

# DEVELOPMENT OF A SPOKEN LANGUAGE SYSTEM

*John Makhoul and Madeleine Bates  
makhoul@bbn.com, bates@bbn.com*

BBN Systems and Technologies  
10 Moulton Street  
Cambridge, MA 02138

## PROJECT GOALS

The primary objective of this project is to develop a robust, high-performance spoken language system. We have achieved this by integrating the BYBLOS speech recognition system with the DELPHI natural language processing system to produce the HARC (Hear And Respond to Continuous speech) system.

## RECENT RESULTS

- Achieved a weighted error rate of 43.7 on the official ATIS spoken language system (SLS) evaluation for the February, 1992 workshop. This is the lowest error rate of all systems evaluated.
  - Achieved a word error rate of 9.4 on the official ATIS speech recognition (SPREC) evaluation for the February, 1992 workshop. This is the lowest error rate of all systems evaluated.
  - Achieved a weighted error rate of 33.9 on the official ATIS natural language (NL) evaluation for the February, 1992 workshop. This is not significantly different from the other top-scoring systems.
  - The 1-best output of BBN's speech recognition component, paired with SRI's natural language component, achieved a weighted error rate of 39.9.
  - Achieved an unofficial weighted error on the February, 1992 test set of 39.23, the lowest (though unofficial) rate of all systems we currently know of.
  - We developed and used a data collection facility to collect 2277 utterances from 62 subjects. We were the only site to reach the data collection goals by the original deadline of 1 September.
- We completed an initial version of a new DELPHI NL system, which incorporates a semantic component integrated with the unification-based syntactic grammar, but separated from it. This allows for multiple semantic interpretations for a single parse, facilitates rule creation and debugging, and allows for both greater expressive power and greater computational efficiency.
  - We developed a fallback understanding component for DELPHI which is composed of a fragment generator, a syntactic combiner, and a frame combiner. This fallback strategy was included in the system used in the official evaluation.
  - For our real-time decoder work, we sped up the decoder so that it can run in real-time with a higher beamwidth, and, therefore, higher accuracy.
  - We ported the real-time speech system to run on the SGI workstation.
  - We developed tools for creating and estimating various types of statistical grammars.

## PLANS FOR THE COMING YEAR

For the coming year, we plan to continue our work on improving both the speech recognition performance and the natural language processing performance of the HARC system. We will pay particular attention to the discourse phenomena that are so important in the ATIS domain, and will take increasing advantage of probabilistic analysis at several levels of processing. We will in particular investigate methods for automatic training of the NL component. We will also study more deeply the interaction of the speech and NL components via the N-best interface.