Vehicle-to-Everything Communications (V2X) in 5G

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Abstract

In the abstract, you write 2-3 paragraphs which summarize the key parts of your report.

I. PAPERS USED & HOW TO CITE THEM

- V2X access technologies: Regulation, research, and remaining challenges [Cite: machardy2018] [1]
- Dedicated short-range communications (DSRC) standards in the United States [Cite: kenney2011] [2]
- Standards for vehicular communication—from IEEE 802.11p to 5G [Cite: festag2015][3]
- Ready to roll: Why 802.11 p beats LTE and 5G for V2x [Cite: filippi2016] [4]
- Heterogeneous Vehicular Networking: A Survey on Architecture, Challenges, and Solutions [Cite: zheng2015] [5]
- LTE-advanced in 3GPP Rel -13/14: an evolution toward 5G [Cite: lee2016] [6]
- LTE for vehicular networking: a survey [Cite: araniti2013] [7]
- Use cases, requirements, and design considerations for 5G V2X [Cite: boban2017] [8]

II. INTRODUCTION

- Cooperative intelligent transportation systems (C-ITS) gained a lot of interest from different groups. V2X, short for Vehicle to Everything communication, is a specific case of ITS, dealing with wireless communication and coordination between vehicles and their environment. - V2X can be taken in this paper to refer specifically to communication between overland road vehicles and other con- cerned entities, be they pedestrians, infrastructure, or other vehicles. [2] - Communication in V2X cases happens in a frequently changing vehicular ad-hoc networks (VANET)s, where nodes of the network leave and join the network at a specific location as frequently as the traffic floads. This VANET is supported by a static network. Nodes of this network a typically referred to as road side units (RSU), helping to coordinate non-static nodes communication traffic, distributing data and providing additional services [2]. - V2X technology tries to increase safety, efficiency and reduce economic costs of the current and future transportation system. [2]

III. USE-CASES

A. Vehicle-to-Vehicle

B. Vehicle-to-Infrastructure/Network

C. Vehicle-to-Person

IV. SERVICES

- Services can be grouped into 4 major categories: Infotainment, Traffic Efficency, Cooperative Driving [2]

- Infotainment: - usually non-driving related topics. - geo-realated advertisment - messaging - general media transfer, like internet services, netflix, etc. - Infotainment services are characterized by relatively low min- imum latency requirements (latency on the order of 500 -

1000 ms, minimum transmission frequency on the order of 1 Hz) and throughput comparable to conventional mobile broadband services, up to around 80 Mbp [2]

- Traffic Efficency: - Broad application, generally tries to optimize traffic flow [2] - intersection timing handling - real time route planning and changing, dependent on current/live situation - needs to exchange all information about current speed, current possition, as also destiny of a car - usually not safety critical [2] - medium latency and throughput [2]

-Traffic Safety: - goal is to reduce frequency, severity of collision in our current transportation system, with regards vehicles involved. - need for critical decision making, coping with non-standard behaviour of traffic participants, increase safety of especially, cyclist, pedestrians - clearing roads for emergency cars - Including not only crash prevention, but also knowing when an inavoidable crash will happen (pre-crash sensing) and taking all needed steps to reduce the impact of that event [2] - pre-crash sensing has highest requirements in this category: minimum round-trip latency of 50ms with 10Hz broadcast frequency [2]. - requirements for troughput will increase in the future, up to 700 mbps between vanet nodes estimated [2] - leads to a need for a high throughput, ultra reliable robust network.

V. V2X IN LTE NETWORKS

- use [7]

A. Network

Access Technologie from LTE point of vi

B. Requirements

Ffrom LTE point of view

C. Services

VI. EVOLUTION FROM LTE TO 5G

- use [6]

A. Network

Something about new infrstucture

B. Requirements

C. Services

VII. OTHER ACCESS TECHNOLOGIES

A. Dedicated Short Range Communication

- use [2] - use [1]

- Most discussions of, vehicular ad-hod networks, or VANETs communications envision the use of dedicated short-range communi- cations (DSRC), supported by the IEEE 802.11p standard [2] - low end-to-end latency, flexible organization due to a lack of centralized control, and relatively low cost. But it is also beset by a number of issues, including service degradation in congested scenarios, security problems, and difficulty coping with compromised line of sight [2]

B. Visible Light Communication

C. Bluetooth

VIII. RESULTS AND DISCUSSION

A. Cellular V2X versus DSRC

- DSRC: need for a dense deployment to cope with line of sight problems, service degradation in congestion scenarios to name a few [2] - Who will pay for theses as IEEE 802.11p networks are typically not used outside, therefore networks typically do not have access control as cellular networks [2] New use case for IEEE 802.11 protocol - DSRC mandated standard by U.S. Department of Transportation (USDOT), European Telecommunications Standards Institute (ETSI), the European Committee for Standardization (CEN) [14], and the Association of Radio Industries and Businesses (ARIB) [2] - Cellular V2X (C-V2X) Compared to DSRC, these technologies offer a number of advantages, including a much larger coverage area, pre-existing infras- tructure, deterministic security and QoS guarantees, as well more robust scalability [2] - C-V2X has on negative side: Centralized architecture, higher price for network, higher end-to-end-latency!, dependency on network connectivity [2] - Latency is a major obstacle for C-V2X deployment. Services with high need for time sensitivity, e.g. cooperative platooning or pre-crash sensing need low latency [2] - Relate here somehow to Ultra Reliable Low Latency stuff from lecture. - How is price determined in DSRC? - Dependency of network connectivity should be able to be done by D2D sidelink without eNB or gNB beeing available. Source here. - Would D2D sidelink also solve latency issues?

B. Other Technologies for V2X

- several other technologies, including Bluetooth, satellite radio, and visible light communications have been considered for use for V2X applications. While each of these technologies has features which make it potentially promis- ing, each also has some unavoidable limitations, as covered in Section III-D, [2]

C. Heterogeneous Network

- maybe something about our opinion if this solution is viable. - good source [5]

D. Standardization

- While much of the technology involved in V2X communi- cation has been well-coordinated internationally, a number of regional differences have arisen. One of the most pointed dif- ference between the U.S. and EU V2X standards are the mes- sage sets defined for communication between vehicles [2] - could be a problem for traveling, common standard would be necessary to enable easier production and easier traveling. - For detailed message evaluation see [2].

IX. CONCLUSION

The conclusion goes here.

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