

# **EU-BRIDGE**

## **Technology Catalogue**



**The EU-BRIDGE Consortium**

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# **EU-BRIDGE Technology Catalogue**

1st edition, July 2014



The work leading to these results has received funding from the European Union under grant agreement n°287658

## EU-BRIDGE

### Bridges Across the Language Divide

[www.eu-bridge.eu](http://www.eu-bridge.eu)



Usecase University Lecture Translation



Usecase European Parliament Translation

**EU-BRIDGE** develops automatic transcription and translation services that facilitate the development of innovative products and applications that require language technologies.

The project proves the usability of the services by implementing four applications as **use cases**:

- **Captioning Translation for TV Broadcasts:** Speech processing technologies improve the work flow in captioning TV shows and translating the captions into multiple languages. The use case demonstrates that by using speech translation technology it is possible to reduce the costs for producing subtitles for media content in many languages. Thus, it will be possible to subtitle and translate more media content and make it available to Europe's citizens.
- **University Lecture Translation:** Spoken content of university lectures is translated in real time and provided as subtitles. The use case demonstrates how speech translation technology can be applied in situations in which the use of human simultaneous translators would be too expensive and, in our case, making university lectures available to international students. The system is currently deployed in lecture halls at the Karlsruhe Institute of Technology.
- **European Parliament Translation:** EU-BRIDGE identifies opportunities for applying language technology in the interpretations of the European Parliament. By automatically identifying unusual terminology and named entities and suggesting appropriate translations we support the parliament's interpreters in their preparation for meetings.
- **Unified Communication Translation:** A web-based speech translation service within a unified communication platform is introduced to support multilingual webinars. The lecturer's speech is translated into another language and output as text chat. The use case demonstrates how the user experience, when using different devices in a communication setting, can be improved by using speech translation technology.

**EU-BRIDGE results:** A high performing speech translation service infrastructure which leads to more cost effective media transcription and translation systems developed throughout the project in a commercial setting.

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# Natural Language Processing Technologies

The services offered by EU-BRIDGE to application developers are all centered around two natural language processing technologies: Automatic speech recognition (ASR) and machine translation (MT).

Automatic speech recognition is the art of automatically converting human speech into a written sequence of words. Within EU-BRIDGE we are especially dealing with Large Vocabulary Continuous Speech Recognition (LVCSR).

Machine Translation systems automatically translate text from a source language into a target language. Many machine translation systems are tailored towards written text that includes punctuation and other text structuring elements, such as paragraphs. However, within EU-BRIDGE, we are very often dealing with spoken language translation (SLT). For this, ASR and MT components are combined in sequence in order to be able to translate human speech, not only text. The translation of automatic transcripts of human speech adds further challenges to the machine translation component.



### **Automatic Transcription: Audio to Text in Real Time**

Modern Large Vocabulary Continuous Speech Recognition (LVCSR) systems are learning systems that make use of statistical models. These models are trained on large amounts of transcribed audio data as well as large amounts of text in the target language. LVCSR systems work best when they are tailored to the specific domain that they are intended for. Also, LVCSR systems have a vocabulary that must contain all words that the system is supposed to recognize.

EU-BRIDGE has also researched and advanced techniques that allow such systems to automatically tune themselves to a new domain and speaker in an unsupervised manner, making use of auxiliary materials, such as slides of speakers or texts from the World Wide Web.

### **Statistical Machine Translation**

Just like speech recognition, modern machine translation (MT) systems are learning systems that make use of statistical models. These models make use of large amounts of parallel texts that contain sentences in the source language and their translation into the target language. Also, large amounts of monolingual texts in the target language are needed.

And, just like speech recognition, MT systems work best if tailored to the exact application domain. Therefore, semi- and unsupervised adaptation techniques were also intensively researched for machine translation.





## EU-BRIDGE Partners

RWTH, KIT, HKUST, UEDIN, FBK, PJIIT, PEV

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[www.eu-bridge.eu](http://www.eu-bridge.eu)

## EU-BRIDGE - the Project

EU-BRIDGE is a European Integrated Project that aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents between European and non-European languages.

## Technology Support for High-quality Automatic Speech Recognition Engines

### Description and Exploitable Knowledge

Ongoing research provides the basis for state-of-the-art and high-quality automatic speech recognition systems. By applying newly developed technology, the recognition quality of existing engines is improved. Further, the engines become more robust and stable for a broad range of languages.

The challenge is to develop methods for the needs of different applications (e.g. recognition of lectures, TV shows etc.). Special focus is given to deep neural network techniques for acoustic and language modelling which improve speech robustness, domain adaptation and recognition accuracy in general.

The ultimate goal is to improve the quality of speech transcription in order to increase the recognition accuracy for transcription services like subtitling or interpreter support of the European Union. To reach this objective, on-going research for automatic speech recognition is very important.

### Infrastructure

An essential part of the technology support is the actual transfer of new methods into the existing engines. However, before a newly developed feature is included into a running system, the impact will be verified in internal evaluations. Besides automatic evaluation metrics, tests based on the word error rate are employed. This verification pipeline ensures a continuous improvement of the used systems and a high-quality automatic speech recognition.

### Terms of Availability

Can be inquired at RWTH Aachen University (Hermann Ney)

### IPR Protection

RWTH Aachen University (Hermann Ney)





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## Automatic Transcription: Audio into Text in Real Time

### Description and Exploitable Knowledge

We turn audio into text in real time with a low latency. Each speech transcription worker contains two models, an acoustic model and a language model. 300+ hours of transcribed audio (Euronews, TED, podcasts, EPPS, etc.) are used for training the neural network or GMM acoustic model. The language model is trained on over 1,000 million words (from newspapers, transcripts, web dumps, etc.). These models can be optimized towards different tasks (Weatherview / Euronews / lectures / etc.) and/or different speakers resulting in many different possible workers.

### Infrastructure

- Server - mediator - client setup
- The mediator receives transcription requests and audio from the client and forwards the audio to the corresponding ASR worker which then returns the transcription to the mediator.
- ASR workers run constantly on a server waiting for audio. They use up no CPU time when not receiving audio or when the audio only contains silence.
- As soon as a worker is selected by the mediator it starts to receive packets of audio data which it then decodes and returns text fragments to the mediator.
- These text fragments can then be combined into sentences by a separate segmentation/punctuation prediction component and then (if required) passed onto an MT worker.

### Application Sectors

- Any situation which requires turning spoken speech into text
- News (e.g., channels like Skynews and Euronews)
- Webinars
- Lectures
- Parliamentary speeches
- Weather reports
- Captioning TV programs
- Speech translation

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### Technical Requirements

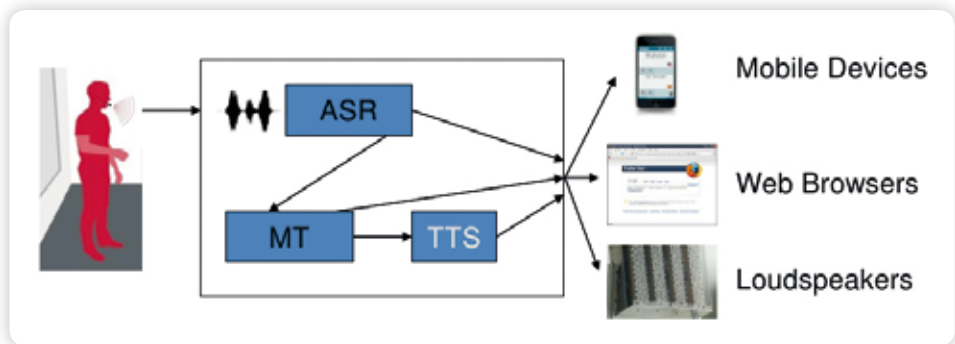
- Server with 8GB of RAM and 8 cores, 8 active systems can run in parallel on a modern server with 4 AMD Opterons (16 cores per CPU) as well as >>100 non-active but ready workers
- OS: Linux Ubuntu LTS 12.04 (Precise Pangolin) or similar
- Mediator connection: The workers can be accessed through the EU-BRIDGE Mediator service infrastructure

### Terms of Availability

Can be inquired at the Karlsruhe Institute of Technology (Prof. Alex Waibel)

### IPR Protection

Karlsruhe Institute of Technology (Prof. Alex Waibel)



Lecture Translation



LT-Client



Display Server



## EU-BRIDGE Partners

Fondazione Bruno Kessler (FBK)

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## Euronews: a Multilingual ASR Benchmark

### Description and Exploitable Knowledge

Recording data from TV and monitoring the Web to look for new audio resources is a fundamental activity in Automatic Speech Recognition (ASR). The TV channel Euronews, which broadcasts news in several languages, is an attractive source of comparable data, which were used to design a multilingual speech corpus for ASR purposes, made of recordings from TV and downloads from the Web.

The corpus includes data in 10 languages: Arabic, English, French, German, Italian, Polish, Portuguese, Russian, Spanish and Turkish; it was designed both to train Acoustic Models (AMs) and to evaluate ASR as well as Language Identification (LID) performance. For each language, the corpus is composed of about 100 hours of speech for training (60 for Polish) and about 4 hours, manually transcribed, for testing. Training data include the audio, some reference text coming from the Euronews portal which sometimes is a partial orthographic transcription, the ASR output and their alignment. Thanks to the light supervision technique, about 60 hours per language can be considered correctly transcribed.

These data are used inside the EU-BRIDGE consortium as a multilingual benchmark to evaluate ASR progress in the 10 languages, using similar amount of training data and comparable evaluation data. More details about this corpus can be found in the paper “Euronews: a multilingual speech corpus for ASR” by Roberto Gretter, in Proceedings of LREC, Reykjavik, Iceland, 2014.



Euronews Portal

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### Application Sectors

ASR and LID training and evaluation

### Terms of Availability

In 2013 the EU-BRIDGE consortium signed an agreement with Euronews, which gives to EU-BRIDGE partners the right to use Euronews material for research purposes, and to exchange it within the project.

Concerning the availability of these data for the whole research community, in 2014 Euronews agreed to make it available for research purposes. At present, part of the data is available as AM training data for the ASR multilingual evaluation benchmark for IWSLT 2014. We plan to make available more data for the next IWSLT evaluations.

| language   | #videos | speech duration | #ref words | #rec words | #common words | aligned speech |
|------------|---------|-----------------|------------|------------|---------------|----------------|
| Arabic     | 4406    | 107:22:58       | 650,146    | 756,100    | 379,000       | 49:54:03       |
| English    | 4512    | 112:18:29       | 973,210    | 1,032,727  | 699,850       | 63:02:34       |
| French     | 4434    | 108:56:37       | 954,242    | 1,123,709  | 796,997       | 62:13:46       |
| German     | 4438    | 108:33:23       | 809,289    | 896,387    | 653,372       | 61:46:27       |
| Italian    | 4464    | 110:35:51       | 900,291    | 1,012,521  | 765,559       | 61:31:36       |
| Polish     | 2626    | 58:32:03        | 350,729    | 454,977    | 278,854       | 27:42:35       |
| Portuguese | 4431    | 108:03:27       | 841,148    | 966,586    | 699,681       | 59:29:38       |
| Russian    | 4418    | 107:42:24       | 714,363    | 828,060    | 611,347       | 60:49:15       |
| Spanish    | 4465    | 109:16:50       | 939,408    | 1,053,255  | 797,698       | 63:29:23       |
| Turkish    | 4387    | 106:30:31       | 683,041    | 764,329    | 556,760       | 60:52:55       |





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The challenge is to develop methods for the needs of different applications (e.g. translation of lectures, TV shows etc.). Special focus is given to adaptation methods in order to take into account the fast changing domains of the application tasks.

Furthermore, the translation of speech is a more challenging task than the written text translation. In contrast to translation of written text, speech translation has to deal with missing punctuation, speech disfluency and recognition errors (as the input is automatic transcribed speech). Thus, the aim of developed techniques is to fix these errors and to reintroduce punctuation marks.

The ultimate goal is to improve the quality of speech translation in order to increase the user acceptance of the produced output. To reach this objective, ongoing research for speech translation is very important.

### Infrastructure

An essential part of the technology support is the actual transfer of new methods into the existing engines. However, before a newly developed feature is included into a running system, the impact will be verified in internal evaluations. Besides automatic evaluation metrics, tests based on human scores are employed. This verification ensures a continuous improvement of the used systems and a high-quality speech translation.

### Terms of Availability

Can be inquired at RWTH Aachen University (Hermann Ney)

### IPR Protection

RWTH Aachen University (Hermann Ney)







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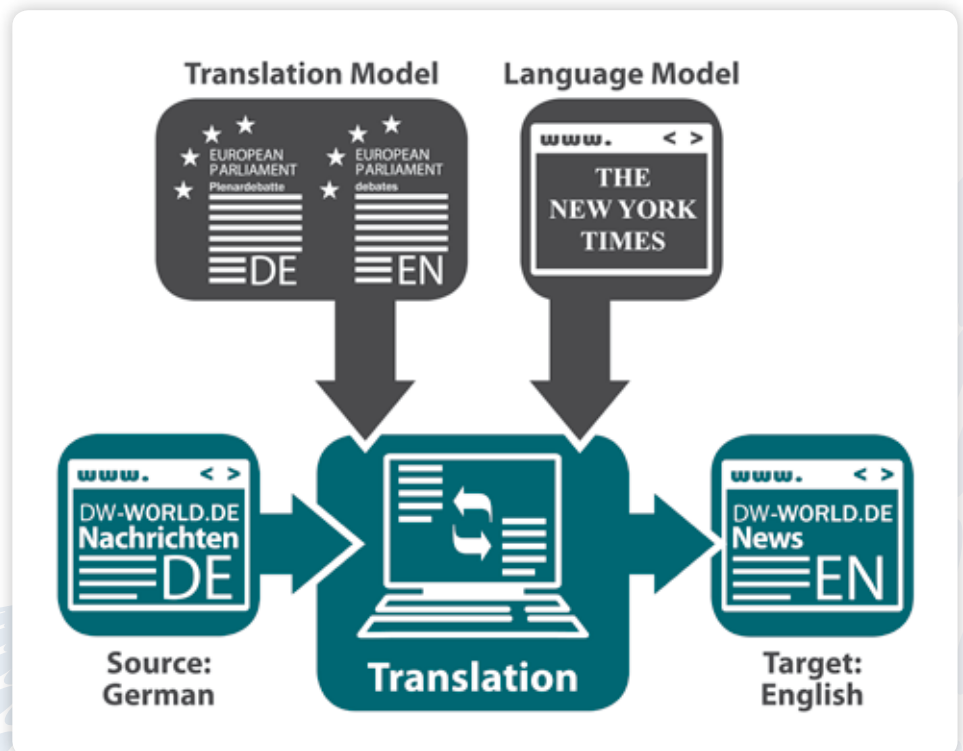
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## Statistical Machine Translation

### Description and Exploitable Knowledge

A statistical machine translation system translates text and transcribed speech from one language into another language.

The systems are trained on large amounts of parallel and monolingual data using publicly available collections such as the EPPS or News Commentary corpora as well as data collected specifically for a given task. In order to achieve the best performance, the systems can be adapted to this task using small amounts of perfectly matching data (lectures, Sky News,...).



Translation Model

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### Infrastructure

- MT engine runs as a worker in the EU-BRIDGE infrastructure
- Worker is constantly on the server waiting for text
- Worker receives segmented text from other workers in the source language and translates this text into the target language
- If needed, different workers can be combined to translate via a pivot language (e.g. French – English – German)

### Application Sectors

- Sky News
- Lecture translation
- Webinars

### Technical Requirements

- Server:
  - 8GB RAM and 1 core
  - Memory requirements can be reduced depending on the task
  - OS: Linux Ubuntu LTS 12.04

### Terms of Availability

Can be inquired at the Karlsruhe Institute of Technology (Prof. Alex Waibel)

### IPR Protection

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## Open Source Statistical Machine Translation

### Description and Exploitable Knowledge

Moses is an open source statistical machine translation (SMT) project, started in 2005 at the University of Edinburgh. Since then, hundreds of researchers have contributed towards the project, and it has become the most widely adopted translation engine both as a baseline research system and for commercial use in industry.

There is extensive online documentation (<http://www.statmt.org/moses>) and there is an active mailing list (<http://mailman.mit.edu/mailman/listinfo/moses-support>) for support.

### Technology / Application Sectors:

SMT models are the dominant technology for automatic machine translation and this is because they can leverage large amounts of human translated text. SMT systems can be trained within a few days, for any language pair, delivering state-of-the-art performance when enough training data is available. SMT models win annual machine translation competitions, and are deployed by the likes of Google and Microsoft. SMT models are trained on parallel corpora, where human translated sentences in the source and target language are aligned. By using parallel corpora, Moses is able to discover which words or phrases are good translations of each other by looking at how often they co-occur. SMT models also use large amounts of monolingual text in the target language to learn what sentences in the target language should look like.

### Components

The two main components in Moses are the training pipeline and the decoder. There are also a variety of contributed tools and utilities. The training pipeline is really a collection of tools (mainly written in perl, with some in C++) which take the raw data (parallel and monolingual) and turn it into a machine translation model and a model of the target language. The decoder is a single C++ application which, given a trained machine translation model and a source sentence, will translate the source sentence into the target language.

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## Development

Moses is an open-source project, licensed under the LGPL, which incorporates contributions from many sources. There is no formal management structure in Moses, so anyone is welcome to contribute. For those interested in getting involved, there is a list of possible project on the Moses website. The annual MT Marathon is also a good way to learn about the Moses project.

In general, the Moses administrators are fairly open about giving out push access to the git repository. This means that trunk occasionally breaks, but given the active Moses user community, it does not stay broken for long. The nightly builds and tests of trunk are reported on the cruise control web page, but for more stable versions, official releases are also available.

## Moses in Use

The liberal licensing policy in Moses, together with its wide coverage of current SMT technology and complete tool chain, make it probably the most widely used open-source SMT system. It is used in teaching, research, and, increasingly, in commercial settings.

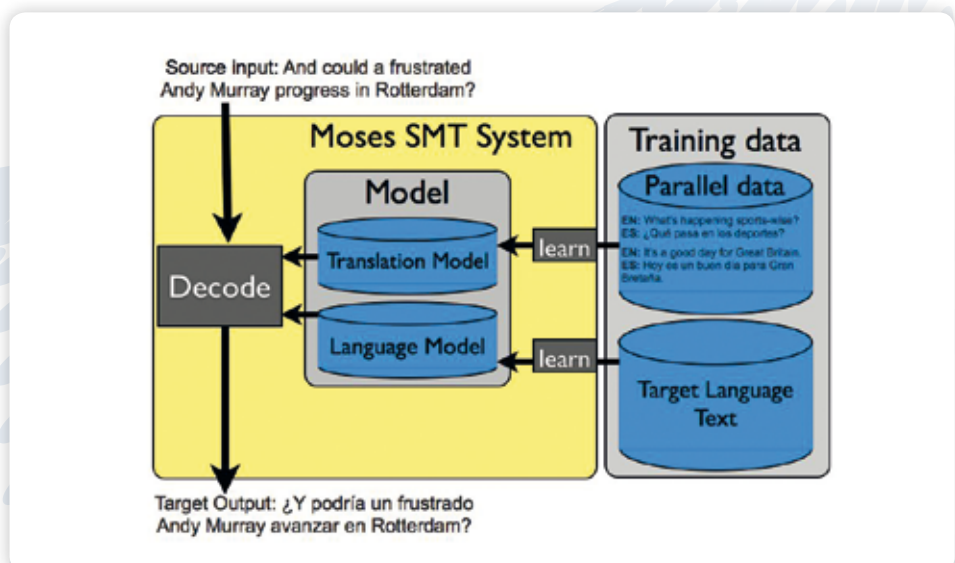
Commercial use of Moses is promoted and tracked by TAUS. The most common current use for SMT in commercial settings is post-editing where machine translation is used as a first-pass, with the results then being edited by human translators. This can often reduce the time (and hence total cost) of translation. There is also work on using SMT in computer-aided translation, which is the research topic of two current EU projects, Casmacat and MateCat. In the EU-Bridge project, Moses is used for spoken language translation and for punctuating and segmenting ASR output.

## Terms of Availability

Can be inquired at the University of Edinburgh (Philipp Koehn)

## IPR Protection

University of Edinburgh (Philipp Koehn)



Moses diagram



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## Polish Spoken Language Translation

### Description and Exploitable Knowledge

Polish, one of the West-Slavic languages, due to its complex inflection and free word order forms a challenge for both automatic speech recognition (ASR) and spoken language translation (SLT). Seven cases, three genders, animate and inanimate nouns, adjectives agreed with nouns in terms of gender, case and number and a lot of words borrowed from other languages which are sometimes inflected as those of Polish origin, cause problems in establishing vocabularies of manageable size for translation to/from other languages and sparseness of data for statistical model training. Despite of ca. 60 millions of Polish speakers worldwide a number of public available resources for preparation of SMT system is rather limited, making the progress slower compared to other languages.

EU-BRIDGE project helped us develop our skills and collect more resources necessary to accomplish the task of Polish SMT, specifically for Polish/English language pair. Our SMT systems have since been successfully applied to various domains, including lecture and broadcast news, parliament speeches, tourist assistance, movie subtitles and medicine-related documents. We developed own BLSTM/DNN ASR decoder, Polish speech synthesis, mobile clients (Android) and specialized tools for the Polish language (text normalizer, corpus alignment, phonetic transcription, speech detection).



Android Client



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### Infrastructure

Depending on application our systems work on dedicated server (e.g. in telecommunication) or on the cloud (for mobile applications). We are currently support MCloud service architecture and the system developed by the U-STAR consortium compatible with ITU F.745 and H.625 recommendations.

### Application Sectors

Telecommunication, tourist, medicine, entertainment

### Technical requirements

Fast internet Connection or dedicated SLU server.

### Terms of Availability

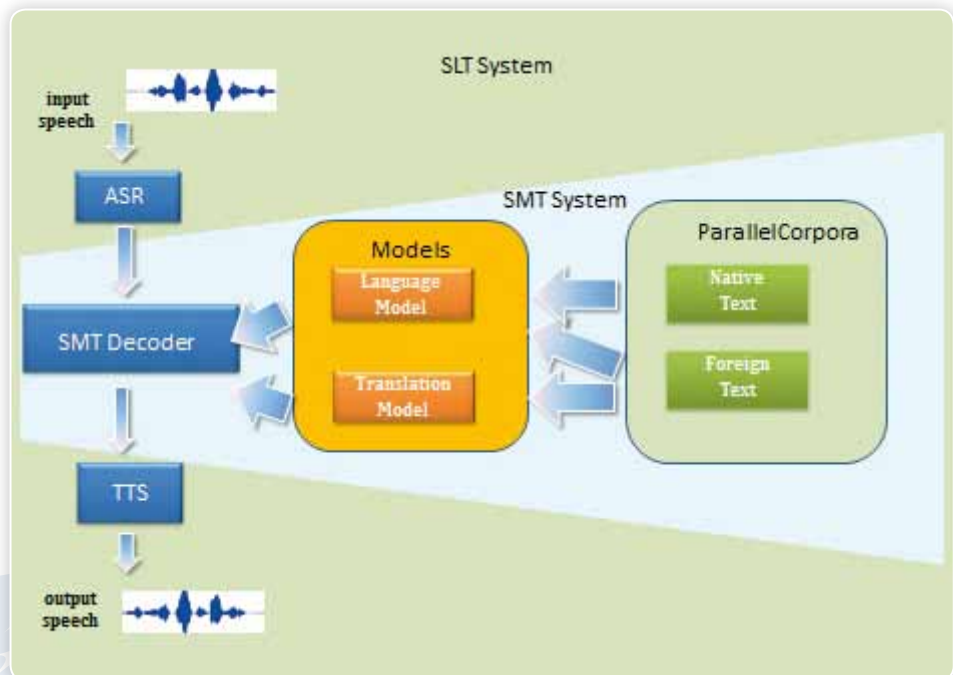
Can be inquired at the Polish-Japanese Institute of Information Technology

### IPR Protection

Polish-Japanese Institute of Information Technology, EU-BRIDGE Consortium

### EU-BRIDGE Partners (involved)

KIT, Pervice, FBK, UEDIN



SLT-Architecture



# Supportive Technologies

When using the output of speech recognition or machine translation technology in real-life applications, the output often needs to be post-processed in order to fulfill application needs.

E.g., the output of a speech recognition system is normally a raw sequence of words. Even numbers are often not written as digits but as their sequences of spoken words. Human readers of such output, however, expect additional mark-up such as punctuation or text structuring via paragraphs and the like.

Also, when dealing with natural language, humans perform many side tasks that they take as given, e.g., the identification of the current language. Core ASR and MT systems lack these abilities.

Instead, additional supportive components are used to enrich the in- and output of these systems to meet the user's expectations.





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## Punctuation

### Description and Exploitable Knowledge

We add punctuation to text. This can be done either in an online mode which only uses a 4 word window and a simple language model to decide which if any punctuation mark to add to a stream of text or in an offline mode that uses 20 word context window and multiple models.

The online system is trained on text which has been double checked for correct punctuation. For the offline system, a phrase table trained on a large amount of text data as well as both maximum entropy and n-gram based language models are combined log linearly.

### Infrastructure

- Server – mediator – client setup
- The mediator receives transcription requests and audio from the client and forwards the audio to the corresponding ASR worker which then returns the transcription to the mediator.
- ASR workers run constantly on a server waiting for audio. They use up no CPU time when not receiving audio or when the audio only contains silence.
- As soon as a worker is selected by the mediator it starts to receive packets of audio data which it then decodes and returns text fragments to the mediator.
- These text fragments can then be combined into sentences by a separate segmentation/punctuation prediction component and then (if required) passed onto an MT worker.

### Application Sectors

anywhere we have text without punctuation, like:

- News (Sky and Euro)
- Webinars
- Lectures
- EPPS stuff
- Weather reports
- subtitles
- 2nd step in speech translation
- many many more

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### Technical Requirements

- Server with 8GB of RAM and 8 cores, 8 active systems can run in parallel on a modern server with 4 AMD Opterons (16 cores per CPU) as well as >>100 non-active but ready workers
- OS: Linux Ubuntu LTS 12.04 (Precise Pangolin) or similar
- Mediator connection: The workers can be accessed through the EU-BRIDGE Mediator service infrastructure

### Terms of Availability

Can be inquired at the Karlsruhe Institute of Technology (Prof. Alex Waibel)

### IPR Protection

Karlsruhe Institute of Technology (Prof. Alex Waibel)

# Service Architecture

Natural language processing technologies are sensitive to misconfigurations and handling errors. Their use and proper integration has been a serious barrier in the past that made their integration into complex applications difficult to impossible.

In order to facilitate the integration of speech recognition and machine translation technology into application, EU-BRIDGE offers its technologies via an easy-to-use network based service infrastructure.

The infrastructure makes use of a simple and easy to handle API that hides most of the complexity of the core technology from the application developer, thus fostering the use of natural language technologies in new, innovative applications.





## EU-BRIDGE Partners

PerVoice (Italy),  
Karlsruhe Institute of Technology  
(Germany)

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## Service Architecture

### Description and Exploitable Knowledge

The Service Architecture is the platform that abstracts the integration of client applications and the transcription/translation service providers. Based on a lightweight library, the Service Architecture lets application developers easily create complex transcription and translation workflows without knowing anything of the underlying transcription and translation engines.

The Service Architecture decouples clients and service providers by providing a simple, XML based protocol and a reference implementation library, available for the major platforms, to connect both end-user application and service engines to it.

Creating transcription and translation workflows requires the audio to be processed in specific sequence by multiple engines. E.g., to get translated and punctuated text in Italian out of an English speech one needs to invoke the following engines:

- English speech to English text transcription engine;
- English phrase segmentation engine;
- English to Italian translation engine;
- Italian punctuation engine.

The Service Architecture simplifies the creation of this workflow by providing automatic workflow creation given the input and output language pairs (called fingerprints).

The Service Architecture provides APIs for both, batch and real-time processing, supporting all of the transcription and translation needs. To simplify the batch processes integration, it also provides a set of web based REST APIs.



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The work leading to these results has received funding from the European Union under grant agreement n°287658



[www.eu-bridge.eu](http://www.eu-bridge.eu)

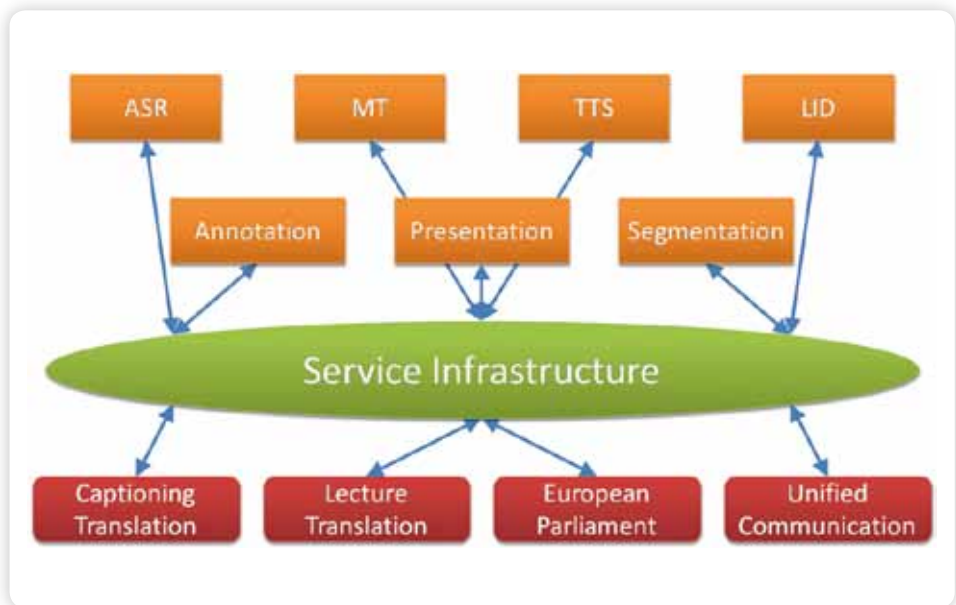
### EU-BRIDGE - the Project

EU-BRIDGE is a European Integrated Project that aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents between European and non-European languages.

## Infrastructure

The Service Architecture is a centralized service hosted at Karlsruhe Institute of Technology and PerVoice. It is composed of two major components: the Service Mediator, that handles all of clients and services connection, and the REST API module.

The Service Architecture has been designed to provide multiple concurrent transcription and translation workflows, by invoking the correct sequence of required service provider engines (workers).



Service Infrastructure

## Application Sectors

Transcription services, Translation services

## Technical Requirements

Fast Internet Connection

## Terms of Availability

Costs and terms are available from PerVoice and KIT upon request.

# Example Applications

In order to proof the benefit of its service architecture EU-BRIDGE has implemented five sample use cases that make use of the technologies and service infrastructure developed in the project.

The four use cases revolve around the transcription and translation of spoken content, such as TV broadcasts, lectures, webinars or translation services in the European Parliament.

The use cases were implemented with industrial leaders in the respective areas and are evaluated in real-life to measure the advantages stemming from the use of EU-BRIDGE technology.





## EU-BRIDGE Partner

Karlsruhe Institute of Technology,  
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## Automatic Simultaneous Translation Service for University Lectures



Bridging the language barrier with automatic simultaneous lecture translation systems



Spoken language translation: Combination of automatic speech recognition and machine translation

### Description and Exploitable Knowledge

Academic lectures and technical talks often provide high quality content that is of value to audiences that have many different mother tongues. But many lectures often do not reach their full potential audience due to the limits imposed by the language barrier between lecturer and potentially interested listeners.

Lectures at Karlsruhe Institute of Technology are mainly taught in German. Therefore, foreign students that want to study at KIT need to learn German, and not only at a conversational level, but must be proficient enough to follow highly scientific and technical lectures carrying complex content. While foreign students often take a one-year preparatory course that teaches them German, experience shows that even after one year of studying, their level of proficiency in German is not high enough in order to be able to follow German lectures and thus perform well.

Since the use of human interpreters for bridging the language barrier in lectures is too expensive, we want to solve this issue with the help of our automatic simultaneous lecture translation system. In this system we employ the technology of spoken language translation (SLT), which combines automatic speech recognition (ASR) and machine translation (MT) together with other auxiliary components to build a system that simultaneously translates continuous speech from German to English.

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The work leading to these results has received funding from the European Union under grant agreement n°287658



[www.eu-bridge.eu](http://www.eu-bridge.eu)

### EU-BRIDGE - the Project

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The system works with the help of a cloud based service infrastructure. The speech of the lecturer is recorded via a local client and sent to the service infrastructure. A service then manages the flow of the data through the ASR, MT, and other components. The final result is then made available as a website which continuously displays the result of the recognition and translation.

At the same time the system also offers the possibility to archive the lectures and make them later searchable via text queries.

### Application Sectors

Universities, Higher Education, Organizers of Conferences

### Technical Requirements

Fast Internet Connection for communication with the server based service infrastructure.

### Terms of Availability

Can be inquired at the Karlsruhe Institute of Technology (Prof. Alex Waibel)

### IPR Protection

Karlsruhe Institute of Technology (Germany)





## EU-BRIDGE Partners

Red Bee Media Limited,  
The University of Edinburgh

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## Automated Captioning of Multimedia Content

### Description and Exploitable Knowledge

Multimedia content has to be accompanied by subtitles in order to be accessible for people with hearing disabilities. Although the process of captioning such content is already highly optimized towards accuracy and efficiency, it is a very costly and demanding part of the production pipeline.

The reason for this is that it demands a significant amount of manual labour performed by trained experts. Subtitles are predominantly created through the act of 're-speaking'. The subtitler listens to the audio of the television programme and repeats it into a highly optimized, personalized ASR (Automatic Speech Recognition) engine, within an idealized acoustic environment, free from noise and reverberation.



Respeaking



Respeaking

The subtitles are frequently created live, which means there are very stringent time requirements. Also, since there is no time to correct possible errors, accuracy is of paramount importance as well. Subtitling is therefore an extremely demanding and exhausting task for the human subtitler.

With the goal of producing subtitles more easily and cheaply, a system was designed to produce captions in an automated way, reducing the need for human intervention.

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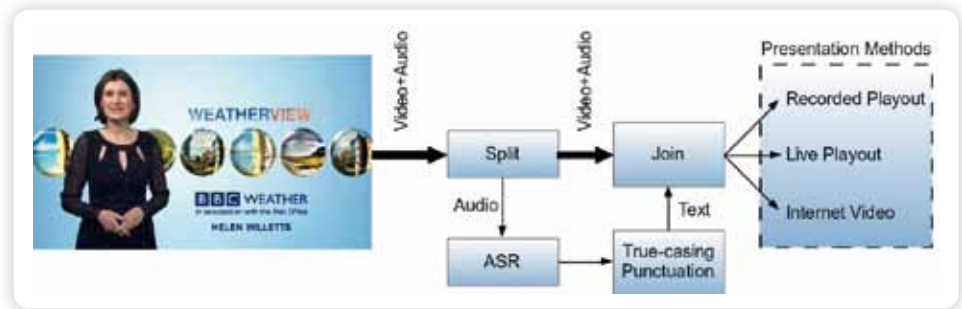


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EU-BRIDGE is a European Integrated Project that aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents between European and non-European languages.

A simplified schematic overview of the system is shown above. It is an end-to-end modular captioning system, that uses state-of-the-art speech and text processing technology. It generates highly accurate transcriptions of the spoken content, and converts the resulting transcriptions into readable text by breaking it in sentences, inserting punctuation, and making words upper-cased where appropriate. Assigning a time stamp to each subtitle is automatically done by the ASR module.



Schematic Overview

### Application Sectors

Currently, two versions of the system have been set up and are in the process of being tested at Red Bee Media®:

1. Weather reports
2. Broadcast news

Although quality and accuracy of the resulting subtitles are not yet on par with manually produced ones, the system provides a valuable and dependable back-up, should the manual production of subtitles fail.

### IPR Protection

Red Bee Media®





## EU-BRIDGE Partners

Karlsruhe Institute of Technology (Germany), RWTH Aachen University (Germany), Fondazione Bruno Kessler (Italy)

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## European Parliament Interpreter Support – Web Service on Terminology and Named Entity



### Description and Exploitable Knowledge

A web-based service, that aims to support the European Parliament (EP) interpreters to reduce their preparation work and find key information easily, has provided easy-to-use and user-friendly terminology extraction and named entity tagging.

As part of the preparation work, interpreters need go through the EP documents provided for the new session and look for terminology which is usually hard to translate. Based on the same (PDF) documents, our web-based service allows interpreters to retrieve terminology lists and translate them automatically.

The name entities are important since interpreters find it difficult to remember and (therefore) accurately translate numbers, names, etc. Our web-service provides named entity tagging on 13 types, which right now works on pre-selected documents, but aims to work on written text, as well as automatic speech transcriptions. Furthermore the 13 types named entities are highlighted in different colours.

Our web-service support the user to upload their own files and the tool also provides access to actual parliamentary documents, which should enable the interpreter to prepare for specific upcoming sessions in his own personal environment.

Finally, welcome to access the web-service and wish you enjoy it.

<https://www.interpreter-support.eu>

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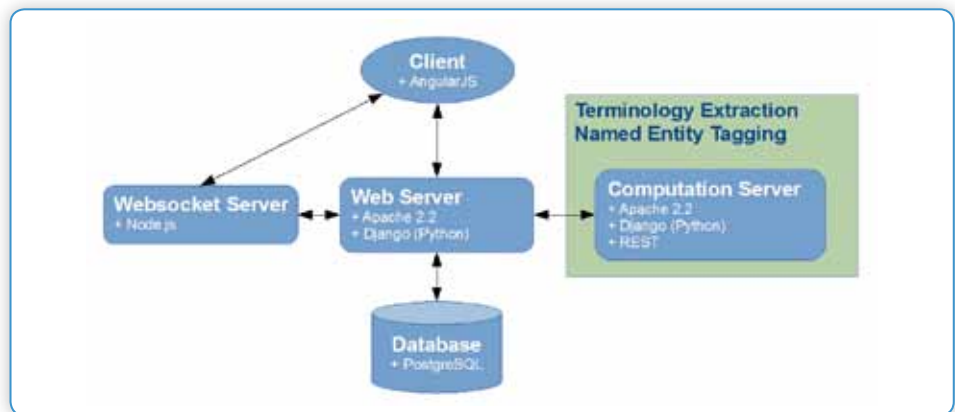
### EU-BRIDGE - the Project

EU-BRIDGE is a European Integrated Project that aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents between European and non-European languages.

## Infrastructure

The website is a single-page application (SPA), using the JavaScript framework AngularJS. On the backend, it is written in Python 2.7 and uses the framework Django. It runs on an Apache 2.2 webserver with PostgreSQL as database. To support real-time events, we use a separate Node.js driven websocket server. The hard work (terminology extraction and named entity tagging) is done by a dedicated computation server, with Celery as task runner and RabbitMQ as message queue.

The following schema illustrates the currently used setup.



## Application Sectors

Translators, Interpreters, Document Editors

## Technical Requirements

Fast Internet Connection

## Terms of Availability

<https://www.interpreter-support.eu>

## IPR Protection

Karlsruhe Institute of Technology (Germany), European Parliament



Help interpreters to work easier and faster.



Highlight the named entities in a document.



## EU-BRIDGE Partner

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## Automatic Simultaneous Translation Service for Voting Sessions

### Description and Exploitable Knowledge

Voting sessions are generally held by a multilingual confluence. Each person's contribution is held in its respective native language. To overcome language barriers between the members of parliament, humans interpret the spoken contributions in real time. While this is an effective solution to this problem, it is costly in terms of human effort and it is a highly demanding task for the interpreters, as voting sessions can take a considerable amount of time, where speaker changes occur rapidly, and the demand for real time translations is high.

Our automatic simultaneous translation system for voting sessions is tailored to solve this issue by providing profound aid for the audience that follows a session and interpreters that are translating. In this system we employ state of the art spoken language translation (SLT) technology, which combines automatic speech recognition (ASR) and machine translation (MT), along with auxiliary components to build a system that is able to simultaneously translate speech produced in voting sessions. Recognition of the voiced contributions as well as the translation into the target languages takes place in real time, thus precisely matching the demands of the voting sessions.

The system works with the help of a cloud based service infrastructure. The speech in the parliament is recorded via a local client and is subsequently sent to the service infrastructure. The data flow is then automatically managed and passes through ASR, MT and auxiliary components. The final translation result is made available in form of a text flow that can be accessed by the audience.

In order to match the system to the needs of the voting session environment, it is trained on large amounts of parallel and monolingual data. The incorporated subsystems use publicly available data collections such as the EPPS or News commentary corpora, as well as data that has been specifically collected for this task.

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The work leading to these results has received funding from the European Union under grant agreement n°287658



[www.eu-bridge.eu](http://www.eu-bridge.eu)

### EU-BRIDGE - the Project

EU-BRIDGE is a European Integrated Project that aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents between European and non-European languages.

## Infrastructure

The EU-BRIDGE service architecture allows a server based recognition and translation of an audio stream, by providing a well-defined and light-weighted API. Voting sessions can be monitored in real time via a client that is connecting to the service. ASR, MT and auxiliary components run as individual workers in the EU-BRIDGE infrastructure.

The service architecture enables a connection-based communication with multiple service requests at the same time. A client connects to the mediator on the server side and the mediator establishes a workflow of the client's output media stream through suitable components in order to accomplish a specific service request. The client's task is to capture the voiced audio of the voting sessions and present it to the server-side service architecture. The individual workers such as speech recognition and machine translation will be requested and allocated in order to complete the requested task.

## Application Sectors

Voting sessions, Parliament talks

## Technical Requirements

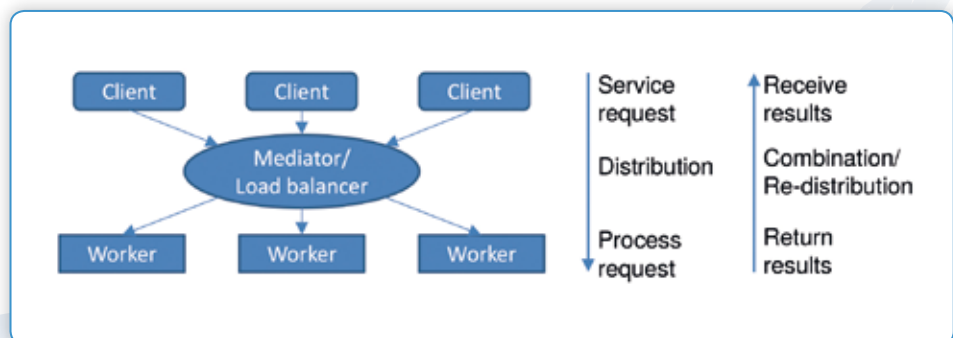
Fast Internet connection for communication with the server based service infrastructure. Recording equipment on client side.

## Terms of Availability

Can be inquired at the Karlsruhe Institute of Technology (Prof. Alex Waibel)

## IPR Protection

Karlsruhe Institute of Technology (Germany), EU-BRIDGE Consortium



Schematic overview of the service architecture





## EU-BRIDGE Partners

KIT for English ASR and English-French Translation engines;  
KIT for online Webinar Language Model adaptation;  
Pervoice for the infrastructure;  
PJIT for English\_Polish translation engine.

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## Serenty a webinar platform for enhanced multi-lingual business communication

### Description and Exploitable Knowledge

Serenty aims at delivering the end-user with real-time webinar captioning and webinar translation. This product addresses corporate clients for their cross-border webinars as well as professional users interested in foreign-language webinars.

Primary target language pairs are English-French and English-Polish.

Serenty's objective is to integrate a translation tool within an online communication system so as to enhance multi-lingual business communication. As a consequence:

- It lowers the communication barriers between businesses based out of different countries
- It creates new markets for businesses who could not address certain markets

Each participant to the conference sees the content of the webinar within a browser on a device of its choice. It also receives the original audio (e.g. spoken by the presenter) and a translation in text form into his/her own language. The translation in the target language is delivered as subtitles. The transcript of the original audio in the original language might also appear on screen, in addition to its translated counterpart, as chosen by the user.

We shall highlight in particular the full web “no-plug-in” and “immediate-play” property of Serenty which is a key element of the system and represents a clear innovation compared to the state-of-the-art.

### Infrastructure

#### Automatic Speech Recognition (ASR)

A cloud-based ASR engine receives a continuous audio stream sent by the unified communication platform. It returns the transcript in text form of what is being said during the webinar. This transcript also serves as a basis for machine translation. Prior to the webinar itself, if the webinar content is made available to Serenty (e.g. in form of slides), a Language Model adaptation module analyses this content in order to detect specific product names and/or acronyms that are not part of the basic ASR engine's vocabulary. These words will be added to the ASR vocabulary for allowing their recognition.

#### Machine Translation (MT)

A cloud-based Machine Translation service takes the ASR transcript as input and return as output a sentence translated in the target language.

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### EU-BRIDGE - the Project

EU-BRIDGE is a European Integrated Project that aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents between European and non-European languages.

The source language is English, first target Languages are: French and Polish. More language pairs involving German, Russian etc. can be provided upon request.

### Unified Communication Platform (UC)

The Unified Communication platform handles the webinar session, the slides, the audio and text inputs and outputs. It interfaces with the other required components (ASR, MT, LM adaptation). It also supports the cross-border webinar User Interface on HTML-5 browsers.

### Application Sectors

The proposed show-case addresses corporate clients for their cross-border webinars.

Serenty allows:

- Companies to present their products and services to a multilingual audience, thus having a maximum market impact;
- Executive management and VPs to address directly international markets or to be part of presentations lead by local sales-forces.

The technology is used as a complementary assistance tool rather than a critical communication component: It is aimed at webinars conducted in a chosen common language – English – but involving non-native speakers, who will benefit from subtitles in their native tongue to help them follow the webinar.

The domain is restricted to “sales&marketing” webinars, to “partners training & products updates” webinars, or in general to “corporate communication” webinars.

The technology approach as a “no-plugin” solution allows the system to be compliant with all the webinar systems of the market (WebEx, AdobeConnect...)

### Technical Requirements

User Device:

- HTML-5 browser (e.g. Chrome)
- Device with microphone and speakers (best is a headset)
- Link to Serenty

Fast Internet Connection



### Terms of Availability

Please contact Andrexen for availability terms.

### IPR Protection

No IPR protection has been considered at publication date of this document.



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