Non-Byzantine Conditions in Distributed Systems

In distributed systems, "non-Byzantine conditions" refers to failure modes where components may fail, but they fail in predictable, well-defined ways rather than exhibiting arbitrary or malicious behavior.

Key Characteristics of Non-Byzantine Conditions

1. **Fail-Stop Failures**: Components either work correctly or stop working entirely
   - A server crashes and stops responding
   - A network link goes down completely
   - A process terminates unexpectedly
2. **Omission Failures**: Messages may be lost, but not corrupted
   - Network packets are dropped
   - Responses to requests never arrive
   - Components fail to send messages they should have sent
3. **Timing Failures**: Components respond correctly but outside of expected time bounds
   - A service responds much slower than expected
   - Clock drift causes timing inconsistencies
   - Network delays cause messages to arrive late
4. **Crash Failures**: Components suddenly stop functioning without warning
   - A server loses power
   - An application process is killed
   - A service terminates due to an unhandled exception

How Non-Byzantine Differs from Byzantine

Non-Byzantine conditions explicitly **exclude**:

- **Malicious behavior**: Components don't deliberately provide false information
- **Arbitrary corruption**: Messages aren't tampered with or corrupted
- **Collusion**: Failed components don't work together to deceive working ones
- **Inconsistent failures**: Components don't present different behaviors to different parts of the system