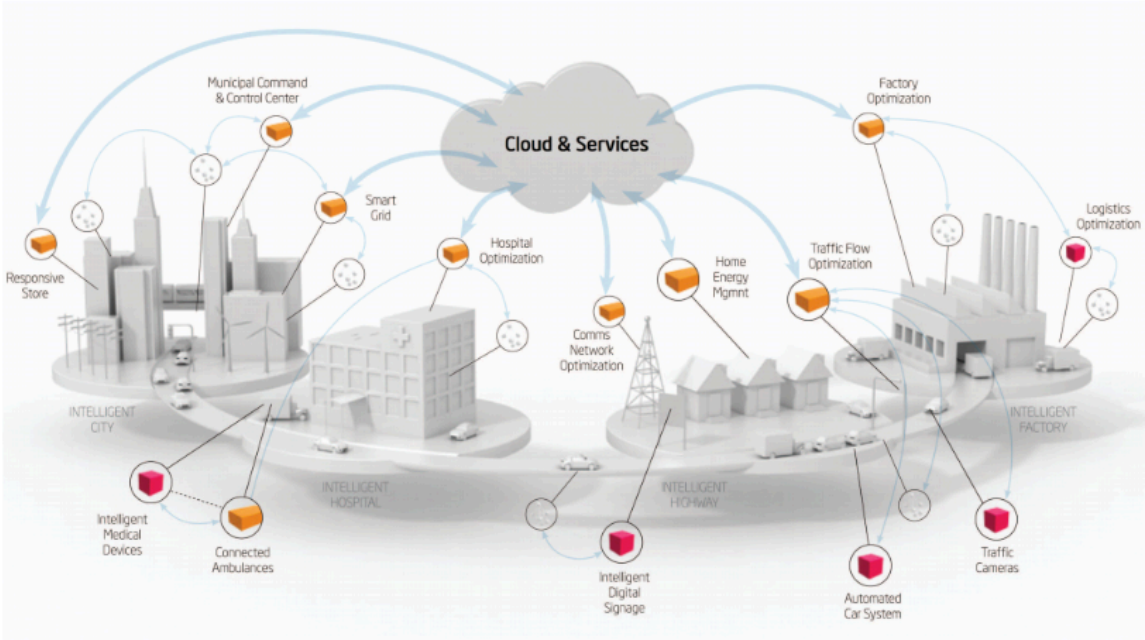
Internet of Things …….. and Disruptive Innovation in Healthcare

Dr. W. John Reeves MD

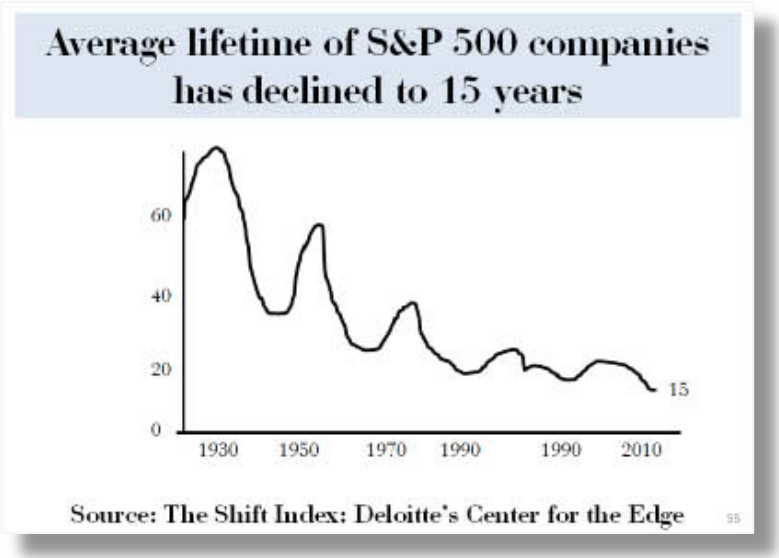
1994 > What type of Innovator are YOU ?

the digital interconnection of billions of devices is today's most dynamic business opportunity

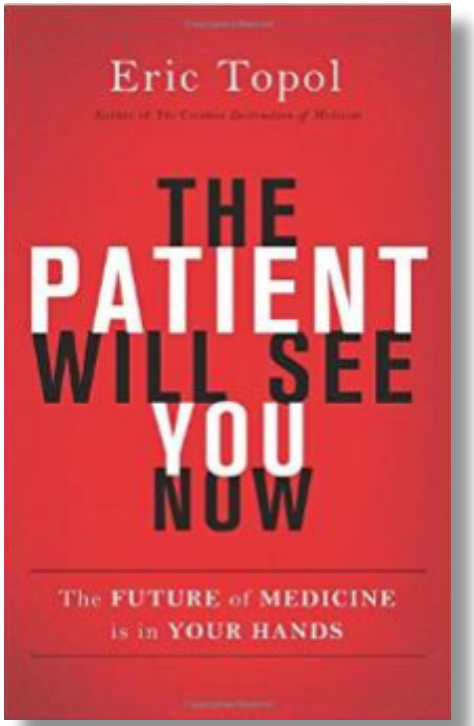


the digital interconnection of billions of devices is today's most dynamic business opportunity ….

and business risk !



Must Read


Eric Topol
THE PATIENT WILL SEE YOU NOW
The FUTURE of MEDICINE is in YOUR HANDS

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Published: November 10, 2014 / Winter 2014 / Issue 77
Technology
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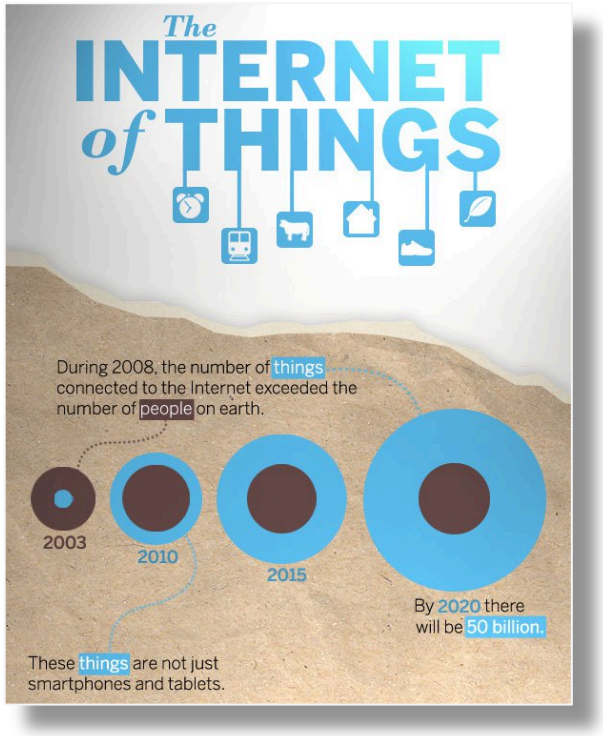
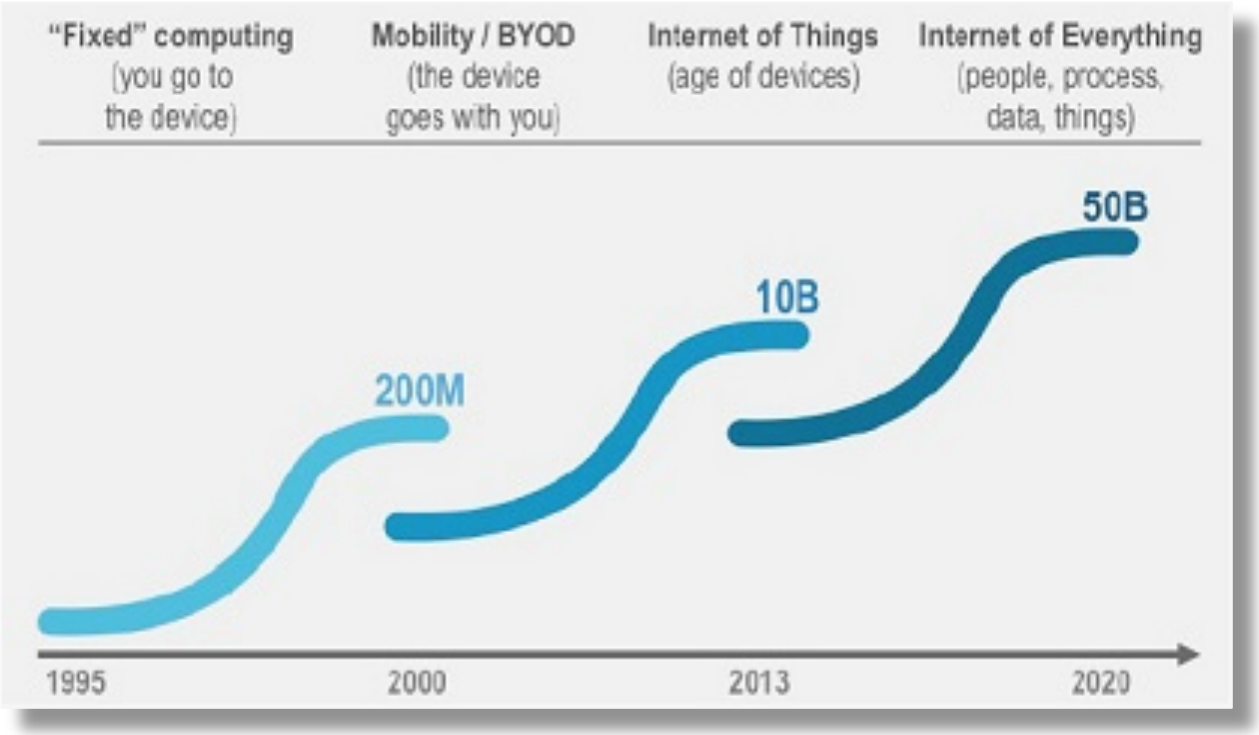
A Strategist's Guide to the Internet of Things
The digital interconnection of billions of devices is today's most dynamic business opportunity.
by Frank Burkitt
Humanity has arrived at a critical threshold in the evolution of computing. By 2020, an estimated 50 billion devices around the globe will be connected to the Internet. Perhaps a third of them will be computers, smartphones, tablets, and TVs. The remaining two-thirds will be other kinds of "things": sensors, actuators, and newly invented intelligent devices that monitor, control, analyze, and optimize our world.
This seemingly sudden trend has been decades in the making, but is just now hitting a tipping point. The arrival of the "Internet of Things" (IoT) represents a transformative shift for the economy, similar to the introduction of the PC itself. It incorporates other major technology industry trends such as cloud computing, data analytics, and mobile communications, but goes beyond them. Unlike earlier efforts to track and control large systems, such as radio-frequency identification (RFID), the Internet connection gives this shift almost limitless versatility. The IoT also opens a range of new business opportunities for a variety of players. These opportunities tend to fall into three broad strategic categories, each reflecting a different type of enterprise:
"Enablers" that develop and implement the underlying technology
"Engagers" that design, create, integrate, and deliver IoT services to customers
"Enhancers" that devise their own value-added services, on top of the services provided by Engagers, that are unique to the Internet of Things
How will your company build value in this new world? That will depend on the type of business you have today, the capabilities you can develop for tomorrow, and, most of all, your ability to understand the meaning of this new technology.
Illustration by Lincoln Agnew

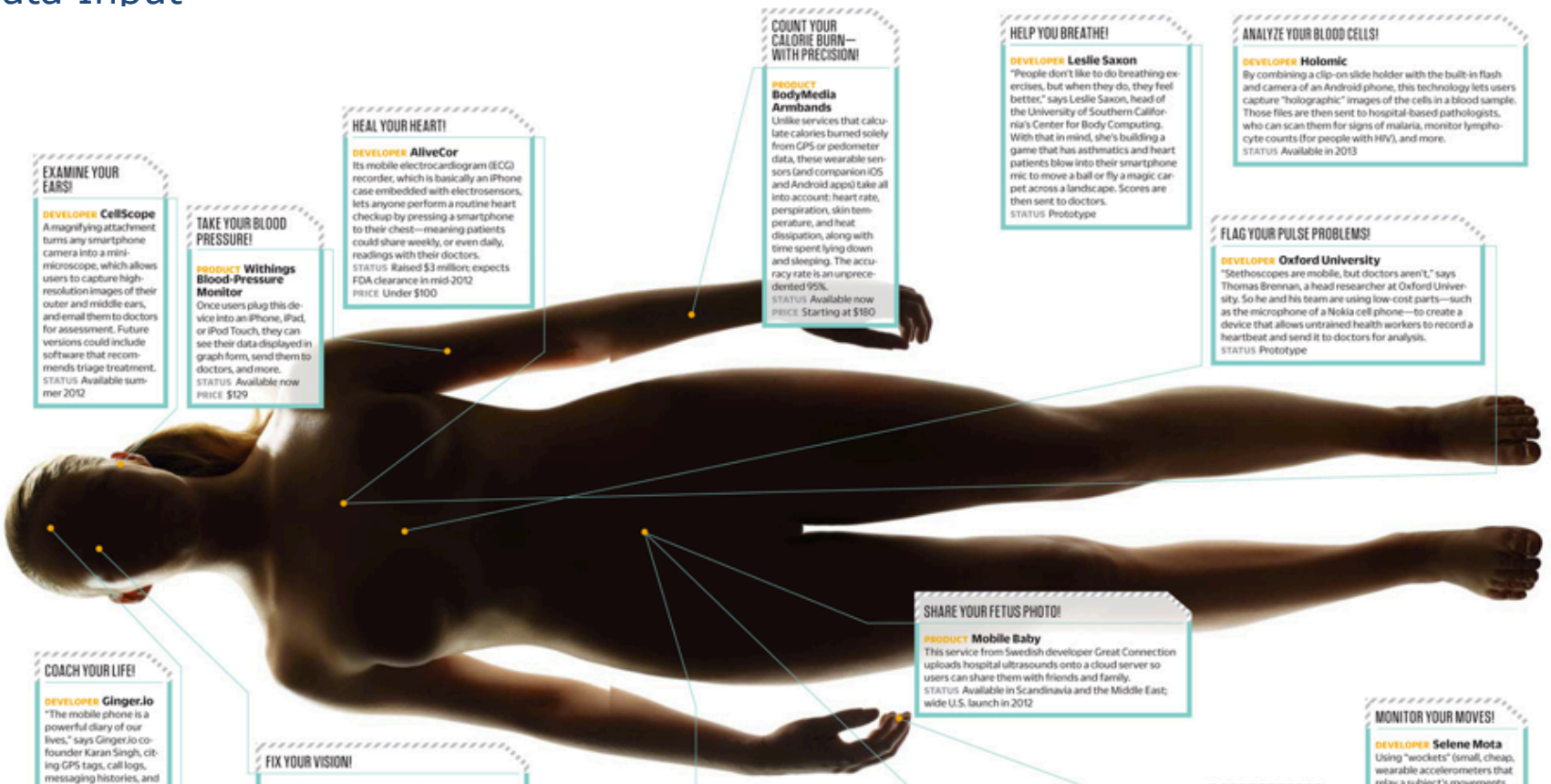
Harvard Business Review
The HBR List of Best-Performing CEOs
The New Deal on Data
Do Business and Politics Mix?
THE INTERNET OF EVERYTHING
Smart, connected products will transform your business PAGE 64

Trend > Things > to Everything





Data Input



EXAMINE YOUR EARS!

DEVELOPER **CellScope**
A magnifying attachment turns any smartphone camera into a mini-microscope, which allows users to capture high-resolution images of their outer and middle ears, and email them to doctors for assessment. Future versions could include software that recommends triage treatment.
STATUS Available summer 2012

TAKE YOUR BLOOD PRESSURE!

PRODUCT **Withings Blood-Pressure Monitor**
Once users plug this device into an iPhone, iPad, or iPod Touch, they can see their data displayed in graph form, send them to doctors, and more.
STATUS Available now
PRICE $129

HEAL YOUR HEART!

DEVELOPER **AliveCor**
Its mobile electrocardiogram (ECG) recorder, which is basically an iPhone case embedded with electrosensors, lets anyone perform a routine heart checkup by pressing a smartphone to their chest—meaning patients could share weekly, or even daily, readings with their doctors.
STATUS Raised $3 million; expects FDA clearance in mid-2012
PRICE Under $100

COUNT YOUR CALORIE BURN—WITH PRECISION!

PRODUCT **BodyMedia Armbands**
Unlike services that calculate calories burned solely from GPS or pedometer data, these wearable sensors (and companion iOS and Android apps) take all into account: heart rate, perspiration, skin temperature, and heat dissipation, along with time spent lying down and sleeping. The accuracy rate is an unprecedented 95%.
STATUS Available now
PRICE Starting at $180

HELP YOU BREATHE!

DEVELOPER **Leslie Saxon**
"People don't like to do breathing exercises, but when they do, they feel better," says Leslie Saxon, head of the University of Southern California's Center for Body Computing. With that in mind, she's building a game that has asthmatics and heart patients blow into their smartphone mic to move a ball or fly a magic carpet across a landscape. Scores are then sent to doctors.
STATUS Prototype

ANALYZE YOUR BLOOD CELLS!

DEVELOPER **Holomic**
By combining a clip-on slide holder with the built-in flash and camera of an Android phone, this technology lets users capture "holographic" images of the cells in a blood sample. Those files are then sent to hospital-based pathologists, who can scan them for signs of malaria, monitor lymphocyte counts (for people with HIV), and more.
STATUS Available in 2013

FLAG YOUR PULSE PROBLEMS!

DEVELOPER **Oxford University**
"Stethoscopes are mobile, but doctors aren't," says Thomas Brennan, a head researcher at Oxford University. So he and his team are using low-cost parts—such as the microphone of a Nokia cell phone—to create a device that allows untrained health workers to record a heartbeat and send it to doctors for analysis.
STATUS Prototype

SHARE YOUR FETUS PHOTO!

PRODUCT **Mobile Baby**
This service from Swedish developer Great Connection uploads hospital ultrasounds onto a cloud server so users can share them with friends and family.
STATUS Available in Scandinavia and the Middle East; wide U.S. launch in 2012

COACH YOUR LIFE!

DEVELOPER **Ginger.io**
"The mobile phone is a powerful diary of our lives," says Ginger.io cofounder Karan Singh, citing GPS tags, call logs, messaging histories, and more. His app mines those data for noteworthy behavior patterns; someone who takes antidepressants and spends days at home, for example, might be advised to change his meds.
STATUS Raised $1.7 million; now beta-testing with plans to launch in 2012

FIX YOUR VISION!

DEVELOPERS **EyeNetra, EyeCatra**
In lieu of visiting an optometrist, EyeNetra helps people find their "refractive error" (the number used to determine an eyeglass prescription) by looking into an eyepiece and aligning patterns on their smartphone screens. EyeCatra uses similar tech to spot cataracts.
STATUS Available early 2012 in Brazil, India, and Mexico
PRICE Under $30, including attachment

HELP YOU SLEEP!

PRODUCT **Zeo Sleep Manager–Mobile**
Sensors in a wireless headband detect patterns of light, deep, and REM sleep; a companion iOS or Android app then turns those data into graphs and an overall "sleep score," which Zeo's website suggests ways to improve.
STATUS Available now
PRICE $99

GET YOU PREGNANT!

PRODUCT **DuoFertility Monitor**
Hundreds of U.K. women have used the sensors—worn under the arm to monitor body temperature and identify peak fertility periods—to help themselves get pregnant. Although the tech now works with a standalone device, a smartphone app is in the works.
STATUS Available stateside within two years
PRICE $800 for the device and one year of service

PERFORM AN ULTRASOUND!

PRODUCT **MobiSante MobiUS SP1**
Beyond monitoring pregnancies, this mobile ultrasound device, which for now works exclusively with the Toshiba TG01 smartphone, could help armed forces evaluate trauma and general practitioners screen for abdominal aneurisms and kidney stones, says CEO Sailesh Chutani.
STATUS Available now; version in works for Android Honeycomb
PRICE $7,495, including the TG01

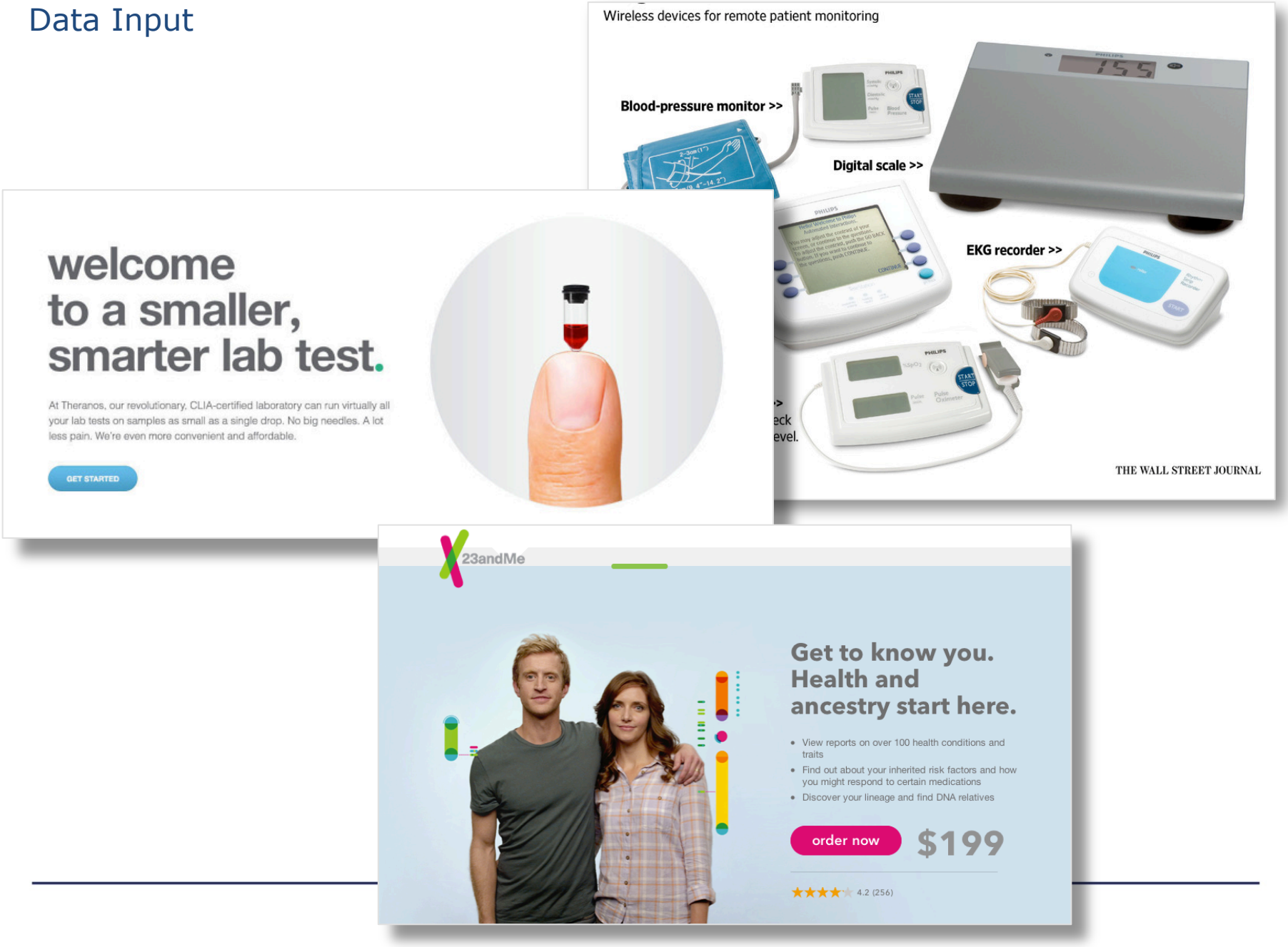
TRACK YOUR BLOOD SUGAR!

PRODUCT **Sanofi-Aventis iBGStar**
Roughly the size of an AA battery, this blood-glucose monitor does work as an independent device. But when synced to a smartphone, its data can be tracked, analyzed, and emailed to care providers—a huge help to the 19 million Americans who live with diabetes.
STATUS Available in Europe; U.S. launch pending FDA approval

MONITOR YOUR MOVES!

DEVELOPER **Selene Mota**
Using "wockets" (small, cheap, wearable accelerometers that relay a subject's movements to an iPhone), Mota, a PhD candidate in the MIT Media Lab, is developing software that can detect compulsive rocking in people with autism, as well as tremors associated with Parkinson's disease.
STATUS Lab testing

Data Input


Wireless devices for remote patient monitoring
Blood-pressure monitor >>
Digital scale >>
EKG recorder >>
THE WALL STREET JOURNAL
welcome
to a smaller,
smarter lab test.
At Theranos, our revolutionary, CLIA-certified laboratory can run virtually all your lab tests on samples as small as a single drop. No big needles. A lot less pain. We're even more convenient and affordable.
GET STARTED
23andMe
Get to know you.
Health and
ancestry start here.
View reports on over 100 health conditions and traits
Find out about your inherited risk factors and how you might respond to certain medications
Discover your lineage and find DNA relatives
order now
$199
4.2 (256)

“for the first time ever in history,

we will be present when a person gets sick”

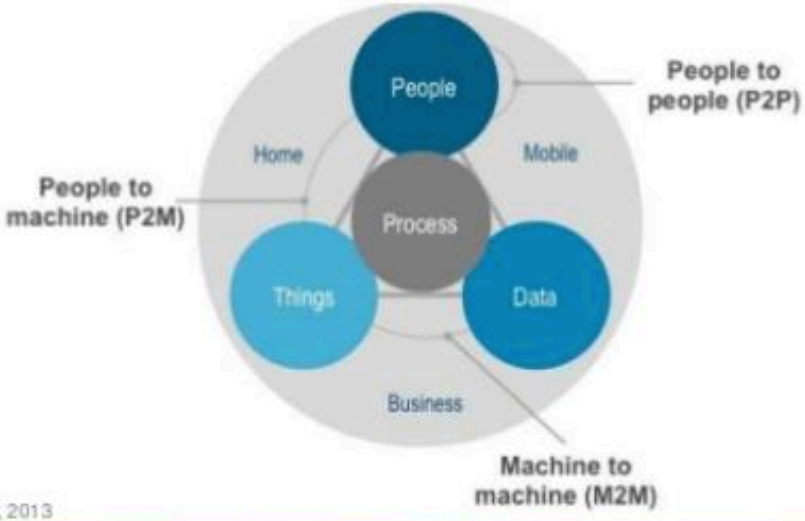
@lucienengelen

Sensors > Embedded

Trend > Internet of Everything

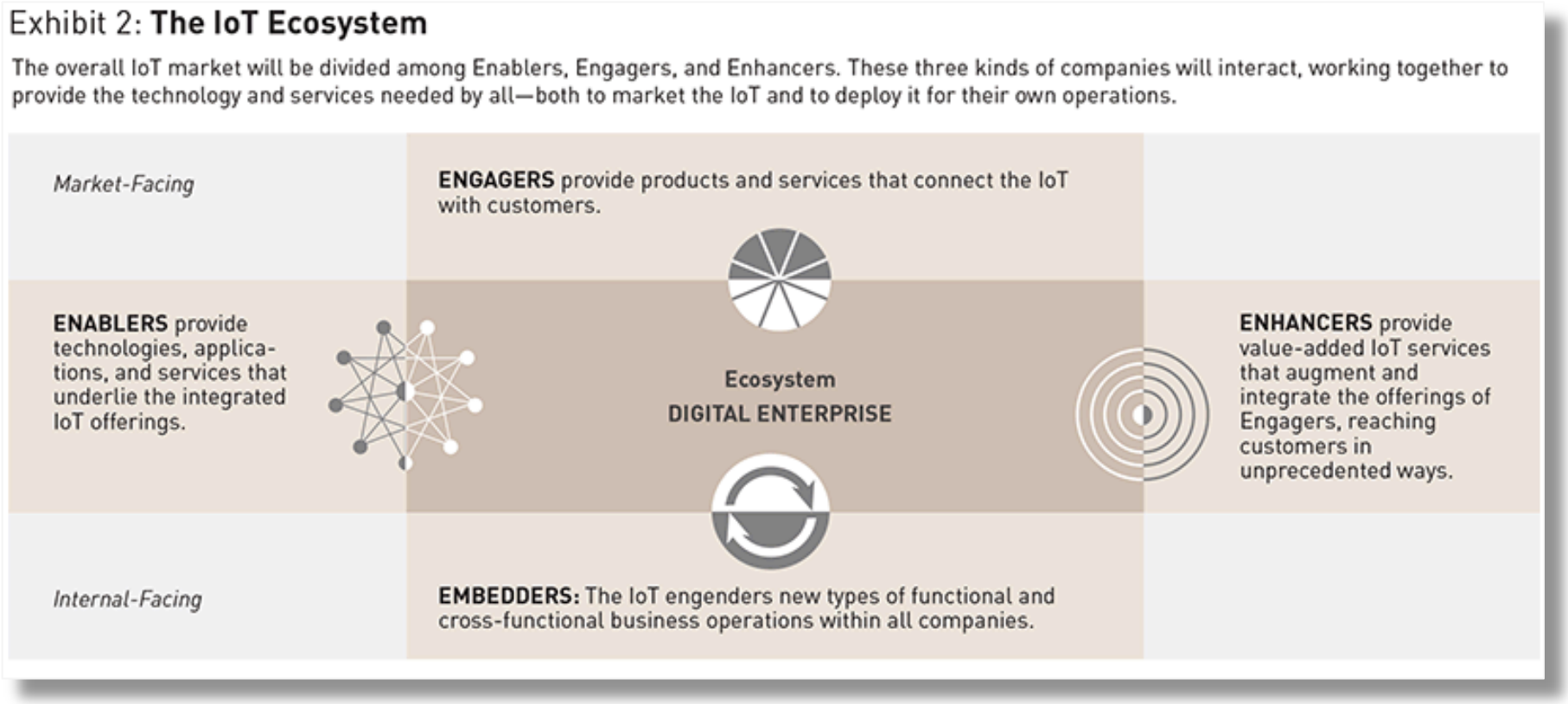
The Internet of Everything Connects the Unconnected

IoE brings together **people, process, data, and things** to make networked connections more relevant and valuable than ever before—turning information into actions that create new capabilities, richer experiences, and unprecedented economic opportunity for businesses, individuals, and countries.



Source: Cisco IBSG, 2013

Trend > Internet of Things > Ecosystem



Internet of Things > 2014

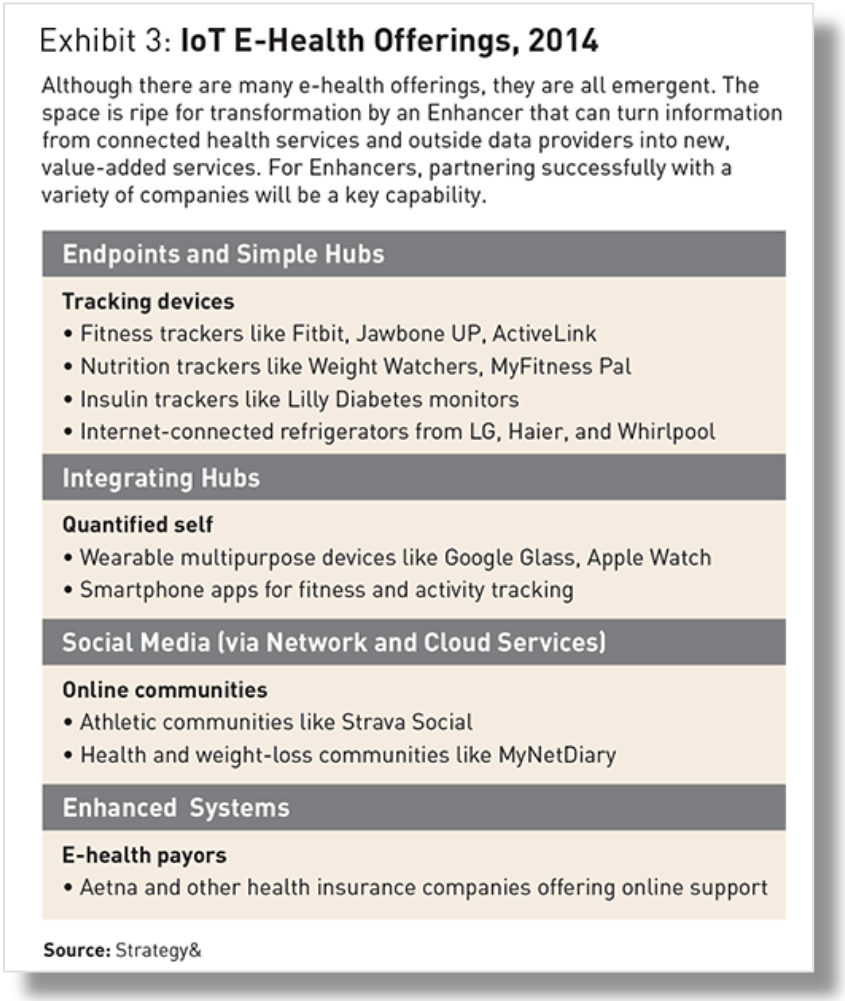


Exhibit 3: **IoT E-Health Offerings, 2014**

Although there are many e-health offerings, they are all emergent. The space is ripe for transformation by an Enhancer that can turn information from connected health services and outside data providers into new, value-added services. For Enhancers, partnering successfully with a variety of companies will be a key capability.

Endpoints and Simple Hubs

Tracking devices
- Fitness trackers like Fitbit, Jawbone UP, ActiveLink
- Nutrition trackers like Weight Watchers, MyFitness Pal
- Insulin trackers like Lilly Diabetes monitors
- Internet-connected refrigerators from LG, Haier, and Whirlpool

Integrating Hubs

Quantified self
- Wearable multipurpose devices like Google Glass, Apple Watch
- Smartphone apps for fitness and activity tracking

Social Media (via Network and Cloud Services)

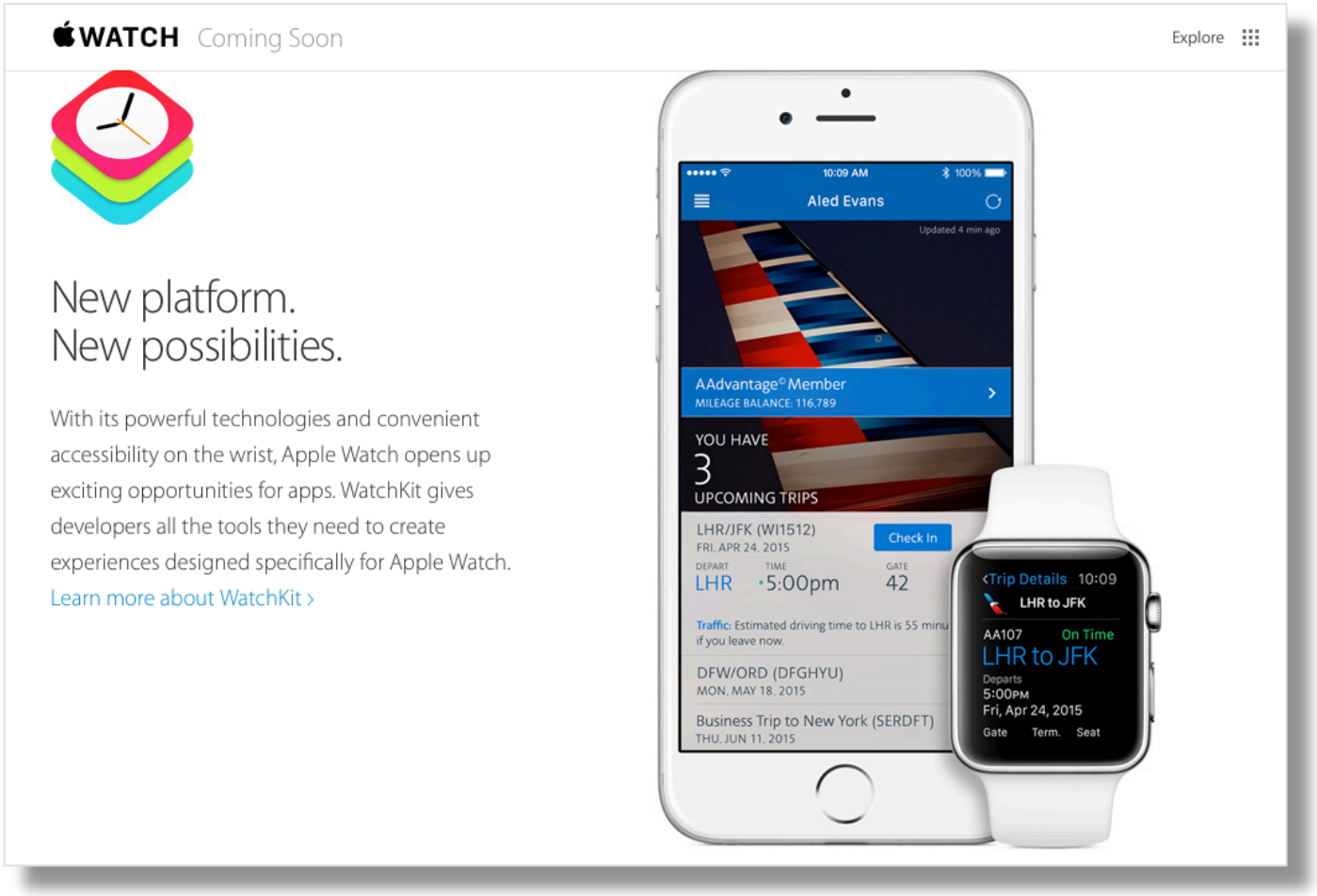
Online communities
- Athletic communities like Strava Social
- Health and weight-loss communities like MyNetDiary

Enhanced Systems

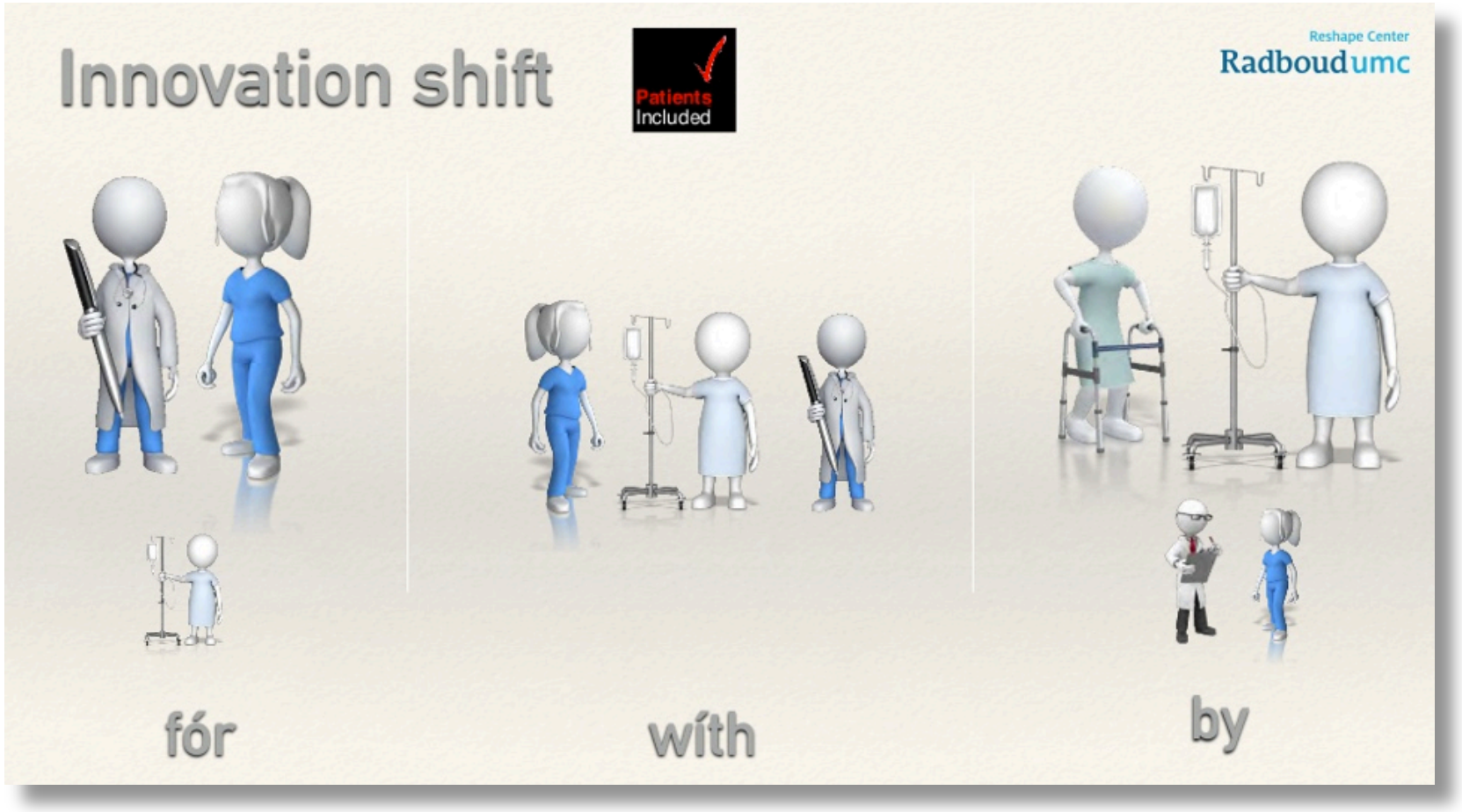
E-health payors
- Aetna and other health insurance companies offering online support

Source: Strategy&

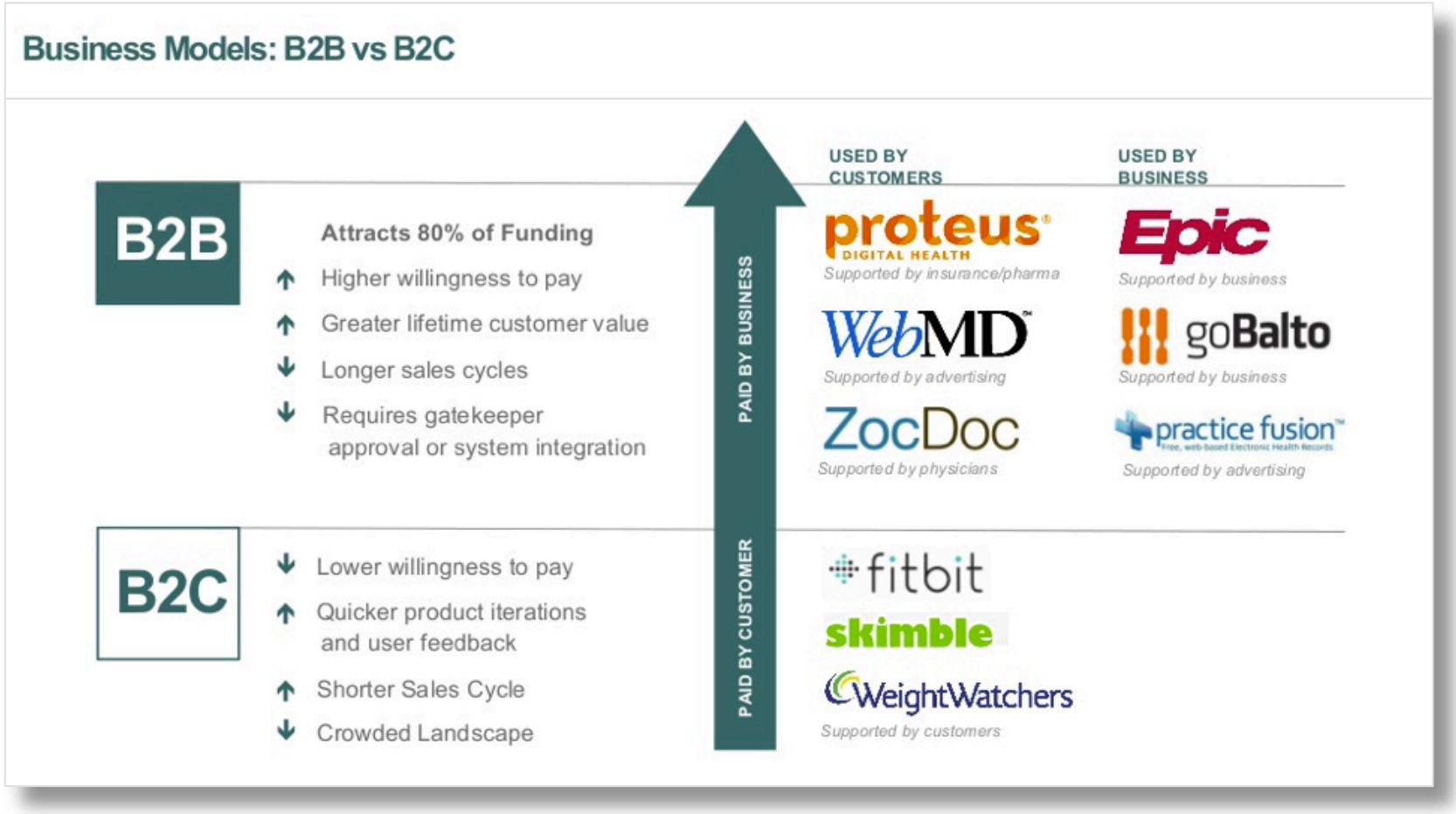
Fuel Trend > Accessibility



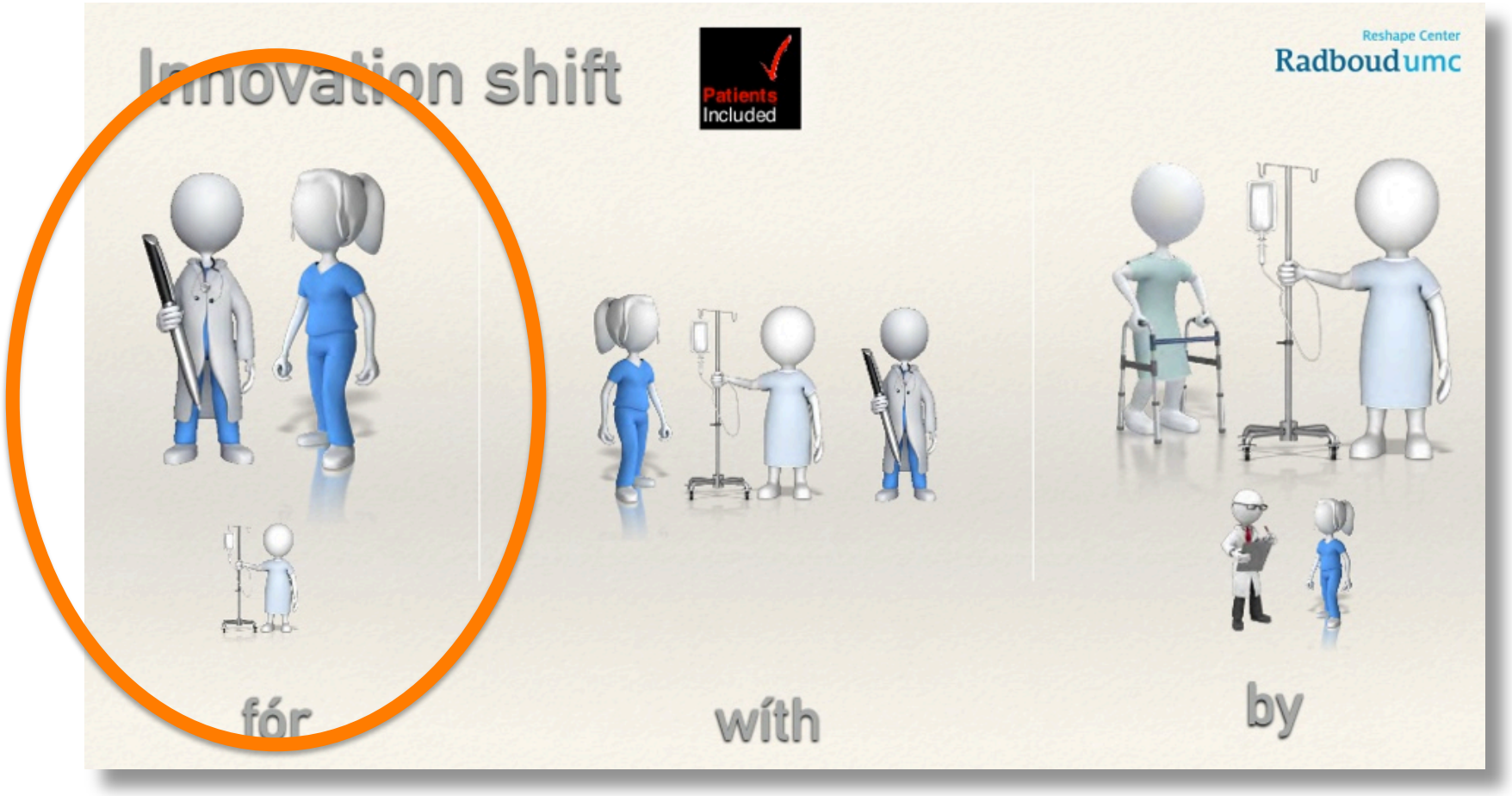
Fuel Trend > Patient Empowerment



Trend > Consumer Focus ???



Fuel Trend > Physician Empowerment



Trend > Data Visualization > Patient

Trend > HCP Data Visualization

TIME
Never Offline.
The Apple Watch is just the start. How wearable tech will change your life—like it or not
BY LEV GROSSMAN AND MATT VELLA
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So how will this change the practice of medicine > and where should innovation focus

HCPs will have 24/7 access to their entire practice with data provided by all the inputs that were described earlier

as a result the practice of medicine moves from;

from episodic to continuous

from condition to prevention

from hospital to home

from average to individual

from doctor to extended care team

from mundane data collection to a focus on consulting value – i.e. treatment planning / activation / adherence observation / ongoing management

So how will this change the practice of medicine > and where should innovation focus

HCPs will have 24/7 access to their entire practice with d ata provided by all the inputs that were described earlier

as a result the practice of medicine moves

HCP >
CEO

So how will this change the practice of medicine > and where should innovation focus

Patients will have 24/7 access to their data, care plans, healthcare team

as a result the patient view of healthcare moves from;

from episodic to continuous

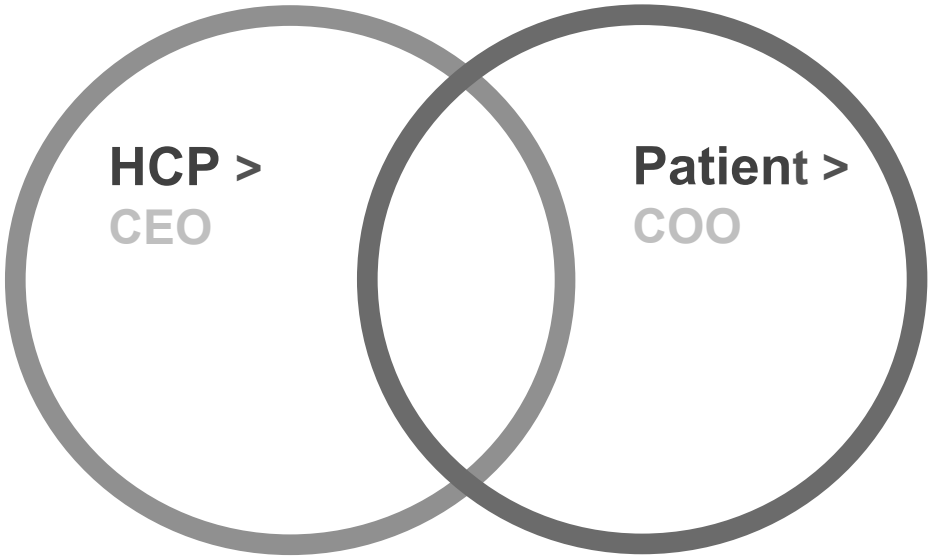
from condition to prevention

from hospital to home

from average to individual

from doctor to extended care team

from passive recipient to activated manager of their health



So how will this change the practice of medicine > and where should innovation focus

Develop or partner with industry to create the sensors / devices / apps that will deliver data to the Patient / Caregiver / HCP > before visit / during visit / after visit

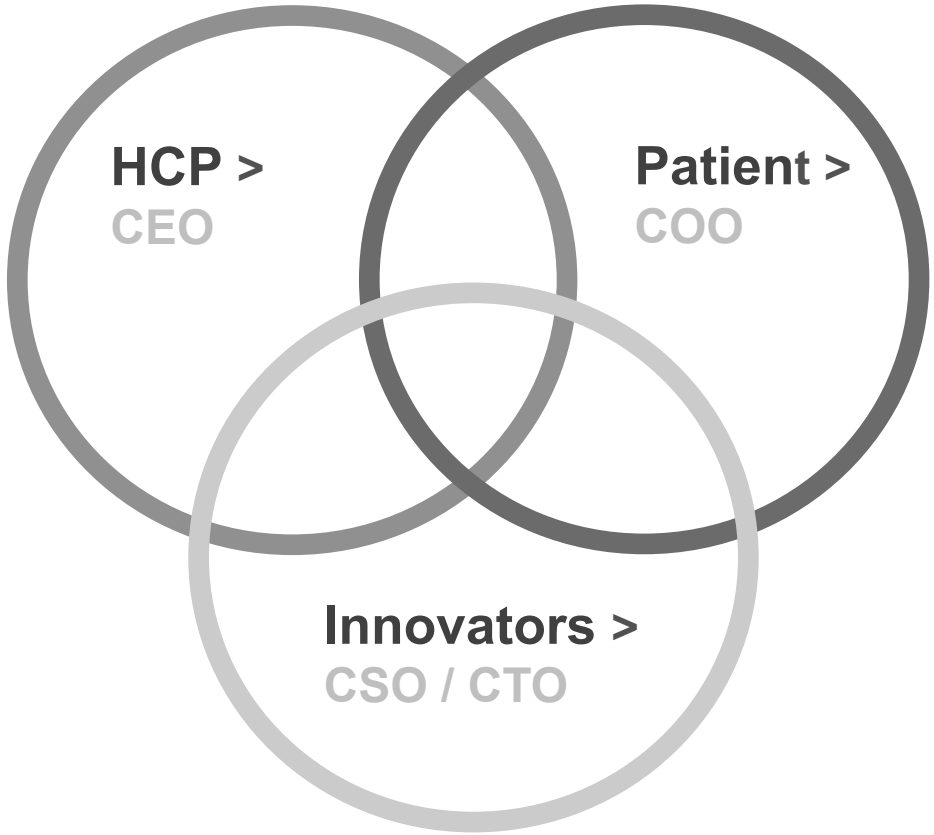
Partner with other businesses to obtain additional data to enhance the clinical experience

Provide dashboards to help visualize this data making it meaningful and actionable

Provide BI that optimizes diagnosis and/or treatment decisions

Open communication / collaboration opportunities with other HCPs based on patient needs

Provide programs that allow HCPs to benchmark their practice – and provide contextual education based on existing gaps



Summary > Key Lesson Learned > Partner >

Pharma / OTC / CPG / Association / Government / Pharmacy / Insurer / Home Care / etc.

- ✓ Incumbent advantage
- ✓ Know the industry better than companies from other sectors
- ✓ Know the regulatory requirements
- ✓ Know the stakeholders
- ✓ Know the payment systems / revenue models
- ✓ Know the conditions and medications

Summary > Key Lesson Learned > Process

Trend > Product +

Trend > Product +

BMW has produced a pair of driving goggles that connect to its MINI brand of cars ©BMW

What you can see from your MINI goggles ©BMW

Internet of Things …….. and Disruptive Innovation in Healthcare

Dr. W. John Reeves MD

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