Emergency Dispatching Center Business Analysis and Modeling

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Chap.1:

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1. Business System Identification

The Emergency Dispatching Center is responsible for managing all aspects of emergency response. It receives emergency calls from citizens, dispatches the appropriate services (police, fire, EMS), logs all communications, and tracks the response status of dispatched units. The system continuously provides real-time updates and generates statistics to enhance response efficiency. In practice, this means that every call is systematically logged, classified, and acted upon following strict protocols determined by business rules.

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2. Business Actors, Agents, Rules, and Stakeholders

Business Actors:

- **Emergency Caller: The individual reporting an emergency.**
- **Dispatcher: The operator who receives calls, logs caller information, determines the type of emergency, and dispatches the appropriate units.**
- **External Stakeholders: Government bodies and regulators who access statistical insights for oversight and evaluation.**

Business Agents:

- **Computer-Aided Dispatch (CAD) System: The core system that supports emergency logging, unit dispatching, tracking communications, and storing historical response data.**
- **Mobile Data Terminal (MDT): Displays dispatch notifications and real-time updates to field units.**
- **Radio Communication System: Enables continuous, real-time communication between dispatchers and emergency units.**
- **Police Officer: Responds specifically to police-related emergencies.**
- **Firefighter: Handles emergencies related to fires.**
- **EMS Personnel: Manage medical emergencies.**

Business Rules:

BR1: All emergency calls must be logged in the CAD system.

BR2: Dispatchers must classify emergencies (police, fire, or medical) and assign the appropriate services.

BR3: Dispatched units must acknowledge their dispatch commands prior to proceeding to the emergency scene.

BR4: Dispatch logs must store all call details, timestamps, and assigned units.

BR5: Emergency responders must submit a post-intervention report detailing the incident handling.

BR6: The system must track workload statistics for all emergency units.

BR7: When a call requires multiple services, the system must prioritize the most urgent need.

BR8: The system must allow users to efficiently query historical emergency response data.

Stakeholders:

- **Emergency Responders (Police, Fire, EMS): Depend on the system for accurate and timely dispatching.**
- **Citizens: Rely on the system for prompt and effective emergency responses.**
- **Government and Regulatory Bodies: Monitor and ensure that the system aligns with public safety standards.**
- **System Administrators: Maintain the system's uptime, reliability, and security.**

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3. Business Use Case Diagram

The Business Use Case Diagram encapsulates the overall functionality and process flows of the Emergency Dispatching Center. The diagram illustrates the following key use cases:

Log Emergency Call:

- **Trigger: The process starts when an Emergency Caller initiates a call.**
- **Flow: The Dispatcher records the caller's details (name, location, emergency type) and logs the call in the CAD System.**

Determine Emergency Type:

- **Flow: The Dispatcher examines call details to classify the emergency as police, fire, or medical and sends the categorised emergency to the CAD System.**

Dispatch Police Unit / Dispatch Fire Unit / Dispatch EMS Unit:

- **Flow: Based on the classified emergency, the Dispatcher assigns and notifies the nearest available emergency unit (Police, Fire, or EMS) via the CAD System.**

Acknowledge Dispatch Command:

- **Flow: Once dispatched, the emergency unit acknowledges receipt of the dispatch command.**

Update Unit Status:

- **Flow: The emergency unit continuously sends progress updates (e.g., en route, on-scene, incident complete) back to the CAD System.**

Submit Intervention Report and Log Incident Report:

- **Flow: After responding to the emergency, the unit submits a detailed intervention report, which is logged as part of the incident report in the CAD System.**

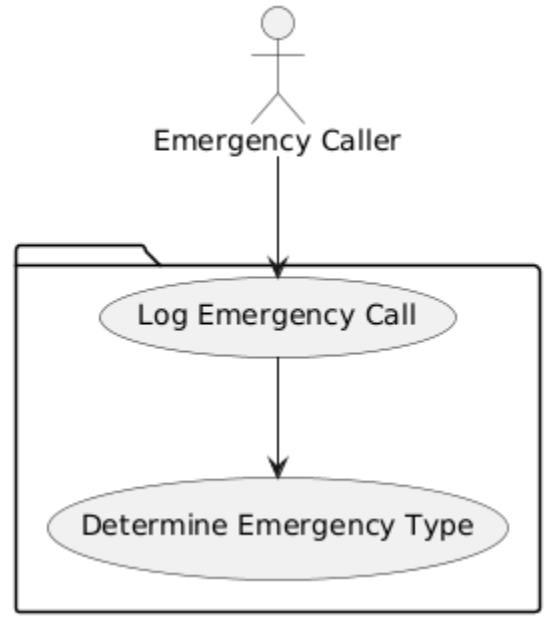
Generate Emergency Statistics:

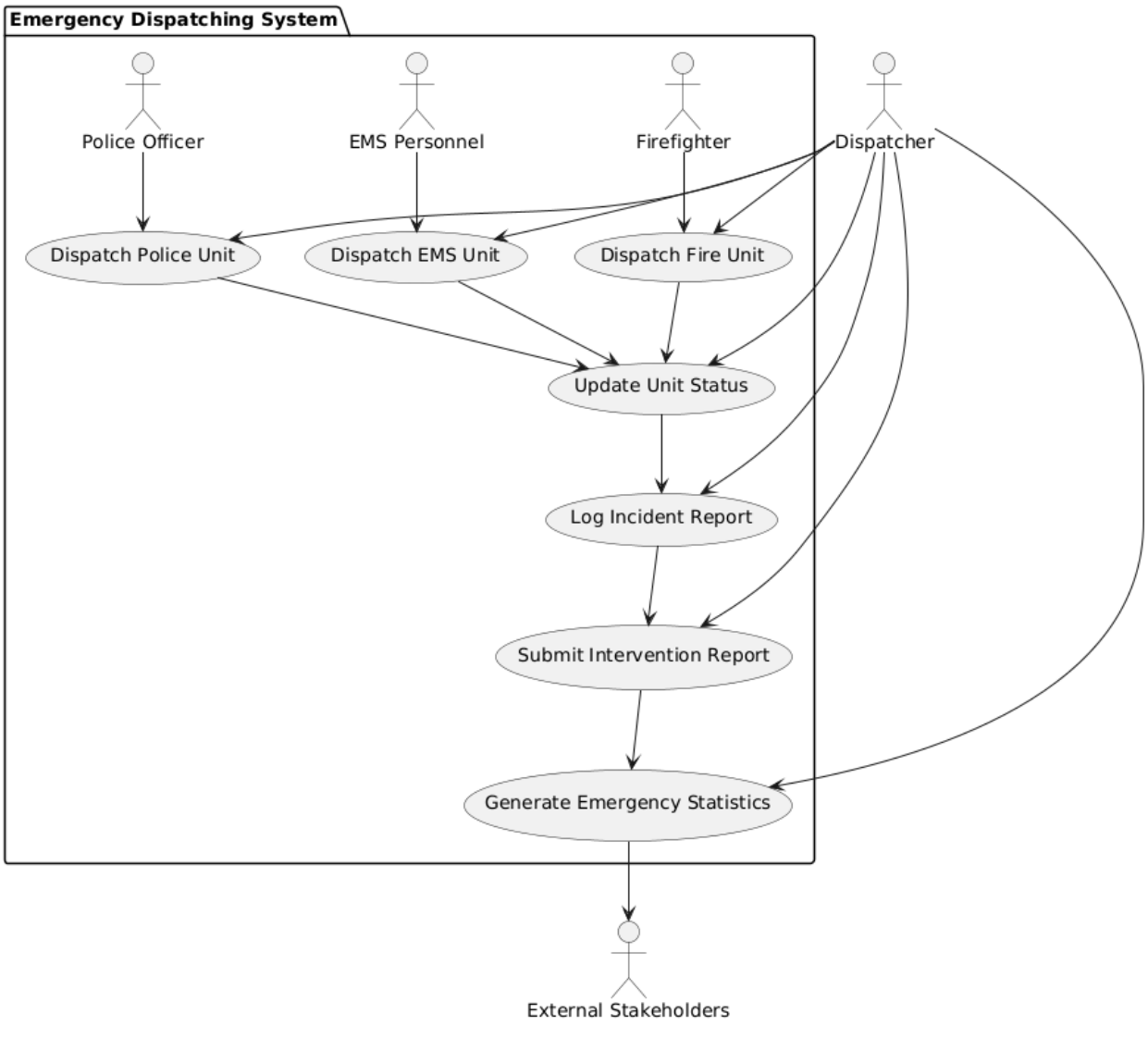
- **Flow: The CAD System uses the logged data and intervention reports to generate statistical insights (e.g., response times, call volumes). External Stakeholders then access these statistics for review and compliance purposes.**

Use Case Relationships:

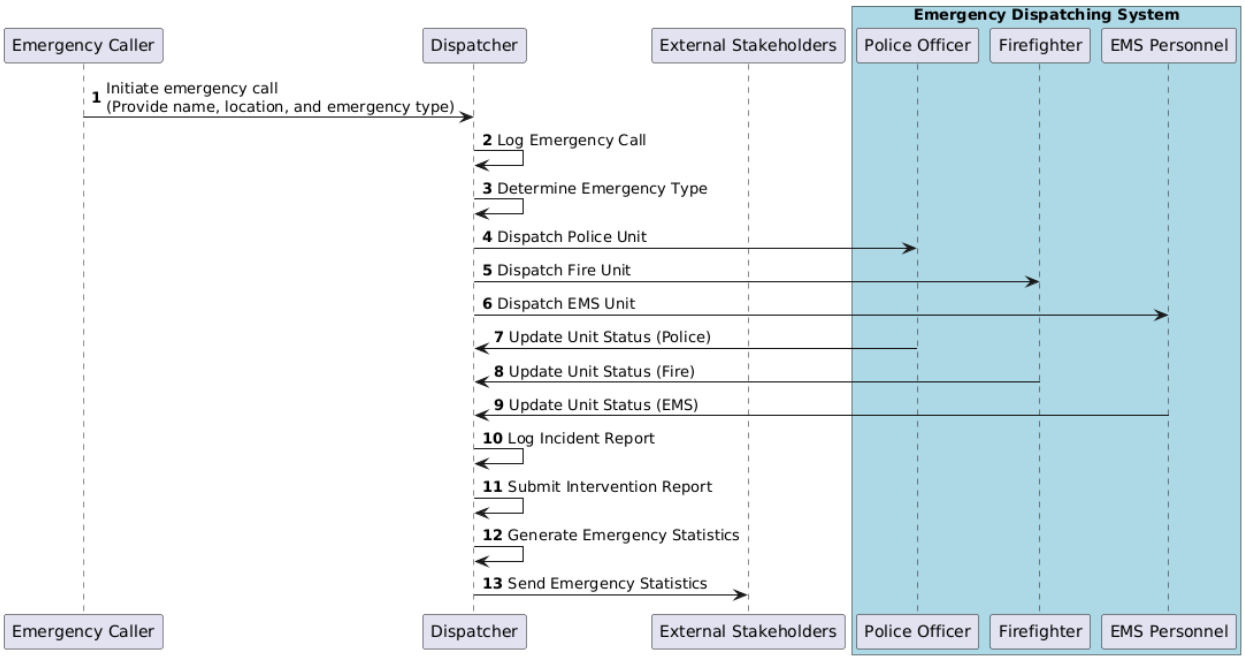
- **The Emergency Caller initiates the Log Emergency Call use case.**
- **Log Emergency Call flows into Determine Emergency Type.**
- **Determine Emergency Type sends the classified emergency to the Dispatcher.**
- **The Dispatcher then dispatches the appropriate emergency unit (Police, Fire, or EMS) by interacting with the CAD System.**
- **Dispatched Emergency Units acknowledge the dispatch command and update their status.**
- **Post-intervention details are recorded via Submit Intervention Report and consolidated under Log Incident Report.**
- **Finally, Generate Emergency Statistics aggregates all data and makes it accessible to External Stakeholders.**

4. Business Use Case Diagram

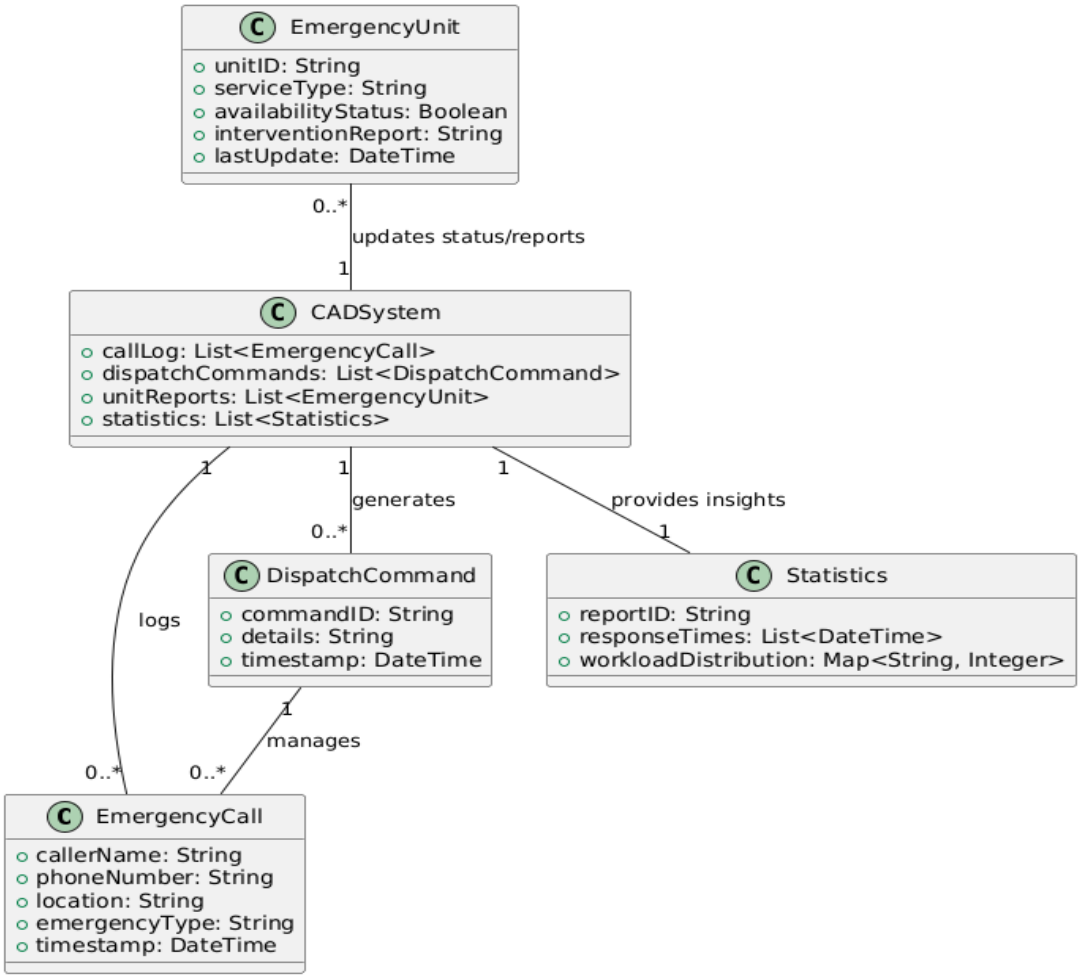




5. Activity Diagram for Business Use Cases

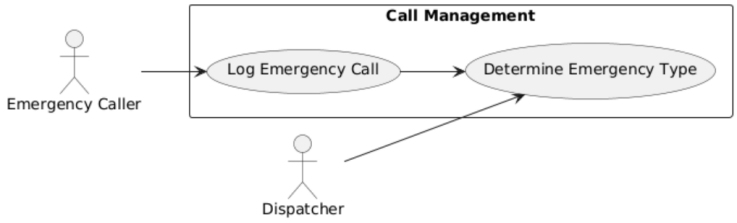


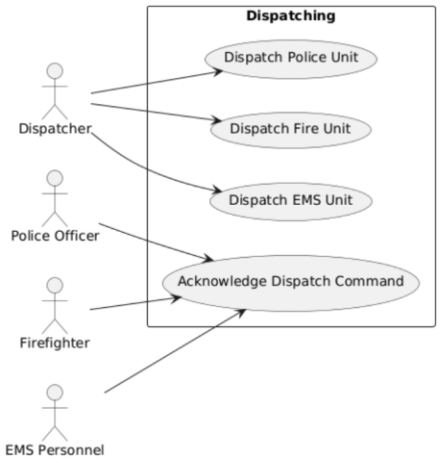
6. Domain Model Chapter

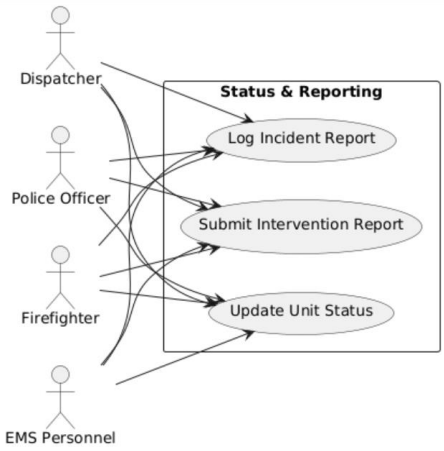


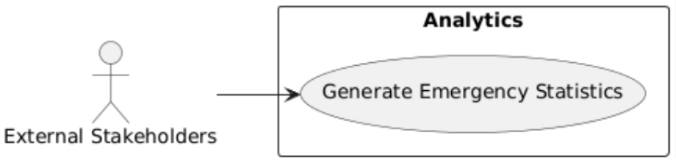
Chap.2:

2a. Software Use Case Diagram









2b. Detailed Functional Requirements

- **Log Emergency Call**
    - Capture caller details (name, phone number, location, emergency type)
- **Determine Emergency Type**
    - Classify the call as police, fire, or medical based on incoming data
- **Dispatch Emergency Unit**
    - Select and notify the appropriate emergency unit based on the classified call
- **Acknowledge Dispatch Command**
    - Ensure that the dispatched unit confirms receipt of the command before proceeding
- **Update Unit Status**
    - Provide real-time updates on unit progress (e.g., en route, on scene, complete)
- **Record Incident**
    - Log all call details, timestamps, and intervention reports for each incident
- **Generate Response Statistics**
    - Aggregate key data such as response times and call volumes for review and analysis

2c. Non-functional Requirements

- **Performance**
    - Ensure system response times are within acceptable limits (e.g., operations processed in under 2 seconds)
- **Availability**
    - Maintain high system uptime, targeting 99.9% availability to support continuous emergency operations
- **Security**
    - Apply robust security measures (e.g., data encryption in transit and at rest, role-based access control)
- **Usability**
    - Provide an intuitive and user-friendly interface for dispatchers and emergency responders
- **Scalability**

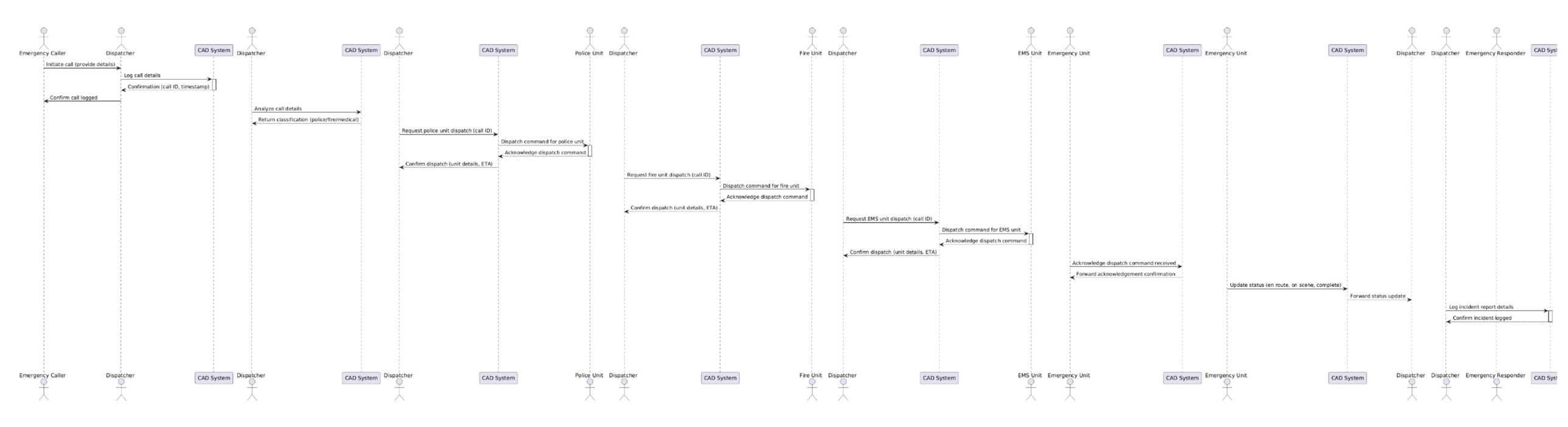
- Design the system to handle increasing volumes of emergency calls and dispatch operations without degradation in performance

- **Maintainability**
  - Ensure the system structure is modular and well-documented to support efficient updates and troubleshooting

- **Reliability**
  - Guarantee consistent system operation with mechanisms for error handling and rapid recovery

2d. Use Case Descriptions

Use Case	Primary Actor(s)	Description
Log Emergency Call	Emergency Caller, Dispatcher	Records call details (name, phone, location, emergency type) and logs the call in the CAD system.
Determine Emergency Type	Dispatcher	Analyzes call details to classify the emergency (police, fire, or medical).
Dispatch Police Unit	Dispatcher	Assigns the closest available police unit based on the emergency type.
Dispatch Fire Unit	Dispatcher	Assigns the closest available fire unit based on the emergency type.
Dispatch EMS Unit	Dispatcher	Assigns the closest available EMS unit for medical emergencies.
Acknowledge Dispatch Command	Police Officer, Firefighter, EMS Personnel	Confirms receipt of the dispatch command by the assigned emergency unit.
Update Unit Status	Police Officer, Firefighter, EMS Personnel	Provides real-time updates on unit progress (en route, on scene, complete).
Log Incident Report	Dispatcher, Emergency Responders	Records incident details, timestamps, and initial intervention information.
Submit Intervention Report	Emergency Responders	Records detailed post-intervention data after the emergency response.
Generate Emergency Statistics	External Stakeholders	Aggregates data (response times, call volumes, etc.) for performance review.

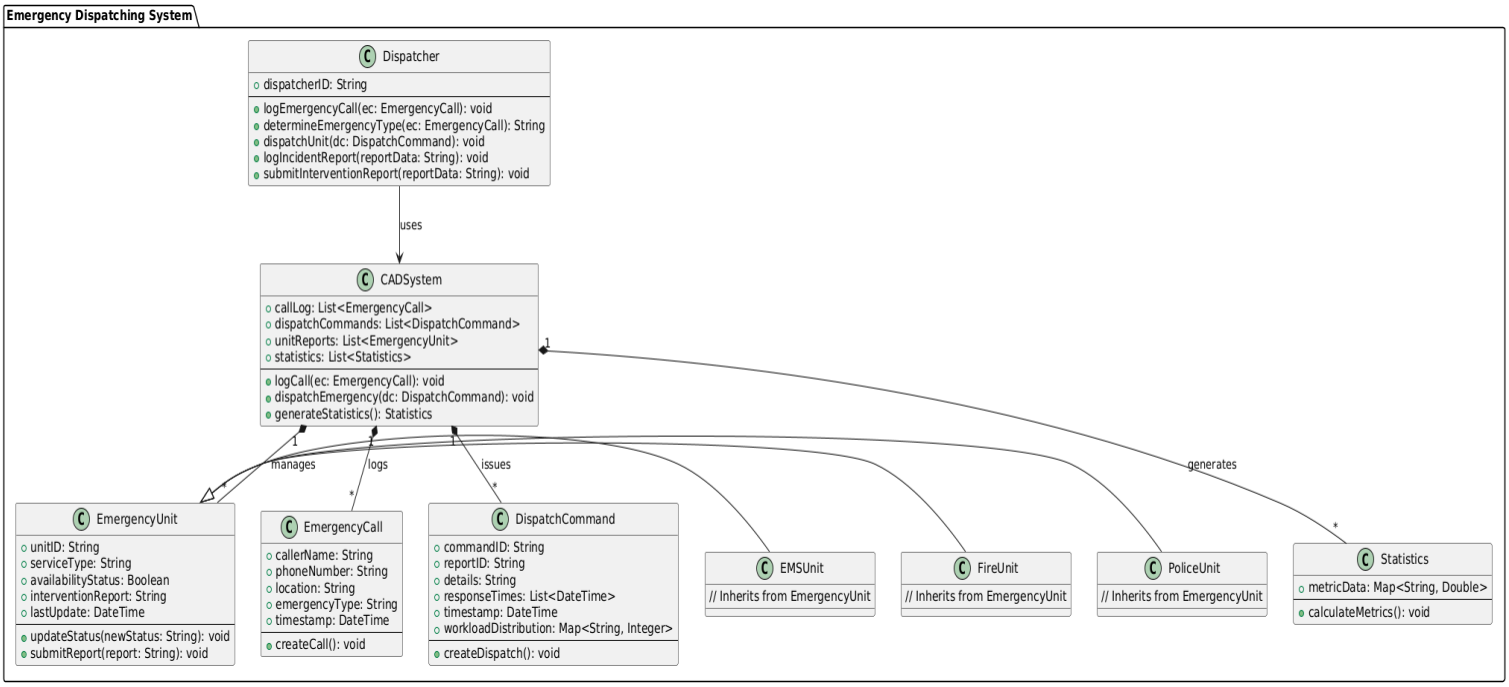

Emergency Caller
Dispatcher
CAD System
Dispatcher
CAD System
Dispatcher
CAD System
Police Unit
Dispatcher
CAD System
Fire Unit
Dispatcher
CAD System
EMS Unit
Emergency Unit
CAD System
Emergency Unit
CAD System
Dispatcher
Dispatcher
Emergency Responder
CAD System
Initiate call (provide details)
Log call details
Confirmation (call ID, timestamp)
Confirm call logged
Analyze call details
Return classification (police/fire/medical)
Request police unit dispatch (call ID)
Dispatch command for police unit
Acknowledge dispatch command
Confirm dispatch (unit details, ETA)
Request fire unit dispatch (call ID)
Dispatch command for fire unit
Acknowledge dispatch command
Confirm dispatch (unit details, ETA)
Request EMS unit dispatch (call ID)
Dispatch command for EMS unit
Acknowledge dispatch command
Confirm dispatch (unit details, ETA)
Acknowledge dispatch command received
Forward acknowledgement confirmation
Update status (en route, on scene, complete)
Forward status update
Log incident report details
Confirm incident logged

2f. Operation Contracts

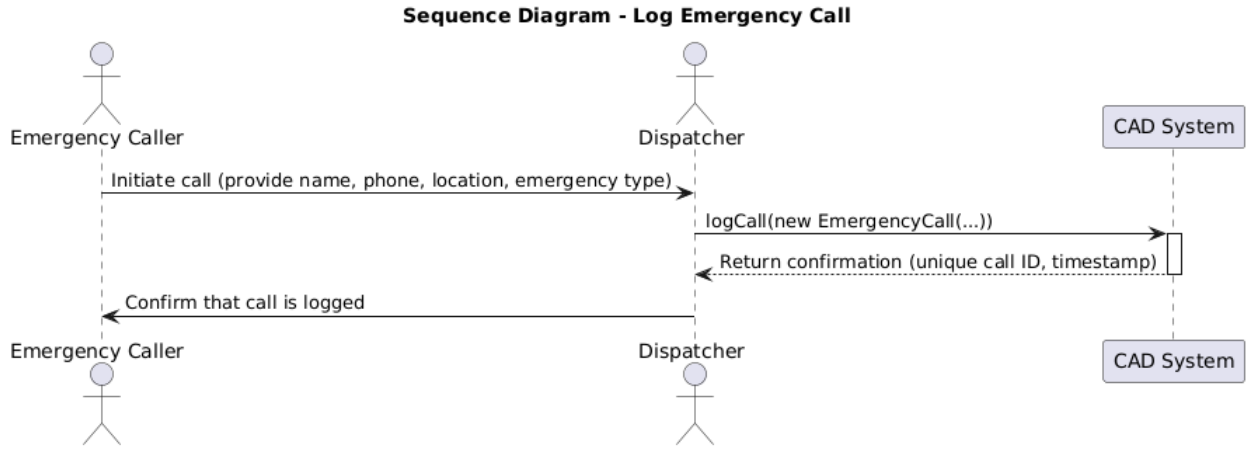
Operation	Cross Reference	Preconditions	Postconditions
logEmergencyCall(callerName, phoneNumber, location, emergencyType)	Log Emergency Call Use Case	Caller must provide valid details; CAD System must be operational	A new emergency call record is created with a unique call ID and timestamp.
dispatchUnit(emergencyCallID, emergencyType)	Dispatch Emergency Unit Use Case	The emergency call is logged and classified; at least one unit must be available	The most appropriate emergency unit is assigned; a dispatch record is created and the unit receives a dispatch notification.

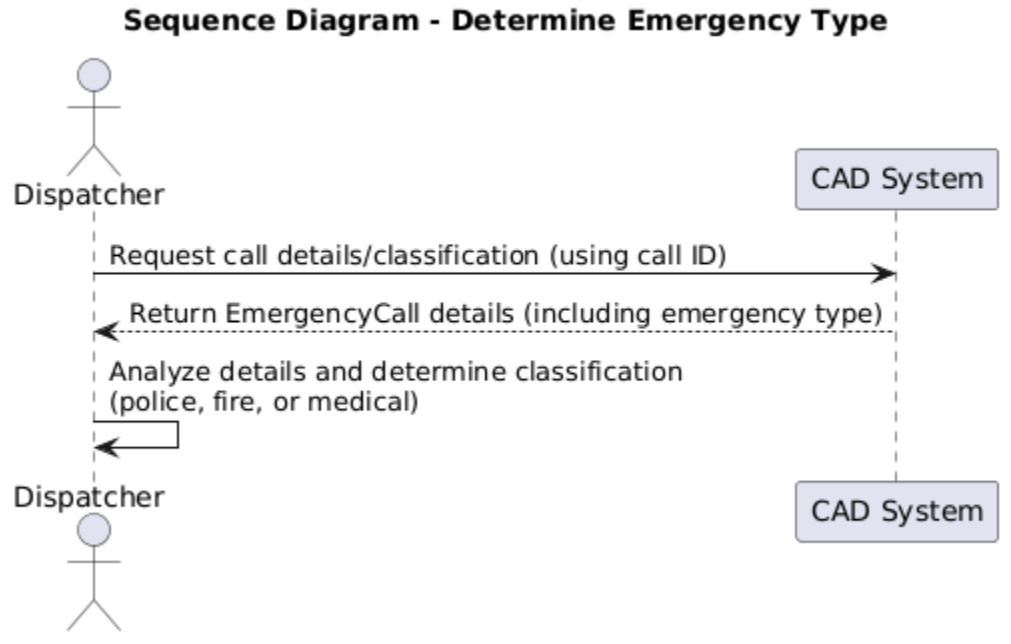
Chap.3:

3a.Design class diagram

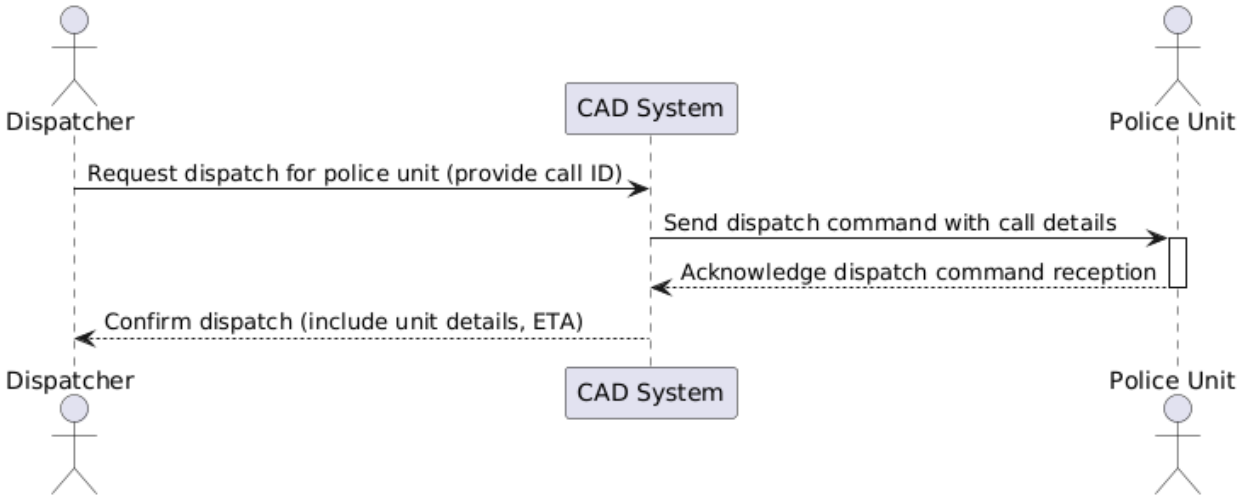


3b. Sequence diagram

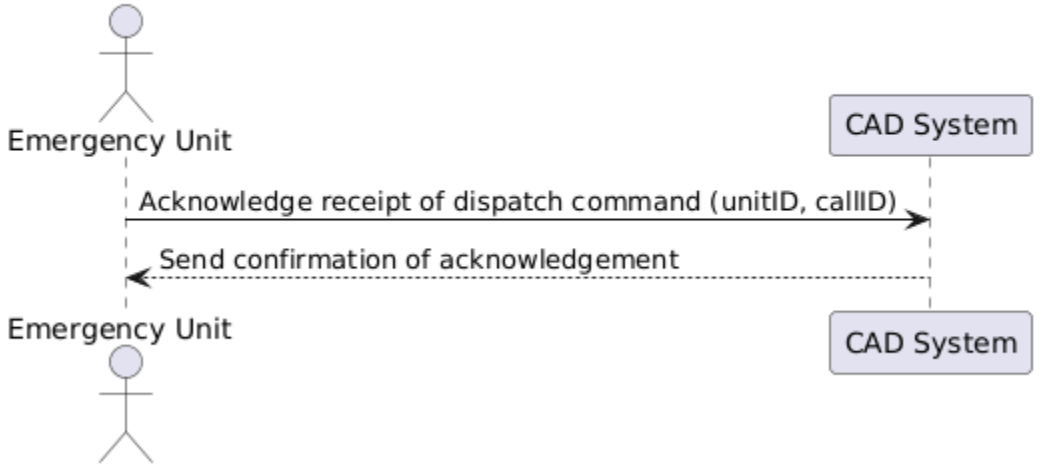




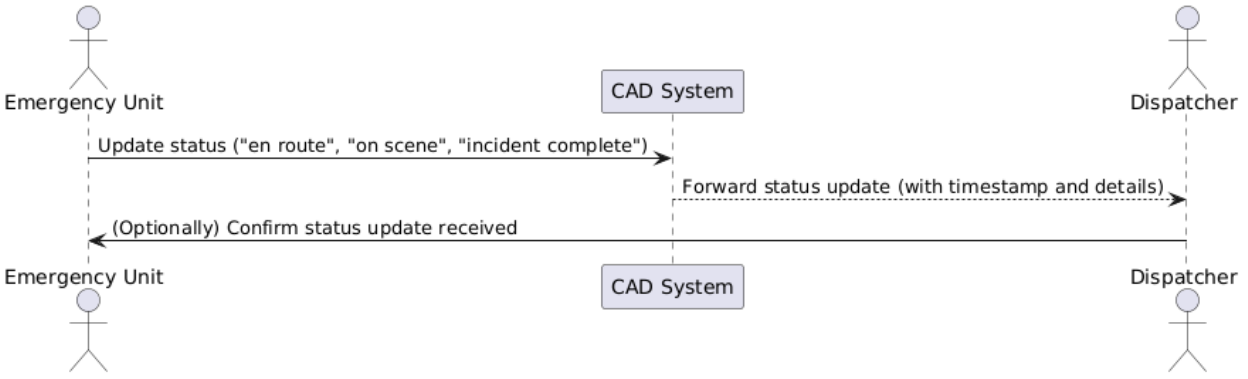
Sequence Diagram - Dispatch Police Unit



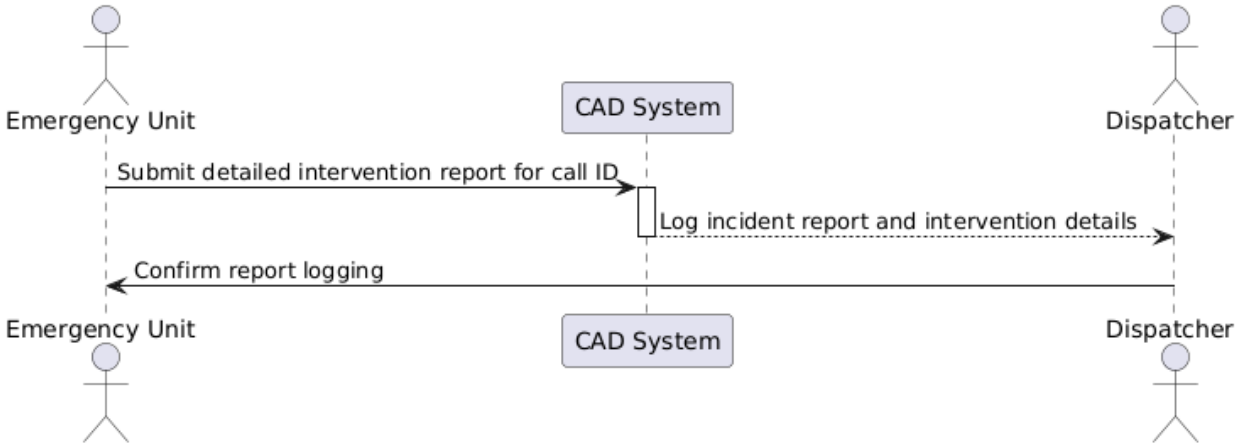
Sequence Diagram - Acknowledge Dispatch Command



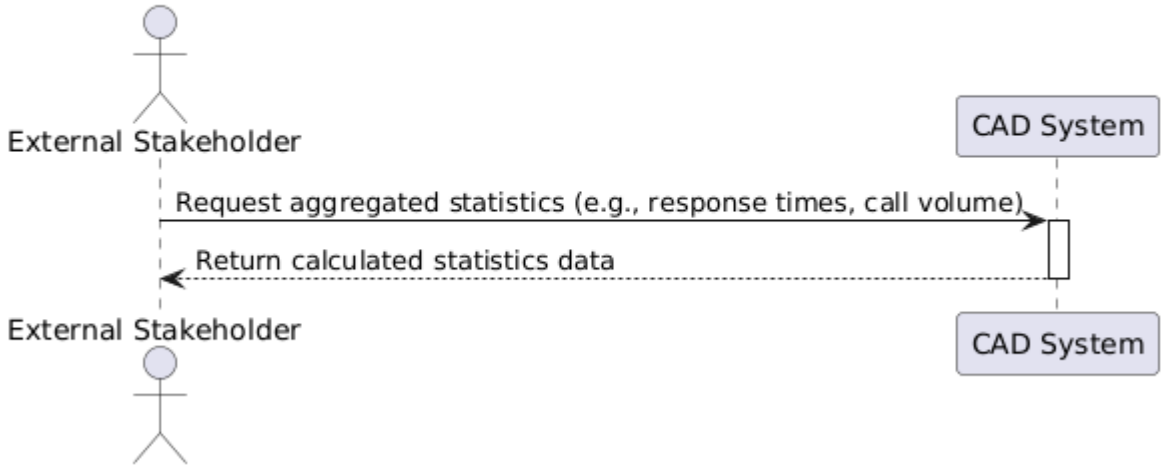
Sequence Diagram - Update Unit Status



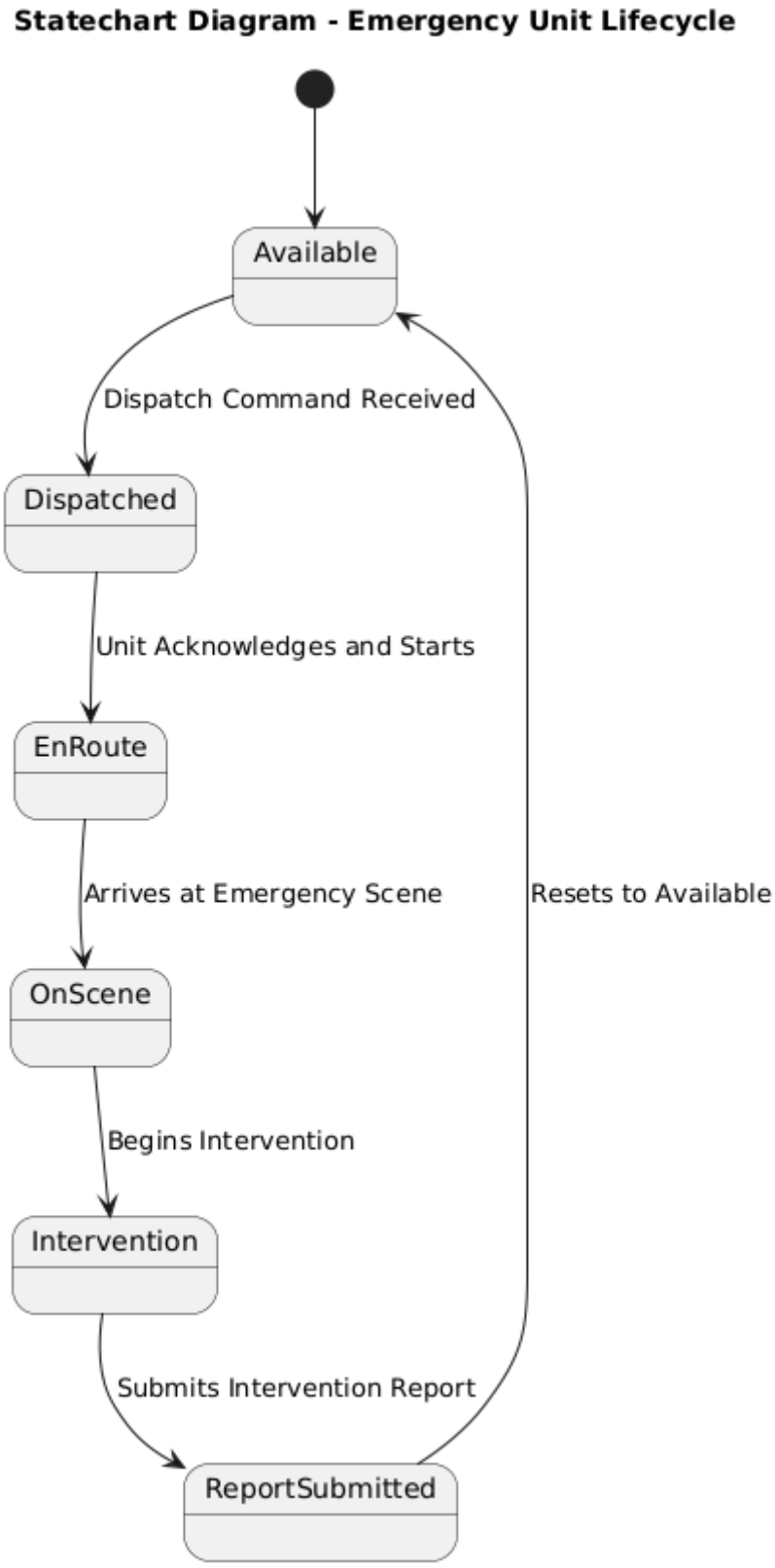
Sequence Diagram - Submit Intervention Report / Log Incident Report



Sequence Diagram - Generate Emergency Statistics



3c. Statechart diagram (one object)



3d. Software architectur