

School of Electronic and Information
Technologies

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Applications

- Verification based on Biometrics
- Speech and Speaker Recognition
- Optimization with Evolutionary Algorithms
- Digital Libraries

Tools and Techniques

- Resource Sharing with Collaborative and Distributed Decision Making
- Computer Network Paravirtualization

Applications

Verification based on Biometrics
Speech and Speaker Recognition
Optimization with Evolutionary Algorithms
Digital Libraries

Problem Definition

- We intend to use the cluster to develop experiment to solve some of the problems of the state-of-the-art Biometric Verification. The problems we intend to improve are performance in Speaker Verification, fingerprint based verification and face based verification.
- If these problems are improved this technology will push many applications for access control.

Technical Approach

- In order to improve performance we will develop experiments using new algorithms that improve our formers techniques.
- Since this task are based on pattern recognition, the training and testing will need all the computer power of the cluster.

Results

- Verification systems based in Biometrics more trustable.
- Improve the results of our previous work [1,2] .

- [1] Moreno, A., Juang, H.J., **Nolazco-Flores, J.A**, Robustness of Bit-stream based features for speaker Verification, accepted at ICASSP, Philadelphia, March, 2005. (45% aceptados)
- [2] Moreno A., Juang, H., and **Nolazco-Flores, J.A.**, Speaker Verification Using Coded Speech, Proc. of the 9th Iberoamerican Congress on Pattern Recognition (Congreso Iberoamericano de Reconocimiento de Patronos -CIARP), Lecture Notes on Computer Sciences (LNCS) 3287, ISNN 0302-9743, ISBN 3-540-23527-2, Vol. LNCS 3287, Springer-Verlag, Puebla, Mexico, Oct., 2004, pp.366-373.

Problem Definition

- We intend to use the cluster to develop experiment to solve some of the problems of the state-of-the-art Automatic Speech Recognition. The problems we intend to improve are performance and deal with Out-Of-Vocabulary (OOV) words.
- If these problems are improved this technology will push many applications.

Technical Approach

- In order to improve performance we will develop experiments using new characterization of the speech waveform.
- In order to improve OOV words, we propose to use two approaches for spoken document indexing: phoneme-based[1] and particle-base [2].

[1] Logan, B.; Moreno, P.; Van Thong, J.M.; Whittaker, E.; “An Experimental Study of an Audio Indexing System for the Web”, International Conference on Spoken Language Processing (ICSLP), October 2000, Beijing (China).

[2] Whittaker, E.; Van Thong, J.M.; Moreno, P.; “Vocabulary Independent Speech Recognition using Particle”, Automatic Speech Recognition and Understanding Workshop (ASRU 2001), December, 2001, Italy.

Results

- ASR more trustable.
- Improve the results of our System [3] by improving the ASR performance and by handling OOV words.

[3] Salgado-Garza, L.R.; Nolazco-Flores, J.A.; Díaz-López, P.D.; “Spoken Information Retrieval for Multimedia Databases”, The 3rd ACS/IEEE International Conference on Computer Systems and Applications (AICCSA-05), Cairo, Egypt, January 2005.

Problem Definition

The PDLib project (personal/portable digital libraries) objective is to provide users with a customizable, general purpose document repository (i.e a personal digital library) and the means to access it from any place at anytime from any computing devices connected to the Internet, including mobile phones, PDAs and laptops.

Key challenges:

- Adaptation of traditional and new digital library services for personal and mobile interactions.
- Scalability
- Interoperability with other systems

Technical Approach

- The definition of a personal digital library system architecture that tackles traditional digital library challenges and mobile computing challenges [1].

[1] Alvarez-Cavazos F., Garza-Salazar, D. , Lavariega-Jarquín, J. “PDLib: Personal Digital Libraries with Universal Access”. Submitted to ACM/IEEE Joint Conference on Digital Libraries 2005.

Results

- A proof-of-concept prototype implementation of the PDLib System Architecture.
- The main components of the architecture are
 - Client-Side Applications
 - Data Server
 - Mobile Communication Middleware (MCM)
- The current architecture supports mobile devices while traditional digital library services are adapted to cope with the restrictions of mobile devices.

Tools and Techniques

Resource Sharing with Collaborative and
Distributed Decision Making
Computer Network Paravirtualization

Problem Definition

- Establish algorithms to share resources such as link capacity, buffers, processing time, jobs, etc.
- Determine rules under which such algorithms would be characterized as:
 - Fixed
 - Alternative
 - Adaptive

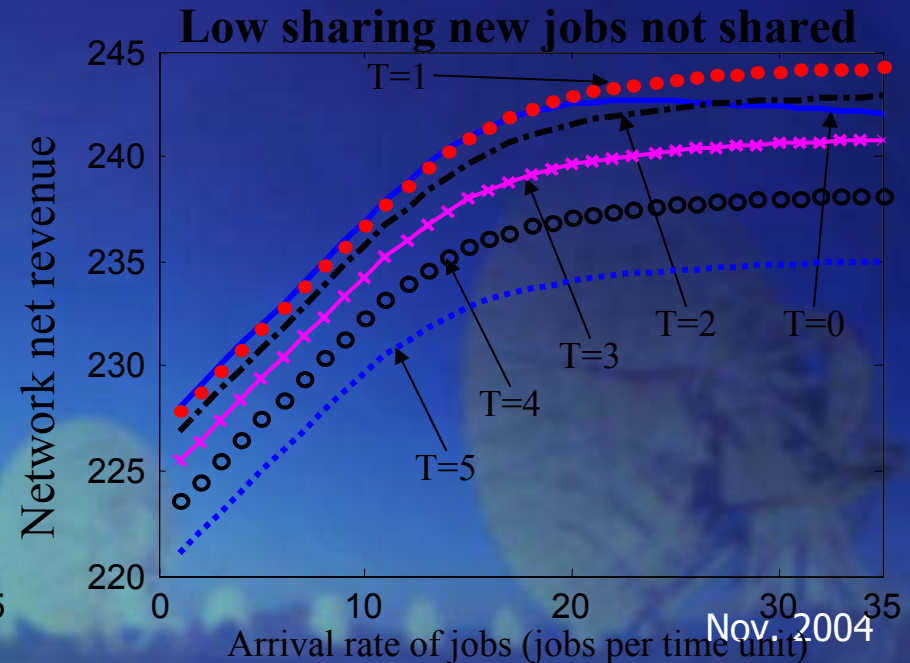
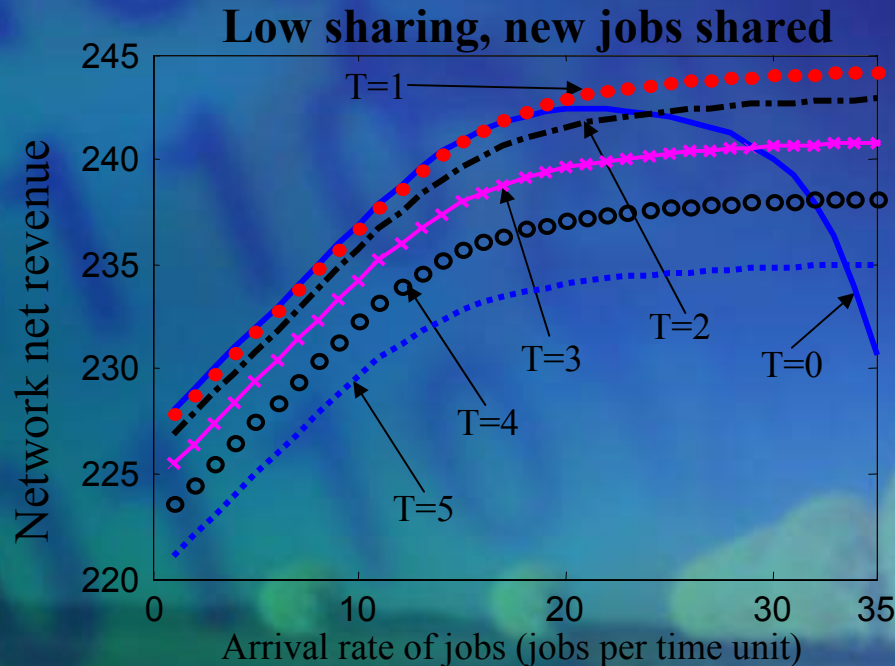
Technical Approach

- Share capacity of processing time in nodes of network
- Reservation of resources for priority of jobs shared
- Jobs can be executed at several processors in a sequence
- Optimize network wide net revenue function of:
 - Number of processes to be shared per time unit
 - Number of processes rejected due to insufficient capacity
 - Number of jobs offered per time unit
 - Number and identification of neighboring processors

Resource Sharing with Collaborative and Distributed Decision Making

Results

- Net revenue improves when priority to jobs already in process is kept.
- No reservation ($T=0$) will degrade revenue when a high amount of jobs to be shared is offered
- When a new job can not be processed, it is better to reject the job if no reservation is used, otherwise, share the job



Problem Definition

- We intend to use the cluster to paravirtualize a large computer network using a small number of nodes in a cluster.
- Beside this kind of networks are functionally correct but timely incorrect, they are useful to test real networks and OSI high level protocols.

Technical Approach

- In order to develop this project we will use UML (Unix Mode Linux) approach [1]. UML approach allows to create paravirtualize networks using switches modules and by installing routers in the nodes.

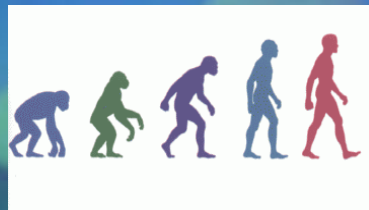
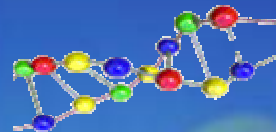
[1] user-mode-linux.sourceforge.net

Results

- A cluster that allows to paravirtualize large networks.
- With the paravirtualization of large networks would be possible to study the functional behaviour of real networks under different conditions.

Evolutionary Computation for Optimization in Logistics

We are currently investigating the use of evolutionary computation (genetic algorithms, learning classifier systems, genetic programming) for the solution of optimization and forecasting problems in logistics. Evolutionary Computation involves computational models and algorithms based on the concept of darwinian evolution, in which individuals are evolved via processes of selection and recombination.



Evolutionary Algorithms for Optimization in Logistics

Logistics is the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, and finished goods from the origin to the point of consumption for the purpose of meeting the customer requirements [Canad. Assoc. for Logistics Mgmt.]. We have been concentrating in solving optimization and logistics problems such as routing and distribution, cutting stock and packing, and inventory control problems.

Evolutionary algorithms are specially well suited for paralelization. We propose the development of a software platform to investigate the application of parallel evolutionary algorithms in logistics.

