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Security challenges at VANET network

Challenges, threats and solutions for secure communication in traffic networks

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Introduction to VANET networks

- Vehicular Ad-Hoc Networks (VANET) are a type of wireless networks intended for communication between vehicles and traffic infrastructure.
- They function without centralized control, allowing vehicles to exchange information in real time.
- They are used to improve traffic safety, inform about road conditions and optimize traffic.

Introduction to VANET networks

Application examples:

- Collision warning.
- Information about weather conditions and blockades.
- Real-time navigation.

Key characteristics of VANET networks

- High mobility: Vehicles move at high speeds, which affects the stability of connections.
- Dynamic topology: The network structure is constantly changing due to the movement of vehicles.
- Decentralization: The network operates without a central server, which is both an advantage and a challenge.
- Short-term connections: Due to the high speed, communication between vehicles can last only a few seconds.
- Low connection capacity: The network must be resilient to delays and data loss.

Advantages applications of VANET networks in traffic

- Improving safety: The exchange of information between vehicles reduces the risk of accidents.

- More efficient traffic flow: Optimizing vehicle movement through dynamic adjustment of traffic lights and bypassing traffic jams.

- Timely information: Informing the driver about road conditions and potential hazards.

- Support for autonomous vehicles: The integration of VANET networks helps coordinate autonomous cars.

Examples of using VANET networks

V2V communication:

- Warning of accidents and sudden braking.
- Coordination when changing lanes and turning.

V2I communication:

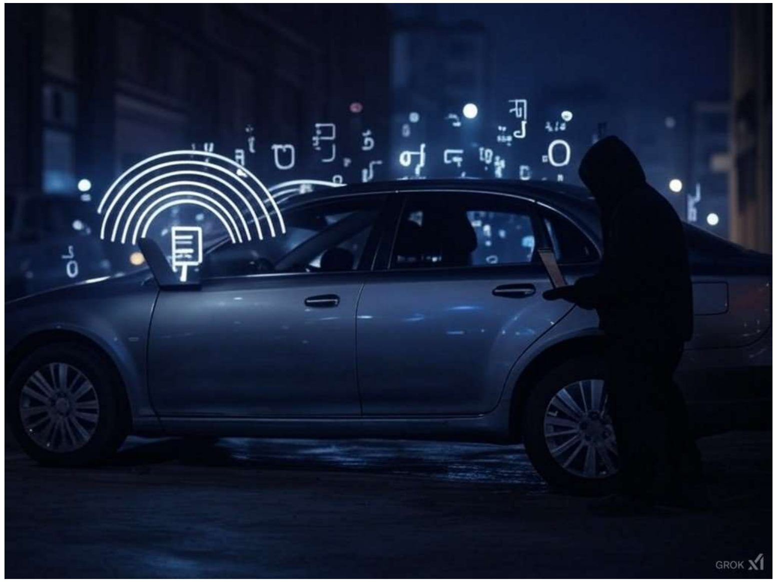
- Dynamic control of traffic lights to reduce congestion.
- Warnings of roadworks or lane closures.

V2X communication:

- Communication with pedestrians, cyclists and smart devices.

Security challenges in VANET networks

- Data Vulnerability: Due to wireless communication, data is susceptible to interception and manipulation.
- Resource constraints: Vehicles have limited processing power and memory for complex security protocols.
- The question of trust: How to ensure that data comes from reliable sources?
- Attack speed: Attacks happen quickly because of the short time intervals in the network.



Attacks on confidentiality data

- **Eavesdropping** :
- Attacker intercepts data between vehicles, such as location and message warnings.

- **Theft identity** :
- Malicious person can take over identity vehicles and send fake informations.

- **Influence on privacy** :
- Possibility monitoring movements of vehicles and driver.

Attacks on integrity data

•**Fake messages**: Attackers can send fake information, such as fake warnings on accident, which can cause confusion .

•**Manipulation data**: Change of traffic data conditions can lead to wrong conclusions in decisions of driver or system.

•**Influence on vehicles coordination**: Wrong data can cause collisions and congestions.

Attacks on availability

- Denial-of-Service (DoS) attacks: Overwhelming network by numberous fake requests blocks communication between vehicles.

- Distributed Denial-of-Service (DDoS) attacks: Coordinated attacks with more sources, making network unusable.

- Influence on traffic : DoS attacks can cause delays, impact on security and increase network traffic.

Attacks identity-based

- Sybil attacks : Attacker creates more fake identity in order to take over control over network.

- False Presentation: Attacker benefits identity legitimate vehicles to send fake data .

- Impact: Sybil attacks can interfere system navigation and bringing decision in the network.

Challenges with authentication and authorization

- Authentication: How to ensure that communication comes from the real one source ?

- Authorization: Who has right access certain data or functions?

- Problems: Complex authentication systems can slow down communication, which is critical in VANET networks.

Cryptoanalysis in VANET networks

- Weaknesses encryption: Inappropriate or outdated algorithms can enable attackers to decrypt data.

- Attacks on keys: Theft or compromising cryptographic keys threatens security system.

- Balance performance and security: More complex algorithms can slow down communication, which is unacceptable in real-time applications.

Protection privacy driver

•Monitoring Locations : Attackers can follow the movement of vehicles and analyze habits of a driver .

•Unauthorized Identification : Private data of the driver can be discovered to third parties.

•Solutions : Use methods for anonymization and encryption .

Role artificial intelligence in prevention attacks

- Detection anomaly : AI can recognize unusual forms in the network traffic and mark them as potential threats .

- Predictive analysis : Prediction attacks on basis historical data .

- Autonomous answer : AI systems I can automatically react on threats and adapt network parameters .

Conclusion

•VANET networks they have huge potential for improvement security and efficiency in traffic .

•Security Challenges : Still going on there are significant problems that must be to be resolved , especially in the area of protection data and authentication .

•Looking to the future : With technology advancements it is expected to be higher integration of VANET networks into traffic.