Coordination of a Multi-Agent System for Emergency Response

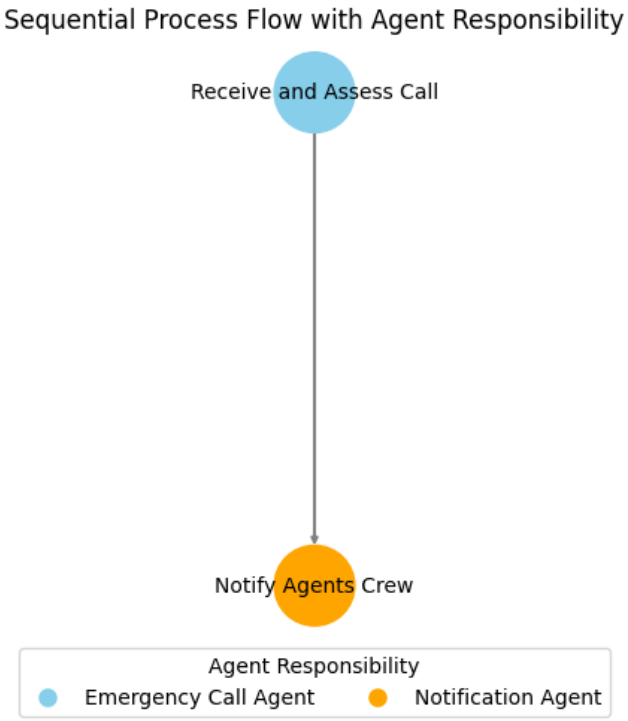
Team 05

December 8, 2024

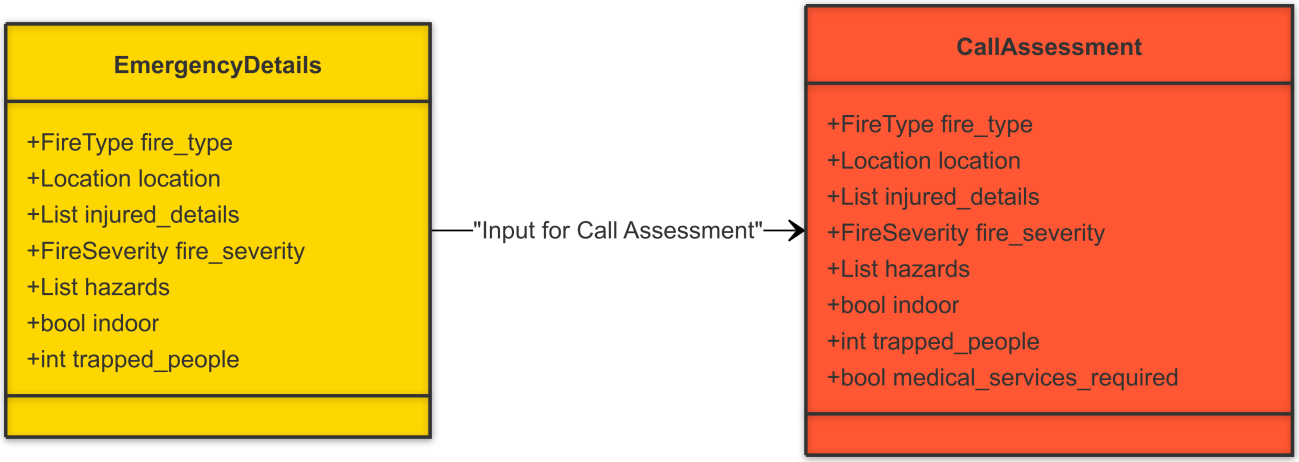
Introduction

- **Objective**: Design the cooperation and coordination mechanisms that will be used to solve the emergency response for fire-related emergencies in Lloret de Mar, Girona.
- **Teams Involved**:
  - Emergency Services
  - Firefighters
  - Medical Services
  - Public Communications
  - *Forensics*
- **Overview**:
  - For each crew: process definition and Pydantic outputs.
  - Agent interactions: flows and routers.

Emergency Services Process and Outputs

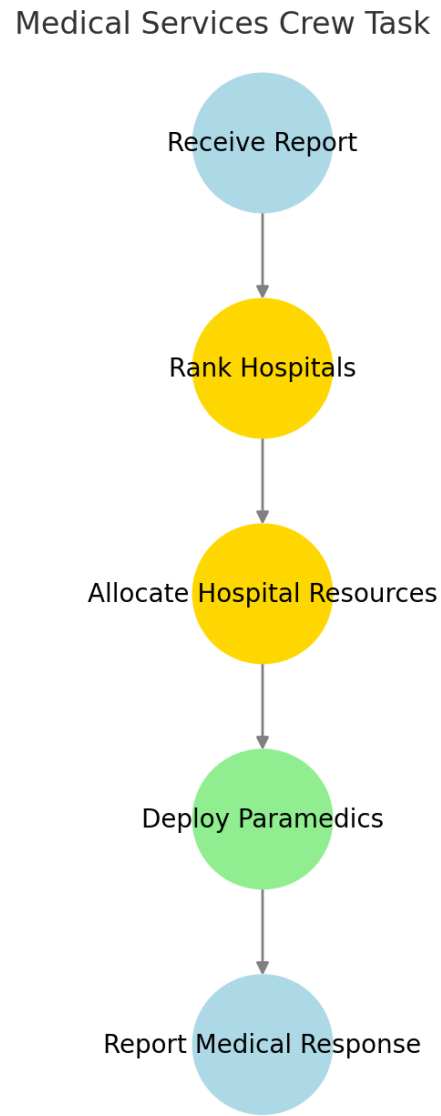


- What type of fire is it?
- Where is it?
- Is anyone injured? How badly?
- How severe is the fire?
- Are there hazards?
- Is it an indoor or outdoor fire?
- Is anyone inside or trapped?

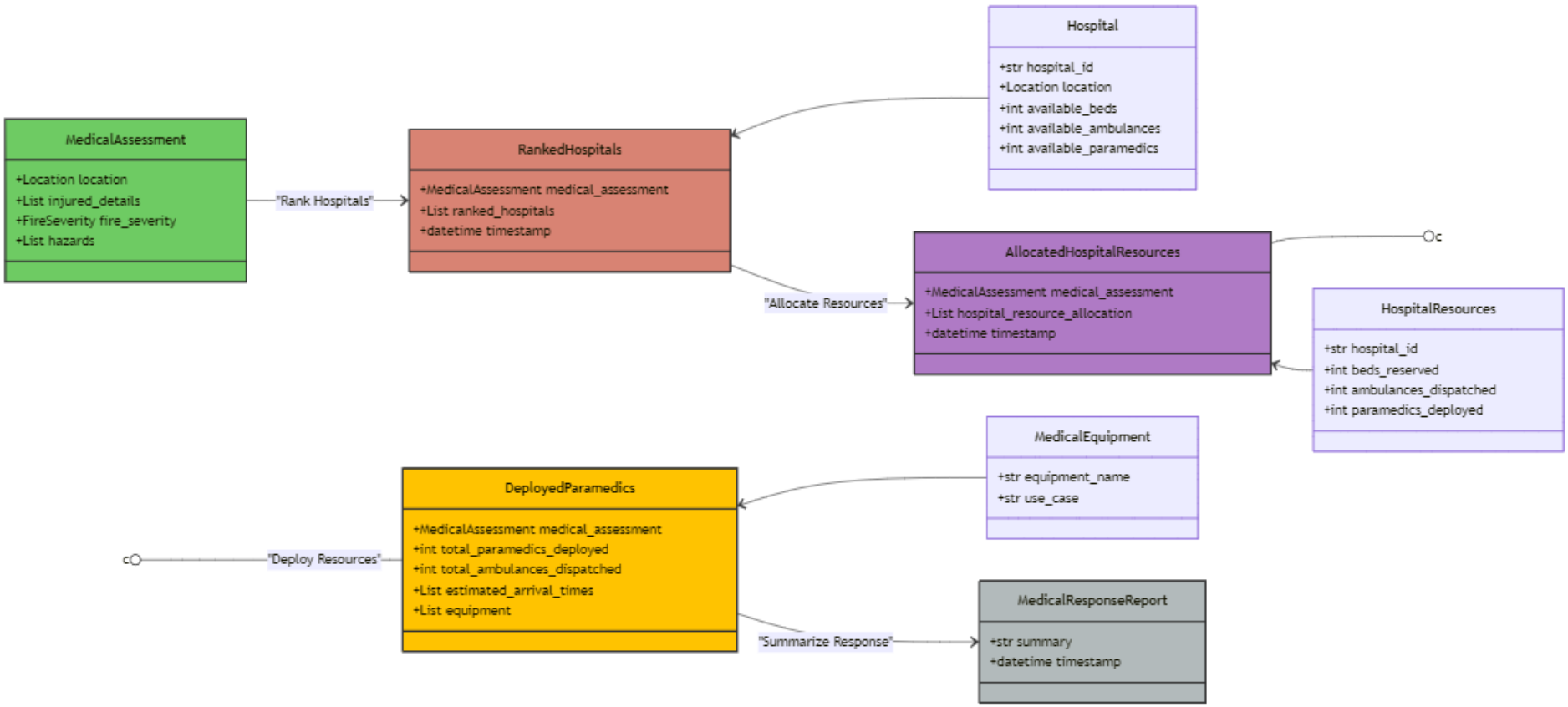


Firefighters Process and Outputs

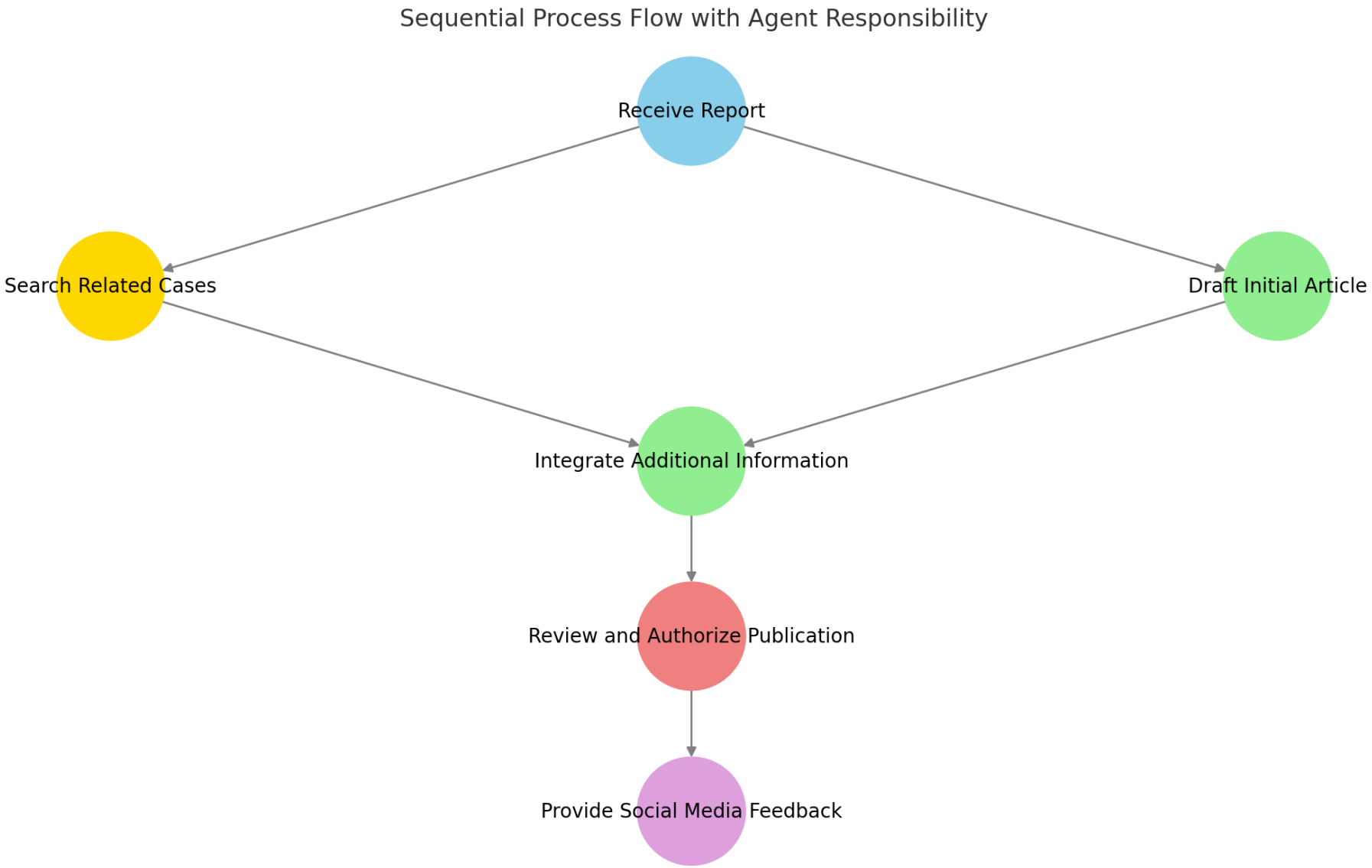
Medical Services Process



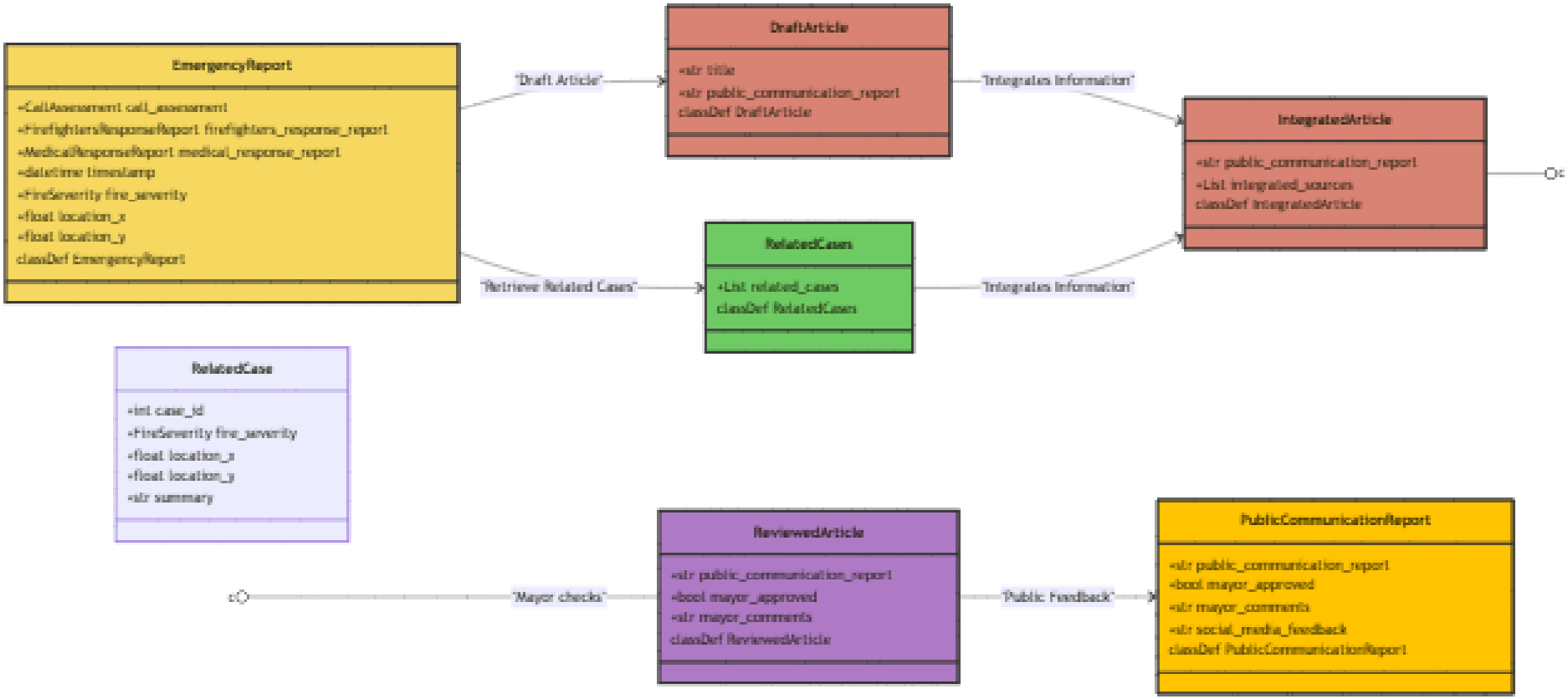
Medical Services Outputs



Public Communications Process

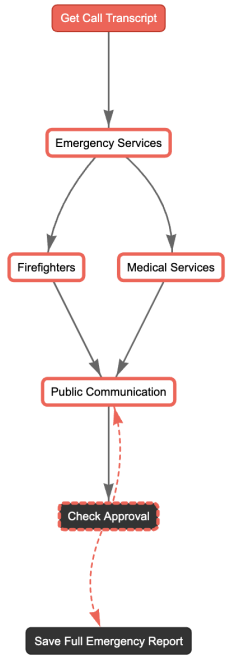


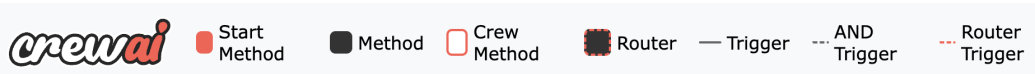
Public Communications Outputs



Emergency Planner Flow

- Crews coordinate through **centralized state**
- Flow manages **state** and **crew kickoffs**
- Use of `_and`, `_or` and `router` allow **complex ordering** and **parallelization**
- **Retry system** facilitates public communications





Emergency Planner State

```
class EmergencyPlannerState:
    call_transcript: str | None
    call_assessment: CallAssessment | None
    firefighters_report: FirefightersReport | None
    medical_report: MedicalReport | None
    public_report: PublicReport | None
    retry_count: int = 0
```

- `call_transcript`: The transcript of the emergency call
- `call_assessment`: From `EmergencyServices` crew
- `firefighters_response_report`: From `Firefighters` crew
- `medical_response_report`: From `MedicalServices` crew
- `public_communication_report`: From `PublicCommunication` crew
- `mayor_approval_retry_count`: Number of mayor approval attempts

Conclusion

- **Emergency Services** establishes robust initial assessment and crew dispatching
- **Firefighters and Medical Services** demonstrates effective parallel operation and complex processes
- **Public Communications** generates useful summaries with mayor approval system and retry mechanisms
- We use a **centralized state management** with the CrewAI flow framework, enabling coordination between crews
- We use a **standardized reporting system** with structured outputs from each specialized crew, which will be compiled into a single report

Thank You!

Questions?

References


Kathleen Keogh and Liz Sonenberg.
Designing multi-agent system organisations for flexible runtime behaviour.
Applied Sciences, 10(15), 2020.


Leonid Sheremetov and Matías Alvarado.
Weiss, gerhard. multiagent systems a modern approach to distributed artificial intelligence.
3, 10 2009.


Michael Wooldridge.
An Introduction to MultiAgent Systems.
Wiley Publishing, 2nd edition, 2009.


Michael Wooldridge.
Properties of intelligent autonomous agents, 2010.