Publishable Summary

The EU-BRIDGE project aims at developing automatic transcription and translation technology that will permit the development of innovative multimedia captioning and translation services of audio-visual documents of European and non-European languages. The project will provide streaming technology that can convert speech from lectures, meetings, and telephone conversations into the text in another language. The consortium puts together the partners representing academics, engineering and business expertise to create competitive offers to existing needs in the fields of translation, communication, content processing and publishing. EU-BRIDGE identified four use cases to be focused on: Captioning translation for TV broadcasts, university lecture translation, European Parliament translation, and unified communication translation. The prospective users of the project are European companies operating in an audio-visual market (in particular TV captioning and translation). The main goal of the EU-BRIDGE project is to develop a speech translation infrastructure upon which the use cases mentioned above will be built. In order to achieve this goal, the research in EU-BRIDGE will focus on the following objectives:

- Development of more advanced automatic speech and text translation capabilities in view of new and more challenging business use cases
- Improvement of the language portability and application of the technology to the languages of interest
- Reduction of the dependency on data
- Preparation of the market insertion and deployment

The objectives listed above have been addressed by means of the work performed in eight work packages. During the first year of the project duration a considerate amount of work was carried out in the domain "Transcription, translation and production of multimedia content". In the speech recognition area the main focus was put on the improvement of the neural network training for both acoustic and language modelling. Further work was conducted in log-linear training, unsupervised acoustic adaptation and language model adaptation. Next, a prototype for the acquisition of new named entities from text corpora was designed and novel fragment-based approaches for language and lexical modelling were proposed. As regards the machine translation domain, various techniques and methods were investigated which aimed at the domain adaptation and improvement of spoken language translation. Here, the effort concentrated most on the novel natural-language processing software and its implementation. In reference to "Reducing data dependency and costs", a significant progress was made in order to reduce both the amount of data necessary for the proper model training and the costs and effort incurred to collect these large amounts of training data. First, a central data repository was created on the KIT (Karlsruhe Institute of Technology) server with the access given to all project participants. Second, three prominent sources for acquiring additional data were identified and successfully incorporated in the project work. Audio data together with the transcriptions and translations into multiple languages are provided by means of the TED website (www.ted.com) and were made available through the public WIT website (https://wit3.fbk.eu) administered by partner FBK (Fondazione Bruno Kessler). This data is particularly important for EU-BRIDGE since it serves as a background for the IWSLT evaluation (International Workshop for Spoken Language Translation, http://hltc.cs.ust.hk/iwslt/) and is extensively used for the currently most advanced use case, that is, the lecture translation use case. An agreement between the consortium and BBC was signed in order to provide the captioning use case with real-life data, and annotated data coming from the BBC weather bulletins (chosen for commercial reasons) was already supplied by the partner Red Bee Media. Complementary multilingual data from TV news broadcasts is being recorded and processed as well, based on an agreement between the company Euronews and EU-BRIDGE project which was established in parallel. As usual, for all speech data there is a definition of training, development and test corpora and some well-defined pre-processing. In this period, Mobile Technologies developed also a tool for the efficient speech transcription of talks and a tool to

maintain pronunciation dictionaries in various languages was implemented. In "Addressing Europe's language needs" the main goal is to build the engines for different languages and tasks that will be afterwards integrated into the established API service infrastructure. Although the partners agreed to focus on the English language only during the first year of the project, 8 and 7 (out of 12) languages listed in the description of work were already covered regarding the development of the automatic speech recognition and machine translation baselines, respectively. Moreover, within the multithreaded and stream decoding, an online speaker adaptation technique was developed, which is suitable to be used in real-time transcription applications (such as automatic closed-captioning of live TV programmes). Parallel to that, work on linguistic processing was carried out, with the special emphasis on the selected languages that were addressed during the first year: German, Turkish, Chinese and Arabic. Two approaches for language identification were successfully tested on the Euronews data. Good cooperation among the partners laid the bases for the international IWSLT evaluation campaign which was this year organized and hosted by EU-BRIDGE partners. Four academic partners developed and compared their systems on this public benchmark. As a result of the effort committed in the first year in the service architecture domain "Design of transcription and translation services", three partners, KIT, Mobile Technologies GmbH and PerVoice S.p.A., have already connected their engines for speech recognition and translation, which is well ahead of the planned schedule. Further, the developed infrastructure together with the engines from Mobile Technologies GmbH and KIT were used for the purpose of two demonstrations: [Figure 1] the world's first automatic simultaneous translation service was presented on June 11, 2012, at the Karlsruhe Institute of Technology, [Figure 2] a keynote address to the delegates of the European Parliament and to a conference of invited Presidents from European and non-European universities on the simultaneous interpretation by machine - here, the lecture given was translated automatically by the lecture translation system into Spanish.

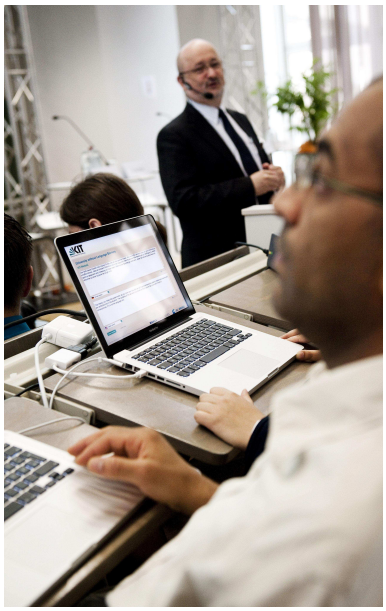

Figure 1: Simultaneous translation presentation

Figure 2: A keynote address at the European Parliament

Mobile Technologies GmbH also adapted its speech-to-speech translation API that is especially tailored to connect speech processing services. The technological solutions devised and developed during the work described in the above mentioned areas are planned to be successfully transferred into the market as a series of translation services referring to the respective use cases. Thus, the partners' effort put in the "Technology transfer and market insertion" workpackage tries to fulfil this goal. At this time point, most of the commitments made in the field of captioning addressed the delivery of the BBC data and its preparation for the first dry-run evaluation. As regards the lecture translation use case, the first prototype system exists already. Concerning the speech translation within the European Parliament, requirements and components were draft specified after the meeting with a representative of the Directorate General for Interpretation and Conferences - Support to Multilingualism in October 2012 so that the prototyp-

ical service developed within the EU-BRIDGE project will be designed in such a way as to be most helpful for the EP interpreters. Last but not least, the use case including the unified communication solutions was addressed by the new partner Andrexen, which joined the consortium in November 2012 and, in collaboration with Mobile Technologies, already produced the specification for the system which aims at real-time webinars translation/captioning. Mobile Technologies committed further work in the area of webinar platform development, so that the first version of the webinar agnostic system can be demonstrated in the middle of 2013. The evaluation process of the technology began in this first year with dry-runs on the standardised test material from Red Bee Media, with the purpose of addressing the business needs of this partner. Moreover, several partners (KIT, the University of Edinburgh, FBK, and RWTH Aachen University) participated in the external evaluation campaign at IWSLT. The work was also continued on the evaluation plan to match best the industry needs with the technology capability. The project's objectives and work progress were extensively promoted and disseminated during the first 12 months. Altogether 9 deliverables (including 8 accessible to the public) were submitted. Brochures, fact sheets, newsletters, press releases, an image video can be found on the official project website www.eu-bridge.eu or can be provided on request at the Communication and Press Office at KIT (Margit Rödder, Adenauerring 2, 76131 Karlsruhe, Germany, phone: +49 721 608 48676, e-mail: margit.roedder@kit.edu)

The deliverables of communication and dissemination cover, among others, communication plan, catalogue with EU-BRIDGE key events and list of related projects, project fact sheet, press release and project flyer. A professionally-made promotional EU-BRIDGE video, produced by KIT and available e.g. on the EU-BRIDGE website, promotes project's goals and brings the essence of the work involved to the wider audience. Apart from that, information about EU-BRIDGE is available through various social channels such as YouTube, Facebook or iTunes U. The undisturbed flow of information among all project partners has been guaranteed by means of the established mailing lists and a well-maintained intranet.

The goal of EU-BRIDGE is to provide services that can deliver cross-lingual communication and dissemination services of speech and language in Europe in an efficient manner and at acceptable cost. Through the development of multilingual speech and language technologies, the consortium aims to build services that help bridge the language divide in Europe and empower its citizens to collaborate, communicate and inform more effectively than has been possible so far. During the first project year, a number of successful milestones have been achieved toward achieving this goal along several use cases:

1 **Lectures** - Lectures are automatically transcribed and translated in online as well a post-hoc offline services. One such online lecture translator was already deployed as a service at KIT for foreign students to follow German lectures in German subtitles as well as English translation. The service operates in real-time and is delivered via a cloud based infrastructure, that students can access by way of common browsers from their personal devices. The service enables KIT to better recruit international students to a German speaking University. Lectures are also transcribed as off-line services, providing textual transcripts, search functionality and translations for various lecture archives and online learning courses. These processing facilities can be accessed off-line/after-the-fact through a simple Web based interface.

2 **Captioning/Broadcast News** - Broadcast news is automatically transcribed and translated and post-processing tools facilitate the production of high-quality material at lower cost: Weather reporting delivered by the BBC is being processed and translated by automatic systems in view of automating a routine reporting task in public media in the UK. First evaluation results have been obtained in dry-run evaluations and progress toward improved error rates is under way. Recognition error rate improvements will move this technology from research systems to services, once low enough error rates can be achieved. In addition, human post-processing tools have been demonstrated for the cost-effective generation of high-quality output. European broadcast news (Euronews) is also processed to assess automating elements of European news delivery in a multilingual fashion.

3 **European Parliament Support** - In collaboration with the European Parliament, the consortium has identified several areas of productive deployment, where EU-Bridge technology can provide assistance to human interpreter needs to improve productivity of high-quality interpretation services in a human-machine symbiotic way. These assistance functions include delivering terminology support, recall of important facts, and handling of repetitive (boring), yet demanding passages such as the read-out of voting results during a parliamentary session. Specification of these requirements have just been completed and first exploratory runs are underway.

4 **Universal communication** - With the inclusion of Andrexen, the consortium is beginning development of cross-lingual universal communication platform for mobile communication. Multilingual communication is to be delivered across media and languages through the speech and language processing capabilities. If successful, the services will empower European citizens to communicate in every form and every language.

During the first project year, these four use cases have been addressed that are at different levels of maturity between exploratory and prototype stage. Still, tangible results have been delivered that demonstrate impact at lowering language barriers for European citizens and supporting education, communication, information delivery, and public discourse across these barriers. Based on these first results, we expect continued progress toward empowering Europeans to operate more effectively in a multilingual community by the end of EU-Bridge. The project is on track to lead to increased productivity and greater understanding in Europe, and perhaps, the world.

The EU-BRIDGE consortium consists of 11 partners:

- Karlsruhe Institute of Technology, Germany (coordinator)
- Fondazione Bruno Kessler, Italy
- Polish-Japanese Institute of Information Technology, Poland
- Rheinisch-Westfaelische Technische Hochschule Aachen, Germany
- The University of Edinburgh, United Kingdom
- Hong Kong University of Science and Technology, Hong Kong
- Red Bee Media Limited, United Kingdom
- Mobile Technologies GmbH, Germany
- PerVoice S.p.A., Italy
- Accipio Projects GmbH, Germany
- Andrexen, France

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