Sect 3

At the application level, the operation is pretty simple: by

looking at Fig. 1, when a vehicle has an accident,

the neighbor cars (if any) detect the accidents (from secondary sensors, say sudden deceleration, stop, pattern recognition on video camera, etc). When the car determines that there is a reasonable probability that an accident occurred, it sends an alarm (auto-

matic safety packet in red) to neighbors (possibly including a still picture of the accident, showing its view of the accident). It also (optionally) posts the video on the web using LTE. Note: this alarm is in addition to the DSRC type beacon continuously exchanged by cars, though it also uses DSRC spectrum. It is imperative NOT to send the full video immediately, else the network may be hopelessly congested by vehicles that mistake a simple slow down for accident.

At this time, a backbone of relay nodes is created,

so that the number of forwarding nodes is limited (details in

Sec. 3.1) and a logical infrastructure becomes available for

transmission. The vehicles that are less than 5km away

from the incident (they check their distance from the sender

of the alert), forward the alarm. Beyond 5km, the video of the accident will be picked up

from the web.

Authorized vehicles near the crash, upon receiving the alert, can request the video download, using an ICN type approach, ie they send a request to one or more of the vehicles that have advertised their videos. The request triggers a video stream delivery from the origin or from other nodes on the “backbone”. For example, suppose an emergency vehicle receives this alert within 5km from the scene, and

it prepares to intervene (even before any 911 call is received). Now, our

application gives the opportunity to the emergency vehicle

to request the video(s) of the incident scene from the most appropriate view points. This video re-

quest (in green) is forwarded back through the backbone

and reaches the nodes with their camera turned on.

Only nodes with a good view of the accident are probed. Automatically, with no driver intervention, the selected

yellow streams are forwarded back to the emergency vehicle

that can evaluate the situation on the incident

scene in real time and understand how to intervene and if

other resources or particular equipment are required.

It is important to notice that all the packets are geo-tagged

with previous hop, originator and/or destination/ROI coor-

dinates, so direction of propagation is implemented. In par-

ticular the safety broadcast is sent in all the directions, while

the other packets are forwarded only if they meet the direc-

tion criteria. For instance, a vehicle on the right of the am-

bulance, farther away from the accident would not forward

the video request packet (the second message of the frame-

work, after the safety one) on its right, because it knows its

position, the position of the accident xa, ya (from the safety

message) and the position of the source of the video request

packet xe, ye (the emergency vehicle). Hence, it can build

the logical ROI as a rectangle with diagonal equal to the

segment from xa, ya to xe, ye and only forward the packet if

it has to.

Since the packets travel in directional multi-hop (and thus

broadcast) fashion, having more video requesters is not an

issue, because the packet propagation is cut at the farthest

destination, or propagated in more directions. For example,

having an emergency vehicle in both directions of the high-

way simply means that the packet propagates both on the

right and on the left of the source node. Moreover, having

2 emergency vehicles in the same direction implies that the

packet’s propagation is not interrupted at the first one, but

at the farthest emergency vehicle: the ROI is calculated for

the coordinates that maximize d(xe,i, ye,i, xa, ya), where i

represents the i-th emergency vehicle).