General development of e-Health

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Course Objectives:

- **Concept and Technologies**
  - **Concept**
  - **Standardization**
  - **Technologies**
- **e-Health experiences in China**

What's e-Health?

Defined by WHO

eHealth is the cost-effective and secure use of information and communications technologies （ICTs） in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research.(Resolution 58/28 of the World Health Assembly, Geneva, 2005)

Defined by JMIR

E-Health 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.

Defined by Intel

Intel, referred to e-health as "a concerted effort undertaken by leaders in health care and hi-tech industries to fully harness the benefits available through convergence of the Internet and health care."

What's e-Health?

Seeing a doctor





What's e-Health?

Healthcare management









What's e-Health?

Medical record





What's e-Health?

Reading medical image







E-Health Standardization in ITU

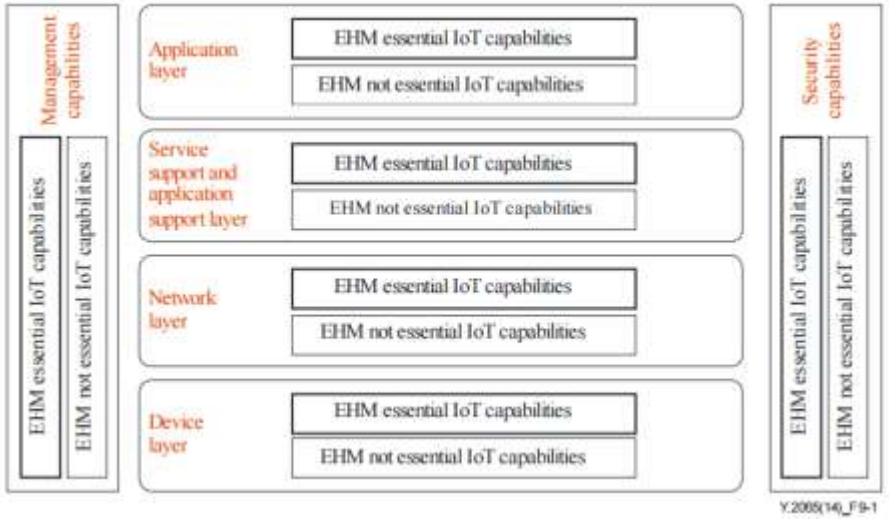
- E-health standardization has been on ITU-T's agenda since **2003.**
- This work was given further impetus by the WTSA,2012, which adopted Resolution 78 - Information and communication technology applications and standards for improved access to e-health.

- **Study Group 16** (Multimedia), **Question 28/16**: *Multimedia framework for e-health applications*



- **Study Group 17** (Security), **Question 9/17**: *Telebiometrics*

- **Study Group 20**(**IoT, smart cities & communities**), **Question 7/20 :** *Performance evaluation frameworks of e-health systems in the IoT.*



Other Organizations

IEEE

- IEEE has launched the project: interoperable communications for professional healthcare devices and 3D medical systems since 2014.
- IEEE 11073™ IEEE 11073 Personal Health Device Working Group
- IEEE 3333-2 3D Based Medical Application Working Group

ISO

ISO/TC 215
Health informatics

Working on the Electronic health record standards together with HL7.	ISO/HL7 10781:2015 Health Informatics -- HL7 Electronic Health Records-System Functional Model, Release 2 (EHR FM)
Personal health equipment standards with IEEE.	ISO/IEEE 11073-10201:2004 Health informatics -- Point-of-care medical device communication ISO/IEEE 11073-10406:2012 Health informatics -- Personal health device communication
Remote and medical information system standards.	ISO/NP TS 11633-1 Health informatics -- Information security management for remote maintenance of medical devices and medical information systems

Joint Initiative Council

CEN Health Informatics TC251, CDISC, GS1, HL7 International, ihtsdo, DICOM, ISO TC215, IHE

- **Built by some related e-Health organizations in April, 2015.**
- **Formed to enable common, timely health informatics standards by addressing and resolving issues of gaps, overlaps, and counterproductive standardization efforts through.**
- **Hosted by Health Level Seven International.**

Scope

2005

- health-care services
- health surveillance
- health literature
- health education
- knowledge and research

2015

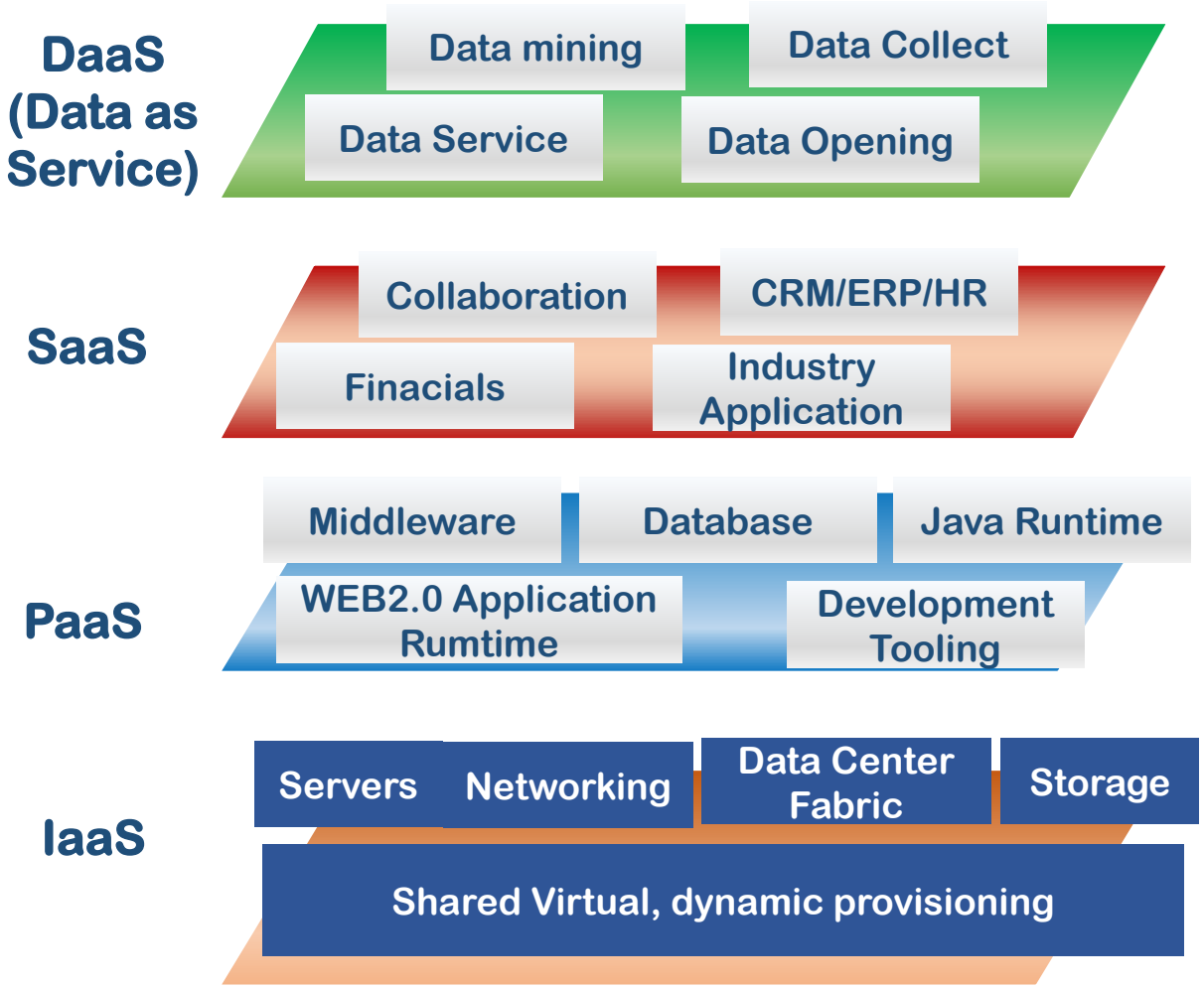
The GOe 2015 survey was divided into eight thematic subjects, each offering its own perspective on the contribution of eHealth to UHC:

- eHealth foundations
- mHealth
- Telehealth
- eLearning in health sciences
- Electronic health records
- Legal frameworks for eHealth
- Social media
- Big data

2017

- Medical artificial intelligence
- Internet Hospitals
- Medical sensing equipment

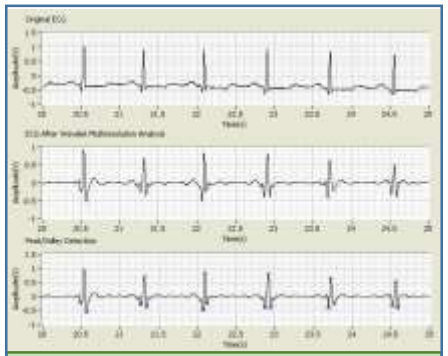
Technologies 1：Cloud Computing



Data Layer	Medical record data, image data, drug data, equipment data, block chain data.		
Service Layer	HIS Cloud	EMR Cloud	Telehealth
	PACS Cloud	e-Medicine	Therapeutic hardware
	HRP Cloud	m-Health	Biological gene
Tech Layer	Hybrid Cloud	Disaster tolerant	
	Shared services	Big-data	
	Cloud Storage	security protection class	
Product Layer	Email service	Big-data analysis	
	Internet security	Cloud Server	
	Object storage	Web certificate	

Technologies 2：Big Data

Medical Big-data: covers the whole life cycle, including personal health data and relates to the medical services, through large data mining modeling, data analysis and processing technology of value.



Data mining



Data processing



Data searching

Medical data







- EMR
- Image
- ECG
- Pathology
- Diagnosis

Data acquisition

Big data mining platform

Big data processing platform

Big data online storage

Technologies 3：AI-Medical image recognition

Medical image recognition: Computer vision & Deep learning

Technologies

Phase A

Multidimensional image fusion

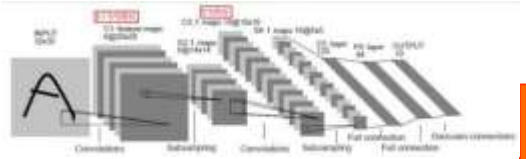


Image Recognition

Image preprocessing → Image separation → Feature extraction → Matching & judging

Phase B

Convolutional neural network



Deep learning

Case Database + Other medical databse → Judgement

Diagnosis effect

CT film



According to lung nodules or lung cancer, the accuracy rate of AI is 50% higher.

X ray film



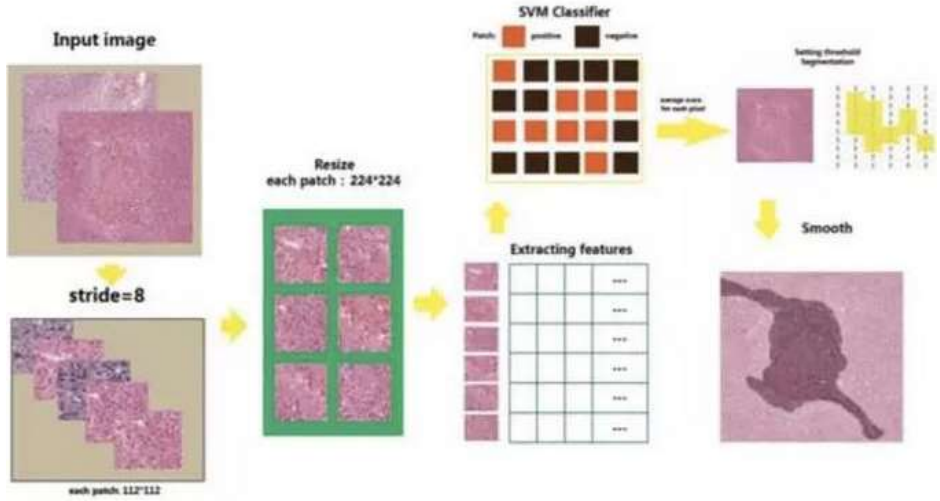
AI can detect a slight fracture of 0.01% of the entire X area.

Technologies 3：AI-Pathological diagnosis

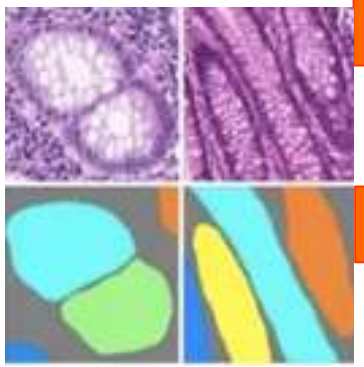
Pathological diagnosis for cancer

» Demand: Cancer has a certain rate of misdiagnosis ;
» Computer Vision： Discovering the details of the human eye that are difficult to detect, and personalize the diagnosis and treatment

Phase A: Processing of large size pathological slices on cell surface



Phase B:pathological changes recognition



Cell differentiation ability

+

Gland condition

+

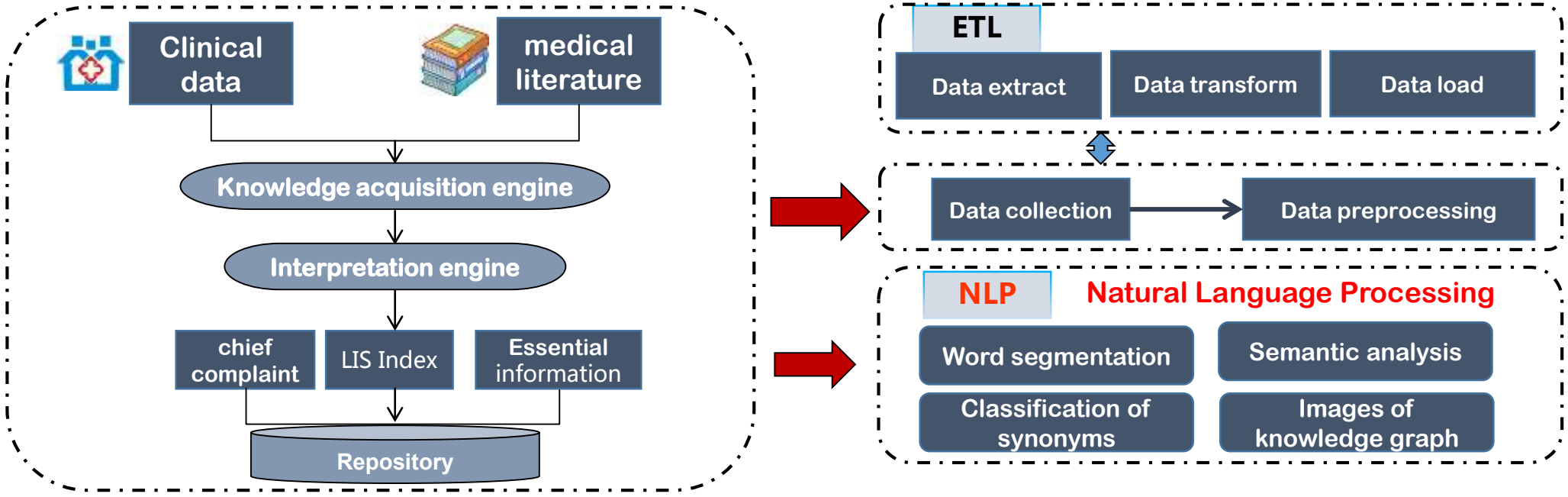
Mitotic level

Judgement

Technologies 3：AI-Clinical decision support

Current status of electronic medical records(EMR)

» A lot of detailed patient information is stored in free text, which often has ambiguity and many nonstandard descriptions, make it difficult to analyze the data



Technologies 4：wearable devices

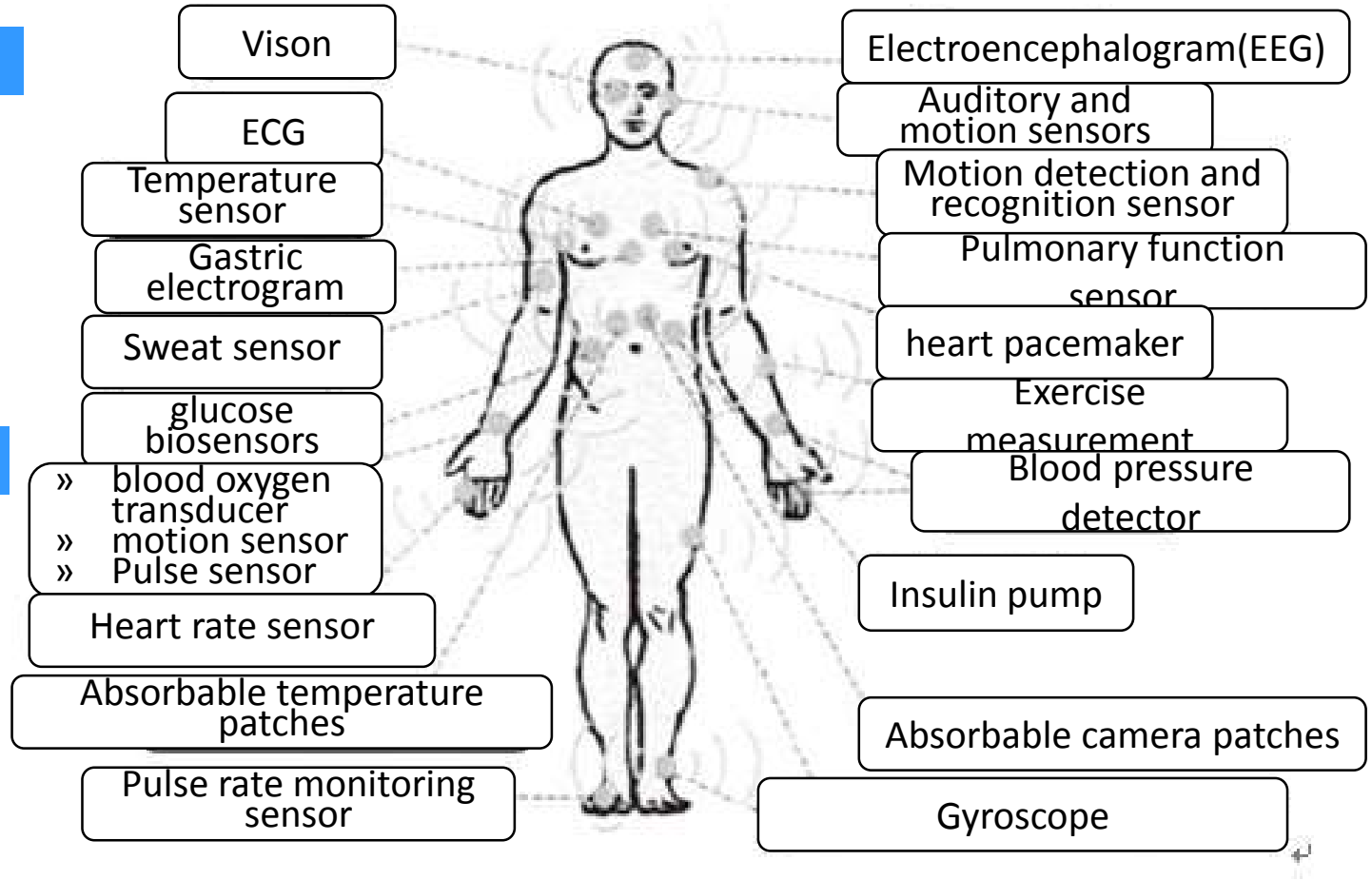
Wearable devices: Help people to health management, get real-time dynamic data anytime, laying the foundation for the analysis of large medical data.

✓ Dynamic monitoring

- Wireless communication module and data analysis system
- Timeliness of data analysis and persistence of test results
- Danger warning function.

✓ Keeping tracking & analysis

- Continual detection of high blood sugar, high blood lipids, high blood pressure, and change bad habits (such as weight loss, smoking cessation), so can help users find the cause, find potential risks, and achieve the purpose of prevention of chronic diseases.



Technologies 5：Block chain constructs a credible medical network environment

» Block chain is a database, a distributed system, a consensus agreement depends on different technical points.

Distributed

Each node has a backup. A single point of failure does not compromise the integrity of the data.

Smart Contracts

Everyone related can do something to the data, including the patient.

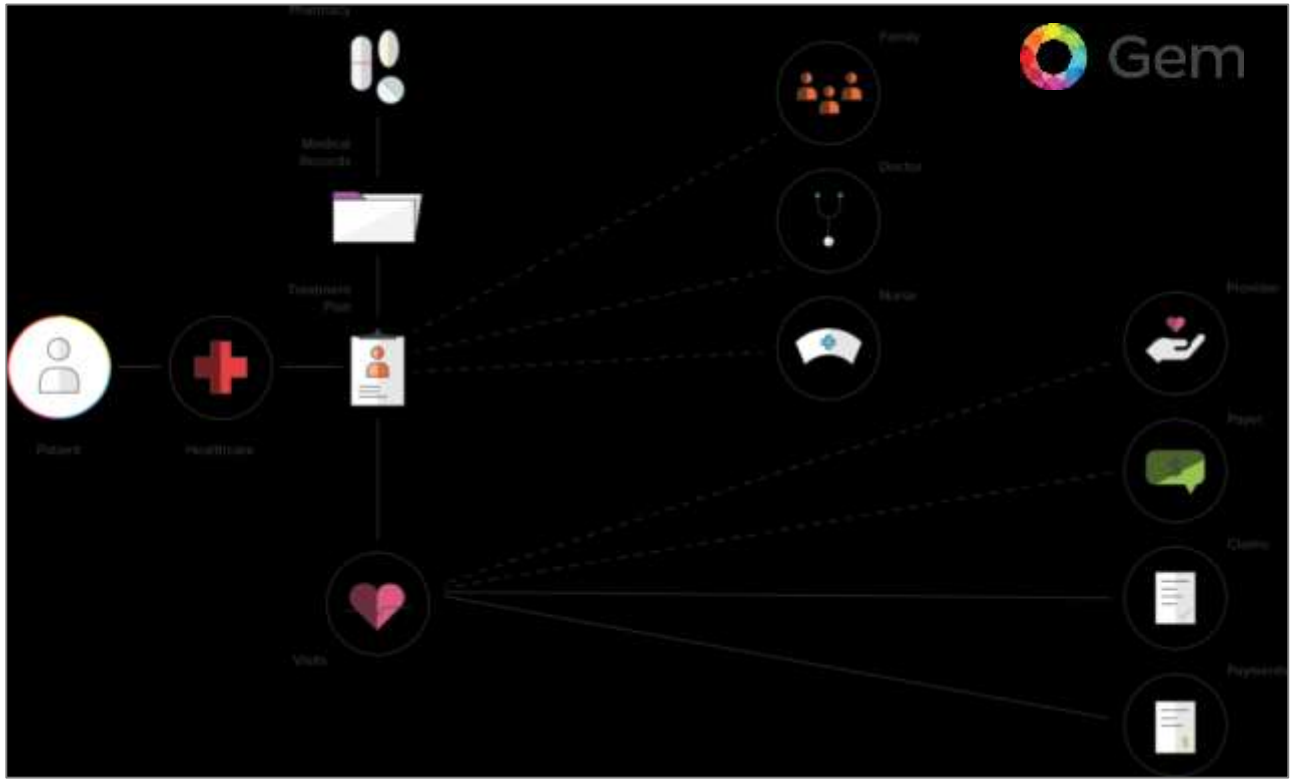
Consensus

- Data access rules.
- Implements single medical record distribution with multiple private keys;

Immutability

- Changing is ok, hiding the original data is impossible.
- Once the medical data is tampered with, it may cause serious harm.

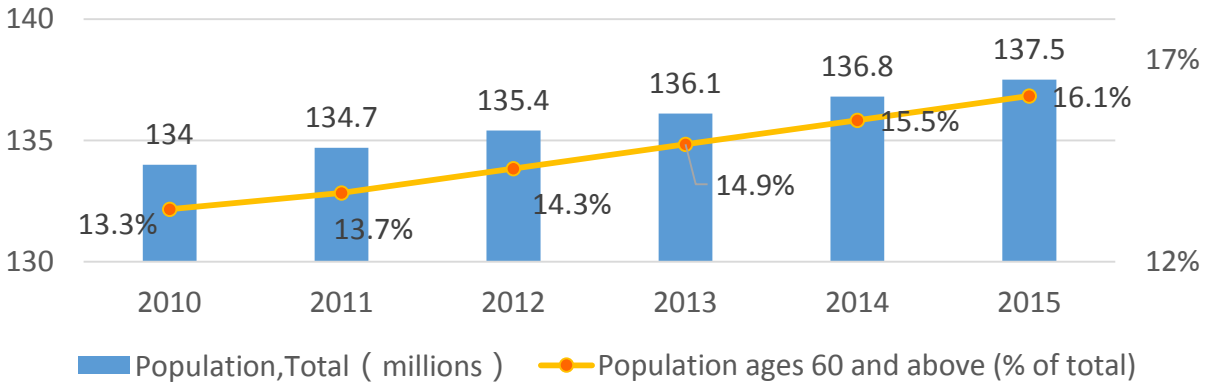
GEM :Building towards a blockchain network for the global community of companies that take part in the continuum of healthcare.



Course Objectives:

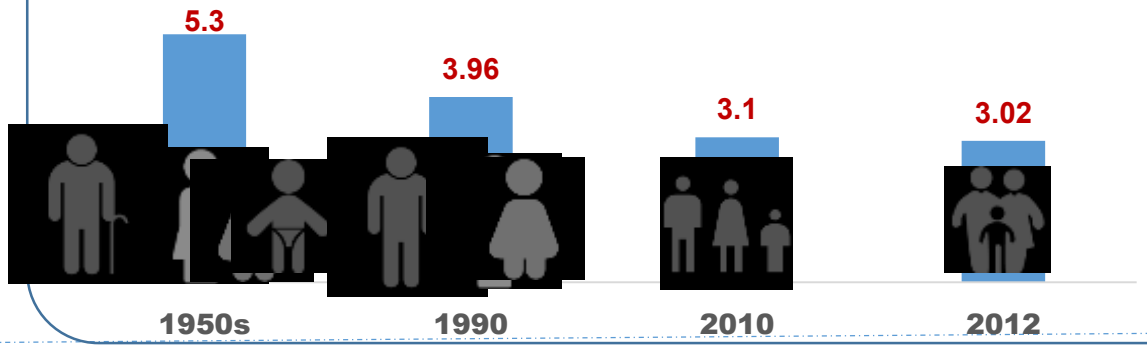
- **Concept and Technologies**
- **e-Health experiences in China**
  - **Background**
  - **Applications**
  - **ICT enterprises’ practice**

Why e-health?

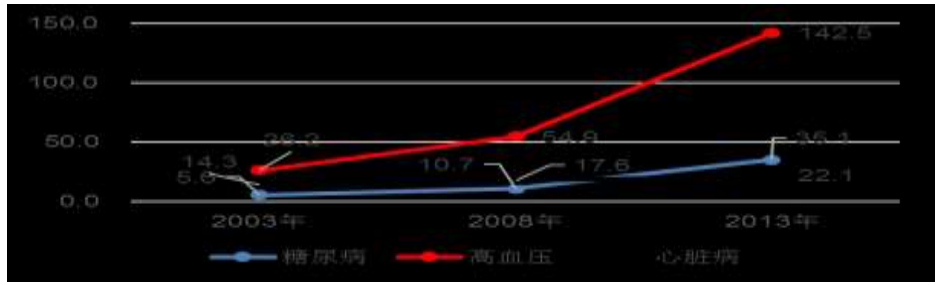


Population aging goes fast: According to statistics, the population aged 60 and above accounted over 16% in 2015, China has entered the ranks of old-type state 。

Average number of persons per household is dropping



Average number of persons per household is falling : The average size of family households in China has been shrinking since1980s. The average size of households was 3.02 in 2012. It brings about the increasing pressure on the aged and the increasing demand for social pension.

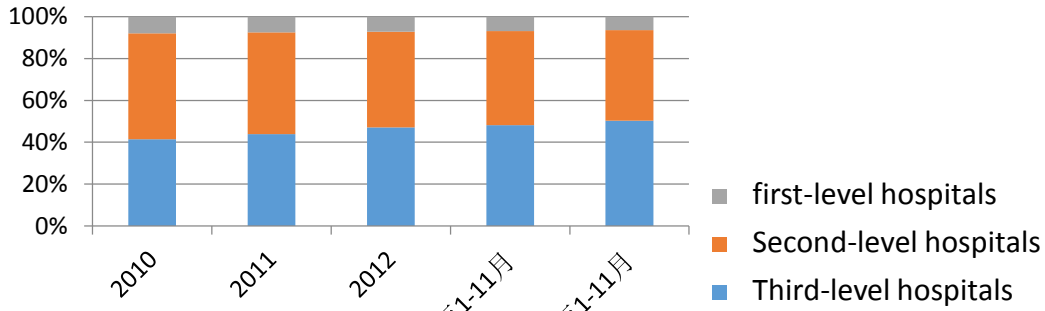


Health condition changes : According to government' data , the prevalence of chronic diseases in our country has increased year by year. There is 260 million confirmed chronic diseases, accounting for about 19% of the total population in China in 2015.

Why e-health?

类别	国家	总人口（亿人）	60岁以上人口比例（%）	人均GDP（美元）	医师密度（每万人拥有量）	护理和助产人员密度（每万人拥有量）	医院床位数（每万人拥有量）
金砖国家	中国	13.64	13.0	5432	14.6	15.1	39.0
	俄罗斯	1.43	18.0	14247	43.1	85.2	97.0
	印度	12.10	8.0	1485	6.5	10.0	9.0
	巴西	1.92	11.0	12788	17.6	64.2	23.0
	南非	0.49	8.0	7512	7.6	*	*
发达国家	美国	3.15	19.0	49922	24.2	98.2	30.0
	日本	1.28	31.0	46895	21.4	41.4	137.0
	德国	0.80	26.0	41168	36.9	113.8	82.0
	法国	0.64	23.0	40009	33.8	93.0	66.0
	英国	0.62	23.0	38891	27.7	94.7	30.0
	意大利	0.61	27.0	36267	38.0	*	35.0
	加拿大	0.35	20.0	50436	20.7	104.3	32.0

资料来源：根据2013年世界卫生统计报告整理，*表示无数据。





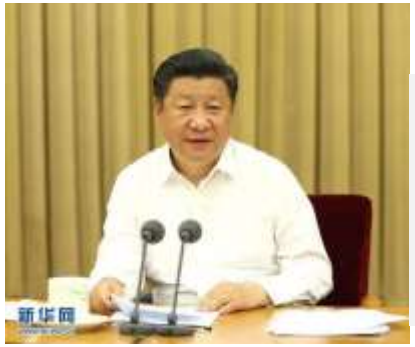
- **Medical resources are sparse:** According to WHO’ s data, the density of physicians and nurses per capita was low compared to developed countries 。

- **Unbalanced distribution :** The medical resources in China are concentrated in large hospitals and the health resources for local service are seriously inadequate.

- **Medical insurance payment system has not been equalized :** Medical expenditure is mainly based on the national basic medical insurance, and there are differences between urban and rural areas.

Why e-health?

"Healthy China" has become a national strategy.



"Without national health, there would be no overall well-off society. Health should be integrated into all policies" 。

——《Xi Jinping's speech at the National Conference on health》（19/8/2016）

中华人民共和国中央人民政府
The Central People's Government of the People's Republic of China

- **General Office of the State Council released the guidance on promoting and standardizing the development of big data for health care on 21/6/2016:**
  - The national and provincial population health information platform and the national drug recruitment platform will be connected in 2017.
  - National medical and health information classification open application platform will be constructed in 2020.

Overall progress of e-Health in China

PATH A : INTERNET COMPANIES PENETRATE INTO THE MEDICAL FIELD

Cutting into the medical service from health consulting, health management, sports statistics, appointment, etc.

With the deep cooperation between internet companies and medical institutions, new formats such as INTERNET HOSPITALS has been built.

Health management





广东省网络医院 GUANGDONG ONLINE HOSPITAL

好大夫在线 智慧互联网医院

浙江大学附属第一医院 浙一互联网医院

乌镇互联网医院 www.wu.gov.cn

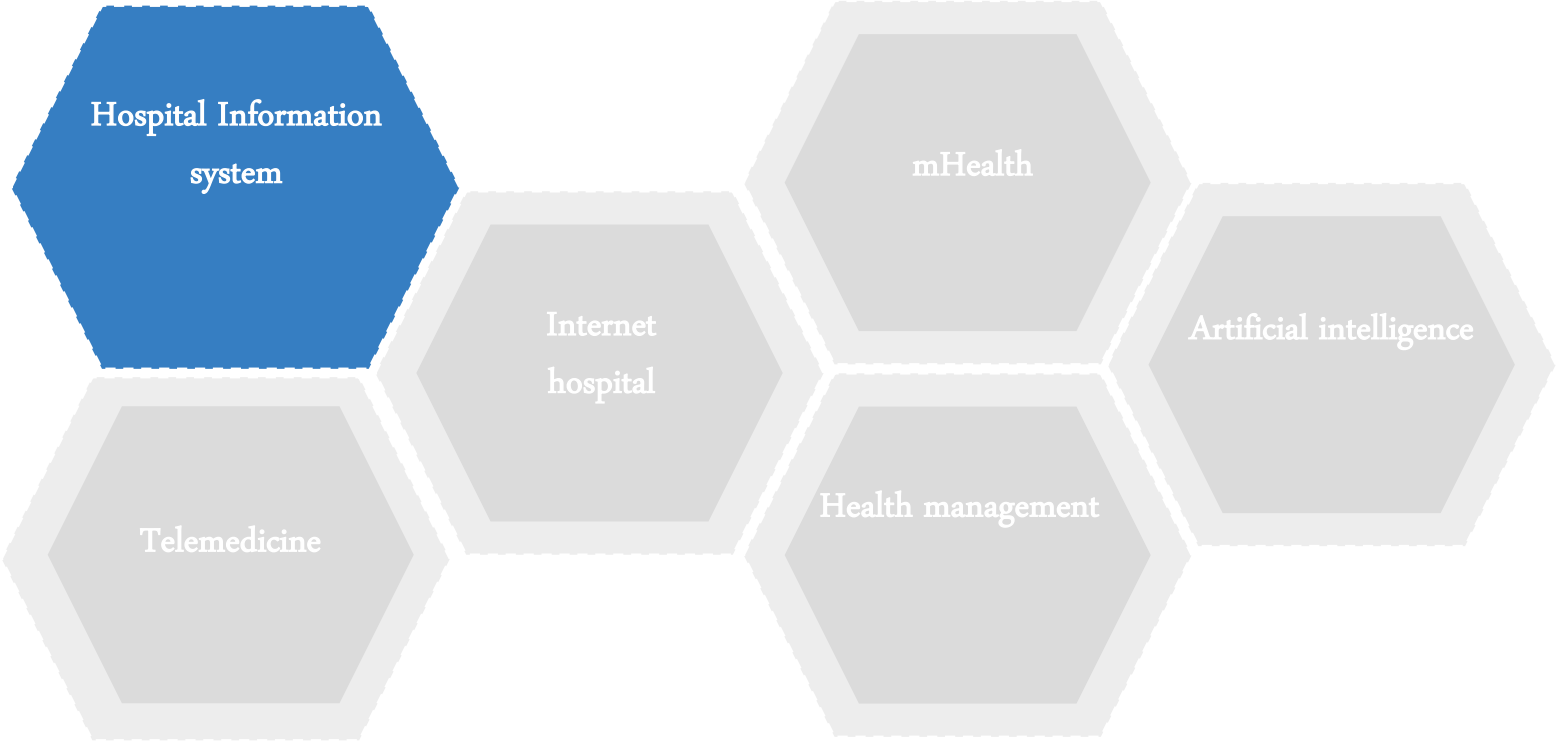
PATH B: EXTENDING TO INTERNET SERVICES

By using technologies to promote telemedicine, pathological diagnosis, remote surgery guidance, telemedicine education, traditional hospitals make their business extend beyond the hospital.

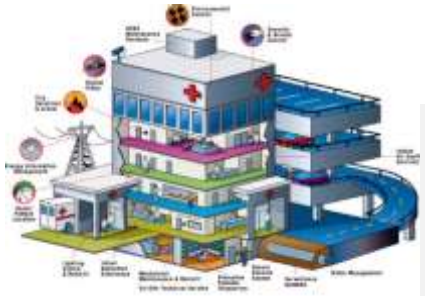
Telemedicine



Six e-Health applications in China

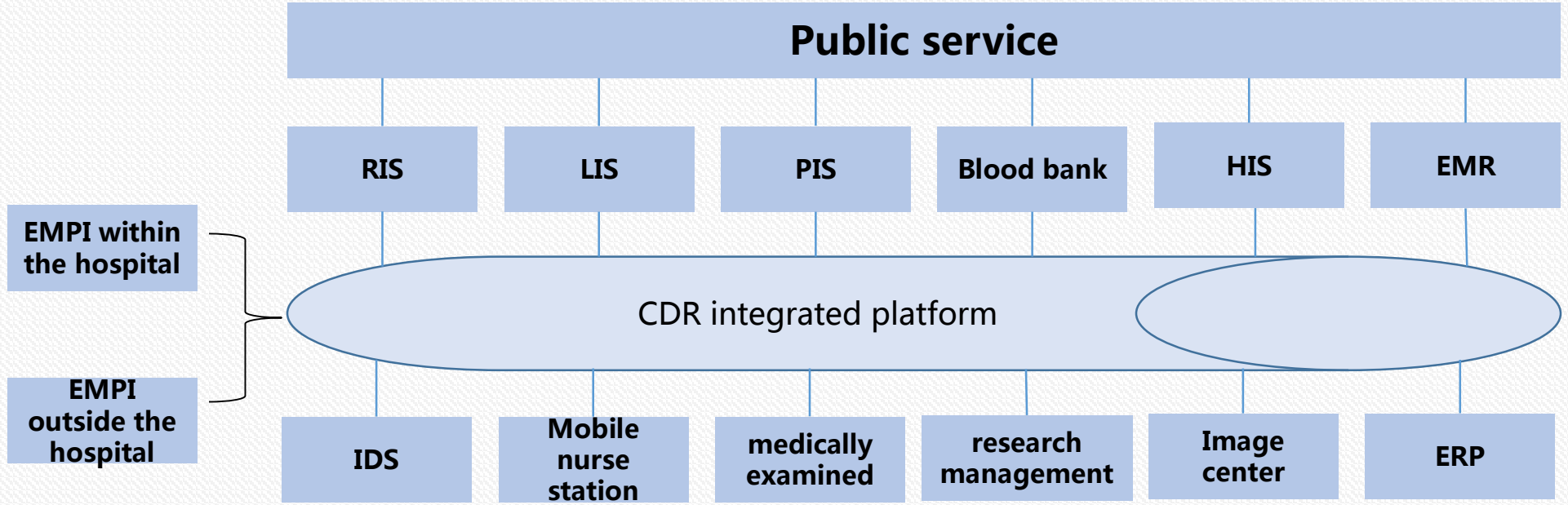


Large scale complex hospital focus on connecting and medical data electronization



- To achieve interconnection and interworking within the hospital information systems and eliminate data islands.
- To achieve unified management through a unified platform integrated all the information systems within the hospital.

Case: CDR integrated platform of Peking University People's Hospital

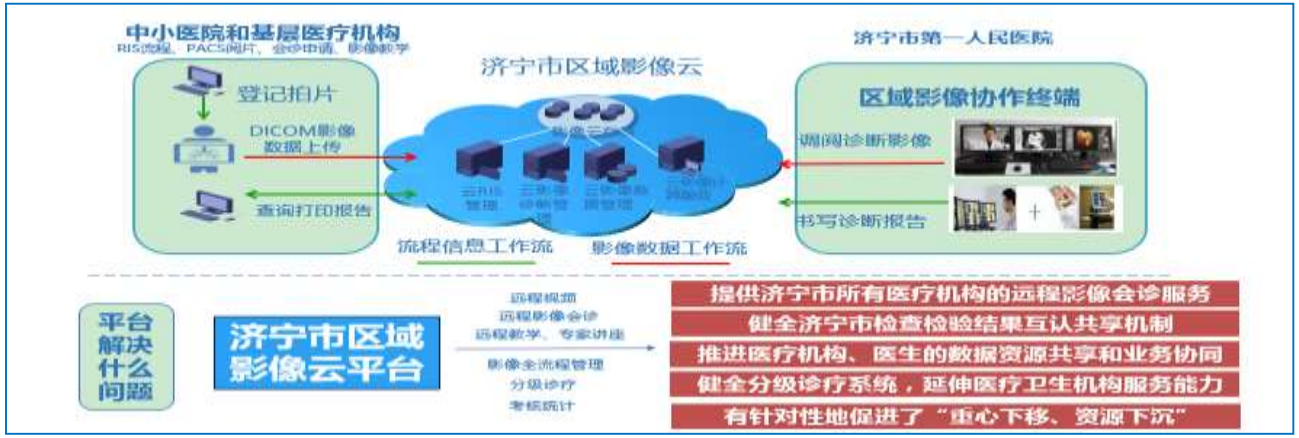


Primary medical institutions focus on regional interconnection

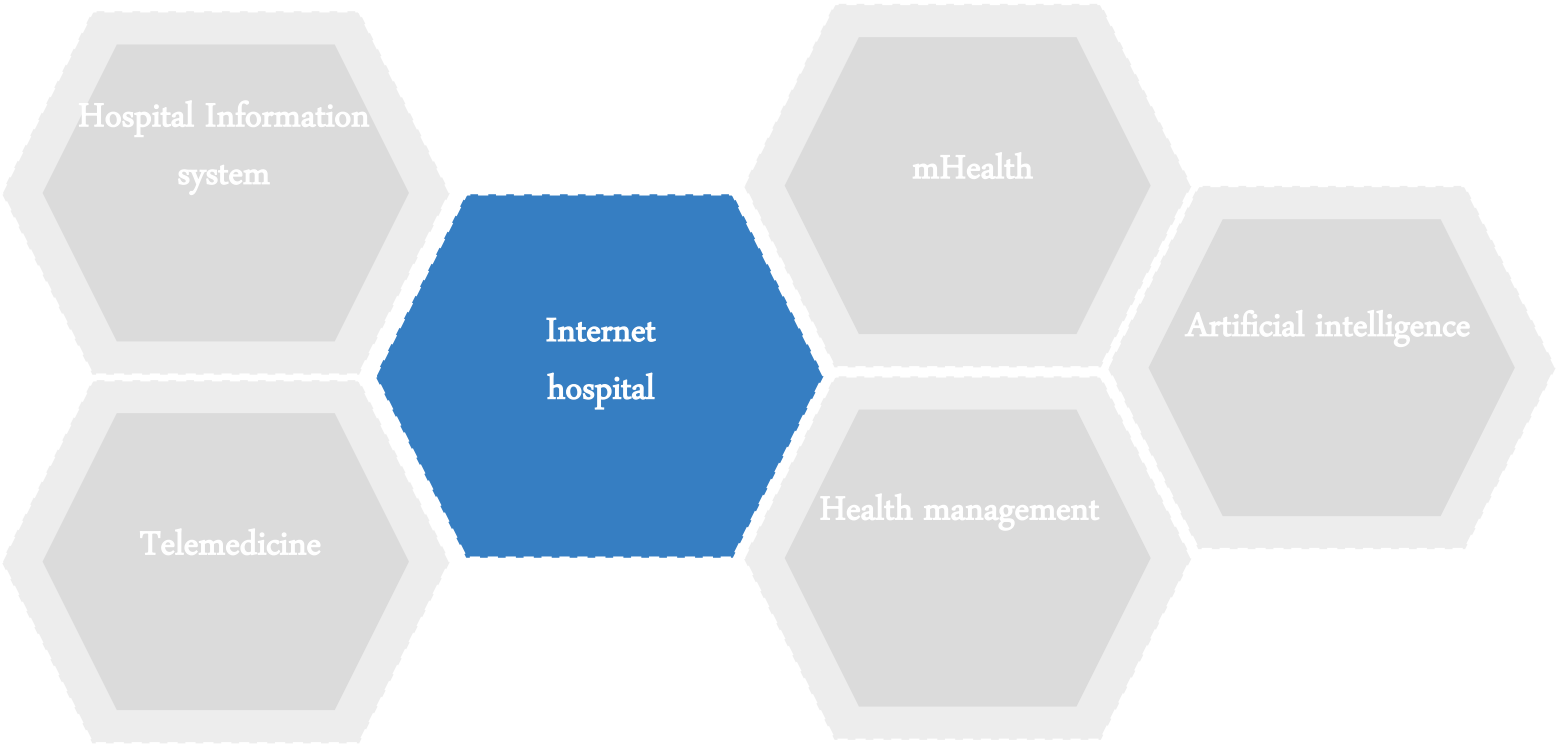
- Medical community cloud connects to the township hospitals and community health service centers, so as to realize the establishment and coverage of the basic medical service information system, and provide technical support for telemedicine and tiered medic service.
- Application scene: primary hospitals with lower information level which have the demand of regional cooperation.

Case: Medical imaging cloud solution offered by China Telecom

- Launches a full range of medical products By cooperatting with Wondersgroup.
- Focus on medical precision providing image cloud services
  - Image storage capability Computing power
  - Access capability
  - Application capability
  - Business Coordination ability



Six e-Health applications in China



What's Internet Hospital?

» Internet Hospital has been mentioned in China since 2015.
» It is a new intelligent health care platform, which doctor resources are shared, and is generally patient- oriented service (2C)model.

» The first internet hospital is :Guangdong Network Hospital.

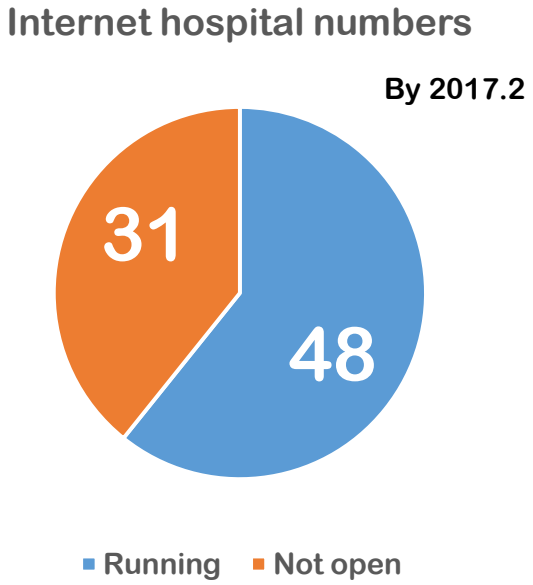
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1
- Have the certificate of a medical institution
- Engage in diagnostic and therapeutic activities

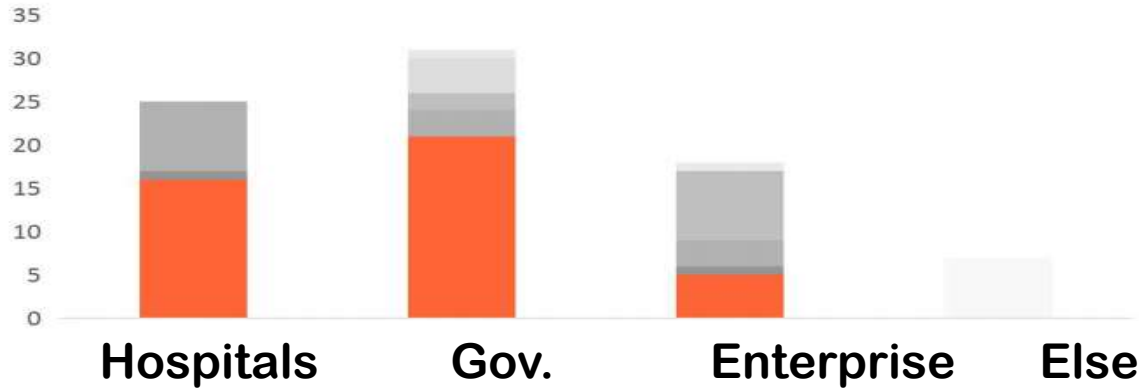
2
- Online diagnosis and treatment behavior should work in coordination with office hospitals.

3
- Professional medical staff
- Medical standards

Overall progress in China



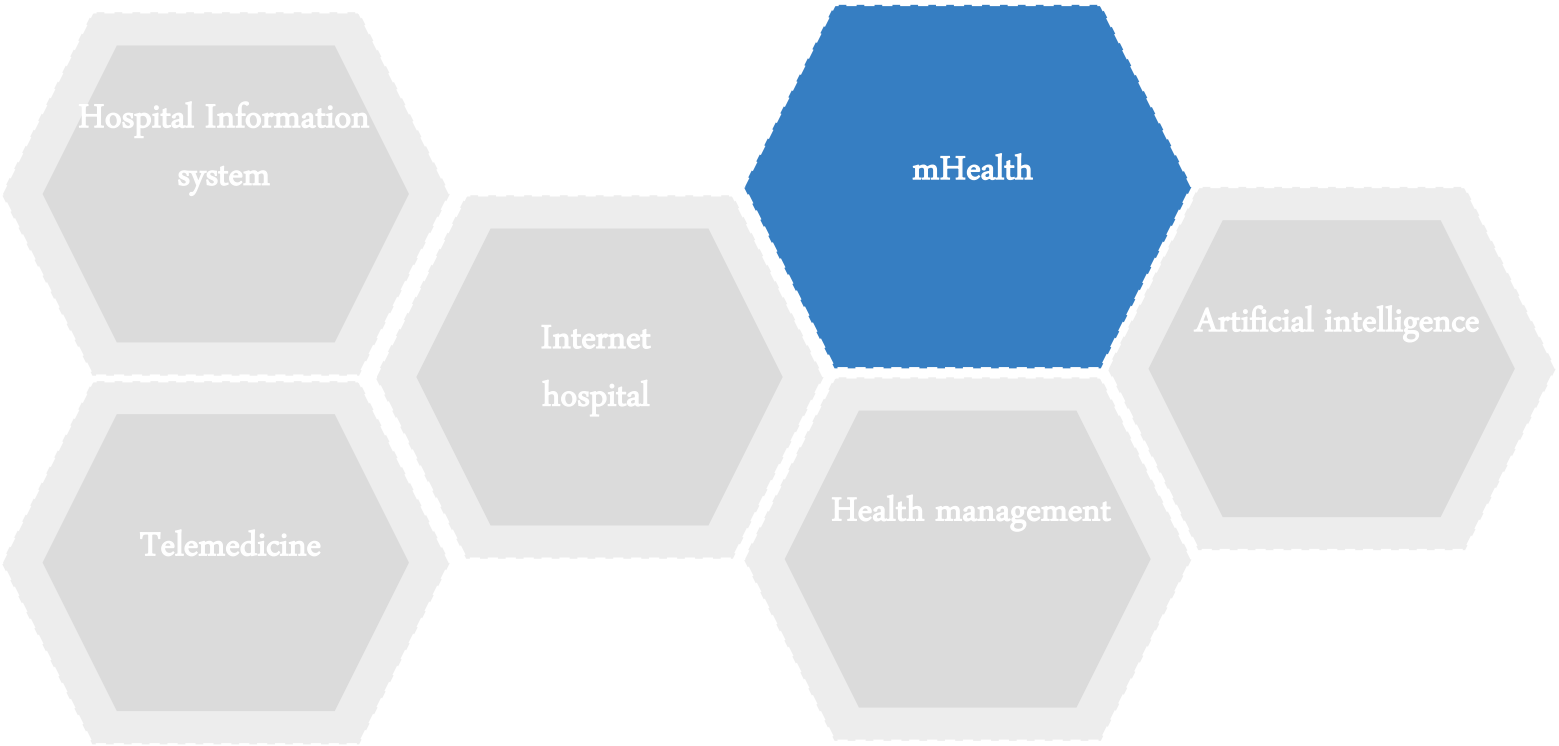
» Local government and hospital usually take the lead, enterprises participate in the construction.



Not fully engaged in the medical industry, the profit model is still under exploration

Pre treatment	During Treatment	After Treatment
• Medical inquiry • Appointment	Treatment is still rely on traditional medical institutions.	• Chronic disease management • Medical electricity supplier

Six e-Health applications in China

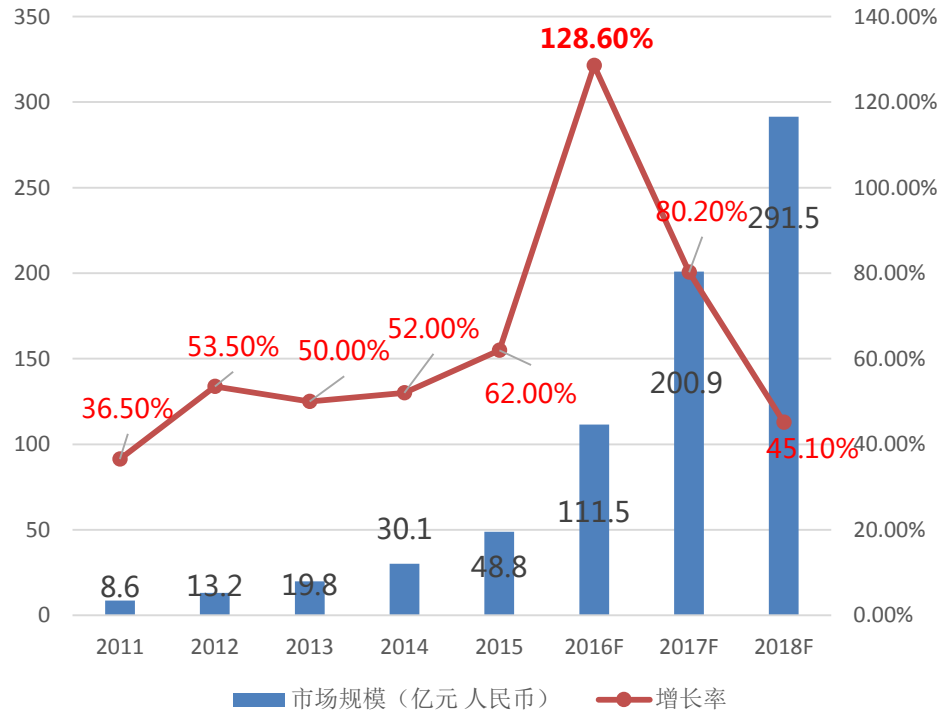


What's m-Health?

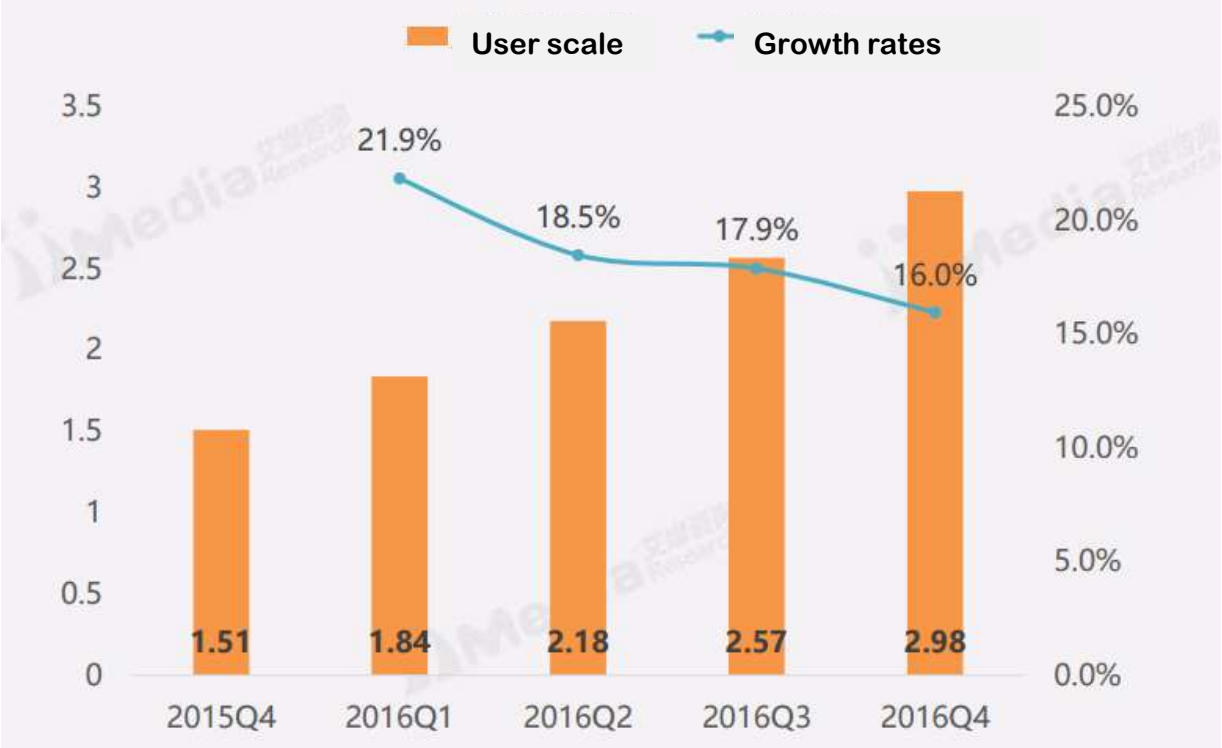


M-health is an abbreviation for mobile health, a term used for the practice of medicine and public health supported by mobile devices.

M-health market in China



M-health user scale in China



m-Health Scenarios in China

For doctors

» Medical information

Provide medical information, such as news, expert lectures, case discussion, etc..



» Doctor-patient communication

Help doctors manage patient information, communicate with patients ,and provide follow-up and other services.



» Doctor service

More like a doctor communication community.



For patients

» Make an appointment

Using cellphone to make an appointment to a certain hospital.



» Inquiry consultation

Asking for treatment advice online.

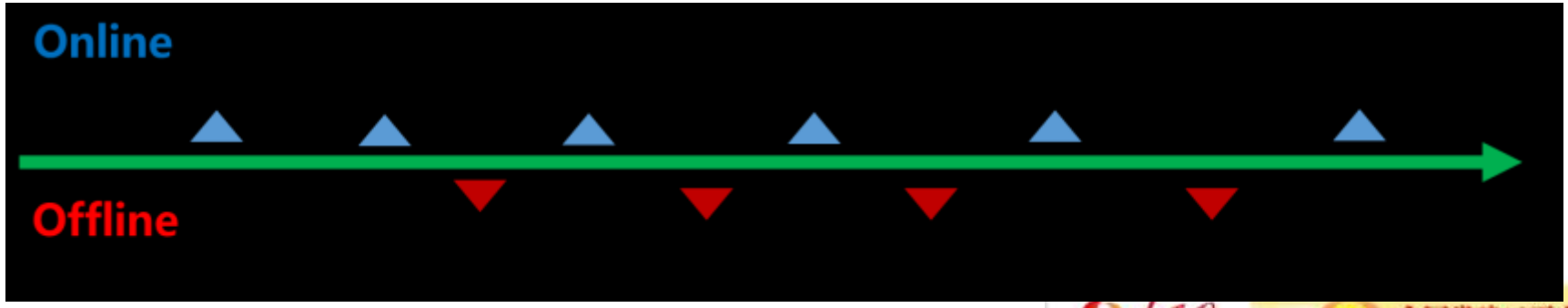


» Disease management



Hospitalize through smartphone gradually become the trend of development

Hospitalize through smartphone : Using smartphone app to seek medical advice, including information guidance and mobile payment(with medical insurance).





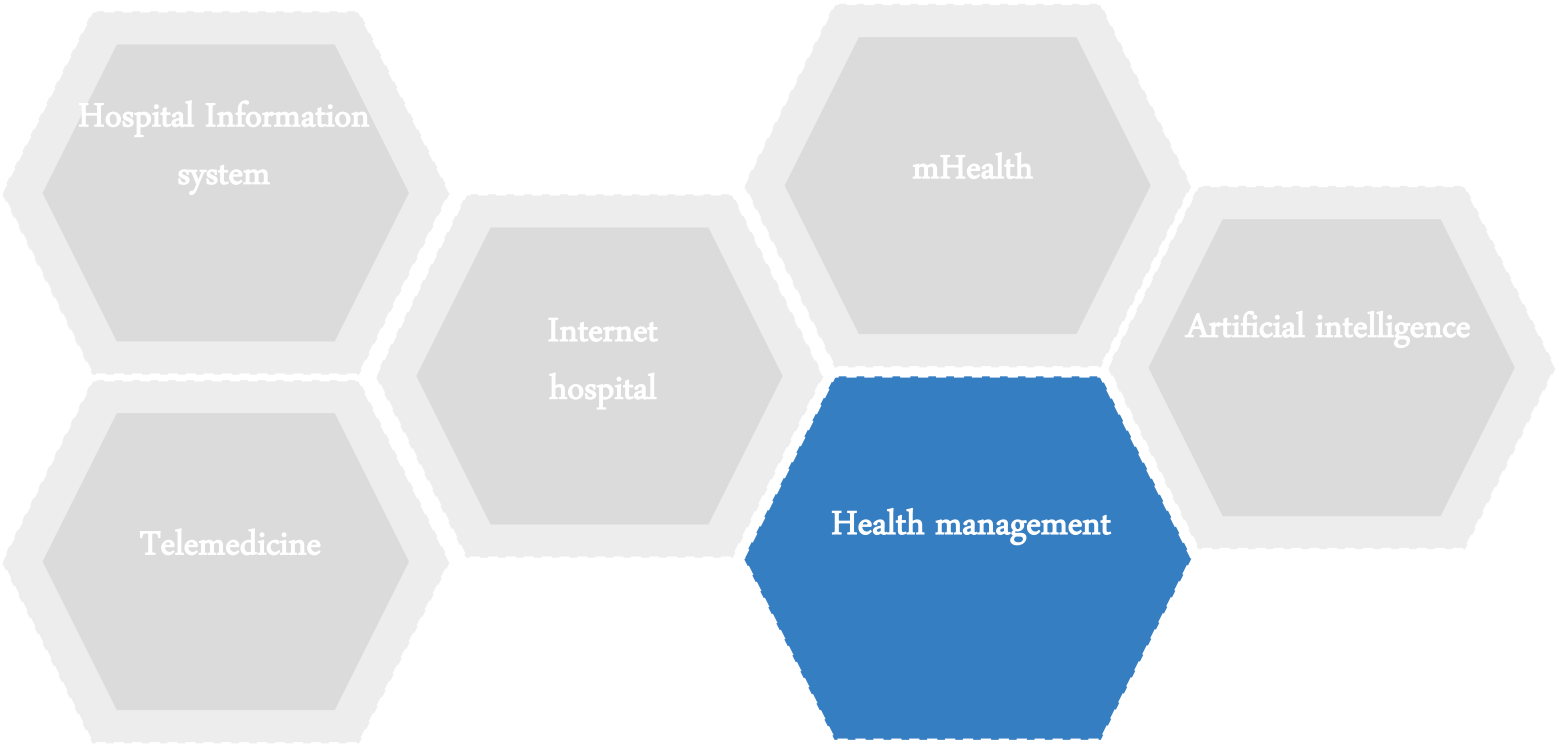
WeChat & Alipay are both creatively promoting hospitalize with app

Sixty percent over more than 1200 hospitals have already support seeking medical service by WeChat.

Alipay has partnered with more than 400 hospitals nationwide, data show that the future hospital has been serving more than 50 million people.

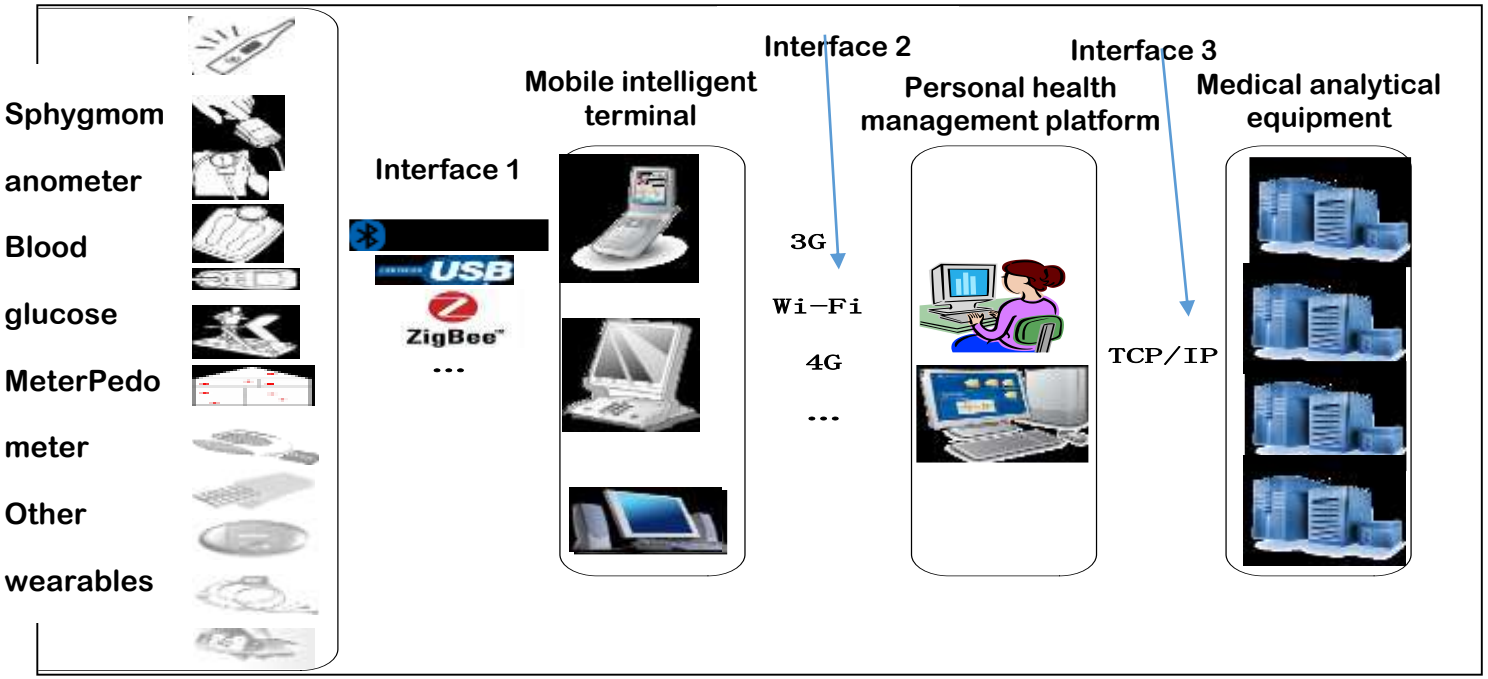


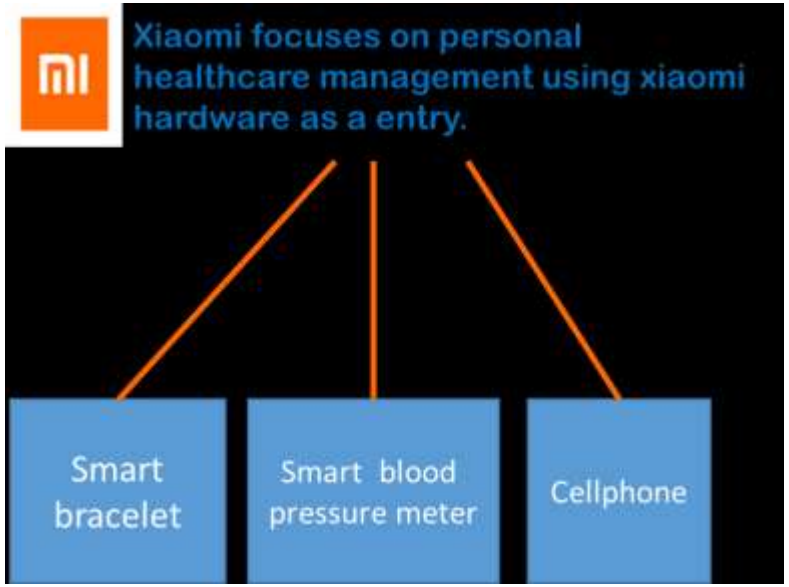
Six e-Health applications in China



Online health management

Online health management： Through online consultation or wearable device continuous monitoring, access to the health of users, dynamic health monitoring of users, and guide their healthy life.





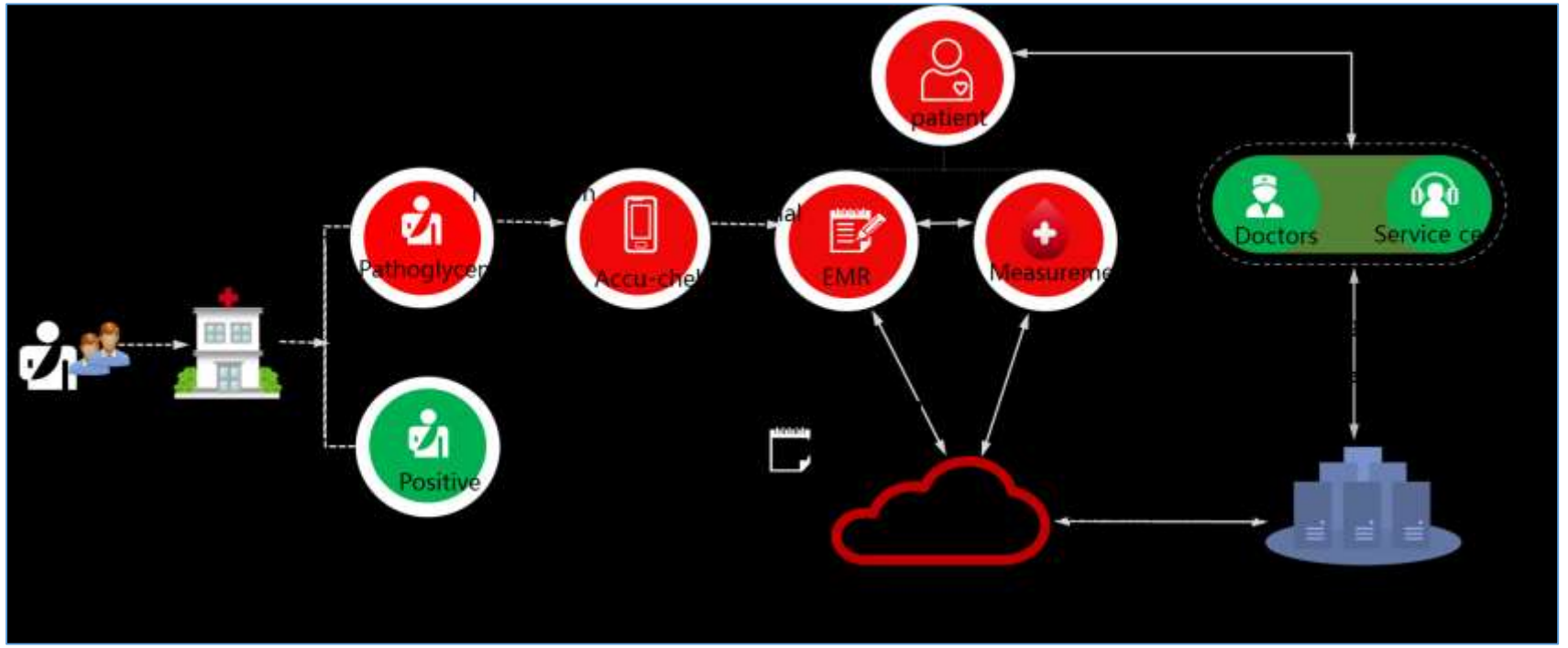
Chronic disease management in China

A whole chronic disease management system has been built in community hospitals in China.

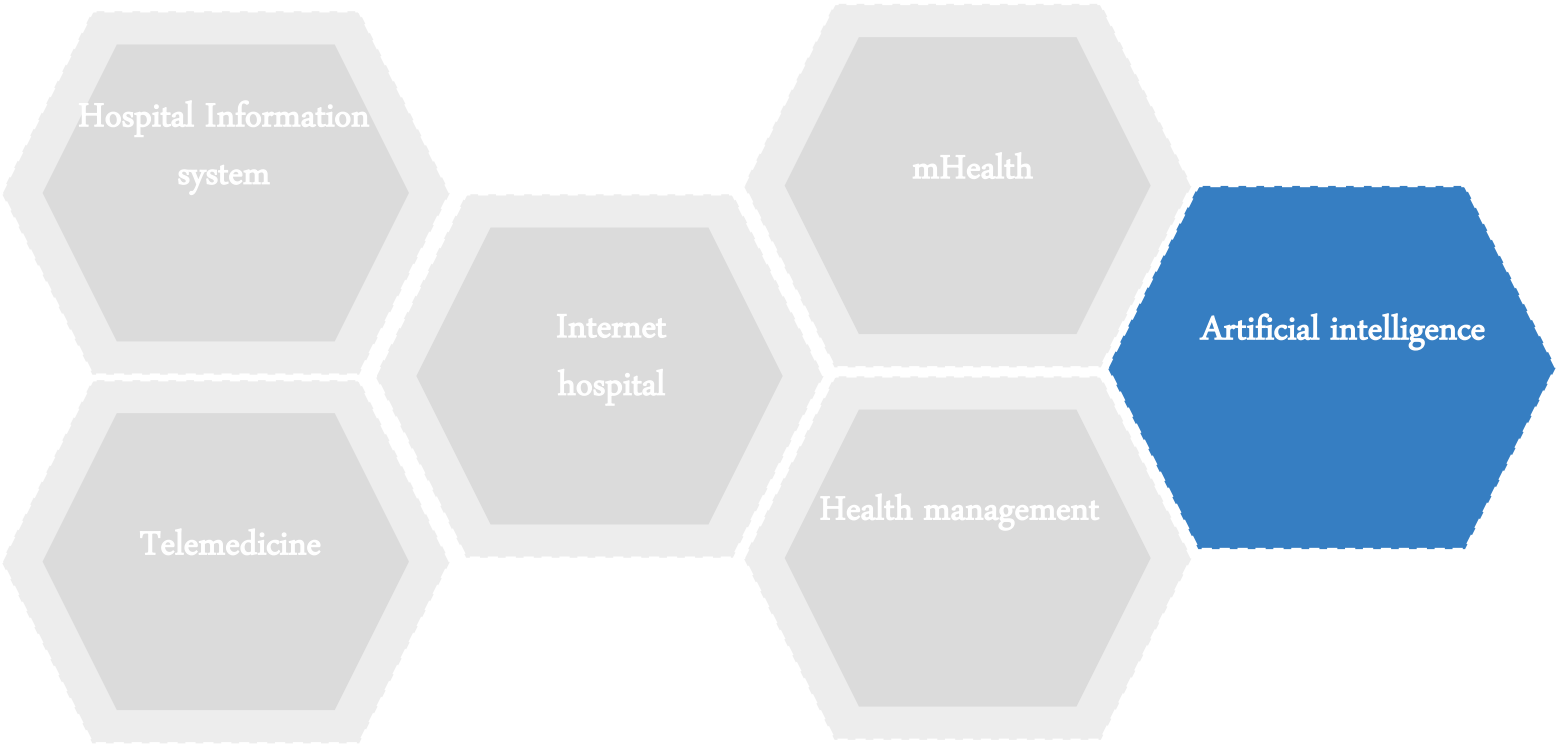
腾讯云

Chronic disease management solution offered by Tencent.

- Tencent Inc officially launched the "Teng Love Medicine" strategic plan in 2016.
- To build "Internet plus medical" open platform
- To build China connector medical industry and the internet.

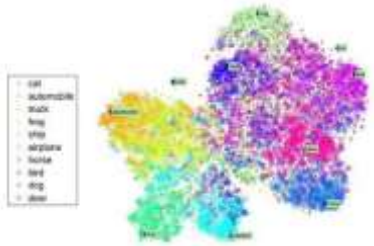


Six e-Health applications in China



Artificial Intelligence Applications

Medical artificial intelligence has many applications.



Natural language processing

decision support system

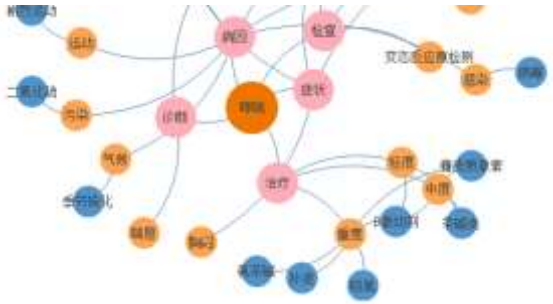


Disease | Examination | Drug



Medical image recognition

Intelligent triage



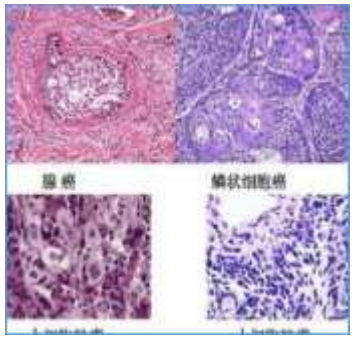
Medical knowledge atlas



Drug Development



Pathological assistant diagnosis



Artificial Intelligence Applications

Medical artificial intelligence has many applications.



Baidu launched Baidu medical brain in 2016.

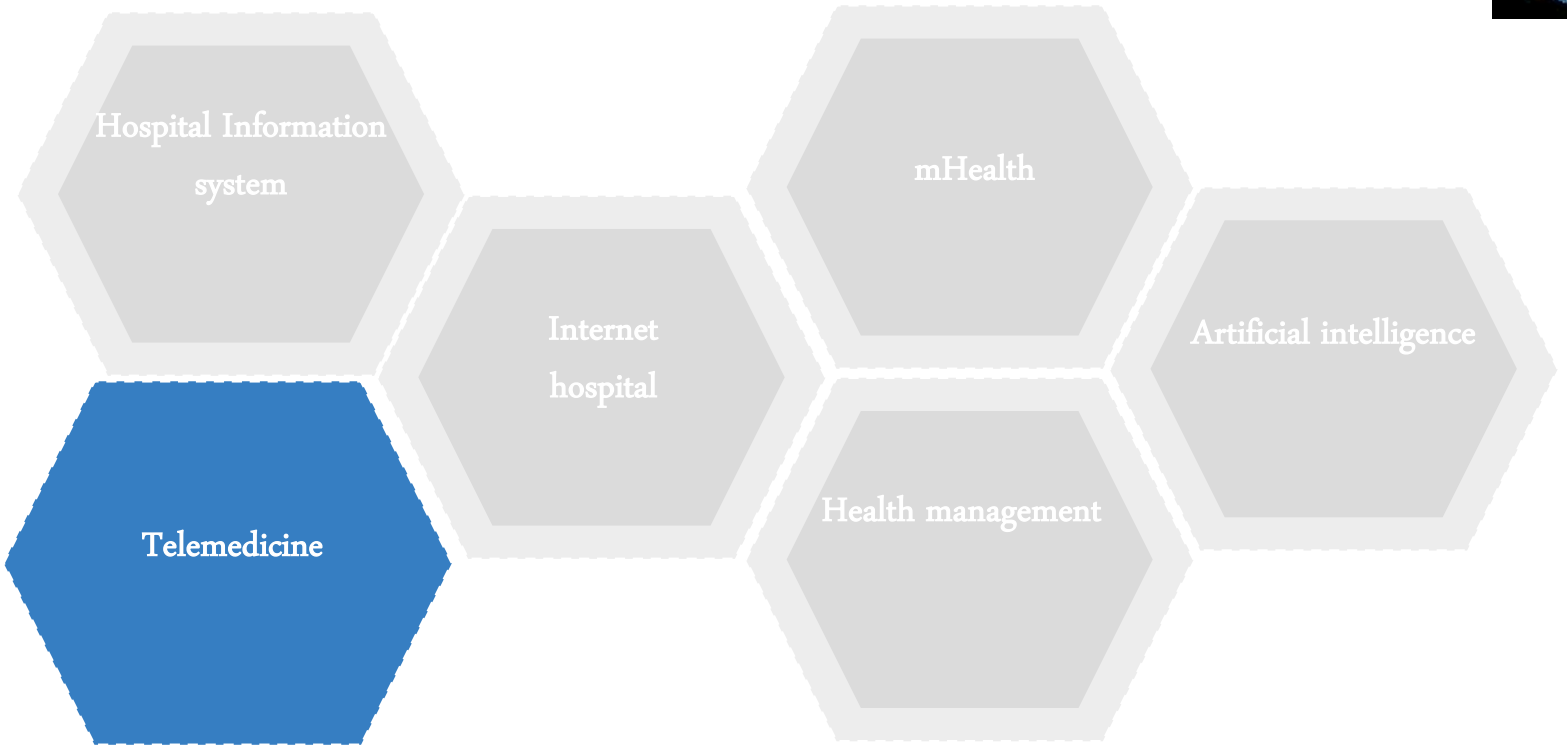
Application area: Provides intelligent assistance for online inquiry, makes user profiles for patients and help patients to manage their chronic disease.

科大讯飞 iFLYTEK

Translate voice into EMR directly

An APP called “Yunzhisheng” has been used in a hospital in Anhui Province, which can record the doctor's instructions directly and make them into an electronic document.

Six e-Health applications in China



What's telemedicine



Telemedicine is the use of telecommunication and information technology to provide clinical health care from a distance.

- Medical management standards should be followed
- Higher technical standards are required

Promotion in the medical industry

Telemedicine

Mode concept

eHealth

Promotion in the Healthcare industry

m-Health

Technology concept

Telemedicine is an effective way to realize hierarchical medical in China

Guiding Opinions of the General Office of the State Council on Propelling the Building of a Hierarchical Diagnosis and Treatment System》〔2015〕No.70，2015-9-11

70% patients go out to seek medical advice in China

HIERARCHICAL MEDICAL TARGET

- 90% **Consultation rate within county**
- 65% **Proportion of medical treatment in local hospitals**
- 2/3 **Critical diseases treated with county**

Telemedicine application in China

Five tier telemedicine architecture has been built by First Affiliated Hospital of Zhengzhou University in Henan Province of China.

郑州大学第一附属医院
The First Affiliated Hospital of Zhengzhou University

01	Tertiary hospitals First level datacenter	Remote Consultation center	Remote education	Remote Library	Remote Image/ECG/ Pathology consultation	
		Monitoring center	recorded Broadcast center	Remote emergency center	Disaster recovery	Organization construction
02	Hospitals in cities Second level datacenter	Remote Consultation center	Remote education	Remote Library	Remote Image/ECG/ Pathology consultation	
03	Hospitals in County Third level datacenter	Remote consultation	Train& Receive training	Remote Image/ECG consultation		
04	Clinics in towns and townships Forth level datacenter	Initially diagnosed	Receive training	Image/ECG diagnosis		
05	Clinics in village Fifth level datacenter	Initially diagnosed	Receive training	Healthcare management		

HUAWEI

» Huawei offers the whole project resolutions and all the video devices.

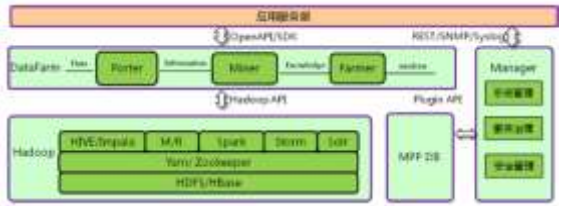


TE30-C-720P



ViewPoint 9030 720P

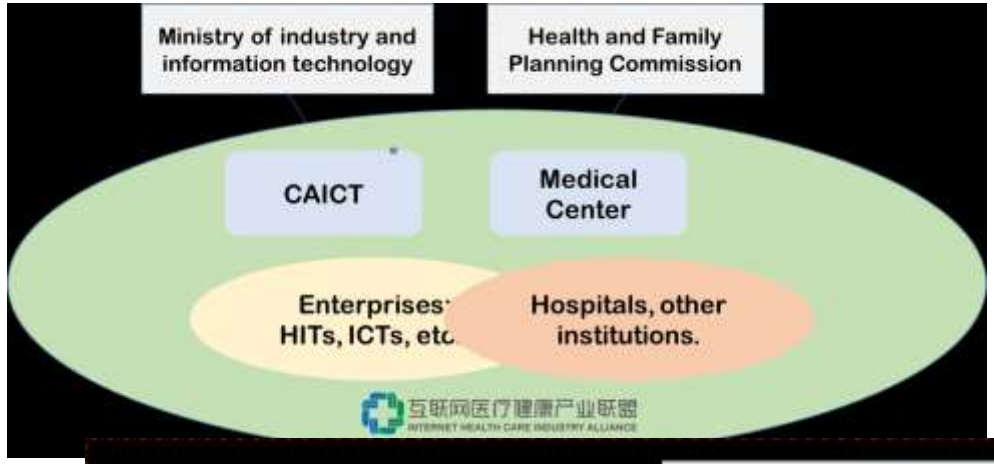
» **Huawei offers the big-data platform.**



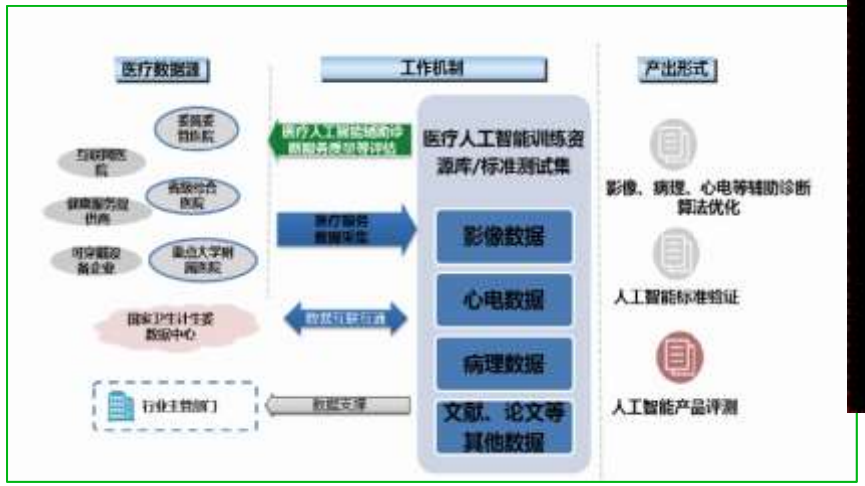
What do we do ?

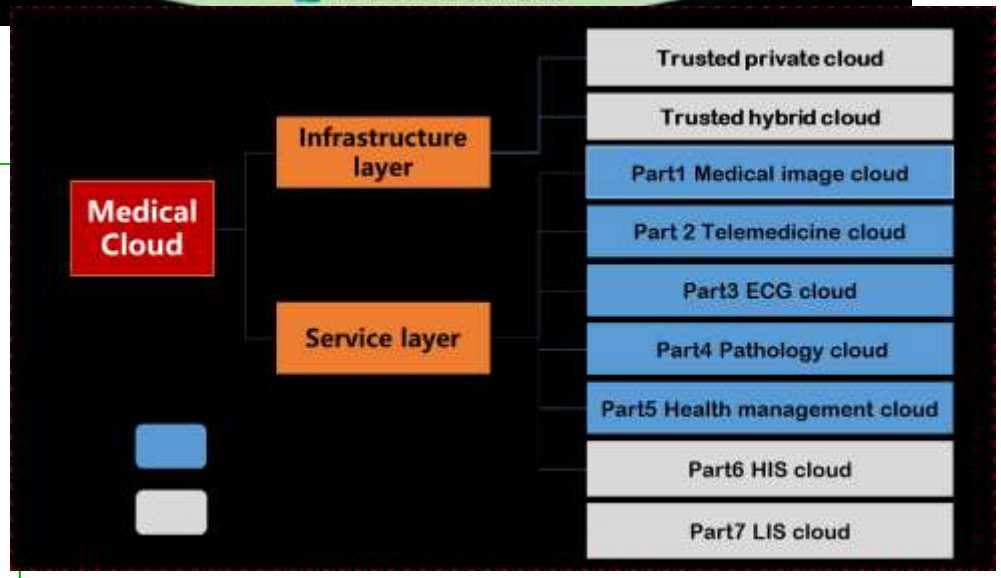
Internet Healthcare industry alliance(IHIA)

- To build a supply-demand contact platform and promote industrial development in many ways.
- Committed to the construction of medical cloud computing, large data and artificial intelligence standardization system, to carry out the relevant services credible type selection certification.
- IHIA has published a series standards of Trusted Medical Computing standards.
- IHIA has launched a project called ” Medical intelligent auxiliary diagnosis large data platform”.





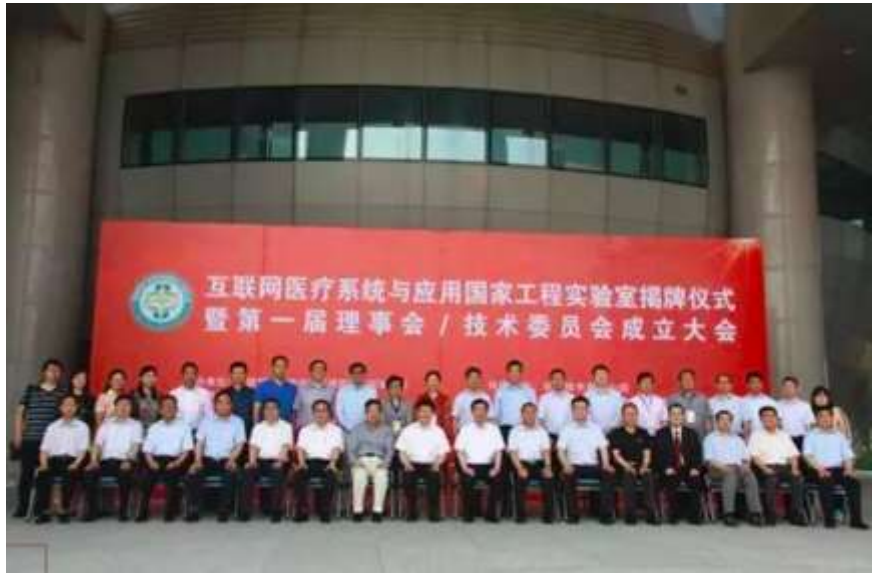


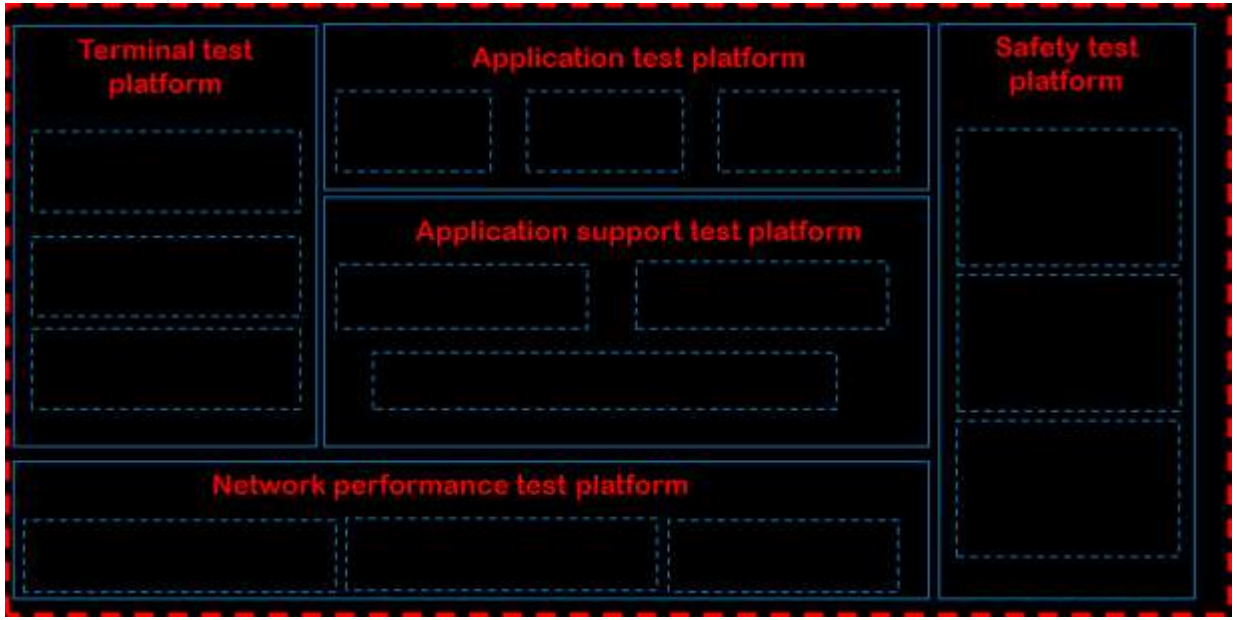


What do we do ?

Internet medical system and application of national engineering laboratory

- Authorized by the national development and Reform Commission
- Built by CAICT, China Mobile, Huawei, hospitals, ect.
- CAICT is responsible for the construction of the internet medical testing and verification center, the internet medical policy and standards research center





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Photo：



Thanks!

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