

**Tinjauan aspek Teknologi
dalam peningkatan mutu pelayanan
kesehatan : *Perkembangan e-health
di Indonesia dan didunia***

Tati .R . Mengko

Pusat Teknologi Kesehatan dan Keolahragaan
Teknik Biomedika -Sekolah Teknik Elektro dan Informatika
Institut Teknologi Bandung

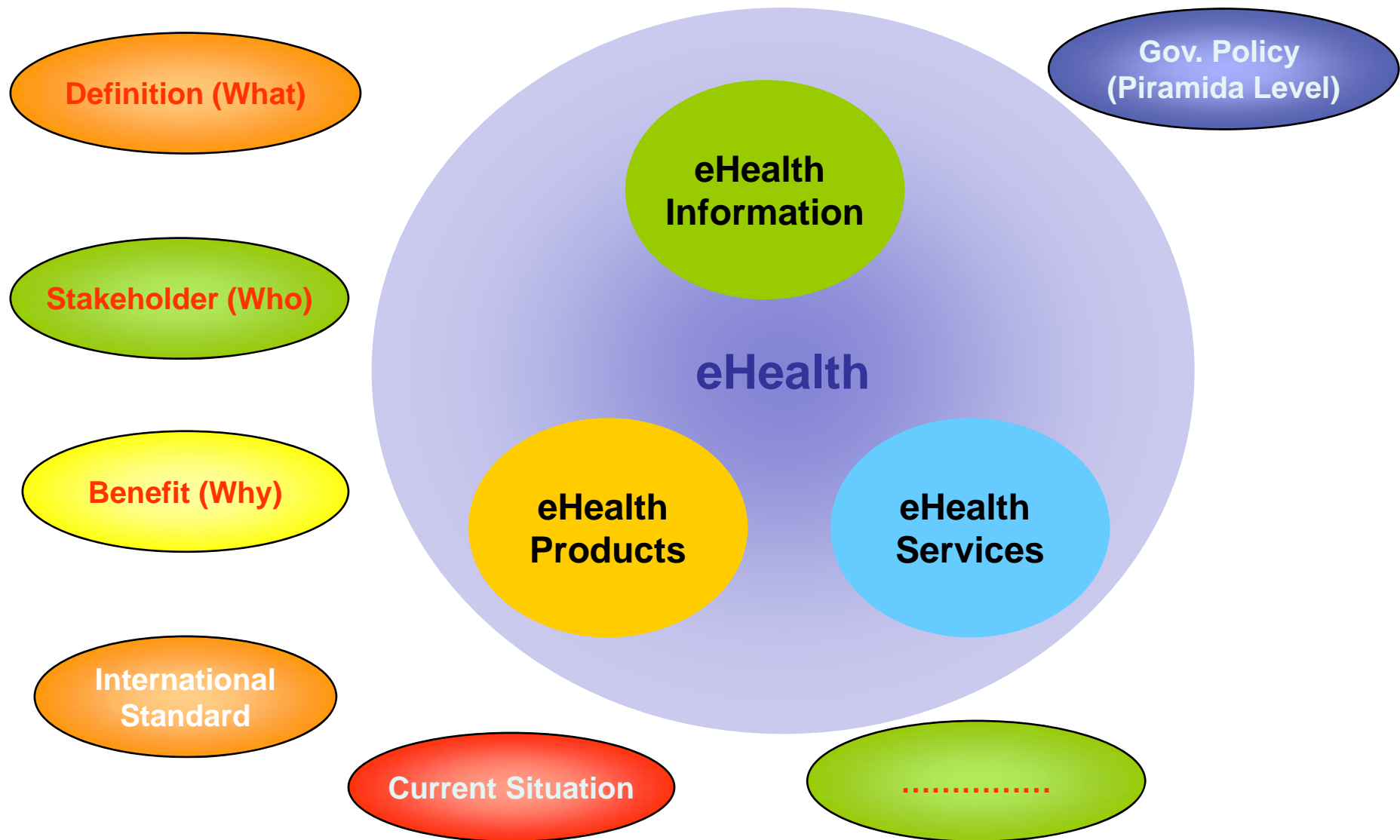
Outline

- E-Health : definition, platform infrastuctur
- Information, products, services, technology
- Current Situation
- Future Planning
- Research activities

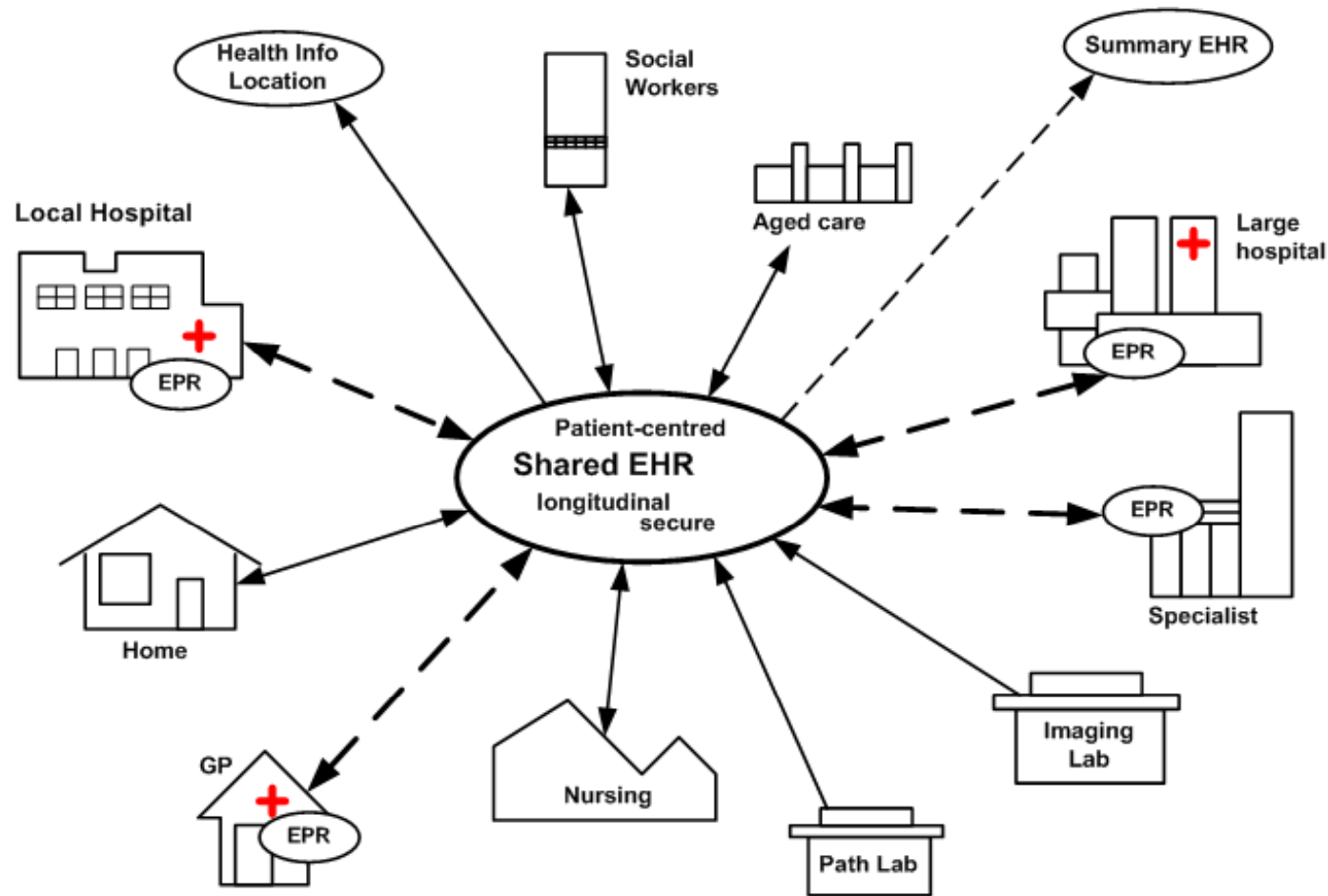
1

E-health : definition , overview

eHealth Components



Future Electronic Health Record

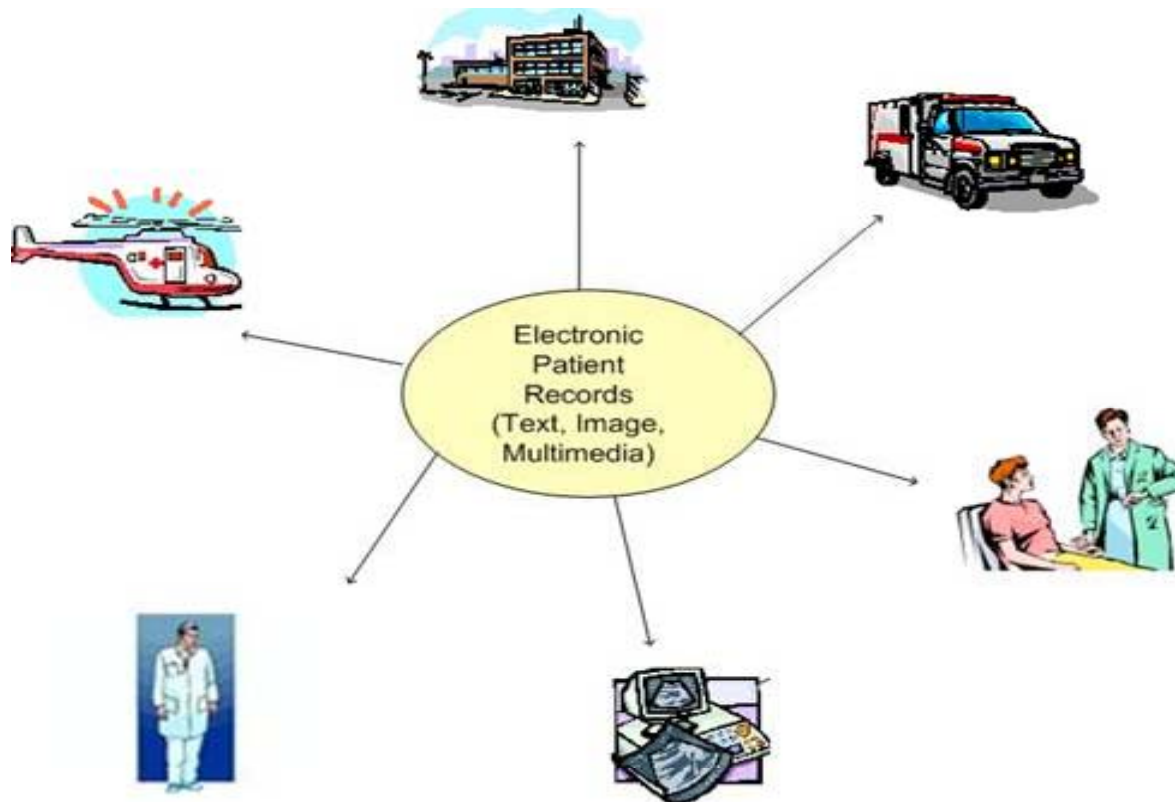


Integrated-longitudinal-and-sharable medical record

Distance Services

Telemedicine

Ubiquitous e-Health Network



Many Medical Devices and Body Sensors are Already Undergoing Wireless Integration

Portable Medical Devices

BP Monitors



Glucometers



ECG Monitors



Peak Flow Meters



Pulse Oximetry Monitors



Body Sensors

Adhesive



Implants



Subcutaneous



Body-Worn



HealthPia – LG Diabetes Phone (Korea, US trials)



VitaPhone (Germany)



The patient takes an ECG by holding phone to chest



The patient is automatically connected to VitaPhone call-center



eHealth - definition

eHealth is an emerging field in the intersection of **medical informatics**, **public health** and **business**, referring to health services and information delivered or enhanced through the **Internet** and related technologies. In a broader sense, the term characterizes not only a technical development, but also a **state-of-mind**, **a way of thinking**, an **attitude**, and a commitment for networked, global thinking, to **improve health care** locally, regionally, and worldwide **by using information and communication technology**

Source: *What is e-health?*, Journal of Med Internet Research 2001;3(2):e20

eHealth - definition

- A systemic review of 358 published definitions for eHealth has been done in 2004
- Associating eHealth with activities such as managing, educating, arranging, connecting, obtaining, providing, redefining, assisting, accessing, supporting
- First def. mentioned improving and increasing the cost effectiveness of health care and making process efficiently
- Second def. solve problems related to access to care, cost, quality, and portability of health care services
- Third def. suggested distance and place no longer remain barrier (telemedicine?)

eHealth - Code of Ethics

- The goal of eHealth Code of Ethics is to ensure that people worldwide can confidently and with full understanding of known risk realize the potential of the internet in **managing their own health** and **the health of those in their care**
- In formulating eHealth code of ethics, it is necessary to envisage the definition of eHealth, the component, and the framework activities

eHealth Information

- It includes information for staying well, preventing and managing disease, and making other decision related to Health and health care
- It includes information for making decision about health product and health services
- It may be in the form of data, text, image, audio, and video
- It may involve enhancements through programming and interactivity

eHealth Products

- Include drugs, medical devices and other goods used to diagnose and treat illness or injuries or to maintain health
- Some must be approved by regulator

eHealth Services

- Includes specific, **personal medical care** or advice, **management of medical records**, **communication between health care provider and/or patient** and health plans or insurers, or health care facilities regarding treatment decisions, claim, billing for services
- It may be in the form of data, text, image, audio, and video
- It may involve enhancements through programming and interactivity

eHealth Guiding Principles

- Candor
- Honesty
- Quality
- Informed Consent
- Privacy
- Professionalism in Online Health Care
- Responsible Partnering
- Accountability

eHealth Stakeholders

- **Provider of care**

Physicians, hospital, nursing home, rehabilitation center

- **Influencer**

IDI, YLKI

- **Policymakers**

Government

- **Consumers**

Patient, family member, caregivers, clinician

- **Provider of infrastructure**

developer, manufacturer of electronics and telecommunication system

Kolaborasi Bersama (stake holder)

DEPKOMINFO

REGULATOR

DEPKES

SIKNAS ONLINE

IDI

LAYANAN ANGGOTA UNTUK SERTIFIKASI

ASPILUKI

Aplikasi RS Daerah, bersama ARSADA
Supply Chain Management (Hulu-hilir)

TELKOMGroup

IT S, Payment Swith

ARSADA

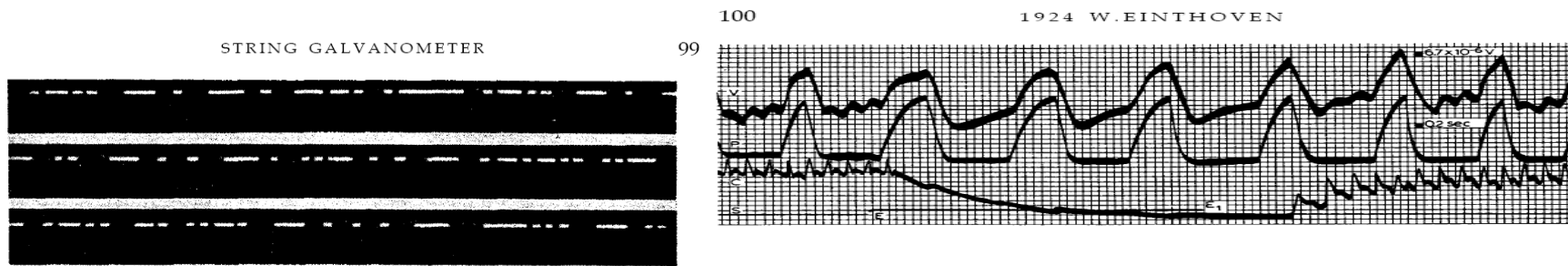
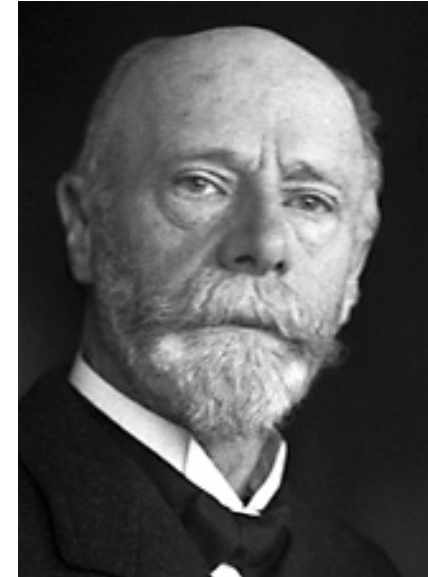
Info RS untuk layanan
masyarakat

Telemedicine - definition

- Application of electronics, telecommunication, information & computer technology (in Biomedical Engineering)
 - To transfer medical information from one site to another
 - To support medical personnel in conducting the Medical Procedures, community healthcare & Education
- Ultimate Goal: to improve the quality of life through existing technology

The Earliest Telemedicine Ever Record in Indonesia

- The earliest telemedicine activities ever record in Indonesia is done at the year 1927 by Willem Einthoven
- 1924 Medicine Nobel Laureate
- The activity is to send and ECG (electrocardiograph) signal from Bandung to Leiden (about 12.000 km)



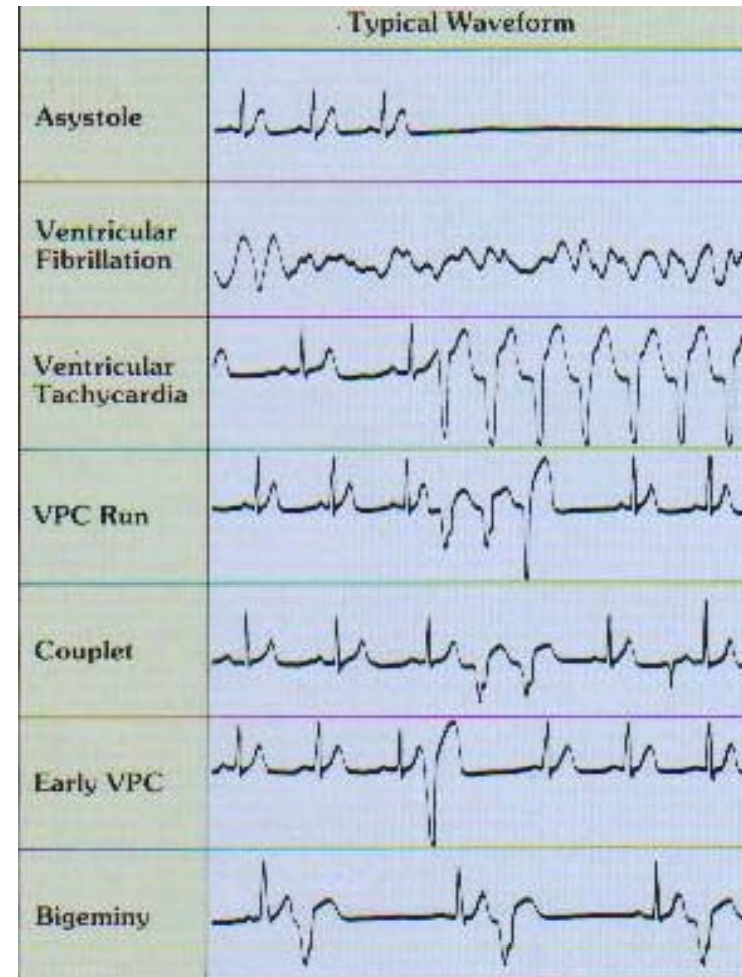
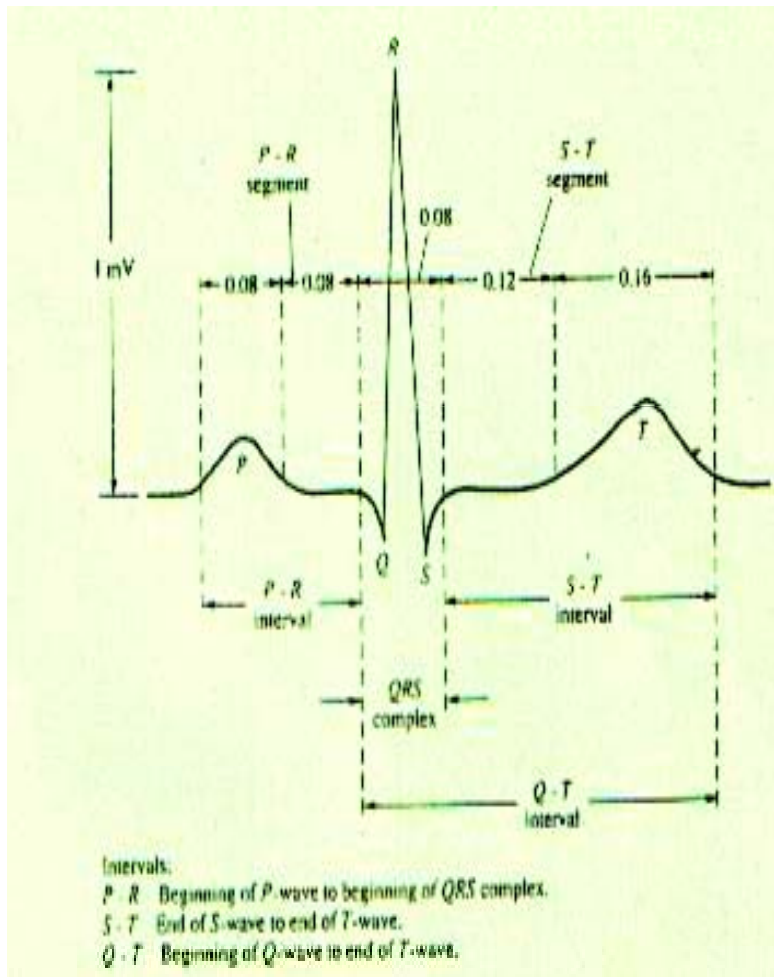
String-galvanometer recording made in Leiden of wireless signals from Bandoeng Netherlands Indies

Medical Information

- Medical information:
 - Text (alphanumeric), e.g.: patient records
 - Physiological signals, e.g.: ECG, EEG, EMG signals
 - Medical images & Biometrics features
 - static images, e.g. X-ray thorax images, X-ray bone images; biometric features, e.g. fingerprint/irisprit...
 - dynamic images, e.g. USG dynamic heart images
 - Sound, e.g. heart sound & Voice
 - Combination of the above information

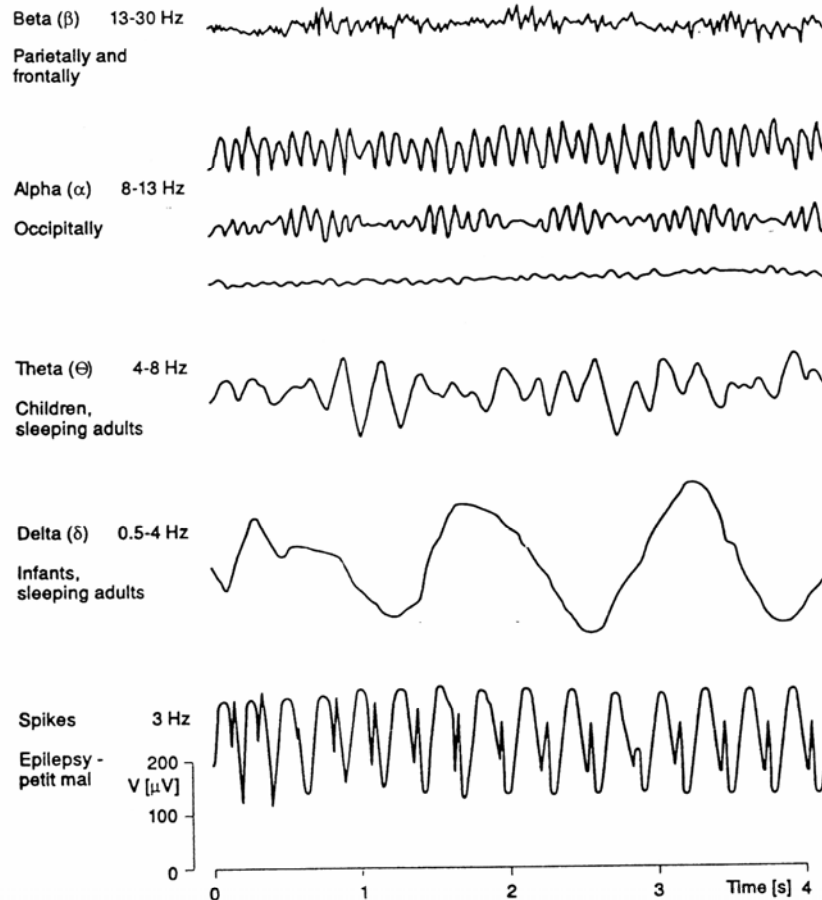
Examples of Physiological Signals

- Physiological signals, e.g.: [Electrocardiogram](#)



Examples of Physiological Signals

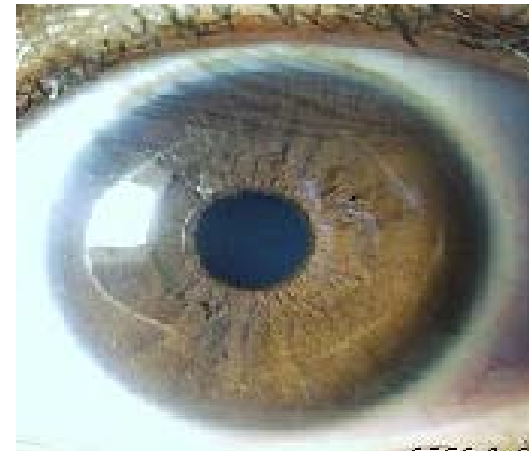
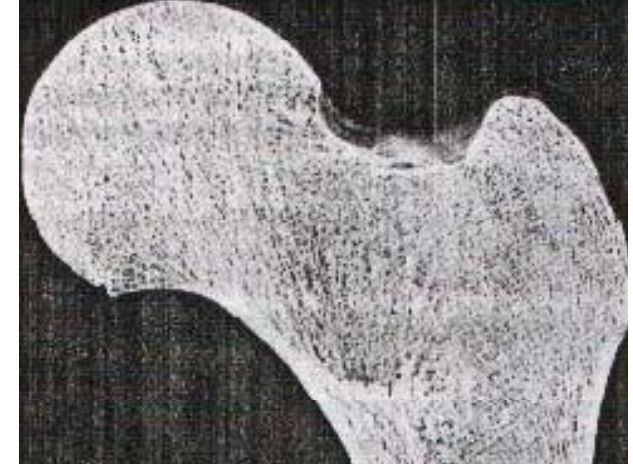
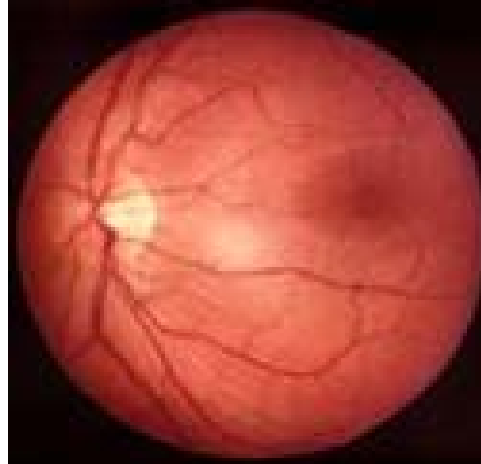
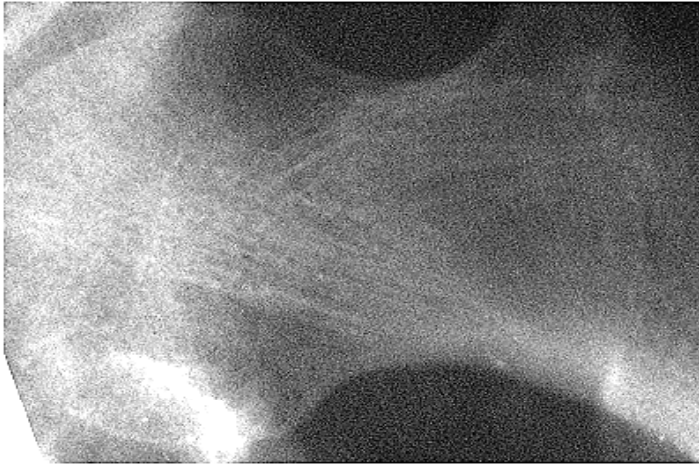
- Physiological signals, e.g.: **Electro-encephalogram**



γ Gamma (22 - 30 Hz & higher)
 β Beta (13 - 22 Hz)
 α Alpha (8 - 13 Hz)
 θ Theta (4 - 13 Hz)
 δ Delta (0,5 - 4 Hz) **Deep sleep**
Spikes
Epilepsy - *Petit mal*

Examples of Medical Images

- Static images, e.g.: X-ray image, thorax X-ray image, retina & iris patterns



Medical Standar

- Medical record and messaging standard? (HL7v3/HL7 Messaging, CEN, ISO)
- Disease classification standard? (ICDx)
- PACS (Picture Archiving and Communication System)?

National standard which has a capability to exchange data with another international standard is needed !

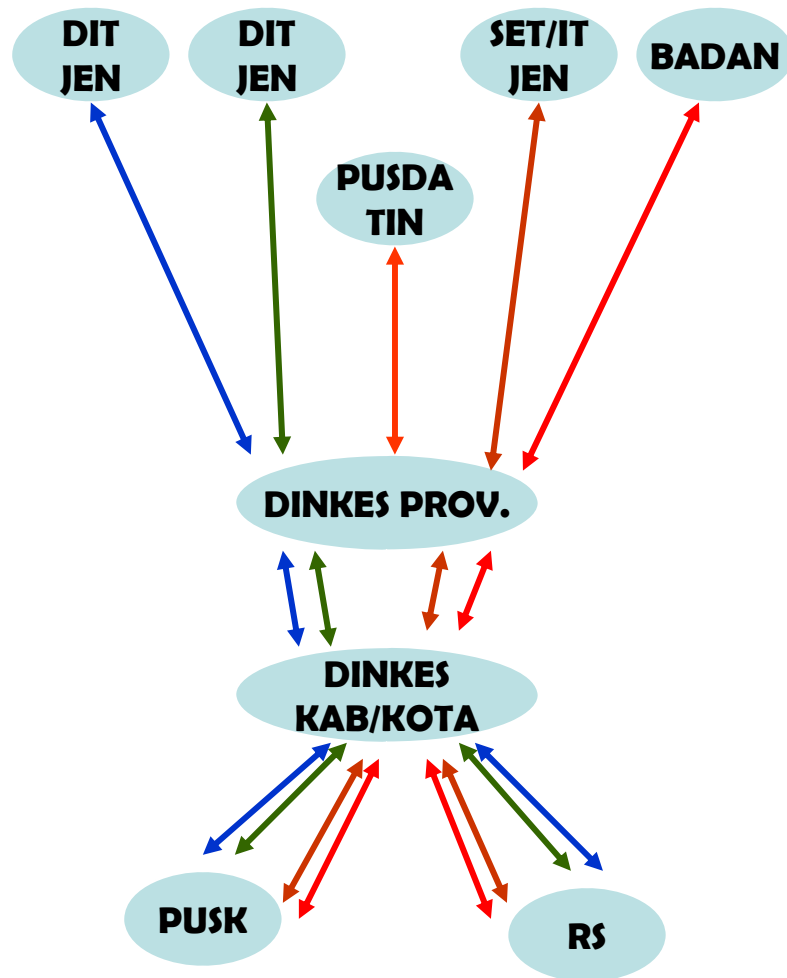
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Current Situation in Indonesia

Government Regulations

- Kepmenkes No. 511 Tahun 2002 Kebijakan dan Strategi Sistem Kesehatan Nasional
- Kepmenkes No. 932 Tahun 2002 Juklak Pengembangan Sistem Kesehatan Daerah di Kabupaten/Kota

Komunikasi Data Terfragmentasi



- Data yang dikirimkan ke tingkat di atasnya memiliki format yang berbeda-beda
- Munculnya peluang perbedaan data pada berbagai tingkat kelembagaan
- Sulit melihat gambaran kesehatan nasional secara keseluruhan

Sumber: Bambang Hartono, *Pengembangan Jaringan Komputer Online Sistem Informasi Kesehatan Nasional*, 2007, Pusdatin, www.depkes.go.id

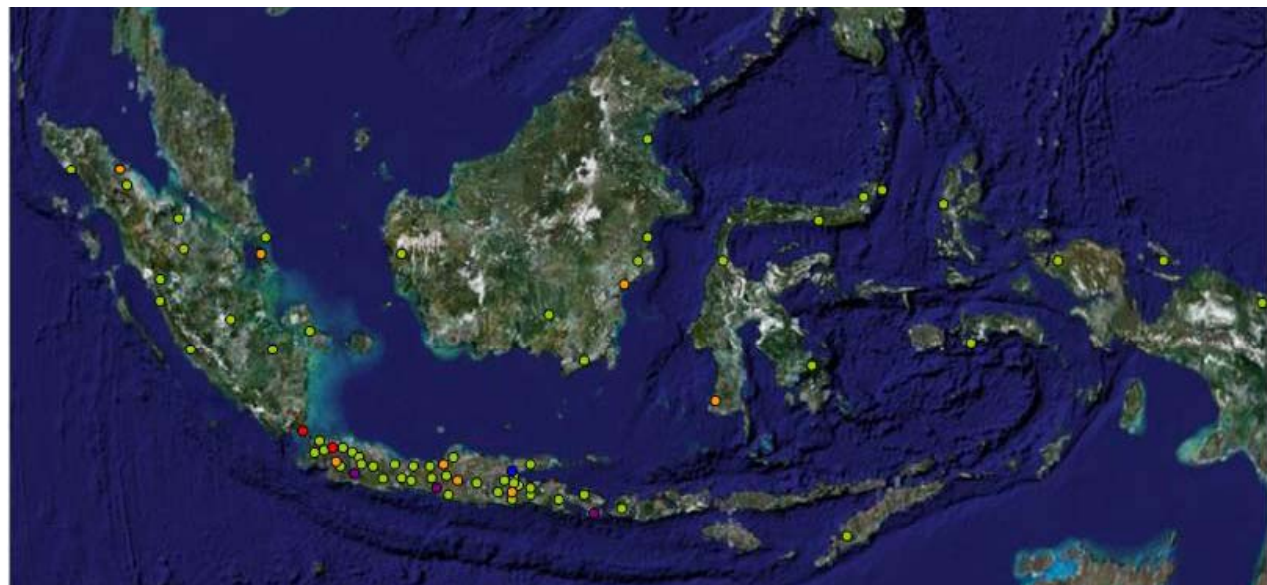
Existing Telecommunication Infrastructure



Fiber Optic Network connecting Sumatera, Jawa, Kalimantan and Sulawesi. The rest are relied on satellite network. Focused for business purpose

Internet Service Provider (ISP) across Indonesia were still focused in Java island

Source: APJII



Pendayagunaan Teknologi Informasi dan Komunikasi unt Komunikasi Data



MASYARAKAT



UNIT2 DI
DEPKES



PUSDATIN

BANK
DATA

INTRANET &
INTERNET
CLOUD ???



DINKES
PROV

BANK
DATA

BANK
DATA



PUSKESMAS

BANK
DATA



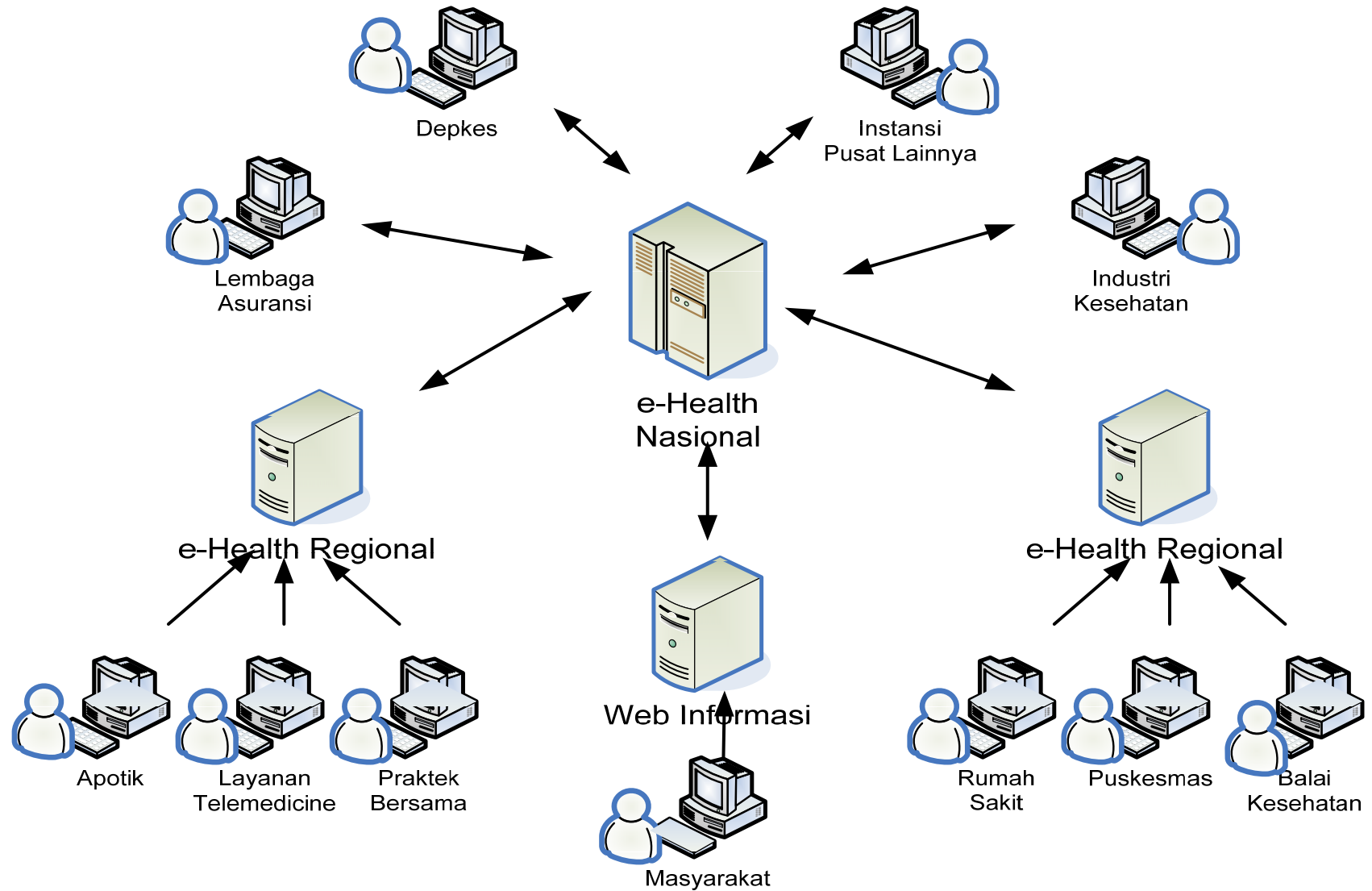
DINKES
KAB/KOTA



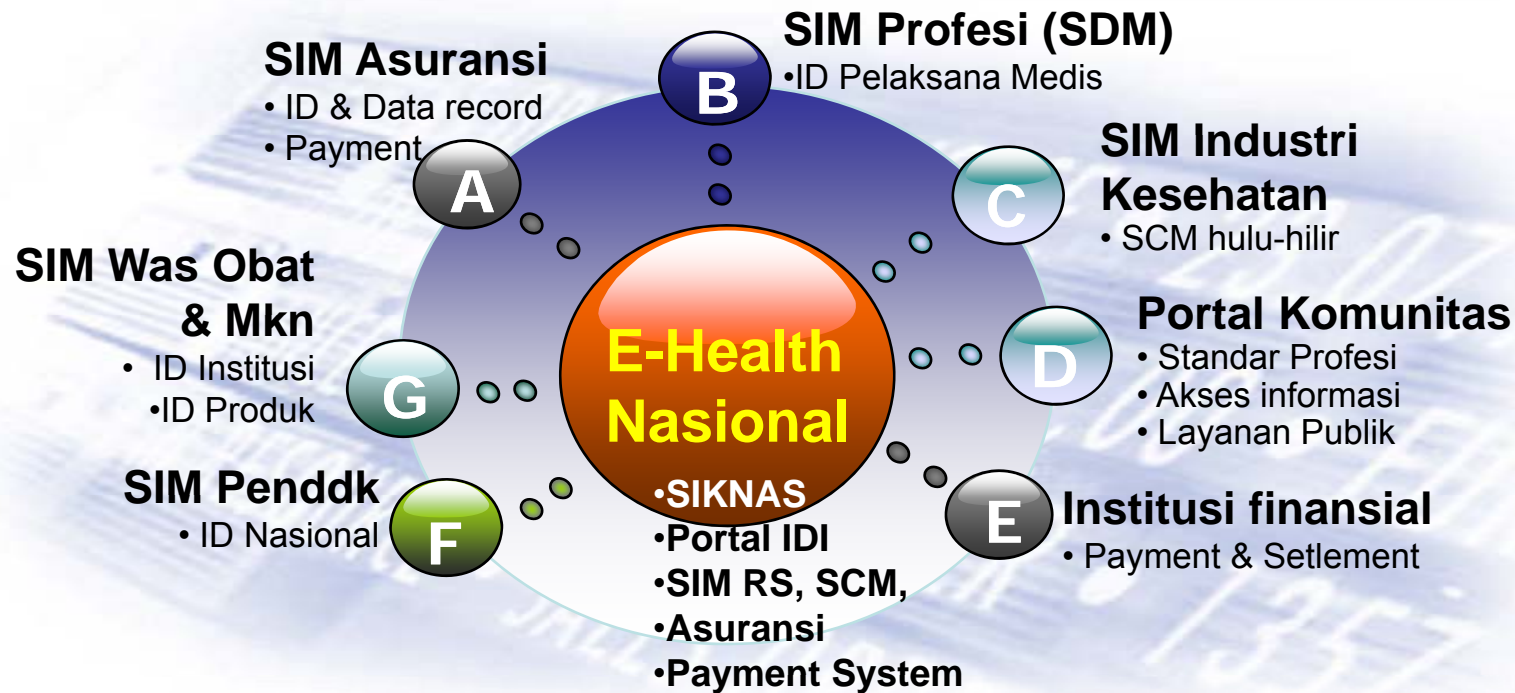
BANK
DATA

RUMAH SAKIT

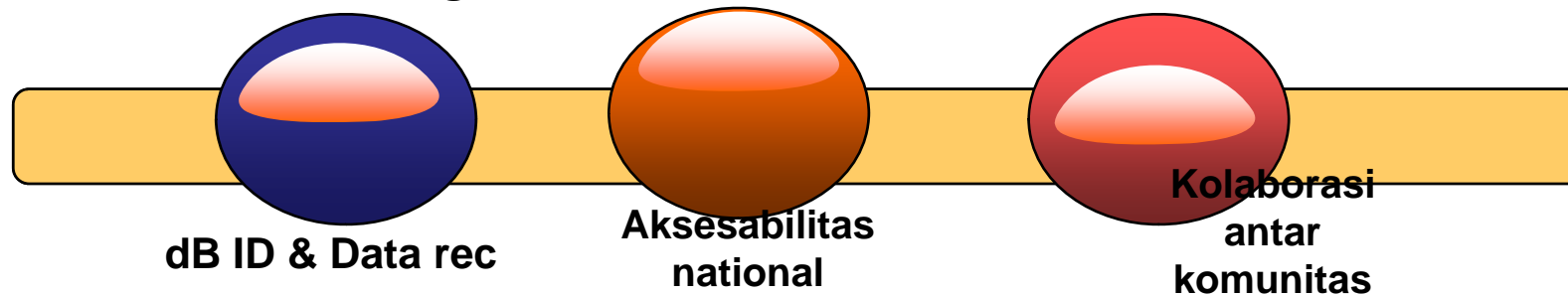
Arsitektur Antar Domain



Integrasi E-health dengan SIM lain



Pilar Utama Integrasi E-health



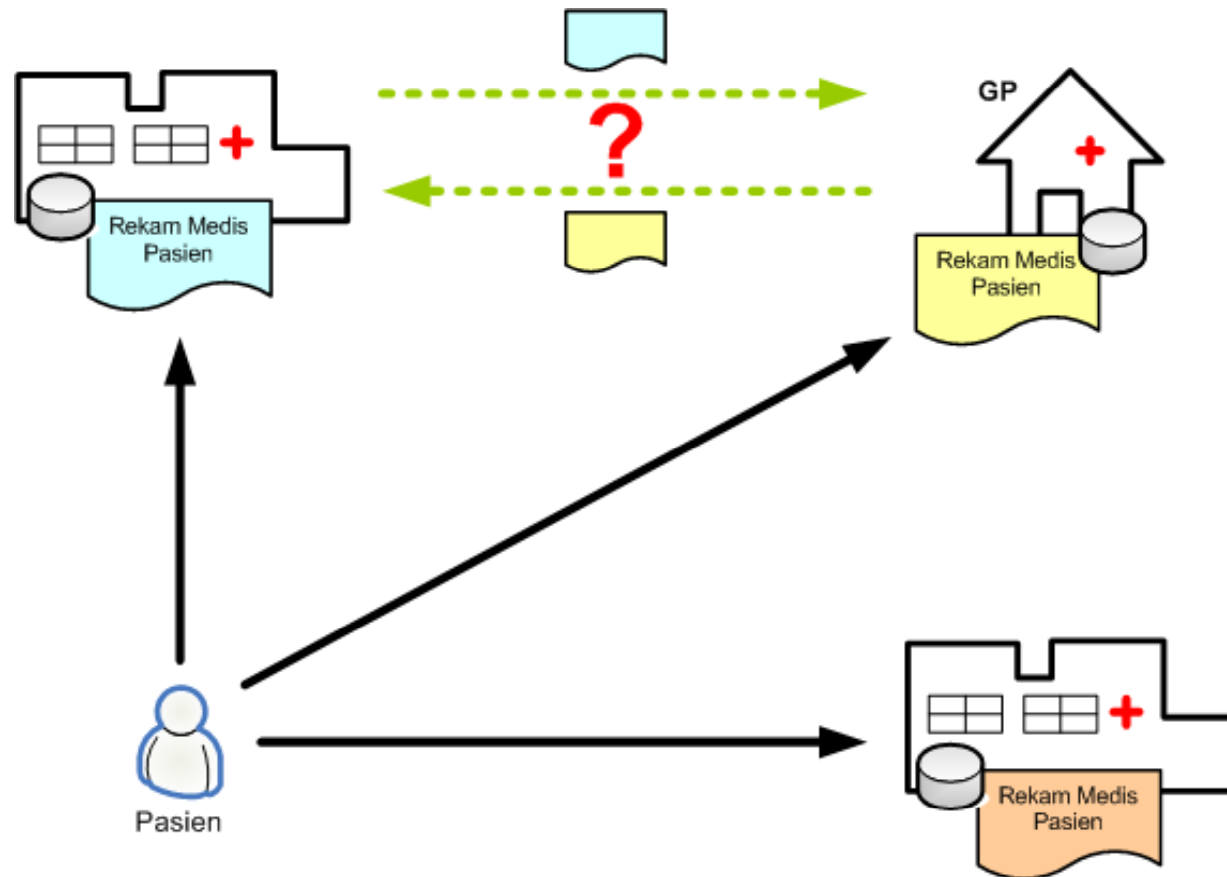
Sistem eHealth yang diharapkan

- Harus mencakup *eHealth guiding principles* dan ditambah beberapa prinsip lain yaitu: accesibility, availibility, reliability, affordibility, acceptibility
- Penggunaan **standar medis** untuk rekam medis dan pertukaran data di lingkungan nasional/internasional
- Berada pada infrastruktur jaringan nasional yang baik (reliable)
- Kebijakan dari pemerintah untuk mendukung eHealth dan aktivitas penelitian yang mendukung eHealth
- pentarifan khusus bagi menggunakan jasa telekomunikasi untuk kegiatan eHealth, terutama akses komunikasi satelit

Kondisi saat ini

- Belum terdapat rekam medis personal yang bersifat longitudinal (mencatat riwayat kesehatan dari lahir hingga mati) secara terintegrasi
- Layanan kesehatan masyarakat belum dicatatkan dalam sebuah rekam medis elektronik
- Program pemerintah: *menuju Indonesia sehat 2010*

Data Fragmentation on Medical Record

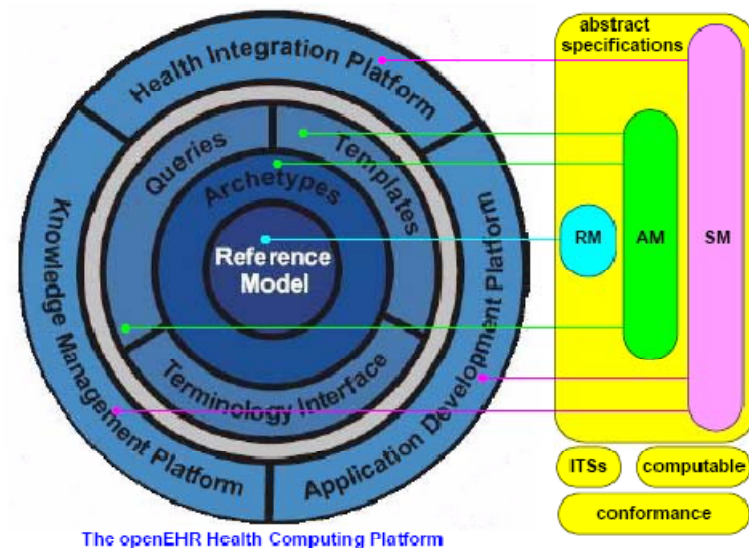


Solusi Yang Diusulkan

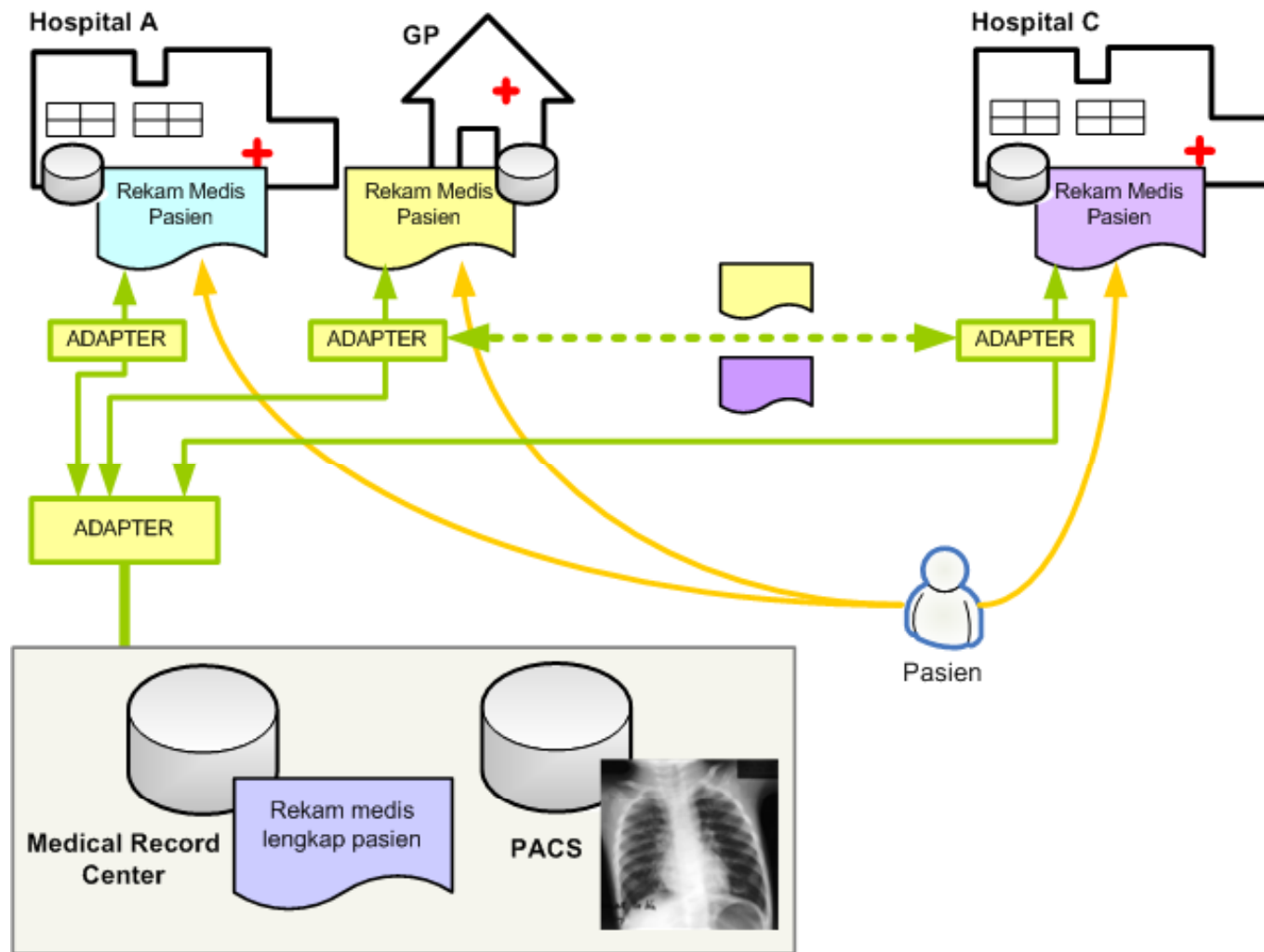
- Implementasi rekam medis terpusat dan terintegrasi berbasis standar terbuka, yaitu openEHR
- Pengembangan sistem informasi kesehatan masyarakat yang bermuara pada **rekam medis**

openEHR

- OpenEHR memanfaatkan TIK untuk mendukung *healthcare* secara efektif
- Merepresentasikan semantik yang mensyaratkan knowledge-oriented computing framework → arti yang kompleks dapat **direpresentasikan dan digunakan bersama (*sharable*)**
- *Adaptable health computing system*
- *Patient-centric electronic health record*



Rekam Medis Terintegrasi



Server Pusat/Nasional

ASPEK BISNIS : e-Commerce

- Kerjasama kemitraan dalam pemanfaatan contente-Health: Telkom/Finnet – ASPILUKI- vendor content – pengelola bisnis – bank
- Public Domain: portal e-Health – Info Sehat – Info Dokter, RS, pendaftaran Pasien via internet, ponsel, ATM (e-payment), penerapan teknologi BREW pada ponsel
- Emergency call (EMS 119) Pelayanan on line 24 jam untuk kasus kegawat-daruratan (medical guide/ info & ambulatory)
- Pengembangan Asuransi Kesehatan, Medical Audit (AMO)

Manfaat Penelitian e-Health

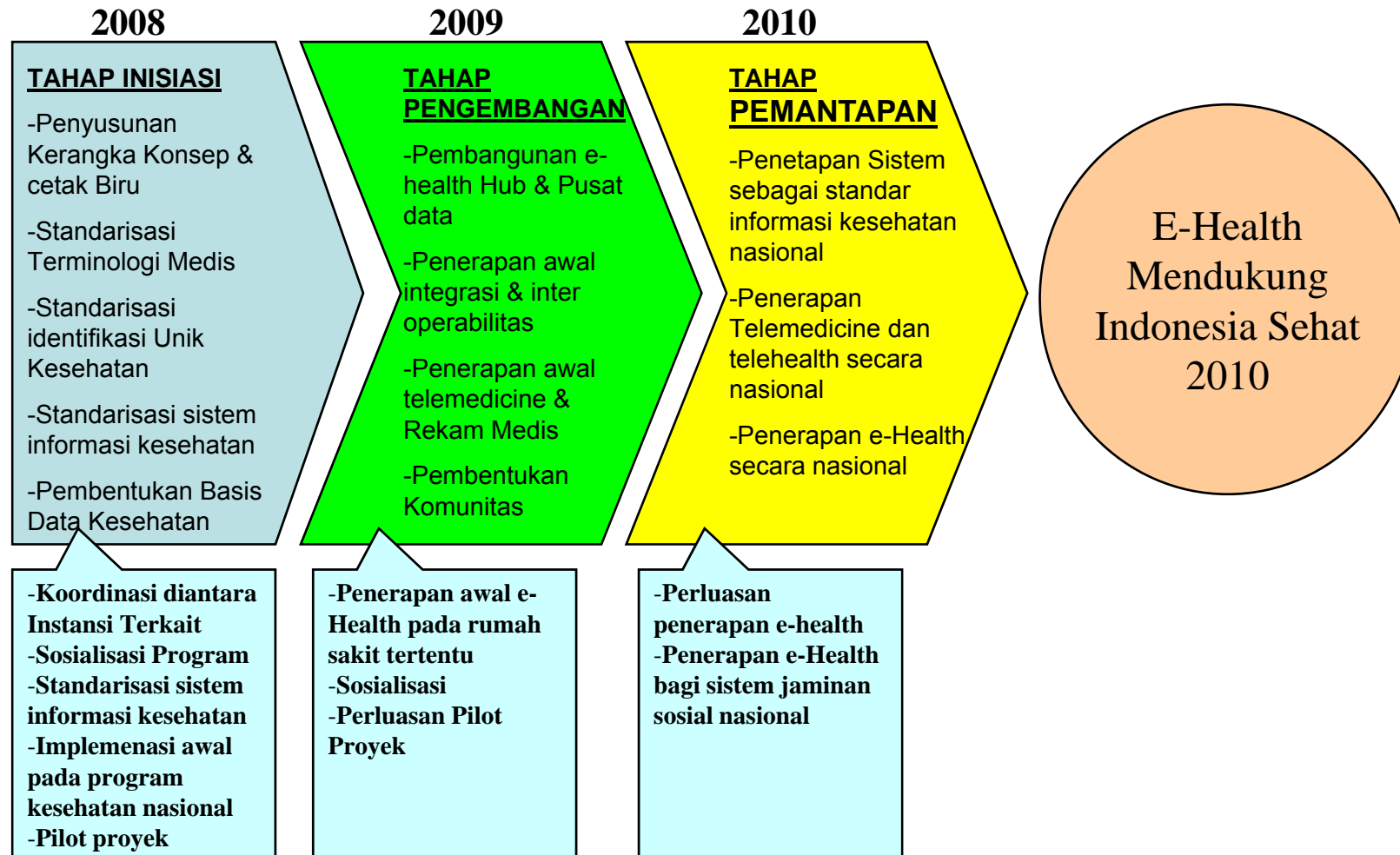
- **Manfaat untuk masyarakat:** memiliki riwayat kesehatan yang lengkap dan mendapatkan informasi kesehatan dengan mudah
- **Manfaat untuk lembaga kesehatan:** data statistik, peningkatan pelayanan masyarakat, dan kredibilitas
- **Manfaat untuk pemerintah:**
 - mendapatkan data yang lengkap untuk menghasilkan data statistik yang lebih akurat (menunjang pengambilan keputusan)
 - Deteksi KLB dapat dilakukan dengan cepat

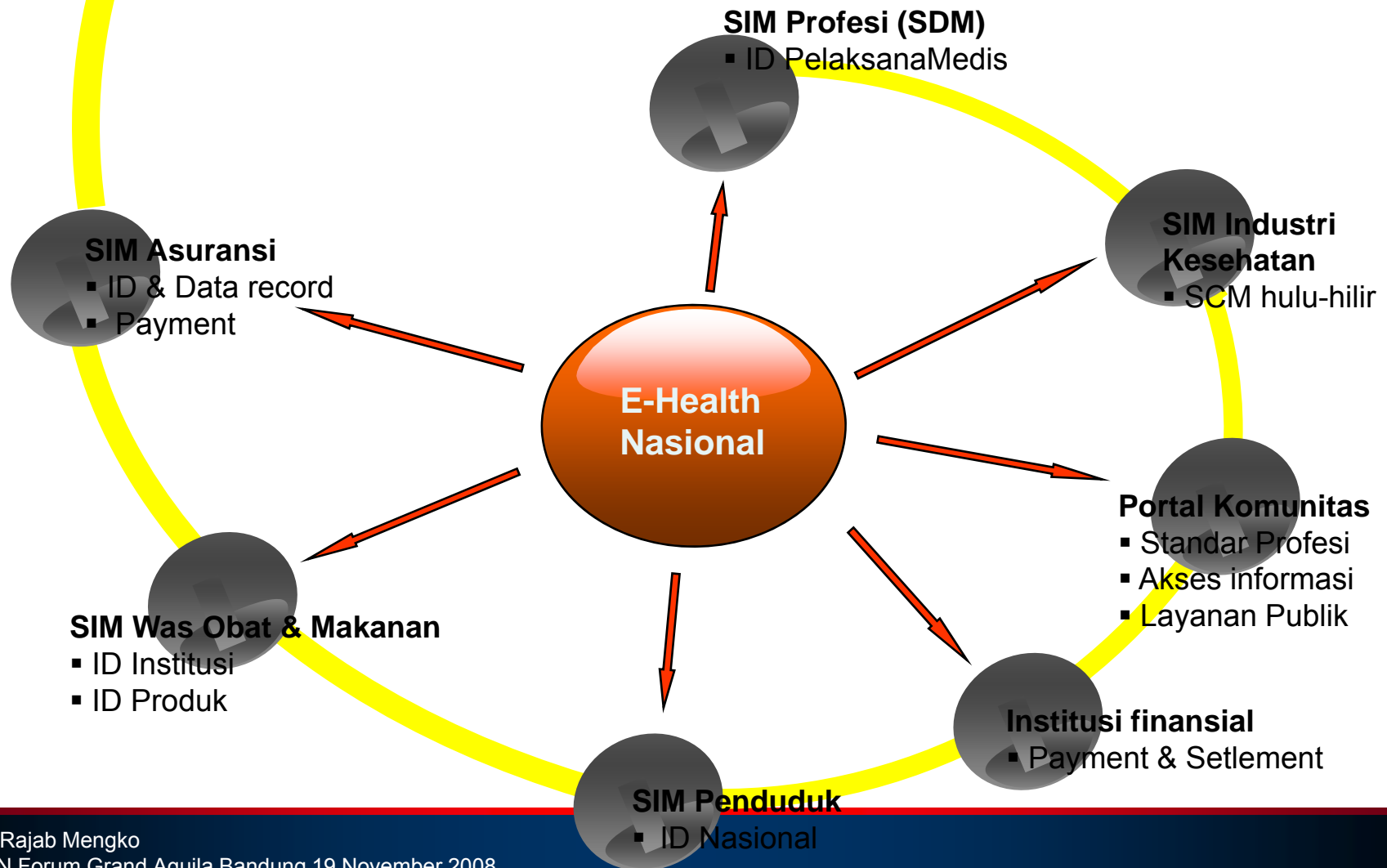
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National Health Information System : *Future Plan*

Road Map Menuju e-Health

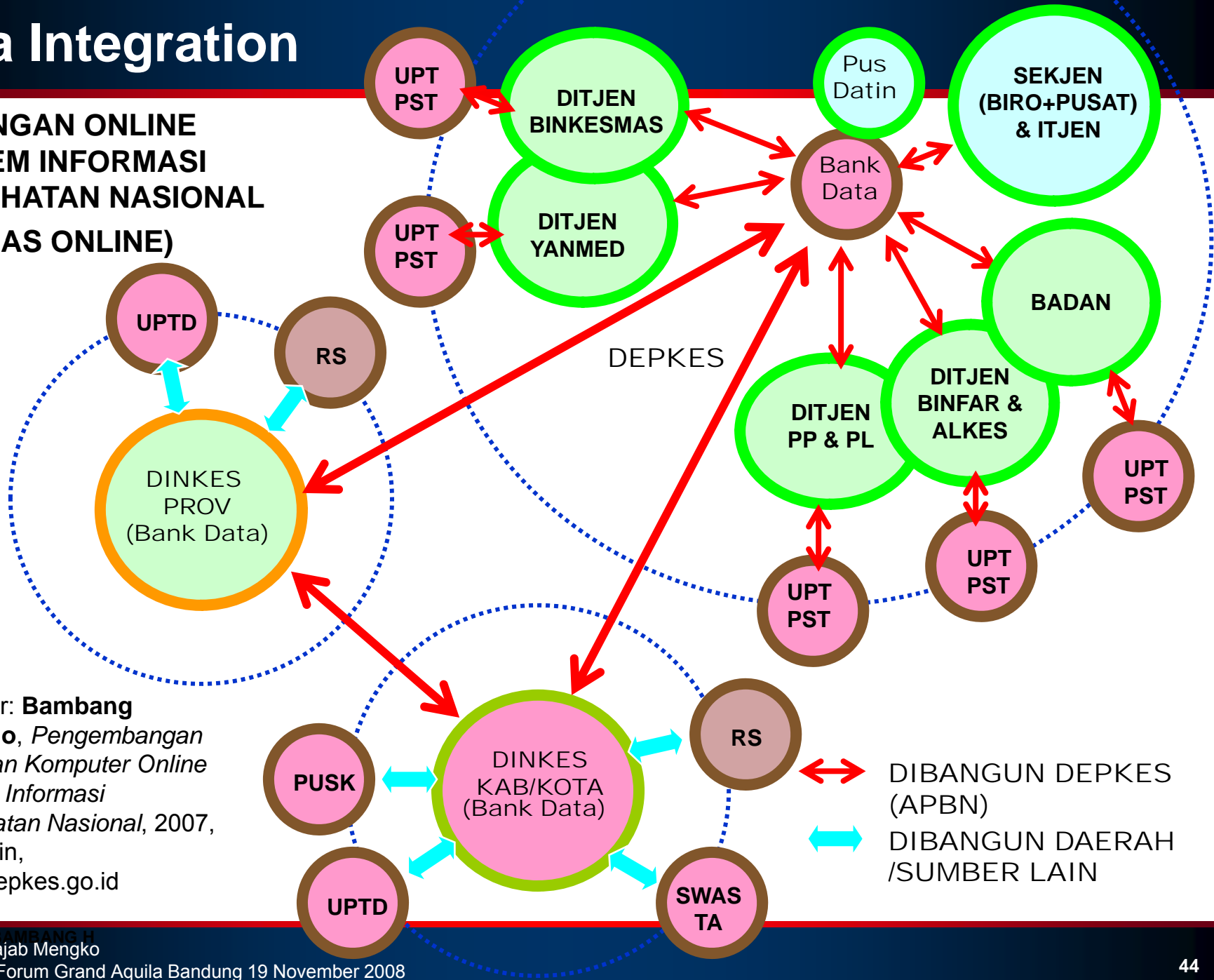
(dari blueprint rencana Depkes)





Data Integration

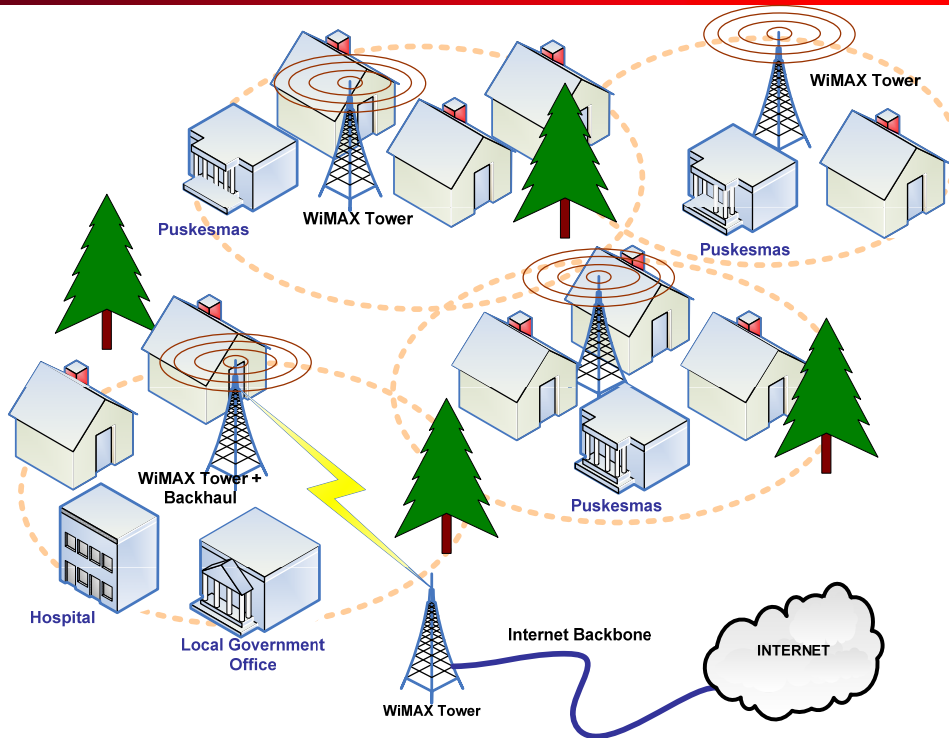
JARINGAN ONLINE
SISTEM INFORMASI
KESEHATAN NASIONAL
(SIKNAS ONLINE)



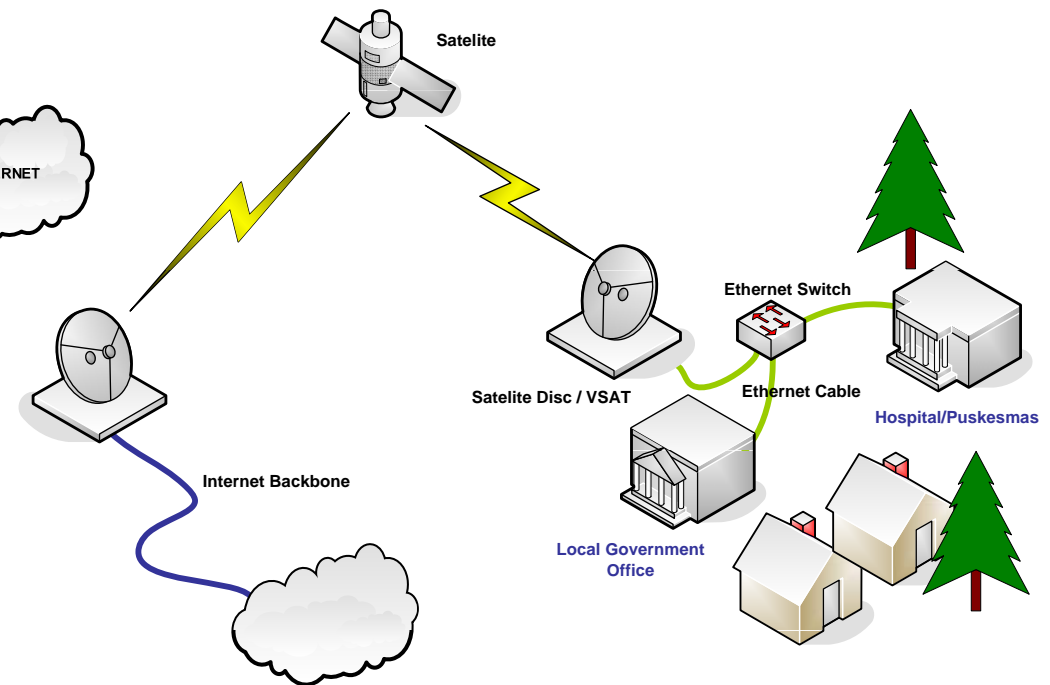
Sumber: **Bambang Hartono**, *Pengembangan Jaringan Komputer Online Sistem Informasi Kesehatan Nasional*, 2007, Pusdatin, www.depkes.go.id

Rural Network Infrastructure

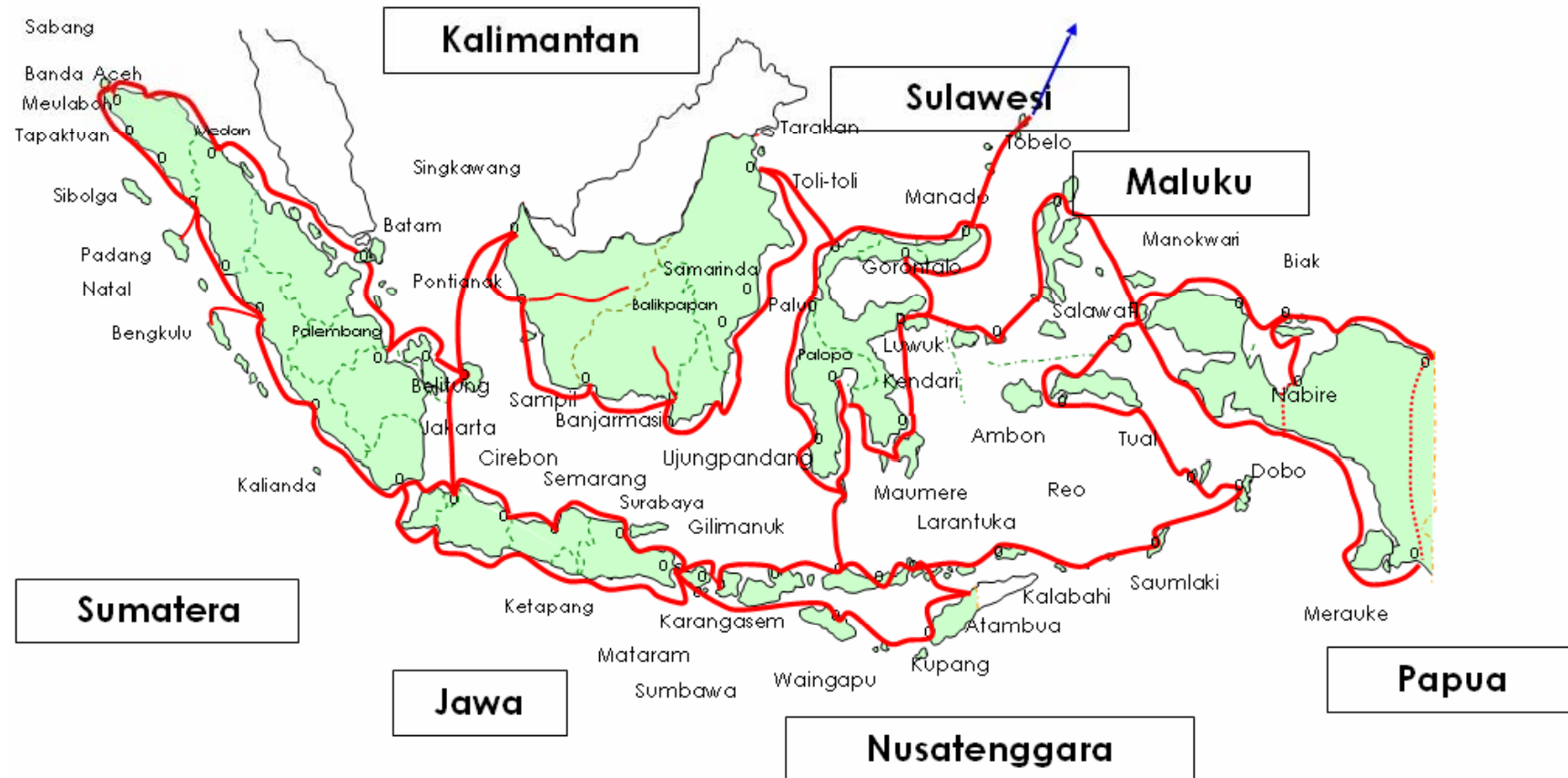
Can be reached by radio communication, such as WiMax and cellular technology



Very remote area, using satellite communication



Future National Network Infrastructure



Palapa Ring Project : Connecting every big city in Indonesia by means of wide bandwidth **fiber optics**

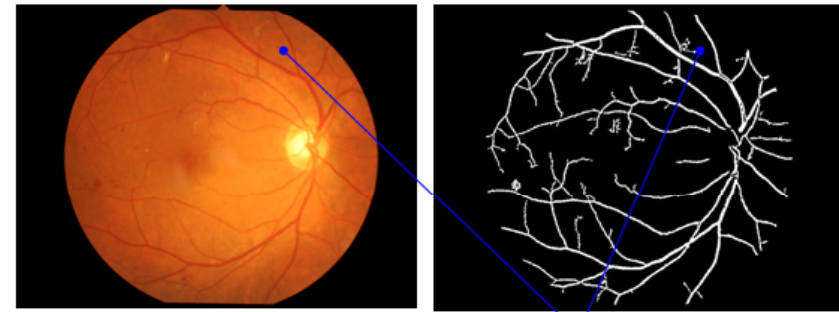
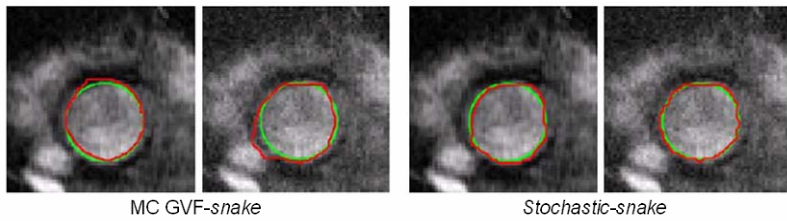
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E-Health related Research Activities in Biomedical Engineering -ITB

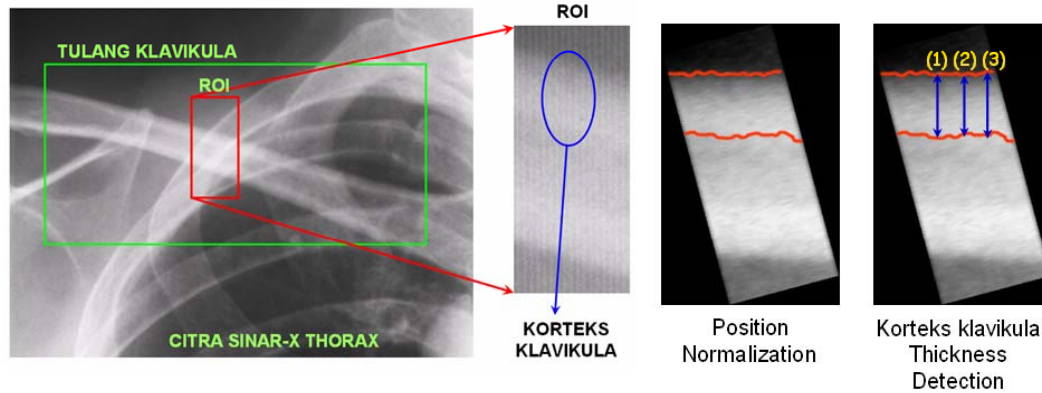
Research Activities (done in BME – STEI ITB)

- eHealth Medical Informatics
 - Open e-Health Record
 - Mobile telemedicine
 - Safe Motherhood
 - Disaster Mitigation Management System
 - Primary Healthcare
 - Telehomecare monitoring
- Application and Digital Content
 - Blood Vessel Segmentation
 - Ultrasound Tomography Imaging System
 - Early Detection for Osteoporosis & Osteoarthritis
 - Diabetic Retinopathy early detection
 - Medical Image Compression
 - Video Communication for Teleophthalmology
- eLearning for Medical Education /Information
 - Pengajaran ANFIS di Universitas Udayana
 - Informasi Kesehatan Puskesmas

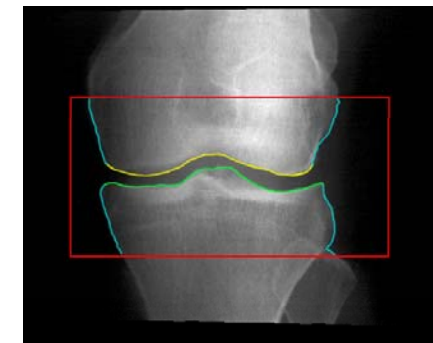
Research Results (example)



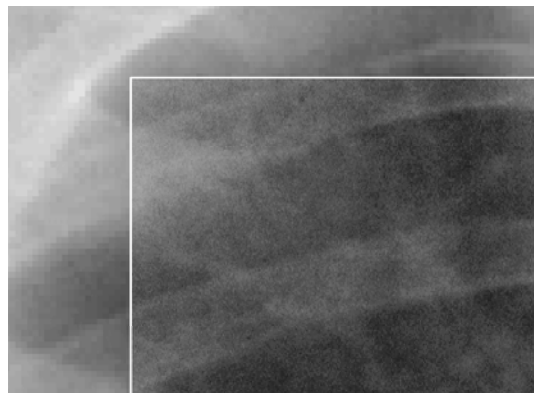
Osteoporosis Early Detection



Osteoarthritis Early Detection



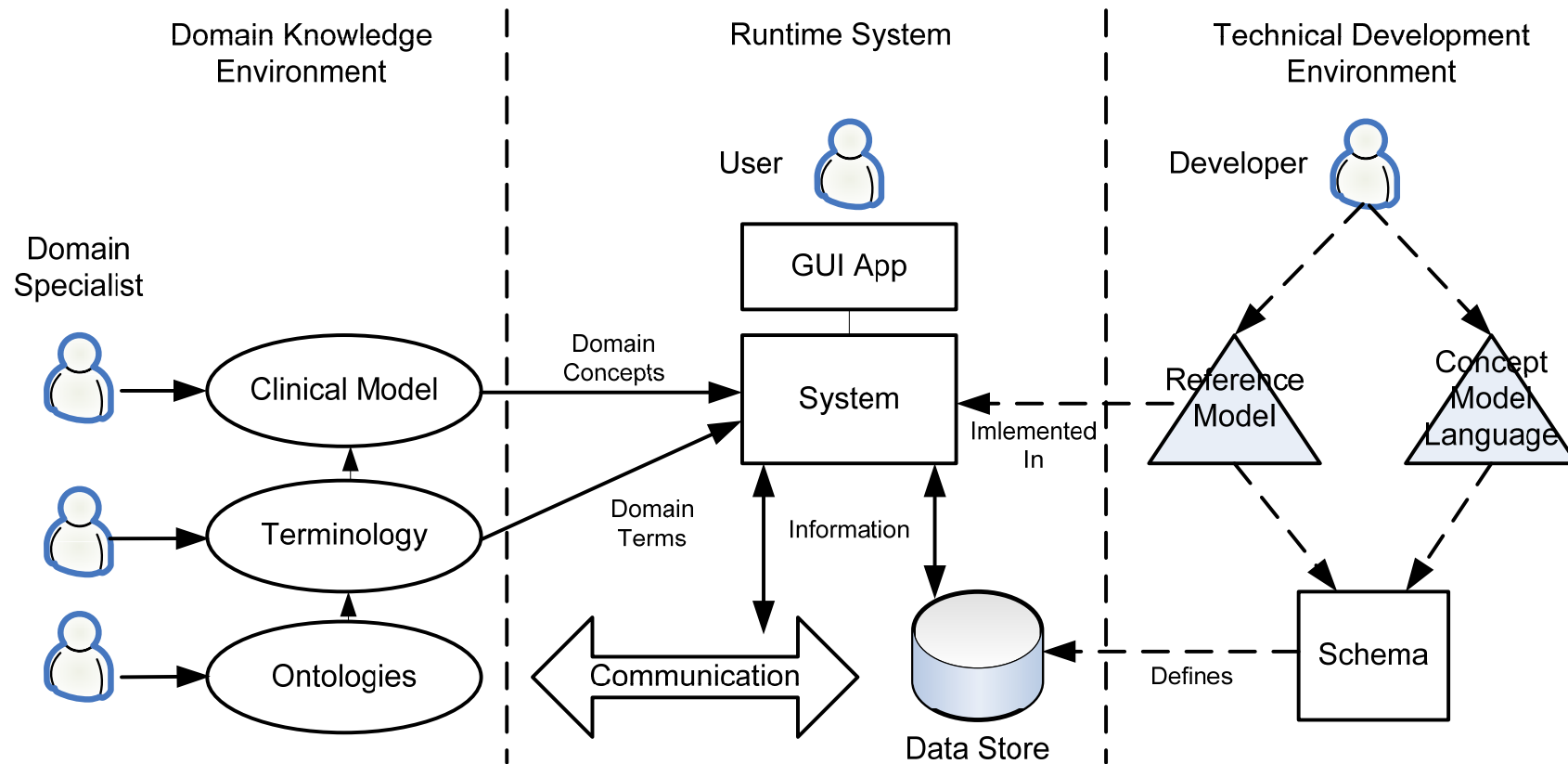
Medical Image Compression



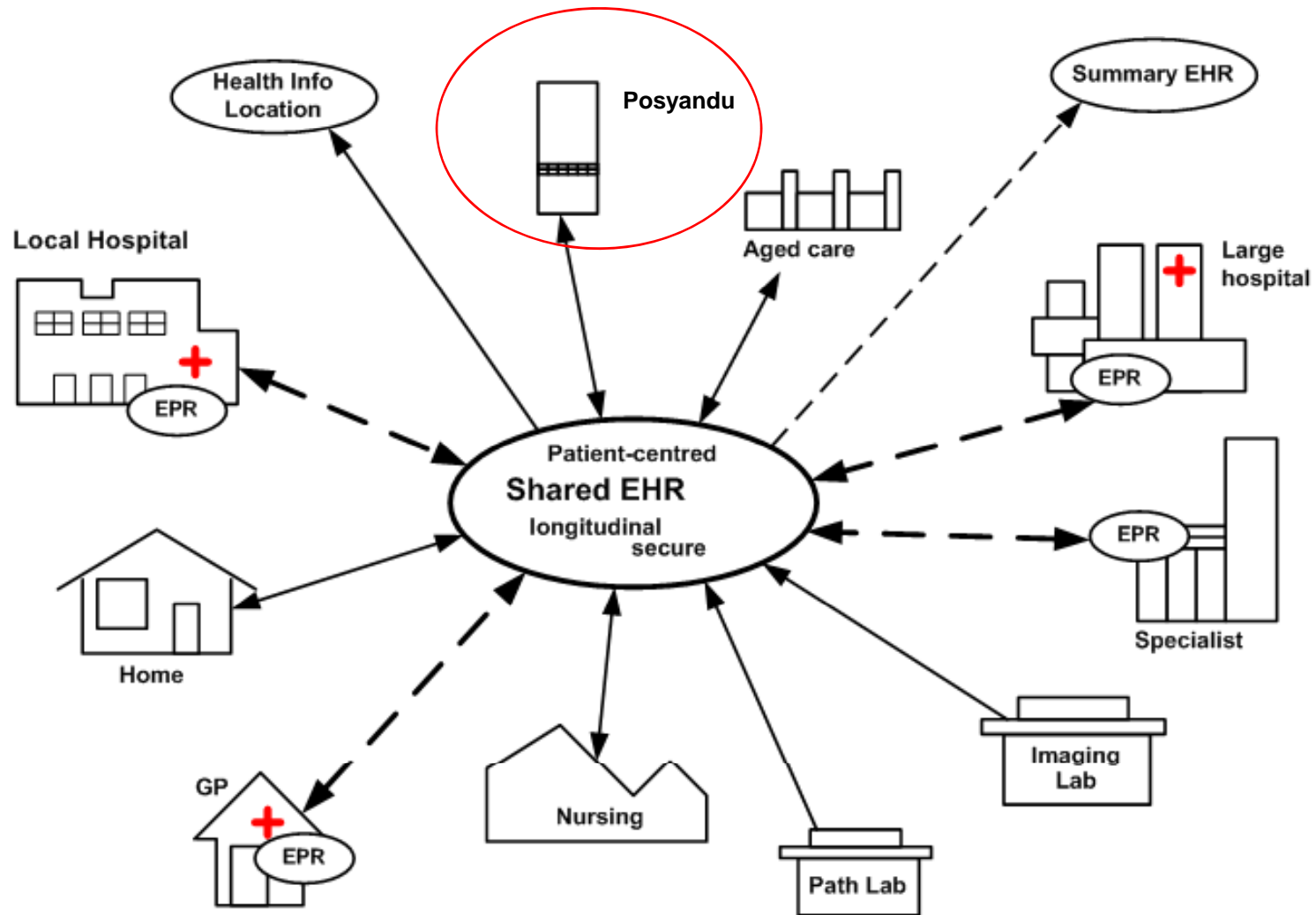
Ultrasound Imaging System



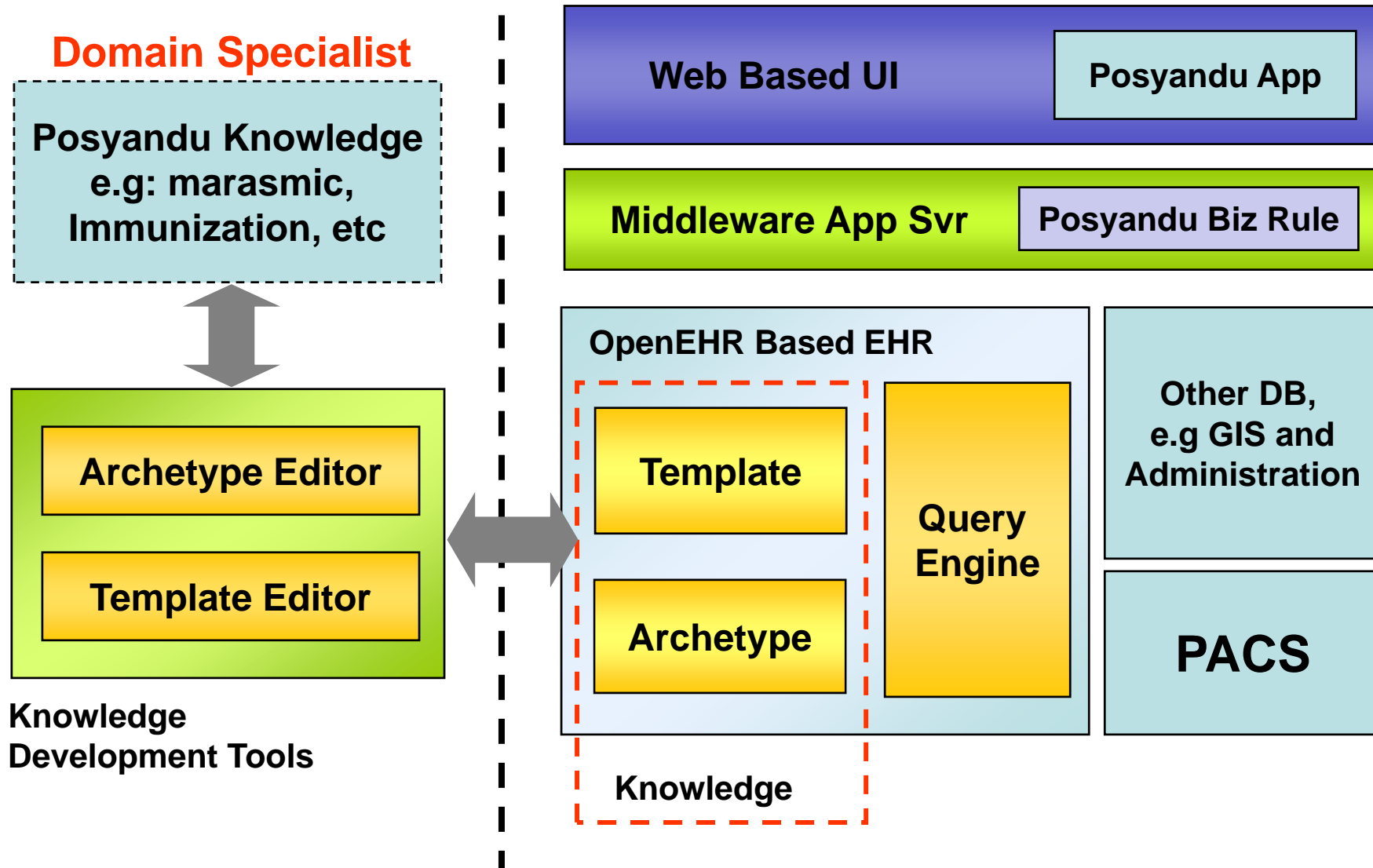
The openEHR Development Methodology



Arsitektur Sistem Informasi Kesehatan



Posyandu Over The System



Sistem Informasi Posyandu

Sistem Informasi Posyandu - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://127.0.0.1/posyandu/kms/index/2

Sistem Informasi Posyandu

home Minggu, 2 November 2008

Tentang UPGK
Teknik Penyuluhan
Materi Penyuluhan

Kartu Menuju Sehat
Kelahiran Anak
Data Balita
Wanita Usia Subur
Kegiatan Posyandu

Manajemen Halaman

Kartu Menuju Sehat

Untuk melihat/mengisi KMS, silakan pilih posyandu dan nama anak terlebih dahulu.

Posyandu : Pos Ganesha

Desa/Kelurahan : Ganesha

Kecamatan : Tamansari

Kabupaten/Kota : Bandung

Provinsi : Jawa Barat

No	Tanggal Daftar	Nama Anak	Nama Ibu
1	2008-10-29	Budi	Ayu
2	2008-10-26	Badu	Ina

Done

References

- R. Wootton, J. Craig, V. Patterson: Introduction to Telemedicine, Royal Society of Medicine Press, 2006
- J.H. van Bommel, M.A. Musen: Handbook of Medical Informatics, Springer-Verlag, 1997
- Proceedings BME Days 2006, Bandung
- Proceedings BME Days 2008, Surabaya
- Penelitian Open EHR Insentif Ristek 2007,2008
- <http://www.ieee.org>
- <http://www.itb.ac.id>
- <http://biomed.ee.itb.ac.id>
- <http://www.ptkk.itb.ac.id>

