

Rajesh Kumar Gupta

Agentic AI / Semantic Solutions Architect

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PROFESSIONAL SUMMARY

Semantic Solutions Architect with 15+ years designing knowledge-graph and AI-driven data platforms, now focused on **agentic AI systems that reason over enterprise semantic layers**. Deep, hands-on expertise architecting **multi-agent workflows, GraphRAG (hybrid graph + vector retrieval), Model Context Protocol (MCP) servers, and context-engineering strategies** that ground LLM responses in ontologies, knowledge graphs, and metadata catalogs. Proven track record rapidly prototyping POC-level agent solutions on top of Neo4j, Amazon Neptune, and vector stores using LangChain, LangGraph, and LlamaIndex — with extensive delivery in regulated financial-services and healthcare domains (credit risk, client onboarding, compliance traceability).

CORE TECHNICAL SKILLS

- **Agentic AI Architecture:** Multi-agent systems, tool-using agents, planning/reasoning loops, agent orchestration, self-correction loops, AutoGen-style collaboration, LangGraph state machines
- **GraphRAG & Retrieval:** Hybrid graph + vector retrieval, graph traversal + semantic search fusion, Neo4j-FAISS / Neptune integration, domain-grounded RAG, GNN/GAT reasoning
- **LLM Orchestration:** LangChain, LangGraph, LlamaIndex, AutoGen, prompt engineering, few-shot grounding, schema-aware prompting, Text2Cypher / Text2SPARQL agents
- **Context Engineering:** Metadata injection, chunking & windowing strategies, semantic compression, embedding optimization, prompt-context assembly for LLMs
- **Model Context Protocol (MCP):** MCP server design & tool patterns, TypeScript/Python MCP servers, agent-to-semantic-system tool interfaces
- **Semantic & Ontology:** Knowledge graphs (Neo4j, Amazon Neptune), OWL 2 DL, RDF, TTL, SHACL, SPARQL, Cypher, Protégé, FIBO, ACORD, metadata-driven architectures
- **Vector & Metadata Platforms:** FAISS, OpenSearch, pgvector, Pinecone/Weaviate concepts, Voyage AI embeddings; DataHub, Amundsen, Colibra (metadata catalogs)
- **Cloud & Languages:** AWS (Neptune, Bedrock, SageMaker, Lambda, S3, Glue), GCP, Docker/Kubernetes; Python, Java, SQL, TypeScript

PROFESSIONAL EXPERIENCE

Bessemer Trust — Data Architect (Ontology & Knowledge Graph)

Oct 2025 – Present

Somerset, NJ

- **GraphRAG & Multi-Agent Query System:** Engineered a LangGraph-orchestrated multi-agent framework — GraphRAG agent, Text2Cypher agent (Neo4j), and Text2SPARQL agent (Neptune RDF) — using Claude/GPT-4 with few-shot prompting, schema-aware grounding, and self-correction loops, enabling natural-language querying of the enterprise knowledge graph by advisors and analysts.
- **Context Engineering for LLM Grounding:** Designed metadata-injection and semantic-chunking strategies that feed ontology class hierarchies and property paths into LLM prompts, materially improving answer accuracy and reducing hallucination on insurance and wealth-planning queries.
- **Agent-Optimized Semantic Layer:** Curated production OWL 2 DL / RDF / SHACL ontologies across insurance (P&C, life, umbrella, excess liability), wealth planning, and equity domains aligned to FIBO and ACORD — structured explicitly for agent traversal and querying.
- **Semantic Document Pipeline:** Built an end-to-end semantic processing pipeline extracting policy structures, clauses, and underwriting attributes from PURE, Chubb, and Berkley One carrier documents into a unified knowledge graph using NLP + LLM-based metadata extraction and semantic tagging.
- **Neptune Integration:** Established secure AWS Neptune connectivity (IAM-authenticated SPARQL/Gremlin endpoints), automated S3 bulk-load pipelines, and reasoning/conformance validation workflows.

Barclays — AVP, Data Architect & Knowledge Graph Engineering Lead

May 2023 – Oct 2025

Whippany, NJ

- **GraphRAG at Scale:** Pioneered a GraphRAG implementation transforming 10TB+/day of unstructured regulatory documents, research reports, and market commentary into queryable graph entities using LangChain + GPT-4, reaching 92% entity-extraction accuracy.
- **Agentic Retrieval over Financial KG:** Architected an enterprise Neo4j financial knowledge graph (500+ entity types, 2M+ nodes) as the semantic layer powering investment-intelligence agents with hybrid graph + vector retrieval.
- **RAGHeat Agent Framework (patent-pending):** Invented a GraphRAG framework combining Graph Attention Networks, heat-diffusion modeling, and retrieval-augmented generation (LangChain / Amazon Bedrock), improving financial-recommendation accuracy 13.2% at sub-1.5s latency via Neo4j-FAISS vector search.
- **Investment-Decision Lineage:** Designed a traceability graph linking research signals to portfolio execution supporting MiFID II / FINRA regulatory compliance — directly analogous to credit-risk and audit use cases.
- **Mentorship:** Trained 12+ engineers on Cypher optimization, graph algorithms (PageRank, community detection), GraphRAG, and RAG architecture patterns.

S&P Global — Senior Data Architect & Knowledge Graph Engineer

Dec 2022 – May 2023

New York, NY

- **Production GraphRAG Pipeline:** Built a GraphRAG system (LangChain + transformer encoders) over 1M+ documents, transforming unstructured content into a queryable property graph at 85% accuracy for supply-chain intelligence.
- **Hybrid Retrieval Infrastructure:** Integrated Snowflake + Neo4j via Airflow ETL with automated schema-drift detection; deployed GNN training (PyTorch Geometric) on AWS for graph analytics.

Johnson & Johnson — Data Architect & Semantic Knowledge Graph Lead

Dec 2019 – Dec 2022

USA

- **Clinical GraphRAG:** Designed a GraphRAG pipeline (BioBERT, SciBERT, PubMedBERT + LangChain) extracting entities from 2M+ research papers into queryable property graphs serving 500+ researchers.
- **Semantic Platform:** Built a MarkLogic + Neo4j semantic platform with RDF triple stores, SPARQL endpoints, and a 500K-entity drug-discovery ontology integrating SNOMED CT, RxNorm, ICD, LOINC, and FHIR.
- **Governed, Compliant Data:** Implemented ontology-driven RBAC and end-to-end lineage ensuring FDA, EMA, and GxP compliance.

Scania — Data Architect & Graph Analytics Engineer

Jun 2018 – Nov 2019

Sweden

- Built an enterprise Neo4j knowledge graph for 50,000+ connected vehicles with an OWL predictive-maintenance ontology (90% parts-recommendation accuracy) and real-time Kafka/Kubernetes ingestion.

AT&T — Data Architect & Knowledge Graph Engineer

Mar 2014 – May 2018

India

- Architected ontology-driven knowledge graphs (Neo4j, MarkLogic, RDF/OWL) for enterprise content analytics serving 50,000+ employees, with Airflow ETL on AWS and fine-grained access control.

Healthcare & Government Projects — Semantic Data Architect

Aug 2009 – Mar 2014

India

- Developed healthcare ontologies (SNOMED CT, ICD, RxNorm, LOINC) and the published “SafeOn” road-safety ontology; created ontology-merging algorithms published in IEEE (50+ citations).

INDEPENDENT RESEARCH & AGENTIC AI PROTOTYPES

- **MCP Server Development:** Built TypeScript and Python Model Context Protocol servers (e.g., an 8-tool HELIOS/RAGHeat MCP server) exposing knowledge-graph and analytics capabilities as agent tools — the exact MCP server patterns this role requires.
- **Multi-Agent Research Platforms:** Prototyped LangGraph multi-agent assistants (FastAPI, PostgreSQL/pgvector, Docker) and a 30-agent SwarmCare healthcare-coordination system (LangGraph, FHIR R4, Neo4j) demonstrating planning loops and tool usage.

- **Hybrid KG + Vector POCs:** Architected an LLM + knowledge-graph system over 100,000+ insurance/wealth PDFs using Amazon Neptune (SPARQL), OpenSearch (vector), Voyage AI embeddings, and LangGraph orchestration — a direct template for credit-risk and customer-onboarding agent prototypes.

PUBLICATIONS & RECOGNITION

- **IEEE:** “An Instance-Based Methodology for Merging Domain Ontology” — 50+ citations.
- **Elsevier / Transportation Research:** “Road Safety Ontology – SafeOn: Overview & Design.”
- **In Progress:** “RAGHeat: A Diffusion-Based GraphRAG Framework for Financial Recommendation.”
- **Speaker:** NextGen Banking Summit 2024 — keynote on Knowledge Graphs & GenAI in Financial Services.

EDUCATION & CERTIFICATIONS

- **M.Tech, Software Engineering** — National Institute of Technology, Allahabad, India (2009)
- **B.E., Computer Science** — Rajiv Gandhi Technological University, Bhopal (2007)
- **Certifications:** Neo4j Certified Professional; Snowflake SnowPro Core; AWS Solutions Architect; AWS Data Analytics Specialty; LangChain AI Development.