JulMar PBX Simulator Sockets Interface Programmer's Guide

TSP++ Version 3.00
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Table of Contents

Introduction and Purpose

The **JulMar PBX Emulator** program will be used to test a client/server 3rd party TAPI service provider sample that will be provided with the TSP++ version 3.0 product. The emulator will be responsible for simulating different aspects of a PBX/ACD switching system, and connecting call information.

The PBX/ACD software will emulate various features of a large-scale PBX system with multiple line devices including:

1) **Stations** – Physical phone devices which agents may interact with.
2) **VRUs** – Voice response unit, similar to station but automated voice only.
3) **Queues** – ACD queue based on agent groups.
4) **Route Points** – Incoming virtual trunks
5) **Predictive Dialer**s – Outgoing trunks with "state" detection abilities

Communication

The PBX Simulator will use the *Windows Socket* API to send and receive information from client programs. All commands and responses will be in ASCII format. The port that the server listens to is configurable so each client should have some facility to request a TCP/IP address and port to communicate with.

Line Identifiers

Each line device (station, VRU, Queue, Route point, Predictive Dialer) is identified by a unique numeric identifier. For stations, VRUs, route points and queues, this is considered a *dialable number* or extension, which may be used in a transfer command. For trunks and predictive dialers, this is simply an integer number. Each number is required to be unique across all line devices. The JPBX software automatically uses a particular range of ids for each line type:

0000 – 0999	Trunk and Predictive Dialers
1000 – 8999	Stations, VRUs and Route Points
9000 – 9999	ACD Queues

Call Appearances

Each call on a line device will be represented by a unique call-id. This call-id will be a 32-bit integer value assigned by the JPBX software when calls are created. They will be unique across all line devices supported on the JPBX. One or more call-ids will be given with each event passed up by JPBX. When a call moves between line devices (such as in a transfer), the call-id will remain consistent, or a new call-id will be assigned and sent in an event.

Trunk Devices

Incoming or Outgoing calls that do not have an internal extension will be directed to virtual *trunk devices* which are defined in the PBX simulator configuration. When an outgoing call is placed, a trunk device will be selected to be the end-point for the call. If no trunk device is available, a resource error will be returned.

Stations

Each station defined in the JPBX is an end-point line device with full 1st part telephony capabilities. In addition, each station has a phone device associated with it. There is a single address on each station that supports a single active call and up to two holding

calls (for a total of three call appearances). The only supported media mode on a station is Interactive Voice.

Line Device Capabilities

The supported telephony functions for each station are:

Function	Description
Place Call	Place the phone into “speaker-phone” mode and dial a number
Accept Call	Accept a signaling call on the handset (call moves to ringing)
Answer Call	Answer a ringing call
Hold Call	Place active call on hold
Retrieve Call	Retrieve an on hold call
Blind Transfer Call	Transfer a call to a specific address in-switch
Transfer	Transfers the on hold call to the active call, releasing both
Release Call	Drops specified call

The JPBX software will generate the following events:

Event	Description
Call Detected	A new incoming call has been detected on the station
Call Placed	An outgoing call has been placed on the station
Call State change	A call has changed state on the station
Call Released	A call has been dropped from the station, it is no longer valid
Conference Created	A conference has been created or changed on the station
Call Transferred	A call that was on this station has been transferred.
Digit Detected	A digit has been recorded on the line

Phone Device Capabilities

The supported phone device functions for each station are:

Function	Description
Set Gain	Sets the gain of the microphone
Set Volume	Sets the volume of the speaker
Set Hookswitch	Sets the hookswitch (speaker)

The JPBX software will generate the following events:

Event	Description
Display changed	The display has changed on the device
Volume changed	The volume has changed on the device
Gain changed	The gain on the microphone has changed
Hookswitch changed	The phone has gone on/off hook
Lamp changed	A lamp has changed state on the station

Agent Features

Before the phone or line device may be used, an agent must log onto the device. Until an agent logs on, any commands sent to a station will be refused.

The agent login is performed through a login function which specifies the agent id and password and optionally which groups to initially assign the agent into. If the agent is not authorized to log into the station or given group(s), the JPBX software will return an error.

Once an agent logs in, the station will be in the *not ready* state. The phone may be used to dial out, pickup calls, etc. No queued calls will be directed to stations which are not ready. Once the station moves to the *ready* state, any queued calls for the agent groups will be moved to the station and marked as signaling. If accepted, the calls will be ringing and may be answered.

If a direct station-to-station call is placed, the phone extension will receive a signaling call as if it were *ready* with the caller-id being the source station.

The supported agent functions for each station are:

Function	Description
Logon	Log an agent in
Set Agent State	Sets the current agent state

The JPBX software will generate the following events:

Event	Description
Agent Logon	An agent has successfully logged onto a station
Agent State Change	An agent has changed state (including logout)
Agent Group Change	An agent has changed group assignments

VRU

The **V**oice **R**esponse **U**nit line device is similar in functionality to the station, but has no phone device associated with it and does not interact with agents. The supported media mode on this device is Automated Voice. There is a single address on each VRU which supports a single active call with no held calls.

Note that for this first release (v3.0), audio streaming is not supported, so the VRU is not fully functional in that you may not play audio across the network. Once TAPI 3.0 is released and the DirectShow interface is finalized, this support will be added into JTSP.

Line Device Capabilities

The supported telephony functions for each VRU are:

Function	Description
Accept Call	Accept a signaling call on the handset (call moves to ringing)
Answer Call	Answer a ringing call
Blind Transfer Call	Transfer a call to a specific address in-switch
Release Call	Drops specified call
Generate Digit/Tone	Generate a DTMF tone or digit

The JPBX software will generate the following events:

Event	Description
Call Detected	A new incoming call has been detected on the station
Call State change	A call has changed state on the station
Call Transferred	A call which was on this VRU has been transferred.
Call Released	A call has been dropped from the station, it is no longer valid
Digit Detected	A digit has been recorded on the line

Queue

A single ACD Queue device will be created for each agent group defined in the PBX configuration. Each queue will have a unique *dialable number* associated with it, which will allow calls to be transferred to a given queue for agent management. Any supported media mode is allowed for queued calls. In addition, calls of almost any state (except *Disconnected*) are allowed to be queued.

Line Device Capabilities

The supported telephony functions for each queue are:

Function	Description
Blind Transfer call	Transfer call to another queue or station
Release Call	Drops specified call
Get Call Statistics	Returns timing statistics of a specific call
Get Queue Statistics	Returns statistics of a specific queue (agents, calls, etc.)

The JPBX software will generate the following events:

Event	Description
Call Detected	A new call has been detected on the station
Call State change	A call has changed state on the station
Call Released	A call has been dropped from the station, it is no longer valid
Call Transferred	A queued call has been moved to another queue or agent station

Route Point

The route point represents a *Trunk* on the PBX. It allows for incoming calls which has DNIS or ANI information associated with them. A simple rule manager will be built into the JPBX software to manage incoming calls based on DNIS or ANI network information. All supported media modes are allowed at the route point.

Line Device Capabilities

The supported telephony functions for each route point are:

Function	Description
Blind Transfer Call	Redirect ringing call to another station
Release Call	Drops specified call

The JPBX software will generate the following events:

Event	Description
Call Detected	A new call has been detected on the route point.
Call Released	A call has been dropped from the route point, it is no longer valid
Call Transferred	A call has been moved to a queue or agent station

Predictive Dialer

The predictive dialer device is an outgoing call only device that supports transitions of call states automatically as if it can detect the end-point media. The following detections will be made:

Type	Description
Answering Machine	End-point represents an answering machine
Voice	End-point represents a real person
Busy	Busy tone
No Answer	No answer at end-point
Unknown	Unable to determine end-point detection.

A single address will be associated with each predictive dialer. The address may have up to 255 simultaneously active calls at any given time. If an attempt is made to place a call once this limit has been reached, an error will be returned. The dialer line has no VRU support and will simply sit in the dialer until either a timeout expires (the call is dropped) or somebody transfers the call out of the dialer.

Line Device Capabilities

The supported telephony functions for each station are:

Function	Description
Place Predictive Call	Dial a predictive call
Blind Transfer	Transfer the call to another station or queue
Release Call	Drops specified call

The JPBX software will generate the following events:

Event	Description
Call Placed	The call has been dialed
Call State change	A call has changed state on the dialer
Call Released	A call has been dropped from the dialer, it is no longer valid
Call Media Detected	Final detection result

Phone Display

The phone display simulated for stations will be a 40x2 display which will support caller network information. When no calls are pending on the station, the display will look like:

```
AGENT STATE                                    DATE/TIME

```

When a call is active on the station, the following information will be available:

```
ACTIVE CALL NETWORK INFO
                                        X CALLS PENDING
```

The “X CALLS PENDING” field will only be present if there are holding or offering calls on the station. When a conference is created, the following display will be generated:

```
CONFERENCED
                                STATIONS CONFERENCED IN
```

When an outgoing call is placed, the following display will be present:

```
DIGITS DIALED
                                        X CALLS PENDING
```

The "X CALLS PENDING" field will only be present if there are holding or offering calls on the station.

Phone Lamps

The following phone lamps will be available on each station:

Identifier	Name
1	Ready
2	In Call Work

Commands

The following commands may be sent to the JPBX software product via *Windows Sockets*. Each element within the command is an ASCII string. Each command starts with a command code of two or more letters, followed by a variable number of arguments separated by commas. The final character should be a CR-LF ("\r\n").

Logon (LO)

This command is valid for all lines. It informs the PBX which events are to be sent to the connection. If a zero is given for the extension, then all events are passed to the given connection and the connection may manipulate any of the line devices. Otherwise it must be a station extension.

Parameters

Extension The line identifier placing the to field events for (4 or less digits).

Place Call (PC)

This command is only valid for stations. It allows a call to be placed on the station to either an in-switch extension (4 or less digits), or off-switch (9 followed by any number of digits). If the incorrect number of digits is sent or the extension doesn't exist, an error is returned.

Parameters

Extension The line identifier placing the call (4 or less digits)
Destination The target extension (4 or less digits) or '9' followed by 5 or more digits.

Accept Call (AC)

This command is only valid for stations and VRU devices. It allows a signaling call to be moved to the ringing state so that it may be answered.

Parameters

Extension The line identifier accepting the call (4 or less digits)
Callid The call-id which is currently signaling

Answer Call (ANC)

This command is only valid for stations and VRU devices. It allows a ringing call to be answered.

Parameters

Extension	The line identifier answering the call (4 or less digits)
Callid	The call-id which is currently ringing.

Hold Call (HC)

This command is only valid for stations. It places the active call on hold and allows another call to be placed on the address if the call limit is not reached. If the call is part of a conference, it is split out. If the conference is then two-party, it is considered a break-down of the conference.

Parameters

Extension	The line identifier which owns the call (4 or less digits)
Callid	The call-id which is to be moved to the holding state.

Retrieve Call (RTC)

This command is only valid for stations. It retrieves a call which is on hold. If there are active calls then a conference is created. If an existing conference exists, then the call is added to the conference.

Parameters

Extension	The line identifier which owns the call (4 or less digits)
Callid	The call-id which is to be moved to the holding state.

Blind Transfer Call (BTC)

This command is valid for all devices except route points. It transfers the given call-id to another station or queue. The target address must be an in-switch address. If the call is transferred to a VRU or station, it will show up as a new call in the ringing state.

Parameters

Extension	The line identifier which owns the call (4 or less digits)
Callid	The call-id which is to be transferred.
Target DN	The extension to transfer the call to (must be queue, VRU, station).

Transfer Call (TC)

This command is only valid for stations. It causes the given on-hold call to be transferred to the active call. If the on-hold call is zero and the active call is a conference, then the conference is transferred to the given active call and the current extension is removed from the conference.

Parameters

Extension	The line identifier which owns the call (4 or less digits)
SCallid	The call-id which is to be transferred (may be zero if TCallid is conference).
TCallid	The call-id which is to now own the transferred call.

Release Call (RC)

This command is valid for all devices. It releases the given call-id from the switch effectively causing the call to hang up.

Parameters

Extension The line identifier which owns the call (4 or less digits)
Callid The call-id which is to be released

Agent Logon (ALO)

This command is valid for stations. It allows an agent to log onto the device.

Parameters

Extension Line device id where agent is logged on
Agent Id Agent identifier
Password Password for agent
AgentGroup1 Group to log into
Agent Group2 Group to log into

Change Agent State (CAS)

This command changes the state of the agent on the extension.

Parameters

Extension Line device id where agent is logged on
Agent ID Numeric agent identifier
Agent State New Agent State (single character):
S - Signed Off
R - Ready
N - Not Ready
W - In Call Work

Generate Tone/Digit (GTD)

This command is only valid for VRU devices. It allows the generation of a frequency or DTMF tone on the specified call.

Parameters

Extension The line identifier which owns the call (4 or less digits)
Callid The call-id which is to have the digit/tone played on
Tone/Digit Tone/Digit field

Get Call Statistics (GCS)

This command is only valid for queue devices. It allows a server to retrieve statistics on a call in-queue.

Parameters

Extension The line identifier which owns the call (4 or less digits)
Callid The call-id to retrieve statistics about

Get Queue Statistics (GQS)

This command is only valid for queue devices. It allows a server to retrieve statistics on a queue.

Parameters

Extension The line identifier of the queue to retrieve statistics for. (4 or less digits)

Place Predictive Call (PPC)

This command is only valid for predictive dialer devices. It initiates a predictive dialing sequence.

Parameters

Extension The line identifier of the predictive dialer. (4 or less digits)
Target DN Target number to dial (must be outside line)
Timeout Timeout (in seconds) before call is released

Retrieve Version Information (VER)

This command retrieves the version of the JPBX software.

Parameters

None

Set Gain (SPG)

This command is only valid for stations. It sets the gain setting of the microphone

Parameters

Extension The line identifier of the station. (4 or less digits)
Gain Numeric setting of the gain (0 – 0xffff)

Set Volume (SPV)

This command is only valid for stations. It sets the volume setting of the speaker

Parameters

Extension The line identifier of the station. (4 or less digits)
Volume Numeric setting of the volume (0-0xffff)

Set Hookswitch State (SPH)

This command is only valid for stations. It sets the current state of the hookswitch. The on/off hook state may not be changed by this function, it may only adjust whether the microphone is on or off (i.e. mute setting).

Parameters

Extension The line identifier of the station. (4 or less digits)
Mute True or false setting for microphone

Responses

The following responses may be received from the JPBX software product as a result of a sent command. A response will always be received for a command assuming the simulator received it. Each element within the response is an ASCII string. Each response starts with a response code of two or more letters, followed by a variable number of arguments separated by commas. At the end of the string is a CR-LF pair.

Command Accepted (ACK)

This response is received if the JPBX software accepts a command. The command that was accepted is returned.

Parameters

Command Code	Two/Three byte command code which generated this response
Extension	The line identifier of the station. (4 or less digits)

Command Rejected (NAK)

This response is received if the JPBX software rejects a command. The command that was rejected is returned.

Parameters

Command Code	Two/Three byte command code which generated this response
Extension	The line identifier of the station. (4 or less digits)
Error Code	Error code which caused rejection.

Error Codes

0001	Invalid device identifier passed in command
0002	Invalid extension passed in command
0003	Invalid value passed in parameter (exceeded bounds)
0004	Invalid call-id passed (call-id either doesn't exist or isn't on given line device.
0005	Resource unavailable (no trunk)
0006	Bad CRC
0007	Bad Command
0008	Bad Call State for Command
0009	Invalid Logon
000A	Invalid Agent ID
000B	Invalid Agent Group
000C	Invalid Agent State
FFFF	Command failed (unknown reason)

Events

The JPBX software in response to external stimulus (simulator UI) or programming within the simulator itself generates the following events. Each element within an event is an ASCII string. Each event is represented by two or more letters representing the type, followed by a variable number of arguments separated by semi-colons. At the end of the string is a CR-LF pair.

Call Detected (CD)

This event is received when a new call-id is generated on a given line device. This call-id may be an existing call from a different device if the call was transferred.

Parameters

Target Extension	Line device id where call is now signaling
Callid	4-byte call id
Source Extension	Extension which generated this call (not present if off-switch)
DNIS	DNIS information associated with the call
ANI	ANI information associated with the call

Call Placed (CP)

This event is received when a call has been successfully placed on a line device using the **PC** command. This will be the first event noticed when a PC request is processed.

Parameters

Extension	Line device id where call was placed from
Callid	4-byte call id
DNIS	DNIS information associated with the call
ANI	ANI information associated with the call

Call State Changed (CS)

This event is received when a call has changed status on the line.

Parameters

Extension	Extension this applies to
Callid	4-byte call id
State	New call state (single character): **Ringing** **Alerting** **Connected** **Busy** **Disconnected** **Held**

Call Released (CR)

This event is received when a call has been released on the line. The call-id is no longer valid after this message.

Parameters

Callid	4-byte call id

Call Conferenced (CC)

This event is received when a conference has been created on the line

Parameters

Extension	Line device id which owns the conference
Callid1	4-byte call id which is now in conference
Callid2	4-byte call id which is now in conference
Callid3	4-byte call id which is now in conference
Callid4	4-byte call id which is now in conference

Call Transferred (CT)

This event is received when a call has been transferred to another station or line device.

Parameters

Callid	4-byte call id which is being transferred
OldCallid	4-byte call id which is being replaced (consultation xfer only)
Target DN	Target extension where call is being transferred to (blind xfer only)

Call Queued (CQ)

This event is received when a call has been transferred to another station or line device.

Parameters

Extension	Line device id which call came from
Callid	4-byte call id which is being queued
Target Queue	Target queue where call is now located

Digit Detected (DD)

This event is received when a DTMF digit is detected on the media.

Parameters

Callid	4-byte call id which tone was played on
Digit	Alpha-numeric digit detected on media.

Call Media Detected (CMD)

This event is received when a predictive call is resolved

Parameters

Callid	4-byte call id which has been identified for end-point resolution
Final detection	Final result detected (single character): **M - Answering Machine** **V - Voice** **B - Busy** **N - No Answer** **U - Unknown**

Display Changed (PDC)

This event is received when the phone display changes on a station.

Parameters

Extension Line device id which owns phone device
New Display New string (40*2 characters) for display

Volume Changed (PVC)

This event is received when the phone volume changes on a station.

Parameters

Extension Line device id which owns phone device
New Volume New speaker volume value (0-0xffff)

Gain Changed (PGC)

This event is received when the phone gain changes on a station.

Parameters

Extension Line device id which owns phone device
New Gain New microphone gain value (0-0xffff)

Hookswitch Changed (PHC)

This event is received when the phone hookswitch changes on a station. This is reported anytime that a call is placed/answered or when the simulator executes the **SPH** command.

Parameters

Extension Line device id which owns phone device
New HS value Current hookswitch state (single character):
M – Mute
O – OnHook
F – OffHook

Lamp Changed (PLC)

This event is received when a phone lamp changes on a station.

Parameters

Extension Line device id which owns phone device
Lamp Identifier Numeric lamp identifier
Lamp State New lamp state (**on**/**off**)

Agent State Changed (ASC)

This event is received when the state of an agent on a station changes

Parameters

Extension Line device id where agent is logged on
Agent State New Agent State (single character):
Signed Off
Ready
Not Ready
Busy
In Call Work

Agent Group Changed (AGC)

This event is received when the current groups an agent is associated with changes

Parameters

Extension Line device id where agent is logged on
Agent ID Agent identifier
Agent Group #1 Agent group 4-byte numeric identifier
Agent Group #2 Agent group 4-byte numeric identifier