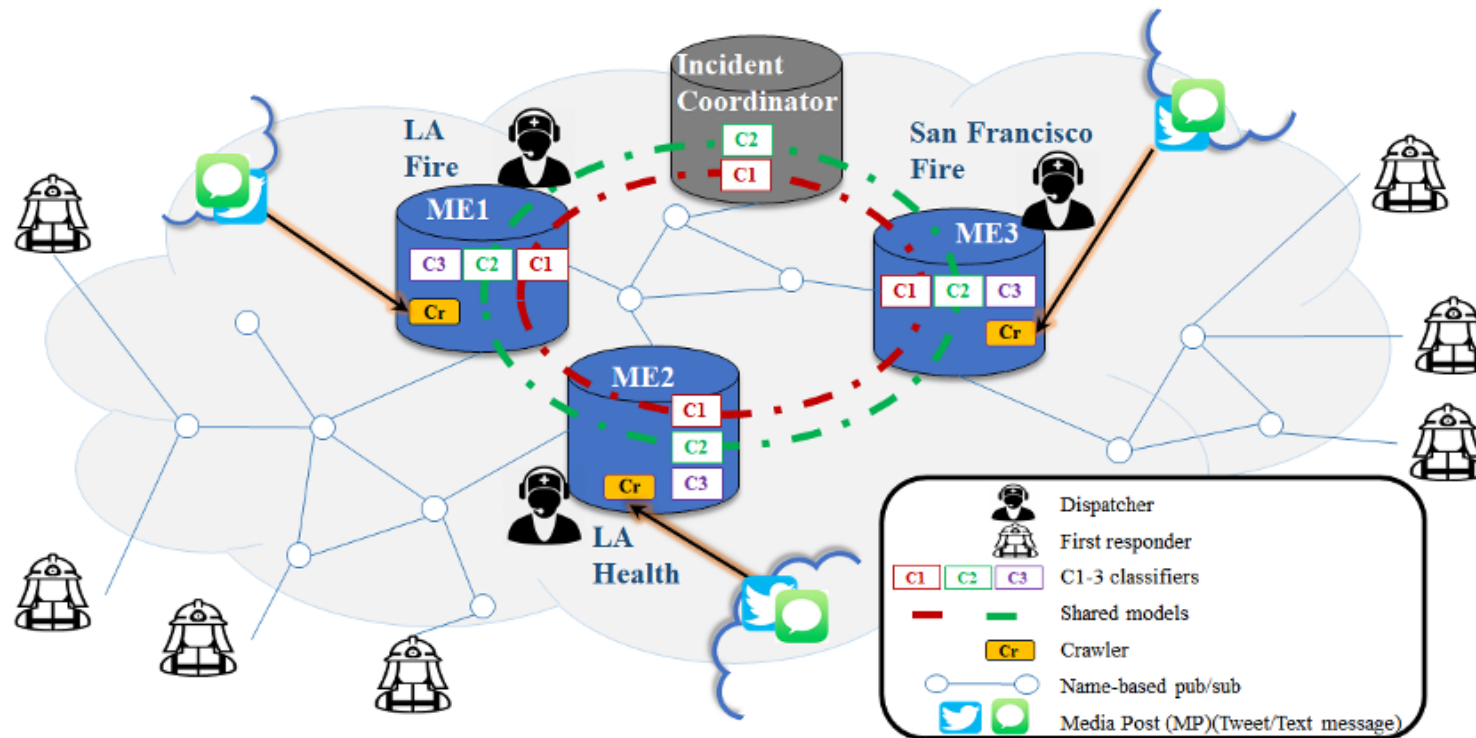


Demo: FLARE: Federated Active Learning Assisted by Naming for Responding to Emergencies

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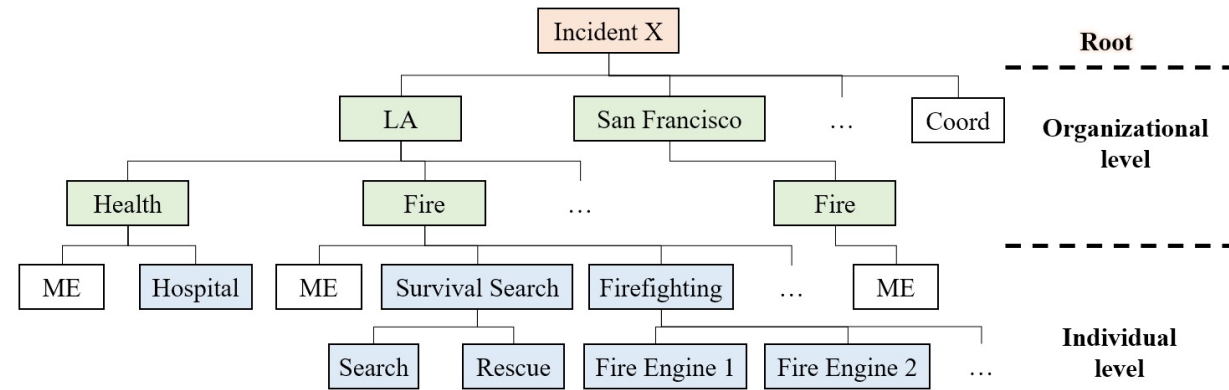
Overview

- **Problem Statement:** how to assign names to free-form text in real-time? (e.g. senders without access to the namespace)
- **Goal:** Provide efficient, timely dissemination of relevant content to first responder teams assigned to different incident response roles using specialized knowledge of first responder (and assisting) departments.



Mapping Content to Names - Integrated with Learning

- **Incident Namespace:** Captures various incident roles and their relations to be used to indicate subscription interests and publication IDs - Also integrated with multiple classifiers:
 - Root level ↔ C1; Organizational level ↔ C2;
Level of individual roles ↔ C3



- **Unified Namespace:** Used for ME-to-first responder, and FL-related messaging (among MEs and Incident Coordinator) as well
 - MEs subscribe to “.../ME”, and Incident Coordinator to “/IncidentX/Coord”
 - In FL: MEs send and receive model results - Incident Coordinator aggregates model and synchronizes MEs
- **Multi-Level Classification**
 - Better overall delivery accuracy accounting for granularity (better C2 classifier leads to the right organization even if C3 sends to inaccurate individual roles within it; better than sending to the wrong organization in a flat classification)
 - Flexibility in managing different mechanisms for AL (every dispatcher specialized for C1, while department-specific dispatchers for C2 and C3) and FL (C1 and C2 shared and federated, while C3 local) per classifier

Media Engine Features

- **DNN Classifier with Universal Sentence Encoder (USE):**
 - Supports incremental learning allowing model to train on new dataset as it is made available
 - USE is pre-trained for sentence embedding over huge data corpus allowing it to capture rich semantic information
- **Active Learning:**
 - Reduces the manual labeling effort of the dispatcher by selecting only crucial messages required for training of the classifier
- **Federated Learning:**
 - Enables learning across various public-safety departments with specialized knowledge to handle notifications related to their roles, in a cooperative manner
- **Message Passing:** A technique to pass the free-form text messages across different Media Engines for their finer-grained classification by specialized knowledge of the dispatcher
 - Leverages organizational expertise in labeling more efficiently to eventually achieve better performance

Results

- **Overall results with streaming data**

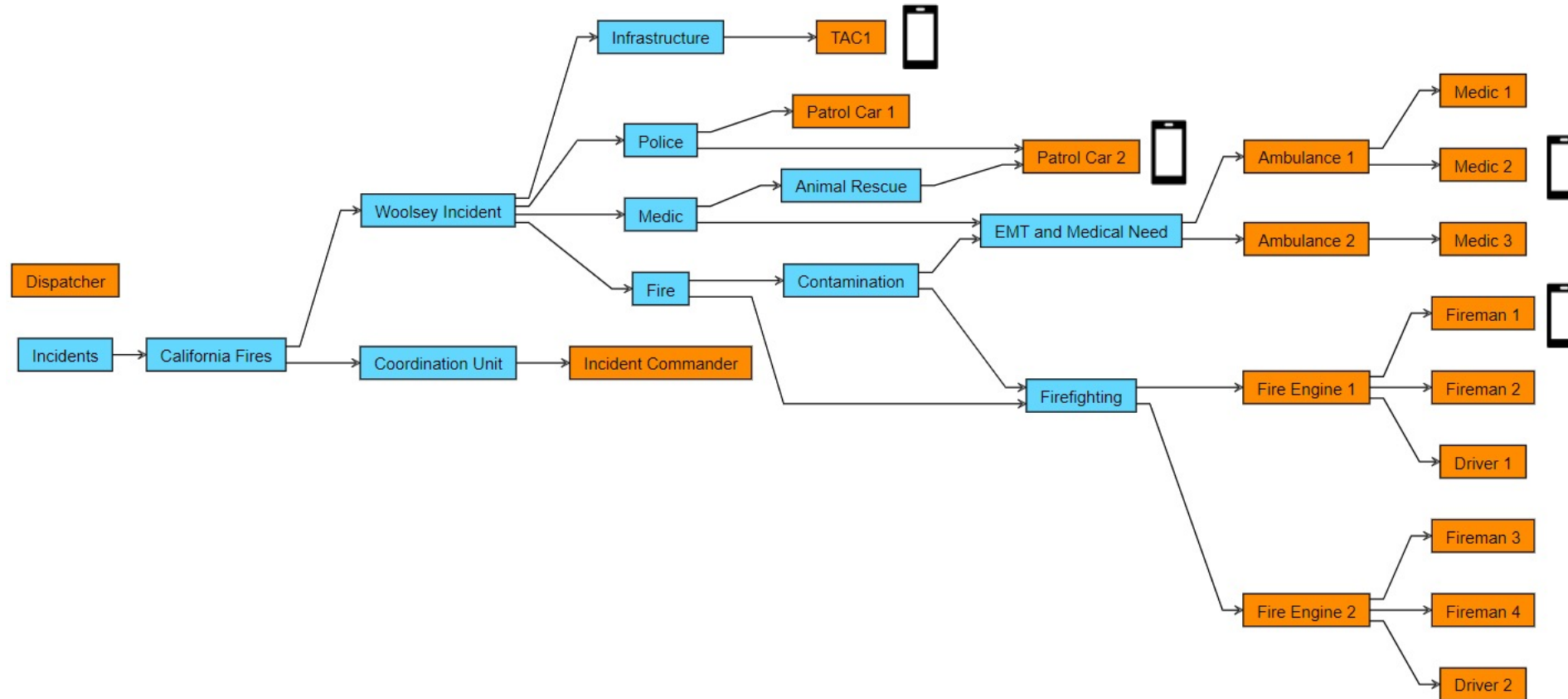
- **98.38%** of all disaster-relevant tweets get published and delivered to “some” first responder(s), some may be to the incorrect organization/role
- **1.62%** of tweets classified “irrelevant” by C1
 - Not examined further
 - But, these tweets appear to be borderline & non-actionable, e.g., opinion

	C1	C2	C3 (avg)
Accuracy (initial)	0.8262	0.6847	0.8553
Accuracy (dispatcher-assisted)	0.9091	0.8963	0.9291
Recall/F1 (initial)	0.9462	0.6183	0.8238
Recall/F1 (dispatcher-assisted)	0.9838	0.8589	0.9034
# of input tweets	3521 (of 3521)	2613 (of 2656)	2342 (of 2656)
# of correctly classified tweets	3201	2342	2176
# of tweets labelled	908	1223	441
Overall accuracy	0.9091	0.8818	0.8193

- **88.18%** of all disaster-relevant tweets get published to first responder(s) in the right organization, whether or not it is to the right fine-grained role
 - Remaining **10.2%** delivered to incorrect organization - but can be delivered correctly based on the feedback from first-responders
- Overall, **81.93%** of all disaster-relevant tweets get published to the first responder with correct role in right organization, at the finest granularity possible

Incident Namespace (Roles and assignment)

- Roles : ■
- First Responders : ■
- Each role can be subscribed by multiple first responders and each first responder can subscribe to multiple roles.



Demo

Text Messages

- Stuck in traffic due to bridge collapse.
- Case of looting witnessed on abc street.
- They're doing fire works when I get off wow.
- Severly injured, in need of medical assistance.
- Fire from above Sylmar Ca at around 4:30 pm.
- I am here for the animations. They're on fire.
- 5 people found dead in cars in Paradise wildfire.
- Animals waiting to be rescued in Malibu.
- Smokes and flames all over the place, unable to breathe.
- Foot cramps will be the death of me.

```
> python3 useClassifierRuntimeWithC1.py  
Enter custom text message: █
```

TAC 1

Medic 2

Patrol Car 2

Fireman 1

