



Knowledge Graphs and AI: The Future of Enterprise Data

David Newman, SVP, Innovation R&D, Wells Fargo Bank

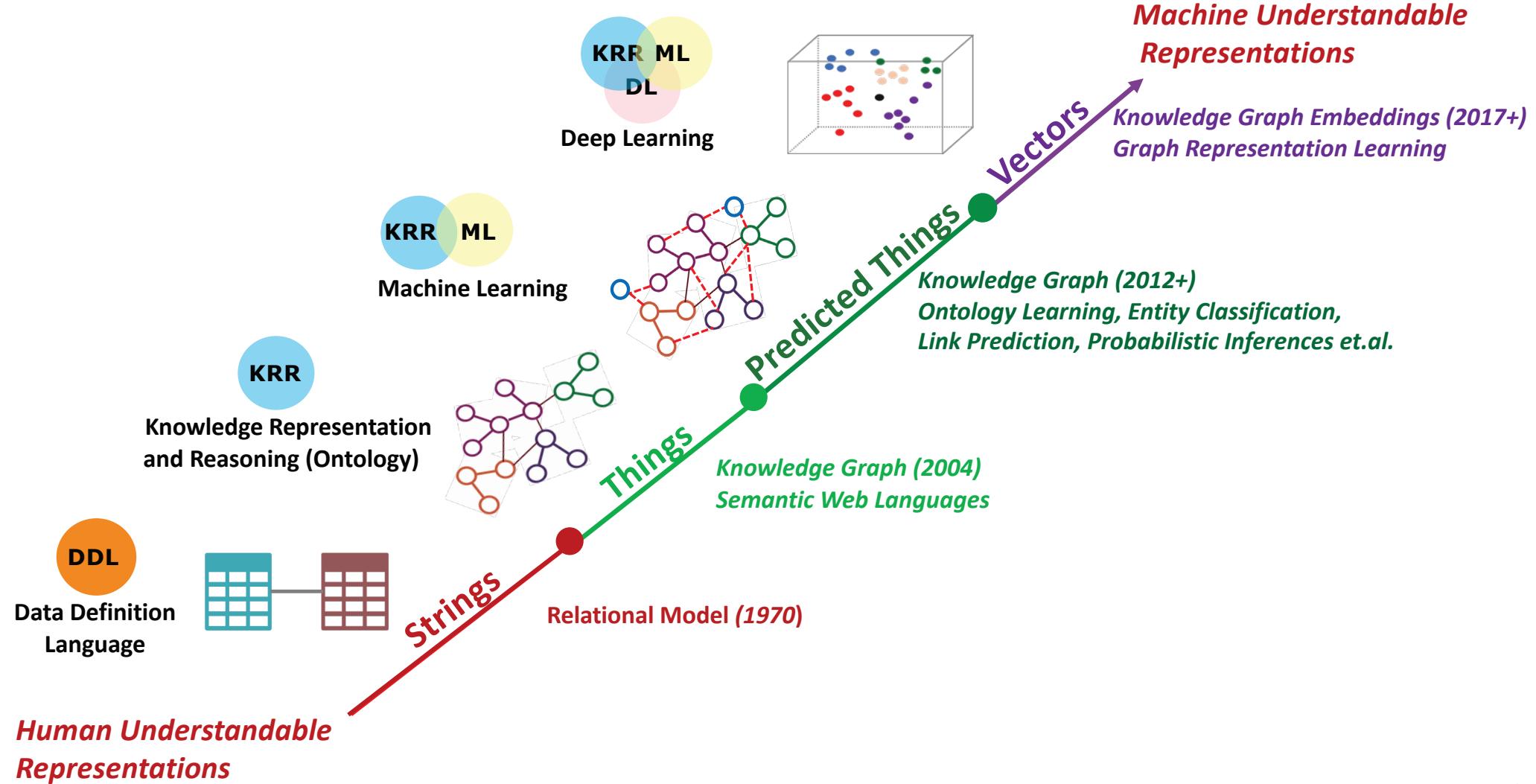
Chair, FIBO Initiative, EDM Council

Data Architecture Summit / Graphorum

Chicago, October 16, 2019



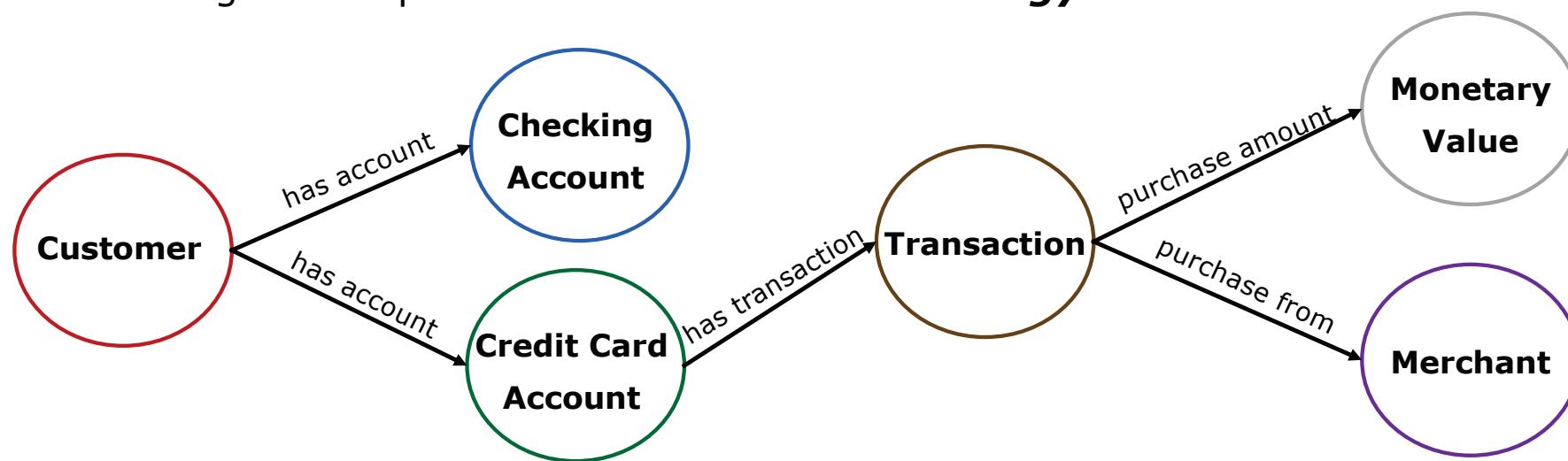
The Future of Data



What is a Knowledge Graph?

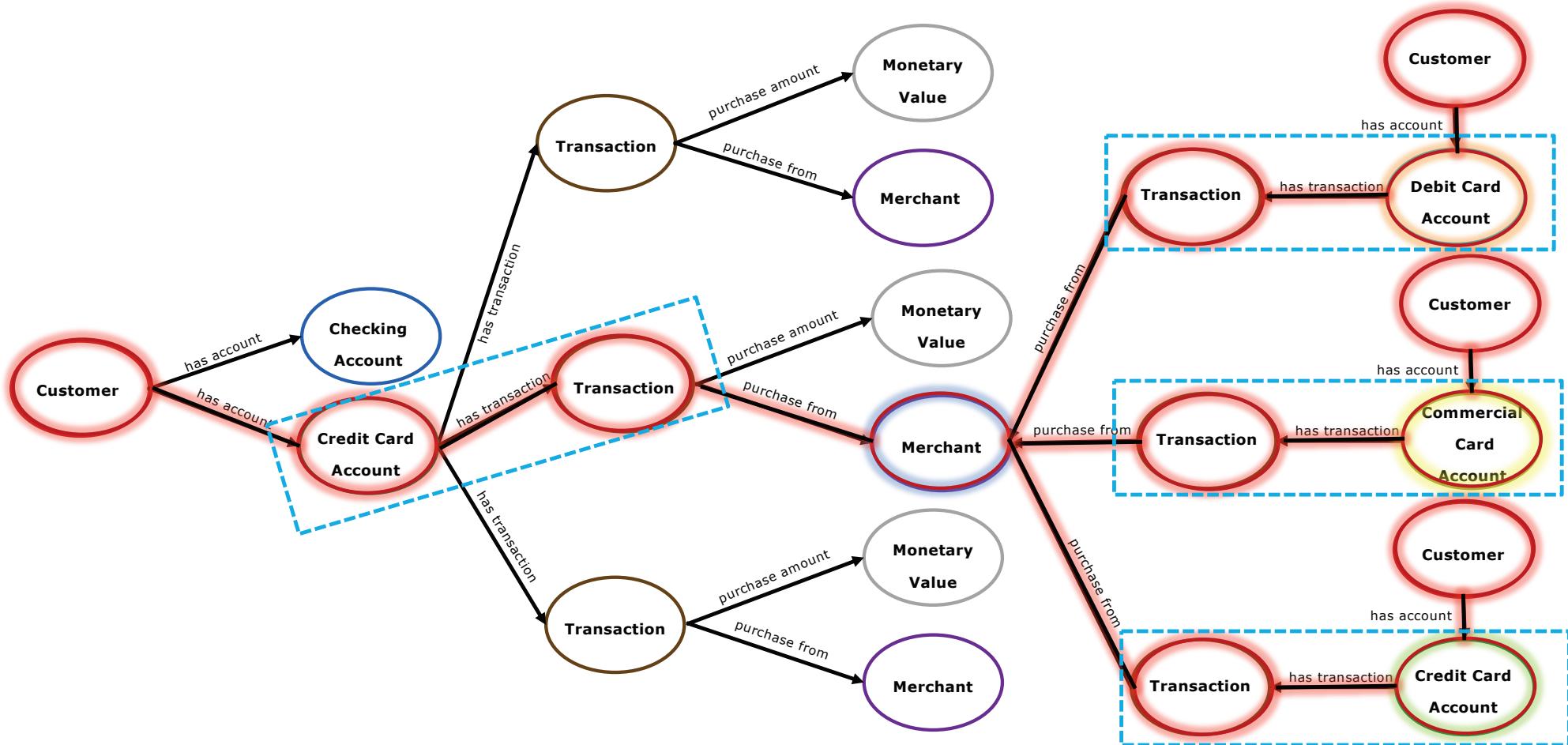
A highly expressive form of data organization that:

- represents *knowledge* and expresses *meaning*
- by linking entities (nodes) to other entities in a *network* pattern
- while *precisely* describing these relationships (edges)
- using a conceptual model known as an ***ontology***

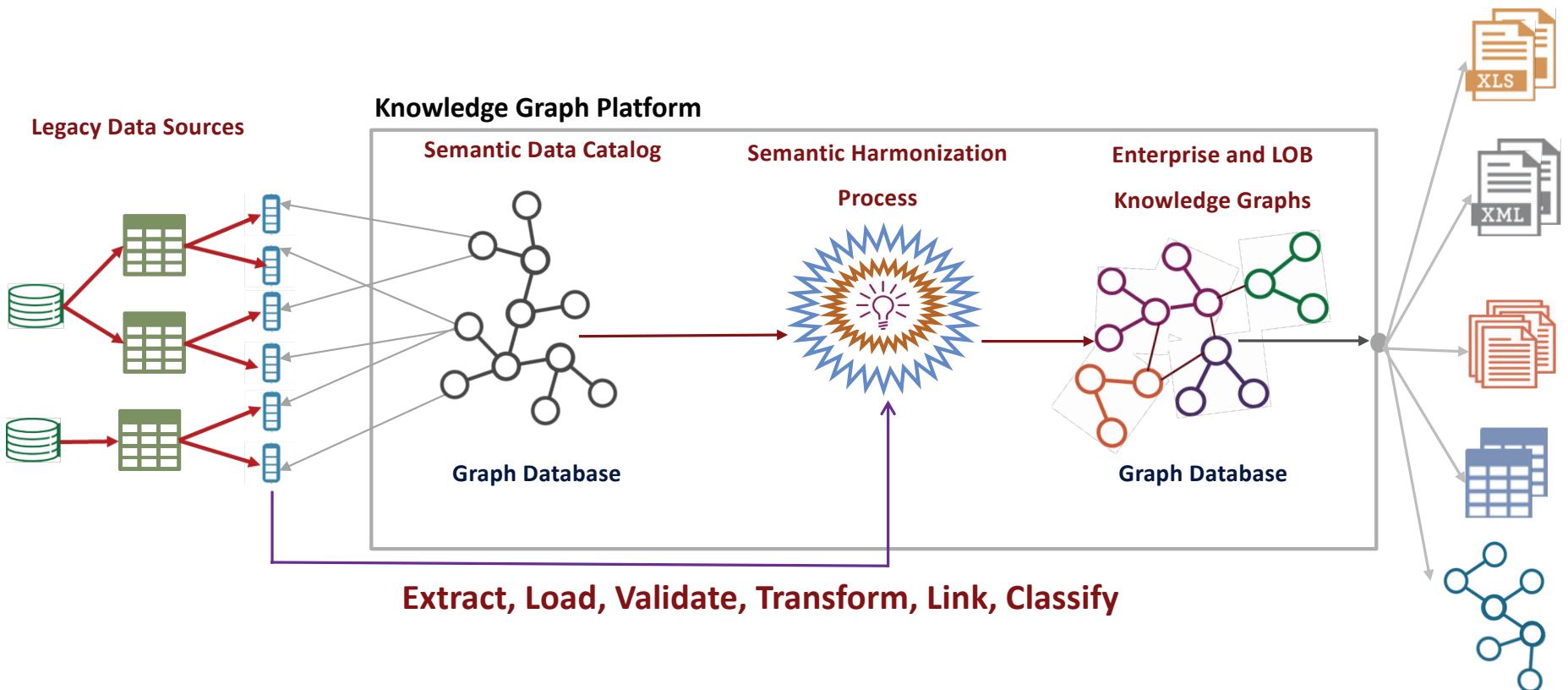


Ontologies Provide a Common Language for Understanding

A Knowledge Graph is a Smart Network of Connected Things

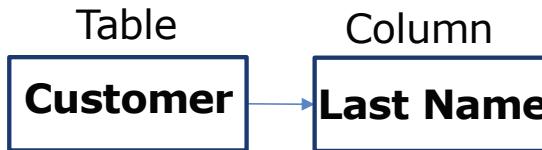


A Proper Knowledge Graph Architecture Must be Deployed

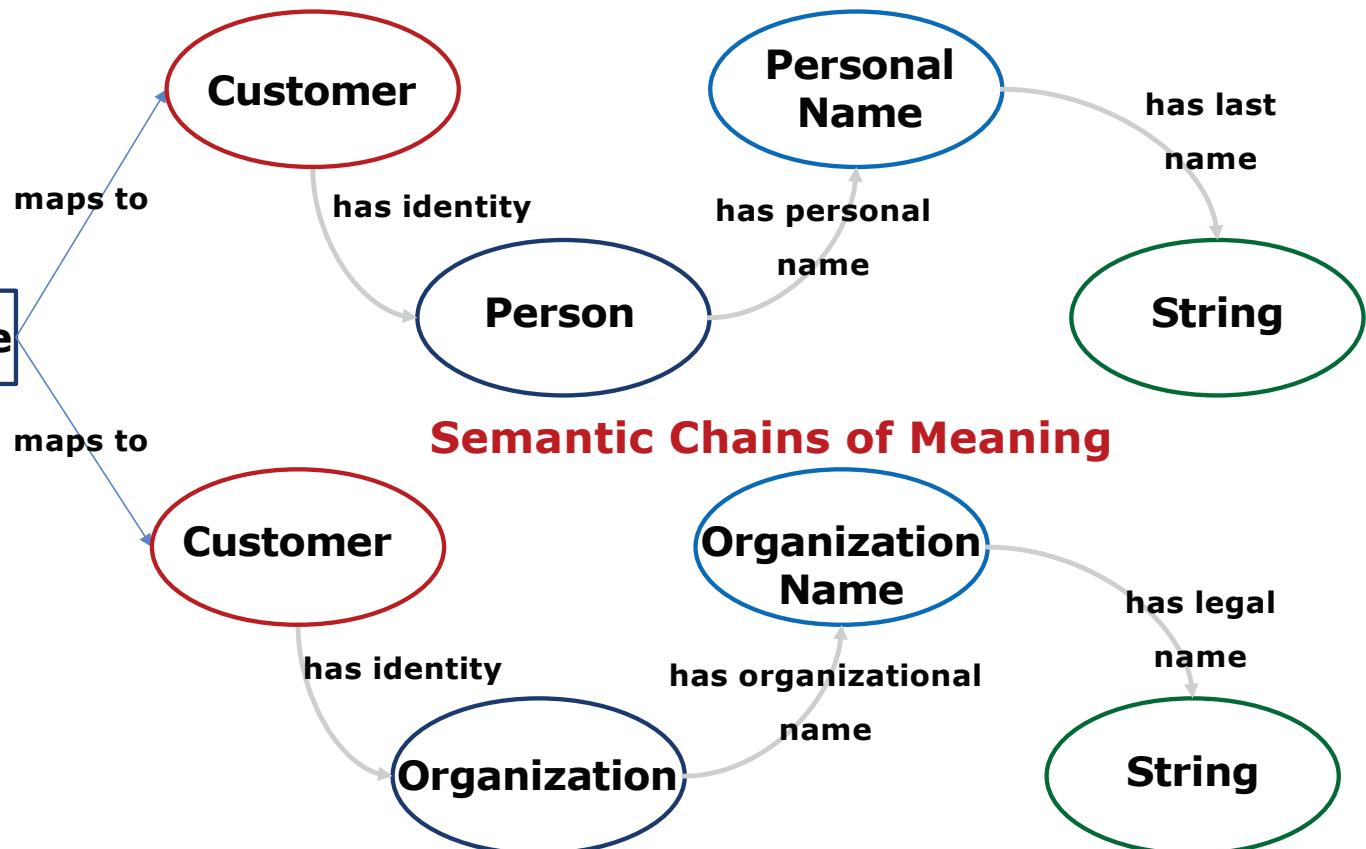


Semantic Data Catalog: Layer of Knowledge over Physical Data Assets

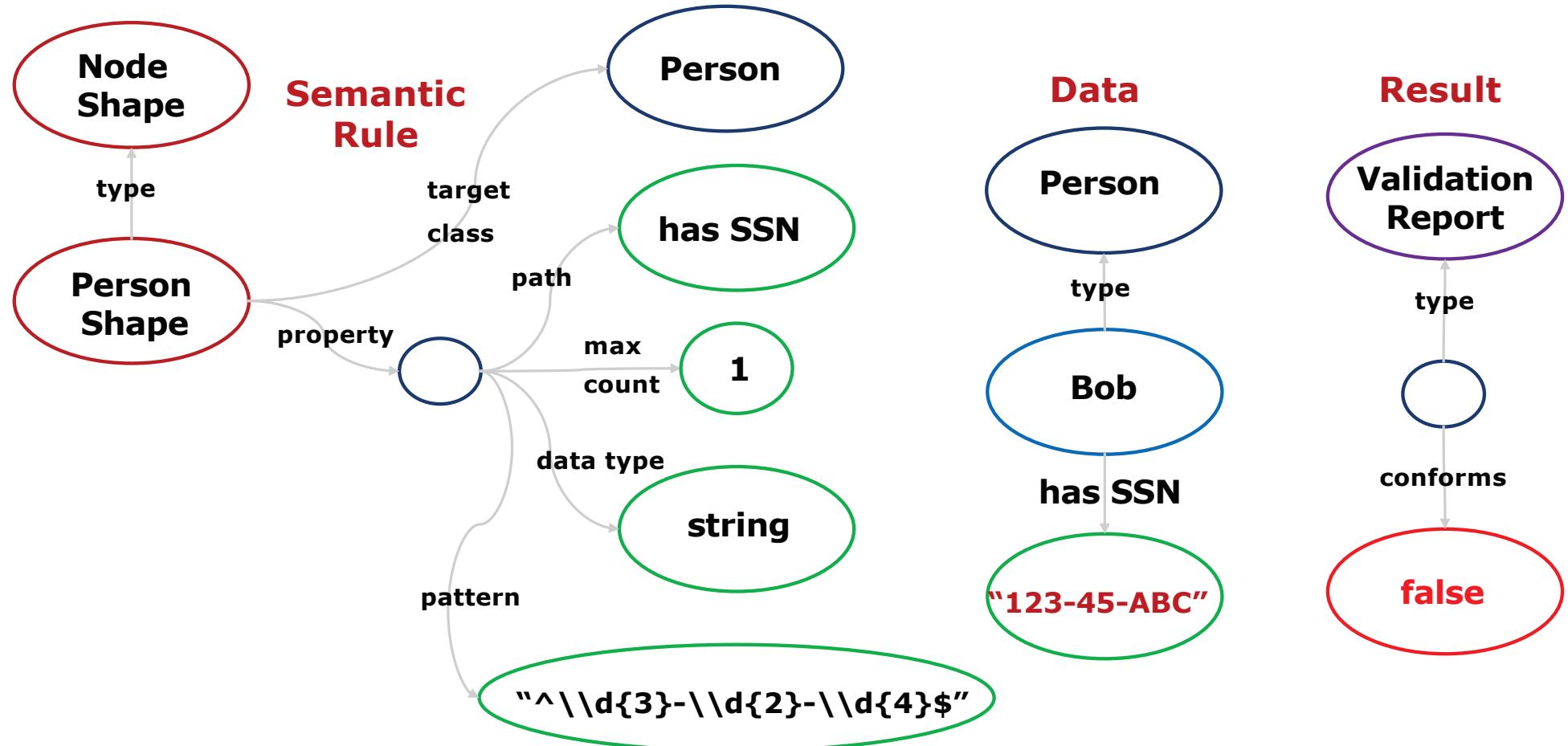
Relational Data Source



Knowledge Graph Representations



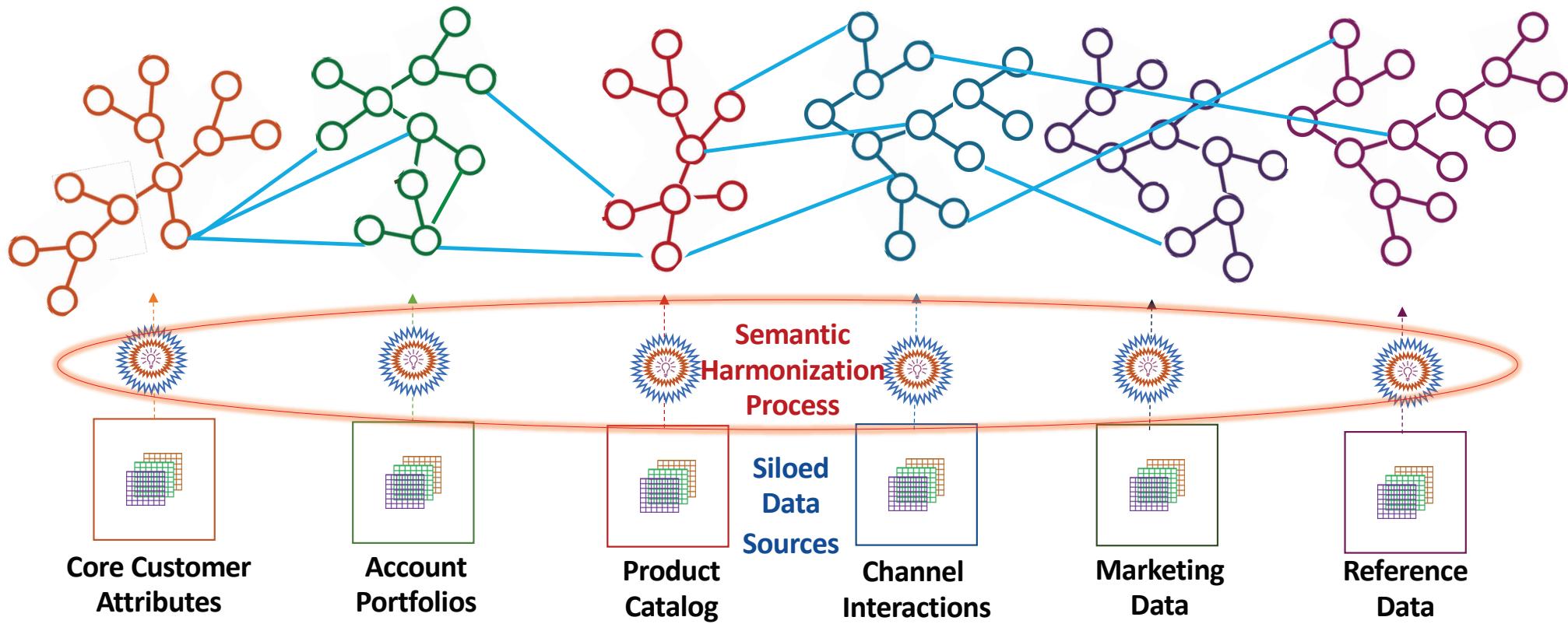
Semantic Validation: Standardized Executable Rules for Data Quality



*W3C Shapes Constraint Language (SHACL)

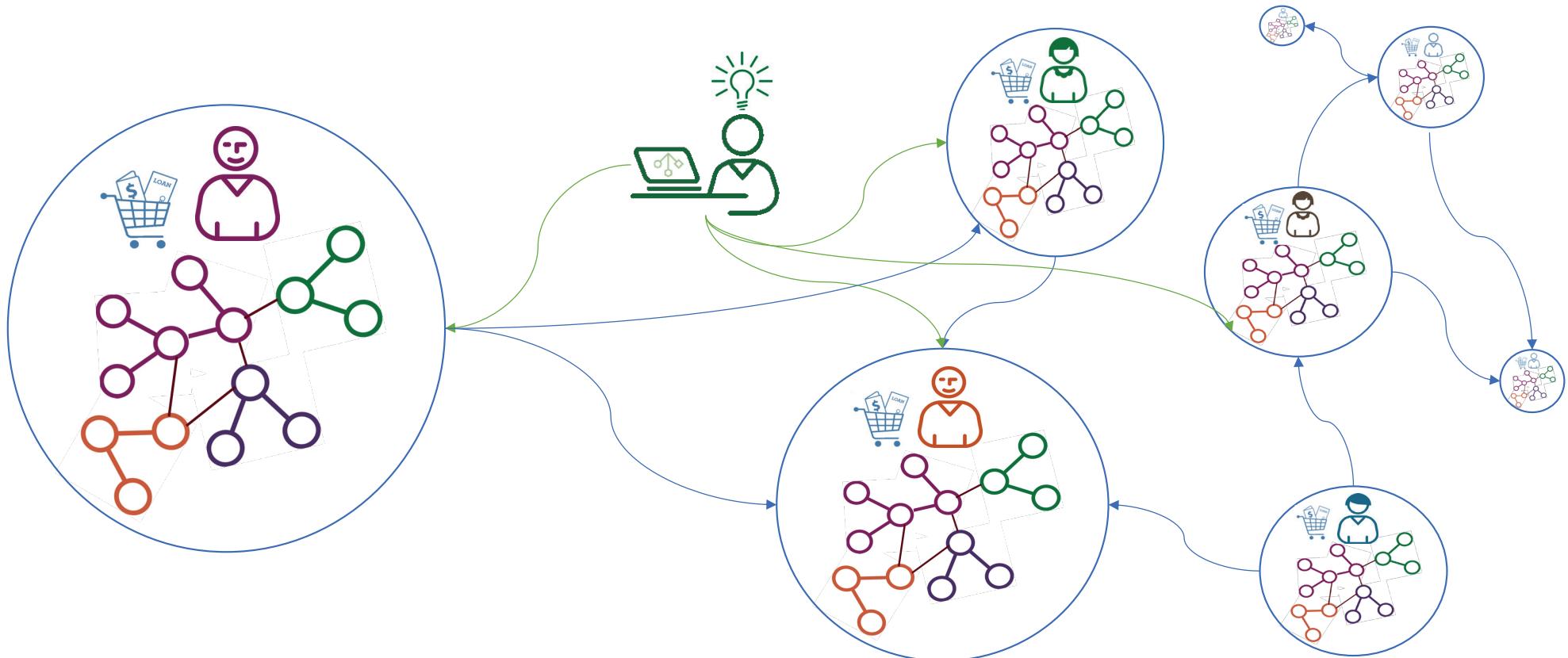
Semantic Harmonization Process: Creating Knowledge from Networked Integration of Aligned Data Across Siloed Data Sources

Enterprise Customer Knowledge Graph (Single, Federated)



Standardized Web Addressable Objects Makes Integration and Linkage Very Easy

Enterprise Knowledge Graph: Will Emerge as the Next Gen Data Lake



Enterprise Customer Knowledge Graph is a Graph of Customer Graphs

The EDM Council is Developing a Free and Open Source Ontology that is Emerging as a De Facto Financial Industry Semantic Standard

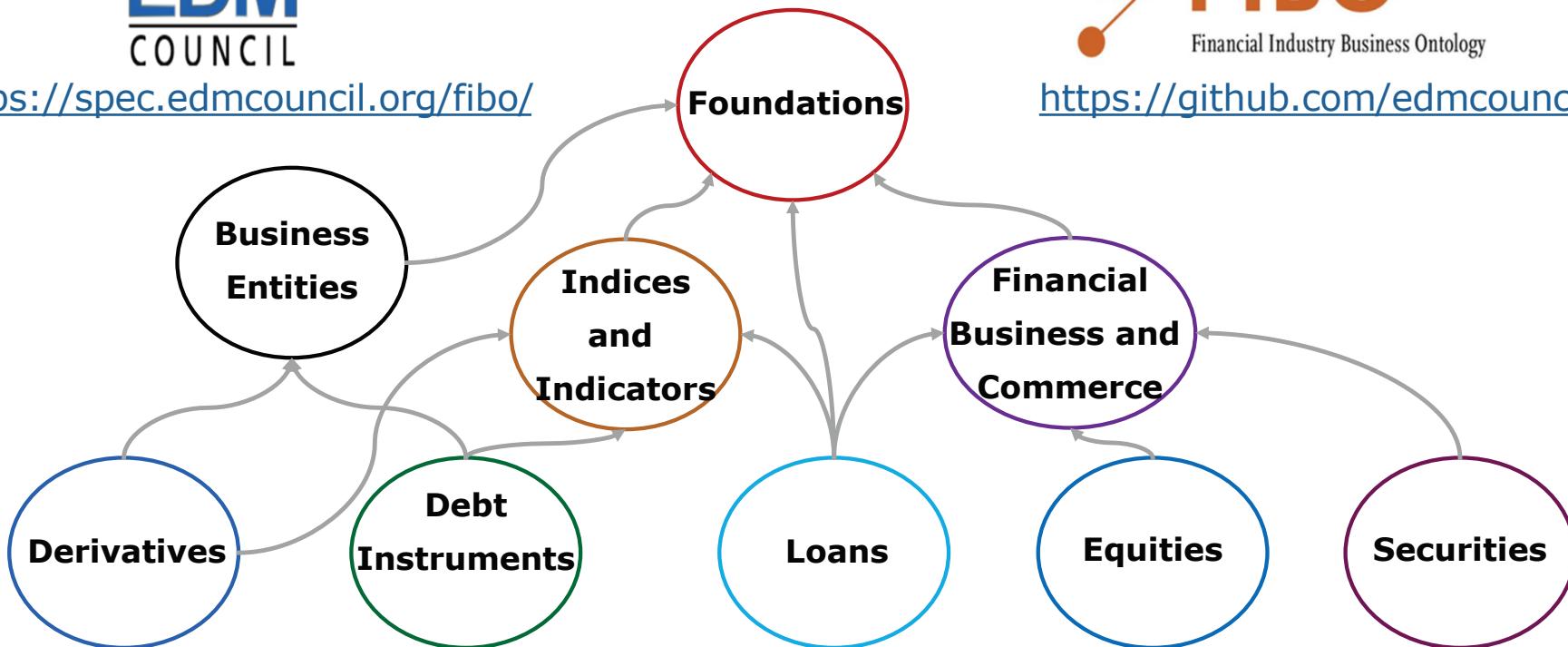


<https://spec.edmcouncil.org/fibo/>

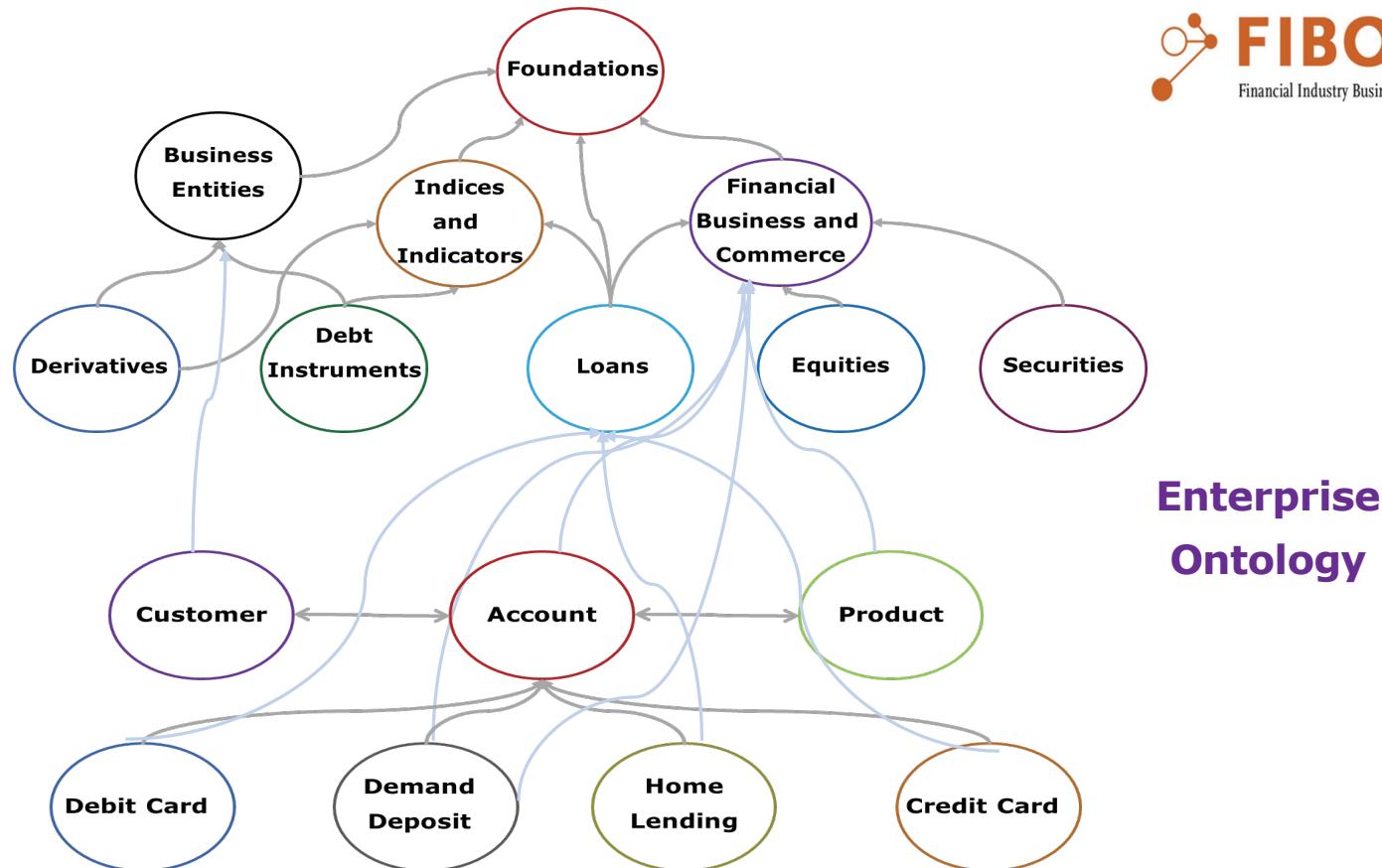


Financial Industry Business Ontology

<https://github.com/edmcouncil>



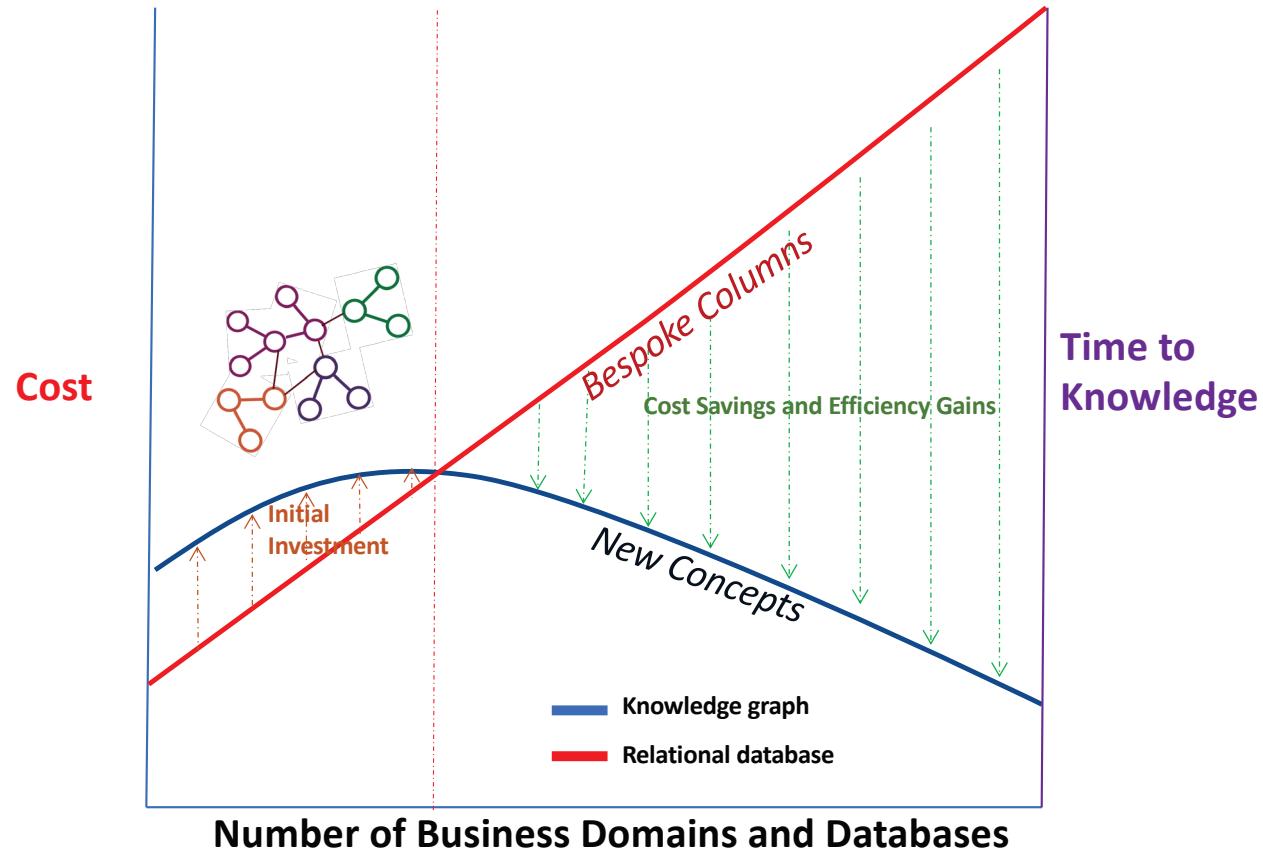
FIBO can be Used to Rapidly Jumpstart Financial Knowledge Graphs



FIBO Aligned Knowledge Graphs will Allow us to Standardize and Align *Data at Rest* With *Data in Motion*



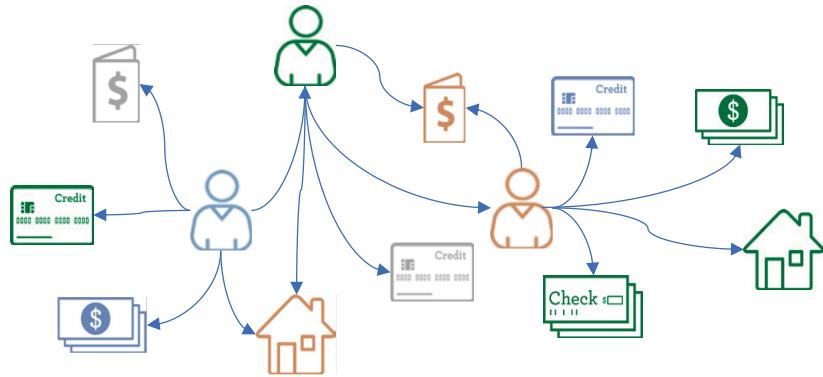
Utilizing a Knowledge Graph can Reduce Costs, Improve Efficiencies and Accelerate Time to Knowledge



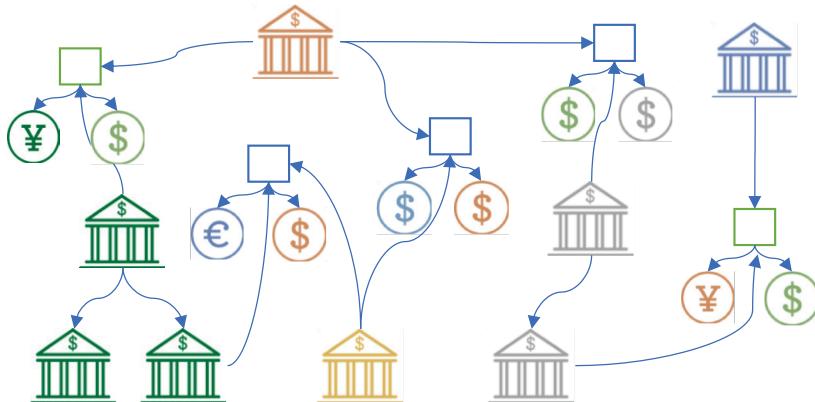
When Should We Invest in Knowledge Graph Technology over Conventional Methods?

*Adapted From: DoD Deputy Chief Management Office

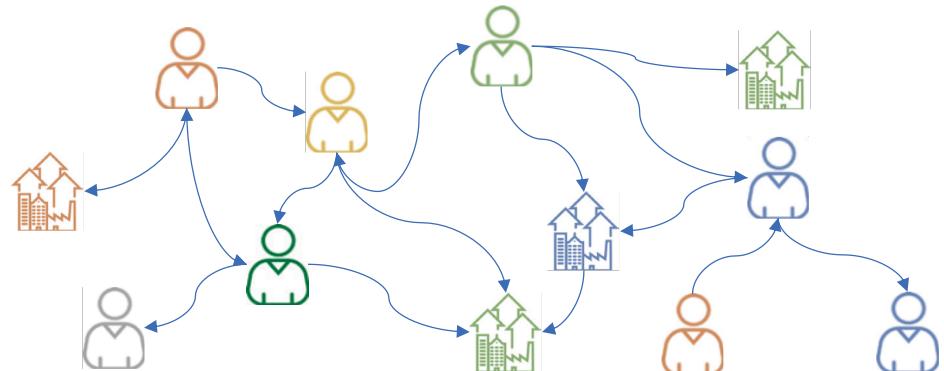
... When the Organization of the Data is a *Network* of Relationships



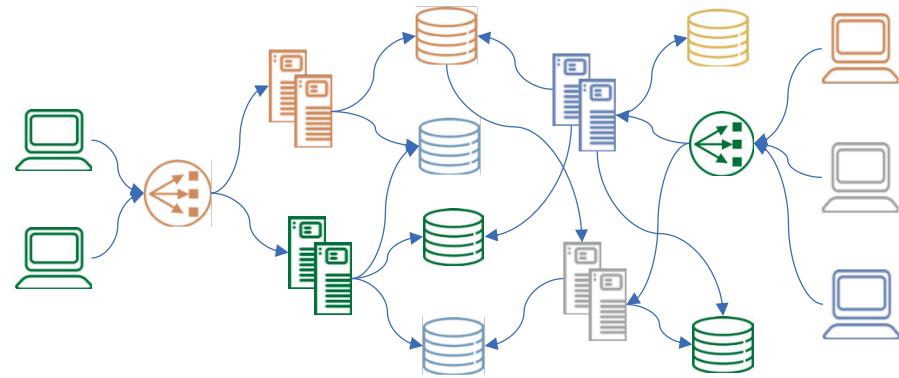
Customer 360 Network: Predict Entity Resolution, Next Best Product, Financial Guidance, Credit Risk



Derivatives Trading Network: Predict Counterparty or Systemic Risk



Payments Network: Predict Money Laundering or Fraud



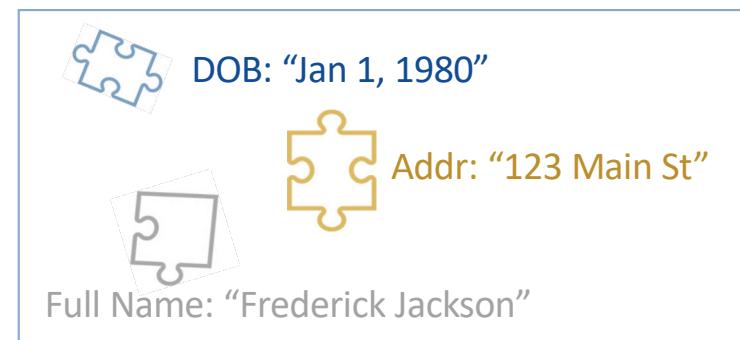
Technology Assets Network: Predict Future Operational Failures and Business Impacts

... When Disparate Data Exists Across Multiple Siloes that Must be Linked, Integrated and Harmonized Using a *Common Model*

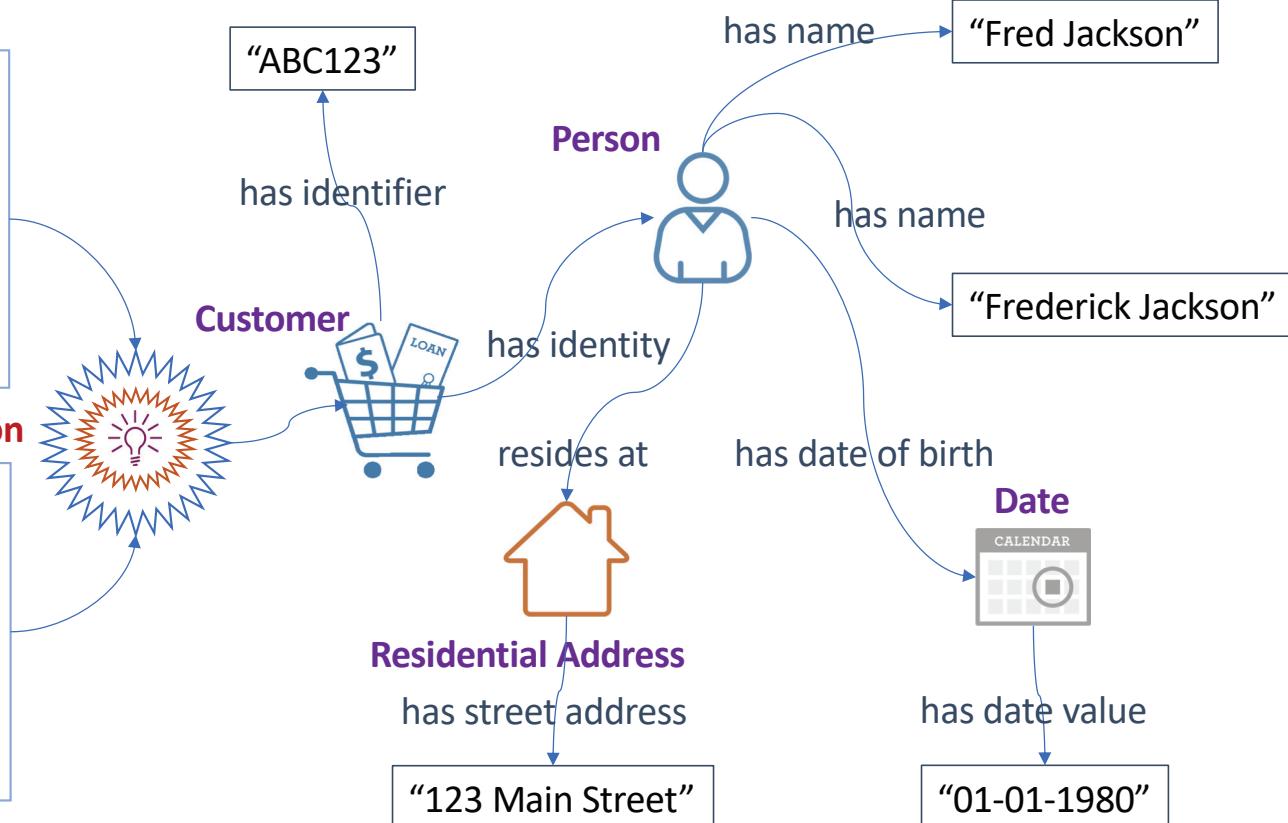
Table: Customer



Table: Cust

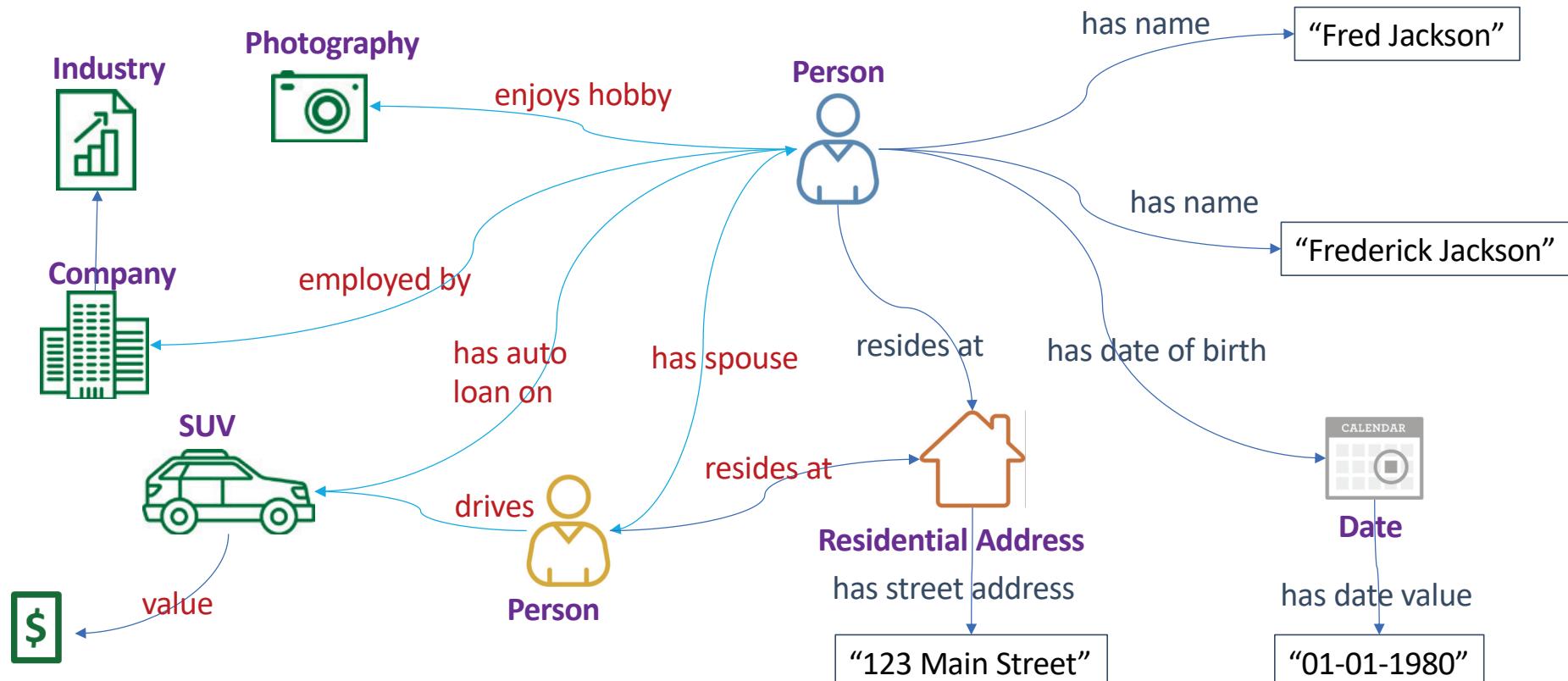


Semantic Harmonization



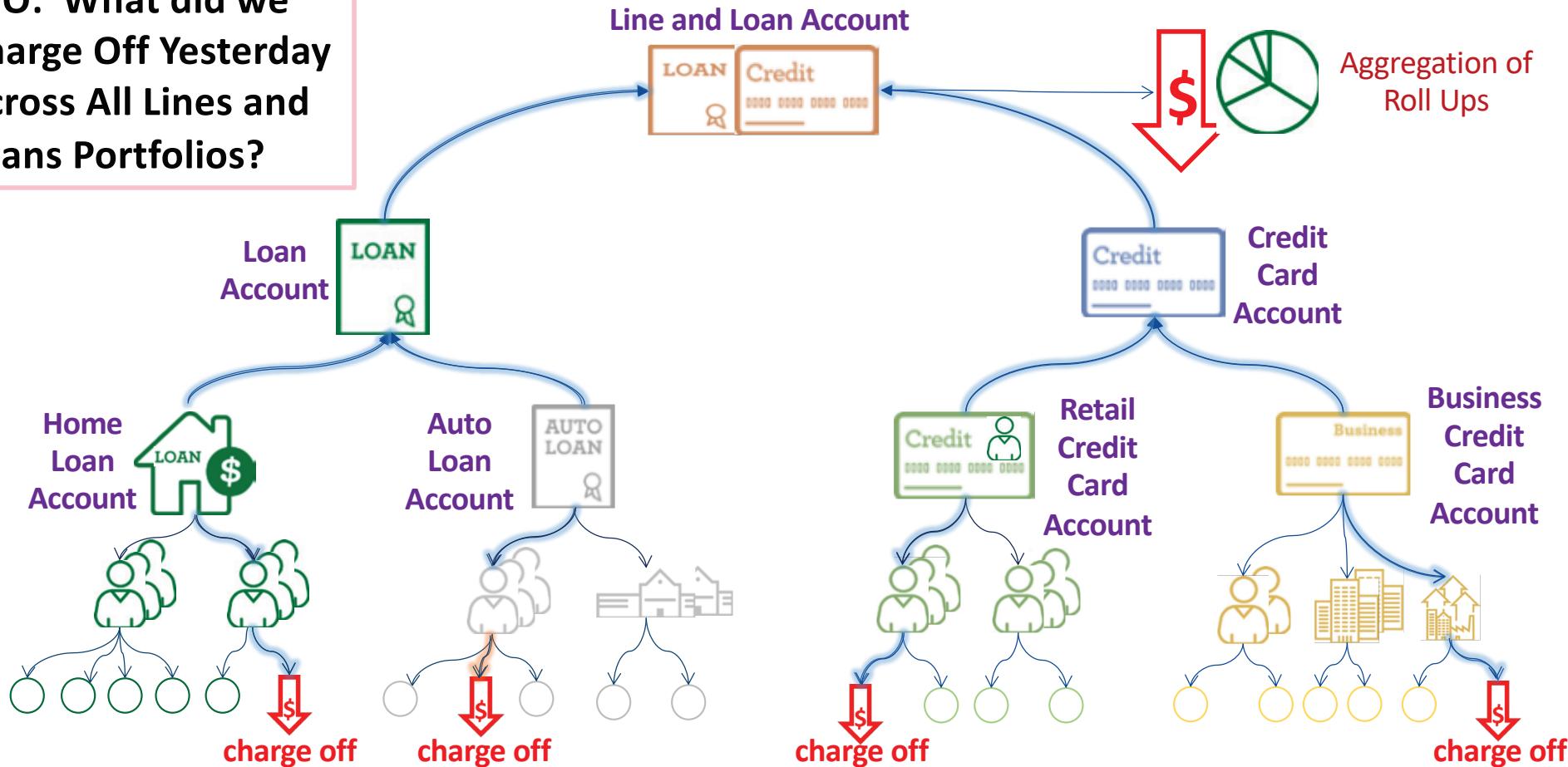
Objects are First Class Things with a Standardized Unique Web Address for Easy Linkage

... When Data that is Highly Variable and Newly Captured or Streamed must be Rapidly Linked to Existing Data

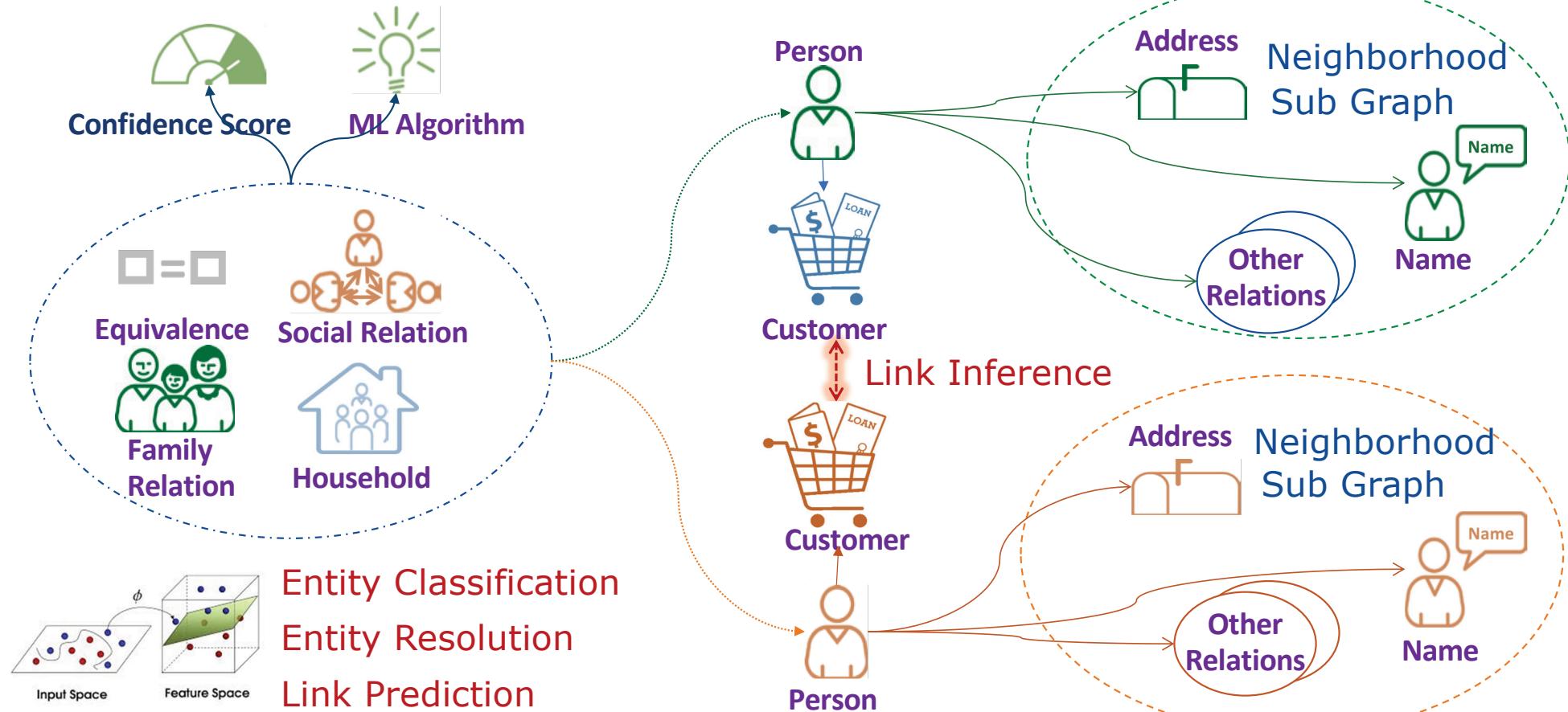


... When Data must be Classified into Categories Within a *Taxonomy*

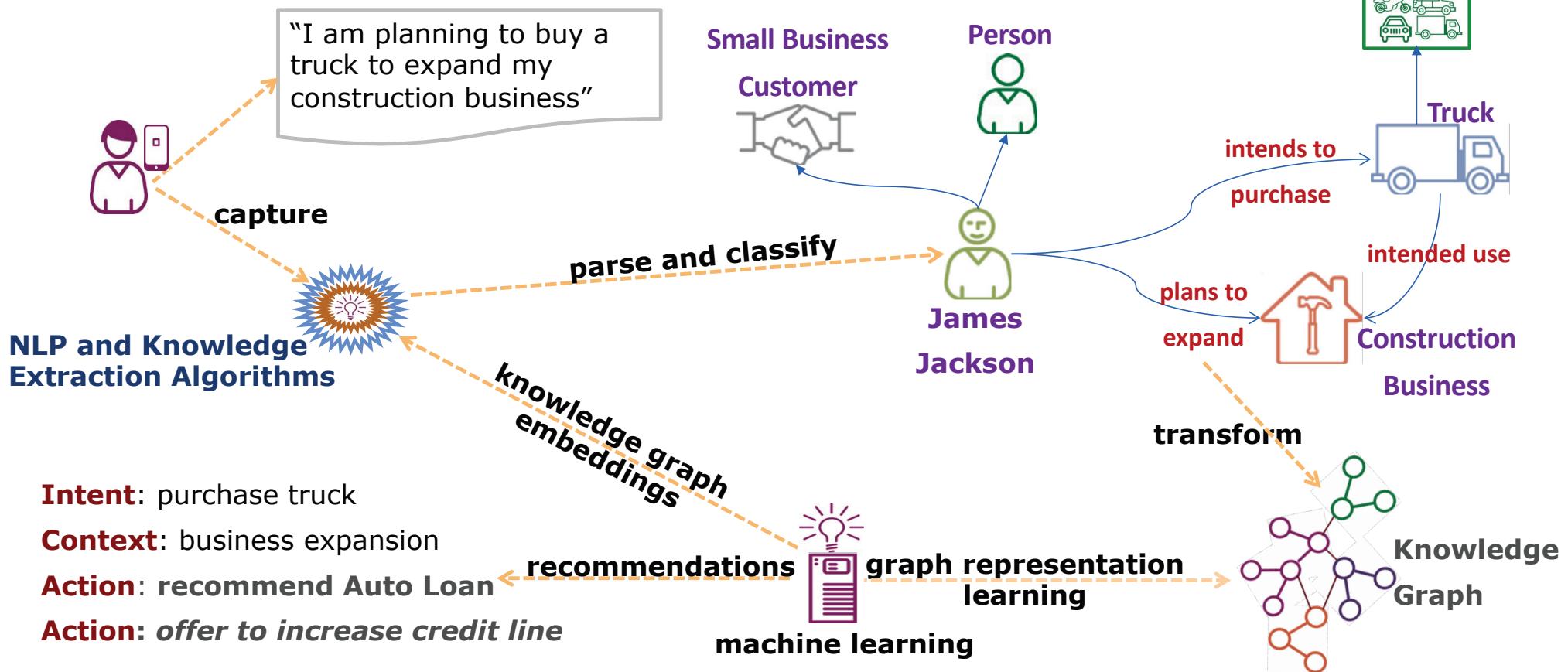
CFO: What did we Charge Off Yesterday Across All Lines and Loans Portfolios?



... When New Insights and Relationships Among Data Must be Discovered, Inferred or Predicted

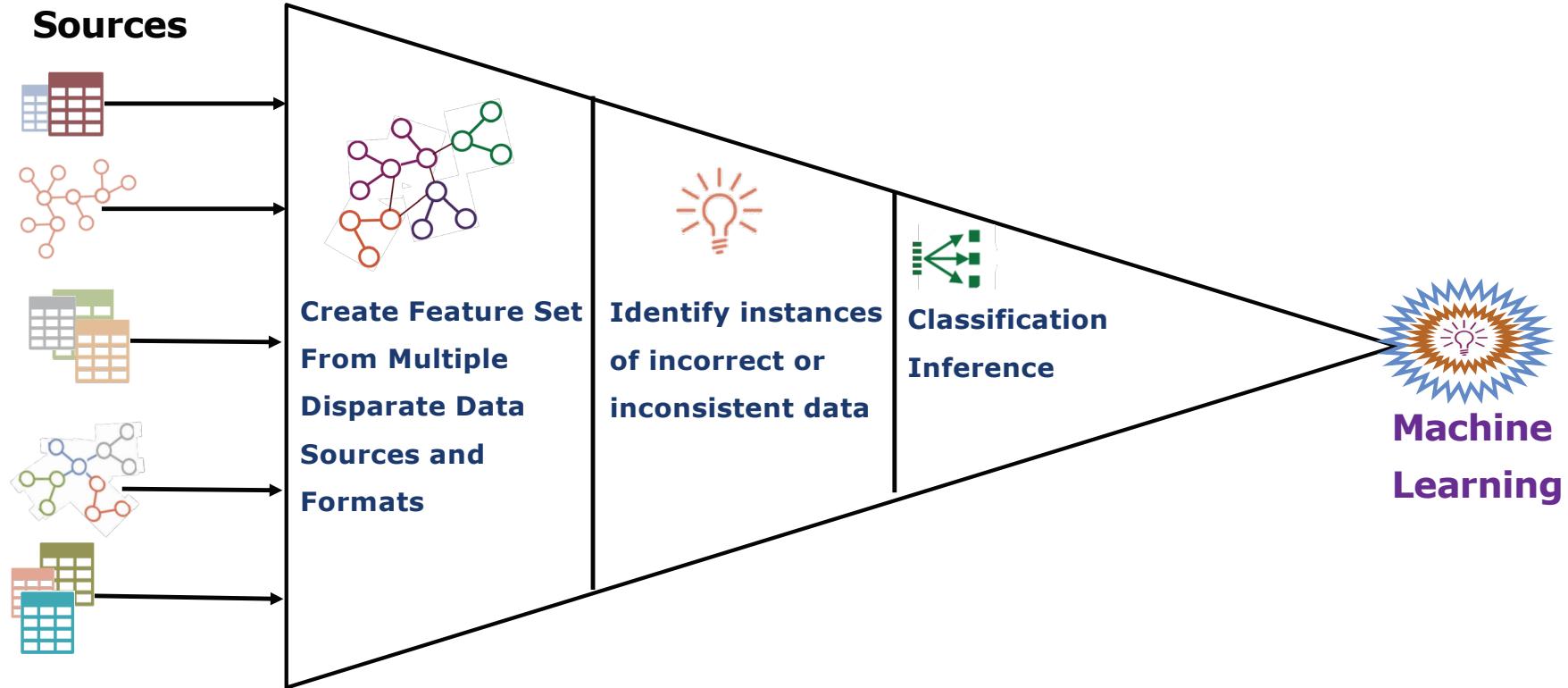


... When Unstructured Data Must be Captured and Stored in a Structured Form for Analysis and Memory



... When we Need to Efficiently Wrangle Multiple Data Sources for ML

Disparate Data

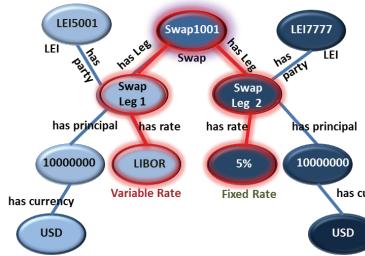


Especially when Graph Relations are Also Feature Sets for Machine Learning

Graph Relations can be Transformed into Standardized Digital Fingerprints (Points in Vector Space) for ML Algorithms

Fixed-Float Single Currency

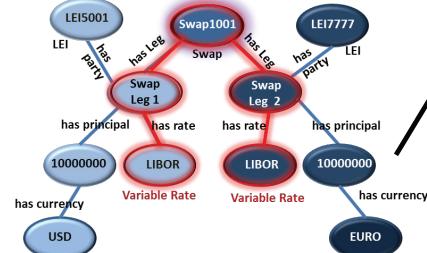
Interest Rate Swap



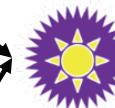
Human Understandable

Float-Float Cross Currency

Interest Rate Swap

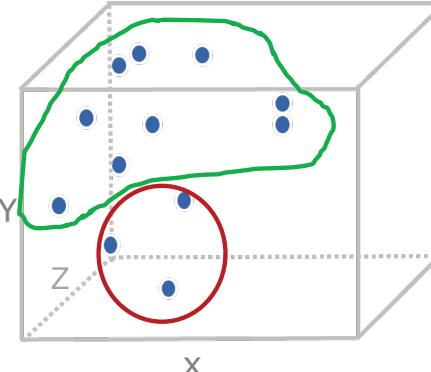


Graph Representation Learning



Concept,
Predicate and
Sub Graph
Vectors

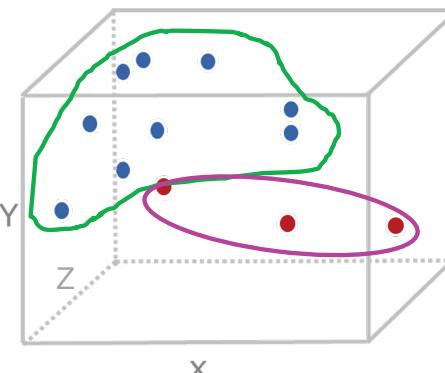
Fixed-Float Single Currency IR Swap Digital Fingerprint



Graph
Embeddings
in Low Dimensional
Vector Space

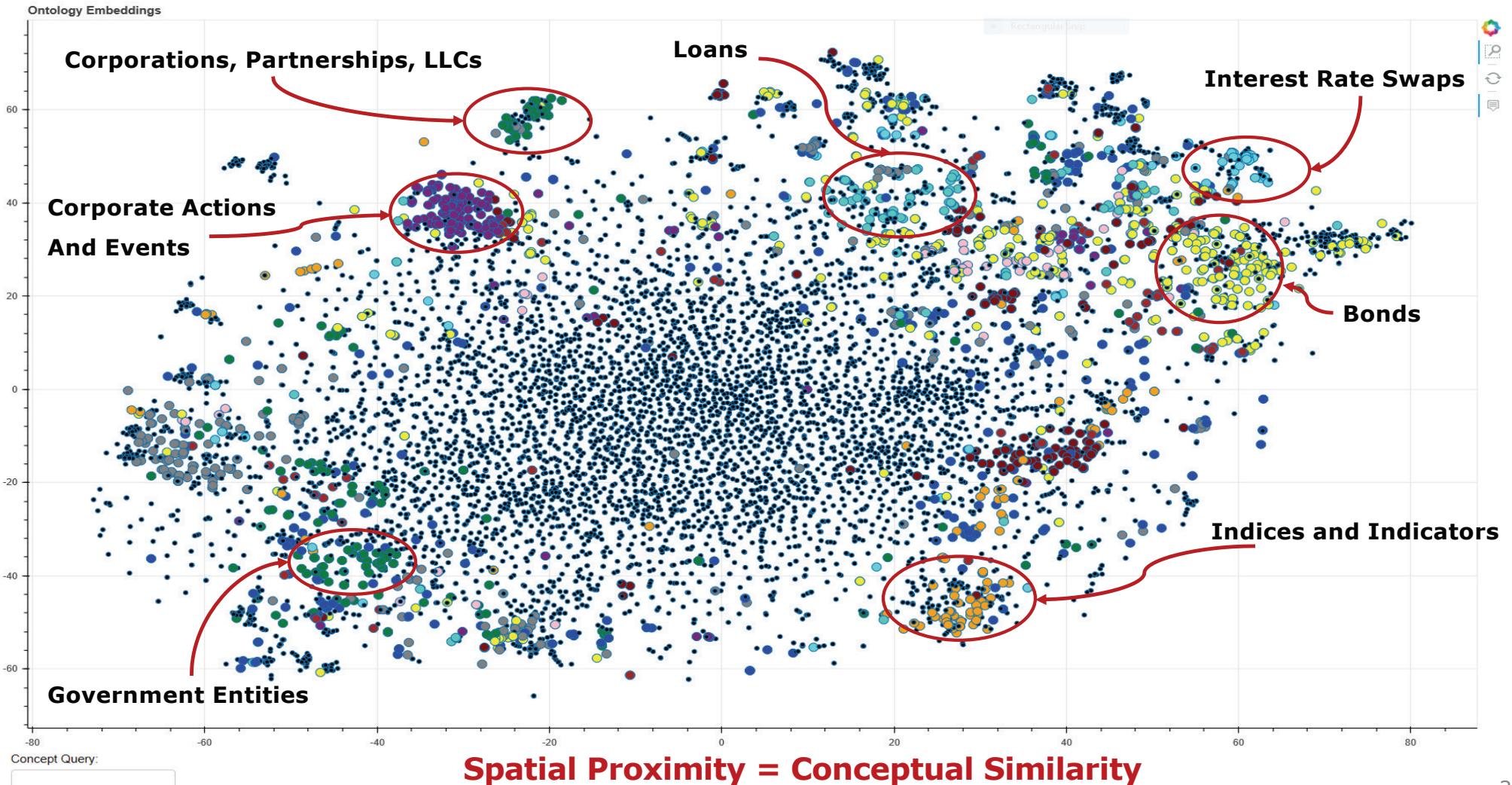
Machine Understandable

Float-Float Single Currency IR Swap Digital Fingerprint

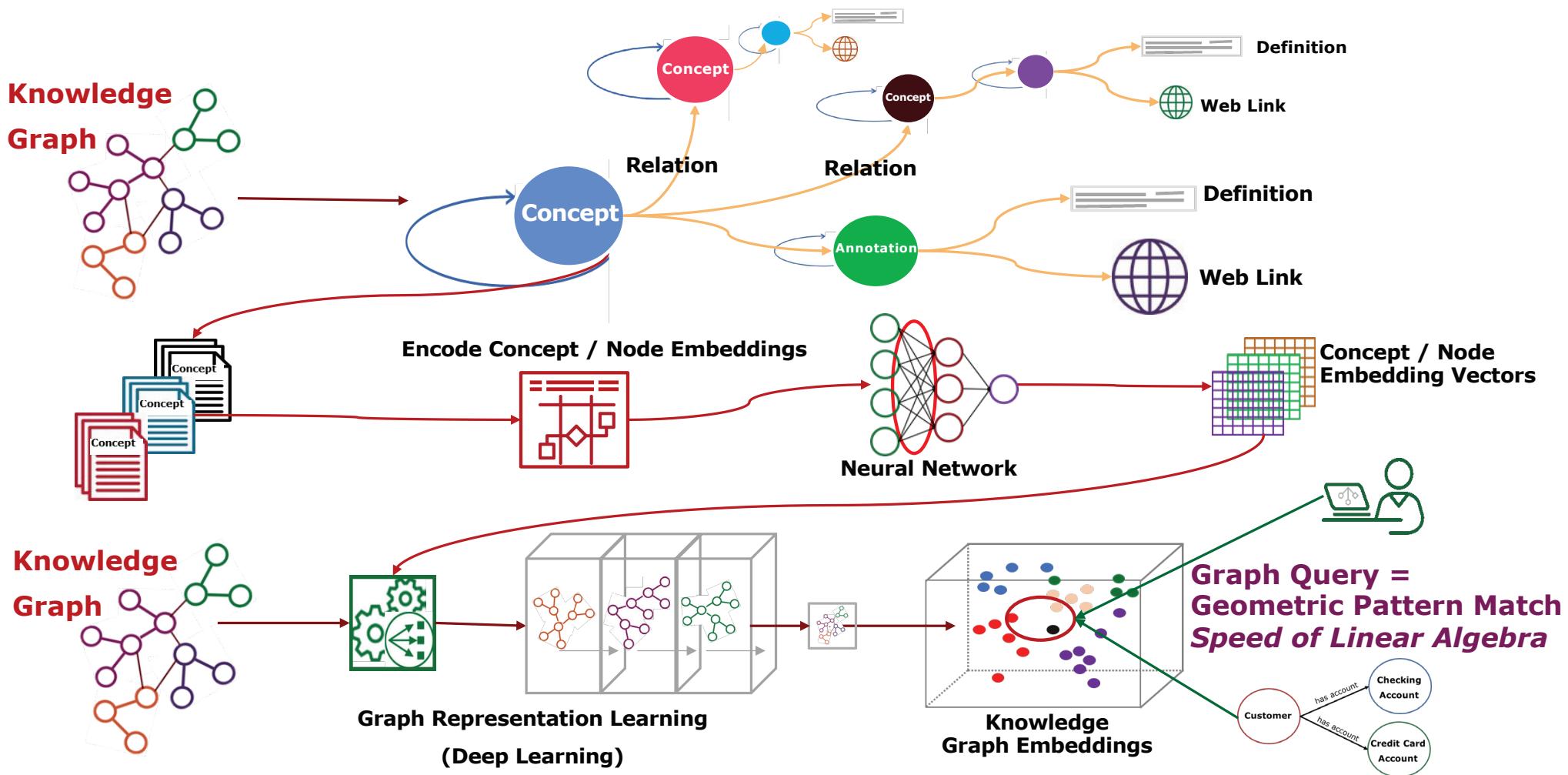


Graph
Embeddings
in Low Dimensional
Vector Space

Representations of FIBO Domains as Concept Embeddings



Training and Querying Knowledge Graph Embeddings



Thank You!

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