Standardisation efforts in lighweight cryptography

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Outline

- Motivation for standardisation.
- Keeloq.
- Standardisation processes and structures at ISO.
- What is in the ISO standards currently?
- Lessons learned from Keeloq.
- Interesting problems to consider.

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- The latter type of standardisation becomes industry specific.

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- World Trade Organisation.

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- This was in other words a requirement for a lightweight block cipher.

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Was this the right way to do it?

Standardisation bodies that deal with crypto

Summary

There are many standardisation bodies that produce standards on crypto. Note that not all of them produce International standards.

- NIST (Neither International nor National)
- ETSI (Regional)
- ITU
- IETF
- ISO/IEC
- IEEE

Relationship between academia, industry and standardisation bodies

Academia, industry and standardisation bodies do not exist in isolation.

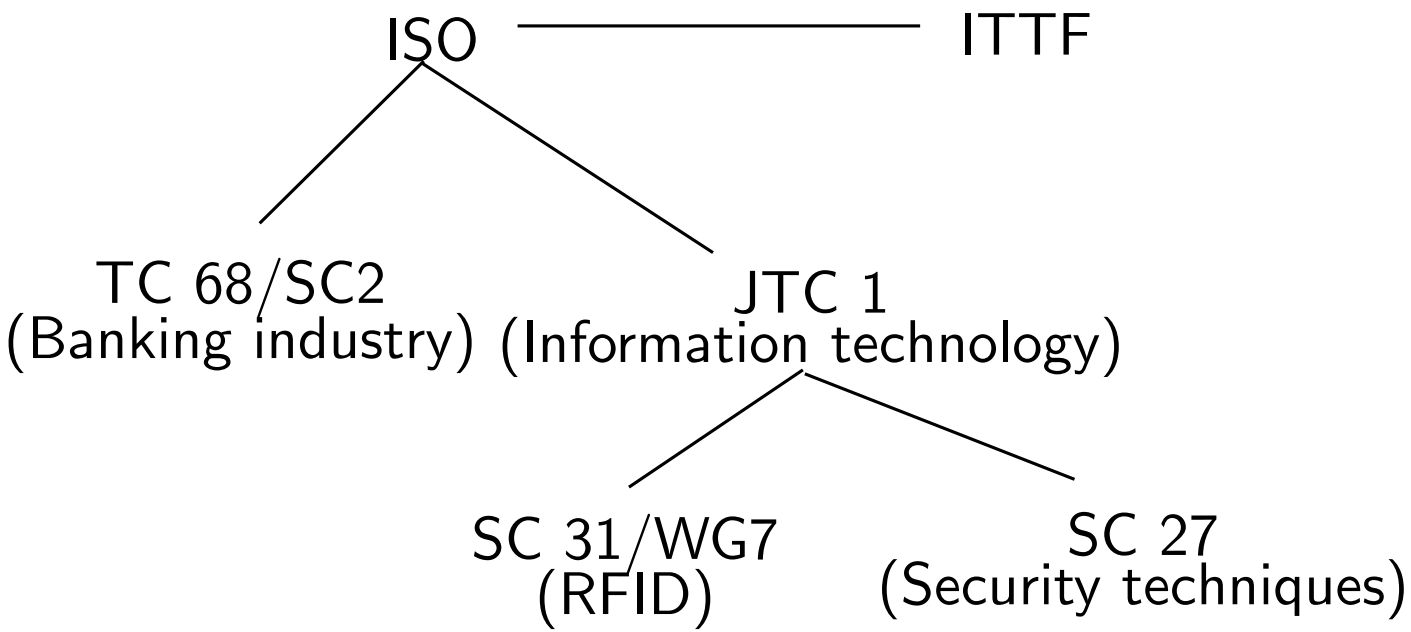
- Academia
  - Explore new horizons.
  - Develop sound theory.
  - Test practice.
- Industry
  - Apply technology developed by Academia.
  - Identify future current problems and find solutions.
- Standardisation
  - Looks for the commonalities to standardise within various industries.
  - Takes its inputs from Academia and Industry and tries to match them.

Relationship between academia, industry and standardisation bodies

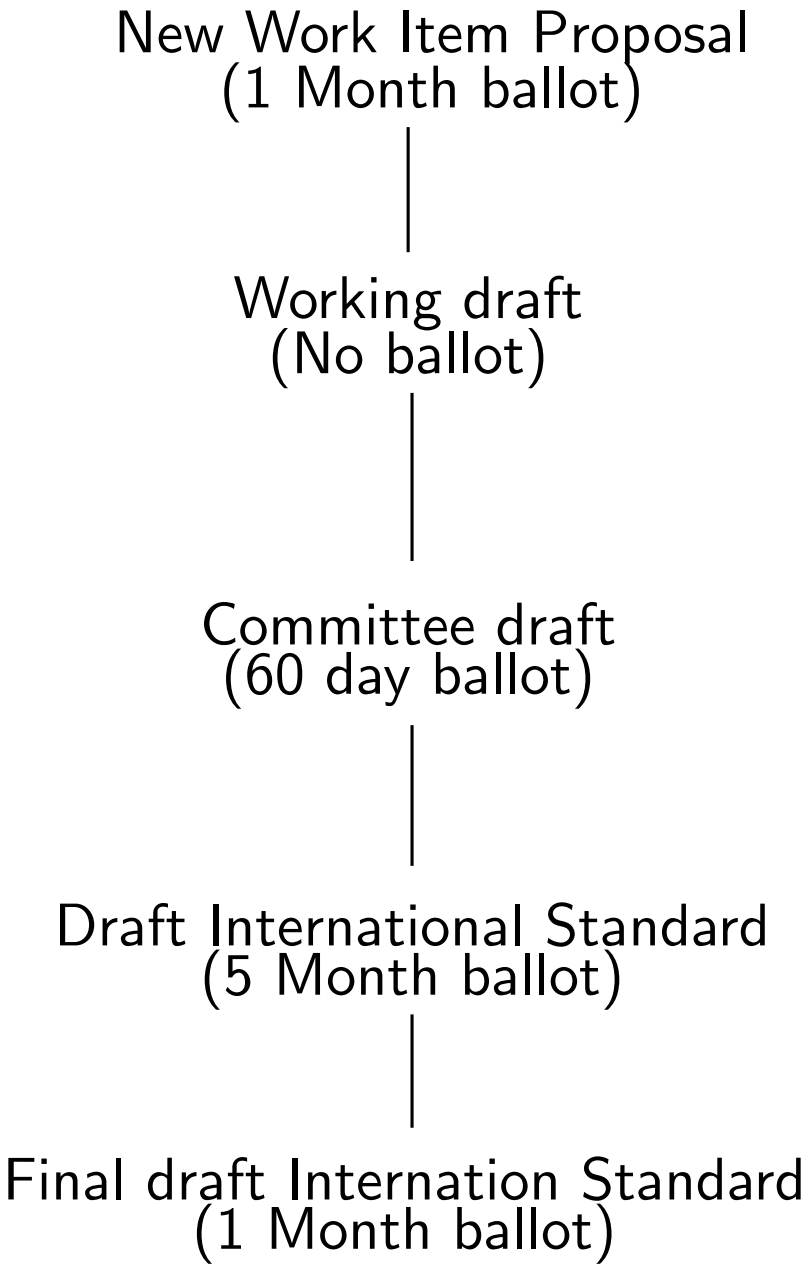
Is there enough communication and understanding between these entities?

ISO structure

Where does the general primitives (building blocks) get standardised?



ISO process of standardisation



Lightweight cryptography standards within ISO/IEC

Breakdown

Lightweight standards developed in ISO JTC 1/ SC 27: ISO/IEC 29192 Lightweight cryptography. It is a 4 (5) part standard.

- Part 1: General
- Part 2: Block ciphers
- Part 3: Stream ciphers
- Part 4: Mechanisms using asymmetric techniques
- (Part 5): Lightweight hash functions (under development)

Part 1: General

This part defines what lightweight cryptography is. It also defines some metrics for hardware used for comparison of different mechanisms.

- Lightweight cryptography is cryptography that has been tailored for a specific environment.
- Minimum security strength must be at least 80-bits.
- Establishes GE formally as a metric and requires all mechanisms tailored for hardware to provide metrics.

Part 2: Block ciphers

- PRESENT
- CLEFIA

Part 3: Stream ciphers

- Enocoro-80
- Enocoro-128V2
- Trivium

Part 4: Mechanisms using asymmetric techniques

- CryptoGPS (Lightweight asymmetric identification scheme and can be implemented making use of "coupons")
- ALIKE (Asymmetric mechanism for authentication and key exchange based on a variant of RSA).
- IBS (Identity based signature scheme and third party is involved in computing of distanct signature keys).
- ELLI (Elliptic Curve Lightweight)(unilateral authentication scheme based on elliptic curves. (Siemens is actually using this in RFIDs. Currently being added as an ammendment).

Part 5: Hash function

- PHOTON
- SPONGENT

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- Caveat: Break leads to compromise of the master key, which makes faking other devices easy.
- Lesson: Key management is a problem.

A lesson from history

Replacing Keeloq

Designer approached Microchip (now in the US) and offered to design a new lightweight cipher. Microchip however declined.

Standards in support of Lightweight cryptography ISO/IEC

There are various standards in support of lightweight cryptography (as currently seen by SC 27 at least).

- ISO/IEC 11770 Key management (actually key agreement/exchange).
- ISO/IEC 9798 Entity Authentication (Basic entity authentication protocols).
- No standard that covers the symmetric setting Keeloq required for key management (perhaps no primitive either).

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- At least in ISO standards in SC 27, there is not enough guidance on cryptographic system design.

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- Cryptography is not seen as an investment, but an expense.
- Lightweight cryptography is seen as "How little can I get away with"?

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- Develop more theory to support risk models.

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- Risk analysis frameworks for cryptographic systems.

End

Questions / Remarks