

Teradici Software Development Kit for Linux

The PCoIP Client Software Development Kit (SDK) for Linux is a set of libraries and binaries that allow developers to build custom PCoIP clients. The SDK is provided as part of Teradici Cloud Access Platform and the resulting client can connect to Cloud Access Software Standard Edition and Graphics Edition through the Cloud Access and Cloud Access Plus plans. The SDK includes the following components:

- Code Examples
- Programming Guide
- Session Client Source Code
- Session Client Binary Executable
- Session Client Libraries and API Headers
- Session Client API Documentation
- Broker Client Example Code
- Broker Client Libraries and API Headers
- PCoIP Core Libraries and API Headers
- PCoIP Core Binary

Supported Platforms

The PCoIP Client SDK can be used on the following **Linux** operating systems:

- Ubuntu 18.04

What Can You Build With the PCoIP Client SDK?

The PCoIP Client SDK provides developers the ability to embed a PCoIP session into any program or solution, or create a standalone client with a completely custom user interface and workflow. With complete control over how a PCoIP client is built, you can create clients that incorporate

customizations in both **pre-session** and **in-session** phases of a PCoIP connection. For example, the following customizations are all typical use cases:

Pre-Session Customizations

- Customizing the client user interface to create a branded, end-to-end solution using company assets such as:
 - Corporate Logos
 - Slogans, trademarks or other text
 - Corporate colors and iconography
- Developing customized authentication workflows, either directly or using a broker.
- Automatically connecting users to specific desktops or applications, based on an identified user type or task.
- Embedding a remote workload into an application.

In-Session Customizations

- Client branding, including:
 - Menu item labels
 - Window titles
 - Application icons
 - Company logos
- Automatic bridging of USB devices.
- In-session menu bar visibility.
- Disabling hot keys.
- Client display size in windowed and fullscreen mode.
- Configuring resolutions.
- Securely using local and bridged USB devices.

Complete control of the in-session user experience is possible using the PCoIP Core API.

Who Should Read This Guide?

This guide provides information for software developers and systems integrators with an understanding of SDK integrations and virtualization systems who are developing customized PCoIP clients. Readers should already understand the Teradici Cloud Access Software and how it is used in virtual environments, in both brokered and nonbrokered sessions. This guide will break down how to use the session client executable and how to use the broker client API, session client API and core API. This document is not intended for users who are unfamiliar with SDK integrations, or for Teradici Cloud Access Software users who do not require a customized PCoIP client. In this guide, you will learn about:

- PCoIP Session Components and Considerations
- Customizing the PCoIP Session
- Setting up a PCoIP Agent Test Environment
- Setting up a Development Environment for Linux
- Troubleshooting Issues related to Setting up, Developing and Building the SDK

Understanding terms and conventions in Teradici guides

For more information on the industry specific terms, abbreviations, text conventions, and graphic symbols used in this guide, see [Using Teradici Product and Component Guides](#) and the [Teradici Glossary](#).

What's in This Release?

This release introduces the following features and enhancements to the PCoIP Client Software SDK for Linux:

Connecting USB flash devices to a remote host

You can now connect USB flash devices to a remote host. Only flash drives can be connected. Only the USB 2.0 protocol is currently supported.

- USB 3.0 flash drives will not work when plugged into a USB 3.0 port, but will work when plugged into a USB 2.0 port.
- USB 2.0 flash drives will work when connected to a USB 3.0 port.

Improved Audio Input Bandwidth

PCoIP monitors the bandwidth available for audio and selects the audio compression algorithm that provides the best quality possible for the available bandwidth. Previously PCoIP endpoints use the Opus audio codec for audio output only, now this codec is available for audio input. By using the OPUS codec for audio input, high quality audio recording is possible even when bandwidth is limited.

Enhanced Security and Stability

This release contains improvements and enhancements around the security and stability of the PCoIP Client Software SDK for Linux.

PCoIP Ultra

This release contains improved support for PCoIP Ultra, our latest PCoIP protocol enhancements. This is an evolving feature that will continually improve with each release. For more information see the [PCoIP Agent](#) documentation.

Auto-Forward USB Devices

This release enables USB devices to be automatically redirected to the remote desktop on connection. Either all devices can be forwarded or a set of devices specified by VID/PID.

System Requirements

The following table outlines the system requirements for the PCoIP Client SDK for Linux:

| System | Version Required |
|--|---|
| PCoIP Client SDK Operating Systems | <ul style="list-style-type: none"> • Ubuntu Bionic Beaver 18.04 <p>You can use an Ubuntu 18 container if you wish to run the client on another OS.</p> |
| Compatible PCoIP agents | All PCoIP agents and versions |
| Compatible Teradici Remote Workstation Cards | TERA22x0 with firmware 5.0.1+ |
| Compatible PCoIP Host Software | <ul style="list-style-type: none"> • Host Software for Windows: 4.3.1+ • Host Software for Linux: 4.7.0+ |



Remote Workstation Platforms

PCoIP Host Software must be installed on Remote Workstation machines to enable keyboard and mouse functionality.

Wacom Tablet Support

Wacom Tablets are not supported with the PCoIP Software Client for Linux at this time.

USB Support

PCoIP Clients supports redirecting USB devices to a remote session. Administrators can set rules governing allowed and disallowed devices, device classes, or device protocols.

Important: USB support is enabled by default

USB bridging is enabled by default. If you want to restrict or disable USB support, you can globally disable or set rules governing USB behavior via GPO settings on the PCoIP Agent.

Client USB Protocol Support

USB 3.0 flash drives will not work when plugged into a USB 3.0 port, but will work when plugged into a USB 2.0 port.
USB 2.0 flash drives will work when connected to a USB 3.0 port.

Isochronous USB device support

USB devices with time-sensitive information, such as webcams, are not generally supported. However, Teradici's technology partners provide additional solutions to expand peripheral support such as webcams. For more information, look for partners listed under *Peripherals* on the [Teradici Technology Partners](#) page.

About PCoIP Sessions

Establishing a PCoIP session involves a number of key components, including system actors, PCoIP session phases, and connection brokers as discussed next.

System Actors

There are at least three components that work together to create a PCoIP session:

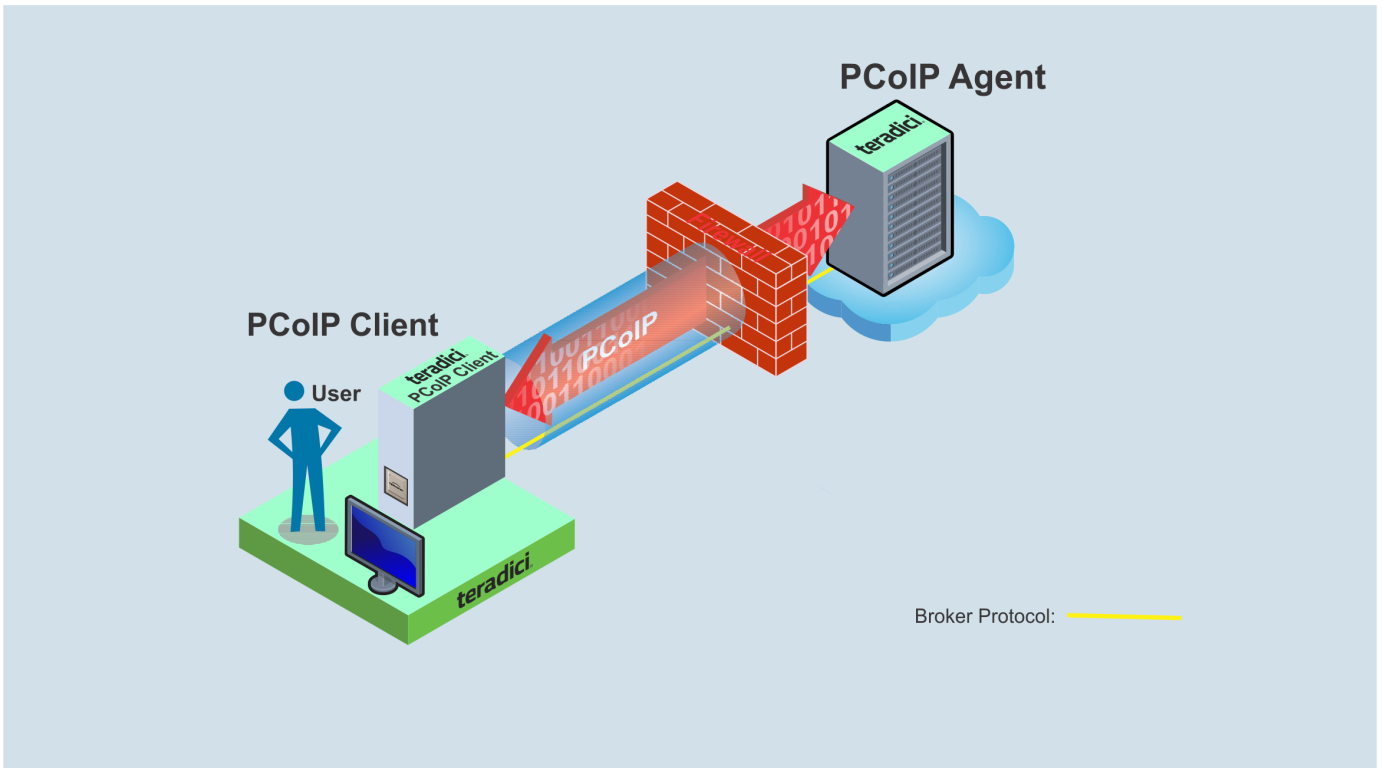
- **PCoIP client:** The hardware or software device, local to the user, which requests and drives the PCoIP session by negotiating with PCoIP brokers and PCoIP agents.
- **PCoIP Broker:** Brokers maintain lists of active users, their authentication information, and the host machines they can connect to. Except for systems using direct connections, all PCoIP sessions are negotiated via third-party brokers.
- **PCoIP agent:** The Teradici extension installed on the host machine. The PCoIP agent is the single point of access for PCoIP clients, and handles all video, audio, and USB exchanges between the client and desktop.

Terminology: Hosts and Desktops

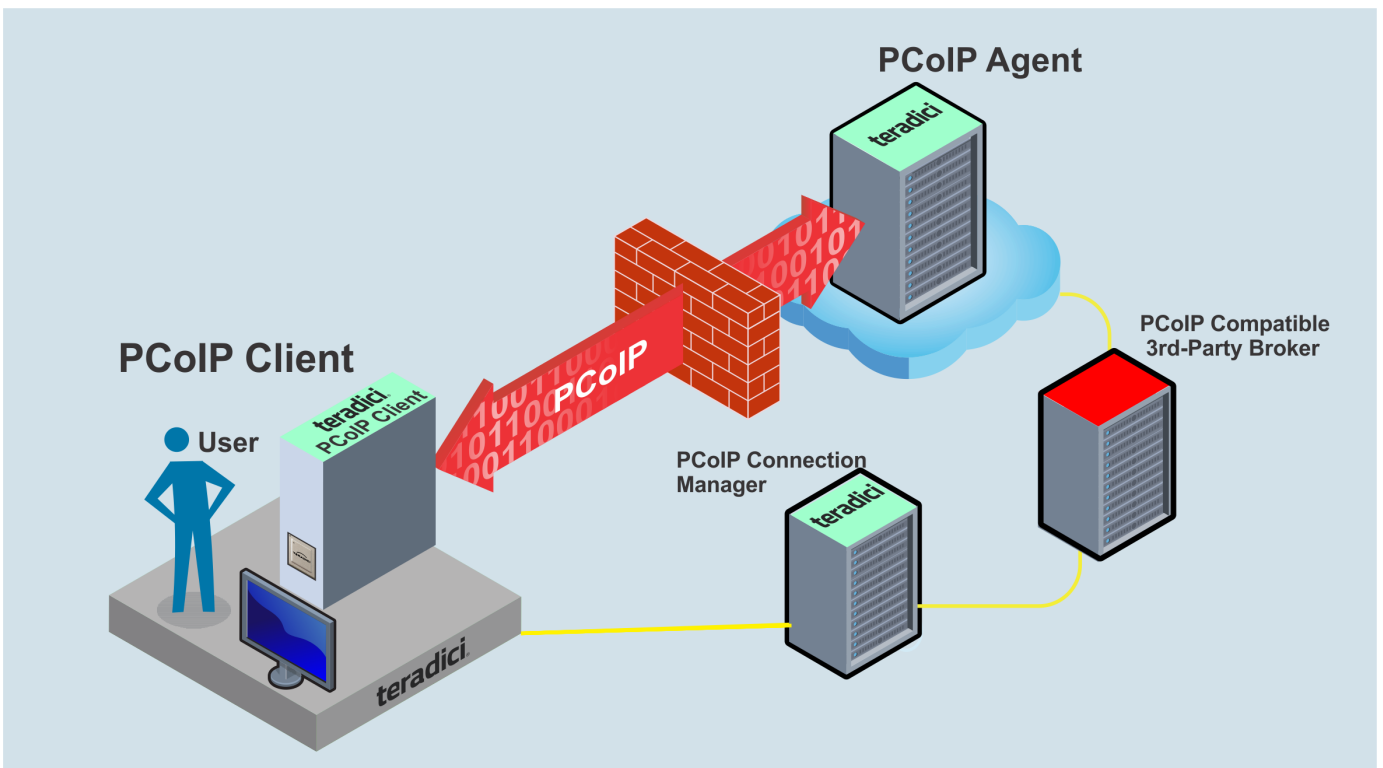
Host refers to a Windows, or Linux machine, either virtual or physical, which has a PCoIP agent installed and can serve a remote desktop to a PCoIP Client. **Desktop** refers to an entity which is delivered to the client as a remote workload. This is typically a full Windows or Linux desktop, but it can also be configured to present a single application.

The following diagrams show the actors outlined above in a brokered and direct connection:

Direct Connection



Brokered Connection



PCoIP Session Phases

There are two phases in a PCoIP session:

- **Pre-session** In the pre-session phase, a PCoIP client communicates with a PCoIP broker to authenticate a user and obtain a list of desktops for which that user is authorized. The client then presents this list to the user for selection, and asks the broker to establish a PCoIP session with the selected desktop.
- **Session** In the session phase, the PCoIP session has been successfully launched and the client is connected to the remote desktop. Once the PCoIP connection is established, a session client is invoked by the pre-session client. The session client is primarily a conduit between the host and the client applications. For a list of customizable in-session properties, with examples, see [Customizing the PCoIP Session](#).

About Brokered and Non-Brokered Connections

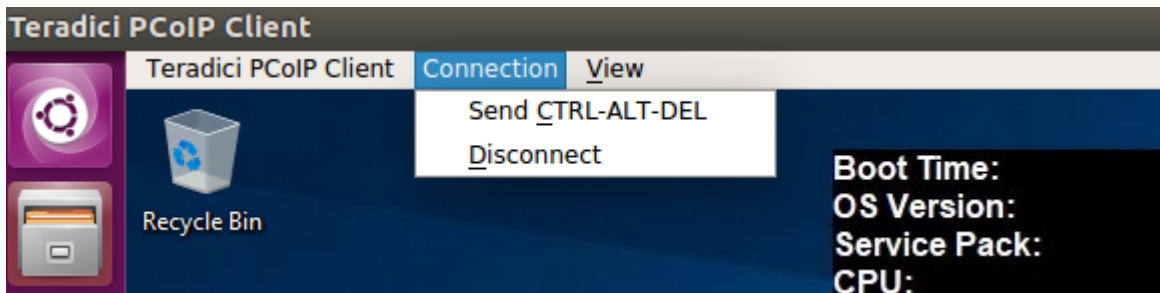
PCoIP-compatible brokers are resource managers that authenticate users and dynamically assign authorized host agents to PCoIP clients based on the identity of the user. PCoIP clients can connect to PCoIP agents using a PCoIP-compatible broker, called a **brokered** connection, or directly, called a **non-brokered** or **direct** connection. The broker client library included in the Client SDK is designed to communicate with PCoIP-compatible brokers using the PCoIP Broker Protocol. In direct connections, when no broker is used, the PCoIP agent acts as its own broker. The client makes the same calls to the broker client library in either case.

Example pre-session Client

The included pre-session client, `broker_client_example`, uses the included broker client library to execute transactions using the PCoIP Broker Protocol. This example client demonstrates how to establish both brokered and non-brokered connections

Disconnecting a Session

To disconnect a PCoIP session from either client, select the **Connection > Disconnect** menu option.



Quitting the application will also disconnect the current session.

Session Reconnection

If a network interruption is detected, the PCoIP session enters a reconnecting phase. In this phase the client will show you the network reconnecting dialog which indicates that there is a network issue and that the client is trying to reconnect and re-establish the PCoIP session. You can click **disconnect** to cancel the attempted reconnect and disconnect the session completely. If the reconnection is successful, the notification dialog will disappear and the session will be restored, if not, the session will be disconnected completely.

Changing the PCoIP Software Client Window Mode

You can use the PCoIP Software Client in full-screen or windowed mode. Full-screen mode is recommended in most cases.

Activating Full Screen Modes

The PCoIP Software Client provides two full-screen modes: one monitor and all monitors.

To switch from windowed mode to full-screen mode:

- To use one full-screen display, select **View > Show Fullscreen One Monitor**.

All open windows and applications will be moved to a single full-screen display. This is equivalent to disconnecting all but one monitor from a physical host.

- To use all available full-screen displays, select **View > Show Fullscreen All Monitors**.

This mode shows full-screen displays on all client monitors.

Keyboard shortcut

You can also enter full-screen mode by pressing **Ctrl+Alt+Enter** while in windowed mode. The shortcut will activate whichever full-screen mode was used last, or *all monitors* if no previous selection was made.

To switch from Fullscreen One Monitor to Fullscreen All Monitors mode:

1. Reveal the menu bar by moving the mouse cursor to the top of a client display.
2. Select **View > Show Fullscreen All Monitors**.

To switch from Fullscreen All Monitors to Fullscreen One Monitor mode:

1. Reveal the menu bar by moving the mouse cursor to the top of a client display.
2. Select **View > Show Fullscreen One Monitor**.

Persistent Display Topology

Depending on the display topology mode you have selected, for example **Fullscreen One Monitor**, if you disconnect and then reconnect to the session, it will maintain that same mode upon reconnection. The state and mode will be preserved.

Minimizing the PCoIP Software Client from a Full-screen Mode

To minimize a software client in full-screen mode:

1. Reveal the menu bar by moving the mouse cursor to the top of any display.
2. Select **View > Minimize Client**.

Keyboard shortcut

You can also minimize the client by pressing **Ctrl+Alt+m** while in any full-screen mode.

Activating Windowed Mode

To switch from full-screen mode to windowed mode:

1. Reveal the menu bar by moving the mouse cursor to the top of any display.
2. Select **View > Leave Fullscreen**.

Keyboard shortcut

You can also enter windowed mode by pressing **Ctrl+Alt+Enter** while in any full-screen mode.

Enhanced Audio and Video Synchronization

Enhanced Audio and Video Synchronization provides improved full-screen video playback, reducing the difference in delays between the audio and video channels and smoothing frame playback on the client. This improves lip sync and reduces video frame drops for movie playback.

This feature introduces a small lag in user interaction responsiveness when enabled. Using enhanced audio and video synchronization will reduce the maximum frame rate.

Enhanced A/V Sync is enabled on a per-display basis, so you can dedicate individual displays to playback without impacting responsiveness on the others.

The enhanced A/V Sync feature is turned off by default and needs to be turned on for the menu items to appear.

To turn on A/V Sync:

1. Go to `~/.config/Teradici/Teradici\PCoIP\Client.ini` and add the following line:

```
enable_enhanced_avsync=1
```

The above text is OS specific. Note the setting changed from 0 to 1.

When enabled, a check mark will appear beside the enhanced A/V Sync menu item on that display. It is disabled on all displays by default.

To use enhanced A/V Sync:

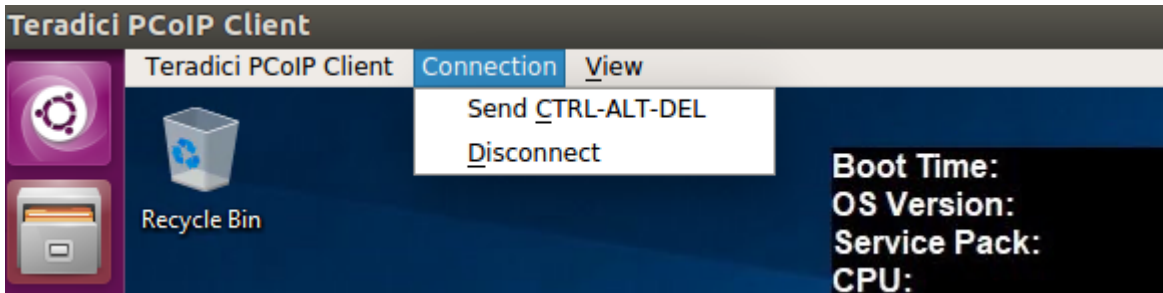
1. If you are in full-screen mode, reveal the menu bar on the display you want to enhance by moving the mouse cursor to the top of the screen.
2. On the display you want to enhance select **View>Enhanced A/V Sync** to toggle the enhanced sync mode.

Persistent Display Topology

The Enhanced Audio and Video Synchronization feature is persistent across sessions from the same client, provided that the display topology has not changed.

Sending a Ctrl-Alt-Del Command

To send the Ctrl-Alt-Del keyboard command to a remote workstation, select the **Connection > Send CTRL-ALT-DEL** menu option.



Changing the Language

In addition to English, the PCoIP Software Client also supports a number of different languages. During installation, you can select one of the supported languages.

To change the language in GNOME

- In the **Settings > Language and Region** panel, select another language from the language setting.

To change the language on the command line

Alternatively, the language can be set with the `locale` parameter on the command line:

```
pcoip-client locale <locale-code>
```

The following table lists the available language translations and codes:

| Language | Code |
|---------------------|-------|
| German | de |
| Spanish | es |
| French | fr |
| Italian | it |
| Japanese | ja |
| Korean | ko |
| Portuguese (EU) | pt |
| Portuguese (Brazil) | pt_BR |
| Russian | ru |

| Language | Code |
|-----------------------|-------|
| Turkish | tr |
| Chinese (Simplified) | zh_CN |
| Chinese (Traditional) | zh_TW |

PCoIP Ultra

The PCoIP Client provides support for PCoIP Ultra, the latest protocol enhancements from Teradici. PCoIP Ultra is optimized for truly lossless support with bit-exact color accuracy and preservation of content detail at the highest frame rates.

PCoIP Ultra protocol enhancements propels our industry-recognized performance into the future of remote computing, with faster, more interactive experience for users of remote workstations working with high-resolution content.

PCoIP Ultra is disabled by default. To enable it, see [Enabling PCoIP Ultra](#).

PCoIP Ultra Enhancements

In version 19.05, PCoIP Ultra provides the following benefits:

- Support for 4K/UHD high frame rate content.
- Efficient scaling across multicore CPUs leveraging AVX2 instruction sets.
- Highest image quality with efficient build-to-lossless and color-accurate.
- Dynamic network adaption and network resilience.

The Software Client for Linux 19.05 with PCoIP Ultra contains certain limitations around USB and printer plugin redirection. The latest beta version of PCoIP Ultra is available via our Technology Preview version, as outlined below.



PCoIP Ultra Technology Preview

PCoIP Ultra is an evolving technology, and new capabilities and enhancements are introduced frequently.

If you would like to test unreleased versions of PCoIP Ultra, we invite you to join the PCoIP Ultra Technology Preview program. Technology Preview users receive pre-release versions of Teradici software for use in non-production environments, and provide feedback to our engineering teams.

To learn more and to join the technology preview, visit the [Teradici Support site](#).

Requirements

To take advantage of PCoIP Ultra, you need to meet these requirements:

- A PCoIP agent (any type) 19.05.0 or later.
- A PCoIP Software Client for macOS, PCoIP Software Client for Windows or PCoIP Software Client for Linux, 19.05.0 or later.

PCoIP Software Client for Linux users

Support for PCoIP Ultra on the PCoIP Software Client for Linux is provided via the PCoIP Ultra Technology Preview as described above.

- The CPUs on both the agent and the client machines must support the AVX2 instruction set.

Session Client Binary

The SDK installs a session client binary (`client_session`), which can be invoked via command line or programmatically from a pre-session client. The session client for Linux is located in the following system path (post-installation):

- `/usr/bin/client_session`

For an example of programmatically invoking the in-session client, search for `launch_session` in `/usr/lib/x86_64-linux-gnu/pcoip-client/examples/broker_client_example/broker_client_example_main.cpp`. After the PCoIP connection is established, several command line options are available from the in-session client, as documented in Customizing the PCoIP Session above.

Customizable Session Features

The following PCoIP session features can be customized:

- Session Menu bar Visibility
- Disable Hot Keys
- Windowed or Fullscreen Mode
- Set Host Resolution
- Custom Client Branding
- Image Scaling
- Maintain Aspect Ratio
- Locale
- Session Log ID
- Log Level
- Log File Name
- Force Native Resolution



Examples show command-line usage

The examples shown here invoke the session client via the command line. You can also set these properties when invoking the session client programmatically.

Disable Session Menu Bar Visibility

To enhance the user experience the PCoIP Session Client enables the menu bar by default, however some use cases may require that it be disabled, or hidden, in order to prevent the user from accessing menu functionality. To disable the menu bar feature use the parameter `disable-menubar` .

Disable Hot Keys

To improve usability, session hot keys, such as **Ctrl+Alt+Enter**(which switches from Fullscreen to Windowed Mode) are available to users by default. The parameter for this feature is `disable-hotkeys` .

Windowed or Fullscreen Mode

Depending on your application needs, you can display the PCoIP session in either windowed or fullscreen mode. Fullscreen mode allows the display topology to support multiple monitors as an extended desktop; windowed mode gives you the flexibility to display multiple application windows in parallel and switch between them quickly. Windowed mode improves the user experience, as well as resulting in an increase in performance. Windowed mode is the default mode, and to activate fullscreen mode use the `full-screen` parameter.

Set Host Resolution

Normally, the session client opens with arbitrary window dimensions. In some cases, you may wish to lock the resolution of your host application displays. This ensures the user's viewing experience is consistent across different monitors and their native resolutions. The parameter for this feature is `set-host-resolution` .

- **Host Resolution Limitations:** It is only possible to specify one target resolution for all displays. The host resolution will not perform to its optimal capability if you have monitors with different resolutions.

Custom Client Branding

You can customize the branding of your custom session client in several ways by creating a client branding package. These customizations affect the user's experience once they have connected to their PCoIP session. The parameters for this feature are `branding-package` and `branding-hash` . The following elements can be customized in the session client:

- The OS application title and logo

- The session client toolbar title and logo
- The logo displayed in the OS taskbar
- The following default menu item label:
 - *About PCoIP Client*
 - *Quit PCoIP Client*
- The content shown in the **About** dialog:
 - Replace the dialog text
 - Provide hyperlinks to corporate resources and product information
 - Add a custom logo
- Customize a client alert and message window titles.

Image Scaling

The image scaling feature enables scaling on the client without having to specify the desktop resolution. You can apply image scaling when the resolution of the client monitor is not the same as the resolution provided by the host. This feature provides a smoother process for image scaling on the client. The parameter for this feature is `enable-scaling`.

Maintain Aspect Ratio

If the host and client aspect ratios do not match, and this parameter is not used then the display will be stretched to fit. The parameter for this feature is `maintain-aspect-ratio`. If the native aspect ratios of the host's display and the client's display do not match, the host's aspect ratio will be preserved and will appear in the client with black bars either on the sides or top and bottom of the display.

Locale

The Local feature enables you to use the appropriate localized user interface for the client session. This feature will make the session GUI more flexible to accommodate a wide range of languages.

You can choose the language translation you require by setting the `locale` parameter. The following table states the available language translations and codes:

| Locale Code | Language |
|-------------|-----------------------|
| de | German |
| es | Spanish |
| fr | French |
| it | Italian |
| ja | Japanese |
| ko | Korean |
| pt | Portuguese (EU) |
| pt_BR | Portuguese (Brazil) |
| ru | Russian |
| tr | Turkish |
| zh_CN | Chinese (Simplified) |
| zh_TW | Chinese (Traditional) |

Default Language

By default, the language is set to English.

Session Log-ID

`log-id` is a UUID that uniquely identifies the session in all PCoIP log files.

Log Level

`log-level` is the log level parameter. It is possible to over-ride the default log-level, which is 2, by specifying a different log-level parameter. All messages at the specified level or lower will be logged. The following parameters apply:

- 0 = Critical
- 1 = Error
- 2 = Info
- 3 = Debug

Troubleshooting and Support

When reproducing issues for the purposes of troubleshooting and support, set the log level to **Debug**. This will enable you to capture a log of all information messages and errors.

Log File Name

The default location of the log file may be overridden using the `logfile` parameter to specify a full path and file name for the log-file.

Custom Location

If a custom location is used for the log file then the support bundler script should be updated to capture the logs from that location.

Force Native Resolution

The resolution of the client monitor can be set to the native resolution when the session client is launched using the `force-native-monitor-resolution` parameter

Branding Your Session Client

You can customize the branding of your custom session client in several ways by creating a client branding package. These customizations affect the user's experience once they have connected to their PCoIP session. The following elements can be customized in the session client:

- The OS application title and logo
- The session client toolbar title and logo
- The logo displayed in the OS task bar
- The following default menu item label:
 - *About PCoIP Client*
- The content shown in the **About** dialog:
 - Replace the dialog text
 - Provide hyperlinks to corporate resources and product information
 - Add a custom logo
- Customize client alert and message window titles.

Supporting USB Devices

Redirection of USB devices is not supported at this time. Local mouse and keyboard devices are accessed via the local Linux OS.

Kernel Network Configuration

The `pcoip-configure-kernel-networking.sh` script is installed with the PCoIP Client SDK for Linux. This script tunes the kernel networking configuration to facilitate the network performance required by the Client. You need to run this script after installing the PCoIP Software Client for Linux.

Run the following command:

```
$ sudo pcoip-configure-kernel-networking.sh --persistent
net.core.rmem_max = 32000000
net.core.rmem_default = 32000000
net.ipv4.udp_mem = 1000000 2000000 4000000
net.core.netdev_max_backlog = 2000
```

The script contains the following parameters:

- `rmem_default` : A kernel parameter that controls the default size of receive buffers used by sockets.
- `rmem_max` : A kernel parameter that controls the maximum size of receive buffers used by sockets.

`rmem_max` size

This parameter must be at least as large as `rmem_default` /

- `ipv4.udp_mem` : A kernel parameter that controls the maximum total buffer-space to allocate.
- `netdev_max_backlog` : A kernel parameter that controls the maximum size of the receive queue.

Session API Features

A list of the features specific to the Session API.

How to Establish a PCoIP Session

Before you can establish a PCoIP session with a host desktop, gather the following host desktop details:

- IP address
- Port number
- Session ID
- Server name indication (SNI)
- Connection tag

This information can then be passed to the provided in-session client to establish a PCoIP session programmatically. See the example code for specific call syntax. In terms of programming interface, there are two ways that the connection and security information can be presented to `client_session`:

Pass the pieces of information individually to the executable. The following command invokes `client_session` to establish a PCoIP session and passes the connection and session information as parameters, where:

- **Connection tag:**

```
SCS1WsopFJ3iz1l48PTJMXFkcD4b6M9aiakHXH3e1lLhUR0BceWAifSSn%2b4AV1FC
8IihWVmsISmYFKeA25AtzFrdMpdaCtqliC0zfxAA
```

- **IP address:** `10.64.60.115`
- **Session ID:** `2305843009213693961`

```
client_session -i connect-tag=
SCS1WsopFJ3iz1l48PTJMXFkcD4b6M9aiakHXH3e1lLhUR0BceWAifSSn%2b4AV1FC
8IihWVmsISmYFKeA25AtzFrdMpdaCtqliC0zfxAA address=10.64.60.115
session-id=2305843009213693961
```

Encode all information into a string container (URI) and then pass to the executable. The following command invokes `client_session` to establish a PCoIP session and passes the

connection tag as a parameter and a URI encapsulating the IP address and Session ID in a string container, where:

- **Connection tag:**

```
SCS1WsopFJ3iz1l48PTJMXFkcD4b6M9aiakHXH3e1lLhUROBceWAifSSn%2b4AV1FC  
8IihWVmsISmYFKeA25AtzFrdMpdaCtqli0zfxAA
```

- **URI:** "teradici-pcoip://10.64.60.115:4172?sessionid=230584300921369396"

URI Format Documentation

There is a document describing the URI format in the root of the SDK.

```
open /Applications/ClientSession.app connecttag=  
SCS1WsopFJ3iz1l48PTJMXFkcD4b6M9aiakHXH3e1lLhUROBceWAifSSn%2b4A  
V1FC8IihWVmsISmYFKeA25AtzFrdMpdaCtqli0zfxAA "teradicipcoip://  
10.64.60.115:4172?session-id=230584300921369396"
```

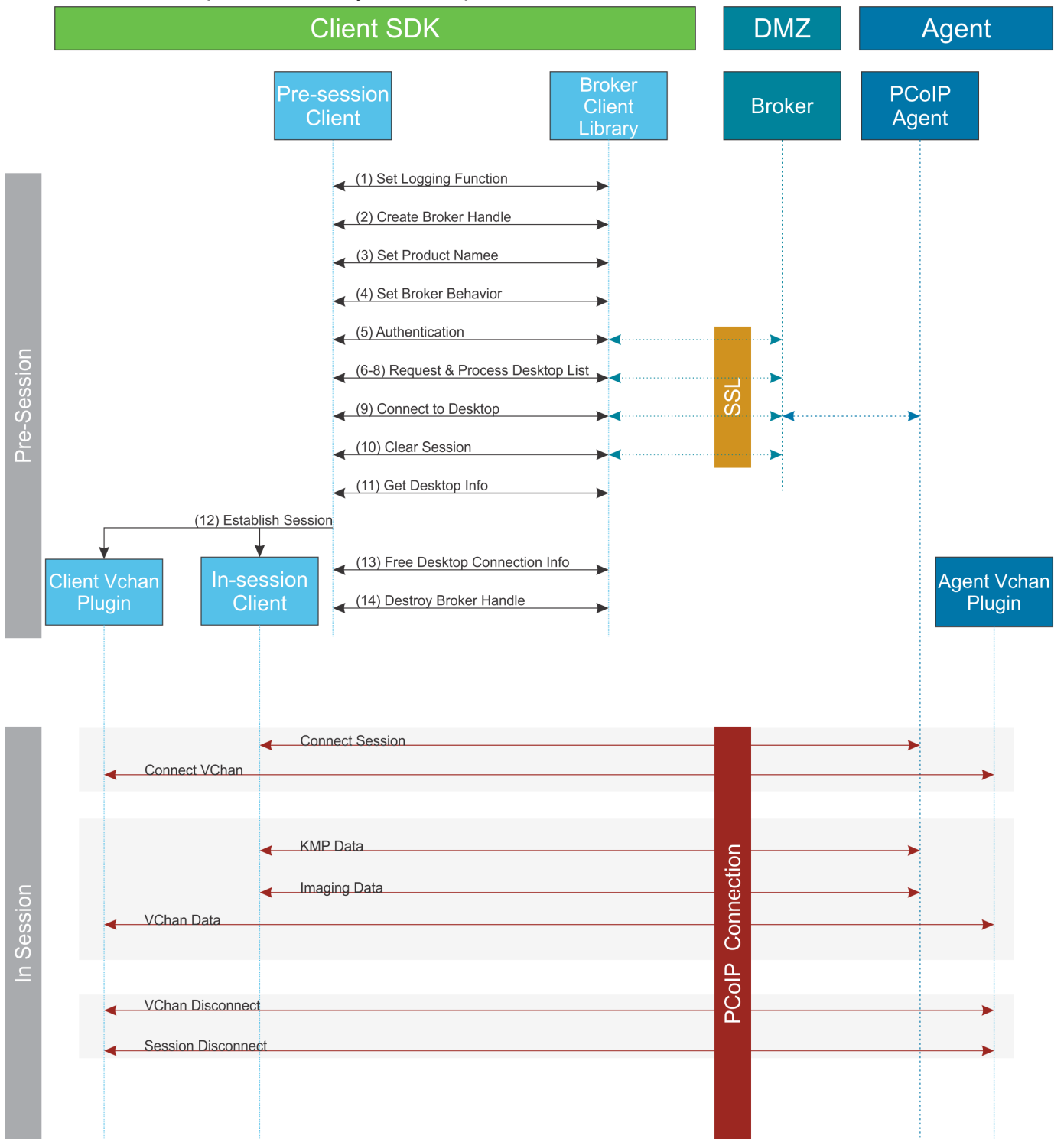
PCoIP Session-Creation Steps and Actors

The steps indicated below are used and documented in the bundled sample code. Refer to the code for specific function calls, expected return values and error-handling requirements. The example C++ code can be found in the SDK package located here:

Direct (non-brokered) connections

When there is no PCoIP broker in a system, as in direct connections, the PCoIP agent acts as its own broker. Clients make the same calls to the Broker Client Library whether there is a PCoIP broker inline or not.

PCoIP Session Sequence used by the Sample Client



Each of these steps is used in the sample code, with a comment identifying the step number.

Custom Log Implementations

You can design and implement your own logging functionality, so long as it follows the same callback signature of the log function template that is required by the PCoIP Client SDK API.

1. **Set a logging function** The `broker_client_library` requires users to provide a log function as part of the logging mechanism. A log function template is provided in the example code.
2. **Create a broker handle** Create a handle for the broker instance.
3. **Set client information** This information identifies your client to the broker. It should include the client name, client version, and client platform.
4. **Set broker address and behavior on unverified certification** This step identifies the address of the broker you want to connect to, and specifies error handling in the event the broker identity cannot be verified.
5. **Authentication between the broker and the client** This step requests an authentication method from the broker, and then submits the user's authentication information to the broker using the supplied authentication method. The client must implement all the authentication methods required by the broker.
6. **Request desktop list** Once the client is successfully authenticated by the broker, request a list of host servers (desktops) that the authenticated user is allowed to access.
7. **Retrieve desktop info** Loop through each desktop in the list acquired in step 6, requesting the name and ID of each desktop.
8. **Process the desktop list** Perform any processing required on the desktop list, and provide it to the user interface for selection.

Desktop Selection Presentation Customization

At this stage, you can also customize the dialogue and interface the user will use to select a desktop.

9. **Connect to selected host server** This step asks the broker to set up the PCoIP session. The broker then contacts the agent, which supplies the necessary information (most notably the session tag) the client will need to establish the connection later. The PCoIP session is not established yet at this stage.
10. **Clear session with broker** On a successful connection, clear the broker session. This effectively disconnects the client from the broker.

11. **Get desktop connection information and launch the session** Request the connection and security properties from the desktop (for example, its IP address, its port number, or a session ID), and handle errors if any of the required properties are not returned.
12. **Proceed with established session** This step invokes `client_session`, and implements the actual PCoIP connection. For specific instructions regarding establishing PCoIP connections, see [How to Establish a PCoIP Session](#).
13. **Free desktop connection information** When the in-session client has been invoked, dispose of the collected desktop information.
14. **Destroy the broker client handle** Destroy the broker handle.

Session Client Integration

There are two methods of integrating the in-session phase, integrating using the session client binary or using the session client API. The following diagrams show these methods in relation to integrating the SDK into a custom application:

Session Client Binary Integration

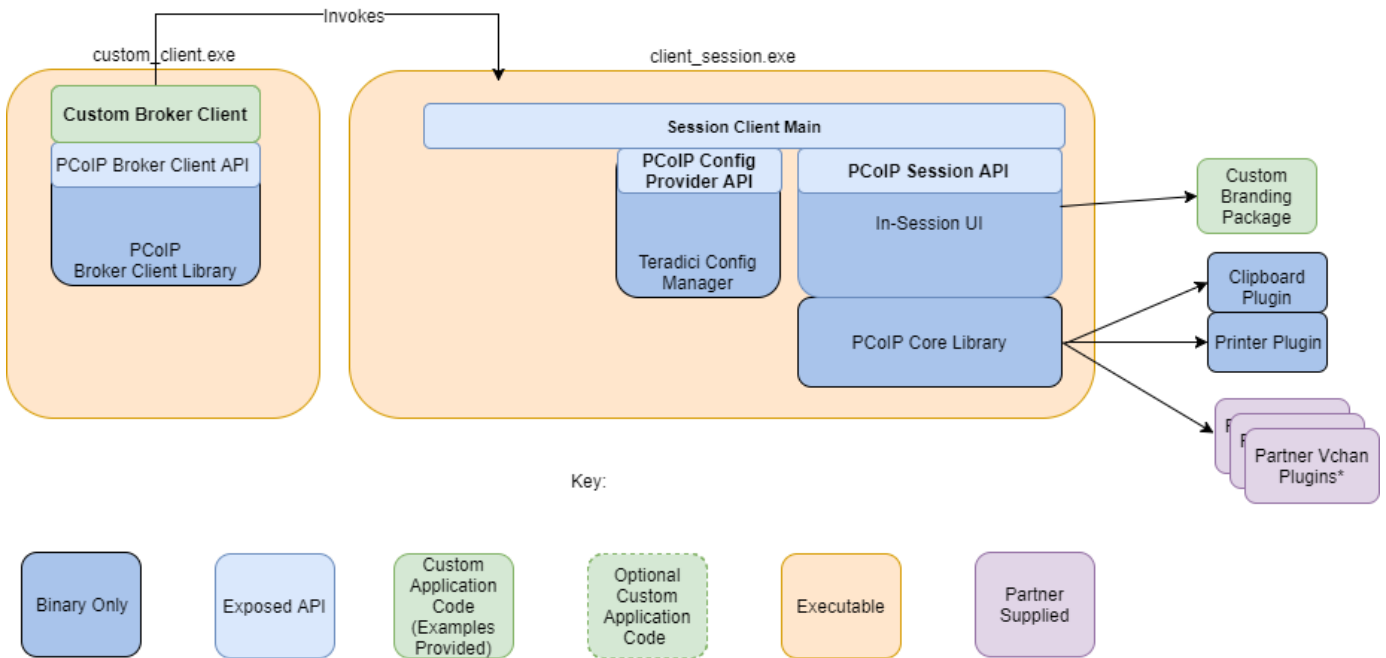
This method uses the session client binary as a separate in-session application. This is the simplest way to use the client SDK and it is recommended as the initial mode to use for developing your own client. In this mode, the pre-session and session phases are handled by separate executables:

- Write a custom pre-session executable according to your workflow and needs using the `broker_client_example` source code as a starting point. For more information see [Session Client API Integration](#).
- Use the stock `client_session` executable, which is located within the SDK at "`path-to-unzipped-sdk-package`"/`usr/bin/client_session`, to establish the connection.

Security Considerations

The values passed to the `client_session` executable include sensitive information required to establish a session with the host. In particular, the connection tag is a single-use time-limited (60 seconds) token that allows the `client_session` executable to connect to the host as an authenticated user. If an attacker is able to gain visibility to command line parameters as they are passed to `client_session`, it is possible that they could use them before `client_session` does and gain access to the host as that user. It is vital to ensure good security practices are applied to the client machine to prevent it from being compromised. This type of attack can be avoided completely by integrating the pre-session and `client_session` into a single executable as described in the following section.

Binary Integration



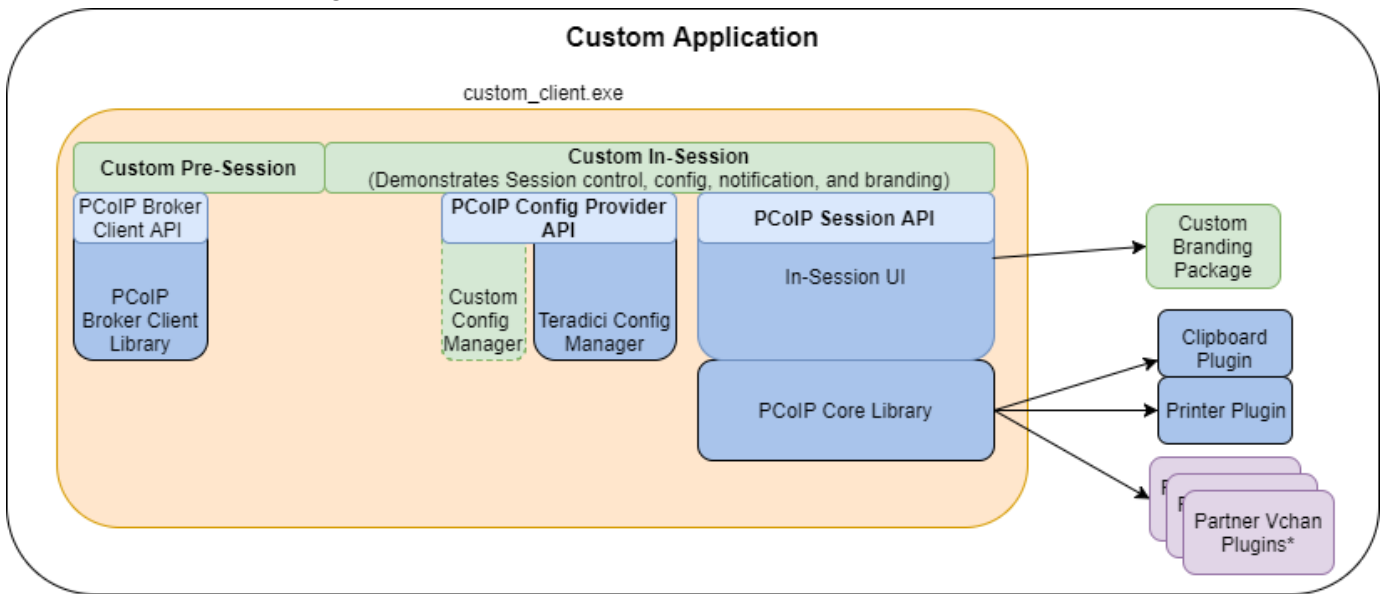
Session Client API Integration

This method uses the session client API to integrate the in-session functionality into a custom application. This method is necessary if you wish to modify the behavior of the `client_session` executable beyond that which is possible via its command line interface, or if you need to integrate the pre-session and `client_session` into a single executable. In this mode you will use:

- The `broker_client_example` source code as a starting point for writing custom pre-session functionality
- The `client_session` source code as a starting point for integrating with the Session Client API.

The Session Client API provides a simple high level C++ interface for configuring, starting, and stopping a session using the values obtained from a broker.

Session Client API Integration



Key:



*Partner Virtual Channel Plugins can be developed using the Virtual Channel SDK to enable this you can combine the PCoIP Client SDK with the PCoIP Virtual Channel SDK. For more information, see the [Virtual Channel SDK](#).

Minimal Client Example

The following is an example of how to use the Teradici broker libraries and the PCoIP Session libraries to connect to an agent and launch a PCoIP session.

The following steps outline how to build this example:

1. Install the SDK.
2. Create a build/directory inside *minimal_client/*
3. From *build/*, run cmake configure and build commands.
4. Update the login_info.txt with the address and credentials of an authentic agent so that the built client can talk to the agent.
5. Run the built minimal_client application. It should be able to launch a brokered PCoIP Session to the agent.

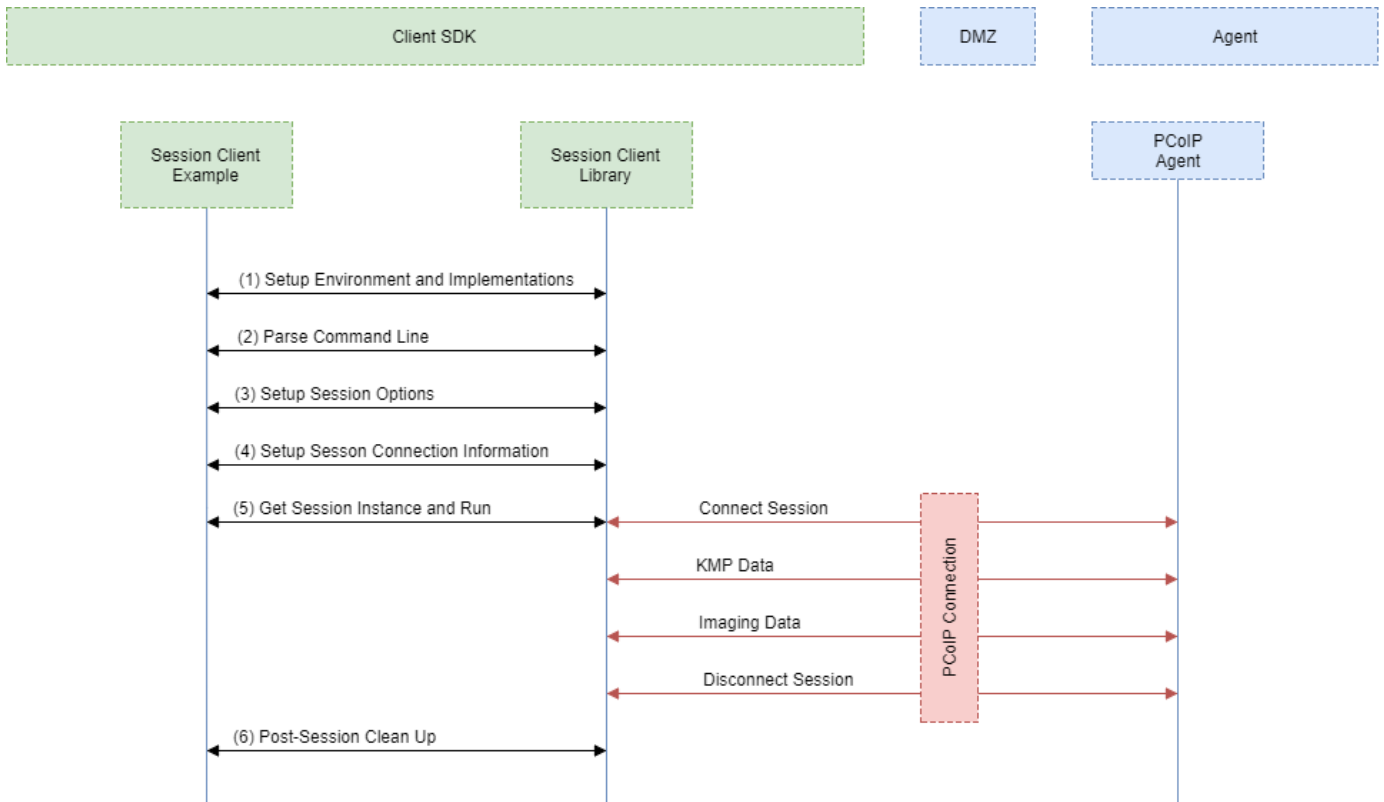
Passing Customization Parameters to the Session Client

When using the `l` parameter to automatically pass session information to the session client, you can pass additional session client parameters by enclosing them in double quotes. This enables you to demonstrate session client functionality without racing to build a command line string within the session client's 60-second window. For example, to invoke the session client with the menu bar disabled, type:

```
broker_client_example login_info.txt l "disable-menubar"
```

Using the Client Session API

Use of the Client Session C++ API is demonstrated in `<pcoip_client_sdk_session/modules/client_session/src/client_session_main.cpp>` . It includes the steps outlined in the diagram below:



PCoIP Session Client API Sequence Diagram

Each of these steps is used by the Session Client API, with a comment identifying the step number:

1. **Setup Environment and Implementations:** Os specific initialization. Instantiate a Configuration Provider object.
2. **Parse Command Line:** Define and parse supported command line parameters.
3. **Setup Session Options:** Validate the options passed via the command line and setup the Configuration Provider object accordingly.
4. **Setup Session Connection Information:** Pack the session parameter, received via the command line, into the structures required by the API.

5. **Get Session Instance and Run::** Obtain the main session object, set the Configuration Provider and run the session. The run call blocks until the session is terminated.
6. **Post-Session Clean-up:** Performs any post-session shutdown processing.

Creating a Branding Text Layout File

The layout file format used to customize the session client is an UTF-8 XML text file. The layout schema is a top-level `<pcoip-client-branding/>` element with a version attribute describing the schema version, and containing the required elements described next:

```
<pcoip-client-branding version="1.0">
...
</pcoip-client-branding>
```

The available elements are outlined in the following table:

| Parent Element | Child Element | Description |
|-----------------------------------|---------------------------------|---|
| <code><app-name></code> | | Required! The name of your custom session client. This will be used as the application window file. |
| <code><app-icon></code> | | Required! The file name of your application icon. In Windows, this appears in the Windows toolbar and the window header. |
| <code><toolbar-menu></code> | | Required! Describes the text labels used in OS toolbar menu's. |
| | <code><about-item></code> | The text label for the About... menu item. Optional. Without this field, there will not be an About menu item. |
| | <code><quit-item></code> | The text label for the Quit... menu item. Optional. Without this field, you will not have a Quit menu item. |
| <code><about></code> | | Required! Describes the contents of the About... dialog. Must have the following required attributes: title (<i>string</i>): The dialog text and minWidth (<i>number</i>): The minimum pixel width of the dialog. For example: <code><about title="My Custom Client" minWidth="100"></code> |

| Parent Element | Child Element | Description |
|----------------|---------------------------|--|
| | <code><line></code> | Describes a line of text in the dialog. All lines are optional, but the About window will be empty unless you provide at least one. <code><line></code> accepts the following attributes: align (<i>string keyword</i>): The text alignment; for example, "center". This alignment applies to all child elements of the line. Lines can be self-closed to create a blank line (). <code><line></code> can contain the following elements: <code><logo></code> contains a filename for a logo or other graphic element: <code><logo>about_logo.png</logo></code> . <code><text></code> contains the display text for each line: <code><text>This text is displayed on the line.</text></code> . <code><hyperlink></code> takes a url parameter and creates a working hyperlink: <code><hyperlink url="www.teradici.com">Teradici</hyperlink></code> . |

A full text layout file looks like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<pcoip-client-branding version="1.0">
<app-name>My Custom Client</app-name>
<app-icon>app_icon.png</app-icon>
<toolbar-menu>
<about-item>About My Custom Client</about-item>
<quit-item>Quit My Custom Client</quit-item>
</toolbar-menu>
<about title="About My Custom PCoIP Client" minWidth="0">
<line align="center"><logo>about_logo.jpg</logo></line>
<line />
<line align="center"><text>My PCoIP Client</text></line>
<line align="center"><text>Version 0.0.0</text></line>
<line align="center"><text>© Copyright 2016 My
Corporation</text></line>
<line align="center">
<hyperlink url="www.my-company.com">My company</hyperlink>
</line>
<line />
<line align="center">
<text>For help, click here: </text>
<hyperlink url="www.google.com">Google</hyperlink>
</line>
</about>
</pcoip-client-branding>
```

Creating a Branding Package

In order to customize your session client, you must create a client branding package using the Teradici Custom Branding Package Utility. The Teradici Custom Branding Package Utility is located in the following location:

- **Linux clients:** `usr/bin/TeradiciBrandingPackageUtility`

To create a custom branding package:

1. Create a product icon as a png file at 128px x 128px.
2. Create a company logo as a png file at any size.
3. Create a text layout file describing the customized UI element strings and dialog content.
4. Create the branding package with `TeradiciBrandingPackageUtility`.

```
TeradiciBrandingPackageUtility -x my_custom_branding.txt -o  
my_custom_branding.bp -i my_custom_icon.png
```

The system will respond with the output file and hash:

```
Output file: my_custom_branding.bp  
Hash:cbc3fd3c6d001a1e1f06342bccccf2a62bd748c3cf1dd2e4c9c29561ea07bd089
```

5. Note the output file name and the hash value. These will be passed to `client_session`.

Using the Branding Package

Once you have created the branding package, it can be used by the session client. The pre-session client is responsible for verifying the package and passing it to the session client executable.

To use the branding package:

1. Verify the branding package signature.
2. Call the session client executable and pass the branding package name and hash using the parameters `-branding-package` and `-branding-hash`.

For example (one command):

```
usr/bin/client_session -branding-package my_custom_
branding.bp
-branding-hash
cbc3fd3c6d001a1e1f06342bccc2a62bd748c3cf1dd2e4c9c29561ea07bd089
<other-params>
```


Limits on Customization

The Linux has elements which are part of the operating system user interface and cannot be modified programmatically, as described in the following sections.

Linux Limitations

The following run-time limitations are enforced by Linux on the application menu:

- The menu title cannot be altered. The menu title will be **PCoIP Client**.
- The *Hide...* menu item label cannot be altered. The menu item will be **Hide PCoIP Client**.
- The *Quit...* menu item label cannot be altered. The menu item will be **Quit PCoIP Client**.

Core API Features

A list of the features specific to the Core API.

PCoIP Core Library Integration

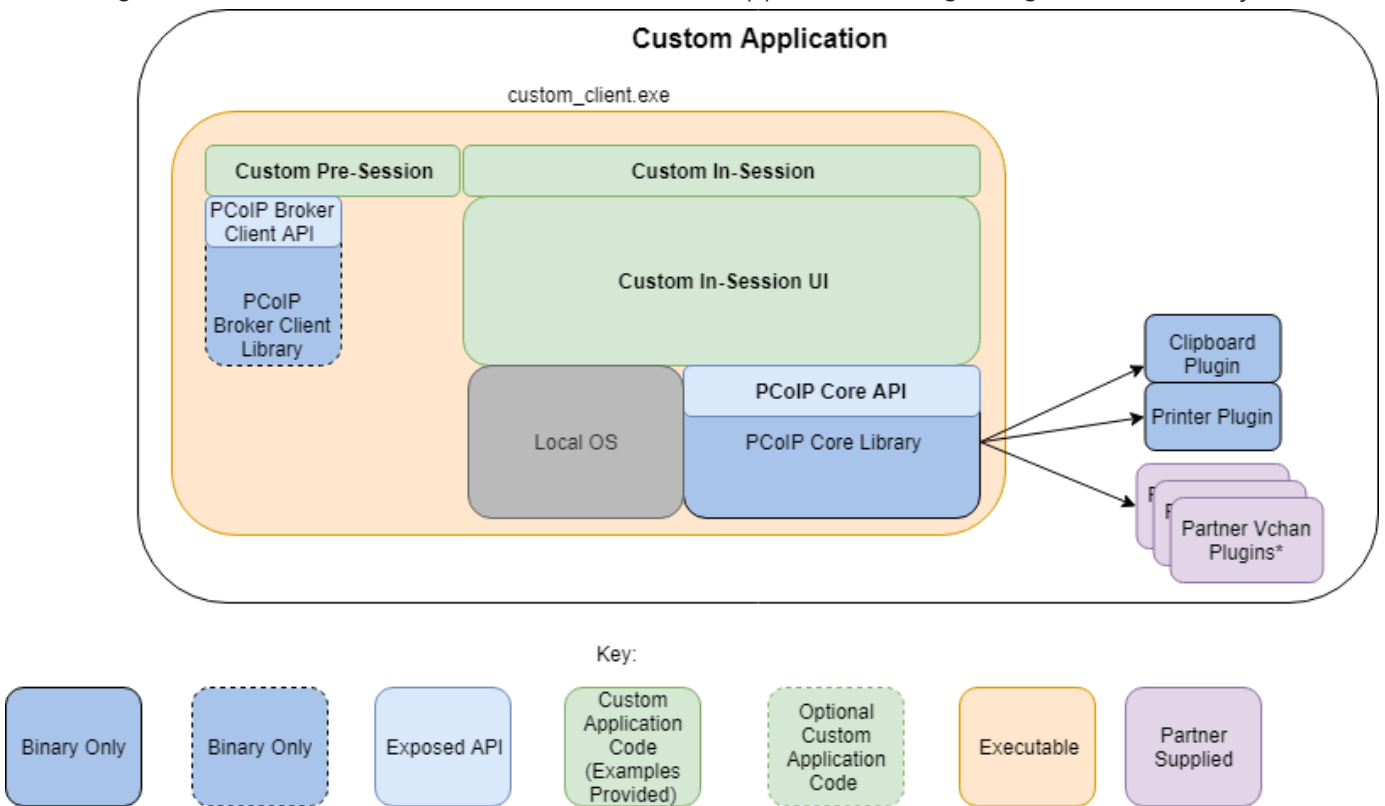
The core library allows an application developer to integrate a PCoIP session directly into an application. The core library facilitates connection to a remote host, decoding PCoIP image data directly into an application supplied frame buffer as well as remoting audio, keyboard and mouse events and supported USB devices. The application is responsible for all of the interactions with the window manager and the local operating system. The following diagram shows how an application would integrate the core library and broker library into a custom application.

PCoIP Core API

This method uses the PCoIP Core API to integrate the PCoIP protocol into a custom application. This method is necessary if you want custom features in the client beyond that which is possible using the Session Client API.

PCoIP Core API

This diagram shows the architecture with a custom application integrating the core library.



*Partner Virtual Channel Plugins can be developed using the Virtual Channel SDK, to enable this you can combine the PCoIP Client SDK with the PCoIP Virtual Channel SDK.

PCoIP Core API and Application Functionality

Using the Core API the application developer has more control over the client application than the PCoIP Session API but the developer must implement the integration between the local OS and the core library.

Broker Interactions

The core library does not implement any of the broker protocol interactions. The application is responsible for obtaining the PCoIP agent address, port number and session tag, using the Broker Client API or some other brokering method, and passing these to the core library.

Session Establishment

The application must provide the PCoIP agent address, port number and session tag to the core library in order to establish a PCoIP session.

Display Topology

The application is responsible for deciding what displays to present to the user. The application may specify up to four displays with resolutions up to 4096x4096. The application must determine the correct display position and the rotations (if any).

Keyboard Events

The application is responsible for handling local keyboard events, and providing the core library with scan codes to send to the remote host.

Mouse Events

The application must provide the mouse events, with either absolute or relative coordinates, for the core library to send to the remote host.

Touch Events

If the application supports touch events, the core library can forward these to the remote host.

Cursor Handling

Local cursor handling is critical for providing the most responsive user experience possible. The application is responsible for updating the local cursor shape and position on call-back from the core library.

Session Reconnection

The core library supports reconnecting a session (for up to 20 minutes) in the event of a network disruption. The application is notified when a network disruption occurs and provides a method for terminating reconnection attempts.

Session Termination

The core library provides a method for the application to terminate the session.

Setting Up the Development Environment

Once you have successfully established a session between a PCoIP Software Client and a PCoIP host, you can start developing your own PCoIP client. To begin, set up your client development environment, as discussed next.

To set up your client development environment:

OpenSSL (v 1.1.1) and Boost (v 1.66) are required as third-party libraries. Download and install these libraries to your system. The CMake modules provided automatically detects the system libraries at CMake configuration time.



CMake support for third-parties

When the third-party libraries are installed on the system, the CMake modules will automatically find them. Please see [Building the SDK for Linux](#) section for instructions on building your applications using CMake.

1. Install the .deb SDK installer. All necessary files will be saved to the corresponding system directories.
2. At this point, the SDK is installed on the system. For build instructions, see [Building the SDK for Linux](#).

Updating SDK Components

Updating the SDK to a new version can be done by installing a new version of the SDK. There is no special upgrade path. Upgrading components will not break compatibility with existing APIs.

Linux Build Prerequisites

The following must be installed to build the PColP Client SDK on Linux:

- Boost 1.65.1
- OpenSSL 1.1.1
- CMake 3.12 <https://cmake.org/files/v3.12/>

The Broker Client Example

The included sample broker client demonstrates how the APIs can be used to customize and control the pre-session and session phases of the connection.

Code is an API Demonstration Only

The sample session client, described in the following sections, demonstrates a simple connection scenario using the supplied `broker_client_library`. The example unrealistically assumes that all requests and calls succeed as expected, and performs only basic error handling. An actual client implementation is likely to be far more complex; for example, you will need to handle failed broker certificate verification, account for other authentication steps beyond a simple user ID and password combination, and any other circumstances dictated by your system requirements.

Using the Broker Client Example

The SDK provides a sample command line pre-session client called broker client example. This would enable you to call the included broker client libraries and establish a PColP connection. The broker client example demonstrates the success path for establishing new PColP sessions.

Do not Use the Broker Client Example in Production

The broker client is provided as an example only, and should not be used in production. The client does not have thorough error handling and does not validate or sanitize user input.

The sample broker client is located here:

`usr/bin/`

There are several files in this directory, but only two are relevant for the broker client example:

- `broker_client_example`
- `login_info.txt`

The `broker_client_example` executable is the sample command-line client; the `login_info` text file contains authentication information used by the client.

About `login_info.txt`

The broker client example uses a small local text file to supply session input values. The following is a sample `login_info.txt` file (one line):

```
sal-w2k8-ch605.autolab.local autolab autorunner "mypassword" sal-w2k8-ch605
```

In the example above:

- The **FQDN** of the host server is `sal-w2k8-ch605.autolab.local`
- The **domain** is `autolab`
- The **user** is `autorunner`

- The **password** is `mypassword`
- The **host name** is `sa1-w2k8-ch605`

Remote sessions established by `broker_client_example` are exactly the same as sessions established using the PCoIP software client, except that the input values are provided by `login_info.txt` instead of the client's user interface.

Initiate Broker Connection Flow

To initiate the broker connection with the broker client example, set up your `login_info.txt` file and then call `broker_client_example` using `login_info.txt` as an argument.

To initiate the broker connection using the broker client example:

1. Open `login_info.txt` in a text editor.
2. Add the following information, in this order, separated by spaces:
 - The **FQDN** of the host server
 - The server **domain**
 - The **user name**
 - The **user password**
 - The **host name**
3. Save the text file.
4. Open a command prompt and type:

```
broker_client_example login_info.txt
```

The broker client example will display a status message similar to the one shown next:

```
Connected Successfully.
Desktop ID : sal-w7p64-sa15.autolab.local
ip_addr : 10.64.60.147
port : 4172
connect_tag:
SCS1fw0Zbk+Eu7q2iz0/M7mxfEE52au/3JedtgP16L/rA8iB00+Er+YJd0yIL0xd9M
v5V0CDLSDmUNKOCwyyV1+u3w1aA7hXxEWmzhAA
session_id : 2305843009213693954
sni : SAL-W7P64-SA15
URI: "teradici-pcoip://10.64.60.147:4172?sessionId=
2305843009213693954&sni=SAL-W7P64-SA15", PARAMETERS: "connect-
tag=SCS1fw0Zbk%2bEu7q2iz0%2fM7mxfEE52au%2f3JedtgP16L%2frA8iB00%2bE
r%2bYJd0yIL0xd9Mv5V0CDLSDmUNKOCwyyV1%2bu3w1aA7hXxEWmzhAA"
```

Building the SDK for Linux

This section includes instructions for building a custom client application by utilizing the SDK.

1. As a reference, follow the **CMakeLists.txt** of the `broker_client_example` to understand the build steps using the cmake tool. It is located at `/usr/lib/x86_64-linux-gnu/pcoip-client/examples/broker_client_example/CMakeLists.txt`.
2. Set the **CMAKE_PREFIX_PATH** to the path of the CMAKE modules installed by the SDK. This is usually `usr/lib/x86_64-linux-gnu/pcoip-client/cmake/`.
3. Run the CMake configure and verify it configures without any errors.
4. Run CMake build to build the application.
5. The `find-package()` command of CMake automatically finds the libraries installed by the SDK as long as **CMAKE_PREFIX_PATH** points to the cmake modules directory.

Setting Up a PCoIP Agent Test Environment

Before developing your custom client, you should set up a working PCoIP system. Teradici recommends establishing a small proof-of-concept system for custom client testing, consisting of a host machine with an installed PCoIP agent.

License Requirement

Before using your test environment, you must install a PCoIP agent development license on the host machine. You received a license when you subscribed to a Teradici All Access solution, specifically Cloud Access or Cloud Access Plus. If you do not have a license, obtain one from Teradici before proceeding.

To establish a working proof-of-concept test system:

PCoIP System Architecture Reference

For details about proof-of-concept deployments, including supported PCoIP agents, environments, and operating systems, see [Teradici All Access Architecture Guide](#).

1. Establish your host virtual machine and determine the PCoIP agent that best fits your actual PCoIP environment.
2. Install the PCoIP agent on the host machine. For PCoIP agent installation instructions, refer to the appropriate administrators' guide:
 - [PCoIP Standard Agent for Windows Guide](#)
 - [PCoIP Graphics Agent for Windows Guide](#)
 - [PCoIP Standard Agent for Linux Guide](#)
 - [PCoIP Graphics Agent for Linux Guide](#)
3. Install your agent license on the host machine. For license installation instructions, see the Administrators' Guide for your host machines PCoIP agent.

Connecting To Your PCoIP Agent

Once your test system is set up, you can establish PCoIP connections to it using Teradici PCoIP Software Clients. For environment testing and troubleshooting purposes, the Teradici PCoIP Software Client is available here:

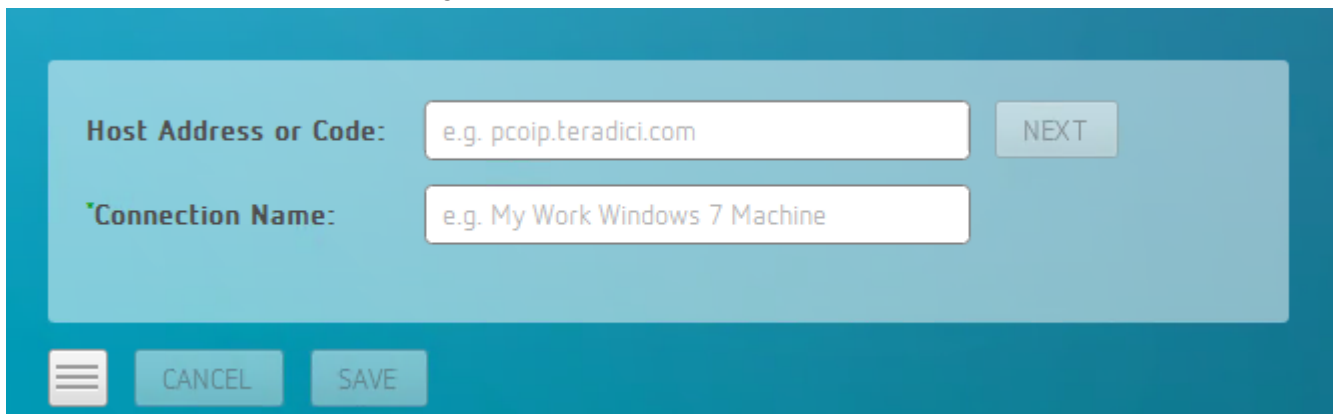
- [Teradici PCoIP Software Client for Linux](#)

Establishing a PCoIP Connection Using a Teradici PCoIP Software Client

To test your development environment, make a direct (unbrokered) connection to your development host using a Teradici Software Client. If you are able to connect using a Teradici software client, your host is correctly configured. The following illustrations show examples of the pre-session phases using a Teradici software client:

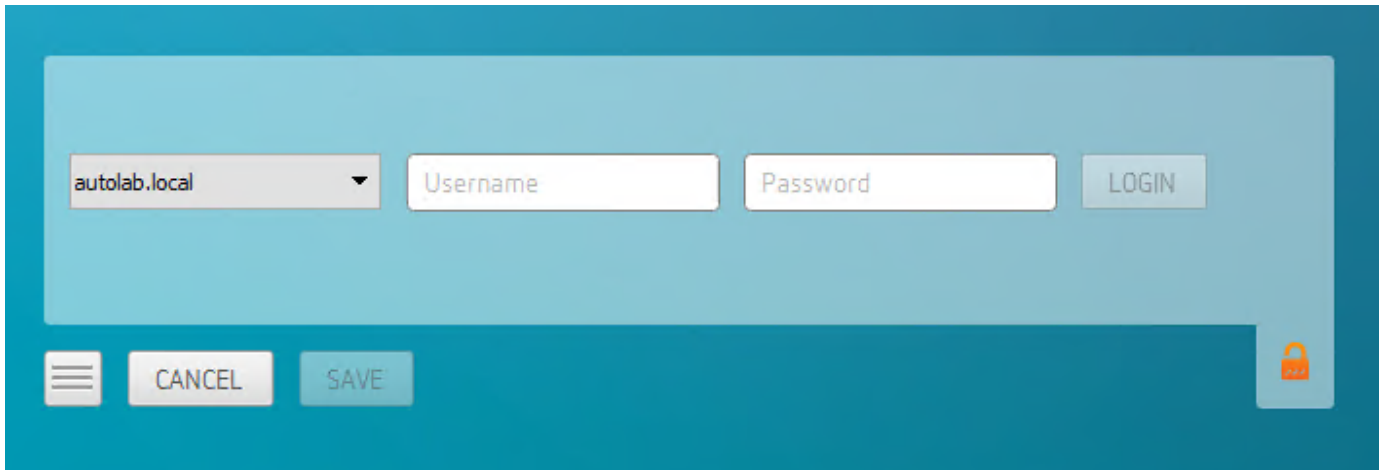
Pre-Session Connection

The user of the PCoIP Client request the PCoIP Agent by providing the FQDN of the remote workstation where the PCoIP Agent has been installed.



The screenshot shows a dialog box for establishing a PCoIP connection. It features two input fields: 'Host Address or Code' with the example 'e.g. pcoip.teradici.com' and 'Connection Name' with the example 'e.g. My Work Windows 7 Machine'. A 'NEXT' button is positioned to the right of the first field. At the bottom, there is a hamburger menu icon, a 'CANCEL' button, and a 'SAVE' button.

The user of the PCoIP client is then authenticated. If authentication is successful, a PCoIP session will be launched.



PCoIP Support Bundler Tool

Teradici may request a support file from your system to help troubleshoot and diagnose PCoIP issues.

Customizable Script

This script can be customized, in the case where the log files are located in a different location the script should be updated appropriately.

To create a support file:

1. Open a terminal window.
2. Launch the support bundler:

```
pcoip_client_sdk_session/product/osx/x86_64/pcoip-client/examples/support-  
bundler/pcoip-client-support-bundler
```

The file will be created and placed in the user's home directory.

Frequently Asked Questions

The following are answers to commonly asked questions when contemplating how to develop custom PCoIP Clients using the Teradici PCoIP Client SDK.

Q: Can I brand the pre-session client with my company logo and colors? A: Yes. Your Teradici Cloud Access Platform agreement will contain detailed information about corporate logos. Follow the Teradici branding guide for including the PCoIP trademark in your final design.

Q: Are there guidelines for using the Teradici and PCoIP Brand? A: Yes. Refer to <http://www.teradici.com/docs/brand-guide> for details.

Q: Does the SDK support localization? A: Yes. In pre-session you have complete flexibility to create clients that incorporate customizations. In-session, you can use the `locale` parameter to pass a locale to `client_session`.

Q: Does my client need Teradici licenses to operate? A: The client itself does not need a license to operate, but the PCoIP agents that it connects to do require licenses. License handling is performed by the PCoIP Broker or PCoIP agent, depending on the connection type. It is not handled by the client.

Q: How can I add additional functionality to my PCoIP Client? A: If you have requirements that go beyond the default capabilities of the Client SDK, you can integrate the PCoIP Virtual Channel SDK. The Virtual Channel SDK gives you the ability to create custom PCoIP Virtual Channel plugins which stream data between clients and hosts.

Q: Will my client work with all PCoIP agents? A: Yes. The PCoIP protocol works with Cloud Access and Cloud Access Plus.

Q: What support options are available for the Client SDK? A: Teradici offers Developer Support and Professional Services options for SDKs and APIs. Please contact your Teradici account manager for details.