Trusted Cyber Technologies

THALES

NIST 800-53 Mapping - Thales TCT Data Security Platform

White Paper

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ABSTRACT

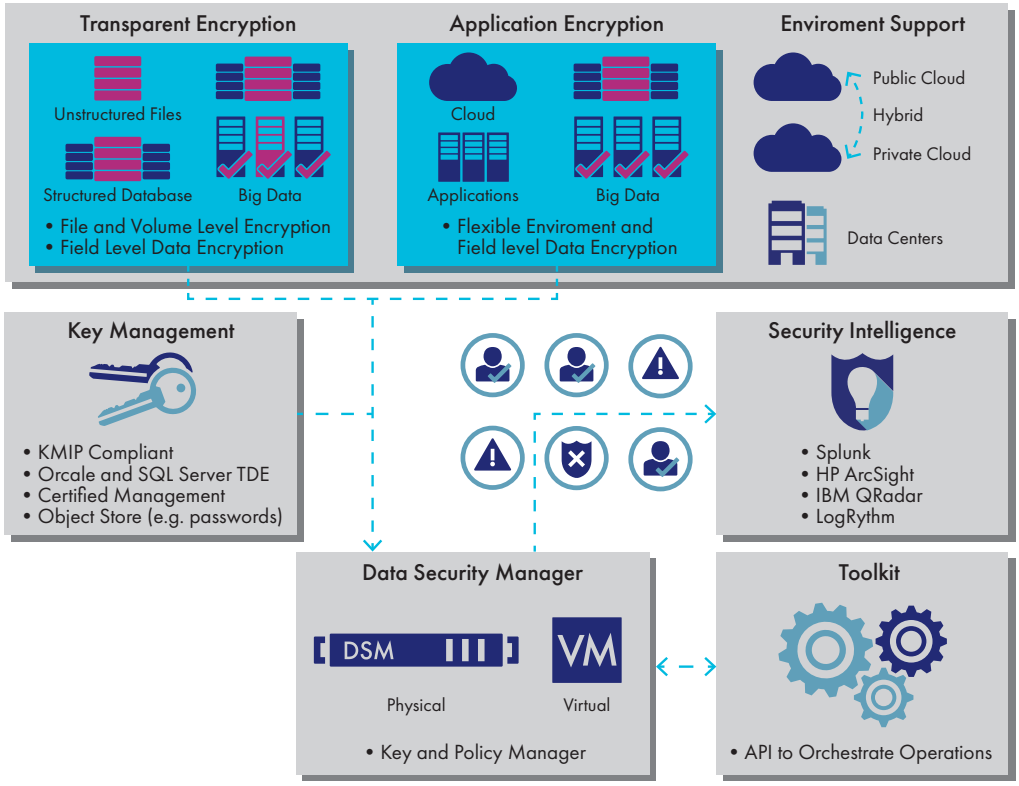
The National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53 provides guidance for the selection of security and privacy controls for federal information systems and organizations. Published by the National Institute of Standard and Technology, the publication details items from the Risk Management Framework that address security controls required to meet requirements in the Federal Information Processing Standard (FIPS) 200. Revision 4 is the most comprehensive update since the initial publication. Revision 4 was motivated principally by the expanding threat space and increasing sophistication of cyber-attacks. Major changes include new security controls and control enhancements to address advanced persistent threats (APTs), insider threats, and system assurance; as well as additions to address technology trends such as mobile and cloud computing.
Critical to certification for meeting FIPS, is the implementation of security controls from NIST 800-53, Appendix F. Focusing on the capabilities needed to meet these requirements, this paper provides background about Thales Trusted Cyber Technologies's (TCT) Data Security Platform and the Transparent Encryption product that is delivered through that platform. It further details a mapping of the Thales TCT product line's capabilities against these NIST security controls, first with an initial summary for each Family Area (in the form of a table), and then with expanded details of how these controls are delivered.

Thales TCT is a key partner in helping organizations to meet the standard. Focusing on protecting data-at-rest, Thales TCT delivers critical data protection controls, as well as training and awareness, to address each area. Core capabilities that support the standard include:

- **Encryption and Key Management** – strong, centrally managed, file and volume encryption combined with simple, centralized key management that is transparent to processes, applications and users.
- **Access Policies and Privileged User Controls** – that restrict access to encrypted data – permitting data to be decrypted only for authorized users and applications, while allowing privileged users to perform IT operations without ability to see protected information.
- **Security Intelligence** – logs that capture access attempts to protected data, providing high value security intelligence information that can be used with a Security Information and Event Management (SIEM) solution and for compliance reporting.

THE THALES TCT DATA SECURITY PLATFORM

The Thales TCT Data Security Platform consists of data protection product offerings that share a common, extensible implementation infrastructure for delivering data at rest encryption, enterprise key management, access control and security intelligence across an agency's infrastructure. Thales TCT makes it simple to solve today's and future security and compliance concerns by simultaneously defending data in databases, files and Big Data nodes across cloud, virtual or traditional data centers. Data security platform products are centrally managed, making it easy to extend data security protection and satisfy compliance requirements across the entire organization, without adding new hardware or increasing operational burdens.



THALES TCT DATA SECURITY PLATFORM PRODUCTS

- Thales TCT Data Security Manager centrally manages policies and keys for all Thales TCT data security products
- Thales TCT Transparent Encryption secures any database, file or volume across large agencies and implementations

Thales TCT Transparent Encryption and the Thales TCT Data Security Manager are the primary focus of this paper.
Other Thales TCT Data Security Platform products include:

- Thales TCT Application Encryption provides a simple framework to deliver field level encryption
- Thales TCT Key Management centralizes KMIP and TDE keys and certificate management
- Thales TCT Security Intelligence accelerates the detection of APTs, Insider Threats and compliance report generation

DEFENDING DATA WHERE IT LIVES

By combining encryption at the file system level with integrated key and policy management, Thales TCT Transparent Encryption protects and controls access to sensitive data in your Cloud, Big Data, database, and file servers. After protecting your sensitive data, least privileged access policies are enforced, preventing privileged insiders and APTs from accessing your data. Because this is "transparent" encryption, there are no changes required to your applications, infrastructure or business practices. Your users will never even know that the sensitive data that they were accessing is now secure, unless they tried to access it in an unauthorized fashion!

DEFENDING DATA WHERE IT BEGINS

Thales TCT Application Encryption enables organizations to design and embed encryption capabilities directly into their applications, when necessary. With this data security protection product, the data is protected from the application, through transmission, and into storage. Most commonly, deploying this data security protection product is to meet specific compliance requirements or to take specific data out of compliance scope. The Thales TCT platform removes the complexity and risk of building encryption into an application by providing libraries for NIST approved AES encryption and simplifying key management with the Data Security Manager.

SIMPLIFY AND CENTRALIZING ENTERPRISE KEY MANAGEMENT FOR AGENCIES

A common data security challenge is how to manage and maintain all the different key and certificate management solutions. Thales TCT Key Management8 delivers centralized control of the most common encryption key management requirements in order to reduce the on-going management and maintenance burden of multiple solutions. Thales TCT Key Management not only manages the keys and policies for the Thales TCT line of data security protection products, but it is also a KMIP server, manages keys for Oracle and Microsoft SQL Server Transparent Data Encryption (TDE), handles certificate inventory and can securely store any object, such as passwords. The Thales TCT Key Management solution offers an intuitive web based interface and APIs. It is typically deployed in an architecture to meet the most demanding high-availability SLAs.

DETECTING THREATS AND ISSUING ALERTS

Thales TCT understands that protecting your data is good, but not good enough; you need awareness of who and what's accessing your private and confidential data, including privileged users masquerading as other users. Every time someone attempts to access a resource under the protection of Thales TCT's platform, rich logs of whom, when, where, which policies applied, and the resulting action can be generated. Because sifting through the rich granular data of Thales TCT's event logs can be time consuming, the Thales TCT platform integrates with leading SIEM (Security Information and Event Management) systems, including HP ArcSight, Splunk, IBM QRadar and LogRhythm, adding to their value with new inside-the-fence security intelligence and awareness. With pre-defined reports and visualizations, you'll be better able to pinpoint which events are worth further investigation.

COMPLIANCE, REGULATIONS AND CONTRACTUAL MANDATES

Thales TCT addresses industry compliance mandates, global government regulations (such as NIST 800-53) and contractual mandates by securing data in traditional on-premise, virtual, Cloud and Big Data infrastructures, through:

- Data at Rest encryption and centralized enterprise key management that allows agencies to lock down data using strong industry approved algorithms coupled with a virtual or physical FIPS 140-2 Level 3 certified appliance for key and policy management.
- Simplify the creation and consistent enforcement of data access and privileged user control policies. Fine-grained control to determine whom can access specific data in order to block privileged users, such as root, as well as preventing Advanced Persistent Threats (APTs) from gaining access to protected data.
- Thales TCT Security Intelligence delivers the fine-grained details of data access required to prove compliance to auditors. In addition, leveraging Thales TCT Security Intelligence connectors and reports for popular SIEM tools simplifies integration and analysis.

SECURITY CONTROL SUMMARY

As found in NIST 800-53: http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-53r4.pdf

Security Control Family	Compliance Baseline	Thales TCT Product Line Mapping
Access Controls (AC)	• Access Enforcement • Account Management • Separation of Duties • Least Privilege	Through the use of kernel level agents providing Suite B and AES 256 Encryption, the Thales TCT Data Security Manager exceeds and augments current access control solutions at the file, directory, drive, or target level at the Operating System and provides Least Privilege.
Awareness and Training(AT)	• Training Policies • Security Awareness Training • Role Based Security Training	Deployment of Thales TCT Transparent Encryption is a part of program's Defense-In-Depth security architecture to protect sensitive data through fine-grained access controls and encryption at rest. On initial deployment, Thales Advanced Solutions Group and a host of learning options (in-class, online) are used to train staff to use the solution. Thales TCT Transparent Encryption has low administrative burden, and the training provided covers tasks and responsibilities for each desired/deployed role, with appropriate documentation provided.
Audit and Accountability(AU)	• Audit Events • Content • Response • Capacity • Non-Repudiation • Report Generation	Thales TCT Transparent Encryption provides full audit data at the Thales TCT Data Security Manager and at host agents in an open format and can integrate with a program or agency's audit reduction tool or SIEM solution.
Security Assessment and Authorization(CA)	• System Interconnects • Plan of Action and Milestones • Continuous Monitoring	Thales TCT Transparent Encryption can be tested as a part of an Information System. The agents are installed on operating systems that undergo security hardening and STIG configurations. The Thales TCT Data Security Manager is FIPS 140-2 Level 2 or Level 3 Compliant depending upon configuration.
Configuration Management (CM)	• Baseline Configuration • Change Control • Security Impact Analysis • Least Functionality	The configuration of the Thales TCT DSM can be changed to match operational requirements for access control and encryption at rest, and can be saved, backed up, and added to a CMDB in order to track changes over time.
Contingency Planning(CP)	• Contingency Plan • Contingency Testing	The Thales TCT DSM component can operate in a clustered environment in active or standby mode, and can be added to a program's COOP/DR strategy.
Identification and Authentication(IA)	• Organizational Users • Device Login • Authentication Management • Crytpographic Module • Incident Handling	The Thales TCT Data Security Platform processes incidents at the individual component level (host system, web GUI, Thales TCT DSM). These incidents and audit events are in an open syslog format that can be sent to an information system's monitoring/reporting tool, including 3rd party SIEM solutions. Log file formats can be tailored to match a program's security policy for user and application behavior.
Maintenance(MA)	• Controlled Maintenance • Tools	As a part of the FIPS 140-2 level 3 certification, the Thales TCT Data Security Manager is tamper resistant. Additionally, maintenance and audit sessions can be separated by domain and by administrator login.
Media Protection(MP)	• Media Access • Media Marking • Storage Transport	As a part of the FIPS 140-2 level 3 compliance evaluation the Thales TCT Data Security Manager has the ability to be zeroized at the appliance console.
Physical and Environmental Protection (PE)	• Access Authorizations • Control • Transmission	The Thales TCT Data Security Manager is a 17"x17"x3" hardware device and can be secured in a lockable data center rack enclosure.
Planning(PL)	• Security Architecture • Concept of Operations	Thales TCT Transparent Encryption provides fine-grained access policies and AES256 encryption that can be used to limit privileged user access and implement least-privilege principles for users authorized for access to sensitive data.
Personnel Security(PS)	• Personnel Termination and Transfer	Thales TCT Transparent Encryption should be operated by personnel at the appropriate level of clearance and information system access.

Security Control Family	Compliance Baseline	Thales TCT Product Line Mapping
Risk Assessment(RA)	• Security Categorization • Vulnerability Scanning	Thales TCT Transparent Encryption can be used as part of a risk assessment process at both components in its architecture in an information system; The Thales TCT DSM is FIPS 140-2 Level 3 compliant and the Host Agents can be installed on hardened servers to minimize risk.
System and Services Acquisition(SA)	• Allocation of Resources • System Development Life Cycle	System Components of the Thales TCT Data Security Manager are assembled in US in Thales's facility in San Jose, CA. It is FIPS 140-2 Level 3 compliant.
Systems and Communications Protection(SC)	• Application Partitioning • Security Function Isolation • Confidentiality and Integrity • Cryptographic Key Management • Platform Agnosticism	As a part of the Thales TCT Transparent Encryption solution, AES 256 encryption keys are passed through an encrypted wrapper. The Administrator Web Interface is accessed through HTTPS. Agent-to-Thales TCT DSM communication is accomplished through the use of ephemeral ports. This provides and additional layer of encryption key protection, reducing risk.
Systems and Information Integrity (SI)	• Certified only for FIPS 140-2 Levels 1 and 2.	System Integrity on the Thales TCT Transparent Encryption product is satisfied through the Thales TCT DSM's FIPS 140-2 validation. Host agents installed on an Information System's server provide encryption at rest capabilities to enhance system integrity.
Program Management(PM)	• Security Alerts and Advisories • Software and Information Integrity	Program Management controls are typically implemented at an Organization Level and not directed to Information Systems. As such, it is not a technical control that the Thales TCT Transparent Encryption addresses.

SECURITY CONTROL DETAIL

1. ACCESS CONTROL

Access Control applies to the following places within the Thales TCT Transparent Encryption solution:

- **Thales TCT Product Policy**
    1. The Thales TCT Data Security Manager (DSM) is a hardened appliance for optimum security and comprises a policy engine and a central key and policy manager. Agents installed on hosts intercept every attempt made to access protected data and, based upon a set of rules, either permit or deny the access attempt.
    2. Thales TCT product line policy is comprised of sets of security rules that must be satisfied in order to allow or deny access to an information system under its control. Each security rule evaluates who, what, when, and how protected data is accessed and, if these criteria match, the agent will permit or deny access.
    3. The set of rules is defined in a policy is configured on the Thales TCT DSM and downloaded to the agent through a secure SSL network connection. It provides separation of duties between data owners, administrators, key managers, and security managers.

- **Thales TCT DSM Login** – The Thales TCT Data Security Manager has both a web-based and command-line GUI that can be configured for both administrator and role based separation.

- **Separation of Domains and Roles** – One of the functions of the Thales TCT DSM is the notion of domain administration. A Domain is logical entry that is used to separate administrators and the data they access from other administrators, and can be applied internally to a program, a fixed number of programs, or externally to an entire enclave. The credentials of each of these domains can be integrated into Active Directory or LDAP groups, and monitors number of logins, login attempts, previous logons, and will lock each role out after 15 minutes of inactivity. The use of these domains and the protection of data through the use of Thales TCT "guard points" enforces Least Privilege that is defined in an Information System's Security Plan, Concept of Operation, and proven through testing.

2. AWARENESS TRAINING

- Deployment of Thales TCT Transparent Encryption is a part of program's Defense-In-Depth security architecture to protect sensitive data through fine grained access controls and encryption at rest. On initial deployment, Thales Advanced Solutions Group consultants and a host of learning options (in-class, online) are used to train staff to use the solution. Thales TCT Transparent Encryption has low administrative burden. Available training covers tasks and responsibilities for each desired/deployed role, with appropriate documentation provided.

3. AUDIT AND ACCOUNTABILITY

- Agent activity is closely monitored and logged. All auditable events, including backups, restores, and security operations can be logged at the Thales TCT Data Security Manager or at the hosts. The Thales TCT DSM is capable of storing up to 110,000 audit messages. The following audit event content is provided:
  - Date and Time
  - Event type
  - Severity
  - User Identity
  - Process from which the attempt is being made
  - Status: success or failure
  - Name of related policy (key, policy, host, etc)
  - Description
- Audit data can also be protected from unauthorized access or modification through encryption using Thales TCT Transparent Encryption. The audit directory can be configured as a guard point and placed under access control. This is also a non-repudiation technique, as it will preserve the content path of any individual accessing an unauthorized component of an Information System.
- Audit data is collected in an open Syslog format and can be integrated with several SIEM and log correlation tools.
- When the agent component of Thales TCT Transparent Encryption cannot contact the central manager (Thales TCT Data Security Manager) for logging (network outage), logs from the agent are stored locally until network connectivity resume, at which point those logs are uploaded to the Thales TCT DSM. By sending agent Host OS logs to an audit reduction or network monitoring tool, correlations can be created with the appropriate alerting.

4. SECURITY ASSESSMENT AND AUTHORIZATION

- Thales TCT Transparent Encryption can be tested as a part of an Information System.
  - The agents are installed on operating systems that undergo security hardening and STIG configurations.
  - The following ports and protocols are required for operation:

Protocol	Port	Communication Direction	Purpose
TCP	7024	DSM -> Agent	Policy/Configuration Exchange
TCP	8080	Agent -> DSM	1-time Certificate Exchange
TCP	8443	Agent -> DSM	Configuration Exchange for TLS with RSAencryption algorithm secure communications
TCP	8444	Agent -> DSM	Log Messages for TLS with RSA encryption algorithm secure communications
TCP	8445	Workstation -> DSM	Management UI for TLS with RSA encryption algorithm secure communications
TCP	8446	Agent -> DSM	Configuration Exchange for TLS with Suite B encryption algorithm secure communications *
TCP	8447	Agent -> DSM	Log Messages Exchange for TLS with Suite B encryption algorithm secure communications *
TCP	8448	Workstation -> DSM	Management UI Exchange for TLS with Suite B encryption algorithm secure communications *
TCP	50000	DSM <-> DSM	Cluster Heartbeat/Information Exchange
TCP	8080	DSM <-> DSMDSM <-> Agent	1-time Certificate Exchange
TCP	8443	DSM <-> DSM	Initial Configuration Exchange
ICMP	Ping	DSM <-> DSM	Check Connectivity
ICMP	22	Workstation -> DSM	CLI Access
If NTP server and Syslog server are used to synchronize appliance time and forward log messages, it will require opening up following ports			
UDP	123	DSM <-> NTP Server	
UDP	123	DSM <-> NTP Server	

* Note: The Thales TCT Data Security Manager will automatically use SuiteB communications unless ports 8446, 8447, 8448 are not available. If not available (or communicating with older versions of Thales TCT agent that do not support SuiteB), communications fall back to using Ports 8443, 8444, 8445 and TLS/RSA encrypted communications

5. CONFIGURATION MANAGEMENT

- The configuration of the Thales TCT DSM can be changed to match operational requirements for access control and encryption at rest, and can be saved/backed up in order to track changes over time.

6. CONTINGENCY PLANNING

- The Thales TCT DSM can operate in a clustered environment and can be added to a program's COOP/DR strategy.

7. IDENTIFICATION AND AUTHENTICATION

- Thales TCT agent policies work in conjunction with a program's authentication and identification policies and procedures and are used to protect:
  - System files
    Data files and folders
  - Applications
- Policy configuration can be fine-tuned to select:
  - A desired database
  - A program's Operating System
  - Host records
  - Key Type
  - User sets (Organizational Users)
  - Group Identification
  - Specific processes and applications that are allowed to access a Thales TCT guard point

- Each Thales TCT agent is cryptographically signed by a certificate authority generated by the Thales TCT DSM in order to identify and authorize access and encryption/decryption operations on the host system. The Thales TCT DSM is available as a FIPS 140-2 Level 2 or 3 hardware appliance.
- The Thales TCT DSM supports integration with existing technologies for identification and authentication(Active Directory and LDAP) and augments that process by specifying (through the use of policy) which user, application, or process is allowed to access a file, directory, or application on an information system component.
- On the Thales TCT Web Console, credentials of each of these domains can be integrated into Active Directory or LDAP groups, and monitors number of logins, login attempts, previous logons, and will lock each role out after 15 minutes of inactivity, requiring re-authentication.
- Communication between Thales TCT DSM and agents are cryptographically signed by the Thales TCT DSM's certificate authority and passed in an encrypted format (AES256).

8. INCIDENT RESPONSE

- Thales TCT Transparent Encryption processes incidents at the individual component level (host system, web GUI, DSM).
- These incidents and audit events are in an open syslog format and can be sent to an information system's monitoring/reporting tool, including 3rd party SIEM solutions.
- Log formats can be tailored to match a program's security policy for user and application behavior.

9. MAINTENANCE

- Is available as a FIPS 140-2 Level 2 or 3 certified configuration (level 3 is tamper resistant)
- Additionally, maintenance and audit sessions can be separated by domain and by administrator login.

10. MEDIA PROTECTION

- As required by FIPS 140-2 level 3 certification, the Thales TCT Data Security Manager has the ability to be zeroized at the appliance console.

11. PHYSICAL AND ENVIRONMENTAL PROTECTION

- The Thales TCT DSM dimensions are 17"x17"x3.5". The Thales TCT DSM:
  - Can be installed into a standard locking rack enclosure.
  - Is available as a FIPS 140-2 Level 2 or 3 certified configuration (level 3 is tamper resistant)

12. PLANNING

- Thales TCT Transparent Encryption provides fine-grained access policies that can be used to limit privileged user access and implement least-privileges principles for users authorized for access to sensitive data. Thales' Advanced Solutions Group also includes top subject matter experts who can help organizations to architect secure and efficient solutions for managing and controlling privileged access and access to their data.
- Key and policy management is centralized using Thales TCT Transparent Encryption.

13. PERSONNEL SECURITY

- The Thales TCT DSM supports integration into an organization's Active Directory tree or LDAP to support existing network and server based authentication methods including the ability to track a users' credentials as they enter and exit a program.

14. RISK ASSESSMENT

- Thales TCT Transparent Encryption can be a part of a risk assessment process at both components in its architecture in an information system; The Thales TCT DSM, and host agents.
  - The Thales TCT Data Security Manager is FIPS 140-2 Level 3 certified.
  - The Thales TCT Encryption Agents are installed on servers in an Information System that should meet security hardening and STIG guidance.

15. SYSTEM AND SERVICES ACQUISITION

- The Thales TCT DSM is a FIPS 140-2 Level 3 appliance.

16. SYSTEMS AND COMMUNICATIONS PROTECTION

- Thales TCT Transparent Encryption provides a fine- grained set of access controls that can act as a secondary set of controls beyond those available from a system or identity management solution to ensure that general users cannot gain access to administrative or security capabilities.
    - The solution is platform independent
    - Security functions on the Thales TCT DSM are isolated from normal operation and include domain creation, key creation, host creation, and audit-only.
    - Once a system's data has been encrypted through data transformation, it remains encrypted at rest and is under fine-grained access controls.
    - If more than one domain is deployed, domain administrators and users are separated by domain. Administrators have the option of using different encryption algorithms and key lengths to provide even more separation. Encryption algorithms for each domain include AES 128 and 256.
    - Encrypted communications between Thales TCT DSM and agent is selectable, options are NSA Suite B or RSA algorithms.
- There is secure transmission control between the Thales TCT DSM, the Thales TCT daemon running on the host, and the SecFS portion that sits in the host's kernel space. The Thales TCT DSM creates a public/private key pair, generates a Certificate Signing Request (CSR), which generates a certificate authority certificate that is stored in the Thales TCT DSM database.
- The user space portion of the Thales TCT agent creates a public/private key pair. The public key is used to create a CSR for the host, and is sent back to the Thales TCT DSM, where the request is signed, sent back to the host, and creates a "blueprint" of the host, along with the certificate.
- The kernel space portion also creates an asymmetric key pair and follows the same certificate creation process in order to send the kernel space public key to the Thales TCT DSM.
- Keys are passed between the Thales TCT DSM and the host by generating a one-time AES256 random key on the Thales TCT DSM. The desired encryption keys are encrypted using the random key. The random key password is encrypted using the kernel space public key. The entire payload is sent to the host system, where the kernel space private key decrypt the random key and password. The random key then un-encrypts the desired encryption keys, and those keys are applied to the file/directory/executable that is to be encrypted.
- The Thales TCT Key Vault is a secure inventory of certificates, keys, and other materials. It provides alerting and upcoming event status regarding certificate and key expiration. Key strength and type are also available to check compliance on any weak keys applied to an information system. Import and export of 3rd party keys is also supported. The key vault is protected from tampering through the Thales TCT DSM, which is a FIPS 140-2 hardened appliance.

17. SYSTEM AND INFORMATION INTEGRITY

- Thales TCT Transparent Encryption monitors an information system at these points, and creates audit data on:
    - Thales TCT Data Security Manager
    - Thales TCT Data Security Manager Web-based GUI
    - Host Agents
      Host logon
- Thales TCT Transparent Encryption enforces information handling through the use of guard points. A guard point is a protected device or directory that is encrypted, and provides de-cryption rules within policy. Each rule specifies a condition that will permit or deny access based on a particular combination of:
    - User (either local user/group or Active Directory user/group)
    - Process (the actual binary used; i.e. mssql.exe)
    - Action (read, write, change attribute, delete, list directory, etc)
    - Result (specific files or directories within the guard point)
    - Time (Time of Day, eg 9am-5pm M-F)

18. PROGRAM MANAGEMENT

- Program Management controls are typically implemented at an Organization Level and not directed to Information Systems. As such, it is not a technical control that Thales TCT Transparent Encryption addresses.

About Thales Trusted Cyber Technologies

Thales Trusted Cyber Technologies, a business area of Thales Defense & Security, Inc., protects the most vital data from the core to the cloud to the field. We serve as a trusted, U.S. based source for cyber security solutions for the U.S. Federal Government. Our solutions enable agencies to deploy a holistic data protection ecosystem where data and cryptographic keys are secured and managed, and access and distribution are controlled.

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