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Cryptographic Techniques Overview

1. Name of Cryptographic Technique
EPOC

Categories (1.Asymmetric Cryptographic Schemes)
2.Symmetric Ciphers
3.Hush Functions
4.Pseudo-random Number Generators

Security ~~Functions of A~~symmetric Cryptographic Schemes
(1.confidentiality) 2. Authentication 3. signature 4. key- sharing

Subcategories of Symmetric Ciphers
1. stream ciphers 2. 64-bits block ciphers 3. 128-bits block ciphers

2. Cryptographic Techniques Overview

2.1 Design policy

The design target of EPOC is as follows:

(1) It should be proven to be secure in the strongest sense (i.e., semantically secure against adaptively chosen-ciphertext attacks) under reasonable assumptions (and in the random oracle model).
(2) Its performance should be comparable to the RSA and other practical encryption schemes based on the factoring assumption.
(3) Its hybrid usage with a symmetric encryption should be also proven to be secure in the strongest sense (i.e., semantically secure against adaptively chosen-ciphertext attacks) under reasonable assumptions (and in the random oracle model).

Our approach to construct EPOC is based on the random oracle model, in which a primitive public-key encryption function is converted to an encryption scheme provably secure in the strongest sense if the underlying hash functions are assumed truly random functions.

Our primitive encryption function is the OU (Okamoto-Uchiyama) function [2], in which to invert the OU function is proven to be as hard as factoring a composite integer public-key).
There are three conversions based on the random oracle model [3,4,5], therefore we have three versions of EPOC: EPOC-1, EPOC-2 and EPOC-3.
These schemes satisfy the above-mentioned target (security, performance and hybrid security). (EPOC-2 and EPOC-3 for the hybrid security)

2.2 Intended applications

(1) EPOC-1:
- Key distribution for a symmetric encryption (at most 256 bit key size)
- Encrypted communication for samll size data (at most 256 bit data size)

(2) EPOC-2:
- Key distribution for a symmetric encryption (no restriction on the size)
- Encrypted communication in a hybrid usage with symmetric encryption, especially envelope type (key distribution and data transmission are synchronized)

(3) EPOC-3:
- Key distribution for a symmetric encryption (no restriction on the size)
- Encrypted communication in a hybrid usage with symmetric encryption, especially ``envelope type'' (key distribution and data transmission are synchronized)
- Encrypted communication in a hybrid usage with symmetric encryption, especially ``session type'' (only once key distribution in the opening phase of a session, and many times data transmissions during the session)

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2.3 Basic theory and techniques

(1) The elliptic curve ElGamal encryption function as a primitiveencryption function.
(2) Our novel three conversion methods [2,3,4], by which we have three versions:PSEC-1, PSEC-2, PSEC-3. Especially PSEC-2 and PSEC-3 are the first public-key encryption schemes whose hybrid usages with symmetric encryption are proven to be secure in the strongest sense under reasonable assumptions and random oracle model.
(3) In the conversion of PSEC-3 [4], ``session type'' (only once key distribution in the opening phase of a session, and many times data transmissions during the session) of a hybrid usage with symmetric encryption is available.
In addition, the overhead of the conversion is almost nothing if practical hash functions such as SHA-1 are employed, namely the conversion is optimal in the performance.

References:

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[3] Fujisaki, E. and Okamoto, T.: Secure Integration of Asymmetric and Symmetric Encryption Schemes, Proc. of Crypto'99, Springer-Verlag, LNCS 1666, pp. 535--554 (1999).
[4] Okamoto, T. and Pointcheval, D.: OCAC: an Optimal Conversion for Asymmetric Cryptosystems, manuscript (2000).