

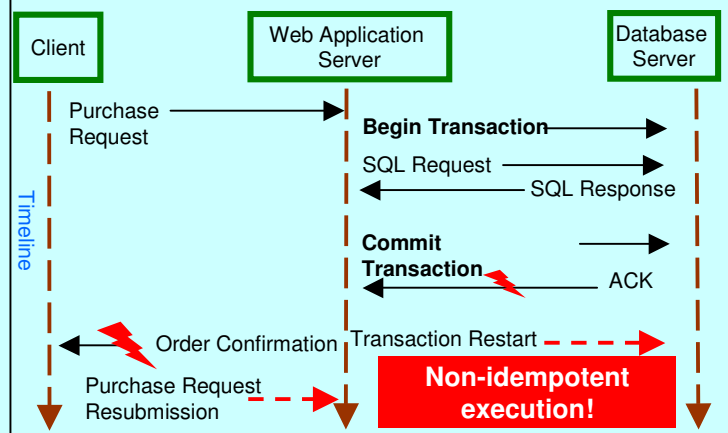
EOS²: Unstoppable Stateful PHP

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Banal Examples (Effect)

- **The same** item is ordered **twice** in an online-store. In some cases the order has to be cancelled by calling a toll hotline.
- Home banking (PIN/TAN procedure). Each TAN may be used only once.
 - The **first try** to place a money transfer order results in a browser **timeout**.
 - After the subsequent browser refresh the server says: "A TAN was used **twice**. All other TAN's have been frozen. To reactivate, please, contact your local branch office".
- **8** health insurance cards for a family of **3** persons.

Banal Cause



Components Guarantees

- **Testable State:** message exec'ed?.
- **Testable Message:** message received/sent?
- **Persistent State:** particular state available, while interaction active.
- **Persistent Message:** particular message available while interaction

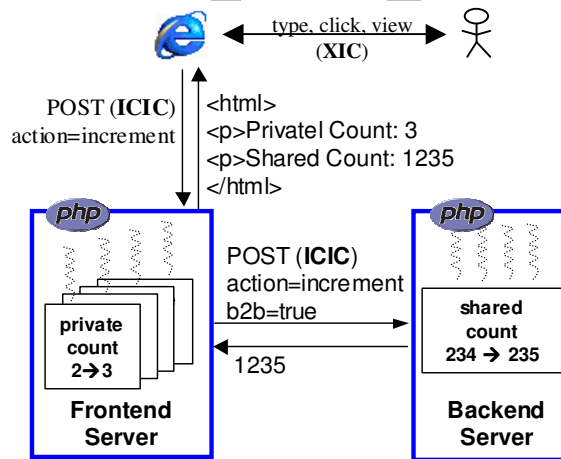
Component Types

- eXternal Component (**XCom**) (e.g., human users)
 - no guarantees ☺
- Persistent Component (**PCom**)
 - persistence and testability
- Transactional Component (**TCom**)
 - persistence and testability only at commit

Interaction Contracts

- Transactional IC (TIC) Pcom ↔ Tcom
- Committed IC (CIC) Pcom ↔ Pcom
- Immediate CIC (ICIC) Pcom ↔ Pcom
- External IC (XIC) Xcom ↔ Pcom

EOS: An Exactly-Once Web Service Platform



Performance enhancements (side effects)

- Log structured data access (sequential I/O)
- LRU buffers for state and log data
- Spinlocks
- Latches (Shared/Exclusive)
- `session_start($read_only)`

Exactly-once semantics featuring

- Transparent browser recovery in JavaScript
- Recoverability for **concurrent** accesses to shared data
- **Nondeterministic** functions: *time, curl_exec, rand*
- Any *n* in *n-tier*, any **fanout**. External Web-Service calls enabled by **CURL** module
- Failure masking: **no changes to app code**, neither to PHP scripts, nor to the browser. **Rapid** app development as if system failures never happen.

Formally specified by Statestate statecharts and formally verified by model checking

Chart: CIC_RECEIVER_SC Version:3

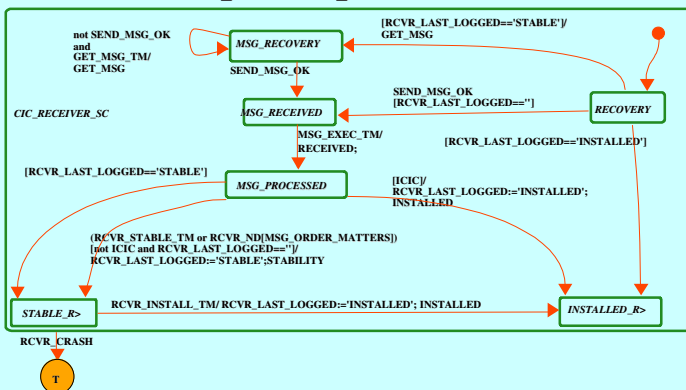
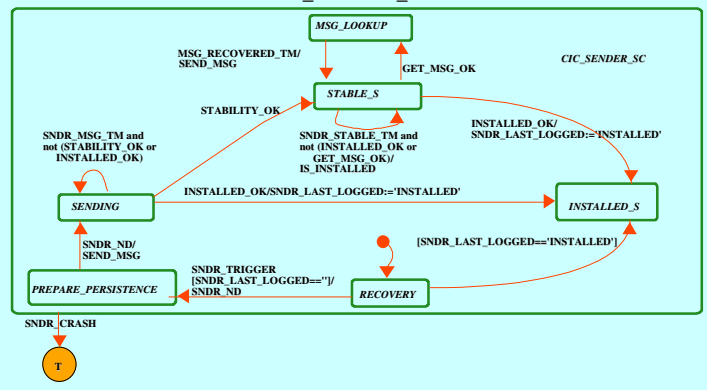


Chart: CIC_SENDER_SC Version:2



AG (EF request_execed ∧ (request_execed → AX AG ¬request_execed))