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Ministry of Electronics & Information Technology
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Lightweight Certificateless Digital Signature Scheme for WSNs

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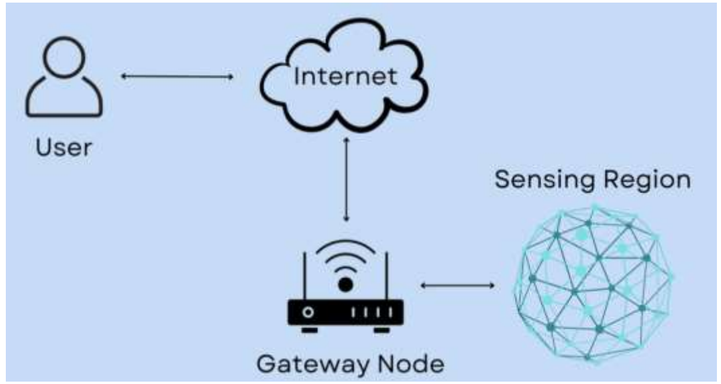
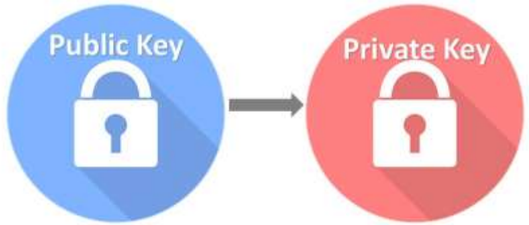
Introduction

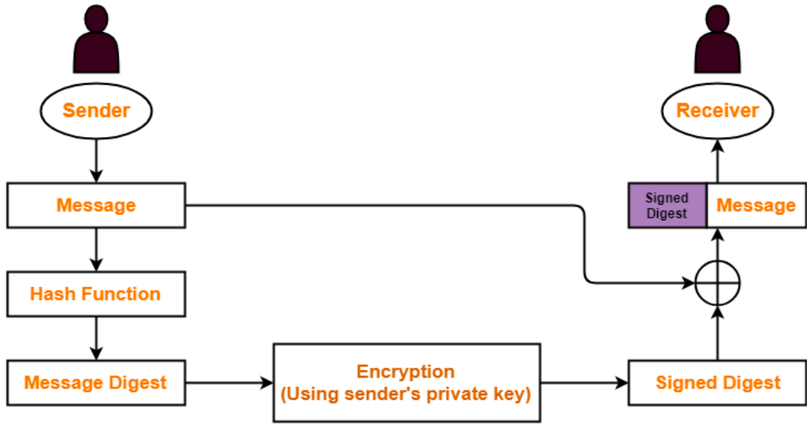
- *Several types of smart devices have emerged in this era.*
- *Ensuring safety and security of each node and to protect the data is important.*
- *In a public network how to ensure the security?*



Background

- *Authentication, Integrity and Confidentiality - 3 important factors in security.*
- *Encryption and digital signatures are different.*
- *Hash functions are irreversible.*
- *Public and private keys - mathematically generated.*



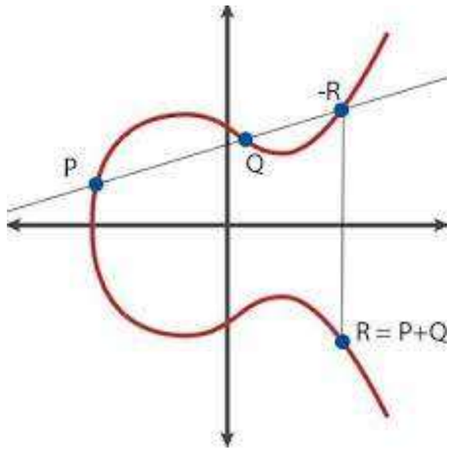


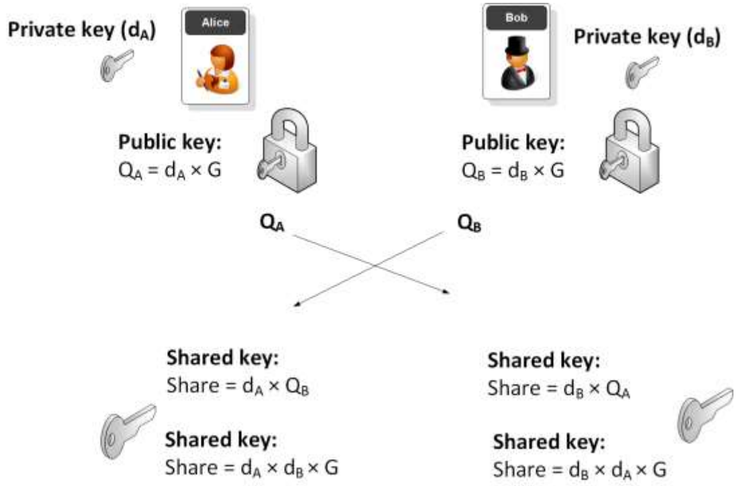
At Sender Side

Background - ECC and ECDLP

- *In Elliptic Curve Cryptography (ECC), the keys are coordinates of an Elliptic Curve. Why ECC?*
- *160 bit key length in ECC is equivalent to 1024 bit key length in RSA.*
- *ECC is intractable under the assumption of Elliptic Curve Discrete Logarithmic Problem (ECDLP).*

$y^2 = x^3 + ax + b$



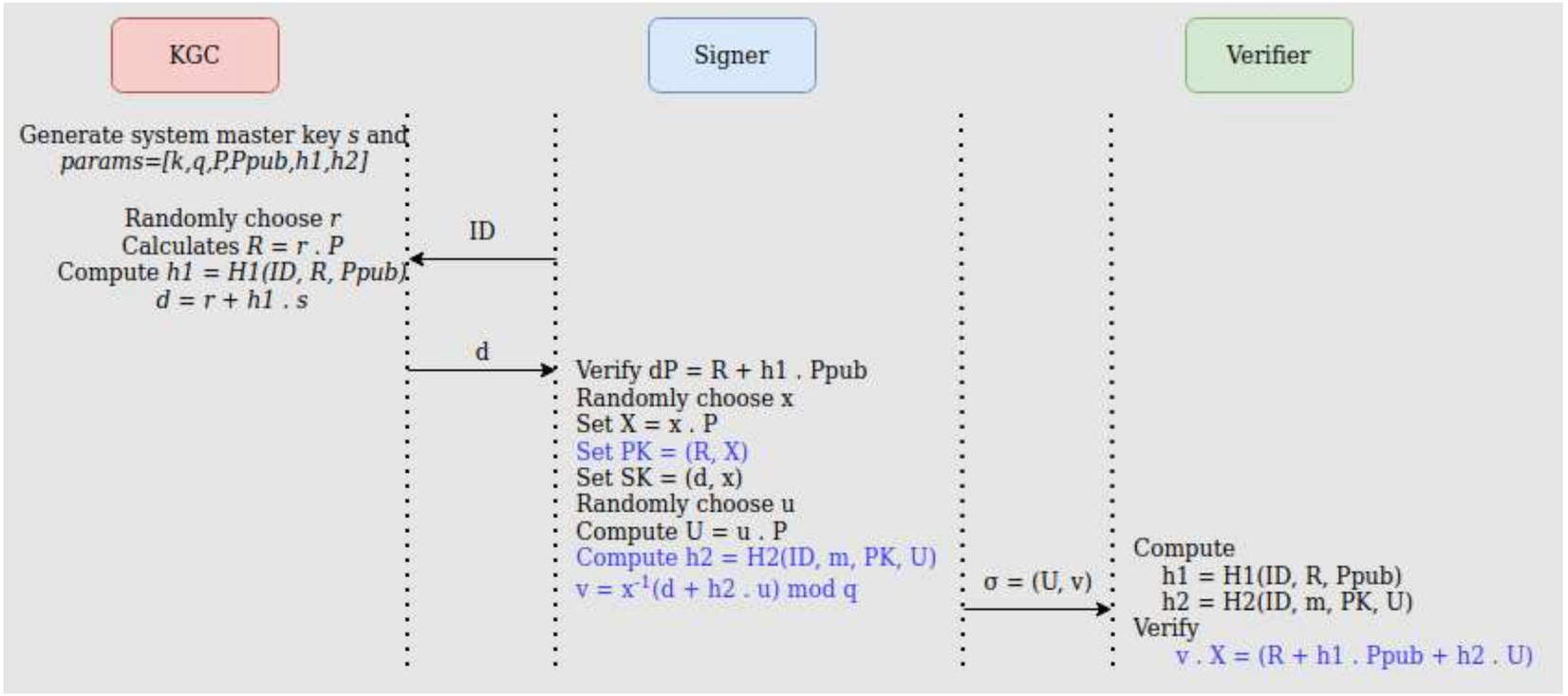


Problem & Solution

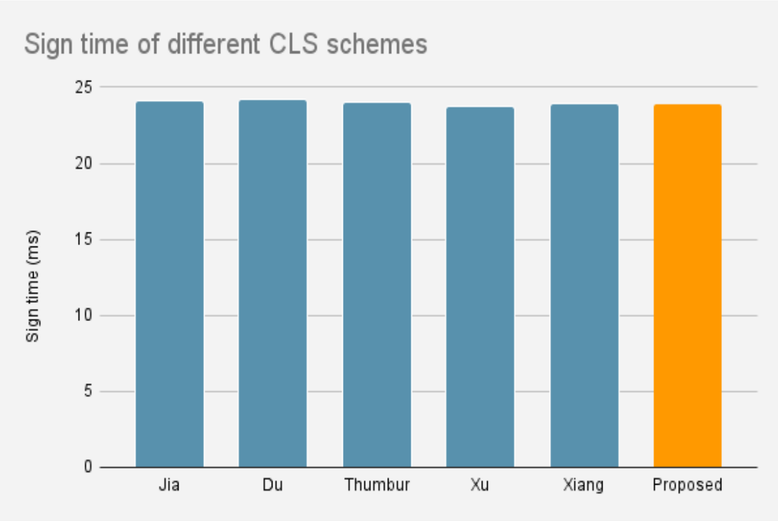
Scheme	Working	Drawbacks
Traditional Scheme	Uses certificates from trusted third party as authentication	High complexity, requires more resources
ID-based cryptography	Uses trusted third party to distribute private public keys to each node	Key escrow problem
Certificateless Signature Scheme (CLS)	In addition to ID based methodology each node generates its own private public private key pairs	If the algorithm is weak, it can become insecure against adversary attacks

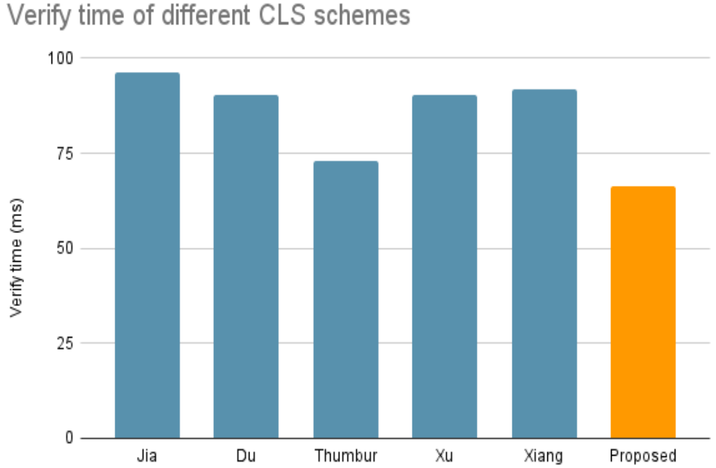
- *Develop a digital signature scheme that has the following properties*
  - *Lightweight*
  - *Requires less sign time and verify time*
  - *Provides good level of security against adversary attacks*

System Model



Results





Scheme	Sign Operation	Verify Operation	Type I security	Type II security
Jia [1]	$T_{sm} + T_{inv}$	$4T_{sm} + 2T_{pa}$	Insecure	Insecure
Du [2]	$T_{sm} + T_{inv}$	$4T_{sm} + 2T_{pa}$	Secure	Secure
Thumbur [3]	T_{sm}	$3T_{sm} + 2T_{pa}$	Insecure	Secure
Xu [4]	T_{sm}	$4T_{sm} + 3T_{pa}$	Secure	Secure
Xiang [5]	$T_{sm} + T_{inv}$	$4T_{sm} + 2T_{pa}$	Secure	Secure
Proposed	$T_{sm} + T_{inv}$	$3T_{sm} + 2T_{pa}$	Secure	Secure

Conclusion and Future work

- *Algorithms with ECC provides more security compared to RSA in lesser key length. So CLS schemes that uses ECC leans towards lightweight nature.*
- *Our proposed scheme is 28% faster than the fastest existing CLS scheme.*

- *In future, we intend to evaluate the performance of proposed scheme in real life WSNs.*
- *Conduct energy analysis on the scheme to improve efficiency and design new solutions.*

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