You are here. Your data is there. Threats are everywhere.

2021 GLOBAL ENCRYPTION TRENDS STUDY

Find out how organizations are protecting data across multiple clouds, and how your encryption strategy compares.
### PART 1. EXECUTIVE SUMMARY

### PART 2. KEY FINDINGS

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2021 Global Encryption Trends Study Independently conducted by Ponemon Institute LLC and sponsored by Entrust
01 Executive Summary
PONEMON INSTITUTE PRESENTS THE FINDINGS OF THE 2021 GLOBAL ENCRYPTION TRENDS STUDY

We surveyed 6,610 individuals across multiple industry sectors in 17 countries/regions – Australia, Brazil, France, Germany, Hong Kong, Japan, Mexico, Middle East (which is a combination of respondents located in Saudi Arabia and the United Arab Emirates), Netherlands, the Russian Federation, Spain, Southeast Asia, South Korea, Sweden, Taiwan, the United Kingdom, and the United States.2

The purpose of this research is to examine how the use of encryption has evolved over the past 16 years and the impact of this technology on the security posture of organizations. The first encryption trends study was conducted in 2005 for a U.S. sample of respondents.3

Since then, we have expanded the scope of the research to include respondents in all regions of the world.

As shown in Figure 1, since 2015 the deployment of an overall encryption strategy has steadily increased. This year, 50 percent of respondents say their organizations have an overall encryption plan that is applied consistently across the entire enterprise, and 37 percent say they have a limited encryption plan or strategy that is applied to certain applications and data types, a slight decrease from last year.

Following are the findings from this year’s research.

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1 This year’s data collection was started in December 2020 and completed in January 2021. Throughout the report we present trend data based on the fiscal year the survey commenced rather than the year the report is finalized. Hence, we present the current findings as fiscal year 2020.

2 Country-level results are abbreviated as follows: Australia (AU), Brazil (BZ), France (FR), Germany (DE), Hong Kong (HK), Japan (JP), Korea (KO), Mexico (MX), Middle East (AB), Netherlands (NL), Russia (RF), Spain (SP), Southeast Asia (SA), Sweden (SW), Taiwan (TW), United Kingdom (UK), and United States (US).

3 The trend analysis shown in this study was performed on combined country samples spanning 16 years (since 2005).
STRATEGY AND ADOPTION OF ENCRYPTION

Enterprise-wide encryption strategies increase. Since conducting this study 16 years ago, there has been a steady increase in organizations with an encryption strategy applied consistently across the entire enterprise. In turn, there has been a steady decline in organizations not having an encryption plan or strategy. The results have essentially reversed over the years of the study.

Certain countries have more mature encryption strategies. The prevalence of an enterprise encryption strategy varies among the countries represented in this research. The highest prevalence of an enterprise encryption strategy is reported in Germany, the United States, Japan, and the Netherlands. Respondents in the Russian Federation and Brazil report the lowest adoption of an enterprise encryption strategy. The global average of adoption is 50 percent.

The IT operations function is the most influential in framing the organization’s encryption strategy over the past 14 years. However, in the United States the lines of business are more influential (35 percent of respondents). IT operations are most influential in Sweden, Korea and France.

TRENDS IN ADOPTION OF ENCRYPTION

The use of encryption increases in all industries. Results suggest a steady increase in all industry sectors, with the exception of communications and service organizations.

50% of respondents say their organizations have an overall encryption plan that is applied consistently across the entire enterprise.

The most significant increases in extensive encryption usage occur in manufacturing, hospitality, and consumer products.

The extensive use of encryption technologies increases. Since we began tracking the enterprise-wide use of encryption in 2005, there has been a steady increase in the encryption solutions extensively used by organizations.

THREATS, MAIN DRIVERS AND PRIORITIES

Employee mistakes continue to be the most significant threats to sensitive data. The most significant threats to the exposure of sensitive or confidential data are employee mistakes.

In contrast, the least significant threats to the exposure of sensitive or confidential data include government eavesdropping and lawful data requests. Concerns over inadvertent exposure (employee mistakes and system malfunction) significantly outweigh concerns over actual attacks by temporary or contract workers and malicious insiders.
The main driver for encryption is the protection of customers' personal information. Organizations are using encryption for the purpose of protecting customers' personal information (54 percent of respondents), to protect information against specific, identified threats (50 percent of respondents), and for the protection of enterprise intellectual property (49 percent of respondents).

A barrier to a successful encryption strategy is the ability to discover where sensitive data resides in the organization. Sixty-five percent of respondents say discovering where sensitive data resides in the organization is the number one challenge. Forty-three percent of all respondents cite initially deploying encryption technology as a significant challenge. Thirty-four percent cite classifying which data to encrypt as difficult.

**DEPLOYMENT CHOICES**

No single encryption technology dominates in organizations. Organizations have very diverse needs. Internet communications, databases, and internal networks are the most likely to be deployed and correspond to mature use cases. For the fourth year, the study tracked the deployment of encryption of IoT devices and platforms. Sixty-one percent of respondents say encryption of IoT devices and 61 percent of respondents say encryption of IoT platforms have been at least partially deployed.

**65%** of respondents say discovering where sensitive data resides in the organization is the number one challenge.

**ENCRIPTION FEATURES CONSIDERED MOST IMPORTANT**

Certain encryption features are considered more critical than others. According to the consolidated findings, system performance and latency, management of keys, and enforcement of policy are the three most important encryption features.

**Which data types are most often encrypted?**

Payment-related data and financial records are most likely to be encrypted as a result of high-profile data breaches in financial services. The least likely data type to be encrypted is health-related information and non-financial information, which is a surprising result given the sensitivity of health information.

**ATTITUDES ABOUT KEY MANAGEMENT**

How painful is key management?

Fifty-six percent of respondents rate key management as very painful, which suggests respondents view managing keys as a very challenging activity.
The highest percentage pain threshold of 69 percent occurs in Spain. At 37 percent, the lowest pain level occurs in France. No clear ownership and lack of skilled personnel are the primary reasons why key management is painful.

**IMPORTANCE OF HARDWARE SECURITY MODULES (HSMs)**

Organizations in the U.S., Germany, and Japan are more likely to deploy HSMs. The United States, Germany, and Japan are more likely to deploy HSMs than other countries. The overall average deployment rate for HSMs is 49 percent.

How HSMs in conjunction with public cloud-based applications are primarily deployed today and will be in the next 12 months. Forty-one percent of respondents say their organizations own and operate HSMs on-premise, accessed real-time by cloud-hosted applications; and 39 percent of respondents rent/use HSMs from a public cloud provider for the same purpose. The use of HSMs with Cloud Access Security Brokers and the ownership and operation of HSMs on-premise are expected to increase significantly.

The overall average importance rating for HSMs, as part of an encryption and key management strategy in the current year, is 66 percent. The pattern of responses suggests the United States, the Middle East, and the Netherlands are most likely to assign importance to HSMs as part of their organization’s encryption or key management activities.

60% of respondents say their organizations transfer sensitive or confidential data to the cloud whether or not it is encrypted.

What best describes an organization’s use of HSMs? Sixty-one percent of respondents say their organization has a centralized team that provides cryptography as a service (including HSMs) to multiple applications/teams within their organization (i.e., private cloud model). Thirty-nine percent say each individual application owner/team is responsible for their own cryptographic services (including HSMs), indicative of the more traditional siloed application-specific data center deployment approach.

What are the primary purposes or uses for HSMs? The three top uses are application-level encryption, TLS/SSL, followed notably by container encryption/signing services. There will be a significant increase in the use of database encryption 12 months from now.
CLOUD ENCRYPTION

Sixty percent of respondents say their organizations transfer sensitive or confidential data to the cloud whether or not it is encrypted or made unreadable via some other mechanism such as tokenization or data masking. Another 24 percent of respondents expect to do so in the next one to two years. These findings indicate the benefits of cloud computing outweigh the risks associated with transferring sensitive or confidential data to the cloud.

How do organizations protect data at rest in the cloud? Thirty-eight percent of respondents say encryption is performed on-premise prior to sending data to the cloud using keys their organization generates and manages. However, 36 percent of respondents perform encryption in the cloud, with cloud provider generated/managed keys. Twenty-one percent of respondents are using some form of Bring Your Own Key (BYOK) approach.

What are the top three encryption features specifically for the cloud? The top three features are support for the KMIP standard for key management (59 percent of respondents), SIEM integration, visualization and analysis of logs (59 percent of respondents), and granular access controls (55 percent of respondents).

Since first conducting this study 16 years ago, there has been a steady increase in organizations with an encryption strategy applied consistently across the entire enterprise.
IN THIS SECTION, WE PROVIDE A DEEPER ANALYSIS OF THE KEY FINDINGS.

We have organized the report according to the following themes:

- Strategy and adoption of encryption
- Trends in adoption of encryption
- Threats, main drivers and priorities
- Deployment choices
- Encryption features considered most important
- Attitudes about key management
- Importance of hardware security modules (HSMs)\(^4\)
- Cloud encryption

### STRATEGY AND ADOPTION OF ENCRYPTION

Enterprise-wide encryption strategies increase. Since first conducting this study 16 years ago, there has been a steady increase in organizations with an encryption strategy applied consistently across the entire enterprise. In turn, there has been a steady decline in organizations not having an encryption plan or strategy. The results have essentially reversed over the years of the study. Figure 2 shows these changes over time.

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\(^4\) HSMs are devices specifically built to create a tamper-resistant environment in which to perform cryptographic processes (e.g., encryption or digital signing) and to manage the keys associated with those processes. These devices are used to protect critical data processing activities and can be used to strongly enforce security policies and access controls. HSMs are typically validated to formal security standards such as FIPS 140-2.
Certain countries have more mature encryption strategies. According to Figure 3, the prevalence of an enterprise encryption strategy varies among the countries represented in this research. The highest prevalence of an enterprise encryption strategy is reported in Germany, the United States, Japan and the Netherlands. Respondents in the Russian Federation and Brazil report the lowest adoption of an enterprise encryption strategy. The global average of adoption is 50 percent.

Figure 3. Differences in enterprise encryption strategies by country

Figure 4 shows that the IT operations function is the most influential in framing the organization’s encryption strategy since the research commenced. However, in the United States the lines of business are more influential than IT operations. IT operations and IT security have a similar level of influence in the United Kingdom.

Figure 4. Influence of IT operations, lines of business and security
Country samples are consolidated
A possible reason why the lines of business are more influential than IT security in many countries is because of the growing adoption of Internet of Things (IoT) devices in the workplace, proliferation of employee-owned devices or BYOD and the general consumerization of IT. A consequence is that lines of business are required to be more accountable for the security of these technologies.

**TRENDS IN ADOPTION OF ENCRYPTION**

The use of encryption increases in most industries. Figure 5 shows the current year and the nine-year average in the use of encryption solutions for 13 industry sectors.

Results suggest a steady increase in all industry sectors, with the exception of communication and service organizations. The most significant increases in extensive encryption usage occur in manufacturing, hospitality and consumer products.
**THREATS, MAIN DRIVERS AND PRIORITIES**

Employee mistakes continue to be the most significant threats to sensitive data. Figure 6 shows that the most significant threats to the exposure of sensitive or confidential data are employee mistakes.

In contrast, the least significant threats to the exposure of sensitive or confidential data include government eavesdropping and lawful data requests. Concerns over inadvertent exposure (employee mistakes and system malfunction) significantly outweigh concerns over actual attacks by temporary or contract workers and malicious insiders.

**The main driver for encryption is protection of customers’ personal information.** Eight drivers for deploying encryption are presented in Figure 7 on the following page.

Organizations are using encryption to protect customer personal information followed by the protection of information against specific, identified threats and to protect enterprise intellectual property (54 percent, 50 percent and 49 percent of respondents, respectively).

This marks the fourth year that compliance with regulations has not been the top driver for encryption indicating that encryption is less of a “checkbox” exercise and is now used to safeguard targeted critical information.

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**Figure 6. The most salient threats to sensitive or confidential data**

Consolidated country samples. Two choices permitted

<table>
<thead>
<tr>
<th>Threat</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee mistakes</td>
<td>53%</td>
</tr>
<tr>
<td>System or process malfunction</td>
<td>31%</td>
</tr>
<tr>
<td>Hackers</td>
<td>29%</td>
</tr>
<tr>
<td>Temporary or contract workers</td>
<td>25%</td>
</tr>
<tr>
<td>Malicious insiders</td>
<td>21%</td>
</tr>
<tr>
<td>Third-party service providers</td>
<td>17%</td>
</tr>
<tr>
<td>Lawful data request (e.g., by police)</td>
<td>12%</td>
</tr>
<tr>
<td>Government eavesdropping</td>
<td>11%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
</tbody>
</table>
A barrier to a successful encryption strategy is the ability to discover where sensitive data resides in the organization. Figure 8 provides a list of six aspects that present challenges to an organization’s effective execution of its data encryption strategy in descending order of importance. Sixty-five percent of respondents say discovering where sensitive data resides in the organization is the number one challenge. In addition, 43 percent of all respondents cite initially deploying encryption technology as a significant challenge. Thirty-four percent cite classifying which data to encrypt as difficult.
DEPLOYMENT CHOICES

No single encryption technology dominates in organizations. We asked respondents to indicate if specific encryption technologies are widely or only partially deployed within their organizations. “Extensive deployment” means that the encryption technology is deployed enterprise-wide. “Partial deployment” means the encryption technology is confined or limited to a specific purpose (i.e., point solution).

As shown in Figure 9, no single technology dominates because organizations have very diverse needs. Internet communications, databases and internal networks are the most likely to be deployed and correspond to mature use cases.

For the fourth year, the study tracked the deployment of encryption of IoT devices and platforms. As shown, 61 percent of respondents say encryption of IoT platforms has been partially deployed and 61 percent of respondents say encryption of IoT devices has been partially deployed.

Figure 9. Consolidated view on the use of 15 encryption technologies
Country samples are consolidated

- 61% of respondents say encryption has been partially deployed for both IoT platforms and devices.
ENCRYPTION FEATURES CONSIDERED MOST IMPORTANT

Certain encryption features are considered more critical than others. Figure 10 lists 12 encryption technology features. Each percentage defines the very important response (on a four-point scale). Respondents were asked to rate encryption technology features considered most important to their organization’s security posture.

According to the consolidated findings, system performance and latency, management of keys and enforcement of policy are the three most important features. The performance finding is not surprising given that encryption in networking is a prominent use case, as well as the often-emphasized requirement for transparency of encryption solutions.

Figure 10. Most important features of encryption technology solutions
Country samples are consolidated. Very important and Important responses combined

- System performance and latency
- Management of keys
- Enforcement of policy
- Support for cloud and on-premise deployment
- Integration with other security tools (e.g., SIEM and ID management)
- System scalability
- Support for emerging algorithms (e.g., ECC)
- Separation of duties and role-based controls
- Formal product security certifications (e.g., FIPS 140)
- Tamper resistance by dedicated hardware (e.g., HSM)
- Support for multiple applications or environments
- Support for regional segregation (e.g., data residency)
Which data types are most often encrypted?

Figure 11 provides a list of seven data types that are routinely encrypted by respondents’ organizations. As can be seen, payment-related data and financial records continue to be the most likely to be encrypted as a result of high-profile data breaches in financial services.

The least likely data type to be encrypted is health-related information and non-financial business information, which is a surprising result given the sensitivity of health information and the recent high-profile healthcare data breaches.

Figure 11. Data types routinely encrypted
Country samples are consolidated. More than one choice permitted

- Payment-related data
- Financial records
- Intellectual property
- Employee/HR data
- Customer information
- Healthcare information
- Non-financial business information
Most companies plan to use blockchain. Fifty-nine percent of respondents say their organizations will use blockchain. As shown in Figure 12, the two primary use cases are for cryptocurrency/wallets and asset transactions/management.

Respondents were asked when they think the solutions in Figure 13 will achieve mainstream enterprise adoption. The solution expected to achieve adoption the soonest is multi-party computation. Quantum algorithms will achieve adoption in eight years.

Figure 12. **What applications does your organization plan to use blockchain for?**
More than one response permitted

- Cryptocurrency/wallets: 62% FY19, 59% FY20
- Asset transactions/management: 57% FY19, 52% FY20
- Identity: 47% FY19, 45% FY20
- Supply chain: 40% FY19, 37% FY20
- Smart contracts: 36% FY19, 35% FY20
- Other: 1% FY19, 1% FY20

Figure 13. **When do you think the following solutions will achieve mainstream enterprise adoption?**
Extrapolated values in years

- Quantum algorithms: 8.36 FY19, 7.90 FY20
- Homomorphic encryption: 6.72 FY19, 6.49 FY20
- Multi-party computation: 5.72 FY19, 5.77 FY20
ATTITUDES ABOUT KEY MANAGEMENT

How painful is key management? Using a 10-point scale, respondents were asked to rate the overall “pain” associated with managing keys within their organization, where 1 = minimal impact to 10 = severe impact. Figure 14 clearly shows that 56 percent of respondents chose ratings at or above 7; thus, suggesting a fairly high pain threshold.

Figure 15 shows the 7+ ratings on a 10-point scale for each country. As can be seen, the average percentage in all country samples is 56 percent, which suggests respondents view managing keys as a very challenging activity.

Figure 14. Rating on the overall impact, risk and cost associated with managing keys
Country samples are consolidated. On a scale from 1 = minimal impact to 10 = severe impact, 7+ responses presented

Figure 15. Percentage “pain threshold” by country
Percentage 7 to 10 rating on a 10-point scale
The highest percentage pain threshold of 69 percent occurs in Spain. At 37 percent, the lowest pain level occurs in France.

**Why is key management painful?** Figure 16 shows the reasons why the management of keys is so difficult. The top three reasons are: (1) no clear ownership of the key management function, (2) lack of skilled personnel and (3) isolated or fragmented key management systems.

**Which keys are most difficult to manage?** In the top position on this list for the fourth year as the most difficult keys to manage, are keys for external cloud or hosted services.

As shown in Figure 17 on the following page, this is followed by SSH keys, signing keys, and end user encryption keys. The least difficult include: (1) encryption keys for archived data, (2) encryption keys for backups and storage and (3) embedded device keys.

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**Figure 16. What makes the management of keys so painful?**
Country samples are consolidated. Three responses permitted

- No clear ownership: 64%
- Lack of skilled personnel: 57%
- Systems are isolated and fragmented: 48%
- Key management tools are inadequate: 46%
- Insufficient resources (time/money): 34%
- No clear understanding of requirements: 27%
- Technology and standards are immature: 14%
- Manual processes are prone to errors and unreliable: 9%
- Other: 1%

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**The top three reasons why key management is painful:**

#1 No clear ownership of the key management function
#2 Lack of skilled personnel
#3 Isolated or fragmented key management systems
IMPORTANCE OF HARDWARE SECURITY MODULES (HSMs)\(^5\)

The United States, Germany and Japan organizations are more likely to deploy HSMs. Figure 18 summarizes the percentage of respondents that deploy HSMs. The United States, Germany and Japan are more likely to deploy HSMs than other countries. The overall average deployment rate for HSMs is 49 percent.

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\(^5\) HSMs are devices specifically built to create a tamper-resistant environment in which to perform cryptographic processes (e.g., encryption or digital signing) and to manage the keys associated with those processes. These devices are used to protect critical data processing activities associated with server based applications and can be used to strongly enforce security policies and access controls. HSMs are typically validated to formal security standards such as FIPS 140-2.
Deployment of HSMs increases steadily. Figure 19 shows a nine-year trend for HSMs. As can be seen, the rate of global HSM deployment has steadily increased.

How HSMs in conjunction with public cloud-based applications are primarily deployed today and in the next 12 months. As shown in Figure 20, 41 percent of respondents own and operate HSMs on-premise for cloud-based applications, and 39 percent of respondents rent/use HSMs from a public cloud provider for the same purpose. In the next 12 months, respondents predict a significant increase in the ownership and operation of HSMs on-premise and the integration with a Cloud Access Security Broker to manage keys and cryptographic operations.

**Figure 19. HSM deployment rate over eight years**
Country samples are consolidated

<table>
<thead>
<tr>
<th>Year</th>
<th>Own and operate on-premise</th>
<th>Rent/use from public cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY12</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>FY13</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>FY14</td>
<td>33%</td>
<td></td>
</tr>
<tr>
<td>FY15</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>FY16</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>FY17</td>
<td>41%</td>
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<tr>
<td>FY18</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>FY19</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td>FY20</td>
<td>49%</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 20. Use of HSMs in conjunction with public cloud-based applications today and in the next 12 months**
More than one choice permitted

- Own and operate HSMs on-premise at your organization, accessed real-time by cloud-hosted applications: 41% today, 56% next 12 months
- Rent/use HSMs from public cloud provider, hosted in the cloud: 39% today, 39% next 12 months
- Own and operate HSMs for the purpose of generating and managing BYOK (Bring Your Own Key) keys to send to the cloud for use by the cloud provider: 17% today, 24% next 12 months
- Own and operate HSMs that integrate with a Cloud Access Security Broker to manage keys and cryptographic operations (e.g., encrypting data on the way to the cloud, managing keys for cloud applications): 14% today, 24% next 12 months
- Not using HSMs with public cloud applications: 3% today, 1% next 12 months

What models do you use today?
What models do you plan to use in the next 12 months?
Figure 21 summarizes the percentage of respondents in 17 countries that rate HSMs as either very important or important to their organization’s encryption or key management program or activities. The overall average importance rating in the current year is 66 percent. The pattern of responses suggests the United States, Middle East and the Netherlands are most likely to assign importance to HSMs as part of their organization’s encryption or key management activities.

Figure 22 shows a nine-year trend in the importance of HSMs for encryption or key management, which has steadily increased over time.
What best describes an organization’s use of HSMs? As shown in Figure 23, 61 percent of respondents say their organization has a centralized team that provides cryptography as a service (including HSMs) to multiple applications/teams within their organization (i.e., private cloud model). Thirty-nine percent say each individual application owner/team is responsible for their own cryptographic services (including HSMs), indicative of the more traditional siloed application-specific data center deployment approach.

Figure 23. Which statement best describes how your organization uses HSMs?

- We have a centralized team that provides cryptography as a service (including HSMs) to multiple applications/teams within our organization (i.e., private cloud model) - 61%
- Each individual application owner/team is responsible for their own cryptographic services (including HSMs) (i.e., traditional siloed, application-specific data center deployment) - 39%
What are the primary purposes or uses for HSMs? Figure 24 summarizes the primary purpose or use cases for deploying HSMs. As can be seen, the top three choices are application-level encryption, TLS/SSL, followed by container encryption/signing services. This chart shows a significant increase in the use of database encryption 12 months from now.

It is significant to note that HSM use for application-level encryption will soon be deployed in 49 percent of the organizations represented in this study.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>HSMs used today</th>
<th>HSMs to be deployed in the next 12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application level encryption</td>
<td>47%</td>
<td>49%</td>
</tr>
<tr>
<td>TLS/SSL including firewalls, and application delivery controllers</td>
<td>44%</td>
<td>49%</td>
</tr>
<tr>
<td>Container encryption/signing services</td>
<td>40%</td>
<td>39%</td>
</tr>
<tr>
<td>Public cloud encryption including for Bring Your Own Key</td>
<td>34%</td>
<td>32%</td>
</tr>
<tr>
<td>Database encryption</td>
<td>32%</td>
<td>44%</td>
</tr>
<tr>
<td>PKI or credential management</td>
<td>31%</td>
<td>30%</td>
</tr>
<tr>
<td>With Cloud Access Security Brokers for encryption key management</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>With Secrets Management solutions to protect secrets storage</td>
<td>28%</td>
<td>33%</td>
</tr>
<tr>
<td>With Privileged Access Management solutions to protect administrative access</td>
<td>27%</td>
<td>28%</td>
</tr>
<tr>
<td>Payment transaction processing or payment credential issuing/provisioning</td>
<td>26%</td>
<td>30%</td>
</tr>
<tr>
<td>Private cloud encryption</td>
<td>25%</td>
<td>23%</td>
</tr>
<tr>
<td>Big data encryption</td>
<td>24%</td>
<td>26%</td>
</tr>
<tr>
<td>Key management root of trust</td>
<td>23%</td>
<td>21%</td>
</tr>
<tr>
<td>Internet of Things root of trust</td>
<td>21%</td>
<td>18%</td>
</tr>
<tr>
<td>Document signing (e.g., electronic invoicing)</td>
<td>21%</td>
<td>20%</td>
</tr>
<tr>
<td>Code signing</td>
<td>19%</td>
<td>21%</td>
</tr>
<tr>
<td>Blockchain applications (e.g., cryptocurrency, financial transfer)</td>
<td>18%</td>
<td>21%</td>
</tr>
<tr>
<td>Not planning to use</td>
<td>7%</td>
<td>14%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
<td>1%</td>
</tr>
</tbody>
</table>
CLOUD ENCRYPTION

According to Figure 25, 60 percent of respondents say their organizations transfer sensitive or confidential data to the cloud whether or not it is encrypted or made unreadable via some other mechanism such as tokenization or data masking. Another 24 percent of respondents expect to do so in the next one to two years. These findings indicate that the benefits of cloud computing outweigh the risks associated with transferring sensitive or confidential data to the cloud.

According to Figure 26, with respect to the transfer of sensitive or confidential data to the cloud, the United States, Germany, Japan, the United Kingdom, and the Netherlands are more frequently transferring sensitive data to the cloud.
How do organizations protect data at rest in the cloud? As shown in Figure 27, 38 percent of respondents say encryption is performed on-premise prior to sending data to the cloud using keys their organization generates and manages. However, 36 percent of respondents perform encryption in the cloud, with cloud provider generated/managed keys. Twenty-one percent of respondents are using some form of Bring Your Own Key (BYOK) approach.

What are the top three encryption features specifically for the cloud? The top three features are support for the KMIP standard for key management (59 percent of respondents), SIEM integration, visualization and analysis of logs (59 percent of respondents) and granular access controls (55 percent of respondents), as shown in Figure 28.

**Figure 27. How does your organization protect data at rest in the cloud?**

Country samples are consolidated. More than one choice permitted.

- Encryption performed on-premise prior to sending data to the cloud using keys my organization generates and manages: 38%
- Encryption performed in the cloud using keys generated/managed by the cloud provider: 36%
- Encryption performed in the cloud using keys my organization generates and manages on-premise: 21%
- None of the above: 5%

**Figure 28. How important are the following features associated with cloud encryption to your organization?**

Very important and important responses combined.

- Support for the KMIP standard for key management: 59%
- SIEM integration, visualization, and analysis of logs: 59%
- Granular access controls: 55%
- Bring Your Own Key (BYOK) management support: 53%
- Privileged user access control: 49%
- Audit logs identifying key usage: 49%
- Ability to encrypt and rekey data while in use without downtime: 46%
- Unified key management solutions across multiple clouds and enterprise: 45%
- Audit logs identifying data access attempts: 39%
- Support for FIPS 140-2 compliant key management: 37%
APPENDIX
Methods & Limitations
Table 1 reports the sample response for 17 separate country samples. Data collection was started in December 2020 and completed in January 2021. Our consolidated sampling frame of practitioners in all countries consisted of 161,607 individuals who have bona fide credentials in IT or security fields. From this sampling frame, we captured 7,331 returns of which 721 were rejected for reliability issues. Our final consolidated 2020 sample was 6,610, thus resulting in an overall 4.1% response rate.

The first encryption trends study was conducted in the United States in 2005. Since then we have expanded the scope of the research to include 17 separate country samples. Trend analysis was performed on combined country samples. This year we added Spain.

<table>
<thead>
<tr>
<th>Legend</th>
<th>Survey response</th>
<th>Sampling frame</th>
<th>Final sample</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>Middle East</td>
<td>9,875</td>
<td>373</td>
<td>3.8%</td>
</tr>
<tr>
<td>AU</td>
<td>Australia</td>
<td>6,595</td>
<td>317</td>
<td>4.8%</td>
</tr>
<tr>
<td>BZ</td>
<td>Brazil</td>
<td>13,046</td>
<td>553</td>
<td>4.2%</td>
</tr>
<tr>
<td>FR</td>
<td>France</td>
<td>10,981</td>
<td>451</td>
<td>4.1%</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>11,400</td>
<td>467</td>
<td>4.1%</td>
</tr>
<tr>
<td>HK</td>
<td>Hong Kong</td>
<td>5,660</td>
<td>267</td>
<td>4.7%</td>
</tr>
<tr>
<td>JP</td>
<td>Japan</td>
<td>11,130</td>
<td>487</td>
<td>4.4%</td>
</tr>
<tr>
<td>KO</td>
<td>Korea</td>
<td>9,337</td>
<td>406</td>
<td>4.3%</td>
</tr>
<tr>
<td>MX</td>
<td>Mexico</td>
<td>10,551</td>
<td>369</td>
<td>3.5%</td>
</tr>
<tr>
<td>NL</td>
<td>Netherlands</td>
<td>7,992</td>
<td>322</td>
<td>4.0%</td>
</tr>
<tr>
<td>RF</td>
<td>Russian Federation</td>
<td>6,195</td>
<td>211</td>
<td>3.4%</td>
</tr>
<tr>
<td>SA</td>
<td>Southeast Asia</td>
<td>7,500</td>
<td>276</td>
<td>3.7%</td>
</tr>
<tr>
<td>SP</td>
<td>Spain</td>
<td>9,224</td>
<td>459</td>
<td>5.0%</td>
</tr>
<tr>
<td>SW</td>
<td>Sweden</td>
<td>6,901</td>
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<tr>
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<td>Taiwan</td>
<td>6,895</td>
<td>292</td>
<td>4.2%</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
<td>10,330</td>
<td>408</td>
<td>3.9%</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
<td>17,995</td>
<td>677</td>
<td>3.8%</td>
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<tr>
<td></td>
<td>Consolidated</td>
<td>161,607</td>
<td>6,610</td>
<td>4.1%</td>
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Table 2 summarizes our survey samples for 17 countries over a 14-year period.

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<th>FY18</th>
<th>FY17</th>
<th>FY16</th>
<th>FY15</th>
<th>FY14</th>
<th>FY13</th>
<th>FY12</th>
<th>FY11</th>
<th>FY10</th>
<th>FY09</th>
<th>FY08</th>
<th>FY07</th>
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</thead>
<tbody>
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<td>316</td>
<td>368</td>
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<td></td>
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<td>315</td>
<td>331</td>
<td>334</td>
<td>359</td>
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<td>938</td>
<td>471</td>
<td>477</td>
<td>482</td>
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<tr>
<td>BZ</td>
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<td>460</td>
<td>472</td>
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<td>511</td>
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<td>TW</td>
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<td>683</td>
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<td>789</td>
<td>892</td>
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<td>912</td>
<td>964</td>
<td>997</td>
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<tr>
<td>Total</td>
<td>6,610</td>
<td>6,457</td>
<td>5,856</td>
<td>5,252</td>
<td>4,802</td>
<td>5,009</td>
<td>4,714</td>
<td>4,275</td>
<td>4,205</td>
<td>4,140</td>
<td>2,947</td>
<td>2,998</td>
<td>2,471</td>
<td>1,758</td>
</tr>
</tbody>
</table>
Figure 29 reports the respondent’s organizational level within participating organizations. By design, 55 percent of respondents are at or above the supervisory levels and 43 percent of respondents reported their position as associate/staff/technician. Respondents have on average 9.8 years of security experience with approximately 6.7 years of experience in their current position.

Figure 30 identifies the organizational location of respondents in our study. Over half (52 percent) of respondents are located within IT operations. This is followed by security at 21 percent of respondents, compliance (10 percent of respondents) and lines of business (9 percent of respondents).
Figure 31 reports the industry classification of respondents’ organizations. Fifteen percent of respondents are located in the financial services industry, which includes banking, investment management, insurance, brokerage, payments and credit cards. Twelve percent of respondents are located in manufacturing and industrial organizations, nine percent are in service organizations, nine percent are located in the technology and software sector.

According to Figure 32 more than half (58 percent) of respondents are located in larger-sized organizations with a global headcount of more than 1,000 employees.
LIMITATIONS

There are inherent limitations to survey research that need to be carefully considered before drawing inferences from the presented findings. The following items are specific limitations that are germane to most survey-based research studies.

• **Non-response bias:** The current findings are based on a sample of survey returns. We sent surveys to a representative sample of IT and IT security practitioners in 17 countries, resulting in a large number of usable returned responses. Despite non-response tests, it is always possible that individuals who did not participate are substantially different in terms of underlying beliefs from those who completed the survey.

• **Sampling-frame bias:** The accuracy of survey results is dependent upon the degree to which our sampling frames are representative of individuals who are IT or IT security practitioners within the sample of 17 countries selected.

• **Self-reported results:** The quality of survey research is based on the integrity of confidential responses received from respondents. While certain checks and balances were incorporated into our survey evaluation process including sanity checks, there is always the possibility that some respondents did not provide truthful responses.

*View the full 2021 Global Encryption Trends Study consolidated findings at:* [Entrust.com/go/2021-GETS-findings](Entrust.com/go/2021-GETS-findings)
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