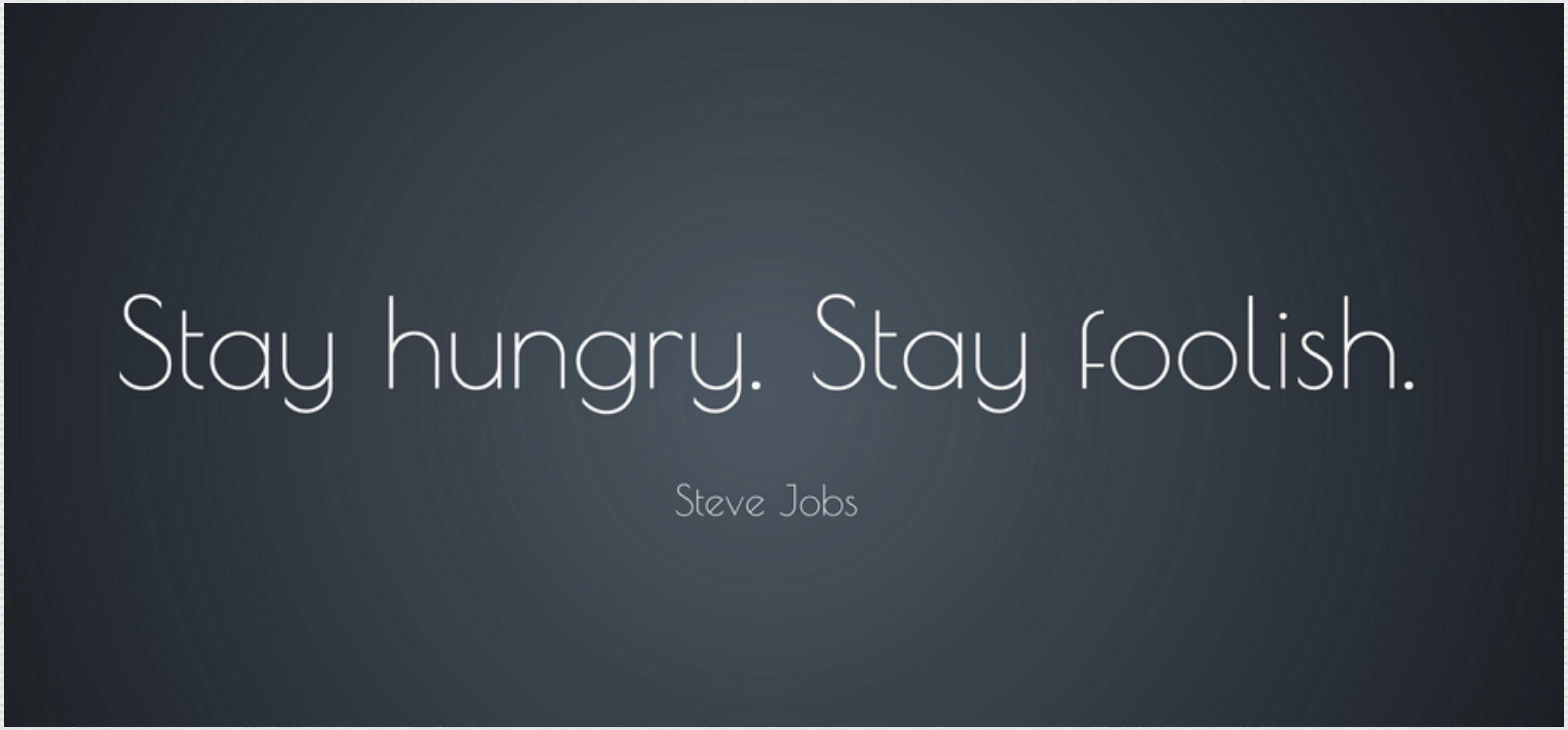
Design Patterns在金融交易系统中的应用

设计高性能，易扩展，高可用容错的分布式系统

引言

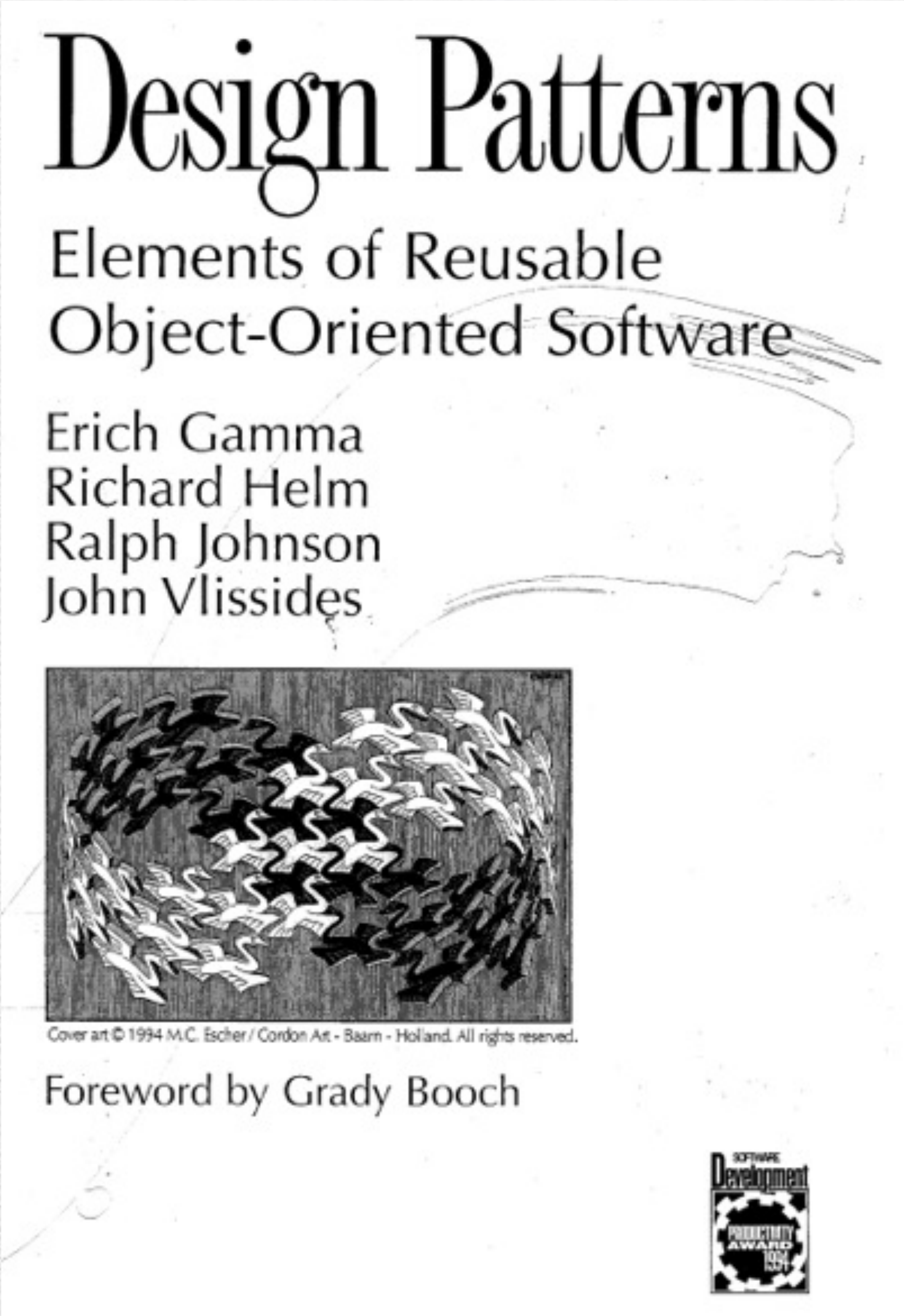
- 做正确的事（What）
- 正确的做事（How）



Stay hungry. Stay foolish.

Steve Jobs

设计模式：可复用面向对象软件的基础



Design Patterns

Elements of Reusable
Object-Oriented Software

Erich Gamma
Richard Helm
Ralph Johnson
John Vlissides

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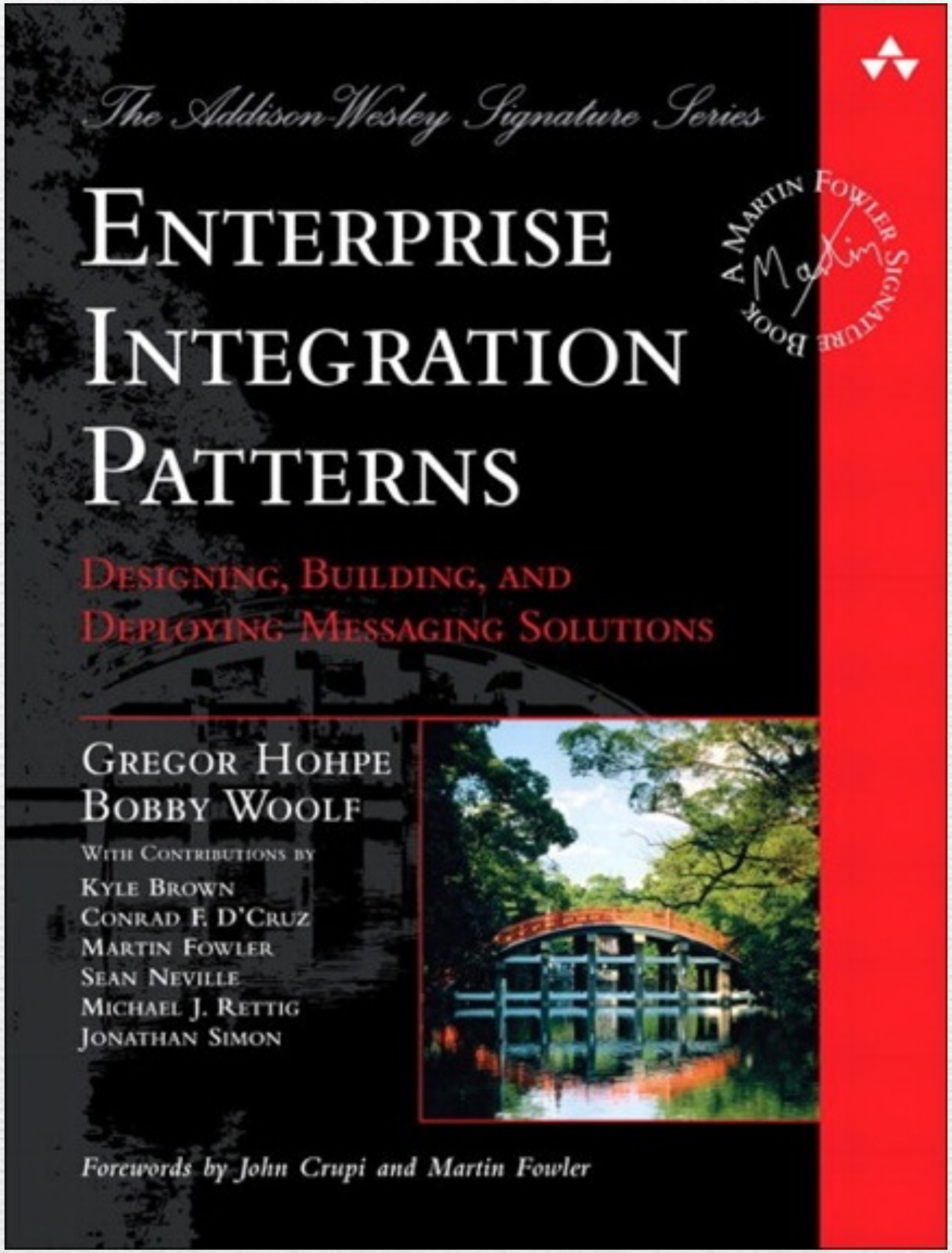
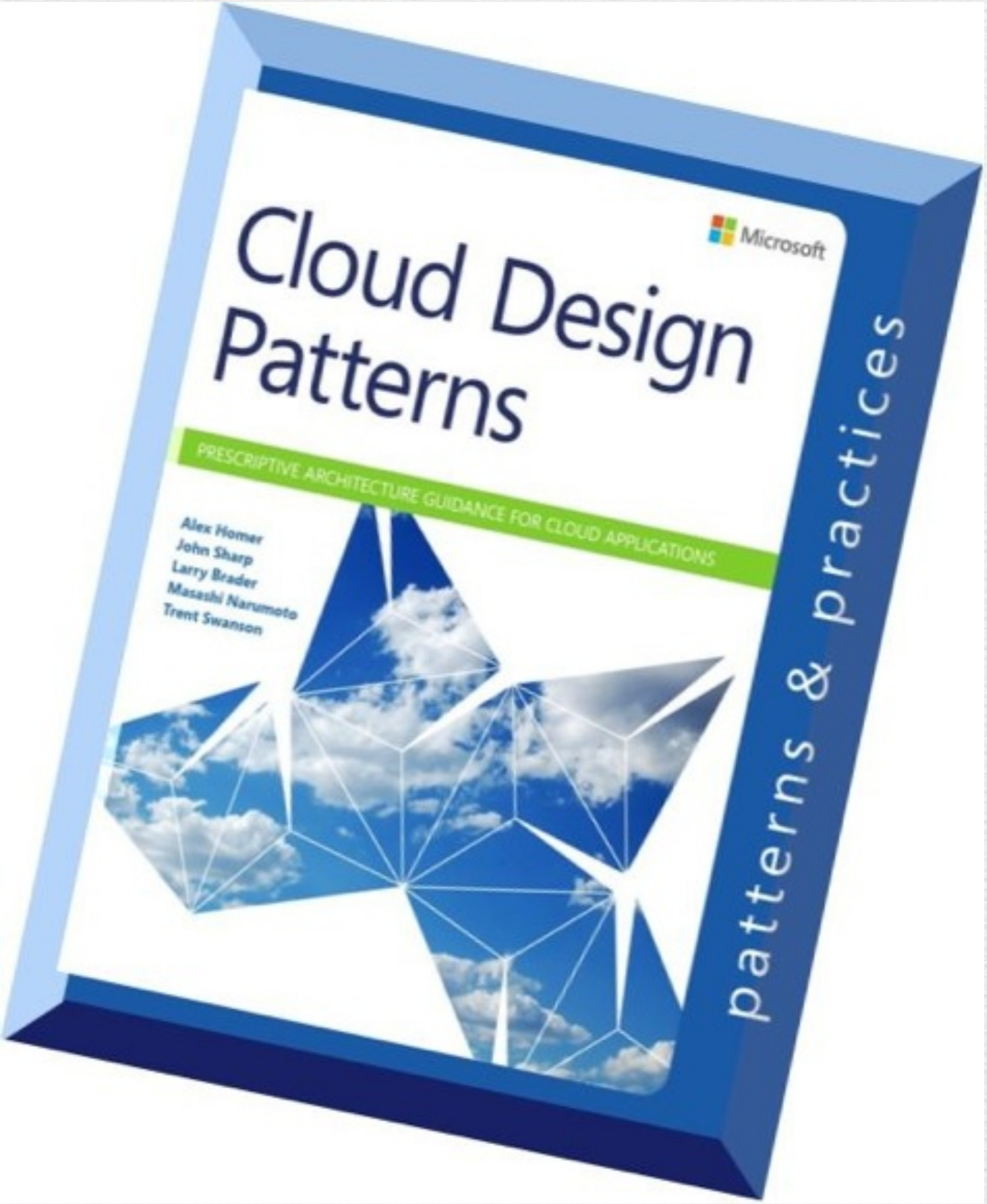
Foreword by Grady Booch

SOFTWARE Development PRODUCTIVITY AWARD 1994

企业集成模式


The Addison-Wesley Signature Series
A Martin Fowler Signature Book
Martin
Enterprise Integration Patterns
Designing, Building, and Deploying Messaging Solutions
Gregor Hohpe
Bobby Woolf
With Contributions by
Kyle Brown
Conrad F. D'Cruz
Martin Fowler
Sean Neville
Michael J. Rettig
Jonathan Simon
Forewords by John Crupi and Martin Fowler

Cloud design pattern

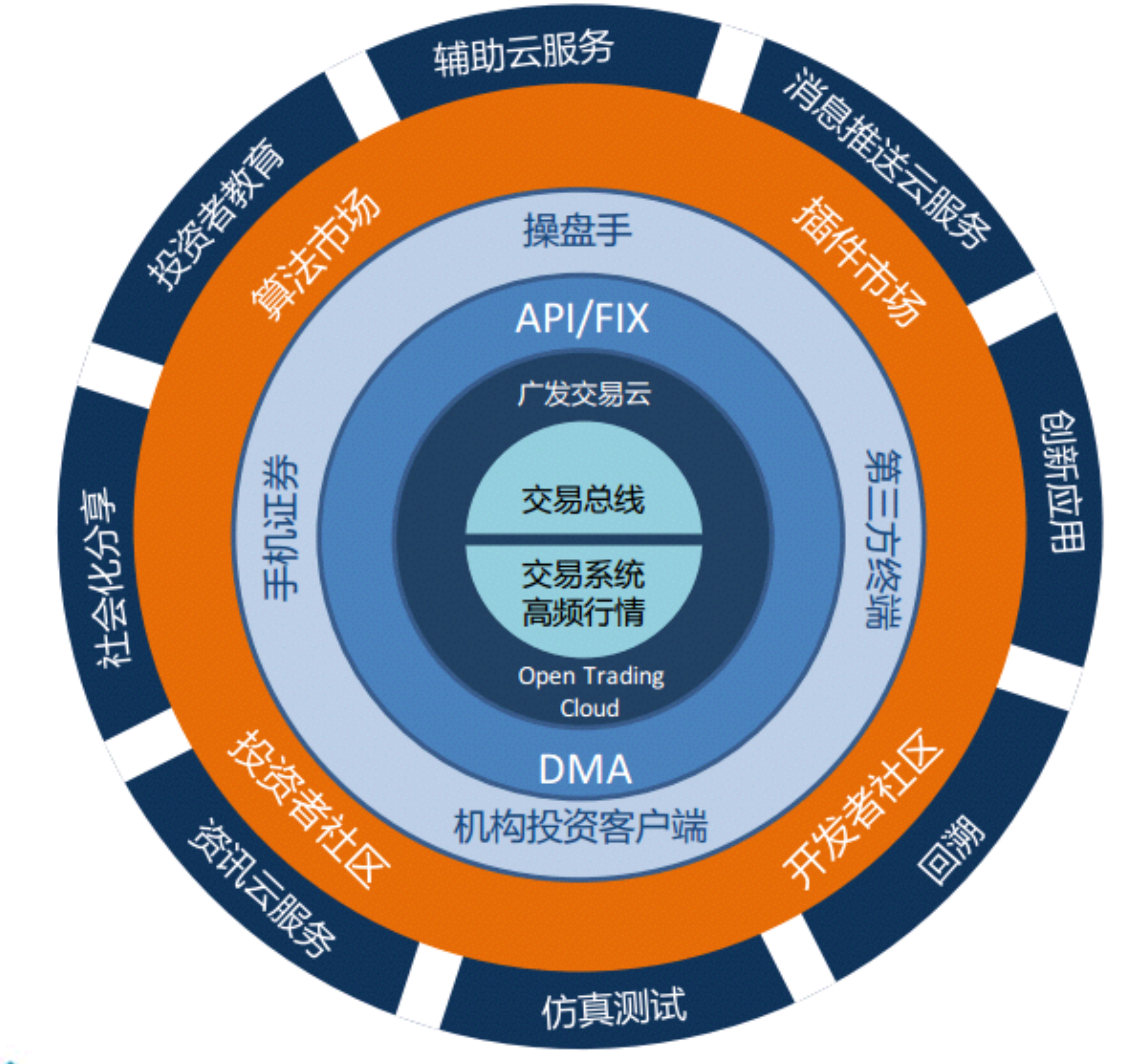


提纲

- 组播（Multicast）
- 事件回溯（Event Sourcing）
- Leader Election
- 命令查询职责分离（CQRS）
- Disruptor/RingBuffer
- Distributed Tracing（Google Dapper）

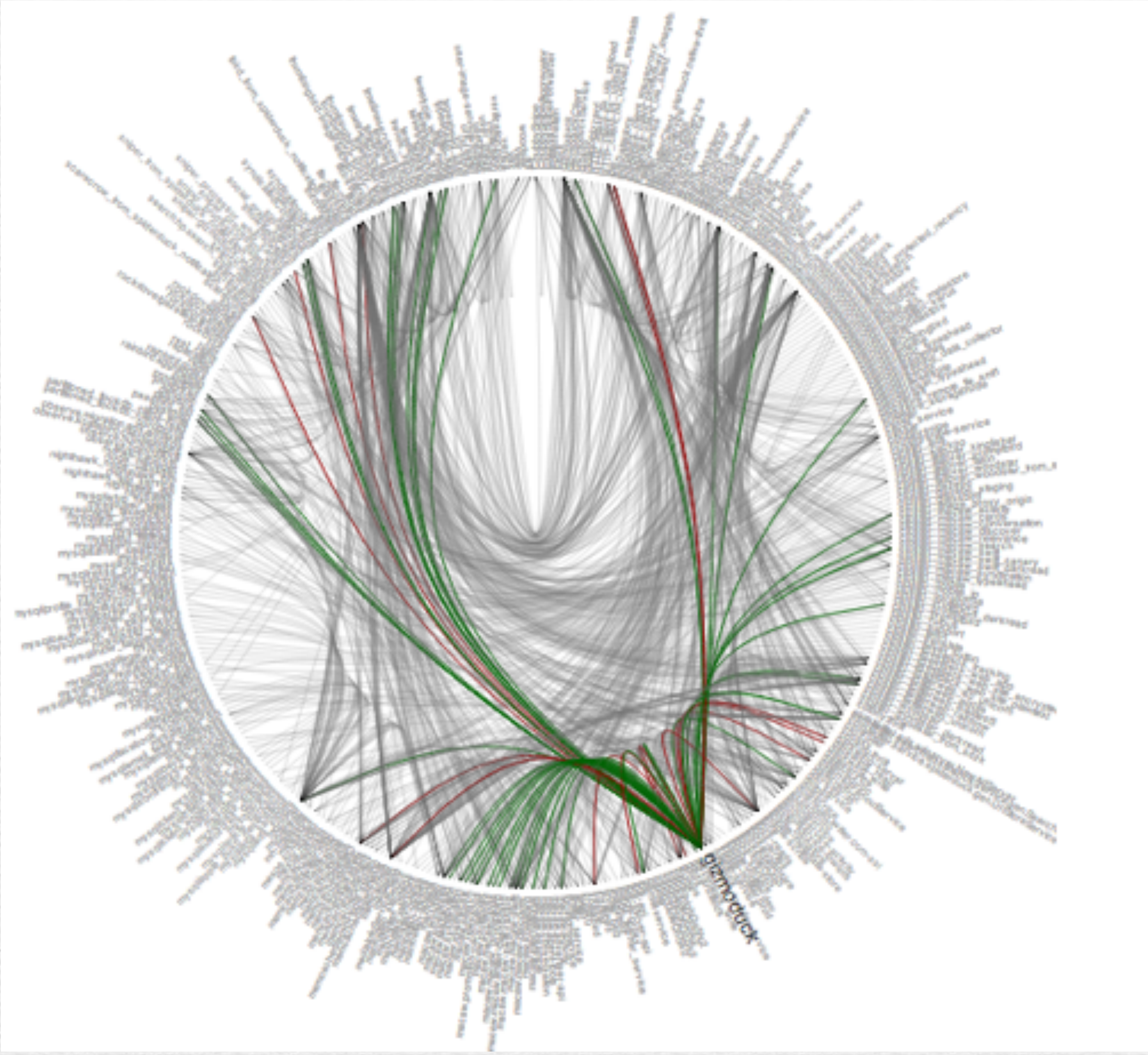
交易系统

- 高性能
- 低延迟
- 强一致
- 高可用
- 可扩展

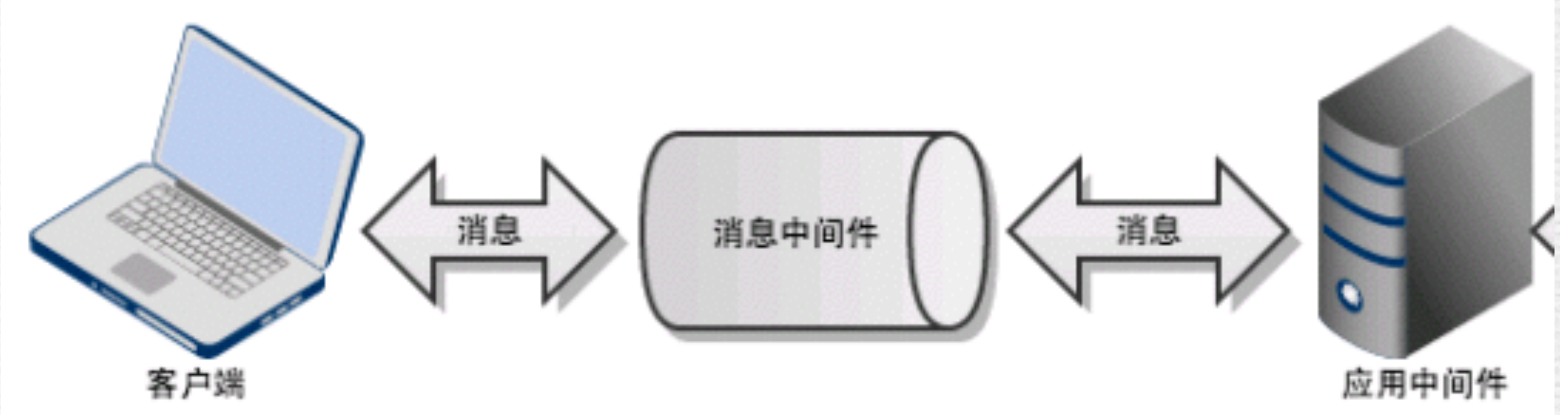


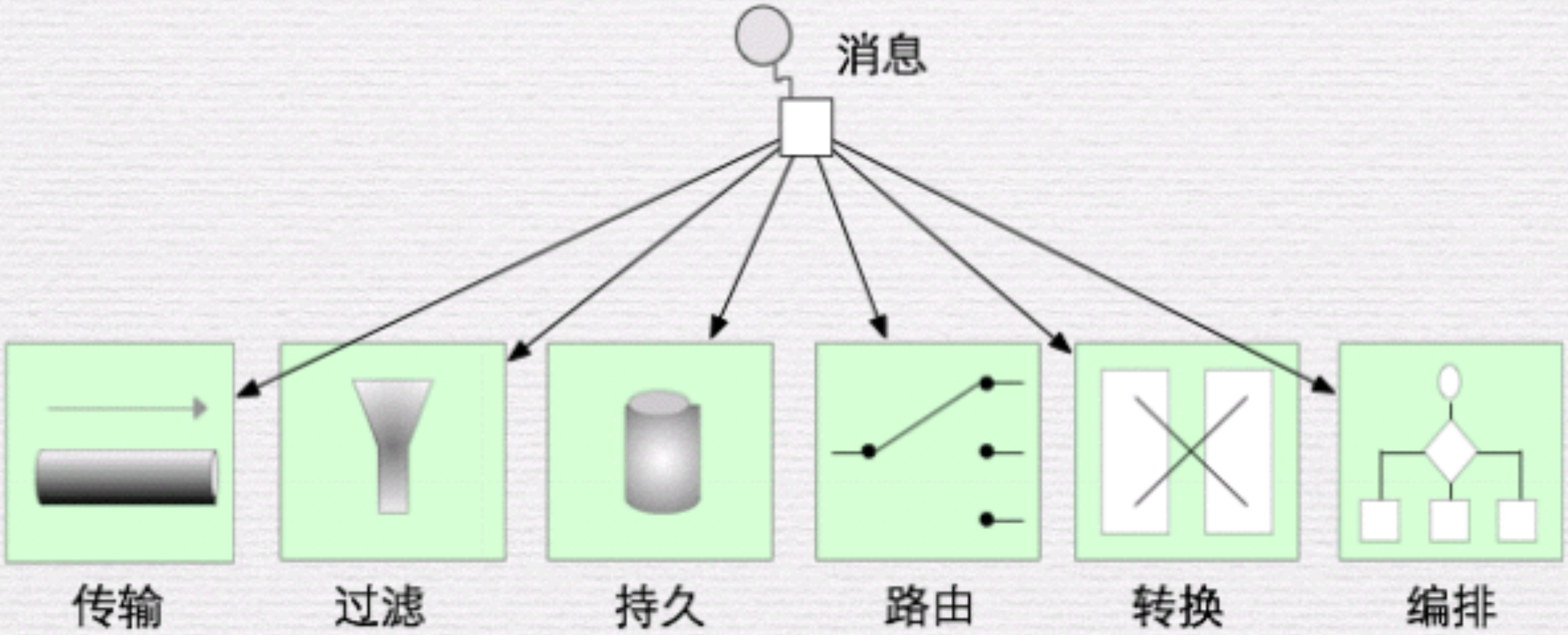
组播（Multicast）

- 问题：分布式的服务如何调用所依赖的服务



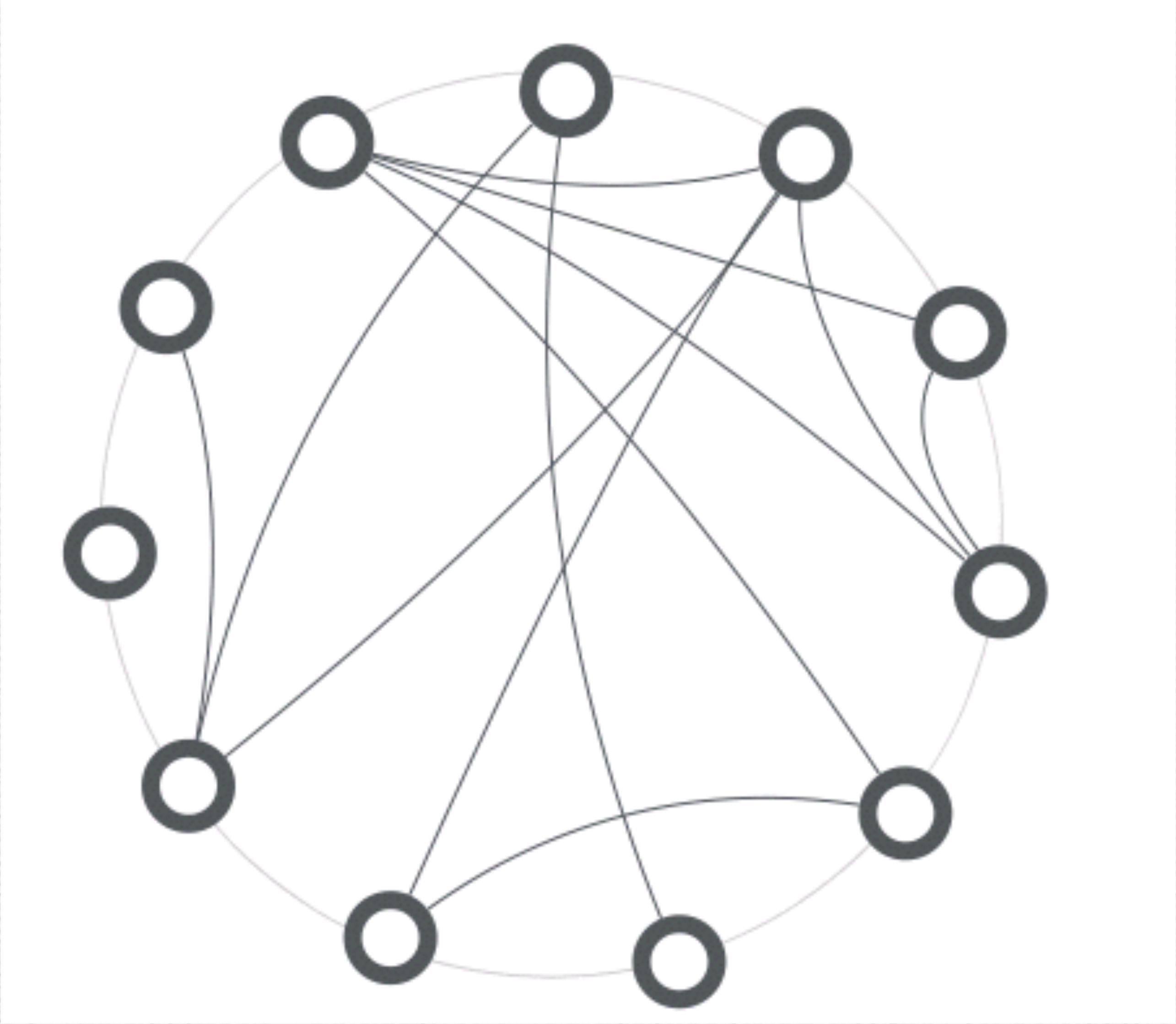
消息中间件





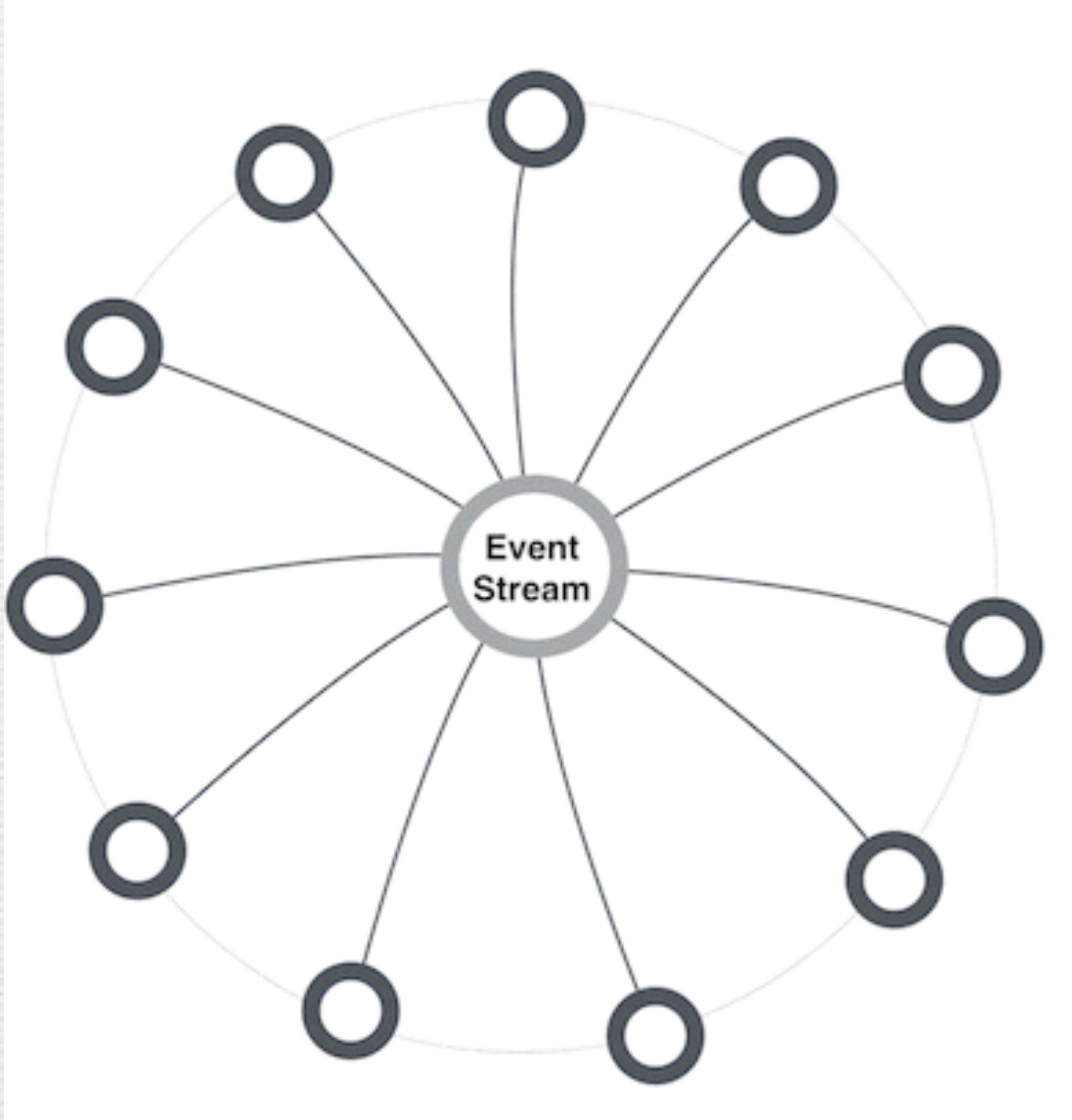
Service Orchestration

- 集中化
- 中心节点

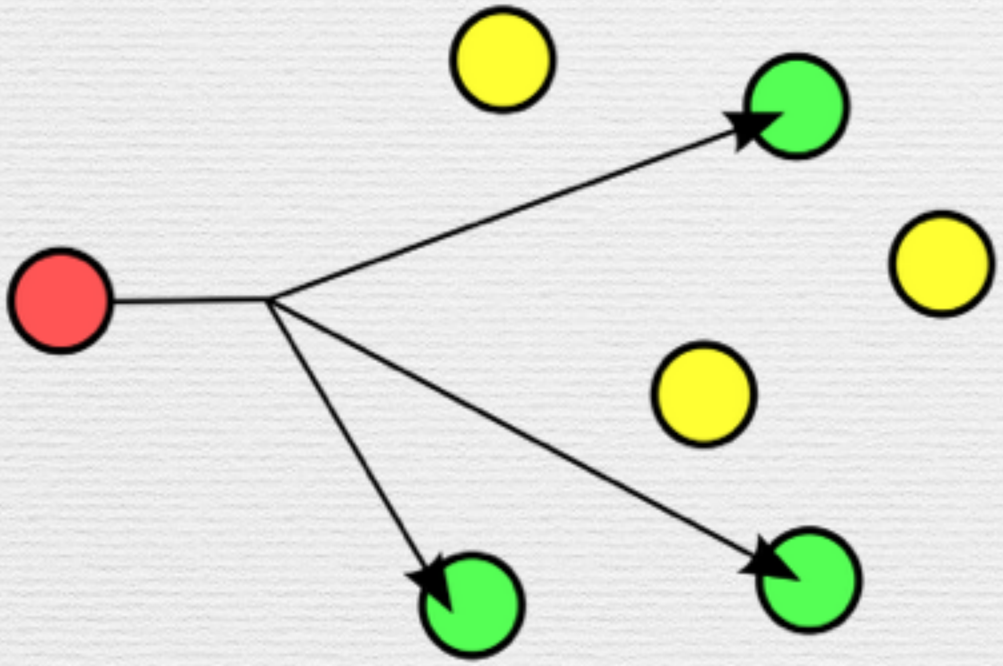


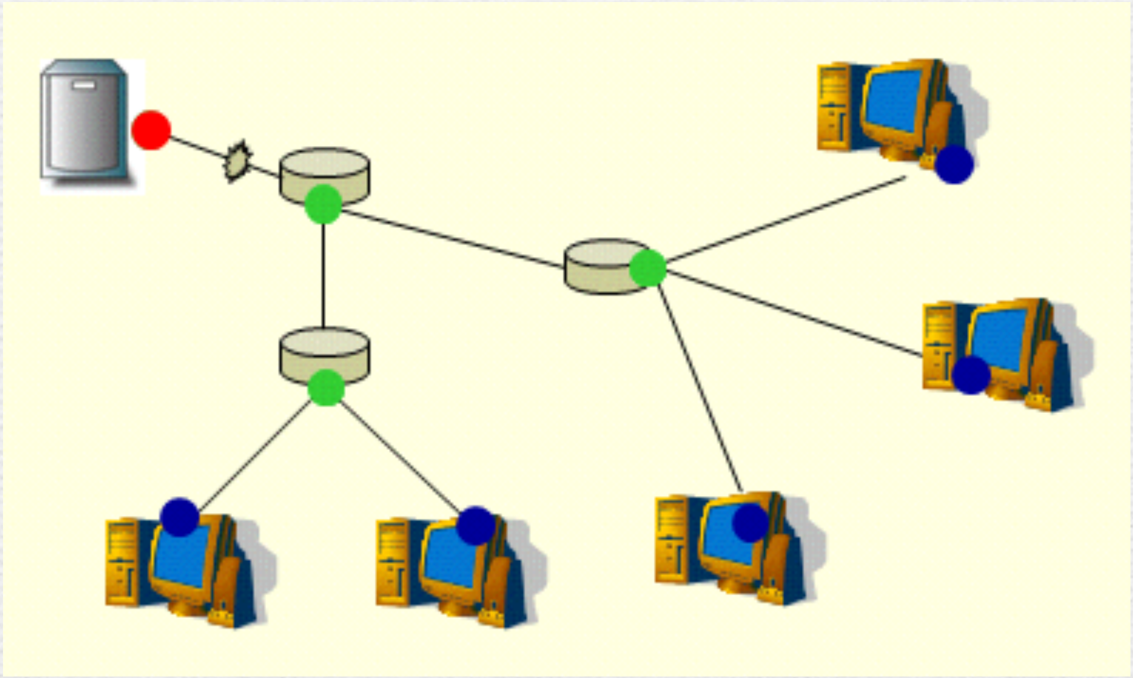
Service choreography

- 事件/消息驱动
- 组播

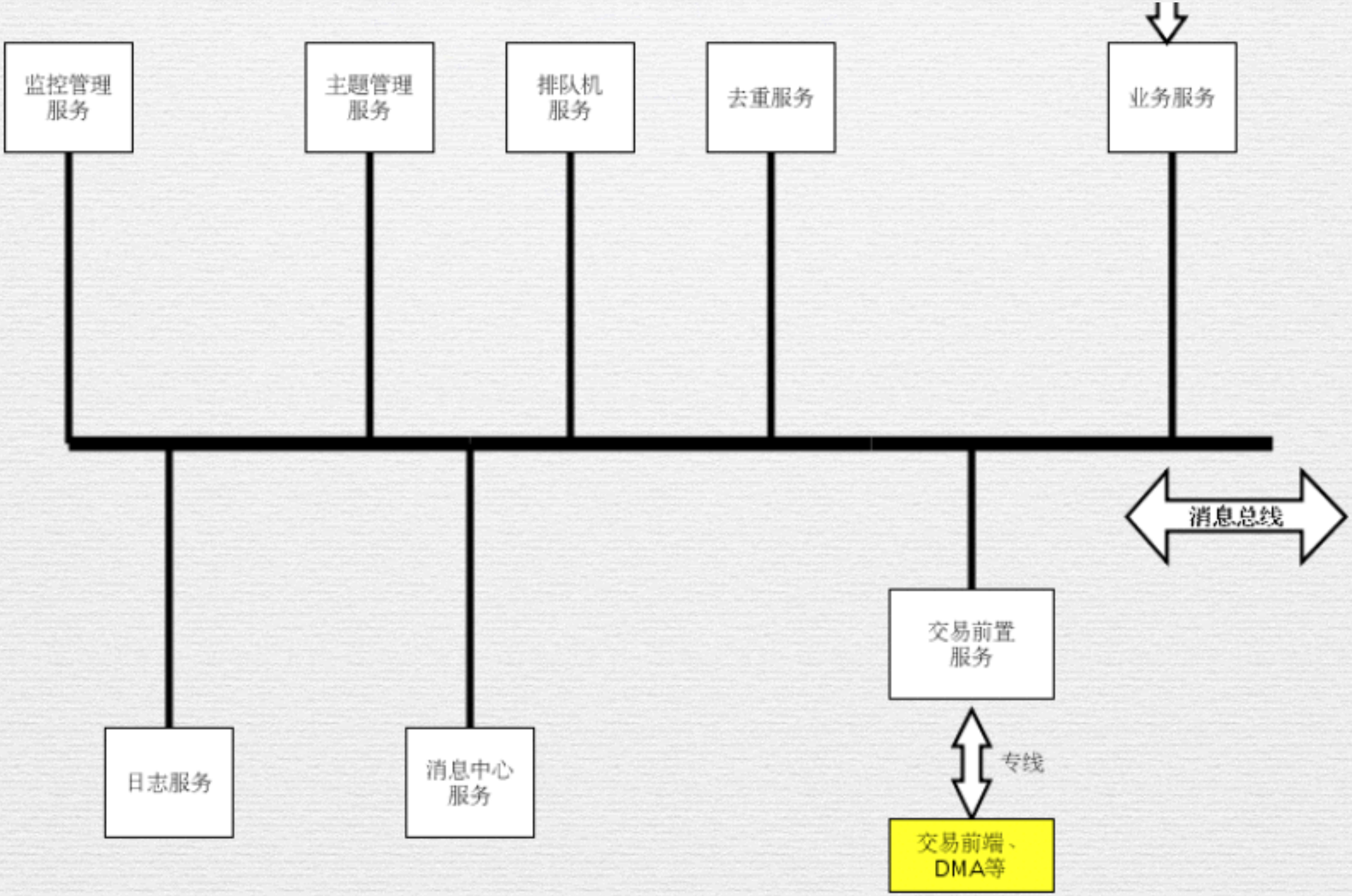


基于组播的服务发现和消息路由



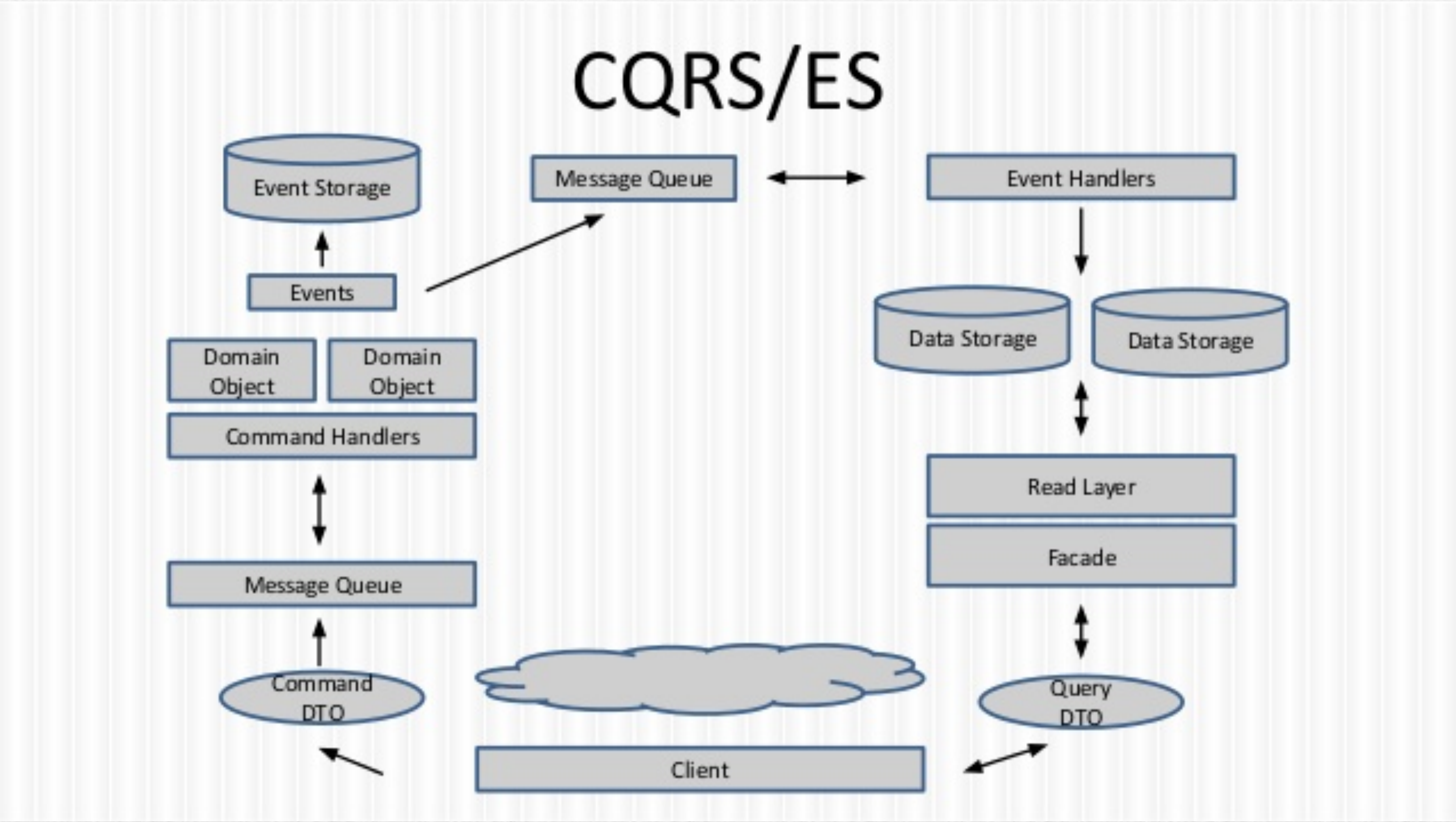


消息总线

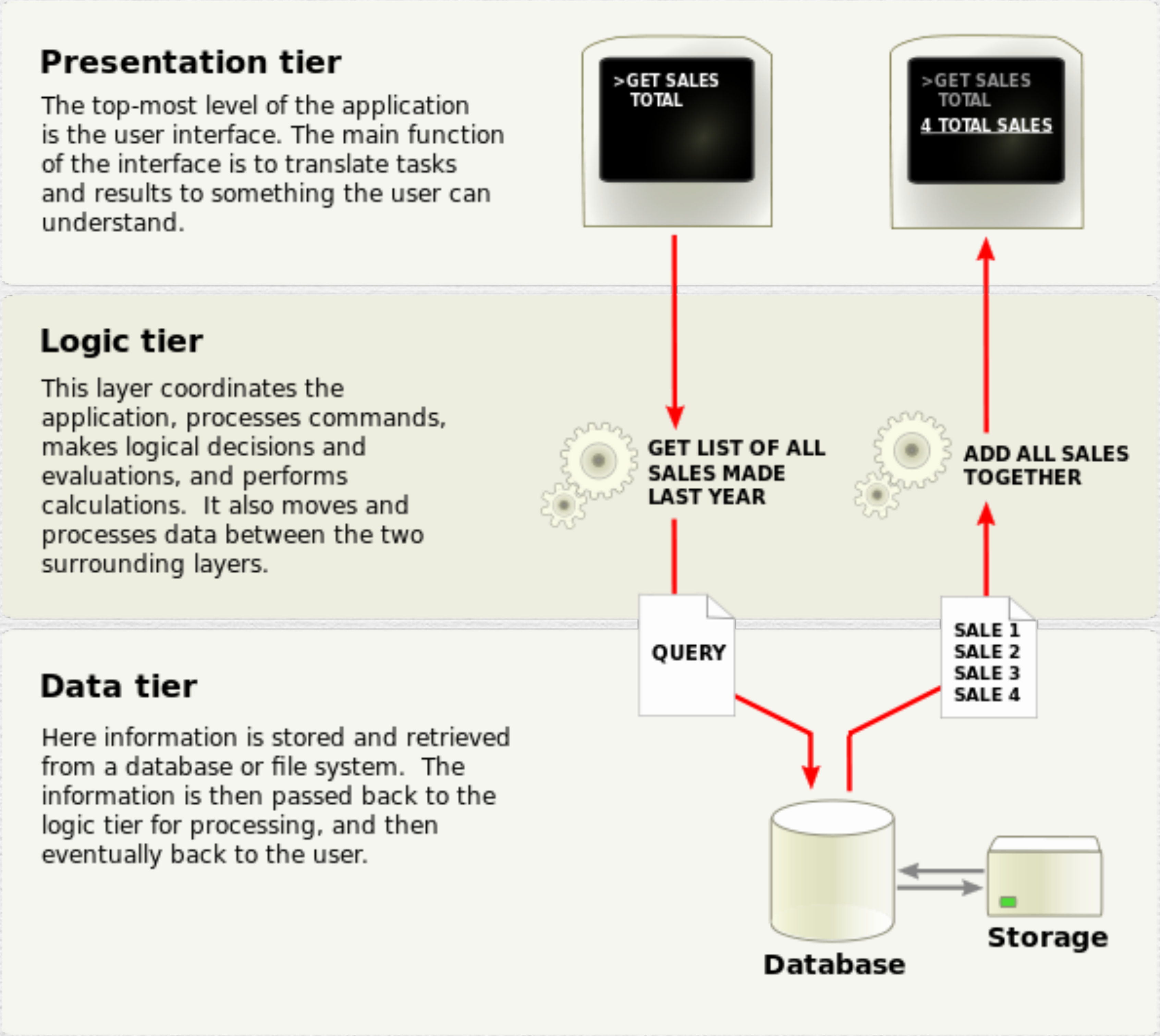

监控管理服务
主题管理服务
排队机服务
去重服务
业务服务
消息总线
日志服务
消息中心服务
交易前置服务
专线
交易前端、DMA等

Event Sourcing Pattern

- 问题：数据强一致前提下的高可用和容错



三层架构



Presentation tier

The top-most level of the application is the user interface. The main function of the interface is to translate tasks and results to something the user can understand.

Logic tier

This layer coordinates the application, processes commands, makes logical decisions and evaluations, and performs calculations. It also moves and processes data between the two surrounding layers.

Data tier

Here information is stored and retrieved from a database or file system. The information is then passed back to the logic tier for processing, and then eventually back to the user.

Event Sourcing

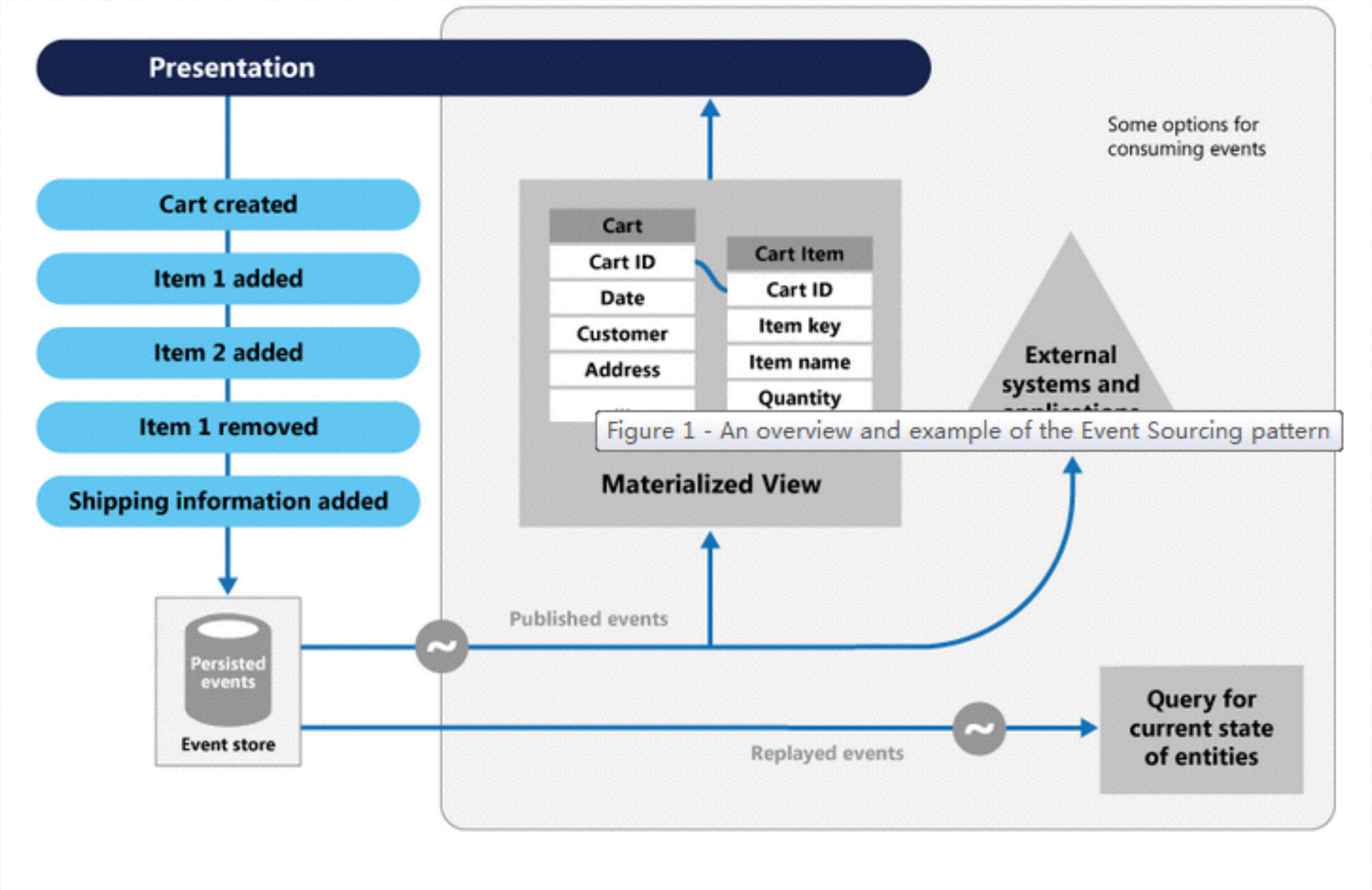
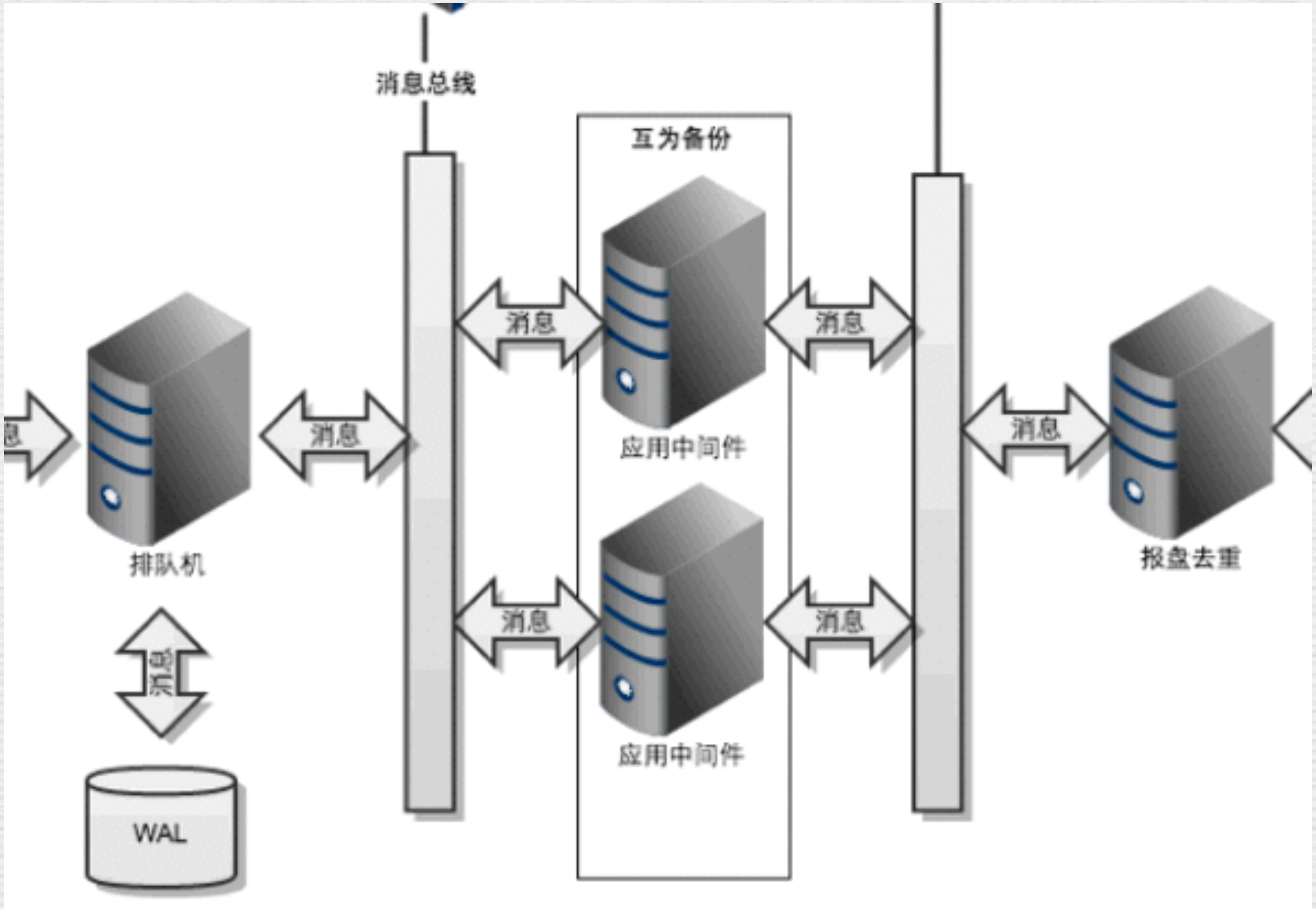
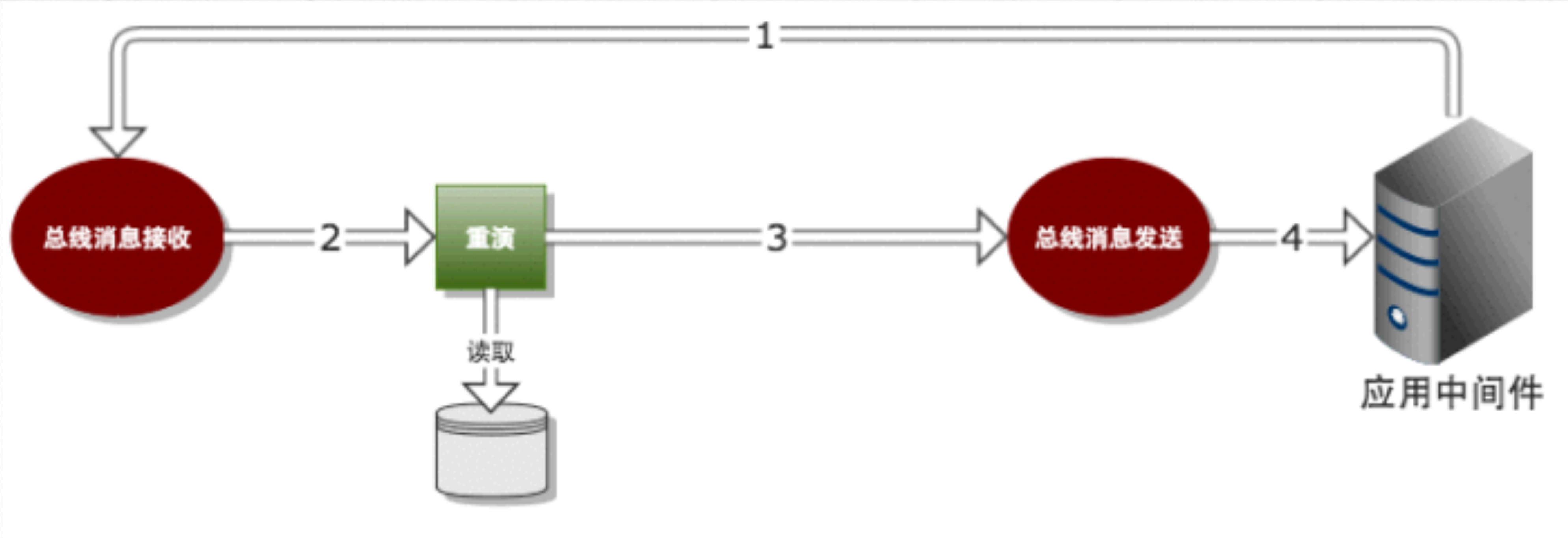


Figure 1 - An overview and example of the Event Sourcing pattern

高可用



失效恢复



1

总线消息接收

2

重演

读取

3

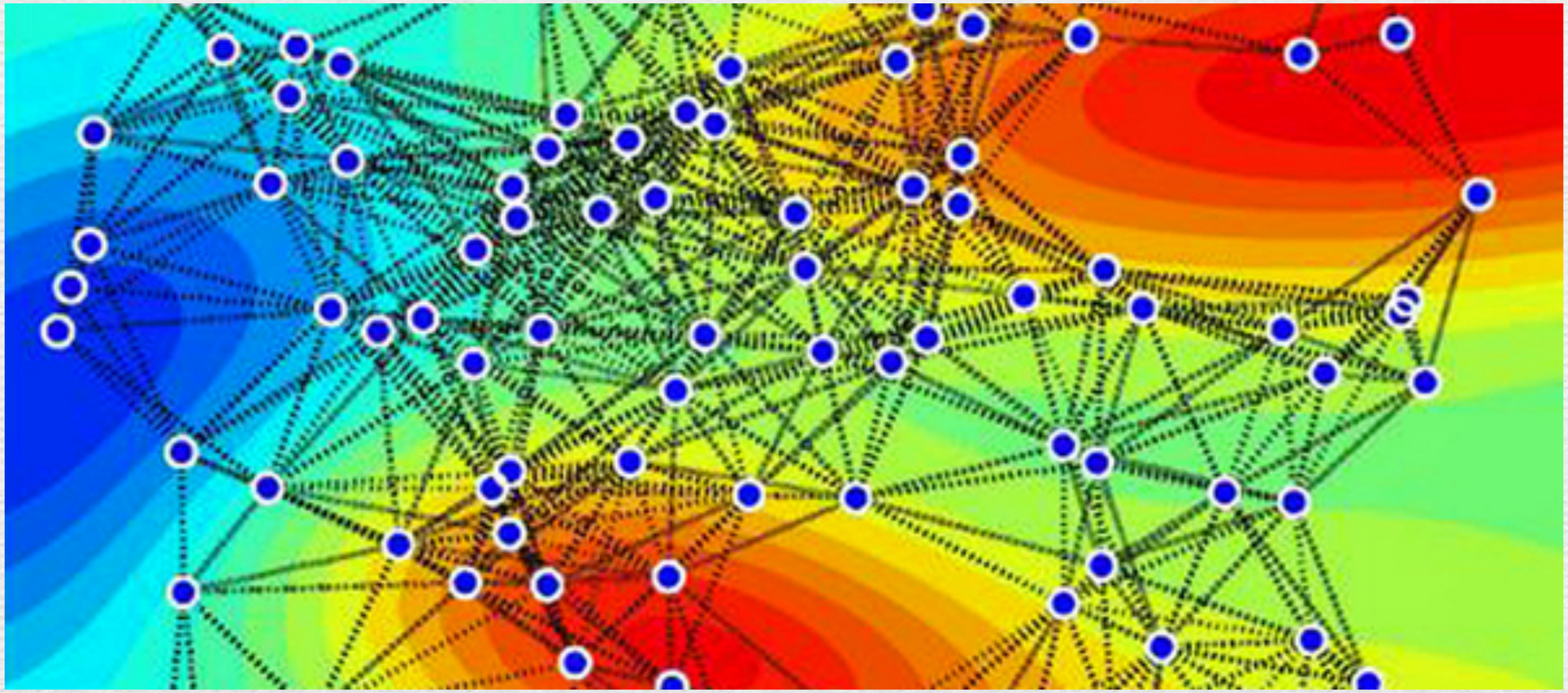
总线消息发送

4

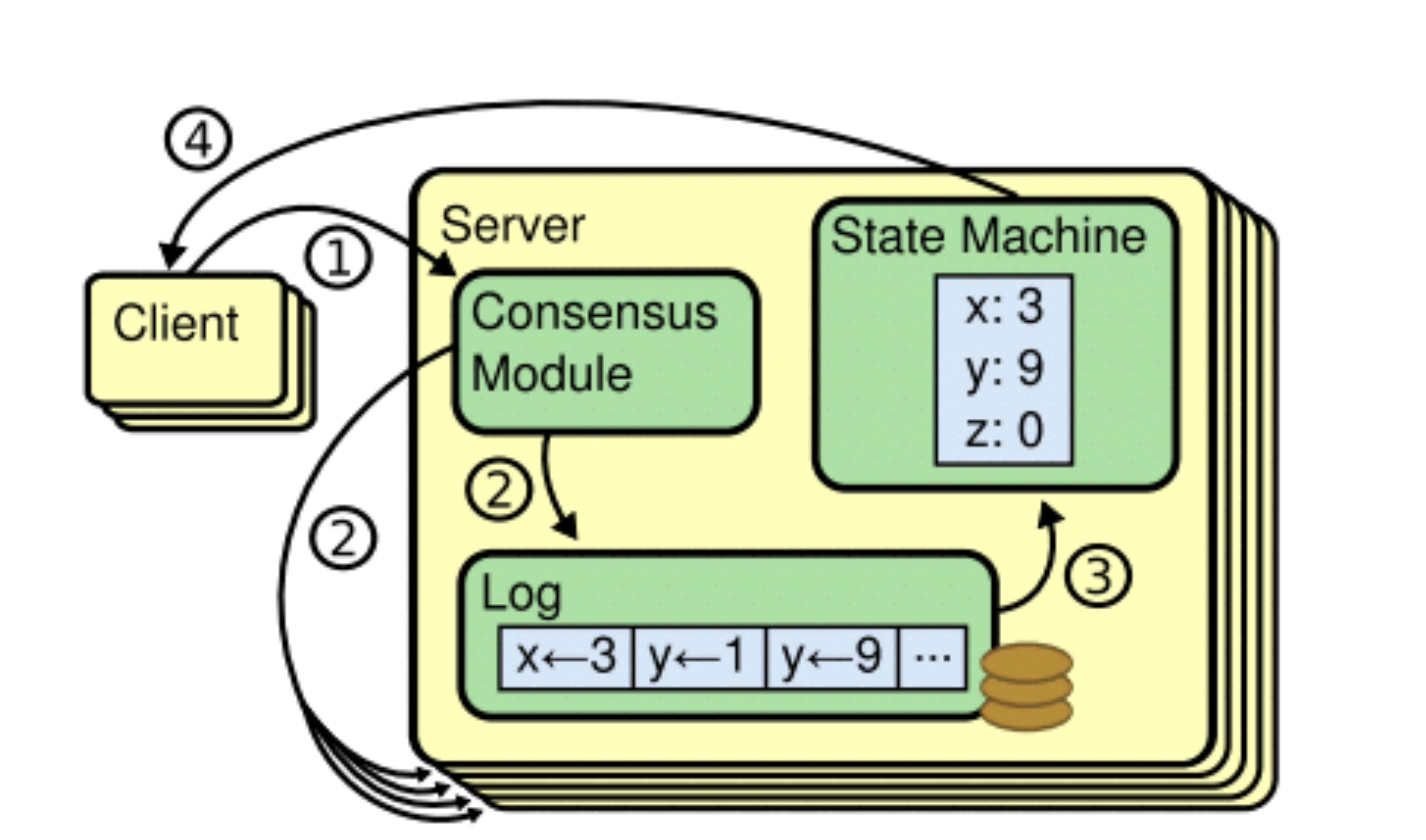
应用中间件

Leader Election Pattern

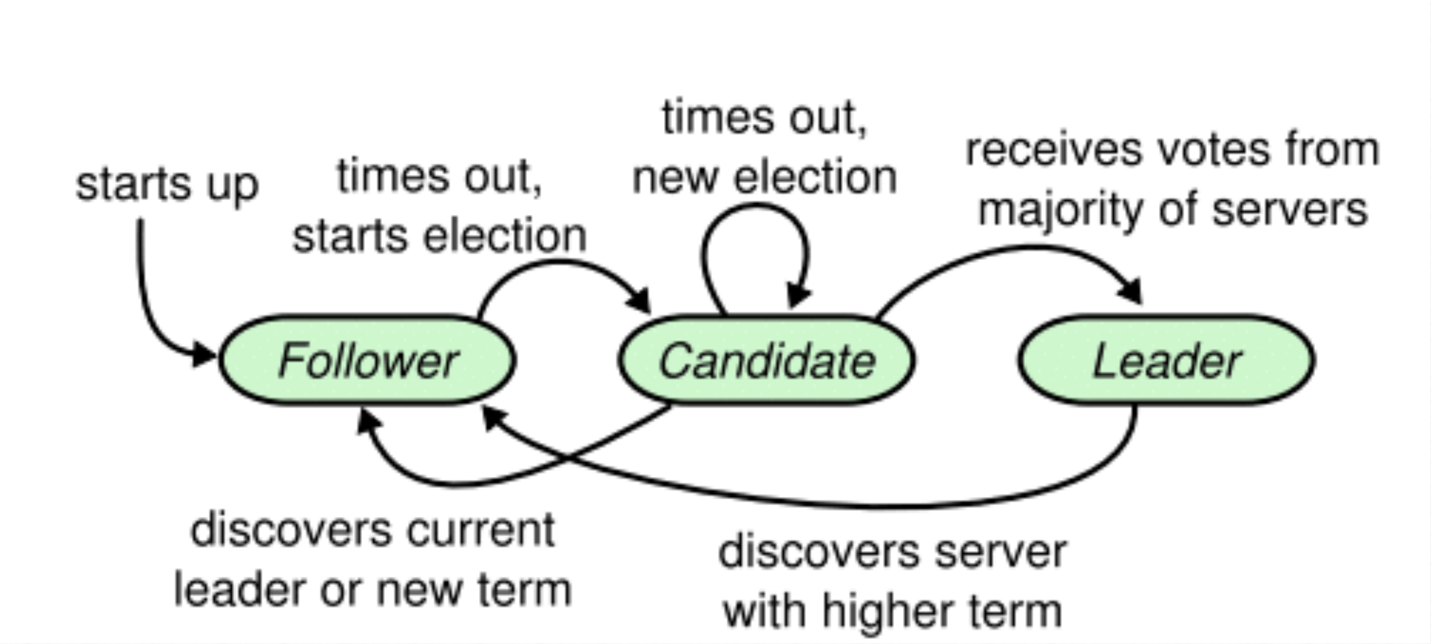
- 问题：排队机自身的高可用容错



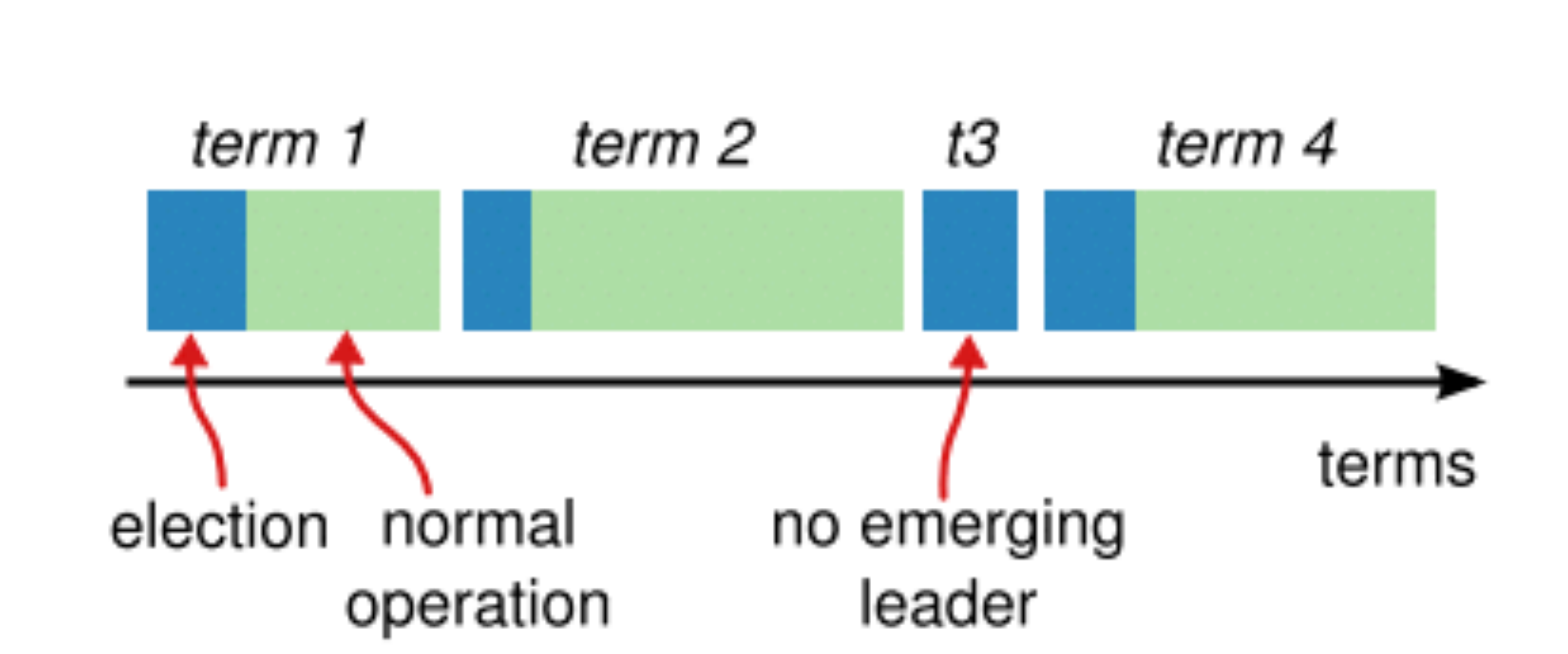
节点一致性


④
①
Client
Server
Consensus Module
②
②
State Machine
x: 3
y: 9
z: 0
Log
x←3
y←1
y←9
...
③

Leader Election

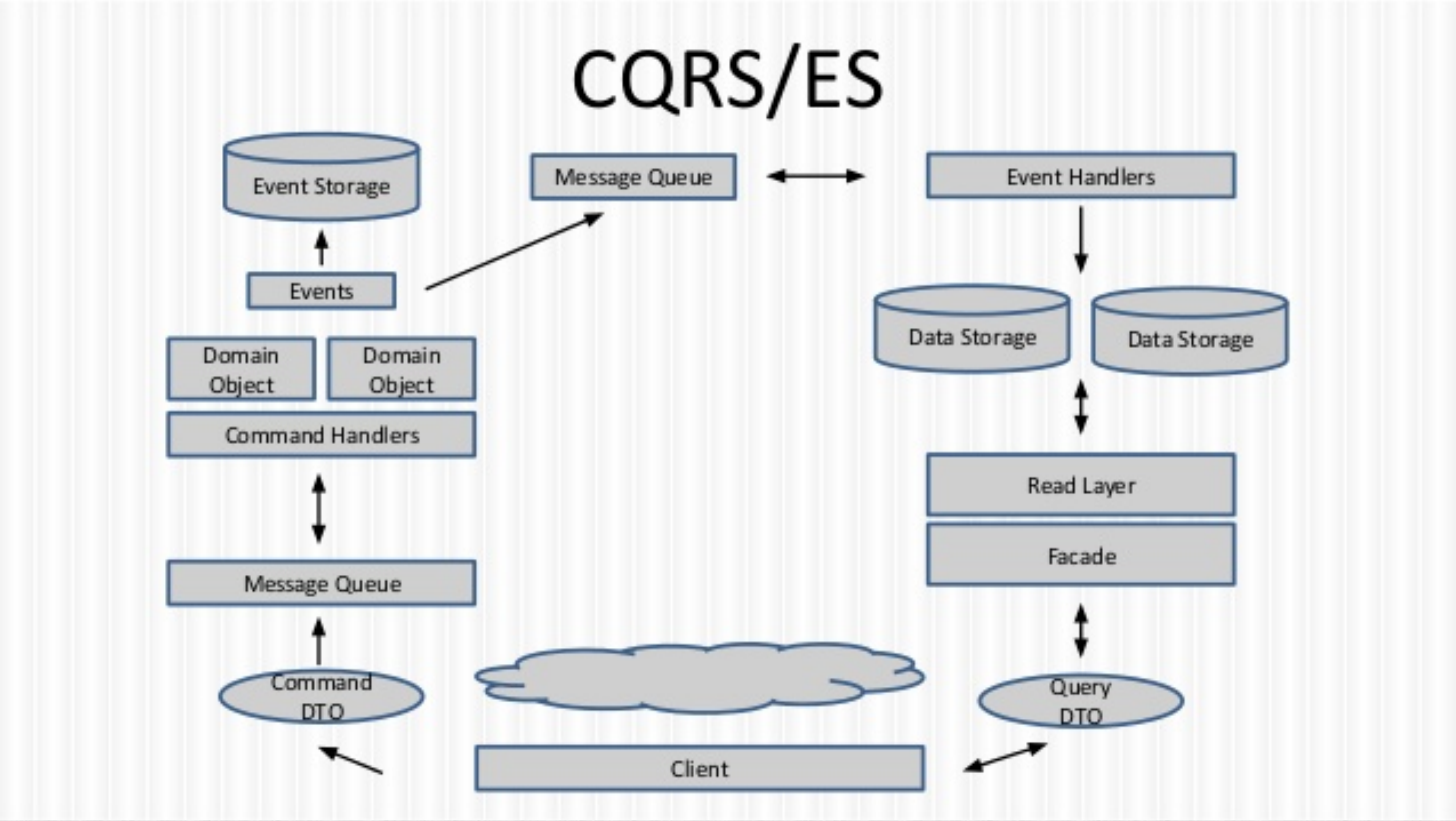


Leader Election

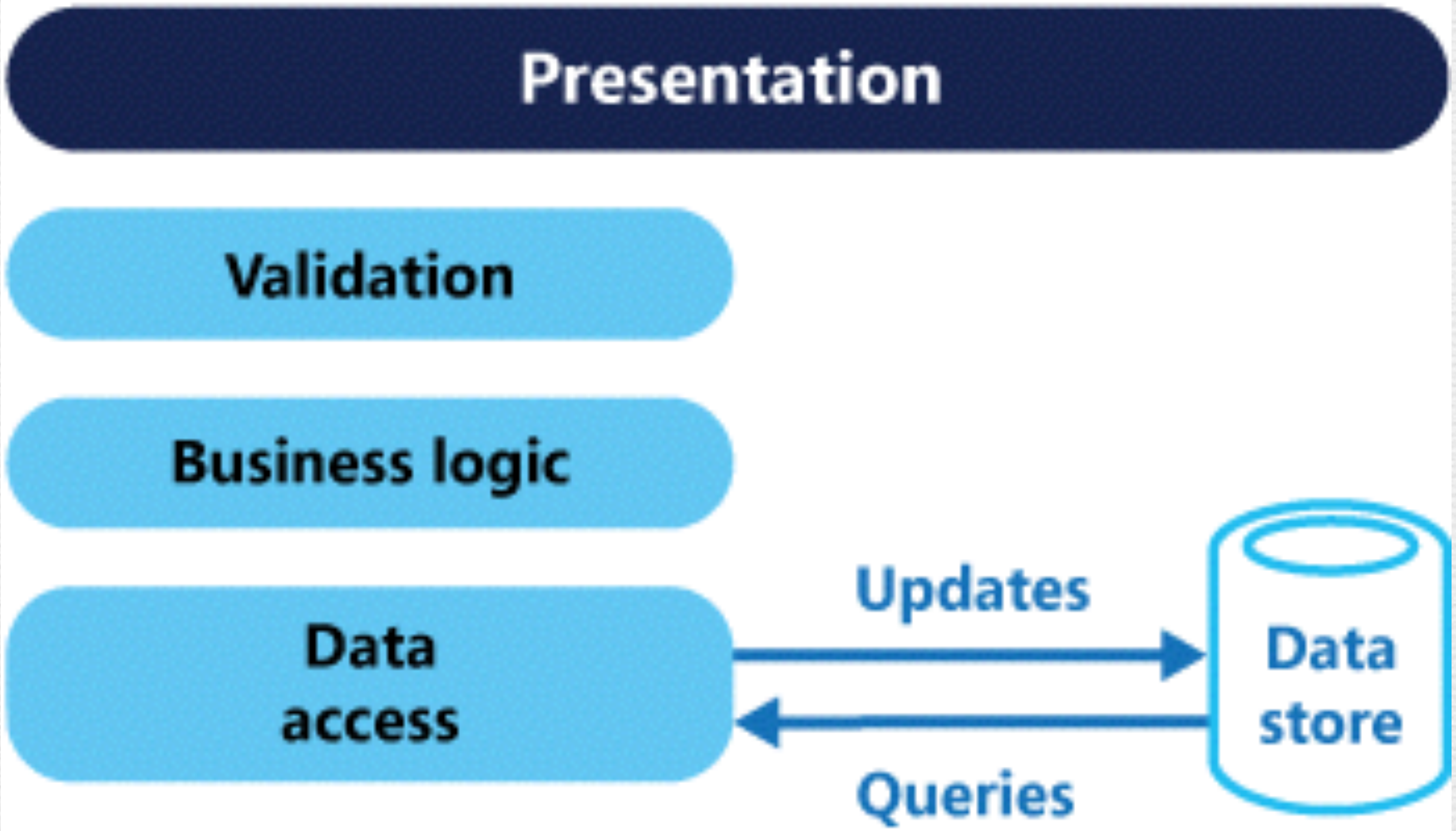


Command Query Responsibility Segregation

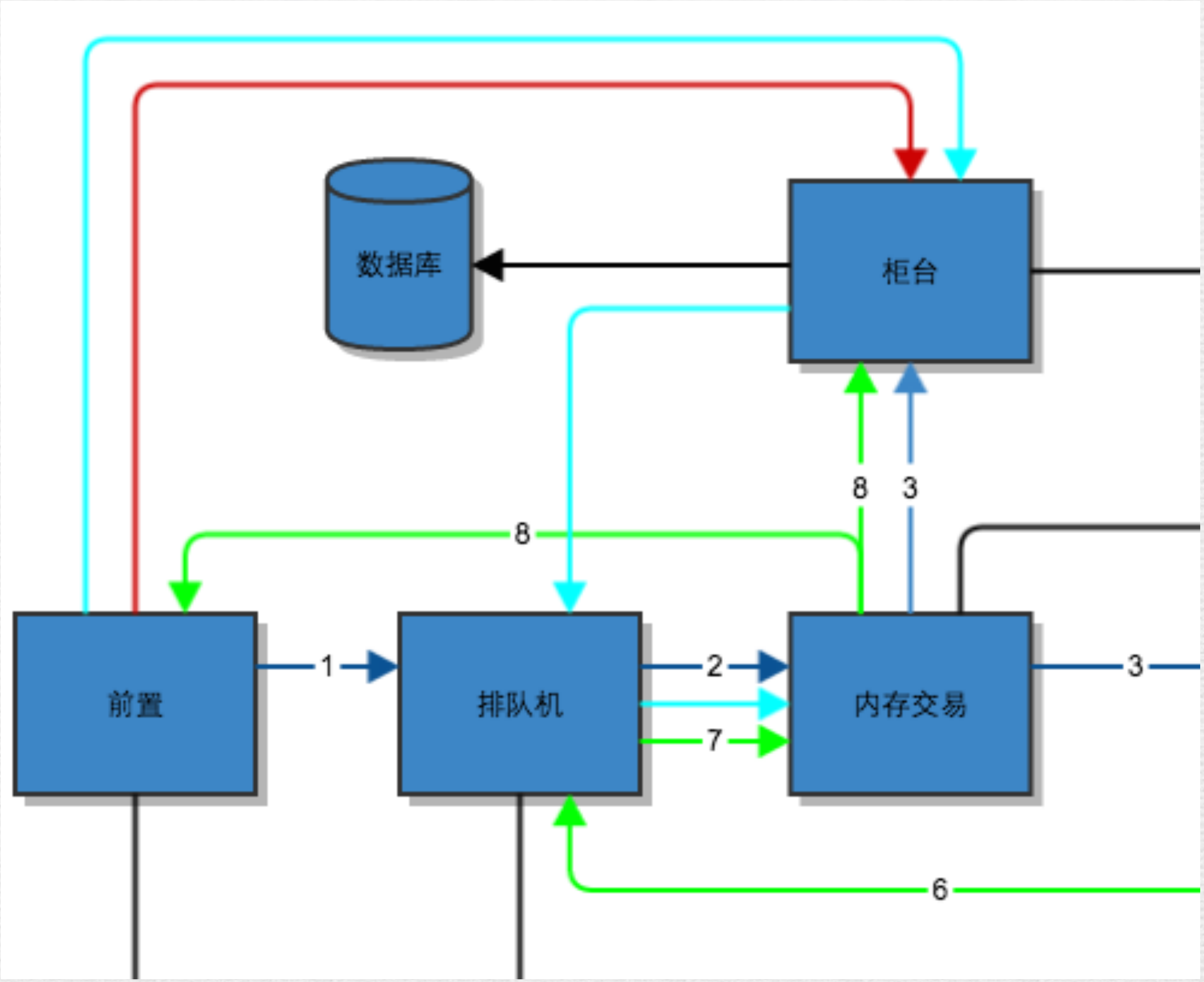
- 问题：如何解耦大量耗时的查询请求与写命令



多层架构

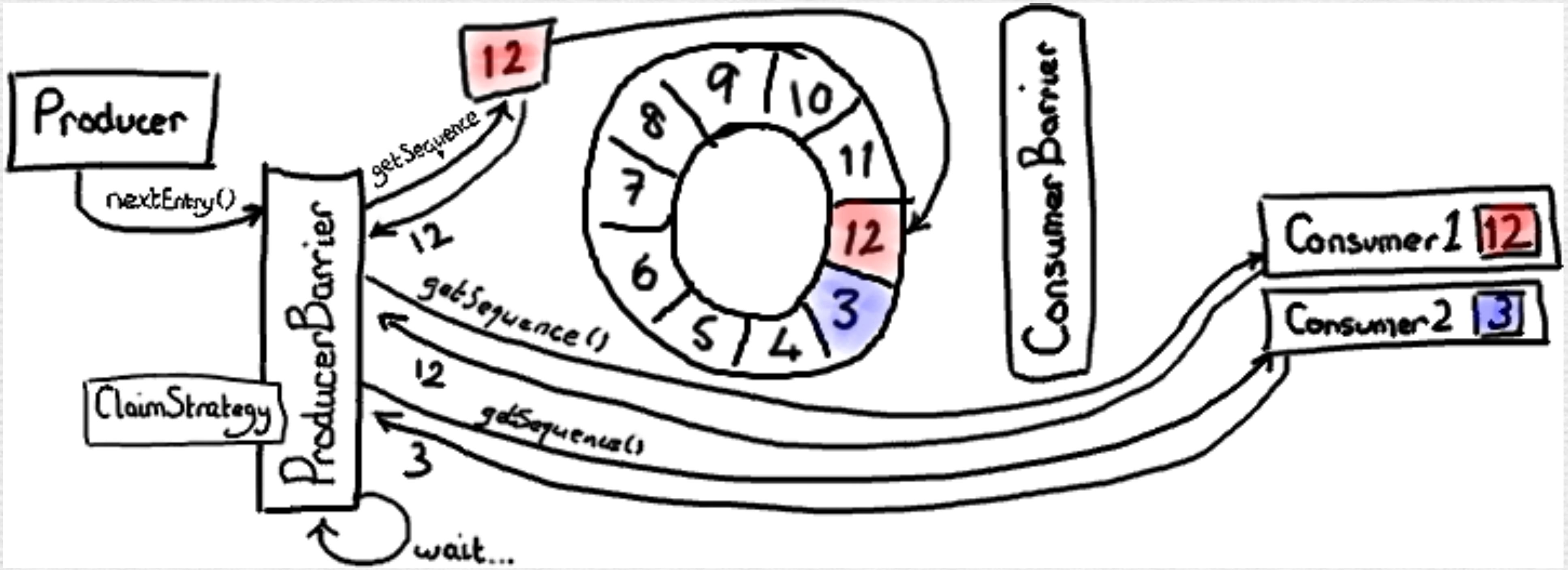

Presentation
Validation
Business logic
Data access
Updates
Queries
Data store

示例

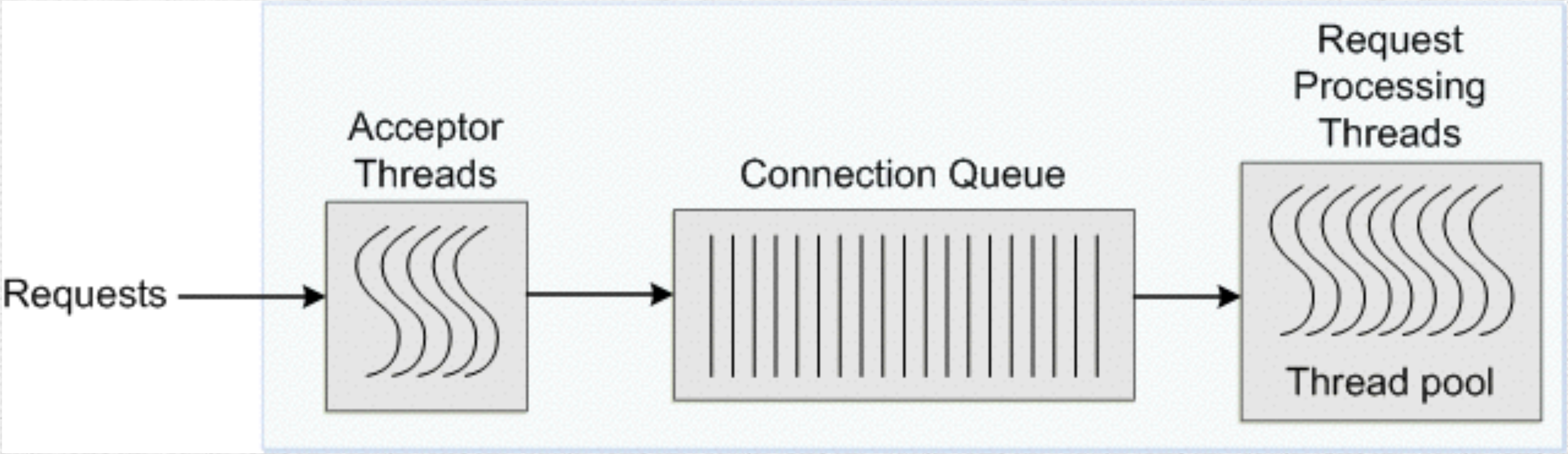


Disruptor & RingBuffer

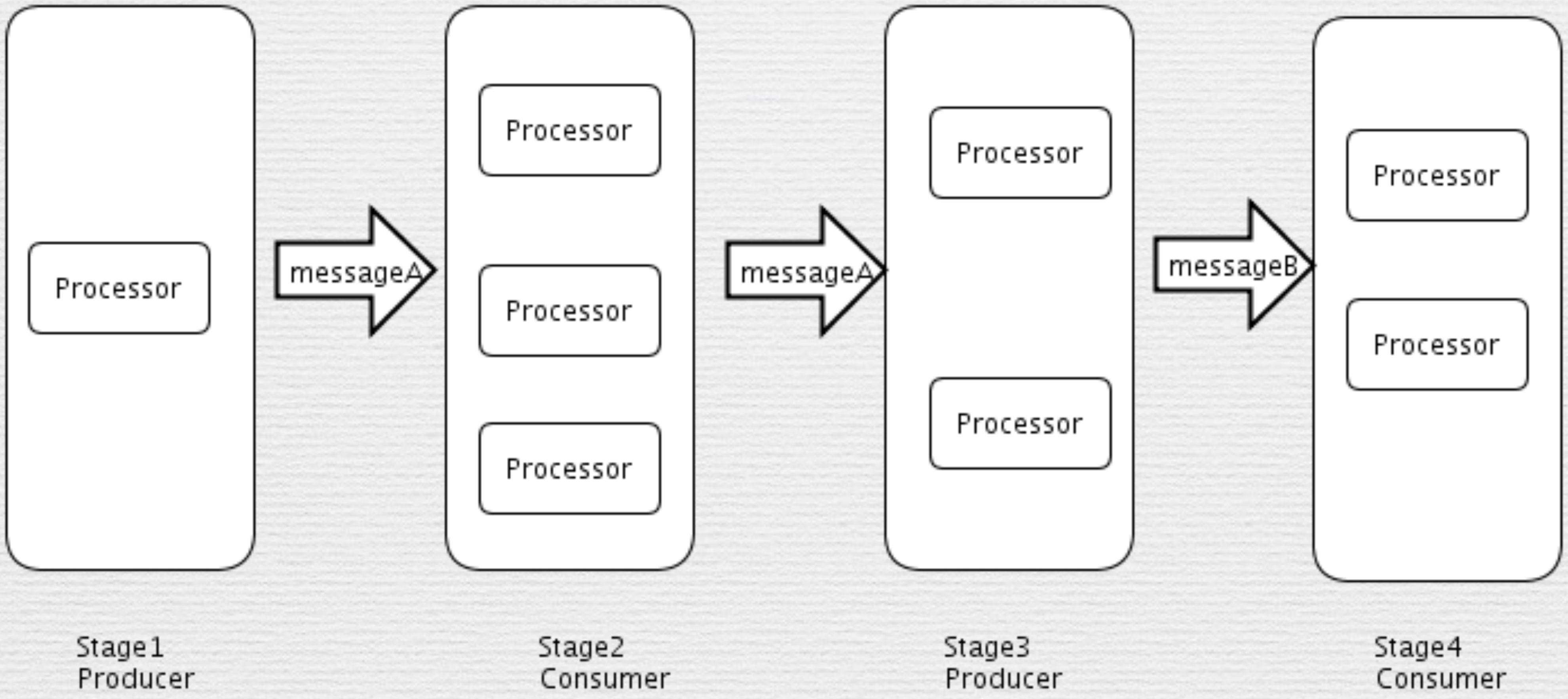
- 问题：线程间无锁快速通信，避免并发



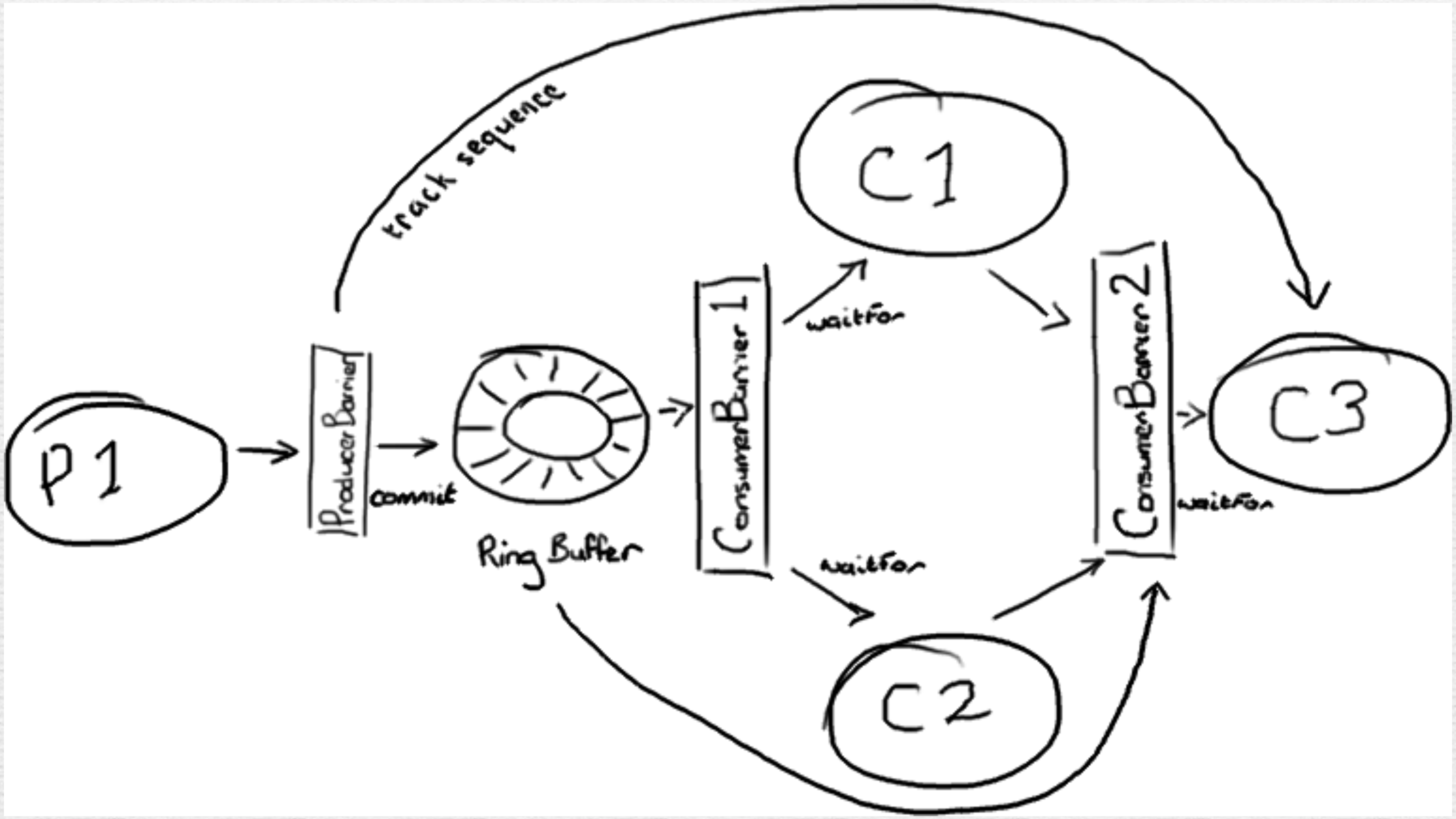
线程池


Requests
Acceptor Threads
Connection Queue
Request Processing Threads
Thread pool

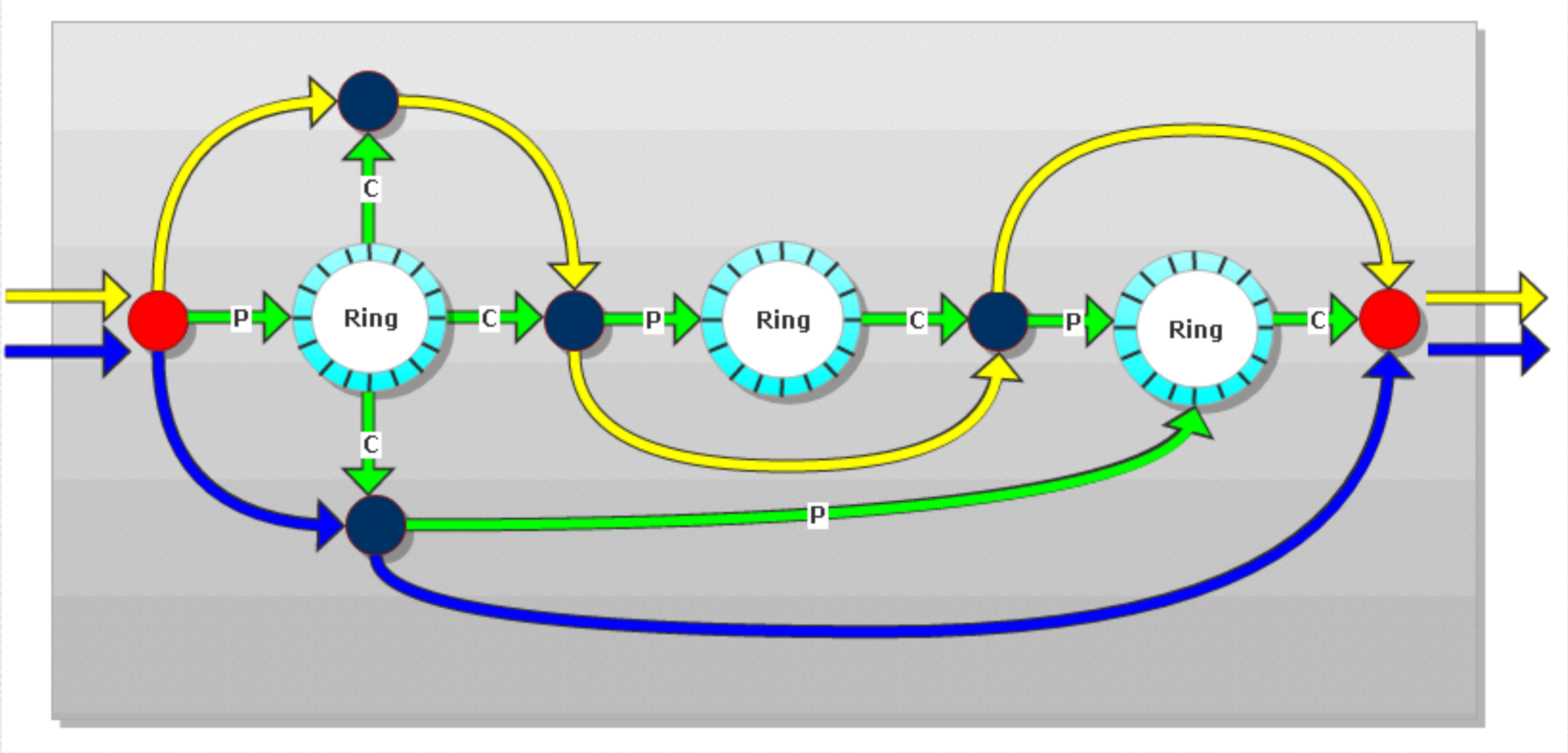
队列


Processor
messageA
Processor
Processor
Processor
messageA
Processor
Processor
messageB
Processor
Processor
Stage1
Producer
Stage2
Consumer
Stage3
Producer
Stage4
Consumer

LMAX Disruptor

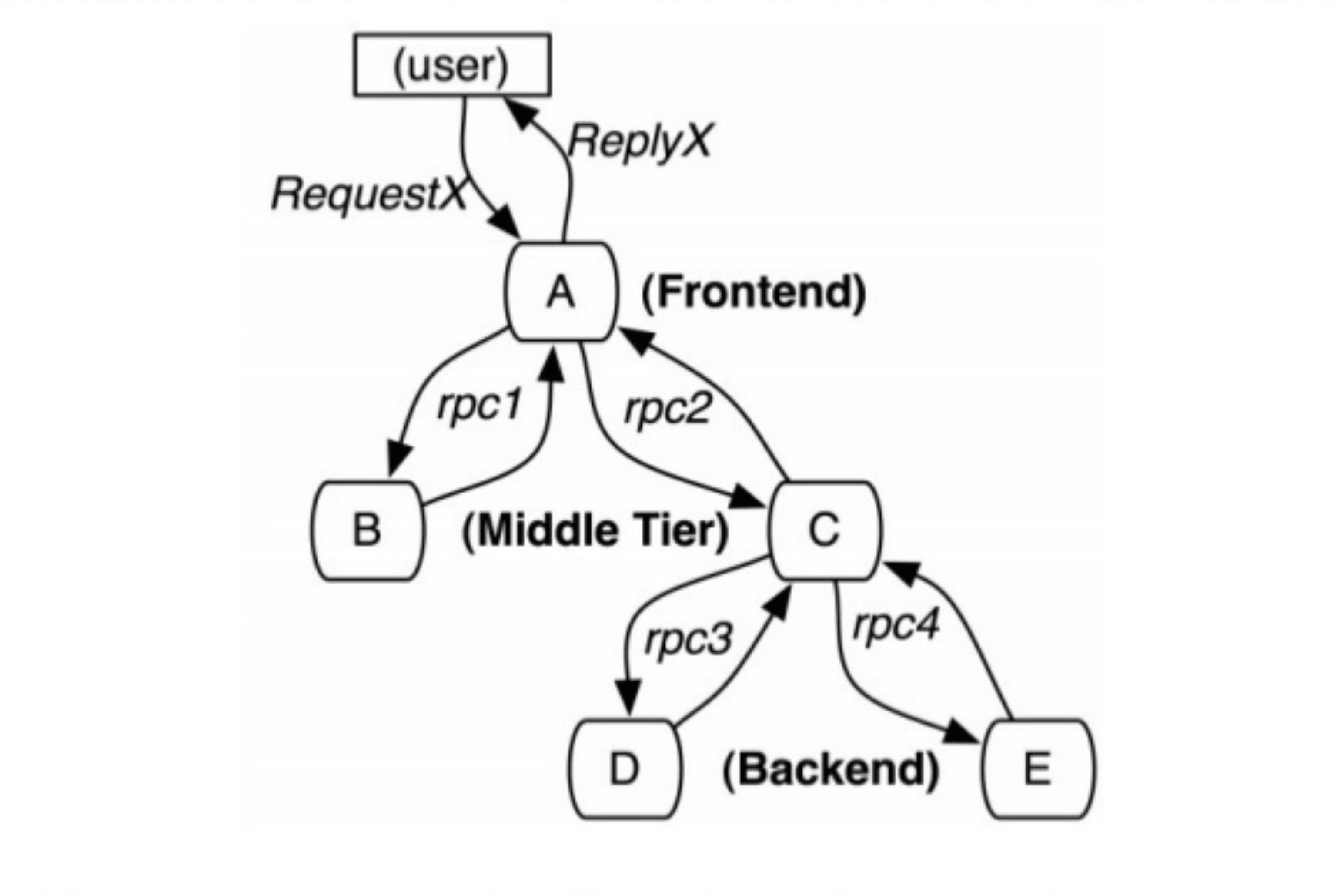


RingBuffer

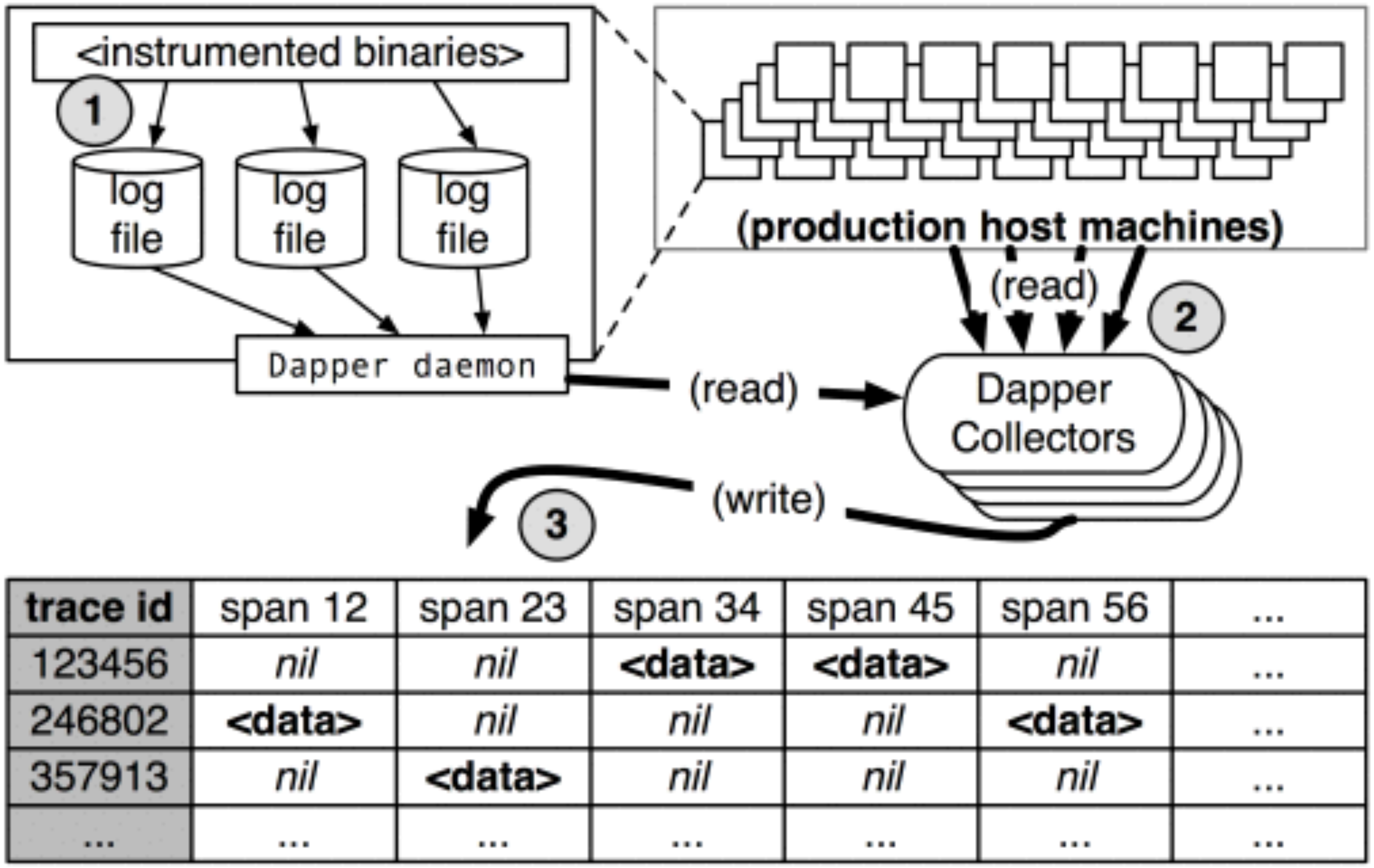


Distributed Tracing

- 问题：分布式系统如何调试，监控系统健康状态



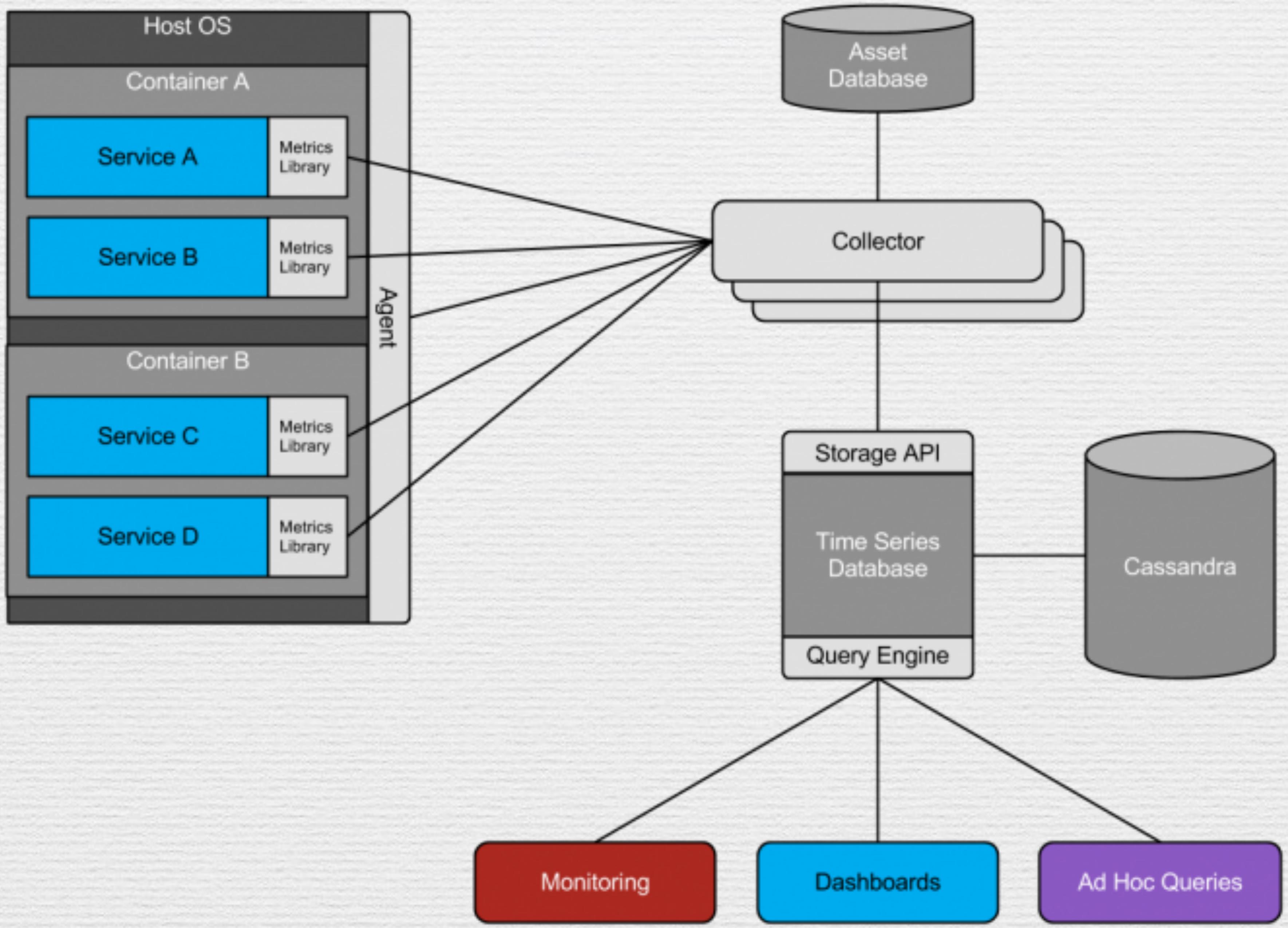
Google Dapper



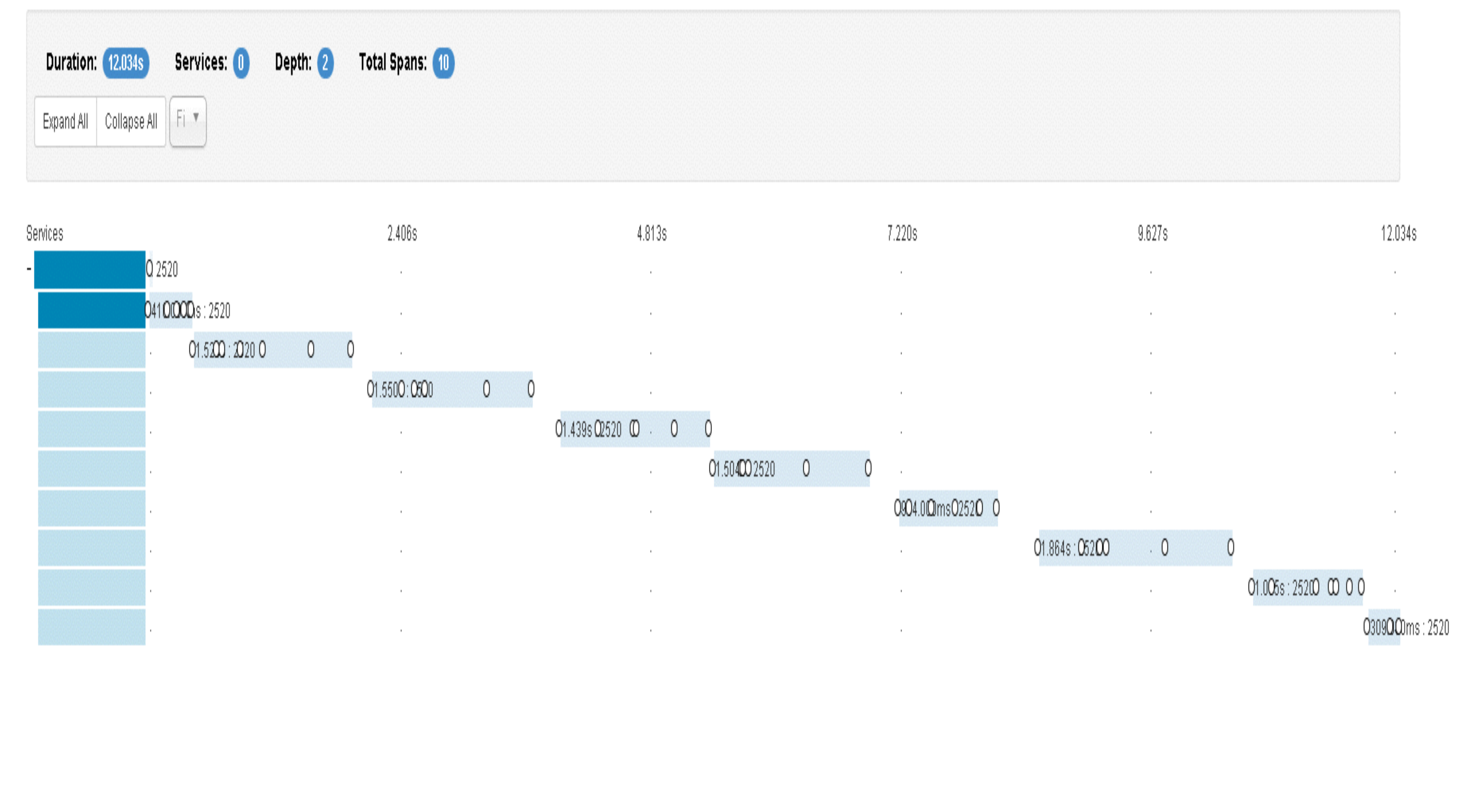
trace id	span 12	span 23	span 34	span 45	span 56	...
123456	*nil*	*nil*	**<data>**	**<data>**	*nil*	...
246802	**<data>**	*nil*	*nil*	*nil*	**<data>**	...
357913	*nil*	**<data>**	*nil*	*nil*	*nil*	...
...	...	...	...	...	...	...

(Central Bigtable repository for trace data)

Zipkin


Host OS
Container A
Service A
Metrics Library
Service B
Metrics Library
Container B
Service C
Metrics Library
Service D
Metrics Library
Agent
Asset Database
Collector
Storage API
Time Series Database
Query Engine
Cassandra
Monitoring
Dashboards
Ad Hoc Queries

Zipkin



Duration: 12.034s Services: 0 Depth: 2 Total Spans: 10

Thanks

- http://developer.gf.com.cn