**What the UAE legal reality demands (why the schema looks like this)**

* **Norm hierarchy & instrument types.** The UAE’s legislative system comprises the **Constitution**, **Federal Laws**, **Federal Decree-Laws**, **Federal Decrees**, **Resolutions of the President/Prime Minister**, **Cabinet Resolutions**, and **ministerial/entity decisions & circulars**. Model these distinctly, or you’ll lose authority/precedence. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en/legislative-system))
* **Publication & entry into force.** By **Constitution Art. 111**, federal laws must be published in the **Official Gazette** (typically within two weeks) and enter into force a month after publication unless specified otherwise—so **valid-time** is first-class in your graph.
* **Federation + local variance.** The UAE has **federal** and **local (emirate) court systems**; Abu Dhabi, Dubai and Ras Al Khaimah maintain their own judiciaries. Your model must represent **jurisdiction and court system** explicitly.
* **Special common-law free zones.** **DIFC** (Dubai) and **ADGM** (Abu Dhabi) run **common-law** systems with their own courts and sources of law—linking statute→free-zone regulations→judgments is essential.
* **Authoritative sources to crawl.** Use the **UAE Legislation** platform (federal), emirate **Official Gazettes** (e.g., Dubai SLC; Abu Dhabi Gazette), and the free-zone courts/judgment portals. These become provenance anchors in your graph. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))

**Entities (vertices) you actually need**

**Instrument** (one node per enactment)

* Types: Constitution, FederalLaw, FederalDecreeLaw, FederalDecree, PresidentialResolution, PMResolution, CabinetResolution, MinisterialDecision, Circular, Treaty (add Emirate‐level analogs).
* Key props: instrument\_no, year, title\_ar, title\_en, issue\_date, publication\_date, entry\_into\_force, repeal\_date, status, language, sector (sector aligns with the official portal). ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))

**Provision** (the text you cite)

* Hierarchy: Part → Chapter → Section → Article → Clause → Paragraph.
* Props: text\_ar, text\_en, number, heading, scope\_tags. Use **Akoma Ntoso** IDs during ingestion for stable, article-level addressing.

**Event / Statement** (n-ary legal facts with time)

* Types: AmendmentEvent, RepealEvent, ConsolidationEvent, InterpretationEvent (judgment), ApplicabilityStatement.
* Props: **bi-temporal**: valid\_from, valid\_to (real-world effect) and tx\_from, tx\_to (when your system recorded/changed it), plus source\_uri, source\_hash, gazette\_no, gazette\_date. (You’re encoding OWL-Time/PROV-O concepts as properties for auditability.)

**GazetteIssue** (official publication)

* Props: gazette\_no, gazette\_date, publisher (federal / emirate); link to PDFs. Use **federal gazette** for federal instruments, and **emirate gazettes** (e.g., SLC Dubai; Abu Dhabi Gazette) for local instruments.

**Authority / Issuer**

* FederalSupremeCouncil, President, PrimeMinister, Cabinet, Ministry, EmirateRuler, ExecutiveCouncil, Regulator. (Needed to reason about **authority level** and delegation chains.) ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en/legislative-system))

**Jurisdiction**

* UAE\_Federal, AbuDhabi, Dubai, Sharjah, Ajman, UAQ, Fujairah, RAK, DIFC, ADGM. (Free zones modeled as child jurisdictions with their own sources of law.)

**Court & Judgment**

* Courts: FederalSupremeCourt, FederalFirstInstance/Appeal, AbuDhabiCourts, DubaiCourts, RAKCourts, DIFCCourts, ADGMCourts.
* Judgment props: case\_no, date, panel, outcome, neutral\_citation. (Arabic is default language of federal/local proceedings.)

**Definition / Concept**

* Normalized terms defined in provisions (e.g., “Taxable Person”), so queries can expand **defined-term networks**.

**Topic / Sector**

* Mirror the official portal’s sectors (e.g., Tax, Labour, Finance, Family) to support **global/community summaries**. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))

**Relationships (edges) that make the graph “think”**

**Structure & provenance**

* INSTRUMENT\_HAS\_PROVISION (Instrument→Provision, with order)
* PUBLISHED\_IN (Instrument→GazetteIssue)
* ISSUED\_BY (Instrument→Authority)
* APPLIES\_IN (Instrument/Provision→Jurisdiction) with optional scope (federal vs emirate-specific) and **valid time** on the edge.

**Lifecycle (temporal)** — all as **Event/Statement** nodes so you can attach time & source

* AMENDS (Event→old Provision **and** Event→new Provision)
* REPEALS (Event→Provision/Instrument)
* CONSOLIDATES (Event→Instrument)
* These events carry valid\_from/valid\_to from **gazette/entry-into-force** dates (or specific dates stated in the law).

**Doctrinal & cross-ref**

* CITES (Provision→Provision / Instrument→Instrument)
* INTERPRETED\_BY (Provision→Judgment) and RELIES\_ON (Judgment→Provision)
* HAS\_BASIS\_IN (Provision/Judgment→Free-zone or other base rule; optionally to recognized religious sources if **officially referenced** in personal status contexts—store **authority level** so advisory vs binding is clear).

**Delegations & implementation**

* DELEGATES\_TO (Instrument/Provision→Authority)
* IMPLEMENTED\_BY (Instrument→Cabinet/Ministerial/Entity Decision) to connect executive regulations to parent laws. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en/legislative-system))

**Topical/sectoral**

* HAS\_TOPIC (Instrument/Provision/Judgment→Topic) — drives **Global** & **DRIFT** community summaries aligned to the official sectors. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))

**The “multi-temporal, hyper-dimensional” bit (operationalized)**

* **Bi-temporal everywhere**: keep valid\_\* on **Event/Statement** (the law’s real-world effect) and tx\_\* (what your system believed when). This lets you answer **“what applied on 2019-05-01?”** vs **“what did the system believe last year?”** and explain deltas. Ground **valid\_from** in **gazette publication** or the specific clause that sets an effective date; **valid\_to** on repeal.
* **N-ary context via Statement nodes**: each AmendmentEvent (for example) can carry: {valid\_from, source\_gazette, jurisdiction, language, authority\_level, sector\_topic, provenance\_uri}—your “extra dimensions” without needing a hypergraph database.
* **Jurisdiction & authority as dimensions**: free-zone rules (DIFC/ADGM) live under their own Jurisdiction nodes; authority\_level distinguishes Constitution > Federal Law > Cabinet Resolution > Entity Circular; LLM prompts can use this to **prefer higher authority** by default. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en/legislative-system))

**How this schema makes GraphRAG sing**

**Local mode (entity-centric lookups)**

* Start from named Instruments/Provisions/Judgments → run **k-hop** across AMENDS/REPEALS/CITES/INTERPRETED\_BY, filtered by as\_of and APPLIES\_IN. This answers: *“What changed in Article 12 of Law X, as of 2023-01-02?”* with citations to Gazette & text spans.

**Global mode (corpus-level sense-making)**

* Run community detection on the HAS\_TOPIC/CITES graph; store **community summaries** (versioned with summary\_as\_of) to answer *“What themes/conflicts exist in private-education rules 2022–2024?”* Summaries cite representative provisions; Local then drills. (This is exactly the GraphRAG Global pattern.) ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))

**DRIFT (aim + drill-down)**

* Use community summaries to **aim** follow-up queries, then fetch concrete provisions/judgments via Local. Great for narrow but under-specified prompts like *“Who approves private-school licensing?”* (education community → implementing Cabinet/ministerial decisions → provisioning edges). ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en/legislative-system))

**Ingestion notes that keep it faithful (UAE sources)**

* **Federal**: crawl the **UAE Legislation** platform; store **instrument type, sector, amendments**, and link to **Gazette** (number, date) where available. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))
* **Emirates**: crawl **Dubai SLC** (legislation portal & gazette) and **Abu Dhabi Gazette**; stamp Jurisdiction and GazetteIssue.
* **Free zones**: collect **DIFC** and **ADGM** court rules/judgments; flag Jurisdiction=DIFC/ADGM and source\_of\_law=common\_law where applicable.

**What the LLM actually sees (and why this wins)**

* **Provision-level TextUnits** (Arabic/English) with back-pointers to Provision and GazetteIssue.
* **Path explanations**: Local retrieval returns short, time-valid **paths** like Provision (Art 12) ← AMENDS (2023) ← Provision (Art 12 old), plus any INTERPRETED\_BY judgments—perfect for grounded, explainable answers.
* **Authority/rank cues**: prompts can instruct the LLM to **prefer higher-authority sources** and **current-validity paths**, because those attributes are explicit in your graph (no guesswork).
* **Jurisdiction routing**: questions naming DIFC/ADGM route to their subgraphs; generic questions over “UAE” default to federal + emirate overlays, but Local filters make **as-of** and **APPLIES\_IN** explicit.

**Minimal deliverable to prove it in your Neo4j demo**

* Model: the nodes/edges above; implement **Event/Statement** nodes for amendments/repeals with bi-temporal props.
* Data slice: 50–100 federal instruments from [**uaelegislation.gov.ae**](http://uaelegislation.gov.ae) + a handful of **Dubai SLC** gazette items + 20 **DIFC/ADGM** judgments. ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en))
* Queries to showcase:
  1. *As-of* consolidated view for an article (shows Gazette, event chain).
  2. “What implements Law X?” (Instrument→IMPLEMENTED\_BY→executive decisions). ([uaelegislation.gov.ae](https://uaelegislation.gov.ae/en/legislative-system))
  3. “How has Article Y been interpreted?” (INTERPRETED\_BY Judgment paths), separated by **jurisdiction** (federal vs DIFC/ADGM).

If you want, I can turn this into a one-pager schema diagram + sample Cypher/Gremlin templates for (a) **as-of** queries, (b) **conflict detection** (overlap of obligations in the same jurisdiction/time window), and (c) **Local/Global/DRIFT** retrieval trees tailored to these node/edge types.

Great question—think of it in two parts: **(A) what you map to color/size/thickness**, and **(B) what pulls nodes together in the layout**.

**A) What defines node/edge size & color (visual encodings)**

In Neo4j Bloom (and Browser), you set these with **rule-based styling** on node/edge properties—string, numeric, boolean **and temporal** fields are supported. You can color, resize, and recaption by rules; relationships can be colored and thickened similarly.

**Practical mappings for the UAE legal graph**

* **Node color (categorical):**
  + Instrument type (Constitution, Federal Law, Decree-Law, Cabinet Resolution, Emirate Decision, DIFC/ADGM rule), or **Jurisdiction** (Federal, Abu Dhabi, Dubai, DIFC, ADGM). These are stable categories and easy to read. Bloom’s legend lets you define category colors and rule sets.
* **Node size (numeric/temporal):**
  + **Authority level** (Constitution > Federal Law > …) or **in-degree of citations / “interpreted\_by” judgments**—use log scaling so outliers don’t dominate.
  + **Recency** (e.g., larger for currently in-force or recently amended); Bloom supports temporal properties for rules.
* **Edge color (type):**
  + Use distinct hues for semantics: **amends/repeals** vs **implements** vs **cites** vs **interpreted\_by**. Bloom supports relationship type palettes + rules.
* **Edge thickness (strength):**
  + Weight by **edge frequency/importance**, e.g., number of times a judgment section cites a provision, or number of consolidated amendments affecting an article. Thicker = stronger/more frequent. (Bloom lets you set relationship thickness via legend rules.)

Tip: Bloom also surfaces **Graph Data Science** scores in-app, and you can style nodes by those (e.g., community, centrality) to power your Global/DRIFT views.

**B) What “attracts” linked vertices (layout forces)**

Most graph UIs (Bloom, D3/Gephi/NetworkX) rely on **force-directed layouts**:

* **Edges behave like springs** (they pull linked nodes toward a **target distance**).
* **Nodes repel** each other like charged particles to avoid overlap.

Common algorithms: **Fruchterman–Reingold**, **ForceAtlas2**, Kamada–Kawai variants.

If you build your own front-end (e.g., with D3):

* **Link distance** controls how close connected nodes “want” to be;
* **Link strength** controls how hard the spring pulls;
* **Charge** (negative) sets how strongly nodes repel.

D3’s forceLink models exactly this spring behavior; you can set these per-edge from your data (e.g., stronger citations → shorter distance / higher strength).

For large graphs, **ForceAtlas2** adds optimizations (Barnes–Hut, degree-dependent repulsion, adaptive “temperature”) to keep layouts readable and fast; it’s the default in Gephi and available in NetworkX/Graphology.

**Recommended, domain-aware defaults (works in Bloom or a custom D3 view)**

* **Color**: by **instrument type** (or **jurisdiction** in a separate perspective).
* **Size**: by **log(citations + interpretations + in-force weight)**—or by **authority rank** if you want a legally intuitive map.
* **Edge thickness**: by **interaction strength** (citations per section, number of amendments).
* **Forces** (if custom D3/Gephi):
  + Map **edge weight → lower link distance & higher link strength** so frequently linked provisions cluster;
  + Use a moderate **negative charge** so clusters separate without flying apart;
  + Increase **gravity**/centrality bias if you want foundational instruments (Constitution, major Federal Laws) to anchor the layout.

**Why this helps your GraphRAG**

* The encodings make **Local** paths obvious (thick “amends/repeals” chains, colored by type), and **Global** themes pop (communities colored/sized by influence).
* Bloom’s **rule-based styling** means you can swap perspectives—e.g., a “Temporal” view sizing by recency vs an “Authority” view sizing by rank—without changing data.

If you want, I can suggest a concrete Bloom **Legend** configuration (rules for colors/sizes/thickness) and, if you’re building a custom UI, a set of D3 forceLink/forceManyBody parameters tied to your edge weights and node properties so the picture reads correctly for lawyers out of the box.

Great prompt. Let’s pin **each visual choice** (size, color, thickness, “attraction”/forces) to **specific UAE legal realities** so the picture means something to lawyers at a glance—and so your GraphRAG benefits from those signals.

**What node COLORS should mean (pick one “perspective” at a time)**

**A. Jurisdiction perspective (recommended default for UAE):**

Color nodes by **jurisdiction family**: **Federal**, each **Emirate** (Abu Dhabi, Dubai, RAK, …), and the **free-zone common-law** jurisdictions (**DIFC**, **ADGM**). This mirrors the UAE’s dual federal–local system and the special free-zone courts that apply common-law (DIFC/ADGM).

**B. Instrument-type perspective (use when exploring legislative hierarchy):**

Color by the **type of enactment** defined on the official portal: **Constitution, Federal Law, Federal Decree-Law, Federal Decree, President/PM Resolutions, Cabinet Resolutions, Ministerial/Entity Decisions & Circulars**. This matches the Cabinet’s “Legislative System” taxonomy.

*(Keep both legends in Bloom and switch per task.)*

**What node SIZE should mean (legally useful signals)**

**1) Authority rank (legal hierarchy)**

Bigger for higher authority: **Constitution > Federal Law/Decree-Law > Federal Decree/Resolutions > Cabinet > Ministerial/Entity**. This visually encodes normative weight for conflict triage and drafting. (Types per official “Legislative System”.)

**2) Impact in practice (counts):**

Alternatively (or in another view), size by **in-degree of citations or court interpretations** (how many provisions/judgments point to this article), and/or by **number of amendments**. That surfaces “workhorse” provisions and heavily litigated clauses. (You’ll compute these from your CITES and INTERPRETED\_BY edges.)

Tip: log-scale so the Constitution doesn’t dwarf everything.

**3) Temporal salience:**

Optionally enlarge **currently in force** or **recently amended** provisions (driven by Official Gazette publication/entry-into-force dates), which in the UAE are set by the Constitution/legislation (e.g., “published in the Official Gazette and enters into force after 30 days unless stated otherwise”).

**What EDGE COLORS & THICKNESS should mean**

**Edge color = legal semantics (make them instantly legible):**

* **AMENDS / REPEALS** (legislative lifecycle) — one color family;
* **IMPLEMENTED\_BY / DELEGATES\_TO** (vertical implementation chain from a law to cabinet/ministerial decisions);
* **CITES** (doctrinal cross-reference between provisions);
* **INTERPRETED\_BY / RELIES\_ON** (linking provisions ↔ judgments in federal courts or DIFC/ADGM).

These are exactly the relationships UAE lawyers trace day-to-day.

**Edge thickness = strength / frequency:**

* **CITES / INTERPRETED\_BY:** thickness by **number of citations** (e.g., a judgment citing multiple sub-paragraphs) or **frequency across cases**.
* **AMENDS:** thickness by **amendment scope** (how many provisions an amendment event touches).
* **IMPLEMENTED\_BY:** thicker where a law has multiple implementing decisions (common in regulated sectors).

**What controls the “attraction” (layout forces) between nodes**

Force-directed layouts treat each edge like a spring; you can drive **spring strength and target distance** from **UAE-specific relationship weightings**:

**Stronger attraction (shorter distance / higher link strength) when:**

* It’s a **lifecycle** edge (**AMENDS/REPEALS**) between versions of the *same* provision—keeps consolidation chains tight.
* It’s a **vertical chain** (**IMPLEMENTED\_BY / DELEGATES\_TO**) from a **parent federal law** down to **cabinet/ministerial decisions**—shows the regulatory stack clearly. (This mirrors how UAE laws delegate to the Cabinet/ministries.)
* **Judgment ↔ Provision** links (**INTERPRETED\_BY/RELIES\_ON**) are numerous or recent—clusters case-law around the provisions it interprets, including DIFC/ADGM judgments within their own jurisdictions.

**Moderate attraction when:**

* It’s **CITES** between instruments/provisions—doctrinal neighborhoods form without collapsing the whole graph.

**Weak attraction when:**

* It’s just **PUBLISHED\_IN (Gazette)** or broad **HAS\_TOPIC** tags—keep gazette and topic nodes as anchors, not magnets.

**Community/cluster bias:**

* Nudge clustering by **Topic/Sector** (the federal portal organizes legislation by sectors), useful for **Global/DRIFT** summaries—education, labor, finance, etc.
* Also cluster by **Jurisdiction** so **DIFC** and **ADGM** islands are visually distinct from federal/on-shore law.

**Why these choices match UAE legal workflows (and help GraphRAG)**

* **Jurisdiction colors** + **authority-rank size** reflect the **federal vs emirate vs free-zone** reality (on-shore civil law + Shari’a personal-status vs free-zone common-law), so reviewers instantly see *where* a rule lives and *how much weight* it carries.
* **Lifecycle edges prominent** (amends/repeals) + **Gazette-driven temporal filters** align to the Constitution’s **publication / entry-into-force** rules, reducing “mixed-epoch” mistakes in answers.
* **Vertical chains pulled tight** (law → cabinet/ministerial decisions) mirror how implementation works in the UAE (Cabinet executes federal policy and issues implementing instruments), making obligations easy to follow.
* **Case-law clustering** by **INTERPRETED\_BY** highlights how provisions are applied in practice, including **DIFC/ADGM** decisions within their own jurisdictions—crucial when mixing civil-law statutes with common-law reasoning.

**A concrete Bloom/D3 recipe you can drop in**

* **Color**: Jurisdiction (Federal, each Emirate, DIFC, ADGM).
* **Size**: Authority rank (fallback: log(citations + interpretations + amendments)).
* **Edge color**: lifecycle vs implementation vs citation vs interpretation (four palettes).
* **Edge thickness**: frequency/scope.
* **Forces**: strong springs for lifecycle & implementation; medium for citations; weak for gazette/topic; add cluster bias by Topic/Sector communities from the federal portal.