ENV-005i — Emulate Membership and Topology Changes

Go to ENV-005 — Emulate Distributed Systems

Statement

The DIDO-TE SHALL emulate the membership and topology changes specified by the applicable Test Definition.

Derived From

- ENV-005 — Emulate Distributed Systems
- ENV-005a — Emulate Distributed Topology
- ENV-005b — Emulate Participating Nodes
- ENV-005c — Emulate Communication Behaviour
- ENV-005h — Emulate Network Partitions
- [DTE5] DIDO-TE Requirements Register, source requirement identifier and obligation to be assigned
- [DTE6] Structured Information Processing Reference Architecture (SIP-RA)
- [DTE7] Federated Data Interpretation Systems Reference Architecture (FDIS-RA)

Rationale

The membership and topology of a distributed system may change during operation.

Membership changes include the joining, leaving, admission, removal, replacement, suspension, reinstatement, and reassignment of participating Nodes. Topology changes include the creation, removal, replacement, or redirection of communication paths and changes to the relationships among participating Nodes.

These changes affect discovery, routing, coordination, leadership, quorum, replication, load distribution, availability, consistency, security, and recovery. Controlled emulation permits assessment of system behaviour while membership and topology change without treating every change as a failure.

Applies To

- Test Environment
- Test Definition
- Test Execution
- Test Object

- Node
- Test Resource
- Configuration
- Constraint
- Evidence

Verification

Verification confirms that:

- The applicable Test Definition identifies each membership or topology change subject to emulation.
- Each specified change has a unique identity.
- The Test Definition identifies the Nodes, Test Resources, communication paths, groups, roles, and relationships affected by each change.
- The Test Definition specifies the initial membership and topology.
- The Test Definition specifies the resulting membership and topology.
- The Test Definition specifies the change type, activation condition, activation time, sequence, duration, scope, and completion criteria.
- The Test Definition specifies the applicable admission, removal, replacement, reassignment, discovery, and notification behaviour.
- The Test Definition specifies the communication paths and relationships created, removed, replaced, or redirected by each topology change.
- The Test Definition specifies the expected system behaviour during and after each change.
- The DIDO-TE confirms the required initial membership and topology before activating each change.
- The DIDO-TE activates each membership and topology change under its specified conditions.
- The DIDO-TE preserves Nodes, communication paths, groups, roles, and relationships outside the specified scope of the change.
- The DIDO-TE records the planned and actual activation and completion times.
- The DIDO-TE observes discovery, admission, removal, reassignment, routing, coordination, and stabilisation behaviour, as applicable.
- The DIDO-TE detects a change that does not occur, occurs at the wrong time, exceeds its specified scope, produces an incorrect topology, or fails to reach its completion criteria.
- The DIDO-TE distinguishes an emulated membership or topology change from an unintended Node or communication failure.
- The DIDO-TE records change identities, affected elements, initial state, resulting state, activation conditions, actual conditions, observed interactions, completion status, and detected deviations as Evidence.
- The DIDO-TE maintains Traceability among each membership or topology change, affected Nodes and communication paths, Test Definition, Test Execution, Evidence, and Test Results.
- A missing, incorrectly activated, incorrectly bounded, uncontrolled, unobserved, unsupported, or untraceable mandatory membership or topology change constitutes nonconformance with this requirement.

Verification includes:

- Inspection of the membership and topology changes specified by the Test Definition
- Inspection of change identities, affected elements, activation conditions, sequences, scopes, and completion criteria

- Comparison of the specified initial and resulting membership and topology
- Observation of a Node joining, leaving, or being removed from the distributed system
- Observation of a Node replacement, reassignment, suspension, or reinstatement, as applicable
- Observation of a communication path or relationship being created, removed, replaced, or redirected
- Testing of simultaneous or sequenced membership and topology changes, as applicable
- Confirmation that unaffected Nodes, paths, roles, and relationships remain unchanged
- Confirmation that each change occurs and completes under its specified conditions
- Confirmation that the DIDO-TE detects an incorrect or incomplete membership or topology change
- Inspection of membership-change and topology-change Evidence and Traceability records
- Confirmation that each mandatory deviation produces a nonconformance result

Referenced By

- ENV-005j — Emulate Recovery Behaviour
- ENV-005k — Observe Distributed Interactions
- ENV-005l — Record Distributed-System Emulation
- ENV-005m — Validate Emulation Fidelity

Related Architecture Sections

- Add links to the architecture sections governing distributed topology, membership, discovery, admission, Node lifecycle, communication paths, coordination, Evidence, and Traceability.

Delivery Phase

Assign the applicable delivery phase.

Requirement Status

Draft

Statement Reference

Use the following syntax to reference this requirement's Statement section from another DokuWiki page:

```
{{section>dido:03-dido-te:99-annexes:annex-c-requirements:02-test-environment-requirements:env-005-emulate-distributed-systems:env-005i-emulate-membership-and-topology-changes#Statement&noheader&nofooter&noeditbtn}}
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