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## Section VII. Technical Specifications

No	Item	Specification	Statement of Compliance
1Lot	1	<p><b>SUPPLY, DELIVERY, INSTALLATION AND TESTING OF DATABASE FIREWALL FOR THE DATABASE CLEANSING AND MANAGEMENT PROJECT</b></p> <p><b>1. Solution Architecture</b></p> <p>1.1. The solution management server and database audit data monitoring collector gateway must all be appliance-based.</p> <p>1.2. The appliances must be available in the following offerings:</p> <p>1.3. Physical appliance</p> <p>1.4. Virtual appliance</p> <p>1.5. Amazon Web Services (AWS) Machine Instance</p> <p>1.6. The solution must support the following hypervisors:</p> <p>1.7. VMWare ESXi 4.x, 5.x and 6.x</p> <p>1.8. Microsoft Hyper-V 2012 and 2016</p> <p>1.9. The solution appliances must be purposefully built and be self-contained with all the necessary software on a pre-hardened Unix operating system.</p> <p>1.10. The solution must be able to monitor databases running on Cloud platforms such as AWS and Microsoft Azure.</p> <p>1.11. The solution's database audit data collector appliance must be able to support BOTH of the following deployment modes to monitor database activity over the network:</p> <p>a. SPAN/TAP port sniffer mode</p> <p>b. Layer-2 transparent inline bridge (must be native support and not via 3rd party integration)</p> <p>1.12. When the solution collector appliance is deployed in Layer-2 transparent inline bridge mode, the solution appliance must have built-in bypass to support "fail-open" mode. The solution must have the ability to support "fail-close" mode as well. This must</p>	





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		<p>be a natively supported feature in the solution and not via a 3rd party integration.</p> <p>1.13. When the solution collector appliance is deployed in Layer-2 transparent inline bridge mode, there must be zero existing session loss when the appliance transit into a "fail-open" mode.</p> <p>1.14. The solution must provide database agent software that can be ran on the DB server to collect local database activities originating from connections RDP, SSH, Telnet, direct access, Shared Memory, IPC, TCP local, BEQ, etc.</p> <p>1.15. The solution collector architecture must be able to be deployed in a clustering mode to provide at least N+1 redundancy where N is the number of active monitoring appliances and one redundant appliance is in standby mode. All the appliances in the cluster must replicate data within each other to ensure full data redunancy in the event of the failure of any appliance.</p> <p>1.16. When the solution collector appliances are deployed as a cluster, the cluster must support:</p> <ul style="list-style-type: none"><li>a. Auto assignment of agents to the different collector appliances</li><li>b. Auto and manual load balancing of agents based on each of the cluster appliances load</li><li>c. Data synchronization between the appliances to prevent data loss in the event of appliance failure</li><li>d. **Note: The load balancing decisions must be carried out and determined by the monitoring collector appliances level and NOT at the DB agents. This is to prevent performance impact on the DB servers to be monitored.</li></ul> <p>1.17. The entire solution must be centrally managed via a management server appliance.</p> <p>1.18. The solution day to day operations such as reporting, policy creation, alerts management, database protection configuration, etc must be managed from the centralised management server.</p>	
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		<p>1.19. The management server must also centrally manage all the different monitoring appliances. The solution must allow the user to use a standard browser to access the management UI.</p> <p>1.20. When scaling the solution, the solution must support a scale-out approach by having only to add more monitoring collector appliances as needed. If the administrator needs to monitor DB activities in a new environment, he must be able to easily:</p> <ol style="list-style-type: none"><li>Add a new monitoring collector gateway,</li><li>Register it to the management server and</li><li>From there on manage the monitoring gateway centrally where all other gateways are managed from.</li></ol> <p>1.21. In addition, varying sized monitoring gateway models must be available to handle the different database load and throughput.</p> <p>1.22. The solution must support a WAN/global distributed deployment and management model whereby there can be multiple Management Servers deployed across the entire enterprise different sites and datacenters. All the Management Servers must be able to be centrally managed by a "Manager of Managers". The "Manager of Managers" must provide the following capabilities:</p> <ol style="list-style-type: none"><li>Unified management and administration of federated environments across all Management Servers</li><li>Creation, configuration and distribution of policies system-wide across all Management Servers</li><li>Single point of access to each Management Server</li><li>Monitoring of solution health for the entire deployment</li><li>System wide view of security activities</li></ol>	
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		<p>1.23. The solution must support external storage such as SAN for increasing audit storage capability.</p> <p>1.24. The solution must have the ability to perform aggregation of collected data from multiple audit data collection monitoring appliances.</p> <p>1.25. The data aggregation function must support two capabilities:</p> <ul style="list-style-type: none"><li>a. Report generation and</li><li>b. Real-time forensics GUI that supports data pivoting used for immediate investigation</li></ul> <p>1.26. In every component of the solution which performs data aggregation, the data aggregation function frequency must not be limited to daily only. This is to prevent aggregation delay of real-time data.</p> <p>1.27. The schedule of the data aggregation function must be configurable down to the level of minutes and hours.</p> <p>1.28. I.e. aggregate data collected over the past 15 minutes, past 1 hour, past 24 hours, past 3 days, past 3 months, etc.</p> <p>1.29. The solution must suport and expose REST API interfaces to enable DevOps and automation requirements.</p> <p>1.30. The solution database security and database audit engine must be independent of each other.</p> <p>1.31. I.e the processing of database security policy and database audit policy must be independent of each other in the solution processing engine.</p> <p>1.32. For every scenario that requires security policy for alerting, there should not be the need to configure another matching audit policy.</p> <p>1.33. For e.g., "Alert when a DB user performs "Select *" on any table in the DB" must not require an audit policy to audit access to every DBs tables.</p> <p>1.34. The solution architecture must not capture and store event data in a RDMS first</p>	
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		<p>before determining the collected data relevance to audit requirements.</p> <p>1.35. This forces heavy processing workloads the data collectors and requires more infrastructure resources to compensate. Such a “post-processing” architecture also adds significant latency to alerting and blocking.</p> <p>1.36. The solution must parse, process and write/log the collected database audit data to the solution storage in real-time at the point of collection even under heavy traffic volume condition. This is to prevent delay in audit anomaly and security anomaly detection.</p> <p>1.37. The collected database audit data must be tamper-proof. It must be stored in an encrypted flat file format/structure in the collector appliance and not stored inside a RDBMS structure.</p> <p>1.38. This is to preserve confidentiality and integrity of the collected audit data and at the same time maintain performance when reading/writing the logs from/to the collector appliance.</p> <p><b>2. Solution Platform Security Requirements</b></p> <p>2.1. The solution must support the following authentication mechanism for accessing the solution management UI:</p> <ul style="list-style-type: none"><li>a. In-built authentication in the solution</li><li>b. Kerberos authentication</li><li>c. LDAPS authentication and authorization with the following Windows platforms: 2003, 2003 R2, 2008, 2008 R2, 2012, and 2012 R2.</li><li>d. RADIUS authentication</li></ul> <p>2.2. The solution must be Common Criteria certified.</p> <p>2.3. The solution must be able to operate in FIPS (Federal Information Processing Standard) 140-2 compliance mode.</p> <p>2.4. The solution must provide Role-Based Access Control or multiple user roles that facilitate separation of duties.</p> <p>2.5. The solution must be able to be deployed in a Sealed Box mode to be STIG-compliant. The Sealed Box mode is to ensure that the solution hardware can operate as a "true</p>	
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		<p>appliance mode". This mode must limit SSH CLI user access to the underlying OS and prevents elevation of privilege instances by only using controlled CLI commands for WAF system set up and configuration.</p> <p>2.6. The solution must support the following password management capabilities without relying on any external system:</p> <ul style="list-style-type: none"><li>a. Password validity period in days</li><li>b. Password length (minimum required number of characters in the password.)</li><li>c. Whether a password must be significantly different from the last password used</li><li>d. Whether a password must include capital letters, numbers, lower case letters and non alpha-numeric characters or not.</li></ul> <p>2.7. The solution must be able to support the configuration of the following lockout settings from the solution management UI:</p> <ul style="list-style-type: none"><li>a. Login failed attempts period (in minutes) in which entering an incorrect password multiple times locks an account</li><li>b. Number of failed login attempts which result an account to be locked</li><li>c. Lock duration in minutes</li></ul> <p>2.8. The database audit data residing on the solution should be encrypted and digitally signed to be deemed as tamper-proof.</p> <p>2.9. There must be a key management mechanism in the solution to import, export and regeneration of the encryption keys.</p> <p>2.10. The solution must support the capability of trust-based communication between the different components in the solution. I.e. Communication between solution components needs to be done using certificates.</p> <p>2.11. The solution must support "sealing mechanism" as part of the requirements to be compatible with the Federal STIG certifications.</p> <p>2.12. The sealed mode must enable the admin to "lock" the machine and permit only limited commands to be ran on the solution's underlying OS.</p>	
		<p>3. Database Discovery</p>	





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		<div>3.1. The solution must be able to discover the following database systems/services running in the environment:<div>a. DB/2</div><div>b. Informix</div><div>c. MariaDB</div><div>d. MSSQL</div><div>e. MySQL</div><div>f. Netezza</div><div>g. Oracle</div><div>h. PostgreSQL</div><div>i. Progress</div><div>j. SAP Hana</div><div>k. Sybase</div><div>l. Sybase IQ</div><div>m. Teradata</div><div>n. Hadoop - Cloudera (Hive, Hbase, HDFS, Impala)</div><div>o. Hadoop - Hortonworks (Hive, Hbase, HDFS)</div><div>p. IBM BigInsights (Hive, Hbase, HDFS)</div><div>q. MongoDB</div><div>r. Cassandra DataStax</div></div> <div>3.2. The solution must provide automated discovery of both new and existing database systems and it will map all of them that exists on the network.</div> <div>3.3. The solution must provide automated discovery of both new and existing database tables.</div> <div>3.4. The solution must keep the historical information about the systems and their configuration.</div> <div>3.5. The solution must show changes since the last scan.</div> <div>3.6. The solution must support identification of rogue or test databases.</div> <div>3.7. The solution must support asset management and change management processes.</div> <div>4. Database Classification<div>4.1. The solution must be able to perform data discovery and classification on the following databases:<div>a. Oracle</div><div>b. MSSQL 2005 and Higher</div><div>c. MSSQL 2000</div></div></div>
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		<div>d. Sybase ASE</div> <div>e. Sybase SQL Anywhere</div> <div>f. Informix</div> <div>g. MySQL</div> <div>h. Sybase IQ</div> <div>i. DB2 on Linux, Unix, Windows, z/OS and System i</div> <div>j. Teradata</div> <div>k. MariaDB</div> <div>l. Netezza</div> <div>m. PostgreSQL</div> <div>n. SAP-HANA</div> <div>4.2. The solution must be able to detect sensitive data types, such as credit card numbers, social security numbers, etc., in database objects.</div> <div>4.3. The solution must support the following sensitive data types out of the box:<div>a. Financial Transactions</div><div>b. Credit card numbers and cardholder information</div><div>c. Credit care track data</div><div>d. Personal identification information (PII)</div><div>e. User defined account numbers</div><div>f. Personal Identification Numbers (PIN)</div></div> <div>4.4. The solution must have the ability to exclude a table or column from the data discovery process.</div> <div>4.5. The solution must locate custom data types in database objects.</div> <div>4.6. The solution must be able to scan views on a database.</div> <div>4.7. The solution must be able to scan synonyms on a database.</div> <div>4.8. The solution must be able to support the data classification methods for dictionaries and regular expressions.</div> <div>4.9. The solution must be able to identify the specific object and column that contain the sensitive data.</div> <div>4.10. The classification solution must maintain low level of falsely identifying non-sensitive data as sensitive.</div> <div>4.11. The solution must support the ability for creation of profiles which can permit users to save custom data classification rules and then reuse them in other scans. A single scan must be able to contain a number of profiles.</div>	
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## 5. Database Vulnerability Assessments

- 5.1. The solution must come with pre-defined database vulnerability assessment policies that correlate to the following specific regulatory benchmarks:
- a. CIS
  - b. DISA (STIG)
  - c. FISMA
  - d. HIPAA
  - e. PCI-DSS
- 5.2. The solution must come with database vulnerability assessment policies that discover known vulnerabilities for the following databases:
- a. DB/2
  - b. Informix
  - c. MSSQL
  - d. MySQL
  - e. Oracle
  - f. Sybase
- 5.3. The solution must come with database assessment policies that detects missing security patches for the following databases:
- a. DB/2
  - b. Informix
  - c. MSSQL
  - d. MySQL
  - e. Oracle
  - f. Sybase
- 5.4. The solution must come with at least 1,000 pre-defined database vulnerability assessment tests out of the box that cover the following categories:
- a. Access Control
  - b. Auditing
  - c. Authentication and User Management
  - d. General Database Info
  - e. Internal Tests
  - f. Known Attacks based on CVEs
  - g. Licensing
  - h. OS Integrity
  - i. Resource Control
  - j. Sensitive Data Detection
- 5.5. The solution must support adding of tags to each of the database vulnerability assessment policies. The policy tag(s) must be used to associate a scan with the policies





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		<p>that are run when a database assessment scan is activated.</p> <p>5.6. The solution must support custom assessment policies to be created and added for the following databases:</p> <ul style="list-style-type: none"><li>a. DB/2</li><li>b. IMS</li><li>c. Informix</li><li>d. MariaDB</li><li>e. MSSQL</li><li>f. MySQL</li><li>g. Netezza</li><li>h. Oracle</li><li>i. PostgreSQL</li><li>j. Progress</li><li>k. SAP Hana</li><li>l. Sybase</li><li>m. Sybase IQ</li><li>n. Teradata</li></ul> <p>5.7. The solution must be able to utilize user created scripts as assessment tests.</p> <p>5.8. The solution must be able to identify missing patches from the database servers.</p> <p>5.9. The solution must be able to verify that default database accounts do not have a “default” password.</p> <p>5.10. The solution must be able to be used to measure compliance with industry standards and benchmarks such as DISA STIG and CIS.</p> <p>5.11. The solution must be able to be used to measure compliance with internal policies.</p> <p>5.12. The solution must be able to support the configuration of a database assessment scan to run one or more database assessment policies on one or more</p> <p>5.13. databases.</p> <p>5.14. The solution must be able to support a policy-based database assessment scan whereby a scan is associated with one policy only.</p> <p>5.15. The solution must be able to support a tag-based database assessment scan whereby a scan is associated with many database assessment policies, via the use of policy tags.</p>	
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		<p>5.16. The solution must be able to apply a database assessment scan to database servers using BOTH</p> <ol style="list-style-type: none"><li>Direct database connection</li><li>Tag association where a database connection tag is used to associate a scan with the database connections on which the scan is to be ran on.</li></ol> <p>5.17. The solution must have the ability to apply a database assessment policy to:</p> <ol style="list-style-type: none"><li>ALL DB versions and</li><li>specific DB versions.</li></ol> <p>5.18. The solution must come with pre-tests that are to be ran on each database connection on which the policy is about to run and tests for the database version. If the pre-test is successful, the policy runs on that database connection. If not, the policy does not run on that database connection.</p> <p>5.19. The solution must keep an an audit trail for assessment configuration which provides information about changes to the DB assessment configuration. Information that is provided must include the creation and deletion of assessment policies and scans, changing of policy tags, editing of assessments, etc.</p> <p>5.20. The solution user interface must allow the administrator to differentiate between multiple database instances on the same machine and provide the ability to run assessment tests successfully when multiple database instances are installed on the same host.</p> <p><b>6. Vulnerability Assessment, Risk Analysis and Reporting</b></p> <p>6.1. The solution must present a view to compare the overall results between assessment scans that have been run. This is to assist in determining the change of test result status from one scan to the next.</p> <p>6.2. The solution must present database assessment scan results analysis that illustrates errors and issues with the following dashboard views:</p> <ol style="list-style-type: none"><li>Server Success Rate</li><li>Test Success Rate</li><li>Common Test Error Messages</li></ol>	
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		<div>d. Database Server Connectivity Errors</div> <div>e. OS Connectivity Errors</div> <div>f. Common OS Connectivity Errors</div> <div>g. Common Database Connectivity Errors</div> <div>6.3. The solution must use the Common Vulnerability Scoring System (CVSS) to analyze the risk presented by the vulnerabilities discovered in the database network and data.</div> <div>6.4. The solution must be delivered with pre-defined reports such as Weekly Summary Top 10 DB Violations and Sensitive Data Discovery.</div> <div>6.5. The solution must support custom report generation of the discovered DB misconfiguration and vulnerabilities.</div> <div>6.6. The solution must compare the results of a discovery, classification or assessment job with a previous run.</div> <div>6.7. The reports must be distributed via email on demand and automatically (on schedule) wiith PDF and CSV formats.</div> <div>7. Remediation</div> <div>7.1. The solution must be able to prevent attempts to exploit known vulnerabilities.</div> <div>7.2. The solution must offer virtual patching capabilities as far as possible to protect the database from known vulnerabilities without deploying a patch or script on the system.</div> <div>8. Database Activity Monitoring</div> <div>8.1. The solution must be able to provide an option to monitor at least 5,000 database transactions per seconds (TPS) with out-of-the-box configuration using a single appliance.</div> <div>8.2. The solution must be able to provide an option to monitor up to 72,000 TPS with out-of-the-box configuration using a single appliance.</div> <div>8.3. The solution must be able to monitor local database activites using a database monitoring agent that is installed on the database server.</div> <div>8.4. The solution should not require a database server reboot after fresh installation/reinstallation/upgrade/unstallati on/configuration of the DB agent.</div>	
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		<p>8.5. A single set of DB agent installation package must be able to perform all of the below functions without the need to further activate other configurations or functions.</p> <p>8.6. I.e. A single DB agent component must be able to achieve all of the below functions to prevent operations and maintenance overhead:</p> <p>a. monitors database or file traffic and forwards information about that traffic to a collection appliance</p> <p>b. monitors communication between internal components of the database server at the database server application level</p> <p>8.7. It should not be the case where the solution should requires a sub-agent module A to pass database traffic data to another sub-agent module B acting as a proxy before passing data to the main agent module C.</p> <p>8.8. The solution's DB agent must support the monitoring of both local database activities and network-based database activites.</p> <p>8.9. The solution must support a hybrid deployment mode for DB agents. The agent must be able to be configured to operate in either mode below:</p> <p>a. local monitoring mode, or</p> <p>b. "local + network" monitoring mode</p> <p>8.10. During normal operations, the DB agent must not write the captured database audit data to the database server. The captured audit data must be sent to the monitoring gateway in real-time without delay.</p> <p>8.11. The only exception to this requirement is for DB/2 over AS/400 and Teradata 2.6 and 12 due to the underlying DB architecture.</p> <p>8.12. The audited data transferred between the DB agent and the monitoring gateway should be through an encrypted channel.</p> <p>8.13. The solution's DB agent must be able to monitor only defined activities to minimize the overhead on the database host. I.e. granular monitoring of database activities.</p> <p>8.14. Due to the frequent patching updates from OS vendors, the DB auditing solution</p>	
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		<p>must provides a dynamic mechanism for updating the DB agents with protocol and other OS changes. It must enable quick, targeted updates required for agents to support changes in the underlying database OS or protocol. Describe how this is achieved.</p> <p>8.15. The solution must support the ability to configure a cap on the memory and CPU utilization of the DB agent on the database server.</p> <p>8.16. The solution must provide Audit Fidelity that allows exlusion of read/write operations while maintaining monitoring for login/logout operations during system overload.</p> <p>8.17. The solution must support management of DB agents via the management GUI. Dashboards must be provided in the UI to show the status, workload and summary of agents being deployed in the entire environment.</p> <p>8.18. The database monitoring agent must support the following OS/platform:</p> <ul style="list-style-type: none"><li>a. AIX</li><li>b. CentOS</li><li>c. HP-UX</li><li>d. OES (SUSE distribution for Teradata)</li><li>e. OEL</li><li>f. RHEL</li><li>g. Solaris</li><li>h. SUSE</li><li>i. Ubuntu</li><li>j. Windows</li><li>k. z/OS</li><li>l. AS/400</li></ul> <p>8.19. The DB monitoring agent must be able to monitor file access in z/OS mainframe computers.</p> <p>8.20. The DB monitoring agent must support DB traffic activity/data collection in a z/OS server at the network (IP) level.</p> <p>8.21. The DB monitoring agent must support auditing MSSQL 2017 running on Linux Systems</p> <p>8.22. When a client connect from a workstation directly to the database running on an AIX server via telnet/SSH/rlogin, the</p>	
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		<p>DB audit logs typically will show the source IP as the DB server IP address.</p> <p>8.23. In such cases, the DB monitoring agent must be able to capture the real source IP address of the source workstation and report it in the captured audit data.</p> <p>8.24. The same DB monitoring agent must be able to automatically discover new network and local interfaces that are processing SQL traffic on an ongoing basis. Database activities from these newly discovered network interfaces must automatically be added to existing monitoring configuration. The solution must not require the usage of another agent to perform this discovery requirement.</p> <p>8.25. The solution must support the following range of heterogeneous databases:</p> <ul style="list-style-type: none"><li>a. DB2 LUW 9.5, 9.7, 10.0, 10.5, 11.0</li><li>b. DB2 for z/OS 10, 11</li><li>c. DB2 on AS/400 V5R3M0, V5R4M0, V6R1M0, V7R1M0, V7R2M0, V7R3M0</li><li>d. Informix 11.5, 11.7, 12.1</li><li>e. MariaDB 5.5, 10.0, 10.1, 10.2</li><li>f. MSSQL 2008, 2008 R2, 2012, 2014, 2016, 2017</li><li>g. MySQL 5.5, 5.6, 5.7</li><li>h. Netezza 7.0, 7.1, 7.2</li><li>i. Oracle 11.2, 12.1, 12.2</li><li>j. Sybase ASE 15.7, 16.0</li><li>k. Sybase IQ 16.0, 16.1</li><li>l. Sybase Anywhere 16, 17</li><li>m. Progress Openedge 11.4, 11.5, 11.6</li><li>n. Teradata 14.1, 15.0, 15.1, 16.0, 16.1, 16.2</li><li>o. PostgreSQL 9.3 - 9.6, 10x</li><li>p. IMS for z/OS 13, 14</li><li>q. SAP-HANA v1 SPS 8 - 12, v2 SPS 0, SAP HANA 2.0 SPS 02</li><li>r. Amazon RDS Oracle 11.2, 12.1 and PostgreSQL 9.6.2</li><li>s. Greenplum 4.3.x, 5.0</li></ul> <p>8.26. The solution must be able to monitor Big Data platforms which include the following distributions and services:</p> <ul style="list-style-type: none"><li>a. Hadoop - Cloudera (Hive, Hbase, HDFS) 5.1.0, 5.1.2, 5.3.0, 5.3.1, 5.4.0–5.4.10, 5.5.0- 5.5.4, 5.5.6, 5.6.0-5.6.1, 5.7.2-</li></ul>	
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		<p>5.7.6, 5.8.0-5.8.5, 5.9.0-5.9.3, 5.10.0-5.10.2, 5.11.0-5.11.2, 5.12.0-5.12.2, 5.13.0-5.13.2, 5.14.0</p> <p>b. Hadoop - Cloudera (Impala) 5.4.5-5.4.10, 5.5.0- 5.5.4, 5.5.6, 5.6.0-5.6.1, 5.7.2-5.7.6, 5.8.0-5.8.5, 5.9.0-5.9.3, 5.10.0-5.10.2, 5.11.0-5.11.2, 5.12.0-5.12.2, 5.13.0-5.13.2, 5.14.0</p> <p>c. Hadoop - Hortonworks (Hive, Hbase, HDFS) 2.1.1- 2.1.5, 2.2.0-2.2.9, 2.3.2-2.3.6, 2.4.0-2.4.3, 2.5.0-2.5.6, 2.6.0-2.6.4</p> <p>d. IBM BigInsights (Hive, Hbase, HDFS) 4.1.0.0-4.1.0.2, 4.2.0.0, 4.2.5.0</p> <p>e. MongoDB (MongoDB) 2.4, 2.6.5, 2.6.6, 3.0.4–3.0.15, 3.2.5-3.2.19, 3.4.0-3.4.10</p> <p>f. Cassandra DataStax 4.7.0, 4.8.6, 4.8.8-4.8.15, 5.0.1- 5.0.12, 5.1.0-5.1.7</p> <p>8.27. Database audit data must be stored within the solution and it must not be stored in any of the database servers which it is monitoring.</p> <p>8.28. The solution must support both out of band deployment to avoid zero impact; as well as inline deployment with fail open for real-time protection.</p> <p>8.29. The solution should not require and rely on the use of native database audit functionality.</p> <p>8.30. The solution should not rely on transaction log auditing to capture or audit database activity.</p> <p>8.31. The solution must have a means to archive and restore the captured DB audit data.</p> <p>8.32. The solution must support archiving of audit information to Amazon S3 buckets in AWS</p> <p>8.33. The solution should not require any changes to monitored database and/or database application.</p> <p>8.34. The solution auditing process and capability must be independent from the database platform being audited (supports separation of duties).</p> <p>8.35. The solution must be able to monitor and audit all SQL activity and records in the SQL audit log which include:</p>	
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		<div>a. Server Group being accessed (grouping of servers can be defined by solution users)</div> <div>b. Specific server accessed (e.g., the individual IP in a cluster)</div> <div>c. Database instance and schema (for Oracle, the schema being accessed on a server that houses multiple different Oracle databases)</div> <div>d. Database username</div> <div>e. Web application username/session ID</div> <div>f. Source OS username, Source OS host name, IP address and user group</div> <div>g. Date and time of each event</div> <div>h. Raw SQL queries</div> <div>i. Stored procedures</div> <div>j. SQL operations, tables and system objects</div> <div>k. The method of access (Source Application) is audited on a per user basis</div> <div>l. Original SQL query (includes query-specific values) and parsed query (replaces specific values with variables to enable pattern analysis of user profiles)</div> <div>m. Response time &amp; size (number of rows)</div> <div>n. 'Response Audit' to include all the actual data (records) returned by the query and</div> <div>o. Failed queries or access attempts which include the exception code and description.</div> <div>8.36. The solution have the ability and option to natively support identification of the web application username/session ID used behind a SQL activity. This has to be using the same solution and not rely on other 3rd party components.</div> <div>8.37. The solution must capture the user name, date, time and application used to connect to the database and perform an actions, for each event. If a user uses a packaged application like SAP, PeopleSoft or Oracle EBS, it must have a mechanism that allows it to capture the end user name form the application.</div> <div>8.38. For applications that use connection pooling (the end-user is masked from the database), the solution must be able to be</div>	
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		<p>configured to capture the end user name from the application and then correlated with its database activity. The configuration must be done using the same solution without relying on other 3rd party components.</p> <p>8.39. The solution must support tracking of changes of the operating system files on any server protected by the solution, monitoring not only changes to database content and structure, but also to the underlying database server configuration. For example, the change Tracking mechanism should detect changes to the database server environment and underlying OS configuration such as start parameters configuration, database executable, network configuration files and OS parameter variables. It must be able to track changes on files belonging to the following Operating Systems:</p> <ol style="list-style-type: none"><li>Unix OS: AIX, HP-UX and Solaris</li><li>Linux</li><li>Windows</li></ol> <p>8.40. The solution must enable an administrator to periodically generate a report of changes to specific database columns in specific database tables in an Oracle 10g server.</p> <p>8.41. The solution must automatically profile and baseline the database users the behaviors immediately upon database audit data collection.</p> <p>8.42. The solution should not to wait for an extended minimal learning period before administrators can see any result.</p> <p>8.43. The solution must enable an administrator to manually tweak and edit the learnt profile as and when required.</p> <p>8.44. The solution must automatically identify database user activity/behavior deviation from the built baseline user behavior and alert/ block on these deviations.</p> <p>8.45. The solution must provide the ability to utilise the learnt profile into an active protection mode by alerting/blocking on ALL of the below anomalous database activities use cases:</p>	
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		<div> <div> <ul style="list-style-type: none"> <li>a. Access to a black-listed table</li> <li>b. Attempt to Execute Privileged Operation</li> <li>c. Time of Day Violation</li> <li>d. Unauthorized Database User</li> <li>e. Unauthorized Database and Schema</li> <li>f. Unauthorized Host</li> <li>g. Unauthorized OS User</li> <li>h. Unauthorized Query</li> <li>i. Unauthorized Query Group</li> <li>j. Unauthorized Sensitive Query</li> <li>k. Unauthorized Sensitive Query Group</li> <li>l. Unauthorized Sensitive Table</li> <li>m. Unauthorized Source Application</li> <li>n. Unauthorized Source IP Address</li> <li>o. Unauthorized Table/Operation Access</li> <li>p. Untraceable Database User</li> </ul> </div> <div> <p>8.46. The solution must be able to capture DML, DDL and DCL database statements by user/role.</p> <p>8.47. The solution must have automated mechanism for updating security configurations/policies.</p> <p>8.48. The solution must support the auditing of ALL database activities without a huge impact on the database server performance. This mean the solution must provide data enrichment capability to map captured audit trails to business context for reporting. For example, adding of a user's department, user groups, change ticket ID, etc.</p> <p>8.49. The solution must come with the following pre-packaged list of database-related objects and commands to simplify administration and management of the solution:</p> <ul style="list-style-type: none"> <li>a. Commands Groups</li> <li>b. Database Table Groups of general &amp; sensitive objects for different DBs</li> <li>c. Privileged Operations Groups</li> <li>d. SQL User Tracking Groups</li> <li>e. Store Procedure Groups</li> <li>f. Provide screenshots to illustrate the information provided by the above lists.</li> </ul> <p>8.50. The solution must be able to decrypt and monitor traffic encrypted with Diffie-Hellman and Kerberos-gMSA based ciphers on MSSQL 2008, 2008R2, 2012, 2014 and 2016 databases.</p> </div> </div>	
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		<p>8.51. The solution must be able to decrypt Oracle DB traffic that is using Oracle's Advanced Security Option (ASO).</p> <p>8.52. The solution must have the ability to send a set of collected DB audit data <b><u>in real-time upon collection</u></b> to an external logger while retaining another same set of the DB audit data on the collection appliance.</p> <p><b>9. Database Security Policy Capabilities</b></p> <p>9.1. The solution must provide a set of security policies out-of-the-box that covers the following security use cases and violations:</p> <ul style="list-style-type: none"><li>a. SQL Protocol Validation</li><li>b. Oracle SQL Protocol Validation</li><li>c. SQL Correlation Policy</li><li>d. SQL Protocol Signatures</li><li>e. PCI-DSS, HIPAA, FISMA and SOX related DB violations</li><li>f. EBS, PeopleSoft and SAP applications</li></ul> <p>9.2. The solution must enable the administrator to create custom security policies based on the existing out-of-the-box policies criteria.</p> <p>9.3. The solution must support the editing and creation of security policies that is driven by an user-friendly click and drop UI.</p> <p>9.4. A security policy must be able to be applied across the entire environment on all of the different types of databases deployed (MSSQL, Oracle, DB2, MySQL, etc). This is to achieve the use case of "define once and reuse consistently multiple times.</p> <p>9.5. The solution must come with a set of pre-configured signatures out-of-the-box that are:</p> <ul style="list-style-type: none"><li>a. Recommended for Blocking for DB applications</li><li>b. Recommended for Detection for DB applications</li><li>c. The signatures must be automatically and periodically updated.</li></ul> <p>9.6. The solution must support the creation of custom signatures using regular expressions.</p> <p>9.7. The solution must support the following types of custom signatures definition:</p> <ul style="list-style-type: none"><li>a. Single Part Signatures (for e.g. part="hello world")</li></ul>	
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		<div>b. Multi Part Signatures (for e.g. part="bash", part="select", part="%27")</div> <div>c. Absolute Modifiers that limit the part to be matched to a specific area of a stream. (for e.g. part="cmd.exe", amin="10", amax="20". This signature searches for the string cmd.exe only from position 10 to position 20 in the stream)</div> <div>d. Relative Modifiers that limit the part to a specific area after the previous part. (for e.g. part="cmd", part=".exe", rmax="10". This signature includes two parts. The second part is searched for in a range of 10 characters from the first part. The string cmd12345.exe matches this signature. However the string cmd12345678.exe does not match the signature because the ".exe" part ends 12 characters after the "cmd" part.)</div> <div>9.8. The solution must enable the administrator to create custom security policies that can be applied at any of the below individual layers:</div> <div>a. Database Service Layer (for e.g. applied to only Oracle service which includes Oracle DB Server 1, 2 and 3)</div> <div>b. Specific Database Layer (for e.g. applied to only Oracle DB Server 1 but NOT Oracle DB Server 2 and 3)</div> <div>9.9. Every configured security policy must be enforced in every collection appliance to support ease of solution maintenance.</div> <div>9.10. The solution must support integration with malware detection products such as the FireEye Malware Protection System (MPS) which identifies malware-infected hosts on internal IPs. This integration must enable the administrator to define defensive actions against database activities generated by the malware-infected hosts (identified by the MPS). Based on the threat level of the malware-infected hosts, the security policies defined in the solution must be able to trigger a defensive action such as audit, alert, or block.</div> <div>10. Database Audit Policy Capabilities</div> <div>10.1. The solution must provide a set of audit policies out-of-the-box that covers the</div>	
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		<p>following audit-worthy use cases and violations:</p> <p>a. Access to Classified Data, Financial Data, PII and other sensitive tables</p> <p>b. DDL Commands</p> <p>c. DB configuration changes</p> <p>d. DB connections</p> <p>e. Change in sensitive tables</p> <p>f. New DBs</p> <p>g. New DB User Accouts</p> <p>h. Table related commands</p> <p>i. Users and Privileges Management Commands</p> <p>j. PCI-DSS, HIPAA, FISMA and SOX related DB violations</p> <p>k. EBS, PeopleSoft and SAP applications access to sensitive and privileged DB tables</p> <p>10.2. The solution must enable the administrator to create custom audit policies based on the existing out-of-the-box policies criteria.</p> <p>10.3. The solution must support the editing and creation of audit policies that is driven by an user-friendly click and drop UI.</p> <p>10.4. An audit policy must be able to be applied across the entire environment on all of the different types of databases deployed (MSSQL, Oracle, DB2, MySQL, etc). This is to achieve the GRC best practice of "Define policy once and reuse consistently multiple times."</p> <p>10.5. The solution must enable the administrator to create custom audit policies that can be applied at any of the below individual layers:</p> <p>a. Database Service Layer (for e.g. applied to only Oracle service which includes Oracle DB Server 1, 2 and 3)</p> <p>b. Specific Database Layer (for e.g. applied to only Oracle DB Server 1 but NOT Oracle DB Server 2 and 3)</p> <p>10.6. Every configured audit policy must be enforced in every collection appliance to support ease of solution maintenance.</p> <p>10.7. The solution must be able to support the creation of targeted audit policies to audit for specific use-cases.</p>	
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		<p>For example, audit for DBA_A accessing Column A, K and Z in Table X from Database 1, 2 and 3 during weekends between 6pm and 6am.</p> <p><b>11. Database Audit Activity Forensics &amp; Investigation Capabilities</b></p> <p>11.1. The solution must be able to present audit data in any time frame (in days and time) - ranging from last hour to last 90 days and older.</p> <p>11.2. The solution must support pivoting of data points and be able to cascade multiple data points together for ease of investigation. For example, clicking and adding the following items to the filter:</p> <ul style="list-style-type: none"><li>a. User Alice followed by</li><li>b. DB service Oracle followed by</li><li>c. Privileged Operations=Yes followed by</li><li>d. Clicking on a Top Queries view</li><li>e. would show the top privileged queries that Alice executed on the Oracle databases across the entire environment.</li></ul> <p>11.3. The solution must simplify and aid forensics investigation by presenting the audited database activities in the following dashboard views out-of-the-box:</p> <ul style="list-style-type: none"><li>a. Summary of Hits breakdown per day, per week and per hour and Traffic overview.</li><li>b. Full captured data list with filters to select the relevant columns to be presented</li><li>c. Statistics of audit policies by disk utilization, collection rate, data snapshot and data match rate.</li></ul> <p>11.4. The solution must provide a set of Server Analysis dashboards/views out-of-the-box that automatically illustrates all the monitored servers, databases and DB server performance per audit policy.</p> <p>11.5. The solution must provide a set of Source Analysis dashboards/views out-of-the-box that automatically illustrates the following items without any additional configuration:</p> <ul style="list-style-type: none"><li>a. Shared DB Users</li><li>b. DB Users</li><li>c. Source Applications</li><li>d. Source Hosts</li></ul>	
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		<div>e. OS Users</div> <div>f. Source IPs</div> <div>g. User Groups</div> <div>h. Application Users</div> <div>i. Login Analysis</div> <div>j. Performance by Source</div> <div>11.6. The solution must provide a set of Data Access Patterns dashboards/views out-of-the-box that automatically illustrates the following items without any additional configuration:</div> <div>a. Top Queries</div> <div>b. Query Type Analysis</div> <div>c. Sensitive Query Overview</div> <div>d. Query Records</div> <div>e. Data Modification Analysis</div> <div>11.7. The solution must provide a set of Privileged Operations dashboards/views out-of-the-box that automatically illustrates the following items without any additional configuration:</div> <div>a. Privileged Query Overview</div> <div>b. Table drops/truncates</div> <div>c. Stored Procedures Changes</div> <div>d. Changes to DB/Schemas</div> <div>e. DCL Commands</div> <div>f. DDL Commands</div> <div>g. Native Auditing Changes</div> <div>h. Newly Created Users</div> <div>11.8. The solution must provide a set of Time Based Analysis dashboards/views out-of-the-box that automatically illustrates the following time frame of hits breakdown without any additional configuration:</div> <div>a. Daily</div> <div>b. Day of the week</div> <div>c. Hour of the day</div> <div>12. Alerting and Blocking Capabilities</div> <div>12.1. The solution must provide automated, real-time event alert mechanism.</div> <div>12.2. The solution must be able to block attacks on databases in real-time.</div> <div>12.3. The solution must be able to monitor and block privileged users when required.</div> <div>12.4. The solution must be able to provide inspection of all database traffic and perform the necessary database security</div>	
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		<p>enforcement to prevent database related threats/attacks even when the violating database traffic is not being audited.</p> <p>12.5. The solution should not rely on database triggers to block the traffic.</p> <p>12.6. The solution must support the interception and blocking of DB traffic to a z/OS server.</p> <p>12.7. The solution must be able to identify and block non-SQL access such as export table direct.</p> <p>12.8. When the solution collector appliance is deployed in SPAN/TAP port sniffer mode, the collector appliance must be able to block database activity violations by sending a TCP Reset signal to terminate the offending connection without relying on the DB agent.</p> <p>12.9. The solution must support sending alerts to SIEM tools such as RSA Envision, Splunk, and Arcsight.</p> <p>12.10. The solution must be able to support a log message size of 8,192 bytes.</p> <p>12.11. The solution must support the creation of custom log messages and provide system variable placeholders mechanism to make this use case possible. For example, the Username placeholder looks like ({Alert.username})</p> <p>12.12. The solution must support sending of logs in CEF standard.</p> <p>12.13. The solution must support a flexible set of follow-up actions to be taken in the event of an alert generation. <i>For example, if an alert is generated based on a Policy, send an email to Administrator X and Manager Y followed by sending a syslog to Destination 1 and a CEF-formatted log to Destination 2.</i></p> <p>12.14. The solution must be able to generate system events/logs for events that have taken place in the system such as a login, or a direct result of system changes such as signature updates, changes to configuration, activation of settings, building profiles, automatic profile updates, rebuilding database indexes, server start/stop, archiving activities, system related errors or warnings (e.g., predefined</p>	
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		<p>threshold definitions being exceeded), and so on.</p> <p>12.15. The solution must be able to automatically perform the following actions in order to act on an alert:</p> <ol style="list-style-type: none"><li>Send Syslog</li><li>Remedy Create Incident</li><li>SNMP trap</li><li>SMTP email</li><li>Run a OS Shell Command</li><li>Monitor an IP</li><li>Monitor an user</li><li>Block an user</li><li>Block an IP</li><li>Create a review task</li><li>Assign a task</li></ol> <p><b>13. User Right Management</b></p> <p>13.1. The solution must be able to identify excessive database user rights to sensitive data and dormant users and enable a complete rights review cycle.</p> <p>13.2. The solution must be able to identify user account with too many privileges, dormant accounts, and accounts that have direct access to system objects.</p> <p>13.3. The solution must be able to establish a baseline of existing privileges after the first rights review full cycle is completed.</p> <p>13.4. The solution must provide the following features and capabilities:</p> <ol style="list-style-type: none"><li>Identify and report all access paths to any object, including indirect access via Roles.</li><li>Streamline reporting and analysis of user access rights to sensitive data</li><li>Allow for data enrichment from other systems to provide business context around user access rights.</li><li>Transparently identify dormant accounts and un-used access rights which can be disabled or removed</li></ol> <p><b>14. Machine Learning for Automatic Data Access Threat Detection</b></p> <p>14.1. The solution must provide the extended option to perform machine learning when required. The data captured</p>	
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		<p>by the DB activity monitoring solution must be fed to the machine learning platform.</p> <p>14.2. The optional and extended machine learning platform must be able to accept, parse and analyse the data captured by the DB activity monitoring solution without any additional policy configuration.</p> <p>14.3. The optional and extended machine learning platform must provide the below security use cases output without any policy configuration or additional data scientist involvement:</p> <ul style="list-style-type: none"><li>a. Service Account Abuse</li><li>b. Suspicious Application Data Abuse</li><li>c. Machine Takeover</li><li>d. Excessive Database or File Access</li><li>e. Data Access Outside of Working Hours</li><li>f. Excessive Failed Logins by User</li><li>g. Excessive Failed Logins from App Server</li><li>h. Suspicious File Access by User</li></ul> <p><b>15. Reporting</b></p> <p>15.1. The solution must provide pre-packaged out of the box reporting capabilities for:</p> <ul style="list-style-type: none"><li>a. Alert analysis</li><li>b. DBA suspicious behavior</li><li>c. Daily &amp; weekly Top 10 DB violations</li><li>d. EBS, PeopleSoft, SAP DB audit activities and security alerts</li><li>e. Database user rights management</li><li>f. Database audit activity</li></ul> <p>15.2. The solution must come with pre-configured reports (PCI, SOX, HIPAA) for ensuring regulatory compliance.</p> <p>15.3. The solution must provide functionality to assist with security event forensics.</p> <p>15.4. The solution must enable the administrator to create custom report templates based on the existing out-of-the-box reports.</p> <p>15.5. The solution must support the editing and creation of security policies that is driven by an user-friendly click and drop UI.</p> <p>15.6. The solution must support generation of reports with both tabular views and data analysis graphical views.</p>	
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		<p>15.7. The solution must support automatic generation of reports based on a defined schedule.</p> <p>15.8. The solution must support scheduling of report generation to start only at a future date.</p> <p>15.9. The solution must natively support the capability to run reports on audit data that span over a long period of time such as over 6 months or 1 year via a dedicated Big Data reporting engine platform. This Big Data reporting engine platform must be available at no cost and be native to the solution.</p> <p>15.10. The solution must provide a Data Management platform that enables organization to scale and speed reporting on data audited across the entire estate providing unified enterprise-wide reporting</p> <p><b>16. Administration &amp; Management</b></p> <p>16.1. The solution must have a dedicated management appliance to support centralized management and reporting for multiple monitoring appliances.</p> <p>16.2. The solution management appliance must be able to manage up to 15 database activity monitoring collector appliances.</p> <p>16.3. The solution management appliance must be able to handle up to 40,000 uploaded SSL certificates (1024-bits key size).</p> <p>16.4. The solution management must be able to support multi tenancy for device management.</p> <p>16.5. The solution must come with a web based administration interface and management GUI.</p> <p>16.6. The solution must have at least two management ports to support out-of-band management.</p> <p>16.7. When the solution is provided as a virtual appliance, the solution must only come as a single OVF file. I.e a single OVF file for the installation of all components (management server, DB activity monitoring appliance, etc.)</p>	
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		<p>16.8. The solution hardware appliance must come with LCD display which minimally display the following functions:</p> <ul style="list-style-type: none"><li>a. Display information for Hostname, Solution Model &amp; Version</li><li>b. Display solution status (configured, running, stopped, etc.)</li><li>c. Network Information: IP Address, Default Gateway IP,</li><li>d. Ability to ping default gateway; Ping an IP address; Set Management IP Address of the appliance; Set Default Gateway</li><li>e. Reboot and Power Off appliance.</li></ul> <p>16.9. During solution upgrade, the solution should not require any human intervention to reboot. All system reboots during upgrades should be automatic and system must reboot itself as needed.</p> <p>16.10. The solution must come with system health monitoring capabilities to provide real-time awareness of the health of all the elements in the solution deployment. The health monitoring must minimally come with alerts/alarms for the following issues:</p> <ul style="list-style-type: none"><li>a. Redundancy &amp; High Availability</li><li>b. Load and Capacity</li><li>c. Network connectivity</li><li>d. Hardware problems</li><li>e. Configuration mismatches between different components</li></ul> <p><b>17. High Availability and Performance</b></p> <p>17.1. The solution management and monitoring collector design must support high availability.</p> <p>17.2. The solution must have a built-in bypass module (fail-open) when the hardware appliance is deployed in inline mode. The solution hardware appliance must have a minimum of 2 internal bypass bridge segments.</p> <p>17.3. The solution appliance must have the option to support dual hot-swap hard drives and dual hot-swap power supplies for high availability.</p> <p>17.4. The solution appliance must have the option to support at least two interface module slot for flexibility of interface expansion.</p>	
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		<p>17.5. The solution must be able to support multi-node operations and deployment.</p> <p>17.6. The DB activity monitoring agent must be able to register to two gateways for high availability.</p> <p>17.7. Each single unit of the DB activity monitoring collector/appliance must minimally be able to support the capturing and processing the below listed database transactions per second (TPS). I.e. the solution must be able to offer the capability to capture and process the below traffic requirement with a single unit of collector/monitoring appliance:</p> <ul style="list-style-type: none"><li>a. 5,000 TPS</li><li>b. 9,000 TPS</li><li>c. 18,000 TPS</li><li>d. 36,000 TPS</li><li>e. 72,000 TPS</li></ul> <p>17.8. The solution must support the add-on of an Intelligent Platform Management Interface (IPMI) hardware module.</p> <p>17.9. The solution must be able to support line-speed throughput and sub-millisecond latency when deployed in layer-2 transparent bridge mode. This is to ensure that the solution does not impact the database servers' performance.</p> <p>17.10. The solution management server appliance must be available in both of the following hardware configuration offerings:</p> <ul style="list-style-type: none"><li>a. 2 x 2TB hard disks in RAID 1 setup with minimally 32 GB of RAM</li><li>b. 1 x 500 GB with minimally 8 GB of RAM</li></ul> <p><b>18. Licensing</b></p> <p>18.1. The solution must be able to provide each of the following capabilities with individual licenses for each of them:</p> <ul style="list-style-type: none"><li>a. Database Assessment</li><li>b. Database Audit &amp; Monitoring</li><li>c. Database Firewall</li></ul> <p>18.2. The solution must be able to be extended to perform File Server (NFS and CIFS) monitoring and SharePoint monitoring using the same solution, UI and appliance that is controlled via turning on a software license.</p>	
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		18.3. The solution must be able to be extended to function as a web application firewall using the same solution, same UI and same appliance that is enabled via a software license.	
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1. Compliance with the statements must be supported by evidence in a Bidders Bid and cross-referenced to that evidence. Evidence shall be in the form of manufacturer’s un-amended sales literature, unconditional statements of specification and compliance issued by the manufacturer, samples, independent test data etc., as appropriate.
2. A statement that is not supported by evidence or is subsequently found to be contradicted by the evidence presented will render the Bid under evaluation liable for rejection.
3. A statement either in the Bidders statement of compliance or the supporting evidence that is found to be false either during Bid evaluation, post-qualification or the execution of the Contract may e regarded as fraudulent and render the Bidder or supplier liable for prosecution subject to the provisions of **ITB** Clause 3.1 (a) (ii) and/or **GCC** Clause 2.1 (a) (ii).

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SUPPLY, DELIVERY, INSTALLATION AND TESTING OF  
DATABASE FIREWALL FOR THE DATABASE CLEANSING AND  
MANAGEMENT PROJECT

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OF AUTHORIZED REPRESENTATIVE,  
DESIGNATION AND PRINTED NAME OF COMPANY