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Hardware Cryptography Support for SSL and User Data

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AIM Enterprise Platform Software

IBM z/Transaction Processing Facility Enterprise Edition 1.1.0

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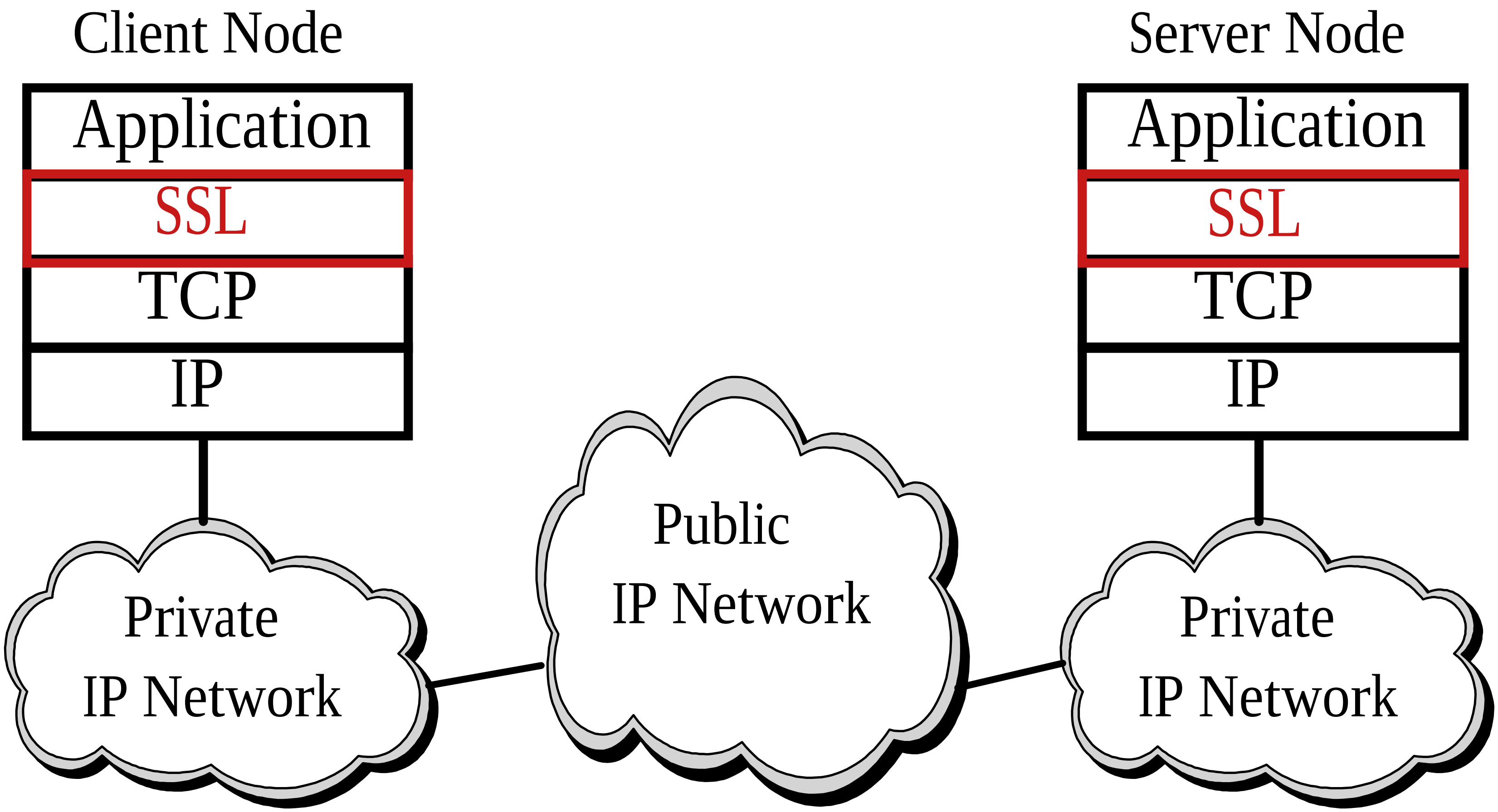
Secure Sockets Layer (SSL)

- Protocol layer that sits between the TCP layer and the application (or middleware)
- Enables applications to communicate in a secure manner over an insecure (public) network
- SSL evolved to the Transport Layer Security (TLS) open standard, defined by RFC 2246
  - Still referred to as "SSL" most of the time
- TPF 4.1 added SSL support on PUT 15
  - Included Apache Secure Web Server

SSL Network Example



Starting an SSL Session

- Client and server use RSA public key cryptography to exchange the following secret keys:
  - KEY1 - key used to encrypt and decrypt data messages flowing on this SSL session
  - KEY2 - key used to create and verify message digests appended to each data message on this SSL session
- RSA operations are very CPU-intensive
  - For example, an RSA private key decrypt operation can execute millions of instructions in software
- The secure key exchange using RSA is the heart of SSL security
- Using software for RSA operations, the number of SSL sessions that can be started is in the tens per second range

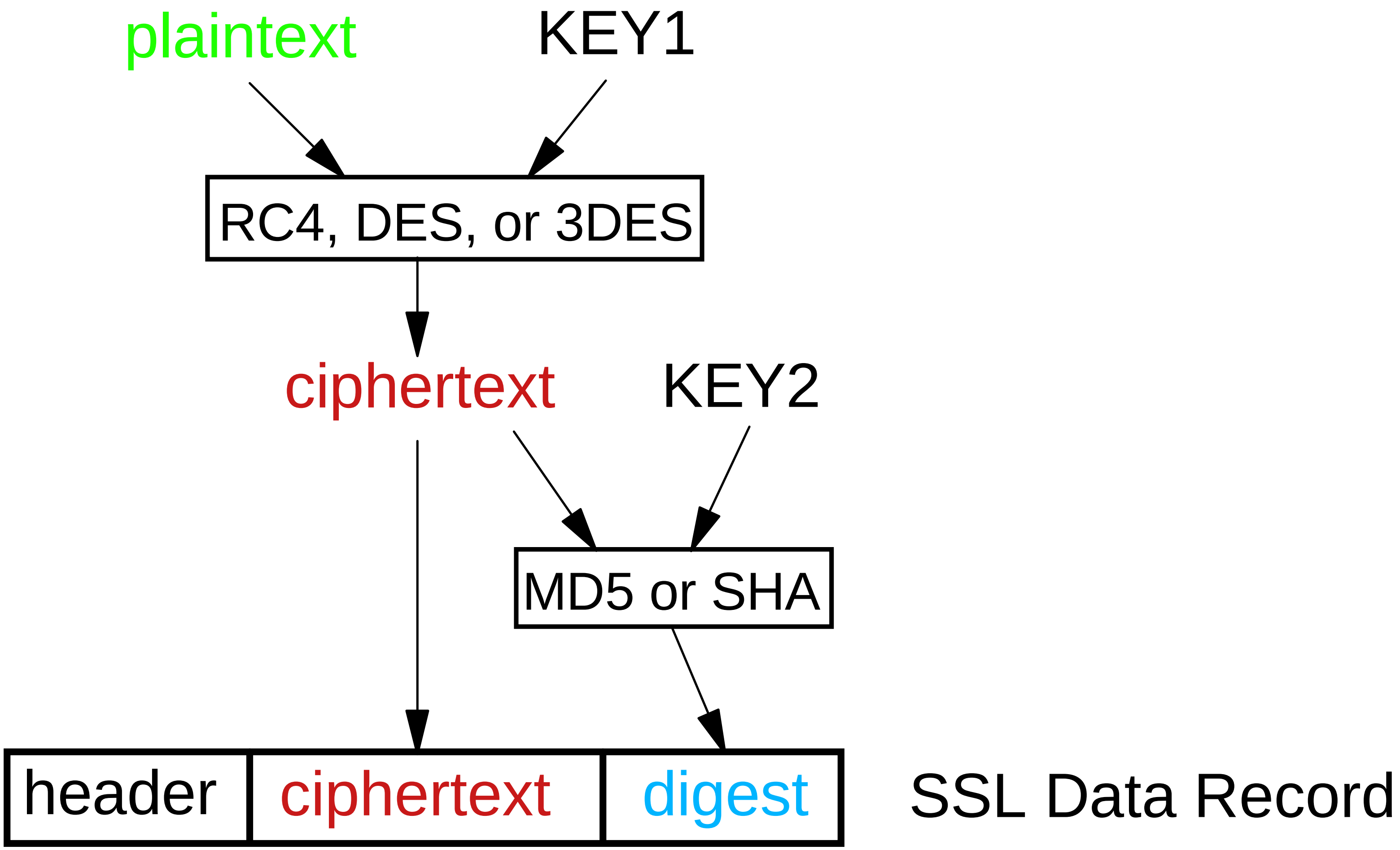
Hardware Acceleration for RSA Operations

- PCI Cryptographic Accelerator (PCICA)
- Hardware cryptographic accelerator card introduced on the IBM z900 server (supported on z900, z800, z990, z890)
- PCICA was designed specifically to improve SSL performance
- PCICA only does RSA operations and does them very quickly
  - Each PCICA can do several hundred to over 1000 operations per second (varies based on things like RSA key size)
- Using PCICA cards enables TPF to start thousands of SSL sessions per second
- SSL support in TPF automatically determines if PCICA(s) exist and uses them for RSA operations if they are installed
- APAR PJ30133 (in test phase) adds this support to TPF 4.1.

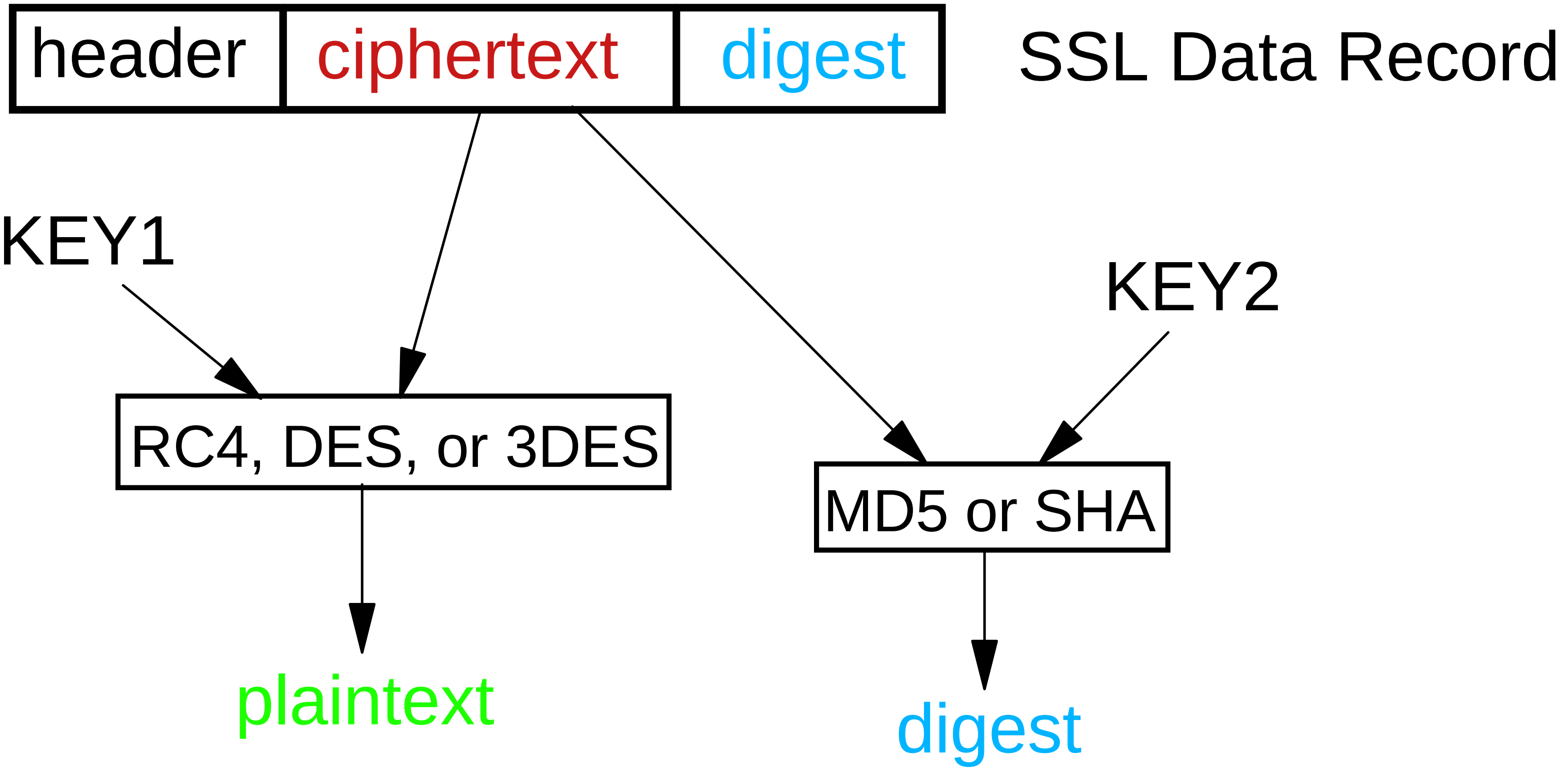
Exchanging Data Messages over SSL

- Each SSL data message is encrypted by the sender using one of the following symmetric cryptography algorithms:
  - RC4, DES, Triple-DES (3DES, TDES)
- Receiver decrypts the data using the same key (KEY1 in previous example) that the sender used to encrypt the data
- The encrypted data is run through a secure one-way hash algorithm (using KEY2 in the previous example) to produce a message digest that is the appended to the SSL data message
  - The MD5 or SHA (SHA-1) algorithm is used to produce the message digest
- The receiver calculates the message digest (using KEY2) and compares that to the digest appended to the message
  - If the two digests do not match, the data has been altered by some node in the network

Building an SSL Data Record



Processing an SSL Data Record



Hardware Acceleration for SSL Data Messages

- Central Processor Assist for Cryptographic Functions (CPACF)
- Hardware cryptographic accelerator coprocessor introduced on the IBM z990 server (supported on z990 and z890)
  - One CPACF coprocessor per CP (I-stream)
- CPACF does DES, 3DES, and SHA operations
- SSL support in TPF automatically determines if CPACF is installed and uses it for DES, 3DES, and SHA operations if CPACF is installed
  - Improves performance of data encryption/decryption as well as message digest creation/validation
- Each CPACF can do DES at 300 MB/sec, 3DES at 100 MB/sec, and SHA at 250 MB/sec
  - Rates vary (up or down) based on data size
- APAR PJ30156 (in test phase) adds this support to TPF 4.1.

Hardware Acceleration for User Data Encryption

- Requirements exist to encrypt/decrypt user data outside the scope of SSL or other standard protocol
  - For example, encrypt credit card numbers or other sensitive data stored in your TPF database
- A new user API has been created allowing you to encrypt/decrypt variable length user data using DES or 3DES
  - Both assembler and C language API interfaces
  - Uses CPACF if installed to do the DES/3DES operation; otherwise, uses software encryption
- APAR PJ30156 (in test phase) adds this support to TPF 4.1.

Summary

- SSL is now ready for mainline applications on TPF
  - PCICA adapters allow you to start thousands of SSL sessions per second
  - CPACF allows you to exchange tens of thousands of messages per second across SSL
- New user APIs enable you to encrypt/decrypt hundreds of MB per second of user data using CPACF to meet the ever growing security requirements of your business
- TPF system automatically determines whether PCICA and CPACF are installed
  - Uses software encryption if the appropriate hardware acceleration is not installed
    - Allows you to test applications running on back-level processors (using software encryption) and then run in production using hardware acceleration

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