IOT – The internet of things…

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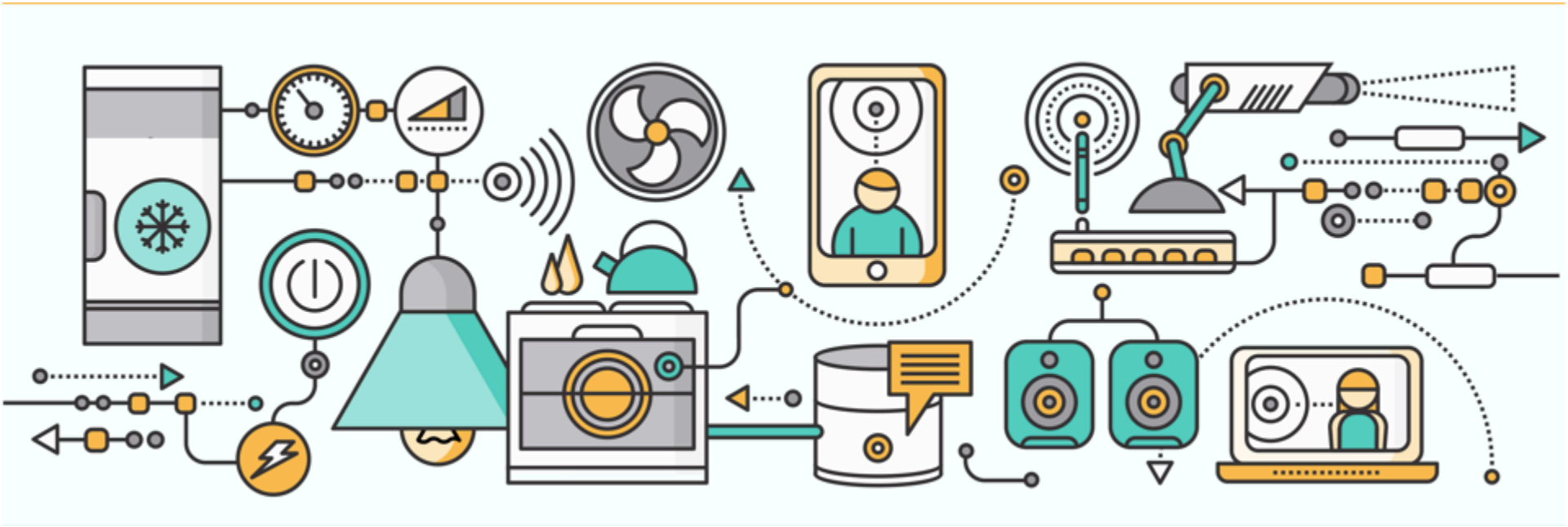

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IREC
Interstate Renewable Energy Council
ISPQ
CERTIFIED
Independent
Master Trainer
TM

GREAT NORTHERN
SOLAR

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CERTIFIED
PV Installation
Professional

Emeritus

The Internet of Things (IOT) – the Nexus of Technologies in the Home and Business

Chris LaForge, Great Northern Solar

Inter·net of things - IoT

noun: ***Internet of things - a proposed development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data.***

"if one thing can prevent the Internet of things from transforming the way we live and work, it will be a breakdown in security"

Internet of things

The Internet of things (IoT) is the internetworking of physical devices, vehicles, buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.

In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications.

The interconnection of these embedded devices (including smart objects), is expected to usher in ***automation*** in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to the areas such as smart cities.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/ food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations.

Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens or refrigerators/freezers that use Wi-Fi for remote monitoring.

The concept of the Internet of Things was invented by and term coined by Peter T. Lewis in September 1985 in a speech he delivered at a U.S. Federal Communications Commission (FCC) supported session at the Congressional Black Caucus 15th Legislative Weekend Conference…

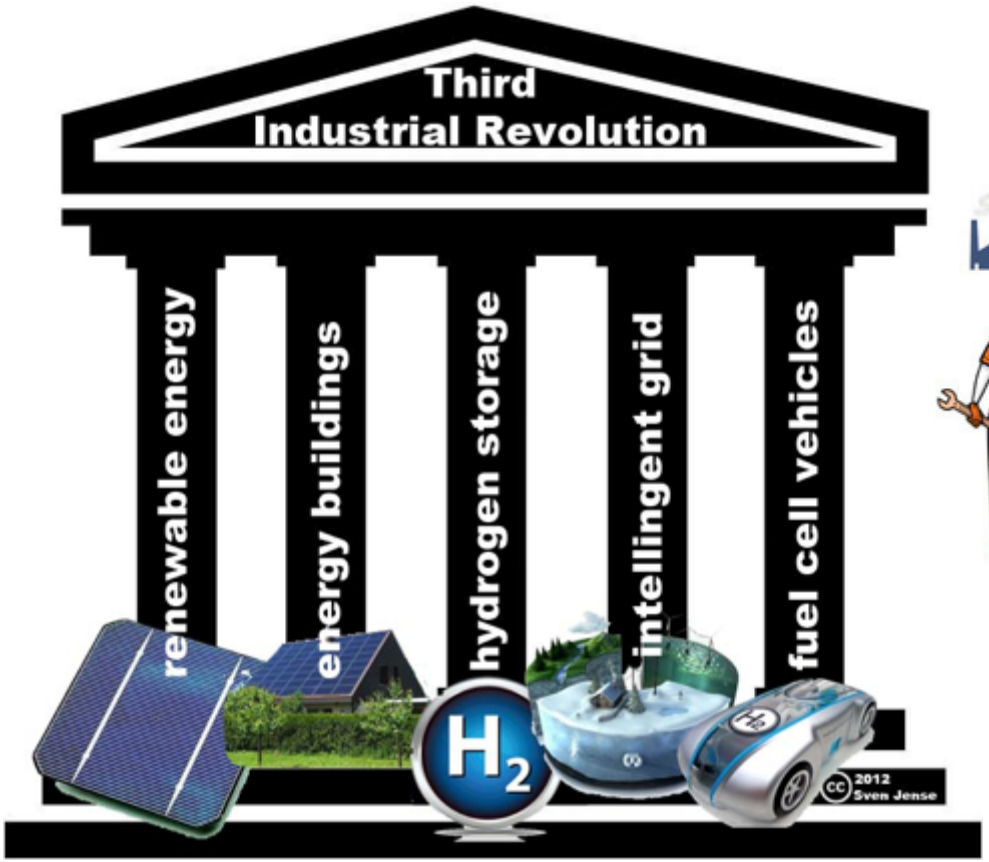
There was no widespread availability of Internet in those days so the Internet didn't archive it.

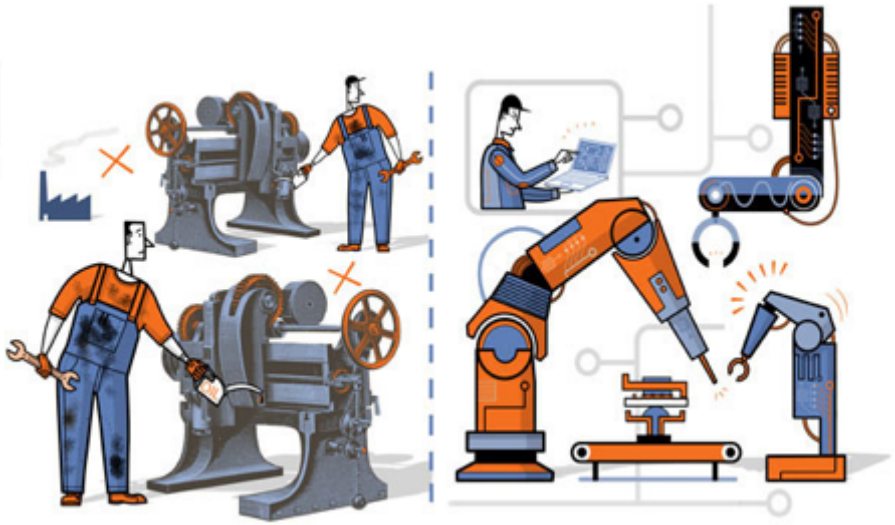
Peter Lewis was busy with his new startup endeavors and the speech was lost track of.

Only a few close friends and colleagues knew about the speech.

Lewis defined the IoT as "the integration of people, processes and technology with connectable devices and sensors to enable remote monitoring, status, manipulation and evaluation of trends of such devices."

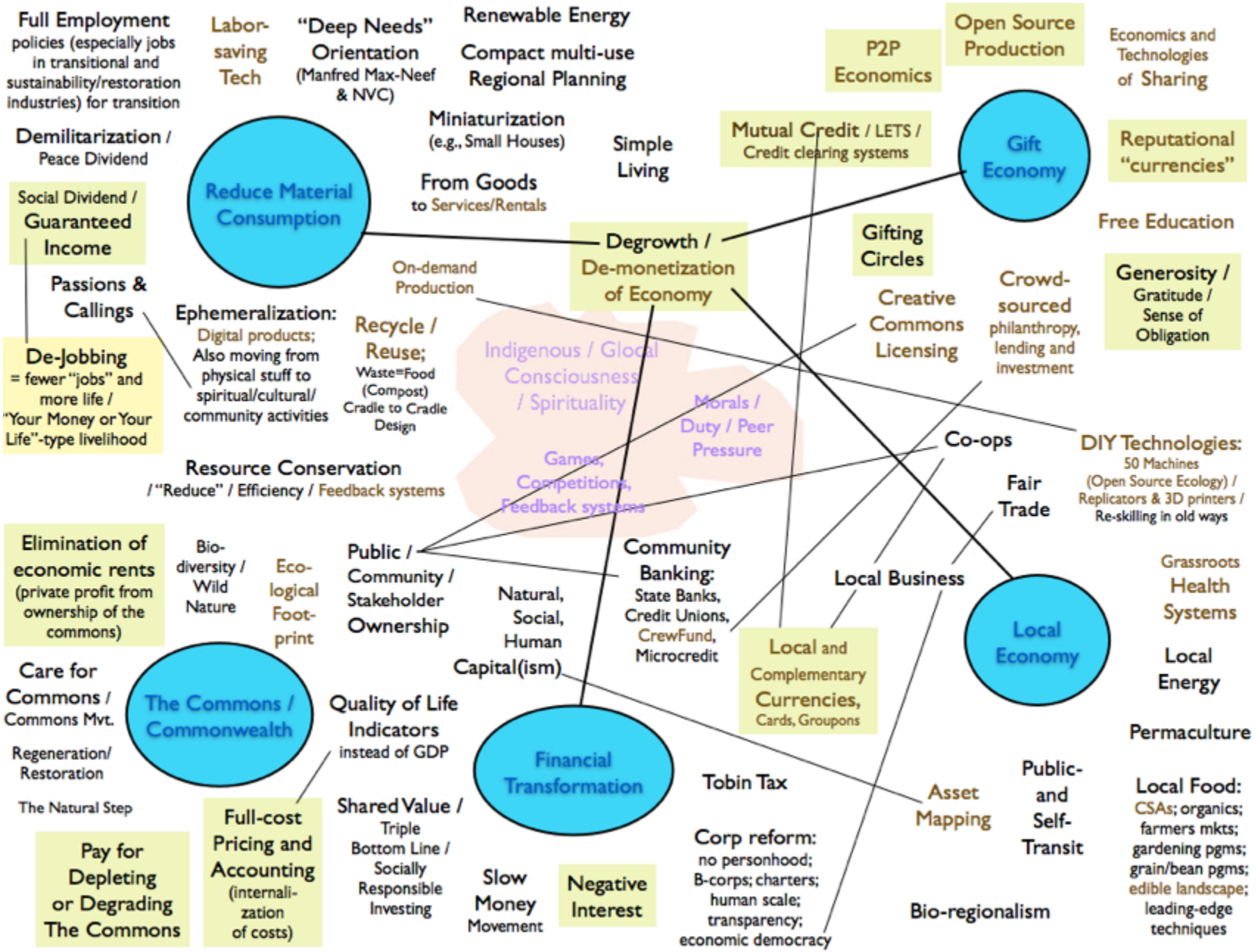
The Internet of things (IoT) is becoming the nexus of the creation of the Third Industrial Revolution (TIR). The shift in infrastructure this represents will bring communications, power sources, and logistics mechanisms into a single operating system.



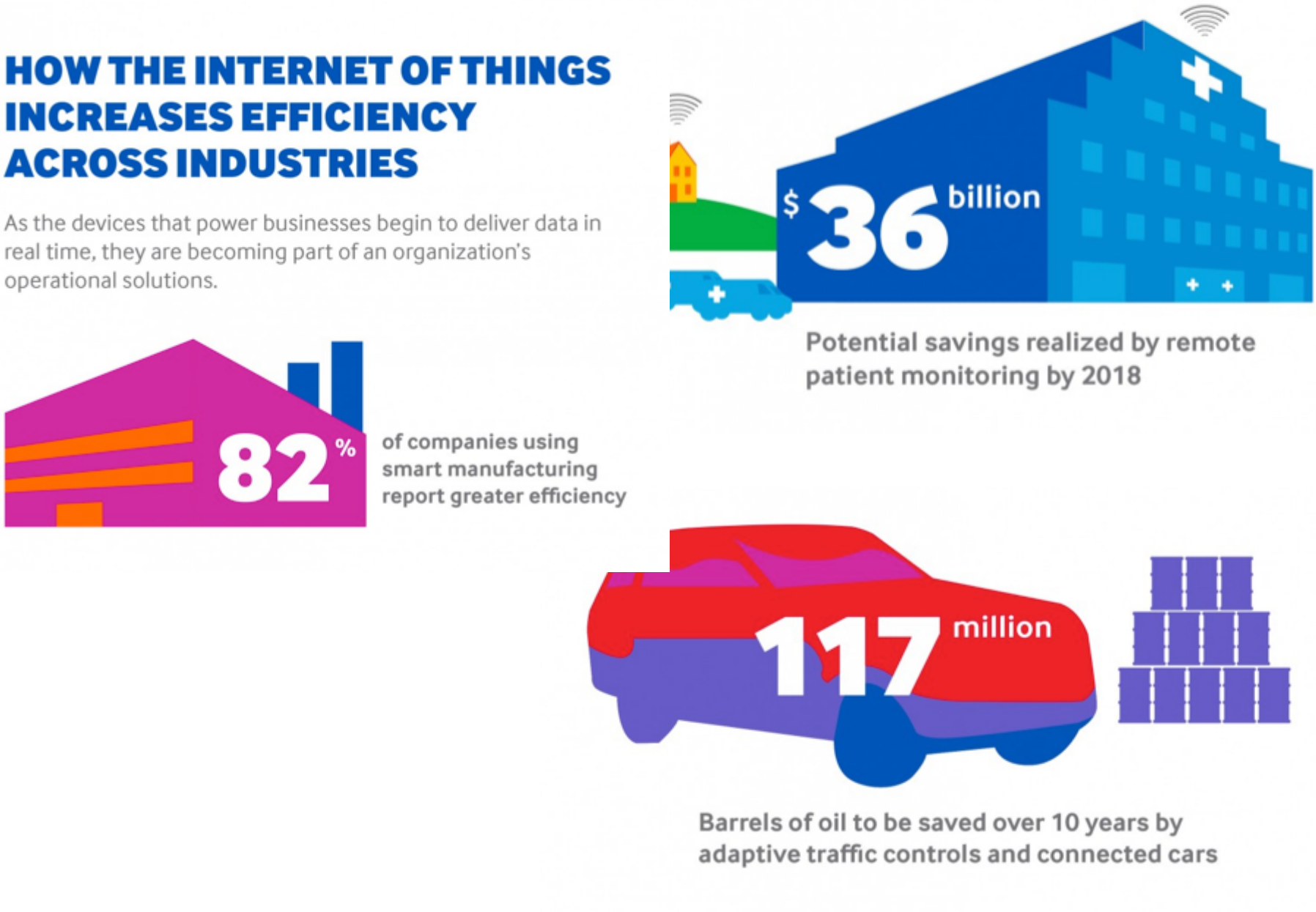


IoT is bringing forward an Open, Distributed, Collaborative Architecture with Peer-to-Peer lateral economies of scale, which move to reduce and even eliminate middlemen.

This process is developing networks geared toward new and different economies:

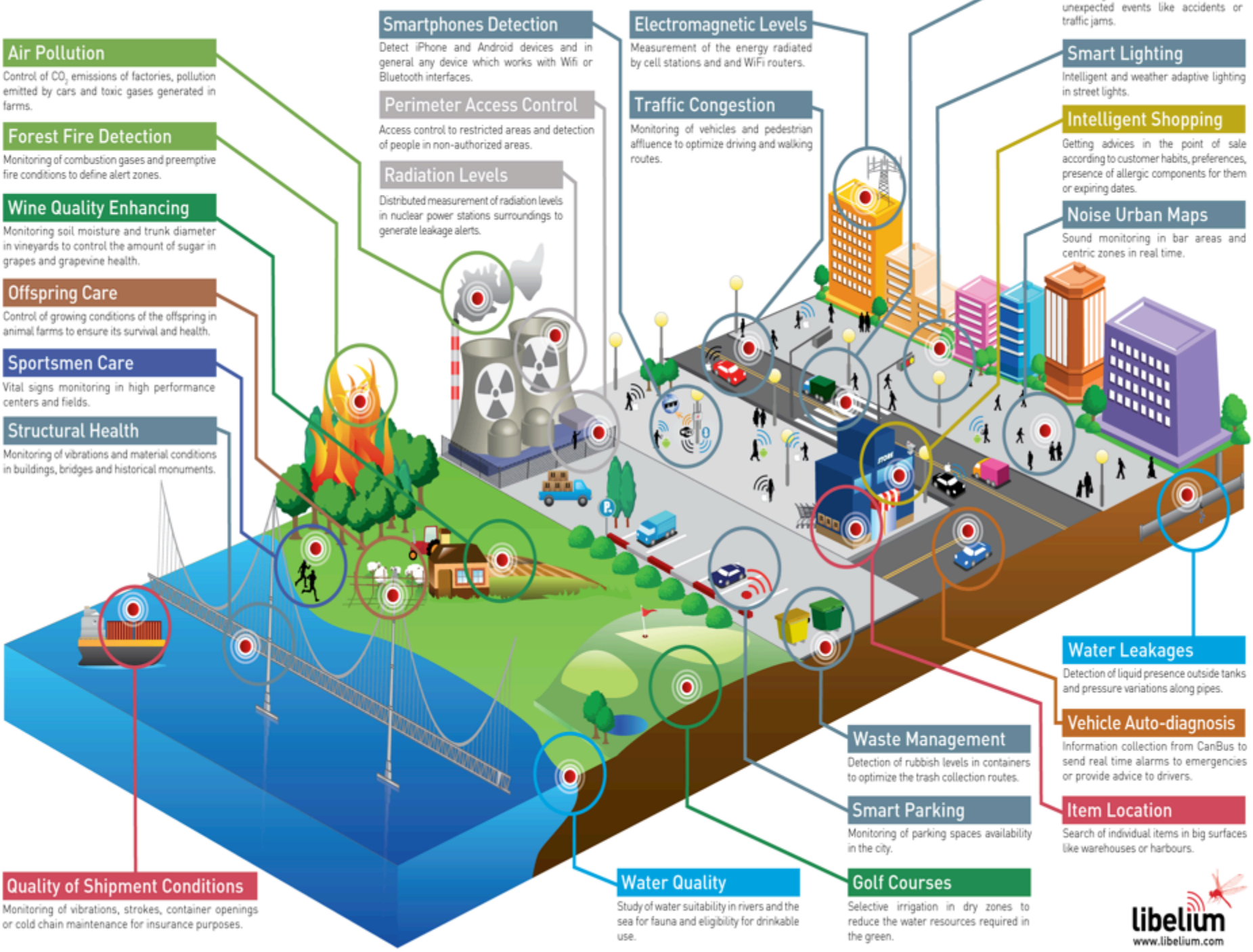


The shift to smart systems using the IoT can allow for increases in efficiency as great as 40%

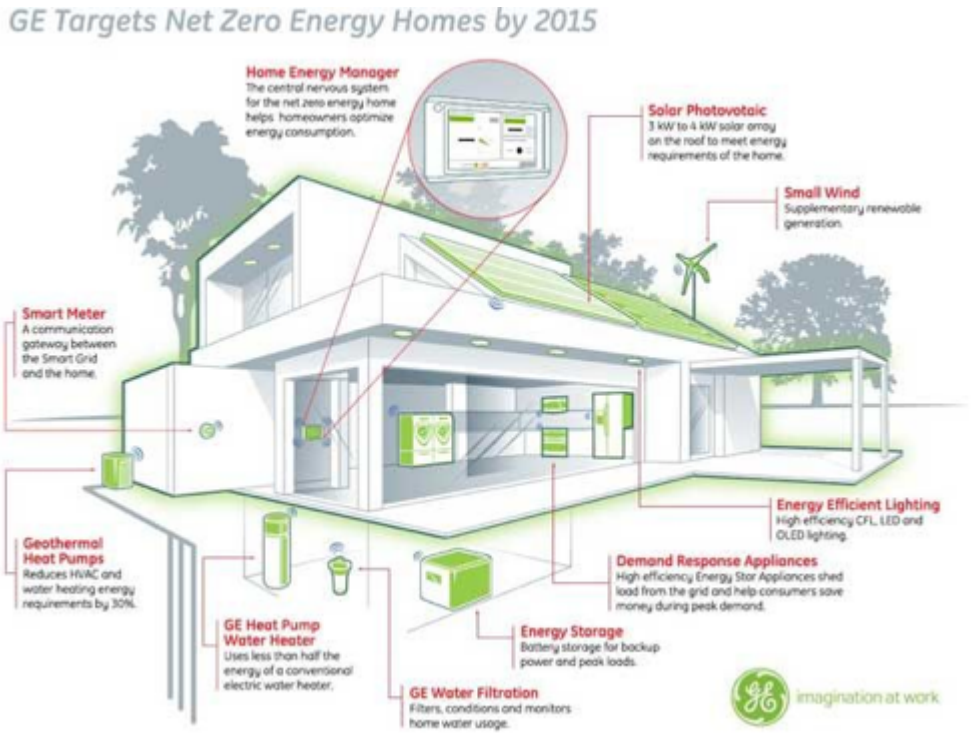


Communication and energy matrices determine the way economic power is organized and distributed in every civilization. IoT is dramatically changing the current matrix.

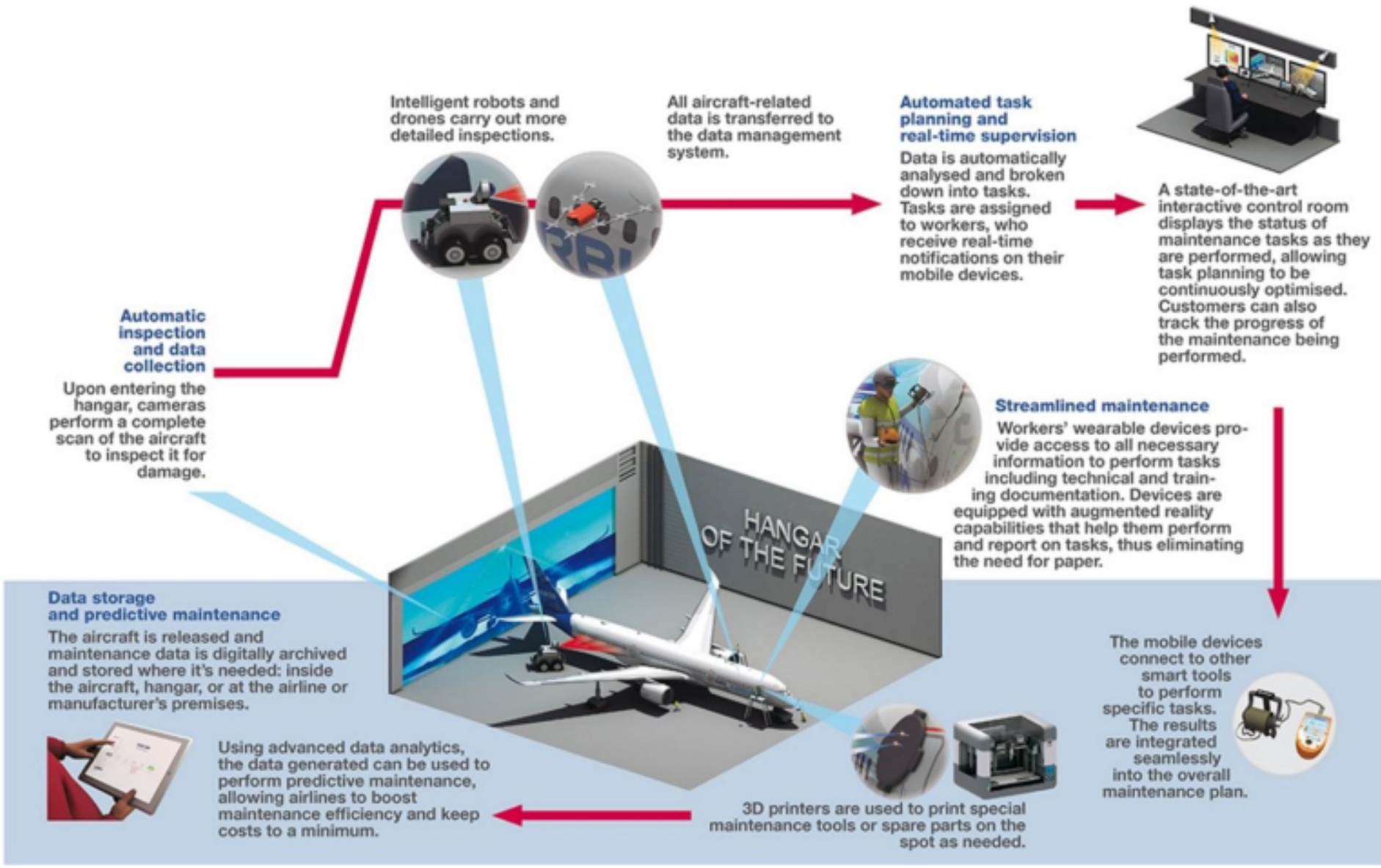
IoT's reach and effects are phenomenal…


Air Pollution
Control of CO_2 emissions of factories, pollution emitted by cars and toxic gases generated in farms.
Forest Fire Detection
Monitoring of combustion gases and preemptive fire conditions to define alert zones.
Wine Quality Enhancing
Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.
Offspring Care
Control of growing conditions of the offspring in animal farms to ensure its survival and health.
Sportsmen Care
Vital signs monitoring in high performance centers and fields.
Structural Health
Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.
Quality of Shipment Conditions
Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.
Smartphones Detection
Detect iPhone and Android devices and in general any device which works with Wifi or Bluetooth interfaces.
Perimeter Access Control
Access control to restricted areas and detection of people in non-authorized areas.
Radiation Levels
Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.
Electromagnetic Levels
Measurement of the energy radiated by cell stations and and WiFi routers.
Traffic Congestion
Monitoring of vehicles and pedestrian affluence to optimize driving and walking routes.
unexpected events like accidents or traffic jams.
Smart Lighting
Intelligent and weather adaptive lighting in street lights.
Intelligent Shopping
Getting advices in the point of sale according to customer habits, preferences, presence of allergic components for them or expiring dates.
Noise Urban Maps
Sound monitoring in bar areas and centric zones in real time.
Water Leakages
Detection of liquid presence outside tanks and pressure variations along pipes.
Vehicle Auto-diagnosis
Information collection from CanBus to send real time alarms to emergencies or provide advice to drivers.
Item Location
Search of individual items in big surfaces like warehouses or harbours.
Waste Management
Detection of rubbish levels in containers to optimize the trash collection routes.
Smart Parking
Monitoring of parking spaces availability in the city.
Water Quality
Study of water suitability in rivers and the sea for fauna and eligibility for drinkable use.
Golf Courses
Selective irrigation in dry zones to reduce the water resources required in the green.
libelium
www.libelium.com

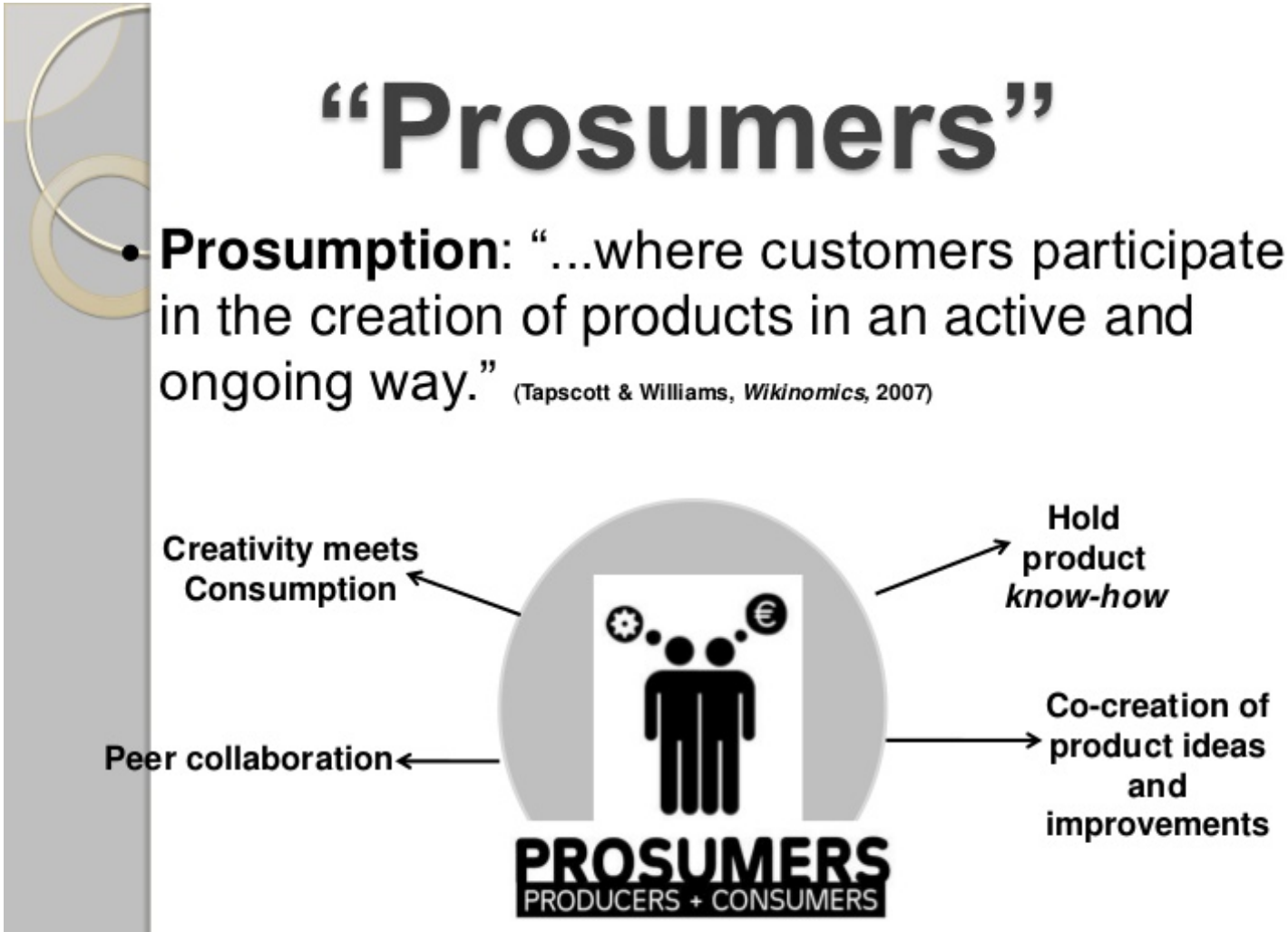
Using some Current Examples will help us broaden our understanding of the coming effects of the employment of IoT and their ramifications for our Nation, Society, and our Global Culture…



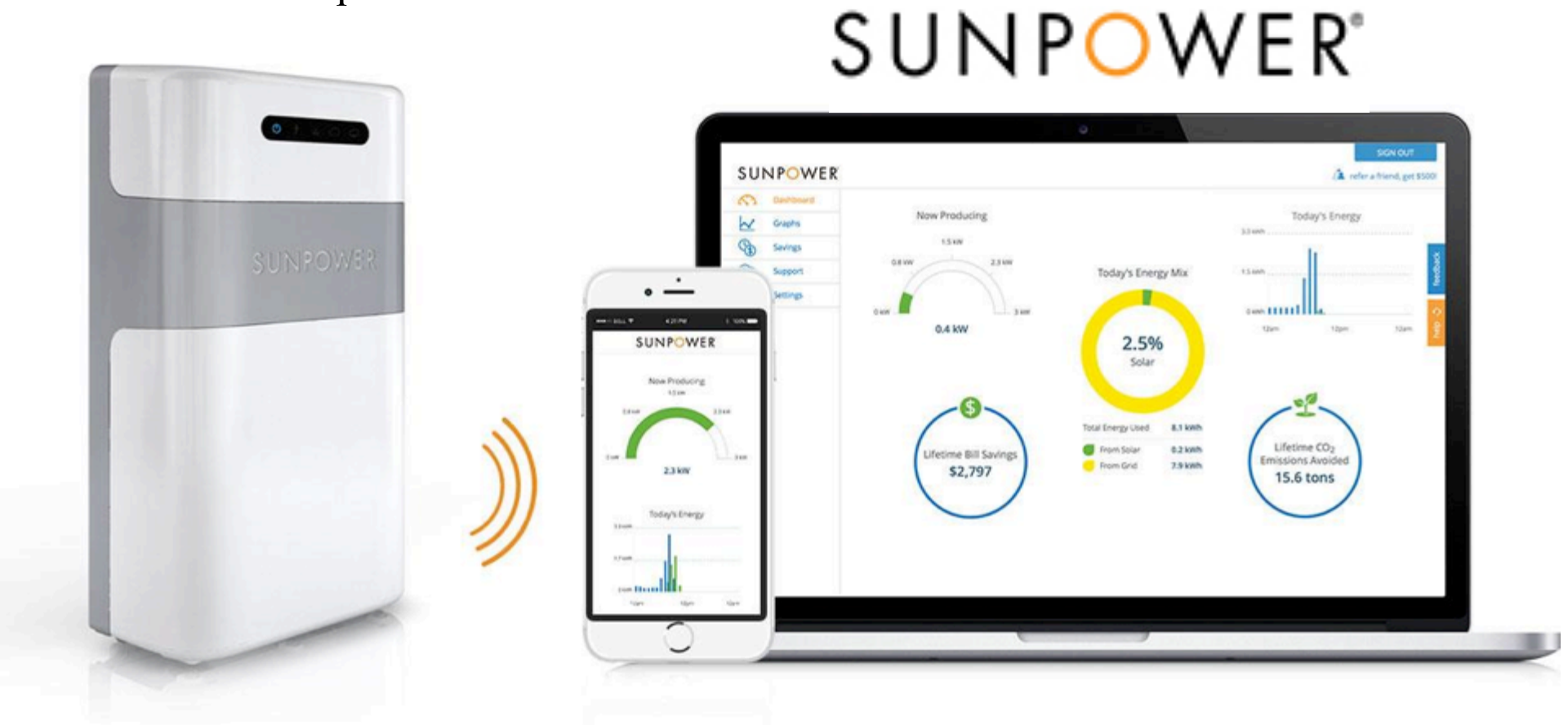
O&M presents a good example of the benefits of the IoT = Predictive Maintenance



Wireless smartgrid developments lead in the energy efficiency and renewable energy applications of IoT. Interconnected buildings and systems well become the norm and move our interactions with Utilities and power production and use into an era of Prosumers (producers that consume).



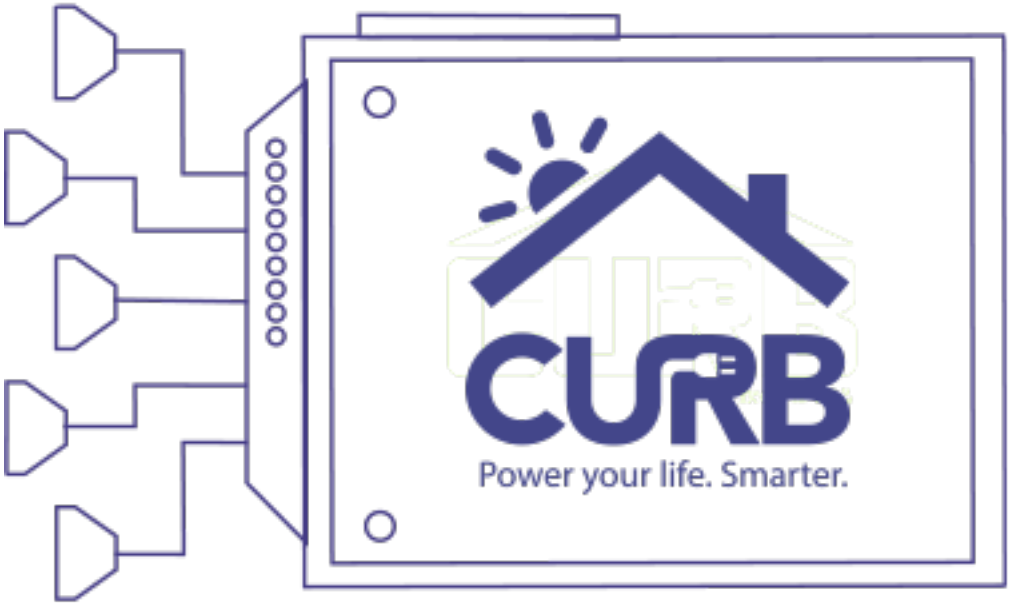
AT&T* and SunPower have entered into an agreement that brings Internet of Things (IoT) technology to SunPower's newest home energy solution—SunPower Equinox™.



EnergyLink™ provides homeowners with real-time data on their system's solar energy production and features added capabilities including real-time energy use data, and Smart Energy capabilities for added insights on a home's energy profile.

The latest innovators in this market, such as Curb, seek to integrate solar monitoring solutions with the Internet of things (IoT) by bringing a wealth of data to consumers or facility managers.

What is CURB?AN INTERACTIVE ENERGY EFFICIENCY SOLUTION FOR YOUR ENTIRE HOME



Works with SmartThings

Works with SmartThings™

Curb hardware sensors connect to the breaker box – the central hub that routes electricity to home appliances and devices. The sensors monitor usage and communicate with Curb's software to give you a pulse on your home.

INSIGHTS & CONTROLS ON THE GO Use the app to see how much you're spending on electricity at any moment, and connect to your favorite smart home devices so that you can remotely turn things off or on from your Smartphone.

TAILORED REPORTS TO STAY ON TRACK Weekly emails report progress, identify changes in consumption and make suggestions that are specific and tailored to your home to help you cut costs the following week.

https://www.youtube.com/watch?v=bMgIx3p1waw

BRINGING THE SMART HOME TO THE SOLAR INDUSTRY Curb monitors everything going on inside your home as well as your solar system. Curb shows customers where their energy is being used and how much is being generated, in real time and for less money than traditional solar monitoring systems.

PERFECT COMPANION FOR YOUR ELECTRIC CAR

Huge innovations are being made in the area of electric vehicles, but do you know how much it costs to charge your car? With Curb, you can be 100% confident that your car battery is being charged and you can know the exact amount it is costing for personal use and for generating expense reports!

Current Example….

Siemens wants to make even greater use of data and analytic functions in the future. All the technologies required for this purpose have been brought together in Sinalytics, which is already up and running. The company's proven remote maintenance and optimization offerings are now bundled with the latest developments in data analytics, connectivity and cybersecurity.

Distributed analytics, which involves the pre-processing and analysis of data directly in local devices, will grow in importance. In the future, devices will make decisions on their own.

Toward the Seamless Integration of the Physical and Virtual Worlds

Whether in factories, rail and traffic management systems, or decentralized power distribution systems, the trend is toward networking individual devices with entire systems – a process that is based on the integration of the physical world with the virtual world of data. The result is what Siemens calls the Web of Systems. As this process evolves, it will allow Siemens to help its customers to enrich their existing equipment through the advantages of the digital universe without endangering or sacrificing either data protection or intellectual property.

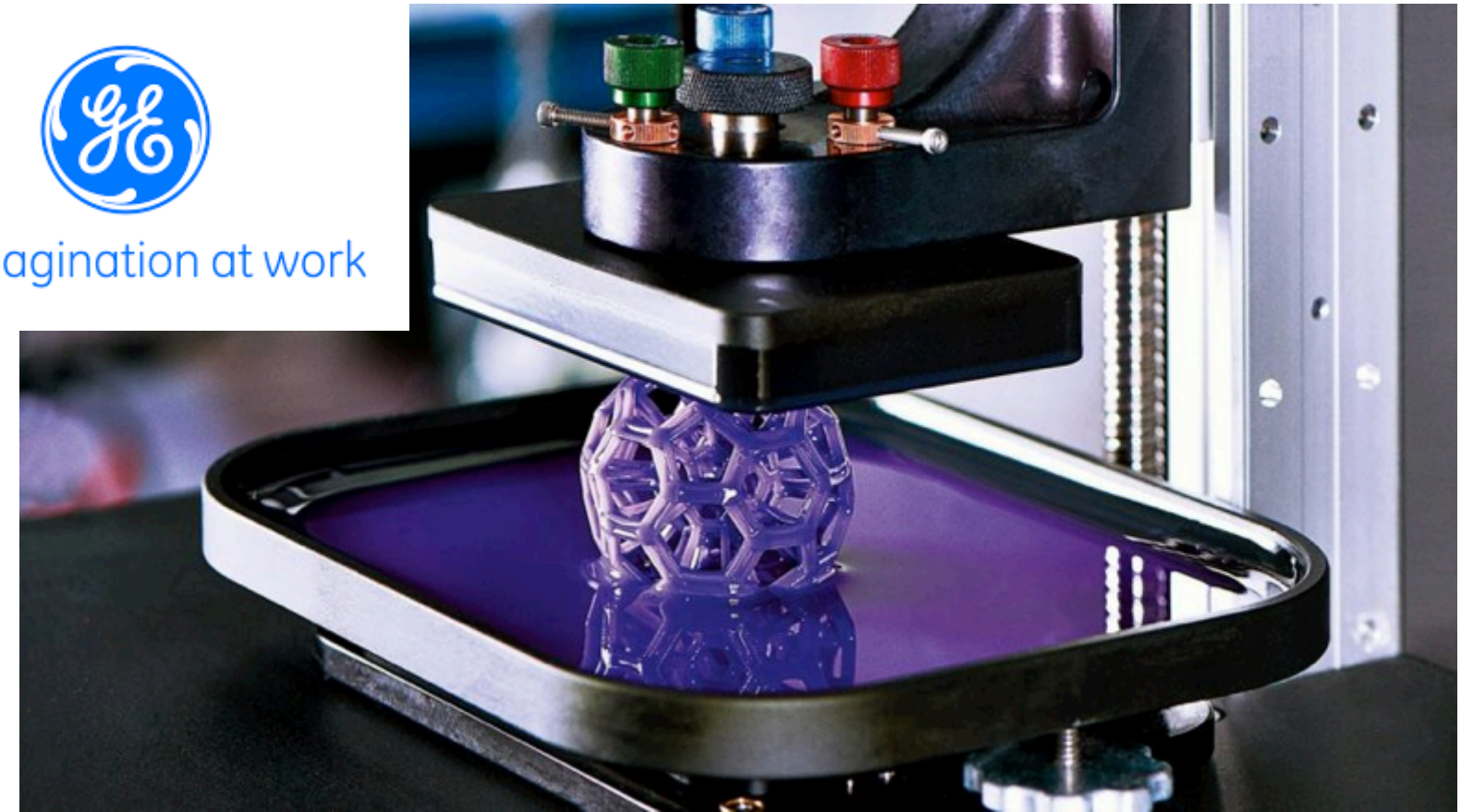
The Open-source development of 3D printing has spawned the "Makers Movement" – employing the IoT to revolutionize manufacturing. With so many people able to freely share ideas and spread inspiration across the web, makers are forming communities of their own, and more people around the world are becoming influenced to be makers. This "do-it-yourself" movement has significant ramifications: Some will use DIY in making robots, printers and other programmable devices hacked together using free software and tools found across the web.

Current Example: Garages are GE's way of empowering anyone and everyone who wants to participate in the next industrial era.

Inside Garages

Technology is changing the way we build — whether sitting at your desk or working on the manufacturing floor. Printers now use plastics and metals instead of just ink. Prototyping happens in a number of hours — not weeks, months or years. Software is sharpening design capabilities beyond a pencil's reach. Using "Fab Lab's" equipped with 3d printers, CNC mills, laser cutters, injection molders GE is getting "Makers" to develop the products of our near future.

GE imagination at work



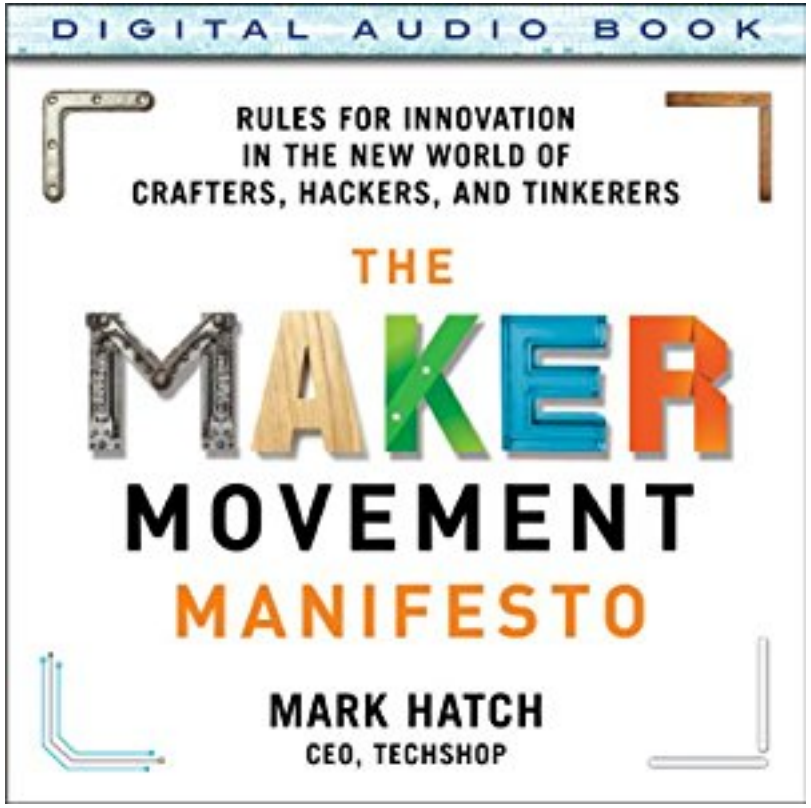
Current Example…Urbee the 3D Printed Car

Stratasys 3D Printers Build Urbee, First Prototype Car to Have Entire Body Created with an Additive Process. Urban electric with ethanol as backup, was designed to use the least energy possible. It is capable of reaching more than 200 mpg on the highway and 100 mpg in the city.

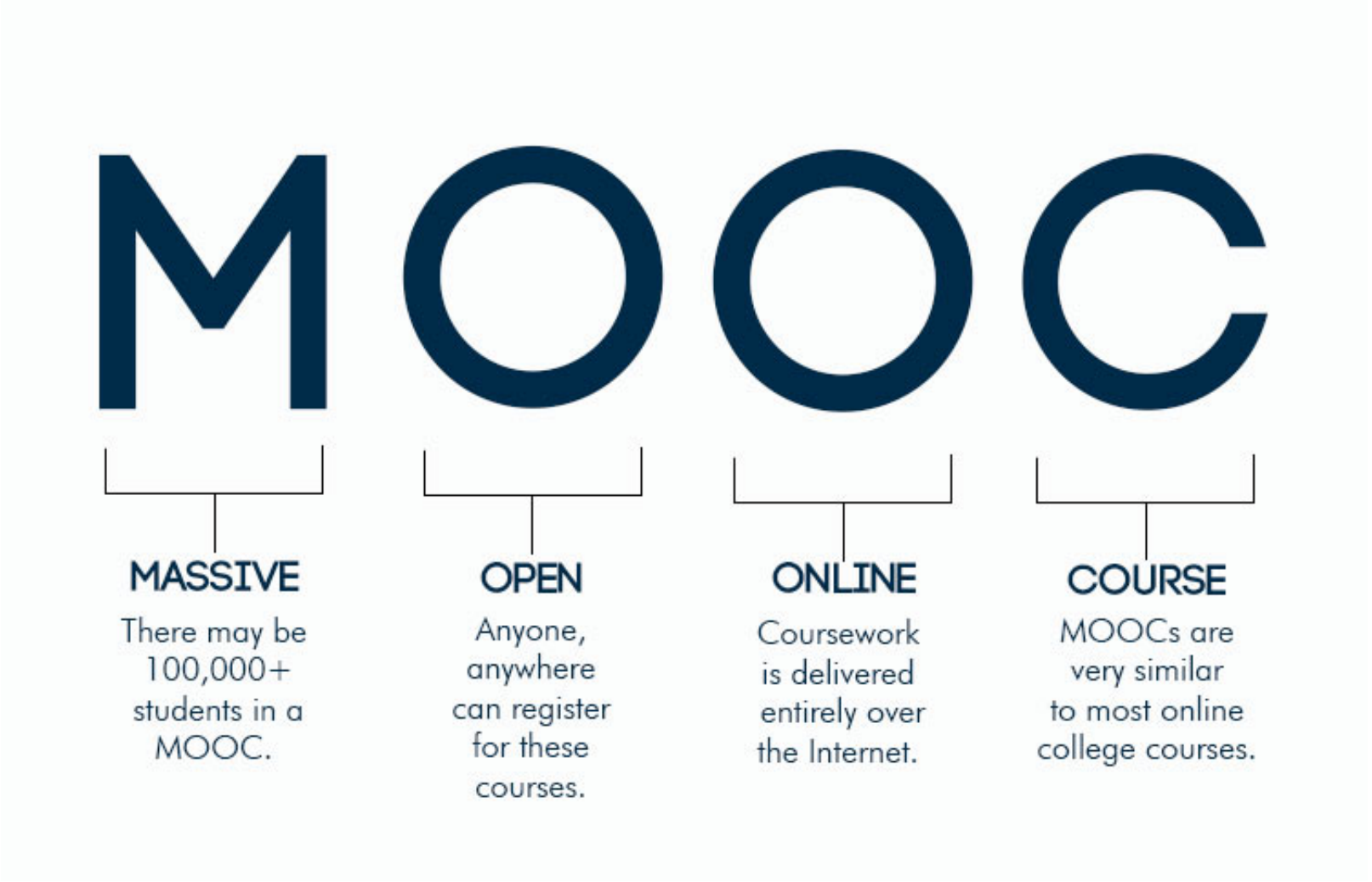
"FDM (Fused deposition modeling) technology made it easy and efficient to make design changes in the Urbee along the way," said Kor (Jim Kor, president and senior designer for the Winnipeg-based engineering group of KOR EcoLogic). "It also helped us meet our environmental goals by eliminating tooling, machining and handwork. If you can get to a pilot run without any tooling, you have advantages."

Urbee

The Makers movement relies on four principles:
1) open-source sharing of new inventions.
2) Promotion of a collaborative learning culture,
3) a belief in community self-sufficiency and
4) a commitment to sustainable productions practices.
All of these principles are empowered by use of the IoT.



IoT is radically changing the distribution of and access to education. With Massive Open Online Courses (MOOC's) education is being democratized on a global scale. With Udacity, Ed-x and many others free access to high-level curriculums is becoming common.



Example: edX – “Free online courses from the best universities and institutions in the world — Harvard, MIT, UC Berkeley, Microsoft, Tsinghua University, The Smithsonian and more. “

edX is a massive open online course (MOOC) provider. It hosts online university-level courses in a wide range of disciplines to a worldwide student body, *including some courses at no charge*. It also conducts research into learning based on how people use its platform. EdX differs from other MOOC providers, such as Coursera and Udacity, in that it is a nonprofit organization and runs on open-source software.

The Massachusetts Institute of Technology and Harvard University created edX in May 2012. More than 70 schools, nonprofit organizations, and corporations offer or plan to offer courses on the edX website. As of 24 March 2016, edX has more than 7 million students taking more than 700 courses online.

EdX courses consist of weekly learning sequences. Each learning sequence is composed of short videos interspersed with interactive learning exercises, where students can immediately practice the concepts from the videos. The courses often include tutorial videos that are similar to small on-campus discussion groups, an online textbook, and an online discussion forum where students can post and review questions and comments to each other and teaching assistants. Where applicable, online laboratories are incorporated into the course.

EdX offers certificates of successful completion and some courses are credit-eligible.

Educator as a Maker Educator

Lead Learner

Safe Environment Manager -> where learners feel free to take risks.

Process Facilitator for producing, assessing, developing, creating, revisiting, revising

Relationship Enabler & Builder -> face-to-face, online PLNs, mentors

Resource Suggester & Provider

Technology Tutor

Normalizer of ambiguous problem finding and solving; failure being iterative.

Facilitator Feedback

Tour Guide of Learning Possibilities

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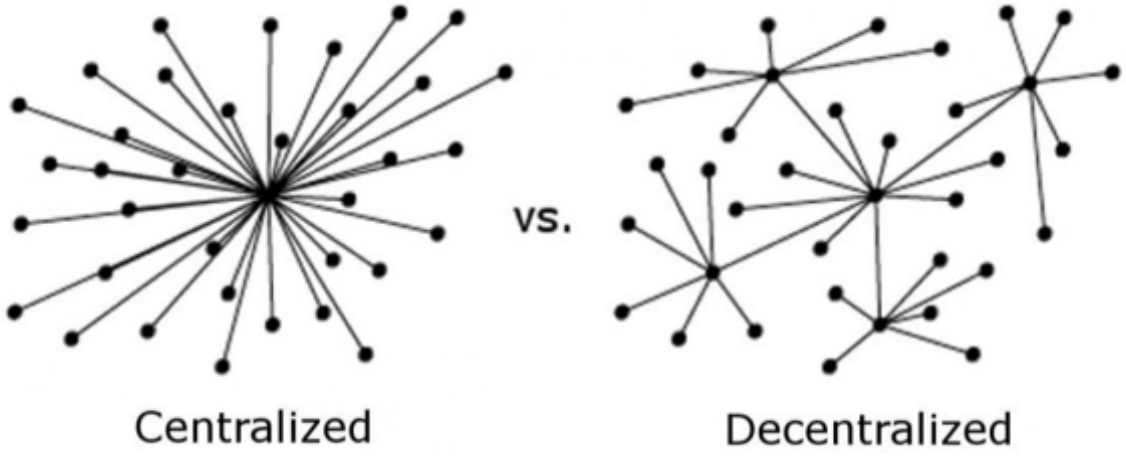
The Evolution is continuing…
Example: Intwine Connect

“The Next Generation of IoT- Intwine Connect has been designing the IoT of the future: groups of devices that interact with each other and are controlled locally. Apps, dashboards, and centralized servers are a thing of the past. What was in an app now runs in an algorithm on a gateway. Now it can be your reality.

Intwine utilizes a decentralized architecture for its IoT networks. Intwine's architecture focuses on allowing devices to communicate in a way that gives them the ability to make decisions at the edge of the network. Nodes of the network no longer rely on a single server to make decisions. Nodes are now capable of making local decisions, which results in less overall bandwidth usage. ‘‘



The Transition is underway…

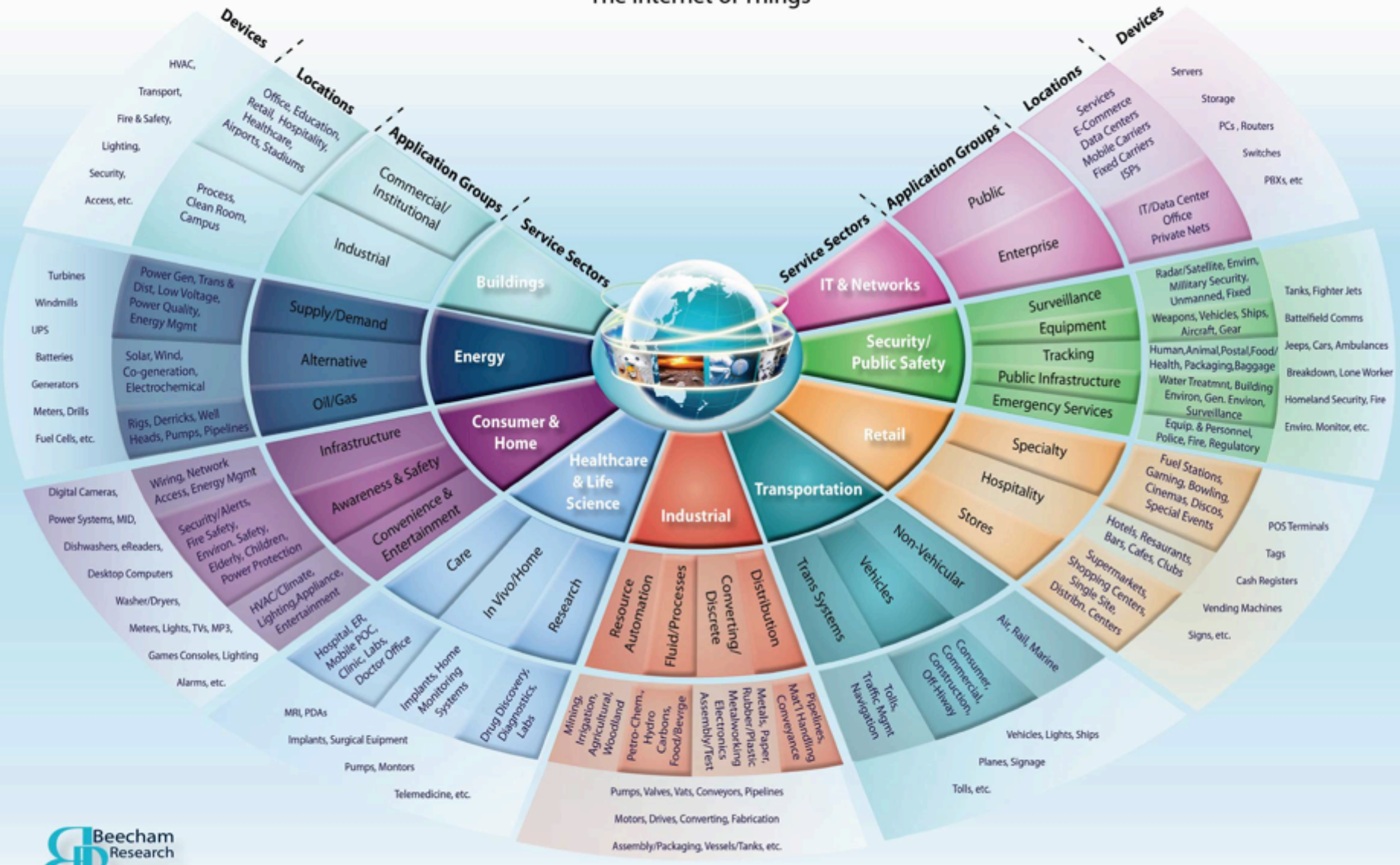
O&M, Energy efficiency, Mass distributed 3D printing manufacturing, Education, Renewable Energy integration and optimization will all be dramatically up scaled in the next few years.

In 2007 there were 10 million sensors connecting every type of human device to the IoT. In 2013 that number exceeded 13.5 billion. By 2030 the projected number of IoT connected device sensors is projected to exceed 100 Trillion.

The transition from the second industrial revolution paradigm is well underway to the third. How this will affect our ways of doing business, making energy, manufacturing and delivering products will be profound and is difficult to predict. One element is sure and constant – that of change.

M2M World of Connected Services

The Internet of Things



Beecham Research

Questions?

Thank you for your interest in the Internet of Things!