



 **valid**  **voice**

VERIFIED BY VOICE

Speaker Verification Engine[®]
Application Program Interface

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Document History

| Revision | Software Version | Published | Notes |
|----------|------------------|-----------|---|
| 001 | 0300 | Nov-2010 | Initial Implementation |
| 002 | 0300 | Nov-2015 | Slight Modifications Made |
| 003 | 0300 | Mar-2016 | Formatted with ValidVoice Document Template |
| 004 | 0300 | May-2016 | Updated to reflect changes in API |
| 005 | 0300 | May-2016 | Added audio pre-requisites in section 5 |
| 006 | 0300 | May-2016 | Updated for Version 1 of the SaaS API Interface |
| 007 | 0300 | Sep-2016 | Updated the cancel method |
| 008 | 0300 | Mar-2017 | Liveness Verification added |
| 009 | 0300 | Jul-2017 | Updated About Us |
| 010 | 0300 | Nov-2017 | Updated the API port to 50202 |
| 011 | 0300 | Dec-2017 | Added Implementation Process Section |



About US

Established in 2005, ValidVoice™ provides the core Speaker Verification Engine (SVE) for some of the leading deployments of this technology. ValidVoice now has operations in North America, and Asia Pacific with plans for further expansion. Long term customers have proven the reliability and robustness of the ValidVoice SVE.

ValidVoice's Speaker Verification Engine provides significantly better performance than other available engines. Independent comparisons show performance in terms of Equal Error Rate (ERR) as being an order of magnitude better than the leading players. ValidVoice packages the SVE with an Application Programming Interface (API). The packaged engine is available to corporate and application developer customers as a superior authentication engine to those already on the market.

ValidVoice continues to build on its more than 5 years of intensive development. EER is considered the best measure of usability of a verification system. It is the measure of where the potential for false accepts and false rejects is balanced. A lower EER value means superior customer satisfaction whilst maintaining the required level of security.

ValidVoice's product focus is to provide enhanced security and privacy for the web on-line world and emerging wireless technologies (transactional & content management). ValidVoice aims to provide security, privacy and convenience for the individual and reduce costs for the business and call center operator. ValidVoice enhances privacy in offshore and virtual contact centers (on-shoring and home agents), but still allow businesses to utilize the cost benefit from operating in low cost jurisdictions. ValidVoice assists in driving automation of self service requirements by providing a secure and convenient method of identifying customers and employees. ValidVoice also continues to work closely with leading research institutions to maintain the Speaker Verification Engine's leading-edge performance.

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1. Introduction

Voice biometrics also known as Voice Authentication or Speaker Verification, verifies the identity of the speaker based on numerous vocal tract traits and style of speech. Voice biometrics is based on the fact that each individual's voice is unique. It is more effective and efficient than other biometric solutions as well as one of the latest non-intrusive technologies commercially available for identity verification. ValidVoice's Speaker Verification Engine (SVE) processes both Text Independent and Text Dependent utterances to provide flexibility across a range of security requirements. These utterances can be used to not only identify what the speaker is saying but it can also be used to identify the speaker by his/her vocal traits.

The Speaker Verification Engine (SVE) by itself when run does nothing except to wait for incoming audio. It is developed with a set of powerful API calls that allow for seamless integration into existing environments. In a live production environment there is usually some other application that interacts with the SVE, such as an Interactive Voice Response (IVR) system that forwards incoming requests to the SVE for enrollment and verification.

This document covers the use of the Representational State Transfer (REST) Application Program Interface (API) for ValidVoice's Speaker Verification Engine (SVE); it does not address issues of engine deployment or tuning. Should greater control of the ValidVoice engine be required, such as changing the locations of stored data or the use of specific encryptions contact your nearest ValidVoice representative for additional support.

This interface supports enrollment and verification processes. It is up to the application developer to ensure that all other processing logic, security and procedures are developed appropriately. Storage of enrollment vectors is the responsibility of the application. The general structure is depicted in Figure 1 below.

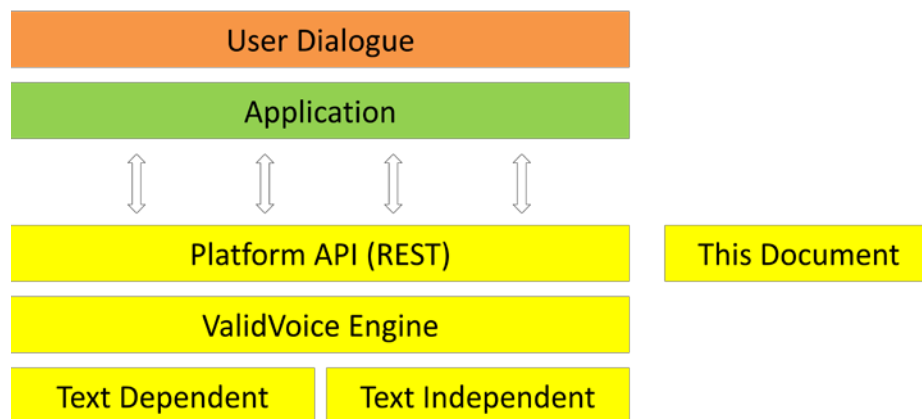


Figure 1-1: Platform API Diagram



2. Response Messages

The SVE REST API uses the JSON Language to send result responses. The API returns only two HTTP response codes: HTTP 200 OK and HTTP 500 INTERNAL SERVER ERROR. The HTTP 200 OK response message varies from API call to API call, while the HTTP 500 INTERNAL SERVER ERROR response message remains the same.

The following is an example of an HTTP 500 INTERNAL SERVER ERROR response message.

```
/* HTTP 500 - Json Error Response */
{
  /* Error Code (API error, not a catastrophic error) */
  "error":0,

  /* Description of the error code */
  "description":"Description of error"
}
```

It is worth noting that for some instances, the HTTP 200 OK response message can have an error block as well; this is considered a catastrophic error and the data inside needs to be transmitted to ValidVoice for inspection, along with the Developer-Key, Application-Key, Client-Id, and Vv-Session-Id from the message it came from.



3. Cancel Method

The Cancel Method is used to cancel an Enrollment or Verification session in the event an error occurred in the voice data phases, noted in sections 4.2 and 5.2.

DELETE - `http://v2ondemand.com:50202/1/sve/Cancel/{reason}`

HTTP Request Headers

| Name | Type | Values | Description |
|---------------|--------|---|---|
| Vv-Session-Id | string | Session Id returned by start enrollment/verification session(s) | Unique identifier of the enrollment/verification. |

Figure 3-1: Session ID Parameter

{reason} – is a “-“ separated string of text of length char (64) supplied as the reason for cancelling the session.

URL Example: `http://v2ondemand.com:50202/1/sve/Cancel/testing-session-connection`

3.1 Successful Result

There is no JSON result response for a successful cancel.



4. Enrollment

The following calls are used to start process and terminate an enrollment.

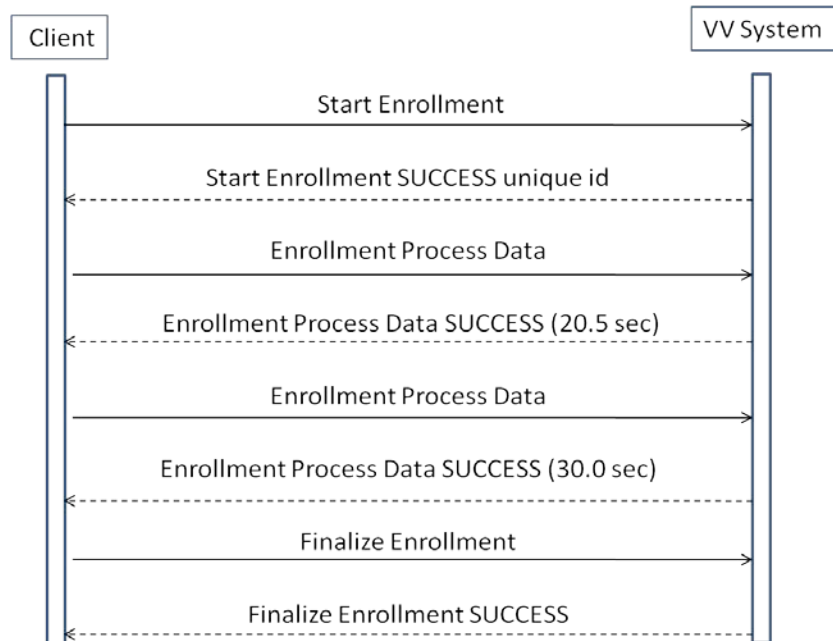


Figure 4-1: Successful Enrollment Sequence

We recommend having over 50 seconds of enrollment data for text independent profiles. In Figure 4-1 above, we have $20.5 + 30.0 = 50.05$ seconds. The seconds returned is the amount of usable speech that the SVE feature extraction process found in the enrollment audio data file. It is important to note here that 50 seconds of audio data does not necessarily equal 50 seconds of enrollment speech. A general rule of thumb is to associate every 3 seconds of audio data with 1 second of enrollment speech data.

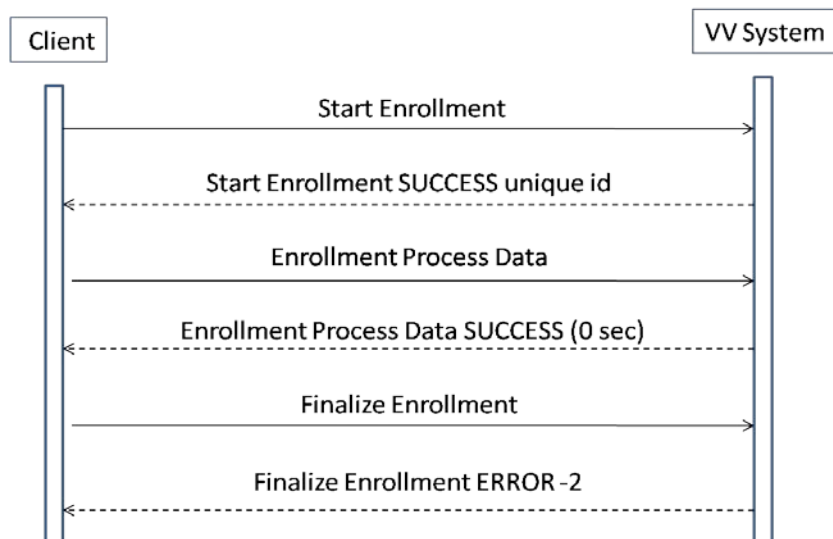


Figure 4-2: Rejected Enrollment Sequence

In this case the client should have called the Enrollment Process Data again, even with the same data. In the case of Text-Dependent processing, this would be the same enrollment phase, while additional data could be sent for Text Independent processing.

4.1 Starting an Enrollment

An enrollment session is initiated using a Developer-Key and an Application-Key to uniquely identify the developers application and requires a unique client id and the sub-pop (gender) of the client enrolling.

POST - http://v2ondemand.com:50202/1/sve/Enrollment/{client_id}/{subpop}

URL Parameters:

| Name | Type | Values | Description |
|-----------|--------|--------------------|-----------------------------------|
| client_id | String | | Unique-ID any alphanumeric string |
| subpop | Char | M=MALE F=FEMALE | Supported Values |

Figure 4-3: Enrollment Start Parameters

HTTP Request Headers:

| Name | Type | Description |
|-----------------|--------|--|
| Developer-Key | String | The Developer-Key located on the Dashboard |
| Application-Key | String | The Application specific Key located on the Dashboard |
| Interaction-Id | String | (Optional) An external session id, used to correlate internal data with. |

Figure 4-4: Enrollment Start Request Headers

HTTP Response Headers:

| Name | Type | Description |
|---------------|--------|--|
| Vv-Session-Id | String | The session Id required to be sent with subsequent processing calls. |

Figure 4-5: Enrollment Start Response Headers

4.1.1 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Enrollment Start Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{ ... },

  /* Profile information only present on enrollment start message */
  "profile.enroll":{

    /* Index number of the profile */
    "index":0,

    /* Kind of Profile: Independent - 1, Liveness - 2 */
    "kind":0,

    /* Type of Audio Codec: pcm_little_endian -or- alaw */
    "codec":"",

    /* Number of seconds of extracted speech required to train an enrollment. */
    "min_seconds_of_speech":0.0
  }
}

```

4.1.2 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Error Description Code | Description |
|------------------------|---|
| 101 | Session Exception |
| 104 | Developer has reached their limit |
| 107 | Unable to acquire a session. |
| 202 | Unable to start the feature extractor |
| 302 | Unable to start the enrollment processor |
| 309 | Invalid Application Key / Application Profile Not Found |
| 310 | Subpopulation parameter incorrect |
| 311 | Enrollment Limit Reached |

Figure 4-6: Enrollment Start Status Codes

4.2 Sending Voice Data to An Enrollment

Sending voice data to an enrollment can be called multiple times. For Text-Independent Processing, we recommend to gather at least 50 seconds of buffered vectors.

POST - <http://v2ondemand.com:50202/1/sve/Enrollment>

HTTP Request Headers:

| Name | Type | Values | Description |
|---------------|--------|---|--|
| Vv-Session-Id | string | Session Id returned by start enrollment session | unique identifier of the enrollment. Received in the start enrollment API. |

Figure 4-7: Enrollment Process Session ID Parameter

Additional Notes:

- ✓ Uses File Upload Standard RFC 1867.
- ✓ "Form-based File Upload in HTML". An HTTP request submitted using the POST method with a content-type of "multipart/form-data".
- ✓ The audio data to be transmitted needs to be encoded by the same audio codec that was received with the *profile.enroll* JSON object from the start enrollment HTTP Data Stream. The audio data is **required** to be transmitting as a raw wav stream without any "RIFF" headers.

Stream Data:

| Name | Type | Values | Description |
|------|--------|------------------------------|---|
| data | binary | Max file size is 2 megabytes | Form data field name to store binary data is "data" |

Figure 4-8: Enrollment Process Data Parameter

4.2.1 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Enrollment Process Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{
    ...
  },

  /* Present on enrollment process and end messages */
  "result.enroll":{

    /* The client_id used in the enrollment start message */
    "{client_id}":{

      /* Index number of the profile */
      "index":0,

      /* Number of seconds of speech extracted from all voice samples thus far */
      "seconds_extracted":0.0,

      /* Current processing call sampling error */
      "error":0
    }
  }
}

```

| Sampling Error Code | Description |
|---------------------|---|
| 0 | Success |
| 303 | Need More Voice |
| 304 | Enrollment Training Error (Only shows up on Finalizing an Enrollment) |

Figure 4-9: Enrollment Sampling Codes

4.2.2 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Error description code | Description |
|------------------------|---|
| 101 | Session Exception (See Log) |
| 102 | Invalid Session (Session Timeout?) |
| 103 | Corrupt Session Id |
| 104 | Developer Limits Reached |
| 311 | Enrollment Limits Reached |
| 315 | Invalid Post Data, No Stream Found, or No voice found in stream |
| 317 | Invalid Post Data, Stream Found, Missing data field |
| 318 | Invalid Post Data, Unknown stream type, Missing form-data |
| 701 | Error occurred while updating database |

Figure 4-10: Enrollment Process Status Codes

4.3 Finalize an Enrollment

Finalize an Enrollment, train and save data, destroy the session.

DELETE - http://v2ondemand.com:50202/1/sve/Enrollment

HTTP Request Headers:

| Name | Type | Values | Description |
|---------------|--------|--|--|
| Vv-Session-Id | string | Session Id as returned in start enrollment process | unique identifier of the enrollment. Received in the start enrollment process. |

Figure 4-11 Enrollment Terminate Session ID Parameter

4.3.1 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Enrollment End Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{
    ...
  },

  /* Present on enrollment process and end messages */
  "result.enroll":{

    /* The client_id used in the enrollment start message */
    "{client_id}":{

      /* Index number of the profile */
      "index":0,

      /* Number of seconds of speech trained from all voice samples */
      "seconds_trained":0.0,

      /* Current processing call sampling error */
      "error":0
    }
  }
}

```

4.3.2 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Error description code | Description |
|------------------------|--|
| 101 | Session Exception (See Log) |
| 102 | Invalid Session (Session Timeout?) |
| 103 | Corrupt Session Id |
| 104 | Application Limits Reached |
| 304 | Enrollment Training Error |
| 701 | Error occurred while updating database |

Figure 4-12: Enrollment Finalize Status Codes



5. Verification

The following calls are used to start, process, and terminate a verification:

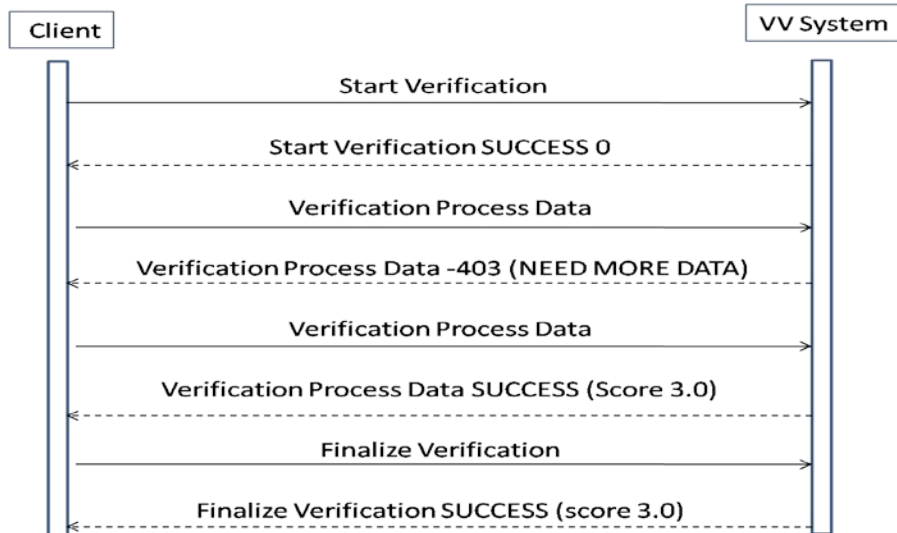


Figure 5-1: Successful Verification Process Flow

The general sequence for a verification is to start a session which may then be left open as long as required. This supports being able to do continuous verifications during the course of an interaction. A verification session can be finalized at any time.

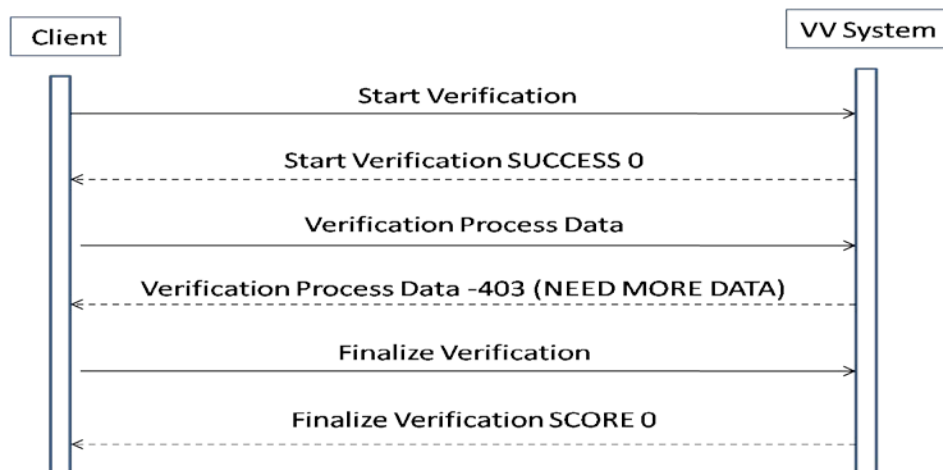


Figure 5-2: Failed Verification Example

Figure 5-2 above gives an example of what a failed verification looks like. In this example, the error returned indicates more data is required to produce a reliable result. In this case we would persist and submit additional data, or if trying to verify against a text dependent profile, we would resubmit the same data file.

5.1 Starting a Verification

Initiate a verification session using a pre-configured profile and the same unique client-id that was used in the enrollment session.

POST - http://v2ondemand.com:50202/1/sve/Verification/{client_id}

URL Parameters:

| Name | Type | Description |
|-----------|--------|---|
| client_id | String | Client Id for the enrollment that this verifier is claiming – i.e. the enrollment that we wish to verify against. |

Figure 5-3: Verification Start Parameters

HTTP Request Headers:

| Name | Type | Description |
|-----------------|--------|--|
| Developer-Key | String | The Developer-Key located on the Dashboard |
| Application-Key | String | The Application specific Key located on the Dashboard |
| Interaction-Id | String | (Optional) An external session id, used to correlate internal data with. |

Figure 5-4: Verification Start Request Headers

HTTP Response Headers:

| Name | Type | Description |
|---------------|--------|--|
| Vv-Session-Id | String | The session Id required to be sent with subsequent processing calls. |

Figure 5-5: Verification Start Response Headers

5.1.1 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Verification Start Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{
    ...
  },

  /* Profile information only present on verification start message */
  "profile.verify":{

    /* Index number of the profile */
    "index":0,

    /* Profile Kind: Independent - 1, Liveness - 2 */
    "kind":0,

    /* Profile Type: Single - 2 */
    "type":0,

    /* Type of Audio Codec: pcm_little_endian -or- alaw */
    "codec":"",

    /* Passing Threshold */
    "pass":0

    /* Failing Threshold */
    "fail":0
  }
}

```


5.1.2 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Error description code | Description |
|------------------------|---|
| 101 | Session Exception |
| 104 | Developer has reached their limit |
| 107 | Unable to acquire a session |
| 202 | Unable to start the feature extractor |
| 402 | Unable to start the verification processor |
| 408 | Invalid Application Key / Application Profile Not Found |
| 409 | Invalid Parameter specified |
| 410 | No Model found for the specified client id |
| 412 | Verification limits have been reached |

Figure 5-6: Verification Start Error Codes

5.2 Sending Voice Data

Sending Voice Data can be called multiple times even with the same data.

POST - <http://v2ondemand.com:50202/1/sve/Verification>

HTTP Request Headers:

| Name | Type | Values | Description |
|---------------|--------|--------|---|
| Vv-Session-Id | String | | The Id received in the start verification result. |

Figure 5-7: Verification Process Session ID Parameter

Additional Notes:

- ✓ Uses File Upload Standard RFC 1867.
- ✓ An HTTP request submitted using the POST method with a content-type of "multipart/form-data".
- ✓ The audio data to be transmitted needs to be encoded by the same audio codec that was received with the *profile.verify* JSON object from the start verification HTTP Data Stream. The audio data is **required** to be transmitting as a raw wav stream without any "RIFF" headers.

Streaming Data:

| Name | Type | Values | Description |
|------|--------|------------------------------|---|
| data | binary | Max file size is 2 megabytes | Form data field name to store binary data is "data" |

Figure 5-8: Verification Process Data Parameter

5.2.1 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Verification Process Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{
    ...
  },

  /* Present on verification process and end messages */
  "result.verify":{

    /* The client_id used in the verification start message */
    "{client_id}":{

      /* Index number of the profile */
      "index":0,

      /* Current processing call sampling error */
      "error":0,

      /* Number of seconds of speech extracted from all voice samples thus far */
      "seconds_extracted":0.0,

      /* Score determined from all samples thus far */
      "score":0.0,

      /* Status of score. (P)assing, (A)mbiguous, (F)ailing */
      "status":"P"
    }
  }
}

```

| Sampling Error Code | Description |
|---------------------|-----------------|
| 0 | Success |
| 403 | Need More Voice |

Figure 5-9: Verification Sampling Codes

5.2.2 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Error description code | Description |
|------------------------|---|
| 101 | Session Exception (See Log) |
| 102 | Invalid Session (Session Timeout?) |
| 103 | Corrupt Session Id |
| 104 | Developer Limits Reached |
| 412 | Verification Limits Reached |
| 416 | Invalid Post Data, Unknown stream type, Missing form-data |
| 417 | Invalid Post Data, No Stream Found, or No voice found in stream |
| 418 | Invalid Post Data, Stream Found, Missing data field |
| 701 | Error occurred while updating database |

Figure 5-10: Verification Process Status Codes

5.2.3 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Verification Process Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{
    ...
  },

  /* Present on verification process and end messages */
  "result.verify":{

    /* The client_id used in the verification start message */
    "{client_id}":{

      /* Index number of the profile */
      "index":0,

      /* Current processing call sampling error */
      "error":0,

      /* Number of seconds of speech extracted from all voice samples thus far */
      "seconds_extracted":0.0,

      /* Score determined from all samples thus far */
      "score":0.0,

      /* Status of score. (P)assing, (A)mbiguous, (F)ailing */
      "status":"P"

      /* Allowed results. (Y)es, (N)o */
      "alive":"Y"
    }
  }
}

```

| Sampling Error Code | Description |
|---------------------|-----------------------------|
| 101 | Session Exception (See Log) |
| 403 | Need More Voice |

Figure 5-13: Verification Liveness Sampling Codes

5.2.4 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Sampling Error Code | Description |
|---------------------|---|
| 0 | Success |
| 102 | Invalid Session (Session Timeout?) |
| 103 | Corrupt Session Id |
| 104 | Developer Limits Reached |
| 412 | Verification Limits Reached |
| 416 | Invalid Post Data, Unknown stream type, Missing form-data |
| 417 | Invalid Post Data, No Stream Found, or No voice found in stream |
| 418 | Invalid Post Data, Stream Found, Missing data field |
| 420 | Returns a Non-Live State |
| 701 | Error occurred while updating database |

Figure 5-14: Verification Liveness Process Status Codes

5.3 Finalize a Verification

Finalize the verification session and get the final score result.

DELETE - http:// v2ondemand.com:50202/1/sve/Verification

HTTP Request Headers:

| Name | Type | Values | Description |
|---------------|--------|--------|---|
| Vv-Session-Id | String | | The Id received in the start verification result. |

Figure 5-15: Verification Terminate Session ID Parameter

5.3.1 Successful Result

HTTP Status Code: 200 (Success)

```

/* HTTP 200 - JSON Verification End Response */
{
  /*
   * Only present if a catastrophic error occurs inside the API.
   * Data inside this block should be sent to ValidVoice for investigation.
   */
  "error":{
    ...
  },

  /* Present on verification process and end messages */
  "result.verify":{

    /* The client_id used in the verification start message */
    "{client_id}":{

      /* Index number of the profile */
      "index":0,

      /* Current processing call sampling error */
      "error":0,

      /* Number of seconds of speech extracted from all voice samples thus far */
      "seconds_extracted":0.0,

      /* Score determined from all samples thus far */
      "score":0.0,

      /* Status of score. (P)assing, (A)mbiguous, (F)ailing */
      "status":"P",

      /* Has the client been authorized. Is status equal to P. true -or- false */
      "authorized":true

    }

  }
}

```

5.3.2 Failure Result

HTTP Status Code: 500 (Internal Server Error)

| Error description code | Description |
|------------------------|--|
| 101 | Session Exception (See Log) |
| 102 | Invalid Session (Session Timeout?) |
| 103 | Corrupt Session Id |
| 701 | Error occurred while updating database |

Figure 5-16: Verification Terminate Status Codes



6. Audio Formats

The engine currently supports the following audio formats:

- ✓ Wave A-Law, 8000 Hz, 64 kbps, mono
- ✓ Wave PCM signed 16 bit, 8000 Hz, 128 kbps, mono

The expected audio format is returned in the Enrollment and Verification initialization response JSON messages located in the field **codec**. Please note, that failure to send in the audio format in any of the specified formats above may result in unintended results, such as for example, an unusually high amount of extracted speech. The extracted speech should always be less than the amount of audio sent to the engine.



7. Best Practices for Implementation

ValidVoice recommends that users who are developing their own interfaces should consider the following methods to implement the on-boarding (Enrollment) and User Authentication processes. Please note that different on-boarding methods can be used based on how the process is implemented.

7.1 Natural Language Enrollment (On-Boarding during an existing call with an Agent (Patented Process))

When implementing a natural language enrollment, the inbound phone channel is monitored, and the live voice used for the process. The benefit to both organization and customer is that the customer/enrollee does not need to utter any specific words or sentence, thus reducing friction, and startup cost. The natural language speech is then sent to v2ondemand which is our voice biometric engine solution (www.v2ondemand.com) system for enrollment.

The engine will return the results of the enrollment, indicating whether it accepted the enrollment, whether it rejected the enrollment and a possible reason why, or whether it requires more speech based on the minimum seconds of speech parameter configured for this specific application instance.

ValidVoice recommends a bare “minimum seconds of speech” enrollment value of **40** seconds. Please note, seconds of speech here indicates trained speech, that is, the seconds of speech the engine was able to extrapolate from the raw audio it received. The number of seconds of raw audio captured is generally more than the number of seconds the engine extrapolates.

7.2 Smartphone App or IVR Enrollment

The application should be developed to guide the user through the enrollment process step by step. When enrolling with this method, it is always good to use a set of questions during the enrollment process. These questions should be asked up to 3 times each to ensure that there is enough variance in the captured voice. A recommended question set, and sequence of questions are as follows:

- ✓ Please say your full name
- ✓ Please say your full address
- ✓ Please repeat your full name
- ✓ Please repeat your full address
- ✓ Please repeat your full name one last time
- ✓ Please repeat your full address one last time
- ✓ Please count from zero to nine
- ✓ Additional Questions if needed:
 - Please say the days of the week
 - Please say the months of the year
 - Please say the four seasons of the year.

The engine will return the results of the enrollment, indicating whether it accepted the enrollment, whether it rejected the enrollment and a possible reason why, or whether it requires more speech based on the minimum seconds of speech parameter configured for this specific application instance.

ValidVoice recommends a bare “minimum seconds of speech” enrollment value of **12** seconds. Please note, seconds of speech here indicates trained speech, that is, the seconds of speech the engine was able to extrapolate from the raw audio it received. The number of seconds of raw audio captured is generally more than the number of seconds the engine extrapolates.

7.3 Natural Language Verification

When implementing a natural language verification, the inbound phone channel is monitored, and the live voice used for the process. The user does not need to utter any specific words or sentence, thus reducing friction and overall continuous cost. The natural language speech is then sent to v2ondemand which is our voice biometric engine cloud solution (www.v2ondemand.com) system for enrollment.

The system will return the results of the verification. It will either return a verified, not verified or ambiguous result or it may ask for more speech. The application should capture and send more speech to www.v2ondemand.com, if requested.

7.4 Mobile App or IVR Verification

The application should be developed to guide the user through the verification process step by step. The process should resemble the outline below:

- ✓ Ask the user “Please say your full name”
- ✓ Either display a set of 4 numbers (pin pattern) and ask the user to repeat them on mobile apps, or say a set of 4 numbers and ask the user to repeat them on an IVR for a liveness test.
- ✓ Additional Questions, if required:
 - Ask the user “Please say your full address”
 - Ask the user “Please say your complete phone number”
 - Ask the user “What day of the week is it today”

The system will return the results of the verification. It will either return a verified, not verified or ambiguous result or it may ask for more speech. The application should capture and send more speech to www.v2ondemand.com, if requested.

