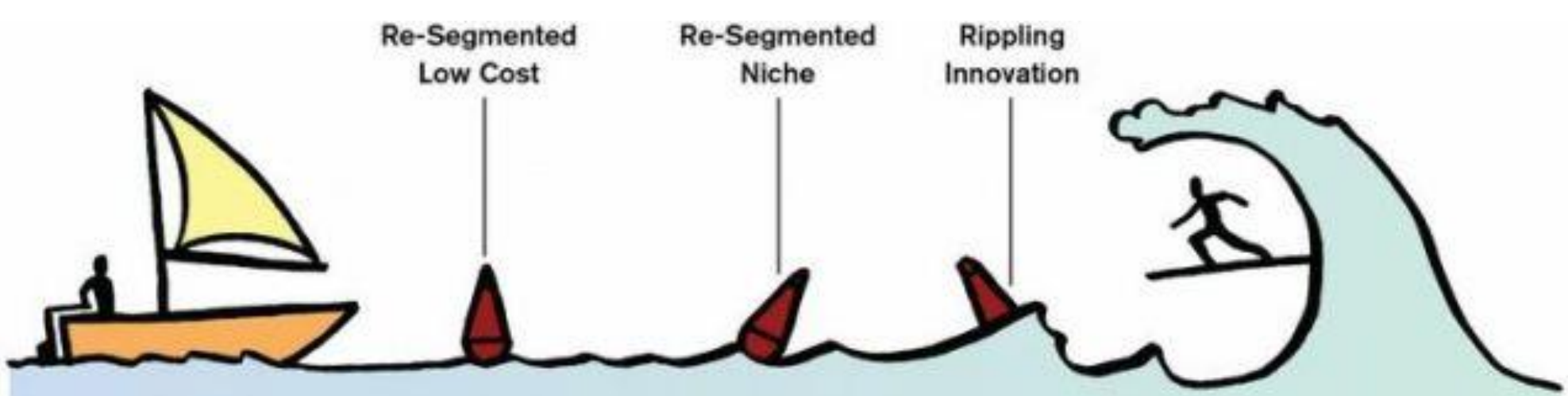
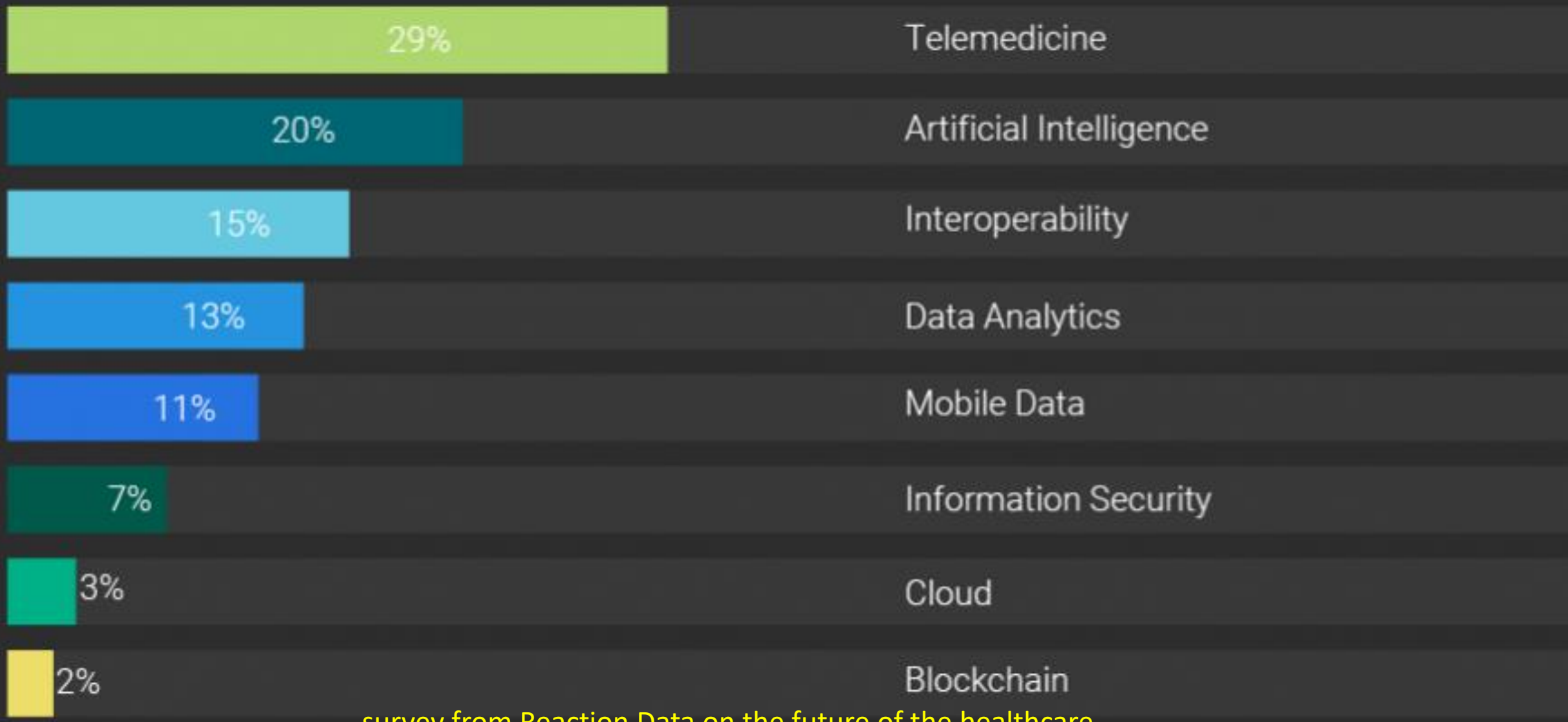
Healthcare Disruptive Technology

Dr.Chanvit Tharathep



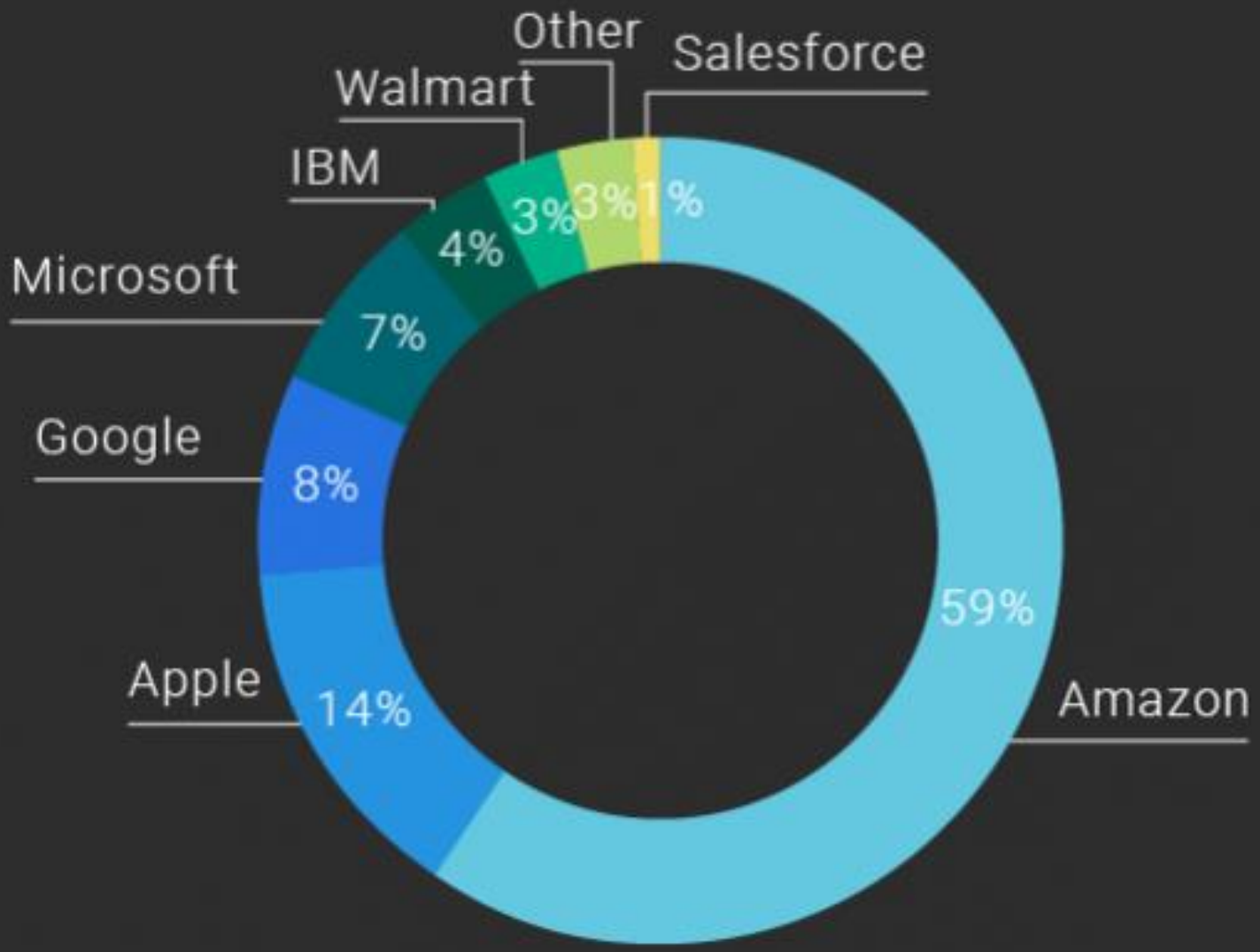
Sustaining Innovation	Disruptive Innovation
Problem is well understood	Problem not well understood
Existing Market	New Market
Innovation improves performance, lower cost, incremental changes	Innovation is dramatic and game changing
Customer is believable	Customer doesn't know
Market is predictable	Market is unpredictable
Traditional business methods are sufficient	Traditional business methods fail

Which Technologies Will Have The Biggest Impact?



survey from Reaction Data on the future of the healthcare market focuses on the theme of "healthcare disruption."

Which Entrant Will Have The Biggest Impact?



"[Amazon has] visionary leadersh
the ability to make the change ha
-CEO

"Amazon has a huge market they
distribute materials. They are alre
household name and the users ar
specific to Apple or Android."
-CEO

The five disrupters

Source: Bain & Company

5 Tech Trends that will DISRUPT HEALTHCARE in 2020

| INTERNET OF THINGS

Global IoT Healthcare Market to Reach **$534.3 Billion** by 2025.

SOURCE – grandviewresearch.com

| 3D PRINTING

Global 3D Printing Market is to be **$2,319.5 Million** by 2020.

SOURCE – alliedmarketresearch.com

| NATURAL LANGUAGE PROCESSING

NLP is Expected to grow at a CAGR of **16.1%** to **$16 Billion** by 2021.

SOURCE – healthitanalytics.com

| MACHINE LEARNING

Virtual Nursing Assistance in Machine Learning is Saving **$20 Billion** Annually.

SOURCE – techgenix.com

| BLOCK CHAIN

Healthcare Market is Expected to Exceed **$1,636.7 Million** by 2025.

SOURCE – healtheuropa.com

"The Confluence of many Industry Shaping Technologies such as 5G, AI, Blockchain, IoT, Edge Computing and others will have a Significant Disruptive Impact on Industry Verticals. Given that there so many Inefficiencies in the Healthcare Supply Chain, it is Ripe for Change."

Chetan Sharma
CEO of CHETAN SHARMA CONSULTING.

Unfold Labs

"Technology has Helped Improved Healthcare over the years. From Connected Devices to Implantable Solutions, Innovation in the Tech Industry is Saving Lives & Helping Doctors with Data, Analytics & Improved Decision Making. Am Looking Forward to Seeing Technologies like 5G, Sensors and Devices Help Implement Newer Programs and Services that Meet the Needs of the Community."

Kulin Tantod, MD
Director of Medical Informatics Neighborhood Healthcare.

Unfold Labs

"Technology and Innovative Devices/Sensors will Enhance Experiences to Healthcare Providers & Payers and also help Build Value-Based Care Delivery Models. Machine Learning Embedded with Practice Management Systems will Change the Landscape of Provider Reimbursement."

Ash Mehta
CEO of PatientClick, INC.

Unfold Labs

The firm with 900 staff and no office

By Felicity Hannah
Wake up to Money, BBC Radio 5 live

5 July 2019 | 129

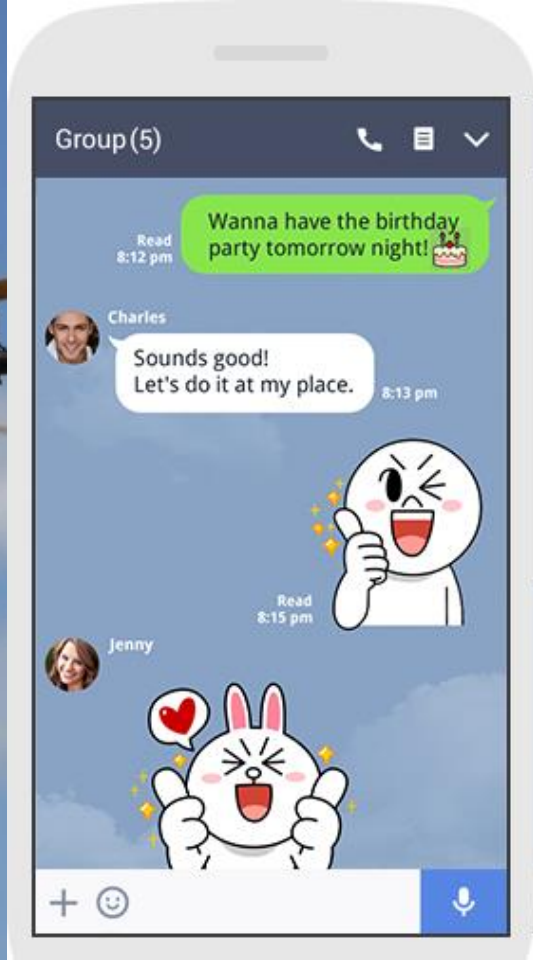
Share

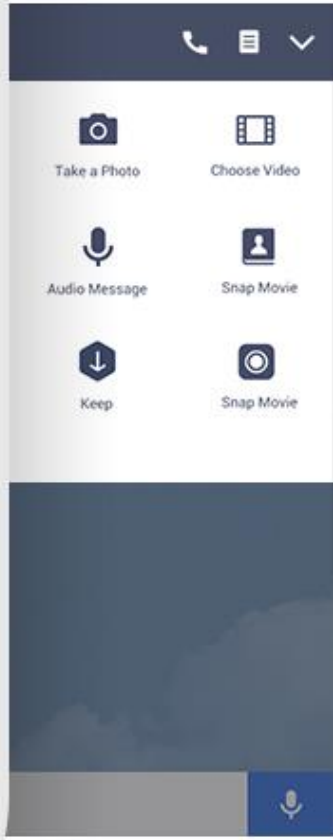

Reebok


DOCTOR

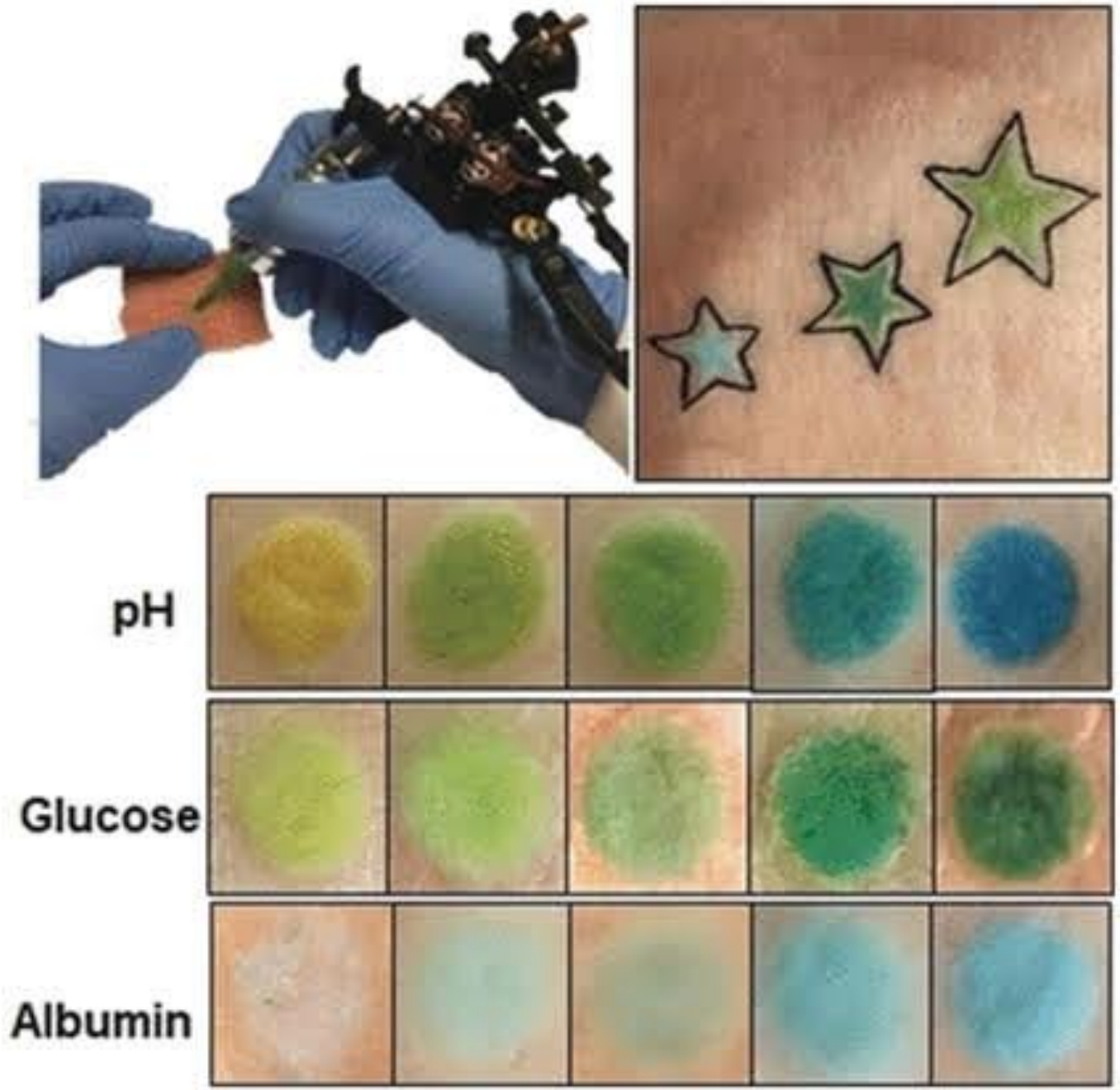

Health Book
72
bpm
Heart Rate
Sleep
Emergency

โลกในวันหน้า





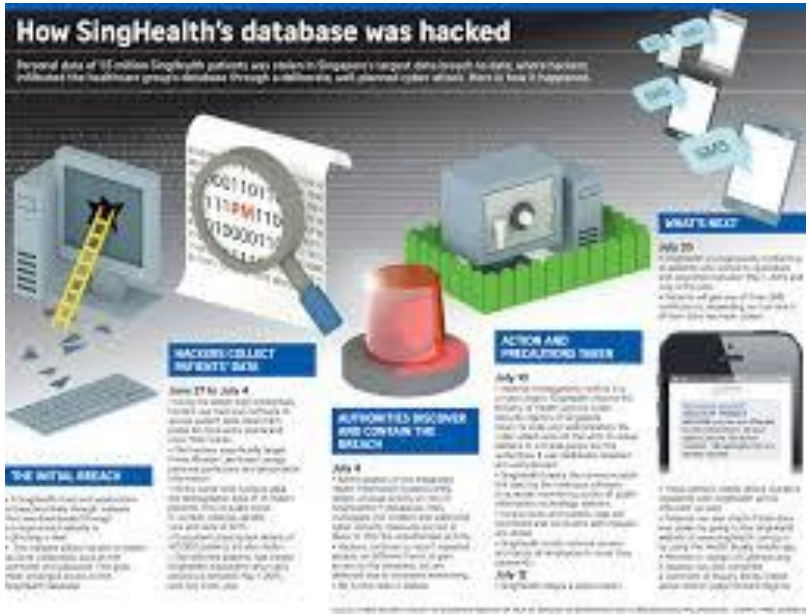
เทคโนโลยีที่เปลี่ยนแปลงวิธีการใช้ชีวิต


pH
Glucose
Albumin

การรั่วไหลของข้อมูล

THE STRAITS TIMES

Personal info of 1.5m SingHealth patients, including PM Lee, stolen in Singapore's worst cyber attack



UNAUTHORISED POSSESSION AND DISCLOSURE OF INFORMATION FROM HIV REGISTRY

German schools ban Microsoft Office 365 amid privacy concerns (Updated)

by RAVIE LAKSHMANAN — 3 days ago in PRIVACY

Facebook ไตรมาส 2/2019 รายได้เติบโต 28% ขณะที่ค่าปรับ FTC บันทึกเพิ่มอีก 2 พันล้านดอลลาร์

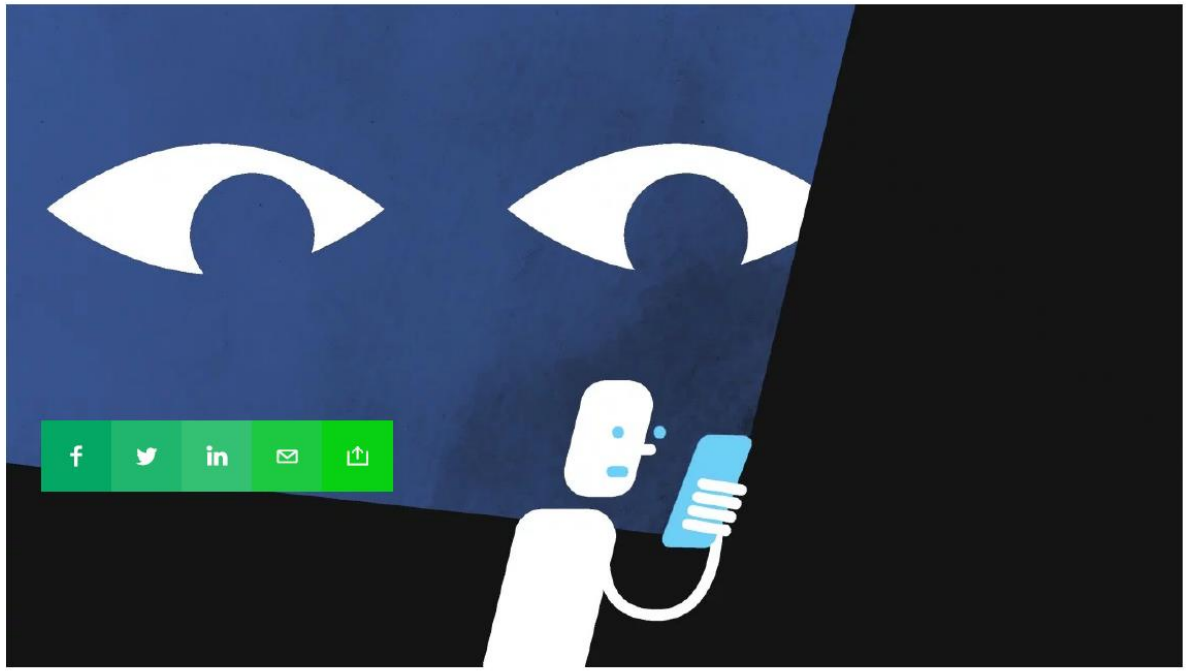
By: arjin on 25 July 2019 - 06:54 Tags: Facebook Financial Report

Facebook รายงานผลประกอบการประจำไตรมาสที่ 2 ของปี 2019 มีรายได้รวม 16,624 ล้านดอลลาร์ เพิ่มขึ้น 28% จากช่วงเดียวกันในปีก่อน และมีกำไรสุทธิ 2,616 ล้านดอลลาร์ โดยในไตรมาสนี้ Facebook บันทึกค่าปรับที่จ่ายให้ FTC เพิ่มเติมอีก 2 พันล้านดอลลาร์ รวมทั้งหมดเป็น 5 พันล้านดอลลาร์ ตามที่รายงานก่อนหน้านี้

Europe's top court sharpens guidance for sites using leaky social plug-ins

Natasha Lomas @riptari / 2 days ago

Comment



Europe's top court has made a ruling that could affect scores of websites that embed the **Facebook** 'Like' button and receive visitors from the region.

SMART HOME

Smart home devices are being used in domestic abuse, report finds

SHARE

Rather than simplifying their lives, some smart home device owners are finding that their connected gadgets and appliances are making their lives a living hell. The New York Times recently reported a disturbing new trend that leverages smart devices as tools of abuse, with some ill-intentioned users (not even hackers), using their smartphones in order to remotely control locks, speakers, thermostats, lights, and the like, and wreak emotional havoc on those within the home. More alarming still is


ร้องโรงพยาบาลดัง
"วินิจฉัยผิด"


KHAENLINK
พอ.รพ.แจงกรณี "ลืมผ้าก๊อซ"


ญาติร้องซ้ำคดีผู้ป่วยตายไม่คืบ

“Res Ipsa Loquitur” the thing speaks for itself

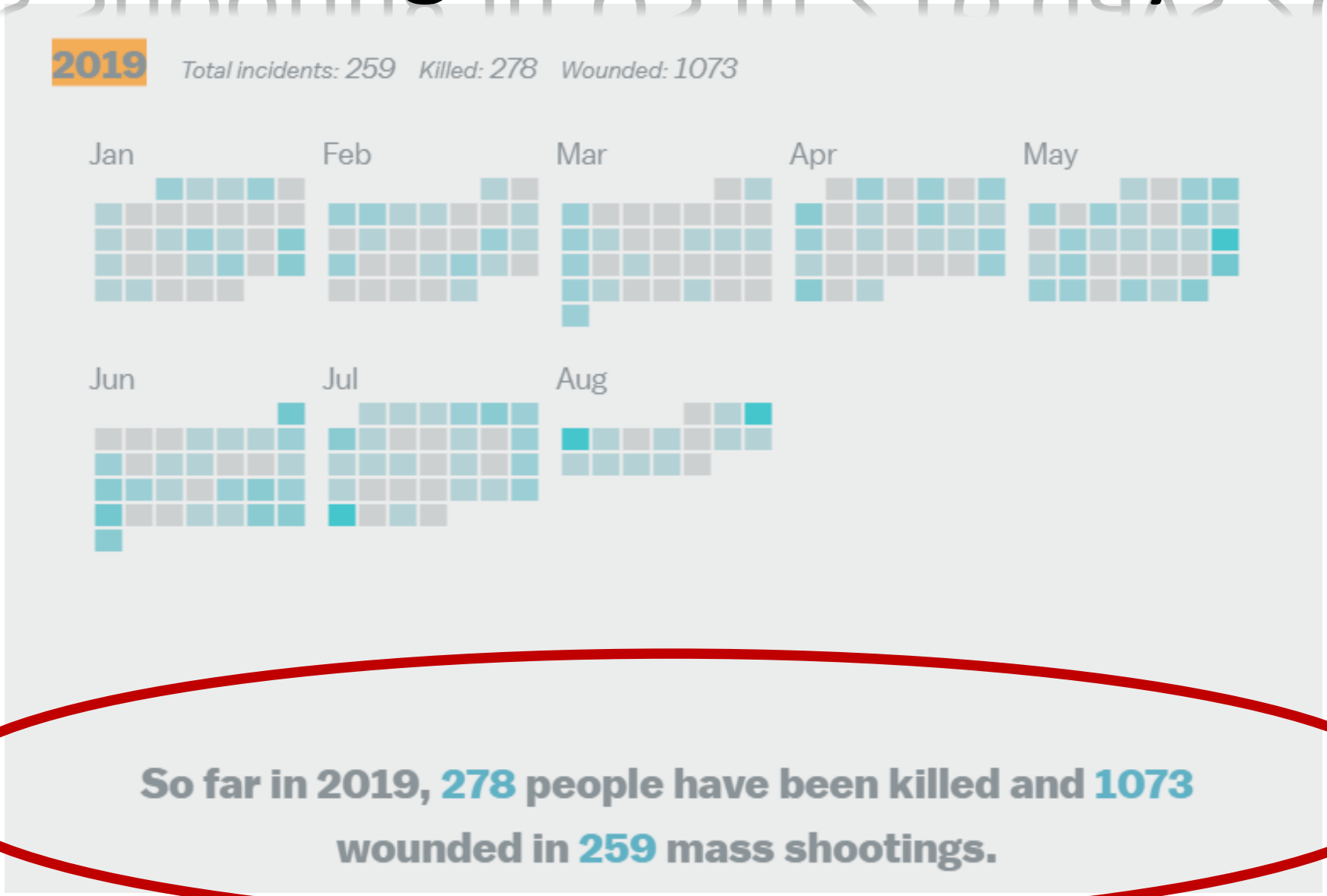
โดยปกติแล้วคู่ความฝ่ายใดกล่าวอ้างข้อเท็จจริง คู่ความฝ่ายนั้นย่อมต้องมีภาระการพิสูจน์ข้อเท็จจริงที่ตนกล่าวอ้าง

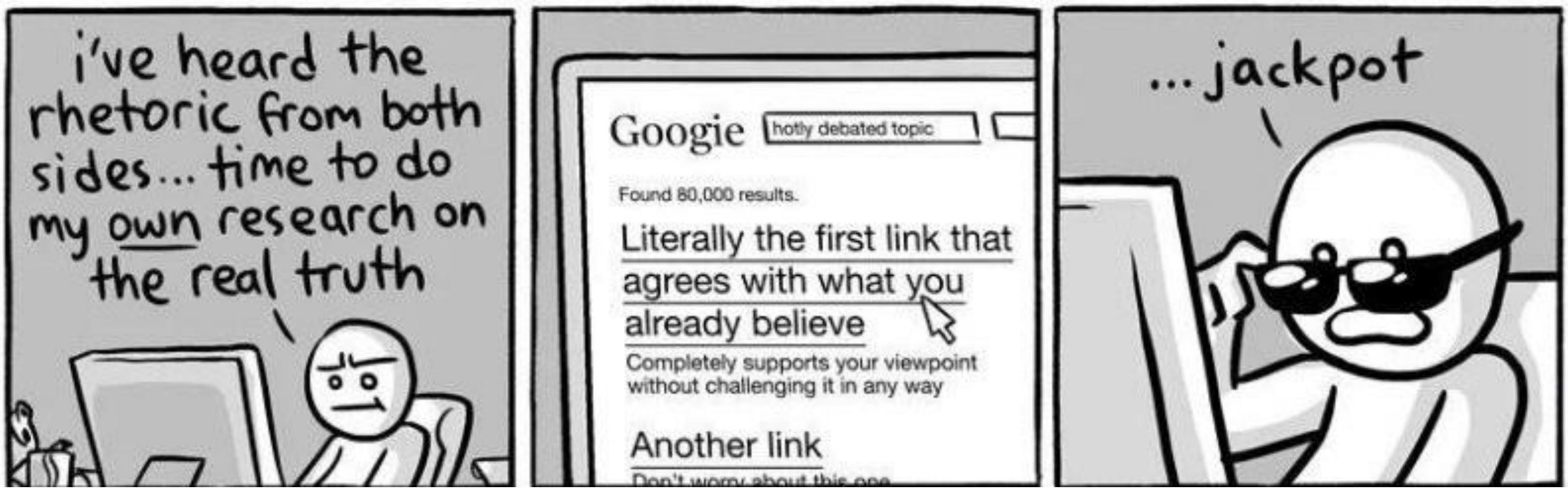
จำเลยน่าจะประมาท ถ้าจำเลยไม่ประมาทแล้ว เหตุร้ายย่อมไม่เกิดขึ้น ดังนั้น เหตุการณ์ที่เกิดขึ้นย่อมบอกอยู่ในตัวว่าฝ่ายใดเป็นผู้ประมาท

Putin: 'I will say this clearly: There are no Russian troops in Ukraine'

I'll say what I want to be true and it's not a lie because I want it to be true and who cares what I believe?

Mass Shooting in US in 216 days 2019



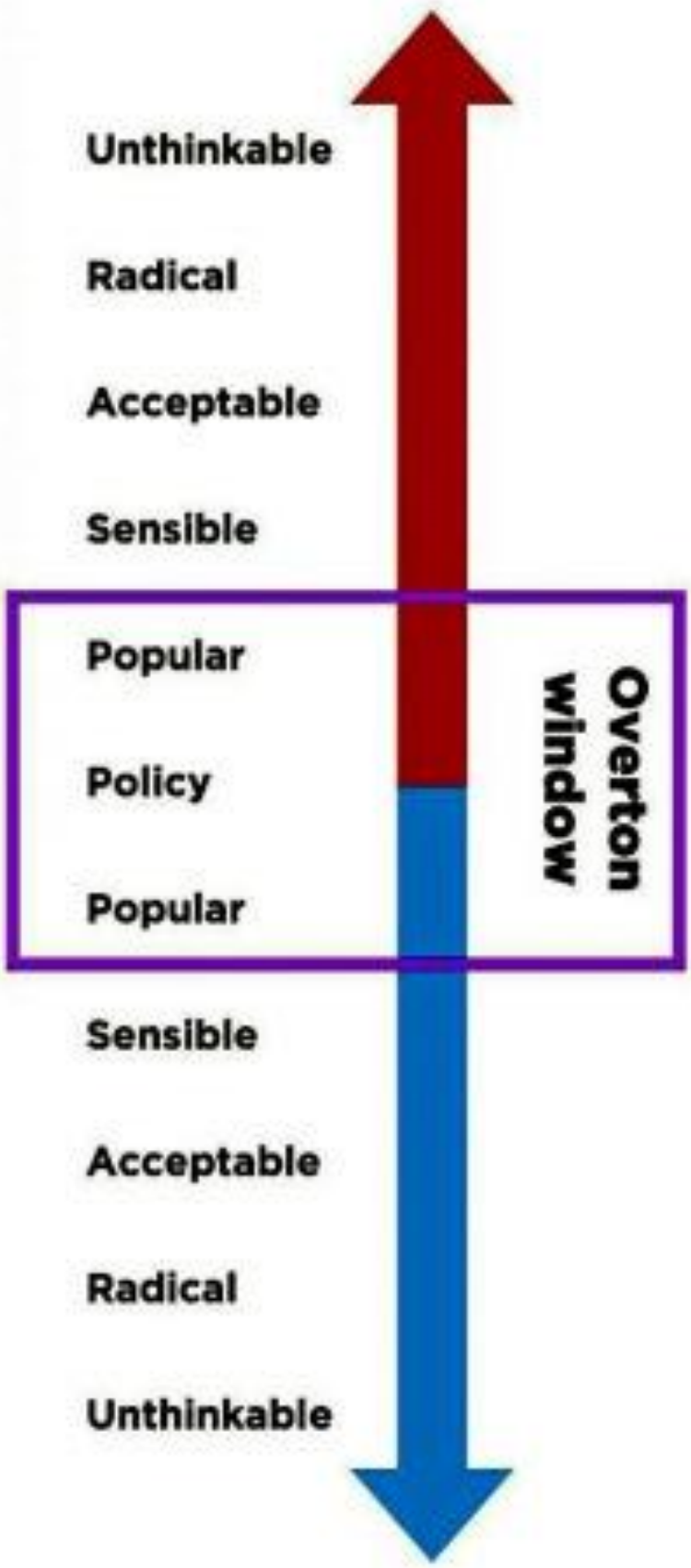


Confirmation Bias

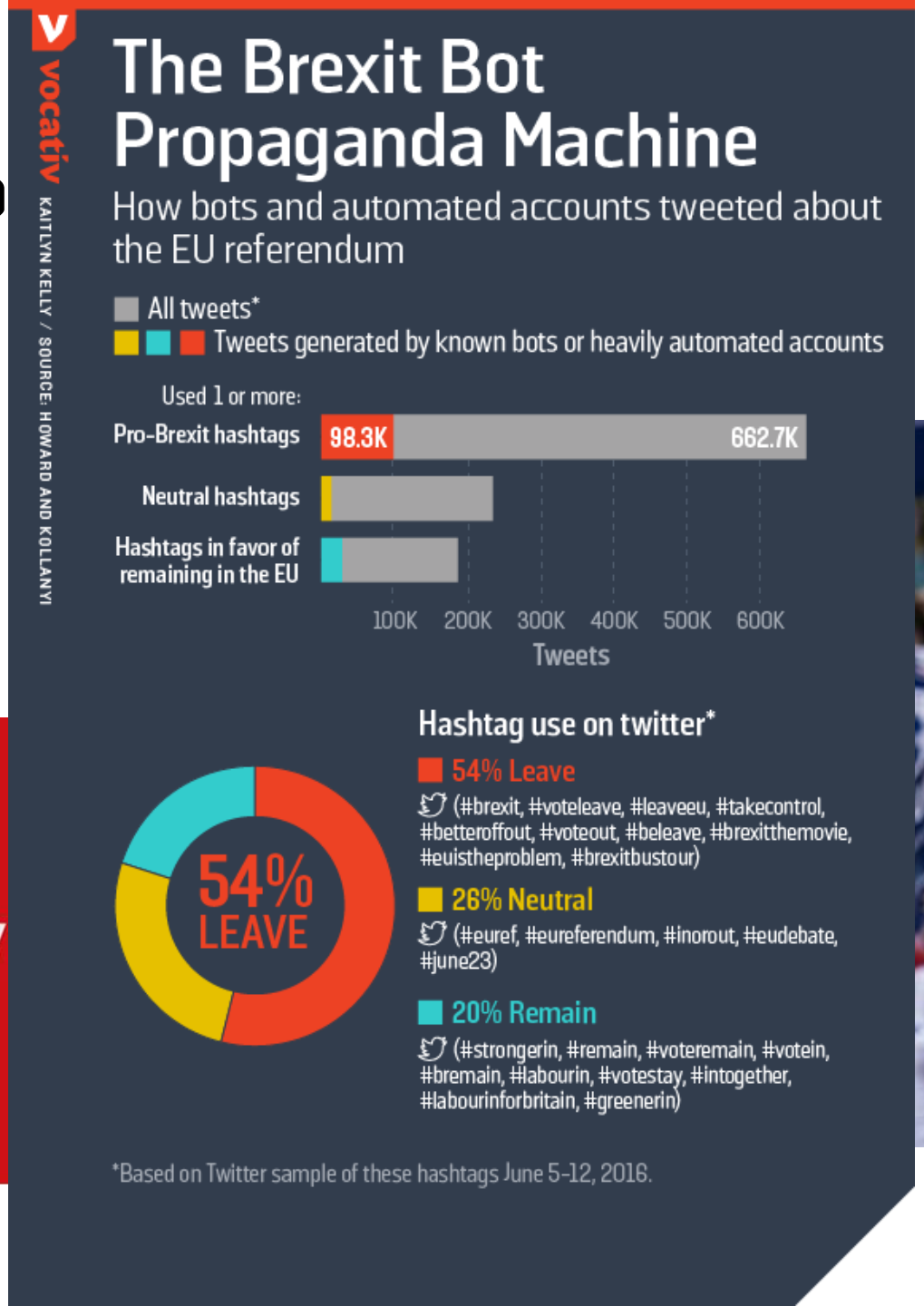

embryo of guinea pig, a sprinkle of unborn baby...
What potion are we making?


Never inject them.
There are NO safe vaccines!
Shaken Baby Syndrome
Chronic Ear Infections
Death
SIDS
Seizures
ADD
Allergies
Asthma
Autism
Diabetes
Meningitis
and polio are caused by adverse reactions to vaccine poisons.

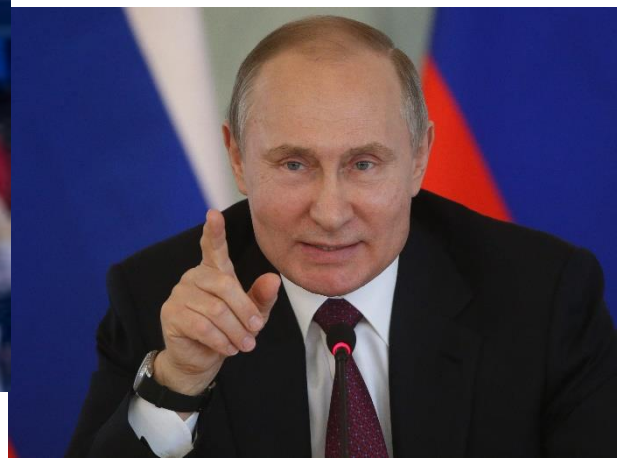

ANTI-VAXXers
SNIP!
PREVENT-ABLE DISEASES


Unthinkable
Radical
Acceptable
Sensible
Popular
Policy
Popular
Sensible
Acceptable
Radical
Unthinkable
Overton window

ทำไมการป้องกันข้อ



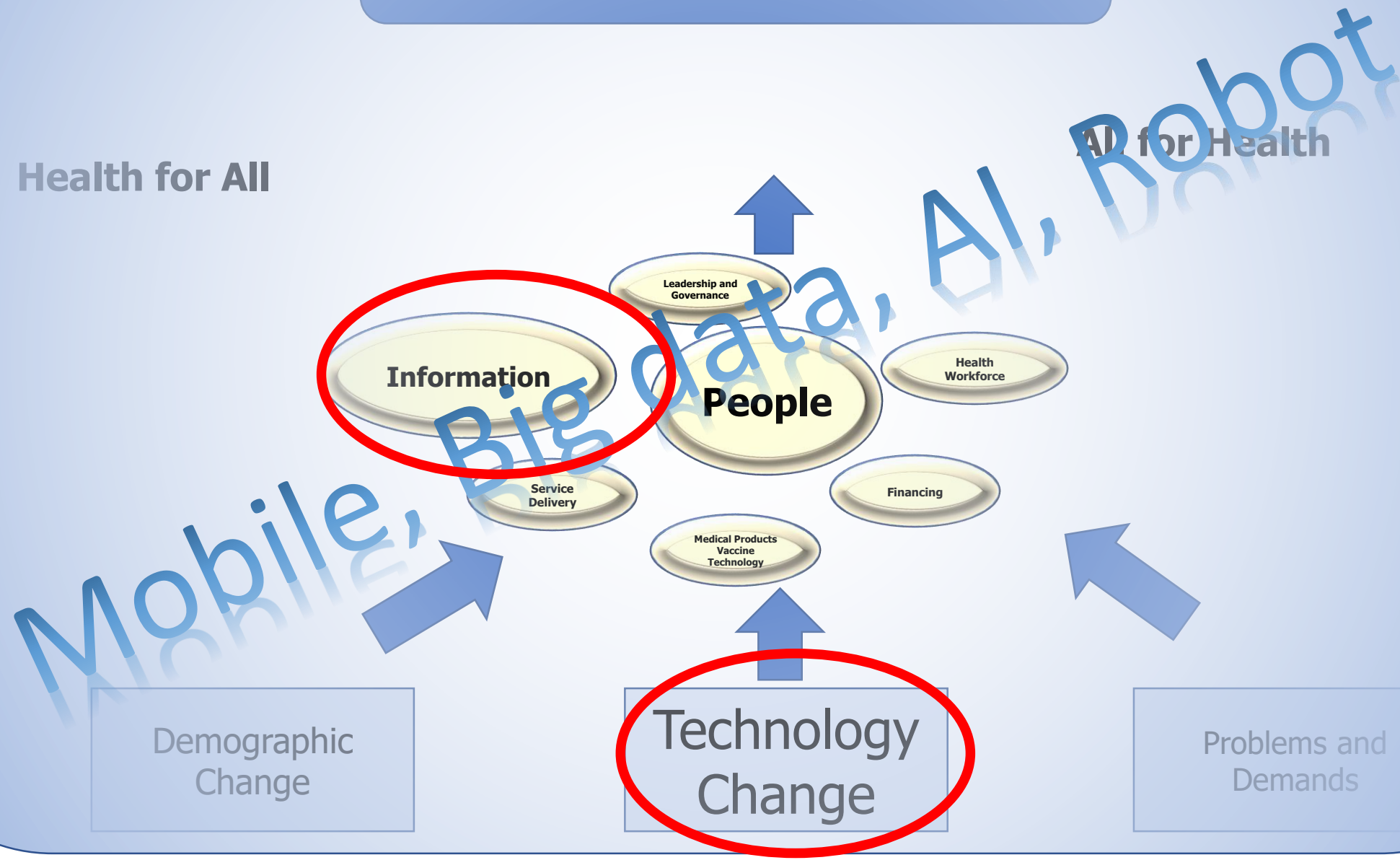
AIQ™

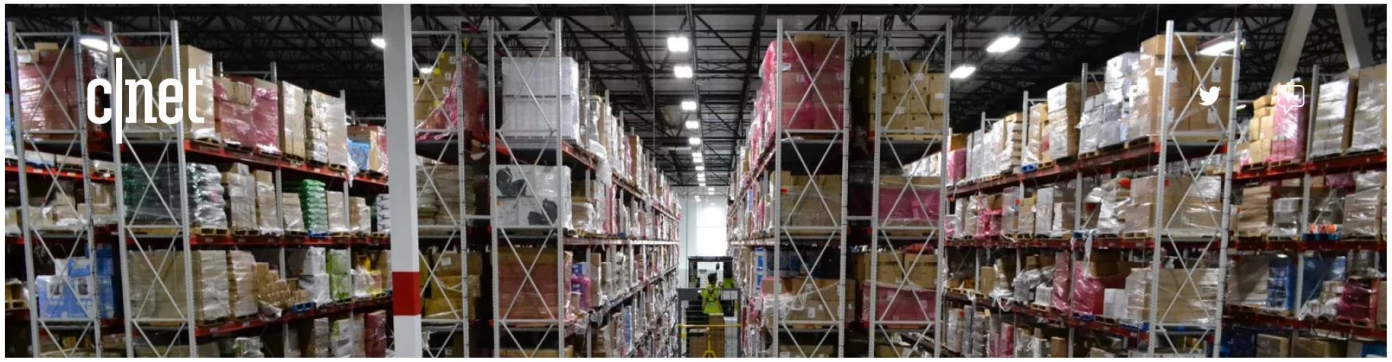


Prolong Healthy Life Expectancy
to Increase Productivity/Life span

Health for All

AI for Health





Amazon fired these 7 pregnant workers. Then came the lawsuits

A warehouse worker told her manager she was pregnant. Less than two months later, she was fired. Several lawsuits against Amazon show a similar pattern.

AI BOSS

Amazon Used An AI to Automatically Fire Low-Productivity Workers

It's a grim glimpse of a future in which AI is your boss – and you're disposable.

Victor Tangermann | April 26th 2019

"THEY'RE MONITORED AND SUPERVISED BY ROBOTS."

Right Direction?

Sick Care

More Sick

Copay

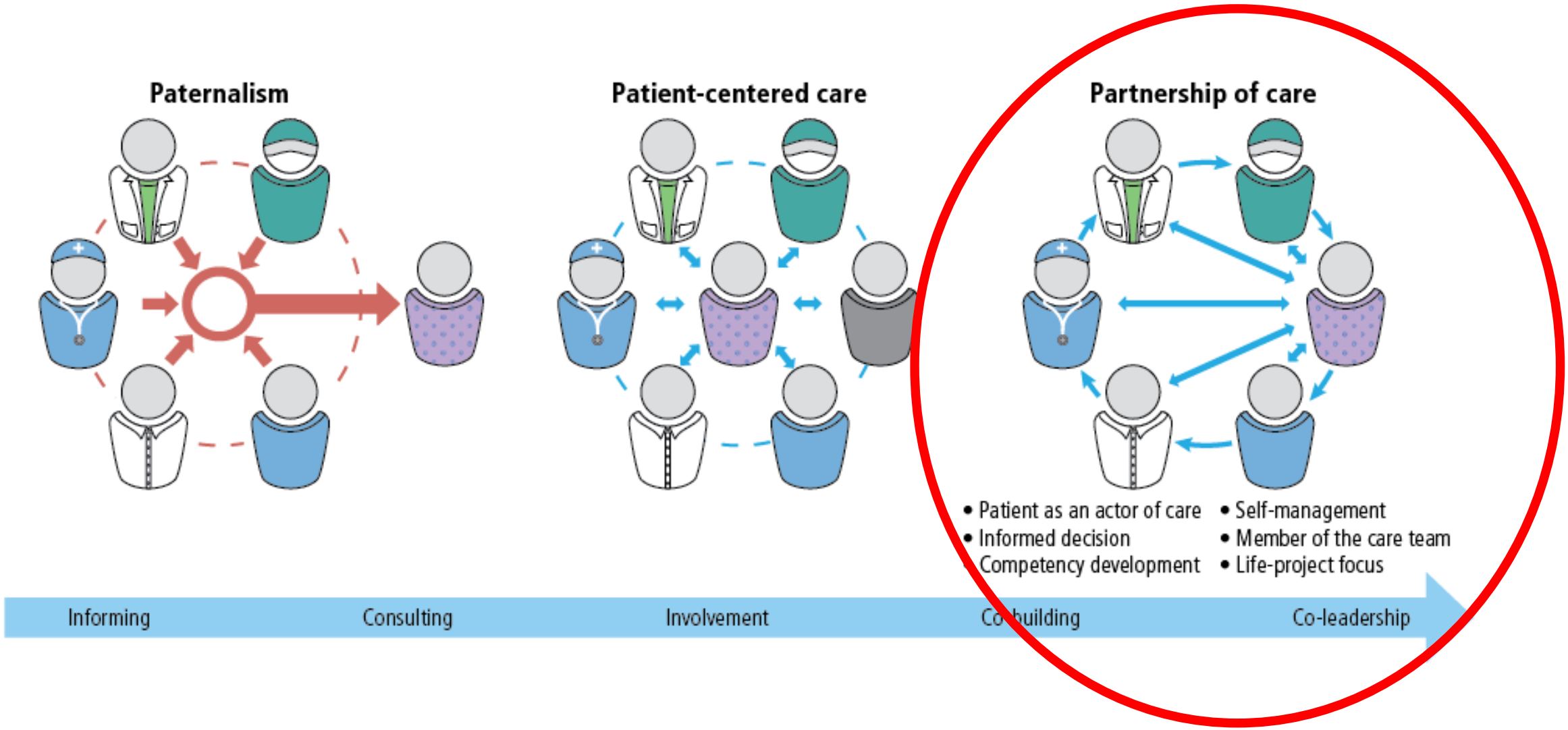
More Copay

Efficiency, Efficiency, Efficiency

More Expenditure

More Capitation

Personalized, Preventive, Predictive, Participation



~~รักษาโรค~~ -> รักษาสุขภาพ

Stop

ote illness

RW, Pay for Chronic Disease, Pay for Specific Disease?

Start

Health Care = Promote Healthy, well being

Pay for Healthy

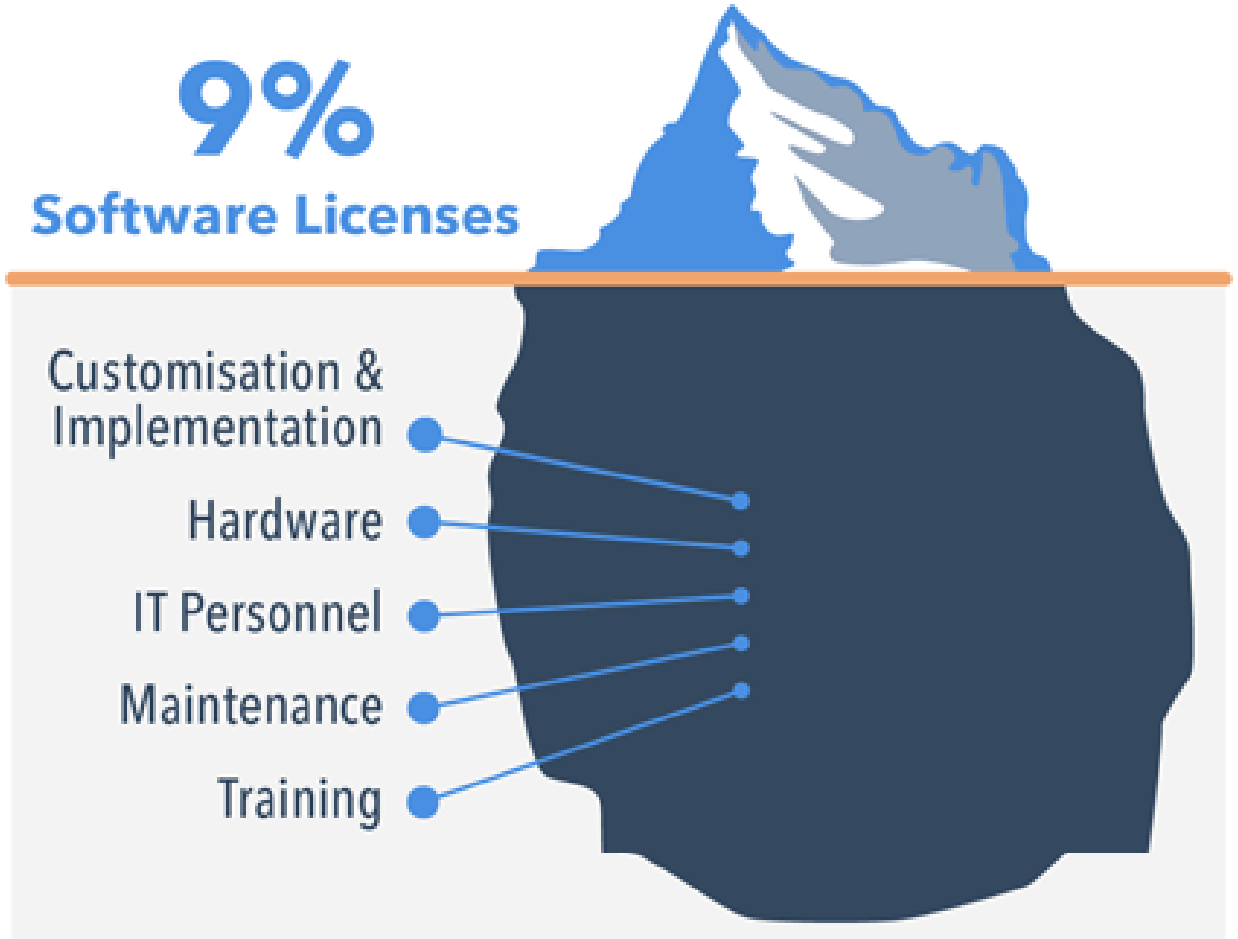
Pay for Well Being

*** Service Focus -> Health Outcome Focus***

On-Premises

9%

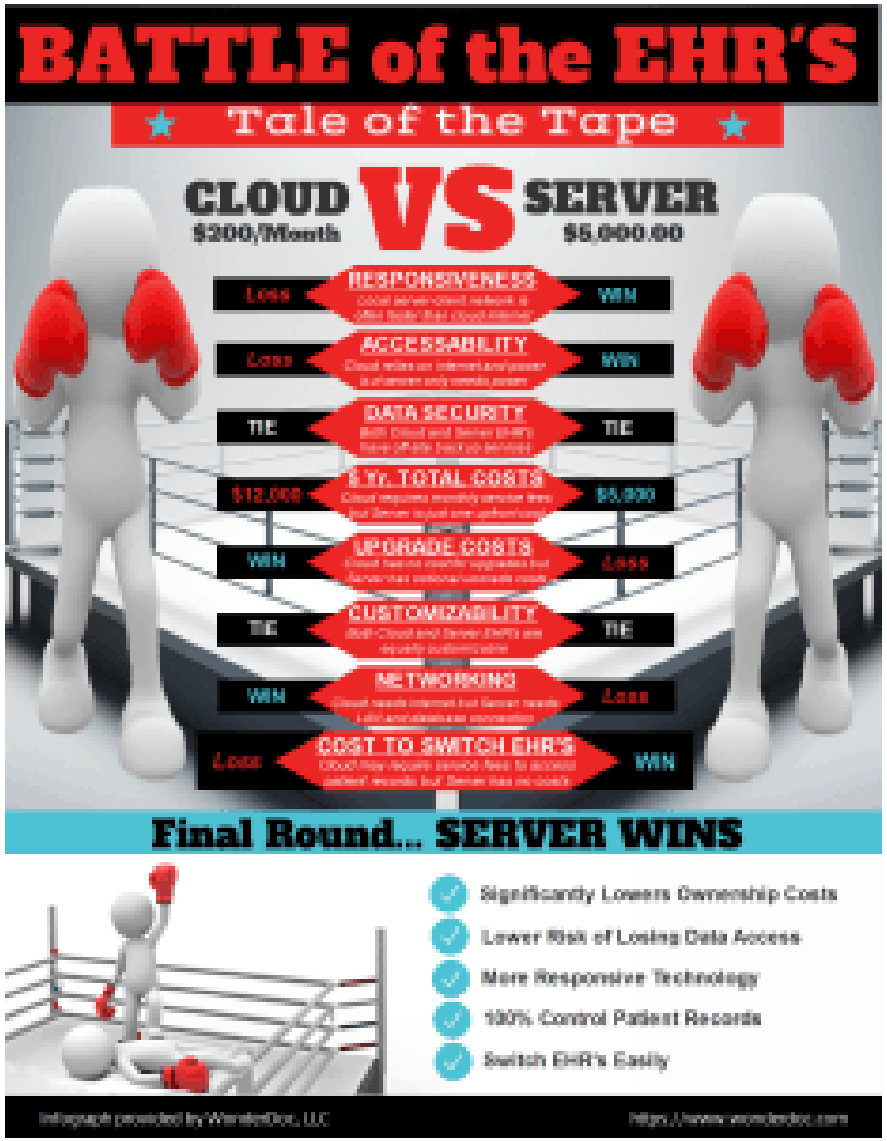
Software Licenses



Cloud Computing

68%

Subscription Fee



2015

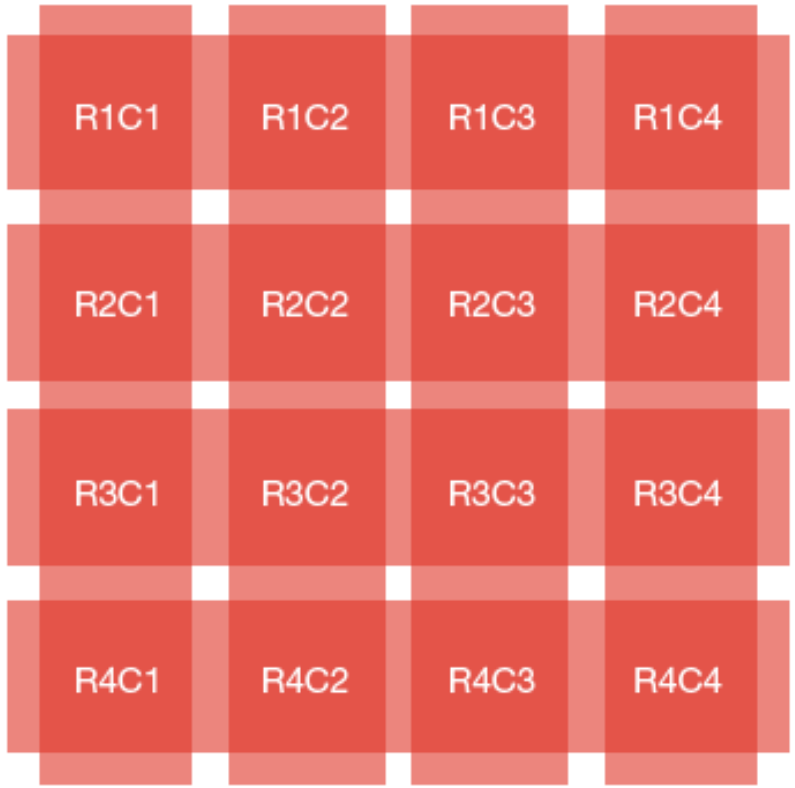
Compare cloud and on-premise EHR using our EHR comparison guide

A survey conducted by market research company Black Book, based on data collected from 5,700 small practices, supports this. The survey found that 83% of practices had named cloud-based EHR systems as the most momentous business decisions they had made over the past several years. Evidence shows that cloud-based EHRs are becoming the platform of choice for practices, so let's have a look at the scorecard between cloud and on-premises EHRs

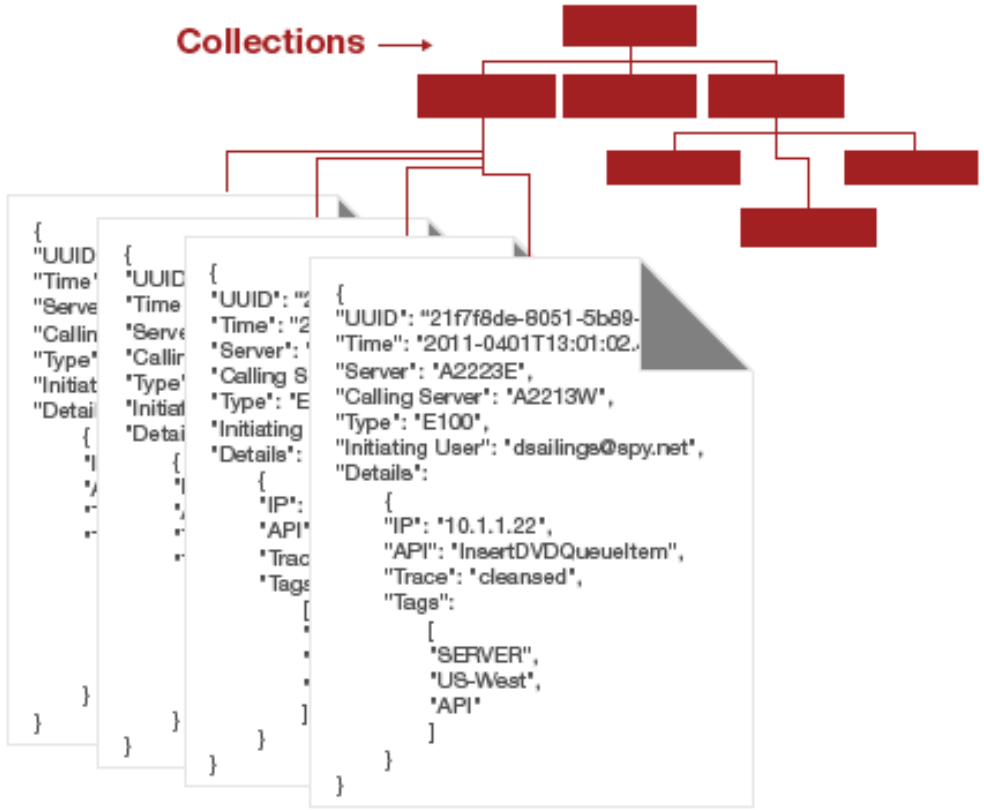
2018

How relational databases and document stores handle four records

Relational data model
Highly structured table organization with rigidly defined data formats and record structure



Document data model
Collections of complex documents with arbitrary, nested data formats and varying “record” format



Hindawi
Advances in Bioinformatics
Volume 2018, Article ID 4059018, 10 pages
https://doi.org/10.1155/2018/4059018

Review Article

Big Data Management for Healthcare Systems: Architecture, Requirements, and Implementation

Naoual El aboudi and Laila Benhlima

International Journal of Computer Applications (0975 – 8887)
Volume 106 – No.1, November 2014

Modeling Stack Framework for Accessing Electronic Health Records with Big Data Needs

Jyotsna Talreja Wassan
Asstt. Professor
Maitreyi College
University of Delhi, India

Sánchez-de-Madariaga *et al. BMC Medical Informatics and Decision Making* (2017) 17:123
DOI 10.1186/s12911-017-0515-4

BMC Medical Informatics and Decision Making

RESEARCH ARTICLE Open Access

Examining database persistence of ISO/EN 13606 standardized electronic health record extracts: relational vs. NoSQL approaches

Ricardo Sánchez-de-Madariaga[1*], Adolfo Muñoz[1], Raimundo Lozano-Rubí[2,3], Pablo Serrano-Balazote[4], Antonio L. Castro[1], Oscar Moreno[1] and Mario Pascual[1]

Abstract

Background: The objective of this research is to compare the relational and non-relational (NoSQL) database systems approaches in order to store, recover, query and persist standardized medical information in the form of ISO/EN 13606 normalized Electronic Health Record XML extracts, both in isolation and concurrently. NoSQL database systems have recently attracted much attention, but few studies in the literature address their direct comparison with relational databases when applied to build the persistence layer of a standardized medical information system.

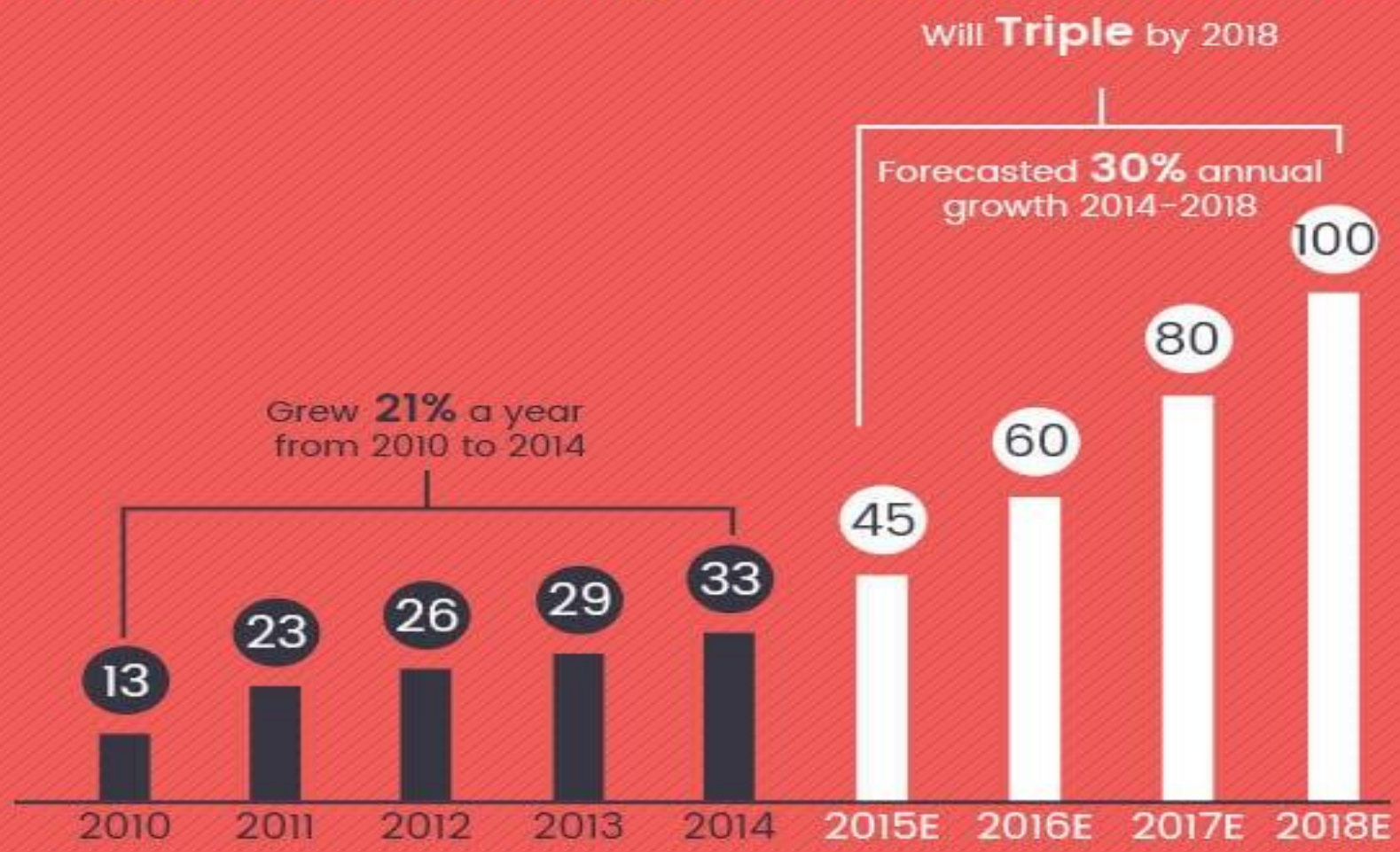
Methods: One relational and two NoSQL databases (one document-based and one native XML database) of three different sizes have been created in order to evaluate and compare the response times (algorithmic complexity) of six different complexity growing queries, which have been performed on them. Similar appropriate results available in the literature have also been considered.

Results: Relational and non-relational NoSQL database systems show almost *linear* algorithmic complexity query execution. However, they show very different linear slopes, the former being much steeper than the two latter. Document-based NoSQL databases perform better in concurrency than in isolation, and also better than relational databases in concurrency.

Conclusion: Non-relational NoSQL databases seem to be more appropriate than standard relational SQL databases when database size is extremely high (secondary use, research applications). Document-based NoSQL databases perform in general better than native XML NoSQL databases. EHR extracts visualization and edition are also document-based tasks more appropriate to NoSQL database systems. However, the appropriate database solution much depends on each particular situation and specific problem.

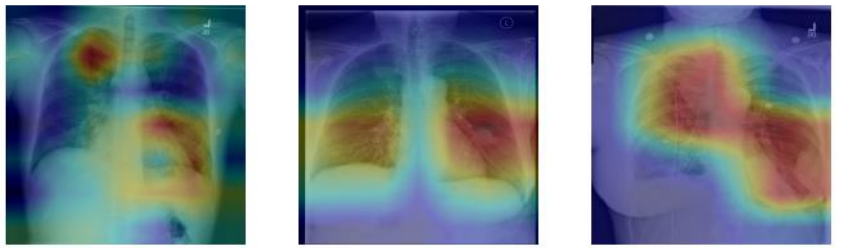
Keywords: Relational database, NoSQL database, Normalized medical information, ISO/EN 13606 standard, Electronic health record extract, Algorithmic complexity, Primary use, Clinical practice, Secondary research use, Document-based task

Rapid growth in FDA approvals of digital health solutions



Cost Savings

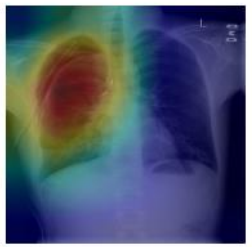
mHealth apps and devices together are expected to save billions for the US Healthcare industry



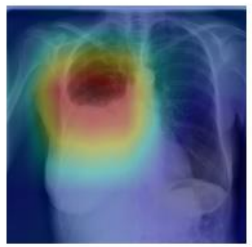
(a) Patient with multifocal community acquired pneumonia. The model correctly detects the airspace disease in the left lower and right upper lobes to arrive at the pneumonia diagnosis.

(b) Patient with a left lung nodule. The model identifies the left lower lobe lung nodule and correctly classifies the pathology.

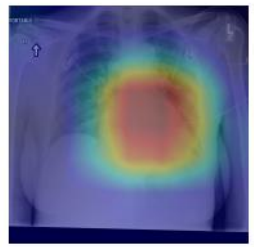
(c) Patient with primary lung malignancy and two large masses, one in the left lower lobe and one in the right upper lobe adjacent to the mediastinum. The model correctly identifies both masses in the X-ray.



(d) Patient with a right-sided pneumothroax and chest tube. The model detects the abnormal lung to correctly predict the presence of pneumothorax (collapsed lung).



(e) Patient with a large right pleural effusion (fluid in the pleural space). The model correctly labels the effusion and focuses on the right lower chest.



(f) Patient with congestive heart failure and cardiomegaly (enlarged heart). The model correctly identifies the enlarged cardiac silhouette.

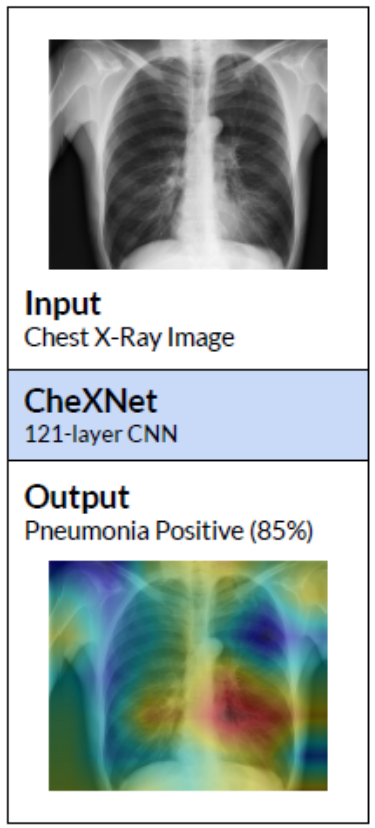
Figure 3. ChexNet localizes pathologies it identifies using Class Activation Maps, which highlight the areas of the X-ray that are most important for making a particular pathology classification.

CheXNet: Radiologist-Level Pneumonia Detection on Chest X-Rays with Deep Learning

Pranav Rajpurkar [*1] **Jeremy Irvin** [*1] **Kaylie Zhu** [1] **Brandon Yang** [1] **Hershel Mehta** [1]
Tony Duan [1] **Daisy Ding** [1] **Aarti Bagul** [1] **Robyn L. Ball** [2] **Curtis Langlotz** [3] **Katie Shpanskaya** [3]
Matthew P. Lungren [3] **Andrew Y. Ng** [1]

Abstract

We develop an algorithm that can detect pneumonia from chest X-rays at a level exceeding practicing radiologists. Our algorithm, CheXNet, is a 121-layer convolutional neural network trained on ChestX-ray14, currently the largest publicly available chest X-ray dataset, containing over 100,000 frontal-view X-ray images with 14 diseases. Four practicing academic radiologists annotate a test set, on which we compare the performance of CheXNet to that of radiologists. We find that CheXNet exceeds average radiologist performance on the F1 metric. We extend CheXNet to detect all 14 diseases in ChestX-ray14 and achieve state of the art results on all 14 diseases.



1. Introduction

More than 1 million adults are hospitalized with pneumonia and around 50,000 die from the disease every year in the US alone (CDC, 2017). Chest X-rays

Scalable and accurate deep learning with electronic health records

Alvin Rajkomar[1,2], Eyal Oren[1], Kai Chen[1], Andrew M. Dai[1], Nissan Hajaj[1], Michaela Hardt[1], Peter J. Liu[1], Xiaobing Liu[1], Jake Marcus[1], Mimi Sun[1], Patrik Sundberg[1], Hector Yee[1], Kun Zhang[1], Yi Zhang[1], Gerardo Flores[1], Gavin E. Duggan[1], Jamie Irvine[1], Quoc Le[1], Kurt Litsch[1], Alexander Mossin[1], Justin Tansuwan[1], De Wang[1], James Wexler[1], Jimbo Wilson[1], Dana Ludwig[2], Samuel L. Volchenboum[3], Katherine Chou[1], Michael Pearson[1], Srinivasan Madabushi[1], Nigam H. Shah[4], Atul J. Butte[2], Michael D. Howell[1], Claire Cui[1], Greg S. Corrado[1] and Jeffrey Dean[1]

Predictive modeling with electronic health record (EHR) data is anticipated to drive personalized medicine and improve healthcare quality. Constructing predictive statistical models typically requires extraction of curated predictor variables from normalized EHR data, a labor-intensive process that discards the vast majority of information in each patient's record. We propose a representation of patients' entire raw EHR records based on the Fast Healthcare Interoperability Resources (FHIR) format. We demonstrate that deep learning methods using this representation are capable of accurately predicting multiple medical events from multiple centers without site-specific data harmonization. We validated our approach using de-identified EHR data from two US academic medical centers with 216,221 adult patients hospitalized for at least 24 h. In the sequential format we propose, this volume of EHR data unrolled into a total of 46,864,534,945 data points, including clinical notes. Deep learning models achieved high accuracy for tasks such as predicting: in-hospital mortality (area under the receiver operator curve [AUROC] across sites 0.93–0.94), 30-day unplanned readmission (AUROC 0.75–0.76), prolonged length of stay (AUROC 0.85–0.86), and all of a patient's final discharge diagnoses (frequency-weighted AUROC 0.90). These models outperformed traditional, clinically-used predictive models in all cases. We believe that this approach can be used to create accurate and scalable predictions for a variety of clinical scenarios. In a case study of a particular prediction, we demonstrate that neural networks can be used to identify relevant information from the patient's chart.

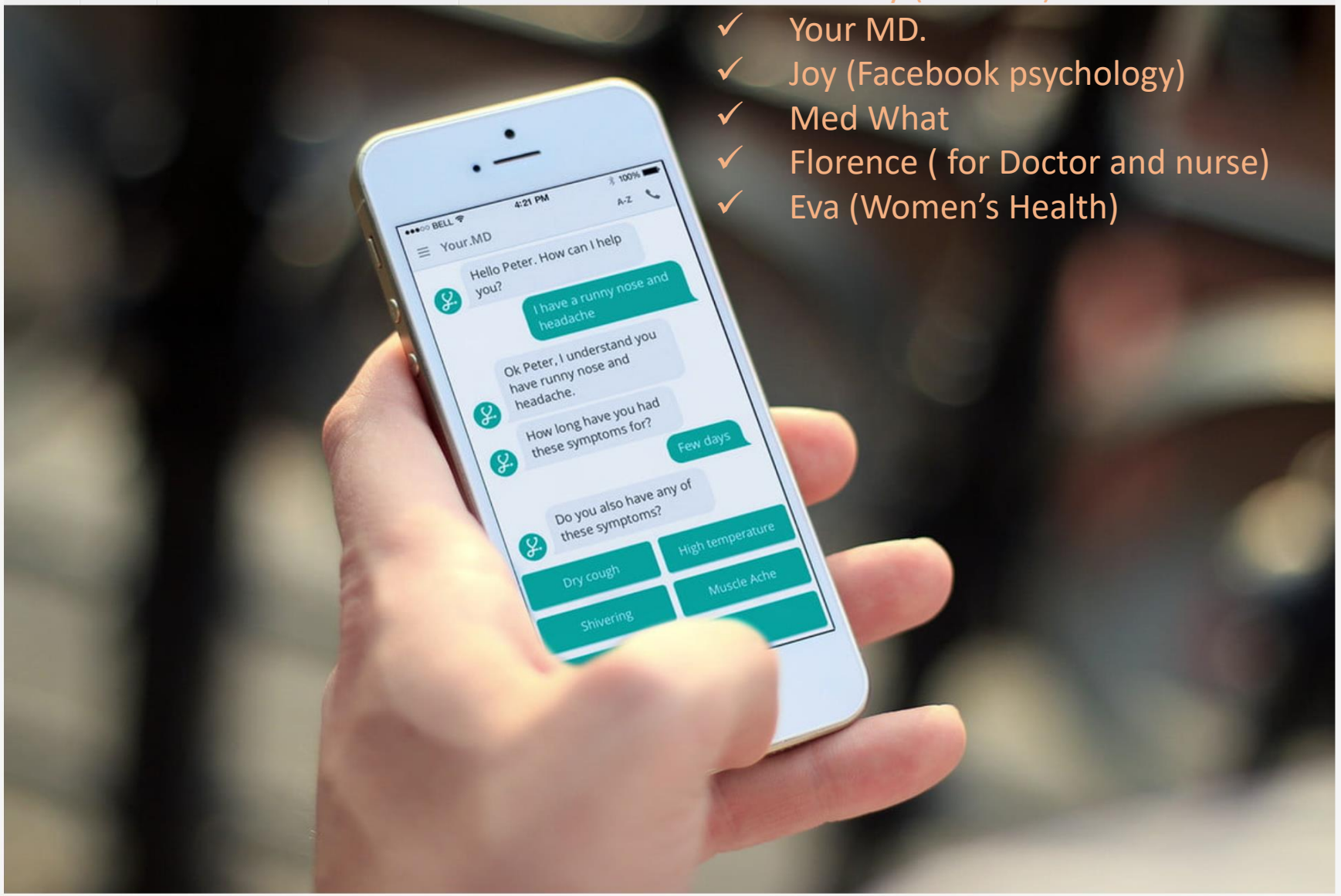
npj Digital Medicine (2018)1:18 ; doi:10.1038/s41746-018-0029-1

Evaluation and accurate diagnoses of pediatric diseases using artificial intelligence.

Our model applies an automated natural language processing system using deep learning techniques to extract clinically relevant information from EHRs. In total, 101.6 million data points from 1,362,559 pediatric patient visits presenting to a major referral center were analyzed to train and validate the framework. Our model demonstrates high diagnostic accuracy across multiple organ systems and is comparable to experienced pediatricians in diagnosing common childhood diseases.

Health Chat Bot

Subscribe Share



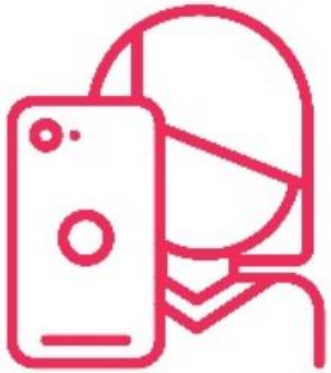
- ✓ Melody (Chinese)
- ✓ Your MD.
- ✓ Joy (Facebook psychology)
- ✓ Med What
- ✓ Florence (for Doctor and nurse)
- ✓ Eva (Women's Health)

PWA

Clip slide

- FAST
- INTEGRATED
- RELIABLE
- ENGAGING

User Experience



#mdbw18
#pwacamp
@nitya

Credit:
The Noun Project


PROGRESSIVE
NATIVE

Lesson learnt from the best

reduction of full scale emergency hospitals and hospital beds

Swedish Association of Local Authorities and Regions

Governmental levels

- State level / 4 Health Regions
- 19 counties
- 422 municipalities Jan 1st 2018 (will be reduced to 354) (primary health care)

Structural changes in Swedish health and social care

In the last years we have seen:

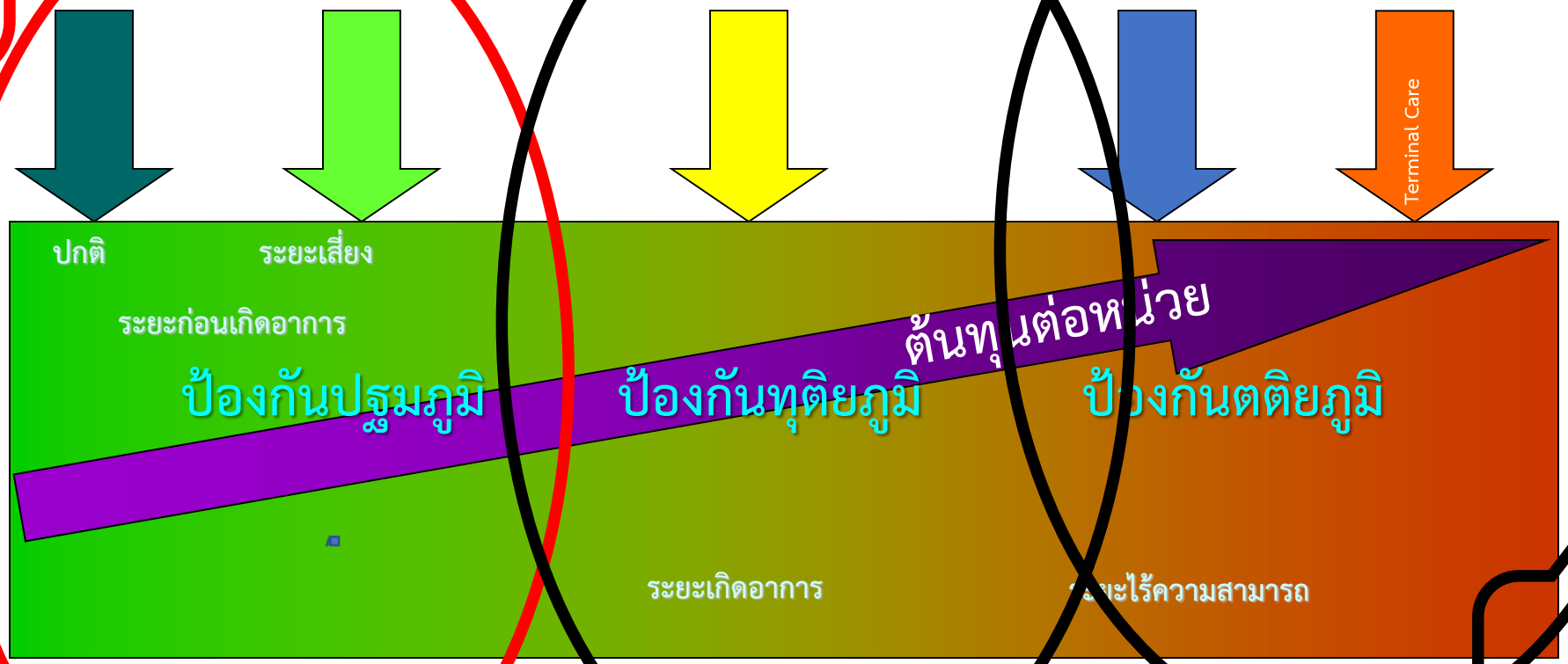
- reduction of full scale emergency hospitals and hospital beds
- increase of health care centres
- development from inpatient care to outpatient care and from hospital care to home care
- increased differentiation and specialization
- increased proportion of patients with chronic diseases
- growing proportion of elderly people – but many are active and healthy
- increased opportunities for users and patients to choose provider
- increase of private providers

422 municipalities Jan 1st 2018 (will be reduced to 354) (primary health care)

แนวคิดและหลักการสร้างสุขภาพ

พฤติกรรมตนเองและครอบครัว > 90%

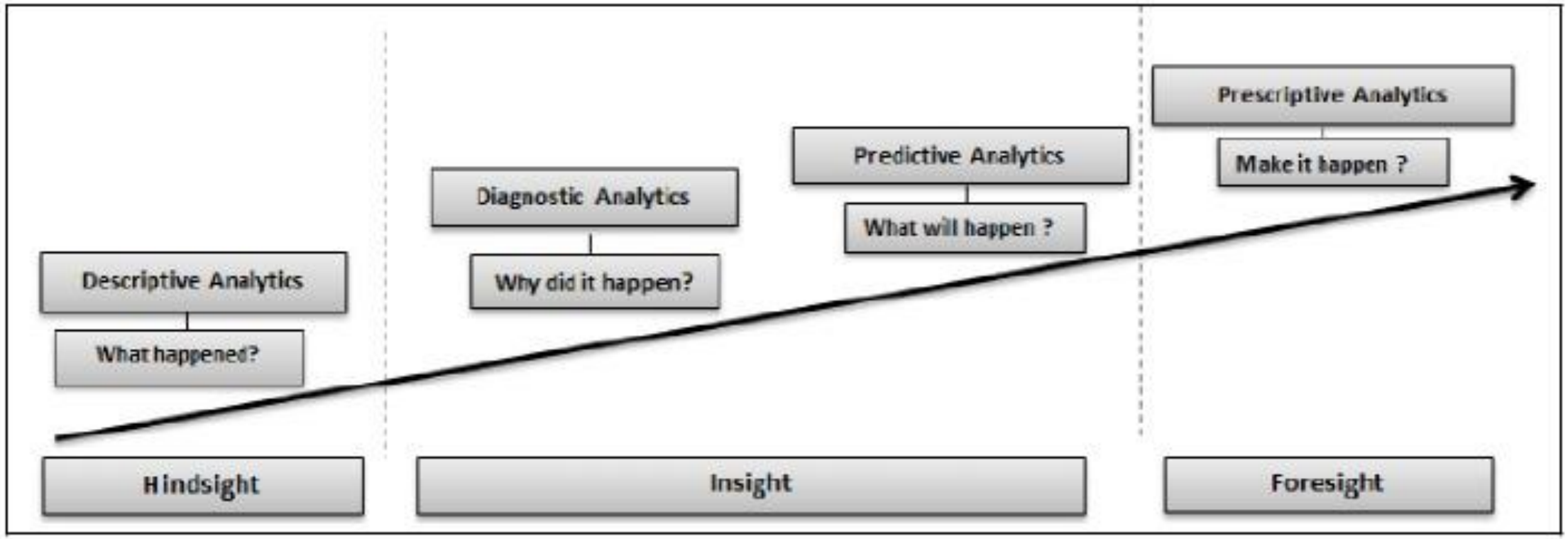
คลินิกหมอครอบครัว



Primary Health Care

Primary Medical Care (PCU, PCC, Family Doctor)

ป่วยเข้าโรงพยาบาล

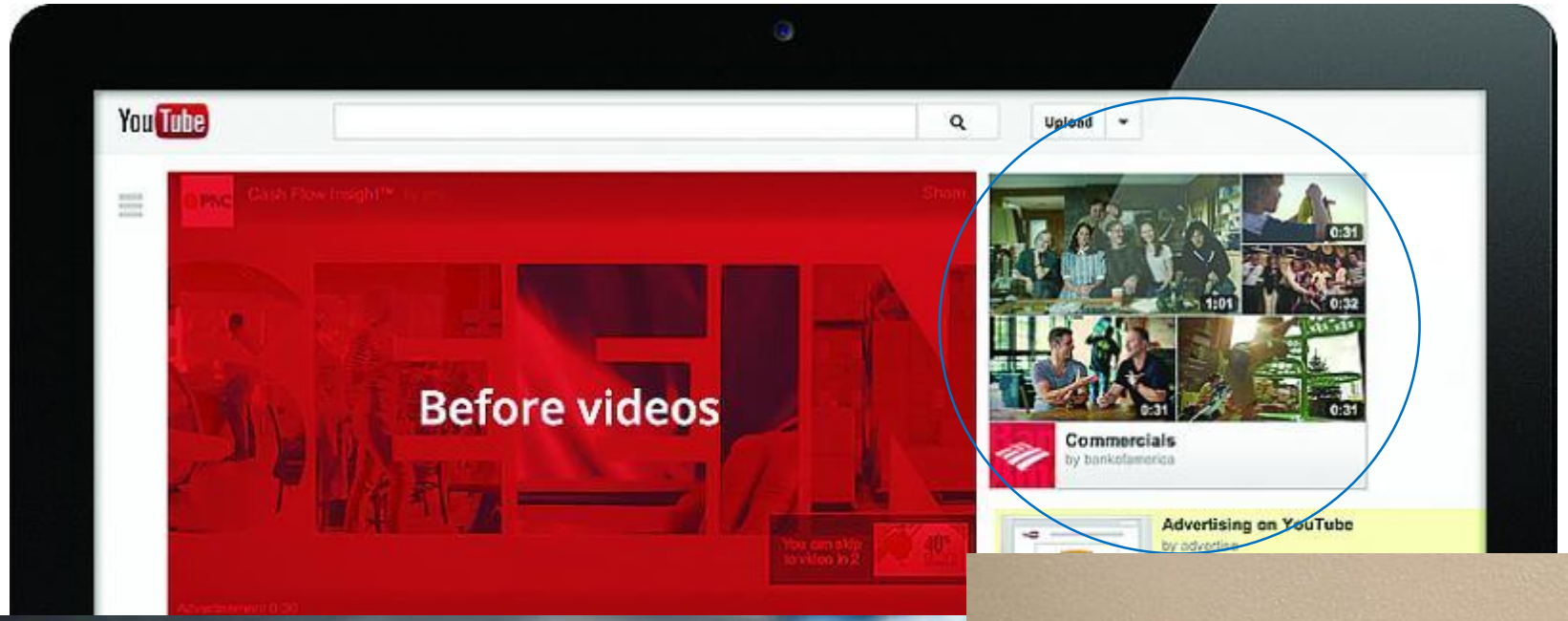

Descriptive Analytics
What happened?
Diagnostic Analytics
Why did it happen?
Predictive Analytics
What will happen ?
Prescriptive Analytics
Make it happen ?
Hindsight
Insight
Foresight


& News
Health A-Z
Drugs & Supplements
VebMD
er information. Better health.
December 22, 2010
fitness
Other search tools:
esults for: fitnes

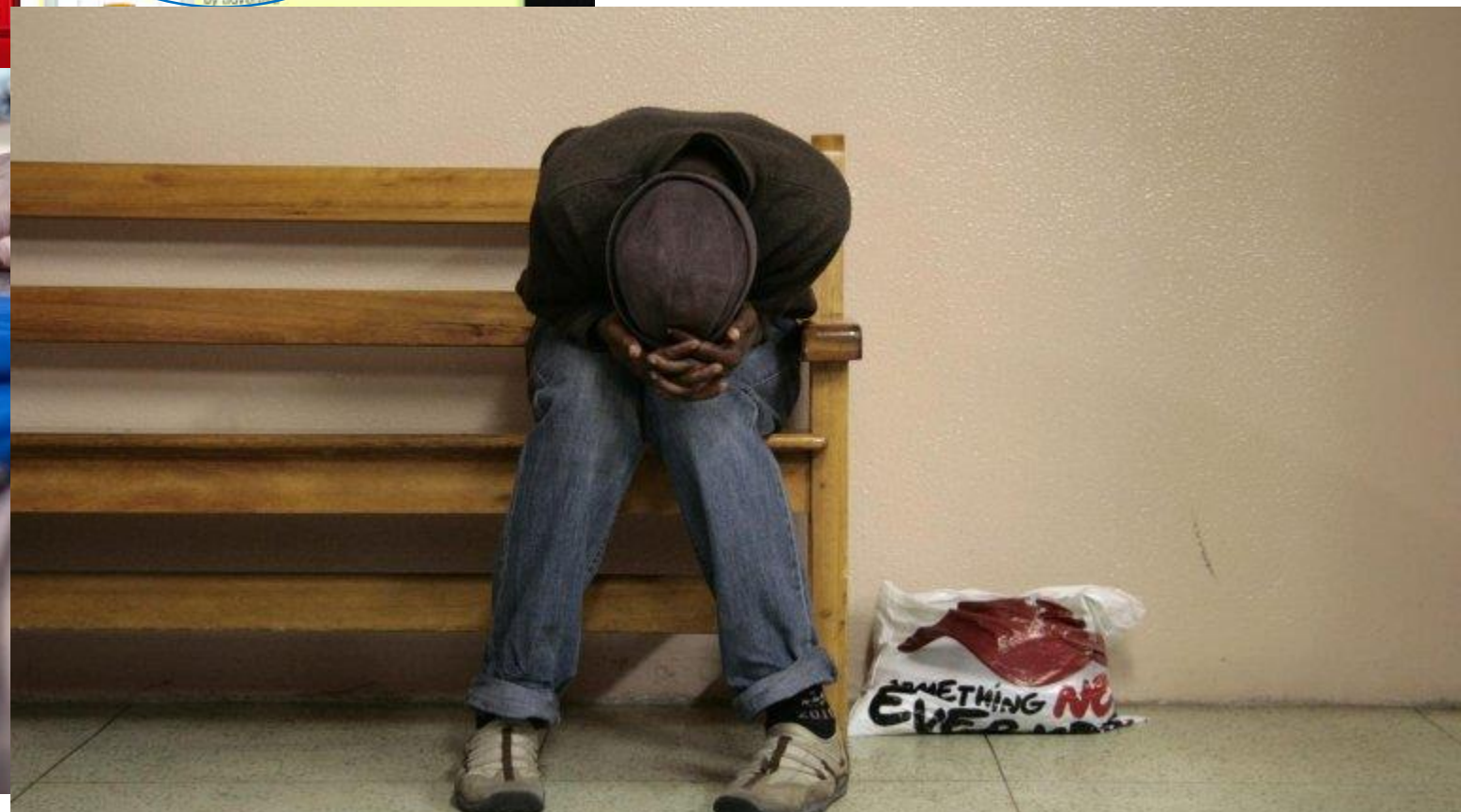

平安好医生
PinG an
good doctor

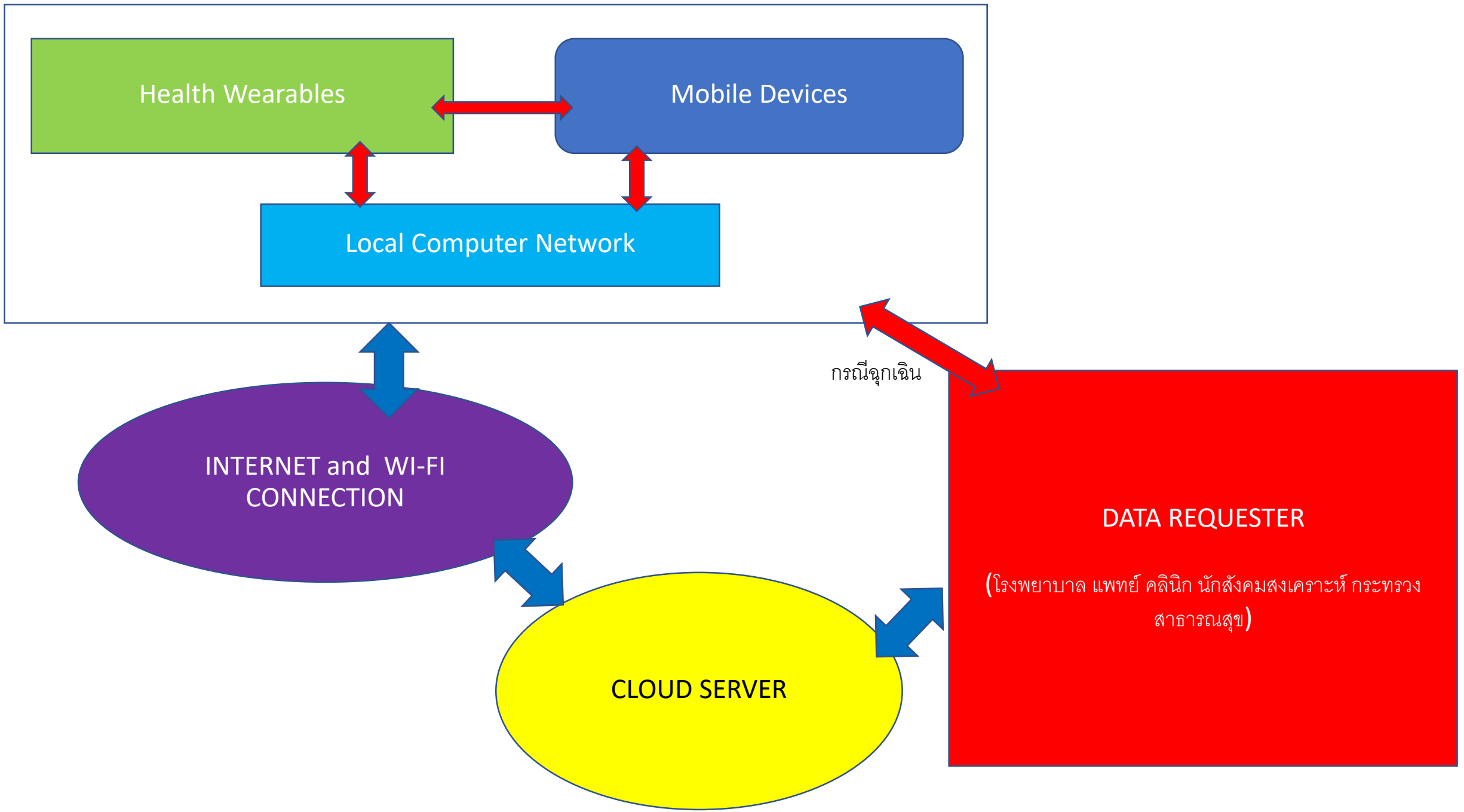

PING AN GOOD DOCTOR
一分钟诊所
平安好医生
24h
问诊室

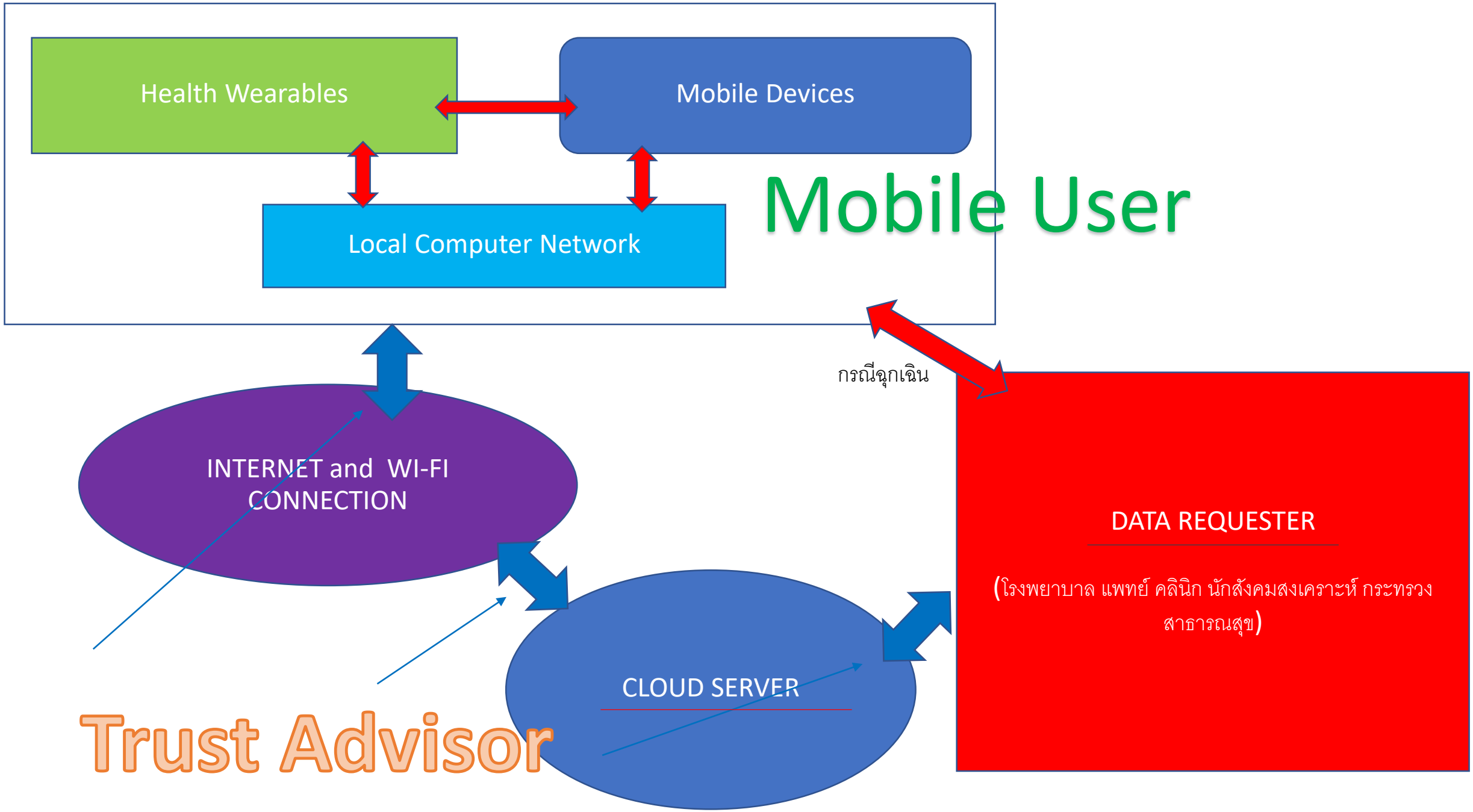

Health
Activity
Heart Rate
Nutrition


YouTube
Upload
Before videos
Commercials
by bankofamerica
Advertising on YouTube


Hi. I'm Cortana.




Health Wearables
Mobile Devices
Local Computer Network
กรณีฉุกเฉิน
INTERNET and WI-FI CONNECTION
CLOUD SERVER
DATA REQUESTER
(โรงพยาบาล แพทย์ คลินิก นักสังคมสงเคราะห์ กระทรวงสาธารณสุข)


Health Wearables
Mobile Devices
Local Computer Network
Mobile User
กรณีฉุกเฉิน
INTERNET and WI-FI CONNECTION
CLOUD SERVER
DATA REQUESTER
(โรงพยาบาล แพทย์ คลินิก นักสังคมสงเคราะห์ กระทรวงสาธารณสุข)
Trust Advisor

Health Wearables

Mobile Devices

Local Computer Network

กรณีฉุกเฉิน

INTERNET and WI-FI CONNECTION

CLOUD SERVER

DATA REQUESTER

(โรงพยาบาล แพทย์ คลินิก นักสังคมสงเคราะห์ กระทรวงสาธารณสุข)

กรณีฉุกเฉิน

INTERNET and
CONNECTION

CLOUD SERVER

DATA REQUESTER

(โรงพยาบาล แพทย์ คลินิก นักสังคมสงเคราะห์ กระทรวงสาธารณสุข)

Health Wearables

Local C

กรณีฉุกเฉิน

INTERNET and WI-FI CONNECTION

CLOUD SERVER

DATA REQUESTER

(โรงพยาบาล แพทย์ คลินิก นักสังคมสงเคราะห์ กระทรวงสาธารณสุข)

Health Wearables

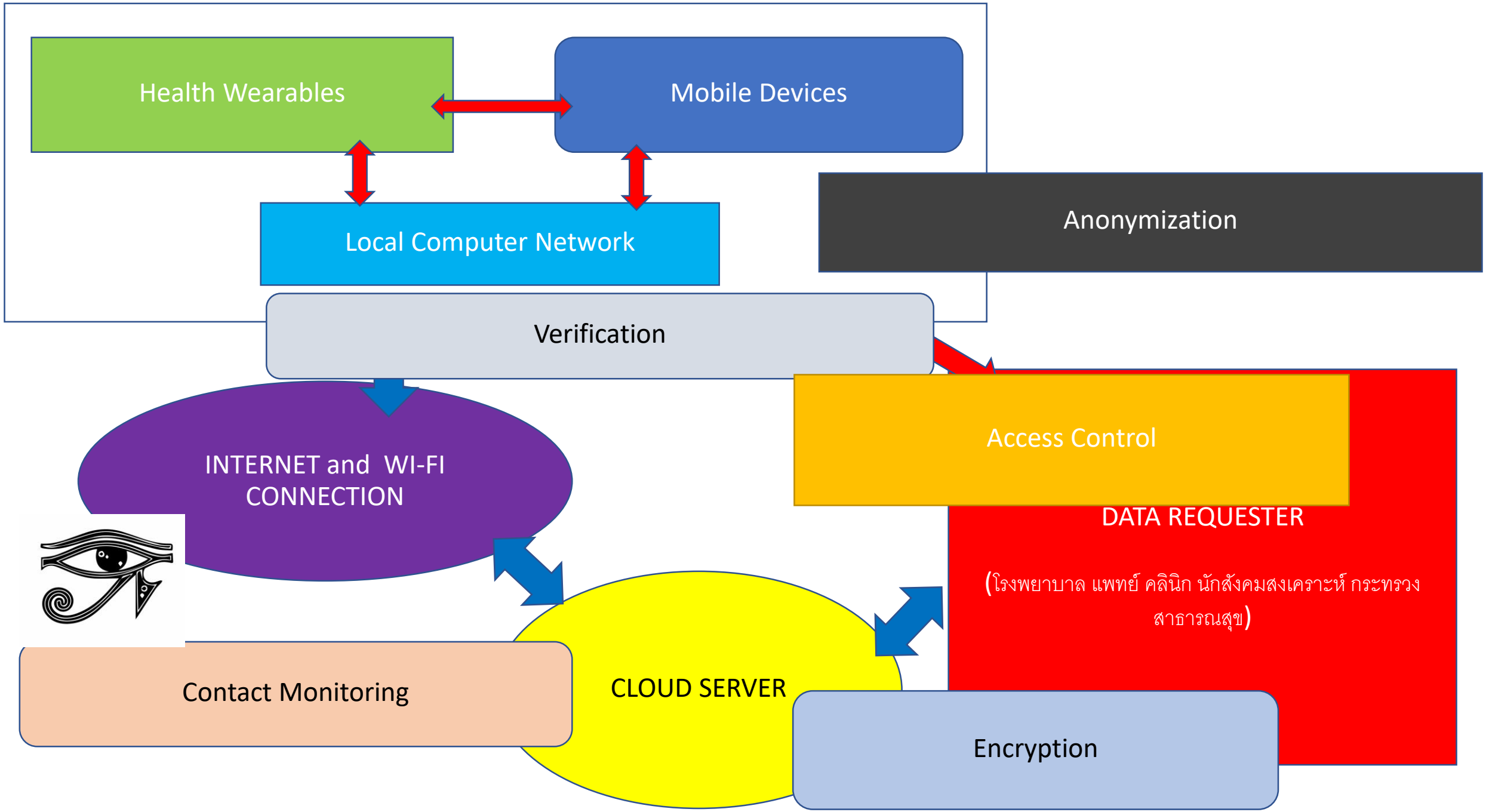
USURPATION

Local Computer Network

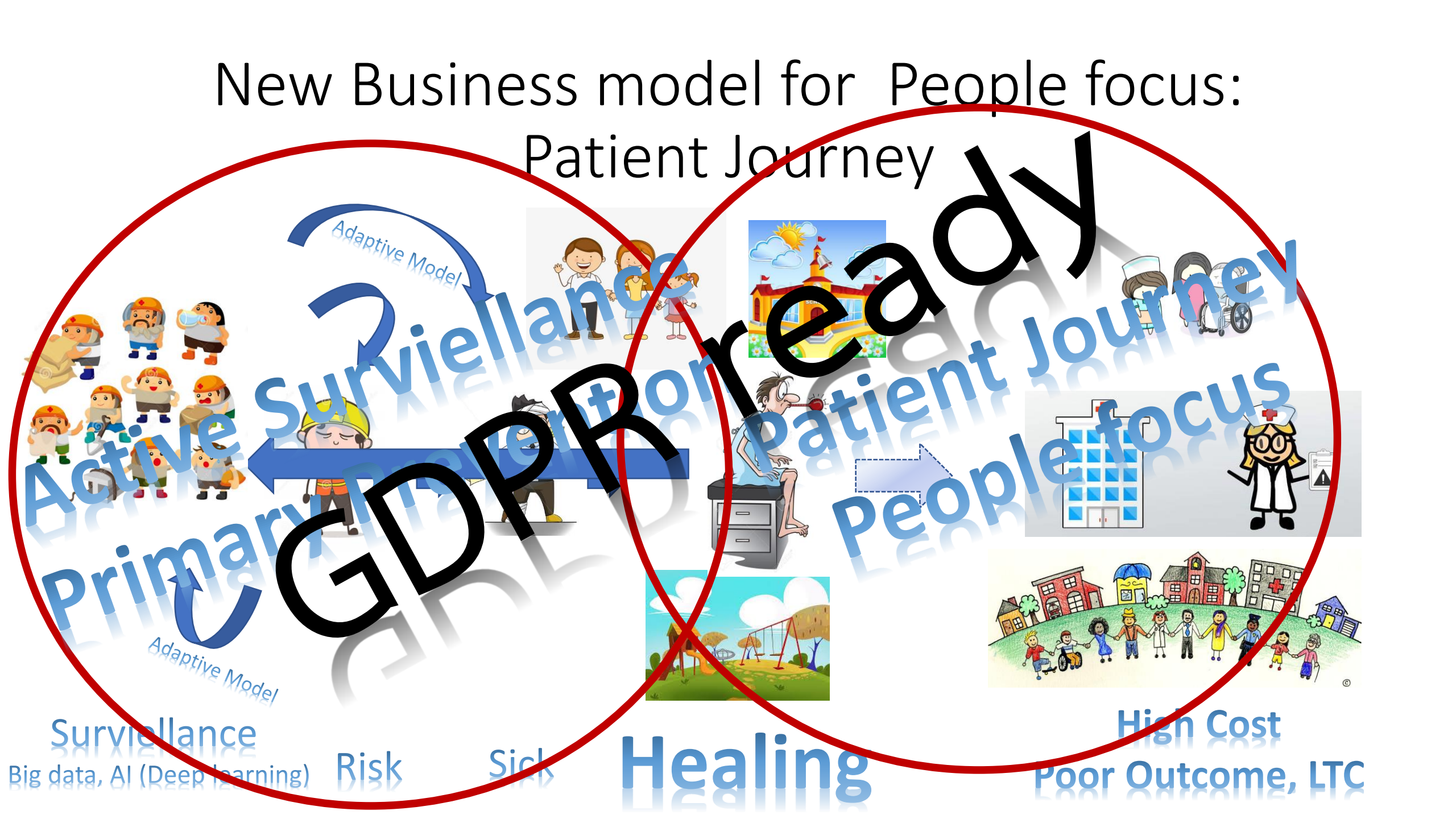
INTERN
CO

QUESTER

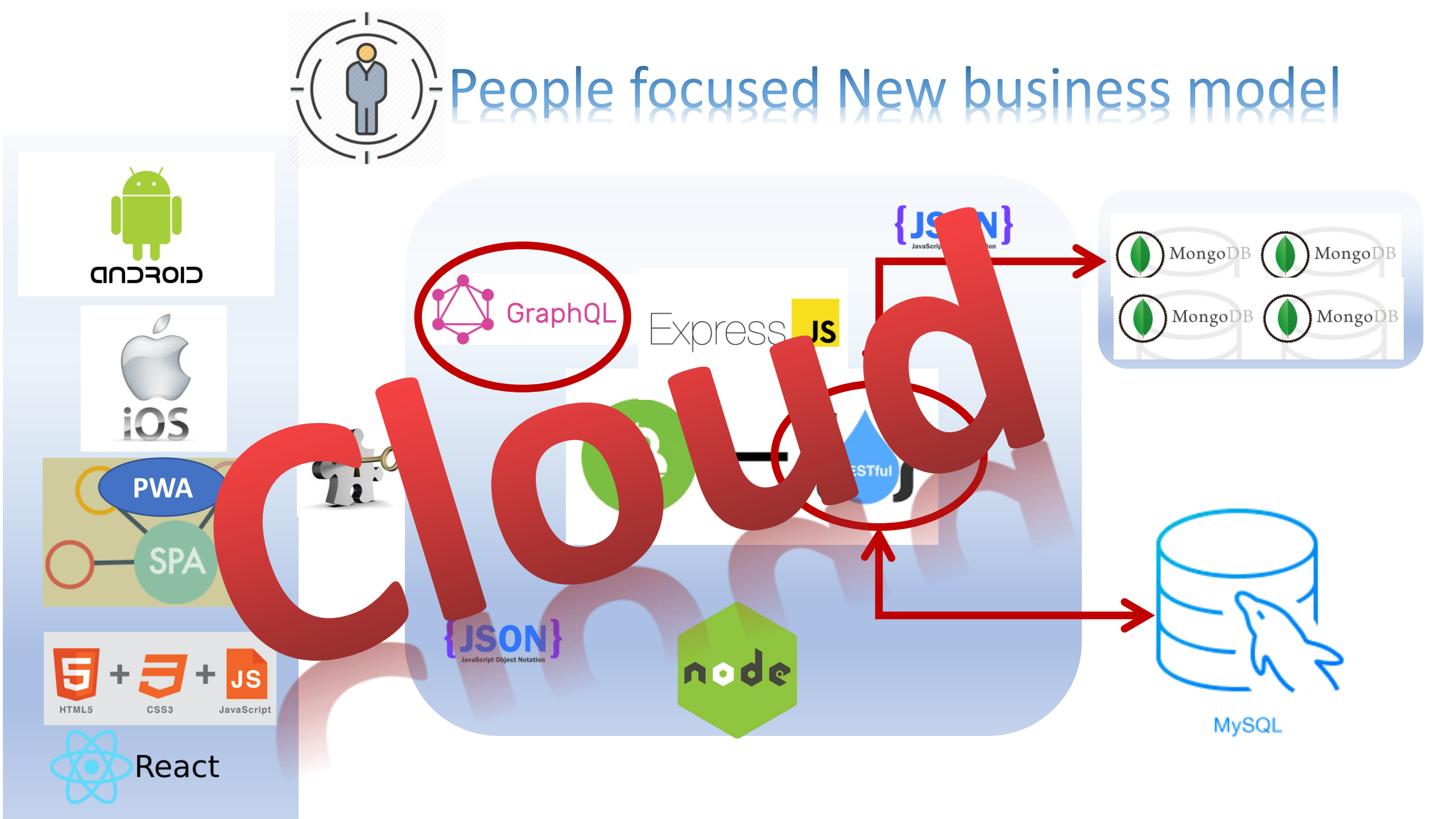
นักสังคมสงเคราะห์ กระทรวง
รณสุข)


Health Wearables
Mobile Devices
Local Computer Network
Anonymization
Verification
INTERNET and WI-FI CONNECTION
Access Control
DATA REQUESTER
(โรงพยาบาล แพทย์ คลินิก นักสังคมสงเคราะห์ กระทรวงสาธารณสุข)
Contact Monitoring
CLOUD SERVER
Encryption

New Business model for People focus: Patient Journey



People focused New business model



Most challenge is Mindset.