ï»¿Full Name - Software Engineer Intern Assignment
Date: 2026-02-10

Project: High-Throughput Fan-Out Engine (Java 21)

Overview
- Streaming ingestion from CSV / JSONL / Fixed-width.
- Fan-out to REST, gRPC, MQ, Wide-DB mock sinks.
- Per-sink transformations, rate limiting, retries, DLQ.
- Backpressure via bounded queues and virtual-thread workers.

Architecture (summary)
- InputReader -> Source Queue -> Dispatcher -> Per-sink Queue -> Sink Workers
- Transformer per sink type: JSON, Protobuf (manual wire encoding), XML, Avro/CQL map.

Backpressure & Concurrency
- Bounded queues for source and sinks prevent OOM.
- Virtual threads per sink worker scale with CPU cores.
- Dispatcher blocks when any sink queue is full, slowing ingestion safely.

Resilience
- Each record retried up to 3 times per sink.
- Permanent failures are appended to dlq/<sink>.jsonl.

Observability
- Every 5 seconds prints: ingested, dispatched, throughput, per-sink success/failure/retries.

Assumptions
- Records are small per line and fit in memory.
- Timestamps are numeric when provided.
- Protobuf payload uses standard wire encoding via CodedOutputStream.

Prompts Used
- â Generate a Java 21 fan-out engine design using Strategy + Factory.â
- â Implement streaming ingestion for CSV/JSONL with backpressure and bounded queues.â
- â Provide a minimal Maven project with tests and README.â

Architecture Diagram

High-Throughput Fan-Out Engine - Architecture

```
+-------------------+        +-------------------+        +-------------------+
|   InputReader     | -----> |   Source Queue    | -----> |    Dispatcher     |
| (CSV/JSONL/FIXED) |        | (bounded, backpr.)|        | (fan-out)         |
+-------------------+        +-------------------+        +---------+---------+
                                                                      |
                                                                      v
      +---------------------+   +---------------------+   +---------------------+
      |  Sink Queue (REST)  |   |  Sink Queue (gRPC)  |   |   Sink Queue (MQ)   |
      |  workers + limiter  |   |  workers + limiter  |   |  workers + limiter  |
      +----------+----------+   +----------+----------+   +----------+----------+
                 |                         |                         |
                 v                         v                         v
           REST Mock Sink            gRPC Mock Sink             MQ Mock Sink

                                    +---------------------+
                                    | Sink Queue (WIDE_DB)|
                                    | workers + limiter   |
                                    +----------+----------+
                                               |
                                        v
                                Wide DB Mock Sink
```

Each sink applies a Strategy Transformer (JSON / Protobuf / XML / Avro+CQL map).
Retries (max 3) + DLQ write on failure. Metrics every 5 seconds.