Biomedical Informatics

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Hospital Information Systems (HIS)

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Πληροφοριακό Σύστημα Νοσοκομείου

HIS

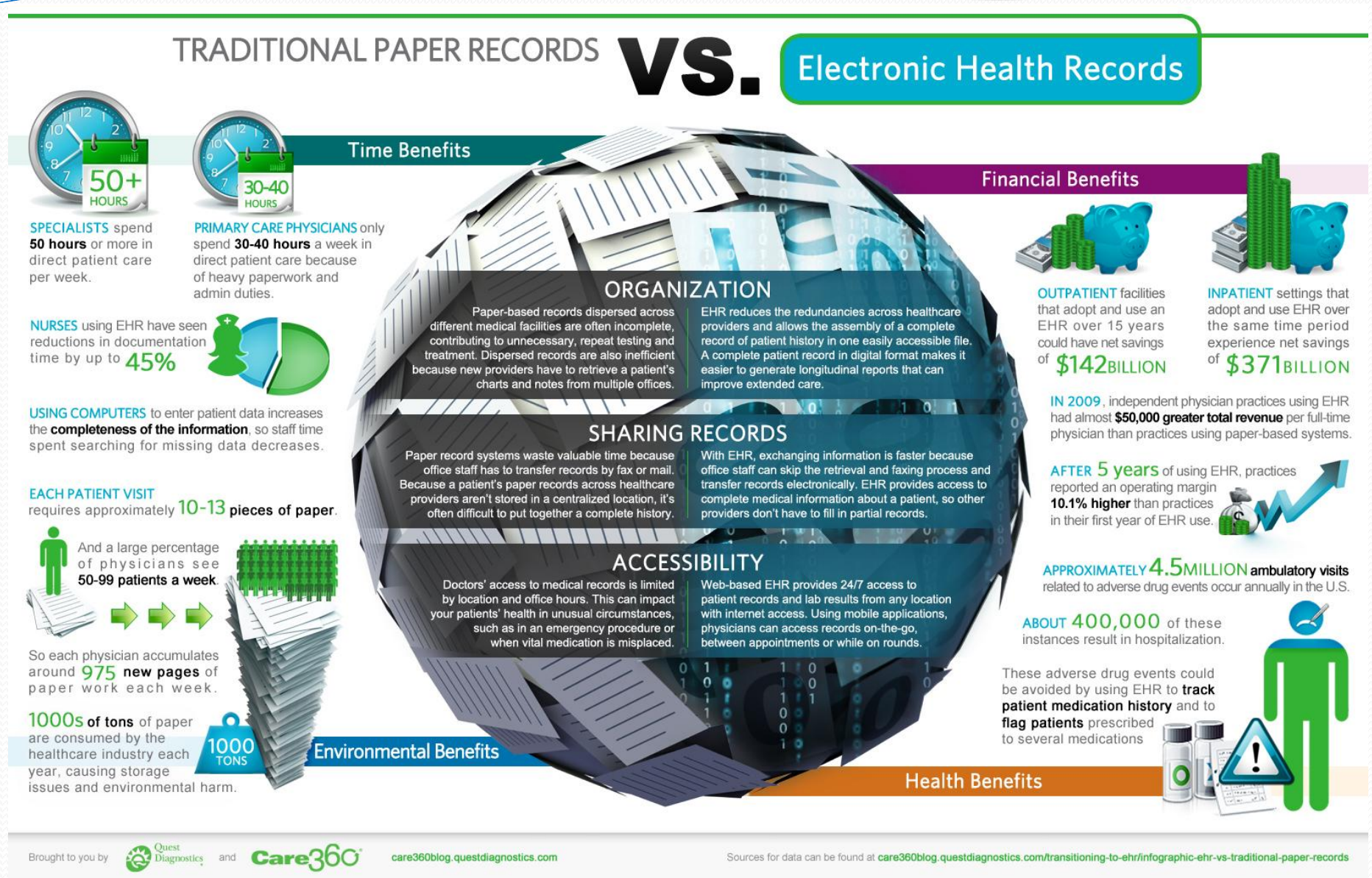
- **What are Healthcare Information Services?**
  - Systems used to **collect, store, manage, and transmit healthcare information**
  - Support clinical, administrative, and financial processes
  - Improve **efficiency, accuracy, and patient care**
- In general, information systems of a healthcare facility facilitate two main group of activities, functions and services i.e.:
  - The core business of providing healthcare to its clients
  - Managing the hospital as a business entity, a provider of hospitality services and a physical facility

Healthcare Industry Overview

- Hospitals
- Clinics
- Diagnostic laboratories
- Pharmacies
- Insurance companies
- Public health organizations

Healthcare IT connects all these entities.

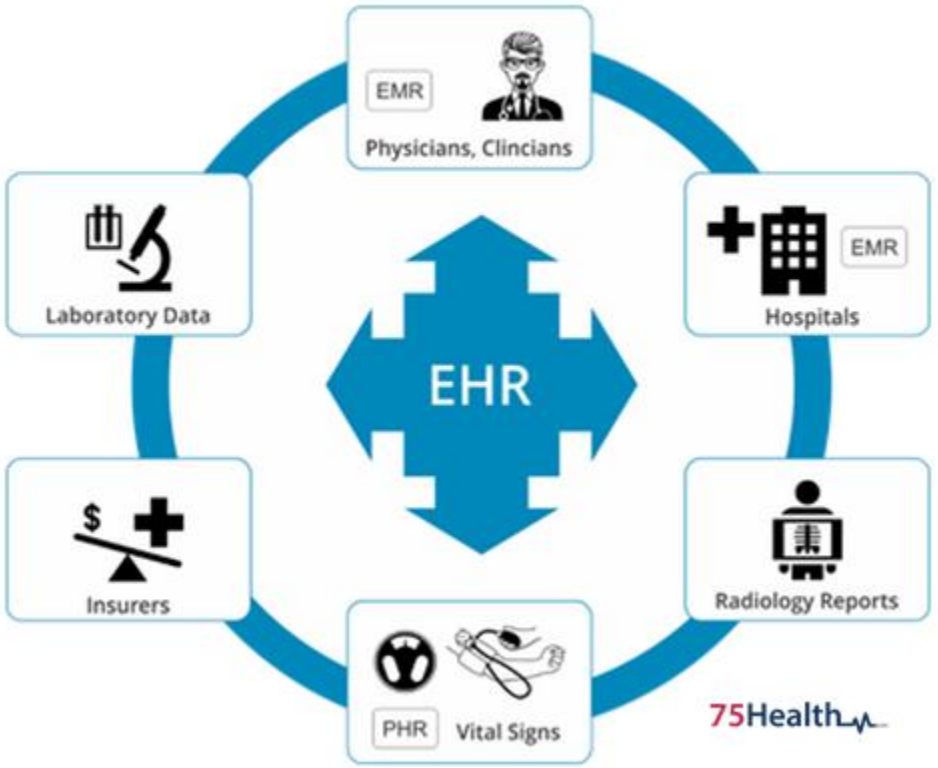
Digital Transformation in Healthcare



Electronic Health Records (EHR)

Electronic Health Records contain:

- Patient demographics
- Medical history
- Diagnoses
- Medications
- Laboratory results
- Radiology reports



Benefits:

- Improved data access
- Better coordination between doctors

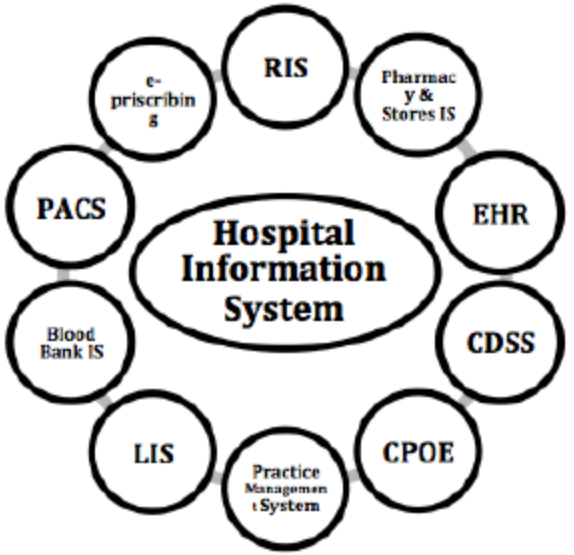
EHR System Architecture

- Typical EHR architecture includes:
  - **User interface**
  - **Application layer**
  - **Database layer**
  - **Integration services**

- Technologies used:
  - Web applications
  - APIs
  - Secure databases

Health Information Systems (HIS)

- A **Health Information System** manages:
  - Patient information
  - Hospital operations
  - Medical records
  - Administrative processes

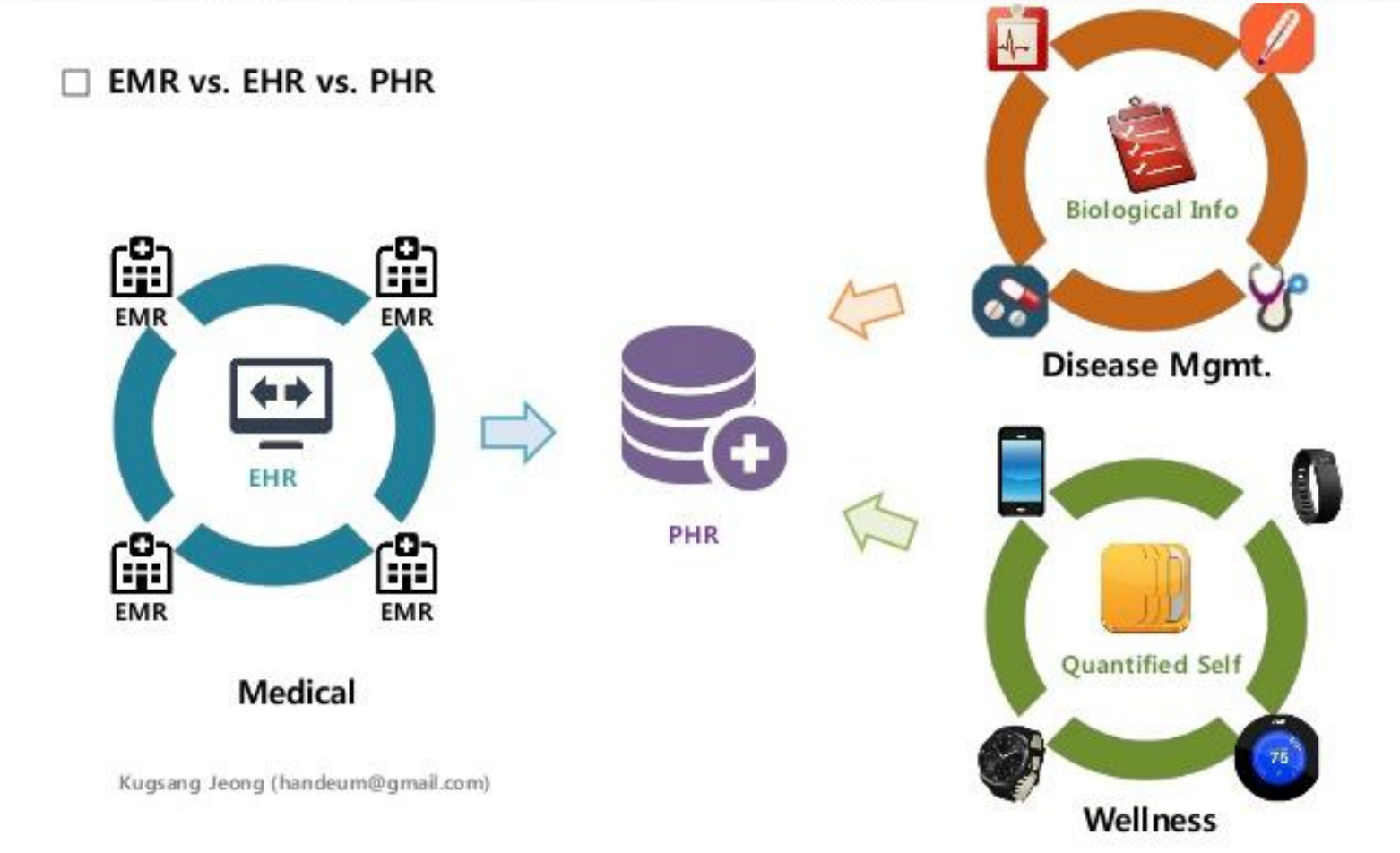


Goal: ***Efficient hospital management***

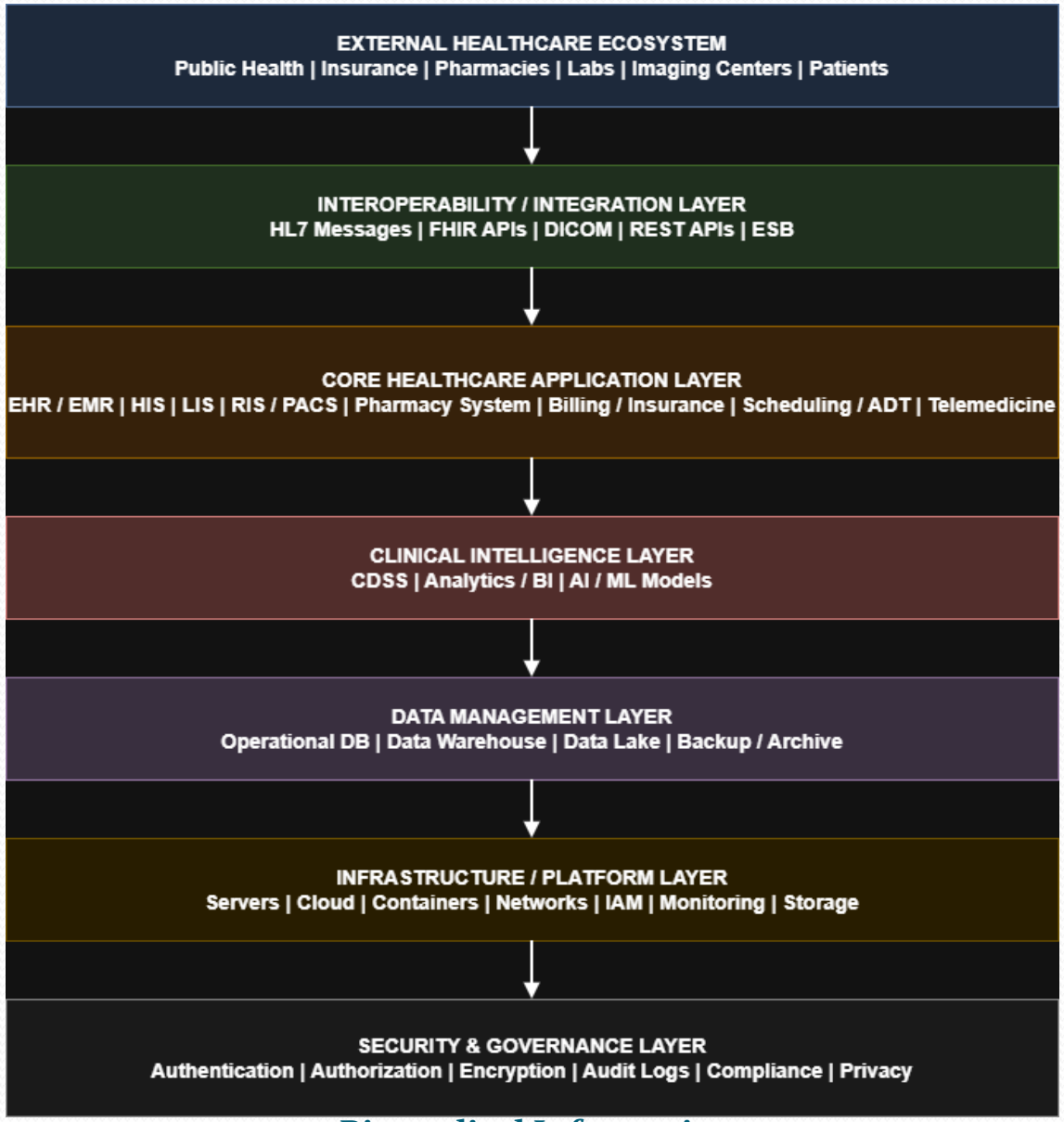
Hospital Information System Modules

- Major modules include:
  - Patient Registration
  - Appointment Scheduling
  - Billing and Insurance
  - Laboratory Management
  - Pharmacy Management
  - Clinical Documentation

EHR vs HIS vs PHR



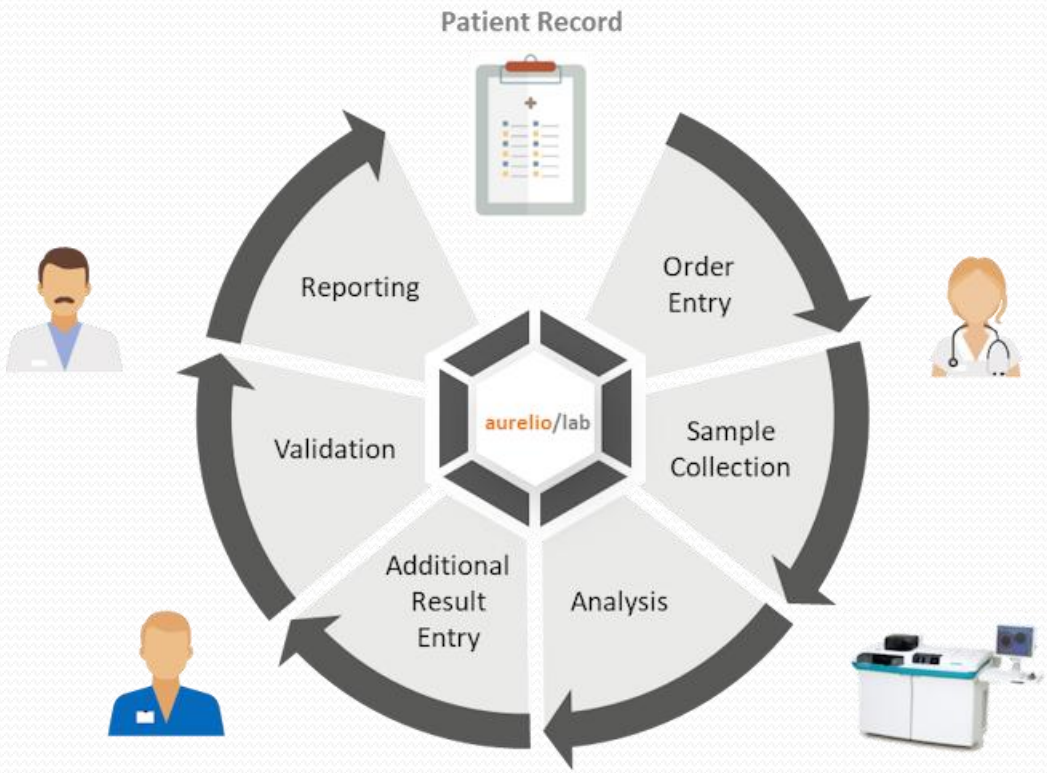
Typical Architecture



Health Information Exchange

Laboratory Information Systems (LIS)

- LIS manages laboratory workflows:
  - Test ordering
  - Sample tracking
  - Test results processing
  - Reporting results to doctors
- Benefits:
  - Faster diagnostics
  - Reduced human error

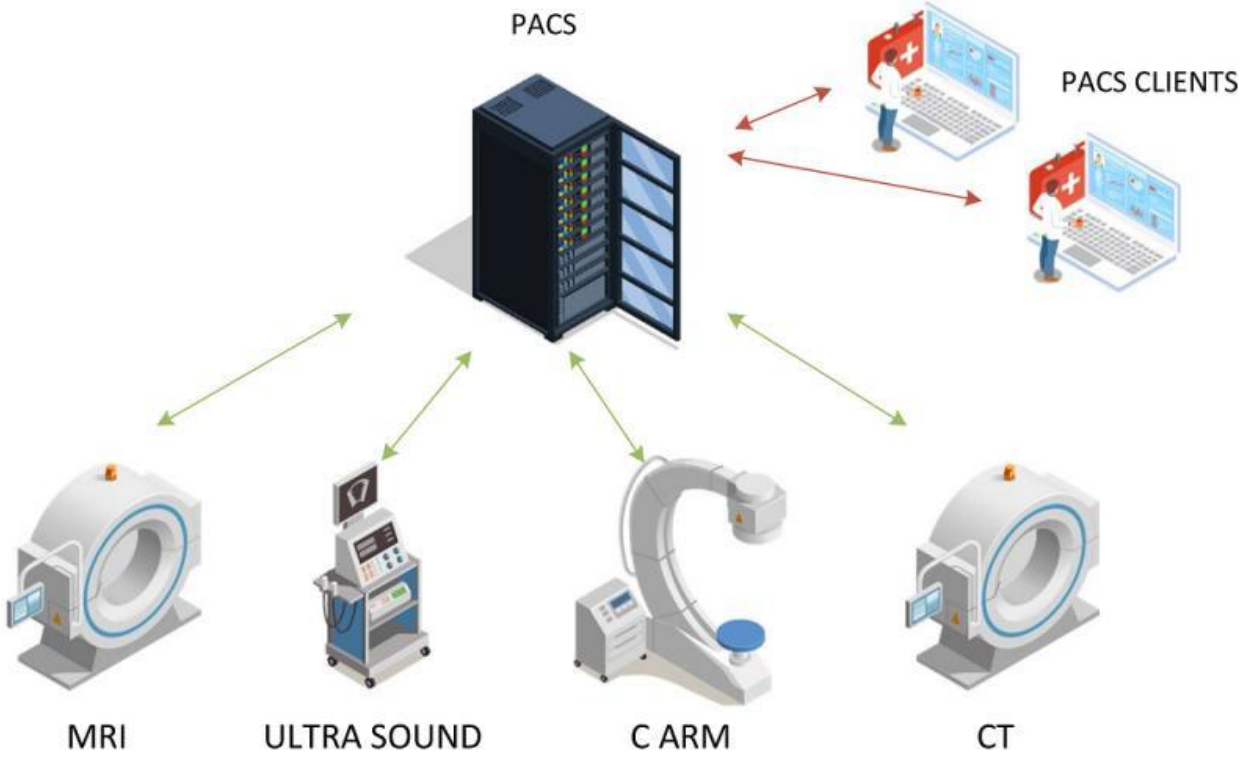


Radiology Information Systems (RIS)

- RIS supports radiology departments:
  - Imaging scheduling
  - Patient tracking
  - Radiology reporting
  - Integration with imaging systems

PACS (Picture Archiving and Communication System)

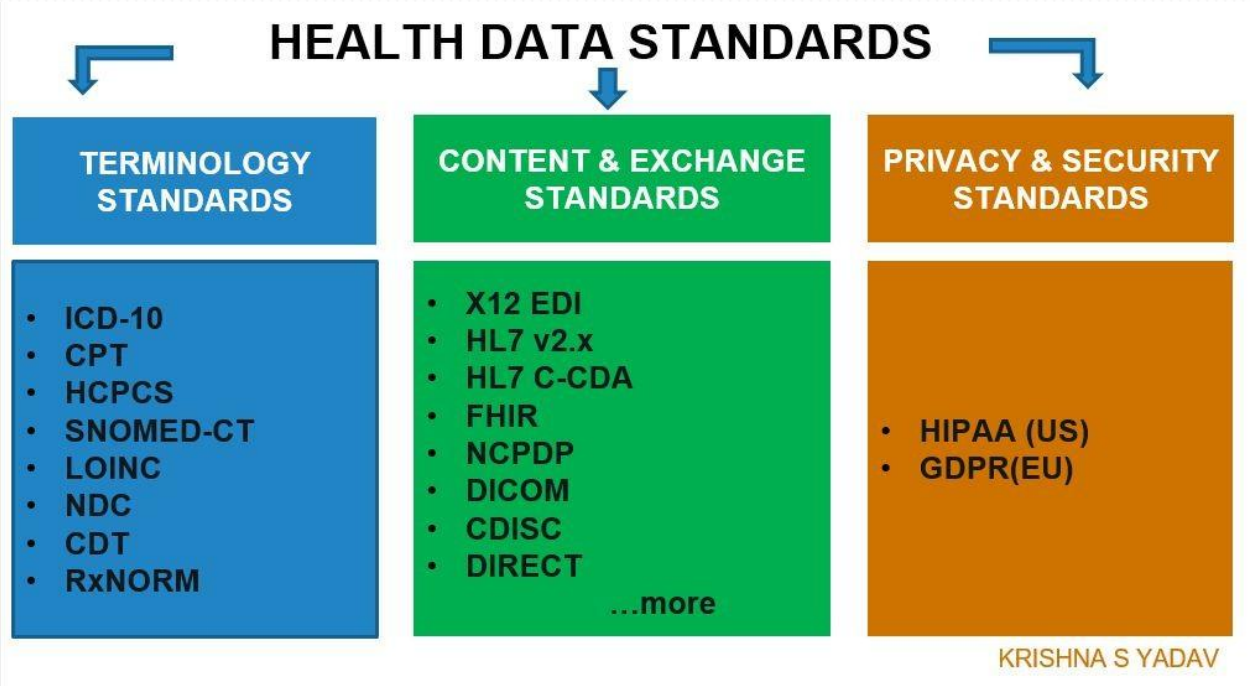
- PACS stores and manages medical images
- Examples:
  - X-ray
  - CT scans
  - MRI scans
  - Ultrasound images
- Benefits:
  - Digital storage
  - Faster access
  - Remote viewing



Healthcare Data Standards

- Healthcare systems communicate using standards
- Important standards:
  - **HL7** – health data exchange
  - **DICOM** – medical imaging format
  - **FHIR** – modern healthcare APIs

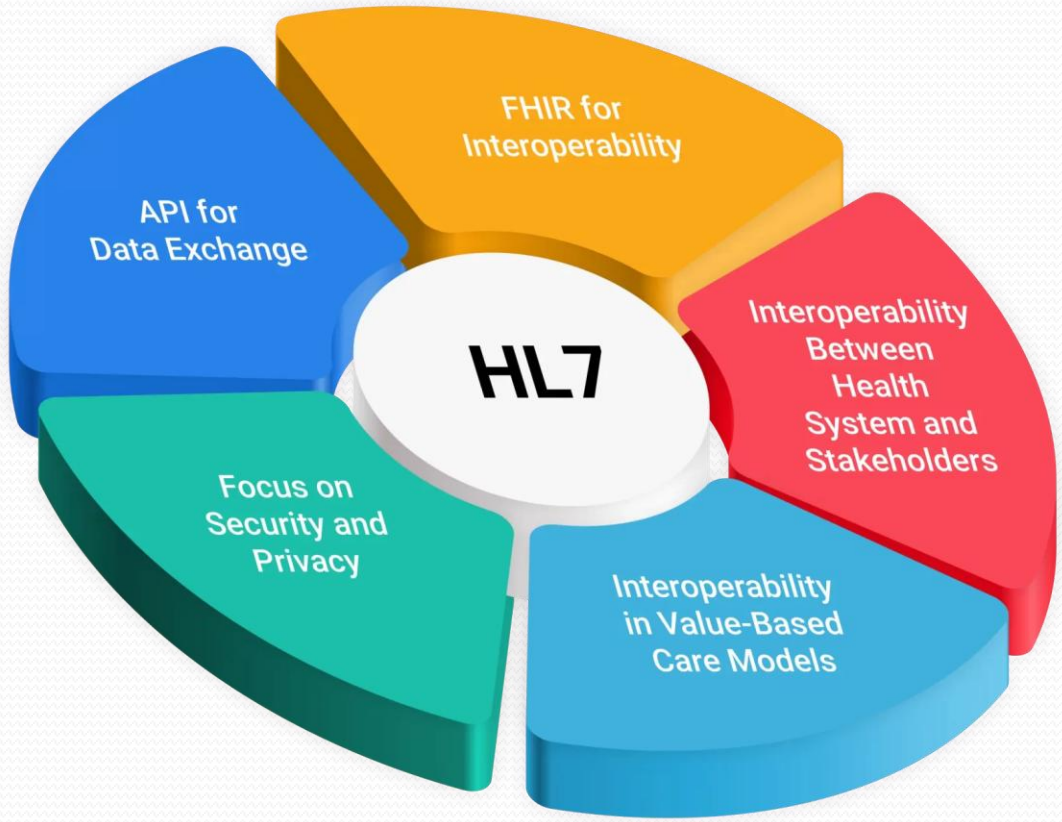
*These ensure **interoperability**.*



Healthcare Interoperability

- Different systems should be able to **exchange and use data**.
- Examples:
  - Hospital ↔ Laboratory
  - Hospital ↔ Pharmacy
  - Hospital ↔ Insurance

- Key technologies:
  - APIs
  - HL7 messages
  - FHIR resources



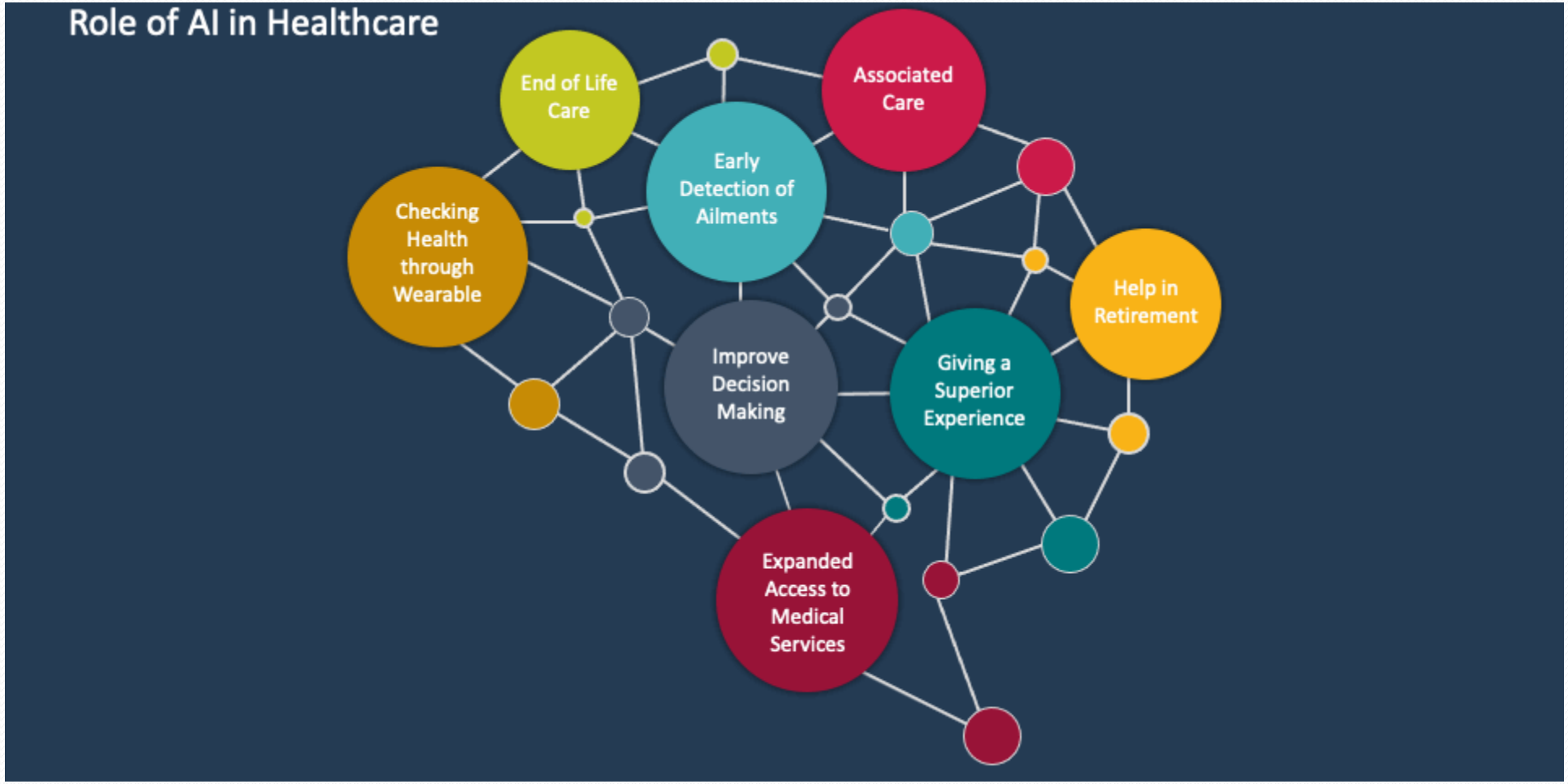
Data Security in Healthcare

- Healthcare data is sensitive.
- Security methods:
  - Encryption
  - Authentication
  - Role-based access control
  - Secure data transmission
- Systems must follow regulations.
- Examples:
  - **GDPR** – Europe
  - **HIPAA** – United States
- Goals:
  - Protect patient privacy
  - Secure personal health data

Telemedicine Systems

- Telemedicine enables **remote healthcare services**.
- Examples:
  - Video consultations
  - Remote diagnostics
  - Digital prescriptions
- Benefits:
  - Improved access to healthcare
  - Reduced hospital visits

Artificial Intelligence in Healthcare



Artificial Intelligence in Healthcare

AI applications include:

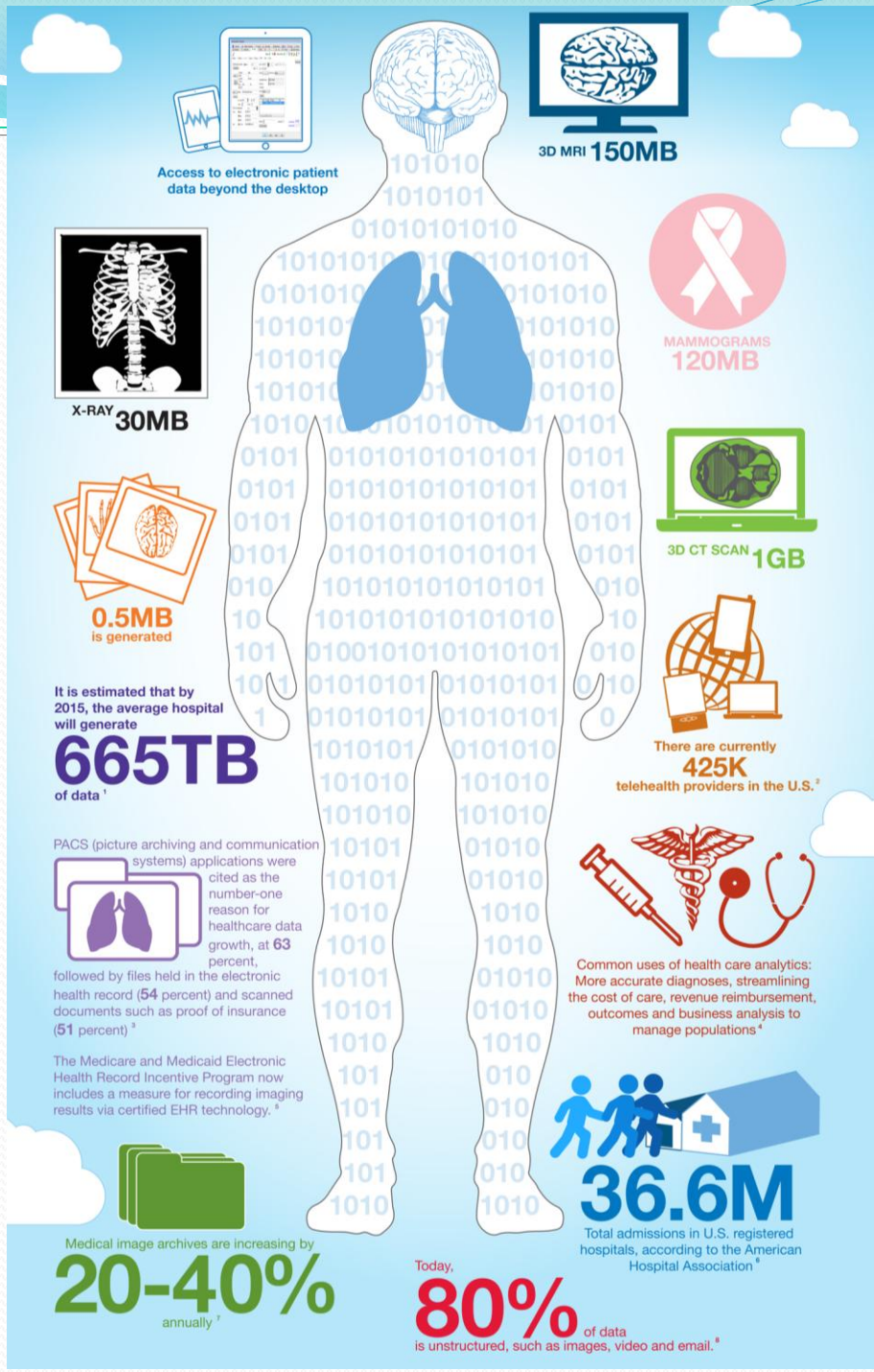
- Medical image analysis
- Disease prediction
- Clinical decision support
- Drug discovery

AI improves **diagnostic accuracy**.

- Machine learning models analyze healthcare data.
  - Predicting disease risk
  - Detecting anomalies
  - Personalized treatment plans
- Algorithms:
  - Neural networks
  - Random forests
  - Deep learning

Big Data

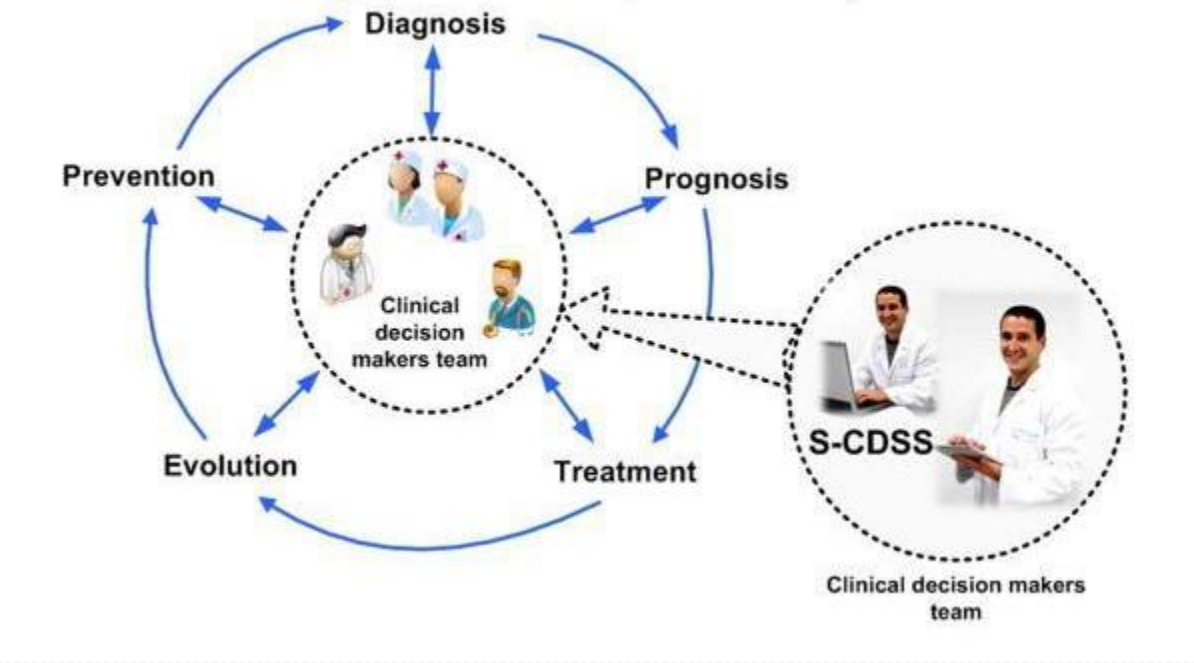
- Healthcare generates massive datasets.
- Sources:
  - Hospitals
  - Wearable devices
  - Genomic data
  - Clinical trials
- Applications:
  - Population health analysis
  - Disease outbreak prediction



Clinical Decision Support Systems (CDSS)

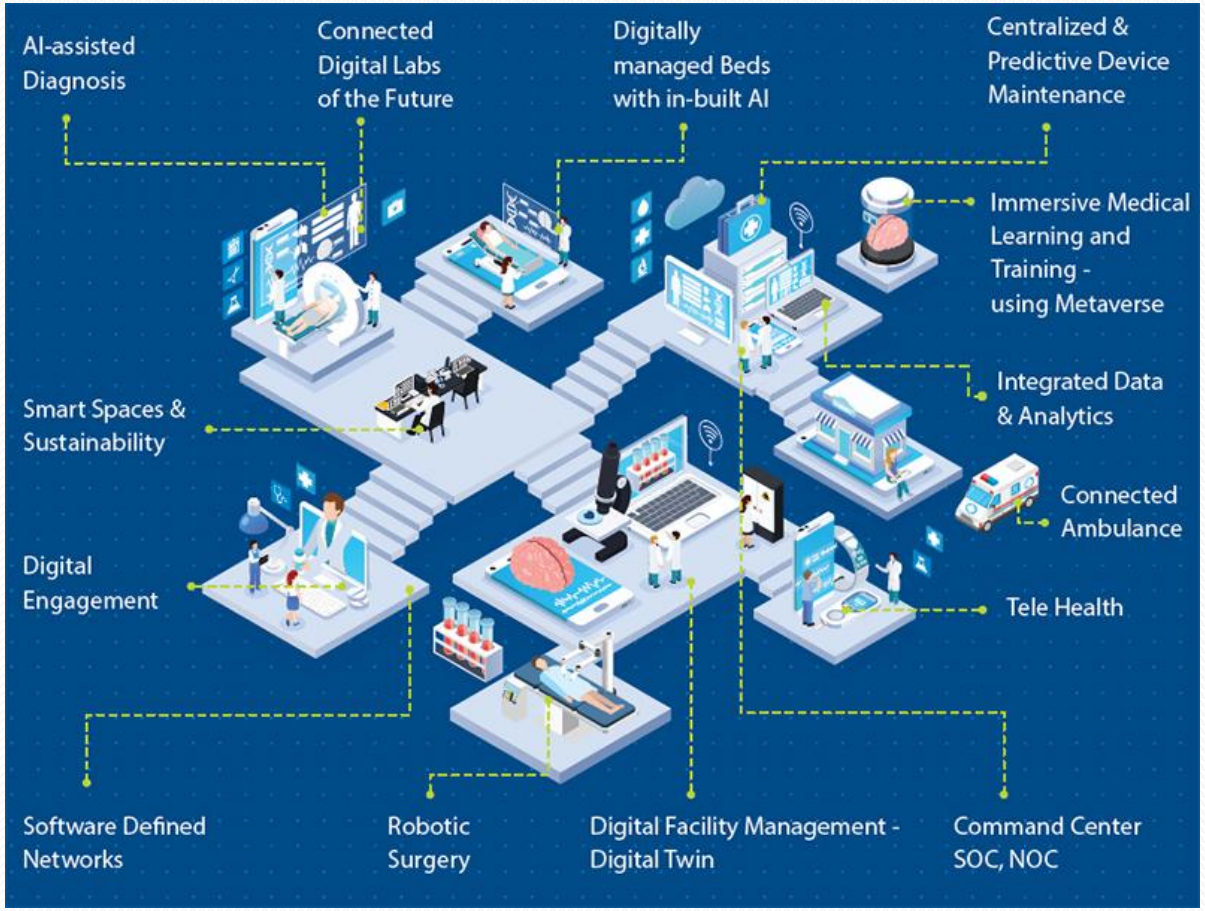
- CDSS helps doctors make better decisions.
  - Drug interaction alerts
  - Diagnostic suggestions
  - Treatment recommendations

*Often integrated with **EHR systems**.*



Future trends

- Future healthcare technologies include:
  - AI-driven diagnostics
  - Personalized medicine
  - Digital twins of patients
  - Smart hospitals
  - Robotics in surgery



Conclusion

- Key points:
  - Healthcare IT is rapidly evolving
  - Computer scientists play a critical role
  - Advanced technologies are transforming healthcare

Opportunities for innovation are enormous.