



IBM Global Healthcare

Innovations in healthcare- GIS based applications

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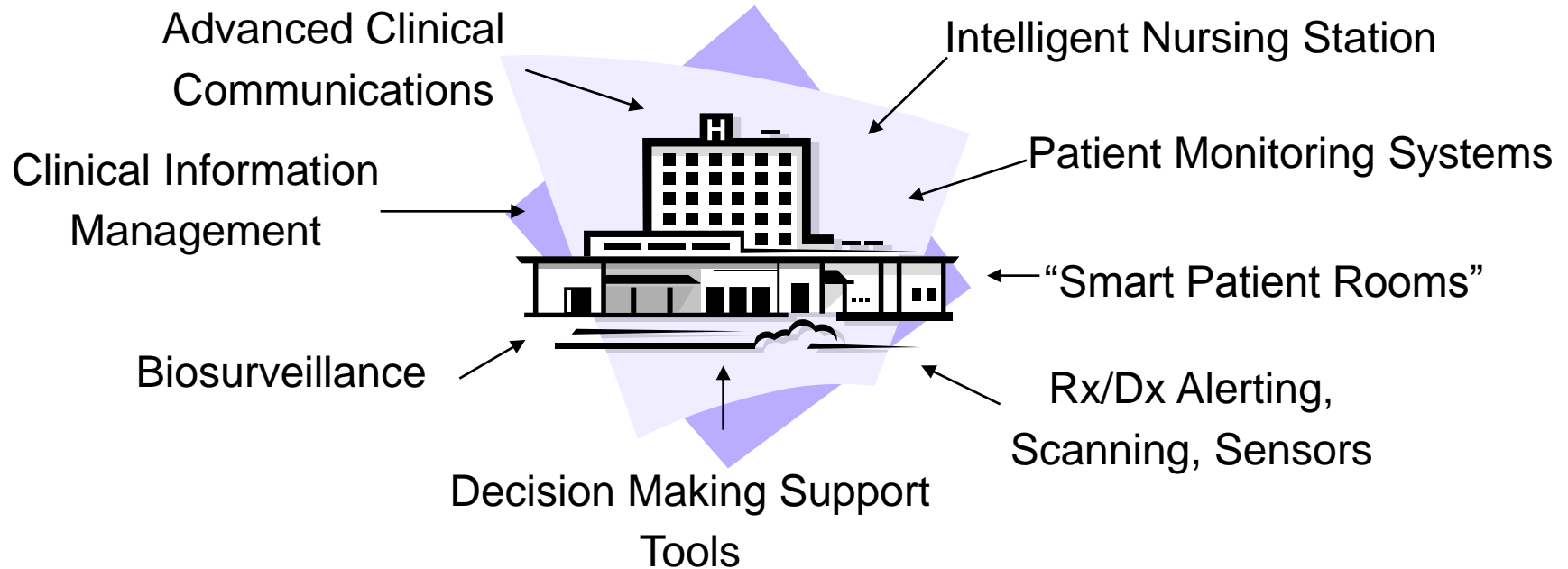


IBM Research Worldwide



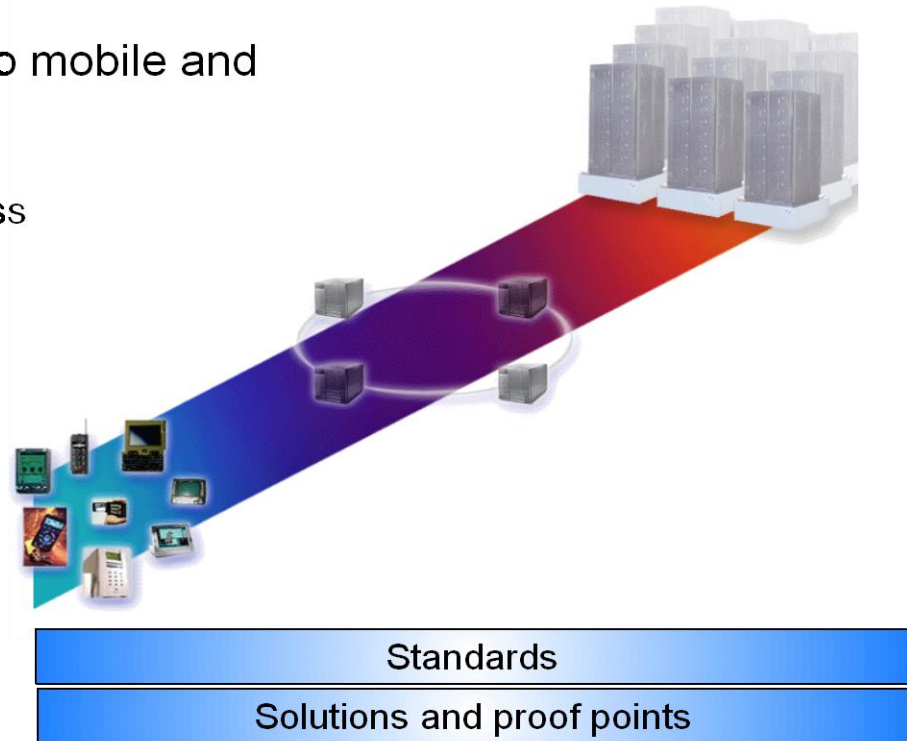
Research activities in Healthcare

Enabling Technologies for the *Intelligent Communications*



Research Strategy in GIS/Mobile/Pervasive Computing

- ▶ Extension of existing applications to mobile and pervasive computing devices
 - ▶ Programming models and tools
 - ▶ Content adaptation, multimodal access
- ▶ Creation of new paradigms for pervasive computing enabled through existing (mobile and wireless) technologies
 - ▶ Context-based, location-aware
 - ▶ Personalization and privacy, mobile web services
- ▶ Exploring new, revolutionary, enabling and paradigm-shifting technologies for pervasive computing
 - ▶ Embedded technologies, Web of trillion devices
 - ▶ User interfaces and new usage paradigms



Overview

- Research Strategy in GIS/Mobile/ Pervasive Computing
- Pervasive Infrastructure Technologies
 - ▶ *User Interaction* – Voice, Multi-Modal, Everywhere Displays
 - ▶ *Mobile Collaboration* – MoMail, Grapevine, Virtual Devices
 - ▶ *Image-based Technologies* – Infoscope, WorldBoard
 - ▶ *Context Technologies* – Location-based Services, Context Aggregation and Analysis
 - ▶ *Standardized Programming Models* – Web Services, eEJBs, Web Portals
 - ▶ *Application Development Tools* – Multi-Device, Voice, Multi-Modal, Disconnected
 - ▶ Security and Privacy- End device security, security on spoken web, context and policy driven security and privacy
 - ▶ Spoken Web- Parallel Web....



Clinical Communications

- Focus: Use IT to improve clinical care (provider focused)
 - Create the physician workflow (take the paper chart process and make it electronic – keep it easy to use, keep the communication simple)
 - Start with flexible, automated notification
 - Based on medical roles, rules and policy
 - Focus on end user programming
 - Roles, rules, policy
 - Validate usefulness of pervasive and other IT technologies in this domain
 - Provide ‘just in time’ access to information for emergency conditions – including clinical data and sharing, patient notes.
 - Support for smart alerts, intelligent notification, real-time applications



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Context Technologies

Location-based Services
Context Aggregation and Analysis



What is context?

Examples of medical context:

Location of patients, providers, and equipment

Patient and provider calendars

Resource schedules/calendars (MRI, XRay,...)

Patient medication information

Patient keystrokes or other interactions with user interfaces

Patient history

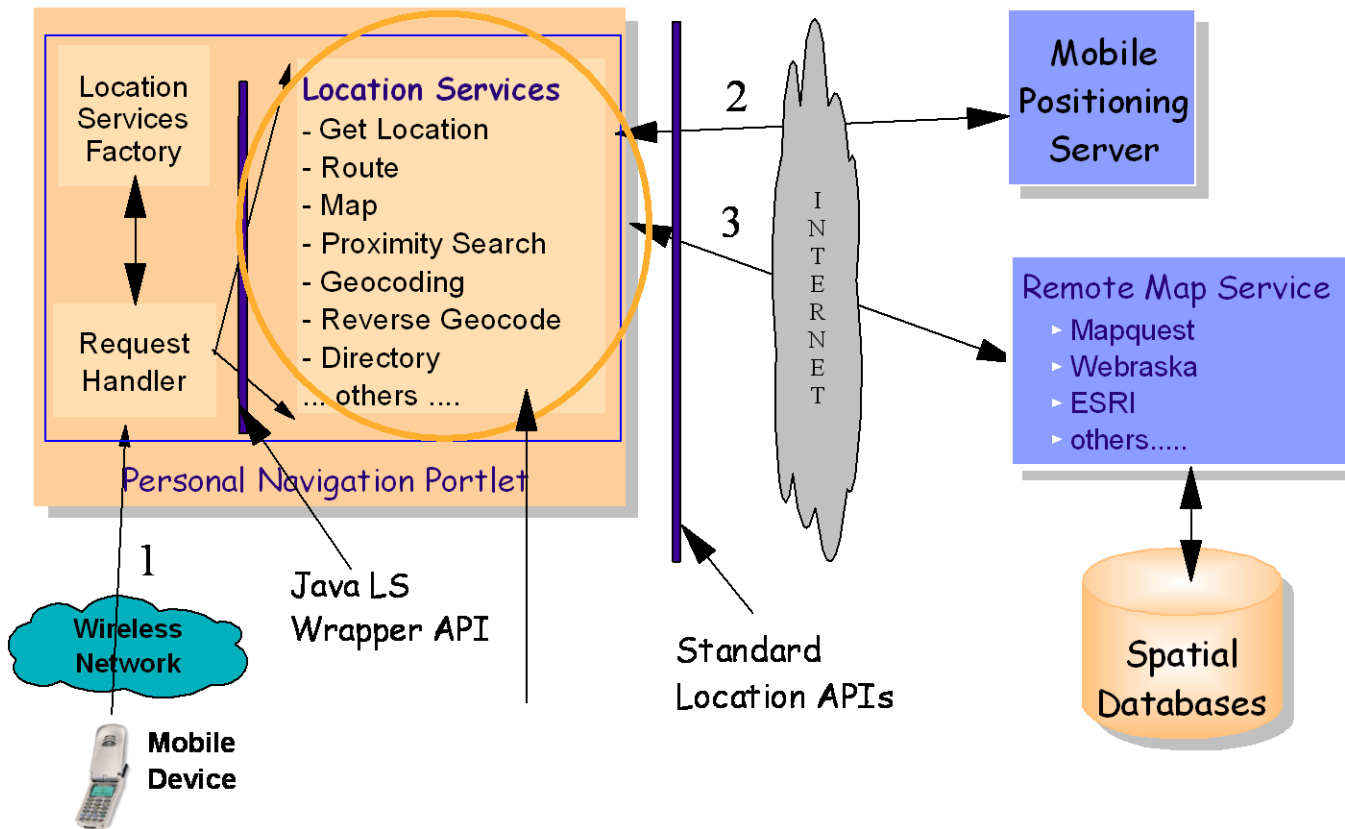
Telemetry from implanted devices

Telemetry and messages from attached monitors



Location Based Services

Augment middleware to enable seamless migration and interoperability of LBS



Intelligent Nursing Station

- Patient sensors integrated into system.
- Nurses have mobile device.
- Detailed patient status alerted to nurse.
- Nurse can triage alerts, based upon medical priority.

Vital Signs

- Room 504: Bi-pap Alarm
- Room 527: Needs meds
- Room 539: IV Alarm
- Room 516: Patient Button
- Room 523: Vitals Normal



Patient Bed Button: ON



IV Alarm: Alarm



Bi-pap: Alarm



Nursing station





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Bio/Disease Surveillance

<http://www.almaden.ibm.com/cs/projects/hii/stem.shtml>

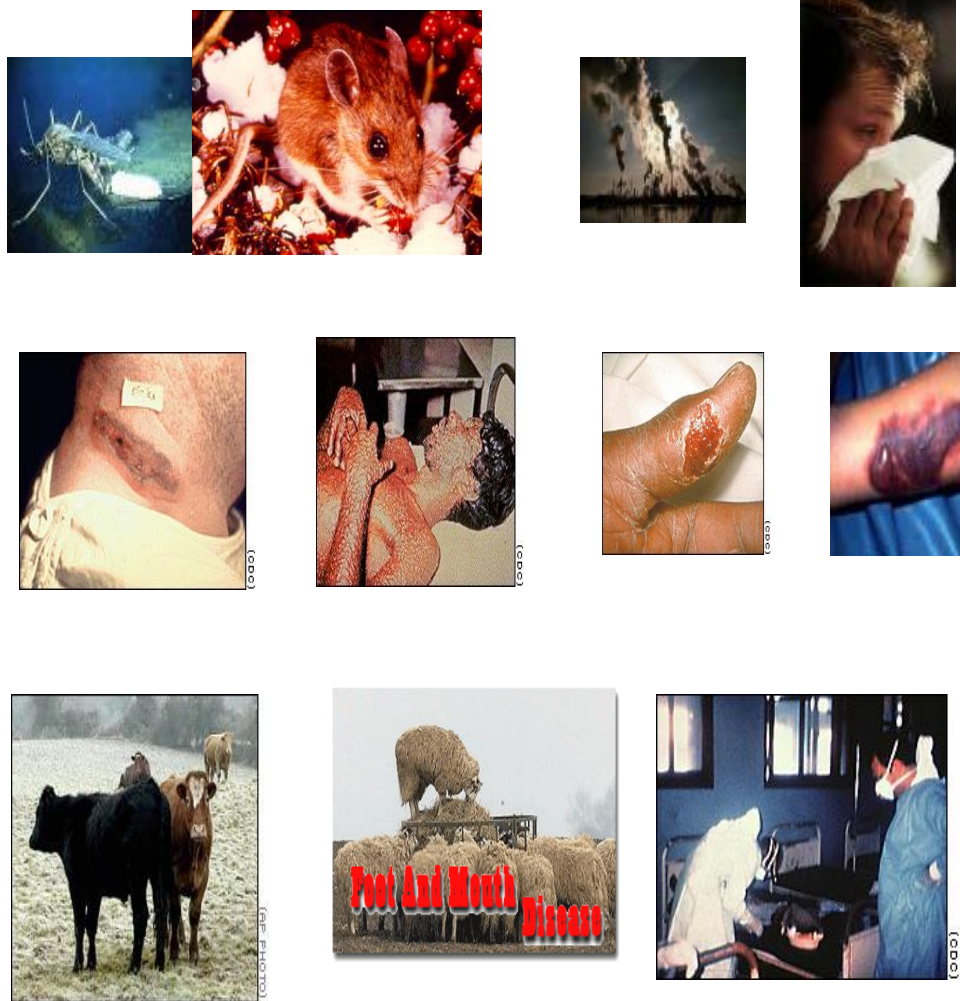


STEM Spatiotemporal Epidemiological Modeler (STEM)

- IBM has made available an advanced software technology that can help predict the transmission of diseases across countries and around the globe to the open source community. The tool will aid scientists and public health officials in understanding and planning more efficient responses to health crises, ultimately providing new tools for protecting population health.

- EpiSPIRE health activity surveillance and early warning system prototype Architected.

Comprehensive study of site-based health activity monitoring, using Watson as a case study

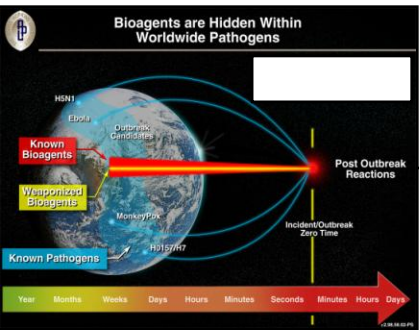


STEM Basics

- A software package, in **open source**, to model spread of infectious diseases
- Builds on the standard compartment models such as
 - ▶ **S**usceptible-**I**nfected-**S**usceptible
 - ▶ **S**usceptible-**I**nfected-**R**ecovered
 - ▶ **S**usceptible-**E**xposed-**I**nfected-**R**ecovered
- Captures transition probabilities between states
 - ▶ Uses cutting edge research to model seasonal and latitude dependencies
- Uses these to predict how the number of people in a given state will evolve over time
- Uses built in GIS (locations, borders, etc) and Transport Information to model people movement in a sophisticated manner.
- “Standard” builds available for Windows/LinuxMac
- GUI to adjust parameters.
- Source code available using Eclipse to add modules/modify models etc.
- Policy Options and their Effect on Parameters – collaboration with Public Policy and Healthcare Experts (ID).

Landscape in Bio-Surveillance

Threats



Event

Human behavior



Phenomenon

Capture

detect

Data Sources

Detector

Statistics

Regression

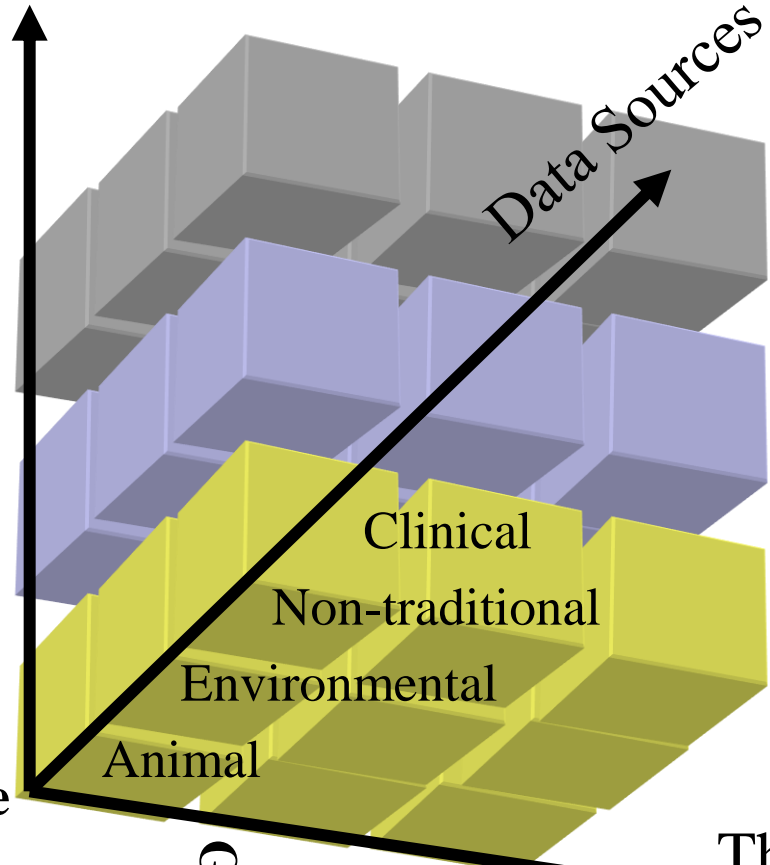
Kalman

Spatial scan

Inductive

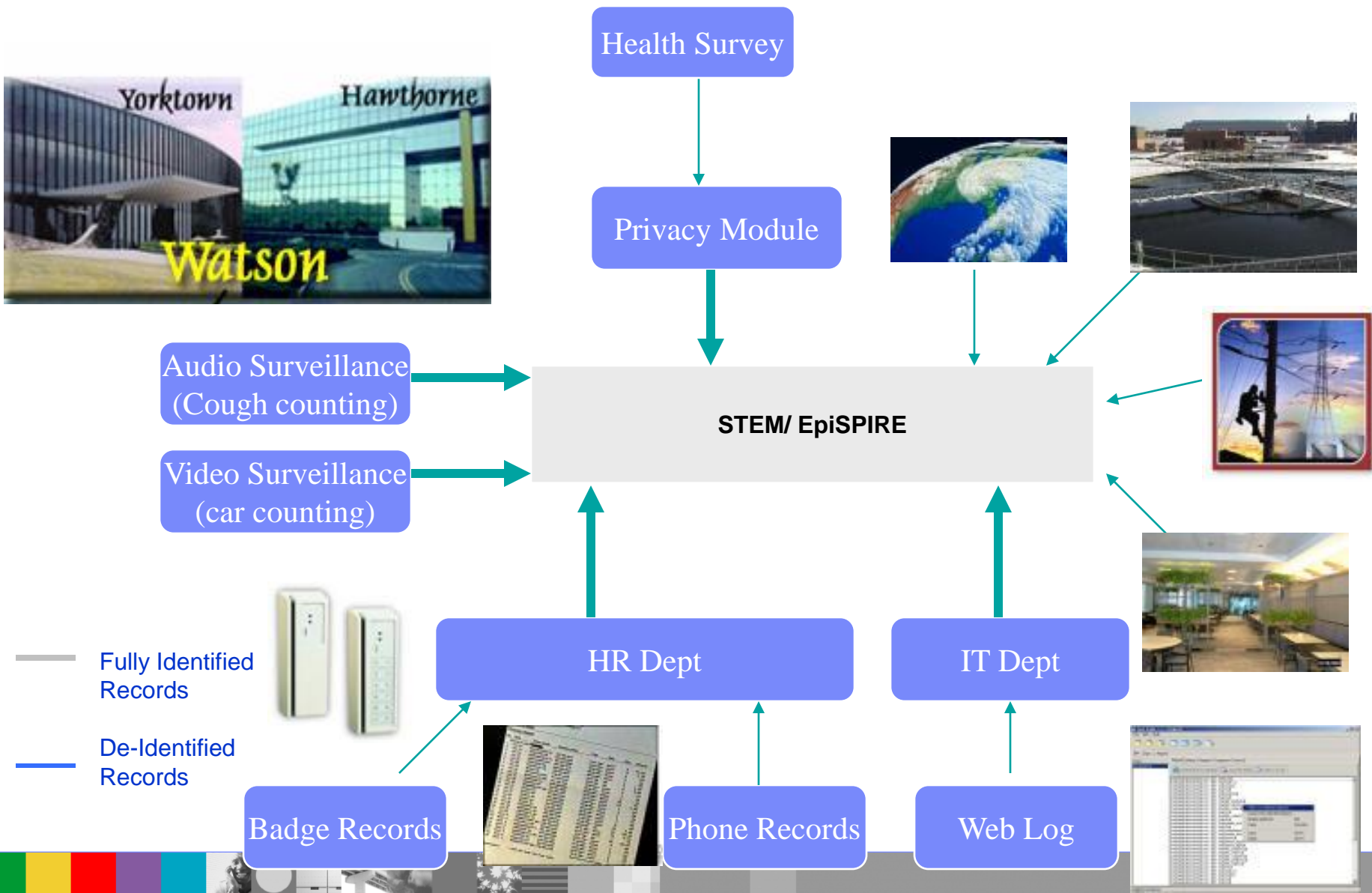
Bayesian net

Deductive



Respiratory

Case Study-Site Specific Data Flow



IBM Research - Main Activities in Health Care

- **Integrated Medical Archive – an Enterprise Medical Information Archive Subsystem**
 - An archiving management infrastructure for all types of medical information and IT systems, including single desktops, service providers and regional archives
 - Standard based – DICOM, HL7, IHE, HIPAA, talks with all PACS, High performance, secure and scaleable
- **Medical Information Integration**
 - A federated solution for correlating all types of medical information, genomic and clinical, providing a virtual warehouse that enables information extraction & mining
 - A must infrastructure in enabling research and mining, advanced services, medical information exchange networks, etc.
- **Content Management for Proteomics**
 - A content management solution to handle the huge data generated by Mass Spectrometers
 - High-throughput algorithms for processing mass spectrometry data with much improved analysis quality
- **m-Health Gateway**
 - A gateway connecting data sources to peripheral devices, addresses issues of provisioning, data reduction, seamless connections...
- **Medical Standards**
 - leading roles in HL7, facilitators of Clinical Genomics SIG

Regional Integrated Archive - Grid

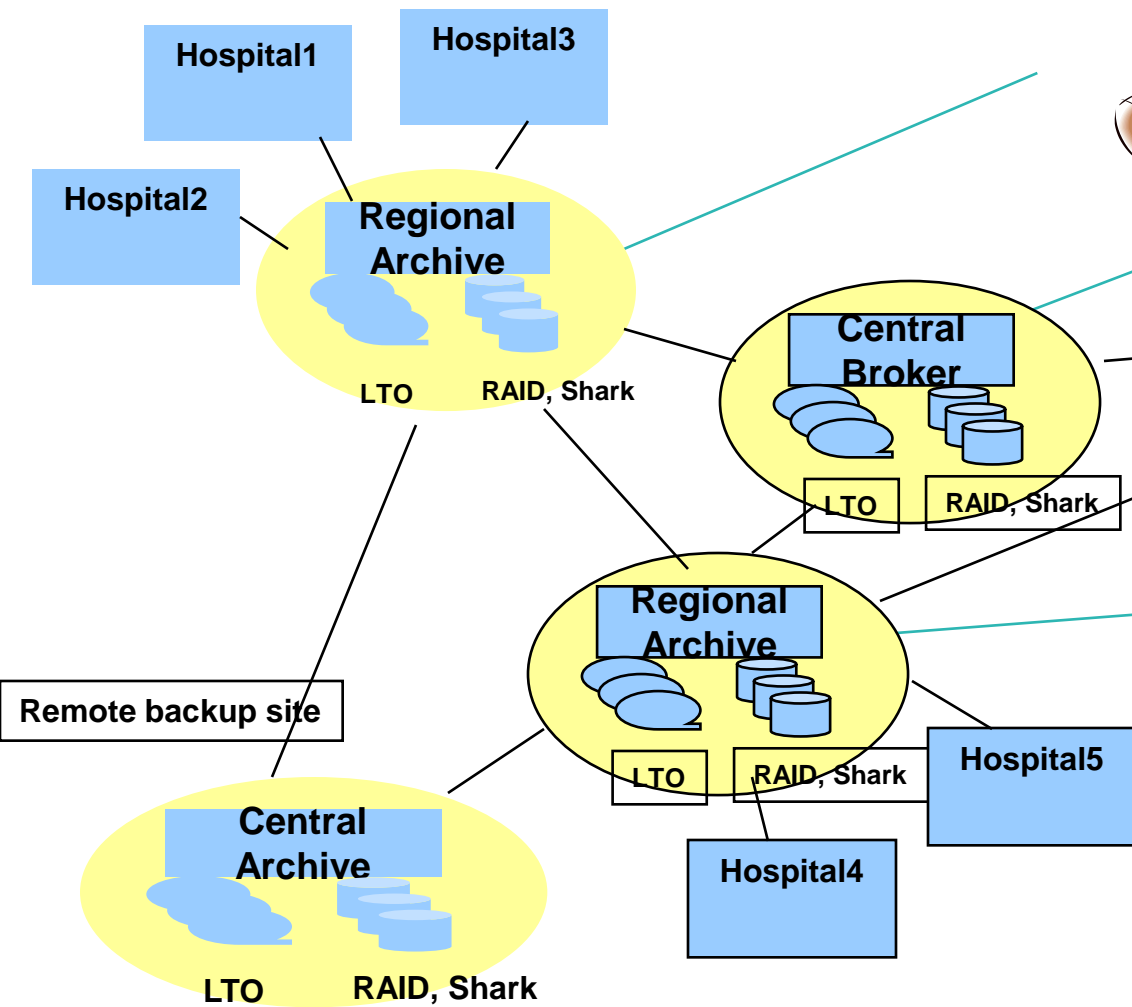
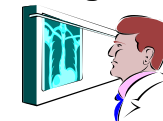
Admin, Monitor, Config,

Researcher



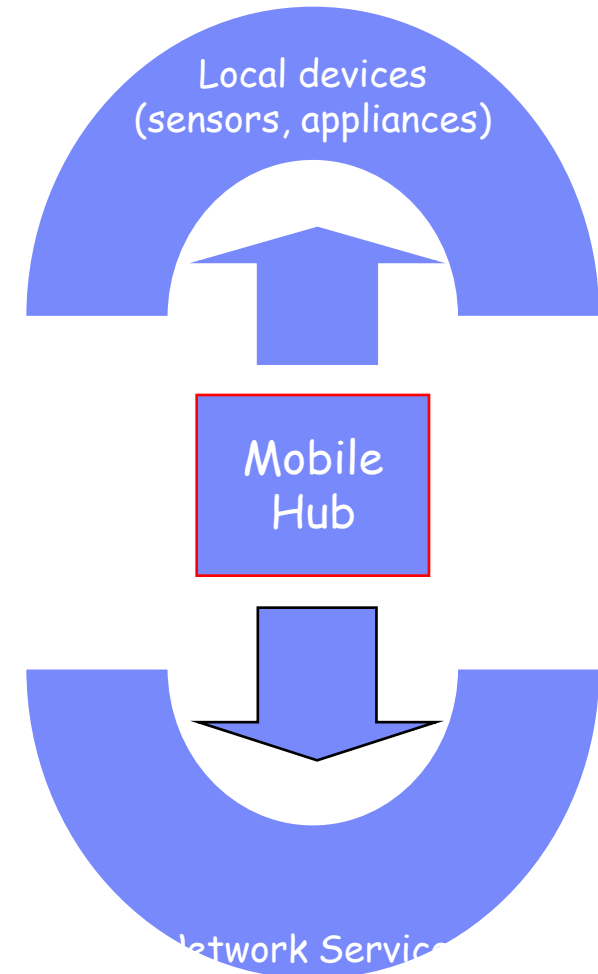
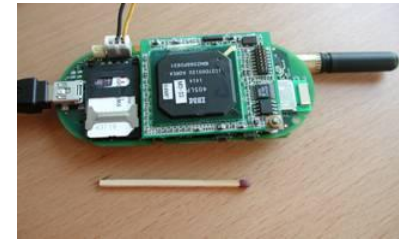
Physician

Radiologist



M-health from IBM

- Monitoring & assisting long term patients
 - (Semi-)automatic sensor data collection
 - Compliance monitoring & alerting of patients/doctors/health professionals
 - Patient “recall” if health deteriorating
 - Emergency assistance
 - Improve quality of life & reduce health care costs
- Open platform for enabling (third party) service provisioning on the mobile device; extending (third party) services to the mobile user
 - Open runtime system (e.g., Linux, Java)
- Mobile Phone: Use mobile phone infrastructure - 2.5G/3G, WLAN, UWB,...
- Simple heart rate monitor developed by 2002Q4
 - Press release (E&TS), NYT article, demonstrated at CeBIT 2003
- Working with Tsinghua University
 - M-Healthcare: a PDA based healthcare solution for doctors to access medical information anywhere in a hospital and get notifications of patient status via SMS (Short Message Services).



Introducing VoiceSites and VoiGen – SPOKEN WEB

A VoiceSite is:

A voice driven application **hosted** in the network and **created by subscribers** themselves

Consists of a set of interconnected **VoicePages** (eg vxml files)

Accessed by calling up the associated phone number and interacting with its underlying application flow through a telephony interface

Analogous to WebSites in the World Wide Web

VoiGen

Is a voice driven generator of voice driven applications

Enables individual phone subscribers to create, deploy and offer their own customized voice driven data services.

Gateway to shared data/voice services

What an Homepage creator is to Websites, VoiGen is to the VoiceSites.