Inter-Vehicular Communications: Quo vadis?
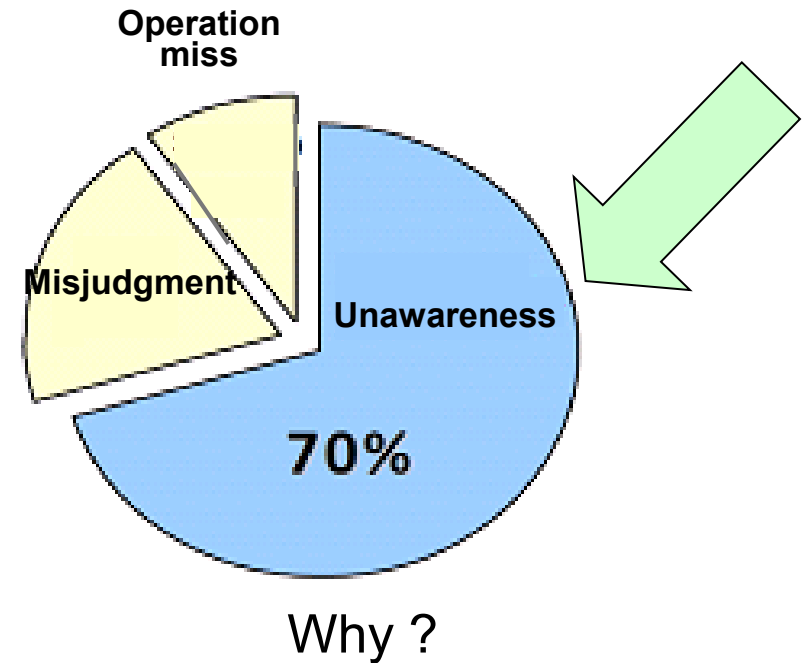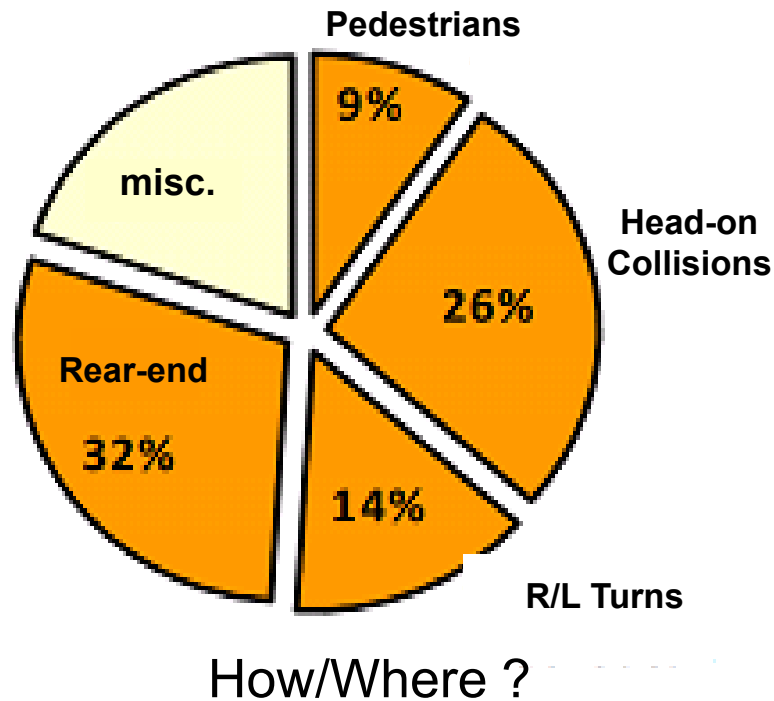
Onur Altintas

Toyota InfoTechnology Center, Japan

Traffic Accident Statistics

How/Where ?

Why ?

Vehicular communications is expected to remove up to 80% of the "unawareness" component

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How does it work?

- V2V communications as of today
  - Broadcast only
  - It is like yelling what you are doing whether it is of interest or not to people around you - 10 times/second
  - Receivers assess other vehicles' "threat levels"
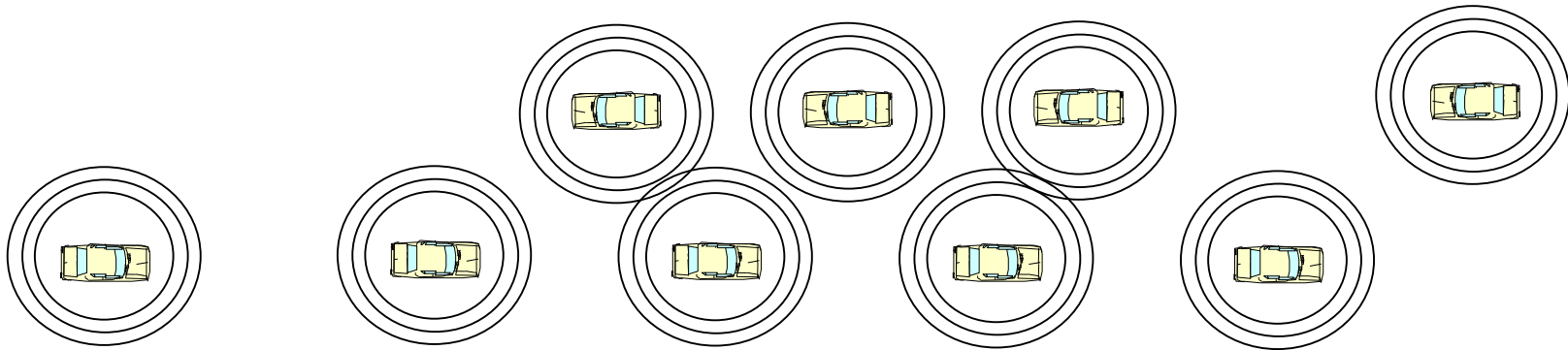
  - Reliability measure (Japan case)
    - 80% correct reception at single attempt
    - 96 % in two attempts

Is it ready to deploy?

- Inclined to say "yes, almost ready" – technically

However,

- Non-mandated solutions must show immediate benefit in order to be accepted by the consumers
  - Seat belts → Airbags → IVC ?
  - Retrofit and aftermarket devices can accelerate deployment
- Ongoing challenges regarding privacy and security
  - Especially consumers in the US are very "privacy-conscious"

Scalability

- CSMA/CA à la highway

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An unexpected role for vehicles

- Vehicles acting as part of "network" infrastructure
- Vehicles carrying "offloaded" data on behalf of infrastructure
  - Non-real time
  - Especially during disrupted/disconnected situations
- Implications for safety-critical vehicular applications need to be dealt carefully

What could be the next?

- If done correctly, V2V/V2I might be a key enabling technology towards autonomous - automated driving

Automated Driving

- 360-degree, real time situational awareness required

- Number of radars, lidars, sensors, cameras in the vehicle increases

- Direct communication with other vehicles and with the infrastructure can significantly augment the sensing capability of a single vehicle
  - Not only the states of other vehicles, but also environmental information needs to be exchanged

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Automated Driving

- Google's self-driving car gathers 750 megabytes of sensor data per second
  - Not all of that needs to be transmitted
  - But how much of it needs to be shared with neighboring vehicles ?
    → analysis of communications capacity needs

Credit: Google

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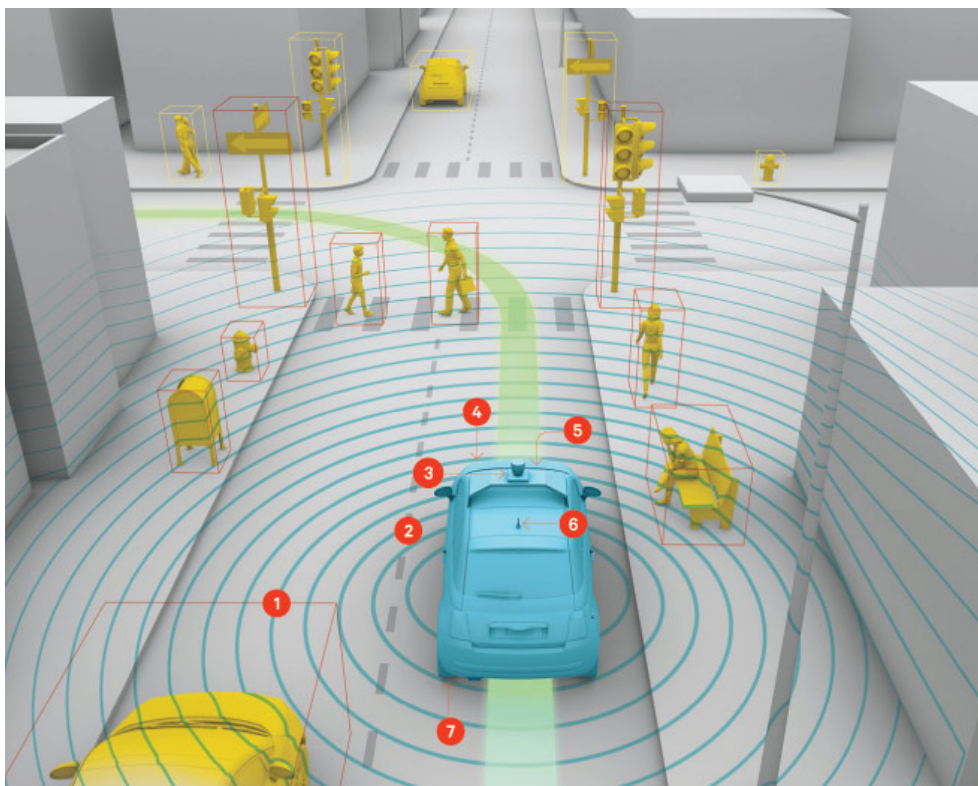
Summary

- Cellular world is now moving to 5G

- Vehicular Communications is getting ready for 1G

- Deployment of the first generation of safety systems will happen soon

- We will only understand and acknowledge the problems by then

- Things will become more interesting for the research community towards the creation of the second and further generations of vehicular networking

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