Cloud Design Patterns

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Design Patterns

A generally reusable solution to a recurring problem

- A template to solve the problem
- Best practices in approaching the problem
- Improve developer communication

Cloud Application Development Issues

Availability

- The guaranteed proportion of time that the system is functional

SLA – Service Level Agreement

Availability (%)	Downtime per year
99	3.7 days
99.9	9 hours
99.95	4.4 hours
99.99	1 hour
99.999	5 minutes

Cloud Application Development Issues

Data Management

- Typically hosted in different locations and across multiple servers for performance, scalability and availability
- Maintaining consistency and synchronizing

Design and Implementation

- Consistent and coherent component design
- Improves ease of deployment and maintenance
- Reusability of components

Cloud Application Development Issues

- Messaging
  - Messaging infrastructure to connect distributed components and services
  - Asynchronous messaging
- Design and Implementation
  - Consistent and coherent component design
  - Improves ease of deployment and maintenance
  - Reusability of components

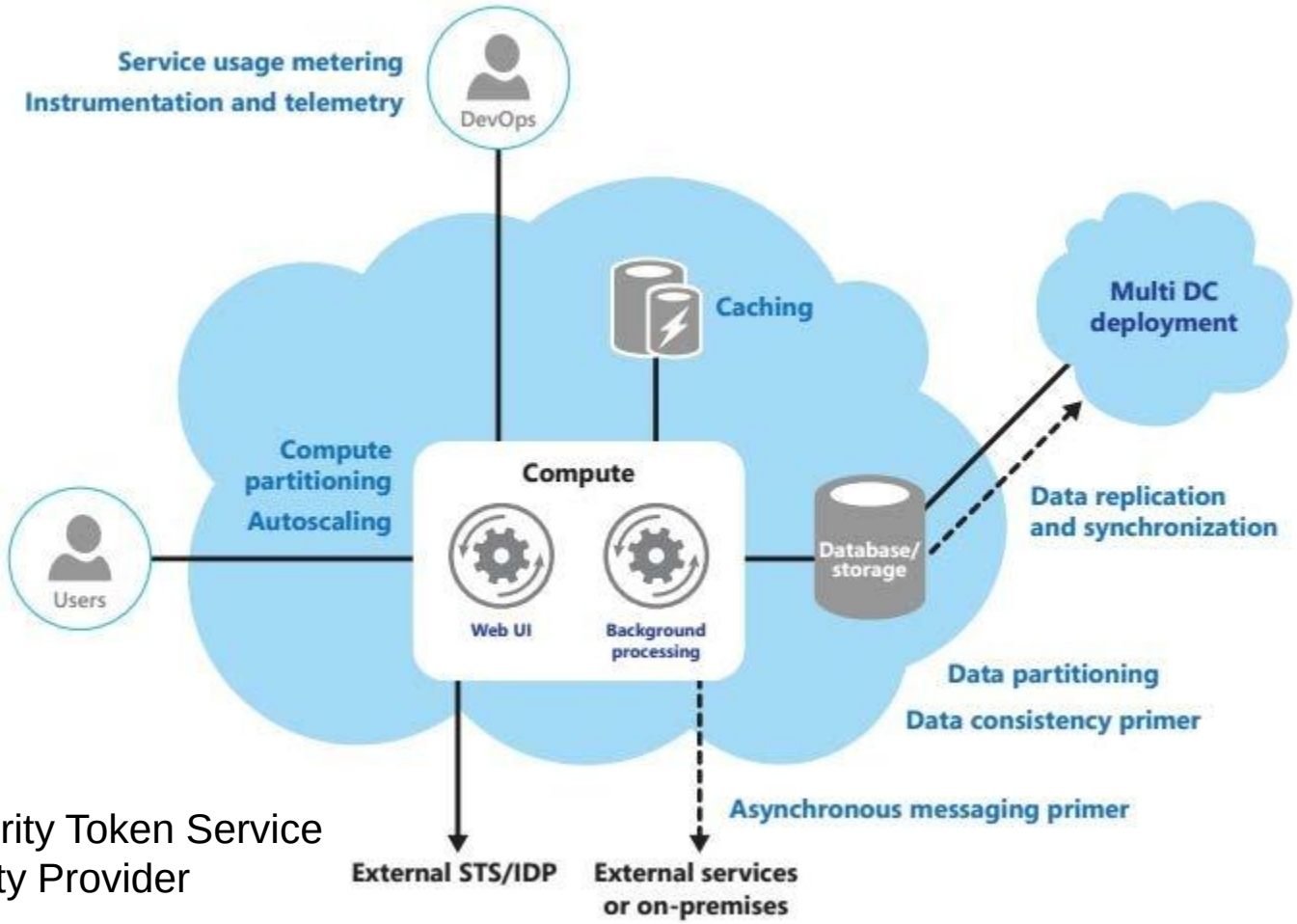
Cloud Application Development Issues

- Management and Monitoring
  - Cloud applications run in in a remote servers with limited control
- Performance and Scalability
  - Responsiveness of a system to execute any action within a given time interval
  - Handle increases in load without impact on performance
  - How to handle variable workloads?

Cloud Application Development Issues

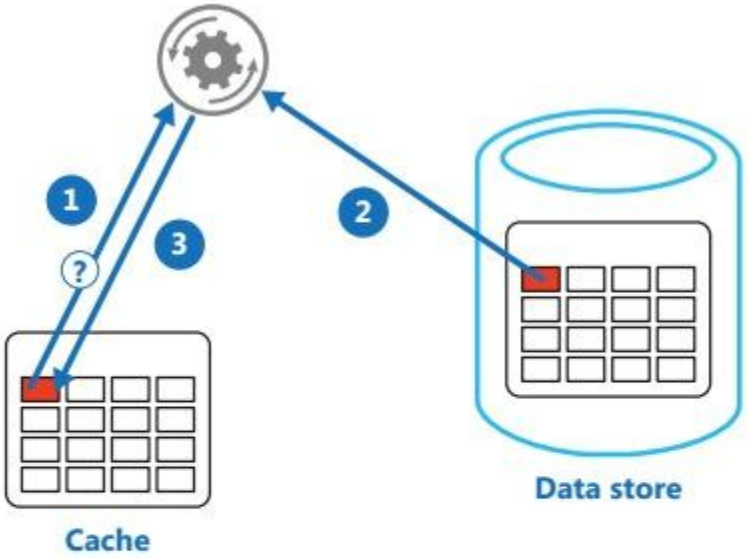
- Resiliency
  - Ability of the application to gracefully handle and recover from failures
  - Applications are more prone to failure in cloud environments
- Security
  - Prevent malicious or accidental actions outside of the designed usage
  - Prevent disclosure or loss of information

High-Level Model



STS – Security Token Service
IDP – Identity Provider

Cache-Aside Pattern



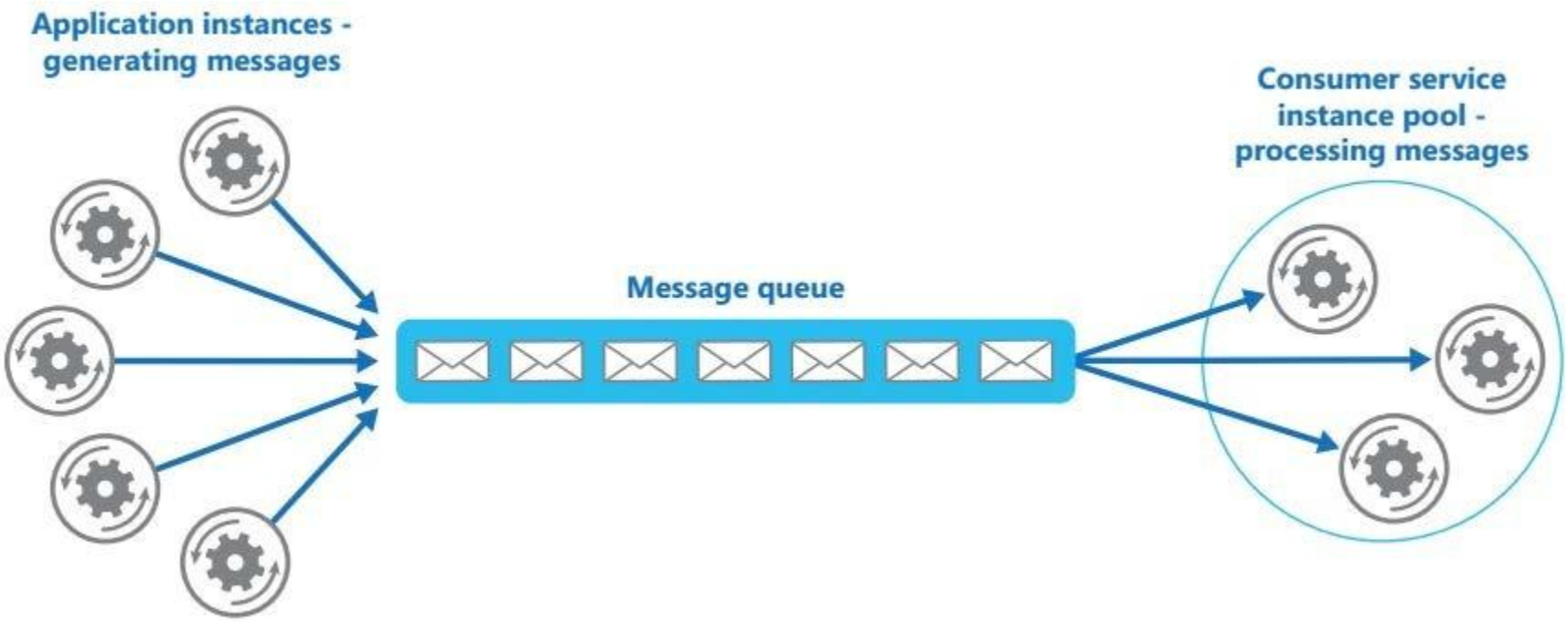
1: Determine whether the item is currently held in the cache.
2: If the item is not currently in the cache, read the item from the data store.
3: Store a copy of the item in the cache.

- Load on demand data into a cache from a data store
- Pros
  - Increased performance
- Cons
  - Maintaining consistency between data in cache & data in underlying data store
- Solutions
  - Azure Cache AWS ElastiCache
  - Google App Engine memcache
  - Redis Cache
  -

Cache-Aside Pattern (Cont.)

- When
  - Read/write performance
- Parameters
  - What to cache
  - Lifetime of cached data
  - Cache size
  - Evicting data In Memory
  - Caching

Competing Consumers Pattern



- Multiple concurrent consumers to process messages received on same channel
- Goals
  - Optimize throughput, improve scalability & availability, load balancing

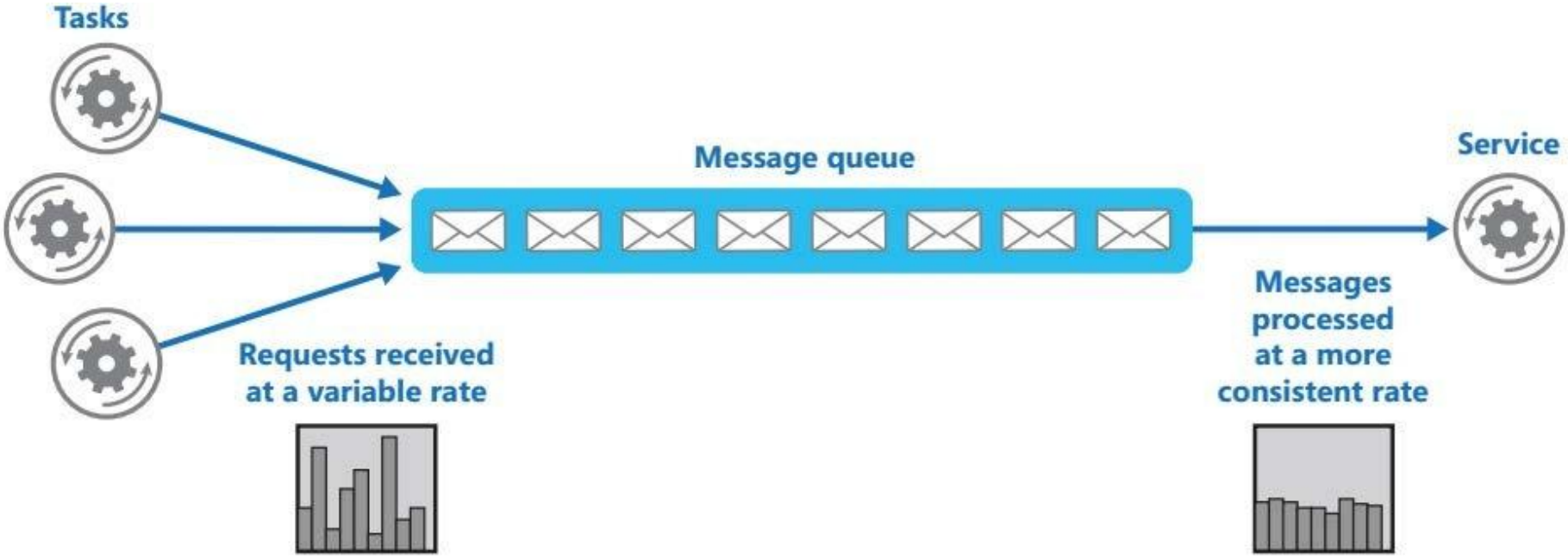
Competing Consumers Pattern (Cont.)

- When
  - Independent tasks that can be processed parallel
  - Volume of work is highly variable
  - High availability

Competing Consumers Pattern (Cont.)

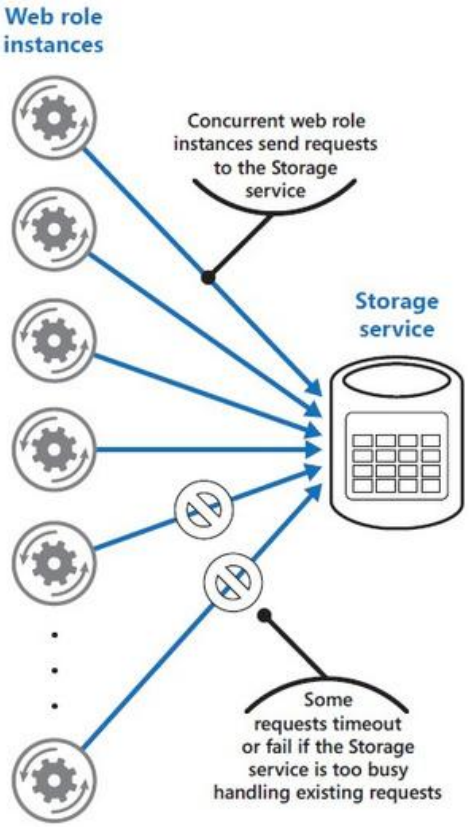
- Parameters
  - Queue size
  - Scaling
  - Not loosing messages
  - Preserving message ordering
  - Resiliency
  - Poison/malformed messages
  - Returning results

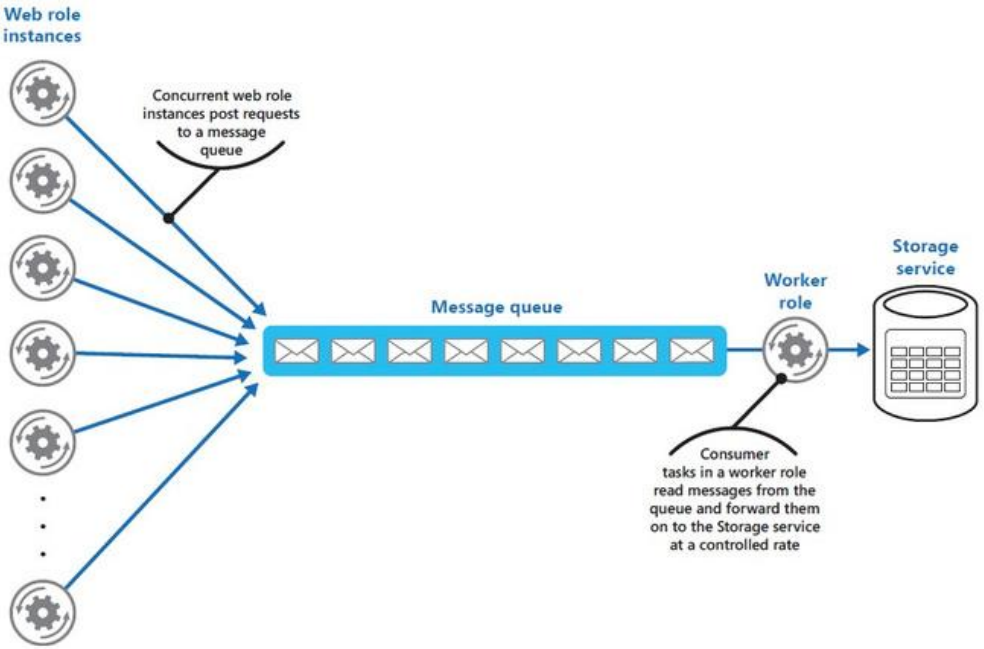
Queue-Based Load Leveling Pattern



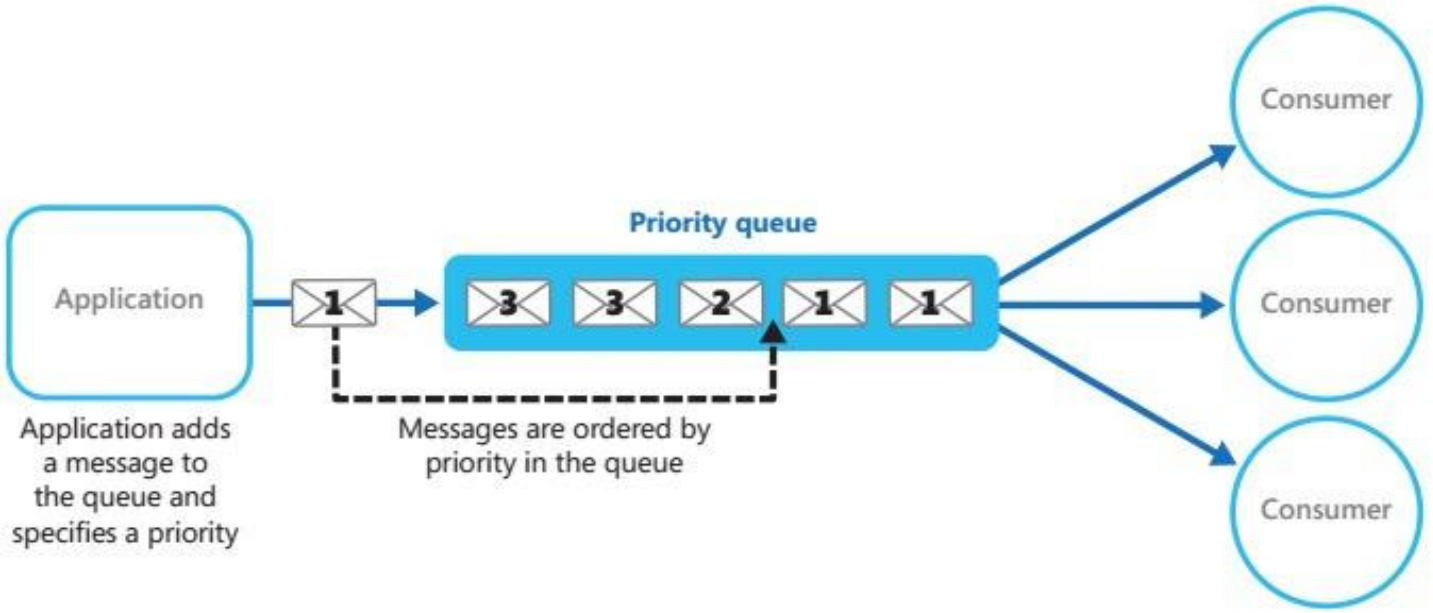
- To smooth intermittent heavy loads that may otherwise cause the service to fail or the task to time out

Queue-Based Load Leveling Pattern



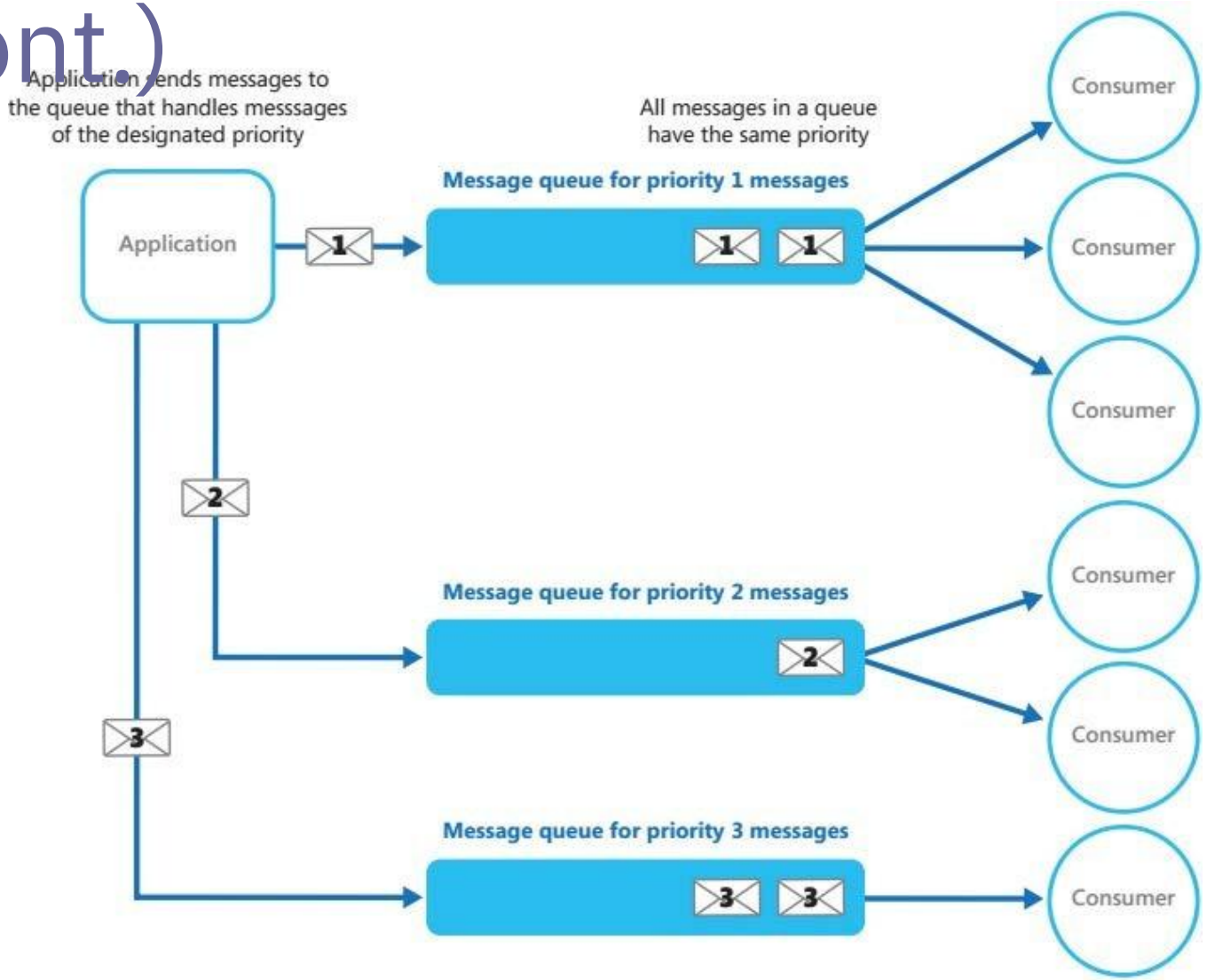


Priority Queue Pattern



- Prioritize requests sent to services so that requests with a higher priority are received & processed quickly

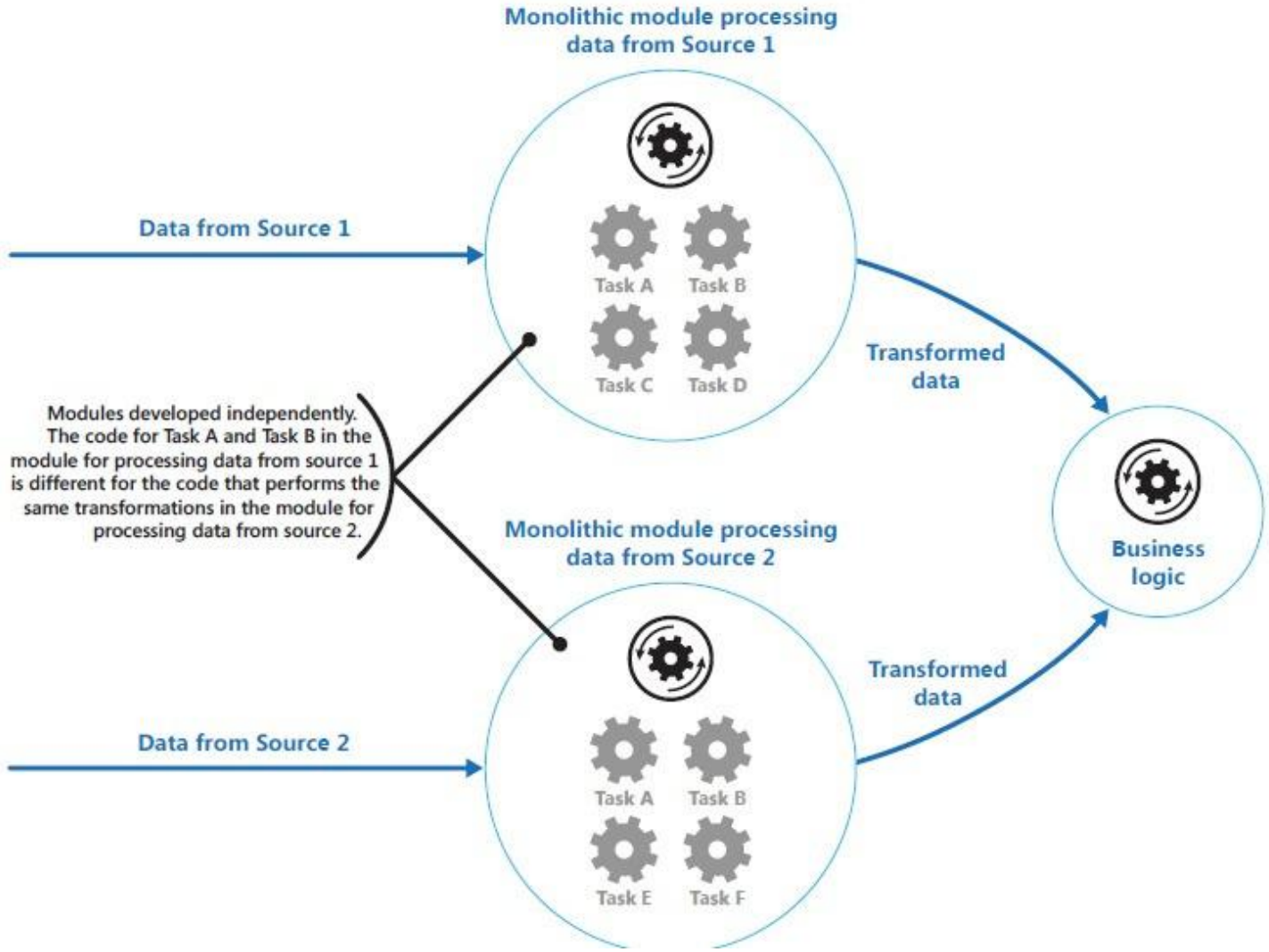
Priority Queue Pattern (Cont.)



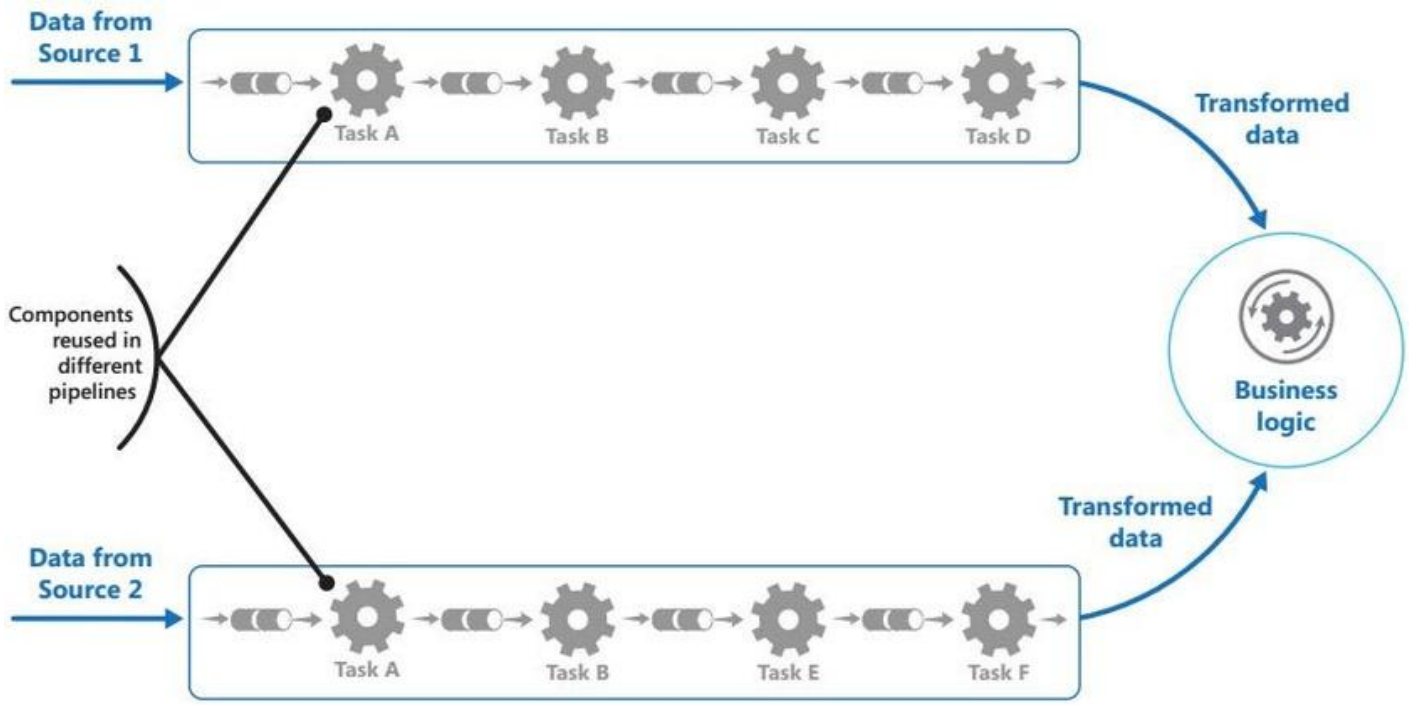
Priority Queue Pattern (Cont.)

- When,
  - The system handles multiple tasks that have different priorities
  - Different users should be served with different priorities

Pipes & Filters Pattern

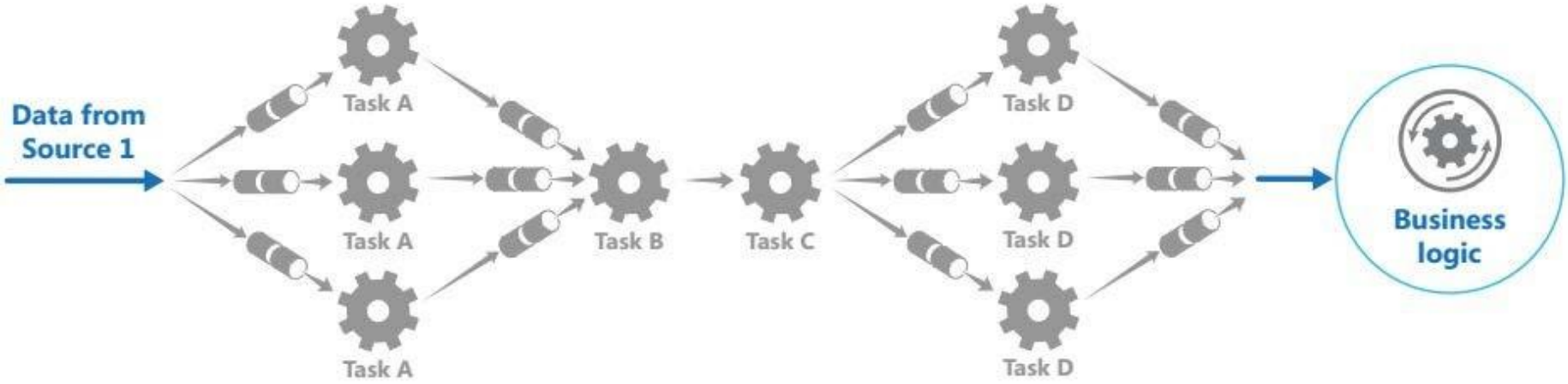


Pipes & Filters Pattern (Cont.)



- Decompose a task that performs complex processing into a series of discrete elements that can be reused

Pipes & Filters Pattern – With Load Balancing



- When,
  - Application can be decomposed to steps
  - Steps have different scalability requirements
  - Flexibility of processing
  - Need distributed processing