REFLECTION ZFE

User Guide

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Contents

About Reflection ZFE

The Reflection ZFE web client provides browser-based HTML5 access to 3270, 5250, VT, and UTS host applications. The Reflection ZFE product eliminates the need to touch the desktop; no software to deploy, patches to apply, or configurations to make. You can provide platform-independent user access to all your host applications.

The web client operates with complete session protection using SSL/TLS to secure communication with your mainframe systems.

Reflection ZFE consists of these components:

- **Micro Focus Host Access Management and Security Server**

  Reflection ZFE uses the Management and Security Server (MSS) Administrative Server to create and manage host sessions. The Administrative Console is a centralized web site that contains administrative tools and its own documentation. You can configure, secure, deploy, and monitor terminal sessions from this central location. You can use a compatible version of MSS or install the version that is available with your Reflection ZFE installation.

- **Session Server**

  The session server is an NT service or UNIX daemon that provides the engine that runs host sessions. You can have multiple session servers serving up multiple sessions to provide efficient and rapid access to your host data.

  Reflection ZFE Components for MSS – The Reflection ZFE management components must be installed on the Management and Security Server to use Reflection ZFE. If you select a remote Management and Security Server, the installation will verify that these components have been installed. If they have not been installed, you will need to install them.

- **Web Client**

  The web client is a terminal emulator that can be accessed using only a browser. Once assigned, users can easily access authorized sessions from any platform and from any location.

- **Documentation**

  Both the Reflection ZFE Web Client and Management and Security Server Administrative Console have complete documentation sets available from the user interface. Each product's documentation is also available from the Micro Focus Support site in both HTML or PDF formats.

Getting Started as an Administrator

For a list of supported platforms and system requirements, see Technical Note 2837.

- After you've installed Reflection ZFE, if you have additional deployment questions, see Configuring Installation Options.
- To walk-through a sample workflow, read the Getting Started Guide. This guide starts with an administrator logging in to Micro Focus Host Access Management and Security Server Administrative Console and ends with your authenticated end-user connecting to a host session.
- You create and authorize sessions for specific users using the Administrative Console, which is the administrative component to MSS and available from the Reflection ZFE Start menu.

- You can use an URL to access Reflection ZFE (for example https://sessionserver:7443/zfe). Alternatively, if you are in an administrator role, you can access the Reflection ZFE web client using the Administrative Console Session Manager.
- The web application initially displays a connection page in which you can enter host-specific information.

Getting Started as an End User

- You have access to a Reflection ZFE session using the URL provided by your administrator. It will look something like this: `https://sessionserver:7443/zfe`.
- Using Sessions provides how-to information and instructions on navigating Reflection ZFE.
- End-user macros are created by individuals for sessions they are authorized to access. The administrator grants permission to create macros when the session is created.

1 Setting Installation Options

There are a number of post-installation configurations that you can make to ensure that Reflection ZFE runs successfully.

- How to Adjust Session Timeout Values
- How to Set Up the Terminal ID Manager for Reflection ZFE
- How to Set Up Metering for Reflection ZFE
- How to Start and Stop Services Automatically
- How to Change Ports
- How to set up Automated Single Sign-On for Mainframe

Related Topics

Management and Security Server Installation Guide
Troubleshooting Reflection ZFE Connections
Connection settings

How to Adjust Session Timeout Values

The default timeout value for an inactive Reflection ZFE session is 30 minutes. This means that a session that was not logged out and has had no activity will close after 30 minutes. You can configure this setting on the server.

1. Open `<install_location>Micro Focus\ReflectionZFE\sessionserver\webapps\zfe|WEB-INF\web.xml.`
2. Adjust the session timeout value:

```
<session-config>
   <session-timeout>30</session-timeout> <!--In minutes-Minimum values of 5-->
   <cookie-config>
         <max-age>604800</max-age> <!--1 week in seconds-->
   </cookie-config>
</session-config>
```

3. Restart the server.

How to Set Up the Terminal ID Manager for Reflection ZFE

The Management and Security Server provides a Terminal ID Manager to manage pooled IDs for different host types.

Before you configure the Terminal ID Manager for Reflection ZFE, verify that you have this option enabled for MSS. There are complete instructions in the MSS Installation Guide.

TIP: If you have MSS and Reflection ZFE installed on the same machine and using port 80, then no additional configuration is necessary.

To configure the Terminal ID Manager for Reflection ZFE, you must provide the correct address to the Terminal ID Manager.

1. Open the `sessionserver/conf/container.properties` file.
2. Update `id.manager.server.url=http://localhost:80/tidm` to reflect the address of the Terminal ID Manager configured in Management and Security Server.
3. Restart the Reflection ZFE Session Server.

How to Set Up Metering for Reflection ZFE

The Management and Security Server provides metering capabilities to monitor Reflection ZFE host sessions.

Before you configure metering for Reflection ZFE, verify that you have metering enabled for MSS. There are complete instructions in the MSS Installation Guide.

In Reflection ZFE metering is set globally for all emulation sessions created by the Reflection ZFE session server. Settings are configured in the `sessionserver/conf/container.properties` file.

Table 1-1 *Metering options*

Property	Description
`metering.enabled`	Turns metering on or off, with a value of "true" or "false". Any value other than "true" turns metering off.
`metering.host.required`	Determines whether the session can connect to the host even if the metering server cannot be contacted. "True" means that session connections will fail if the metering host is unavailable. "False" means that session connections will still work even if the metering host is unavailable.
`metering.server.url`	Specifies the name or address of the metering server, the port, the protocol, and the webapp context. The syntax is "`host:port|protocol|context`". This syntax is the same as that used by the MSS server in the `MssData/serverconfig.props` file to register metering servers. The host:port section of the URL must escape the ":" character. For example, `test990.attachmate.com\:8080`.

```
#Example additions to sessionserver/conf/container.properties
metering.enabled=true
metering.host.required=false
metering.server.url=10.10.11.55\:80|http|rwebmeter
```

NOTE: In the event that all licenses are in use and you attempt to make a connection, the session will be disconnected.To determine whether the host has disconnected or the metering service has stopped the connection, see the `Reflection ZFE/sessionserver/logs/server.log` file.

How to Start and Stop Services Automatically

All server components are installed as services and can be configured to start during installation.

If you are running on Linux, Solaris, or AIX platforms, follow these steps to set the session server to start automatically when your system first boots up.

Create a file called `zfe` containing the following and using your installation directory:

```
#!/bin/sh
#
#This script manages the service needed to run the session server
#chkconfig:235 19 08
#description:Manage the Reflection ZFE session server

###BEGIN INIT INFO
# Provides:          zfe
# Required-Start:    $all
# Required-Stop:     $all
# Default-Start:     2 3 4 5
# Default-Stop:      0 1 6
# Description:       Start the Reflection ZFE Session Server
### END INIT INFO

INSTALL_DIR=<enter installation directory>
BIN_DIR=$INSTALL_DIR/sessionserver/bin
case "$1" in
start)
echo "Starting Reflection ZFE Session Server"
$BIN_DIR/server start

RETVAL=0
;;
stop)
echo "Stopping Reflection ZFE Session Server"
$BIN_DIR/server stop

RETVAL=0
;;
status) echo "Current Reflection ZFE Session Server status"
$BIN_DIR/server status

RETVAL=0
;;
restart) echo "Restart Reflection ZFE Session Server"
$BIN_DIR/server restart

RETVAL=0
;;
*)
echo "Usage: $0 (start|stop|status|restart)"

RETVAL=1
;;
esac
exit $RETVAL
```

Then select your platform and complete the relevant steps.

Platform	Follow these steps
Linux	1. Copy the file to the `/etc/init.d` directory. 2. Set the file permission. Run `chmod` using the value 755. For example, `chmod 755` zfe 3. Run `chkconfig` to add the initialization script. For example, `/sbin/chkconfig --add zfe`
Solaris	1. Copy the file to the `/etc/init.d` directory. 2. Set the file permission. Run `chmod` using the value 755. For example, `chmod 755` 3. Create a symbolic link in `/etc/rc.d/rc3.d`. For example, ln `-s/etc/init.d/zfe/etc/rc3.d/S99zfe`
AIX	1. Copy the file to `/etc/rc.zfe`. For example, `cp zfe /etc/rc.zfe` 2. Set the file permission. Run `chmod.` For example, `chmod +x /etc/rc.zfe` 3. Add these lines at the end of the `/etc/rc.tcpip` file: `start/etc/rc.zfe "" "start"`

How to Change Ports

Both the Reflection ZFE session server and MSS ports can be modified depending on your network needs. The default ports used by Reflection ZFE are:

Table 1-2 *Reflection ZFE and MSS Default Ports*

Session server	HTTP - 7070 HTTPS - 7443
Reflection ZFE Components for MSS	HTTP - 7080 HTTPS - 7444
Management and Security Server	HTTP - 80 HTTPS - 443

To change the default ports:

Table 1-3 *Changing default ports*

Component	Instructions

Reflection ZFE session server	The Reflection ZFE session server ports are set, and can be modified, in `sessionserver/conf/container.properties`.
	
	`servletengine.port=7070`
	`servletengine.ssl.port=7443`
	
	To turn the port off, set the port value to 0. You can disable your non-secure SSL port by changing the value from 7070 to 0.

Management and Security Server	The SSL port MSS uses to make an HTTPS connection is set to 443 by default. If you need to change the port number, start the Management Server. This creates the default PropertyDS.xml file. Then, open PropertyDS.xml in the MssData directory. Change the value from 443 to the appropriate port number in the section below, and then restart the Management Server. `<CORE_PROPERTY NAME="sslport"> <STRING>443</STRING>`

How to set up Automated Single Sign-On for Mainframe

Automated Sign-On for Mainframe is an add-on product to Management and Security Server that enables an end user to authenticate to a terminal emulation client and be automatically logged on to a host application on the z/OS mainframe.

This add-on, when implemented and configured in Management and Security Server is supported by Reflection ZFE and is configured using the Administrative Console.

After you have configured Automated Single Sign-On in Management and Security Server, a Reflection ZFE login macro sends the user's mainframe username and pass ticket to the host application. The user is automatically logged in.

Related Topics

Automated Sign-On for Mainframe Administrator Guide
Using the Macro API
Sample Macros

2 Making Secure Connections

When you open up your legacy hosts to users outside the corporate firewall--business partners, remote users, mobile sales personnel, and others--you need to shield your information from known security threats. With Reflection ZFE, you can provide secure web-to-host access to all your users. Reflection ZFE, along with the Management and Security Server, provides HTTPS connections and a variety of authorization and authentication options.

In a typical Reflection ZFE installation there are three main connection points that you need to consider in regard to security:

- Web browser to the Reflection ZFE Session Server
- Reflection ZFE Session Server to the Reflection Host Access Management and Security Server (MSS)
- Reflection ZFE Session Server to your legacy host systems

There are instructions for securing each of these connections.

About Java Keytool and certificates

Reflection ZFE and MSS use the Java Key and Management Tool to manage keys and certificates. Using it, you can manage public/private key pairs and certificates. Keys and certificates are stored in a keystore, which, by default, is implemented as a file.

To.....	Use this.....
List certificates	`keytool -list -keystore keystore.jks`
Delete certificates	`keytool -delete-alias mydomain -keystore keystore.jks`
Export a certificate	`keytool -export -alias mydomain -file mydomain.cer -keystore keystore.jks`
Import a certificate	`keytool -importcert -file <path to certificate> -alias <some-alias> -keystore servletcontainer.jks -storetype jceks -storepass not-secure`
View stand alone certificate	`keytool -printcert -v -file mydomain.crt`

For more information, see the Java Key and Certificate Management Tool documentation.

Securing the Web Browser to Reflection ZFE Session Server

NOTE: The file paths noted here are for a default installation. If you have installed Reflection ZFE to another location, you must modify the path appropriately.

When an HTTPS connection is made to the session server, it authenticates itself to the client browser using a server certificate. The client checks the server certificate against its trusted certificate store. If the certificate or its root is in the trusted store, the connection proceeds. However, if the certificate is not trusted, you are warned by the browser and asked to agree to the connection.

By default, a self-signed certificate is generated and used by the session server to identify itself to the client. When you initiate a secure web browser connection to the session server using the HTTPS URL with the self-signed certificate in use, you are warned by the browser that the certificate is not trusted. At this point you can instruct the browser to trust the certificate and proceed with a secure connection.

You can avoid the need to instruct the browser to trust the default self-signed certificate by configuring the session server to use a trusted certificate. The necessary certificate, which most likely will be one signed by a certificate authority (CA) that is universally trusted, is provided by the administrator in charge of the ZFE installation.

The key and certificate chain must be in a keystore in either JCEKS format, or a PKCS12 format with strong encryption (PBE-SHA1-3DES). The password for the key and for the keystore must be the same.

To configure the Reflection ZFE session server to use the keystore:

1. Open the `sessionserver/conf/container.properties` file and add the following three lines, making sure to use either forward slashes or double backward slashes:

   ```
   servletengine.ssl.keystore=full path to keystore
   servletengine.ssl.keystoretype=format name of keystore, either JCEKS or PKCS12
   servletengine.ssl.keystorepassword=password for the keystore file you specified
   ```

2. Restart the session server.

It is possible to change the default behavior and disable the client browser from making an insecure HTTP connection to the ZFE session server from the start. To do this:

Open `sessionserver/conf/container.properties` and set the `servletengine.port` property to 0 and restart the session server.

Securing Reflection ZFE Session Server and Management Component to MSS

NOTE: The file paths noted here are for a default installation and assume that `Java\bin` is in your system path. If you have installed Reflection ZFE to another location, you must modify the path appropriately.

These instructions pertain to both the session server and management component and require a change to the `container.properties` file located here:

- `sessionserver/conf/container.properties`
- `managementserver/conf/container.properties`

The `<component-path>/container.properties` file contains the URL of the Management and Security Server (MSS) that will be used by both Reflection ZFE session server and management component:

```
management.server.url=http://my-company.com:80/mss
```

During the installation, you can specify that you want to configure a secure communication channel between both the Reflection ZFE session server and MSS, which means the install process will handle obtaining the MSS certificate and configure the Reflection ZFE session server. The management component must be configured manually.

To make this configuration manually after you complete the installation follow these steps:

1. Change the `management.server.url` property in `<component-path>/conf/container.properties` to use the HTTPS protocol and specify the correct MSS port.
2. Use the browser to connect to the HTTPS Management and Security Server URL and instruct the browser to save the certificate.
3. Import the certificate into the appropriate Reflection ZFE keystore by running the following command (the command may vary depending on specific values) in the `<component-path>/etc` directory: `keytool -importcert -file <path-to-the-MSS-certificate> -alias <some-alias> -keystore servletcontainer.jks -storetype jceks -storepass not-secure`
4. Restart the appropriate service.

These instructions use the default password, **not-secure** as the keystore password. You can change the keystore password by running the following command in the `<component-path>/etc` directory:

`keytool -storepasswd -new new_password -keystore servletcontainer.jks -storetype jceks -storepass not-secure`.

Securing Reflection ZFE Session Server to the Host

Follow these basic steps to configure a TLS connection between the Reflection ZFE session server and a host that supports TLS:

1. Install unlimited strength policy jars from Oracle.
2. Configure a keystore location on the Reflection ZFE session server. (Optional)
3. Configure the keystore using the MSS Administrative Server.
4. Configure a Reflection ZFE terminal session for TLS.

How to install unlimited strength policy jars

TLS/SSL encryption between the Reflection ZFE session server and the host computer requires the unlimited strength policy files from Oracle or IBM. If you installed using the standard installation process, these files are already installed. However, if needed, you can find the files here:

- For Oracle Java 8 - `http://www.oracle.com/technetwork/java/javase/downloads/jce8-download-2133166.html`
- For IBM Java 8 - `https://www14.software.ibm.com/webapp/iwm/web/preLogin.do?source=jcesdk`

The Oracle readme file included with the download explains how to install their files.

How to configure the keystore location on the Reflection ZFE Server

This step is not required if you are using a default Reflection ZFE installation. However, some performance adjustments can require a local keystore directory.

By default, Reflection ZFE creates an MSS parameter that points to a local directory, `keystore`, located under the current working directory of the Reflection ZFE session server (typically, `sessionserver/bin/keystore`). You can specify an alternate keystore directory by defining the Java system property, `haapi.ecl.keystore.location=<path_to_dir>`.

How to configure the keystore in MSS

For a Reflection ZFE session to trust the TLS host it connects to, the public certificate of the host must be added to a trusted keystore using the Reflection Management and Security Server (MSS). The Reflection ZFE session retrieves this certificate the first time a session connects.

To configure the keystore with the public certificates of trusted TLS hosts:

1. Connect to the system where MSS is installed.
2. Copy the public certificate file of the new trusted host into the `MssData/certificates` folder. In an automated Windows installation this file is located in `C:\ProgramData\Micro Focus\mss\MssData`. The file can be either a base64-encoded DER certificate or a binary Reflection Administrative Server certificate.
3. Log in to MSS For example, `http://mycompany.com/mss/AdminStart.html`.
4. Click **Administrative WebStation** at the bottom right of the links list panel.
5. In the Administrative WebStation, click Security Setup section, and then open the Certificates tab.
6. On the Certificates tab, click the link to **View or modify certificates trusted by the terminal emulator applet.**
7. On the Certificates page, the certificates that were imported are listed at the top, while trusted root certificates (CA certificates) are listed in the bottom section of the page. To import a certificate for a new trusted host, click **Import**.
8. On the Import Trusted Certificate page, enter the name of the certificate file that you copied to `MssData/certificates`, the password of the public cert file, if needed, and a friendly name for identifying the certificate on the MSS certificates page.
9. Click **Submit**.

When the certificate is successfully added to the MSS server's trusted keystore, you are returned to the list of certificates and you should see the new host.

How to configure a Reflection ZFE terminal session

To connect to the new trusted host, configure a Reflection ZFE terminal session as usual, and in the Settings dialog box, specify TLS/SSL as the security protocol. Make sure to specify the correct TLS port for the connection.

Using Secure Shell (SSH)

Secure shell provides encrypted communications between the client and a VT host.

MSS has a known hosts list that contains the public keys of hosts that you can connect to using SSH. SSH connections can be made only to hosts already trusted by an administrator.

The first time an SSH connection is made from a Reflection ZFE session to a host, the known hosts file is downloaded from the Management and Security Server to the Reflection ZFE session server.

When you attempt to create or edit a session using SSH in Session Manager, you will be notified if the key is not recognized as trusted and asked if you want to trust the key and continue.

- If you enter yes, the host will be trusted and added to the known host list, and you will be prompted for the SSH host password.
- If you do not answer yes, then the host will remain untrusted and the session will be disconnected.

You can also configure the SSH Known Hosts file manually by establishing an SSH connection from a Reflection ZFE session to the host, and adding the remote host's key fingerprint to the known hosts list in MSS.

Configure known hosts file for SSH connections using MSS

To configure the known hosts file for SSH connections in MSS:

1. Connect to the system where MSS is installed and navigate to the server's certificates folder: `C:\ProgramData\Micro Focus\Mss\MssData\certificates` (Windows) or `/var/opt/microfocus/mss/Mssdata/certificates` (UNIX).
2. Copy the public certificate file of the new SSH host into the `MssData/certificates` (Windows) or `/etc/ssh/ssh_host_rsa_key.pub` (UNIX) folder described above. Only `ssh-rsa` and `ssh-dss` are valid as public key types for MSS known_hosts entries.

   The host's public key format can be OpenSSH, Base64-encode, .DER, or.PFX. The file should follow this format: hostname, IP-address key-type key. For example, a public key entry might look like this: `alpsuse132, 10.117.16.232 ssh-rsa AAAAB3NzaC1yc2EAAAADAQABA.....`
3. Log in to MSS (for example, `http://mycompany.com/mss/AdminStart.html`).
4. Click **Administrative WebStation** at the bottom right of the links list panel.
5. In the Administrative WebStation, click Security Setup, and open the Secure Shell tab.
6. In the **Administer Secure Shell Known Hosts List**, click the **View or modify secure shell known hosts list** link. The **Secure Shell Known Hosts** page displays.
7. Click **Import**. The **Import Known Host** page displays.
8. Enter the name of the file containing the public key, the name of the host, optionally the password for the public key file, and the IP address of the host. The name of the host you enter must exactly match the name on the key; for example, if the name on the key is *hostname.example.com*, you cannot enter just *hostname*.
9. Click **Submit**.

After the public key is imported into the Reflection Known Hosts file, you will return to the Secure Shell Known Hosts page and the new host will appear in the list.

Enabling SSL

SSL 3.0 has been deactivated by default in the JDK 8 java.security file due to discovered vulnerabilities. If SSL 3.0 is absolutely required, see Technical Note 2771 (http://support.attachmate.com/techdocs/2771.html) on the Micro Focus support site for more information.

3 Configuring Sessions

Your users gain access to the host through sessions that you create and configure. Sessions are created by an administrator in the Management and Security Server Administrative Console. When you launch a session from the Administrative Console, the web client **Connection** panel opens in a separate browser window.

Connection configuration options are always available from the navigation pane.

1. Click  open the left navigation panel.
2. Under **Current Session**, click **Settings**.

NOTE: You can create a direct link to a specific Reflection ZFE session using the following format:

```
<rzfe-session-server:port>/?name=<session-name>
```

Users can access this link and directly launch a Reflection ZFE web session. A new session will not be launched if the specified session already exists when the user opens the link.

Related Topics

- How to configure a connection
- Using Quick Keys
- File and Data Transfer
- Making Secure Connections

How to configure a connection

When you create a new session there are various connection settings that must be configured for the session.

1. From the **Type** drop down list, select the type of host you are connecting to.
2. Identify the host to which you want to connect. You can use a full host name or its IP address.
3. Type the number of the port you want to use.
4. Save your connection settings.

Related topics

Connection settings

How to Set Up the Terminal ID Manager for Reflection ZFE

Connection settings

These options vary depending on the host type.

- **Connect at startup**

  By default, sessions are configured to connect to the host automatically when you create or open a session. However, you can set up a session so that it doesn't automatically connect to the host. Choose **No** to manually connect to the host.

- **Protocol**

  From the drop down list, select the protocol you want to use to communicate with the host. To establish a host connection, both the Reflection ZFE Web Client and the host computer must use the same network protocol. The available values are dependent on the host to which you are connecting. They are:

  Table 3-1 *Protocol Descriptions*

Protocol	Description
TN3270	TN3270 is a form of the Telnet protocol, which is a set of specifications for general communication between desktop and host systems. It uses TCP/IP as the transport between desktop computers and IBM mainframes.
TN3270E	TN3270E or Telnet Extended is for users of TCP/IP who connect to their IBM mainframe through a Telnet gateway that implements RFC 1647. The TN3270E protocol allows you to specify the connection device name (also known as LU name), and provides support for the ATTN key, the SYSREQ key, and SNA response handling. If you try to use Telnet Extended to connect to a gateway that doesn't support this protocol, standard TN3270 will be used instead.
TN5250	TN5250 is a form of the Telnet protocol, which is a set of specifications for general communication between desktop and host systems. It uses TCP/IP as the transport between desktop computers and AS/400 computers.
Secure Shell (VT)	You can configure SSH connections when you need secure, encrypted communications between a trusted VT host and your computer over an insecure network. SSH connections ensure that both the client user and the host computer are authenticated; and that all data is encrypted
Telnet (VT)	Telnet Secure Socket Layer (SSL) and Transport Layer Security (TLS) are available to provide secure connections.
INT1 (UTS)	Provides access to Unisys 1100/1200 hosts using the TCP/IP network protocol.

- **Device name**

  If you selected TN3270, TN3270E, or TN5250 as the protocol, specify the device name to use when the session connects to the host. The device name is also known as the host LU or pool. If you do not specify a device name for the session, the host dynamically assigns one to the session. A device name that is set within a macro will override this setting.

  If you selected **Terminal ID Manager** you can use it to provide IDs to client applications at runtime. You can use the Terminal ID Manager to manage pooled IDs for different host types. An ID is connection data that is unique for an individual host session. To use Terminal ID Manager, you must have a Terminal ID Manager server configured. See Terminal ID Manager in the Management and Security Server Installation Guide.

If you decide to use Terminal ID Manager and have configured the Terminal ID Manager server, then you can select from the options below to configure the criteria for acquiring an ID. All criteria must be met in order for an ID to be returned.

NOTE: Keep in mind that by specifying a criterion, you are indicating that the ID should be allocated only when an ID that has that specific value is found. The set of criteria selected here must be an exact match of the set of criteria specified on a least one Pool of IDs in Terminal ID Manager before the ID request can succeed.

Table 3-2 *Terminal ID Manager Criteria*

Criterion	Description
Pool name	Include this attribute and enter the name of the pool to limit the ID search to a specified pool.
Client IP address	The IP address of the client machine will be included as part of the request for an ID.
Host address	The address of the host configured for this session will be included as part of the request for an ID.
Host port	The port for the host configured for this session will be included as part of the request for an ID.
Session name	When selected, requires that the ID is configured to be used by this session exclusively.
Session type	The session type (for example, IBM 3270, IBM 5250, or UTS) is always included as part of any request for an ID.
User name	Use this criterion to ensure that only IDs created for exclusive use by specific users will be allocated. The current user's name, which must be found on an ID before it can be allocated, is the name of the user that the session is allocated to at runtime. To configure a session based on user names, a default place holder user name is available: **tidm-setup**. For the administrator to configure sessions using **tidm-setup**, the Terminal ID Manager needs to have IDs provisioned for tidm-setup. You can override the default name with one of your own by modifying the `Micro Focus/ReflectionZFE/sessionserver/conf/container.properties` file as follows: `id.manager.user.name=custom-username` Where custom-username is replaced by the name you want to use.
Application name (UTS)	The name of the host application will be used as part of the request for an ID.

To determine the connection attempt behavior if Terminal ID Manager does not successfully allocate an ID to this session, use **If ID is not allocated**:

- **Fail connection attempt** -If selected, the session will not attempt to connect when an ID is not allocated.
- **Allow connection attempt** -If selected, the session will attempt to connect when an ID is not allocated. The attempt may be rejected by the host. There are some host types that permit a user to connect without an ID.

To confirm that Terminal ID Manager can provide an ID using the criterion and value selections you have made, click Test.

- **Terminal model**

  Choose the terminal model you are connecting to.

Table 3-3 *VT session configuration options*

VT Settings	Description
Terminal ID	This setting determines the response that Reflection ZFE sends to the host after a primary device attributes (DA) request. This response lets the host know what terminal functions it can perform. The Reflection ZFE response for each Terminal ID is exactly the same as the VT terminal's response; some applications may require a specific DA response. This terminal ID setting is independent of the Terminal type setting. The options are: VT220, VT420, VT100, DEC-VT100, and VT52.
Local Echo	Automatic(default). How Reflection ZFE responds to remote echo from a Telnet host: Automatic attempts to negotiate remote echo, but does what the host commands. Yes means Reflection ZFE negotiates local echo with the host, but always echoes, while No means Reflection ZFE negotiates remote echo with the host, but does not echo.
Set Host Window Size	Yes (default). This setting sends the number of rows and columns to the Telnet host whenever they change. This enables the Telnet host to properly control the cursor if the window size is changed.
Request Binary	No (default). Telnet defines a 7-bit data path between the host and the terminal. This type of data path is not compatible with certain national character sets. Fortunately, many hosts allow for 8-bit data without zeroing the 8th bit, which resolves this problem. In some cases, however, it may be necessary to force the host to use an 8-bit data path by selecting this check box.
Send LF after CR	No (default). A "true" Telnet host expects to see a CrNu (carriage return/null) character sequence to indicate the end of a line sent from a terminal. There are some hosts on the Internet that are not true Telnet hosts, and they expect to see a Lf (linefeed) character following the Cr at the end of a line. If you're connecting to this type of Telnet host, select Yes.
Host Character Set	The default value for the Host character set depends on the type of terminal you are emulating. This setting reflects the current terminal state of VT Host Character Set, which can be changed by the host. The associated default setting, saved with the model is DEC Supplemental.
Auto Answerback	No (default). This setting specifies whether the answerback message (set with the Answerback property) is automatically sent to the host after a communications line connection.
Answerback String	This setting allows you to enter an answerback message if the host expects an answer in response to an ENQ character.
Display columns	Number of columns to display 80 (default)
Display rows	24 rows (default). This setting specifies the number of rows to display.

Table 3-4 *UTS INT1 session configuration options*

UTS INT1 options	Description
Application	The name of the host application or host operating mode to be accessed. This is the word or phrase that the local machine sends to the host when you first establish communication with the host. If you were using a host terminal, this would be the $$OPEN name of the application.The application name is typically the same as the environment name. However, they can be different. For example, the environment name might be MAPPER, and the application might be UDSSRC. During a terminal emulation session, you would type $$OPEN MAPPER at the prompt, and INT1 would send UDSSRC to the host once the connection is established.
TSAP	The desired Transport Service Access Point (TSAP), up to 32 characters (such as TIPCSU for TIP connections, RSDCSU for Demand connections).A TSAP is required only if you are connecting to a Host LAN Controller (HLC) or to a Distributed Communications Processor (DCP) in IP router mode. If you're not sure which value to use, contact your host administrator.
Initial transaction	The character, word, or phrase that the local machine will send to the host when communication with the host is first established (up to 15 characters).This parameter is optional and is primarily used with TIP. For example, you might type ^ to run MAPPER. This parameter can also be used to transmit passwords. Click Advanced for additional settings to configure when this string should be sent.
Terminal ID	Choose whether to specify a terminal ID or use the Terminal ID Manager. To specify a terminal ID, type it in the **Specify Terminal ID** field. If you choose **Use Terminal ID Manager**, you are prompted to select the Terminal ID attributes you want to use to obtain an ID. See Terminal ID Manager Attributes. To test the attributes, click Test selected attributes.
Specify Terminal ID	The Terminal ID, a terminal identifier (typically up to 8 alphanumeric characters) to use for the communication session associated with this path. Also known as a TID or PID, each terminal ID should be unique to the host.

- **Host character set**

  Select the 3270 or 5250 host character set you want to use. This setting chooses a conversion table to convert host characters (EBCDIC) into PC characters (ANSI). This setting should match the national character set used by your host system. If it doesn't match, then some characters, such as accents, may not display correctly. See your host documentation for definitions of the characters in each set. The default value is US English (037).

- **TLS/SSL Security**

  SSL and TLS protocols allow a client and server to establish a secure, encrypted connection over a public network. When you connect using SSL/TLS, ZFE authenticates the server before opening a session, and all data passed between and the host is encrypted using the selected encryption level. The following options are available:

Table 3-5 TLS/SSL Descriptions

Security options	Description
TLS 1.2, 1.1, 1.0, and SSL 3.0	Allow connection through TLS 1.2, TLS 1.1, TLS 1.0, or SSL 3.0, depending on the capabilities of the host or server to which you are connecting.
TLS 1.2, 1.1, 1.0	Select this value to connect using TLS, but not SSL. As part of the TLS protocol, the client checks the server or host name against the name on the server certificate. Therefore, TLS connections require the common name on the server certificate to match the host or proxy server name.
SSL 3.0	Select this value to connect using SSL, but not TLS. This is not recommended, but some hosts do not support TLS. If you plan on using this option, there is an additional configuration step to follow: SSL 3.0 has been deactivated by default in the JDK 8 java.security file. If SSL 3.0 is absolutely required, you can reactivate the protocol by removing "SSLv3" from the `jdk.tls.disabledAlgorithms` property in the java.security file or by dynamically setting this Security property to "true" before JSSE is initialized. For example: You must remove or comment out the line, `jdk.tls.disabledAlgorithms=SSLv3`, in `<install_dir>\Micro Focus\ReflectionZFE\jre\jre\lib\security\java.security`.

NOTE: See the section on Making Secure Connections for information on adding trusted certificates, key stores, using SSH, and other advanced security information.

How to test Terminal ID Manager criteria

The Terminal ID Manager provides IDs to client applications at runtime. To confirm that Terminal ID Manager can provide an ID using the criteria and value selections you selected use this test option.

Criteria for the current session are specified on the Connection panel after selecting **Use Terminal ID Manager** from either the Device Name (3270, 5250 host types) or the Terminal ID (UTS) field. By default, the selected criteria for the current session are displayed.

Click **Get ID** to confirm that Terminal ID Manager can provide an ID matching the configured criterion and value selections. The test returns the name of an available ID that satisfies the selected attribute values.

Testing for other criteria and values

You can also use this panel to test criteria different from those associated with the current session.

1. Select any of the session types from the Session type list, and select the criteria you want to test. You can test alternate values that you want to use in a sample Terminal ID Manager request.
2. Click **Get ID** to confirm that Terminal ID Manager can provide an ID matching the criterion and value selections. The test returns the name of an available ID that satisfies the selected values.

Related topics

- Connection settings
- Terminal ID Manager Criteria

How to configure Display settings

You can customize host foreground and background colors and set up hotspots to make it easier to navigate the host application. These settings are specific to the session you are configuring.

Related Topics

- How to customize host screen colors
- How to configure hotspots

How to customize host screen colors

You can customize the color of your screen and the appearance of different host attributes in the terminal window. For each item, you can select a color for the foreground and the background colors for 3270, 5250 and UTS host connections. Colors are specified using the color grid or by entering the Hex code format.

There are many web sites that list available Hex colors, for an example see w3schools.com HTML Color Picker

You may see different options depending on the type of host connection. If you are connecting to an UTS host, these host-specific options are available:

- **Use color information from the host** - To use the colors specified here rather than any colors specified by the host, clear this option.
- **Enable blink** - To disable blinking, clear this option.
- **Select attribute to edit** - In UTS emulation, colors are set directly by the host. You can specify colors for text associated with specific screen display options. Including the following and available combinations:

  Plain, Underline(UND), Strikethru (STK), Left Column Separator (LCS), Control Page, and Status Line (OIA).
- **Video intensity**

  The video intensities, Blink, Dim, Protected, and Reverse are combined with the attributes to create additional combinations. For example, you could map foreground or background colors to all cells with Dim + Blink + Underline or Reverse + Protected + Strikethru + Underline.

  When you select a video intensity (or combination of intensities), those intensities are combined with the value of the attribute drop down list to form a single color mapping.

To customize colors

1. From the left navigation panel, click **Display**.
2. Under **Color Mappings**, click the background color field to open the color grid. From the color grid, select the color you want to use as the host background color. Alternatively, type the Hex color number for the color you want to use.
3. From the drop down list, select the default host color you want to change.
4. Open the color grid for the **Element Foreground** to choose a color to map the new color for the element text or type the Hex code you want to use. Select **Element Background** to map the new color to the element background field.
5. Click **Save** to close the Display panel and resume configuring your host connection.

Restore defaults clears any changes you made and resets the colors to the default host settings.

How to configure hotspots

Hotspots are buttons that appear over common host commands in terminal sessions. When you use hotspots you can control the terminal session using a mouse or a finger-tap instead of the keyboard. The hotspot transmits a terminal key or command to the host. By default, hotspots are configured for the most common 3270, 5250, and VT commands.

Hotspots are enabled and visible by default, however you can disable hotspots for a particular session or choose to hide them.

- **Enable hotspots**

  Choose **No** to disable hotspots for the session you are connecting to.
- **Show hotspots**

  Choose **No** to hide hotspots on the screen. Hotspots remain functional.

Table 3-6 *Hotspots for 3270 Hosts*

Hotspot	Description
PF1...PF24	Transmits a PF1...PF24 to the host
PA1, PA2, or PA3	Transmits a PA1, PA2, or PA3 to the host
enter	Transmits an Enter key to the host
more	Transmits a Clear key to the host

Table 3-7 *Hotspots for 5250 Hosts*

Hotspot	Description
enter	Transmits an Enter key to the host
more...	Transmits a Roll Up key to the host (scrolls down one page)
PF1 - PF24	Transmits a PF1...PF24 to the host

Table 3-8 *Hotspots for VT Hosts*

Hotspot	Description
F1 - F20	Transmits a F1...F20 to the host

How to map keys

You can create keyboard shortcuts that perform any assignable action during a session. The View Keyboard Map option on the left panel provides a view of the default keyboard map for each host type and the mapped custom keys for that session.

TIP: Browsers use keyboard shortcuts to save both time and mouse clicks. When mapping keystrokes it is important to keep this in mind. For example, Cntrl+F1 opens Internet Explorer help as well as the UTS control page. Handy Keyboard Shortcuts gives a brief overview of the keyboard shortcuts used by different browsers.

1. Open the **Manage Key Mappings** panel.
2. Under Key, click to add the key or key combination you want to use to trigger the assigned action in the Key field.
3. From the Mapped To drop down box, select the action you want to associate with the key selection.
4. Click the blue check mark to complete the association and add the key map to the session.
5. Click  to close the Key Mapping panel and resume configuring your host connection. Click **Connect** to save the configuration.

After you complete mapping keys for the session, click View Keyboard Map on the left panel to reference the updated map that includes the boldface custom key mappings. Click the column header to sort the list by Key or Mapped to action.

Related Topics

IBM 3270 Keyboard Maps

IBM 5250 Keyboard Maps

VT Keyboard Maps

UTS Keyboard Maps

Using Quick Keys

3270, 5250, VT, and UTS Keyboard Mapping

The following tables provide the default keys, key name, and key description for the different host keyboard mappings.

Table 3-9 *IBM 3270 Keyboard Mapping*

Key	Maps to	Description
Ctrl + F1	Attention	Sends the ATTENTION key to the host
Shift + Tab	Backtab	Moves the cursor to the previous unprotected field
Ctrl + F2	Clear	Clears the screen and sends the CLEAR key to the host
Alt + ArrowLeft	Cursor left double	Moves the cursor two positions to the left
Alt + ArrowRight	Cursor right double	Moves the cursor two positions to the right
Ctrl + F3	Cursor select	Simulates a lightpen select in the current field
Alt + Delete	Delete word	Deletes three characters from the current field
Ctrl + 5	Duplicate	Inserts the DUP character at the cursor location

Key	Maps to	Description
Enter	Enter	Sends the ENTER key to the host
End	Erase end of field	Erases all data from the cursor location to the end of the current field
Alt + F5	Erase input	Erases all data in all unprotected fields of the current screen.
Ctrl + Alt + F	Field delimiter	Toggles whether field delimiters are displayed on screen
Ctrl + 6	Field mark	Inserts the Field Mark character at the cursor location
Home	Home	Moves the cursor to the first unprotected field on the screen
Insert	Insert	Toggles Insert mode
Shift + Enter	New line	Moves to the next unprotected field
Ctrl + 1	PA1	Sends the PA1 key to the host
Pageup	PA1	Sends the PA1 key to the host
Ctrl + 2	PA2	Sends the PA2 key to the host
Pagedown	PA2	Sends the PA2 key to the host
Ctrl + 3	PA3	Sends the PA3 key to the host
F1	PF1	Sends the PF1 key to the host
F2	PF2	Sends the PF2 key to the host
F3	PF3	Sends the PF3 key to the host
F4	PF4	Sends the PF4 key to the host
F5	PF5	Sends the PF5 key to the host
F6	PF6	Sends the PF6 key to the host
F7	PF7	Sends the PF7 key to the host
F8	PF8	Sends the PF8 key to the host
F9	PF9	Sends the PF9 key to the host
F10	PF10	Sends the PF10 key to the host
Alt + 1	PF11	Sends the PF11 key to the host
F11	PF11	Sends the PF11 key to the host
Al + 2	PF12	Sends the PF12 key to the host
F12	PF12	Sends the PF12 key to the host
Shift + F1	PF13	Sends the PF13 key to the host
Shift + F2	PF14	Sends the PF14 key to the host
Shift + F3	PF15	Sends the PF15 key to the host
Shift + F4	PF16	Sends the PF16 key to the host
Shift + F5	PF17	Sends the PF17 key to the host
Shift + F6	PF18	Sends the PF18 key to the host

Key	Maps to	Description
Shift + F7	PF19	Sends the PF19 key to the host
Shift + F8	PF20	Sends the PF20 key to the host
Shift + F9	PF21	Sends the PF21 key to the host
Shift + F10	PF22	Sends the PF22 key to the host
Alt3	PF23	Sends the PF23 key to the host
Shift + F11	PF23	Sends the PF23 key to the host
Alt4	PF24	Sends the PF24 key to the host
Shift + F12	PF24	Sends the PF24 key to the host
Ctrl +P	Print	Prints the contents of the screen to the printer
Escape	Reset	Resets keyboard error conditions
Ctrl + S	System request	Sends the SYSTEM REQUEST key to the host

Table 3-10 *IBM 5250 Keyboard Mapping*

Key	Maps to	Description
Escape	Attention	Sends the ATTENTION key to the host
Ctrl + F2	Clear	Clears the screen and send the CLEAR key to the host
Ctrl + F3	Cursor select	Simulates a lightpen select in the current field
Ctrl + Backspace	Destructive backspace	Moves the cursor one position to the left
Ctrl + 5	Duplicate	Inserts the DUP character at the cursor location
Ctrl + End	End of field	Moves the cursor to the end of the field
End	Erase end of field	Erases all data from the cursor location to the end of the current field
Alt + End	Erase input	Erases all data in the all unprotected fields of the current screen
Alt + F5	Erase input	Erases all data in all unprotected fields of the current screen.
Ctrl + Enter	Field exit	Moves the cursor out of an input field
KP + Subtract	Field exit minus	Moves the cursor out of a signed-numeric or numeric-only field
Ctrl + Subtract	Field exit minus	Moves the cursor out of a signed-numeric or numeric-only field
KP + Add	Field exit plus	Moves the cursor out of a signed-numeric or numeric-only field
Ctrl + Add	Field exit plus	Moves the cursor out of a signed-numeric or numeric-only field
Ctrl + 6	Field mark	Inserts the field mark character at the cursor location

Key	Maps to	Description
Ctrl + H	Help	Sends the Help key to the host
Ctrl + X	Hex mode	Places the terminal in Hex mode
Home	Home	Moves the cursor to the first unprotected field on the screen
Insert	Insert	Toggles Insert mode
Shift + Enter	New line	Moves to the next unprotected field
Ctrl + 1	PA1	Sends the PA1 key to the host
Ctrl + 2	PA2	Sends the PA2 key to the host
Ctrl + 3	PA3	Sends the PA3 key to the host
F1	PF1	Sends the PF1 key to the host
F2	PF2	Sends the PF2 key to the host
F3	PF3	Sends the PF3 key to the host
F4	PF4	Sends the PF4 key to the host
F5	PF5	Sends the PF5 key to the host
F6	PF6	Sends the PF6 key to the host
F7	PF7	Sends the PF7 key to the host
F8	PF8	Sends the PF8 key to the host
F9	PF9	Sends the PF9 key to the host
F10	PF10	Sends the PF10 key to the host
F11	PF11	Sends the PF11 key to the host
Alt + 1	PF11	Sends the PF11 key to the host
Alt + 2	PF12	Sends the PF12 key to the host
F12	PF12	Sends the PF12 key to the host
Shift + 1	PF13	Sends the PF13 key to the host
Shift + F2	PF14	Sends the PF14 key to the host
Shift + F3	PF15	Sends the PF15 key to the host
Shift + F4	PF16	Sends the PF16 key to the host
Shift + F5	PF17	Sends the PF17 key to the host
Shift + F6	PF18	Sends the PF18 key to the host
Shift + F7	PF19	Sends the PF19 key to the host
Shift + F8	PF20	Sends the PF20 key to the host
Shift + F9	PF21	Sends the PF21 key to the host
Shift + F10	PF22	Sends the PF22 key to the host
Alt + 3	PF23	Sends the PF23 key to the host

Key	Maps to	Description
Shift + F11	PF23	Sends the PF23 key to the host
Alt + 4	PF24	Sends the PF24 key to the host
Shift + F12	PF24	Sends the PF24 key to the host
Ctrl + P	Print	Prints the contents of the screen to the printer
Control	Reset	Resets the keyboard error conditions
Pageup	RollDown	Sends the RollDown key to the host
Pagedown	RollUp	Sends the RollUp key to the host
Ctrl + Home	Start of field	Moves the cursor to the start of the field
Ctrl + S	System request	Sends the SYSTEM REQUEST key to the host

Table 3-11 *VT Keyboard Mapping*

Key	Maps to	Description
Ctrl + Cancel	Break	Sends the Break key to the host
Ctrl + Enter	Enter	Send the Enter key to the host
Alt + F1	F1	Sends the F1 key to the host
Ctrl + F1	F11	Sends the F11 key to the host
Ctrl + F2	F12	Sends the F12 key to the host
Ctrl + F3	F13	Sends the F13 key to the host
Ctrl + F4	F14	Sends the F14 key to the host
Ctrl + F5	F15	Sends the F15 key to the host
Ctrl + F6	F16	Sends the F16 key to the host
Ctrl + F7	F17	Sends the F17 key to the host
Ctrl + F8	F18	Sends the F18 key to the host
Ctrl + F9	F19	Sends the F19 key to the host
Ctrl + F10	F20	Sends the F20 key to the host
Home	Find	Sends the Find key to the host
F1	Hold	Sends the Hold Screen to the host
Pause	Hold	Sends the Hold Screen to the host
Insert	Insert	Sends the Insert key to the host
Ctrl + Insert	Keypad 0	Sends the numeric keypad 0 key to the host
Ctrl + End	Keypad 1	Sends the numeric keypad 1 key to the host
Ctrl + ArrowDown	Keypad 2	Sends the numeric keypad 2 key to the host
Ctrl + Pagedown	Keypad 3	Sends the numeric keypad 3 key to the host

Key	Maps to	Description
Ctrl + ArrowLeft	Keypad 4	Sends the numeric keypad 4 key to the host
Ctrl + Clear	Keypad 5	Sends the numeric keypad 5 key to the host
Ctrl + ArrowRight	Keypad 6	Sends the numeric keypad 6 key to the host
Ctrl + Home	Keypad 7	Sends the numeric keypad 7 key to the host
Ctrl + ArrowUp	Keypad 8	Sends the numeric keypad 8 key to the host
Ctrl + Pageup	Keypad 9	Sends the numeric keypad 9 key to the host
Ctrl + Alt-add	Keypad comma	Sends the numeric keypad Comma key to the host
Ctrl + add	Keypad minus	Sends the numeric keypad Minus key to the host
Ctrl + decimal	Keypad period	Sends the numeric keypad Period key to the host
Ctrl + Delete	Keypad period	Sends the numeric keypad Period key to the host
Pagedown	Next	Sends the Next Screen key to the host
Ctrl + Pause	PF1	Sends the PF1 key to the host
Ctrl + Divide	PF2	Sends the PF2 key to the host
Ctrl + Multiply	PF3	Sends the PF3 key to the host
Ctrl + Subtract	PF4	Sends the PF4 key to the host
Pageup	Previous	Sends the Prev Screen key to the host
Delete	Remove	Sends the Remove key to the host
End	Select	Sends the Select key to the host
Shift + F6	UDK6	Sends the User Defined Key 6 to the host
Shift + F7	UDK7	Sends the User Defined Key 7 to the host
Shift + F8	UDK8	Sends the User Defined Key 8 to the host
Shift + F9	UDK9	Sends the User Defined Key 9 to the host
Shift + F10	UDK10	Sends the User Defined Key 10 to the host
Shift + Ctrl + F1	UDK11	Sends the User Defined Key 11 to the host
Shift + Ctrl + F2	UDK12	Sends the User Defined Key 12 to the host
Shift + Ctrl + F3	UDK13	Sends the User Defined Key 13 to the host
Shift + Ctrl + F4	UDK14	Sends the User Defined Key 14 to the host
Shift + Ctrl + F5	UDK15	Sends the User Defined Key 15 to the host
Shift + Ctrl + F6	UDK16	Sends the User Defined Key 16 to the host
Shift + Ctrl + F7	UDK17	Sends the User Defined Key 17 to the host
Shift + Ctrl + F8	UDK18	Sends the User Defined Key 18 to the host
Shift + Ctrl + F9	UDK19	Sends the User Defined Key 19 to the host
Shift + Ctrl + F10	UDK20	Sends the User Defined Key 20 to the host

Table 3-12 *UTS Keyboard Mapping*

Key	Maps to	Description
F4	Clear Change Bit	Sends the CLEARCHANGEBIT key to the host.
Keypad+Enter	Carriage Return	Sends a carriage return to the host.
Ctrl+PageDown	Clear End of Display	Clears text from the cursor location to the end of the display.
Ctrl+PageUp	Clear End of Display FCC	Clears all data (including FCC information) from the cursor to the end of the display
Ctrl+End	Clear End of Field	Clears text from the cursor location to the end of the field.
Ctrl+Shift+end	Clear End of Line	Clears text from the cursor location to the end of the row.
F7	Clear FCC	Clears the field control character
Ctrl+Home	Clear Home	Sends the CLEAR_HOME key to the host.
Ctrl+H	Column Separator Right	Sends the COLUMN_SEP_RIGHT key to the host.
Ctrl+F1	Control Page	Sends the CONTROL_PAGE key to the host.
Keypad+2	Cursor Down	Moves the cursor one row down.
Keypad+4	Cursor Left	Moves the cursor one column to the left.
Keypad+6	Cursor Right	Moves the cursor one column to the right.
Keypad+8	Cursor Up	Moves the cursor one row up.
Delete	Delete in Line	Sends the DELETE_IN_LINE key to the host.
Ctrl+Delete	Delete in Page	Sends the DELETE_IN_PAGE key to the host.
Ctrl+Shift+Delete	Delete Line	Deletes the row at the cursor location.
Ctrl+ArrowDown	Duplicate Line	Duplicates the row at the cursor location.
F8	Enable FCC	Enables the field control character.
Keypad+-	End of Display and Transmit	Sends the EOD_AND_TRANSMIT key to the host.
Shift+End	End of Field	Moves the cursor to the end of the field.
End	End of Line	Moves the cursor to the end of the row.
Ctrl+ArrowRight	End of Page	Moves the cursor to the end of the page.
Shift+Space	Erase Character	Erases the character at the cursor location.
Ctrl+Shift+E	Euro Character	Sends the Euro character to the host.
Ctrl+1 - Ctrl+9	F1 - F9	Sends the F1 - F9 key to the host
Ctrl+0	F10	Sends the F10 key to the host.
Ctrl+-	F11	Sends the F11 key to the host.
Ctrl+=	F12	Sends the F12 key to the host.
Ctrl+Q	F13	Sends the F13 key to the host.

Key	Maps to	Description
Ctrl+W	F14	Sends the F14 key to the host.
Ctrl+E	F15	Sends the F15 key to the host.
Ctrl+R	F16	Sends the F16 key to the host.
Ctrl+T	F17	Sends the F17 key to the host.
Ctrl+Y	F18	Sends the F18 key to the host.
Ctrl+U	F19	Sends the F19 key to the host.
Ctrl+I	F20	Sends the F20 key to the host.
Ctrl+O	F21	Sends the F21 key to the host.
Ctrl+P	F22	Sends the F22 key to the host
Shift+F3	FF	Sends a formfeed to the host.
F9	Generate FCC	Generates a field control character.
Home	Home	Moves the cursor to the first field in the display.
Ctrl+Shift+Space	Insert in Line	Sends the INSERT_IN_LINE key to the host.
ICtrl+Space	Insert in Page	Sends the INSERT_IN_PAGE key to the host.
Ctrl+Shift+Insert	Insert Line	Inserts a new row into display memory.
Insert	Insert Mode	Toggles insert character mode.
F5	Locate FCC	Disables the field control characters and moves to the first character of the next field to the right of the cursor.
F3	Message Wait	Sends the MESSAGE_WAIT key to the host.
Shift+F2	New Line	Moves the cursor to a new row.
Keypad+Shift+2	Next Field	Moves the cursor to the next field.
Keypad+Shift+4	Next Field	Moves the cursor to the next field
PageDown	Page Down	Sends the Page Down key to the host.
PageUp	Page Up	Sends the Page Up key to the host.
Keypad+Shift+6	Previous Field	Moves the cursor to the previous field.
Keypad+Shift+8	Previous Field	Moves the cursor to the previous field.
Clear	SOE Character	Sends the SOE character to the host.
F12	SOE Character	Sends the SOE character to the host.
Ctrl+Clear	Set Tab	Sends the SET_TAB key to the host.
Ctrl+Tab	Set Tab	Sends the SET_TAB key to the host.
Shift+Home	Start of Field	Moves the cursor to the start of the field.
Ctrl+ArrowLeft	Start of Line	Moves the cursor to the start of the row
Ctrl+[	System Mode	Sends the SYSTEM_MODE key to the host.
Ctrl+J	Toggle Column Separator	Toggles the column separator.

Key	Maps to	Description
Ctrl+F12	Toggle Message Wait Beep	Sends the TOGGLEMSGWAITBEEP key to the host.
Ctrl+L	Toggle Strike Thru	Toggles strike thru mode.
Ctrl+K	Toggle Underline	Toggles underline mode.
Ctrl+Enter	Transmit	Transmits the contents of the display to the host.
ScrollLock	Transmit	Transmits the contents of the display to the host.
Keypad++	Transmit	Transmits the contents of the display to the host.
Keypad+Ctrl+	Transmit	Transmits the contents of the display to the host.
Escape	Unlock	Sends the UNLOCK key to the host.
Ctrl+]	Workstation Mode	Sends the WORKSTATION_MODE key to the host.

How to configure macros for your users

Use the Macro panel to select which macros to run and set when they should run.

- **Run macro on startup** - Choose a macro to run automatically when the session is opened.
- **Run macro on connect** - Choose a macro to run automatically when the session connects to the host.
- **Run macro on disconnect** - Choose a macro to run automatically when the session disconnects from the host.

Related Topics

Using the Macro API
Sample Macros
Creating Macros

How to transfer files to and from the host

You can transfer information between your computer and a 3270 host computer. From the drop down list, choose which IBM 3270 operating environment the host is running: CMS, TSO, or None (the default).

You cannot transfer files unless you are connected to the host. After establishing a connection, from the left panel, select **IND$FILE** to open the File Transfer dialog box.

Related Topics

File and Data Transfer

How to specify copy and paste options

You can specify different options to use for copy and paste operations.

Copy options

Select text by dragging over it with the mouse. By default, different host types use different selection modes when copying text; IBM 3270, 5250 and UTS hosts use a block selection mode, while VT hosts use a linear selection mode. To toggle between block and linear selection modes, press and hold down the **Alt** key, then select the text.

- **Copy input fields only** -. Select this option to only copy data from input fields. Data from protected fields is replaced with spaces when placed on the Clipboard.
- **Use entire display when there is no selection** - This option applies the Copy command to the entire terminal display when nothing else is selected. If you do not select this option, this command is disabled unless you've selected data on the terminal display.

Paste options

Click Paste to paste the contents of the Clipboard at the cursor location.

- **Restore starting cursor position after paste**- By default, the host cursor is positioned at the end of the data following a paste operation. Select this option to restore the host cursor to its starting position after the paste operation is complete.

Related Topics

Managing your sessions
How to configure a connection

How to set user preference rules

As an administrator you can choose what options users can configure for their sessions. These options are set on a per session basis and all users who have access to a particular session can configure their session instance.

1. From the left navigation panel, choose **User Preference Rules.**
2. Select which options you want to allow your users to configure.
3. Click Save.

Each user's configurations are specific to their instance of the session and will not conflict with those of other users.

Related Topics

Connection settings
How to customize host screen colors
How to configure hotspots
How to map keys
Recording macros for the session
How to transfer files to and from the host

4 Using Sessions

All the sessions you have access to are available in the Connect list. Sessions are initially created and configured by your system administrator and accessed through a distributed URL (for example, https://<sessionserver>:7443/zfe).

Opening a session

1. Select the session and click to open.
2. Interact with your host application using the open session.
3. You can create multiple instances of a configured session.

Managing your sessions

In the upper left corner of the screen, click  to expand the left side menu panel. Here you can close the session, disconnect from the host, open another configured session or create additional instances of available sessions.To close the session, click **Close Session**. Sessions stay available to you for 30 minutes. When you click Connect a list of available sessions display. You can connect to any of the sessions by selecting it.

Click  in the upper right corner of the screen to display a list of all open sessions. The number in the icon represents the number of sessions you have open. You can easily switch between sessions by selecting the session listed. Each session remains active for 30 minutes.

Using Quick Keys

Use the Function button  to display Quick Keys for quick access to terminal keys for host sessions. The Quick Key terminal keyboard provides a graphical representation of the keys on a host keyboard. Click the terminal keys on the Quick Key keyboard to send a terminal key to the host. Hovering over a key provides a tool tip that shows the mapping.

Table 4-1 *3270 Quick Keys*

Keys	Description
Program Attention Keys PA1-PA3	Select to send a program attention key to the host.
Program Function Keys PF1-PF24	Select to send a program function key to the host.
Attention	Select to send an Attention key to the host.
Enter	Select to send an Enter key to the host.
Erase	Select to erase all characters, from the cursor to the end of the entry.
Clear	Set buffer locations for the active partition to nulls and the Reply mode to the default, transmit the Clear Aid key to the host, and move the cursor position to the top left corner.
Reset	Clear the Input Inhibited indicator and reset the Insert mode.
SYSRQ	Sends the System Request key to the host.

Table 4-2 *5250 Quick Keys*

Key	Description
Program Function Keys PF1-PF24	Select to send a program function key to the host.
Attention	Select to send an Attention key to the host.
Enter	Select to send an Enter key to the host.
Erase	Select to erase all characters, from the cursor to the end of the entry.
Clear	Signal the host to erase all user-entered text from the current screen.
Reset	Exit insert mode, diacritical mode, or hex mode; end help and system request functions; clear operator errors; and remove the Input Inhibited indicator and reset the Insert mode. Select Reset twice (consecutively) to exit Plus CR mode.
Roll Up	Select to scroll down one page in the current host screen. This option is equivalent to Page Down.
Roll Down	Select to scroll up one page in the current host screen. This option is equivalent to Page Up.

Table 4-3 *VT Quick keys*

Key	Description
VT Function Keys	Select to send a VT function key to the host.
F1-F20	
Program Function Keys	Select to send a program function key to the host.
PF1-PF24	
Break	Sends the Break key to the host.
Enter	Select to send an Enter key to the host.
Find	Sends the Find key to the host. <ESC>[1~
Insert	Toggles Insert mode. <ESC>[2~
Remove	Sends the Remove key to the host. <ESC>[3~
Select	Sends the Select key to the host. <ESC>[4~
Previous	Sends the Previous key to the host. <ESC>[5~
Next	Sends the Next key to the host. <ESC>[6~

Recording macros for the session

If your administrator has given you permission to record your own macros for the session, you can do so using the Macro icon  on the right toolbar.

See Creating Macros for instructions on how to record macros.

Logging out

Select Log Out as <user-name> to finish working with the host application.

Related Topics

- How to map keys
- Creating Macros

5 Creating Macros

A macro is a series of keyboard actions that you record and then run. You can use these JavaScript macro programs to automate user interactions with the terminal. You can access and run macros from all supported devices.

Reflection ZFE records and saves advanced macros as JavaScript, making it easy to edit and enhance your recorded macros. You can record macros to playback later, run macros at startup or when the session connects or disconnects from the host. You can also write macros from scratch to perform complex tasks that the recorder cannot capture.

Macros are made available to users in two ways; created by an administrator or recorded by users for their own private use. All advanced macros are associated with a session and they all accomplish the same goal, automating host interaction. The only difference between the two flavors is simply who can access them and who manages their creation and availability:

- **Macros created by administrators**

  Administrators create macros when they create the session. They are specific to a session and are available to all users who have access to the session from the Macro icon on the toolbar. Administrators can designate macros to run at startup or when the session connects or disconnects from the host.

- **Macros created by users**

  End-user macros are created by individuals for sessions they are authorized to access. The administrator grants permission to create macros by setting a User Preference Rule. Users can access the session under their own credentials or in a **Guest** role. Macros that Guest users create are available to all Guest users. Users who are logged in using their own credentials can only see macros that they have created.

Advanced macros are listed in alphabetical order in the drop down list available from the toolbar. Macros created by the end-user are listed first and followed by an indicator of three vertical grey dots, which when selected, displays the Edit and Delete options. Macros created by the administrator are listed without the indicator as those macros cannot be modified by the end-user.

Related Topics

How do I work with macros?

How do I?

- Record a macro
- Edit a macro
- Run a macro
- Stop a macro
- Delete a macro

- View my macros
- Debug my macros

Record a macro

If you have been granted permission from your administrator, you can record macros to automate any series of host actions. Macros that were recorded by the administrator and associated with the current session are available to you from the Macro drop down list.

To record a macro:

1. Click  from the toolbar, and then click 

.
2. Navigate the host application to record the series of steps you want included in the macro.
3. Click  on the toolbar to stop recording. The red dot pulses to indicate the recording is in process.
4. When prompted, type a name for the macro.

Edit a macro

You can edit macros that you have recorded. These macros are listed under **My Macros**.

To edit an existing macro:

1. From the Macro drop down list, select the macro you want to edit.
2. Click to expand the field.
3. Click 

to open the Macro Editor.

   The Macro Editor opens in the left panel.
4. Use JavaScript to make whatever changes are necessary. You can run and save the modified macro using the toolbar icons in the upper panel of the editor.

Run a macro

To run a macro, choose the macro from the drop down list and click  .

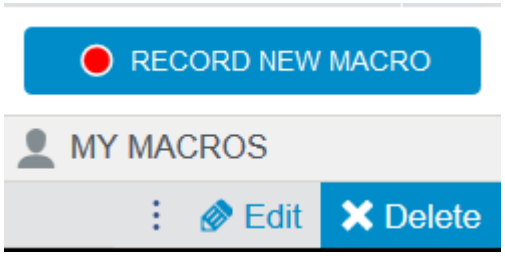
Stop a macro

You can stop a macro before it completes from either the Macro Editor or the toolbar. Click  to stop the macro. To rerun the macro, navigate back to the macro starting screen.

Delete a macro

1. From the Macro drop down list, select the macro you want to delete.
2. Expand the field, by clicking the three vertical dot icon.

3. Click **Delete**.



View my macros

The Macro drop down list is available from the toolbar to all users who have permission to record macros or are accessing a session where macros have been pre-recorded by the administrator for use with that session.

Macros are listed under either **MY MACROS** or **MACROS** depending on how they were recorded.

All users, whether they are logged in using their credentials or as Guest, can see the macros associated with the session. Macros listed under the MY MACROS heading are listed in alphabetical order by name and are visible to those users that recorded them. Macros recorded by the administrator and attached to a session are listed alphabetically under MACROS.

Debug my macros

Since macros are written in JavaScript and executed in the browser, the best way to debug and troubleshoot them is by using your web browser's built-in tools. Modern browsers come with a very capable set of tools for debugging JavaScript code. You can place breakpoints, step through code, and output debug information.

TIP: JavaScript is case sensitive. Keep that in mind when editing JavaScript code.

To debug a macro:

1. Open the macro for editing. See Edit a macro for instructions.
2. Open your browser's development tools.

Table 5-1 *Browser debugging support*

Browser	Open debugger
Mozilla Firefox 40.0.3	◆ From the toolbar, open the Menu, and choose Developer. ◆ From the Web Developer menu, choose Debugger. The debugger opens in a lower panel.
Google Chrome 45.0	◆ From the toolbar, open the Menu, and choose More tools. ◆ Choose Developer Tools to open the Debugger.
Microsoft Internet Explorer 11	◆ From the toolbar, open Settings, and choose F12 Developer Tools. ◆ Open the Debugger tab.

These instructions are for supported browsers and are dependent on the versions used.

3. Use one of the these tools in your macro code, and run the code.
   - *debugger*

     The most thorough approach to debugging is to use the 'debugger;' statement. When you insert these statements into your macro code then run it, with the browser's development tools open, the execution will stop on those lines. You can step through your macro, view the value of local variables and whatever else you need to check.

     You are encouraged to place multiple debugger; statements in your code to help get to the correct line. The asynchronous nature of JavaScript can make stepping through code challenging. This can be offset by using multiple, carefully placed debugger; statements.

     Example 5-1 *Debugger*

     ```
     ---------------------
     var hostCommand = menuSelection + '[enter]';
     debugger;  // <— Browser's debugger will stop here
     ps.sendKeys(hostCommand);
     ---------------------
     ```

   - `console.log(), alert()`

     These two functions are commonly used for debugging JavaScript. While not as flexible as the debugger statement they provide a quick way to output debug information. These functions output the information to the JavaScript "Console" tab in the browser's developer tools.

Example 5-2 *console.log(), alert()*

```
---------------------
var hostCommand = menuSelection + '[enter]';
console.log('Command:' + hostCommand);  // <— Will output the string to
"Console" tab
alert('Command:' + hostCommand); // Will pop up a small window containing
the data
ps.sendKeys(hostCommand);
---------------------
```

- `ui.message()`

  The Reflection ZFE Macro API provides an ui.message() function that is very similar to JavaScript's alert() function. You can also use ui.message() to output debug information.

Example 5-3 *ui.message()*

```
---------------------
var hostCommand = menuSelection + '[enter]';
ui.message('Command:' + hostCommand);  // <— Will pop up a ZFE message
window
ps.sendKeys(hostCommand);
---------------------
```

Notes

- Stepping and "yields"

  While the yield statements in macros make them easier to understand, they can make the code more challenging to step through with the debugger. Consider either using multiple debugger statements or carefully placed debugger statements of `console.log()` calls to output the right debug information.

- Internet Explorer

  Debugging in Internet Explorer involves transformed code and may be more difficult than on other browsers.

6 Using the Macro API

In Reflection ZFE macros are recorded and written using JavaScript. JavaScript is a popular and prevalent programming language. There are a wide variety of learning resources and tools available to you.

The Reflection ZFE Macro API consists of a set of objects which you can use to interact with the host, wait for screen states, and interact with the user.

Important things to keep in mind

Because JavaScript is single threaded and uses 'callback functions' and 'promises' to help manage the flow of execution through code, often code can be difficult to follow. Reflection ZFE combines the concept of 'promises' with the 'yield' keyword so macro code can be organized in a more linear fashion.

- **Promises**

  Promises are patterns to help simplify functions that return their result asynchronously, at some point in the future. All 'wait' and 'ui' functions in the Reflection ZFE Macro API return promise objects.

- **Yield**

  Reflection ZFE macros use the yield keyword to block the execution of the macro until a promise is resolved, or done. So putting yield in front of any 'wait' or 'ui' function makes the macro execution pause until that function has finished executing. You can place the yield keyword in front of any function that returns a promise, even your own custom functions.

NOTE: The ability to make macro execution block by combining yield with promises is enabled by the `createMacro()` function.

Errors

Errors are handled in macros using a try / catch statement. Some API functions may throw errors if, for example, conditions can't be met or a timeout occurs. The thrown error is 'caught' in the catch statement. You can wrap smaller blocks of code in a try / catch statement to handle errors at a more granular level. Macro developers can also throw errors with `'throw new Error('Helpful error message');`

Macro API Objects

You can create macros using the Macro API. By default for use in macros, there are four primary objects available:

- Session

  Session is the main entry point for access to the host. You use the Session object to connect, disconnect and provide access to the PresentationSpace object.

- PresentationSpace

  The PresentationSpace object represents the screen and provides many common capabilities such as getting and setting the cursor location, sending data to the host and reading from the screen. It is obtained by calling `session.getPresentationSpace()`.

- Wait

  Provides a simple way to wait for various host states to occur before continuing to send more data or read from the screen. For example, you can wait for the cursor to be located at a certain position, text to be present in a position on the screen or simply wait for a fixed amount of time. All 'Wait' function calls require the yield keyword, which is explained below.

- User Interface

  The UI object is made automatically available in your macro as the "ui" variable. It provides basic user interface capabilities. You can use this object to display data to the user or prompt them for information. All 'UI' function calls require the yield keyword.

Other available objects

- Attribute
- AttributeSet
- AutoSignon
- Color
- ControlKey
- DataCell
- Dimension
- Field
- FieldList
- OIA
- OIAStatus
- Position
- SessionType
- StatusSet

Attribute

Use the Attribute, along with the AttributeSet, to decode the formatting information present on the data cell.

Table 6-1 *Attributes*

Attribute	Description
PROTECTED	Indicates a protected data cell.
MODIFIED	Indicates a modified data cell.
NUMERIC_ONLY	Indicates the beginning of a numeric only data cell.
ALPHA_NUMERIC	Indicates an alpha numeric data cell.
HIGH_INTENSITY	Indicates whether the data cell contains high intensity text.

Attribute	Description
HIDDEN	Indicates whether the data cell contains hidden text
PEN_DETECTABLE	Indicates whether the data cell is pen detectable
ALPHA_ONLY	Indicates an alpha only data cell.
NUMERIC_SHIFT	Indicates the beginning of a numeric shift. field
NUMERIC_SPECIAL	Indicates the data cell marks the beginning of a numeric special field
KATAKANA_SHIFT	Indicates a section of Katakana text.
MAGNETIC_STRIPE	Indicates the data cell marks the beginning of a magnetic strip field.
SIGNED_NUMERIC_ONLY	Indicates the data cell is a signed numeric field.
TRANSMIT_ONLY	Indicates the data cell is a transmit only field
FIELD_END_MARKER	Indicates the data cell marks the end of a modified field.
FIELD_START_MARKER	Indicates the data cell marks the start of a modified field.
SPECIAL_EMPHASIS_PROTECTED	Indicates a special emphasis protected field.
TAB_STOP	Indicates that the data cell contains a tab stop.
REVERSE	Indicates the data cell displays in reverse video mode.
BLINKING	Indicates the data cell contains blinking text
RIGHT_JUSTIFIED	Indicates the data cell marks the beginning of a right justified field.
LEFT_JUSTIFIED	Indicates the data cell marks the beginning of a left justified field.
LOW_INTENSITY	Indicates the data cell contains low intensity text
UNDERLINE	Indicates the data cell contains underlined text.
DOUBLE_BYTE	Indicates the data cell contains double byte text.
COLUMN_SEPARATOR	Indicates the data cell contains a column separator.
BOLD	Indicates the data cell contains bold text.
DOUBLE_WIDTH	Indicates the data cell marks a double width field.
DOUBLE_HEIGHT_TOP	Indicates a double height top data cell.
DOUBLE_HEIGHT_BOTTOM	Indicates a double height bottom data cell.
CONTROL_PAGE_DATA	Indicates the data cell contains control page data.
RIGHT_COLUMN_SEPARATOR	Indicates the data cell contains a right column separator.
LEFT_COLUMN_SEPARATOR	Indicates a data cell containing a left column separator.
UPPERSCORE	Indicates the data cell contains an upperscore.
STRIKE_THROUGH	Indicates the data cell contains strike through text.

AttributeSet

The AttributeSet object allows the user to decode the attributes that are present on the data cell. The AttributeSet object returns values defined in the Attribute object and when used together, you can get formatting information from the data cell.

Table 6-2 *AttributeSet*

METHODS	
`contains(attribute)`	Determines if the set contains the specified Attribute. **Parameters** `{Number}` attribute to check **Returns** `{Boolean}` True if the attribute is in the set.
`isEmpty()`	Determines if the attribute set is empty. **Returns** `{Boolean}`True if the set is empty.
`size()`	Indicates the number of attributes in a set. **Returns** `{Number}` The attribute count.
`toArray()`	Converts the internal attribute set to an array. **Returns** `{Number[]}`Array of values of attributes in the set.
`toString()`	Converts the internal attribute set to a string. **Returns** `{String}` Space-delimited names of attributes in the set.
`forEach(callback, thisArg)`	Function to iterate over each element in the attribute set. **Parameters** `{forEachCallback}` Callback to perform the specific operation. Called with the name of each attribute in the set. `{Object}` this Arg optional pointer to a context object.
`forEachCallback(string, object)`	A user provided callback function where you provide the behavior, to be used as the callback parameter to forEach. **Parameters** `{String}` `String` name of an attribute in the attribute set. `{Object}` `thisArg` optional pointer to a context object.

Color

Color constants to use for the DataCell object foreground and background colors.

Table 6-3 *Color constants*

Color	Description	Numeric Value
BLANK_UNSPECIFIED	No color specified	0
BLUE	Blue	1
GREEN	Green	2
CYAN	Cyan	3
RED	Red	4
MAGENTA	Magenta	5
YELLOW	Yellow	6
WHITE_NORMAL_INTENSITY	Normal intensity white	7
GRAY	Gray	8
LIGHT_BLUE	Light blue	9
LIGHT_GREEN	Light green	10
LIGHT_CYAN	Light cyan	11
LIGHT_RED	Light red	12
LIGHT_MAGENTA	Light magenta	13
BLACK	Black	14
WHITE_HIGH_INTENSITY	High intensity white	15
BROWN	Brown	16
PINK	Pink	17
TURQUOISE	Turquoise	18

ControlKey

The ControlKey object defines constants for sending cursor control keys and host commands using the sendKeys method. Constants are available for these host types:

- IBM 3270
- IBM 5250
- VT
- UTS

IBM 3270

Table 6-4 *IBM 3270*

Key word	Description
ALTVIEW	Alternate view
ATTN	Attention
BACKSPACE	Back space
BACKTAB	Back tab
CLEAR	Clear or clear display
CURSOR_SELECT	Cursor select
DELETE_CHAR	Delete, delete character
DELETE_WORD	Delete word
DEST_BACK	Destructive backspace
DEV_CANCEL	Device cancel
DOWN	Cursor down
DSPSOSI	display SO/SI
DUP	Duplicate field
END_FILE	End of field
ENTER	Enter
ERASE_EOF	Erase end of field
ERASE_FIELD	Erase field
ERASE_INPUT	Erase input
FIELD_MARK	Field mark
HOME	Cursor home
IDENT	Ident
INSERT	Insert
LEFT_ARROW	Cursor left
LEFT2	Left two positions
NEW_LINE	New line
PA1 - PA3	PA1 - PA3
PF1 - PF24	PF1 - PF24
PAGE_DOWN	Page down
PAGE_UP	Page up
RESET	Reset, reset terminal
RIGHT2	Right 2 positions
RIGHT_ARROW	Cursor right, right

Key word	Description
SYSTEM_REQUEST	System request
TAB	Tab key
UP	Cursor up

IBM 5250

Table 6-5 *IBM 5250*

Key word	Description
ALTVIEW	Alternate view
ATTN	Attention
AU1 - AU16	AU1 - AU16
BACKSPACE	Back space
BACKTAB	Back tab
BEGIN_FIELD	Begin field
CLEAR	Clear
DELETE_CHAR	Delete, delete character
DEST_BACK	Destructive backspace
DOWN	cursor down
DSPSOSI	Display SO/SI
DUP	Duplicate field
END_FILE	End of field
ENTER	Enter
ERASE_EOF	Erase end of field
ERASE_FIELD	Erase field
ERASE_INPUT	Erase input
FIELD_EXT	Field exit
FIELD_MINUS	Field minus
FIELD_PLUS	Field plus
FIELD_MARK	Field mark
HELP	Help request
HEXMODE	Hex mode
HOME	cursor home
INSERT	Insert
LEFT_ARROW	Cursor left

Key word	Description
NEW_LINE	New line
PA1 - PA3	PA1 - PA3
[PF1 - PF24	PF1 - PF24
[print]	Print
RESET	Reset, reset terminal
RIGHT_ARROW	Cursor right, right
PAGE_UP	Page up
PAGE_DOWN	Page down
SYSTEM_REQUEST	System request
TAB	Tab
UP	Cursor up

VT

Table 6-6 *VT*

Keywords	Description
BACKSPACE	Back space
BREAK	Break
CLEAR	Clear or clear display
CURSOR_SELECT	Cursor select
DELETE_CHAR	Delete, delete character
DOWN	Cursor down
EK_FIND	Edit keypad find
EK_INSERT	Edit keypad insert
EK_NEXT	Edit keypad next
EK_PREV	Edit keypad previous
EK_REMOVE	Edit keypad remove
EK_SELECT	Edit keypad select
ENTER	Enter
END_FILE	End of field
F1 - F24	F1 - F24
HOLD	Hold
HOME	Home
INSERT	Insert

Keywords	Description
KEYPAD_COMMA	Keypad comma
KEYPAD_DOT	Keypad decimal
KEYPAD_MINUS	Keypad minus
KEYPAD_ENTER	Keypad enter
KEYPAD0 - KEYPAD9	Keypad 0 - Keypad 9
LEFT_ARROW:	Cursor left
PF1 - PF20	PF1 - PF20
PAGE_DOWN	Page down
PAGE_UP	Page up
RESET	Reset, reset terminal
RETURN	Return, carriage return
RIGHT_ARROW	Cursor right, right
TAB	Tab key
UDK16 - UDK20	User defined key 6 - User defined key 20
UP	Cursor up

UTS

Table 6-7 *UTS*

Key word	Description
BACKSPACE	Moves the cursor to the previous tab position on the screen.
BACKTAB	Back tab <Shift> <Tab>
CHAR_ERASE	Erases character at the cursor and advances the cursor.
CLEAR_DISPLAY	Clear display
CLEAR_EOD	Clear to end of display
CLEAR_EOF	Clear to end of field
CLEAR_EOL	Clear to end of line
CLEAR_FCC	Clear Field Control Character
CLEAR_HOME	Clear display and cursor home
CONTROL_PAGE	Toggles the control page
DELETE_LINE	Deletes the line containing the cursor and shifts remaining lines up one row
DOWN	Moves the cursor down one line. Wraps at bottom.
DELIN_LINE	Deletes character under cursor and shifts remaining characters on line to the left.

Key word	Description
DELIN_PAGE	Deletes character under cursor and shifts remaining characters on page to the left.
DUP_LINE	Creates a copy of the current line and overwrites the next line with the duplicate.
EURO	Inserts the Euro character
END_FIELD	Moves the cursor to the end of the current field.
END_PAGE	Moves the cursor to the end of the current page.
F1 - F22	Function keys F1-F22
HOME	Moves the cursor to beginning of current page (row 1, col 1)
INSERT	Toggles insert/overwrite mode.
INSERT_IN_LINE	Inserts space at cursor position and shifts the remaining characters on the line to the right. The character in the far right column on the line is discarded.
INSERT_IN_PAGE	Inserts space at cursor position and shifts the remaining characters on the page to the right. The character in the far right column on each line is discarded.
INSERT_LINE	Inserts a new line at the cursor row and shifts the remaining lines down. The last row on the page is discarded.
LEFT_ARROW	Moves the cursor one position to the left wrapping if necessary.
LOCATE_FCC	Finds the next field control character on the screen.
MSG_WAIT	Retrieves messages queued to the terminal.
RETURN	Carriage return
RIGHT_ARROW	Moves the cursor one position to the right, wrapping if necessary.
SOE	Inserts the Start of Entry character
START_OF_FIELD	Moves the cursor to the beginning of the field.
START_OF_LINE	Moves the cursor to column 1 of current line.
TAB	Moves the cursor to the next tab position of the screen.
TOGGLE_COL_SEP	Toggles the column separator attribute.
TOGGLE_STRIKE_THRU	Toggles the strike-through attribute on the current data cell.
TOGGLE_UNDERLINE	Toggles the underline attribute on the current data cell.
TRANSMIT	Transmits changed field data to the host.
UNLOCK	Sends the UNLOCK key to the host.
UP	Moves the cursor up one row, wrapping if necessary.

DataCell

The DataCell object provides information about a particular position on a terminal screen.

Table 6-8 *DataCell*

METHODS	
`getPosition()`	Returns the position of this data cell on the screen. **Returns** `{Position}` the position of the data cell on the screen
`getChar()`	Obtains the character associated with the cell. **Returns** `{String}` The character associated with the cell.
`getAttributes()`	Returns the set of attributes specified for this data cell instance. See AttributeSet. **Returns** `{AttributeSet}`Of attributes for this data cell instance.
`getForegroundColor()`	Returns the foreground color, as defined in the Color object, for this data cell. **Returns** `{Number}`Foreground color for this data cell. The color is defined in the Color object.
`getBackgroundColor()`	Returns the background color, as defined in the Color object, for this data cell. **Returns** `{Number}`Background color for this data cell. The color is defined in the Color object.
`toString`	Converts the internal data cell to a string. **Returns** `{String}` The string representation of a data cell.
`isFieldDelimiter()`	Tests if this cell represents a field delimiter. **Returns** `{Boolean} True if this cell is a field delimiter, false if otherwise.`

Dimension

Represents the size of the screen or screen area.

Table 6-9 Dimension

Method	
`Dimension(rows,cols)`	Creates a new Dimension instance. **Parameters** `{Number} rows` screen rows dimension `{Number} cols` screen columns dimension

Field

Use the Field object, along with FieldList, to obtain the information present in a field on the screen.

Table 6-10 Field

Method	
`getAttributes()`	Returns the set of attributes specified for this field instance. See AttributeSet. **Returns** `{AttributeSet}` The set of attributes for this field
`getForegroundColor()`	Returns the foreground color of the field. **Returns** `{Number}` the foreground color for this field. These values are defined in the Color object.
`getBackgroundColor()`	Returns the background color of the field. **Returns** `{Number}` the background color for this field. These values are defined in the Color object.
`getStart()`	Returns the starting position of the field. The starting position is the position of the first character of the field. Some host types use a character position to store field level attributes. In this case, the attribute position is not considered the start position. **Returns** `{Position}` Starting position of the field. **Throws** `{RangeError}` For zero length fields.

Method	
`getEnd()`	Returns the ending position of the field. The ending position is the position in the presentation space containing the last character of the field. **Returns** `{Position}` Ending position of the field. **Throws** `{RangeError}` For zero length fields.
`getLength()`	Returns the length of the field. For host types that use a character position to store the field attributes, the field length does not include the field attribute position. **Returns** `{Number}` Length of the field.
`getDataCells()`	Obtains the data cells that comprise this field. See DataCell. **Returns** `{DataCell[]}`Data cells that comprise this field.
`getText()`	Obtains the text from the field. **Returns** `{String}` field text.
`setText()`	Sets the field text. For certain host types, like VT, the text is transmitted to the host right away, but in other host types, the text is not transmitted to the host until an Aid key is invoked. If the text is shorter than the field, the text is placed in the host field, and the remainder of the field is cleared. If the text is longer than the host field, then as much text as will fit is placed in the field. **Parameters** `{String}`Text to set on the field. **Throws** `{Error}` If the field is protected.
`clearField()`	Clears the current field in an emulation-specific manner. **Throws** `{Error}` If the field is protected or clear is not supported.
`getPresentationSpace()`	Obtains the presentation space which created this field. **Returns** `{PresentationSpace}` Parent of this field instance.
`toString()`	Creates a user-friendly description of the field. **Returns** `{String}` A user readable rendition of the field.

FieldList

Use the FieldList object, along with Field object, to obtain field list information.

Table 6-11 *FieldList*

Method	
`getPresentationSpace()`	Obtains the presentation space which created this field list. **Returns** `{PresentationSpace}`Parent of this field list instance.
`findField(position, text, direction)`	Returns the field containing the specified text. The search starts from the specified position and proceeds either forward or backward. If the string spans multiple fields, the field containing the starting position is returned. When searching forward the search will not wrap to the top of the screen. When searching backward the search will not wrap to the bottom of the screen. **Parameters** `{Position}` Position from which to start the search. See Position object. `{String}` The text to search for (optional). If not provided, returns the next field to the right of or below the specified position. `{Number}` direction of the search (optional). Use PresentationSpace .SearchDirection constants for this parameter. For example, `PresentationSpace.SearchDirection.FORWARD` or `PresentationSpace.SearchDirection.BACKWARD`. If not provided, searches forward. **Returns** `{Field}` containing the string or null if a field meeting the given criteria is not found. **Throws** `{RangeError}` If the position is out of range.
`get(index)`	Obtains the field at the given index. **Parameters** `{Number}`index into the field list. **Returns** `{Field}` located at the specified index. **Throws** `{RangeError}` If the index is out of range.
`isEmpty()`	Determines if the field list is empty. **Returns** `{Boolean}` True if the list is empty.

Method	
`size()`	Indicates the number of fields in the list. **Returns** `{Number}` The field count
`toString()`	Creates a user-friendly description of the field list. **Returns** `{String}` User readable rendition of the field list.

OIA

Operator Information Area (OIA) interface. The OIA object returns values which are defined in the OIAStatus object.

Table 6-12 *OIA*

Method	
`getStatus` ()	Returns the set of enabled status flags. See StatusSet. **Parameters** **Returns** `{StatusSet}` Containing the status information.
`getCommErrorCode()`	Returns the current communication error code. **Returns** `{Number}` the current communication error code. If one doesn't exist, it will be 0.
`getProgErrorCode()`	Returns the current program error code **Returns** `{Number}` the current program error code. If one doesn't exist, it will be 0.

OIAStatus

Table 6-13 *OIAStatus*

OIAStatus	Description
CONTROLLER_READY	Controller ready
A_LINE	Online with a non-SNA connection
MY_JOB	Connected to a host application
OP_SYS	Connected to a SSCP (SNA)

OIAStatus	Description
UNOWNED	Not connected
TIME	Keyboard inhibited
SYS_LOCK	System lock following AID key
COMM_CHECK	Communication check
PROG_CHECK	Program check
ELSEWHERE	Keystroke invalid at cursor location
FN_MINUS	Function not available
WHAT_KEY	Keystroke invalid
MORE_THAN	Too many characters entered in the field
SYM_MINUS	Symbol entered not available
INPUT_ERROR	Operator input error (5250 only)
DO_NOT_ENTER	Do not enter
INSERT	Cursor in insert mode
GR_CURSOR	Cursor in graphics mode
COMM_ERR_REM	Communications error reminder
MSG_WAITING	Message waiting indicator
ENCRYPT	Session is encrypted
NUM_FIELD	Invalid character in numeric only field

AutoSignon

Some mainframe hosts have a Digital Certificate Access Server (DCAS). You can request a temporary, one-time pass ticket from DCAS for logging into a host application. Using this object, you can write and configure a macro to run when the session starts and to automatically log you in using the credentials of the currently logged in Reflection ZFE user.

Table 6-14 *AutoSignon*

Method	
`getPassTicket()`	Obtains a pass ticket to be used for signing onto a mainframe application. Multiple pass tickets may be requested using different application IDs. **Parameters** `{String}` application ID tells the host which application the sign on is for **Returns** `{Promise}` fulfilled with the pass ticket key or rejected if the operation fails. The pass ticket obtained from DCAS only works with the current host session and is valid for ten minutes.
`sendUserName()`	Applies the user name contained in the pass ticket to the field at the current cursor location on the current host screen. The user name must be sent before the password. Sending the password first will invalidate the pass ticket, and you will need to get another one. **Parameters** `{String}` passTicketKey opbtained from getPassTicket **Returns** `{Promise}` fulfilled if the user name is successfully sent. Rejected if the operation fails.
`sendPassword()`	Applies the password contained in the pass ticket to the field at the current cursor location on the current host screen. The user name must be sent before the password. Sending the password first will invalidate the pass ticket, and you will need to get another one. **Parameters** `{String}` passTicketKey obtained from getPassTicket **Returns** `{Promise}` fulfilled if the password is successfully sent. Rejected if the operation fails.

Position

Represents a row and column on the screen.

Table 6-15 Position

Method	
`Position(row,col)`	Creates a new Position instance. **Parameters** `{Number} row` screen row coordinate `{Number} col` screen column coordinate

PresentationSpace

Use the PresentationSpace object to interact with the terminal screen. Setting and getting the cursor position, sending keys, and reading text are some of the interactions available.

Table 6-16 PresentationSpace

METHODS	
`getCursorPosition()`	Returns a Position instance representing the current cursor position. An unconnected session has a cursor position of 0,0. **Returns** `{Position} current cursor location`
`setCursorPosition(position)`	Moves the host cursor to the specified row and column position. For some hosts, such as VT, the host may constrain the movements of the cursor. **Parameters** `{Position}` Position new cursor position. **Returns** None **Throws** `{RangeError}` If the position is not valid on the current screen.
`isCursorVisible()`	Tests that the cursor is currently visible in the presentation space. The cursor is considered not visible if the session is not connected. **Returns** `{Boolean}` True if the cursor is visible. False if the cursor is not visible.

METHODS

`sendKeys(keys)`

Transmits a text string or ControlKeys to the host at the current cursor position in the presentation space. If the cursor is not in the desired position, then use `setCursorPosition` function first.

The text string can contain any number of characters and ControlKeys

For example: `"myname" + ControlKey.TAB + "mypass" + ControlKey.ENTER` will transmit a user ID, tab to the next field, transmit a password, and then transmit the Enter key.

If you need to transmit a square bracket, double the brackets ([[or]]).

Parameters

`{String} keys text and/or control keys to transmit`

`getText(position,length)`

Returns a string representing a linear area of the presentation space. No new line characters are inserted if row boundaries are encountered.

Parameters

`{Position} start position from which to retrieve text`

`{Number} length the maximum number of characters to return. If the length parameter causes the last position of the presentation space to be exceeded then only those characters up to the last position will be returned.`

Returns

`{String) representing a linear area of the presentation space which may be empty if the session is not connected.`

Throws

`{RangeError}` If the position or length are not valid on the current screen.

`getSize()`

Gets the dimensions of the screen as a Dimension object.

Returns

`{Dimension}` Containing the number of rows and columns. The screen size is [row:0, col:0] if the session is not connected.

METHODS

`getDataCells(start, length)`	Returns DataCell instances where the first member will be for the position specified by the start parameter. The maximum number of DataCell instances in the list is specified by the length parameter. **Parameters** `{Position}` start the first position on the host screen in which to retrieve DataCell instances. See Position. `{Number}` length of the maximum number of DataCell instance to be retrieved. If not specified, returns DataCells from the start position to the end of the screen. **Returns** `{DataCell[]}` Instances which may be empty if the session is not connected. If position is not specified, returns all DataCells. If length is not specified, returns DataCells from the start position to the end of the screen. **Throws** `{RangeError}` if start or length are out of range.
`getFields()`	Returns a list of the fields in the presentation space. If the host type does not support fields or the current screen is not formatted then the return value will always be an empty list. See FieldList. **Returns** `{FieldList}` of host defined fields in the presentation space.

Session

The session object is the main entry point for interacting with the host. It contains functions for connecting, disconnecting, and obtaining the PresentationSpace object.

Table 6-17 *Session object functions*

METHODS

`connect()`	Connects to the configured host. If needed, use `wait.forConnect()` to block macro execution until the session is connected. **Returns** `None`
`disconnect()`	Disconnects from the configured host. If needed, use `wait.forDisconnect()` to block macro execution until the session is connected. **Returns** `None`
`isConnected()`	Determines whether the connection to the host is connected. **Returns** `{Boolean} true if host connection is established; false if not`

METHODS

`getPresentationSpace()` Provides access to the PresentationSpace instance for this session.

Returns

`{PresentationSpace}` instance associated with this session.

`getDeviceName()` Returns the connected available device name, the configured device name, or null if no device name is configured.

The connected device name is the name agreed upon during the connection negotiation process between the host and the terminal. It may be what is specified, or it could possibly be different, if for example a device name pool was specified.

Returns

`{String}`The connected device name, the configured device name, or null.

`getType()` Returns the type of host session. See SessionType.

Returns

`{String}` The type of host session.

`setDeviceName()` Provides a means to modify the device name on a session instance.

Parameters

`{String}` `name` Device name to use when connecting to a host.

Throws

`{Error}` If an attempt is made to set the device name while the session is connected.

`getOIA()` Provides access to the Operator Information Area (OIA) instance for this session.

Returns

`{OIA}` Associated with this session

SessionType

Constants used to identity the type of host to which the connection is being made. See Session object.

Table 6-18 *SessionType*

Host Type	Description
IBM_3270	Indicates an IBM 3270 terminal session.
IBM_5250	Indicates an IBM 5250 terminal session.
VT	Indicates a VT session.

StatusSet

You can use the StatusSet object to decode the OIA status. The StatusSet object returns values defined in the OIAStatus object and when used together, you can get status information from the OIA.

Table 6-19 *StatusSet*

Method	
`contains(statusFlag)`	Determines if the set contains the specified status flag from OIAStatus constants. **Parameters** `{Number} statusFlag` status to check **Returns** `{Boolean}` True if the status flag is present in the set.
`isEmpty()`	Determines if the status set is empty. **Returns** `{Boolean}` True if the set is empty.
`size()`	Indicates the number of status flags in the set. **Returns** `{Number}` The status count
`toArray()`	Converts the internal status set to an array. **Returns** `{Object []}` Array of status flags in the set.
`toString()`	Converts the internal status set to a string. **Returns** `{String}` Space delimited names of status flags in the set.
`forEach(callback, thisArg)`	Function to iterate over each element in the status set. **Parameters** `{forEachCallback}` Callback to perform the specific operation. Called with the name of each status in the set. `{Object}` thisArg optional pointer to a context object.
`forEachCallback(string, thisArg)`	A user provided callback function where you provide the behavior, to be used as the callback parameter to forEach. **Parameters** `{String} String` The name of a status in the status set. `{Object} thisArg` Optional pointer to a context object

User Interface

The user interface object provides functions for interacting with the user, prompting for and displaying basic information. The UI object is made automatically available in your macro as the “ui” variable”.

NOTE: Important! All UI functions require the ‘yield’ keyword in front of them. This allows the macro to block execution until the conditions of the UI function have been met.

`[parameter]` denotes an optional parameter.

Table 6-20 *User Interaction*

METHODS	
`prompt(message,[defaultAnswer], [mask])`	Prompt the user for information in the user interface, **Parameters** `{String} message title to display to the user.` Default: blank String. `{String} defaultAnswer to use if user leaves it blank.` Default: blank String `{Boolean} mask indicates whether to hide the prompt (as with a password).` **Returns** `{Promise}` Fulfilled when the user closes the dialog window. Returns the users input on “OK” or null on “Cancel”.
`message([message])`	Display a message in the user interface. **Parameters** `{String} message to display to the user.` Default: blank String. **Returns** `{Promise}` Fulfilled when the user closes the message window.

Wait

Use the wait object to wait for a particular session or screen state. For example, you can wait until the cursor is found at a particular location or text is present at a certain location before continuing with the macro execution.

Wait functions are often used in conjunction with asynchronous functions such as connect() and sendKeys().

NOTE: All functions take timeouts as an optional parameter and have a default time out value of 10 seconds (10000ms).

Important: All wait functions require the ‘yield’ keyword in front of them. This allows the macro to block execution until the conditions of the wait function are met.

`[parameter]` denotes an optional parameter.

Table 6-21 *Waiting for the host*

METHODS

`setDefaultTimeout(timeout)`	Sets the default timeout value for all functions. **Parameters** `{Number}` `default timeout to use for all wait functions in milliseconds.` **Returns** None **Throws** `{RangeError}` If the specified timeout is less than zero.
`forConnect([timeout])`	Waits for a connect request to complete. **Parameters** `{Number}` in milliseconds. **Returns** `{Promise}` Fulfilled if the session is already connected or when connection occurs. Rejected if the wait times out.
`forDisconnect([timeout])`	Waits for a disconnect request to complete. **Parameters** `{Number}` timeout in milliseconds. **Returns** `{Promise}`Fulfilled if the session is already disconnected or when it finally disconnects. Rejected if the wait times out.
`forFixedTime([timeout])`	Waits unconditionally for fixed time. Time is in milliseconds (ms) **Parameters** `{Number}` timeout in milliseconds. **Returns** `{Promise}`Fulfilled after time elapses

`forCursor(position, [timeout])`	Waits for the cursor to arrive at the specified position.
	Parameters
	`{Position} The position specifying the row and column,`
	`{Number} timeout in milliseconds`
	Returns
	`{Promise}`Fulfilled if the cursor is already located or when it is finally located. Rejected if the wait times out.

METHODS

`forText(string, position, [timeout])`	Wait for text located at a specific position on the screen **Parameters** `{String}` text to expect `{Position}` position specifying the row and column `{Number}`timeout in milliseconds **Returns** `{Promise}` Fulfilled if the text is already at the specified position or whenever it is located. Rejected if the wait times out. **Throws** `{rangeError}` if the position is not valid.
`forHostPrompt(string, column,[timeout])`	Waits for a command prompt located at a particular column on the screen. **Parameters** `{String}` text prompt to expect `{Number}` column where cursor is expected `{Number}` timeout in milliseconds. **Returns** `{Promise}` Fulfilled if the conditions are already met or when the conditions are finally met. Rejected if the wait times out. **Throws** `{rangeError}` if the column is out of range.

Sample Macros

To help you create successful macros that take advantage of all the capabilities of the Macro Editor and Reflection ZFE, these samples are available as a starting point.

Basic Host Interaction

This sample illustrates basic host interaction, including:

- Sending data to the host
- Waiting for screens to display
- Using the `yield` keyword to wait for asynchronous functions
- Reading text from the screen
- Displaying basic information to the user
- Handling error basics

All macros have the following objects available by default:

1. **session** - Main entry point for access to the host. Can connect, disconnect and provides access to the PresentationSpace.

   The PresentationSpace object obtained from the session represents the screen and provides many common capabilities such as getting and setting the cursor location, sending data to the host and reading from the screen.
2. **wait** - Provides a simple way to wait for various host states before continuing to send more data or read from the screen.
3. **UI** - Provides basic user interface capabilities. Display data to the user or prompt them for information.

```
// Create a new macro function
var macro = createMacro(function*(){
  'use strict';

  // All macros have the following objects available by default:
  // 1. session - Main entry point for access to the host. Can connect, disconnect
and provides access to the PresentationSpace.
  //    The PresentationSpace object obtained from the session represents the
screen and provides many common capabilities such as getting and setting the
  //    cursor location, sending data to the host and reading from the screen.
  // 2. wait - Provides a simple way to wait for various host states before
continuing to send more data or read from the screen.
  // 3. ui - Provides basic User Interaction capabilities. Display data to the user
or prompt them for information.

  // Declare a variable for reading and displaying some screen data.
  // As a best practice all variables should be declared near the top of a function.
  var numberOfAccounts = 0;

  // Start by obtaining the PresentationSpace object, which provides many common
screen operations.
  var ps = session.getPresentationSpace();

  try {
    // Can set and get the cursor location
    ps.setCursorPosition(new Position(24, 2));

    // Use the sendKeys function to send characters to the host
    ps.sendKeys('cics');

    // SendKeys is also used to send host keys such as PA and PF keys.
    // See "Control Keys" in the documentation for all available options
```

```
    ps.sendKeys(ControlKey.ENTER);

    // Wait for the cursor to be at the correct position.
    // The wait object provides various functions for waiting for certain states to
occur
    // so that you can proceed to either send more keys or read data from the
screen.
    yield wait.forCursor(new Position(24, 2));

    // You can mix characters and control keys in one sendKeys call.
    ps.sendKeys('data' + ControlKey.TAB + ControlKey.TAB + 'more data' +
ControlKey.ENTER);

    // The "yield" keyword must be used in front of all "wait" and "ui" function
calls.
    // It tells the browser to pause execution of the macro until the
    // (asynchronous) wait function returns.  Consult the documentation for which
functions
    // require the yield keyword.
    yield wait.forCursor(new Position(10, 26));
    ps.sendKeys('accounts' + ControlKey.ENTER);

    // Can also wait for text to appear at certain areas on the screen
    yield wait.forText('ACCOUNTS', new Position(3, 36)) ;
    ps.sendKeys('1' + ControlKey.ENTER);

    // All wait functions will timeout if the criteria is not met within a time
limit.
    // Can increase timeouts with an optional parameter in the wait functions (in
milliseconds)
    // All timeouts are specified in milliseconds and the default value is 10
seconds (10000ms).
    yield wait.forCursor(new Position(1, 1), 15000);
    ps.sendKeys('A' + ControlKey.ENTER);

     // PS provides the getText function for reading text from the screen
    numberOfAccounts = ps.getText(new Position(12, 3), 5);

    // Use the ui object to display some data from the screen
    ui.message('Number of active accounts: ' + numberOfAccounts);

    // The try / catch allows all errors to be caught and reported in a central
location
  } catch (error) {
    // Again we use the ui object to display a message that an error occurred
    yield ui.message('Error: ' + error.message);
  }
  //End Generated Macro
});

// Run the macro and return the results to the Macro Runner
// The return statement is required as the ZFE application leverages
// this to know if the macro succeeded and when it is finished
return macro();
```

User Interaction

This sample illustrates how to use the provided API methods to prompt the user for input or alert them with a message.

```
var macro = createMacro(function*(){
  'use strict';

  // The "ui" object provides functions for prompting the user for information and
displaying information

  // Declare variables for later use
  var username;
  var password;
  var flavor;
  var scoops;

  //Begin Generated Macro
  var ps = session.getPresentationSpace();

  try {
    // Prompt the user to enter their name and store it in a variable.
    // Note that 'yield' keyword is needed to block execution while waiting for the
user input.
    username = yield ui.prompt('Please enter your username');

    // Prompt the user to enter a value with a default provided to them.
    flavor = yield ui.prompt('What is your favorite flavor of ice cream?',
'Chocolate');

    // Prompt the user to enter private information by using the 'mask' option and
the input field will be masked as they type.
    // If a parameter is not used, 'null' can be used to specify that it isn't to
be used.
    // Here we illustrate that by specifying that we don't need to show a default
value .
    password = yield ui.prompt('Please enter your password', null, true);

    // The prompt function returns null if the user clicks the 'Cancel' button
instead of the 'OK' button.
    // One way to handle that case is to wrap the call in a try/catch block.
    scoops = yield ui.prompt('How many scoops would you like?');
    if (scoops === null) {
      // This will exit the macro.
      return;
      // Alternatively could throw an Error and have it be caught in the "catch"
below
    }
   // Use the collected values to order our ice cream
    ps.sendKeys(username + ControlKey.TAB + password + ControlKey.ENTER);
    yield wait.forCursor(new Position(5, 1));
    ps.sendKeys(flavor + ControlKey.TAB + scoops + ControlKey.ENTER);
```

```
    // Display a message to the user.  Using the 'yield' keyword in front of the
call will block
    // further execution of the macro until the user clicks the 'OK' button.
    yield ui.message('Order successful.  Enjoy your ' + scoops + ' scoops of ' +
flavor + ' ice cream ' + username + '!');
  } catch (error) {
    // Here we use the ui object to display a message that an error occurred
    yield ui.message(error.message);
  }
  //End Generated Macro

 });

 return macro();
```

Paging Through Data

This sample illustrates how to page through a variable number of screens and process the data on each screen.

```
 // Create a new macro function.
var macro = createMacro(function*(){
  'use strict';

  // Create variable(s) for later use
  var password;
  var accountNumber;
  var transactionCount = 0;
  var row = 0;

  // Obtain a reference to the PresentationSpace object.
  var ps = session.getPresentationSpace();

  try {
    // Enter Username and Password to log on to the application.
    yield wait.forCursor(new Position(19, 48));
    ps.sendKeys('bjones' + ControlKey.TAB);

    yield wait.forCursor(new Position(20, 48));
    password = yield ui.prompt('Password:', null, true);
    ps.sendKeys(password);
    ps.sendKeys(ControlKey.ENTER);

    // Enter an application command.
    yield wait.forCursor(new Position(20, 38));
    ps.sendKeys('4');
    ps.sendKeys(ControlKey.ENTER);

    // Going to list transactions for an account.
    yield wait.forCursor(new Position(13, 25));
    ps.sendKeys('2');
    // Input an account number.  Hard coded here for simplicity.
    yield wait.forCursor(new Position(15, 25));
    accountNumber = yield ui.prompt('Account Number:', '167439459');
    ps.sendKeys(accountNumber);
    ps.sendKeys(ControlKey.ENTER);

    // Wait until on account profile screen
    yield wait.forText('ACCOUNT PROFILE', new Position(3, 33));

    // Search for text that indicates the last page of record has been reached
    while (ps.getText(new Position(22, 12), 9) !== 'LAST PAGE') {

      // While the last page of record has not been reached, go to the next page of records.
      ps.sendKeys(ControlKey.PF2);
      yield wait.forCursor(new Position(1, 1));

      // If the cursor position does not change between record screens, and there is no text
```

```
      // on the screen you can check to confirm a screen is updated, you may wait for a
      // fixed time period after an aid key is sent for the screen to settle.
      // For example:
      // yield wait.forFixedTime(1000);

      // For each of the rows, increment the count variable if it contains data.
      for (row = 5; row <= 21; row++) {

        // There are 2 columns on the screen. Check data on column 1.
        // In this eaxmple we know that if there is a space at a particular
        // position then there is a transaction.
        if (ps.getText(new Position(row, 8), 1) !== ' ') {
          transactionCount++;
        }
        // Check data on column 2.
        if (ps.getText(new Position(row, 49), 1) !== ' ') {
          transactionCount++;
        }
      }
    }
 // Check data on column 2.
        if (ps.getText(new Position(row, 49), 1) !== ' ') {
          transactionCount++;
        }
      }
    }

    // After going through all record pages, display the number of records in a message box.
    yield ui.message('There are ' + transactionCount + ' records found for account ' +
accountNumber + '.');

    // Log out of the application
    ps.sendKeys(ControlKey.PF13);
    ps.sendKeys(ControlKey.PF12);

    // The try / catch allows all errors to be caught and reported in a central location
  } catch (error) {
    // Here we use the ui object to display a message that an error occurred
    yield ui.message(error.message);
  }
});

// Here we run the macro and return the results to the Macro Runner
// The return statement is required as the ZFE application leverages
// this to know if the macro succeeded
return macro();
```

Invoking a Web Service

This sample illustrates how to make an AJAX / REST call directly from a macro to a web service. You can integrate data from your host application into the web service call or from the web service into your host application.

In this example, we are calling the Verastream Host Integrator (VHI) CICSAcctsDemo REST service. However, you can easily adapt the code to call any web service. You are not limited to VHI.

In the example the call goes through a proxy configured in the session server (shown below) to avoid a “Same Origin Policy” complication. If you are using a web service that supports Cross-origin Resource Sharing (CORS) and are using a modern browser, the proxy is unnecessary.

Since the jQuery library is available in macros, so you may use the $.post() function directly to invoke REST services.

This example also demonstrates how to wrap a jQuery REST call in a new Promise. The promise returned from the custom function below allows "yield" to be used in the main macro code. This allows the main macro execution to wait until the service call is complete before continuing.

```
 var macro = createMacro(function*() {
  'use strict';

  // Create a few variables for later user
  var username;
  var password;
  var accountNumber;
  var accountDetails;

  // Create a function that will make an AJAX / REST call to a VHI Web Service.
  // Could be adjusted to call any web service, not just VHI.
  // If not using CORS, the request will likely need to pass through a
  // proxy on the session server. See sample notes for more information.
  /**
   * Hand-coded helper function to encapsulate AJAX / REST parameters, invoke the
   * REST service and return the results inside a Promise.
   * @param {Number} acctNum to send to the REST query.
   * @param {String} username to access the REST service.
   * @param {String} password to access the REST service.
   * @return {Promise} containing $.post() results that are compatible with yield.
  */
  var getAccountDetails = function (acctNum, username, password) {
    var url = "proxy1/model/CICSAcctsDemo/GetAccountDetail";
    var args = {"filters": {"AcctNum": acctNum}, "envVars": {"Username": username,
"Password": password}};

    // Wrap a jQuery AJAX / HTTP POST call in a new Promise.
    // The promise being returned here allows the macro to yield / wait
    // for its completion.
    return Promise.resolve($.post(url, JSON.stringify(args)))
      .catch(function (error) {
      // Map errors that happen in the jQuery call to our Promise.
      throw new Error('REST API Error: ' + error.statusText);
    });
  };

  // Begin Generated Macro
  var ps = session.getPresentationSpace();
  try {
    // Could interact with the host here, log into a host app, etc...
    // Gather username and password
    username = yield ui.prompt('Username:');
    password = yield ui.prompt('Password:', null, true);
    accountNumber = yield ui.prompt('Account Number:');
    if (!username || !password || !accountNumber) {
      throw new Error('Username or password not specified');
    }

    // Invoke external REST service, and yields / waits for the call to complete.
    accountDetails = yield getAccountDetails(accountNumber, username, password);

    // We now have the data from our external service.
    // Can integrate the data into our local host app or simply display it to the user.
    // For this sample we simply display the resulting account details.
    if (accountDetails.result && accountDetails.result.length > 0) {
      yield ui.message(accountDetails.result[0].FirstName + ' $' +
accountDetails.result[0].AcctBalance);
    } else {
      yield ui.message('No records found for account: ' + accountNumber);
    }
  } catch (error) {
    // If an error occurred during the AJAX / REST call
    // or username / password gathering we will end up here.
    yield ui.message(error.message);
  }
});

// Run our macro
return macro();
```

Cross Origin Scripting Proxy Support

If you have web services that do not support CORS, AJAX/REST calls will fail if they attempt to access a different server than the one where the ZFE application originated. This is a browser security feature.

The Reflection ZFE server provides a way explicitly to proxy to trusted remote servers.

- Open `\webclient\zfe-app\target\zfe\WEB-INF\web.xml` in your ZFE deployment (war file).
- Modify the file as shown:

```
<!--
   Example of how to proxy 3rd party services that do not support CORS.
   The following configuration would allow you to invoke remote VHI REST
   services via local URLs (e.g. an HTTP POST to
   "proxy1/model/CICSAcctsDemo/GetAccountDetail" would be routed to
   "http://remote-vhi-server:9680/vhi-rs/model/CICSAcctsDemo/GetAccountDetail").
   -->
   <servlet>
       <servlet-name>vhi-rs-proxy1</servlet-name>
       <servlet-class>org.eclipse.jetty.proxy.ProxyServlet$Transparent</servlet-class>
       <init-param>
           <param-name>proxyTo</param-name>
           <param-value>http://remote-vhi-server:9680/vhi-rs/</param-value>
       </init-param>
       <init-param>
           <param-name>prefix</param-name>
           <param-value>/proxy1</param-value>
       </init-param>
       <async-supported>true</async-supported>
   </servlet>
   <servlet-mapping>
       <servlet-name>vhi-rs-proxy1</servlet-name>
       <url-pattern>/proxy1/*</url-pattern>
   </servlet-mapping>
```

- Uncomment the servlet and servlet-mappings sections.
- Change `http://remote-vhi-server:9680/vhi-rs` to the actual URL of your target REST server. You can also rename the url-pattern.
- Keep in mind that even when a REST server supports CORS headers, some older browsers may not, so this example may still be relevant.

TIP: Your customized `web.xml` file may be replaced whenever you redeploy Reflection ZFE. Always back up your files.

Working with DataCells and Attributes

This macro illustrates how to use DataCells and AttributeSet to inspect a given row/column on the screen for text and attributes. In this sample you can see:

- How to get a collection of DataCells for a given position and length.
- How to iterate through DataCells to build up a text string
- How, for comparison, you can also do a similar thing using getText().
- And finally, how to work with attributes, get a string listing, or determine whether specific ones are set at a given screen location.

```
var macro = createMacro(function*() {
    'use strict';

    // Obtain the PresentationSpace for interacting with the host
    var ps = session.getPresentationSpace();

    // Declare variables for later use
    var cells;
    var text;
    var attrs;

    // Set the default timeout for "wait" functions
    wait.setDefaultTimeout(10000);

    // Sample macro for working with DataCells and Attributes
    try {
        yield wait.forCursor(new Position(24, 2));

        // Get DataCells from the presentation space.
        // Row 19, col 3 is the prompt, 35 characters long
        // "Choose from the following commands:"
        cells = ps.getDataCells({row:19, col:3}, 35);
        text = '';

        // You can display text using getText
        yield ui.message("Screen text: " + ps.getText({row:19, col:3}, 35));

        // Or you can assemble the text from the DataCells at each position
        for(var index = 0; index < cells.length; index++) {
            text = text.concat(cells[index].getChar());
        }
        // And display the text
        yield ui.message("Cells text: " + text);

        // Get the attributes for the first DataCell (cell[0])
        attrs = cells[0].getAttributes();

        // Display whether we have any attributes on the data cell
        yield ui.message("Attribute set is empty: " + attrs.isEmpty());

        // Display how many attributes are set
        yield ui.message("Number of attributes: " + attrs.size());

        // Display which attributes are set
        yield ui.message("Attributes: " + attrs.toString());

        // Now display whether the high intensity attribute is set
        yield ui.message("Is high intensity: " +
                         attrs.contains(Attribute.HIGH_INTENSITY));

        // Now display whether the underline attribute is set
        yield ui.message("Is underline: " +
                         attrs.contains(Attribute.UNDERLINE));

        // Now display whether alphanumeric, intensified and pen-detectable attributes are
set
        yield ui.message("Is alphanumeric, intensified and pen-detectable: " +
                       attrs.containsAll([Attribute.ALPHA_NUMERIC, Attribute.HIGH_INTENSITY,
Attribute.PEN_DETECTABLE]));

        // Now display whether underline, intensified and pen-detectable attributes are set
        yield ui.message("Is underline, intensified and pen-detectable: " +
                         attrs.containsAll([Attribute.UNDERLINE, Attribute.HIGH_INTENSITY,
Attribute.PEN_DETECTABLE]));
    } catch (error) {
        yield ui.message(error);
    }
    //End Generated Macro
});

// Run the macro
return macro();
```

Using Fields and Field Lists

This macro sample illustrates how to use common functions to interact with the fields in the Macro API. For example, how to get field text, view field information, and how to use field.setText as an alternative to sendKeys to interact with the host.

NOTE: Due to browser considerations ui.message collapses strings of spaces down to a single space. The spaces are preserved in the actual JavaScript.

```
var macro = createMacro(function*() {
    'use strict';

    // Obtain the PresentationSpace for interacting with the host
    var ps = session.getPresentationSpace();

    // Declare variables for later use
    var fields;
    var field;
    var searchString = 'z/VM';

    // Set the default timeout for "wait" functions
    wait.setDefaultTimeout(10000);

    // Sample macro for working with FieldList and Fields
    try {
        yield wait.forCursor(new Position(24, 2));

        // Get the field list.
        fields = ps.getFields();

        // Run through the entire list of fields and display the field info.
        for(var index = 0; index < fields.size(); index++) {
            field = fields.get(index);

            yield ui.message("Field " + index + " info: " + field.toString());
        }

        yield ui.message("Now, find a field containing the text '" + searchString + "'");
        field = fields.findField(new Position(1, 1), searchString);

        if(field !== null) {
            yield ui.message("Found field info: " + field.toString());
            yield ui.message("Found field foreground is green? " + (Color.GREEN ===
field.getForegroundColor()));
          yield ui.message("Found field background is default? " + (Color.BLANK_UNSPECIFIED
=== field.getBackgroundColor()));
        }

        // Now, find command field and modify it.
        field = fields.findField(new Position(23, 80));
        if(field !== null) {
            field.setText("cics");
        }

        yield ui.message("Click to send 'cics' to host.");
        ps.sendKeys(ControlKey.ENTER);

        // Wait for new screen; get new fields.
        yield wait.forCursor(new Position(10, 26));
        fields = ps.getFields();

        // Find user field and set it.
        field = fields.findField(new Position(10, 24));
        if(field !== null) {
            field.setText("bvtst01");
        }

        // Find password field and set it.
        field = fields.findField(new Position(11, 24));
```

```
        if(field !== null) {
            field.setText("milk");
        }

        yield ui.message("Click to send login to host.");
        ps.sendKeys(ControlKey.ENTER);

        // Wait for new screen; get new fields.
        yield wait.forCursor(new Position(1, 1));
        fields = ps.getFields();

        // Find command field and set logoff command.
        field = fields.findField(new Position(24, 45));
        if(field !== null) {
            field.setText("cesf logoff");
        }

        yield ui.message("Click to send logoff to host.");
        ps.sendKeys(ControlKey.ENTER);

    } catch (error) {
        yield ui.message(error);
    }
    //End Generated Macro
});

// Run the macro
return macro();
```

Automatic Sign-On Macro for Mainframes

In this example the Autosignon object is used to create a macro that uses the credentials associated with a user to obtain a pass ticket from the Digital Certificate Access Server (DCAS).

```
var macro = createMacro(function*() {
    'use strict';

    // Obtain the PresentationSpace for interacting with the host
    var ps = session.getPresentationSpace();

    // Variable for login pass ticket
    var passTicket;

    // Login application ID
    var appId = 'CICSV41A';

    // Set the default timeout for "wait" functions
    wait.setDefaultTimeout(10000);

    // Begin Generated Macro
    try {
        yield wait.forCursor(new Position(24, 2));

        // Obtain a pass ticket from DCAS.
        passTicket = yield autoSignon.getPassTicket(appId);

        ps.sendKeys('cics');
        ps.sendKeys(ControlKey.ENTER);

        yield wait.forCursor(new Position(10, 26));

        // Replace generated username with sendUserName(passTicket) ...
        yield autoSignon.sendUserName(passTicket);

        // ps.sendKeys('bvtst01' + ControlKey.TAB + ControlKey.TAB);
        ps.sendKeys(ControlKey.TAB + ControlKey.TAB);

        yield wait.forCursor(new Position(11, 26));

        // Replace generated password with sendPassword(passTicket) ...
        yield autoSignon.sendPassword(passTicket);
```

```
        // var userInput3 = yield ui.prompt('Password:', '', true);
        // if (userInput3 === null) {
            // throw new Error('Password not provided');
        // }
        // ps.sendKeys(userInput3);
        ps.sendKeys(ControlKey.ENTER);

        yield wait.forCursor(new Position(1, 1));
        yield ui.message('Logged in. Log me off.');
        ps.sendKeys('cesf logoff');
        ps.sendKeys(ControlKey.ENTER);
    } catch (error) {
        yield ui.message(error);
    }
    //End Generated Macro
});

// Run the macro
return macro();
```

7 File and Data Transfer

Mainframe file transfer copies files between your computer and a 3270 mainframe using the IND$FILE host program. As an administrator, you can choose to transfer files using either TSO or CMS host filing systems.

Mainframe file transfer

Before you can transfer files, you (as the administrator) must enable the transfer option for the current session. This is done on the Connect dialog box.

From the **Host File System** drop down list, select which IBM 3270 operating environment the host is running. ZFE supports TSO (Time Sharing Option) and CMS (Conversational Monitor System). The default selection is None.

There is support for ASCII or binary transfers.

Transferring files

You must be connected to the host to transfer files for the current 3270 session.

1. Verify that the host is in a 'ready' state to accept the IND$FILE command.
2. From the left panel, click **IND$FILE**.
3. The File Transfer dialog box displays, containing a list of host files and directories that are available to transfer. Directories and files are indicated by an icon when you select the file.
4. Select the transfer method. The options are:
   - Binary

     Use for program files and other types of files that should not be translated, such as files that have already been formatted for a particular type of printer or files with application-specific formatting. Binary files contain non-printable characters; using this method, a file is not converted or translated during the transfer.
   - ASCII

     Use to transfer text files with no special formatting. ASCII files on the PC are translated to the EBCDIC character set on the host and host text files are converted from EBCDIC to ASCII when they are downloaded.

You can refresh the file list at any time by clicking the **Refresh** icon in the upper right corner of the File Transfer dialog box.

Downloading files

1. From the list, select the file or directory to initiate the transfer. You can choose to save or open the files in the format you selected in step 3.
2. If necessary, you can cancel the transfer from the transfer progress panel.

Uploading files

NOTE: IBM mainframe computer systems impose certain naming conventions for files. For detailed information on naming requirements, see the IBM documentation.

There are two methods for uploading files:

1. From the File Transfer dialog box, click **Upload**.
2. Choose the file you want to upload from the Browse window. The uploaded file displays in the list in alphabetical order.

Or:

1. Drag the file you want to upload from its location to the File Transfer dialog box.
2. Click **Refresh** to verify the file was successfully uploaded.

If you cancel the upload process before a file has been completely transferred, a partial file will be left behind on the host.

Troubleshooting your file transfers

Occasionally you might encounter errors when attempting a file transfer. These errors may be mainframe issues or, because you are transferring files using a browser; browser settings can be a source of unplanned errors.

For example, a browser may prompt you to action, such as a Save As prompt, despite the fact that the file transfer failed. This issue can be resolved by simply changing the browser setting.

For host-specific errors, see IBM File Transfer Error Messages.

8 Logging

Reflection ZFE uses Log4J 1.2 to implement logging. Log4J has its own configuration file and documentation. The configuration file, located in `ReflectionZFE/sessionserver/conf/log4j.xml`, has a number of logging levels configured for output, and contains comments about the type of information that you can gather by changing logging levels.

For more information, see the Log4J documentation (http://logging.apache.org/log4j/1.2).

The default logging (log4j) configurations are:

- Log file output is saved to `logs/server.log`
- In addition to logging to the `server.log` file, all console output is captured by the Reflection ZFE session server and stored in a file on disk.
- The configuration for how the console output is stored on file in `ReflectionZFE/sessionserver/conf/container.conf`.

  The file storage configuration properties include, but are not limited to the following (there are comments in `container.conf` that provide more information):

  - `wrapper.logfile` - the location of the captured log file (default is `.../logs/server.log`)
  - `wrapper.logfile.rollmode` - the mechanism in which the existing log file is stored as a backup and a new file is created (default is rolling over when the log file reaches a certain size and storing the rolled over log file with a roll number modifier)
  - `wrapper.logfile.maxsize` - the maximum size the log file can reach before it is rolled over (default is 10MB)
  - `wrapper.logfile.maxfiles` - the maximum number of rolled log files to keep on disk (default is 10)
- There are various types of logging levels you can use to produce different types of information. Log4j supports the following levels (these definitions are taken from the Log4j documentation where you can find more detailed information:
  - Trace - this level designates finer-grained informational events than Debug
  - Debug - this level designates fine-grained informational events that are most useful to debug an application.
  - Info - This level designates informational messages that highlight the progress of the application at coarse-grained level.
  - Warn - This level designates potentially harmful situations.
  - Error - This level designates error events that might still allow the application to continue running.
  - Fatal - This level designates very severe error events that will presumably lead the application to terminate.

9 Troubleshooting

This section documents miscellaneous known issues and work around tips for Reflection ZFE. For a more detailed list of known issues in Reflection ZFE, see Technical Note 2853.

Installation Connection Issues

Certificate authentication or other connection issues are well documented in Technical Note 2838.

SSL/TLS Error Message

- **(ECL1011) Error connecting to host: Connection to host failed.**

  This error can display in a number of situations that are not simply due to a connection failure.

  - You may see this error if an SSL/TLS connection failed due to the lack of a trusted certificate in the MSS trust store.
  - This error displays when a TLS handshake failure occurs when you use SSL/TLS to connect to or from a plain text host.

Displaying the Euro character

- If the EURO character does not display correctly on the terminal screen, talk to your system administrator to make sure the host character set for the session is setup correctly. By default, Reflection ZFE uses a character set which does not support the Euro character (€). To display the Euro character, change the character set to one that supports the Euro character.