



Information Security Manual

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Guidelines for System Hardening

Operating system hardening

Operating system selection

When selecting operating systems, it is important that an organisation preferences vendors that have demonstrated a commitment to secure-by-design principles, secure programming practices and maintaining the security of their products. This will assist not only with reducing the potential number of security vulnerabilities in operating systems, but also increasing the likelihood that timely patches, updates or vendor mitigations will be released to remediate any security vulnerabilities that are found.

Security Control: ISM-1743; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Operating systems are chosen from vendors that have made a commitment to secure-by-design principles, secure programming practices and maintaining the security of their products.

Operating system releases and versions

Newer releases of operating systems often introduce improvements in security functionality. This can make it more difficult for an adversary to craft reliable exploits for security vulnerabilities they discover. Using older releases of operating systems, especially those no longer supported by vendors, may expose an organisation to security vulnerabilities or exploitation techniques that have since been mitigated. In addition, 64-bit versions of operating systems support additional security functionality that 32-bit versions do not.

Security Control: ISM-1407; Revision: 4; Updated: Sep-21; Applicability: All; Essential Eight: ML3

The latest release, or the previous release, of operating systems are used for workstations, servers and network devices.

Security Control: ISM-1744; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A

The latest release, or the previous release, of operating systems are used for other ICT equipment.

Security Control: ISM-1408; Revision: 4; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Where supported, 64-bit versions of operating systems are used for workstations, servers, network devices and other ICT equipment.

Standard Operating Environments

Allowing users to setup, configure and maintain their own workstations and servers can result in an inconsistent operating environment. Such operating environments may assist an adversary in gaining an initial foothold on networks due to the higher likelihood of poorly configured or maintained workstations and servers. Conversely, a Standard

Operating Environment (SOE) is designed to facilitate a standardised and consistent operating environment within an organisation.

When SOEs are obtained from third parties, such as service providers, there are additional cyber supply chain risks that should be considered, such as the accidental or deliberate inclusion of malicious code or configurations. To reduce the likelihood of such occurrences, an organisation should endeavour to obtain their SOEs from trusted third parties while also scanning them for malicious code and configurations.

As operating environments naturally change over time, such as patches or updates are applied, configurations are changed, and applications are added or removed, it is essential that SOEs are reviewed and updated at least annually to ensure that an up-to-date baseline is maintained.

Security Control: ISM-1406; Revision: 2; Updated: Aug-20; Applicability: All; Essential Eight: N/A

SOEs are used for workstations and servers.

Security Control: ISM-1608; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

SOEs provided by third parties are scanned for malicious code and configurations.

Security Control: ISM-1588; Revision: 0; Updated: Aug-20; Applicability: All; Essential Eight: N/A

SOEs are reviewed and updated at least annually.

Hardening operating system configurations

When operating systems are deployed in their default state it can lead to an insecure operating environment that may allow an adversary to gain an initial foothold on networks. Many configuration settings exist within operating systems to allow them to be configured in a secure state in order to minimise this security risk. As such, the Australian Cyber Security Centre (ACSC) and vendors often produce guidance to assist in hardening the configuration of operating systems. Note, however, in situations where ACSC and vendor guidance conflicts, preference should be given to implementing ACSC hardening guidance.

Security Control: ISM-1409; Revision: 1; Updated: Sep-18; Applicability: All; Essential Eight: N/A

ACSC and vendor guidance is implemented to assist in hardening the configuration of operating systems.

Security Control: ISM-0380; Revision: 9; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Unneeded accounts, components, services and functionality of operating systems are disabled or removed.

Security Control: ISM-0383; Revision: 7; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Default credentials for pre-configured accounts are changed.

Security Control: ISM-0341; Revision: 4; Updated: Dec-21; Applicability: All; Essential Eight: N/A

Automatic execution features for removable media are disabled.

Security Control: ISM-1654; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Internet Explorer 11 is disabled or removed.

Security Control: ISM-1655; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

.NET Framework 3.5 (includes .NET 2.0 and 3.0) is disabled or removed.

Security Control: ISM-1492; Revision: 2; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Operating system exploit protection functionality is enabled.

Security Control: ISM-1745; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Early Launch Antimalware, Secure Boot, Trusted Boot and Measured Boot functionality is enabled.

Security Control: ISM-1584; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: N/A

Unprivileged users are prevented from bypassing, disabling or modifying security functionality of operating systems.

Security Control: ISM-1491; Revision: 3; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Unprivileged users are prevented from running script execution engines, including:

- *Windows Script Host (cscript.exe and wscript.exe)*
- *PowerShell (powershell.exe, powershell_ise.exe and pwsh.exe)*
- *Command Prompt (cmd.exe)*
- *Windows Management Instrumentation (wmic.exe)*
- *Microsoft Hypertext Markup Language (HTML) Application Host (mshta.exe).*

Application management

Unprivileged users' ability to install any application can be exploited by an adversary using social engineering in order to convince them to install a malicious application. One way to mitigate this security risk, while also removing burden from system administrators, is to allow unprivileged users the ability to install approved applications from organisation-managed software repositories or from trusted application marketplaces. Furthermore, to prevent unprivileged users from removing security functionality, or breaking system functionality, unprivileged users should not have the ability to uninstall or disable approved software.

Security Control: ISM-1592; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Unprivileged users do not have the ability to install unapproved software.

Security Control: ISM-0382; Revision: 7; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Unprivileged users do not have the ability to uninstall or disable approved software.

Application control

Application control can be an effective way to not only prevent malicious code from executing on workstations and servers, but also to ensure only approved applications can execute. When developing application control rulesets, determining approved executables (e.g. .exe and .com files), software libraries (e.g. .dll and .ocx files), scripts (e.g. .ps1, .bat, .cmd, .vbs and .js files), installers (e.g. .msi, .msp and .mst files), compiled HTML (e.g. .chm), HTML applications (e.g. .hta), control panel applets (e.g. .cpl) and drivers based on business requirements is a more secure method than simply approving those already residing on a workstation or server. Furthermore, it is preferable that an organisation defines their own application control rulesets, rather than relying on those from application control vendors, and validate them on an annual or more frequent basis.

In implementing application control, an organisation should use a reliable method, or combination of methods, such as cryptographic hash rules, publisher certificate rules or path rules. Depending on the method chosen, further hardening may be required to ensure that application control mechanisms and application control rulesets cannot be bypassed by an adversary.

Finally, to assist with incident response activities, it is important that application control event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Security Control: ISM-0843; Revision: 9; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Application control is implemented on workstations.

Security Control: ISM-1490; Revision: 3; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Application control is implemented on internet-facing servers.

Security Control: ISM-1656; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3
Application control is implemented on non-internet-facing servers.

Security Control: ISM-1657; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Application control restricts the execution of executables, software libraries, scripts, installers, compiled HTML, HTML applications and control panel applets to an organisation-approved set.

Security Control: ISM-1658; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Application control restricts the execution of drivers to an organisation-approved set.

Security Control: ISM-0955; Revision: 6; Updated: Apr-20; Applicability: All; Essential Eight: N/A

Application control is implemented using cryptographic hash rules, publisher certificate rules or path rules.

Security Control: ISM-1582; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Application control rulesets are validated on an annual or more frequent basis.

Security Control: ISM-1471; Revision: 2; Updated: Apr-20; Applicability: All; Essential Eight: N/A

When implementing application control using publisher certificate rules, both publisher names and product names are used.

Security Control: ISM-1392; Revision: 3; Updated: Mar-22; Applicability: All; Essential Eight: N/A

When implementing application control using path rules, only approved users can write to and modify content within approved folders and files.

Security Control: ISM-1746; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A

When implementing application control using path rules, only approved users can change file system permissions for approved folders and files.

Security Control: ISM-1544; Revision: 2; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Microsoft's 'recommended block rules' are implemented.

Security Control: ISM-1659; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Microsoft's 'recommended driver block rules' are implemented.

Security Control: ISM-0846; Revision: 8; Updated: Mar-22; Applicability: All; Essential Eight: N/A

All users (with the exception of local administrator accounts and break glass accounts) cannot disable, bypass or be exempted from application control.

Security Control: ISM-1660; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Allowed and blocked executions on workstations are logged.

Security Control: ISM-1661; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Allowed and blocked executions on internet-facing servers are logged.

Security Control: ISM-1662; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Allowed and blocked executions on non-internet-facing servers are logged.

Security Control: ISM-1663; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Application control event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

PowerShell

PowerShell is a powerful scripting language developed by Microsoft and, due to its ubiquity and ease with which it can be used to fully control operating systems, is an important part of system administrator toolkits. However, PowerShell can also be a dangerous exploitation tool in the hands of an adversary.

In order to prevent attacks leveraging security vulnerabilities in earlier PowerShell versions, Windows PowerShell 2.0 should be disabled or removed from operating systems. Additionally, PowerShell's language mode should be set to Constrained Language Mode to achieve a balance between security and functionality.

Finally, logging and transcription functionality available in PowerShell can provide invaluable information for incident responders. As such, it is important that PowerShell event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Security Control: ISM-1621; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Windows PowerShell 2.0 is disabled or removed.

Security Control: ISM-1622; Revision: 0; Updated: Oct-20; Applicability: All; Essential Eight: ML3
PowerShell is configured to use Constrained Language Mode.

Security Control: ISM-1623; Revision: 0; Updated: Oct-20; Applicability: All; Essential Eight: N/A
PowerShell is configured to use module logging, script block logging and transcription functionality.

Security Control: ISM-1624; Revision: 0; Updated: Oct-20; Applicability: All; Essential Eight: N/A
PowerShell script block logs are protected by Protected Event Logging functionality.

Security Control: ISM-1664; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Blocked PowerShell script executions are logged.

Security Control: ISM-1665; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3
PowerShell event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Host-based Intrusion Prevention System

Many security products rely on signatures to detect malicious code. This approach is only effective when malicious code has already been profiled and signatures are available from security vendors. Unfortunately, an adversary can easily create variants of known malicious code in order to bypass traditional signature-based detection. A Host-based Intrusion Prevention System (HIPS) can use behaviour-based detection to assist in identifying and blocking anomalous behaviour as well as detecting malicious code that has yet to be identified by security vendors. As such, it is important that a HIPS is implemented on workstations, critical servers and high-value servers.

Security Control: ISM-1341; Revision: 2; Updated: Sep-18; Applicability: All; Essential Eight: N/A
A HIPS is implemented on workstations.

Security Control: ISM-1034; Revision: 7; Updated: Mar-22; Applicability: All; Essential Eight: N/A
A HIPS is implemented on critical servers and high-value servers.

Software firewall

Traditional network firewalls often fail to prevent the propagation of malicious code on networks, or an adversary from exfiltrating data from networks, as they only control which ports or protocols can be used between different network segments. Many forms of malicious code are designed specifically to take advantage of this by using common protocols, such as Hypertext Transfer Protocol, Hypertext Transfer Protocol Secure, Simple Mail Transfer Protocol or Domain Name System. Software firewalls are more effective than traditional network firewalls as they can control which applications and services can communicate to and from workstations and servers. As such, a software firewall should be implemented on workstations and servers to restrict inbound and outbound network connections to an organisation-approved set of applications and services.

Security Control: ISM-1416; Revision: 3; Updated: Mar-22; Applicability: All; Essential Eight: N/A
A software firewall is implemented on workstations and servers to restrict inbound and outbound network connections to an organisation-approved set of applications and services.

Antivirus software

When vendors develop software they may make coding mistakes that lead to security vulnerabilities. An adversary can take advantage of this by developing malicious code to exploit any security vulnerabilities that have not been detected and remedied by vendors. As significant time and effort is often involved in developing functioning and reliable exploits, an adversary will often attempt to reuse their exploits as much as possible. While exploits may have been previously identified by security vendors, they often remain viable against an organisation that does not have antivirus software in place.

Security Control: ISM-1417; Revision: 4; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Antivirus software is implemented on workstations and servers with:

- *signature-based detection functionality enabled and set to a high level*
- *heuristic-based detection functionality enabled and set to a high level*
- *reputation rating functionality enabled*
- *ransomware protection functionality enabled*
- *detection signatures configured to update on at least a daily basis*
- *regular scanning configured for all fixed disks and removable media.*

Device access control software

Device access control software can be used to prevent removable media and mobile devices from being connecting to workstations and servers via external communication interfaces. This can assist in preventing the introduction of malicious code or the exfiltration of data by an adversary.

In addition, an adversary can connect to locked workstations and servers via external communication interfaces that allow Direct Memory Access (DMA). In doing so, the adversary can gain access to encryption keys in memory or write malicious code to memory. The best defence against this security risk is to disable access to external communication interfaces that allow DMA, such as FireWire, ExpressCard and Thunderbolt.

Security Control: ISM-1418; Revision: 4; Updated: Mar-22; Applicability: All; Essential Eight: N/A

If there is no business requirement for reading from removable media and devices, such functionality is disabled via the use of device access control software or by disabling external communication interfaces.

Security Control: ISM-0343; Revision: 6; Updated: Mar-22; Applicability: All; Essential Eight: N/A

If there is no business requirement for writing to removable media and devices, such functionality is disabled via the use of device access control software or by disabling external communication interfaces.

Security Control: ISM-0345; Revision: 6; Updated: Dec-21; Applicability: All; Essential Eight: N/A

External communication interfaces that allow DMA are disabled.

Operating system event logging

Certain operating system events can assist in monitoring the security posture of operating systems, detecting malicious behaviour and contributing to investigations following cyber security incidents. In doing so, operating system event logs should be centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Security Control: ISM-0582; Revision: 7; Updated: Mar-22; Applicability: All; Essential Eight: N/A

The following events are logged for operating systems:

- *application and operating system crashes and error messages*
- *changes to security policies and system configurations*
- *successful user logons and logoffs, failed user logons and account lockouts*
- *failures, restarts and changes to important processes and services*
- *requests to access internet resources*
- *security product-related events*
- *system startups and shutdowns.*

Security Control: ISM-1747; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Operating system event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Further information

Further information on cyber supply chain risk management can be found in the cyber supply chain risk management section of the [Guidelines for Outsourcing](#).

Further information on patching or updating operating systems can be found in the system patching section of the [Guidelines for System Management](#).

Further information on end of support for Microsoft Windows operating systems can be found in the ACSC's [End of Support for Microsoft Windows 10](#) and [End of Support for Microsoft Windows Server 2008 and Windows Server 2008 R2](#) publications.

Further information on securely configuring Microsoft Windows operating systems can be found in the ACSC's [Hardening Microsoft Windows 10 version 21H1 Workstations](#) publication.

Further information on securely configuring Linux workstations and servers can be found in the ACSC's [Hardening Linux Workstations and Servers](#) publication.

Further information on [exploit protection functionality](#) within Microsoft Windows is available from Microsoft.

Further information on implementing application control can be found in the ACSC's [Implementing Application Control](#) publication.

Further information on Microsoft's '[recommended block rules](#)' and '[recommended driver block rules](#)' are available from Microsoft.

Further information on the use of PowerShell can be found in the ACSC's [Securing PowerShell in the Enterprise](#) publication.

Further information on [the use of PowerShell by blue teams](#) is available from Microsoft while further information on obtaining [greater visibility through PowerShell logging](#) is available from FireEye.

Further information on independent testing of security products' ability to [detect or prevent various stages of network intrusions](#) is available from The MITRE Corporation.

Further information on independent testing of antivirus software is available from [AV-Comparatives](#) and [AV-TEST](#).

Further information on the use of removable media can be found in the media usage section of the [Guidelines for Media](#).

Further information on event logging can be found in the event logging and monitoring section of the [Guidelines for System Monitoring](#).

Application hardening

Application selection

When selecting applications, it is important that an organisation preferences vendors that have demonstrated a commitment to secure-by-design principles, secure programming practices and maintaining the security of their products. This will assist not only with reducing the potential number of security vulnerabilities in applications, but also increasing the likelihood that timely patches, updates or vendor mitigations will be released to remediate any security vulnerabilities that are found.

Security Control: ISM-0938; Revision: 5; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Applications are chosen from vendors that have made a commitment to secure-by-design principles, secure programming practices and maintaining the security of their products.

Application releases

Newer releases of applications often introduce improvements in security functionality. This can make it more difficult for an adversary to craft reliable exploits for security vulnerabilities they discover. Using older releases of applications, especially those no longer supported by vendors, may expose an organisation to security vulnerabilities or exploitation techniques that have since been mitigated. This is particularly important for office productivity suites, web browsers and their extensions, email clients, Portable Document Format (PDF) software, and security products, as well as web server applications and other internet-accessible server applications.

Security Control: ISM-1467; Revision: 3; Updated: Mar-22; Applicability: All; Essential Eight: N/A

The latest release of office productivity suites, web browsers and their extensions, email clients, PDF software, and security products are used.

Security Control: ISM-1483; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

The latest release of web server applications, and other internet-accessible server applications, are used.

Hardening application configurations

When applications are deployed in their default state it can lead to an insecure operating environment that may allow an adversary to gain an initial foothold on networks. This can be especially risky for office productivity suites, web browsers, email clients, PDF software and security products as such applications are routinely targeted for exploitation. Many configuration settings exist within such applications to allow them to be configured in a secure state in order to minimise this security risk. As such, the ACSC and vendors often produce guidance to assist in hardening the configuration of such applications. Note, however, in situations where ACSC and vendor guidance conflicts, preference should be given to implementing ACSC hardening guidance.

Security Control: ISM-1412; Revision: 3; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

ACSC or vendor hardening guidance for web browsers, Microsoft Office and PDF software is implemented.

Security Control: ISM-1470; Revision: 5; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Unneeded components, services and functionality of office productivity suites, web browsers, email clients, PDF software and security products are disabled or removed.

Security Control: ISM-1235; Revision: 4; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Add-ons, extensions and plug-ins for office productivity suites, web browsers, email clients, PDF software and security products are restricted to an organisation-approved set.

Security Control: ISM-1486; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Web browsers do not process Java from the internet.

Security Control: ISM-1485; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Web browsers do not process web advertisements from the internet.

Security Control: ISM-1666; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2

Internet Explorer 11 does not process content from the internet.

Security Control: ISM-1667; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Microsoft Office is blocked from creating child processes.

Security Control: ISM-1668; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Microsoft Office is blocked from creating executable content.

Security Control: ISM-1669; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Microsoft Office is blocked from injecting code into other processes.

Security Control: ISM-1542; Revision: 0; Updated: Jan-19; Applicability: All; Essential Eight: ML2, ML3
Microsoft Office is configured to prevent activation of Object Linking and Embedding packages.

Security Control: ISM-1670; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
PDF software is blocked from creating child processes.

Security Control: ISM-1601; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Microsoft's Attack Surface Reduction rules are implemented.

Security Control: ISM-1585; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Web browser, Microsoft Office and PDF software security settings cannot be changed by users.

Security Control: ISM-1748; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Office productivity suite, email client and security product security settings cannot be changed by users.

Microsoft Office macros

Microsoft Office files can contain embedded code, known as a macro, written in the Visual Basic for Applications programming language. A macro can contain a series of commands that can be coded or recorded and replayed at a later time to automate repetitive tasks. Macros are powerful tools that can be easily created by users to greatly improve their productivity. However, an adversary can also create macros to perform a variety of malicious activities, such as assisting to compromise workstations in order to exfiltrate or deny access to data. To reduce this security risk, an organisation should disable Microsoft Office macros for users that do not have a demonstrated business requirement and secure their use for the remaining users that do.

Finally, to assist with incident response activities, it is important that Microsoft Office macro event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Security Control: ISM-1671; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Microsoft Office macros are disabled for users that do not have a demonstrated business requirement.

Security Control: ISM-1488; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Microsoft Office macros in files originating from the internet are blocked.

Security Control: ISM-1672; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Microsoft Office macro antivirus scanning is enabled.

Security Control: ISM-1673; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Microsoft Office macros are blocked from making Win32 API calls.

Security Control: ISM-1674; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3
Only Microsoft Office macros running from within a sandboxed environment, a Trusted Location or that are digitally signed by a trusted publisher are allowed to execute.

Security Control: ISM-1487; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML3
Only privileged users responsible for validating that Microsoft Office macros are free of malicious code can write to and modify content within Trusted Locations.

Security Control: ISM-1675; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3
Microsoft Office macros digitally signed by an untrusted publisher cannot be enabled via the Message Bar or Backstage View.

Security Control: ISM-1676; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3
Microsoft Office's list of trusted publishers is validated on an annual or more frequent basis.

Security Control: ISM-1489; Revision: 0; Updated: Sep-18; Applicability: All; Essential Eight: ML2, ML3
Microsoft Office macro security settings cannot be changed by users.

Security Control: ISM-1677; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Allowed and blocked Microsoft Office macro executions are logged.

Security Control: ISM-1678; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Microsoft Office macro event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Further information

Further information on cyber supply chain risk management can be found in the cyber supply chain risk management section of the [Guidelines for Outsourcing](#).

Further information on patching or updating applications can be found in the system patching section of the [Guidelines for System Management](#).

Further information on securely configuring Microsoft Office can be found in the ACSC's [Hardening Microsoft 365, Office 2021, Office 2019 and Office 2016](#) publication.

Further information on configuring Microsoft Office macro settings can be found in the ACSC's [Microsoft Office Macro Security](#) publication.

Further information on event logging can be found in the event logging and monitoring section of the [Guidelines for System Monitoring](#).

Authentication hardening

Account and authentication types

The guidance within this section is equally applicable to all account types. This includes unprivileged accounts, privileged accounts, break glass accounts and service accounts. In addition, the guidance is equally applicable to interactive authentication and non-interactive authentication.

Authenticating to systems

Before access to a system and its resources is granted to a user, it is essential that they are authenticated. This can be achieved via multi-factor authentication, such as a username along with a passphrase and security key, or via single-factor authentication, such as a username and a passphrase.

Security Control: ISM-1546; Revision: 0; Updated: Aug-19; Applicability: All; Essential Eight: N/A

Users are authenticated before they are granted access to a system and its resources.

Multi-factor authentication

Multi-factor authentication uses two or more authentication factors. This may include:

- something a user knows, such as a memorised secret (i.e. personal identification number, password or passphrase)
- something a user has, such as a security key, smart card, smartphone or physical one-time password token
- something a user is, such as a fingerprint pattern or their facial geometry.

Note, however, that if a memorised secret is written down, or stored in a document on a system, this becomes something that a user has rather than something a user knows.

Privileged users, users of remote access solutions and users with access to important data repositories are more likely to be targeted by an adversary due to their access. For this reason, it is especially important that multi-factor authentication is used for these accounts. In addition, multi-factor authentication is vital to any administrative activities

as it can limit the consequences of a compromise by preventing or slowing an adversary's ability to gain unrestricted access to assets. In this regard, multi-factor authentication can be implemented as part of jump server authentication where assets being administered do not support multi-factor authentication themselves.

When implementing multi-factor authentication, several different authentication factors can be implemented. Unfortunately, some authentication factors, such as biometrics or codes sent via Short Message Service, Voice over Internet Protocol or email, are more susceptible to compromise than others. For this reason, authentication factors that involve something a user has should be used as part of multi-factor authentication. Furthermore, for increased security, the use of verifier impersonation resistant authentication factors are recommended to protect against real-time phishing attacks.

Finally, to assist with incident response activities, it is important that multi-factor authentication event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Security Control: ISM-0974; Revision: 6; Updated: Sep-21; Applicability: All; Essential Eight: N/A

Multi-factor authentication is used to authenticate unprivileged users of systems.

Security Control: ISM-1173; Revision: 4; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Multi-factor authentication is used to authenticate privileged users of systems.

Security Control: ISM-1504; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Multi-factor authentication is used by an organisation's users if they authenticate to their organisation's internet-facing services.

Security Control: ISM-1679; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Multi-factor authentication is used by an organisation's users if they authenticate to third-party internet-facing services that process, store or communicate their organisation's sensitive data.

Security Control: ISM-1680; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Multi-factor authentication (where available) is used by an organisation's users if they authenticate to third-party internet-facing services that process, store or communicate their organisation's non-sensitive data.

Security Control: ISM-1681; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Multi-factor authentication is enabled by default for non-organisational users (but users can choose to opt out) if they authenticate to an organisation's internet-facing services.

Security Control: ISM-1505; Revision: 1; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Multi-factor authentication is used to authenticate users accessing important data repositories.

Security Control: ISM-1401; Revision: 5; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Multi-factor authentication uses either: something users have and something users know, or something users have that is unlocked by something users know or are.

Security Control: ISM-1682; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Multi-factor authentication is verifier impersonation resistant.

Security Control: ISM-1559; Revision: 2; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Memorised secrets used for multi-factor authentication are a minimum of 6 characters, unless more stringent requirements apply.

Security Control: ISM-1560; Revision: 2; Updated: Mar-22; Applicability: S; Essential Eight: N/A

Memorised secrets used for multi-factor authentication on SECRET systems are a minimum of 8 characters.

Security Control: ISM-1561; Revision: 2; Updated: Mar-22; Applicability: TS; Essential Eight: N/A

Memorised secrets used for multi-factor authentication on TOP SECRET systems are a minimum of 10 characters.

Security Control: ISM-1683; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3

Successful and unsuccessful multi-factor authentications are logged.

Security Control: ISM-1684; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3

Multi-factor authentication event logs are centrally stored and protected from unauthorised modification and deletion, monitored for signs of compromise, and actioned when cyber security events are detected.

Single-factor authentication

A significant threat to the compromise of accounts is credential cracking tools. When an adversary gains access to a list of usernames and hashed credentials from a system they can attempt to recover username and credential pairs by comparing the hashes of known credentials with the hashed credentials they have gained access to. By finding a match an adversary will know the credential associated with a given username.

In order to reduce this security risk, an organisation should implement multi-factor authentication. Note, while single-factor authentication is no longer considered suitable for protecting sensitive or classified data, it may not be possible to implement multi-factor authentication on some systems. In such cases, an organisation will need to increase the time on average it takes an adversary to compromise a credential by continuing to increase its length over time. Such increases in length can be balanced against useability through the use of passphrases rather than passwords. In cases where systems do not support passphrases, and as an absolute last resort, the strongest password length and complexity supported by a system will need to be implemented.

Security Control: ISM-0417; Revision: 5; Updated: Oct-19; Applicability: All; Essential Eight: N/A

When systems cannot support multi-factor authentication, single-factor authentication using passphrases is implemented instead.

Security Control: ISM-0421; Revision: 8; Updated: Dec-21; Applicability: All; Essential Eight: N/A

Passphrases used for single-factor authentication are at least 4 random words with a total minimum length of 14 characters, unless more stringent requirements apply.

Security Control: ISM-1557; Revision: 2; Updated: Dec-21; Applicability: S; Essential Eight: N/A

Passphrases used for single-factor authentication on SECRET systems are at least 5 random words with a total minimum length of 17 characters.

Security Control: ISM-0422; Revision: 8; Updated: Dec-21; Applicability: TS; Essential Eight: N/A

Passphrases used for single-factor authentication on TOP SECRET systems are at least 6 random words with a total minimum length of 20 characters.

Security Control: ISM-1558; Revision: 2; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Passphrases used for single-factor authentication are not a list of categorised words; do not form a real sentence in a natural language; and are not constructed from song lyrics, movies, literature or any other publicly available material.

Security Control: ISM-1596; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Passphrases are not reused for single-factor authentication across different systems.

Setting credentials for user accounts

Before new credentials are issued for user accounts, it is important that users' provide sufficient evidence to verify their identity, such as by users physically presenting themselves and their pass to a service desk or by answering a set of challenge-response questions. Following the verification of user identity, credentials should be randomly generated and provided to users via a secure communications channel or, if not possible, split into two parts with one part provided to users and the other part provided to supervisors. Subsequently, users should reset their credentials on first use to ensure that they are not known by other parties.

Security Control: ISM-1593; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Users provide sufficient evidence to verify their identity when requesting new credentials.

Security Control: ISM-1227; Revision: 5; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Credentials set for user accounts are randomly generated.

Security Control: ISM-1594; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Credentials are provided to users via a secure communications channel or, if not possible, split into two parts with one part provided to users and the other part provided to supervisors.

Security Control: ISM-1595; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Credentials provided to users are changed on first use.

Setting credentials for service accounts

To provide additional security and credential management functionality for service accounts, Microsoft introduced group Managed Service Accounts to Microsoft Windows Server. In doing so, service accounts that are created as group Managed Service Accounts do not require manual credential management by system administrators, as the operating system automatically manages the credentials. This ensures that service account credentials are not misplaced or forgotten, and that they are automatically changed on a regular basis.

Security Control: ISM-1619; Revision: 0; Updated: Oct-20; Applicability: All; Essential Eight: ML2, ML3

Service accounts are created as group Managed Service Accounts.

Account lockouts

Locking an account after a specified number of failed logon attempts reduces the likelihood of successful credential spraying attacks by an adversary. However, care should be taken as implementing account lockout functionality can increase the likelihood of a denial of service. Alternatively, some systems can be configured to automatically slowdown repeated failed logon attempts (known as rate limiting) rather than locking accounts. Implementing multi-factor authentication is also an effective way of reducing the likelihood of successful credential spraying attacks.

Security Control: ISM-1403; Revision: 2; Updated: Oct-19; Applicability: All; Essential Eight: N/A

Accounts are locked out after a maximum of five failed logon attempts.

Insecure authentication methods

Authentication methods need to resist theft, interception, duplication, forgery, unauthorised access and unauthorised modification. For example, Local Area Network (LAN) Manager and NT LAN Manager authentication methods use weak hashing algorithms. As such, credentials used as part of LAN Manager authentication and NT LAN Manager authentication (i.e. NTLMv1, NTLMv2 and NTLM2) can easily be compromised. Instead, an organisation should use Kerberos for authentication within Microsoft Windows environments and ensure all privileged accounts are members of the Protected Users security group.

Security Control: ISM-1603; Revision: 0; Updated: Aug-20; Applicability: All; Essential Eight: N/A

Authentication methods susceptible to replay attacks are disabled.

Security Control: ISM-1055; Revision: 4; Updated: Oct-20; Applicability: All; Essential Eight: N/A

LAN Manager and NT LAN Manager authentication methods are disabled.

Security Control: ISM-1620; Revision: 0; Updated: Oct-20; Applicability: All; Essential Eight: N/A

Privileged accounts are members of the Protected Users security group.

Protecting credentials

When local administrator accounts use common usernames and credentials, it can allow an adversary that compromises credentials on one workstation or server to easily compromise other workstations and servers. As such, it is critical that credentials for local administrator accounts and service accounts are unique, unpredictable and managed.

Storing physical credentials with a system, such as security keys, smart cards, one-time password tokens and written down memorised secrets, increases the likelihood of an adversary gaining access to the system. For example, when

passphrases are written down and stuck to a computer monitor, smart cards are left on desks or security keys are left in laptop bags. Furthermore, obscuring credentials as they are entered into systems can assist in protecting them against screen scrapers and shoulder surfers.

If storing credentials on a system, sufficient protection should be implemented to prevent them from being compromised. For example, credentials can be stored in a password manager or hardware security module, while credentials stored in a database should be hashed, salted and stretched. In addition, Windows Defender Credential Guard and Windows Defender Remote Credential Guard can be enabled to provide additional protection for credentials.

When using Microsoft Windows systems, cached credentials are stored in the Security Accounts Manager database and can allow a user to logon to a workstation they have previously logged onto even if the domain is not available. Whilst this functionality may be desirable from an availability perspective, this functionality can be abused by an adversary who can retrieve these cached credentials. To reduce this security risk, cached credentials should be limited to only one previous logon.

Security Control: ISM-1685; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML2, ML3
Credentials for local administrator accounts and service accounts are unique, unpredictable and managed.

Security Control: ISM-0418; Revision: 5; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Physical credentials are stored separately from systems to which they grant access.

Security Control: ISM-1597; Revision: 0; Updated: Aug-20; Applicability: All; Essential Eight: N/A
Credentials are obscured as they are entered into systems.

Security Control: ISM-1402; Revision: 6; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Credentials stored on systems are protected by a password manager; a hardware security module; or by salting, hashing and stretching them before storage within a database.

Security Control: ISM-1686; Revision: 0; Updated: Sep-21; Applicability: All; Essential Eight: ML3
Windows Defender Credential Guard and Windows Defender Remote Credential Guard are enabled.

Security Control: ISM-1749; Revision: 0; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Cached credentials are limited to one previous logon.

Security Control: ISM-1590; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A
Credentials are changed if:

- *they are directly compromised*
- *they are suspected of being compromised*
- *they appear in an online data breach database*
- *they are discovered stored on networks in the clear*
- *they are discovered being transferred across networks in the clear*
- *membership of a shared account changes*
- *they have not been changed in the past 12 months.*

Session termination

Implementing measures to automatically terminate user sessions and reboot workstations outside of business hours, after an appropriate period of inactivity, can assist in both system maintenance activities as well as removing an adversary that may have compromised a system but failed to gain persistence.

Security Control: ISM-0853; Revision: 2; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Outside of business hours, after an appropriate period of inactivity, user sessions are automatically terminated and workstations are rebooted.

Session and screen locking

Session and screen locking prevents unauthorised access to a system which a user has already authenticated to.

Security Control: ISM-0428; Revision: 8; Updated: Mar-22; Applicability: All; Essential Eight: N/A

Systems are configured with a session or screen lock that:

- *activates after a maximum of 15 minutes of user inactivity, or if manually activated by users*
- *conceals all session content on the screen*
- *ensures that the screen does not enter a power saving state before the session or screen lock is activated*
- *requires users to reauthenticate to unlock the session*
- *denies users the ability to disable the session or screen locking mechanism.*

Logon banner

Displaying a logon banner to users before access is granted to a system reminds them of their security responsibilities. Logon banners may cover topics such as:

- the sensitivity or classification of the system
- access to the system being restricted to authorised users
- acceptable usage and security policies for the system
- an agreement to abide by acceptable usage and security policies for the system
- legal ramifications of violating acceptable usage and security policies for the system
- details of any monitoring activities for the system.

Security Control: ISM-0408; Revision: 4; Updated: Sep-18; Applicability: All; Essential Eight: N/A

Systems have a logon banner that requires users to acknowledge and accept their security responsibilities before access is granted.

Security Control: ISM-0979; Revision: 4; Updated: Sep-18; Applicability: All; Essential Eight: N/A

Legal advice is sought on the exact wording of logon banners.

Further information

Further information on implementing multi-factor authentication can be found in the ACSC's [Implementing Multi-Factor Authentication](#) publication.

Further information on event logging can be found in the event logging and monitoring section of the [Guidelines for System Monitoring](#).

Further information on [randomly generating passphrases](#) (preferably using five dice rolls and a long word list) is available from the Electronic Frontier Foundation while a [random dice roller](#) is available from RANDOM.ORG.

Further information on mitigating the use of stolen credentials can be found in the ACSC's [Mitigating the Use of Stolen Credentials](#) publication.

Further information on mitigating the use of stolen credentials can also be found in Microsoft's [Mitigating Pass-the-Hash \(PtH\) Attacks and Other Credential Theft Techniques, Version 1 and 2](#) publication.

Virtualisation hardening

Containerisation

Containers allow for versatile deployment of systems and, in doing so, should be treated the same as any other system. However, security controls in a containerised environment may take a different form when compared to other types of systems. For example, patching the operating system of a workstation may be performed differently to ensuring that a patched image is used for a container, however, the principle is the same. In general, the same security risks that apply to non-containerised systems will likely apply to containerised systems.

Functional separation between computing environments

Physical servers often use a software-based isolation mechanism to share their hardware among multiple computing environments. In doing so, a computing environment could consist of an entire operating system installed in a virtual machine where the isolation mechanism is a hypervisor, such as cloud services providing Infrastructure as a Service, or alternatively, a computing environment could consist of an application which uses the shared kernel of the underlying operating system of the physical server where the isolation mechanism is an application container or application sandbox, such as cloud services providing Platform as a Service. Note, however, the logical separation of data within a single application, such as cloud services providing Software as a Service, is not considered to be the same as multiple computing environments.

An adversary who has compromised a single computing environment, or who legitimately controls a single computing environment, might exploit a misconfiguration or security vulnerability in the isolation mechanism to compromise other computing environments on the same physical server or compromise the underlying operating system of the physical server. As such, it is important that additional security controls are implemented when a software-based isolation mechanism is used to share a physical server's hardware.

Security Control: ISM-1460; Revision: 3; Updated: Mar-22; Applicability: All; Essential Eight: N/A

When using a software-based isolation mechanism to share a physical server's hardware, the isolation mechanism is from a vendor that has made a commitment to secure-by-design principles, secure programming practices and maintaining the security of their products.

Security Control: ISM-1604; Revision: 0; Updated: Aug-20; Applicability: All; Essential Eight: N/A

When using a software-based isolation mechanism to share a physical server's hardware, the configuration of the isolation mechanism is hardened by removing unneeded functionality and restricting access to the administrative interface used to manage the isolation mechanism.

Security Control: ISM-1605; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

When using a software-based isolation mechanism to share a physical server's hardware, the underlying operating system is hardened.

Security Control: ISM-1606; Revision: 1; Updated: Mar-22; Applicability: All; Essential Eight: N/A

When using a software-based isolation mechanism to share a physical server's hardware, patches, updates or vendor mitigations for security vulnerabilities are applied to the isolation mechanism and underlying operating system in a timely manner.

Security Control: ISM-1607; Revision: 0; Updated: Aug-20; Applicability: All; Essential Eight: N/A

When using a software-based isolation mechanism to share a physical server's hardware, integrity and log monitoring are performed for the isolation mechanism and underlying operating system in a timely manner.

Security Control: ISM-1461; Revision: 5; Updated: Mar-22; Applicability: S, TS; Essential Eight: N/A

When using a software-based isolation mechanism to share a physical server's hardware for SECRET or TOP SECRET computing environments, the physical server and all computing environments are of the same classification and belong to the same security domain.

Further information

Further information on container security can be found in National Institute of Standards and Technology Special Publication 800-190, [Application Container Security Guide](#).

Further information on the use of cloud services can be found in the managed services and cloud services section of the [Guidelines for Outsourcing](#).

Further information on cyber supply chain risk management can be found in the cyber supply chain risk management section of the [Guidelines for Outsourcing](#).

Further information on hardening operating systems can be found in the operating system hardening section of these guidelines.

Further information on patching or updating operating systems and applications can be found in the system patching section of the [Guidelines for System Management](#).

Further information on event logging can be found in the event logging and monitoring section of the [Guidelines for System Monitoring](#).

Further information on hypervisor security can be found in National Institute of Standards and Technology Special Publication 800-125A Rev. 1, [Security Recommendations for Server-based Hypervisor Platforms](#).