Navigation Message Authentication (NMA) for NavIC SPS

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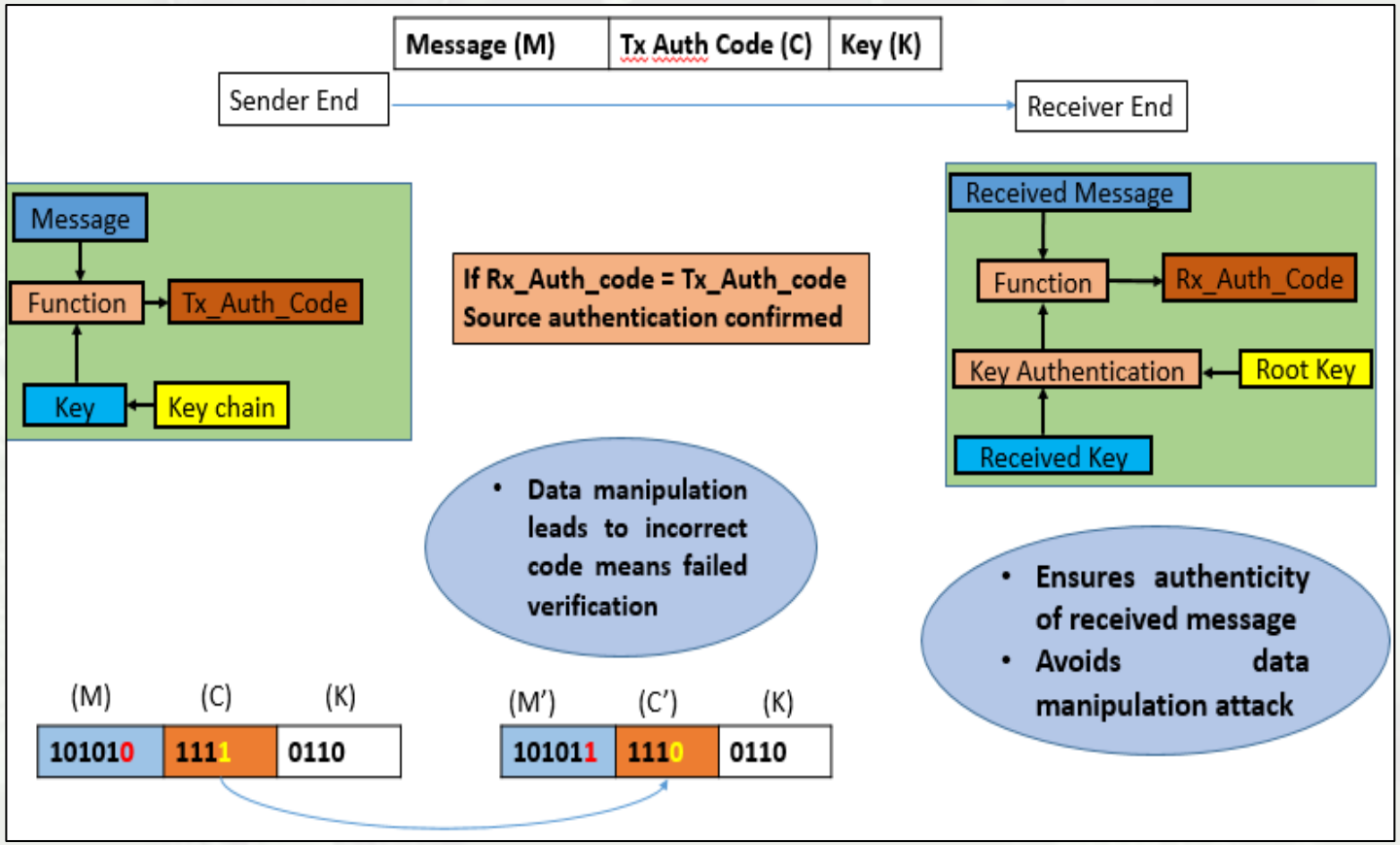
NMA as Anti-spoofing Measure

- Spoofing involves simple repeater attacks - moderate signal generation attacks - highly sophisticated signal estimation attacks.
  - Data manipulation attack: wherein the spoofer alters the navigation data containing satellite ephemeris and clock corrections.
- The ***Navigation Message Authentication (NMA) in NavIC SPS*** proposes to provide data authentication as value added provision.
  - The NMA shall provide NavIC receivers with the assurance that the received navigation message is coming from the system itself and has not been modified.

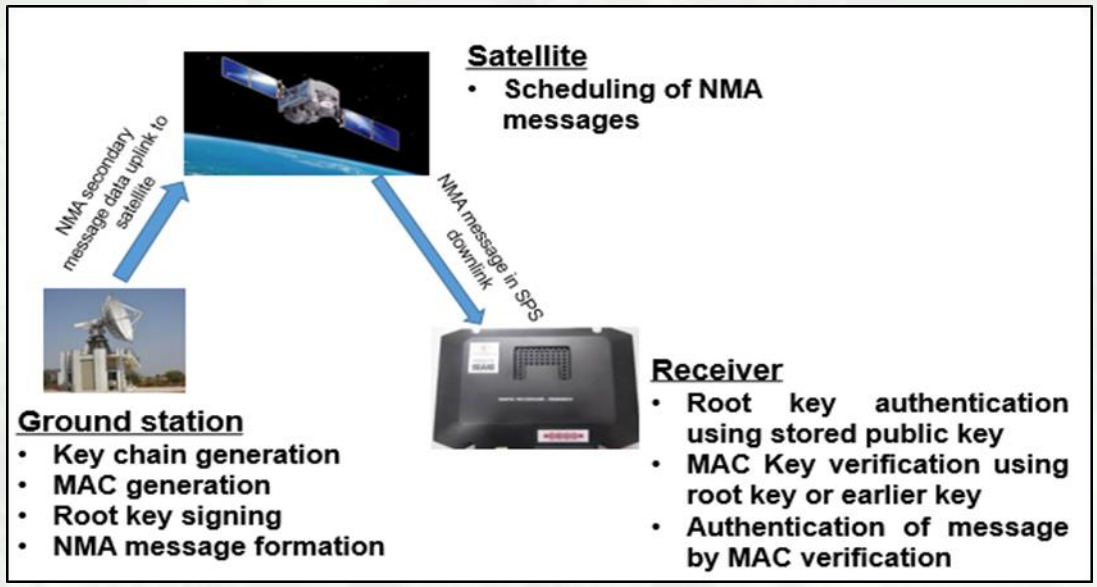
NMA Concept



Major Constraint:
The receiver and sender should be in ***loose synchronization***.

NMA for NavIC SPS

- The functional elements of NavIC –SPS NMA scheme are distributed over control, space and user segments.
  - The apportionment is done considering minimum change at the space segment.
- The NMA in NavIC SPS is proposed to be offered by defining a new secondary message.
  - Utilizing the flexibility of NavIC SPS data structure
  - The generation of such secondary message shall be done by control segment.
  - The space segment will only transmit it as per the scheduling requirements.



NMA for NavIC SPS

- The NavIC SPS data structure consists of four sub frames: Two Primary and Two Secondary.
  - Secondary sub frames are proposed to be used for transmission of NMA messages containing authentication code, key and root key.
- In best possible case NMA messages can be transmitted in one secondary sub frame of alternate frames.
- By incorporating the NMA secondary messages, spoofing detection capability is possible with present satellites, without altering existing data structure.

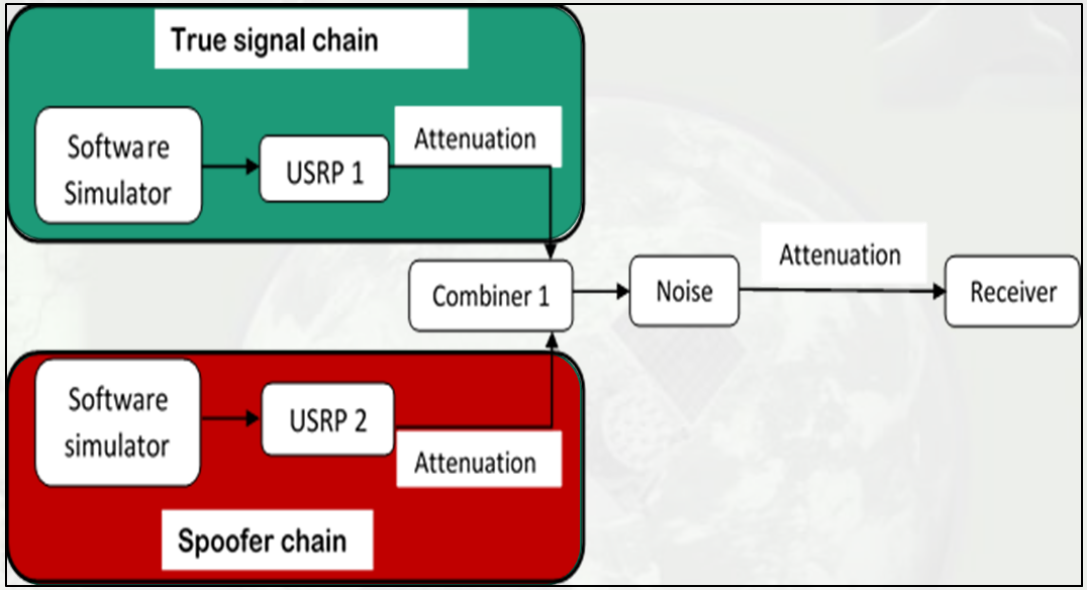
SF1 (292 bits)	SF2 (292 bits)	SF3 (292 bits) Data: 220 bits	SF4 (292 bits) Data : 220 bits
Data for Navigation Message		Other Secondary Messages	NMA Message

NavIC NMA: Key Design Drivers

Attribute	Description
Key Disclosure Delay (KDD)	>96 Seconds
Time To First Authenticated Fix (TTFAF)	>144 Seconds
Time between Authentication (TBA)	>96 Seconds
Size of MAC	30 bits
Size of key	116 bits
Time Synchronisation Requirement	<48 seconds

The root key distribution will be done through slow rate data embedded into the NMA message.

NavIC NMA: Test and Experiments

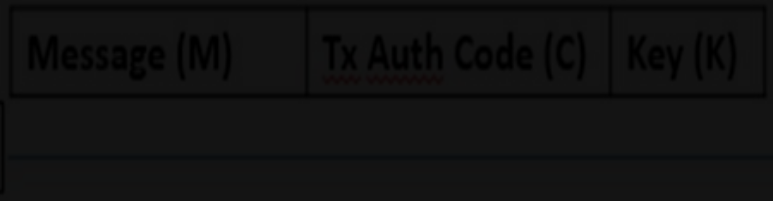


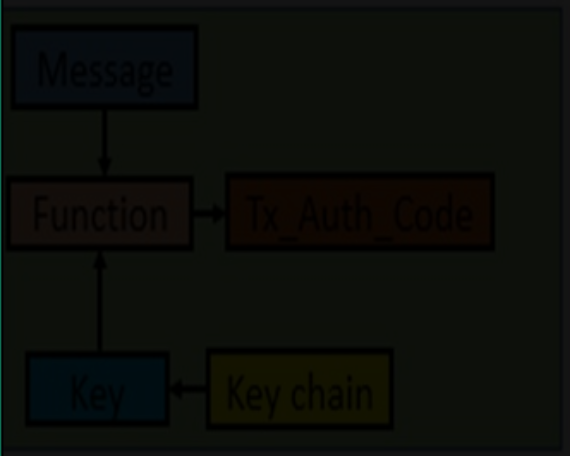
The proposed scheme is end to end tested under various attack scenarios using NavIC simulator and NavIC receiver.

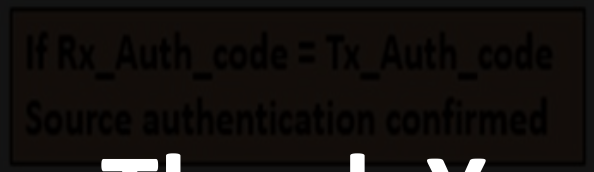
- Navigation data manipulation test
- Time synchronisation test
- Key manipulation test

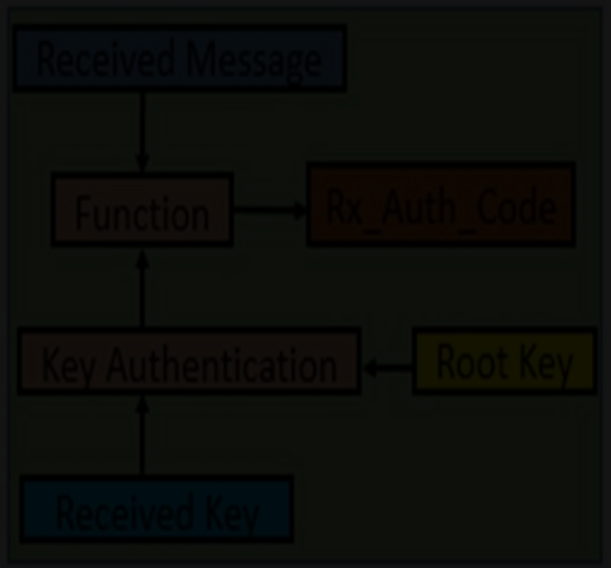
Summary

- NMA for NavIC SPS users have been proposed as value added service.
- NavIC shall be able to support the civil signal authentication within the existing SPS signals and with existing satellites.
- The SIS experiments for NavIC SPS NMA are currently being worked out.
- The experimental transmission of new NMA message is expected by 2023.









Thank You

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