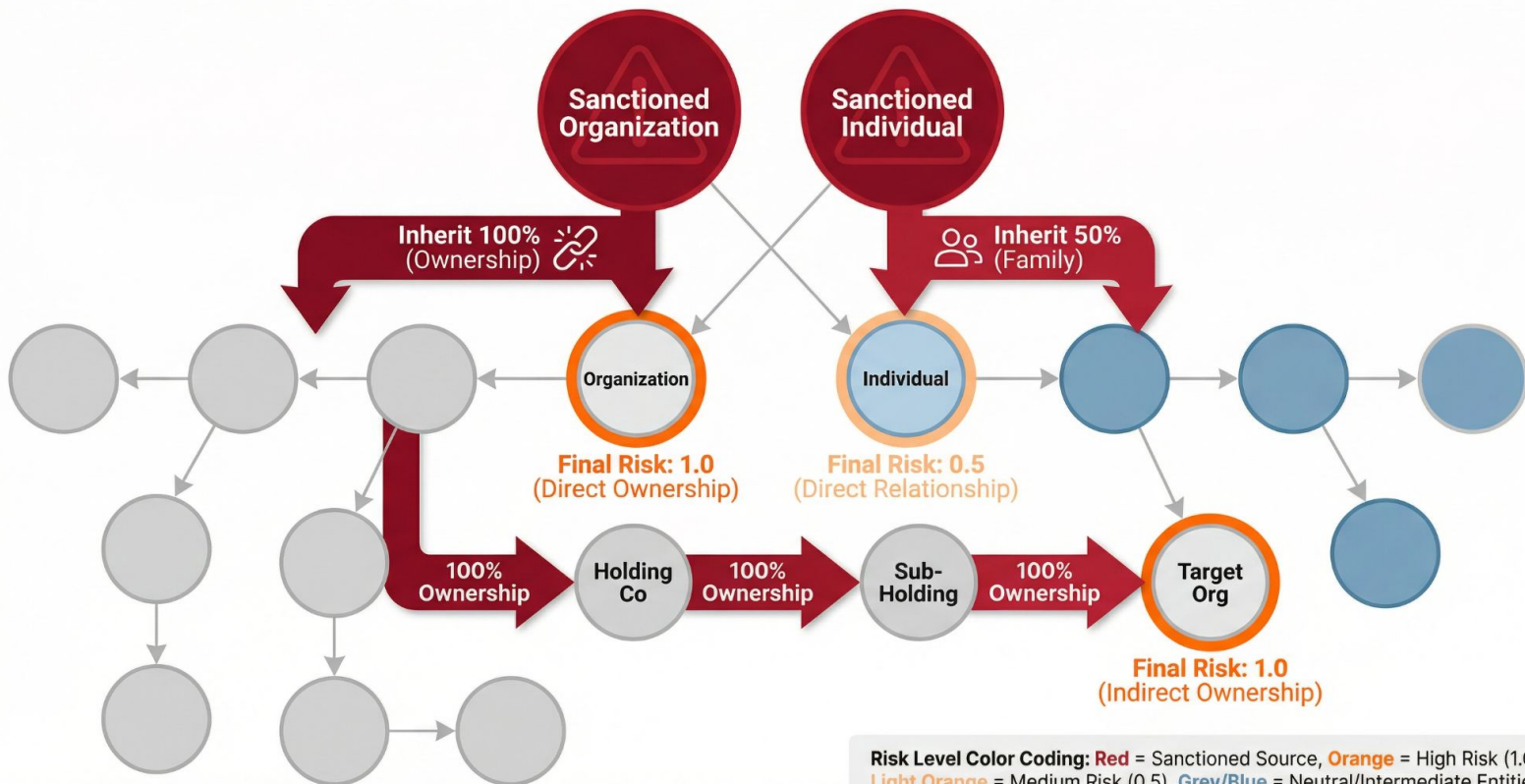
Computing Transitive Risk

Arthur Keen - Senior Solution Architect
01 28, 2025



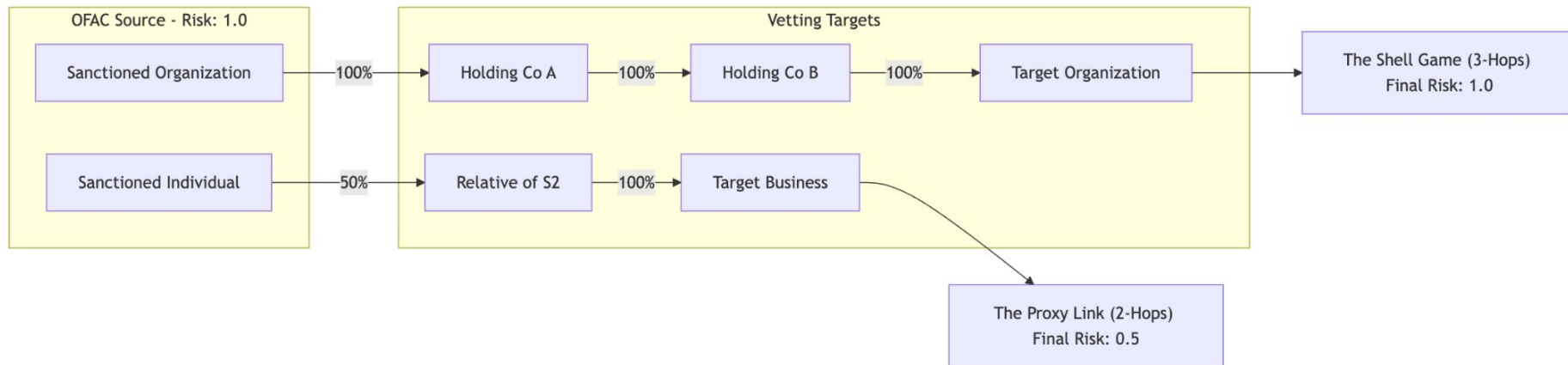
Transitive Risk Propagation

GRAPH-BASED RISK PROPAGATION LOGIC



Risk Propagation Logic

- **Ownership** (owned_by): 100% risk inheritance.
- **Leadership** (leader_of): 80% risk inheritance.
- **Family** (family_member_of): 50% risk inheritance.



AQL Query for Computing Transitive Risk

```
FOR v, e, p IN 1..3 ANY @entityID owned_by, leader_of, family_member_of
  // Validate path direction for risk flow
  FILTER (IS_SAME_COLLECTION('owned_by', e) ? e._from == @entityID : true)
  FILTER (IS_SAME_COLLECTION('leader_of', e) ? e._to == @entityID : true)

  // Compute path multiplier from edge weights
  LET pathMultiplier = PRODUCT(p.edges[*].propagationWeight)

  // Aggregate risk from sanctioned targets
  COLLECT entity = @entityID AGGREGATE
    inheritedRisk = SUM(pathMultiplier * (v.riskScore || 0))

  LET baseScore = DOCUMENT(@entityID).riskScore || 0
  RETURN {
    label: DOCUMENT(@entityID).label,
    directRisk: baseScore,
    inferredRisk: inheritedRisk,
    totalExposure: baseScore + inheritedRisk
  }
```


Demo

Quick reference

Example	_key	Hops	Description
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Synthetic Vetting Target - 3-Hop Link	64166673	3	Best for demo - Shell Game
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Vetting Target - 3-Hop Link	64166683	3	Alternative 3-hop
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Synthetic Vetting Target - Indirect Link	64166667	2	2-hop chain
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Synthetic Holding - Layer 2	64166672	2	Intermediate in chain
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Use 64166673 for the best demonstration — it shows a 3-hop ownership chain to a sanctioned entity.

Person/10000 Person/10007

Demo - Find Organization

Show Demo

← Graph: KnowledgeGraph General

Node type

Search

Organization

64166673

✓ Organization/64166673
64166673

Organization/64166673

primaryName "Synthetic Vetting Target - 3-Hop Link"

label "Synthetic Vetting Target - 3-Hop Link"

dataSource "Synthetic"

riskScore 0

inferredRisk 1

Add 1 nodes

Legend: Default

Nodes (0)

Edges (0)

Filter node type

Aircraft 0

Class 0

ObjectProperty 0

Ontology 0

Organization 0

Q

Please use the explore button to search for a node.

Q

Please add a node to the graph

431%

Force Directed

Arango

© Arango

15

Demo - Identify Sanctioned Entities related

Show Demo

← Graph: KnowledgeGraph General

Search & add nodes to canvas Queries

Node: Organization/6416

- View node
- Dismiss node
- Dismiss other nodes
- Create node
- Create edge
- Expand (1)
- Canvas Action
 - [Organization] Trace to Sanctioned Entities
 - [Person] Trace to Sanctioned Entities
 - [Vessel] Expand Relationships
 - [Property] Expand Relationships
 - [Person] Expand Relationships
 - [Organization] Expand Relationships
 - [Ontology] Expand Relationships
 - [ObjectProperty] Expand Relationships
 - [Class] Expand Relationships
 - [Aircraft] Expand Relationships
 - Find 2-hop neighbors (default)
- Clear Canvas
- Delete Node

Legend: Default

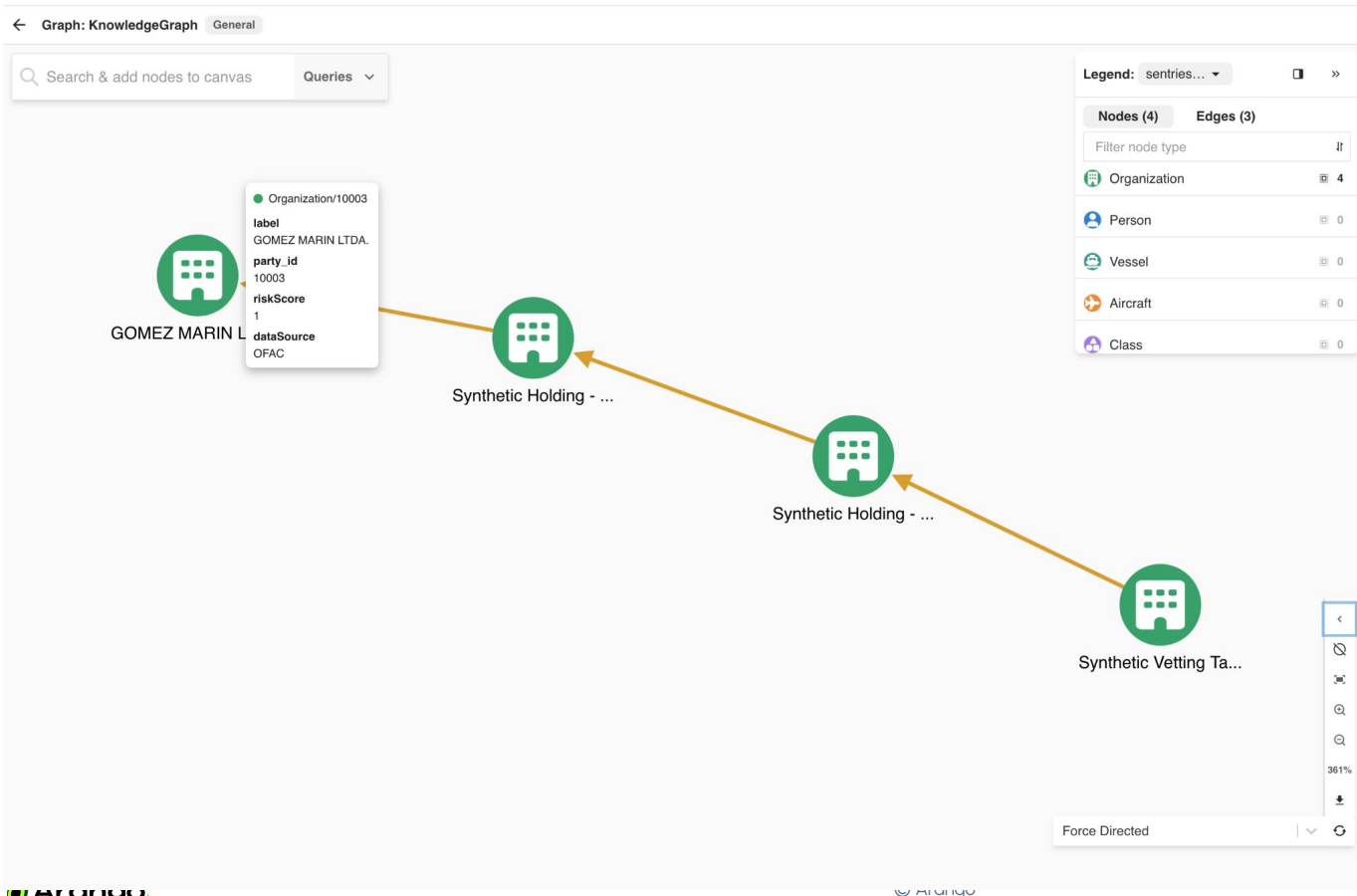
Nodes (1)	Edges (0)
Filter node type	It
Organization	1
Aircraft	0
Class	0
ObjectProperty	0
Ontology	0

Organization/6416

Force Directed

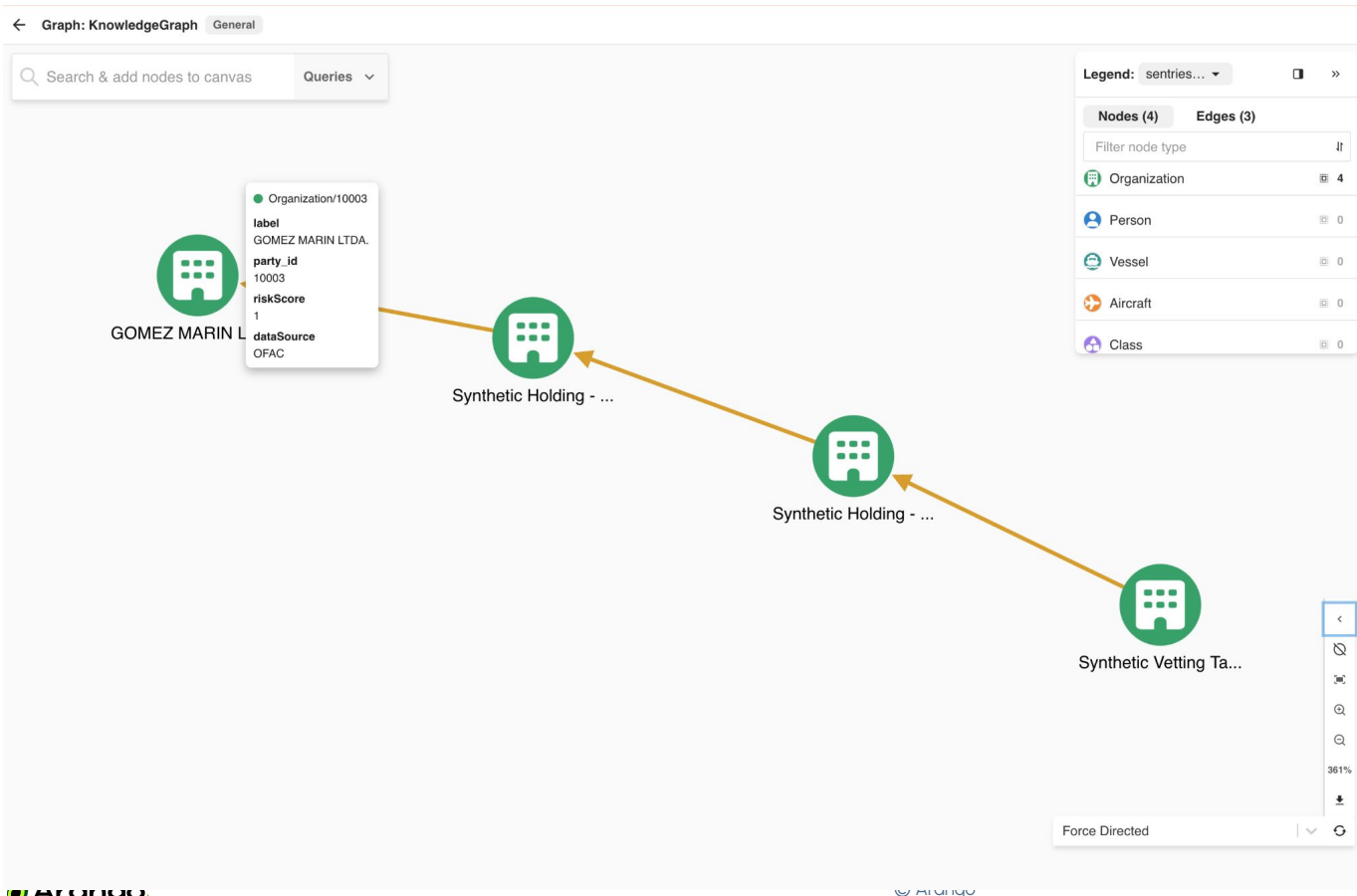
Demo - Sanctioned Entities Identified

Show Demo



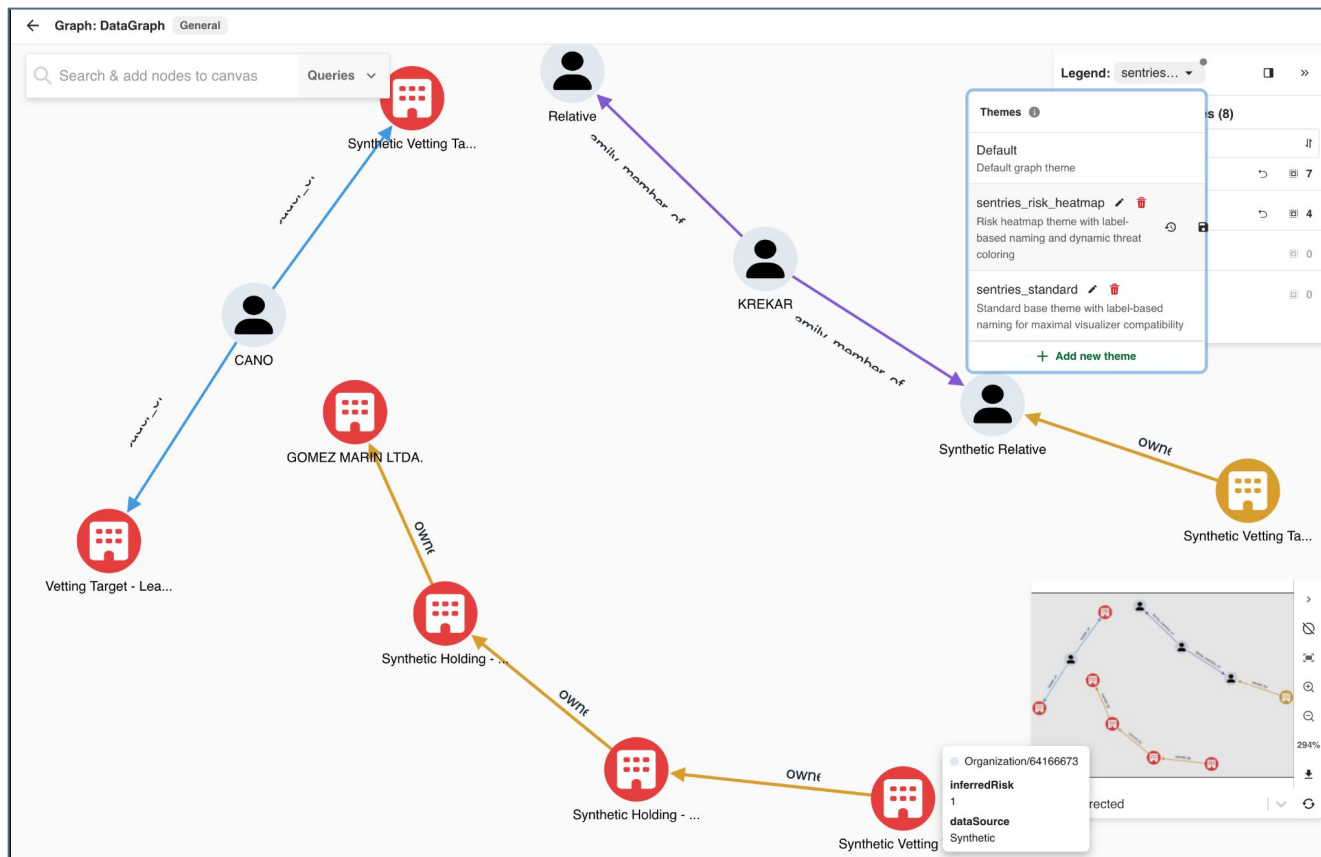
Demo - Sanctioned Entities Identified

Show Demo



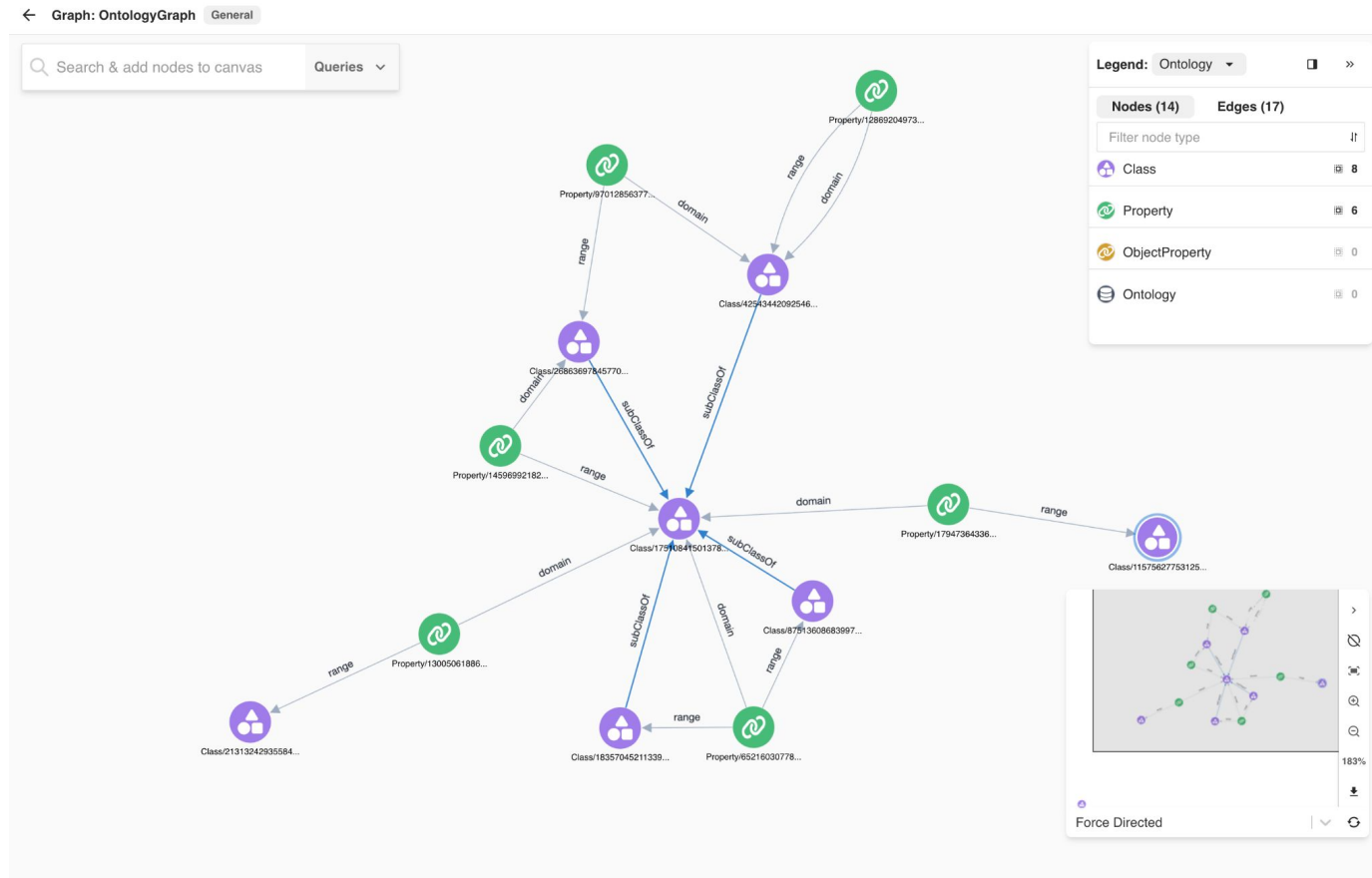
Demo - Risk Heat Map Theme

Show Demo



The Ontology (Conceptual Schema)

Show Demo



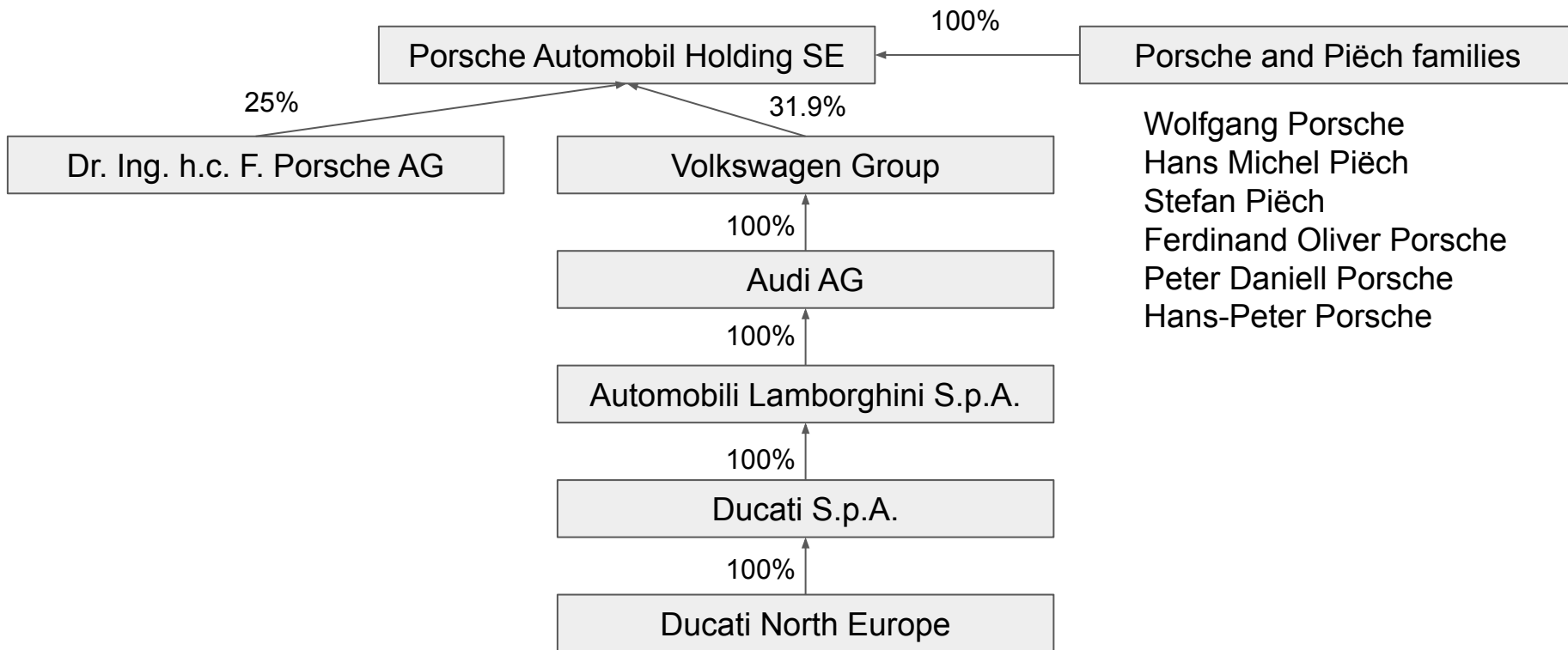


Computing Ultimate Beneficial Owner

Arthur Keen - Senior Solution Architect
01 28, 2025



Company Ownership Graph Model

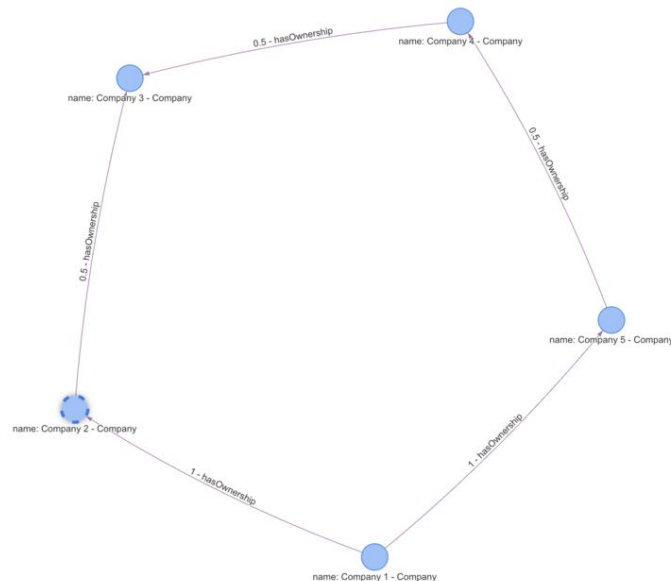


Computing Ultimate Beneficial Owners

```
1
2 /* Compute company UBO, e.g., Company/3 */
3 WITH Company
4 // Traverse incident hasOwnership edges from Subject Company
5 FOR company, owns, ownershipPath IN 1..10 INBOUND @SubjectCompany hasOwnership
6 //compute incremental ownership percent product on ownership path
7 LET pathPercent = PRODUCT(ownershipPath.edges[*].ownershipPercent)
8 //Aggregate ownership percent products on all ownership paths going through company
9 COLLECT companyOwnership=LAST(ownershipPath.vertices)
10 AGGREGATE totalOwnership = SUM(pathPercent)
11 // Return companies and ownership
12 RETURN {company: companyOwnership._id, ownershipPercent : totalOwnership}
```

Query 4 elements 12.904 ms

company	ownershipPercent
Company/1	0.75
Company/2	0.5
Company/4	0.5
Company/5	0.25



Thank You

Build Your System of Context

Powered by the Arango AI Data Platform

