

# Cross-Lingual Communication to Bridge the Language Divide

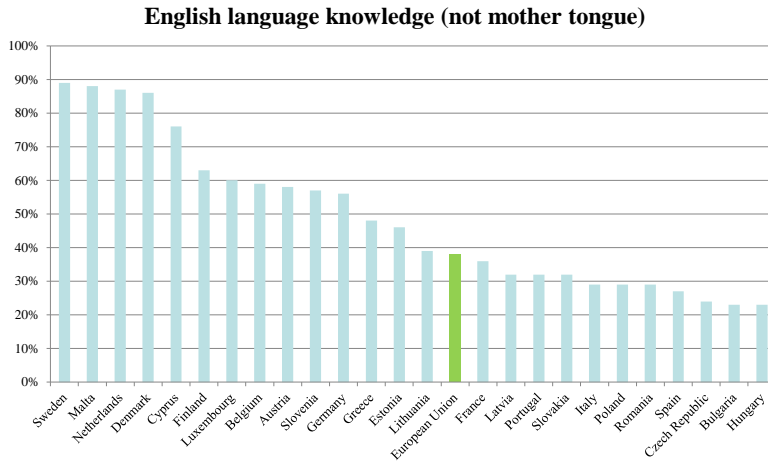
Alex Waibel  
InterACT  
Karlsruhe Institute of Technology  
The EU-Bridge Consortium

alex@waibel.com



# “Everyone Speaks English”... ???

In Europe:



## Communication

Effective Communication is not only Text,  
But:

– Speech



– Images



– Ill-formed Text

“lol-jah I want hr to be like dat...”, Hppyyyy BD, CU, LMK

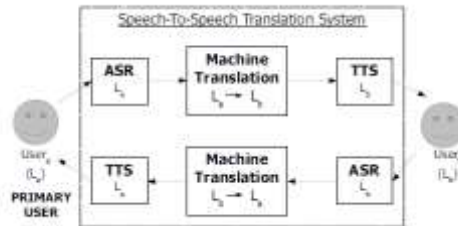


## Human Effort



*What about the Rest of us??*

# An Interpreting Machine



## To Build a Language Communicator

- 6 Component-Engines: Automatic Speech Recognition, Machine Translation, and Text-to-Speech Synthesis
- Each is in Principle Language Independent, but Requires Language Dependent Models
- Models are Automatically Trained but Require Large Corpora
- Certain Language Dependent Challenges still Persist



## Why is this so Hard ?

### Language is Ambiguous at All Levels:

- Semantics:
  - The Spirit is Willing but the Flesh is Weak
  - → The Vodka is Good but the Meat is Rotten
- Syntax:
  - Time Flies Like an Arrow → 6 Different Parses
- Phonetics:
  - This Machine Can Recognize Speech → This Machine Can Wrack a Nice Beach
  - Give me a New Display → Give me a Nudist Play



## Scientific Challenge

---

Language Problems can only be Conquered,  
if Machines Embrace, Represent, Process:

- **Ambiguity:**  
Scores, Statistics, Neural Activations, ..
- **Learning:**  
Build Models, Extract Knowledge from  
Human Data & Interaction, Automatically

→ Performance Depends on Data & Computing



## First Speech Translation VideoCall '91-92

---

- 1992 – C-STAR Consortium for Speech Translation Advanced Research
- 1993 – Public C-STAR Demo, ATR-CMU-UKA-Siemens



# Neural Nets: Bigger, Deeper, Faster

(1987)



TDNN: Shift-Invariance, Waibel '87

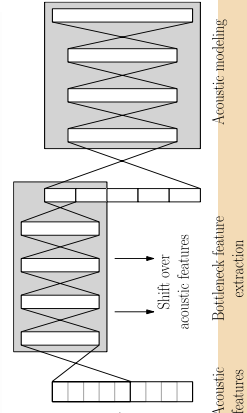
(1989)



Fig. 7. Modular construction of an AI connection network.

Modular (deep) TDNN: Waibel '87

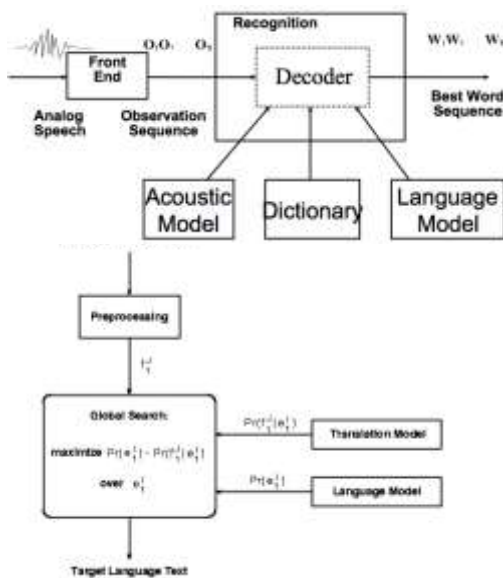
(2013)



Waibel et al. Babel, 2013

Weights:	~6,000	~40,000	~33,000,000
TrnData[hrs]:	~0.1	~1	~1,000
Time[weeks]	~1	~1	~1

## Statistical Models



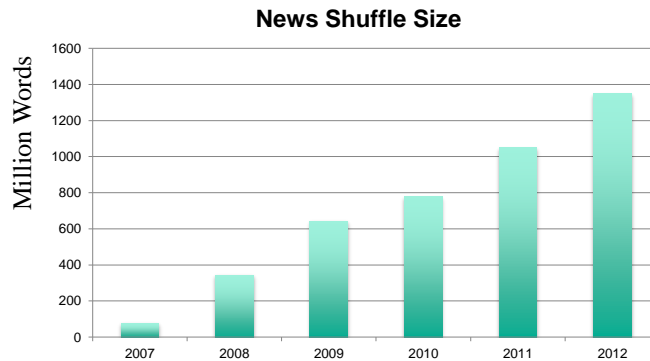
*Speech Recognition*

*Machine Translation*



## English Text Copora

---



- Computer MT or ASR systems train on >> 1GWords
  - News Shuffle, GigaWord, Europarl, VideoLectures, ...
- Human speaks 0.5 GigaWords in a Lifetime!!

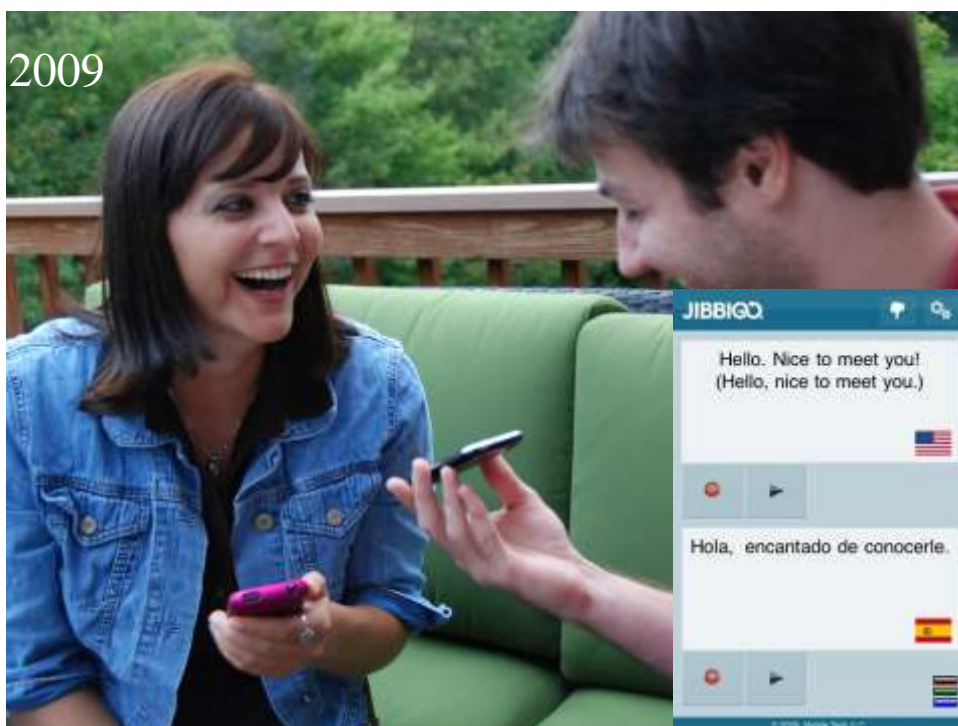
## Challenges

---

- Scientific – Language Technology
  - Ambiguous, Context Dependent
  - Scaling to Many Languages
- Expertise – Effective Platforms for Developers
  - Experts - Non-Experts; Access to Tech
- Appropriate Deployment
  - Mobile vs. Stationary,
  - Embedded vs. Cloud Based
  - Online (Real-Time)/Offline
- Tech Insertion
  - How to Deliver Language Bridges
  - Effective in Different Human Situations

---

*Pocket Translators*  
*Off-Line, Embedded,*  
*Real-Time, Small Footprint*





App Store + Travel + Jibbigo LLC



### Jibbigo Translator

Description

★★★★★ Finally! A FREE online voice translation app with Unlimited Online Use! ★ Download Offline Translations

Jibbigo LLC Web Site • Jibbigo Translator

What's New in Version 2.1

- Support for iPhone 5 Resolutions
- Better Download UI
- Bugfixes / Improved Error Handling...

Category: Travel  
Updated: Oct 12, 2012  
Version: 2.1  
Size: 10.0 MB  
Languages: English, Arabic, Chinese, French, German, Italian, Japanese, Korean, Spanish, Thai  
Seller: Jibbigo LLC  
© 2012

Rated 4+

Requirements: Compatible with iPhone, iPod touch, and iPad. Requires iOS 5.0 or later. This app is optimized for iPhone 5.

Top In-App Purchases

1 Spanish-Engl...	\$4.99
2 European Bund...	\$9.99
3 Chinese-Engl...	\$4.99
4 French-Englsh...	\$4.99
5 Avian Bundle...	\$9.99
6 Japanese-Engl...	\$4.99
7 Italian-Englsh...	\$2.99
8 German-Engl...	\$4.99
9 Thai-Englsh (I...	\$4.99
10 Filipino (Taga...	\$4.99

Screenshots




Jibbigo brings state-of-the-art speech-to-speech translation technology right to the palm of your hand.

**Jibbigo:**

- Real-Time Translation
- 15++ languages
- 40,000 Words
- All on the Phone
- No Server Necessary



The Economist Jan. 2013. "...The most sophisticated technology currently belongs to Jibbigo....."



IN "STAR TREK". a television series of the 1960s. no matter how far across the universe the

*Humanitarian Relief*



# Humanitarian Deployment







Cambodia





# *Media Subtitling & Lectures*

*Unlimited Domain  
Simultaneous, Real-Time,  
Complex Vocabularies  
Server Based Delivery*



## **EU-BRIDGE – Bridges across the Language Divide**



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



# EU-BRIDGE Partners



22.05.2015

Alex Waibel / EU-BRIDGE Overview

www.eu-bridge.eu

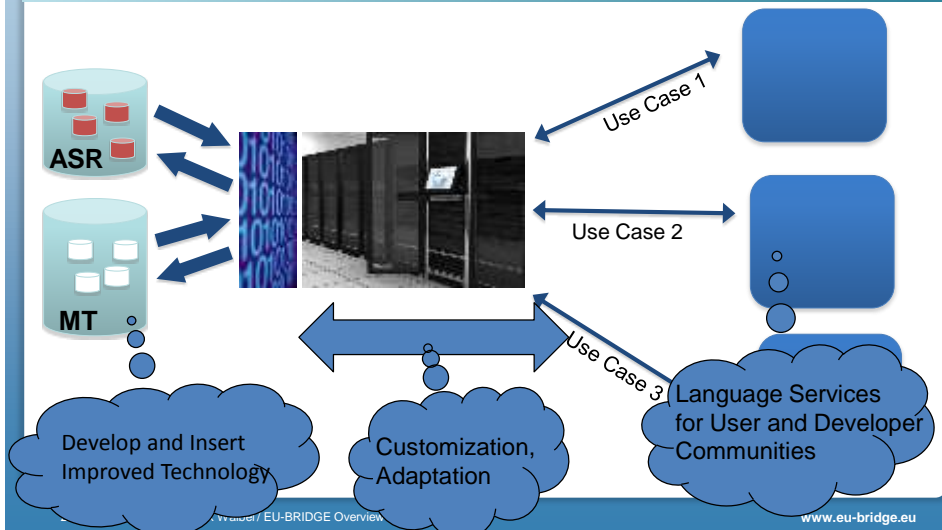
# Language Service



Engines

Services

Use Cases

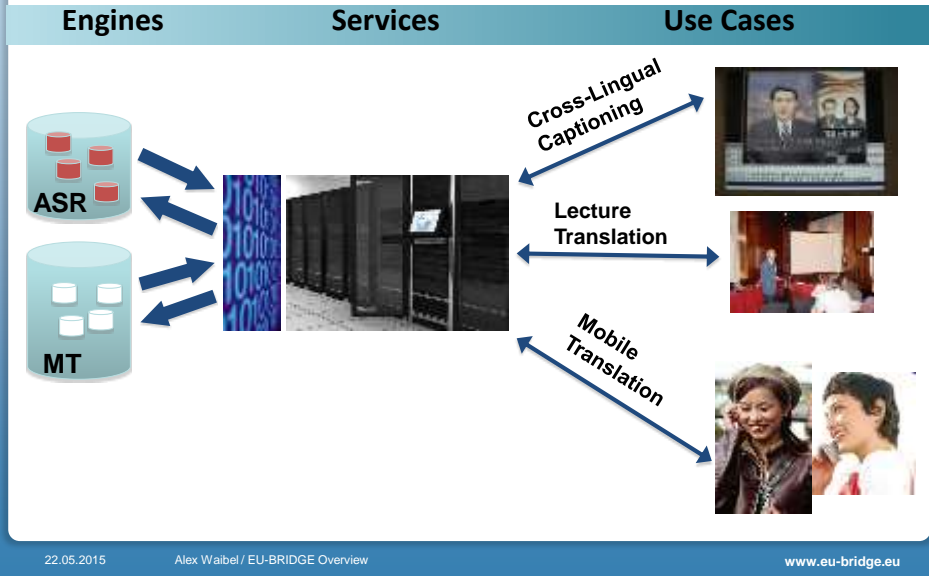


www.eu-bridge.eu / EU-BRIDGE Overview

www.eu-bridge.eu



# Language Service



22.05.2015

Alex Waibel / EU-BRIDGE Overview

www.eu-bridge.eu

## EU-Bridge User Portal

The screenshot shows the EU-Bridge User Portal with a navigation bar (Home, Settings, Personal Area, Support, admin) and a central video player titled "Bridges Across the Language Divide - EU-BRIDGE". Below the video are three buttons: "Register..", "..Test..", and "..Use!".



## Broadcast News

### Weatherview

The use-case illustrates the latest version of one of the Ericsson / Red Bee Media tools for processing broadcast media via the MCloud interface, and sample output from BBC Weather and Sky News will be presented.



### Sky News

The use-case illustrates the latest version of one of the Ericsson / Red Bee Media tools for processing broadcast media via the MCloud interface, and sample output from Sky News will be presented.



## Euro-News

### Euronews

Language ID + multilingual ASR + MT  
8 Euronews languages

Video Transcription [list of news]

riconquistare Tikrit l' esercito iracheno ha lanciato lunedì mattina un' operazione per riprendere la città che diede i natali a Saddam Hussein è finita a giugno sotto il controllo del sedicente Stato islamico con 30 mila uomini impegnati sul campo non solo soldati ma anche appartenenti alle forze di polizia e alle milizie sciite l' appoggio di truppe iraniane il dell' aviazione irachena e internazionale si tratta di una delle principali offensive lanciate da Baghdad e contro i gi a visti annunciata domenica dal primo ministro fa Eder ' Alaba B

Daphne

il nostro obiettivo è liberare la gente dall' oppressione dal terrorismo dell' Isil dobbiamo proteggere i cittadini e le loro proprietà

**FOREIGN-SPEECH** [uah uah @bg uah @bg uah nelle @bg] un tentativo di rassicurare la popolazione civile sunnita della città timorosa di ritorsioni e violenze denunciate in altre situazioni in cui sono intervenute

## *Lectures*

*Unlimited Domain  
Simultaneous, Real-Time,  
Complex Special Vocabularies  
Server Based Delivery*



## Lecture Transcription/Translation at KIT

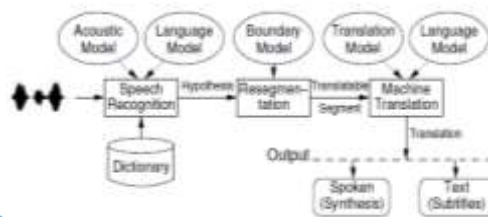


- Speech more Spontaneous than TED
- Real-Time Requirement
- Specialist Vocabularies

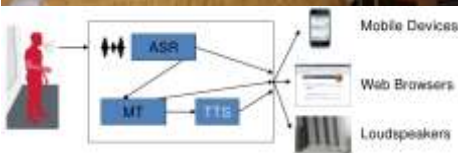
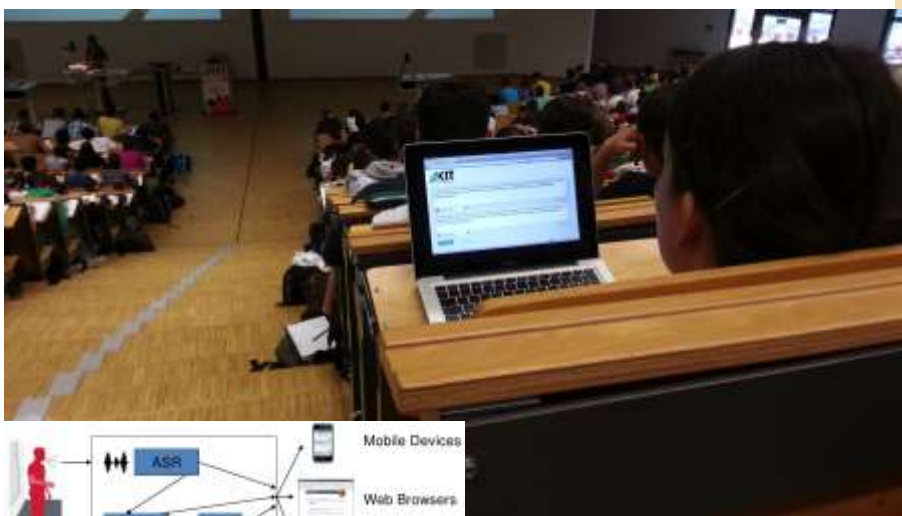


## University Lecture Translation

- Service running in three lecture halls, especially in KIT's largest lecture hall
- Unsupervised, automatic adaptation to every lecturer
- Thin client in the lecture hall
- Web based display client
- Field Test Done: foreign students report being helped in their studies



## Lecture Translator in Karlsruhe





Frankfurter Allgemeine Zeitung  
April 12, 2015



Spiegel Online March 22, 2015



Die Zeit. March 5, 2015

## *European Parliament Support*

### *Tools for a Human-Machine Symbiosis*



## Can Tech Support Human Interpretation?



## EP Rectors' Conference '12-'14

- Demonstrating automatic real-time lecture interpretation
- University Presidents; Interpretation Training & Services
- Promising but Controversial



## EP Rectors' Conference

---



## European Parliament

---

### Directorate for Interpretation

- Dir. General Olga Cosmidou Speaks at IWSLT'14
- Dir. General Agnieszka Walter-Drop Secretary General K. Welle Continue Support in '15 and '16



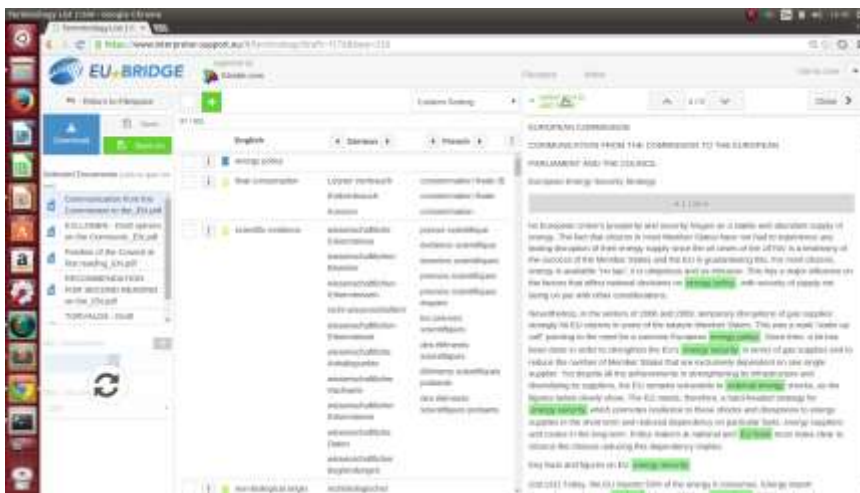
# Interpreter Support

- Terminology
  - Find Special Terms in Agenda & Session Index
  - Search & Prepare Relevant Terminology List
  - Find Translations & Make Editable List
- Named Entities
  - Track & Highlight for Memory



# Interpreter Support: Terminology

- On-demand terminology list generation





## Interpreters' Cruise Control

Interpreting Voting Sessions is...

- Boring and Repetitive
- Still Stressful, and Demanding
- Many Numbers  
and Named Entities

•→ selective automation



## Voting Session Test at the EP



## Conclusions

---

### The Multilingual Digital Signal Market

- Must Embrace the Language Challenge
- Technology is Ready to Support Citizens
- Delivery Must be Appropriate for Situation

