

Knowledge Graphs & Semantic Web

Operations with LLMs

Build, Validate, Govern, and Use

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Working Draft Chapter

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This chapter covers operational pipelines for building and governing KGs with LLM assistance, hybrid retrieval (symbolic + vector), and evaluation aligned to the book's governance patterns.

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0.1 Ingestion and Mapping Pipeline

From documents and APIs to RDF: normalize inputs, resolve entities, mint IRIs, map to SKOS/OWL terms, and validate with SHACL at each stage. Treat shapes and mappings as code with version control. (**w3c-shacl**)

Alignment with Evidence Record

Carry source IRIs, dates, jurisdiction codes, and content hashes into the graph so KG facts link back to the book’s Evidence Record (Chapter 3, Structured Outputs).

0.2 Provenance and Versioning

Use PROV-O to record “who/what/when/how” for dataset creation, extraction runs, human curation, and publication. Align agent roles and timestamps with your audit requirements. (**w3c-provo**)

Minimal Provenance Pattern

- Activities for ingestion, mapping, validation; entities for inputs/outputs; agents for systems and reviewers.
- Version IRIs for datasets and vocabularies; maintain change logs.

0.3 LLM-Assisted Construction and Curation

LLMs can propose entities, relations, and candidate axioms from text, tables, and schemas; they can also draft SPARQL queries and SHACL shapes. Keep humans-in-the-loop and gate changes through validation and provenance capture. Surveys highlight promise and current limits for schema-precise extraction. ([survey-llm-kg-2024](#))

Human-in-the-Loop Gates

- Candidate triples and shapes must pass SHACL and reviewer checks before merge.
- Keep suggested vs. accepted changes separate for measurement.

0.4 Hybrid Retrieval: SPARQL + Text/Vector

Combine symbolic queries (SPARQL) for precise filters (jurisdiction, effective date, identifiers) with text/vector retrieval for semantic matching. Use KGs to disambiguate entities and assemble authoritative context before LLM generation. ([w3c-sparql11-overview](#))

Pattern

- Resolve entities via IRIs (LEI/CIK/etc.), then retrieve related filings, rulings, or contracts.
- Pass grounded snippets plus citations (Chapter 3, Structured Outputs) to the LLM.

0.5 Domain Examples

Finance. Link LEI/CIK identifiers to disclosures and reporting taxonomies (IFRS/US GAAP) to track obligations and exposures across entities and instruments. ([gleif-lei](#); [sec-cik](#); [ifrs-taxonomy-2024](#); [fasb-usgaap-2025](#))

Law. Use ELI/ECLI to connect legislation, consolidated versions, and case law across jurisdictions; publish JSON-LD for developer access. (**ecli-ejustice**)

0.6 Evaluation and Operations

Evaluate extraction precision/recall, SHACL violation rates, SPARQL endpoint performance, and user-facing outcomes (e.g., retrieval quality) alongside audit metrics. Tie quick retrieval checks to Chapter 5 (Prompt Design and Evaluation) and governance to Agents Part III.

Operational Metrics

- SHACL violations per release; time-to-fix; coverage of required fields.
- SPARQL latency/availability; cache hit rates; change impact reports.
- Reviewer acceptance rates for LLM-suggested changes.