# MICROSERVICES

# PATTERNS

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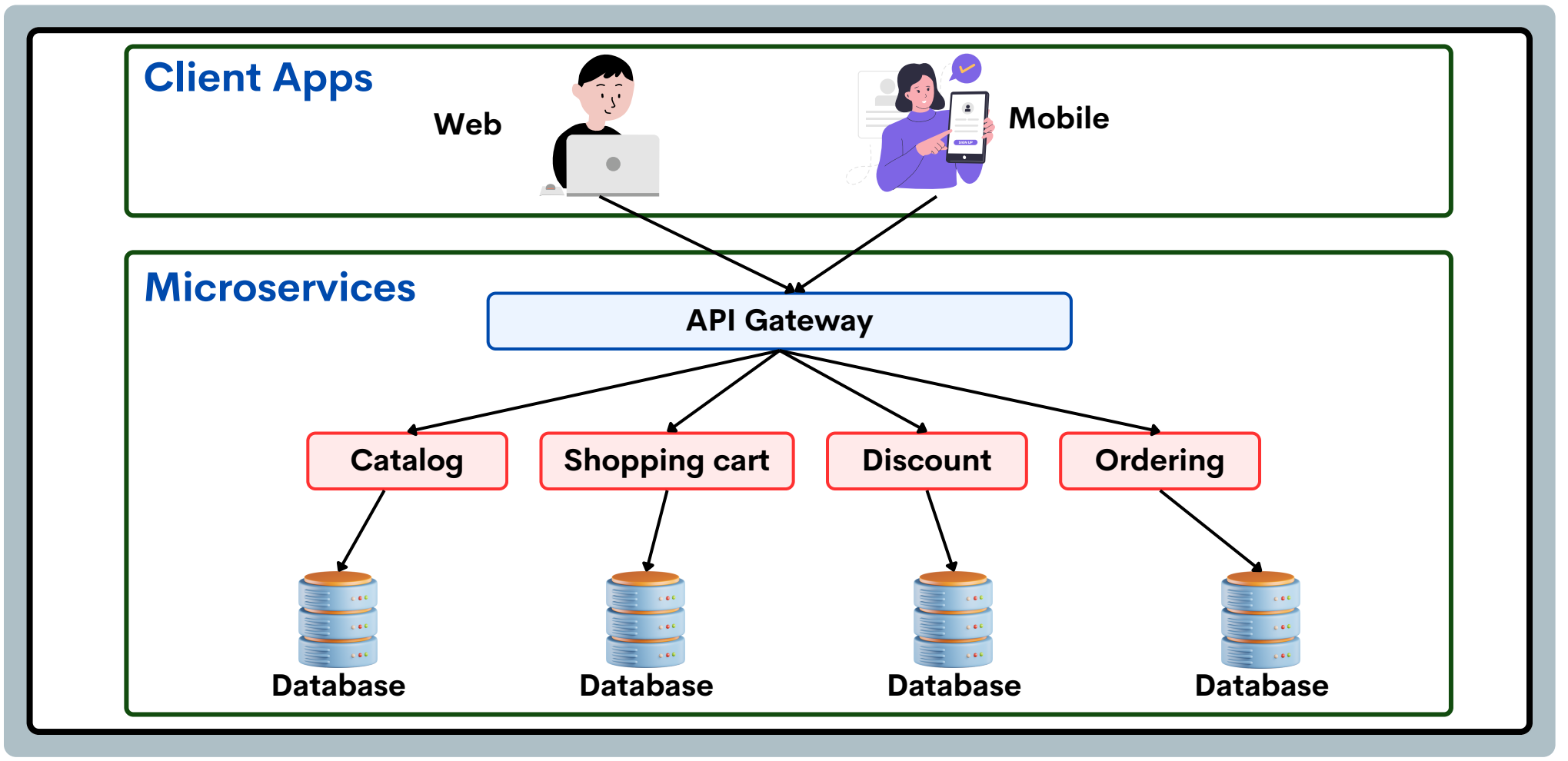
# API GATEWAY PATTERN




- **Definition: A single entry point that routes client requests to the appropriate microservices.**
- **Benefits: Simplifies client-side code, centralizes cross-cutting concerns like authentication and rate limiting.**
- **Use Case: Providing unified access to multiple microservices in a distributed system.**

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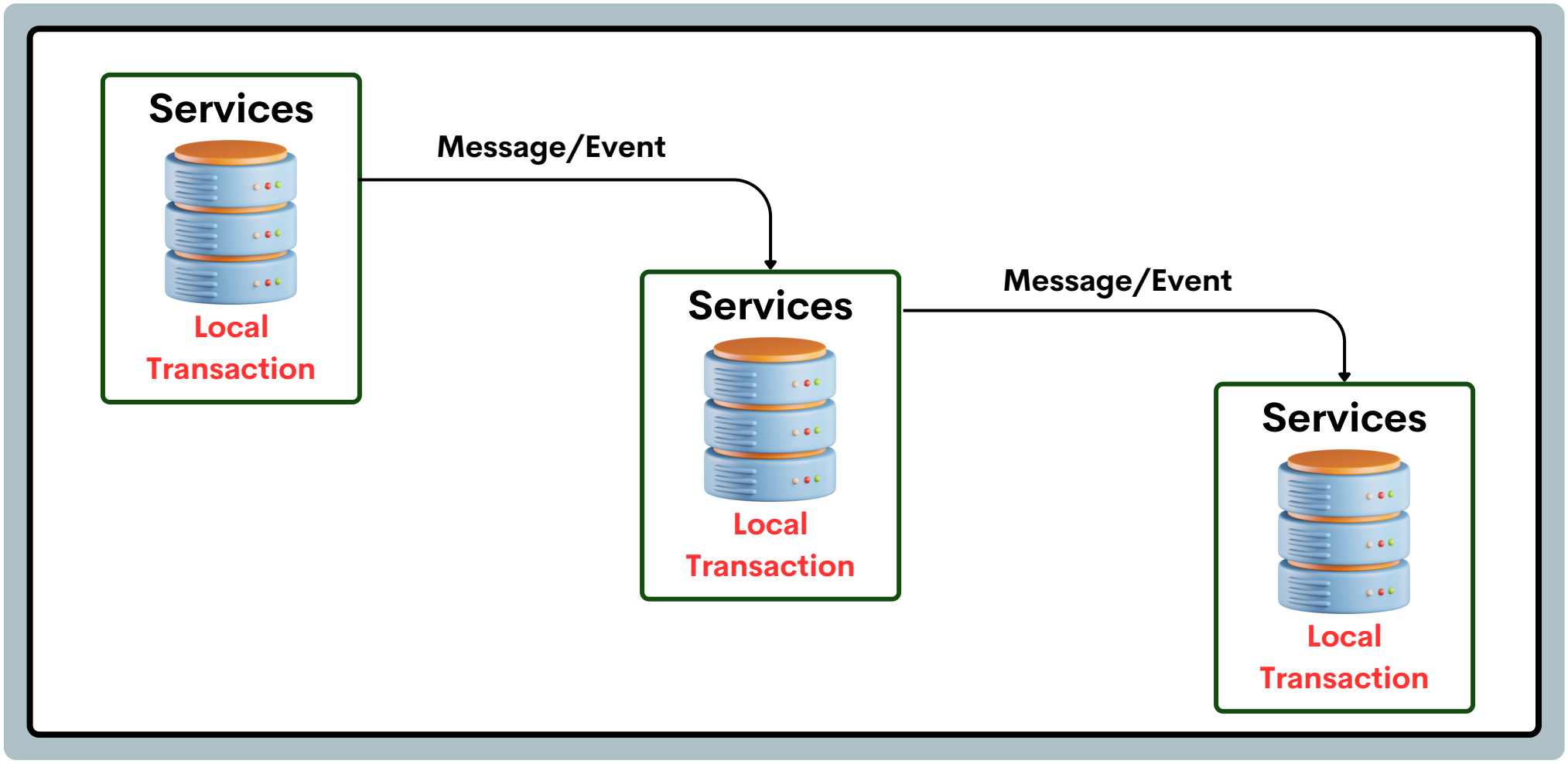
# SAGA PATTERN




- Definition: A pattern to manage distributed transactions across multiple microservices, ensuring data consistency.
- Benefits: Avoids distributed locks, supports long-running transactions.
- Use Case: E-commerce systems handling order processing or payment workflows.

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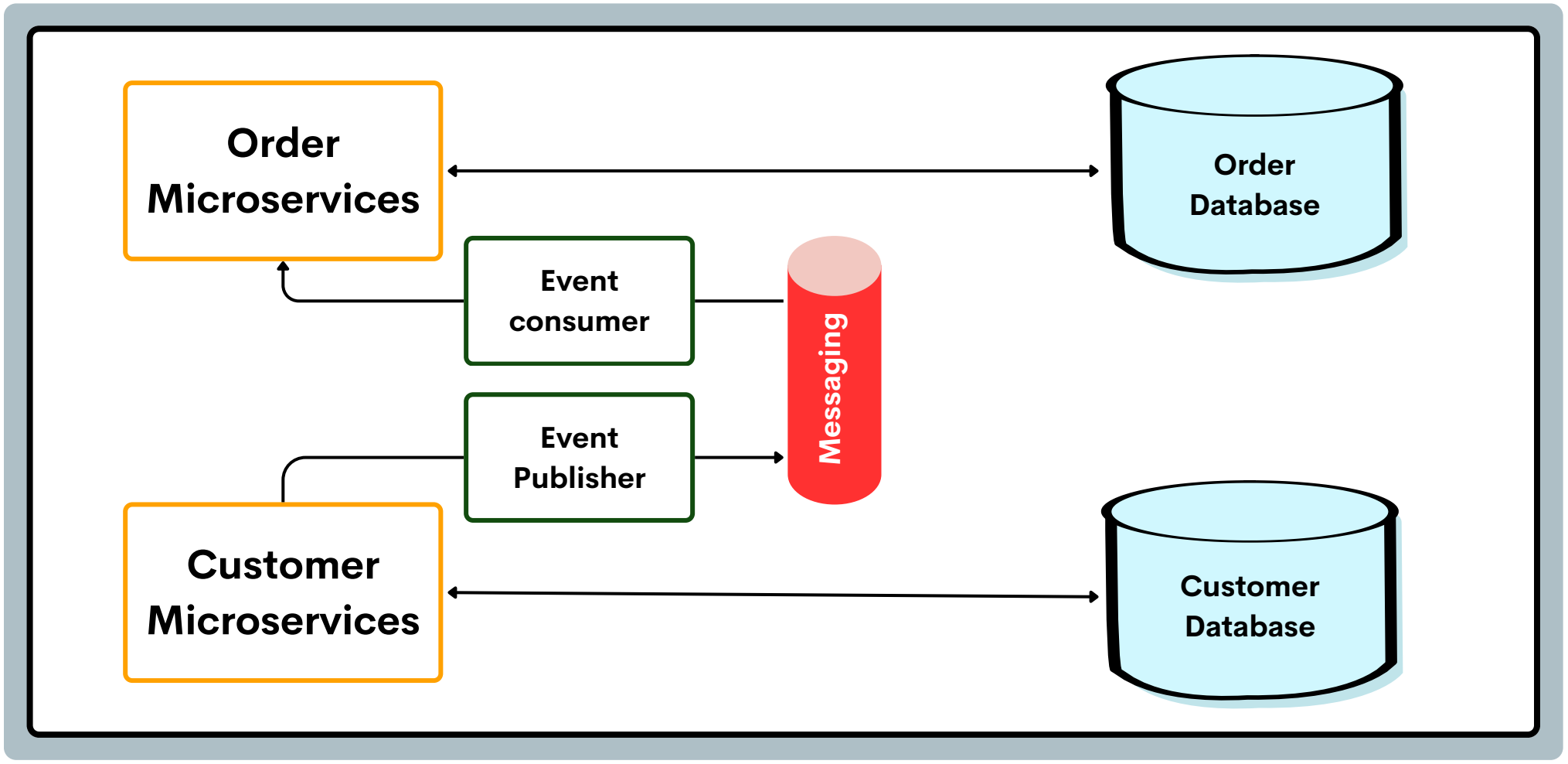
# EVENT SOURCING PATTERN




- **Definition: Stores the state of an application as a sequence of events, enabling state reconstruction.**
- **Benefits: Provides auditability, replayability, and fault tolerance.**
- **Use Case: Systems requiring historical records or complex state transitions.**

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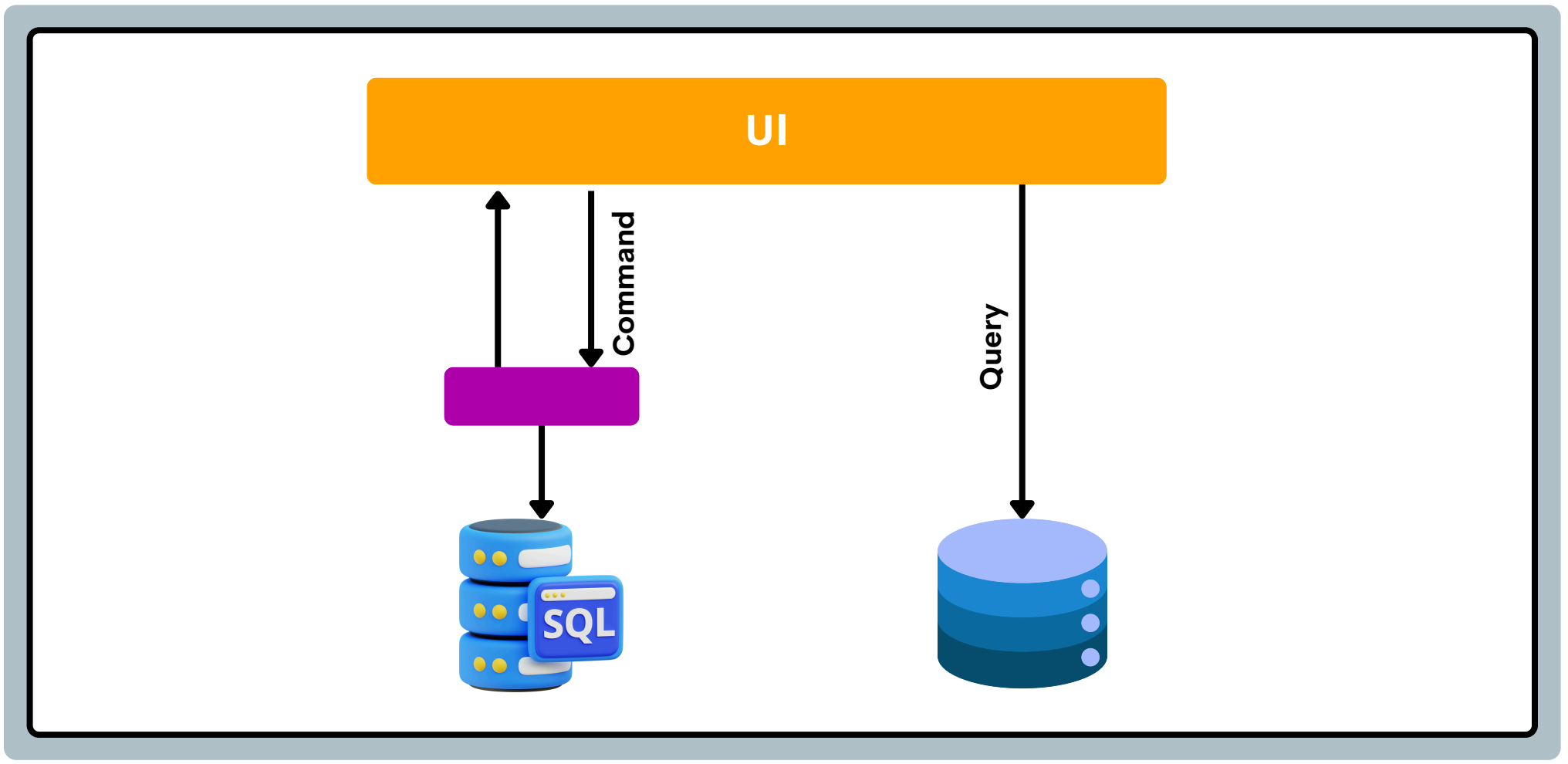
# CQRS




- **Definition: Separates read and write operations into distinct models for optimized performance.**
- **Benefits: Independent scaling of read/write workloads, simplifies complex queries.**
- **Use Case: Systems with high read/write asymmetry or complex query requirements.**

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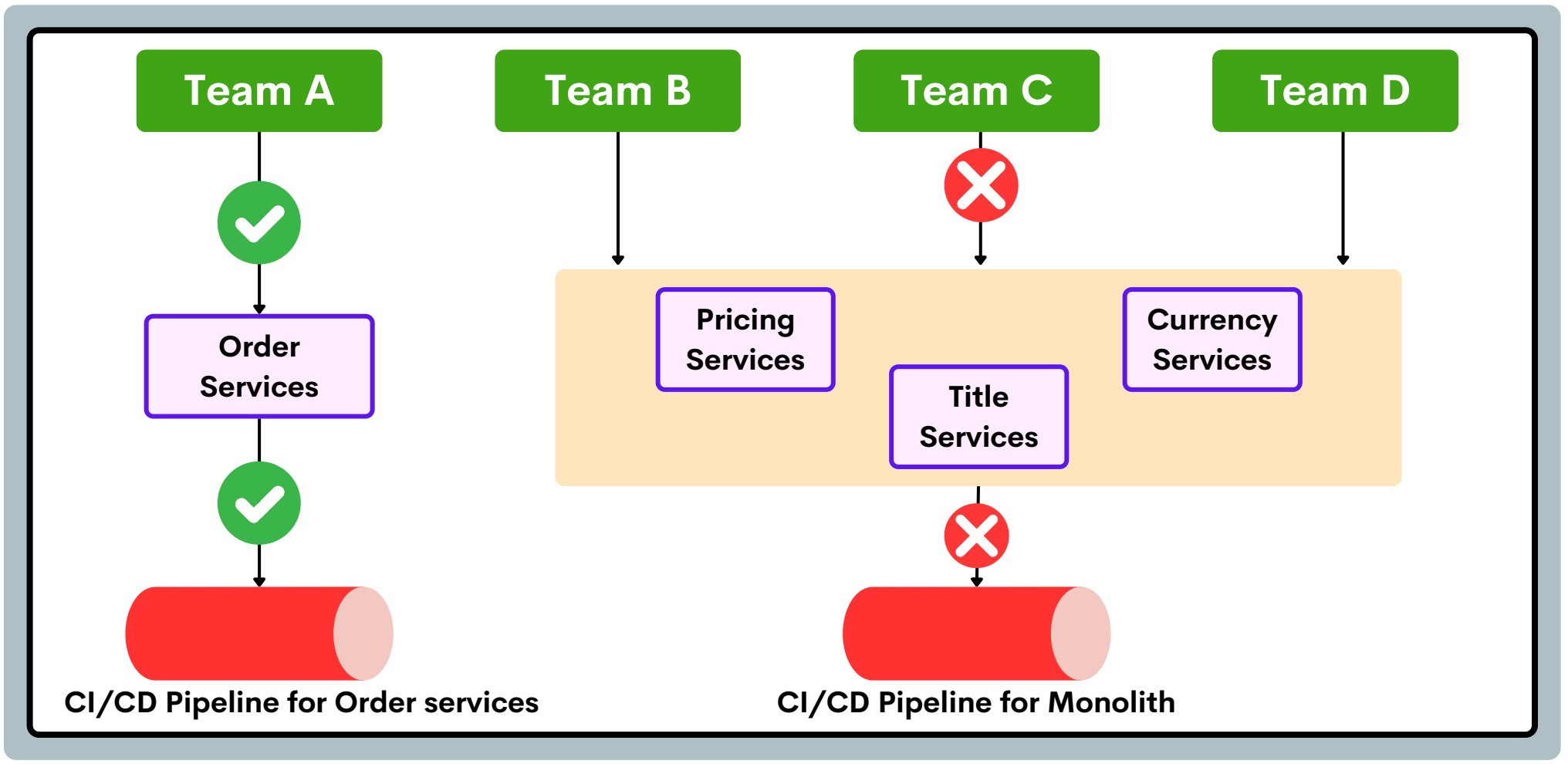
# STRANGLER FIG PATTERN




- **Definition: Gradually replaces a legacy system by building new functionality around it.**
- **Benefits: Reduces risk, avoids a complete system rewrite.**
- **Use Case: Incrementally modernizing legacy systems.**

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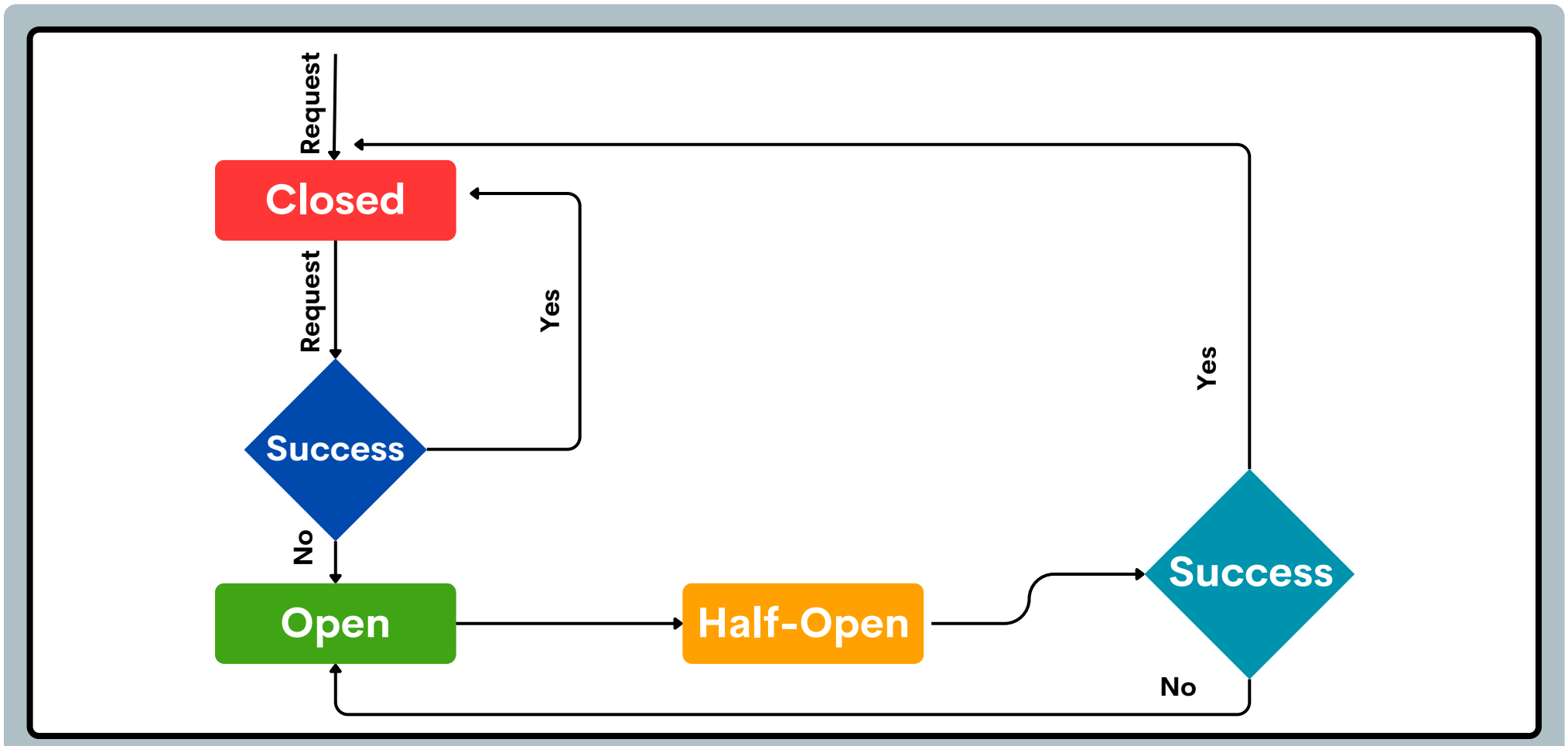
# CIRCUIT BREAKER PATTERN




- **Definition: Prevents repeated execution of failing operations to avoid system overload.**
- **Benefits: Improves resilience, prevents cascading failures.**
- **Use Case: Handling failures in external service calls or dependencies.**

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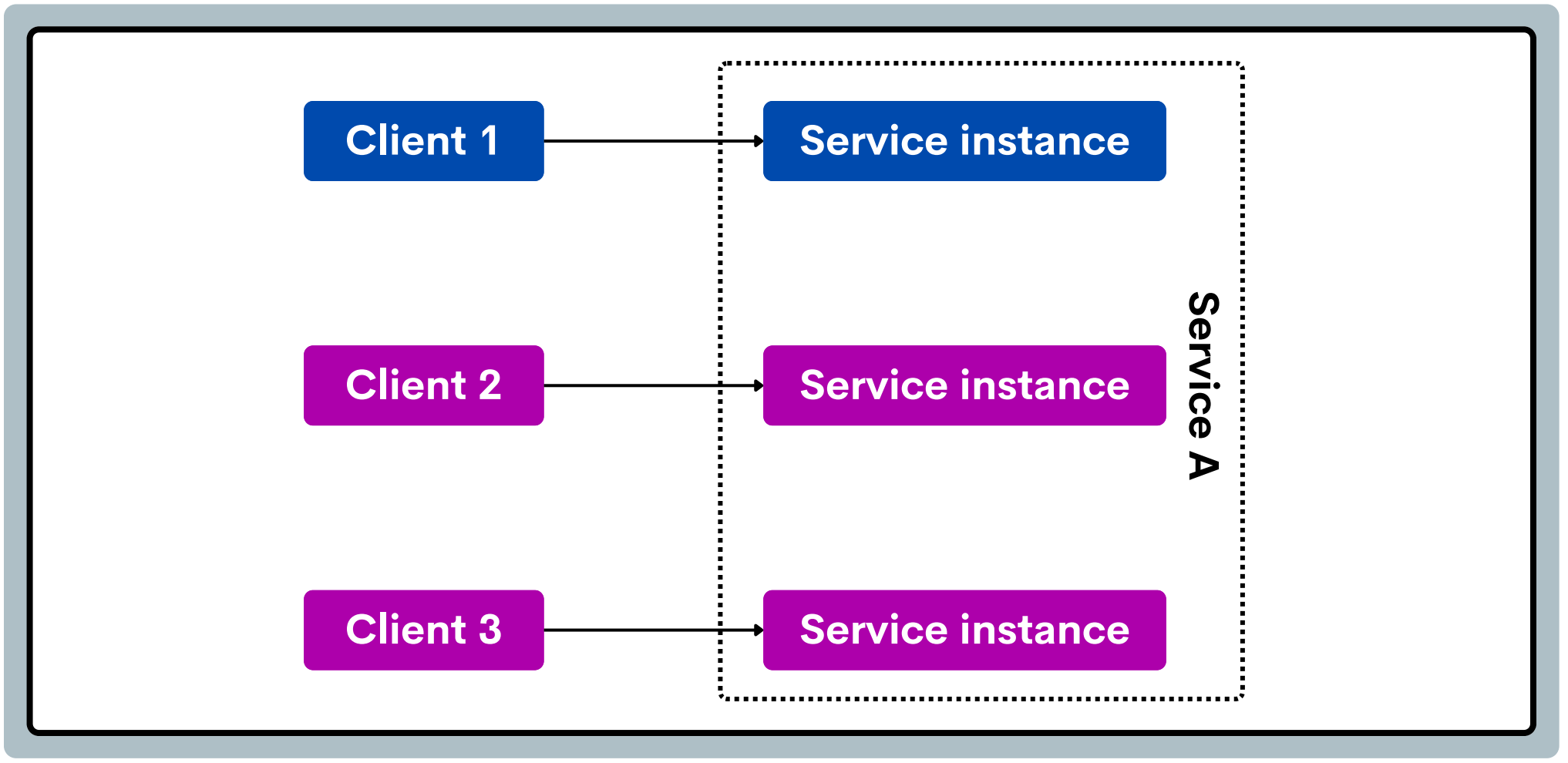
# BULKHEAD PATTERN




- **Definition: Isolates resources (e.g., threads, connections) to prevent failures in one service from affecting others.**
- **Benefits: Enhances fault tolerance and system stability.**
- **Use Case: Systems with multiple interdependent services.**

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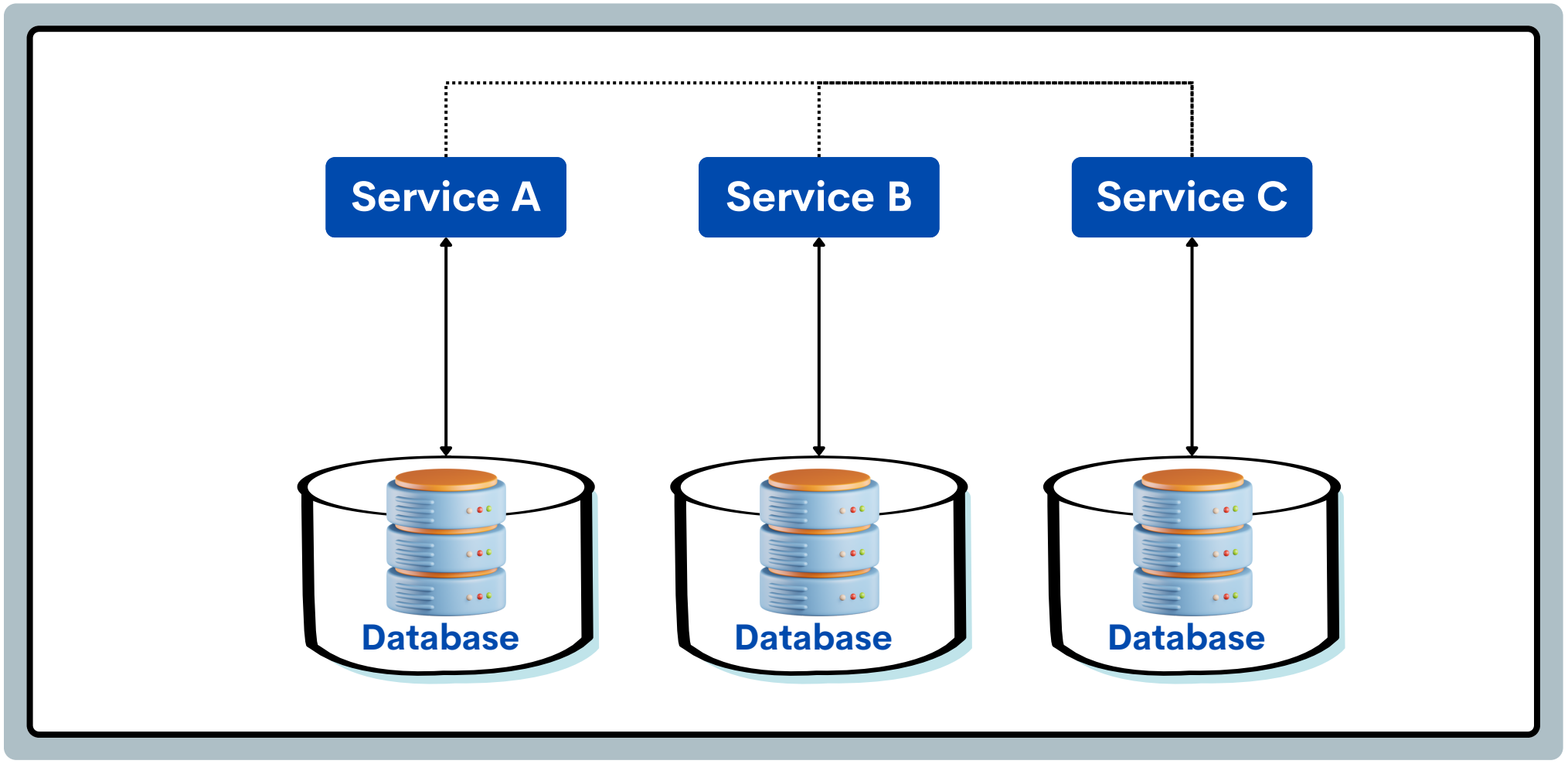
# DATABASE PER SERVICE PATTERN




- **Definition: Each microservice has its own dedicated database for data management.**
- **Benefits: Ensures loose coupling and independent scaling.**
- **Use Case: Microservices architectures requiring independent data storage.**

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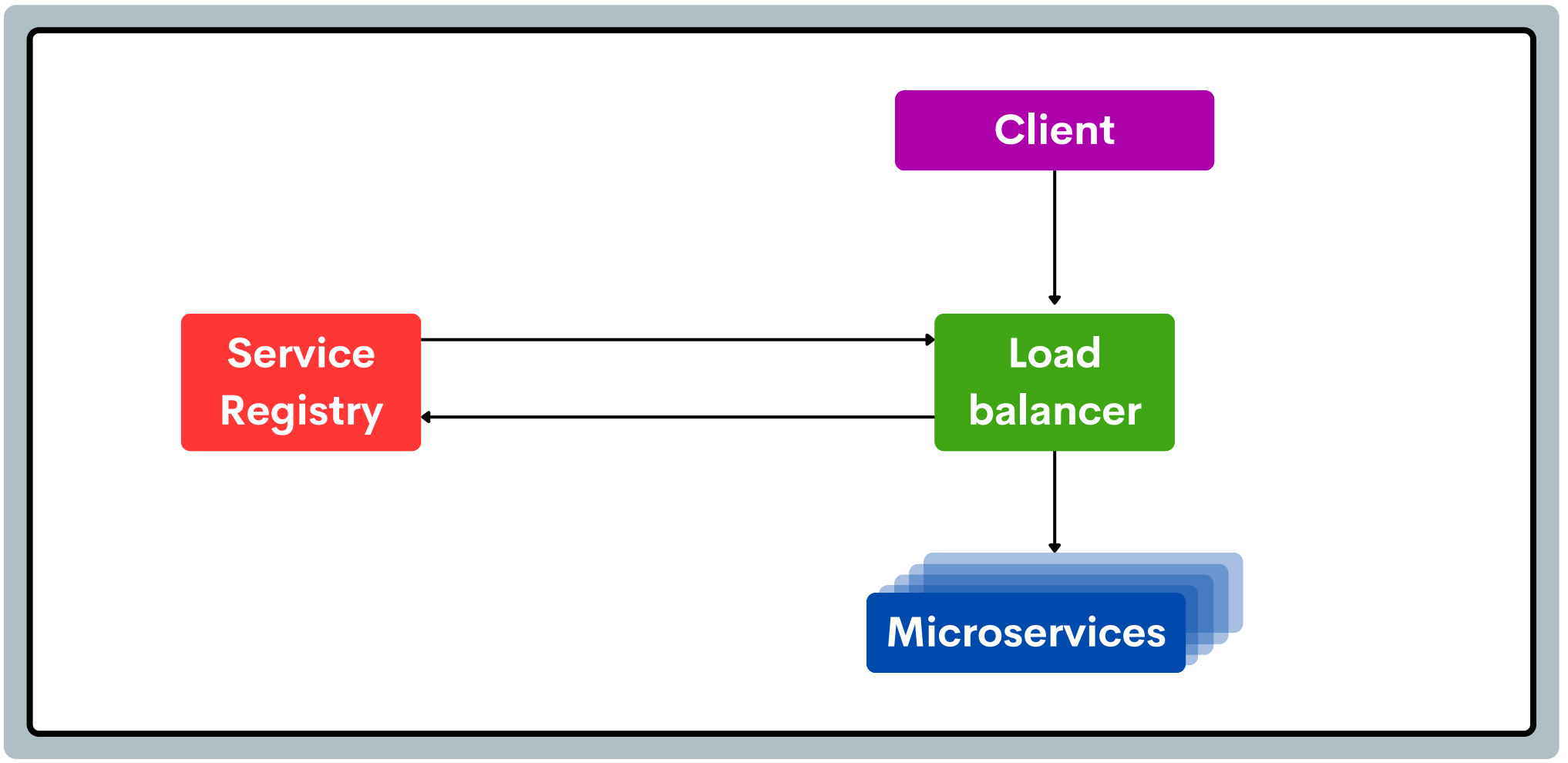
# SERVICE DISCOVERY PATTERN




- **Definition: Enables microservices to dynamically discover and communicate with each other.**
- **Benefits: Supports dynamic environments with frequent service changes.**
- **Use Case: Cloud-based systems with auto-scaling or containerized services.**

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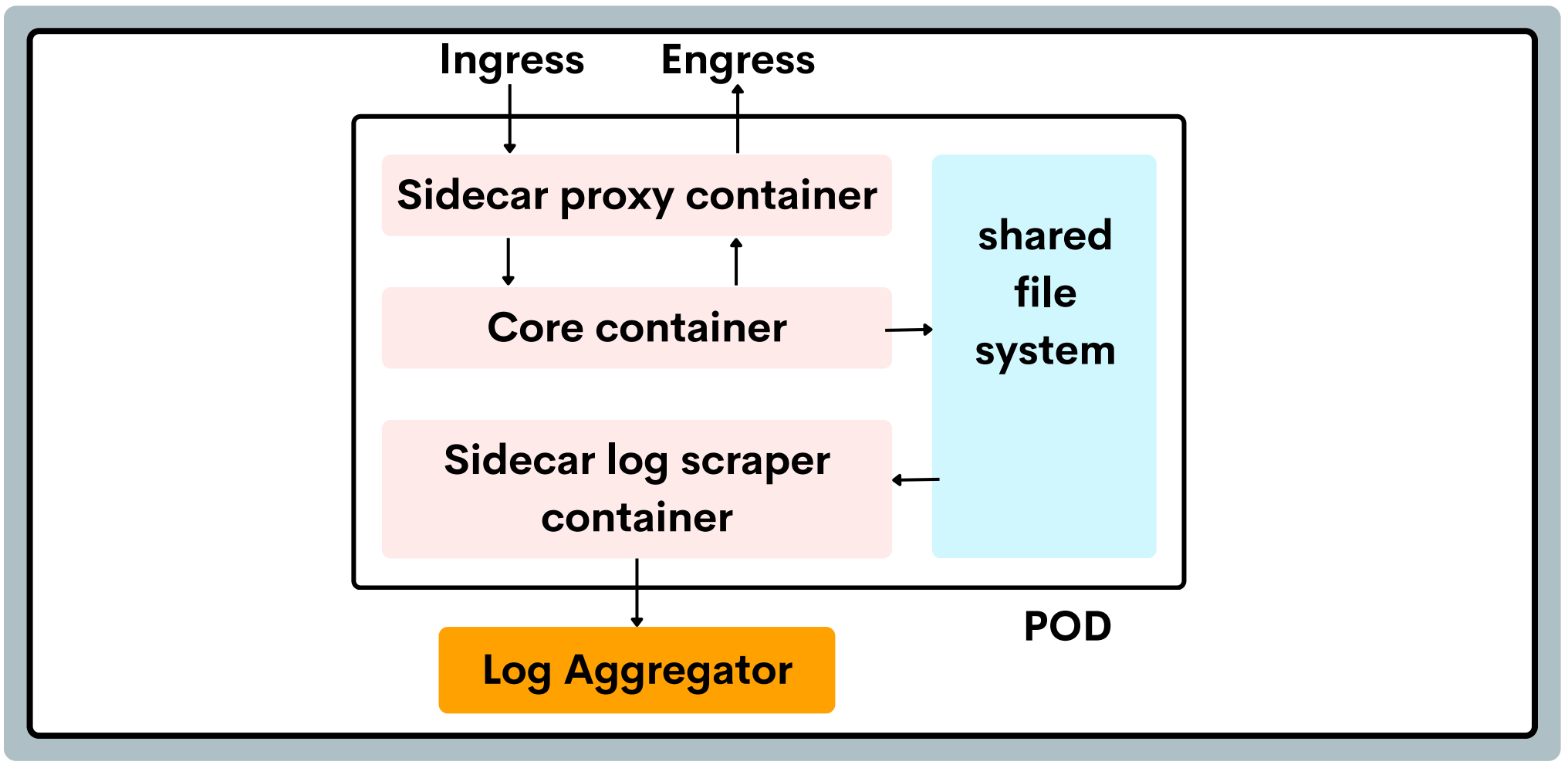
# SIDECAR PATTERN




- **Definition: Attaches a helper component (sidecar) to a service to provide additional functionality.**
- **Benefits: Keeps the main service lightweight and focused on core logic.**
- **Use Case: Adding cross-cutting concerns like logging, monitoring, or security.**

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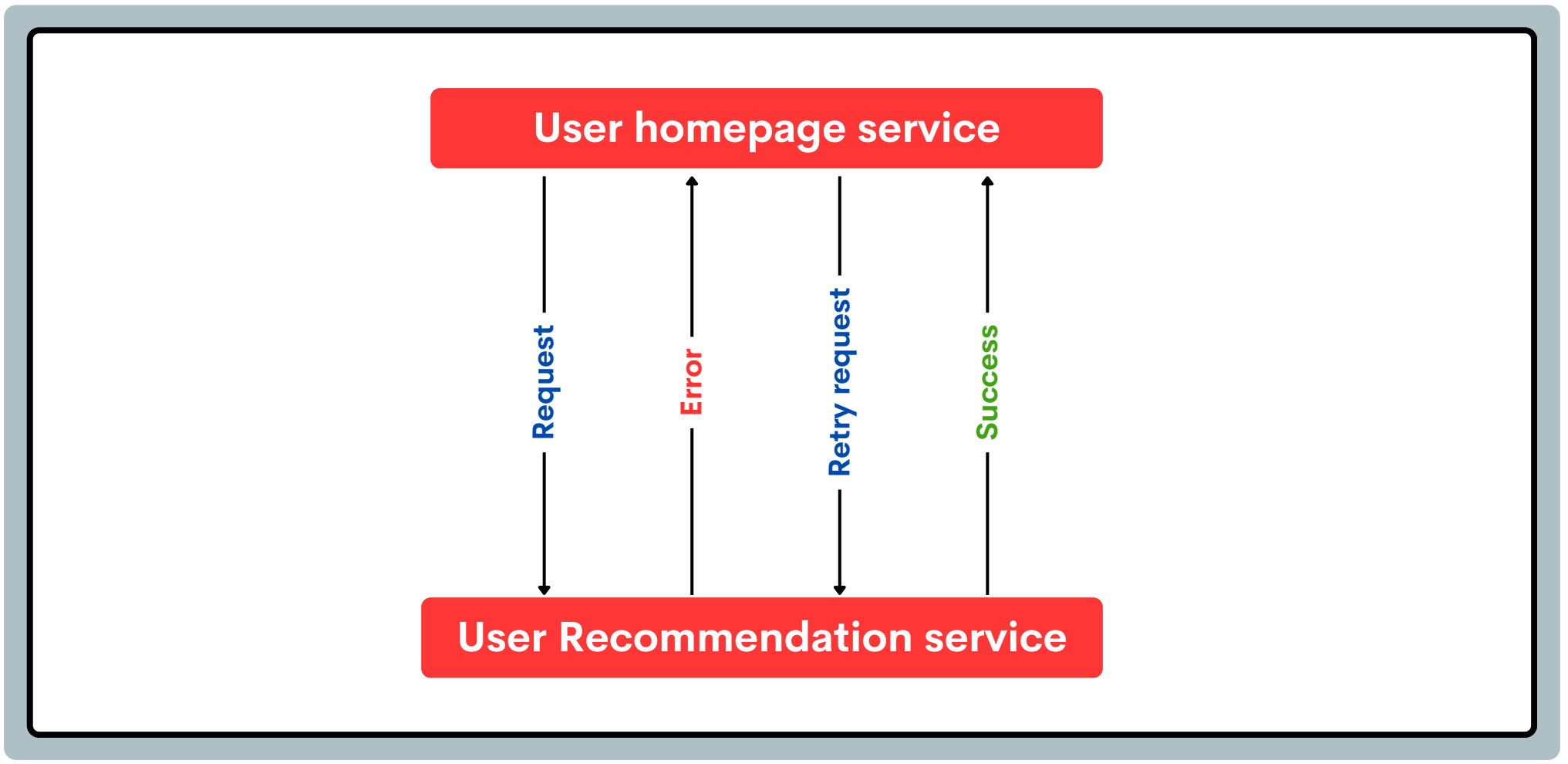
# RETRY PATTERN




- **Definition: Automatically retries failed operations, often with exponential backoff.**
- **Benefits: Handles transient failures, improves system resilience.**
- **Use Case: Temporary network or service availability issues.**

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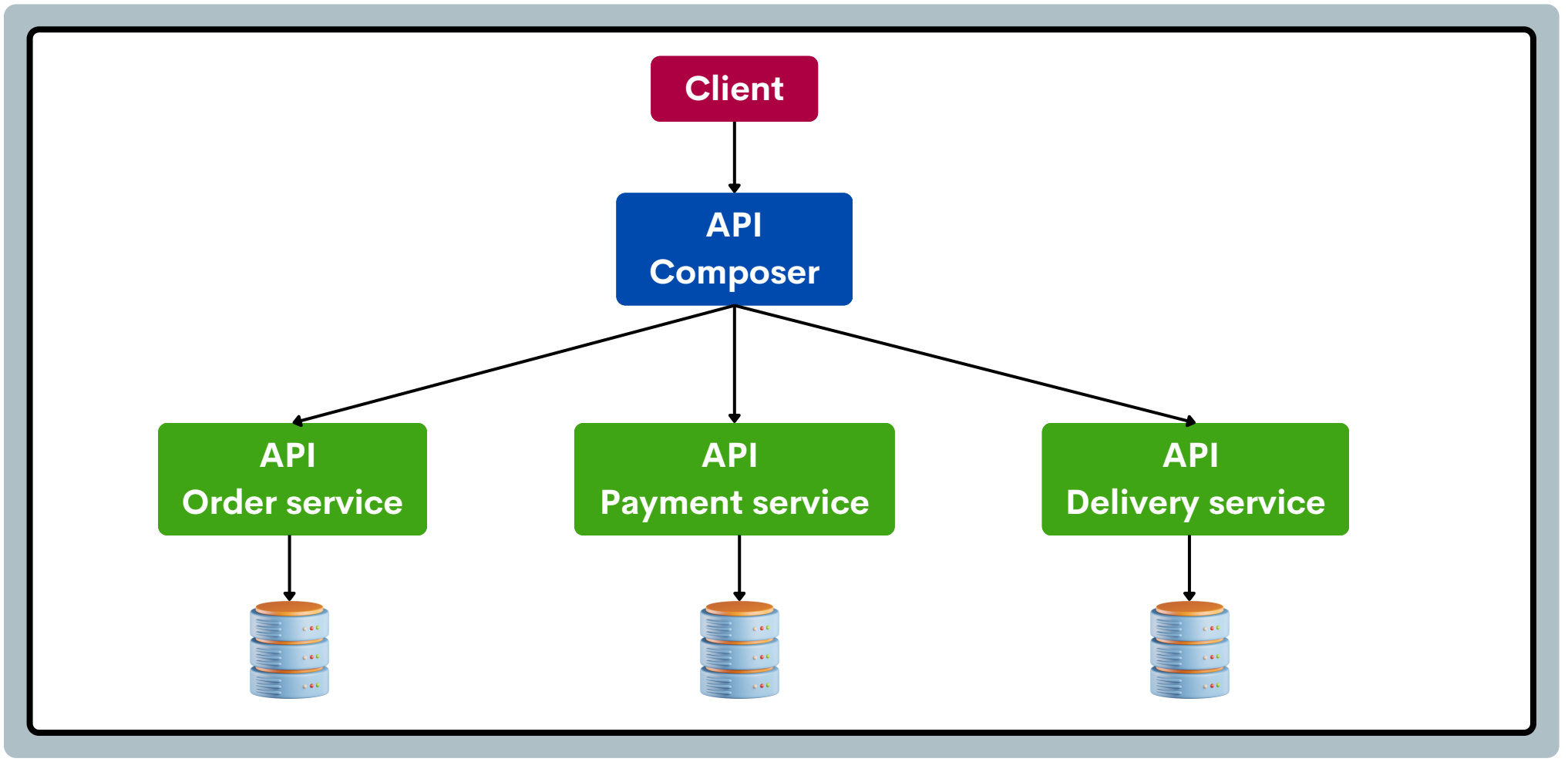
# API COMPOSITION PATTERN




- **Definition: Combines data from multiple microservices into a single response for the client.**
- **Benefits: Simplifies client-side logic by aggregating data server-side.**
- **Use Case: Aggregating data from multiple services for a client request.**

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