Deutsche Telekom Laboratories

W3C SIV Workshop (Menlo Park, March 5-6, 2009)

Ingmar Kliche, Martin Eckert

W3C SIV Workshop.
Agenda.

- SIV Architecture
- Use cases
- SIV syntax
- Conclusion

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What should SIV in VoiceXML 3.0 support?

Combination of SIV with other resources (esp. ASR) :

- SIV only (i.e. without ASR, standalone SIV)
- SIV in parallel to ASR (ASR and SIV are separate resources)
- SIV integrated with ASR as one (combined) resource

SIV types:

- Text independent
- Text dependent
- Text prompted

Decision control:

- Either the SIV engine or the application may control decisions (e.g. regarding acceptance/rejection)

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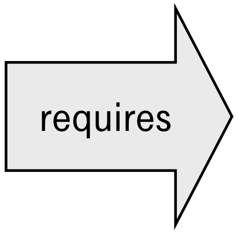
SIV Core Functionality in VoiceXML 3.0.

SIV must support:

- Enrollment
- Verification
- Identification



requires

- Save voiceprints (after enrollment)
- Load voiceprints (before verification/identification)

Note: V3 should load/store voiceprints implicitly (without explicit markup)

Further basic/core functionalities for application development:

- Adaptation of voiceprints (during verification)
- Buffering of user utterances for later use
- Rollback/Undone of last turn
- Query SIV results (e.g. accept/reject information, score etc.)
- Catch SIV events (e.g. “noinput” or “nomatch” events)
- Query, copy, delete voiceprints (administration purposes) ⇨ outside of VoiceXML 3.0

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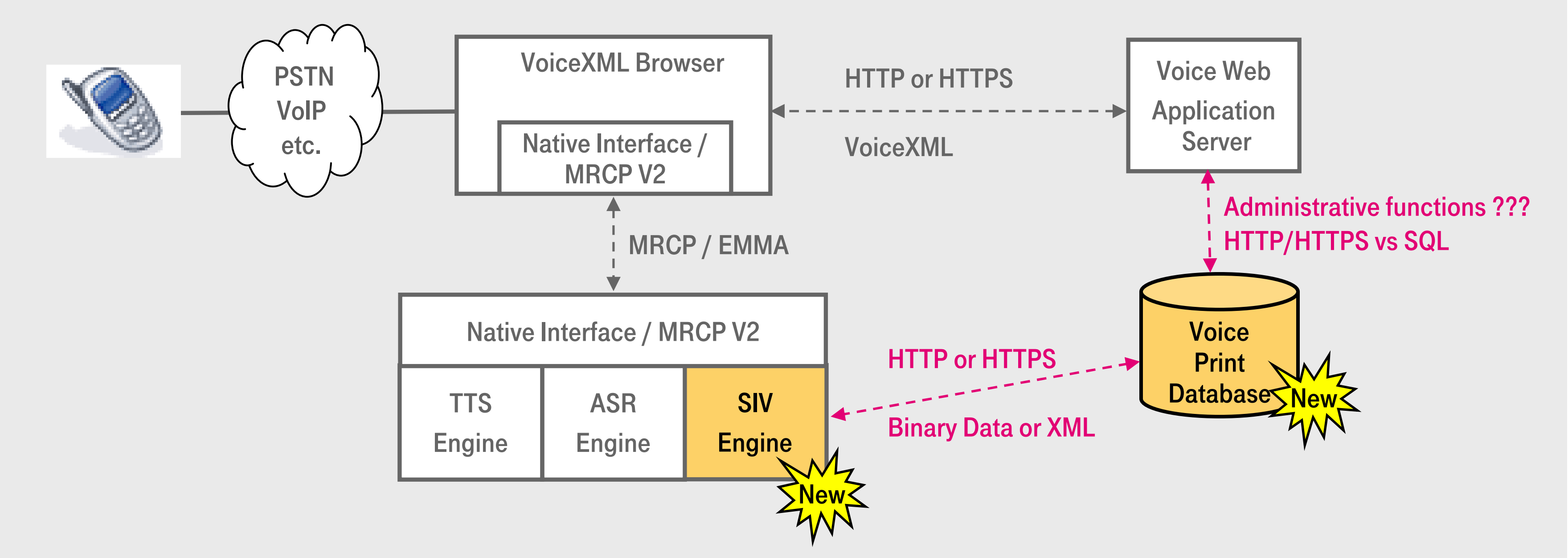
SIV Architecture.

Proposed Architecture



- Standard VoiceXML architecture extended by MRCP-based SIV engine and voiceprint store

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SIV Architecture.

Architectural key statements

- Support MRCP v2 for integration of SIV engines
  - SIV engine should be integrated using a standardized interface to allow flexible replacement of SIV resources (product replacement).
- Extend MRCP vs. limited SIV functionalities
  - Some SIV vendors require functionalities which are not covered by MRCP v2 (e.g. COPY voiceprint, expected utterance). A decision is necessary for either using a standardized interface or to support the full set of SIV features of various vendors.
- Use EMMA for representation of SIV results
  - SIV results should be represented using EMMA standard.
- Use web protocols for voice print transport
  - Use of HTTP/HTTPS provide flexibility in deployment scenarios

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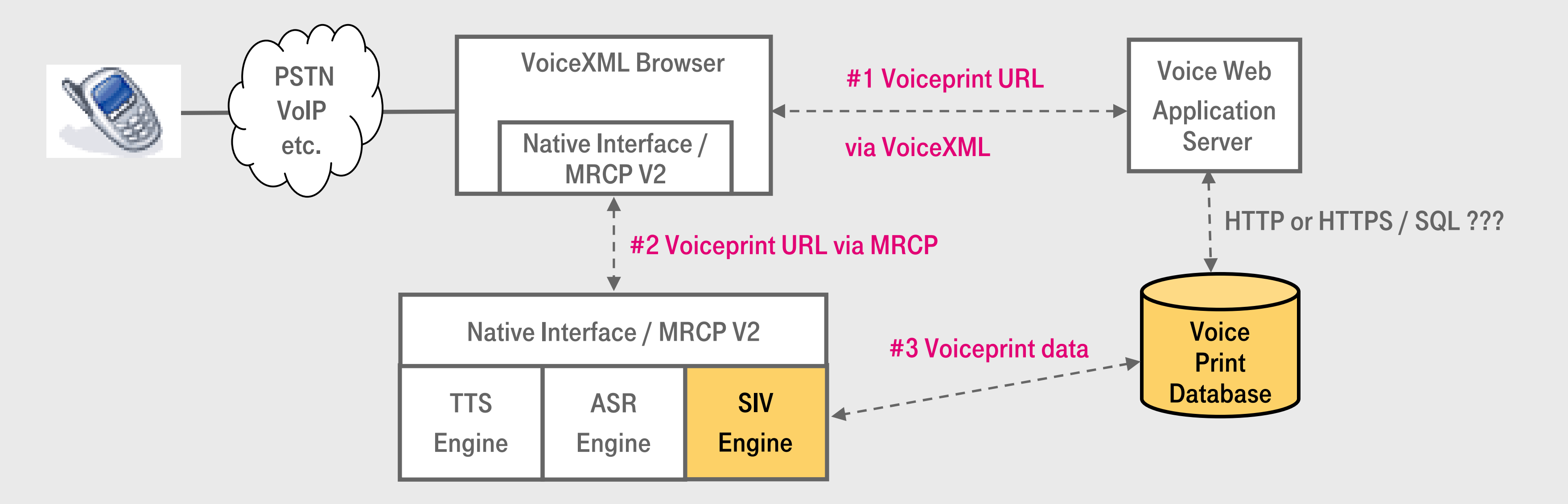
SIV Architecture.

Voiceprint management: load and save voiceprints via MRCP



- MRCPv2 supports voiceprint URLs only (i.e. not the voiceprint itself)
- For identification a list of voiceprint URLs or a URL identifying a group will be necessary
- Loading/storing of voiceprints should be implicitly done by V3

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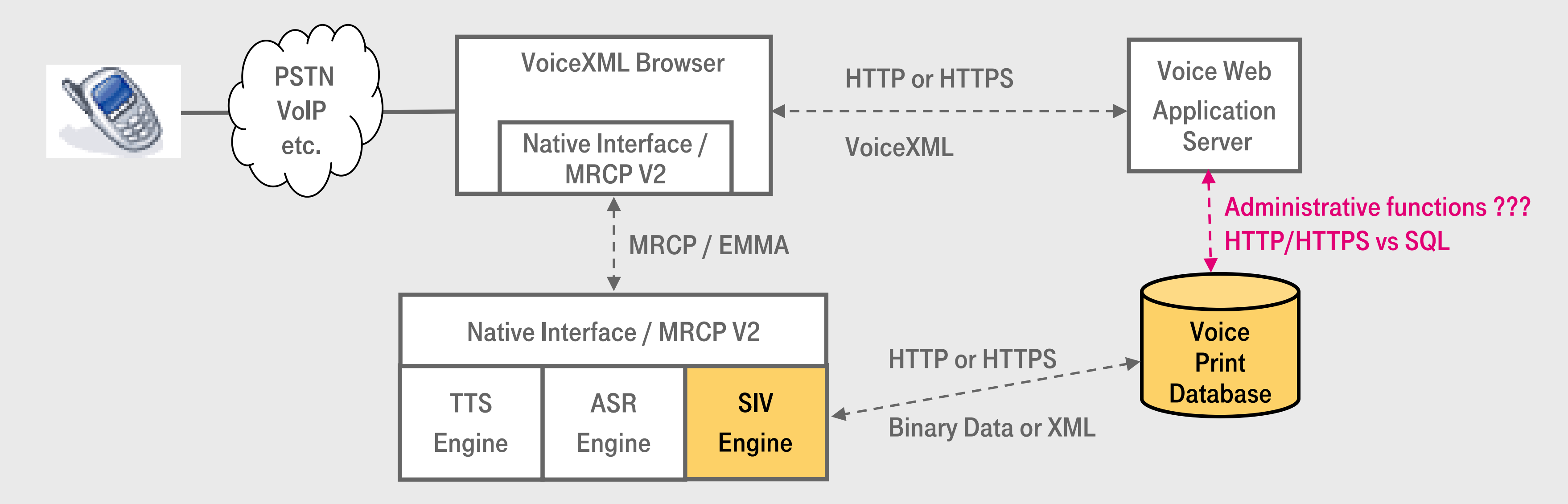
SIV Architecture.

Voiceprint management: query/copy/delete voiceprints (Option 1)



- MRCPv2 does not provide all necessary administrative functions (e.g. COPY).
- Advantages option 1: administrative functions not executed by VoiceXML
- Disadvantage option 1: proprietary interface to voiceprint database.

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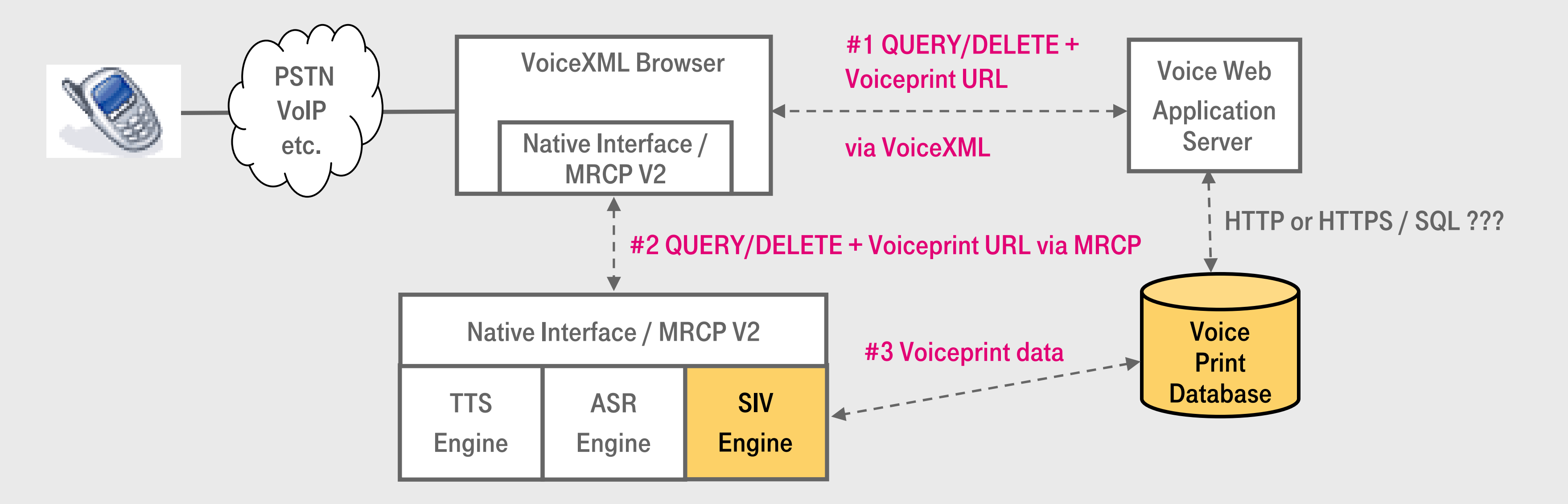
Voiceprint management: query/copy/delete voiceprints (Option 2)


PSTN
VoIP
etc.
VoiceXML Browser
Native Interface / MRCP V2
#1 QUERY/DELETE + Voiceprint URL
via VoiceXML
Voice Web Application Server
HTTP or HTTPS / SQL ???
#2 QUERY/DELETE + Voiceprint URL via MRCP
Native Interface / MRCP V2
TTS Engine
ASR Engine
SIV Engine
#3 Voiceprint data
Voice Print Database

- MRCPv2 supports QUERY and DELETE commands
- Option 2: Reflect QUERY and DELETE at V3 syntax level
- Disadvantage option 2: admin functions executed via VoiceXML

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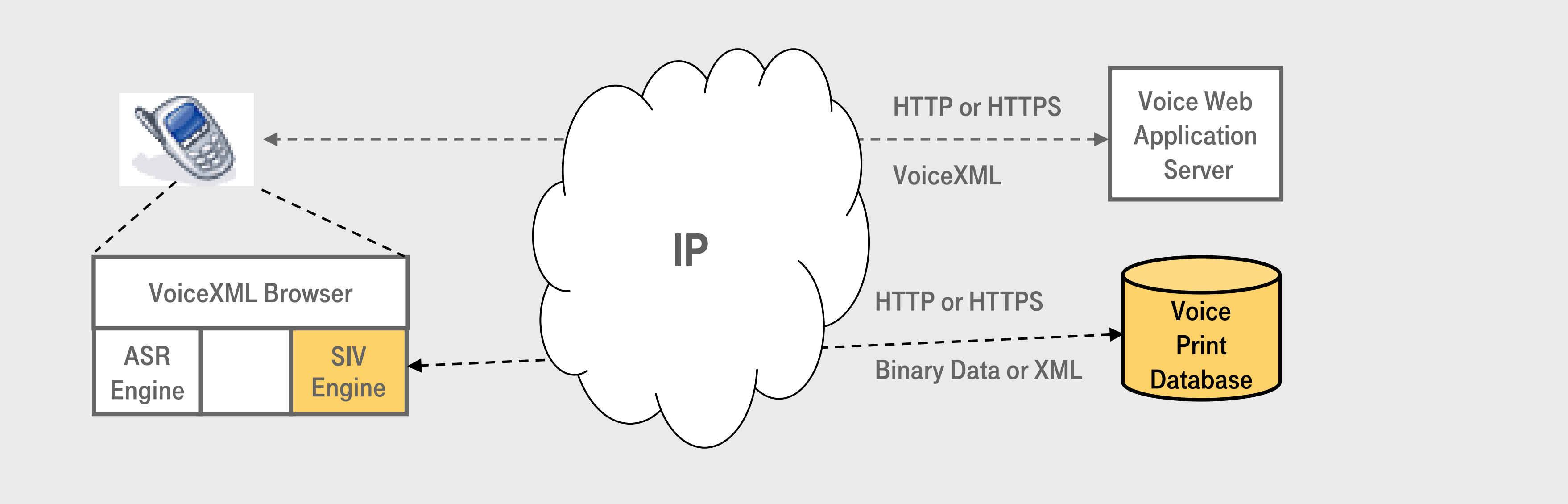
SIV Architecture.

Embedded deployment supported by proposed architecture



- Usage of web protocols (HTTP/HTTPS) for voiceprint transport supports future deployment scenarios

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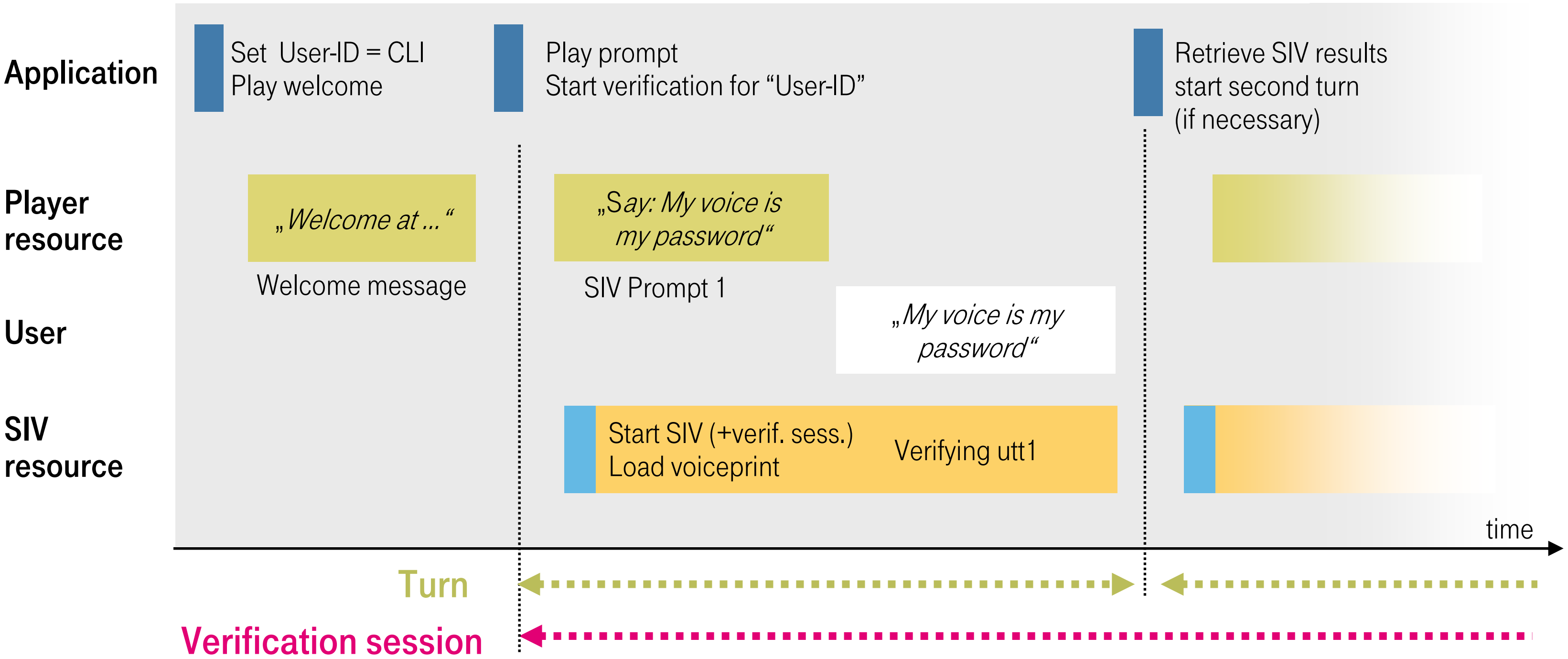
SIV use cases.

Basic uses case #1: standalone SIV without ASR



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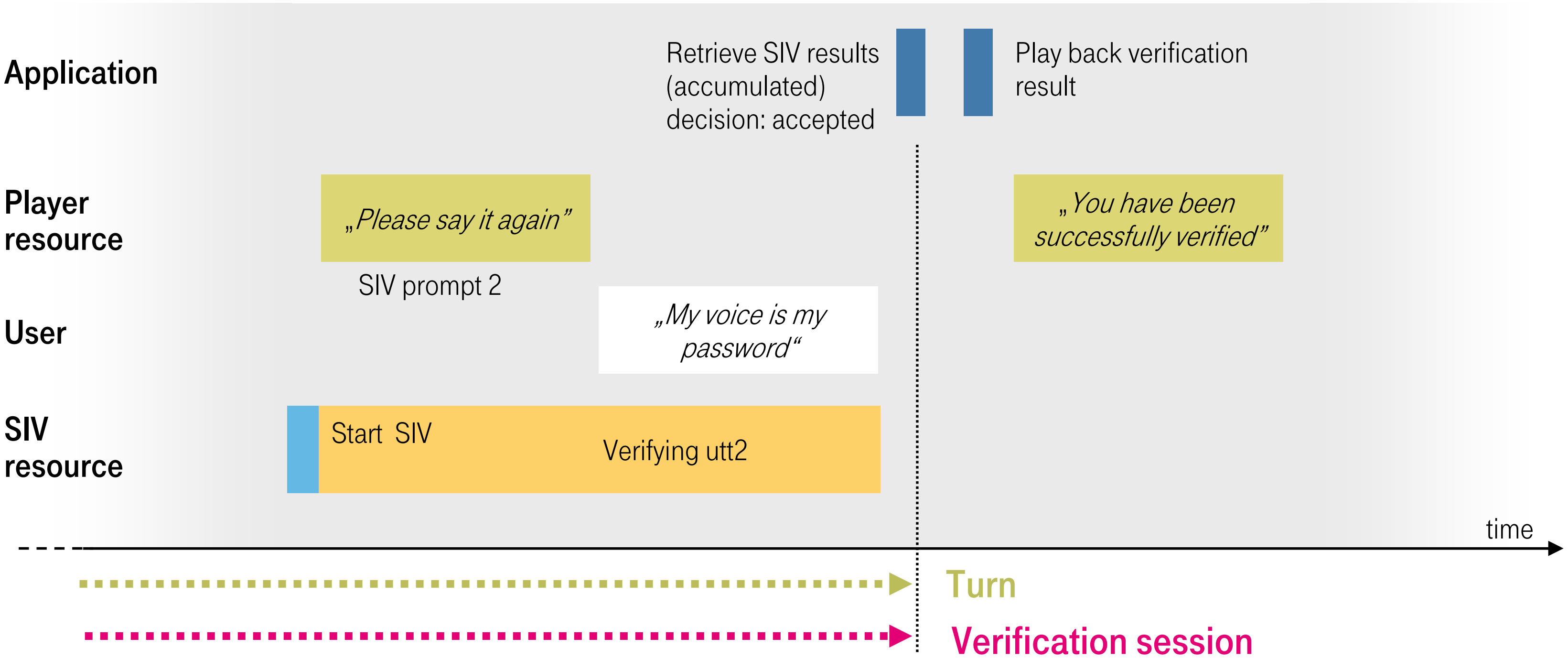
SIV use cases.

Basic uses case #1: standalone SIV without ASR (cont'd)



Application

Retrieve SIV results (accumulated) decision: accepted

Play back verification result

Player resource

„Please say it again"

SIV prompt 2

„You have been successfully verified"

User

„My voice is my password"

SIV resource

Start SIV

Verifying utt2

Turn

Verification session

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SIV use cases.

Basic uses case #1: standalone SIV without ASR (cont'd)

- SIV needs to implement speech detection/endpointing (like ASR)
- SIV needs to implement timeouts (like ASR)
- SIV should in this use case provide bargein functionality

- SIV may need multiple turns (within one SIV session)
- Author needs control of whether another turn is necessary or not (⇨ syntax)

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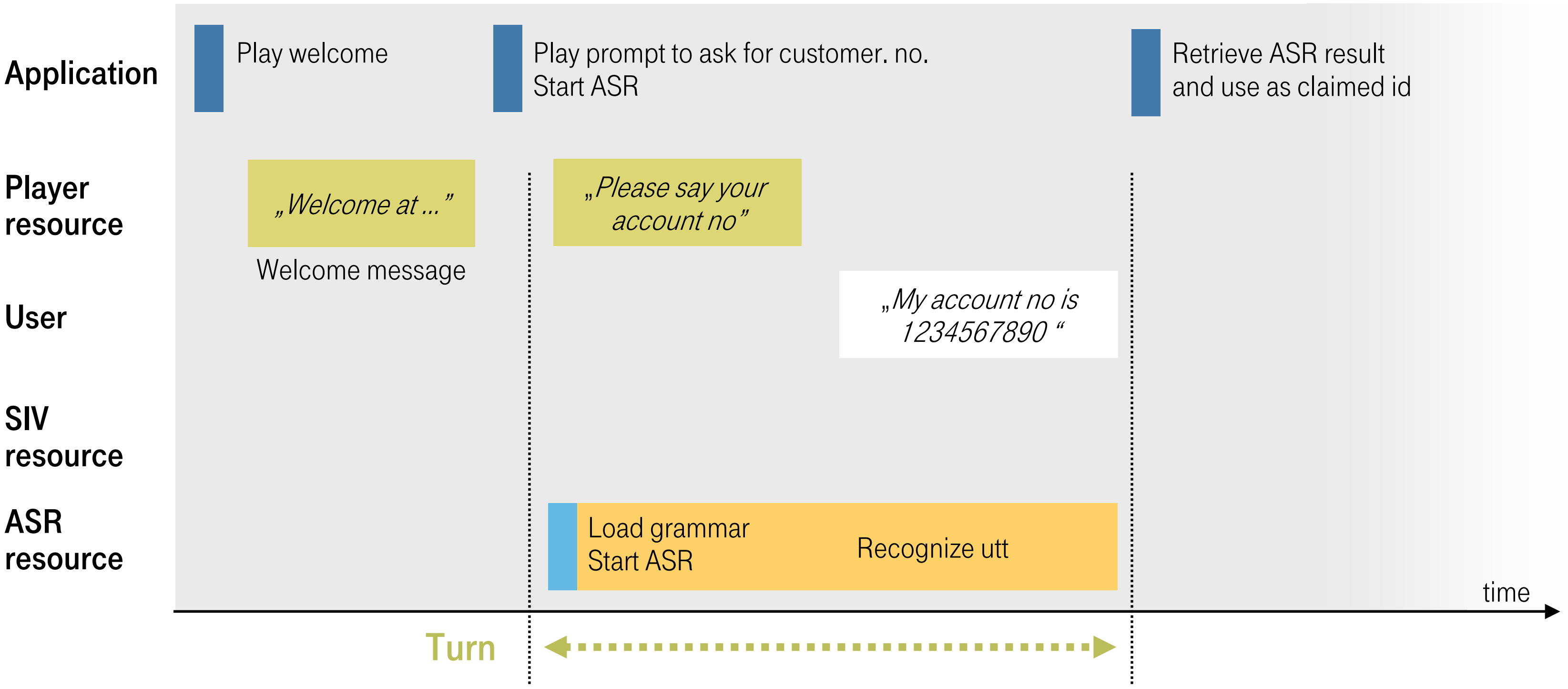
SIV use cases.

Basic uses case #2: SIV + ASR



Application

Play welcome

Play prompt to ask for customer. no.
Start ASR

Retrieve ASR result
and use as claimed id

Player resource

„Welcome at ...”

Welcome message

„Please say your account no”

User

„My account no is 1234567890 “

SIV resource

ASR resource

Load grammar
Start ASR

Recognize utt

time

Turn

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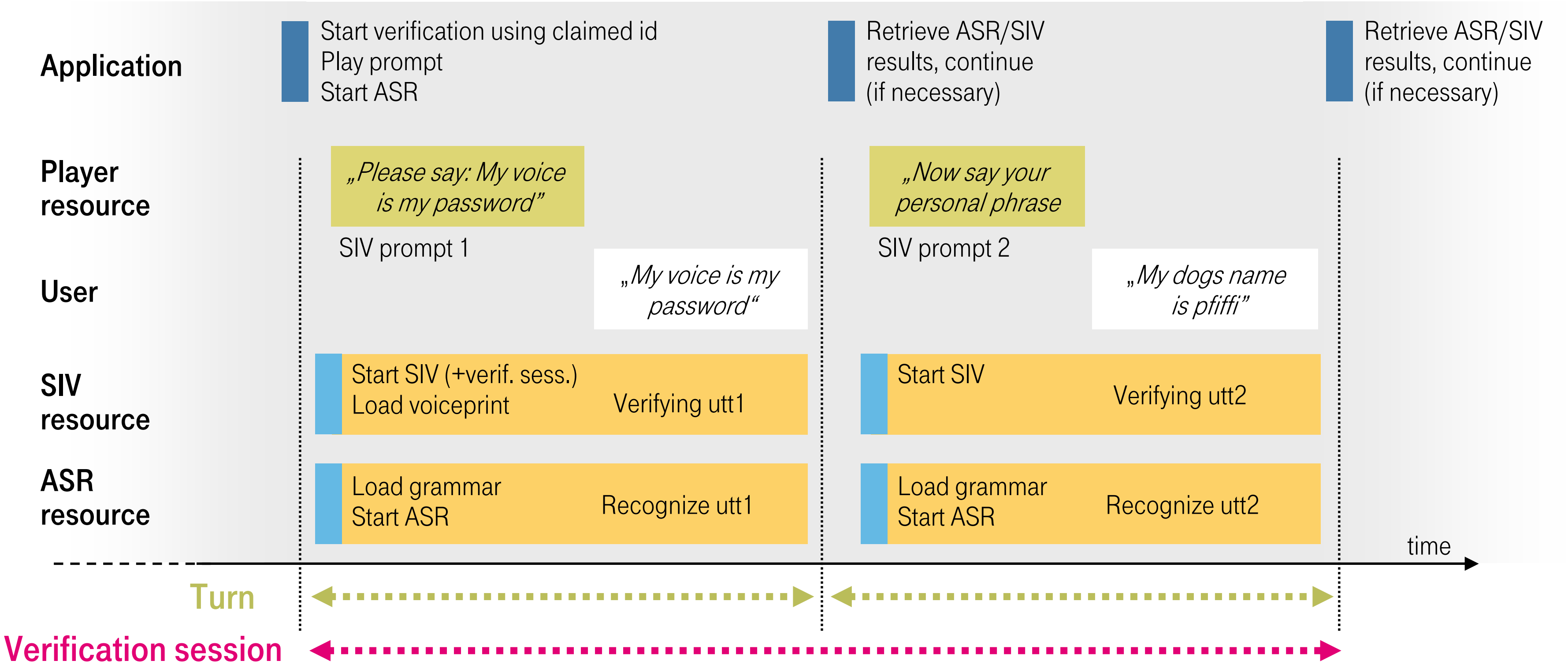
SIV use cases.

Basic uses case #2: SIV + ASR (cont’d)



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SIV use cases.

Basic uses case #2: SIV + ASR (cont'd)

- SIV may run in parallel to ASR (difference to use case #1)
- Idea: use ASR to make sure that the user repeated the correct (prompted) utterance
- Both ASR and SIV can return events like noinput etc. ⇨ application has to catch them

Issues:

- What if user repeated wrong utterance and ASR is used to check if SIV is not successful? ⇨ conclusion: undone/rollback functions necessary to remove latest utterance from cumulated result
- Problem if engine ended session by itself ⇨conclusion: session has to be ended by app only
- Same problem if adaptation was enabled ⇨ rollback for adaptation necessary (supported by MRCP thru abort header for end-session method)

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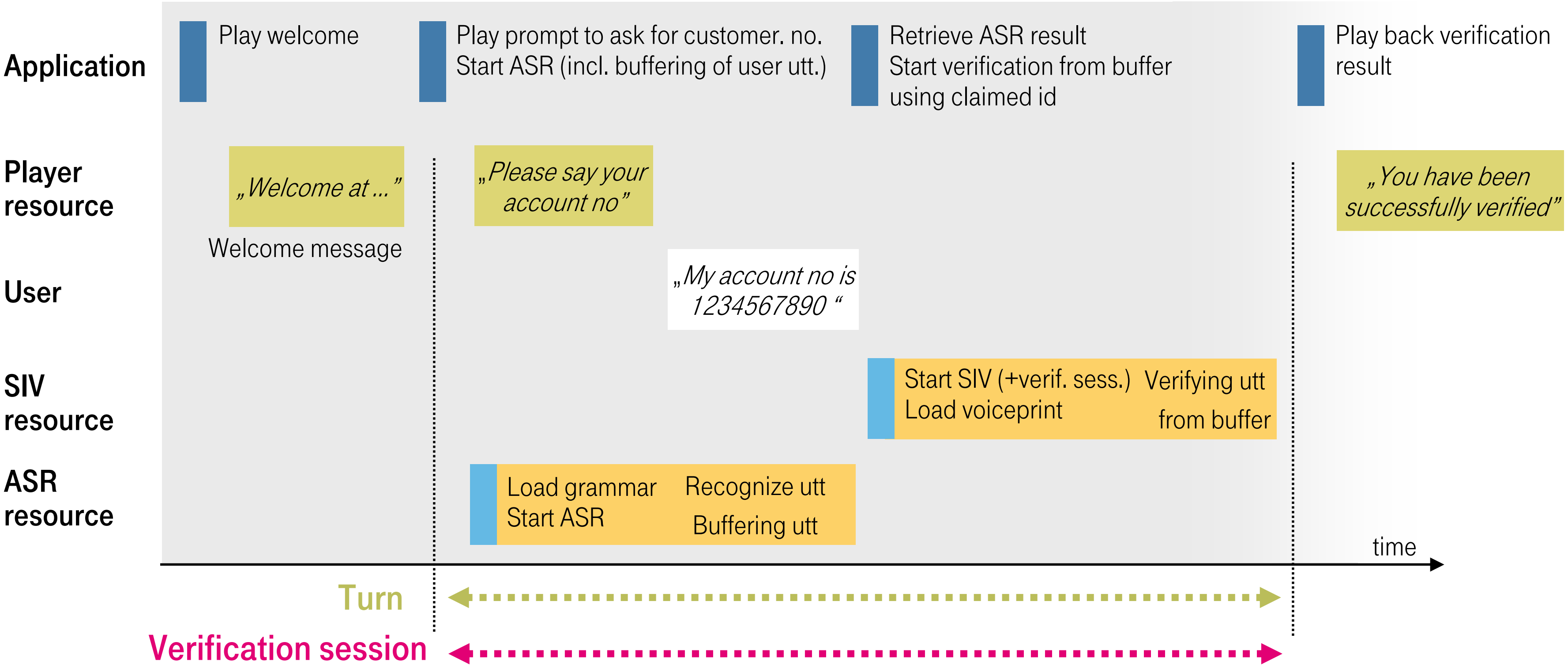
SIV use cases.

Basic uses case #3: ASR + SIV from buffer


Application
Player resource
User
SIV resource
ASR resource
Play welcome
Play prompt to ask for customer. no. Start ASR (incl. buffering of user utt.)
Retrieve ASR result Start verification from buffer using claimed id
Play back verification result
„Welcome at ...”
Welcome message
„Please say your account no”
„My account no is 1234567890 “
„You have been successfully verified”
Start SIV (+verif. sess.) Load voiceprint
Verifying utt from buffer
Load grammar Start ASR
Recognize utt
Buffering utt
time
Turn
Verification session

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SIV use cases.

Basic uses case #3: ASR + SIV from buffer (cont'd)

- ASR must be able to buffer one (or more?) utterances for later verification
- Requires new ASR functionality (e.g. new attribute siv_buffer)

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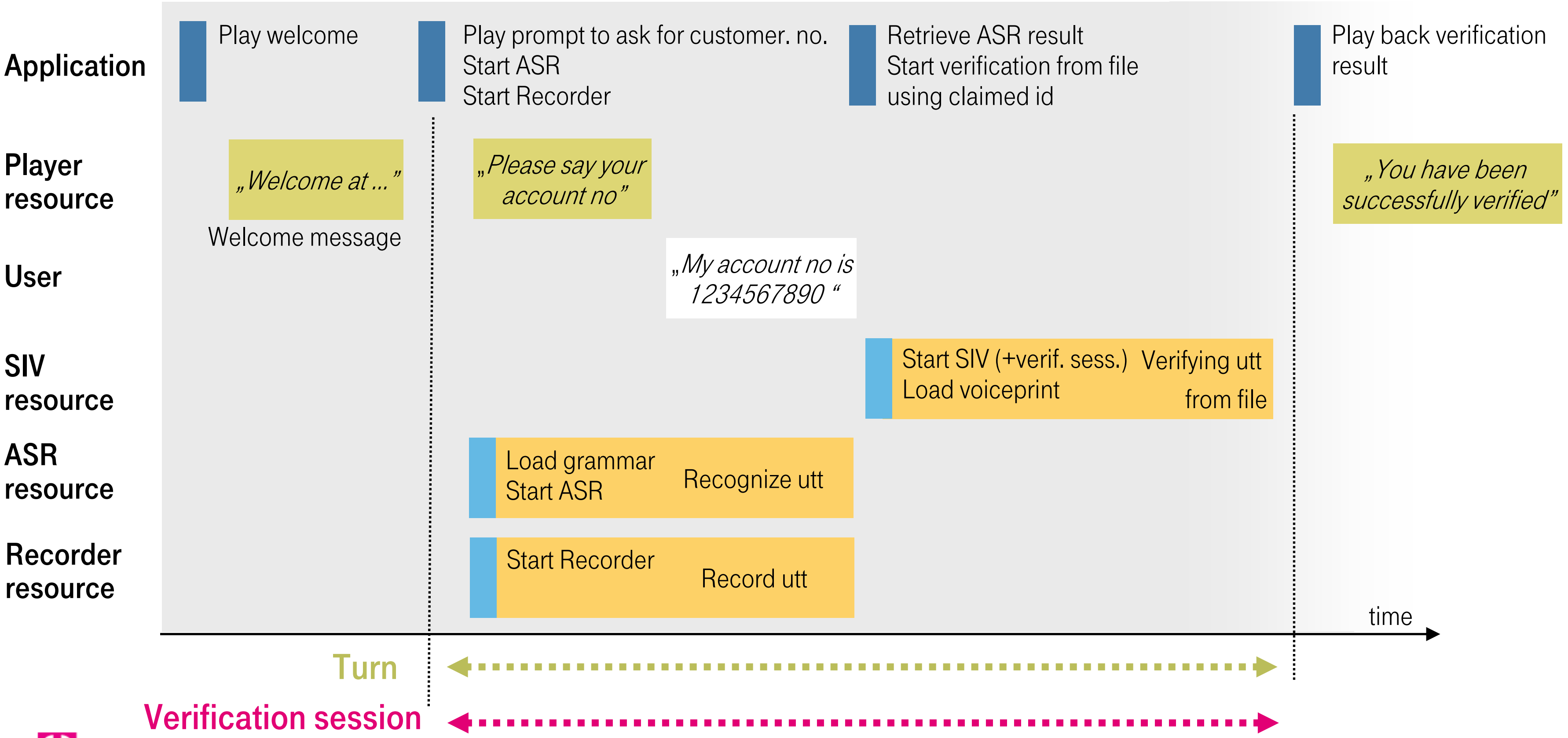
SIV use cases.

Basic uses case #4: ASR + SIV from file



Application

Play welcome

Play prompt to ask for customer. no.
Start ASR
Start Recorder

Retrieve ASR result
Start verification from file
using claimed id

Play back verification
result

Player resource

„Welcome at ...“

Welcome message

„Please say your account no“

„You have been successfully verified“

User

„My account no is 1234567890 “

SIV resource

Start SIV (+verif. sess.)
Load voiceprint

Verifying utt
from file

ASR resource

Load grammar
Start ASR

Recognize utt

Recorder resource

Start Recorder

Record utt

time

Turn

Verification session

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SIV use cases.

Basic uses case #4: ASR + SIV from file

- Recorder resource running in parallel to ASR to record user utterance
- Verification of recorded utterance requires special parameter (WAV file reference for verification from file)
- Which audio-formats are supported?

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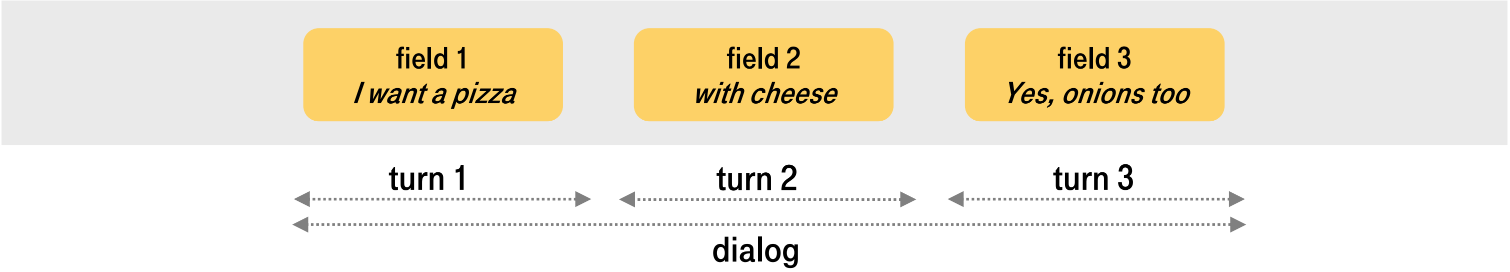
SIV vs. ASR.

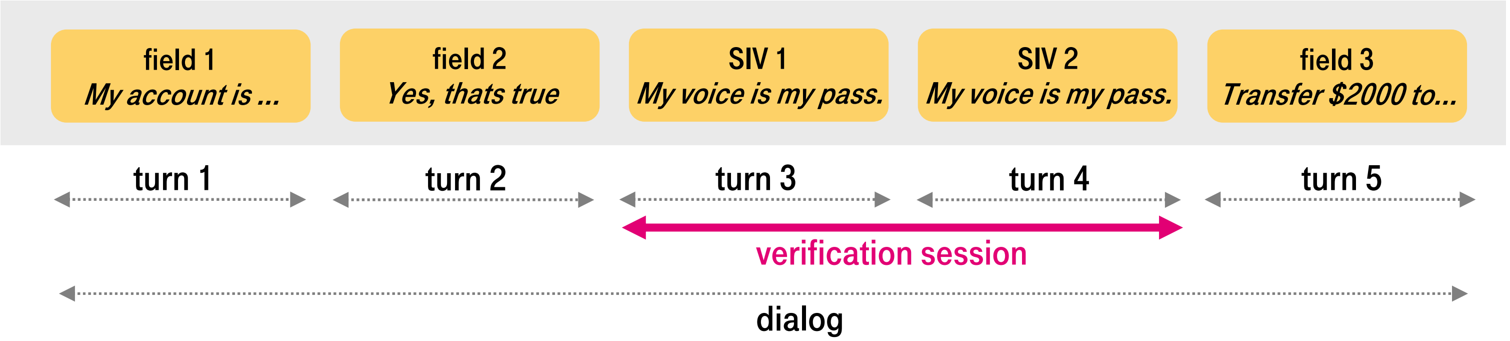
ASR

- ASR dialogs consists of one or more independent turns



SIV

- SIV dialogs consists of one or more turns that are part of an enrollment/verification session



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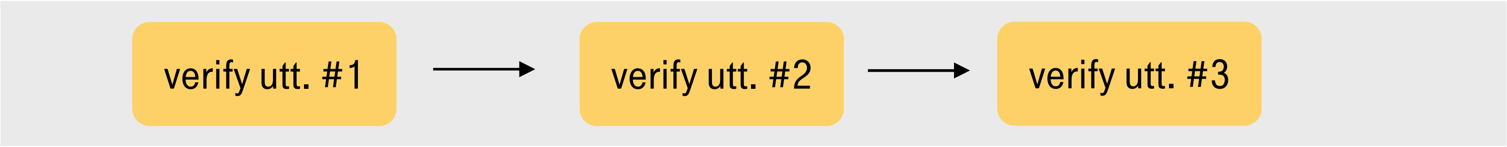
SIV sessions.

Sessions:

- Enrollment and verification/identification can be session based
- SIV engines often compute (internally) cumulative results when verifying several utterances (turns)



score: 0.1 cum. score: 0.1 decision: unsure	score: 0.3 cum. score: 0.2 decision: unsure	score: 0.8 cum. score: 0.4 decision: accepted

- MRCP provides Start-Session and End-Session methods
- Voiceprint-ID (given when session is started) defines which voiceprint to be trained or matched during the enrollment/verification session

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SIV syntax.

Inputs for VoiceXML 3.0 SIV elements:

- Mode (enroll/verify/identify)
- SIV-ASR (SIV only, SIV+ASR)
- Adaptation (bool)
- Buffering (for <field>) and “useBuffer” for <siv>
- Req. phrase
- Decision threshold
- Timeouts, like ASR
- ID (voiceprint URL), WAV file reference for verification from file (file URL)
- Rollback

Administrative functions:

- Query/copy/delete function

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SIV syntax.

Syntax option 1: Extend existing <field ...> element

- Example:

```
<field name="utt1" siv_type="verify" …>
  <voiceprint src="voiceprint_url"/>
  <grammar src="speech_grammar"/>
</field>
```

- Advantage:
  - reuse of existing element
- Disadvantages:
  - increased complexity of <field> element
  - control of begin and end of SIV session not sufficient
- Comment
  - multiple fields may belong to a single SIV session and hence use the same voiceprint. Referencing the same voiceprint URL in subsequent <field> is redundant.

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SIV syntax.

Syntax option 2: Create one new <siv> element

- Example:

```
<par>
  <siv name=“utt1“ type=“enroll / verify / identify” …>
    <voiceprint src=“voiceprint_url”/>
  </siv>
  <field>
    <grammar src=“speech_grammar”/>
  </field>
</par>
```

- Advantage:
  - no increased complexity of <field> element
  - clear separation of SIV and ASR syntax
- Disadvantages:
  - additional element necessary
  - control of begin and end of SIV session not sufficient

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SIV syntax.

Syntax option 3: Create a new element for each of the 3 basic functions:

- Example:

```
enrollment          <enroll …>
verification        <verify …>
identification      <identify …>
```

- Advantage:
  - better control of meaningful combinations of attribute values
  - example: `<siv type=“enroll” adaptation=“true”... >` is not meaningful, whereas `<enroll>` would not have a adaptation attribute

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SIV syntax.

Open issues:

- Control of begin/end of SIV session
- Session needs to be closed by application (to allow control of rollback)
- How to execute a rollback? Separate `<rollback>` element?

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SIV results.

Training:

- more_data_needed [true, false]
- decision [accepted, rejected, undecided]
- score (0 ... 100, 50 = decision threshold)

Verification:

- more_data_needed [true, false]
- decision [accepted, rejected, undecided], cumulative and local
- score (0 ... 100, 50 = decision threshold), cumulative and local
- adapted [true, false]

Identification:

- more_data_needed and adapted like for verification
- array of decision, score and voiceprint-ID

⇨ These are core results, should be mandatory within VoiceXML 3.0

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SIV results.

Additional results:

- Various vendors provide more results. Most of them are nice-to-have.

⇨Could be optional within VoiceXML 3.0

Examples:

- valid [true, false] (is the utterance valid?)
- device [cellular phone, electret phone, carbon button phone]
- gender [male, female]
- matched (is gender and device type same as in training?)
- num_utterances (number of utterances)
- ...

⇨ **Proposal:** Collect list of results of existing technologies and generate list of mandatory results. Decide on whether optional results should be allowed

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Other open issues.

The following issues have not been addressed here:

- Events: SIV might generate a “noinput” event, a combination of SIV and ASR leads to doubled or conflicting events
- Timeout parameters: Should SIV and ASR always use the same timeouts? Different resources (e.g. from different vendors) may behave inconsistently on the same timeouts.

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Summary / Conclusion.

Similarities and differences between ASR and SIV

- SIV and ASR share some similarities, but do also have a lot of differences (e.g. SIV session)

Detailed requirements / use case description necessary:

- VoiceXML 3.0 requirements document contains a very generic set of SIV requirements
- For a further discussion, a common understanding regarding use cases is necessary

Proposed next steps:

- Collect and describe use cases **in detail**, to achieve a common understanding
- Decide which use cases to support in VoiceXML 3.0 (and which not)
- Collect list of (mandatory) results and decide whether optional results will be allowed
- Compare with MRCP and decide what functionality from MRCP also to support in VoiceXML 3.0