# Module XX – Visual Trace Example Pack & Capsule Path Demonstrations

Version: 4.1 | Classification: CTO Mandatory (Illustrative Capsule Flow)

Scope: Replay detection, fork divergence, federation recovery, grace execution flow

## 0. Purpose & Visual Documentation Goal

This module provides illustrative examples of key capsule interactions and trust-path behaviors, enabling CTOs, auditors, developers, and governance stakeholders to understand the structure, flow, and enforcement logic of MaxOneOpen v4.1 in concrete scenarios. Each scenario maps a full capsule chain, its triggers, recovery path, and audit overlay footprint.

## 1. Example A – Replay Attack Detection

Capsule Sequence:  
- COMMIT-001: Manifest Capsule (M)  
- COMMIT-002: Execution Capsule (EC)  
- COMMIT-003: Replay Injection (duplicate EC with altered time)  
- System emits: Replay Alert Capsule (RAC), Trust Violation Capsule (TVC)  
- Audit Engine confirms: replay confirmed → Capsule chain frozen  
- Output: Recovery required via GRCC → REC capsule

## 2. Example B – Fork Divergence & Federation Reentry

Capsule Sequence:  
- COMMIT-010: Policy Capsule (PCC)  
- COMMIT-011: Alternate Policy by Forked Federation (unregistered FAC)  
- System emits: Fork Alert Capsule (FDAC), triggers FAC dispute  
- Federation Reconciliation Capsule (FRC) emitted with fork delta trace  
- Federation consent updates FCC → Reentry via updated REC capsule

## 3. Example C – Grace Recovery after Subsystem Failure

Capsule Sequence:  
- COMMIT-020: Execution Capsule (EC)  
- Subsystem: Audit Engine outage  
- System emits: Grace Capsule (GC) with TTL = 20 cycles  
- Operations continue in isolation tier  
- Post-recovery: Audit replay triggers GRCC → Chain Repair Capsule (CRC)  
- REC capsule binds path to RFC for final certification inclusion

## 4. Capsule Role Mapping

- Tier 1: signs COMMIT, FAC, FCC, CCC, REC  
- Tier 2: issues ASC, GRCC, VSC  
- Tier 3: triggers RAC, PCC  
- Tier 4: reads overlays, submits manifests  
- Tier 5: sandbox only, no emissions

Note: Visual diagrams are available as supplemental overlays and not embedded in this document. Use capsule simulation or trace viewer tools for visual replays.