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# Bing SR Plugin

## Usage Guide

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# 1 Overview

This guide describes how to configure and use the Microsoft Bing Speech Recognition (BingSR) plugin to the UniMRCP server. The document is intended for users having a certain knowledge of Microsoft Bing Speech API and UniMRCP.



## 1.1 Installation

For installation instructions, use one of the guides below.

- RPM Package Installation (Red Hat / Cent OS)
- Deb Package Installation (Debian / Ubuntu)

## 1.2 Applicable Versions

Instructions provided in this guide are applicable to the following versions.



UniMRCP 1.5.0 and above

UniMRCP BingSR Plugin 1.0.0 and above

## 2 Supported Features

This is a brief check list of the features currently supported by the UniMRCP server running with the BingSR plugin.

### 2.1 MRCP Methods

- ✓ DEFINE-GRAMMAR
- ✓ RECOGNIZE
- ✓ START-INPUT-TIMERS
- ✓ STOP
- ✓ SET-PARAMS
- ✓ GET-PARAMS

### 2.2 MRCP Events

- ✓ RECOGNITION-COMPLETE
- ✓ START-OF-INPUT

### 2.3 MRCP Header Fields

- ✓ Input-Type
- ✓ No-Input-Timeout
- ✓ Recognition-Timeout
- ✓ Waveform-URI
- ✓ Media-Type
- ✓ Completion-Cause
- ✓ Confidence-Threshold
- ✓ Start-Input-Timers
- ✓ DTMF-Interdigit-Timeout
- ✓ DTMF-Term-Timeout
- ✓ DTMF-Term-Char
- ✓ Save-Waveform
- ✓ Speech-Language
- ✓ Cancel-If-Queue
- ✓ Sensitivity-Level

## 2.4 Grammars

- ✓ Built-in speech transcription grammar
- ✓ Built-in/embedded DTMF grammar

## 2.5 Results

- ✓ NLSML
- ✓ Microsoft Speech JSON

# 3 Configuration Format

The configuration file of the BingSR plugin is located in `/opt/unimrcp/conf/umsbingsr.xml`. The configuration file is written in XML.

## 3.1 Document

The root element of the XML document must be `<umsbingsr>`.

### Attributes

Name	Unit	Description
<b>license-file</b>	File path	Specifies the license file. File name may include patterns containing '*' sign. If multiple files match the pattern, the most recent one gets used.
<b>subscription-key-file</b>	File path	Specifies the Microsoft subscription key file to use. File name may include patterns containing '*' sign. If multiple files match the pattern, the most recent one gets used.

### Parent

None.

### Children

Name	Unit	Description
<code>&lt;ws-streaming-recognition&gt;</code>	String	Specifies parameters of streaming recognition employed via Microsoft Speech WebSocket protocol.
<code>&lt;speech-dtmf-input-detector&gt;</code>	String	Specifies parameters of the speech and DTMF input detector.
<code>&lt;utterance-manager&gt;</code>	String	Specifies parameters of the utterance manager.
<code>&lt;rdr-manager&gt;</code>	String	Specifies parameters of the Recognition Details Record (RDR) manager.
<code>&lt;monitoring-agent&gt;</code>	String	Specifies parameters of the monitoring manager.
<code>&lt;license-server&gt;</code>	String	Specifies parameters used to connect to the

		license server. The use of the license server is optional.
--	--	--

### Example

This is an example of a bare document.

```
< umsbingr license-file="umsbingr_*.lic" subscription-key-
file="cognitive.subscription.key">
</ umsbingr>
```

## 3.2 Streaming Recognition

This element specifies parameters of Microsoft WebSocket streaming recognition.

### Attributes

Name	Unit	Description
<b>language</b>	String	Specifies the default language to use, if not set by the client. For a list of supported languages, visit <a href="https://docs.microsoft.com/en-us/azure/cognitive-services/speech/api-reference-rest/supportedlanguages">https://docs.microsoft.com/en-us/azure/cognitive-services/speech/api-reference-rest/supportedlanguages</a>
<b>max-alternatives</b>	Integer	Specifies the maximum number of speech recognition result alternatives to be returned. Can be overridden by client by means of the header field <i>N-Best-List-Length</i> .
<b>results-format</b>	String	Specifies the format of results to be returned to the client (use "standard" for NLSML and "transparent" for Microsoft JSON).
<b>start-of-input</b>	String	Specifies the source of start of input event sent to the client (use "service-originated" to rely on service-originated startDetected event and "internal" for plugin-originated event).
<b>auth-validation-period</b>	Integer	Specifies a period in seconds used to re-validate access token based on subscription key. The lifetime of retrieved access token is set to 10 min by Microsoft.

### Parent

<umsbingr>



## Children

None.

## Example

This is an example of streaming recognition element.

```
<ws-streaming-recognition
  language="en-US"
  max-alternatives="1"
  results-format="standard"
  start-of-input="service-originated"
  auth-validation-period="480"
/>
```

## 3.3 Speech and DTMF Input Detector

This element specifies parameters of the speech and DTMF input detector.

### Attributes

Name	Unit	Description
<b>vad-mode</b>	Integer	Specifies an operating mode of VAD in the range of [0 ... 3]. Default is 1.
<b>speech-start-timeout</b>	Time interval [msec]	Specifies how long to wait in transition mode before triggering a start of speech input event.
<b>speech-complete-timeout</b>	Time interval [msec]	Specifies how long to wait in transition mode before triggering an end of speech input event.
<b>noinput-timeout</b>	Time interval [msec]	Specifies how long to wait before triggering a no-input event.
<b>input-timeout</b>	Time interval [msec]	Specifies how long to wait for input to complete.
<b>dtmf-interdigit-timeout</b>	Time interval [msec]	Specifies a DTMF inter-digit timeout.
<b>dtmf-term-timeout</b>	Time interval [msec]	Specifies a DTMF input termination timeout.
<b>dtmf-term-char</b>	Character	Specifies a DTMF input termination

		character.
<b>speech-leading-silence</b>	Time interval [msec]	Specifies desired silence interval preceding spoken input.
<b>speech-trailing-silence</b>	Time interval [msec]	Specifies desired silence interval following spoken input.
<b>speech-output-period</b>	Time interval [msec]	Specifies an interval used to send speech frames to the recognizer.

### Parent

<umsbingsr>

### Children

None.

### Example

The example below defines a typical speech and DTMF input detector having the default parameters set.

```
<speech-dtmf-input-detector
  vad-mode="1"
  speech-start-timeout="300"
  speech-complete-timeout="1000"
  noinput-timeout="5000"
  input-timeout="10000"
  dtmf-interdigit-timeout="5000"
  dtmf-term-timeout="10000"
  dtmf-term-char=""
  speech-leading-silence="300"
  speech-trailing-silence="300"
  speech-output-period="200"
/>
```

## 3.4 Utterance Manager

This element specifies parameters of the utterance manager.

### Attributes

Name	Unit	Description
<b>save-waveforms</b>	Boolean	Specifies whether to save waveforms or not.

<b>purge-existing</b>	Boolean	Specifies whether to delete existing records on start-up.
<b>max-file-age</b>	Time interval [min]	Specifies a time interval in minutes after expiration of which a waveform is deleted. Set 0 for infinite.
<b>max-file-count</b>	Integer	Specifies the max number of waveforms to store. If reached, the oldest waveform is deleted. Set 0 for infinite.
<b>waveform-base-uri</b>	String	Specifies the base URI used to compose an absolute waveform URI.
<b>waveform-folder</b>	Dir path	Specifies a folder the waveforms should be stored in.

### Parent

<umsbingsr>

### Children

None.

### Example

The example below defines a typical utterance manager having the default parameters set.

```
<utterance-manager
  save-waveforms="false"
  purge-existing="false"
  max-file-age="60"
  max-file-count="100"
  waveform-base-uri="http://localhost/utterances/"
  waveform-folder=""
/>
```

## 3.5 RDR Manager

This element specifies parameters of the Recognition Details Record (RDR) manager.

### Attributes

Name	Unit	Description
<b>save-records</b>	Boolean	Specifies whether to save recognition details

		records or not.
<b>purge-existing</b>	Boolean	Specifies whether to delete existing records on start-up.
<b>max-file-age</b>	Time interval [min]	Specifies a time interval in minutes after expiration of which a record is deleted. Set 0 for infinite.
<b>max-file-count</b>	Integer	Specifies the max number of records to store. If reached, the oldest record is deleted. Set 0 for infinite.
<b>record-folder</b>	Dir path	Specifies a folder to store recognition details records in. Defaults to <code>\${UniMRCPIInstallDir}/var</code> .

### Parent

<umsbingsr>

### Children

None.

### Example

The example below defines a typical utterance manager having the default parameters set.

```
<rdr-manager
  save-records="false"
  purge-existing="false"
  max-file-age="60"
  max-file-count="100"
  waveform-folder=""
/>
```

## 3.6 Monitoring Agent

This element specifies parameters of the monitoring agent.

### Attributes

Name	Unit	Description
<b>refresh-period</b>	Time interval [sec]	Specifies a time interval in seconds used to periodically refresh usage details. See <usage-refresh-

		handler>.
--	--	-----------

### Parent

<umsbingsr>

### Children

<usage-change-handler>

<usage-refresh-handler>

### Example

The example below defines a monitoring agent with usage change and refresh handlers.

```
<monitoring-agent refresh-period="60">
  <usage-change-handler>
    <log-usage enable="true" priority="NOTICE"/>
  </usage-change-handler>
  <usage-refresh-handler>
    <dump-channels enable="true" status-file="umsbingsr-channels.status"/>
  </usage-refresh-handler >
</monitoring-agent>
```

## 3.7 Usage Change Handler

This element specifies an event handler called on every usage change.

### Attributes

None.

### Parent

<monitoring-agent>

### Children

<log-usage>

<update-usage>

<dump-channels>

### Example

This is an example of the usage change event handler.

```

<usage-change-handler>
  <log-usage enable="true" priority="NOTICE"/>
  <update-usage enable="false" status-file="umsbingsr-usage.status"/>
  <dump-channels enable="false" status-file="umsbingsr-channels.status"/>
</usage-change-handler>

```

## 3.8 Usage Refresh Handler

This element specifies an event handler called periodically to update usage details.

### Attributes

None.

### Parent

<monitoring-agent>

### Children

```

<log-usage>
<update-usage>
<dump-channels>

```

### Example

This is an example of the usage change event handler.

```

<usage-refresh-handler>
  <log-usage enable="true" priority="NOTICE"/>
  <update-usage enable="false" status-file="umsbingsr-usage.status"/>
  <dump-channels enable="false" status-file="umsbingsr-channels.status"/>
</usage-refresh-handler>

```

## 3.9 License Server

This element specifies parameters used to connect to the license server.

### Attributes

Name	Unit	Description
<b>enable</b>	Boolean	Specifies whether the use of license server is enabled or not. If enabled, the license-file attribute is not honored.

<b>server-address</b>	String	Specifies the IP address or host name of the license server.
<b>certificate-file</b>	File path	Specifies the client certificate used to connect to the license server. File name may include patterns containing a '*' sign. If multiple files match the pattern, the most recent one gets used.
<b>ca-file</b>	File path	Specifies the certificate authority used to validate the license server.
<b>channel-count</b>	Integer	Specifies the number of channels to check out from the license server. If not specified or set to 0, either all available channels or a pool of channels will be checked based on the configuration of the license server.

### Parent

<umsbingsr>

### Children

None.

### Example

The example below defines a typical configuration which can be used to connect to a license server located, for example, at 10.0.0.1.

```
<license-server
  enable="true"
  server-address="10.0.0.1"
  certificate-file="unilic_client_*.cert"
  ca-file="unilic_ca.crt"
/>
```

For further reference to the license server, visit

<http://unimrcp.org/licserver>

# 4 Configuration Steps

This section outlines common configuration steps.

## 4.1 Using Default Configuration

The default configuration should be sufficient for the general use.

## 4.2 Specifying Recognition Language

Recognition language can be specified by the client per MRCP session by means of the header field *Speech-Language* set in a *SET-PARAMS* or *RECOGNIZE* request. Otherwise, the parameter *language* set in the configuration file *umsbingsr.xml* is used. The parameter defaults to *en-US*.

For supported languages and their corresponding codes, visit the following link.

<https://docs.microsoft.com/en-us/azure/cognitive-services/speech/api-reference-rest/supportedlanguages>

## 4.3 Specifying Sampling Rate

Since the Bing Speech API supports PCM audio sampled at 16 kHz only, the corresponding codecs needs to be specified in the configuration file *unimrcpsrver.xml* under the XML element `<rtp-settings>` as follows.

```
<rtp-settings id="RTP-Settings-1">
  <codecs own-preference="false">PCMU/97/16000 PCMA/98/16000 L16/99/16000
    telephone-event/102/16000</codecs>
</rtp-settings>
```

## 4.4 Specifying Speech Input Parameters

While the default parameters specified for the speech input detector are sufficient for the general use, various parameters can be adjusted to better suit a particular requirement.

- `speech-start-timeout`

This parameter is used to trigger a start of speech input. The shorter is the timeout, the sooner a *START-OF-INPUT* event is delivered to the client. However, a short timeout may also lead to a false positive. Note that if the *start-of-input* parameter in the *ws-streaming-recognition* is set to *service-originated*, then a *START-OF-INPUT* event is sent to the client at a later stage, upon reception of a *speech.startDetected* response from the service.



- `speech-complete-timeout`

This parameter is used to trigger an end of speech input. The shorter is the timeout, the shorter is the response time. However, a short timeout may also lead to a false positive.

Note that both events, an expiration of the speech complete timeout and a *speech.endDetected* response delivered from the Bing Speech service, are monitored to trigger an end of speech input, on whichever comes first basis. In order to rely solely on an event delivered from the speech service, the parameter *speech-complete-timeout* needs to be set to a higher value.

- `vad-mode`

This parameter is used to specify an operating mode of the Voice Activity Detector (VAD) within an integer range of [0 ... 3]. A higher mode is more aggressive and, as a result, is more restrictive in reporting speech. The parameter can be overridden per MRCP session by setting the header field *Sensitivity-Level* in a *SET-PARAMS* or *RECOGNIZE* request. The following table shows how the *Sensitivity-Level* is mapped to the *vad-mode*.

Sensitivity-Level	Vad-Mode
[0.00 ... 0.25)	0
[0.25 ... 0.50)	1
[0.50 ... 0.75)	2
[0.75 ... 1.00]	3

## 4.5 Specifying DTMF Input Parameters

While the default parameters specified for the DTMF input detector are sufficient for the general use, various parameters can be adjusted to better suit a particular requirement.

- `dtmf-interdigit-timeout`

This parameter is used to set an inter-digit timeout on DTMF input. The parameter can be overridden per MRCP session by setting the header field *DTMF-Interdigit-Timeout* in a *SET-PARAMS* or *RECOGNIZE* request.

- `dtmf-term-timeout`

This parameter is used to set a termination timeout on DTMF input and is in effect when `dtmf-term-char` is set and there is a match for an input grammar. The parameter can be overridden per MRCP session by setting the header field *DTMF-Term-Timeout* in a *SET-PARAMS* or *RECOGNIZE* request.

- `dtmf-term-char`

This parameter is used to set a character terminating DTMF input. The parameter can be overridden per MRCP session by setting the header field *DTMF-Term-Char* in a *SET-PARAMS* or *RECOGNIZE* request.

## 4.6 Specifying No-Input and Recognition Timeouts

- `noinput-timeout`

This parameter is used to trigger a no-input event. The parameter can be overridden per MRCP session by setting the header field *No-Input-Timeout* in a *SET-PARAMS* or *RECOGNIZE* request.

- `input-timeout`

This parameter is used to limit input (recognition) time. The parameter can be overridden per MRCP session by setting the header field *Recognition-Timeout* in a *SET-PARAMS* or *RECOGNIZE* request.

## 4.7 Maintaining Utterances

Saving of utterances is not required for regular operation and is disabled by default. However, enabling this functionality allows to save utterances sent to the Google Cloud Speech service and later listen to them offline.

The relevant settings can be specified via the element *utterance-manager*.

- `save-waveforms`

Utterances can optionally be recorded and stored if the configuration parameter *save-waveforms* is set to true. The parameter can be overridden per MRCP session by setting the header field *Save-Waveforms* in a *SET-PARAMS* or *RECOGNIZE* request.

- `purge-existing`

This parameter specifies whether to delete existing waveforms on start-up.

- `max-file-age`

This parameter specifies a time interval in minutes after expiration of which a waveform is deleted. If set to 0, there is no expiration time specified.

- `max-file-count`

This parameter specifies the maximum number of waveforms to store. If the specified number is reached, the oldest waveform is deleted. If set to 0, there is no limit specified.

- `waveform-base-uri`

This parameter specifies the base URI used to compose an absolute waveform URI returned in the header field *Waveform-Uri* in response to a *RECOGNIZE* request.

- `waveform-folder`

This parameter specifies a path to the directory used to store waveforms in. The directory defaults to *\${UniMRCPInstallDir}/var*.

## 4.8 Maintaining Recognition Details Records

Producing of recognition details records (RDR) is not required for regular operation and is disabled by default. However, enabling this functionality allows to store details of each recognition attempt in a separate file and analyze them later offline. The RDRs are stored in the JSON format.

The relevant settings can be specified via the element *rdr-manager*.

- save-records

This parameter specifies whether to save recognition details records or not.

- purge-existing

This parameter specifies whether to delete existing records on start-up.

- max-file-age

This parameter specifies a time interval in minutes after expiration of which a record is deleted. If set to 0, there is no expiration time specified.

- max-file-count

This parameter specifies the maximum number of records to store. If the specified number is reached, the oldest record is deleted. If set to 0, there is no limit specified.

- record-folder

This parameter specifies a path to the directory used to store records in. The directory defaults to *\${UniMRCPIInstallDir}/var*.

## 4.9 Monitoring Usage Details

The number of in-use and total licensed channels can be monitored in several alternate ways. There is a set of actions which can take place on certain events. The behavior is configurable via the element *monitoring-agent*, which contains two event handlers: *usage-change-handler* and *usage-refresh-handler*.

While the *usage-change-handler* is invoked on every acquisition and release of a licensed channel, the *usage-refresh-handler* is invoked periodically on expiration of a timeout specified by the attribute *refresh-period*.

The following actions can be specified for either of the two handlers.

- log-usage

This action logs the number of in-use and total licensed channels. The following is a sample log statement, indicating 0 in-use and 2 total channels.

```
[NOTICE] BINGSR Usage: 0/2
```

- update-usage

This action writes the number of in-use and total licensed channels to a status file *umsbingsr-usage.status*, located by default in the directory *\${UniMRCPIInstallDir}/var/status*. The following is a sample content of the status file.

```
in-use channels: 0
total channels: 2
```

- dump-channels

This action writes the identifiers of in-use channels to a status file *umsbingsr-channels.status*, located by default in the directory *\${UniMRCPInstallDir}/var/status*.

# 5 Recognition Grammars and Results

## 5.1 Using Built-in Speech Transcription

For generic speech transcription, having no speech contexts defined, a pre-set identifier *transcribe* must be used by the MRCP client in a RECOGNIZE request as follows:

```
builtin:speech/transcribe
```

## 5.2 Using Built-in DTMF Grammars

Pre-set built-in DTMF grammars can be referenced by the MRCP client in a RECOGNIZE request as follows:

```
builtin:dtmf/$id
```

Where *\$id* is a unique string identifier of the built-in DTMF grammar.

Note that only a DTMF grammar identifier *digits* is currently supported.

## 5.3 Retrieving Results

Results received from the speech service are either transformed to the [NLSML](#) format or used transparently in the [Microsoft Speech JSON](#) format. This behavior is specified via the *results-format* parameter in the *ws-streaming-recognition* element.

# 6 Usage Examples

## 6.1 Speech Transcription

This examples demonstrates how to perform speech recognition by using a RECOGNIZE request.

C->S:

```
MRCP/2.0 336 RECOGNIZE 1
Channel-Identifier: 6e1a2e4e54ae11e7@speechrecog
Content-Id: request1@form-level
Content-Type: text/uri-list
Cancel-If-Queue: false
No-Input-Timeout: 5000
Recognition-Timeout: 10000
Start-Input-Timers: true
Confidence-Threshold: 0.87
Save-Waveform: true
Content-Length: 25

builtin:speech/transcribe
```

S->C:

```
MRCP/2.0 83 1 200 IN-PROGRESS
Channel-Identifier: 6e1a2e4e54ae11e7@speechrecog
```

S->C:

```
MRCP/2.0 115 START-OF-INPUT 1 IN-PROGRESS
Channel-Identifier: 6e1a2e4e54ae11e7@speechrecog
Input-Type: speech
```

S->C:

```
MRCP/2.0 498 RECOGNITION-COMPLETE 1 COMPLETE
Channel-Identifier: 6e1a2e4e54ae11e7@speechrecog
Completion-Cause: 000 success
Waveform-Uri: <http://localhost/utterances/utter-6e1a2e4e54ae11e7-1.wav>;size=20480;duration=1280
Content-Type: application/x-nlsml
```

Content-Length: 214

```
<?xml version="1.0"?>
<result>
  <interpretation grammar="builtin:speech/transcribe" confidence="0.95">
    <instance>what's the weather like</instance>
    <input mode="speech">what's the weather like</input>
  </interpretation>
</result>
```

## 6.2 DTMF Recognition

This examples demonstrates how to reference a built-in DTMF grammar in a RECOGNIZE request.

C->S:

```
MRCP/2.0 266 RECOGNIZE 1
Channel-Identifier: d26bef74091a174c@speechrecog
Content-Type: text/uri-list
Cancel-If-Queue: false
Start-Input-Timers: true
Confidence-Threshold: 0.7
Speech-Language: en-US
Dtmf-Term-Char: #
Content-Length: 19

builtin:dtmf/digits
```

S->C:

```
MRCP/2.0 83 1 200 IN-PROGRESS
Channel-Identifier: d26bef74091a174c@speechrecog
```

S->C:

```
MRCP/2.0 113 START-OF-INPUT 1 IN-PROGRESS
Channel-Identifier: d26bef74091a174c@speechrecog
Input-Type: dtmf
```

S->C:

MRCP/2.0 382 RECOGNITION-COMPLETE 1 COMPLETE

Channel-Identifier: d26bef74091a174c@speechrecog

Completion-Cause: 000 success

Content-Type: application/x-nlsml

Content-Length: 197

```
<?xml version="1.0"?>
```

```
<result>
```

```
  <interpretation grammar="builtin:dtmf/digits" confidence="1.00">
```

```
    <input mode="dtmf">1 2 3 4</input>
```

```
    <instance>1234</instance>
```

```
  </interpretation>
```

```
</result>
```

### 6.3 Speech and DTMF Recognition

This examples demonstrates how to perform recognition by activating both speech and DTMF grammars. In this example, the user is expected to input a 4-digit pin.

C->S:

MRCP/2.0 275 RECOGNIZE 1

Channel-Identifier: 6ae0f23e1b1e3d42@speechrecog

Content-Type: text/uri-list

Cancel-If-Queue: false

Start-Input-Timers: true

Confidence-Threshold: 0.7

Speech-Language: en-US

Content-Length: 47

```
builtin:dtmf/digits?length=4
```

```
builtin:speech/pin
```

S->C:

MRCP/2.0 83 2 200 IN-PROGRESS

Channel-Identifier: 6ae0f23e1b1e3d42@speechrecog

S->C:

MRCP/2.0 115 START-OF-INPUT 2 IN-PROGRESS

Channel-Identifier: 6ae0f23e1b1e3d42@speechrecog

Input-Type: speech



S->C:

MRCP/2.0 399 RECOGNITION-COMPLETE 2 COMPLETE

Channel-Identifier: 6ae0f23e1b1e3d42@speechrecog

Completion-Cause: 000 success

Content-Type: application/x-nlsml

Content-Length: 214

```
<?xml version="1.0"?>
```

```
<result>
```

```
  <interpretation grammar=" builtin:speech/pin" confidence="1.00">
```

```
    <instance>one two three four</instance>
```

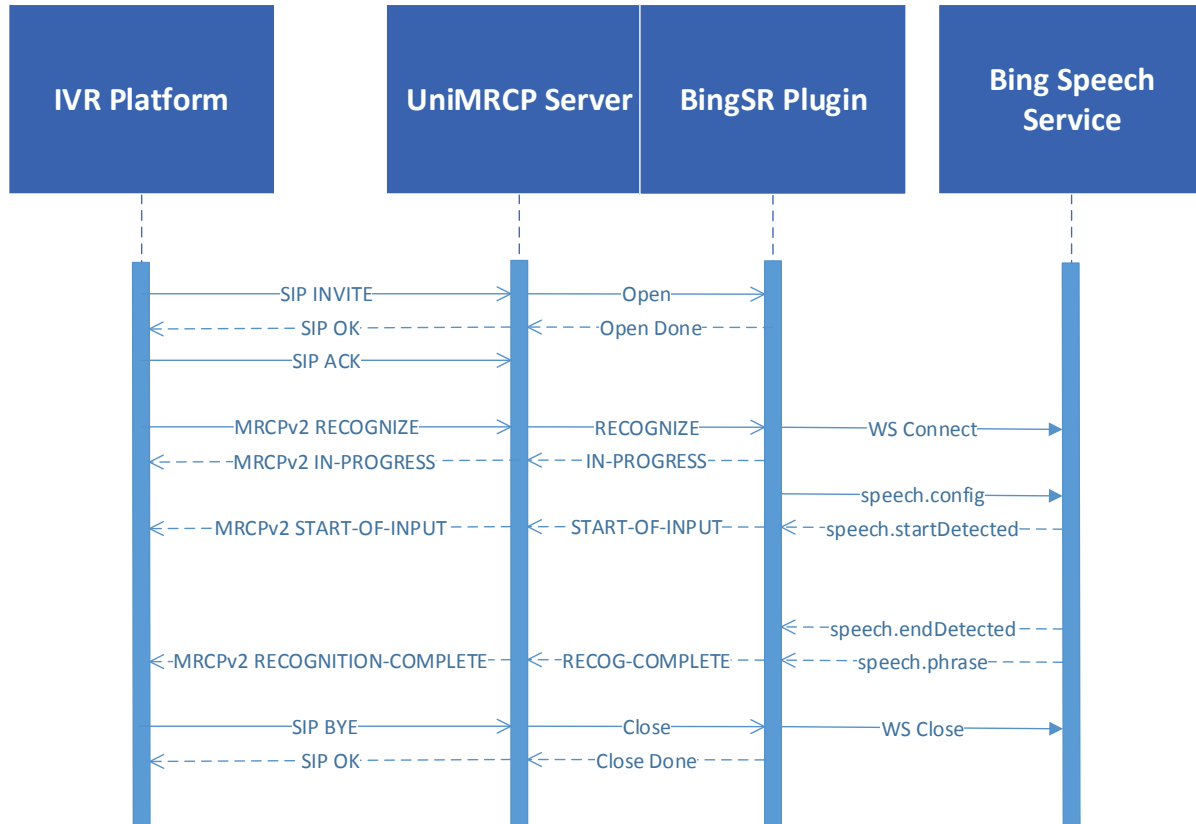
```
    <input mode="speech">one two three four</input>
```

```
  </interpretation>
```

```
</result>
```

# 7 Sequence Diagram

The following sequence diagram outlines common interactions between all the main components involved in a typical recognition session performed over MRCPv2.



# 8 References

## 8.1 Microsoft Azure

- [Speech WebSocket Protocol](#)
- [Basic Concepts](#)
- [Authentication](#)

## 8.2 Specifications

- [Speech Recognizer Resource](#)
- [NLSML Results](#)