Transmission of IPv6 Packets over IEEE 802.11-OCB Networks

draft-haerri-ipv6-over-80211OCB-00

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Introduction to 802.11-OCB (a.k.a. DSRC)

Classic 802.11 WLAN	IEEE 802.11p – aka IEEE 802.11-2012 OCB
Synchronizing	OPTIONAL HIGHER LAYER Synchronization
Scanning	NO Scanning
Authentication	HIGHER LAYER Authentication
Association	IMPLICIT Association
Communication	DIRECT Communication
Concept of Basic Service Sets (BSS)	"Communication outside of the context of the BSS"

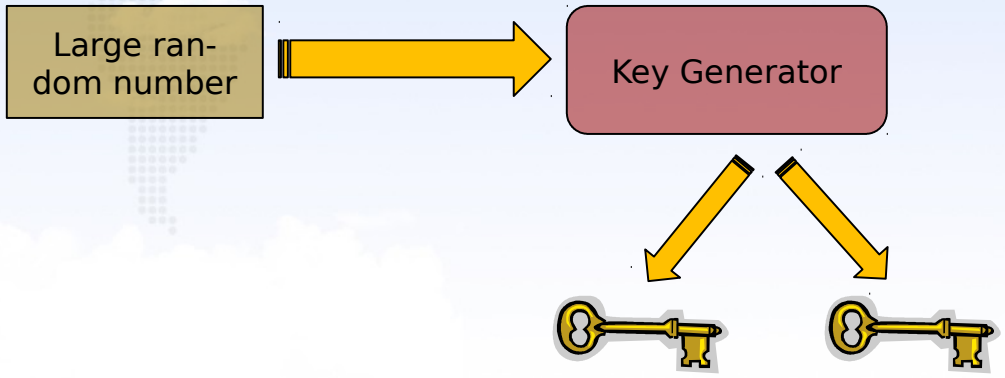
- Scenario:
  - IPv6 is for non-safety related traffic ONLY (according to the ITS charter)
  - Single hop IPv6 communication – Multi-hop is in MANET (according to ITS charter)
  - Vehicles contain one or multiple IPv6 'things'
  - Vehicles are not specifically connected to Internet (or only episodically)
  - IPv6 stack may co-exist with non-IP stack…or not
    - some 'things' may only have an IPv6 stack
  - For Cars: Any car with its engine turned 'on' and participating to traffic MUST trans mit non-IP traffic on ch. 178 (US)/ch. 180 (EU).
    - IPv6 traffic may co-exist but shall not break any non-IP mechanism or generate any interferen ce with non-IP traffic

Challenges (some of them…)

- IPv6 over WiFi OCB:
  - Scanning
    - How can we dynamically 'find' a channel
      - CCH (ch. 178 US, ch. 180 EU) forbidden for IPV6
      - Need service announcement on a 'well-known' channel !
  - Security
    - If an RSU is connected to Internet, what is forbidding me to hacking into the Internet?
    - For OBUs or other RSUs: how can we be sure that the one claiming to transmit is truly the transmitter?
  - WiFi OCB link:
    - Link asymmetry (Tx power, antenna heights): how can IPv6 and IPv6-related mechanisms adapt to asym metric IPv6 links (non-reflective & non transitive) ?
      - E.g.: IPv6 ND (e.g. 6lowPAN ND: RFC 6775)
  - IP addressing & Privacy:
    - How can I generate my IPv6 address ? DaD not fully working…(RFC4429 an option..)
    - How can I generate my IPv6 'temporary/optimistic' address?
      - How can IPv6 mechanisms softly handle spontaneous change of IPv6 addresses (including routers)? IETF WG DMM/MIP ?
    - Privacy:
      - IPv6 prefix shall not reflect my true subnetwork, not allow anybody to trace me back to my home network
        - » IPv6 Link Local address required, when not connected to DHCPv6
      - NIC/MAC shall not reflect my true ID: need NIC/MAC pseudonyms

Security in 802.11-OCB Systems - Asymmetric Cryptography

- In order to initiate the system, a set of public/private keys needs to be obtained.

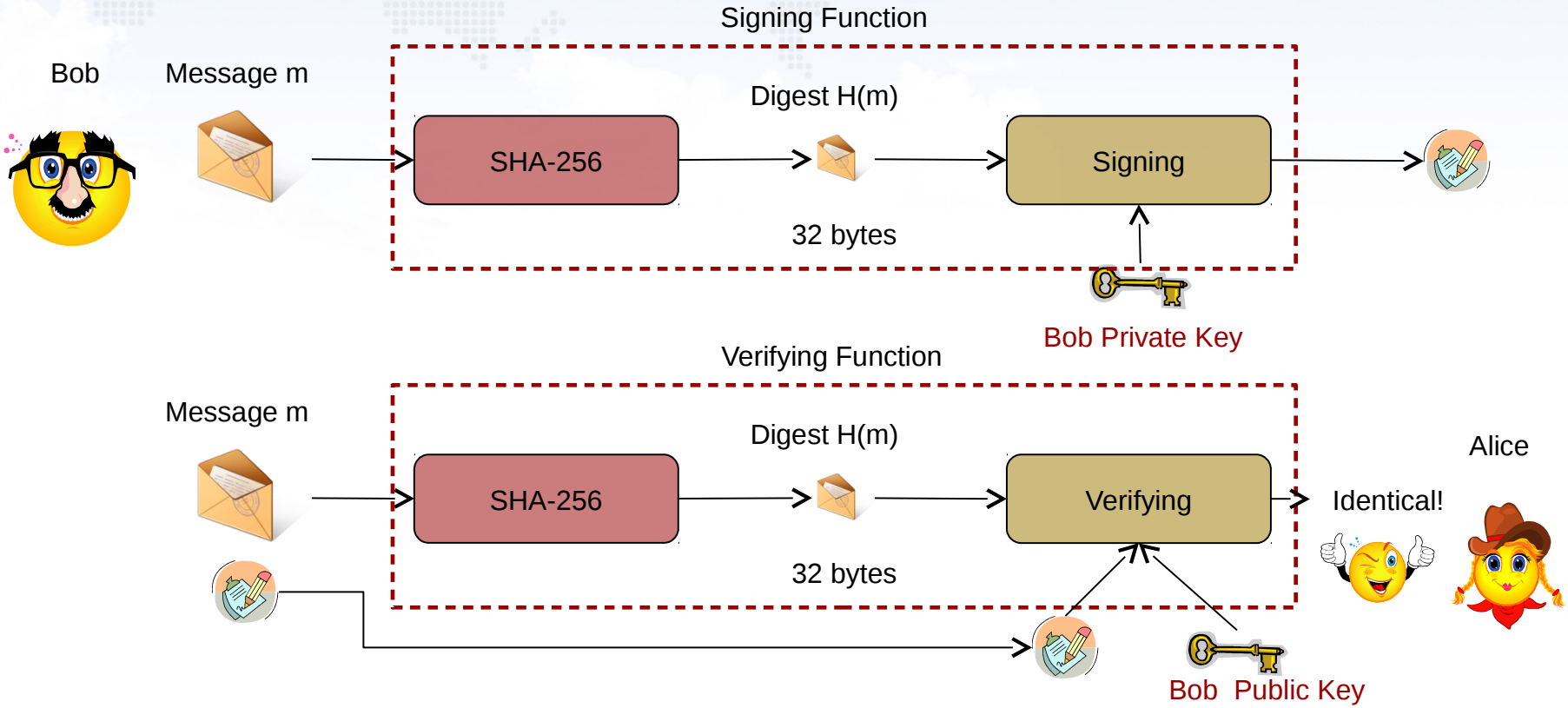


- Who generates these keys?
  - A Certifying Authority / PKI third party

- Vehicles are „pre-loaded“ with a set of public/private key
  - Similar to registering a vehicle and getting a license plate
  - For anonymity, vehicles receive a „pool“ of public/private keys

Authentication in 802.11-OCB systems- Elliptic Curve Digital Signature Algorithm (ECDSA)

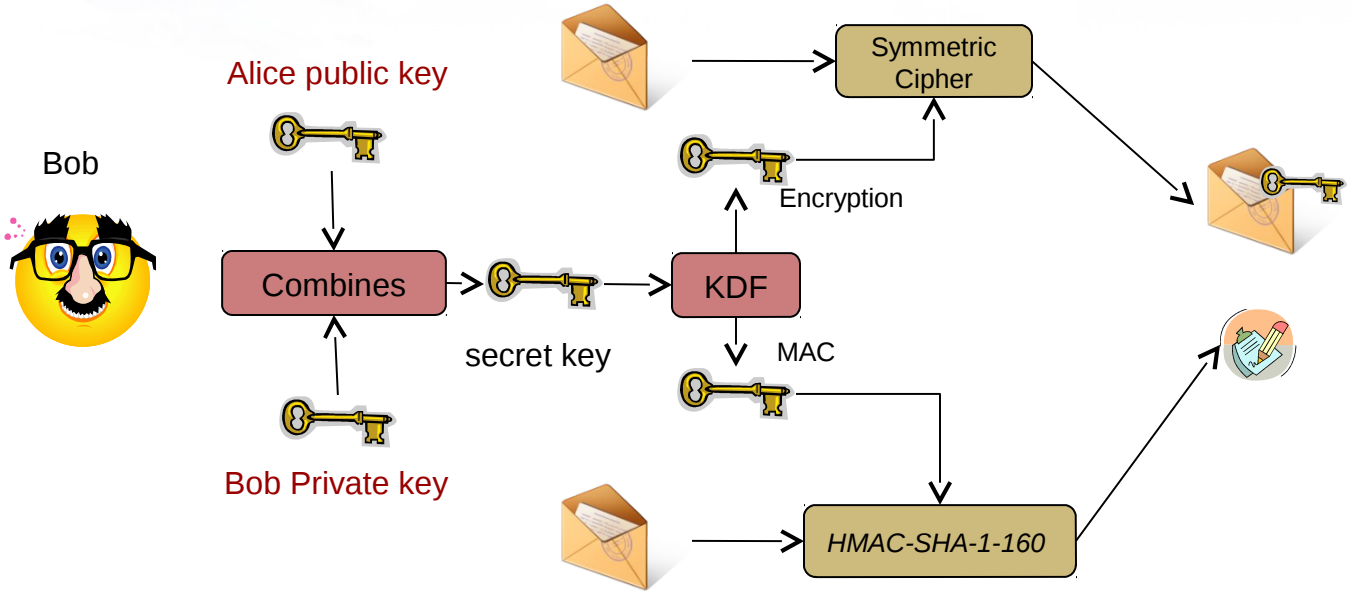
- Signing a hash version of the message is more efficient than signing th e message itself
  - The crypto-hash algorithm is SHA-256



Encryption in 802.11-OCB systems - Elliptic Curve Integrated Encryption Scheme (ECIES)

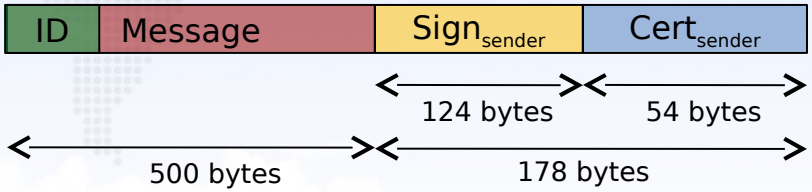
- Encrypting each message using an asymmetric cipher is computationally too expensive
  - Use the property of shared secret from asymmetric cryptography
    - Bob combines his private key with Alice‘s public key
    - Alice combines her private key with Bob‘s public key

- Extract an Encryption and a MAC key from the shared secret

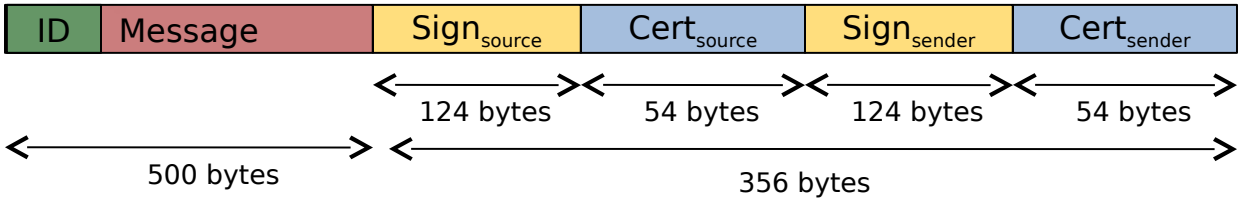


Exchanging Security Credentials

- Example: Authentication and Integrity
  - Single Hop Communication:



  - Multi-hop Communication:



- For a 500 bytes message, the security overhead may reach up to 71%...
- But more important:
  - **Who is assigning my ID?**
  - **Who is assigning my certificate?**

Address Randomization

- Identifiers enable tracking
  - MAC Address,
  - IPv6 Prefix,
  - IPv6 Host Identifier
- Randomization needs to be coordinated
  - Certificate, MAC Address, IPv6 address all change on “renumbering event”
- Perform changes at the right time
  - When it is safe, e.g., car is stopped
  - Preferably “in a crowd”

Proposal

- Disclaimer:
  - If a vehicle is having access to the IEEE 1609.2 or ETSI ITS security mechanisms
    - USE THEM ^^
  - Here, we look at the case where vehicles or other IPv6-compliant ‘things’ would not have ac cess to them..

- Pseudonyms:
  - Random generation of a 48-MAC address,
  - Coordinated with certificate change, IPv6 address generation
  - Alternative: RFC4941

- Security:
  - Use well used/known security mechanisms to generate public/private keys, certificate (+ we b-of-trust)
    - CGA+RSA as in RFC 3971 (SEND) could be an option
    - IPSec..but need mechanisms for preshared secret
    - PGP..
  - Each associated to one of the random pseudonym
  - Challenge: PKI? Root certificate? (vendors, specific ITS-related IPv6 service?)