Rich Algorithm Support

ACE (FIPS MODE)

Digital Signature Algorithms

- RSA (FIPS 186-4) Key lengths: 2048, 3072 Padding Modes: ANSI X9.31, PKCS #1v1.5, PSS
- DSA (FIPS 186-4) Key lengths: 2048, 3072
- ECDSA (FIPS 186-4) Curves: NIST P-224, P-256, P-384, P-521

Digital Signature Algorithms

- AES Key lengths: 128, 192, 256 Modes: ECB, CBC, CTR, CFB1, CFB8, CFB128, OFB, CCM
- AES-GCM Key lengths: 128, 192, 256
- AES-XTS Key lengths: 128, 256
- TripleDES Modes: ECB, CBC, CFB1, CFB8, CFB64, OFB

Digital Signature Algorithms

- SHA-1
- SHA-224
- SHA-256
- SHA-384
- SHA-512
- SHA3-224
- SHA3-256
- SHA3-384
- SHA3-512

Message Authentication

- HMAC-SHA-1
- HMAC-SHA-224
- HMAC-SHA-256
- HMAC-SHA-384
- HMAC-SHA-512
- AES-GMAC Keylengths: 128, 192, 256
- AES-CMAC Keylengths: 128, 192, 256

Key Agreement

- DH (NIST SP 800-56A)
- ECDH Curves: NIST P-224, P-256, P-384, P-521

Digital Signature Algorithms

- Password-Based Key Derivation Function 2 (PBKDF2)
- TLS Key Derivation Functions

Random Number Generator

- DRBG (NIST SP 800-90A)

ACE (Non-FIPS Mode)

All of the above in addition to the following:

Digital Signature Algorithms

- RSA: key lengths 1024, 2048, 3072
- DSA: key lengths 1024, 2048, 3072

Symmetric Keys

- DES
- RC4

Hash Functions

- MD2
- MD4
- MD5

Message Authentication

- HMAC-MD5

The rapid adoption and deployment of modern communication technologies is enabling new applications in healthcare, military applications, energy management, and consumer devices that are often referred to as the Internet of Things (IoT). With the inherent threats that come with connectivity, manufacturers are putting pressure on developers to deploy strong security, authentication, and encryption technologies to mitigate the risk of potential vulnerabilities in their designs.

When deployed in your application, ACE is a cryptographic library module that provides software implementations of FIPS-approved algorithms for the calculation of:

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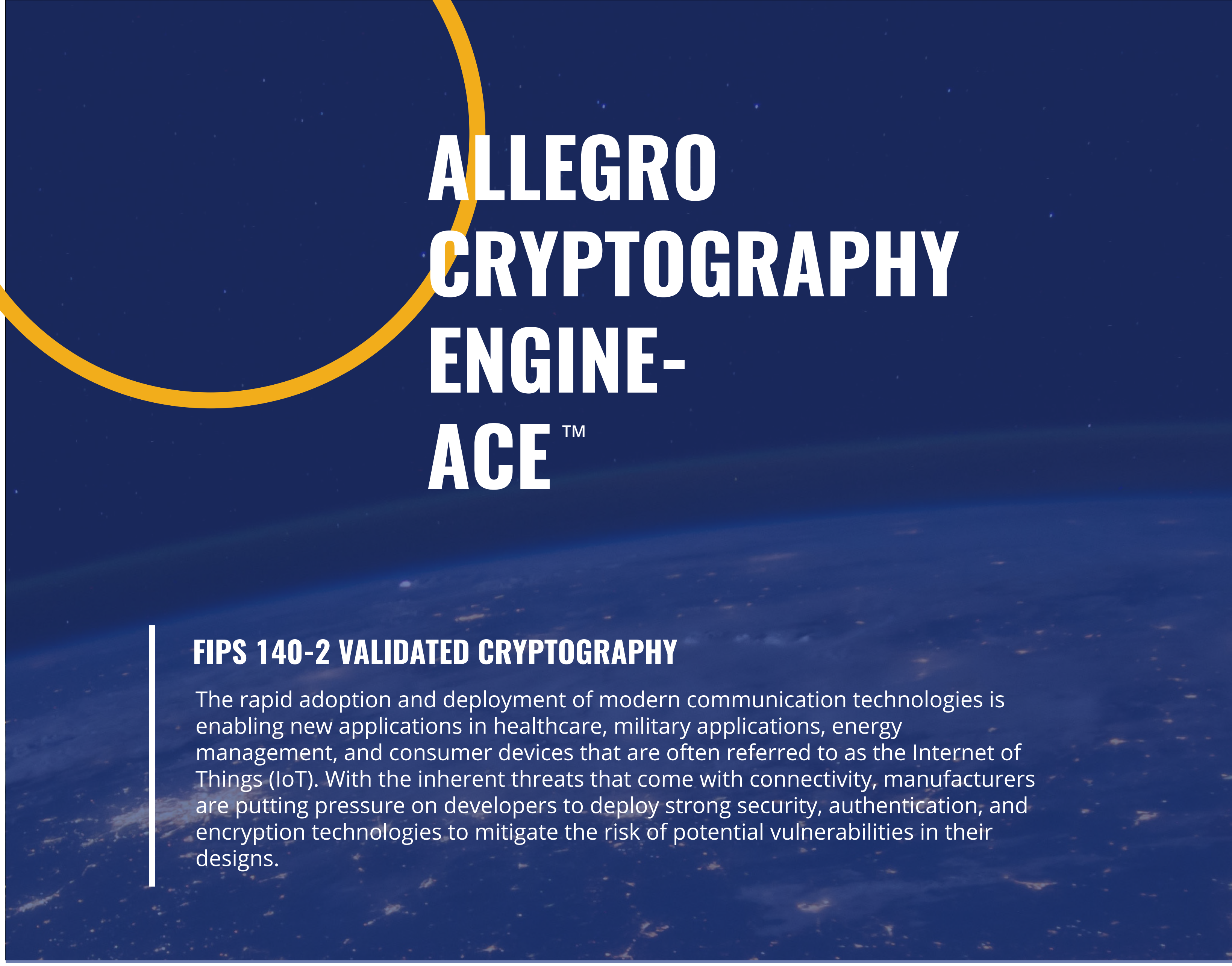

ALLEGRO CRYPTOGRAPHY ENGINE- ACE™

FIPS 140-2 VALIDATED CRYPTOGRAPHY

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ALLEGRO CRYPTOGRAPHY ENGINE (ACE)

The rapid adoption and deployment of modern communication technologies is enabling new applications in healthcare, military applications, energy management, and consumer devices that are often referred to as the Internet of Things (IoT). With the inherent threats that come with connectivity, manufacturers are putting pressure on developers to deploy strong security, authentication, and encryption technologies to mitigate the risk of potential vulnerabilities in their designs.

When deployed in your application, ACE is a cryptographic library module that provides software implementations of FIPS-approved algorithms for the calculation of:

- Message digests
- Digital signature creation and verification
- Bulk encryption and decryption
- Key generation
- Key exchange

Used standalone or pre-integrated with complete Allegro AE product suite, ACE provides government validated implementations of sophisticated encryption algorithms for use in your application.

ACE BENEFITS

- Improve time to market by leveraging field-proven embedded solutions
- Highly portable via field-proven abstraction layer
- NIST Validation of FIPS 140-2 algorithms
- Full Power-On Self-Test support
- NSA Suite B cryptography
- GPL-Free code protects your intellectual property
- Simple development model
- Independently developed by US citizens to meet Free From Foreign Influence (FFFI) requirements
- Small RAM/ROM footprint
- ANSI-C source code distribution
- Support for hardware acceleration
- Compilation switches for size and speed trade-offs
- Pre-integrated with Allegro's advanced device management and communication toolkits

FIPS VALIDATION INCLUDING SUITE B

The ACE implementions of FIPS 140-2 algorithms have been validated by NIST on multiple platforms since 2013. ACE allows your device to meet the criteria necessary for FIPS 140-2 validation.

In 2005, the National Security Agency (NSA) defined a set of cryptographic algorithms that, when used together, are the preferred method for assuring the security and integrity of information passed over public networks such as the Internet. Today, the Suite B algorithms are globally recognized as an advanced standard for cryptography used for encryption, hashing, calculating digital signatures, and key exchange. ACE includes a platform independent validated implementation of the NSA Suite B defined suite of cryptographic algorithms, as well as validated implementations of other FIPS 140-2 cryptography algorithms.

SECURING DATA IN MOTION

Many IoT applications collect and correlate valuable sensitive information at the edge of the Internet and routinely transmit it to servers in the cloud securely. TLS and DTLS are seen as the "defacto" standard for keeping data secure when communicating with servers in the cloud. Allegro's RomSTL, embedded TLS and DTLS toolkit, tightly integrates FIPS validated cryptography with a standards based, embedded implementation of TLS/DTLS to keep your data secure while in motion. RomSTL can additionally make use of ACE's support of Suite B algorithms with TLS and DTLS.

Secure Shell (SSH) encrypts communications between hosts over an insecure network and is another method employed for securing data in motion. Allegro's RomSShell is a fast, full featured SSH client/server solution designed for resource sensitive environments. RomSShell is pre-integrated with ACE and includes support for NSA Suite B algorithms so your product can securely link hosts in civilian applications as well as government based deployments.

PRE-INTEGRATED SOLUTIONS

The Allegro AE product family is pre-integrated with the ACE cryptography module, enabling manufacturers to add standardsbased cryptography to resource-sensitive environments easily and reliably. The family of Allegro AE product toolkits deliver fieldproven standards-based protocol components to:

- Securely serve Web pages, images or applets via TLS
- Manage security certificates
- Securely retrieve files from resources on the Web via TLS
- Quickly create a secure and robust Command Line Inter face(CLI)
- Exchange XML and SOAP messaging with enterprise or cloudbased computing and storage resources

SECURING DATA AT REST

Before offloading data to cloud based applications, any sensitive information stored by IoT devices faces numerous threats and risks of unintentional exposure. Adding data encryption to the transmission process has been the traditional method for reducing this risk. However, simply encrypting data transmissions doesn't fully address many of the threats aimed at recovering small segments of data or potentially an entire collection of data stored on an IoT device. The Allegro AE and ACE product suite provide IoT design engineers the ability to proactively address the threat surface created when storing sensitive data on persistent media. Rather than encrypting data at a volume or drive level where exposing a single set of keys potentially compromises a significant amount of sensitive data, Allegro's secure data-at-rest solution encrypts information at the file level and makes use of FIPS 140-2 validated cryptography.

SPEED DEVELOPMENT EFFORTS

ACE is a ready-made, pre-optimized and exhaustively tested cryptography solution that frees your in-house development team to focus on product differentiation: the functionality that makes your project unique and adds value to your target customer. ACE gives your development team the freedom to develop proprietary systems while giving the ability to use commercially available software components of your choice.

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PLATFORM INDEPENDENT

ACE, in addition to the entire Allegro AE product suite, is CPUarchitecture and platform independent. ACE relies on our fieldproven abstraction layer and can be utilized in the most resource sensitive environments, including those without an RTOS.

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GPL-FREE CODE

ACE is delivered as ANSI C source code. The total cost of ownership for ACE is less expensive than "free" open source code, especially when considering maintenance engineering, testing and support costs are taken into consideration. ACE contains no GPL code, and you can be confident your intellectual property won't accidently become public domain due to "GPL contamination", one of the risks of using open source software