OntologyOne

Smarter Human Resource Data Management

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GlobalTech: The Use Case

Company Profile

- Global technology consultancy
- Offices in China, Germany, Singapore, and the United States

Business Need

- Rapid corporate growth and regional expansion
- **Unified HR system** to efficiently manage global talent
- Support **multilingual operations** and **regional autonomy**

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GlobalTech: The Use Case

Challenge

- Integrate diverse employee datasets
- **Minimize disruption** to local workflows
- Preserve **local language and terminology**

Solution Goal

- Seamless, ontology-driven HR data integration across borders
- Maintain **local usability,** enable **global visibility**

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GlobalTech: Traditional Data Integration Option

- Requires **manual data mapping** and **harmonization across departments**
- Involves building **centralized database** with **standardized terminology** and **documented semantics**
- **Cultural and political friction** when reconciling and interpreting terms
- Often demands **new app development** and **training for local staff**
- **Multilingual support** adds significant cost and complexity

❌ **Complex & Costly**

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GlobalTech: Ontology-Drive Integration Option

- **No disruption** to local office workflows or tools
- Teams continue using **familiar terms** and **native languages**
- **Semantic alignment** happens behind the scenes via ontology mappings
- **Scalable, cross-border integration** with minimal overhead
- **Low learning curve**: HR teams do not need to learn new systems
- Future-proof: easily extendable to support **new departments**, **countries**, or **policies**

✓ **Seamless & Scalable**

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OntologyOne: The GlobalTech Solution

A proof-of-concept application leveraging semantic technologies and LLMs to enable natural language interaction with HR data across global offices. It integrates:

- Ontology-based data modeling and representation
- Large Language Models (LLMs) for query translation
- React + FastAPI application architecture

Ultimate vision: Transform HR data interaction—from passive reporting to intelligent, language-driven data management with full CRUD capabilities across global offices.

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OntologyOne: The GlobalTech Solution

Semantic layer

- **4 local ontologies** (one per regional office)
- **1 unified ontology** for cross-office alignment and standardization
- Aligns **departments** and **job titles** across all offices

AI interfacing

- **LLM-powered interface** for natural language interaction
- Accessible by HR staff at both **local offices** and **headquarters**
- Enables **intuitive querying** and management of employee data

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OntologyOne: The GlobalTech Solution

Current Capabilities

- Query existing employee records
- View organizational alignment across locations

Future Enhancements

- Add, update, and remove employee records
- Align qualifications and work experience
- Expand multilingual capabilities
- Integration with analytics tools for workforce insights

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OntologyOne: System Architecture

Building OntologyOne

- Protégé: Ontology modeling and authoring
  - Data federation across countries with local and unified ontologies
    → Supports unified querying over international HR datasets and querying of local office data
- GraphDB: Semantic graph database (aka RDF triplestores)
- Google Gemini: Query translation
  - SPARQL queries executed on GraphDB
- FastAPI backend and React frontend on the cloud

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Ontology: Regional Office Ontologies

- Modelled using local HR data → reflects specific practices, terminology and language used by that office.
- Tailored to local context → intuitive and immediately usable by local HR teams.

Key characteristics

- **Local Terminology**: Define job titles, departments and other HR attributes using familiar terms that reflect local organizational structure and culture.
- **Native Language Support**: Labels and descriptions are provided in local language → improve usability, reduce need for additional training.

Regional ontologies connect to unified ontology through carefully defined mappings → enable seamless integration without compromising local flexibility.

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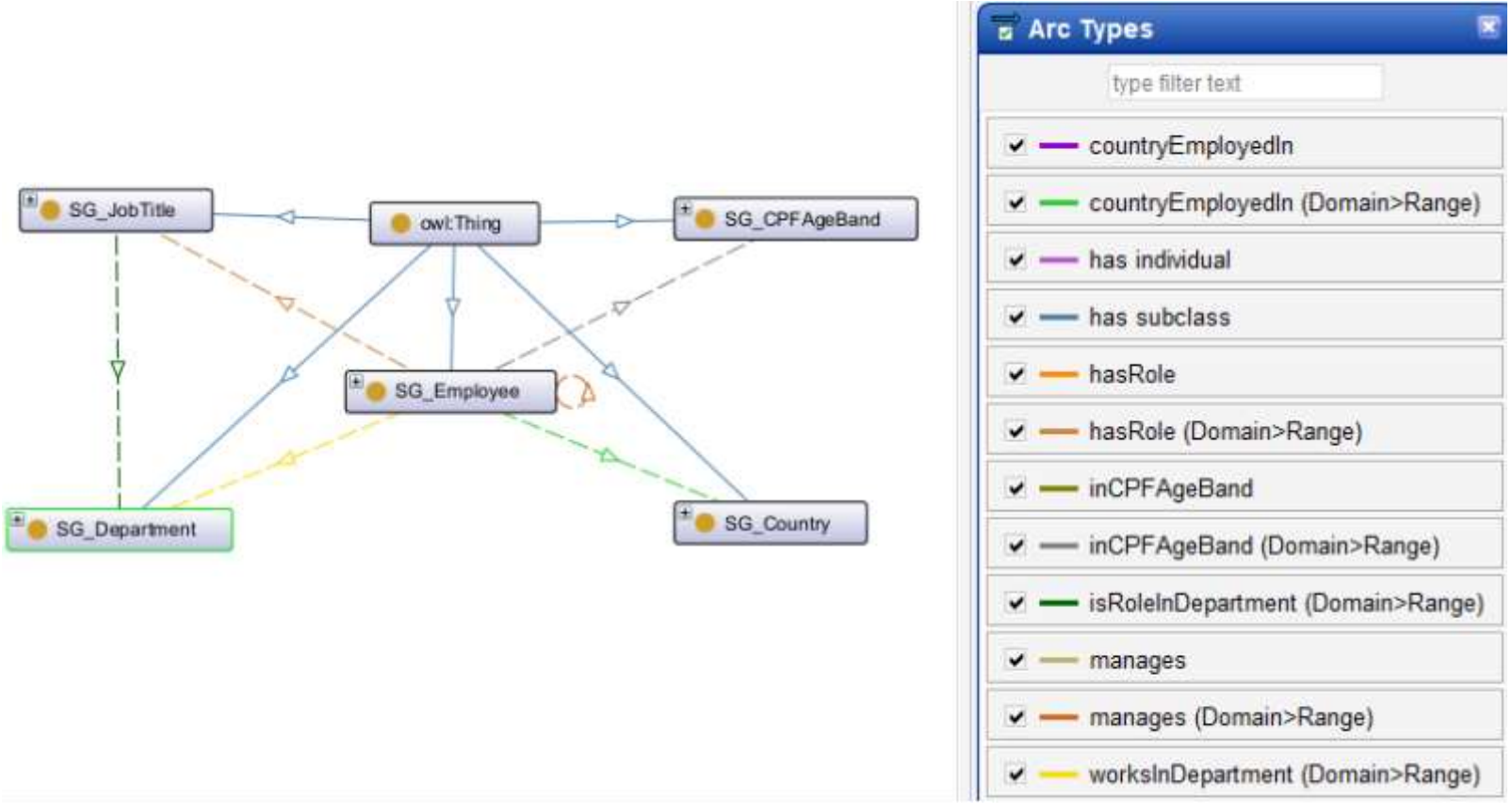
Ontology: Classes (Singapore)



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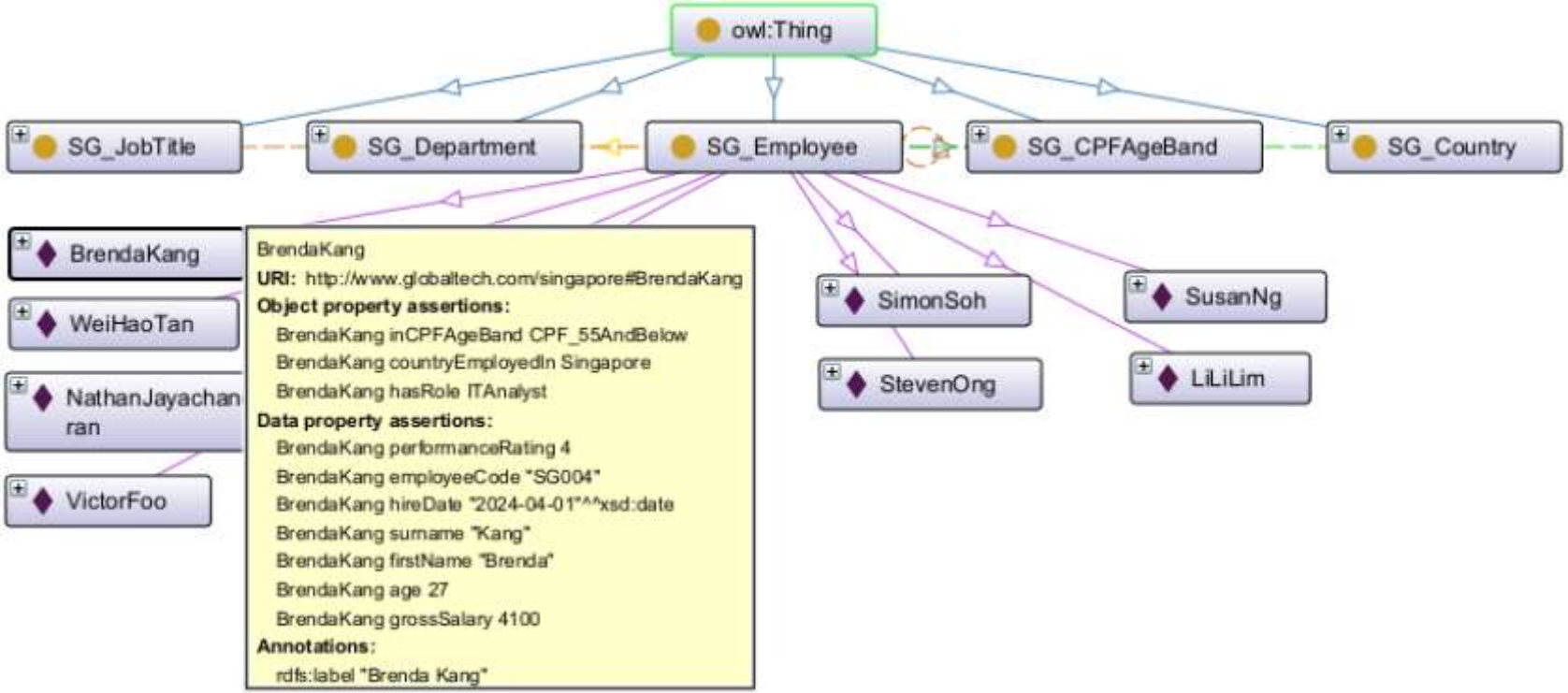
Ontology: Employee Instances (Singapore)



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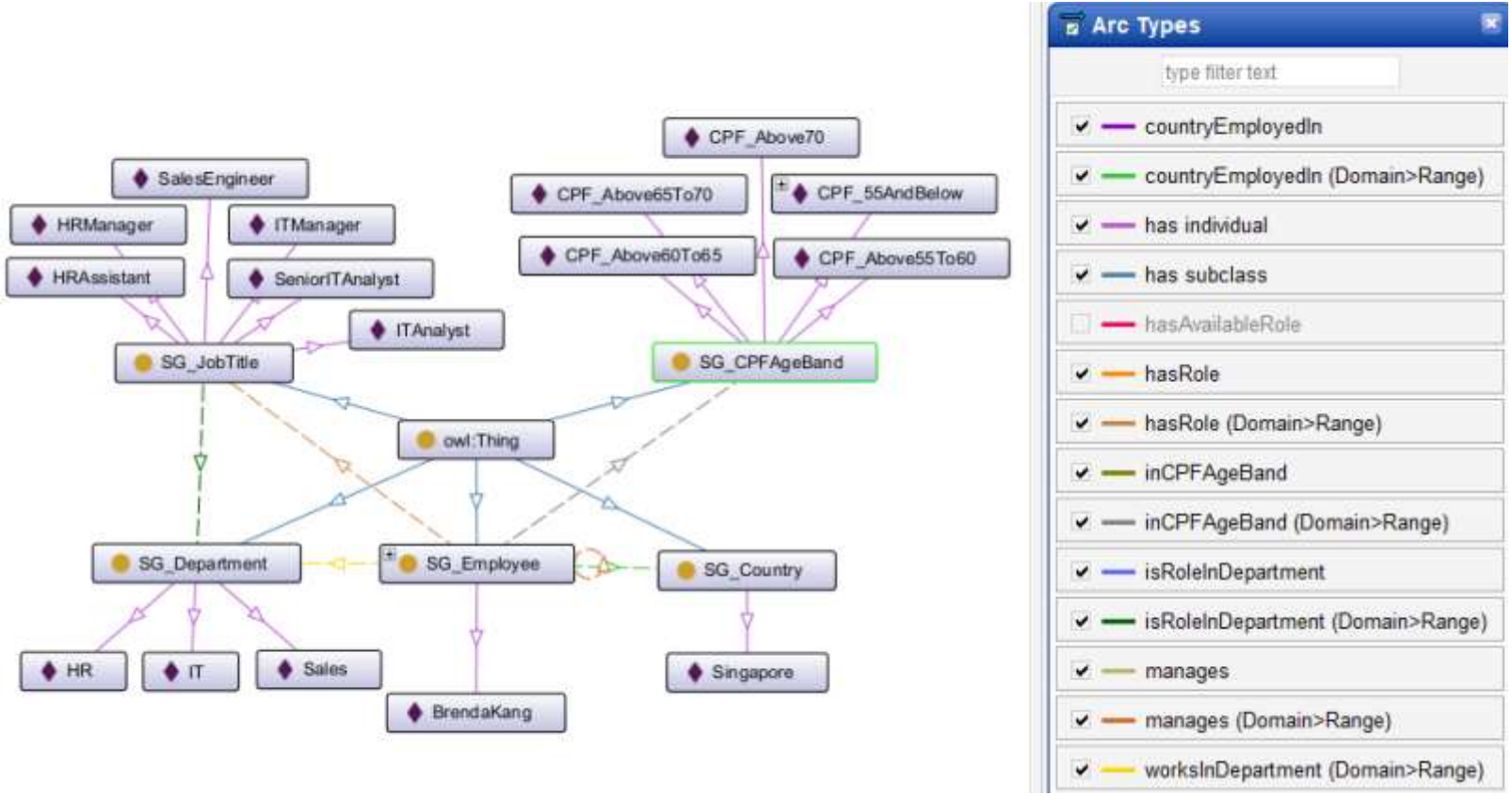
Ontology: Instances (Singapore)



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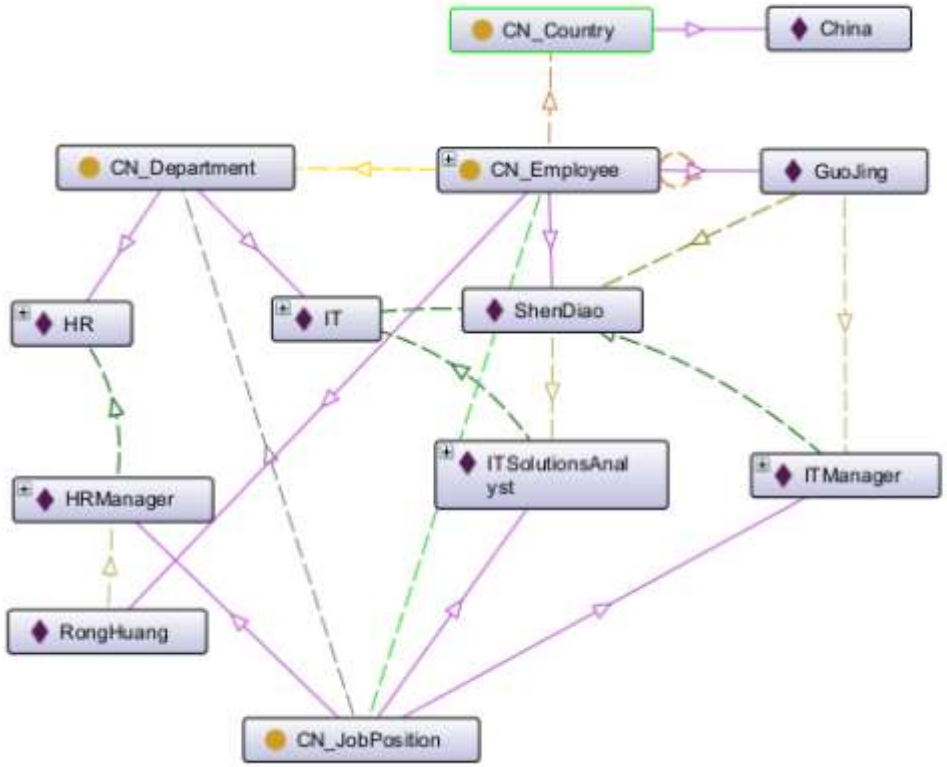
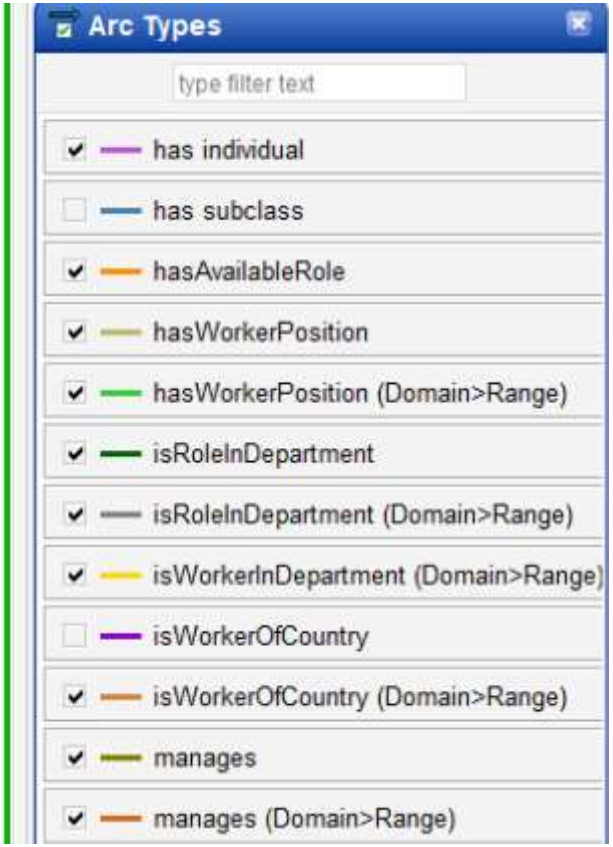
Ontology: Classes (China)





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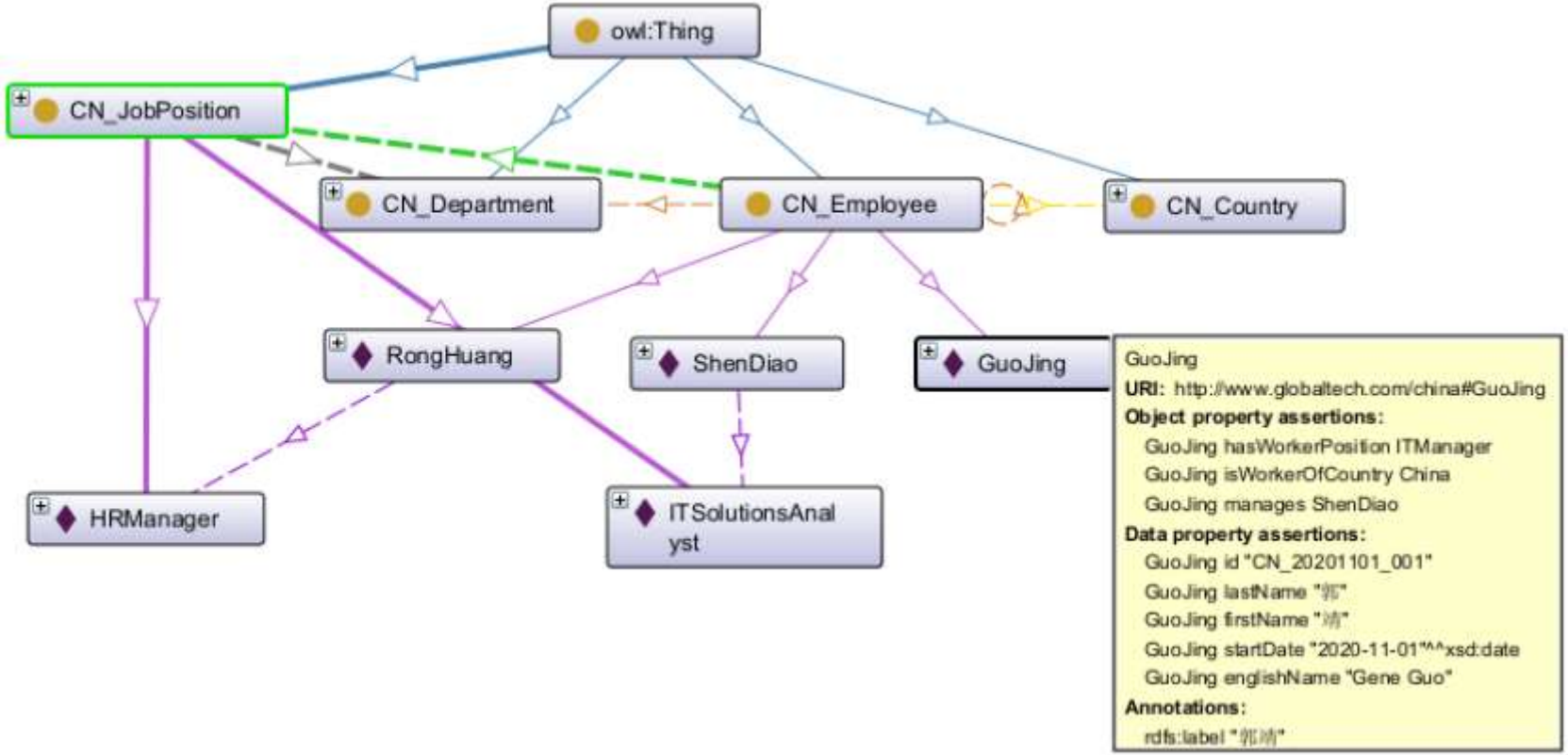
Ontology: Employee Instances (China)



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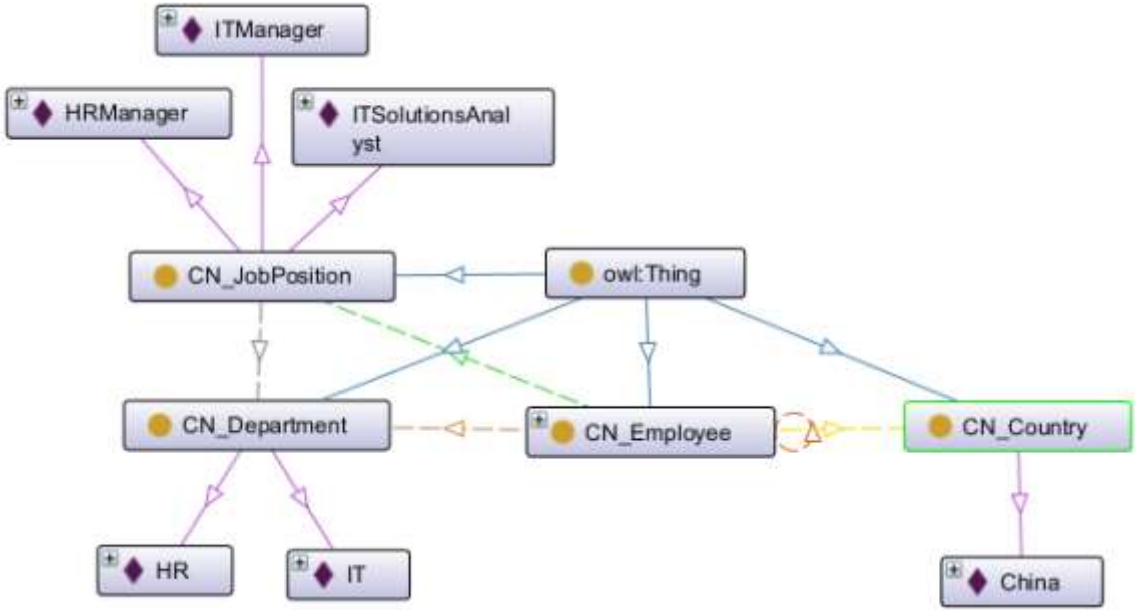
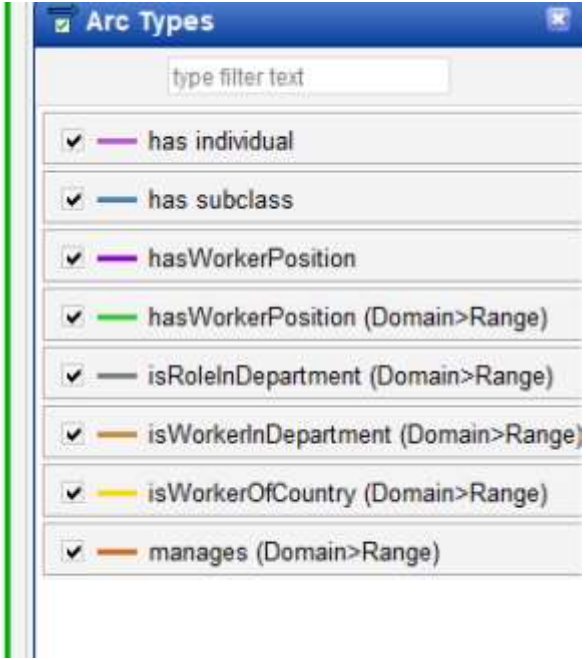
Ontology: Instances (China)





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Ontology: Unified Ontology

Central semantic model

- Defines organization-wide standards.
- Bridge region-specific variations in terminology and structure.

Key components

- **Aligned Department**: Maps local department names to standardized departments
- **Aligned Role**: Translates localized job titles into unified role definitions used across the enterprise → enable consistent reporting and analysis.
- **Currency Conversion**: Specifies exchange rates to normalize salaries from local currencies into USD → regional comparison and budgeting.

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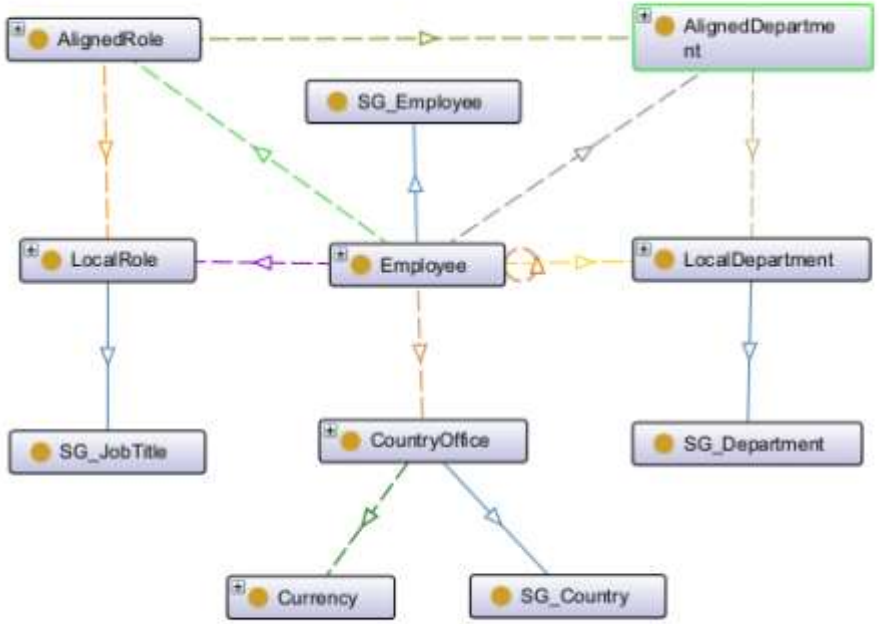
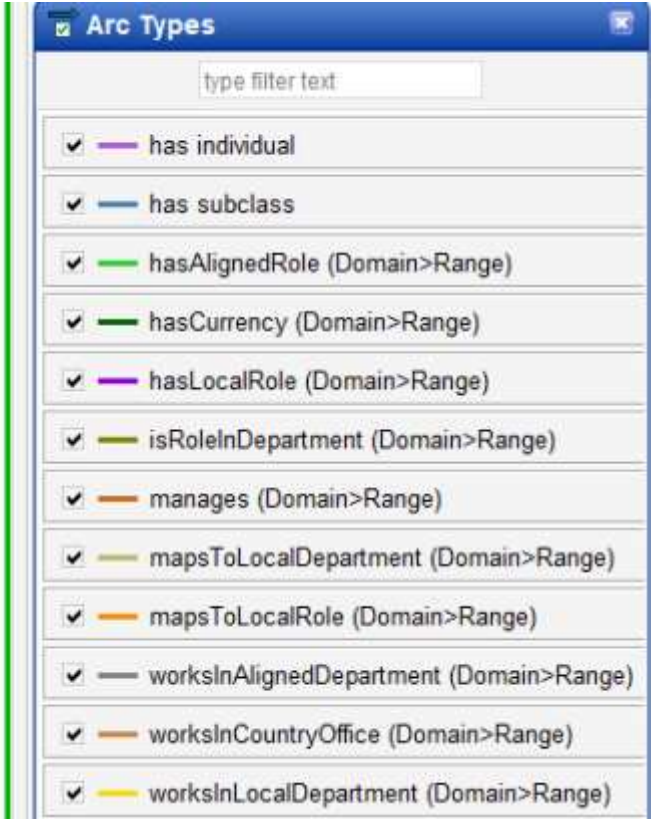
Ontology: Classes (Unified)





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Ontology: Employee Instances (Unified)

country	localDepartment	alignedDepartment	name	localRole	alignedRole
China	人力资源部	Human Resource	黄, 蓉	人力资源经理	Human Resource Manager
China	信息技术部	Information Technology	沈, 雁	信息技术解决方案分析师	Information Technology Consultant
China	信息技术部	Information Technology	郭, 靖	信息技术经理	Information Technology Manager
Germany	HR-Abteilung	Human Resource	Mustermann, Max	HR-Manager	Human Resource Manager
Germany	IT-Abteilung	Information Technology	Schmidt, Anna	IT-Spezialist	Information Technology Consultant
Singapore	Human Resource	Human Resource	Lim, LiLi	Human Resource Assistant	Human Resource Officer
Singapore	Human Resource	Human Resource	Ng, Susan	Human Resource Manager	Human Resource Manager
Singapore	Information Technology	Information Technology	Foo, Victor	IT Manager	Information Technology Manager
Singapore	Information Technology	Information Technology	Jayachandran, Nathan	Senior IT Analyst	Senior Information Technology Consultant
Singapore	Information Technology	Information Technology	Kang, Brenda	IT Analyst	Information Technology Consultant
Singapore	Information Technology	Information Technology	Tan, Wei Hao	IT Analyst	Information Technology Consultant
Singapore	Sales	Sales	Ong, Steven	Sales Engineer	Sales Consultant
Singapore	Sales	Sales	Soh, Simon	Sales Engineer	Sales Consultant
United States of America	Human Resource	Human Resource	Rooney, Robert	Human Resource Manager	Human Resource Manager
United States of America	Information Technology	Information Technology	Tanner, Irene	IT Consultant	Information Technology Consultant
United States of America	Sales	Sales	Doe, John	Sales Representative	Sales Consultant
United States of America	Sales	Sales	Miller, Stanley	Sales Manager	Sales Manager
United States of America	Sales	Sales	Sontag, Sarah	Sales Representative - State Level	Senior Sales Consultant

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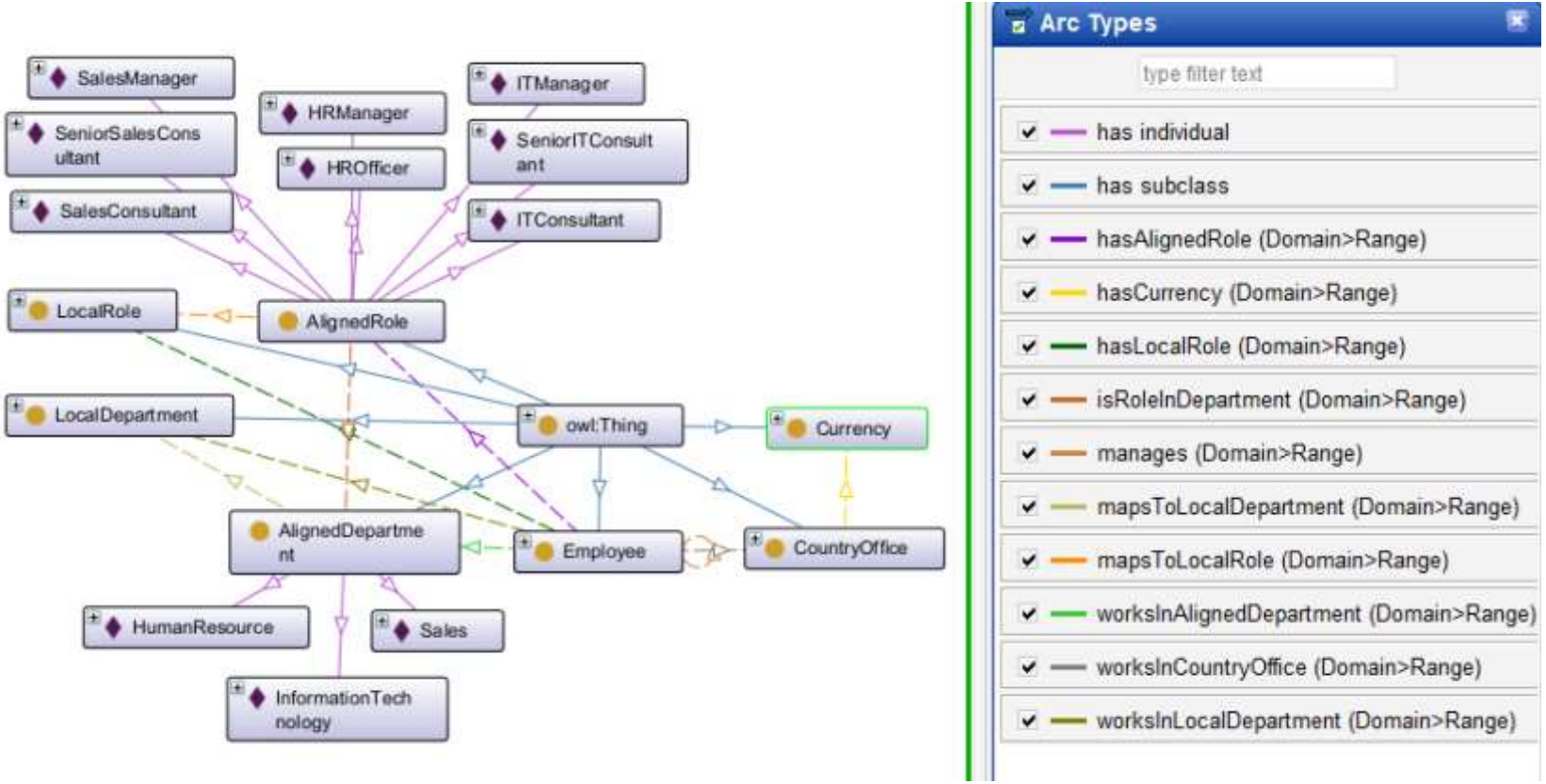
Ontology: Instances (Unified)



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AI-Powered Natural Language Querying

Challenge

HR staff typically lack know-how to write SPARQL queries/operate knowledge graph database.

Solution: Ontology + LLMs

- Use LLMs to translate natural language queries into SPARQL
- No need for:
  - SPARQL training
  - Specialized technical staff

Real-world usability

- As with any AI assistant, users may need to refine how they ask questions for optimal results
- Minimal training, no major workflow disruptions

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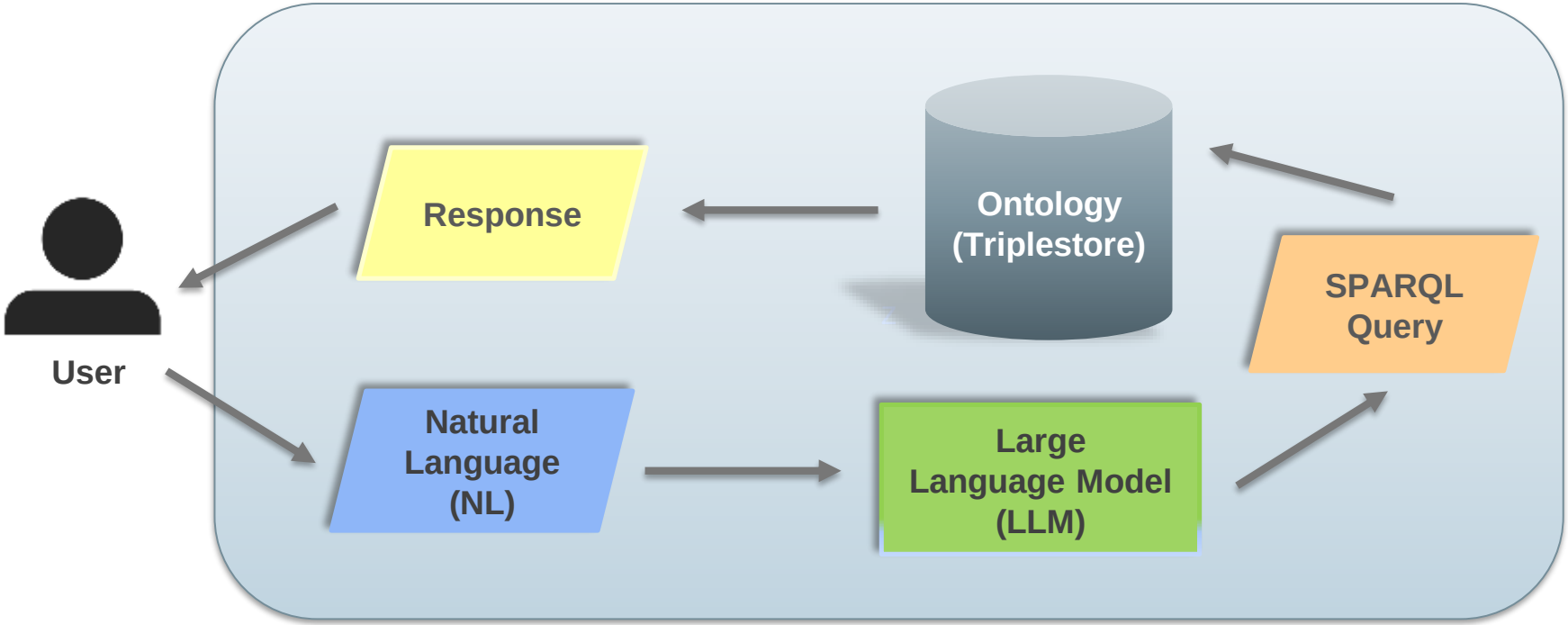
OntologyOne: System Architecture



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Role of GraphDB and SPARQL Queries

Explain the use of **GraphDB** for managing **HR data** as a semantic graph (ontology-based).

Discuss how the system queries GraphDB using **SPARQL** to retrieve data in response to user queries.

Provide a **real-world example** of a SPARQL query (e.g., retrieving an employee's role, department, and qualifications).

Optionally, show an example of how a user query is transformed into a SPARQL query

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About OntologyOne: Harper the Chatbot

Explain how users can interact with the chatbot to ask HR-related questions.

Mention key features, such as **example questions** and the ease of getting answers without technical knowledge.

Optionally, show a **screenshot** or **short video** of the chatbot in action.

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Ontology and AI in HR Data Management

Ontologies for Seamless Integration

- **Unify** data from disparate HR systems through a shared semantic model
- Ensure **semantic consistency** in job roles, departments, qualifications
- Enable **cross-office reasoning** while preserving local autonomy

AI for Truly Accessibility

- Use **LLMs** to let HR staff ask questions in **natural language**
- Empower non-technical users to generate insights on-demand

Real-World Use Cases

- Ask: *"Who are our developers and how much are they paid?"*
- Automate: Generate region-specific **compliance reports**
- Track: Identify skills **gaps or overlaps** across offices
- Integrate: Harmonize job titles like “IT Analyst” and “IT Solutions Specialist” across geographies

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Live Demo (or Walkthrough)

Briefly walk the audience through interacting with the chatbot.

Show how it processes a real HR-related query and provides an answer based on the ontology.

Optionally, highlight how the chatbot can answer queries based on the underlying semantic graph.

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Conclusion

Invite users to ask any further questions or schedule a follow-up meeting.

Mention that the project is designed to demonstrate **ontology** and **AI expertise**, and is a stepping stone to more advanced HR solutions.

Optionally, provide links to your **GitHub**, **LinkedIn**, or any **portfolio** showcasing similar projects.

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Skills Demonstrated

- Ontology design and alignment across knowledge domains
- GraphDB & SPARQL for semantic querying
- Full-stack app development with FastAPI & React
- LLM integration for intelligent query processing
- Practical use of vector embeddings and semantic search

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System Architecture (High-Level View)

- **React (Frontend)**: User interface for interacting with the chatbot.
- **FastAPI (Backend)**: Handles user input, processes queries, communicates with GraphDB.
- **GraphDB**: Stores HR data using the ontology and responds to SPARQL queries.
- **Gemini API**: Translates natural language into SPARQL queries (via AI).
- **Deployment on cloud**: Render (OntologyOne, Harper), GCP (GraphDB), Pinecone (Vector database for embeddings)

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