Embedded Authentication

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Advanced Embedded Systems

Agenda

- Introduction
- Motivation
- Security Obstacles
- Authentication Methods
- Implementation
- Conclusion

Introduction

- Circuit Cellar, January 2013
- Patrick Schaumont
- Three methods of implementing authentication protocols in embedded systems

Motivation

- Black Hat 2012 Hotel Room Door Hack - Cody Brocious
- 4 Million Locks Vulnerable
- Less than 1 second to unlock any door
- COTS Hardware

Motivation

- “Hackers can unlock cars via SMS” – 2011
- “Black Hat hacker details lethal wireless attack on insulin pumps” – 2011

Security Obstacles

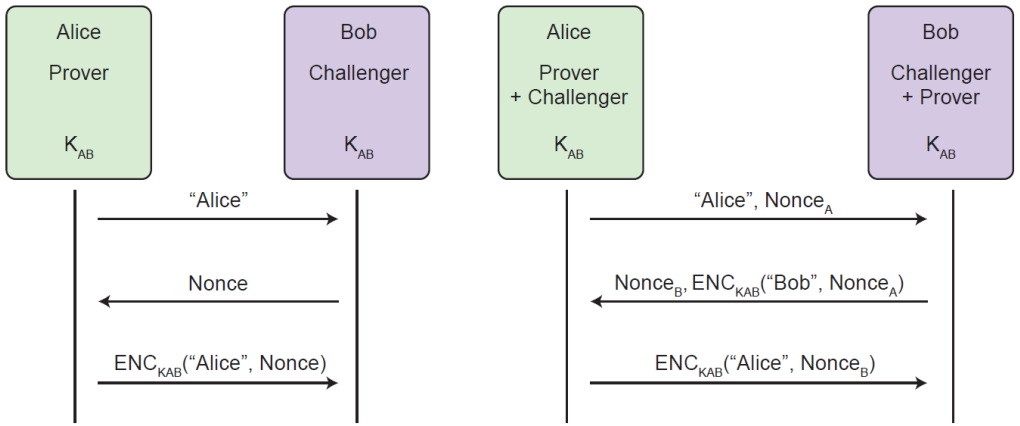
- Cost
- Lack of knowledge
- Memory Constraints
- No standard practice
- Difficult to implement after production

Authentication Methods

- HMAC-based protocol on chip
- HMAC-based protocol on separate chip
- Public-key Cryptography on separate chip

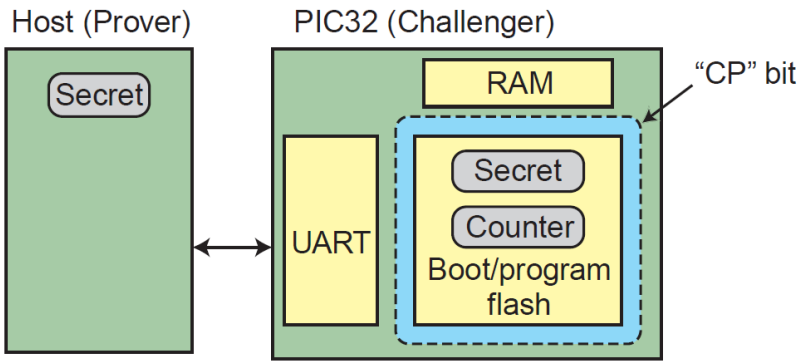
Basic Authentication

- One-way
  - Challenger/Prover have shared secret
  - Prover sends public identifier to Challenger
  - Challenger sends nonce
  - Prover encrypts public identifier and nonce using shared secret
  - Challenger performs same encryption and compares with Prover encrypted response
- Mutual
  - Both systems act as both Challenger and Prover



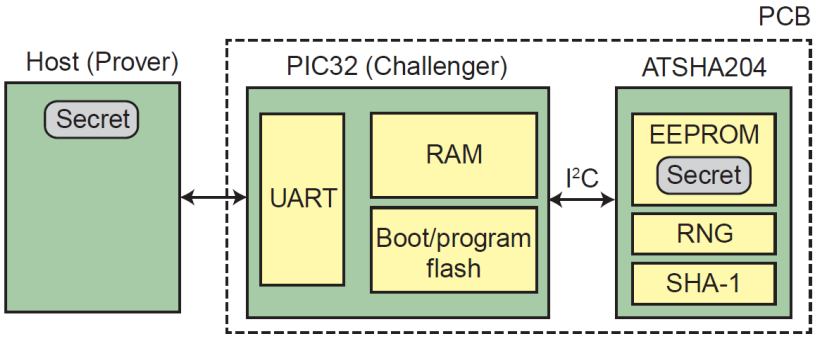
PIC32 Implementation

- HMAC protocol implemented on single chip
- Secret & Counter must be stored in flash
- Program memory can be read via software
- Vulnerable if secret is discovered



ATSHA204

- Read protected non-volatile memory
- Random Number generator
- SHA-1 algorithm hardware



Origa SLE95050

- Asymmetric key authentication device
- Chip contains secret key that never leaves the package
- Releases matching public key
- More scalable since challenger only handles public-key values

Conclusion

- Necessity of embedded security
- Obstacles to security implementation
- Basic authentication methods
- Implementation of authentication

References

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