Fujitsu mPollux DigiSign Client
Technical References

This reference document contains technical information necessary for system administrators, who are installing Fujitsu mPollux DigiSign Client in their IT system.

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1 DigiSign Client smart card reader software

Fujitsu mPollux DigiSign Client software can be used with a smart card for secure access to electronic services or organization networks or for signing documents or email messages electronically.

1.1 Supported operating systems and standards

DigiSign Client supports the following operating systems and standards.

Supported operating systems and standards	
Computing operating systems	Microsoft supported Windows versions for desktop and server use Linux SUSE Enterprise Desktop Red Hat Enterprise Linux Linux Ubuntu CentOS Linux MacOS, three latest operating system versions
Reader driver interfaces	PC/SC
Smart card operating systems	Aventra MyEID applet for JCOP Atos CardOS 5.3 and 5.3DI Gemalto EID2048 applet Gemalto EID classic with PACE/SM Gemalto IP10 Gemalto IDPrime 3940 IDEMIA ID.me MIOCOS v1.1 or newer (Atmel) MIOCOS v2.3 (Fujitsu FRAM) Oberthur IAS-ECC v1.0.1 Oberthur FINEID applet SetCOS Java EID applet SetCOS 4.3.1, 4.3.2 and 4.4.1
Standard Cryptographic interfaces	Cryptography API: Next Generation (CNG) CryptoAPI v2.0 PKCS#11 v2.01 CryptoTokenKit for MacOS
Other interfaces	DigiSign Toolkit (DLL) WebSigner and WebToolkit
Cryptographic algorithms	MD4, MD5, SHA (different variants) RC-2, DES, 3-DES, AES, RSA, ECDSA, ECDH

1.2 References

The following documentation is provided with the software:

- *Fujitsu mPollux DigiSign Client Technical References* (this guide)
- *Fujitsu mPollux DigiSign Client Installation and User Guide – Windows*
- *Fujitsu mPollux DigiSign Client Installation and User Guide – Linux*
- *Fujitsu mPollux DigiSign Client Installation and User Guide – Mac OS*

2 Installation

2.1 Installation in Windows operating systems

In the Windows operating system, you can install the DigiSign Client by using the installation wizard (see *Fujitsu mPollux DigiSign Client Installation and User Guide – Windows*) or silently.

When Windows .EXE installer is used, the following command installs DigiSign Client silently without the wizard or the background image. Only installation progress is shown.

```
# <DigiSign installation package> /SILENT
```

The following command installs DigiSign Client silently without even the installation progress.

```
# <DigiSign installation package> /VERYSILENT
```

2.2 "PIN2" behaviour

Typically, PIN2 protects nonrepudiation signature key. Even though DigiSign application has PIN1 cache to make user experience likeable, PIN2 is never stored into DigiSign cache. In other words, DigiSign pops-up PIN2 dialog only then card needs it to be able to execute desired cryptographic operation.

Please be aware that there are cases when card remembers the PIN2 code and allows user to execute nonrepudiation key operation without asking PIN2 code:

- Some smart cards enables PIN2 code when PIN2 code is unlocked or changed
- PIN2 is introduced by using
    - DigiSign Application GUI
    - Cryptoki, minidriver or toolkit interface
    - Some other application or interface

2.3 Notes for Cryptoki application users

You can find Cryptoki, the PKCS#11 module named `cryptoki.dll`, in the installation directory. Installation directory location depends on used platform, according table below.

Cryptoki location in different platforms

Platform	Path
Windows	C:\Program Files\Fujitsu\mPollux DigiSign Client\cryptoki.dll
32bit application path in 64bit Windows operating system	C:\Program Files (x86)\Fujitsu\mPollux DigiSign Client\cryptoki.dll
MacOS	/Library/mPolluxDigiSign/libcryptoki.dylib
Linux	/usr/lib/libcryptoki.so

2.4 Notes for Cryptoki developers

By default, the secondary authentication mechanism (auto-login) is enabled. If auto-login causes logical application errors, you can disable it by setting the value of the `disableCryptokiAutoLogin` registry key or environment variable to `1`.

2.5 Notes for Citrix users

The following setting should be verified:

- Define the path to the smart card cached and set full rights to all users (`SmartCardCachePath=`<set path>)
- When publishing applications, "DigiSign Application" shoud be published to the same desktop. Accessing card gets faster and certificate loading to certificate storage gets more precise (see chapter "Certificate Propagation Service").
- DigiSign Application should be closed when published application is closed.

For more details about settings, see Chapter 3, "DigiSign Client settings".

2.6 Notes for MacOS users

Starting from version 4.1.0, deprecated "tokend"-interface has been replaced with Apple's currently supported smart card interface, "CryptoTokenKit".

From the user's point of view, the biggest change is that smart card certificates cannot be seen in the keychain's graphical user interface. However, if there is a need to see if CryptoTokenKit is properly installed, following commands may be used:

1. Open terminal
2. Write "pluginkit -vv -m -p com.apple.ctk-tokens"
    a. Installed plugins are listed
3. List smart cards and certificates
    a. "system_profiler SPSmartCardsDataType"
4. User pairing to the inserted smart card
    a. Query satatus: "sc_auth pairing_ui -s status"
    b. Enable pairing: "sc_auth pairing_ui -s enable"
    c. Unpair inserted card: "sc_auth unpair"
    d. List paired cards: "sc_auth list"

3 DigiSign Client settings

This section describes the settings that can be used to change the behavior of DigiSign Client. The settings can be found in the following locations:

- Windows registry settings:
  - Registry keys in Windows 32-bit operating systems:
    - `HKEY_LOCAL_MACHINE\SOFTWARE\Fujitsu\DigiSign Client`
  - Registry keys in Windows 64-bit operating systems:
    - 64-bit applications:
      - `HKEY_LOCAL_MACHINE\SOFTWARE\Fujitsu\DigiSign Client`
    - 32-bit applications:
      - `HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Fujitsu\DigiSign Client`
- File in Linux: `DigiSign.conf`
- File in Mac OS: `com.fujitsu.DigiSign.conf`

DigiSign Client and mPollux Service Manager settings

Key	Default value	Description
aboutDialogBitmap	Empty	Default path to the image in the About dialog and tab.
allowUnknownCards	1	If set to 0, parse only known cards
buildReaderListTimer	5	The interval in seconds in which DigiSign polls the smart card. If you are using DigiSign through a slow remote connection or a thin client, increase the value to reduce the polling frequency.
certExpirationWarningDays	30	Warn about certificates that will expre within defined count of days
changePinCacheCount	5	How many old PIN codes are stored (if PIN expiration feature is turned on)

changePinInitialPeriod	0	If defined and PIN expiration object is defined at the first time, PIN should be changed according this definition. Unit is days.
changePinPeriod	0	How often PIN should be changed (days). If set to '0', PIN expiration information is not stored into card
closeBrowsers	0/1	Depending version; Tries to close web browser when card is removed from the reader
closeBrowsersConfirm	0	If closeBrowsers is set, ask confirmation form the user before closing the browsers
closeBrowsersExcludeReader	0	Do not close browsers if received event comes from this reader. Same wildcards are allowed than in 'excludeReader'
closeGUIServerWhenLock	1	If defined, GUI server is closed when screen is locked
cryptokiPinCache	1	If defined, PIN cache is used from cryptoki- interface. This setting has no effect if 'disableCryptokiAutoLogin' is set
cryptokiSoftwareKeyGen	0	If defined, key generation is performed by software - not card
DataPath	Depends on the operating system	Linux and Mac only: The pipe path.
disableAuthTab	0	If set to 1, the Authentication tab in DigiSign Manager is hidden.
disableCryptokiAutoLogin	0	If set to 1, the DigiSign PIN dialog is disabled. The user is shown the program's own dialog with the program's own functionality.
disableCryptokiBufferCheck	0	If set to 1, the set buffer size for cryptoki may be exceeded.
disableCryptokiPIN2Slot	0	By default, cryptoki creates to slots for PIN codes, one for Pin 1 and another for PIN2. If set to 1, PIN 2 is disabled.
disablePinUnblocking	0	If set to 1, PIN unblocking is disabled from DigiSign Application's GUI.
dropAuthentication	0	If set to 1, the user must re-authenticate after each asymmetric key operation. Please note that all cards doesn't support this feature.
excludeReader	Empty	A list of those PC/SC (Personal Computer/Smart Card) readers that DigiSign should ignore. This list enables DigiSign to be used in computers that have several card readers. In the list, wild cards are allowed; for example, *O2*||*CCID* ignores all readers that contain the substring O2 or CCID.
forceSelectApplet	0	If set to 1, DigiSign always selects the EID applet at startup.
HTTPSignerDisabled	0	Some anti-virus programs consider the HTTP signer service as malware. Setting this value to 1 disables the HTTP signer service.
HTTPToolkitEnabled	0	If set to 1, enables the httpToolkit interface that can be used for creating spare cards on work stations.
Language	Empty	Sets the language for the user interface. The possible values are fi (Finnish), en (English), and sv (Swedish).
managerBannerBitmap	Empty	The path to the default banner image in mPollux Service Manager.
minidriverAuthMode	1	If set to 1, minidriver uses DigiSign dialog. Otherwise Window's own dialog is presented.
minidriverAutoAuthExclude	0	Applications matching this expression are not allowed to use DigiSign's PIN dialog resulting that Windows' own PIN dialog is used. Expression format is the same than with 'exclude reader'

minidriverPinCache	1	If set to 1, PIN1 value is stored to cache to avoid unnecessary PIN requests. PIN cache is cleared when card is removed from the reader.
minidriverReadOnly	0	If set to 1, minidriver acts as 'RO minidriver'
pinComplexityCheck	0	Bit mask that defines what kind of PINs are accepted; bit 0 = no same numbers, 1 = no followed numbers, 2 = avg diff must be <=4, 3 = only numbers, 4 = PIN must contain lowerCase, upperCase and digit
pinDialogBitmap	Empty	The path to the default image in the PIN dialog.
pinIgnorePinTypeCheck	0	If defined, pin type restrictions are ignored (including pinNumericValuesOnly)
pinMinLength	0	If defined, this setting overrides defintion read from smart card
pinNumericValuesOnly	0	If defined, this setting overrides defintion read from smart card
removeAllCertificatesOnEmptyEvent	1	If set to 1, certificates are removed from certificate storage when last smart card is removed from the card reader(s).
showAsn1CertInWindows	0	If the operating system supports showing the contents of the certificate, the contents are shown in the format set by the operating system. If this value is set to 1, the certificates are always shown in ASN.1 format, regardless of the operating system capabilities.
SmartCardCachePath	Depends on the operating system	The path to the temporary directory for the smart card cache files.
SmartCardSNCache	3	Smart card caching enabling flag: SmartCardSNCache = 0 - - Cache is disabled. It is not recommended to use this setting because it decreases performance. SmartCardSNCache = 1 Smart card data content (cache file) is stored in plain text format. SmartCardSNCache = 2 Cache file is stored in encrypted format with fixed key. Use this setting when there is a need to share same cache between different computers. SmartCardSNCache = 3. Recommended value(set during imnstallation); Cache file is stored in encrypted format with computer specific key. Cache file can't be used with another computer.
SplashBitmap	0	Path to bitmap that is shown during DS application startup
strictSCSkeyPolicy	0	SCS web signer option; If "keyalgorithms" is defined with one key type and card doesn't contain such keys for requested operation: 0 => allow signature operations with other key types 1 => signature requesting operation is cancelled If 'strictKeyPolicy' is set in SCS request, it overwrites this selection.
toolkitPinCache	1	If set, PIN cache is allowed to DS Toolkit
userLevel	0	If set to 0, all advanced features are disabled. Possible values are 0, 1, 2 and 3. userLevel > 0: Remove object + Compute PIN/PUK challenge userLevel > 1: PKCS#12 import userLevel > 2: Card initialization features
validTokenInfoLabel	0	If set, accept only those cards that label's meets this expression. Expression format is the same than with 'exclude reader'

loadCertificates	1	If set, DigiSign application will load and clean card certificates when card is inserted. Otherwise, minidriver and Certification Propagation service is responsible for loading certificate.
pdfOnlyDS	0	If set, only certificates with digital-signature key-usage can be selected.
pdfOnlyNonRep	1	If set, only certificates with non-repudiation key-usage can be selected.
pdfAddRevocationInfo	1	If set, revocation info is added into signature (OCSP-response or CRL)
pdfRevocationList	1	If set, CRL is added into revocation info if OCSP-response can't be requested
pdfRevocationListMaxSize	(not set)	CRL maximum size in kilobytes.
pdfSignatureSubFilter	1	0 = adbe.pkcs7.detached 1 = ETSI.CAdES.detached
pdfTimeStampServer	(not set)	URL of RFC-3161 compliant time-stamp server. If set, timestamp of signing time is requested into document to support long-term pdf signatures.
pdfLockDocument	0	If set, add certification instead of signature and mark document locked. In other words, appending new content is forbidden, including additional signatures.
versionValidation	1	If set, DigiSign application will check if the newest version is available on the download site. Version validation depends from the user preferences from version validation dialog.

3.1 Optional settings

These settings are not set by application installer but may be used in certain use-case scenarios:

Key	Default	Description
gpMasterKey	OS specific default key	Global platform master key. Used while initializing GP SCP03 compatible cards.
gpCardManager	OS specific default AID	Global platform card manager AID (asci-hex encoded string)
scCVCert	Default	Base64 encoded CVC certificate to be stored into card during initialization.
scCVCSignerKey	Default	CVC issuer's public key to be stored into card during initialization. Base64 encoded PKCS#1 or PKCS#8 formatted public key.
scTerminalKey	Default	Terminal side private key to be used during external authenticate. Stored as ASCII-HEX encoded string.
scMaxRsaObjectSize	OS specific maximum size	Depending on card operating system. Usually 2048 or 4096.
activationDialogWallpaper	Default	Activation dialog's background image.
activationDialogTextColor	white	Activation dialog's text color. Suggested values 'black' and 'white'

3.2 Web signer technical notes

DigiSign Client implements two different interfaces for web signing:

- Older, HTML-based WebSigner
- Newer, HTML5-based SCS-signer

Both interfaces follows specifications that are publicly available from https://vrk.fi/en/fineid-specifications.

3.2.1 SCS signer additions

By default, SCS V1.1 defines optional "signatureType" that specifies two signature types

- "signature" – that produces "raw" signature of given data or digest
- "cms" – resulting attached or detached cms signature

In addition to default signature types, DigiSign Client's SCS interface supports following signature types:

- "pkcs7" – compliant with "cms" definition
- "xml" – computes xmldsig-signature and returns xml-document that includes given data inside signature-tag
- "cms-pades" – When contentType is "digest" and signatureType is "cms-pades", DigiSign Client generates pades-compliant signature without timeStamp.

4 DigiSign Toolkit

The DigiSign Toolkit is a C interface that is included in the DigiSign Client Windows installation package. The Toolkit allows you to program your own system to use DigiSign Client. The Toolkit provides functions such as the following:

- Searching for user certificates
- Computing and verifying digital signatures
- Authenticating against the mPollux Server
- Transmitting Certificate Management Protocol (CMP) messages to different Certificate Authority (CA) systems

After default installation in Windows environment, you can find the Toolkit in the following directory:

```
C:\Program Files\Fujitsu\mPollux DigiSign Client\Toolkit
```

For more information on the Toolkit, see the `DigiSign_Toolkit.h` file in that directory.

5 Windows specific notifications

This chapter includes windows specific notifications that can be ignored while using other platforms.

5.1 Smart Card Minidriver

Windows security interfaces (CryptoAPI and Microsoft Cryptography API: Next Generation (CNG)) needs ***provider*** to connect smart card to existing security infrastructure. Older DigiSign Client versions (from 1.0 – 3.2.X) included so called "***CSP module***" to access keys and certificates from smart card.

Because of the need of new cryptographic features, "***Windows Smart Card Minidriver***" was introduced first time in DigiSign Client version 3.5.0. Starting from version 4.0.0, CSP is no longer included to installation package. Current version follows "Windows Smart Card Minidriver Specification" with level 6.

There are two remarkable differences between 3.X and 4.X versions:

1) How certificates are moved from card to certificate storage and
2) How correct interface is introduced to the operating system when card is inserted.

5.1.1 Certificate Propagation Service

Certificate Propagation Service is native service of Microsoft Windows operating system. It monitors smart cards when new card is found, it loads certificates to certificate repository.

However, there are two major difficulties with CertPropService:

1) It doesn't introduce "Friendly Names" that makes it difficult to user to figure out what certificate is requested
2) It doesn't remove certificates from certificate storage, that causes practical difficulties when card is not present.

DigiSign Application tries to fix situation as follows:

Versions 4.0.0 … 4.0.14;

- Relies on CertPropService. If service is turned off, certificates are not loaded
- When all cards are removed from the readers, DSApp removes certificates from certificate storage

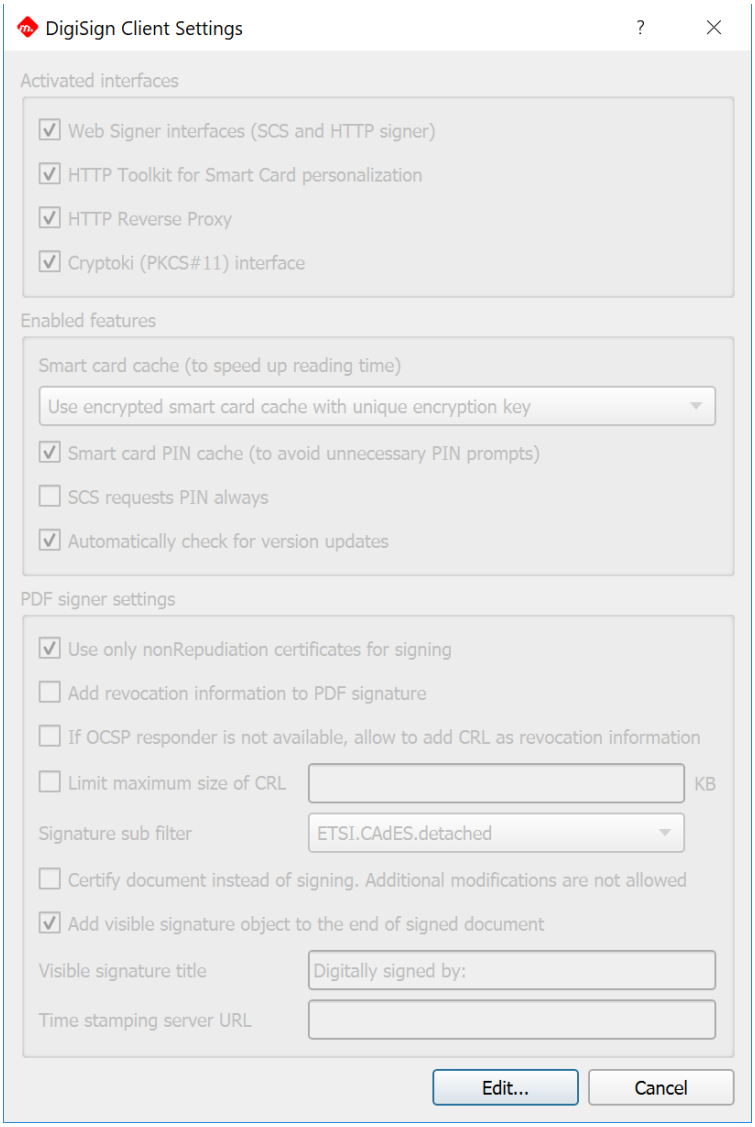
Versions 4.0.16 ...

- CertPropService is not used; DigiSign Application introduces certificates with friendly name
- When card is removed, that card's certificates are removed from certificate storage
- When application is closed, all card associated certificates are removed from certificate storage

6 Options-dialog

Windows and MacOS operating system offers the possibility to change some settings with the help of "Options" dialog. Dialog can be opened from DigiSign Application's taskbar menu and it offers possibility to change certain settings. Changing settings is enabled after entering "elevated" user credentials when clicking "Edit..." button.

Windows ".exe" installer displays the same dialog and allows you to modify settings during the installation of the application.



Options dialog features	
Web Signer interfaces	When this feature is turned on, DigiSign application allows web browsers to access local web server to request signatures. Local webs server supports web based signature requests based on Web Signing- and SCS V1.1 interface. Please see https://eevertti.vrk.fi/fineid-maaritykset.
HTTP Toolkit	HTTP Toolkit enables possibility to personalize cards over http interface. There is no need to turn on this interface unless card personalization services are used.
HTTP Reverse proxy	Reverse proxy is a service that allows to open web pages via proxy. Reverse proxy is useful in the cases where • web browser doesn't support client authentication or • user needs to use better encryption algorithms that are not supported by browser. By default, proxy is turned off.
Cryptoki interface	Cryptoki (PKCS#11) is a platform independent interface for cryptographic tokens or devices. The reason why this interface exist is that even Windows and MacOS operating systems contains own cryptographic framework, there are applications that doesn't support them. For example, Firefox browser is good example of such application. Please see more details about Cryptoki and Firefox from User's Guide.
Smart card cache	Reading card content is quite slow procedure and it might take up to 30 seconds. To speed up card reading, card data content can be stored to cache file. There are number of different options how to handle cache files. Please see chapter "DigiSign Client settings" for more details.
Smart card PIN cache	Typically, smart card remembers PIN1 code until card is reset. However, depending on operating system version, card might be reset "too often" causing annoying PIN prompting. To make application more user friendlier, it is possible to use PIN1 cache that introduces PIN code to card on demand. Please be aware that quite often user friendliness is opposite of information security. Therefore, to avoid possibility for misuse, card should be removed from the reader every time when it is not used.
SCS requests PIN always	To add information security, it is possible to define SCS interface to request PIN code even in the cases when card remembers the code. If this feature is turned on, PIN is asked every time even if smart card PIN case is turned on.
PDF Signer settings	Please find the details from chapter 3, DigiSign Client Settings

6.1.1 Smart Card Plug-and-Play Service

With older DigiSign Client versions (1.0. … 3.5.X), CSP module was introduced by installation package and there was no need to do anything else to get correct driver loaded.

Starting from version 4.0.0, minidriver is installed as plug-and-play driver and operating system should load the correct driver when card is inserted. In other words, SCPnP stands for "Smart Card Plug-and-play" service and it is used to install correct minidriver when smart card is inserted to smart card reader.

However, when using Windows Server versions, ScPNP is not supported by operating system. Therefore, when installing versions 4.0.0 … 4.0.14:

- Minidriver must be installed manually
    - Manual installation can be done in two ways;
        - Double-clicking .inf file that can be found from installation folder or
        - By adding "Legacy Hardwader" under "Device Manager"

Versions 4.0.16. …

- Installer notices if used platform is Microsoft Server
    - Minidriver is installed automatically

7 Web browser SSL/TLS Client Authentication challenges

Quite often SSL/TLS client authentication is associated to be similar method than other web authentication method, like username/password, digest or Windows-SSO authentication. Therefore, it is easy to make false expectation that web application's session is the only storage where user credentials are stored.

Setting up a secure socket session between a client and a server is the most time-consuming step in secure socket handshaking protocol and may take several hundreds of milliseconds to complete. On the other hand, a modern web browser opens multiple simultaneous secure socket sessions against the server to allow the page content to be displayed to the user as quickly as possible. Therefore, renegotiating the shared secret for each http request would make the browsing experience extremely slow.

To fix this problem, SSL/TLS offers mechanism to store the result of slowly negotiated "master secret" and when client opens new session it can just refer previously negotiated session ID with the result of much faster key agreement procedure.

Talking about SSL/TLS level client authentication, handshaking procedure is almost the same compared to the first time handshaking procedure. Only difference is that during handshaking, server requests the client to proof its identity. In DigiSign Client case, proving is done by performing cryptographic operation inside the smart card. If server successfully validates client's identity, "master secret" is shared and server associates authenticated user's certificate into newly created SSL/TLS session.

Here comes the most important part: Authenticated session is stored in the same way like any other SSL/TLS session and when the web browser requests new resource from server, it just refers to SSL/TLS session ID instead of running cryptographic operation inside smart card for every SSL/TLS request.

Web application can request the status of secure socket session, among authenticated user's certificate. Therefore, it is quite possible that session status is stored also inside the web application's session. In other words, authenticated user information may be stored in two different places: inside the secure socket session AND the web application session.

Therefore, web application developer should understand following session handling related details, before spending a lot of time while trying to figure out why new session remembers previous session credentials:

- Browser remembers old SSL/TLS sessions, most likely as far as it is running
    - Browser most likely does not forget secure socket sessions when
        - smart card is removed or changed in the reader,
        - browser has crashed and restarted or
        - sometimes even in the case when browser closed on purpose and restarted by the user.
- Server does not clear SSL/TLS sessions automatically when user logs out.
    - SSL/TLS session cache needs to be cleared by web application explicitly.
    - If SSL/TLS session cache is not cleared, a new session may end up to the situation where authentication is not required and a new user gets logged to the system with previous user credentials.

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