Borboleta:

Integrated Mobile System for Primary Home Healthcare

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IME - USP

Collaborators: Experimental Primary Health Care Center, School of Medicine, USP
EACH - USPLeste
Department of Science and Technology - UNIFESP

Project Goals

- Technological contributions:

    – Develop an open source infrastructure for home healthcare using mobile computing (smartphones)

    – Improve the quality of *Primary Healthcare* in Brazil by providing an Open Source Integrated System to manage public healthcare institutions.

    – Use of advanced Data Mining techniques to support Public Health Administration

Project Goals

- Scientific contributions:

    - Abstract modeling of the Brazilian Public Health System with focus on Primary Healthcare

        - *Centros de Saúde*

    - New algorithms and methods for assuring privacy and good-quality cryptography in smartphones and PDAs.

    - New algorithms and methods for data consistency in distributed, mobile databases.

    - Systematic study of multimedia data capture and transmission over wireless networks

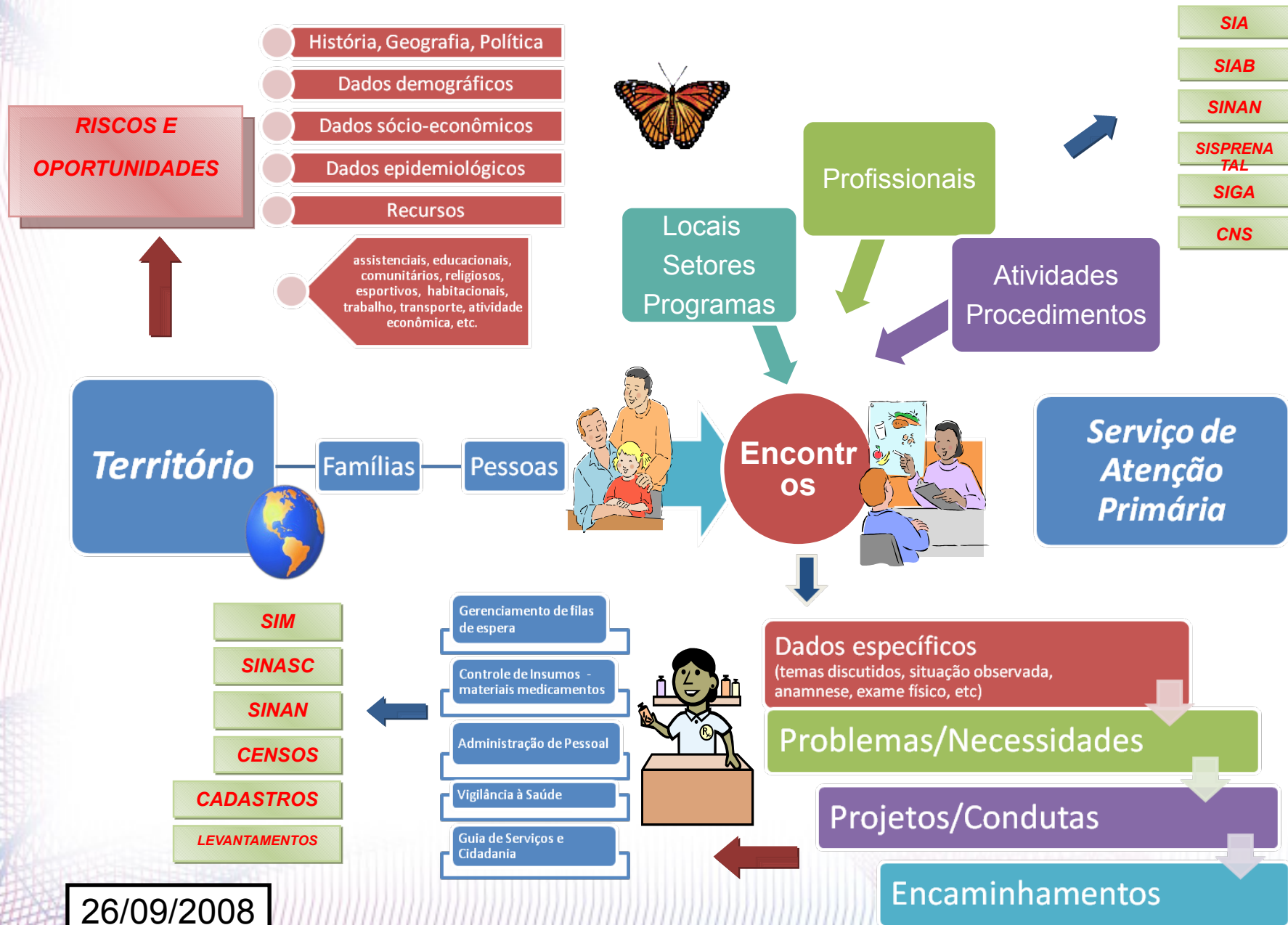   - Systematic methodology for evolution of databases

Abstract modeling of the Brazilian Public Health System with focus on Primary Healthcare

- Most research on Medical Informatics deals with
    - Hospital management
    - Expensive high-tech customized equipments
    - Remote monitoring of patients with specific diseases.
- Very little research on Preventive Medicine and Primary Homecare
    - This is extremely important in a country with scarse resources and a large population

Abstract modeling of the Brazilian Public Health System with focus on Primary Healthcare
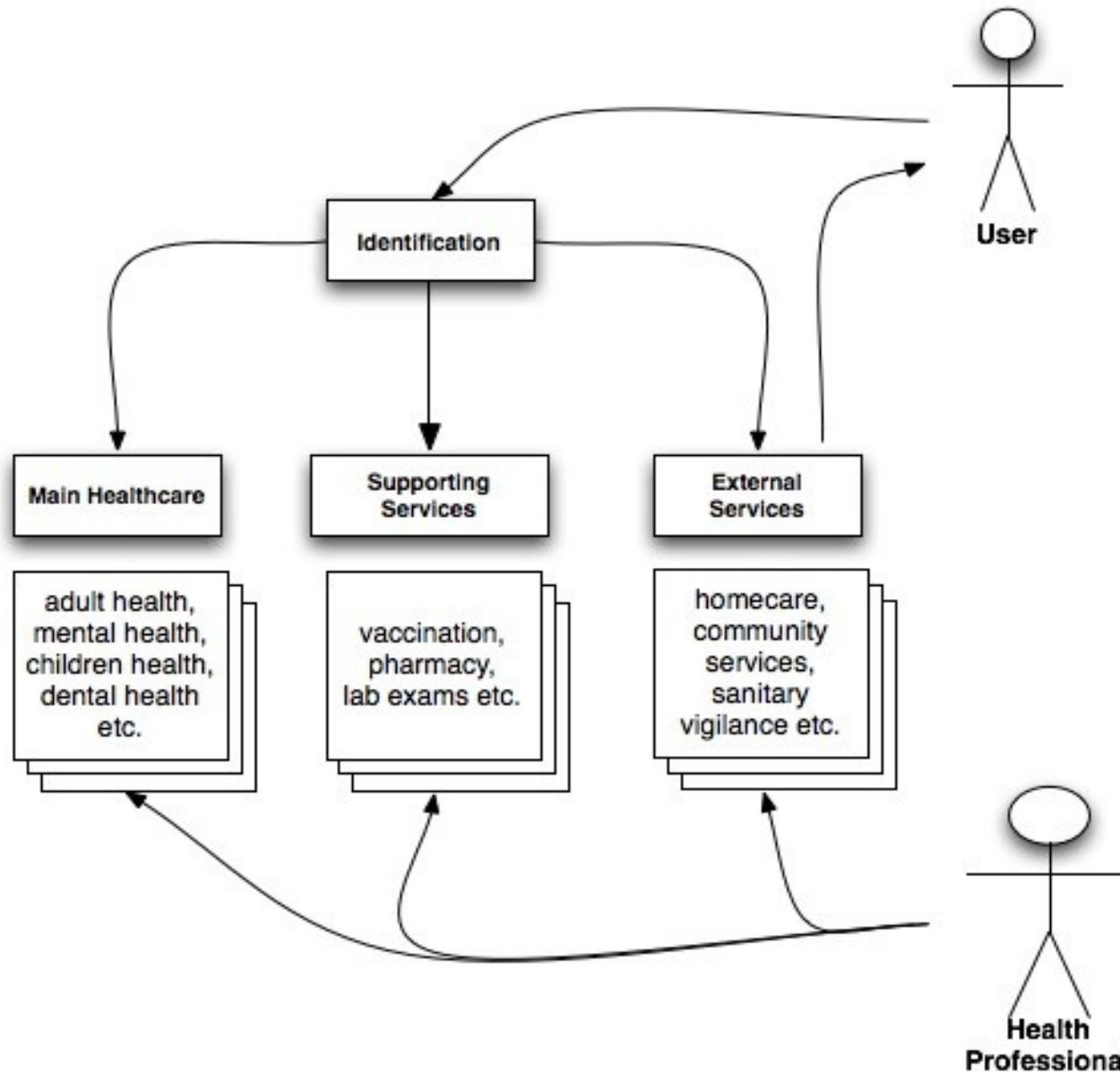
- During the 2nd semester of the project:

  - carried out 4 full-team meetings and about 10 small team meetings

  - to model an "ideal" Primary Healthcare Center within the Brazilian public context.

    - (ideal in the sense of completeness)

- PhD project on Public Health to start in 2009.

Primary Healthcare Center Model

RISCOS E OPORTUNIDADES

- História, Geografia, Política
- Dados demográficos
- Dados sócio-econômicos
- Dados epidemiológicos
- Recursos
- assistenciais, educacionais, comunitários, religiosos, esportivos, habitacionais, trabalho, transporte, atividade econômica, etc.

Locais Setores Programas

Profissionais

Atividades Procedimentos

SIA
SIAB
SINAN
SISPRENATAL
SIGA
CNS

Território — Famílias — Pessoas

Encontros

Serviço de Atenção Primária

SIM
SINASC
SINAN
CENSOS
CADASTROS
LEVANTAMENTOS

Gerenciamento de filas de espera

Controle de Insumos - materiais medicamentos

Administração de Pessoal

Vigilância à Saúde

Guia de Serviços e Cidadania

Dados específicos
(temas discutidos, situação observada, anamnese, exame físico, etc)

Problemas/Necessidades

Projetos/Condutas

Encaminhamentos

26/09/2008

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SaguiSaúde:
next generation Information System for Primary Healthcare Management

SaguiSaúde: Patient data

SaguiSaúde: Schedulling exams

Multimedia on Mobile Computing

- Objective: integration of multimedia features to the mobile component

- Features implemented in the last semester:
    - Voice Message Recording
    - Image Capturing

- Next semester:
    - Implementation of video capturing
    - Integration of multimedia data into patient records

- Following semester:
    - Tools for communication between health professionals (VoIP and videoconference)

Multimedia on Mobile Computing

- Contributions until now:

  - Characterization of the capabilities of data storage in mobile devices

  - Understanding of the limits of capturing and transmitting multimedia content in mobile devices

  - Implementation of voice and picture capturing

- Expected scientific contribution:

  - Scientific evaluation of the benefits (?) of the use of multimedia content in Primary Healthcare services in the Brazilian context.

- Other future investigation on mobile devices

  - Integration of geographic position information (GPS) into the health information system.

Distributed Mobile Databases

- Problem:

  - Heterogeneous databases

  - Disconnected operations

  - Long-duration transactions

- Solution:

  - Database integration and separation processes optimized by using metadata and semantic information,

  - reducing conflicts and assuring ACID properties.

Transactional Model

ED: Estrutura de Dados
PS: Processo de Separação
PI: Processo de Integração

Modelo de Dados
Sagui Saúde

ED

Modelo de Dados
Móvel

ED

Autenticação
XML

XML

PI

Meta
Dados

XML

PS

Módulo de Separação e Integração de Dados
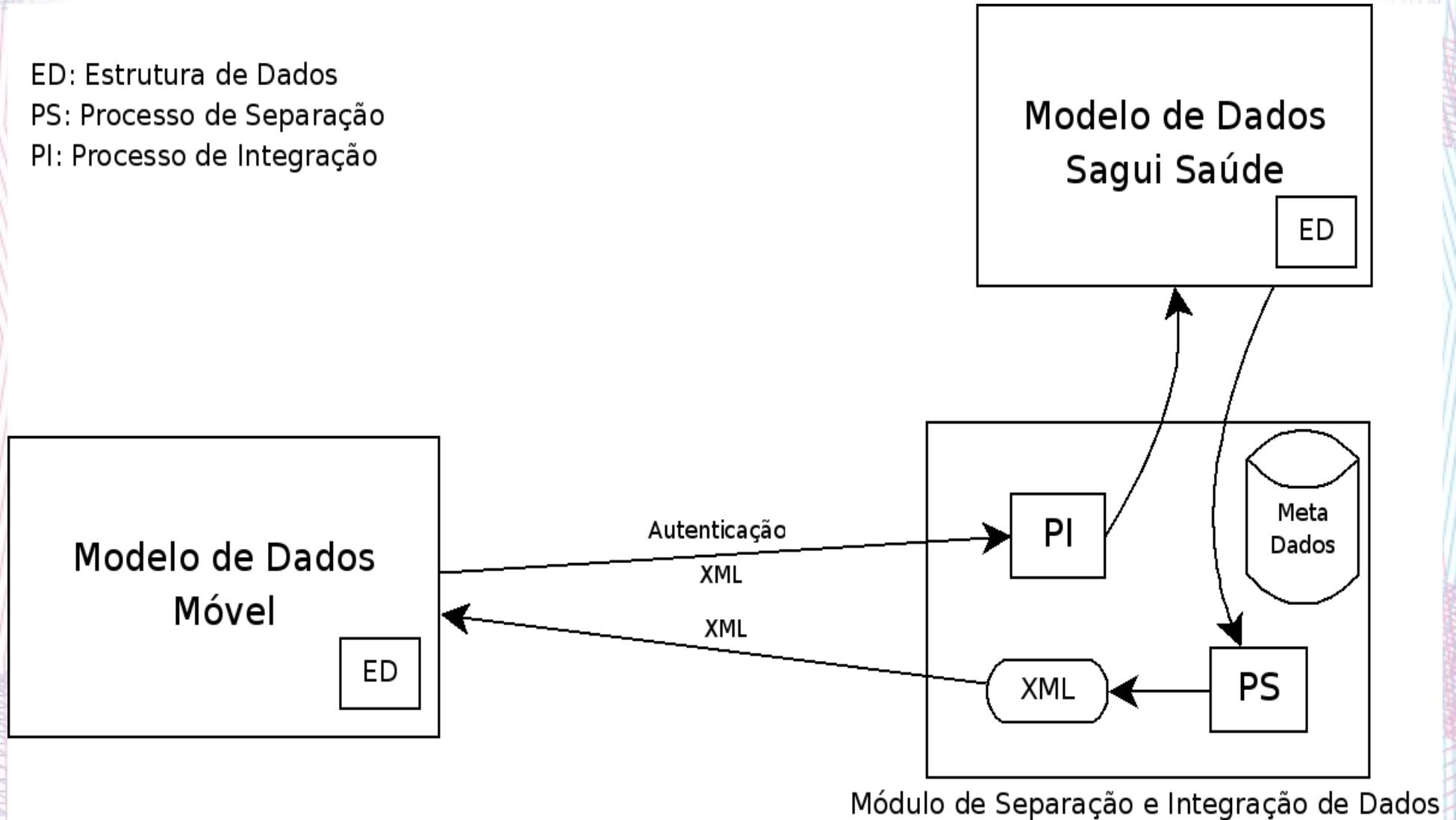
Transactional model current state

- **Done in the last semester:**

    - Defined the architecture for the Data Separation and Integration Module.

    - Preliminary, simplified implementation of this architecture.

- **Next steps:**

    - Define and implement more sophisticated protocols by using metadata and semantic information to reduce conflicts and optimize performance.

Criptology in Mobile Devices

- Security requirements according to the Brazilian law.

  - Authentication of the health professiona (NGS1.02 - ISO/IEC 17799);

  - Security in the communication protocols between the mobile nodes and the servers (NGS1.03 - ISO/IEC 15408);

  - Security in data storage and passwords (NGS1.07).

Criptology in Mobile Devices

- Ongoing:
  - Development of novel algorithms for encrypting data for transmission over the network, based on elliptic curves.

- Next:
  - Use of Cipher-block chaining (AES-25) for encrypting data on the mobile devices.
  - Implementation of module based on existing algorithms for authentication of health professionals and security key generator.

Data Mining

If *A* And *B* Then C

If *X* And *Y* Then Z

If *1* And *2* Then 3

etc.

Data Mining in Borboleta/SaguiSaúde

- Automated scanning of large bodies of data, searching for previously unveiled patterns that can be expressed as *If-Then* rules (similarly, as first order formulae or as ***PROLOG*** clauses).

- Patterns can inform and/or explain useful relations, e.g., between locations and density of occurrence of diseases.

Next steps

- Controlled experiments to evaluate the use of the mobile system by the health professionals.

- Incremental deployment of the new centralized system in the Healthcare center, evaluating the usability and effectiveness.

- Incremental development of new system features releasing new versions every 2 months.

  - Security, multimedia, and DB synchronization.

Publications

Refereed Conference and Workshop papers

- Análise e Modelagem Conceitual de um Sistema de Prontuário Eletrônico para Centros de Saúde
  Helves Domingues, Rafael Correia, Fabio Kon, Rubens Kon, João Eduardo Ferreira.
  In SBC - Workshop de Informática Médica, Belém, Brazil, Jul 2008.(slides)

- Knowledge-based Modality Selection for Information Presentation in a Mobile System for Primary Homecare
  Flavio Soares Correa da Silva.
  *In Artificial Intelligence and Simulation of Behaviour - Workshop on Multimodal Output
  Generation, Aberdeen, UK. 2008.*(slides)

- Borboleta: A Mobile Telehealth System for Primary Homecare.
  Rafael Correia, Fabio Kon, Rubens Kon.
  In ACM Symposium on Applied Computing. Fortaleza, Brazil, Mar 16-20, 2008.(slides)

- Um Sistema de Software Livre para Gerenciamento de Centros de Saúde.
  Rafael Correia, Fabio Kon, Rubens Kon, João Eduardo Ferreira.
  Em III Simpósio de Iniciação Científica e Pós-Graduação do IME-USP. São Paulo, Brazil, Nov 12-14, 2007.(slides)

Tutorial

- Evolução de Banco de Dados em Métodos Ágeis
  Helves Domingues, Fabio Kon, João Eduardo Ferreira.
  *SBBD e SBES -XXIII Simpósio Brasileiro de Banco de Dados, XXII Simpósio Brasileiro de Engenharia de Software, Campinas,
  Brasil, Outubro 2008.*

Posters and Short Papers

- Projeto Borboleta: Ferramentas Móveis e Multimídia para Atenção Básica Domiciliar
  Arlindo F. da Conceição, Rafael L. Pereira, João V. P. Rezende, Bruno N. M. Silva,
  Rafael J. P. Correia, Helves H. Domingues, Rubens Kon e Fabio Kon
  CBIS - Congresso Brasileiro de Informática em Saúde Campos de Jordão, Brasil, 2008.

- Desenvolvimento de Modelo Conceitual de Sistema de Informação para Atenção Primária à Saúde
  Rubens Kon, Norma Sueli Colucci da Silva, Gisele Magalhães Lanferini, Shirlei C. Faria
  CBIS - Congresso Brasileiro de Informática em Saúde Campos de Jordão, Brasil, 2008.

🇬🇧 English 🇧🇷 Portuguese

Borboleta

A Mobile Telehealth System

An Open Source Project - Mobile Telehealth Services for all

Menu

kon

Borboleta Project

A Free Software System for Health Center Management

One of the factors of greatest impact on quality of life is access to good health services. Despite the fact that Brazil has a well structured public health system (SUS), the country clearly has not been able to dedicate enough financial and human resources to offer agile and efficient services for its 140 million users. In particular, the home care iniciatives (Family Health and Homecare Program) have been shown to be effective public health tools because they can, at a relatively low cost, significantly improve the health conditions of the targeted population. Still, in their current versions, there is no Information Technology to support the work of health care professionals under these programs.

The goal of the Borboleta Project is to investigate tools and innovative methodologies in IT to support home care programmes in public health, using advanced tools of Mobile Computing to promote the improvement of health services offered to people with low income.

Why "Borboleta"?

The Borboleta (Butterfly) System is an initiative of the FOSS Competence Center (CCSL) of IME/USP. The incubated projects in CCSL are part of ARCA, the group of interest in free software at IME. The systems created by members of ARCA are named after animals in reference to Noah's Ark. Since Borboleta is a mobile system that "flies" gracefully from home to home bringing attention, health and happiness to the residents, we chose to use the butterfly as the symbol for this system.

Development and Financing

The Borboleta project is developed at the IME/USP Department of Computer Science, with collaboration of the Schooling and Health Center of Butantã, part of the Medicine School of USP, and the Department of Medical Informatics of UNIFESP in São Jose dos Campos. The project is financed by FAPESP and Microsoft Research.