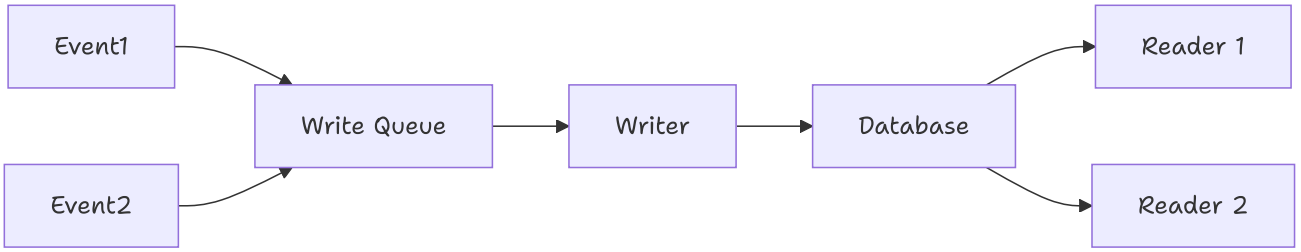
Command Query Responsibility Segregation Pattern

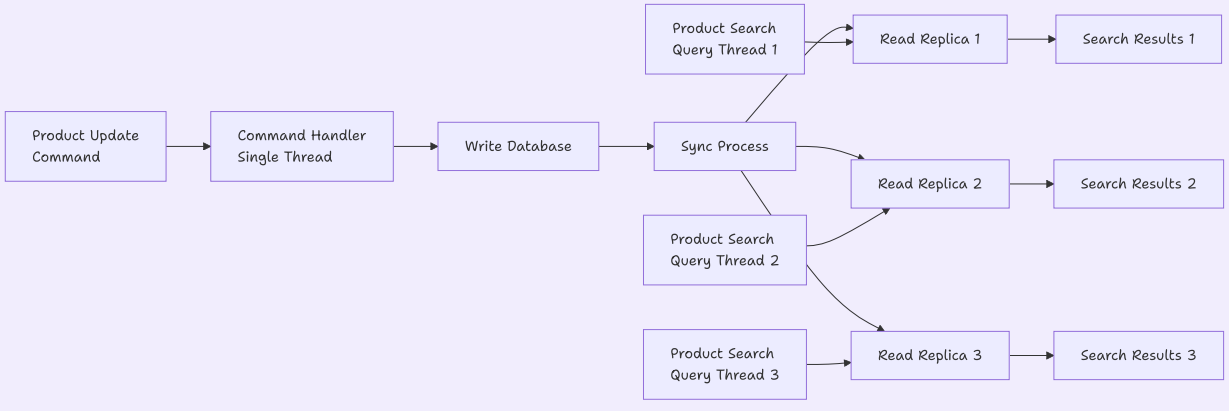
Separate the responsibilities of write model (commands) from the read model (queries).



- Commands modify state (writes) - use single-threaded or carefully synchronized
- Queries read state (reads) - can be highly parallel.
- Often combined with the Event Sourcing Pattern

Benefits: Optimizes reads and writes separately, scales better under different load patterns.

E-commerce



Real-world example:
E-commerce site where product updates (commands) go through a single-threaded validation pipeline, but product searches (queries) are served by multiple read-only replicas.

Design Considerations

Choosing

Ask yourself this when choosing this system:

- Do you have very different read and write patterns?
- Are your read queries complex and numerous compared to writes?
- Do you need to scale reads and writes independently?
- Do you have multiple different views of the same data?
- Are your write operations complex business workflows?
- Do you need different consistency guarantees for reads vs writes?

Building

Command Side Design:

- How do you model and validate commands?
- What's your command processing workflow?
- Do you need command queuing and async processing?
- How do you handle command failures and compensation?
- What's your transaction and consistency strategy?

Query Side Design:

- What read models do you need?
- How do you optimize each read model for its specific queries?
- Can read models be eventually consistent?
- How do you handle read model rebuilding?
- What's your caching strategy for read models?

Synchronization:

- How do you keep read models synchronized with writes?
- What's your acceptable lag between writes and read visibility?
- How do you handle synchronization failures?
- Do you need real-time updates for some read models?

Data Consistency:

- What consistency level do you need? (strong, eventual, session)
- How do you handle read-your-own-writes scenarios?
- What's your conflict resolution strategy?
- How do you handle partial failures in synchronization?

Multi-threading Considerations:

- Can multiple threads safely process commands?
- How do you handle concurrent updates to read models?
- What's your strategy for scaling command processors?
- How do you handle read model update ordering?

Operational Considerations:

- How do you monitor and debug a CQRS system?
- What's your deployment strategy for schema changes?
- How do you handle data migrations?
- What's your backup and disaster recovery strategy?