

7.4 Replicated System

Intent

Structure a system which allows provision of service from multiple points of presence, and recovery in case of failure of one or more components or links.

Also Known As

Redundant Components, Horizontal Scalability

Motivation

Transactional systems often susceptible to outages because of failure of communication links, communication protocols, or other system elements. Nevertheless, it is important to assure availability of transaction services in the face of such failures.

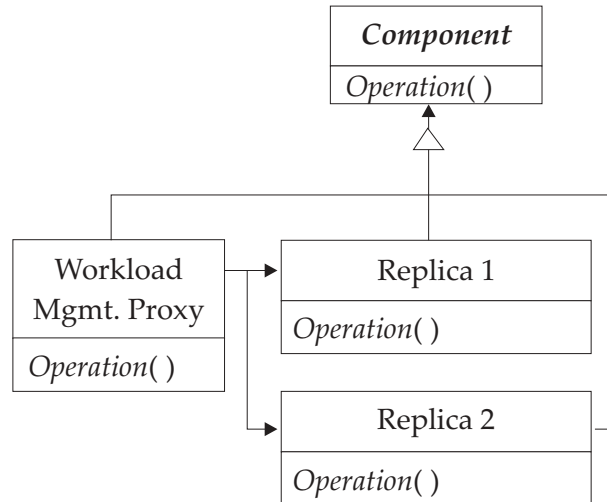
Applicability

Use Replicated System when:

- A system's state is updated via a series of individual transactions.
- The completion state and result of each transaction must be accurately reflected in the system state.
- Equivalent services must be provided simultaneously from multiple "points of presence", each of which must rely on and consistently update the same system state.
- Link failures are more likely than component failures.
- Each point of presence can be provided with reliable access to a master copy of the system state.
- Operational procedures call for a service to be periodically relocated from one platform or site to another, and brief pauses in processing for the purpose of relocation are acceptable. (Relocation might be desired to match the point of provision of the service to the locality of the offered load, or when the service may need to be relocated to a more capable ("larger") platform to meet peak load demands.) Service must continue to be provided in the face of component or link failures.

Structure

Replicated System consists of two or more Replicas and a Workload Management Proxy which distributes work among the components. The Replicas must all be capable of performing the same work. The Replicas may be stateless or stateful. If they are stateful, they may be allowed to be inconsistent. If the Replicas are stateful and must be kept consistent, the Standby pattern may be used to ensure consistency of state across components.



Participants

- **Replica**

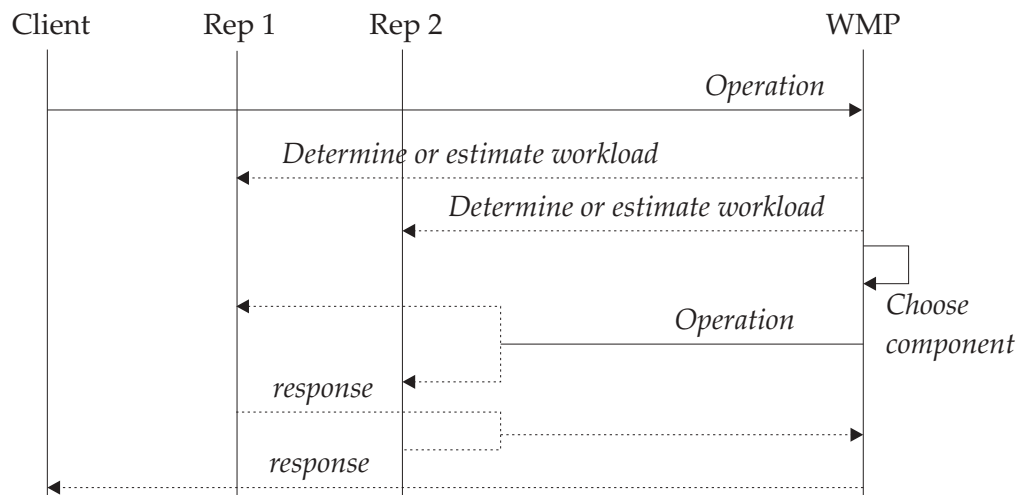
Implements operations. All Replicas in a replicated system must support the same set of operations.

- **Workload Management Proxy**

Dispatches operations to components based on workload scheduling algorithm.

Collaborations

- Workload Management Proxy responds to requests for operations.
- Workload Management Proxy dispatches operation requests to Replicas which are best able to handle them.



Consequences

Use of the Replicated System pattern:

- Improves system tolerance to component failures.
- Improves system ability to handle distributed load and link failures.
- Makes the Workload Management Proxy a single point of failure; may make the persistent data store a single point of failure.

Implementation

Future Writer's Workshops will identify appropriate text for this section.

Known Uses

Network Load Balancers (fronting replicated Web Servers, for example) are instances of the Replicated System pattern.

Related Patterns

Replicated System may use Standby [TG_SDP] to ensure consistency of state among its Replicas if this is required.

Replicated System's Workload Management Proxy is a Proxy [GoF].