InduSoft @ UPRM

Center for Industrial Software Development

Bienvenido Vélez Ph.D.
Principal Investigator

Outline

- What is a Center of Excellence?
- InduSoft Precepts: Mission and Vision
- InduSoft Structure
- Why a Center of Excellence at UPRM?
- Budget
- University Commitment
- Self-Sustainability Plan
- An Example Flagship Project: Paper Equivalent Forms

What is a Center of Excellence?

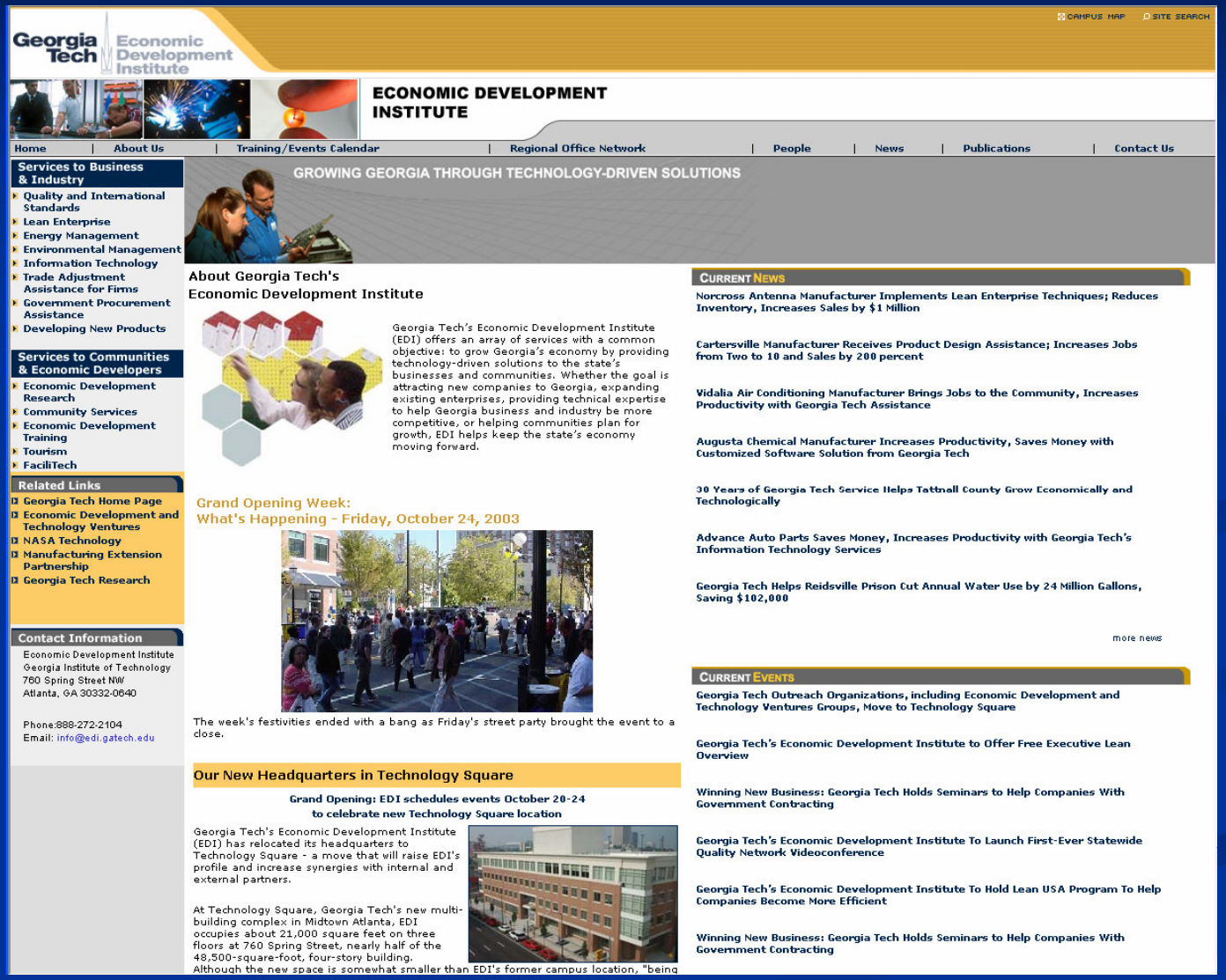
- Driven by long term mission and vision
- Self-sustainable
- Supported by stable critical mass of resources
  - Technical/Scientific Fundamental Expertise
  - Physical Facilities
  - Financial resources
  - Administrative Support
- Capable of adapting to future technological developments

InduSoft Precepts: Mission

- Collect long term organizational memory on innovation and technology commercialization and make it available to the public
- Support industry and entrepreneurs in bringing new software products to market
- Support PR economic development based on commercialization of globally competitive disruptive software technologies
- Serves as Hub connecting partners involved in commercialization of technology: Inventors, Intellectual Property Protection Experts, Venture Capitalists, Government Agencies

InduSoft modeled on Georgia Tech's Economic Development Institute (EDI)

Georgia Tech EDI



InduSoft Precepts: Vision

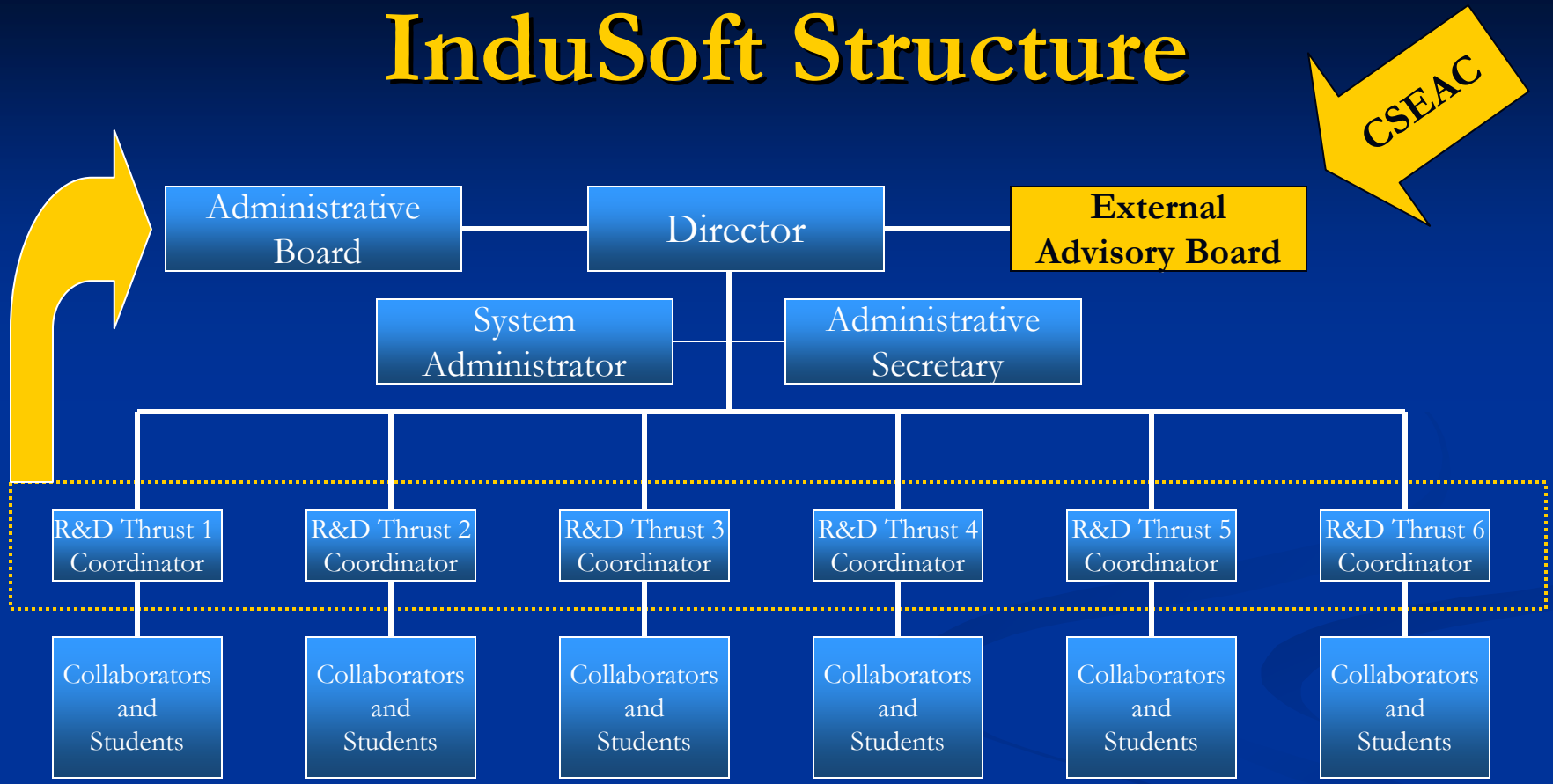
InduSoft will become the most important knowledge and support center on software technology innovation an commercialization in Puerto Rico

How can InduSoft Support Economic Development Based on Technological Innovation?

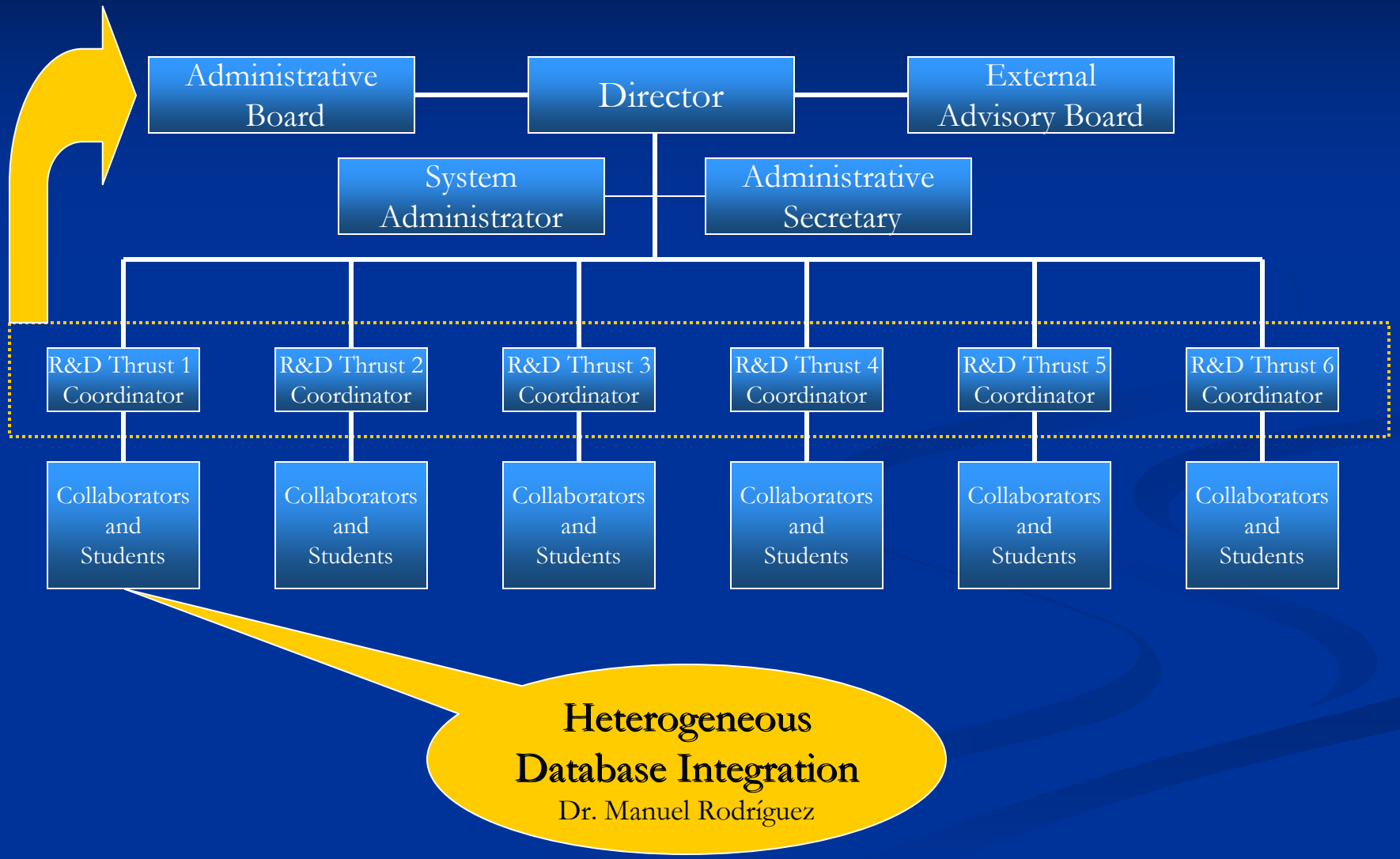
Thru the experiences gained developing an initial product portfolio of flagship products:

- Assessment of commercial potential of emergent software technologies
- Support developing proof of concept prototypes
- Assessment of alternative business models
- Advising on intellectual property protection
- Advising on creating and developing companies
- Advising on how to attract and retain investors
- Connecting inventors with investors

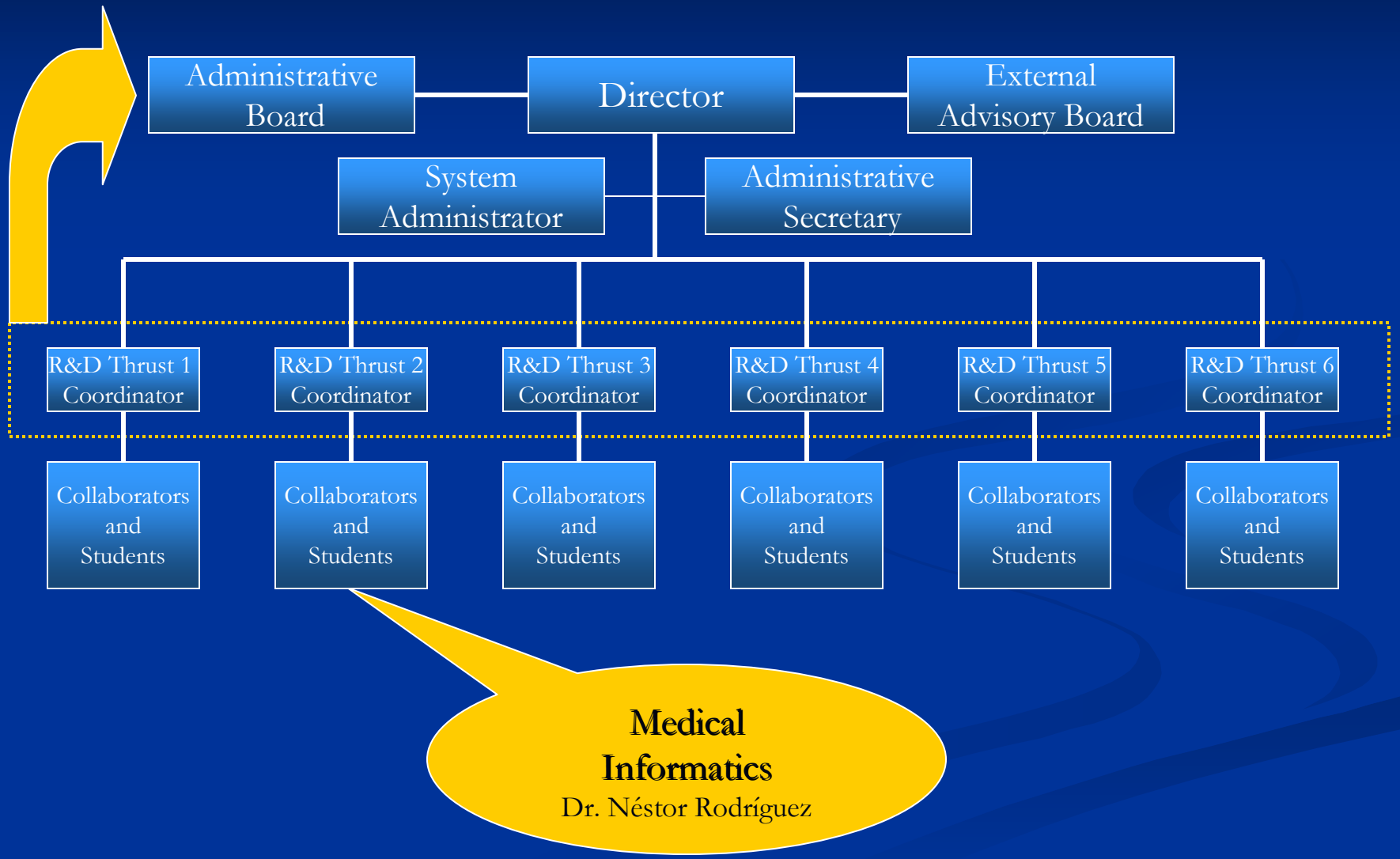
InduSoft Structure



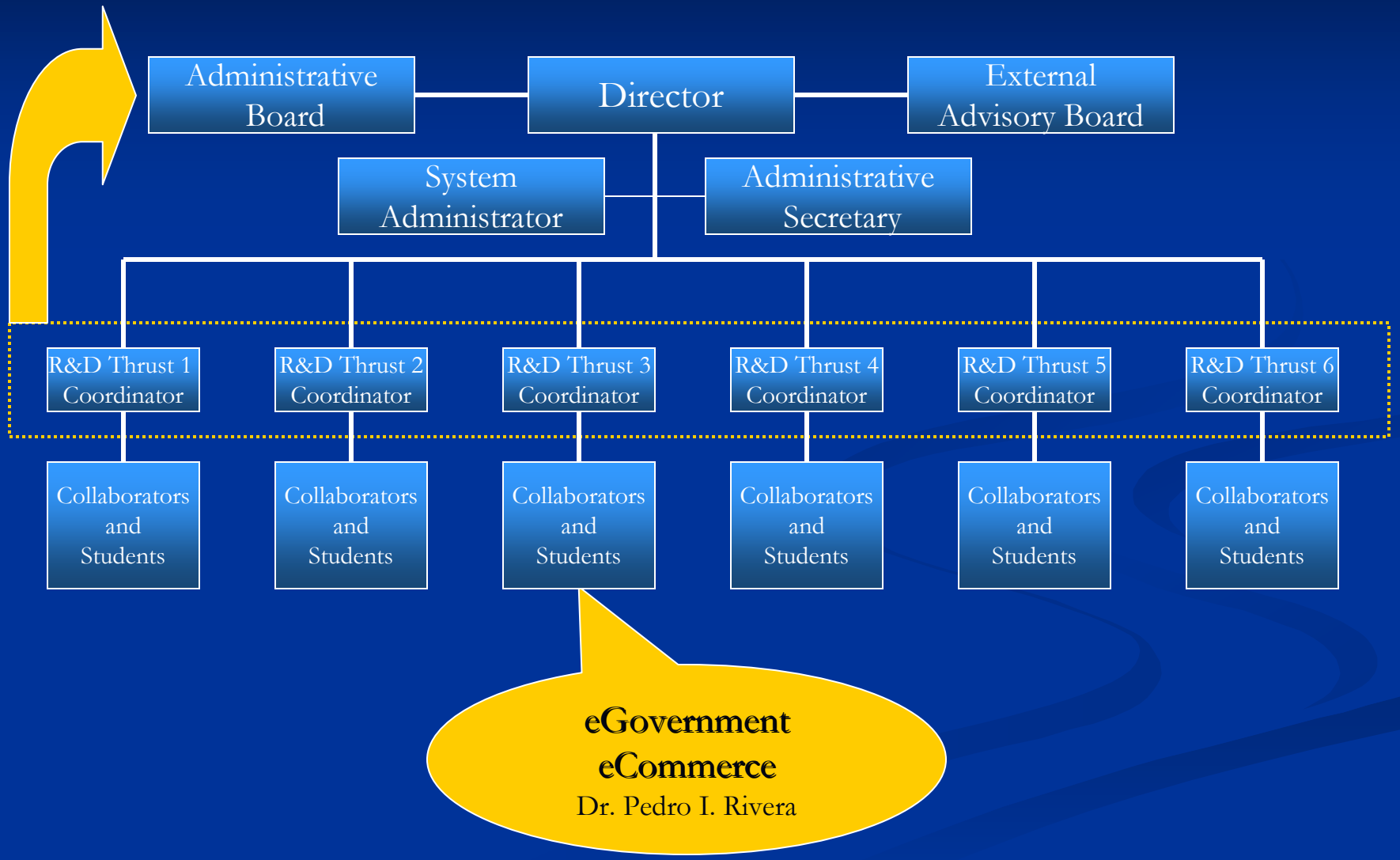
InduSoft Structure



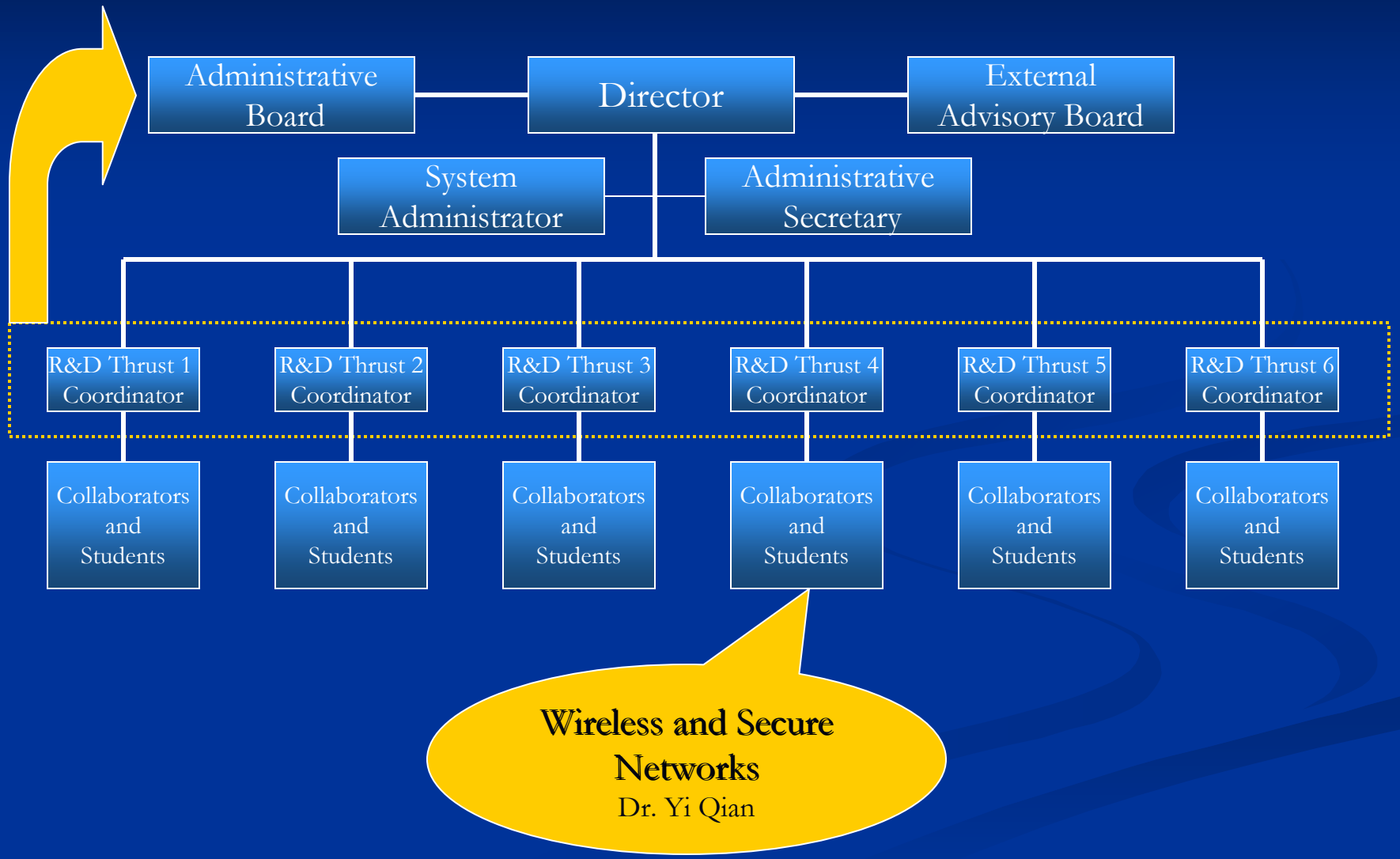
InduSoft Structure



InduSoft Structure



InduSoft Structure



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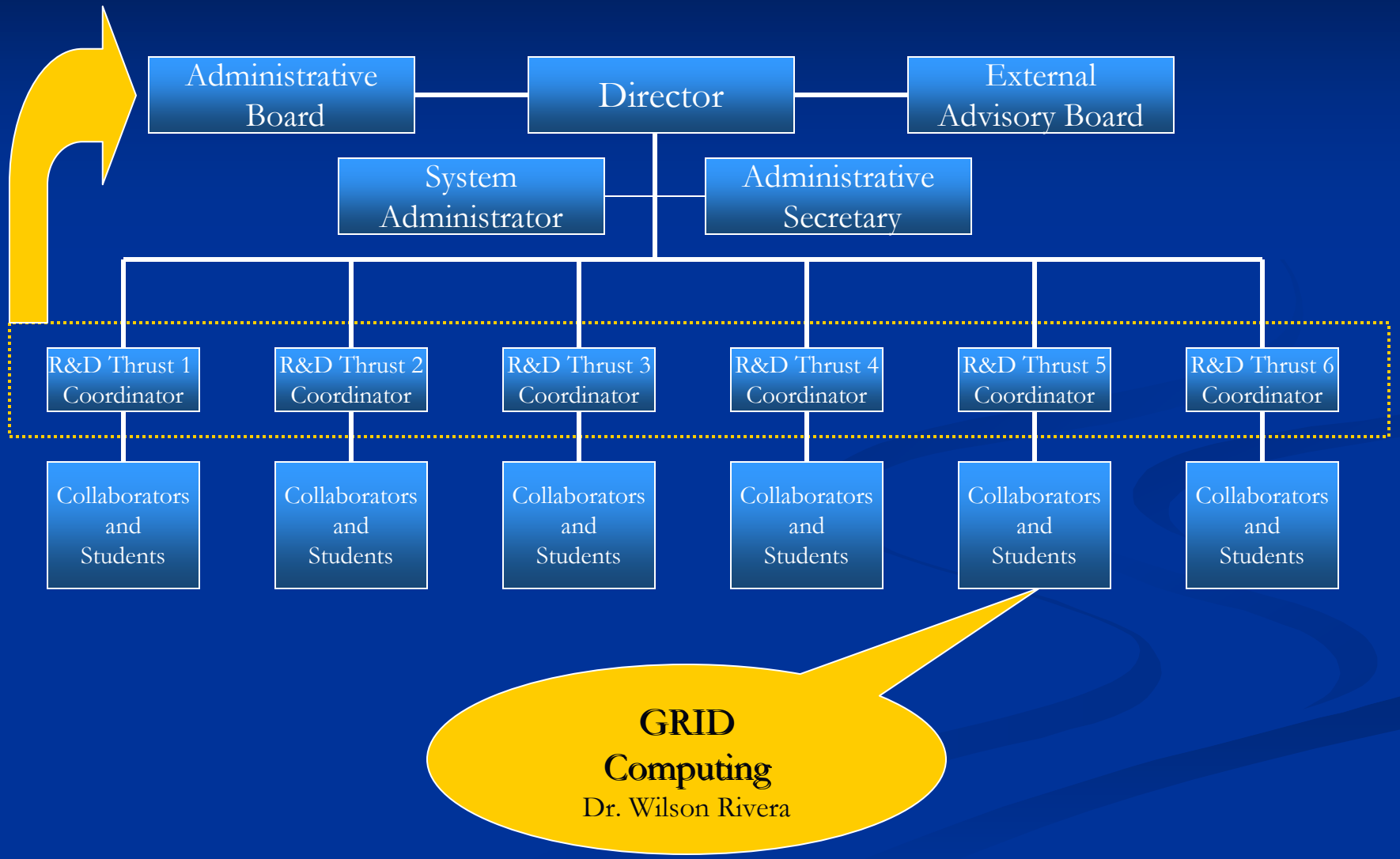
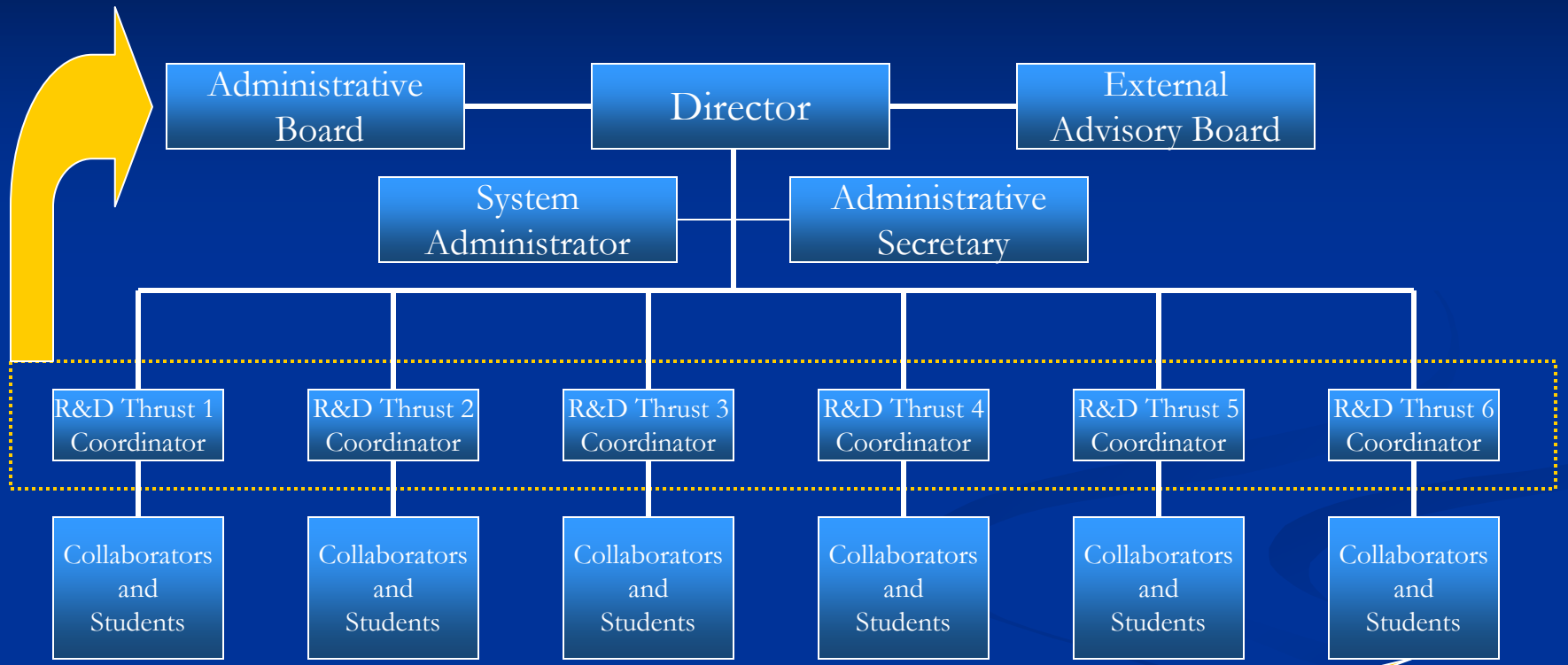


InduSoft Structure



Communications
Signal Processing
Dr. Domingo Rodriguez

Why a C&IT Center of Excellence @ UPRM?

- Leverage on strong research program in C&IT
- Critical mass of human resources
- Large pool of talented engineering students
- Successful track obtaining and managing external funding
- Strong university support
- Strong relationships with industrial partners

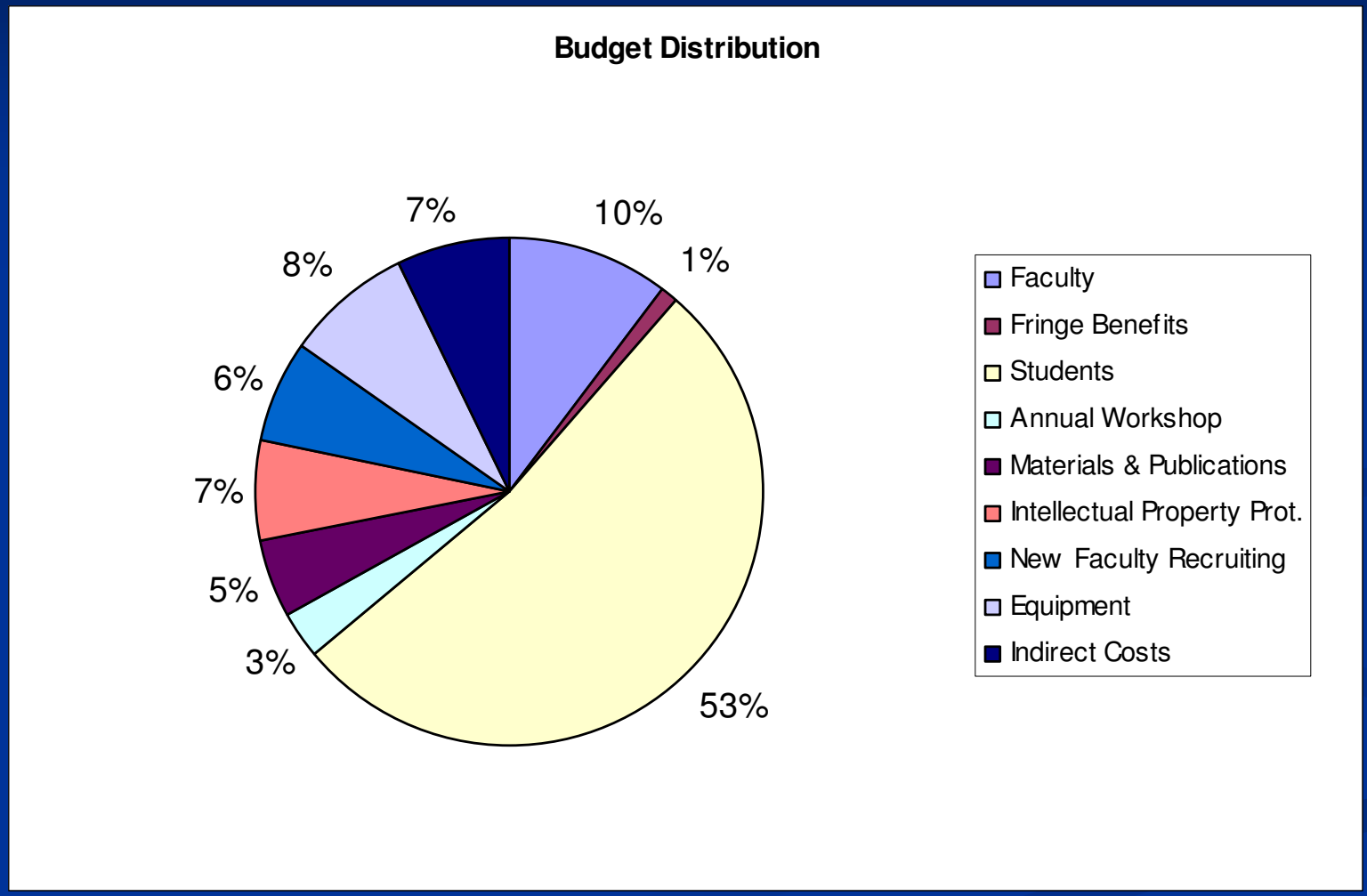
InduSoft Human Resource in C&IT

Name	Degree	Institution	Interests
Javier Arroyo	Ph.D./CS	U. of Florida	Databases, OS
José A. Borges	Ph.D./CS	U. of Illinois	Human-Computer Int.
Isidoro Couvertier	Ph.D./CpE	LSU	Networking, OS
Yi Qian	Ph.D./EE	Clemson University	Wireless Nets
Wilson Rivera	Ph.D./CEng	Mississippi State	High Performance Comp
Pedro Rivera	Ph.D./CS	U. of Florida	Parallel and Distributed Algorithms
Manuel Rodríguez	Ph. D./CS	U. of Maryland, College Park	Wireless Databases, Network Middleware
Nestor Rodríguez	Ph.D./EE	U. of Wisconsin, Madison	Usability Eng, Medical Informatics
Domingo Rodríguez	Ph.D./EE	NYU	Digital Signal Processing
Jaime Seguel	Ph.D./Comp Math	NYU	High Performance Computing
Bienvenido Vélez	Ph. D./CS	MIT	PL's, E-government

Budget

	Year 1		Total	
	PRIDCO	UPRM	PRIDCO	UPRM
Faculty	49,000	122,326	152,958	366,979
Staff	-	38,850	-	118,082
Fringe Benefits	4,508	30,090	14,072	90,631
Students	257,100	-	771,300	-
Annual Workshop	15,000	-	45,000	-
Travel	-	17,500	-	17,500
Materials & Publications	24,600	-	73,800	-
Intellectual Property Prot.	32,000	-	96,000	-
New Faculty Recruiting	30,000	-	90,000	-
Equipment	120,000	-	120,000	-
Indirect Costs	43,022	-	106,366	-
TOTAL	575,230	208,766	1,469,497	628,192
TOTAL PRIDCO/UPRM	783,996		2,097,689	
UPRM Cost Sharing %	30%			
UPRM Cost Sharing Cash	261,213			

PRIDCO Budget Distribution



Strong UPRM Commitment

- Matching Funds
  - Over 260K in Cash
  - Over 360K in Kind
- Administrative Support
  - UPRM R&D Center (accounting, purchasing, payroll, etc.)
- Physical Facilities
  - Institute for Computing and Information Studies Labs
- Industrial Relationships
  - Industrial Affiliates Program

University committed to provide long term support to Center of Excellence

Self-Sustainability Plan

- Long term in kind support from UPRM
- Long term cash support from external grants
  - Collaborative projects with industry
  - PRIDCO/PRCCA CITI Programs
  - NSF SBIR/STTR
  - NIH SBIR/STTR
- **Each R&D thrust responsible for its own survival**
- Other sources of revenue
  - Consulting fees/donations
- *InduSoft* may become a permanent division of UPRM

Electronic Government/Commerce Thrust

- Develops software technologies to overcome the barriers impairing the effectiveness of public administration and government services
- Develops software technologies helping industries comply with government regulations pertaining to electronic records and signatures (e.g. CFR21-Part11)

Many of today's business transactions are conducted on paper for one single reason

We trust paper more than we trust bits

Why?

eSignature Efforts At All Levels

egov -- E-Authentication Portfolio - Microsoft Internet Explorer

http://www.whitehouse.gov/omb/egov/ea.htm

egov — My Government. My Terms.

The Official Web Site of the President's E-Government Initiatives

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Government to Citizen | Government to Government | Government to Business | Internal Efficiency & Effectiveness | E-Authe

Providing the gateway to support the Government-wide E-Government initiatives

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E-Authentication

Hundreds of federal services are available to Americans electronically, but many require some form of identity verification before an agency-to-citizen or agency-to business transaction can take place. It takes an estimated 3 to 5 years for federal agencies to develop electronic identity authentication systems. Duplicative agency efforts to create such systems, which do not communicate with each other, are a substantial cost burden for the government. Moreover, the public is burdened by having to complete a separate registration process (e.g., user name, password, or other electronic credential) for each agency with which they want to conduct on-line transactions.

The E-Authentication initiative will provide the trusted and secure infrastructure – or gateway – to support the 24 government-wide E-Government initiatives, eliminating the need for each initiative to develop a redundant solution for the verification of identity and electronic signatures. The development of a gateway will allow citizens and businesses to conduct transactions with the government through a single sign-on and will provide a uniform process for establishing electronic identity.

Common solutions, addressing how identity is established electronically, authentication security, privacy, and electronic signing capabilities, which are an appropriate match to the level of risk and agency business needs will be shared across the E-Government initiatives. An interim gateway was launched in September 2002.

Successful implementation of E-Authentication will produce numerous benefits for the public and the federal government. Citizens and businesses will have a secure, easy-to-use and consistent method of proving identity to the government and will be spared the burden of having to keep track of multiple sets of registration information. Federal agencies will be able to reduce authentication system development and acquisition costs and reallocate labor resources previously used to develop such systems.

Projects — E-Authentic

Portfolio Mana — Jeanette I. T — E-Authenticatio, Portfolio Manag, Office of Manag, Budget — Bio

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OMB Website — FIRSTGOV Your First Click to the U.S. Government — WhiteHouse.gov

Allanan camino para firmas electrónicas

ANTONIO R. GÓMEZ
PRIMERA HORA

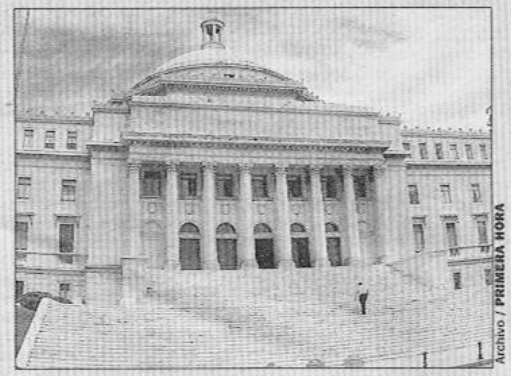
VALIDEZ PARA las firmas electrónicas.

Legislación para reconocer a las firmas generadas electrónicamente el mismo efecto o valor legal que se le otorga a la firma de "puño y letra" fue presentada a la Legislatura mediante un proyecto de administración que crea la nueva "Ley de Firmas Electrónicas de Puerto Rico".

La medida, según se expresa en su exposición de motivos, se fundamenta en la política pública del Gobierno de "facilitar y fomentar la participación de Puerto Rico en el nuevo orden comercial y que se mantenga competitivo en los mercados internacionales creados por la globalización". Se asegura que es también política pública del Estado "establecer la infraestructura necesaria para que los ciudadanos puedan realizar transacciones y recibir servicios gubernamentales con el uso de la firma electrónica".

El proyecto establece los requisitos para la validez de una firma electrónica e incluye entre éstos el que identifique a "una persona natural o jurídica, denominada signatario", que sea creada con datos que el signatario mantiene bajo su exclusivo control, "de manera que esté única e individualmente vinculada al signatario", que sirva para "autenticar al signatario como el autor de cualquier mensaje, documento, o transacción que sea generado o transmitido por medios electrónicos, al cual se aneja la referida firma" y que corresponda a un "Certificado de Firma Electrónica" vigente y emitido por una "autoridad certificadora" debidamente acreditada.

La legislación crea un "Comité de Infraestructura de Firmas Electrónicas", que estará adscrito al Departamento de Justicia y que será responsable de supervisar, reglamentar, organizar y fiscalizar la infraestructura necesaria para instituir el uso de firmas electrónicas en Puerto Rico. Ese comité estará integrado por el Secretario de Justicia, el Comisionado de Instituciones Financieras, el Director de la Oficina de Presupuesto y Gerencia y dos comisionados del sector privado que serán nombrados por el Ejecutivo.



Archivo / PRIMERA HORA

La Legislatura busca que las firmas generadas electrónicamente tengan la misma validez que una a mano.

Se excluyen expresamente de la aplicación de esta ley varias transacciones entre las que destacan el derecho de sucesiones, derecho de familia, procesos judiciales, terminación o cancelación de servicios básicos, notificaciones sobre incumplimiento, aceleración, reposesión, ejecución, desahucio, cancelación o terminación de una póliza o de los beneficios de una póliza y notificaciones para retirar productos del mercado o un defecto esencial de un producto.

Paper vs. Bits as Secure Media

- Pros of Paper
  - Difficult to change
  - Difficult to forge
  - Difficult to replicate
- Pros of Bits
  - Weightless
  - Spaceless (almost)
  - Easy to replicate
  - Easy to transport
  - Easy to search

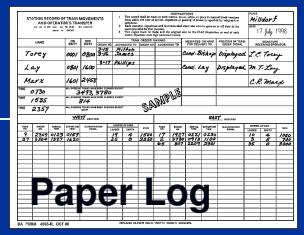
Can we have the
best of both worlds?

Paper Equivalent Forms
a.k.a
PEF's

Paper Equivalent Forms (PEF's)

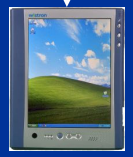
- Underlying software technology is Auditable Secure GUI Components (AGC)
- Some applications of PEF's:
  - Industry: FDA regulated record keeping of manufacturing process data
  - Government: Providing services requiring citizen/agency certification/authentication

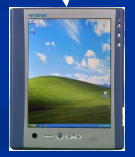
Use of PEF's in Manufacturing



Inspired on visit to McNeil Pharmaceutical in Las Piedras

Use of PEF's in Manufacturing





Inspired on visit to McNeil Pharmaceutical in Las Piedras

END

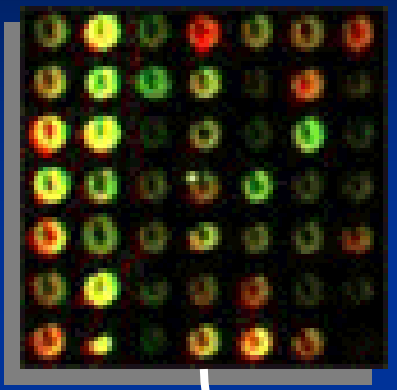
Heterogeneous Database Integration Thrust #1

Director: Dr. Manuel Rodríguez

Heterogeneous Databases

- Focus:
  - Develop software solutions for Database Integration for Pharmaceutical and Biotech Domains
- Flagship Product: **BioWeb**
  - Middleware for Database Integration over the Web
  - Components:
    - Transactional Switch and Application Server
    - Java and C# Development APIs for Third-Party Solutions
    - Clearinghouse and Warehouse Hosting Service
- Target Customer Base:
  - Pharmaceutical and Biotech sector in PR, USA and EU
    - IDC Research estimated future IT investment by 2006: **$30B**

Data Integration via BioWeb



Data Integration Problem: a major roadblock for new drug design and analysis

Microarray Database @ NIH

BioWeb Middleware Solution

Uniform View and Distributed Access API via Web Services

D Protein tabase Pfeizer

Text Database @RCM

Sequence Database @ ProSite

Sequence ID	start	end	weight	10	20	30	40	50	60
3 EPO_HUMAN	.	.	2.41	APPRLICDSRVLERYLLEAKEAENVTMGCSEHCSLNENITVPDTKVNFYAWKRMEVGQQAVEVWQG					
2 EPO_RAT	.	.	2.61	APPRLICDSRVLERYILEAKEAENVTMGCAEGPRLSENITVPDTKVNFYAWKRMEVEEQAIEVWQG					
3 EPO_FELCA	.	.	2.99	APPRLICDSRVLERYILEAREAENATMGCAEGCSFSENITVPDTKVNFYAWKRMEVQQQALEVWQG					
8 Consensus			8.01	APPRLICDSRVLERYILEAKEAENVTMGCAEGCSLNENITVPDTKVNFYAWKRMEVGQQAVEVWQG					
1 PROSITE				----------					

XML Data

Commercialization Plan

- BioWeb Component Commercialization
  - Development APIs – Free of charge
  - Transactional Switch
    - Professional – range of $500 - $1,000 /5 user-license
    - Enterprise Edition – range of $5,000-$10,000 /10 user-license
  - Database Specific Modules - $1,000 / license
  - Clearinghouse and Warehousing Services
    - Pay-per-transaction
    - Monthly service Fee
- Commercialization through Daedalus Inc. and MOU with UPRM

Market Comparison

- BioWeb Advantages
  - Light-Weight System based on Web Services and XML
  - Distributed Processing for Scalability and Efficiency
  - Based on Well-accepted Object-relational technology
  - Support for SQL-type queries, XML and Open Standards
- Alternative Products
  - DiscoveryLink by IBM
    - Centralized DB solution
  - discoveryHub by Genetic Exchange
    - Proprietary Solution with complex query language
  - SRS by LION Bioscience AG
    - Hyperlink-based system with little querying capabilities

Medical Informatics Thrust #2

Director: Dr. Néstor Rodríguez

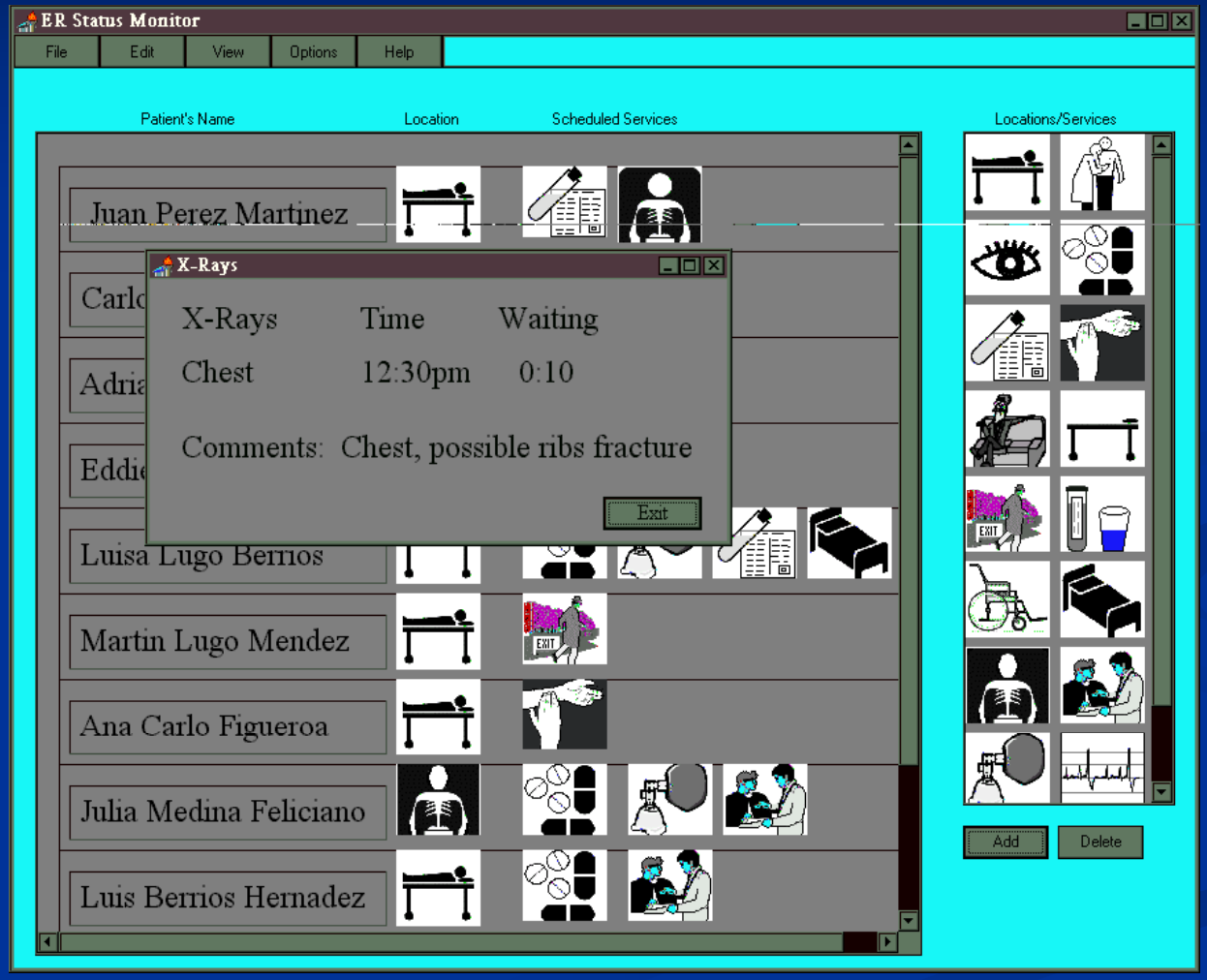
Medical Informatics Thrust

- Focus on development of scientific knowledge to develop usable applications to support physicians and nurses on their clinical tasks
- Relies on:
  - scientific experimentation in human-computer interaction
  - principles of usability engineering
- Involves activities such as:
  - task analysis of clinical settings
  - development of novel user interfaces
  - development of electronic patient record systems
  - interaction experiments involving physicians and nurses

Development of a Patient Tracking System for the Emergency Room

- It will provide the following status information:
  - the location of the patients in the ER
  - the services, treatment and procedures awaiting the patients
  - warning messages on services, treatment or procedures that are approaching or exceeding a predetermined time to be rendered.
- It involves the integration of various technologies
  - Patient tracking system application
  - Electronic patient record system
  - Barcode hardware and software
  - PDAs (Palm/iPAQ) and PCs
  - Wireless networks
- It will improve the flow of patients in the ER while improving quality of care of the patients

User interface concept



Commercialization of the System

- Every hospital in PR is a potential customer
  - No competing products in hospitals in PR
  - Competing products in USA are very expensive (~ $1,000,000)
- The system will be tested at the Ramon Emeterio Betances Hospital of Mayaguez
- The system will be transferred to Tecnium Products Corp. for its commercialization
  - It will be made through a signed agreement between Tecnium and UPRM
  - It will involve licensing and royalties

A Patient Tracking System for the Emergency Room

- It will provide the following status information:
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Electronic Government and Electronic Commerce Thrust #3

Adaptive GRID Middleware
Thrust #4

Adaptive Grid Middleware Thrust

Develop adaptive grid middleware software solutions targeted to electronic business on demand and digital publishing.

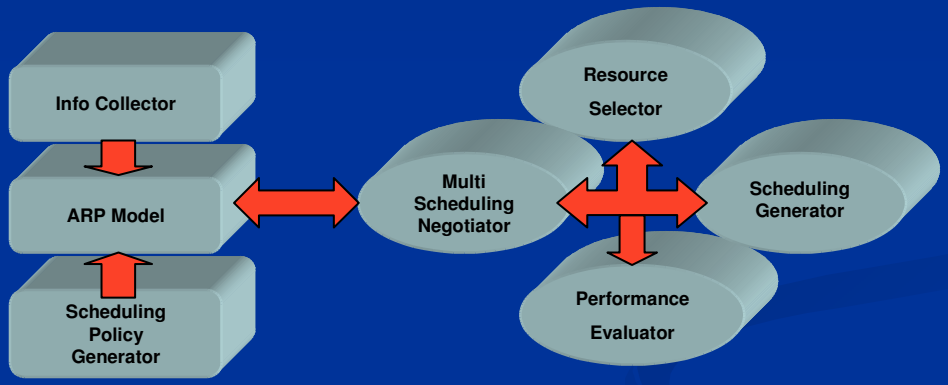
Layers of Grid Architecture

- ***"The next 18 months is a critical period of market development."***
- ***"Financial services, life sciences and manufacturing are 75% of early customer adoption."***
- ***"Grid-related M&A exceeded US$1 billion over the past year."***

The 451 Group, "Grids 2004: from rocket science to business service."

OPtimized e-business scheduleR & Adaptivity (OPeR-A)

An adaptive, scalable and secure meta-scheduler for electronic business applications



Digital Publishing Workflow Characterization (Preflight Automation)

- Software that is proof of concept implementation of methods
- Collaboration with HP Labs

Commercialization

Competing Technologies

PLATFORM
JOBSCHEDULER
Intelligent batch
process automation

OPeR-A **Advantages**

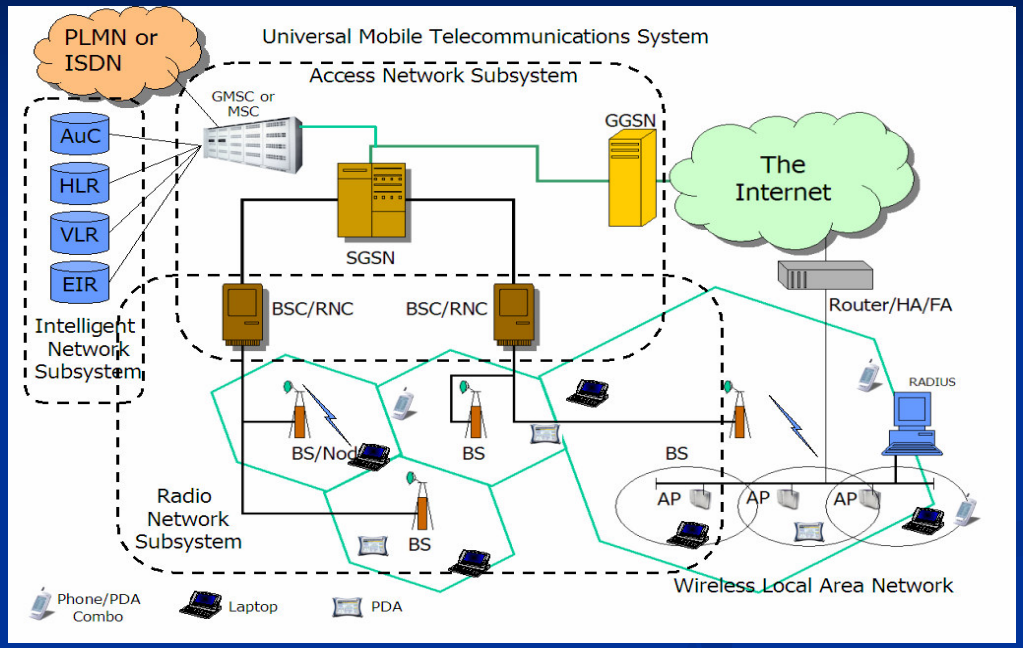
- New performance models and evaluation
- Automatic configuration of scheduling policies
- Grid-aware scheduling framework
- Multi-scheduling

Secure Wireless Networks
Thrust #5

Secure Wireless Networking Thrust

- For future generation wireless packet networks, two most important aspects need to be addressed: QoS guarantee, and Security
  - Because the wireless access channels are the bottleneck of the end-to-end communication links, there is a need to develop resource management and traffic control schemes for wireless channels that provide QoS guarantees for heterogeneous traffic.
  - Security is very important particularly because of the broadcasting nature of the radio transmissions in wireless networks.
- Wireless networks are characterized by poor quality links, mobility, limited power, computational constraints and scarce spectrum resources. QoS and security mechanisms need to be specially investigated and treated.

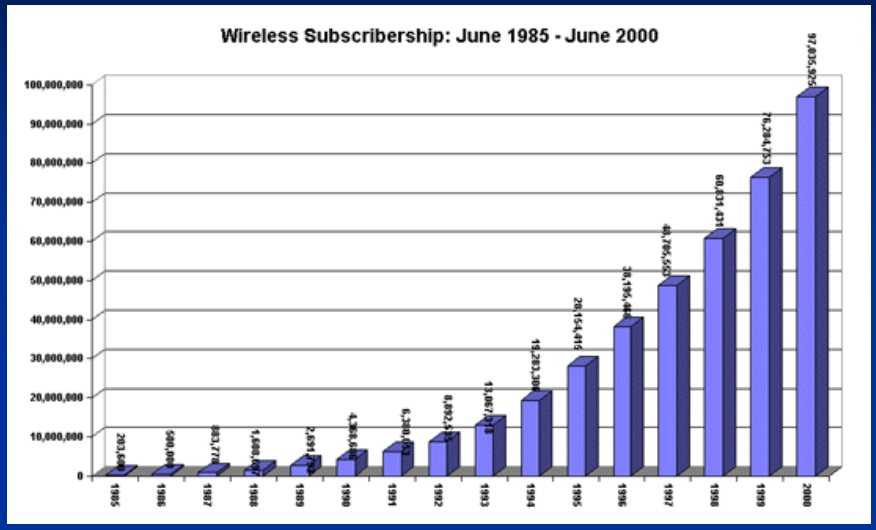
Wireless Network Protocols Providing QoS



- A hybrid wireless data network architecture will be examined to develop the QoS guarantee and security mechanisms.
- The interactions of the QoS schemes and the security mechanisms will also be studied in detail.
- Lab software will be developed at first to test the QoS guarantee and security mechanisms.
- Because of the huge market for future generation wireless packet networks, we can easily transfer the technology to local industries in Puerto Rico and we have huge potentials for commercialization.

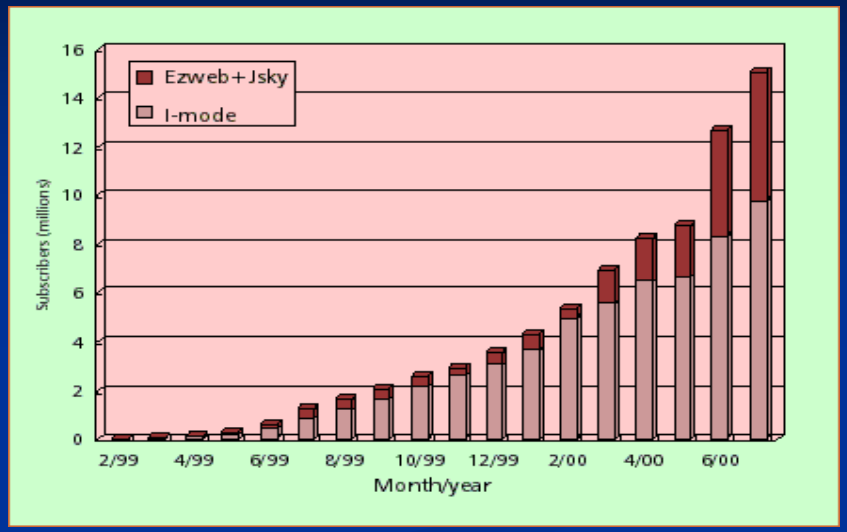
Market Positioning

US Mobile Phone Statistics



Over 120 Million mobile phone users in U.S in June 2001

US Wireless Web Access Statistics

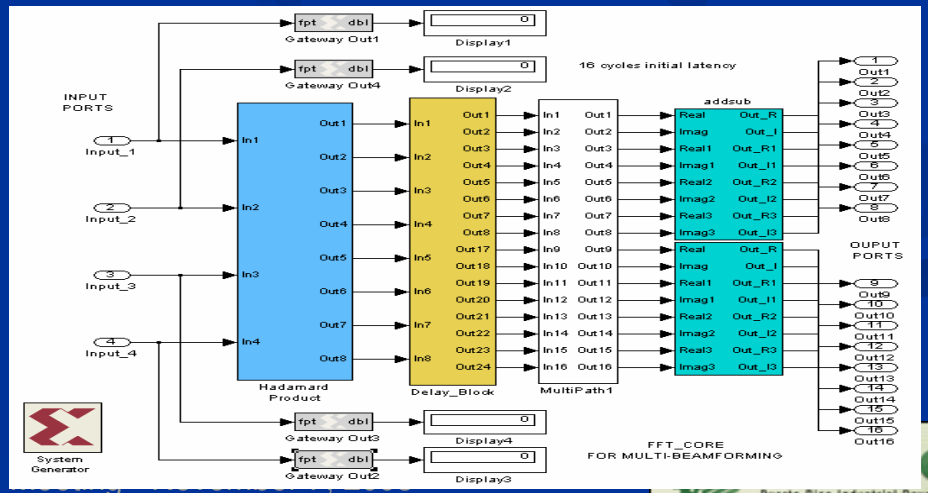


- By looking at the US mobile phone statistics and the wireless web access statistics, we have a feeling of potential wireless market.
- Many of the problems dealt in this project is the first time to get the attention but really need to be solved.
- The QoS schemes and the security mechanisms developed in this project will be patented, therefore the technology developed will be protected.
- Software products will be developed to work with the wireless network hardware and the network infrastructure.

Communications Signal Processing Thrust #5

Advanced Communications Signal Processing: Thrust Description

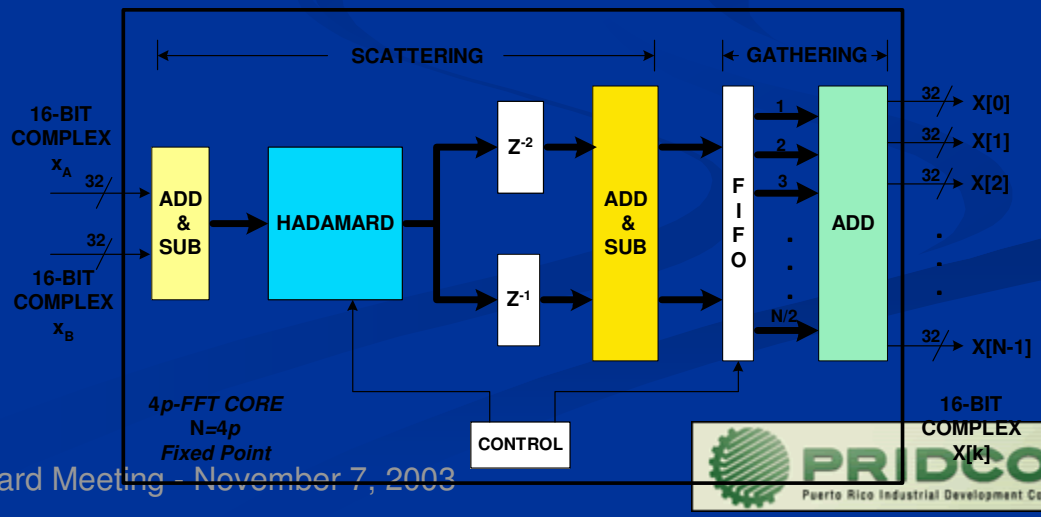
This project proposes the design and development of integrated configurable hardware/software embedded products for the automated processing of sensor-based signal data information generated in industrial and residential applications with access to wired or wireless communications networks.



Advanced Communications Signal Processing Thrust

Main Project:

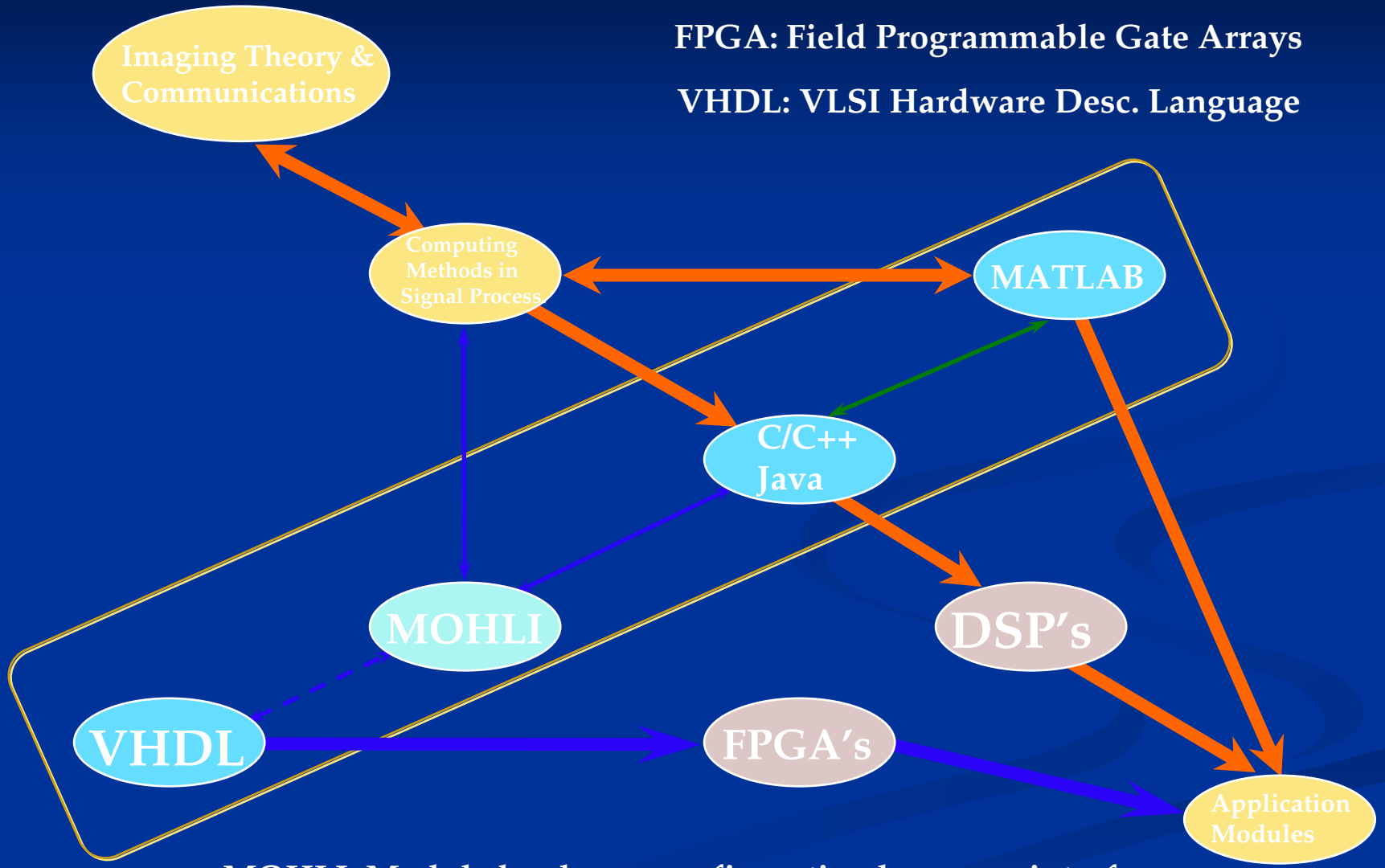
- Low-cost power signal monitoring modules for systems security applications:
  - Unique signal processing methods for feature selection
  - XML-type interface
  - Proprietary hardware designs



Advanced Communications Signal Processing Thrust: Hardware Module Development Process

FPGA: Field Programmable Gate Arrays

VHDL: VLSI Hardware Desc. Language



MOHLI: Module hardware configuration language interface