Secure PMIPv6-based Mobility Solution for LoRaWAN

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Hassan JRADI

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- Received Master of Engineering in "Telecommunications, Network and Security" from the University Saint Joseph of Beirut in 2019.
- Currently a Ph.D. student at:
  - Lebanese University – CRSI, Lebanon
  - INSA de Rennes – IETR, France
- Research interests: Internet of Things, Low Power Wide Area Networks, Network Security and Mobility Management.

Outline

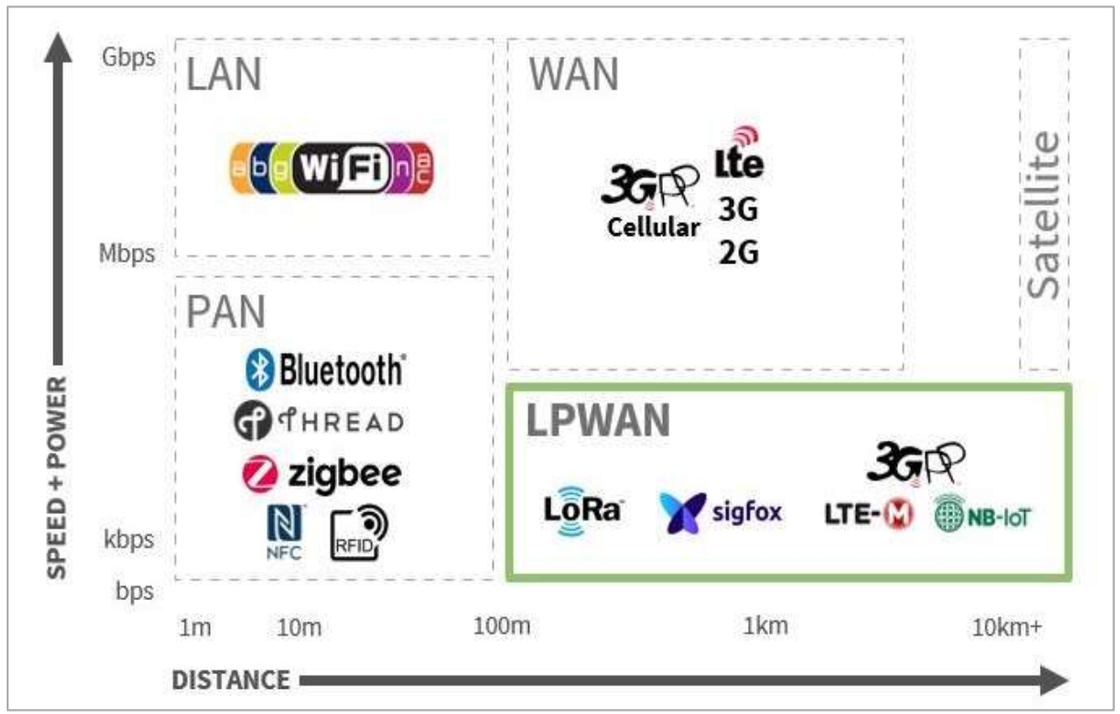
1. Introduction
2. Problematic
3. Contribution
4. Proposed Solution
5. Results & Analysis
6. Conclusion

1. Introduction

- The widespread of IoT had stimulated the invention of new communication technologies.

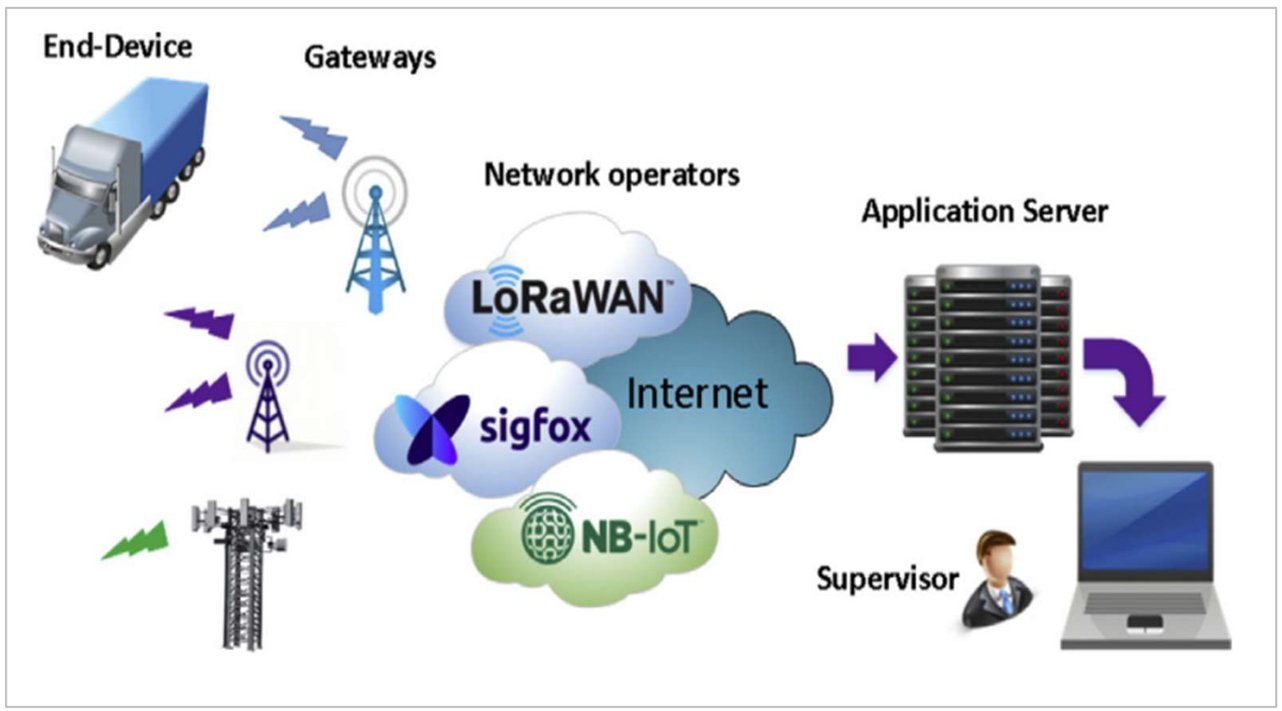
- LPWAN[1] characteristics:
  - Low power consumption
  - Long coverage range
  - Low data rate

- LoRaWAN[2]: the most important LPWAN technology.



2. Problematic (1/2)

- Several applications require secure mobility solution.
- The solution should be independent of the used technology.



2. Problematic (2/2)

- Network layer protocols like IPv4 and IPv6 supports mobility.
- PMIPv6[3] is one of IPv6 protocol extensions.
- PMIPv6 does not deploy an authentication mechanism.
- PMIPv6 is not directly compatible with LoRaWAN.

. Network Architecture . Payload Length < 255 Bytes

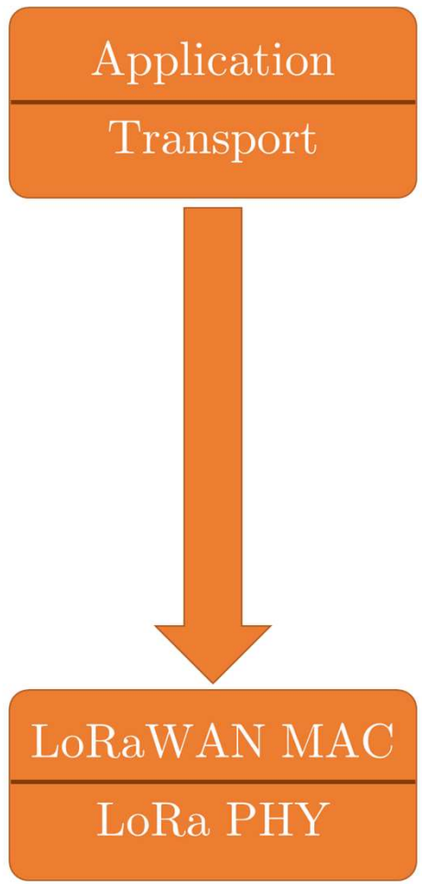
3. Contribution

1. Proposal of PMIPv6-based **mobility** solution for **LoRaWAN**.

2. Proposal of an **authentication** scheme to provide **secure access**.

4. Proposed Solution 4.1. Protocol Stack

- Protocol stack for the communication between the mobile node and the network.
- Use of IPv6 and PMIPv6 at network layer → mobility and global addressing.
- Max LoRaWAN payload = 255 Bytes → compression needed.
- Use of SCHC[4] as an adaptation layer.



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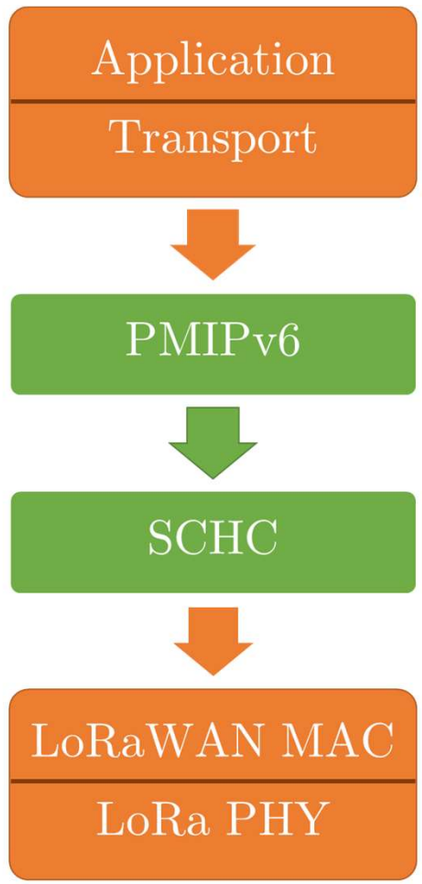
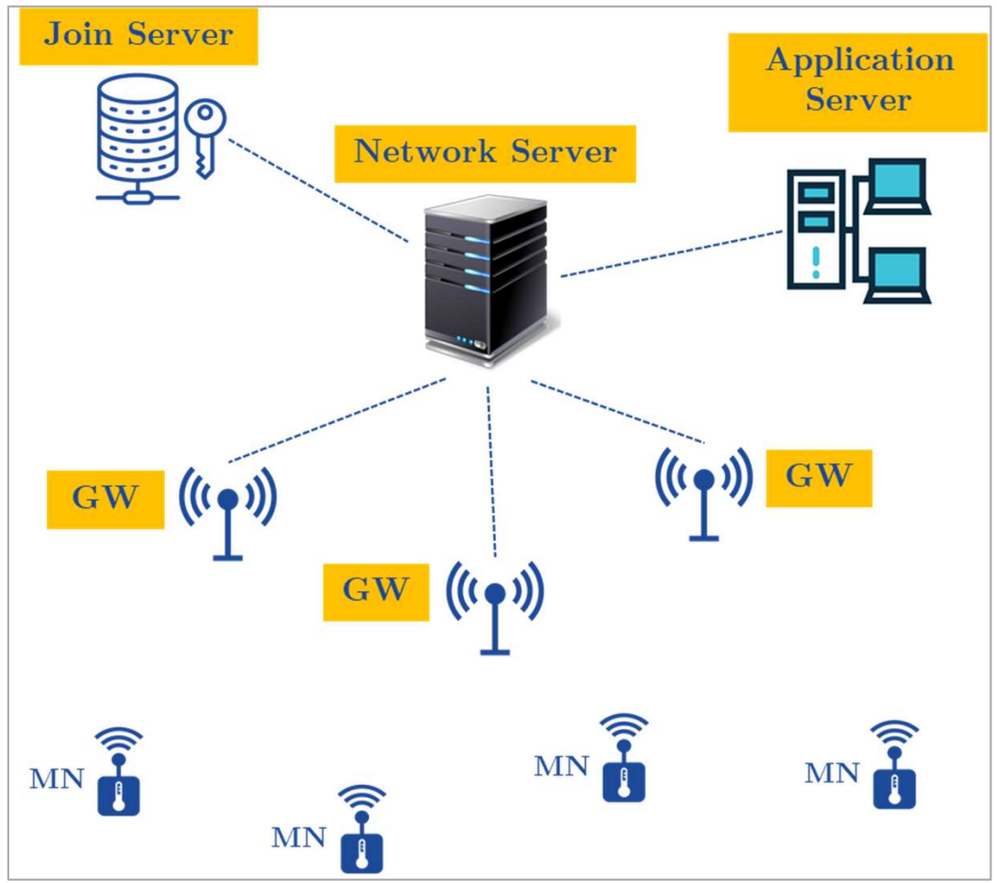


4. Proposed Solution 4.2. Network Architecture

- LoRaWAN network:

  .GW .NS .JS .AS



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- LoRaWAN network:

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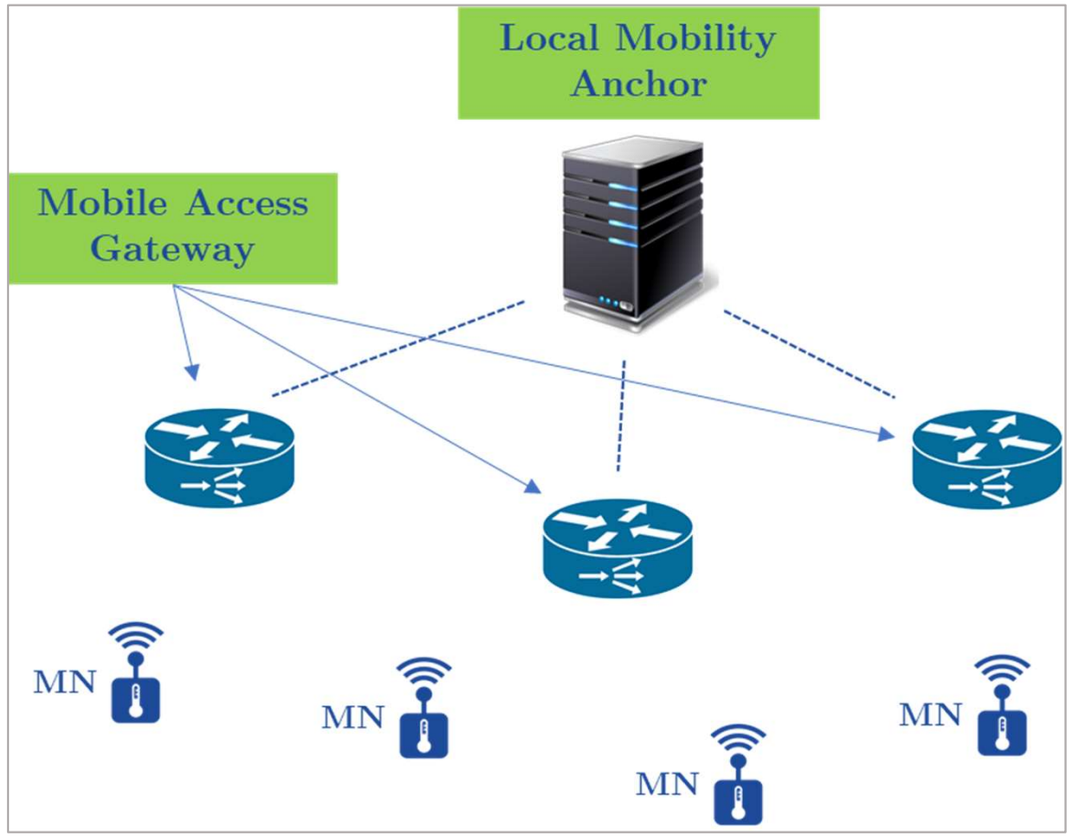
- PMIPv6 network:

  .MAG .LMA



4. Proposed Solution 4.2. Network Architecture

- LoRaWAN network:

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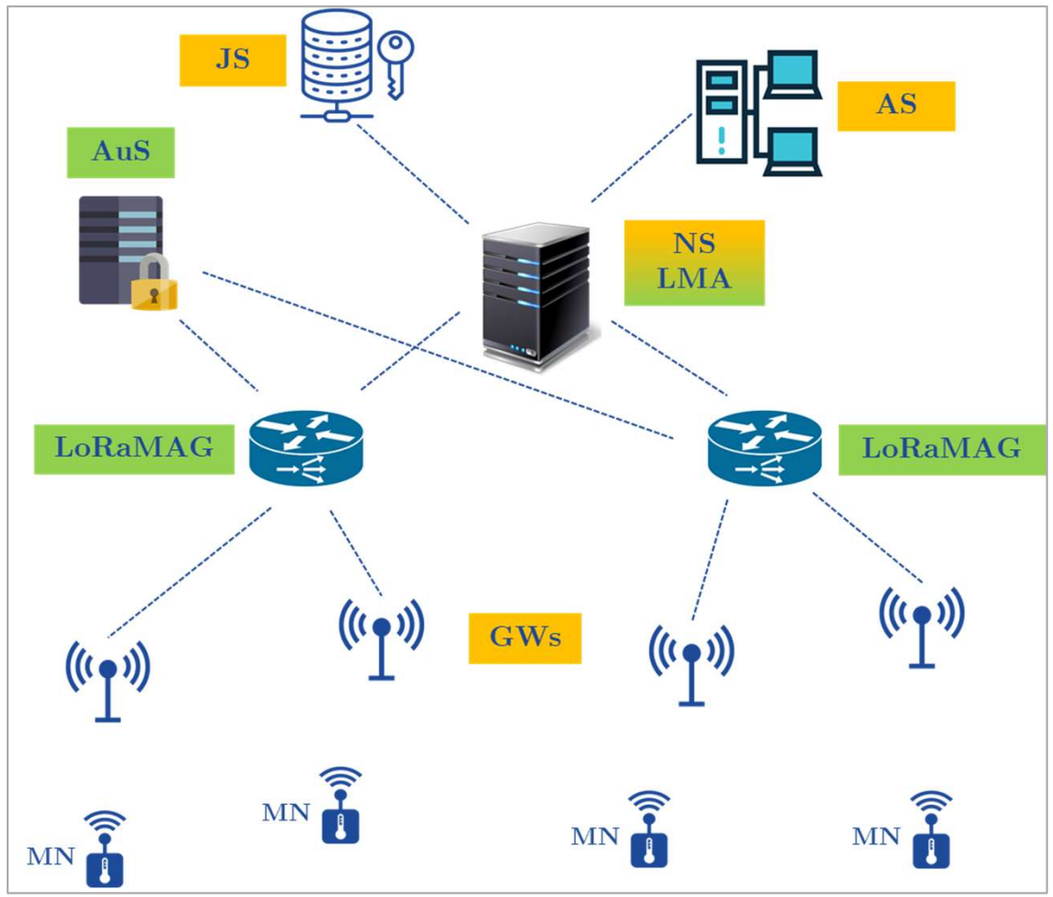
- PMIPv6 network:

  .MAG .LMA

- How to integrate PMIPv6 in LoRaWAN ?
  - NS plays the role of LMA
  - New entities: LoRaMAG , AuS



4. Proposed Solution 4.3. Authentication Scheme

- Authenticate MN with LMA and LoRaMAG.
- Two phases:
  1. Registration phase
  2. Authentication phase
- Two cases:
  1. Intra domain
  2. Inter domain

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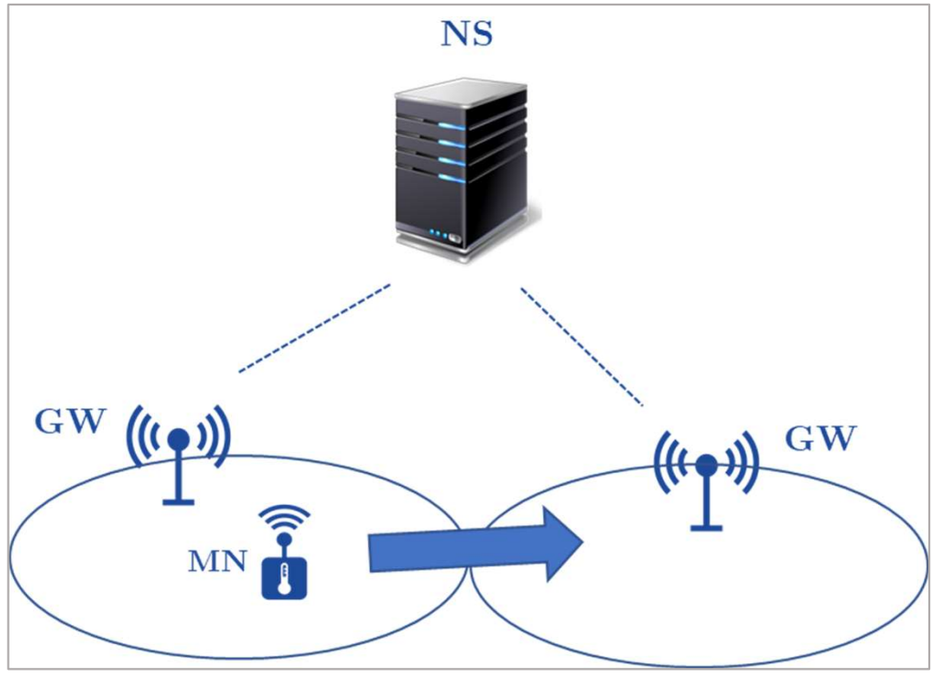

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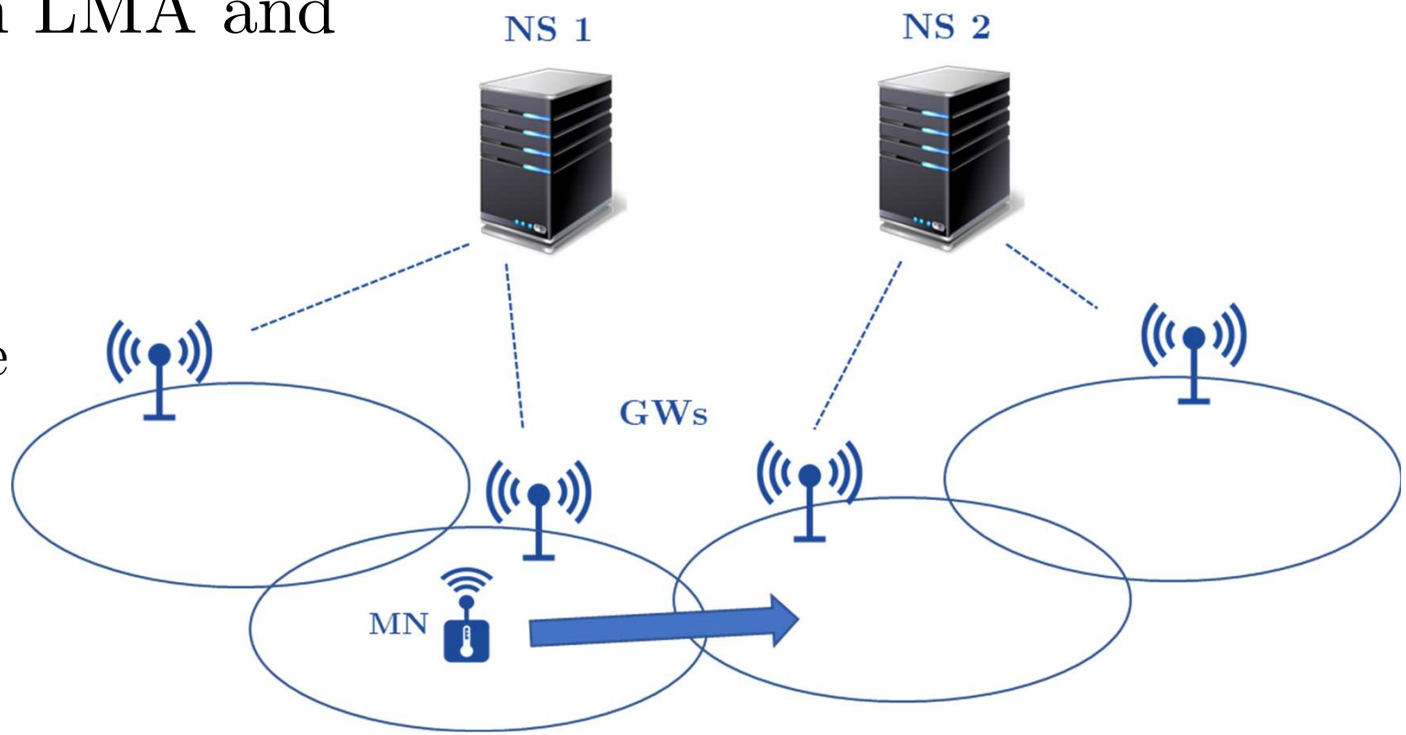

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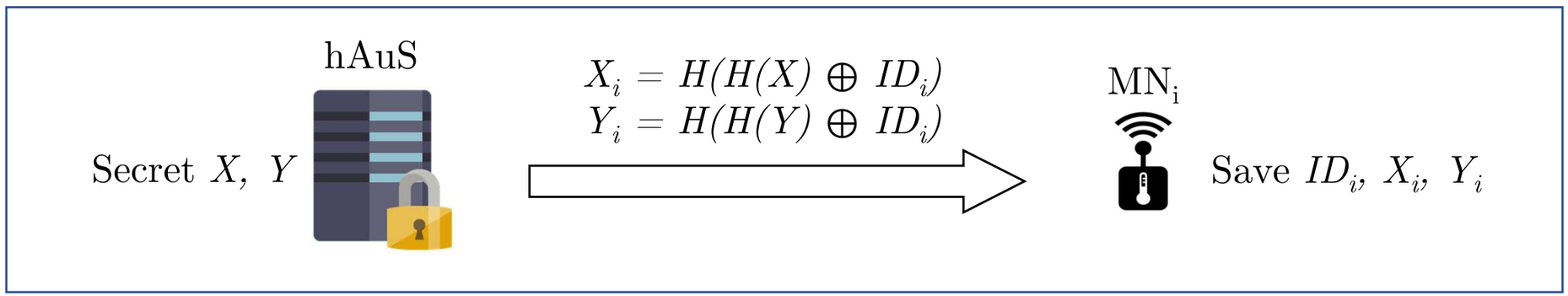
- Registration Phase:



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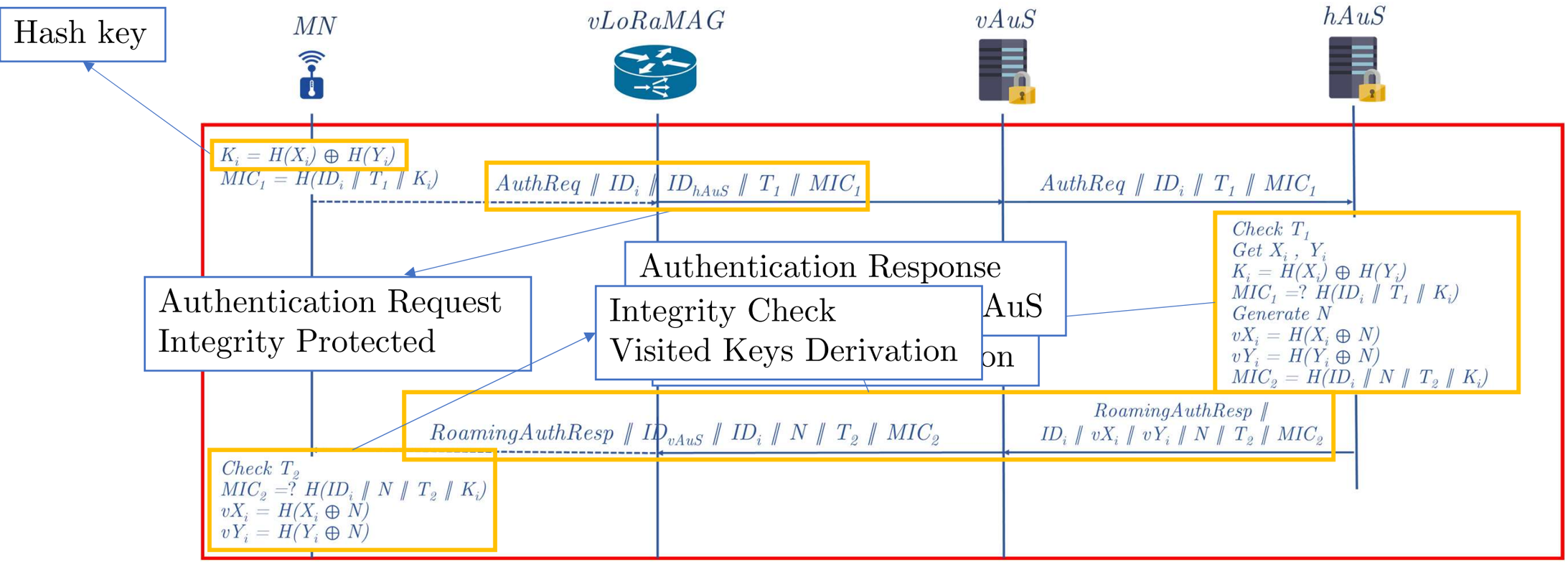
- Authentication Phase: Roaming Case - Once per visited domain



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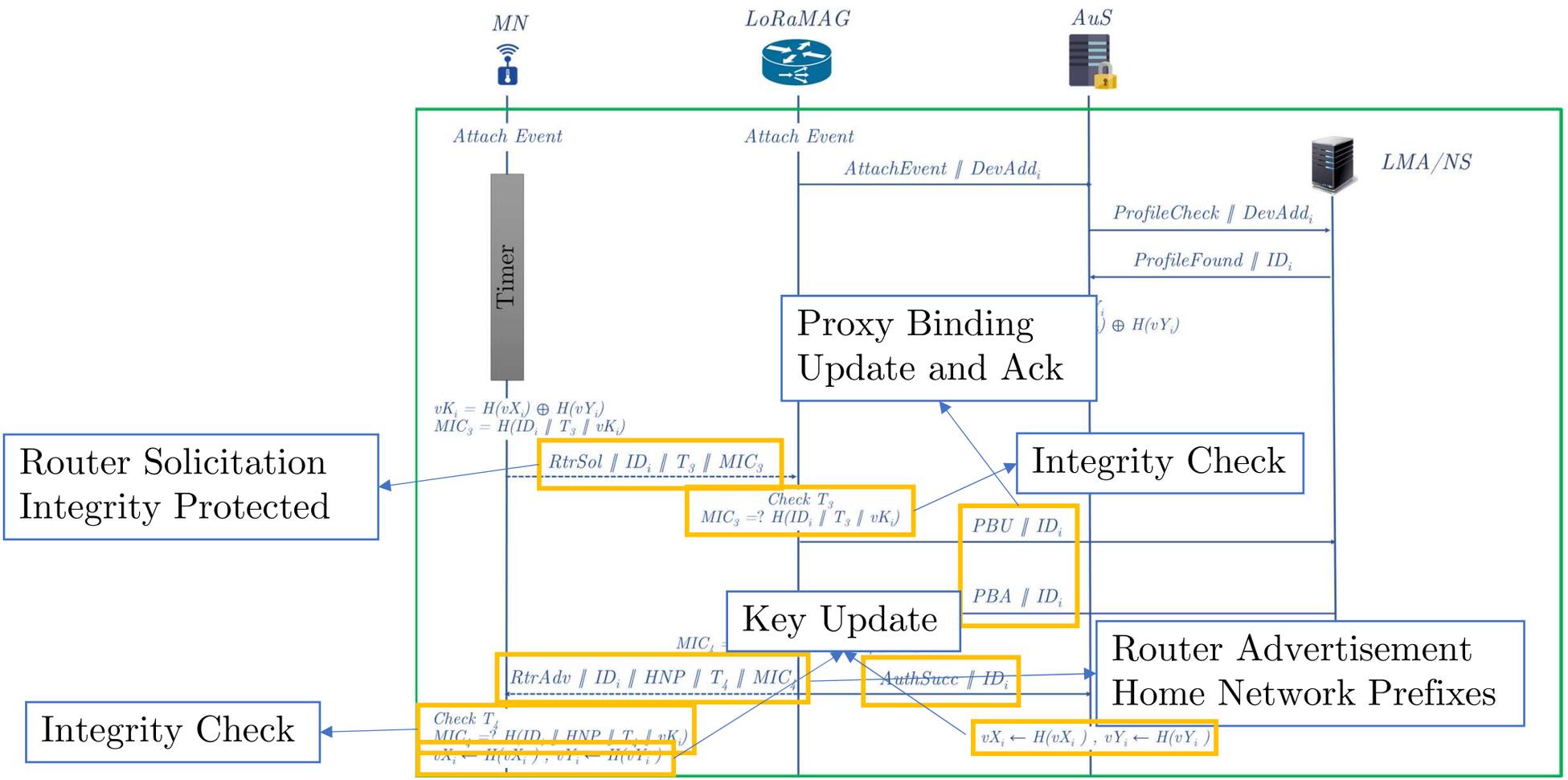
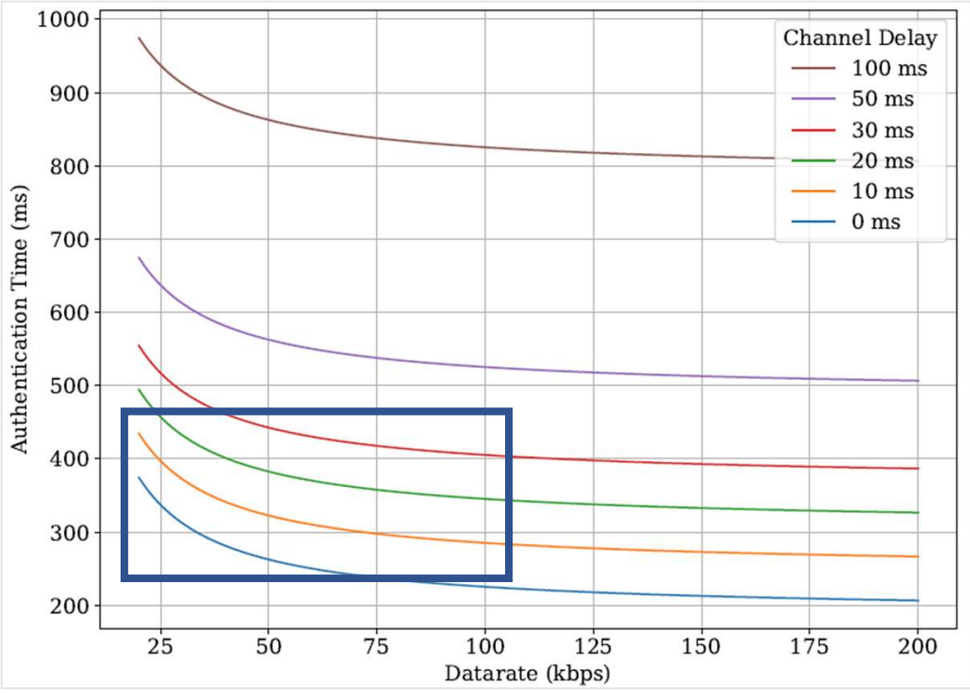
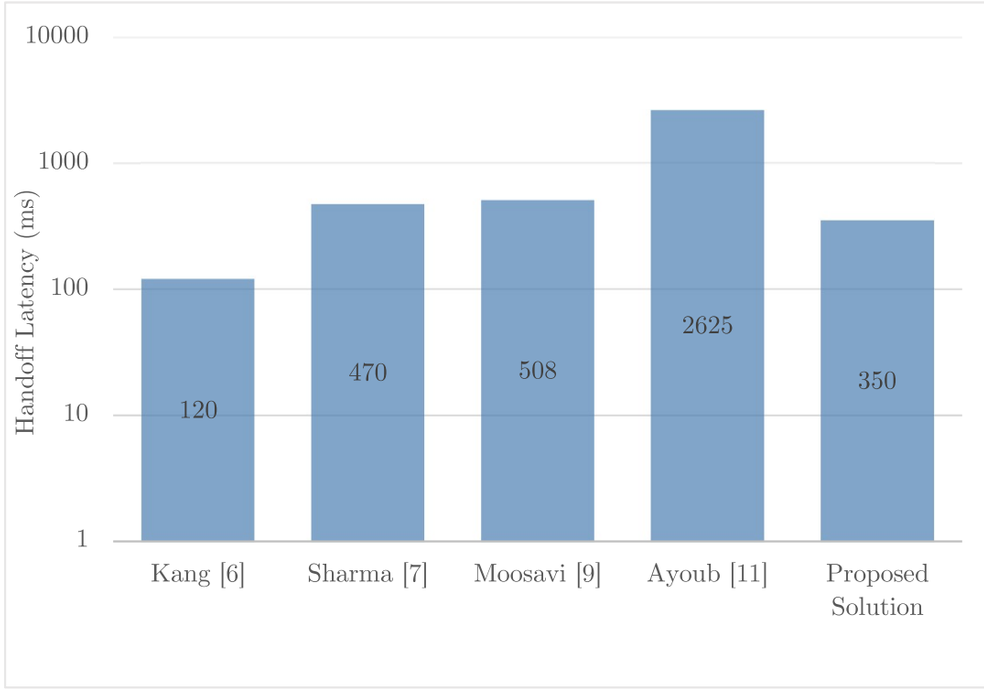


5. Results & Analysis 5.1. Performance Evaluation

- Simulation using Network Simulator 3.



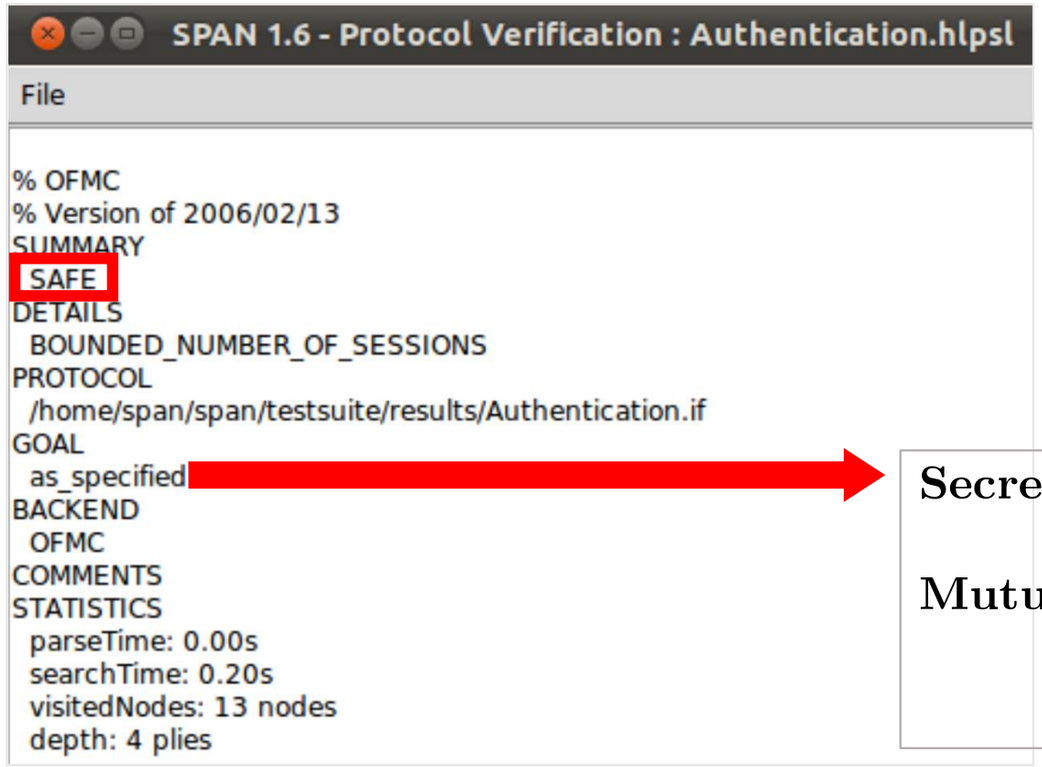


5. Results & Analysis 5.2. Security Analysis

- Device re-authentication
- Spoofing signaling message
- Address squatting and spoofing
- Old address control
- Mutual authentication
- Key freshness
- Replay attack

5. Results & Analysis 5.3. Security Validation

- AVISPA[6]: Automated Validation of Internet Security Protocols.



Secrecy of:
$\mathbf{X_i}$, $\mathbf{Y_i}$, $\mathbf{K_i}$, $\mathbf{vK_i}$, $\mathbf{vX_i}$, $\mathbf{vY_i}$
Mutual authentication:
MN and vLoRaMAG
MN and vAuS

References

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Thank You !
Q & A