知识图谱构建与应用最佳实践

关键词：知识图谱、图数据库、数据模型、MLOps、知识提取、图表征

2021.10.18

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Presetation available at: https://github.com/SmartDataLab/KG-Share

Written with Marp and Mermaid on Markdown

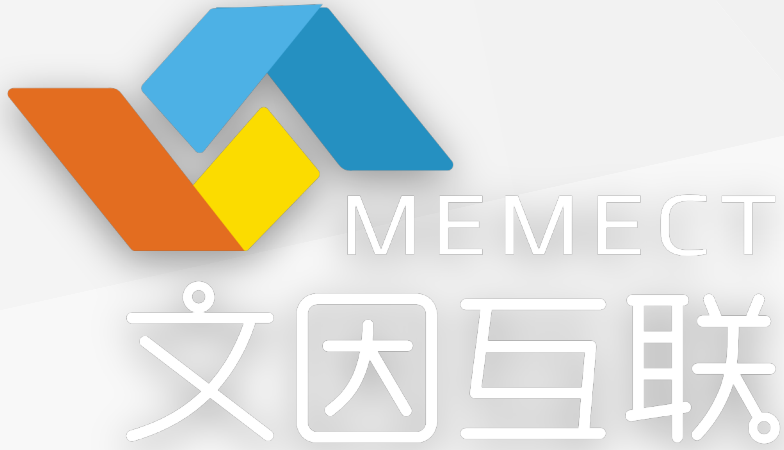
引子

> One hidden layer Perception with non-linear activation function -- Logistic Regression

知识图谱、图神经网络概念火热，国内有成熟的知识图谱产品吗？

知识图谱技术落地需要 **表子好看，里子实在。**

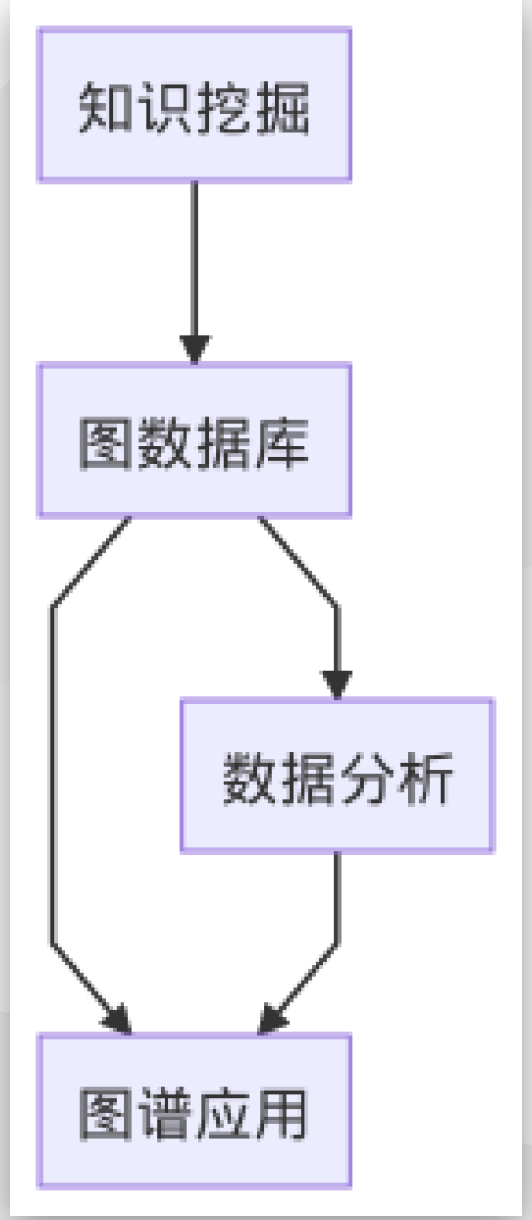
商业智能-行业数据库-知识挖掘



背后依托的技术

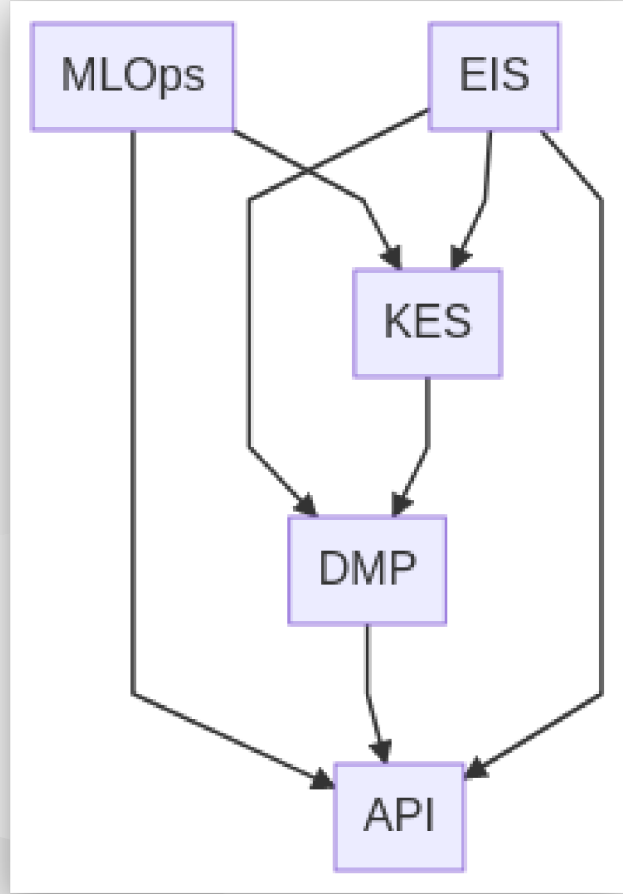
1. 知识挖掘：用户交互以及NLP
2. 数据存储：图数据库 😄
3. 数据分析：图算法及可视化技术 😄
4. 图谱应用：图表征以及图神经网络

```
graph TD;
    A[知识挖掘]-->B[图数据库];
    B-->C[数据分析];
    B-->D[图谱应用];
    C-->D;
```



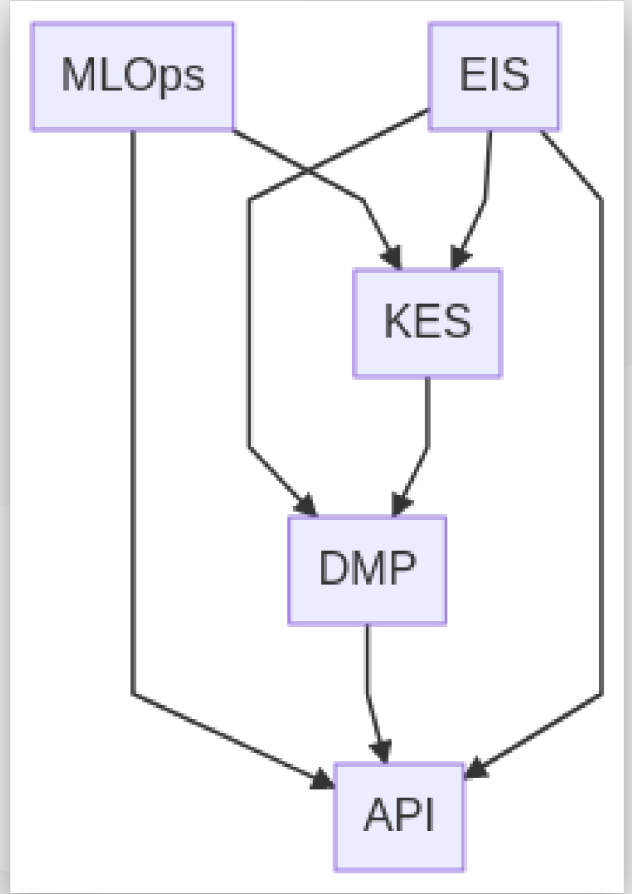
知识图谱产品架构

- MLOps System
  - Kubernetes
  - Jenkins X: MLOps Quickstarts
  - General ML Deployment: ONNX
- EIS: Expert Interact System
  - Human Labelling & Heuristic Algorithm
  - Monitoring & Back-testing
  - Quality: Bad Cases in KG



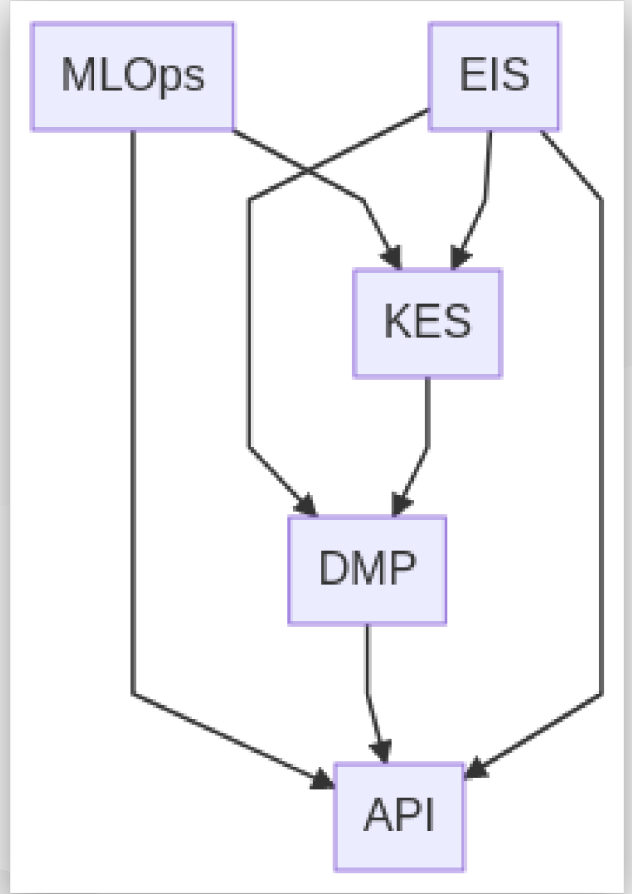
知识图谱产品架构 cont.

- KES: Knowledge Extraction System
  - Transfer from RDBS
  - Entity Recoginition
    - Node presentation
    - Breadth first priority search
  - Link Prediction
    - shortest path
    - NLP semantic distance
  - Attribution Extration



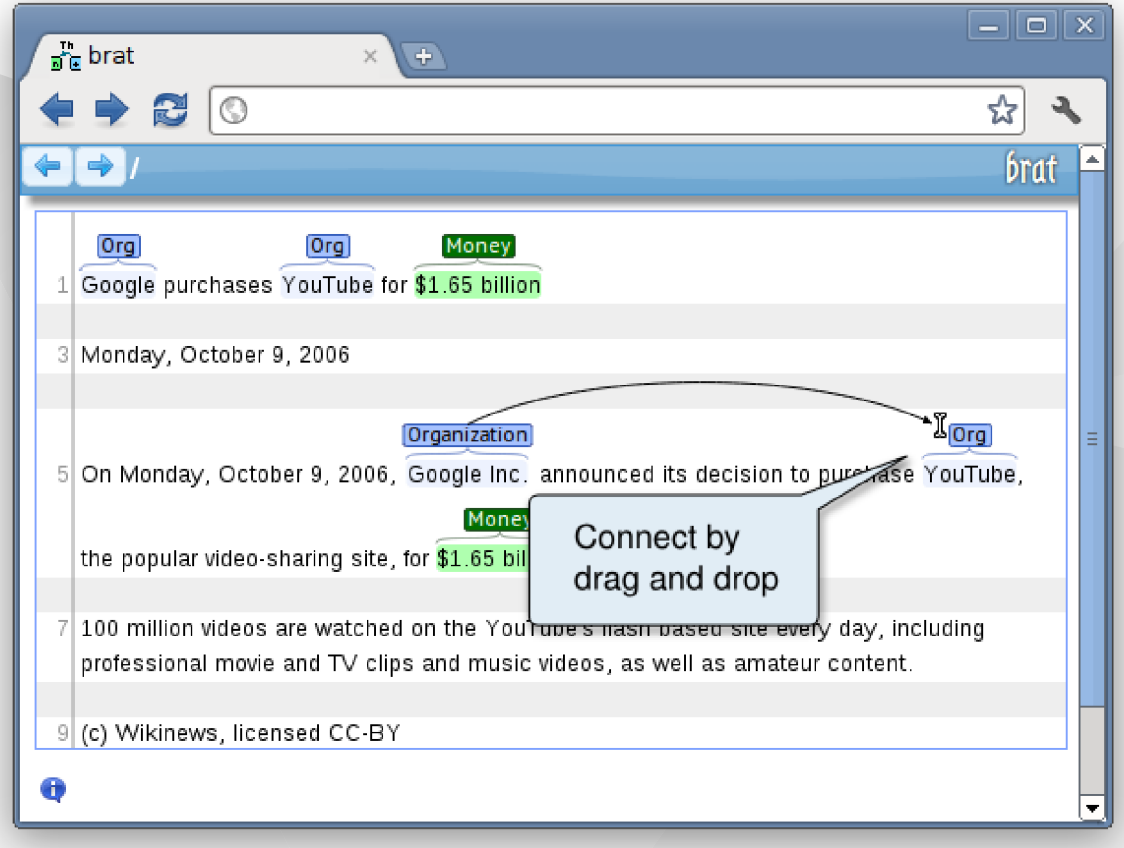
知识图谱产品架构 cont.

- DMP: Data Manage Platform
  - DataHub to manage the dirty data
  - Graph Database
- API Platform
  - Graph Visualization
  - Node Representation
  - Prediction Tasks
    - intelligent search(google page rank)
    - KG-based Q&A (NLP)



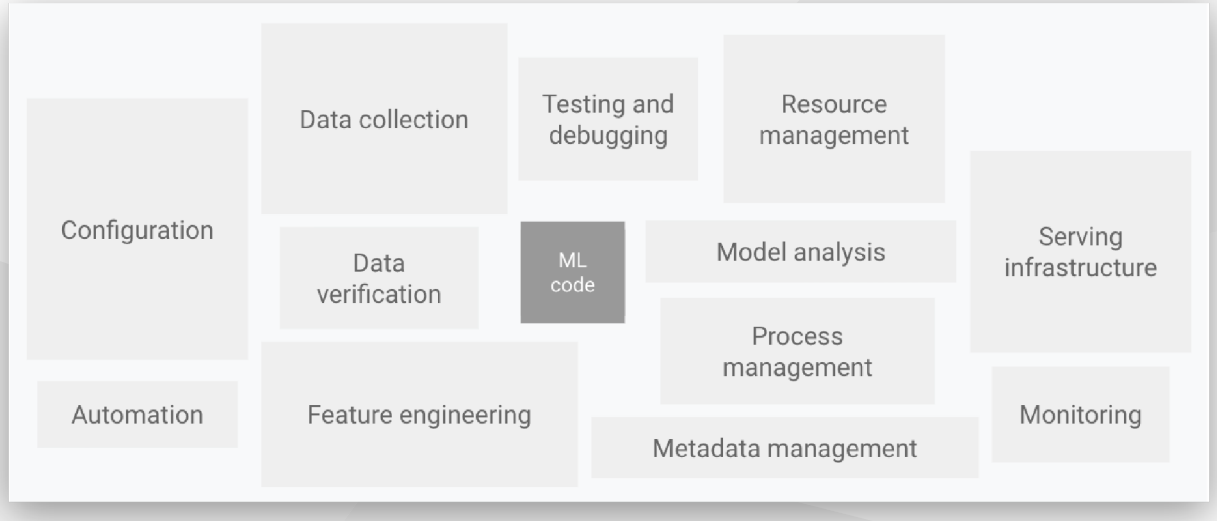
Expert Interact System

- Brat (labelling tool) [link]



为什么要MLOps

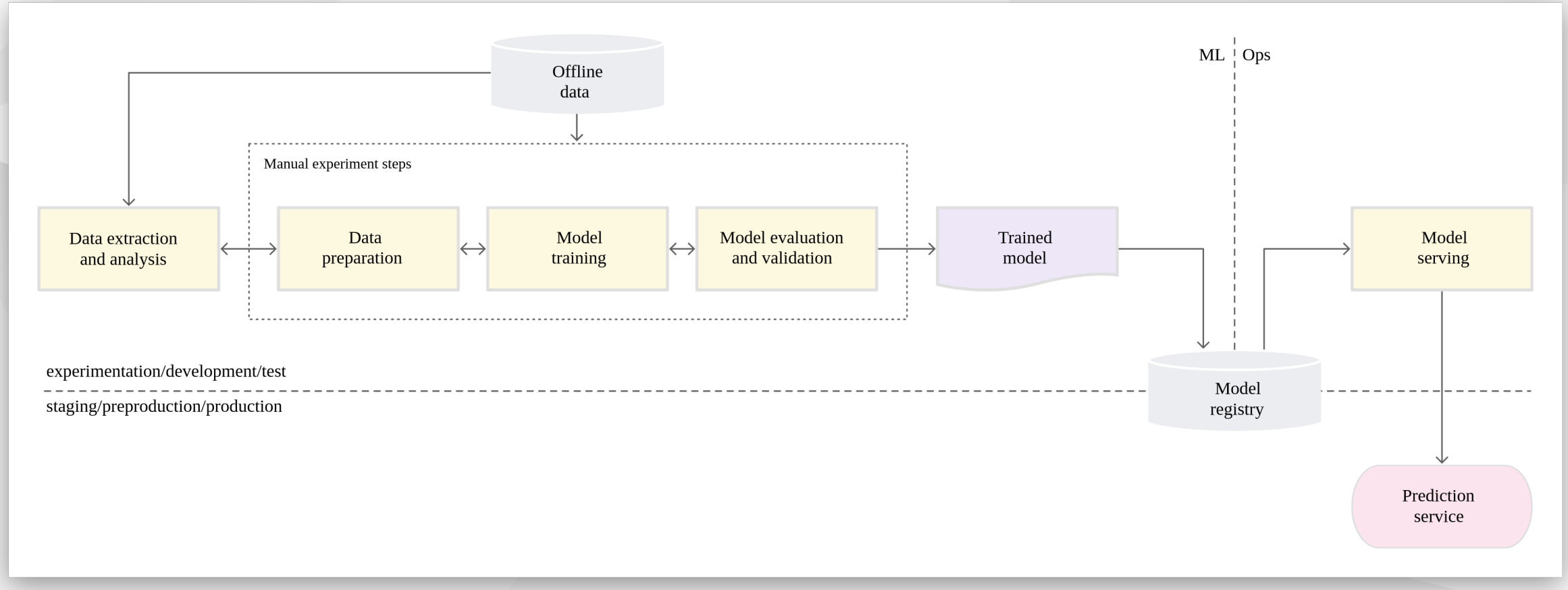
Machine Learning: The High Interest Credit Card of Technical Debt
A paper in NIPS 2014 workshop



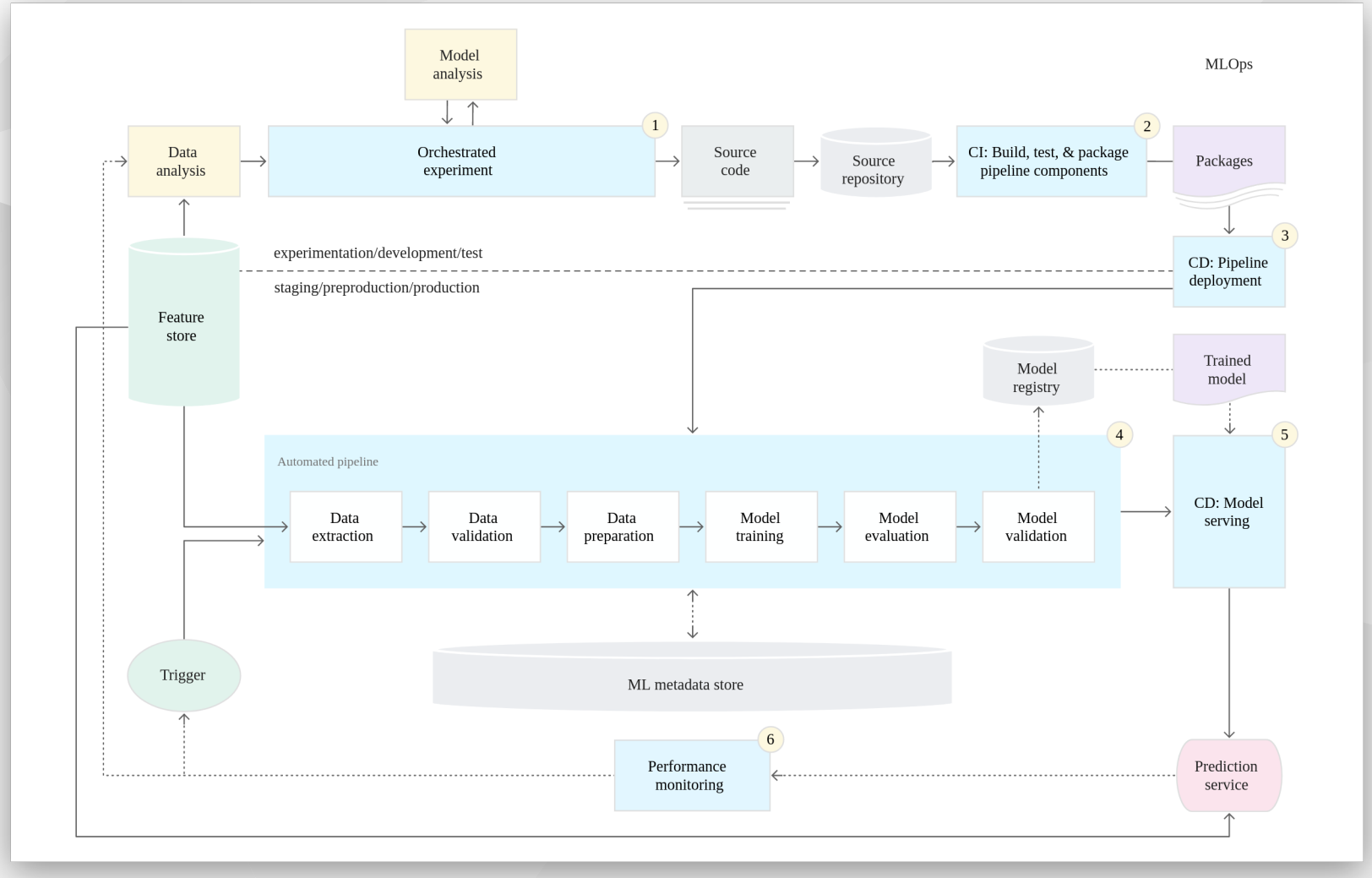
Rules of Machine Learning: Best Practices for ML Engineering link

training-serving skew 😄

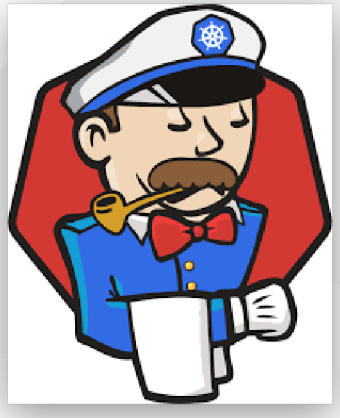
MLOps(low level)



MLOps(high level)

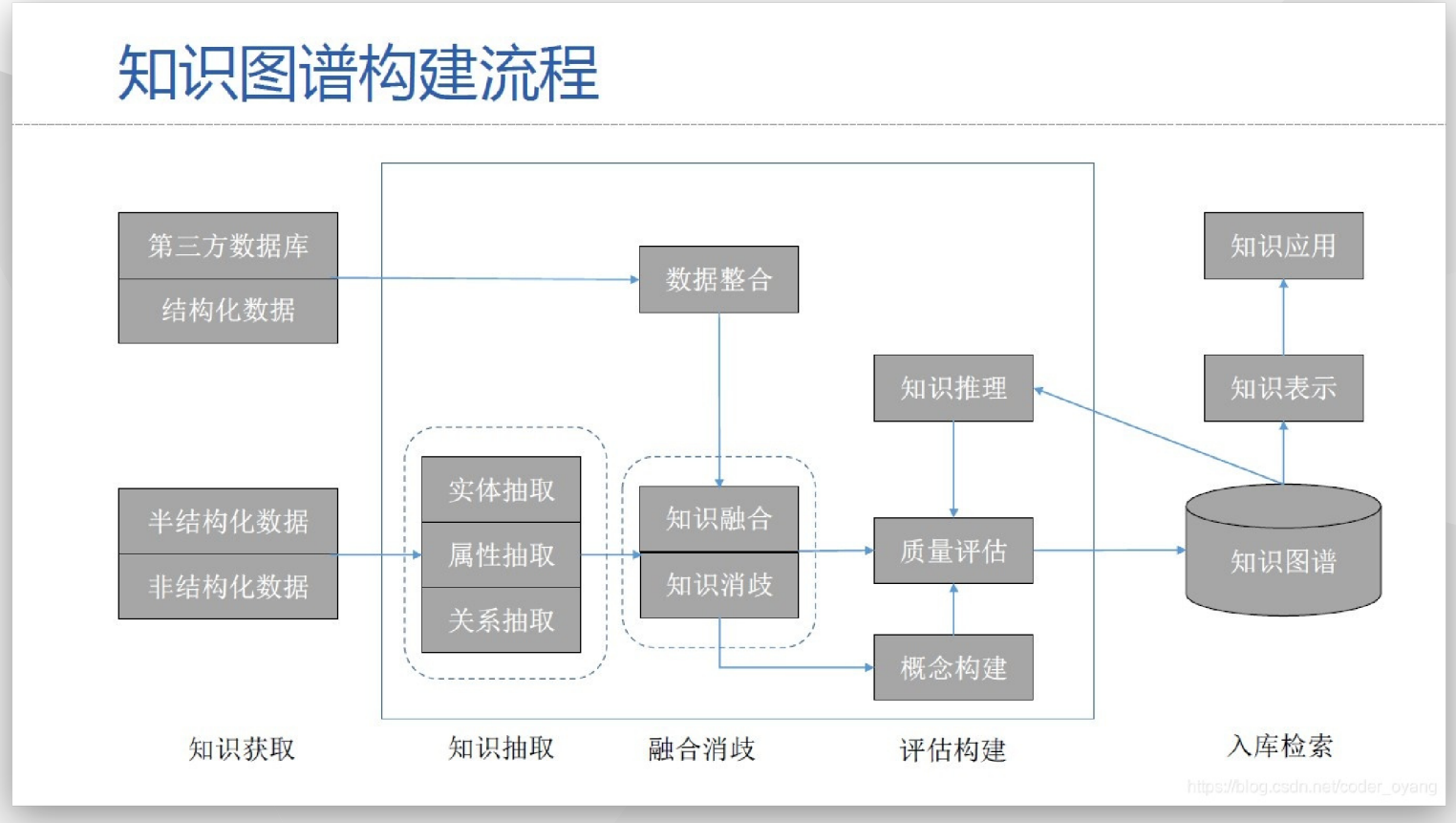


MLOps Tools(support gpu)



Knowledge Extraction System

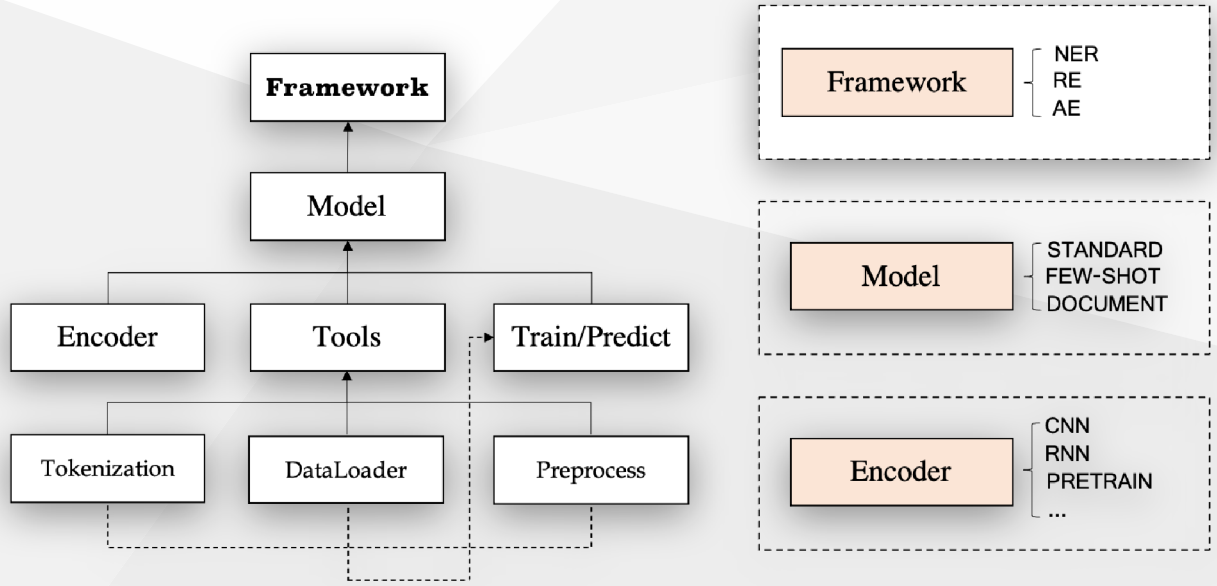
A structure from CSDN(author: coder_oyang)



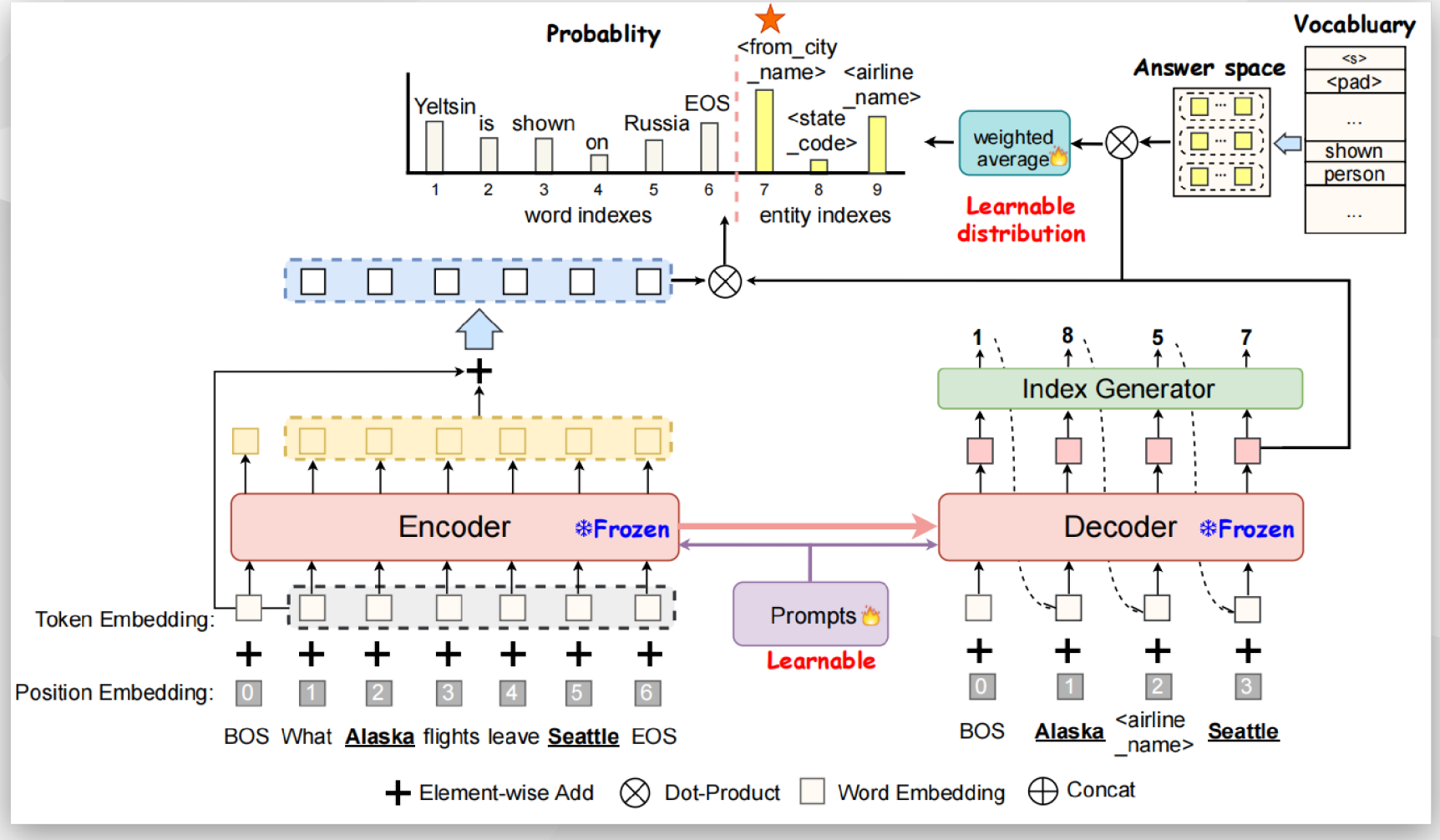
构建工具

推荐OpenKG(浙大),网站整理了大量工具和相关技术文章

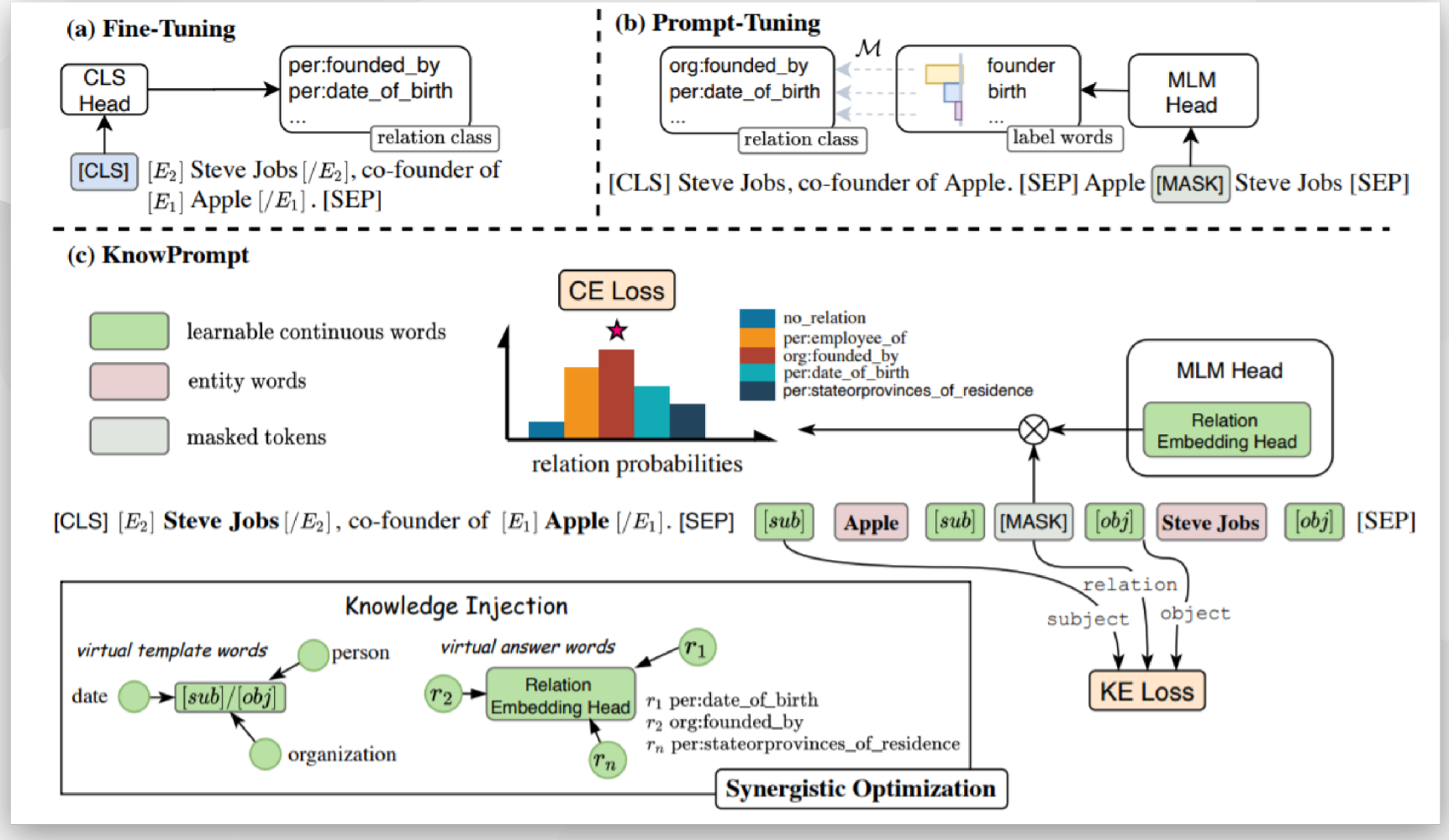
- 中文NLP工具:(哈工大LTP，车万翔)
- 知识提取工具:DeepKE(浙大，结合prompt，适合few-shot场景)



LightNER arXiv



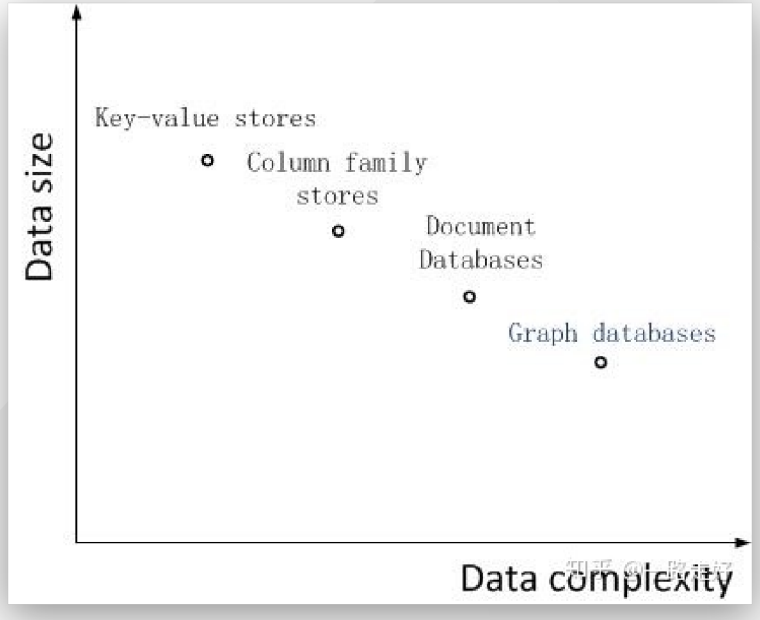
LightRE github



Data Manage Platform

思考🤔关系型数据库(RDBMS)与NoSQL的发展和知识图谱有什么联系

> “ Web2.0进入了“可读可写”模式，交互内容的急剧增加，RDBMS在超大规模数据的高并发处理力不从心,NoSQL应运而生。 ”



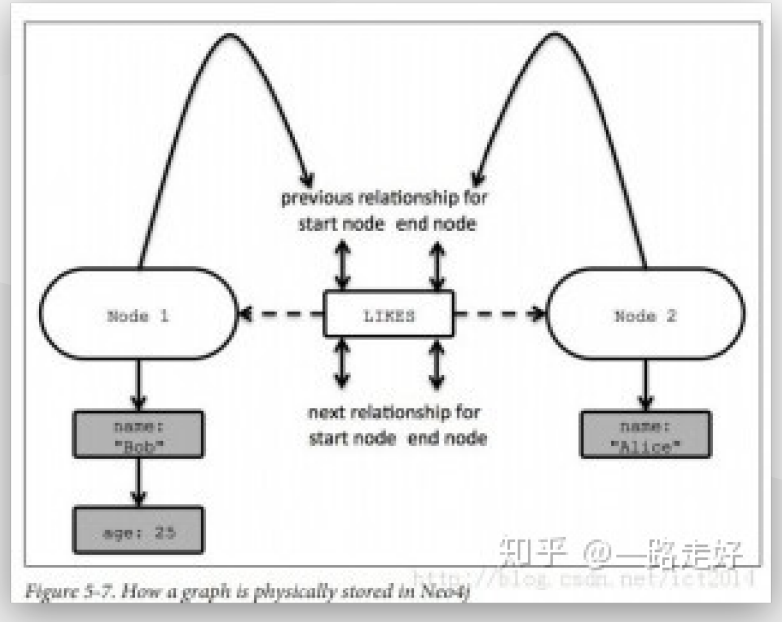


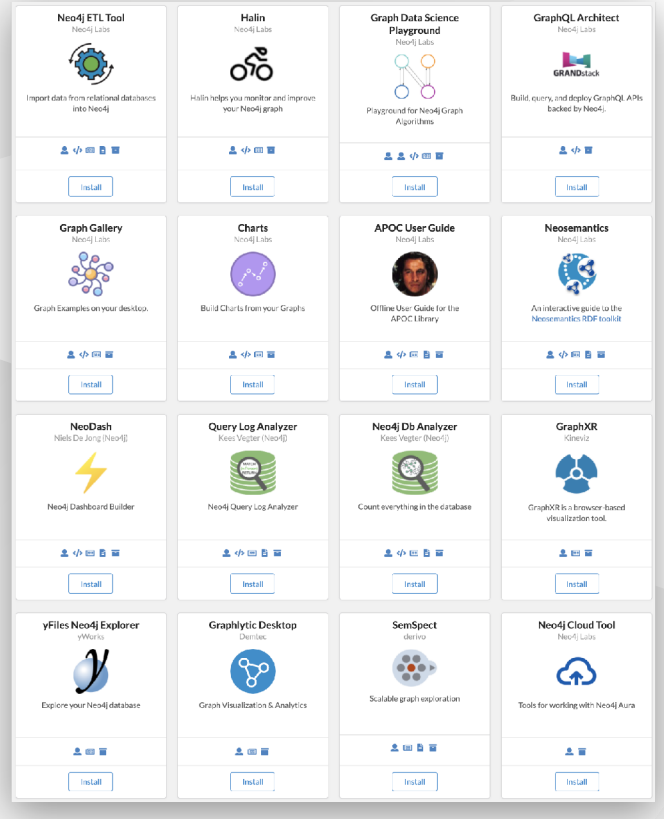
Figure 5-7. How a graph is physically stored in Neo4j

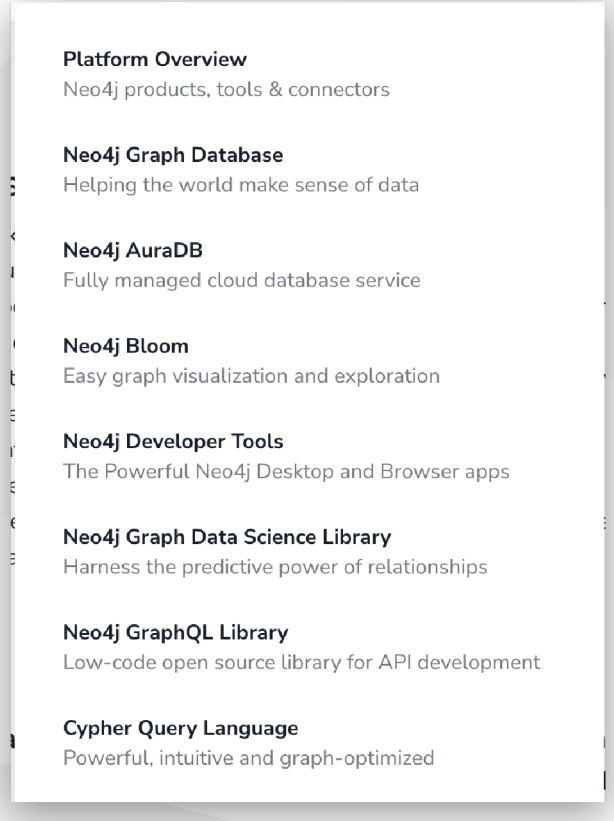
图数据库的选择

☐ include secondary database models — 33 systems in ranking, December 2019

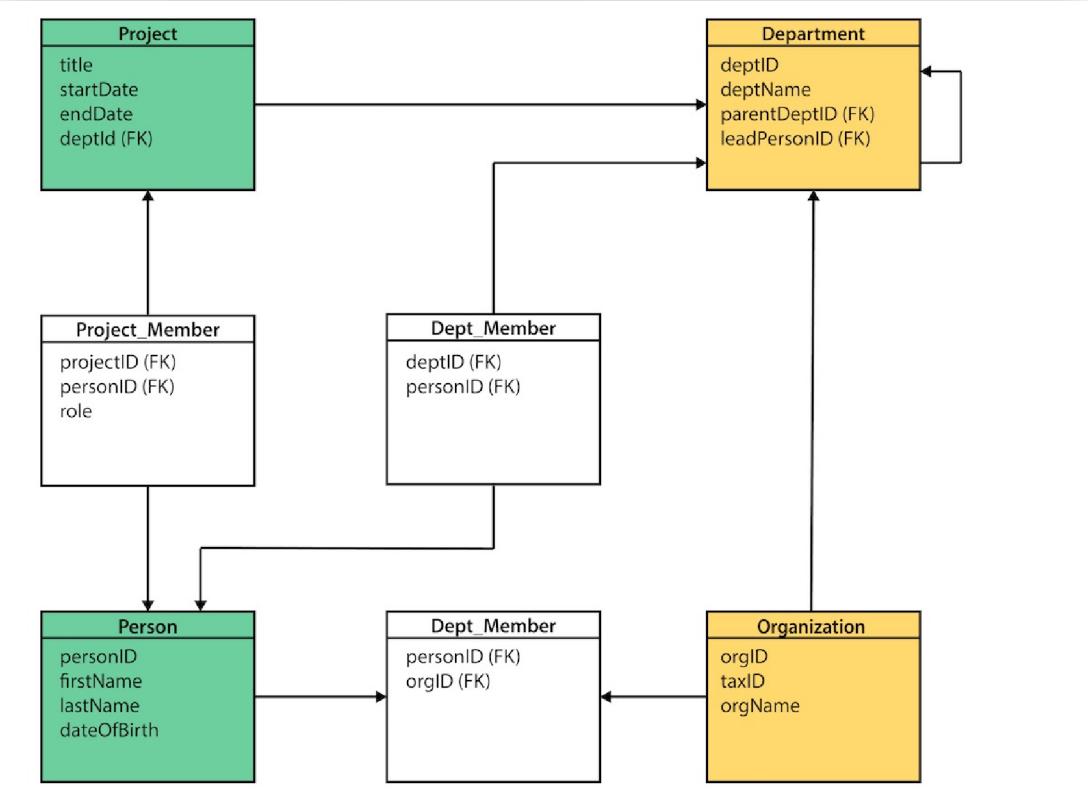
Rank Dec 2019	Rank Nov 2019	Rank Dec 2018	DBMS	Database Model	Score Dec 2019	Score Nov 2019	Score Dec 2018
1.	1.	1.	Neo4j	Graph	50.56	+0.03	+5.00
2.	2.	2.	Microsoft Azure Cosmos DB	Multi-model	31.43	-0.54	+8.06
3.	3.	3.	OrientDB	Multi-model	4.93	-0.46	-1.15
4.	4.	4.	ArangoDB	Multi-model	4.87	-0.14	+0.60
5.	5.	5.	Virtuoso	Multi-model	2.64	+0.00	+0.16
6.	6.	6.	JanusGraph	Graph	1.75	-0.05	+0.49
7.	7.	7.	Amazon Neptune	Multi-model	1.57	-0.03	+0.35
8.	8.	↑ 10.	GraphDB	Multi-model	1.15	+0.01	+0.43
9.	↑ 11.	↓ 8.	Giraph	Graph	1.04	+0.03	+0.04
10.	10.	↑ 14.	TigerGraph	Graph	0.96	-0.05	+0.49

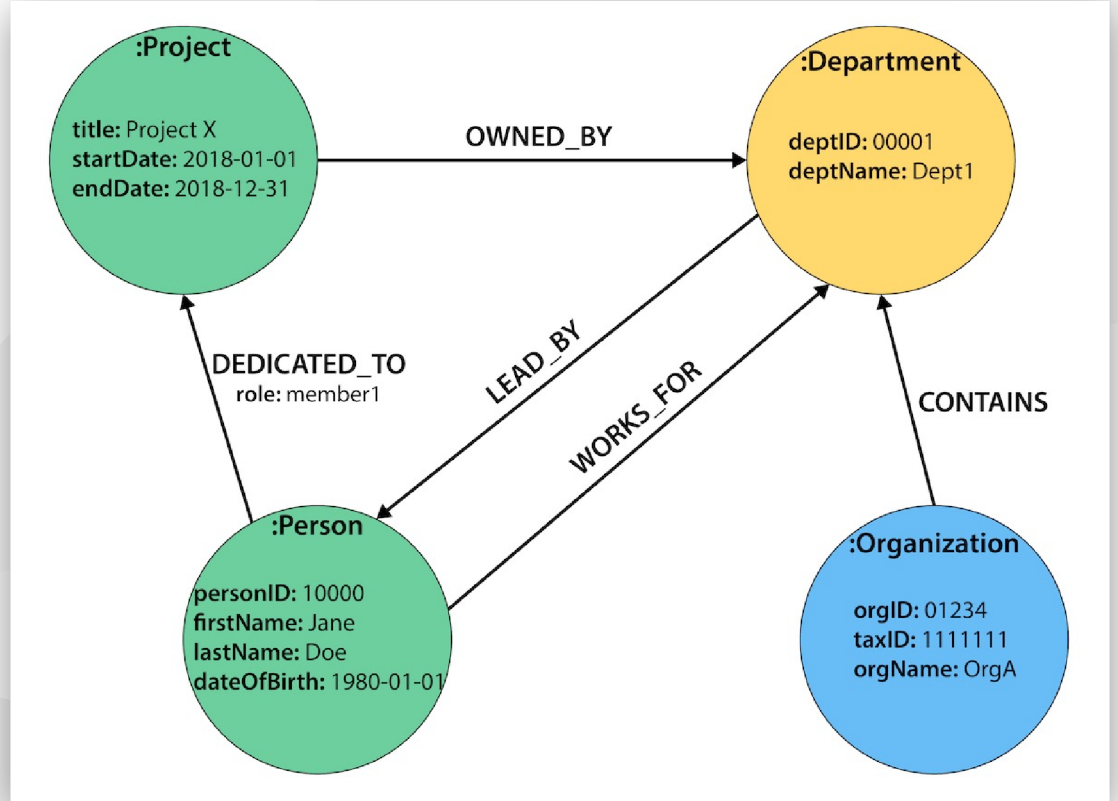
Neo4j生态


Neo4j ETL Tool
Neo4j Labs
Import data from relational databases into Neo4j
Install
Halin
Neo4j Labs
Halin helps you monitor and improve your Neo4j graph
Install
Graph Data Science Playground
Neo4j Labs
Playground for Neo4j Graph Algorithms
Install
GraphQL Architect
Neo4j Labs
GRANDstack
Build, query, and deploy GraphQL APIs backed by Neo4j.
Install
Graph Gallery
Neo4j Labs
Graph Examples on your desktop.
Install
Charts
Neo4j Labs
Build Charts from your Graphs
Install
APOC User Guide
Neo4j Labs
Offline User Guide for the APOC Library
Install
Neosemantics
Neo4j Labs
An interactive guide to the Neosemantics RDF toolkit
Install
NeoDash
Niels De Jong (Neo4j)
Neo4j Dashboard Builder
Install
Query Log Analyzer
Kees Vegter (Neo4j)
Neo4j Query Log Analyzer
Install
Neo4j Db Analyzer
Kees Vegter (Neo4j)
Count everything in the database
Install
GraphXR
Kineviz
GraphXR is a browser-based visualization tool.
Install
yFiles Neo4j Explorer
yWorks
Explore your Neo4j database
Install
Graphlytic Desktop
Dentec
Graph Visualization & Analytics
Install
SemSpect
derivo
Scalable graph exploration
Install
Neo4j Cloud Tool
Neo4j Labs
Tools for working with Neo4j Aura
Install

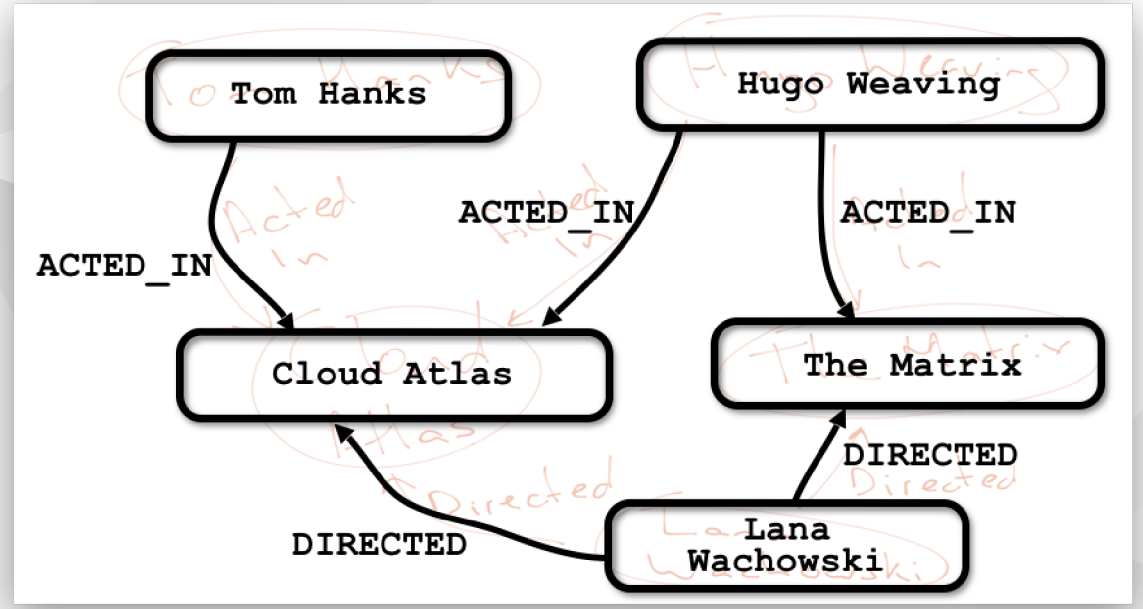

Platform Overview
Neo4j products, tools & connectors
Neo4j Graph Database
Helping the world make sense of data
Neo4j AuraDB
Fully managed cloud database service
Neo4j Bloom
Easy graph visualization and exploration
Neo4j Developer Tools
The Powerful Neo4j Desktop and Browser apps
Neo4j Graph Data Science Library
Harness the predictive power of relationships
Neo4j GraphQL Library
Low-code open source library for API development
Cypher Query Language
Powerful, intuitive and graph-optimized

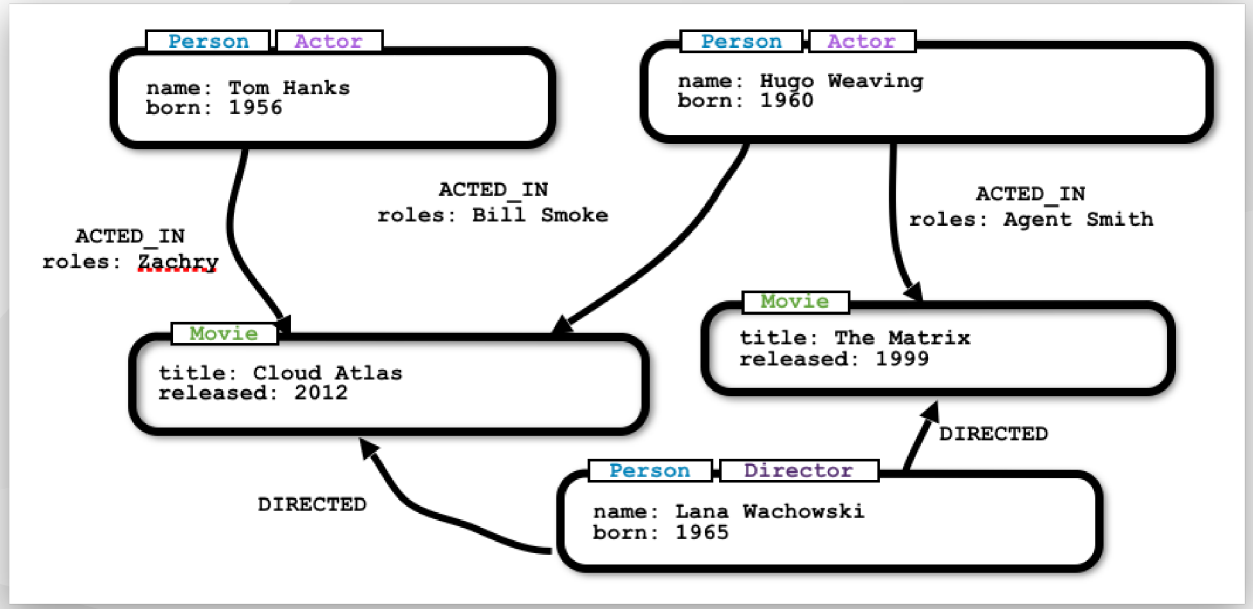
Transfer from RDBMS





Schema: Model Design

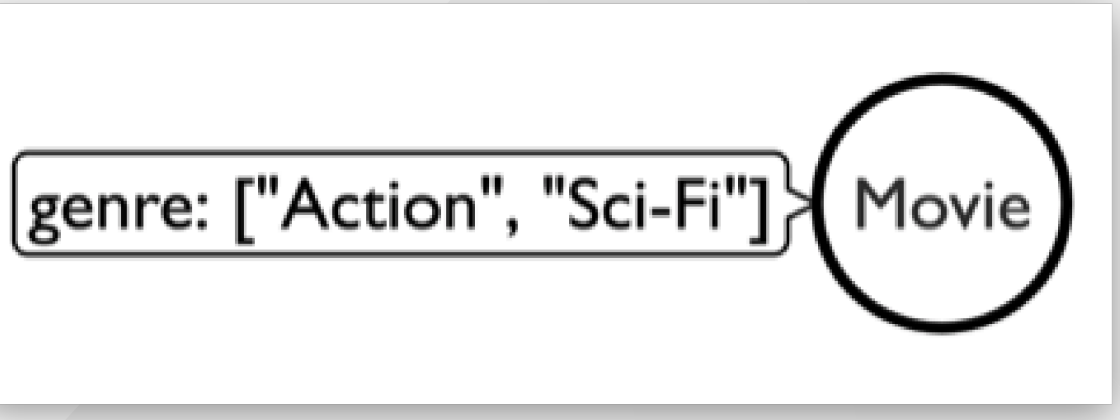


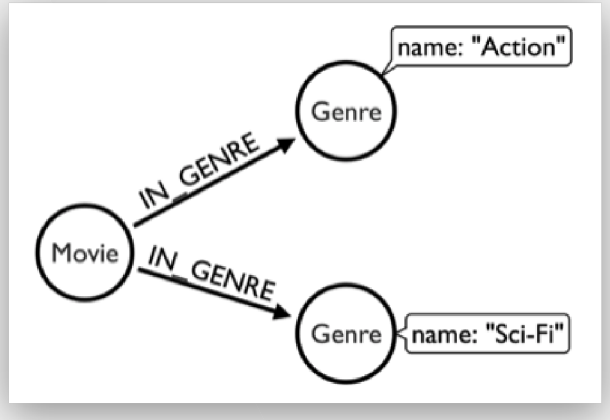


Complex Case 1:

“ Property vs Relationship ”

```
//find which movies share genres
MATCH (m1:Movie), (m2:Movie)
WHERE any(x IN m1.genre WHERE x IN m2.genre)
AND m1 <> m2
RETURN m1, m2;
```





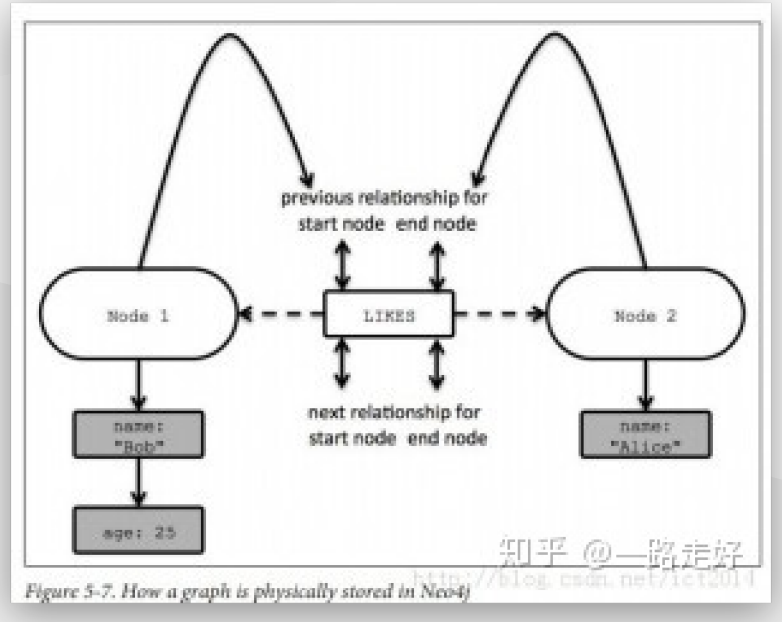


Figure 5-7. How a graph is physically stored in Neo4j

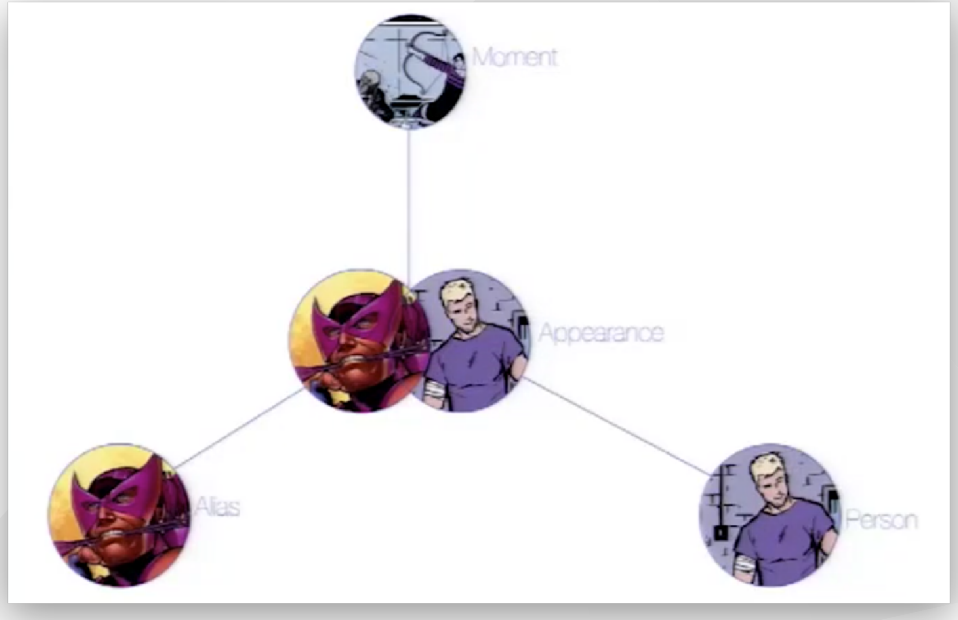
Complex Case 2:

“ Hyperedges or
Intermediate Nodes ”

Cypher Target:Coappearance

```
MATCH (a:Moment)--(b:Role) WHERE b.name == "Alias"
WITH a as a1
MATCH (a:Moment)--(b:Role) WHERE b.name == "Person"
WITH a as a2
WITH apoc.coll.intersection(a1, a2) as a3
RETURN a3
```

```
MATCH (c:Appearance = "Alias-Person")
```



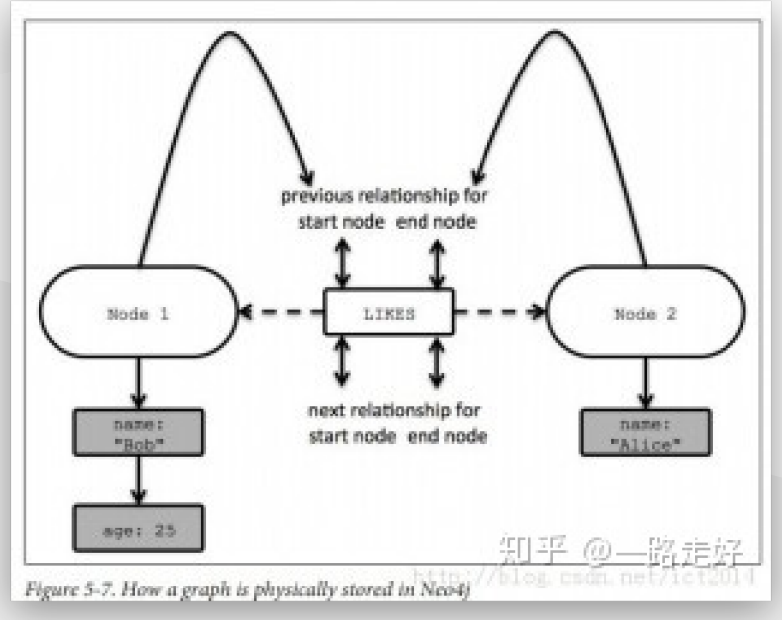
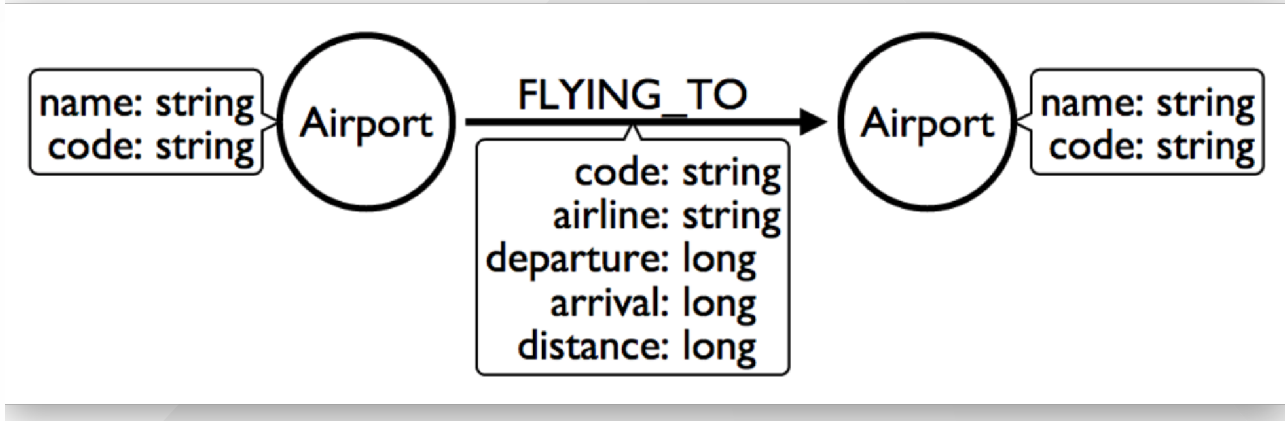


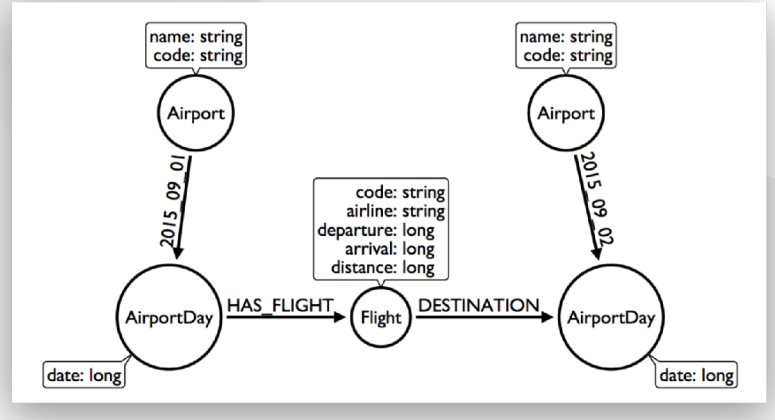
Figure 5-7. How a graph is physically stored in Neo4j

Complex Case 3:

“ Property vs Relationship ”

Cypher Target:Flight Date





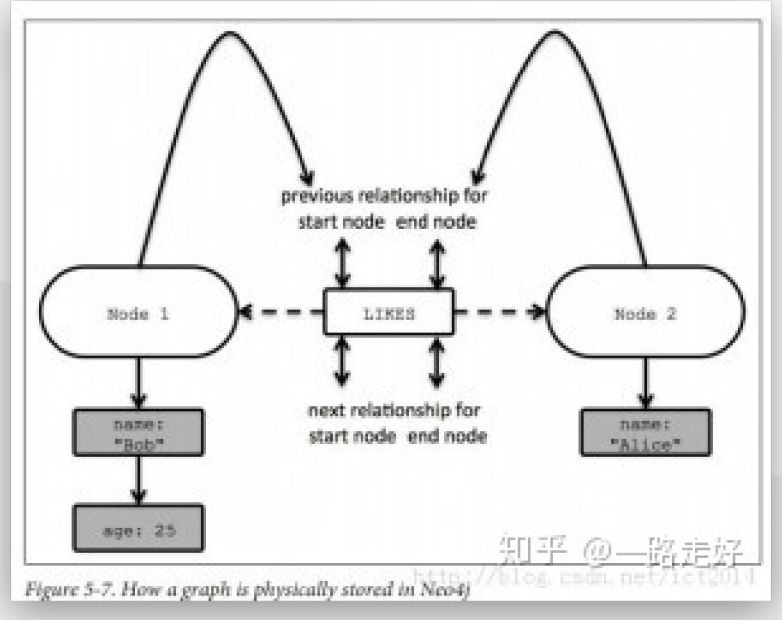


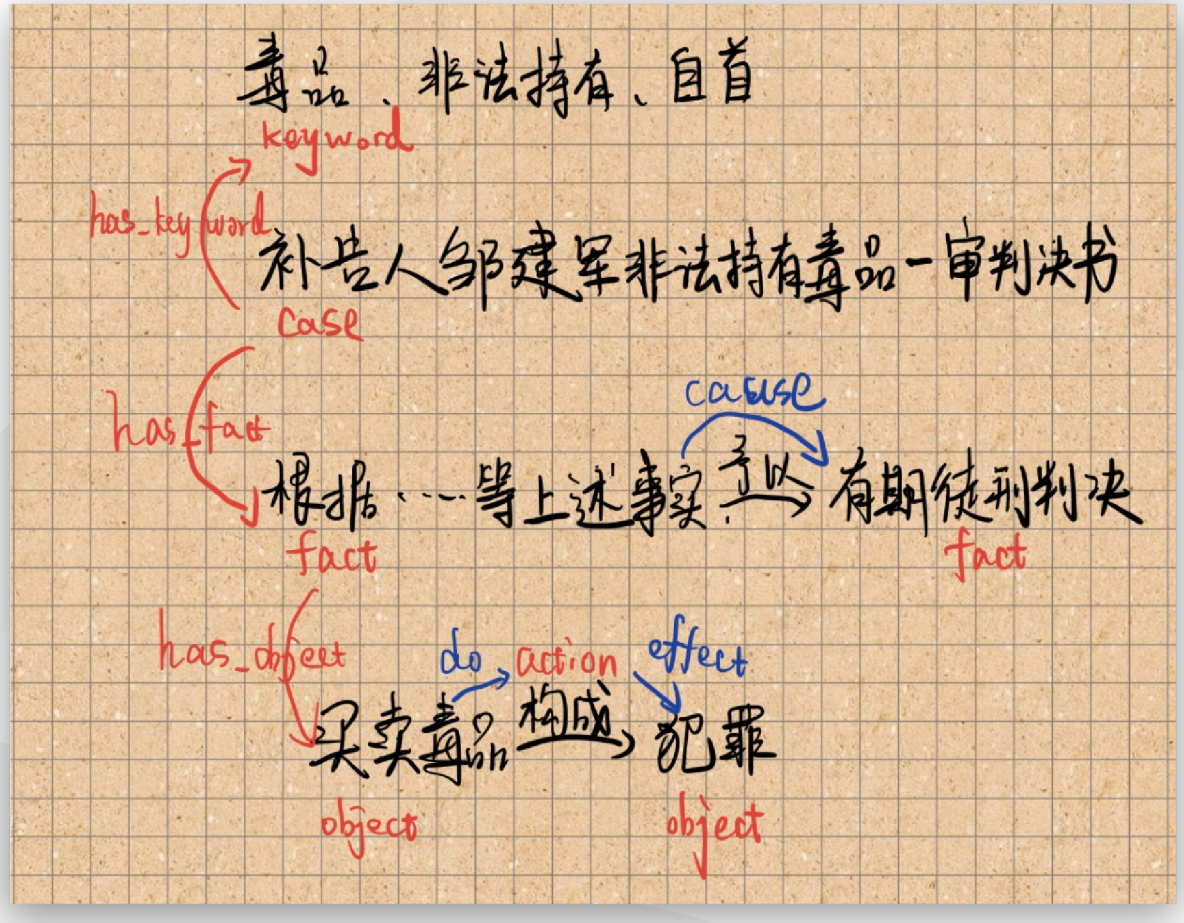
Figure 5-7. How a graph is physically stored in Neo4j

My Bad Case&A

Good Case:

False Litigation

Salesman Outlier Dection



图谱应用工具

- 知识表示：清华大学OpenKE
  - RESCAL
  - DistMult, ComplEx, Analogy
  - TransE, TransH, TransR, TransD
  - SimplE
  - RotatE
- 可视化工具
  - Boom(Neo4j Lab)
  - Echarts(Baidu)

Thanks