

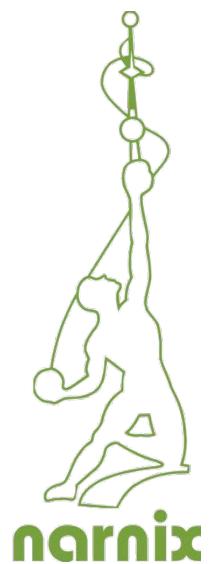
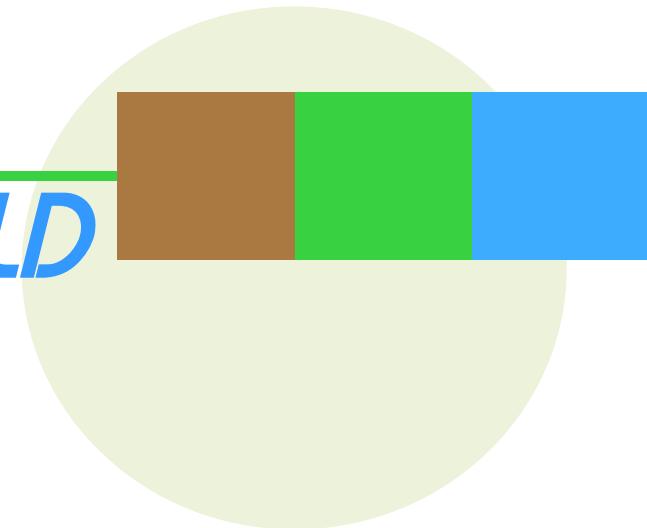


INDRAPRASTHA INSTITUTE of  
INFORMATION TECHNOLOGY **DELHI**

***designed in INDIA***  

---

***for the WORLD***

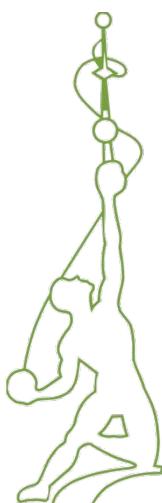


**narang n. kishor,**  
*mentor & principal design architect*  
**narnix technolabs pvt. ltd.**

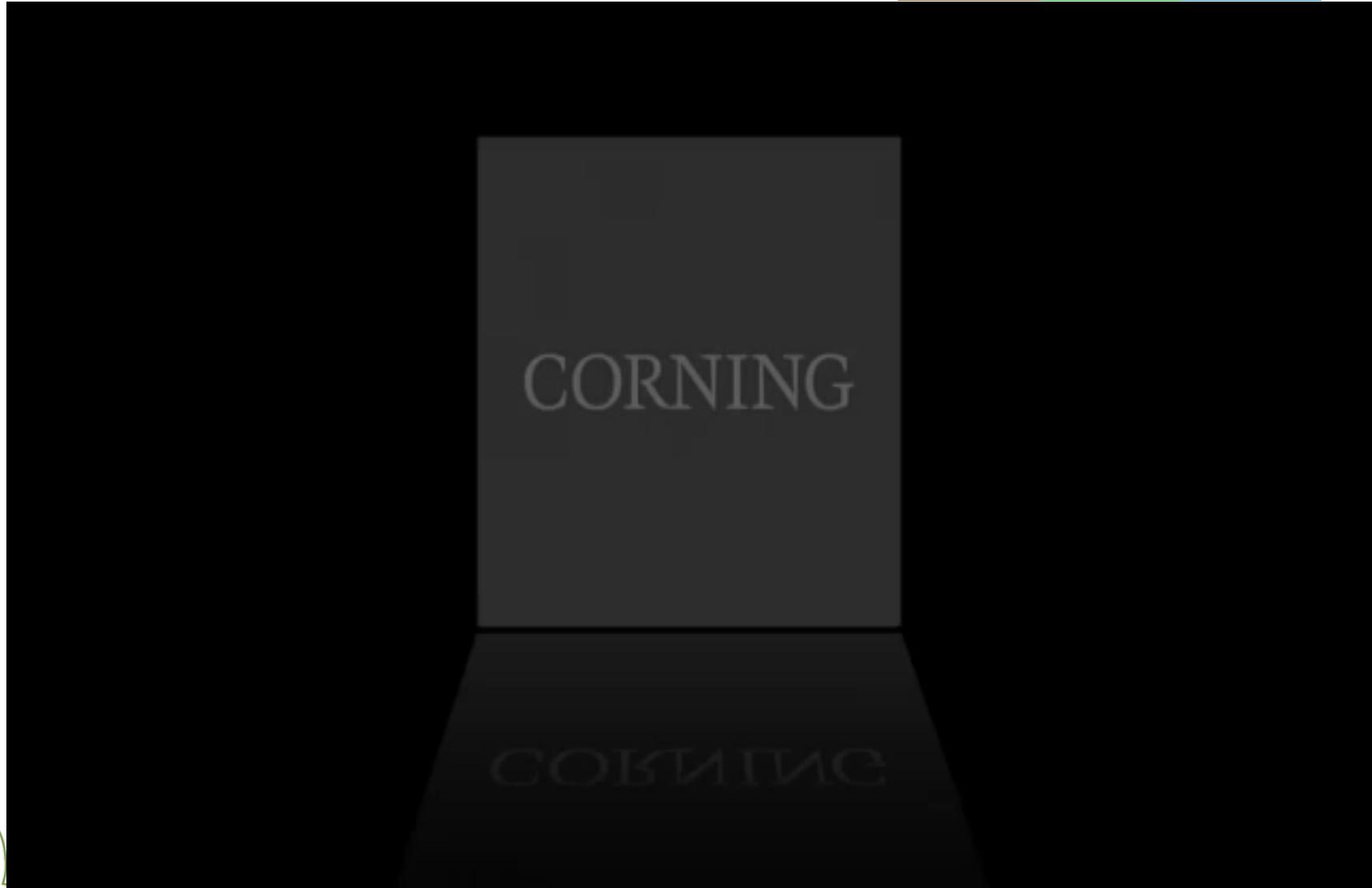


*The most profound technologies  
are those that disappear.*

They weave themselves into the  
fabric of everyday life until they  
are indistinguishable from it.



# A peep into future...



# *Pervasive computing*



- *Disappearing Computer...*
- *Wearable Computer*
- *Ubiquitous Computing*
- *Machine to Machine (M2M) ...*
- *Internet of Things (IoT)...*
- *Internet of Everything (IoE)...*
- *Augmented Reality...*

***and what next ? ? ?***



# **Pervasive computing**



*Pervasive computing is about making the computer disappear and this can be done in several ways.*

*Disappearance of computer has been described in two ways as:*

***physical disappearance*** that refers to integrating devices in everyday use objects such as, clothes.

and secondly as:

***mental disappearance*** refers to objects that can be big in size but are not generally perceived as computers such as, interactive walls or interactive tables, with technology moving into the background.





The future way of  
*pervasive computing*  
lies in the manner, man designs  
*“human-information interaction”*  
and supports  
*“human-human communication & collaboration”*,  
and takes advantage of  
*the existing technologies.*



**The Society is highly motivated by speed;  
be it cars or internet**



Hoffrich Satouch 2004

**1001 bhp**

**Top Speed – 253 mph**

**0 – 60 mph in 2.5 seconds**

**0 – 125 mph in 7.5 sec**

**0 – 250 mph in 16.7 sec**



**Price: € 1,300,000 (plus tax!)**



**But what if the  
internet  
environment  
looks more like  
this? Would  
having a super  
car help?**

**Top end bandwidth internet is a bit like the top end automotive**

- It is undeniably real



**But, even if you have it, where and how often can you experience it?**



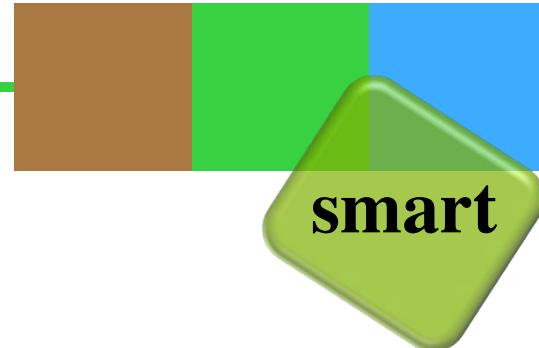
smart

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⇒ *Smart !!!*

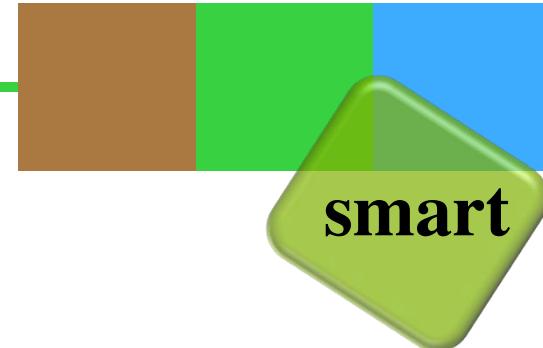


- ⇒ Smart Grid....
- ⇒ Smart Meters...
- ⇒ Smart Homes...
- ⇒ Smart Buildings..
- ⇒ Smart Cities...
- ⇒ Smart Networks...



---

⇒ *Smart !!!*

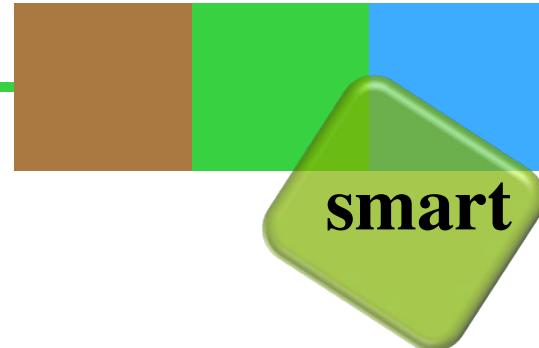


Today, every thing has to be  
'smart' to be lapped up by the  
new generations..



---

⇒ *Smart !!!*

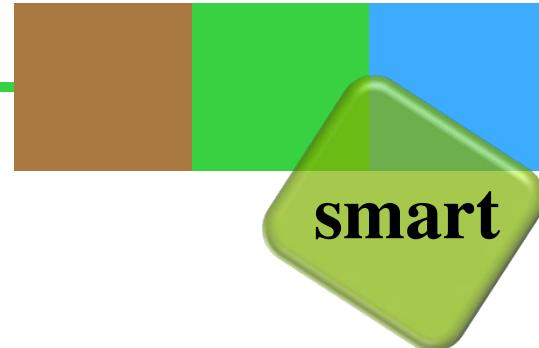


Be it Smartphone or the Smart TV or Smart Fridge & AC; unless it is “SMART”, it does not get a second look, forget about any attention or respect....



---

⇒ *Smart !!!*



But, what make anyone  
or any gadget smart?



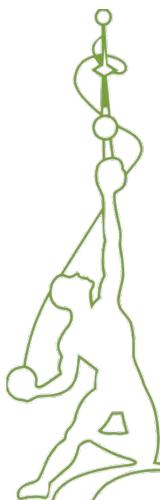
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⇒ *Smart !!!*

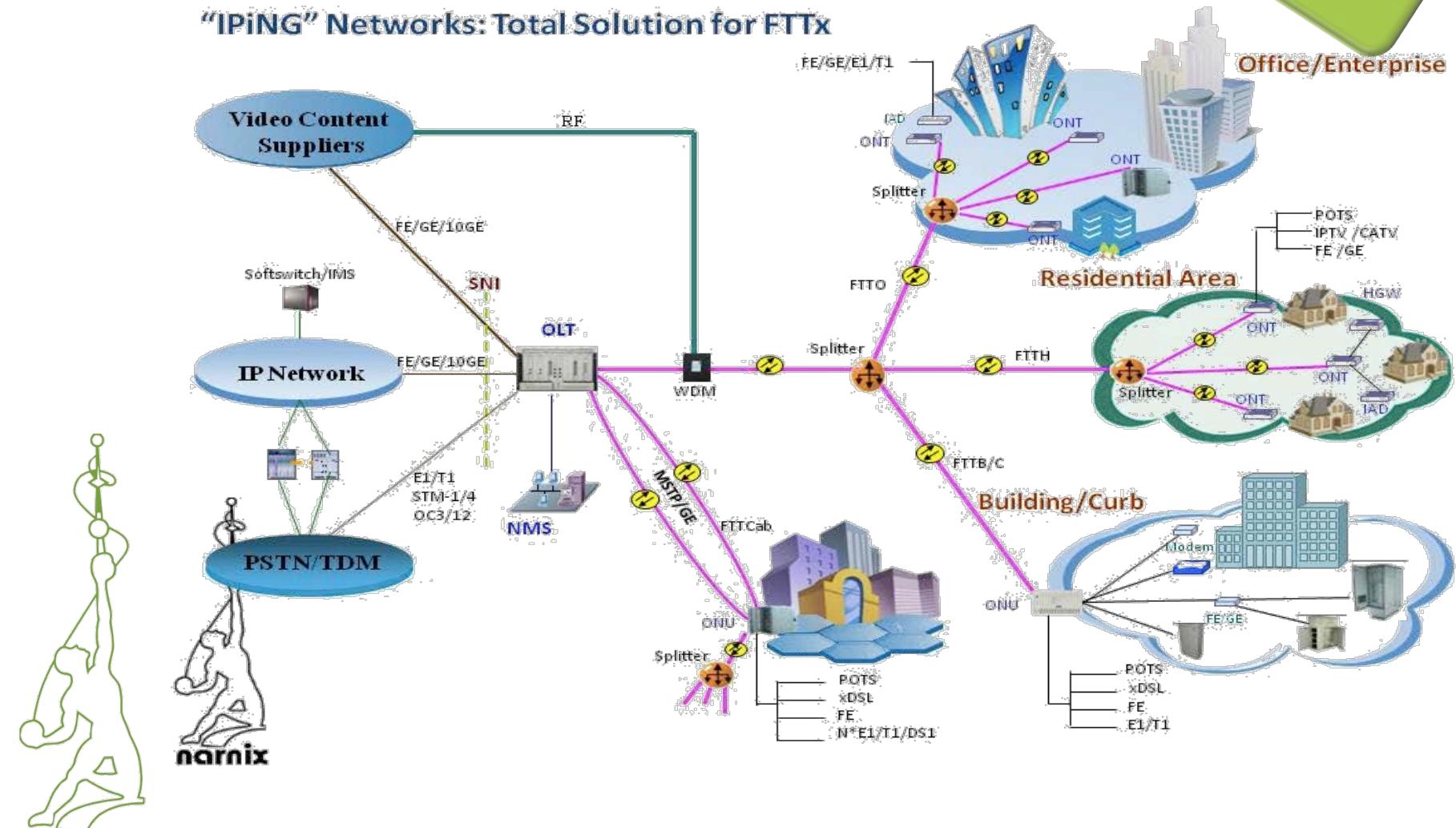


It needs to be enabled & empowered  
by :

- ⇒ Data & Information
- ⇒ Analysis & Interpretation Capability,
- ⇒ Knowledge, and
- ⇒ Precise & succinct Communication ability



# The smart cities



# *The smart grid deployments !!!*



# *The Intelligent Digital Homes & Buildings*



Voice

Video

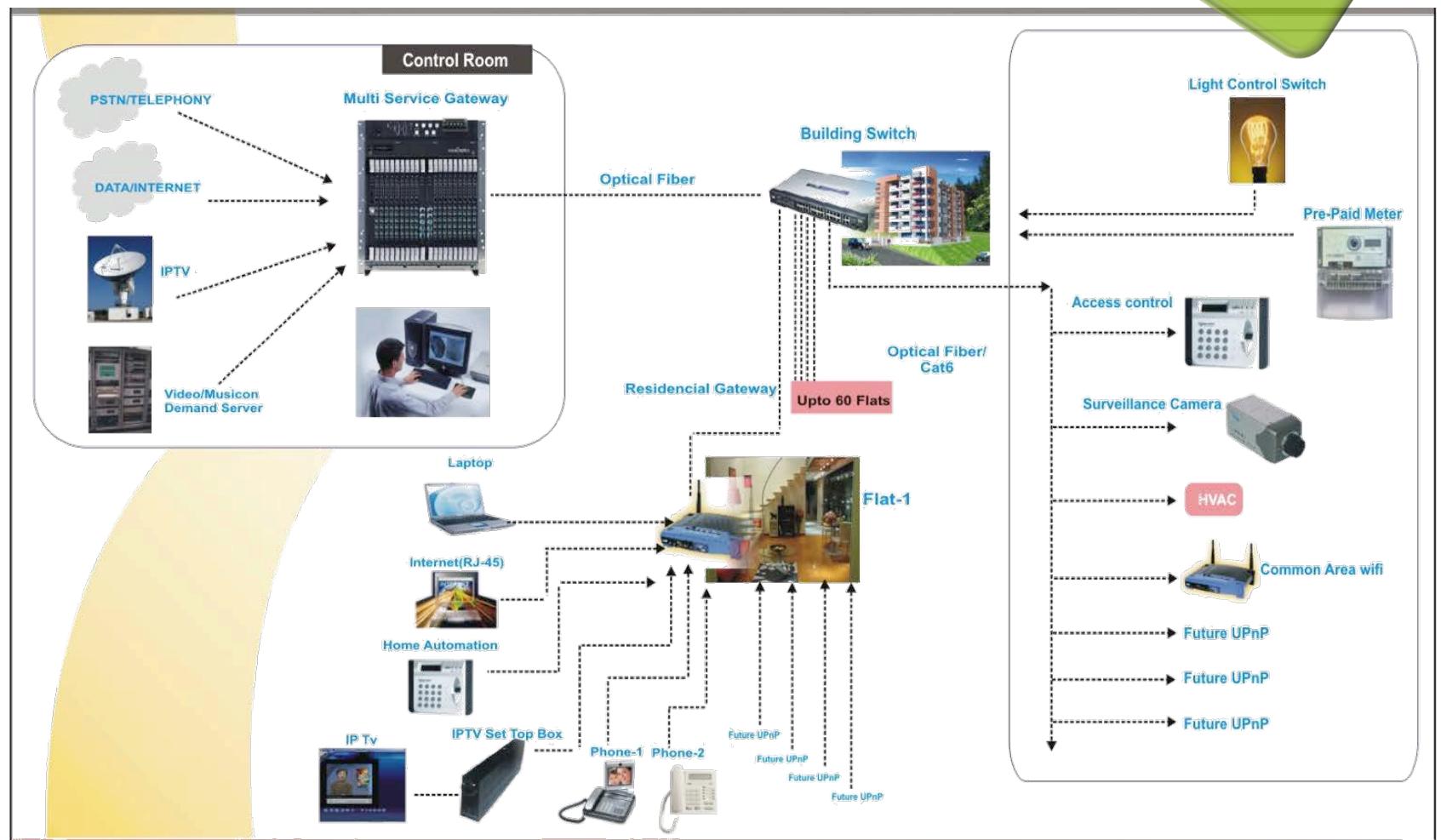
Data

Convergence Solution  
for  
**‘Information Communication Entertainment  
Security & Surveillance  
Networks’**

one Network : one Wire : one Box



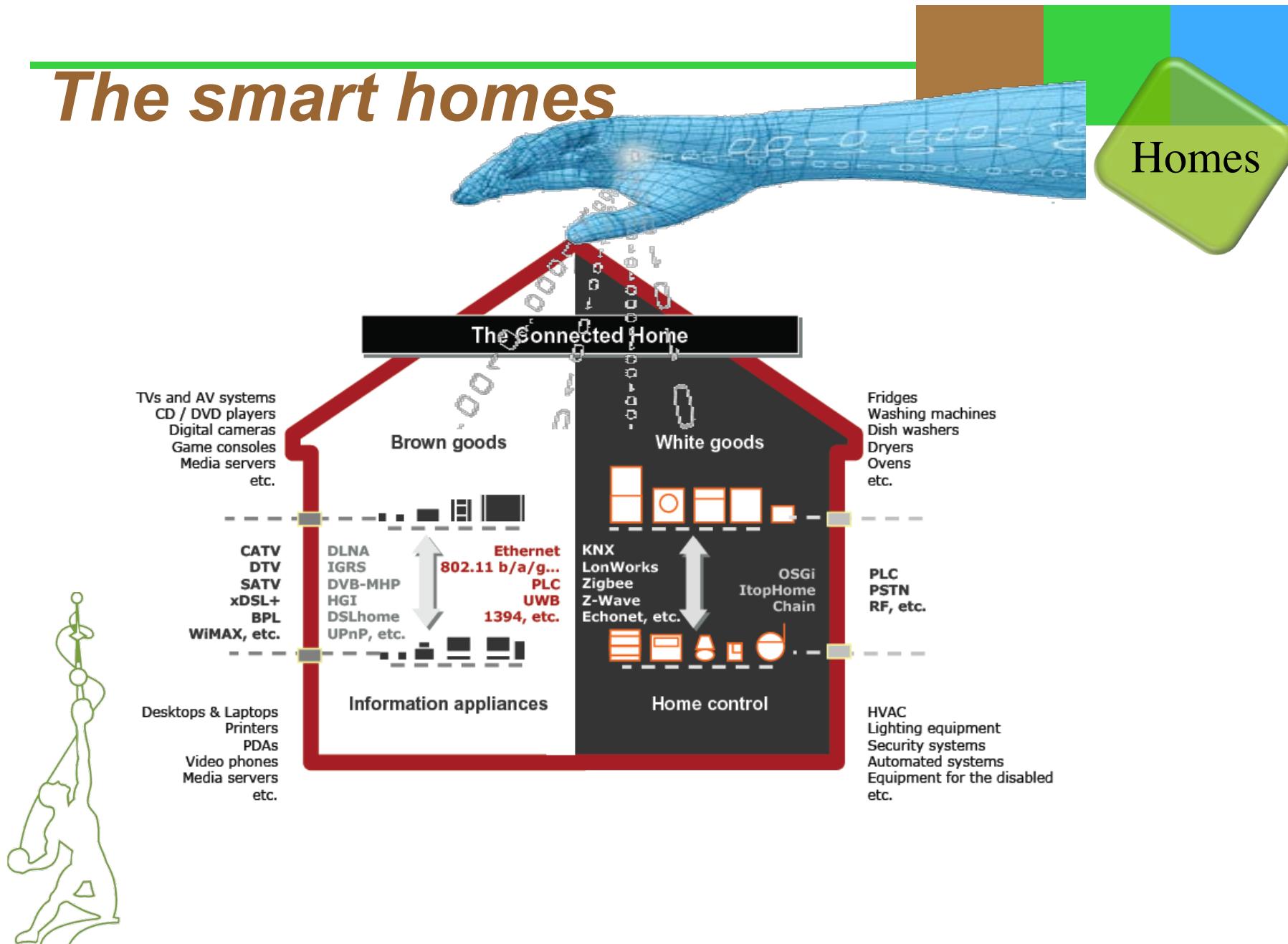
# The smart buildings



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# The smart homes



# The Connected world.....



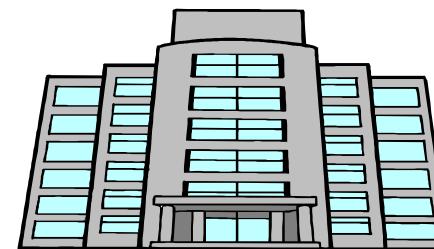
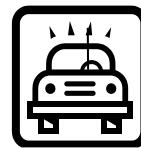
## Connected office

Video conferencing, VoIP, accessing information files and emails, accessing services provided in the home.



## Always connected

Remote Managing Home appliances. Connecting to the home network



## Connected Content

Music, Video  
Games  
Banking, Billing  
Infochannel, TV  
Chatting  
Video telephony  
Video Conferencing  
Information Storage  
Messaging  
Etc..



## Connected Services

Home Appliance Control  
Home Appliance Automation  
Remote Management  
Entertainment  
Healthcare & Security  
Communications  
Energy Savings  
Real-time E-commerce  
Lighting, Shutters  
Internet  
Customised solutions



**Homes of Future designed  
yesterday**





Green  
Community

# *The smart n green community*



---

# *The smart n green planet:*



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# *The rise of renewables...*



renewables



# *The rise of renewables...*



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renewables

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# *The rise of semiconductors...*



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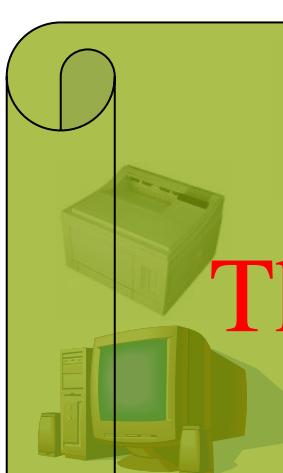
# *The rise of ICT Appliances...*

ICT

Paper Age



PC Age



Networking Age



Mobile Age



Ubiquitous Age



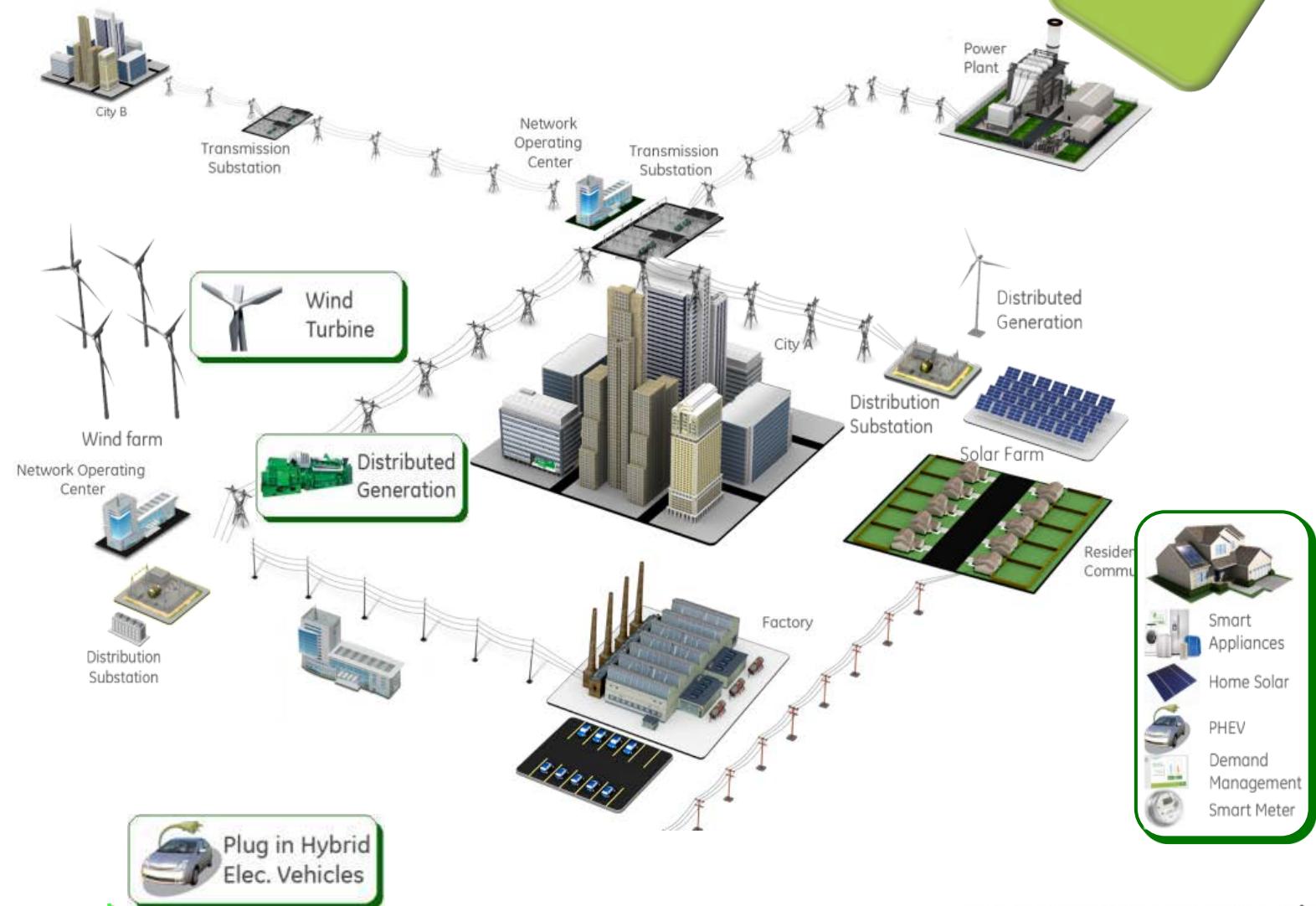
Tablet Age?

The Peripherals are  
Proliferating!



# *The rise of grid complexity*

Grid...

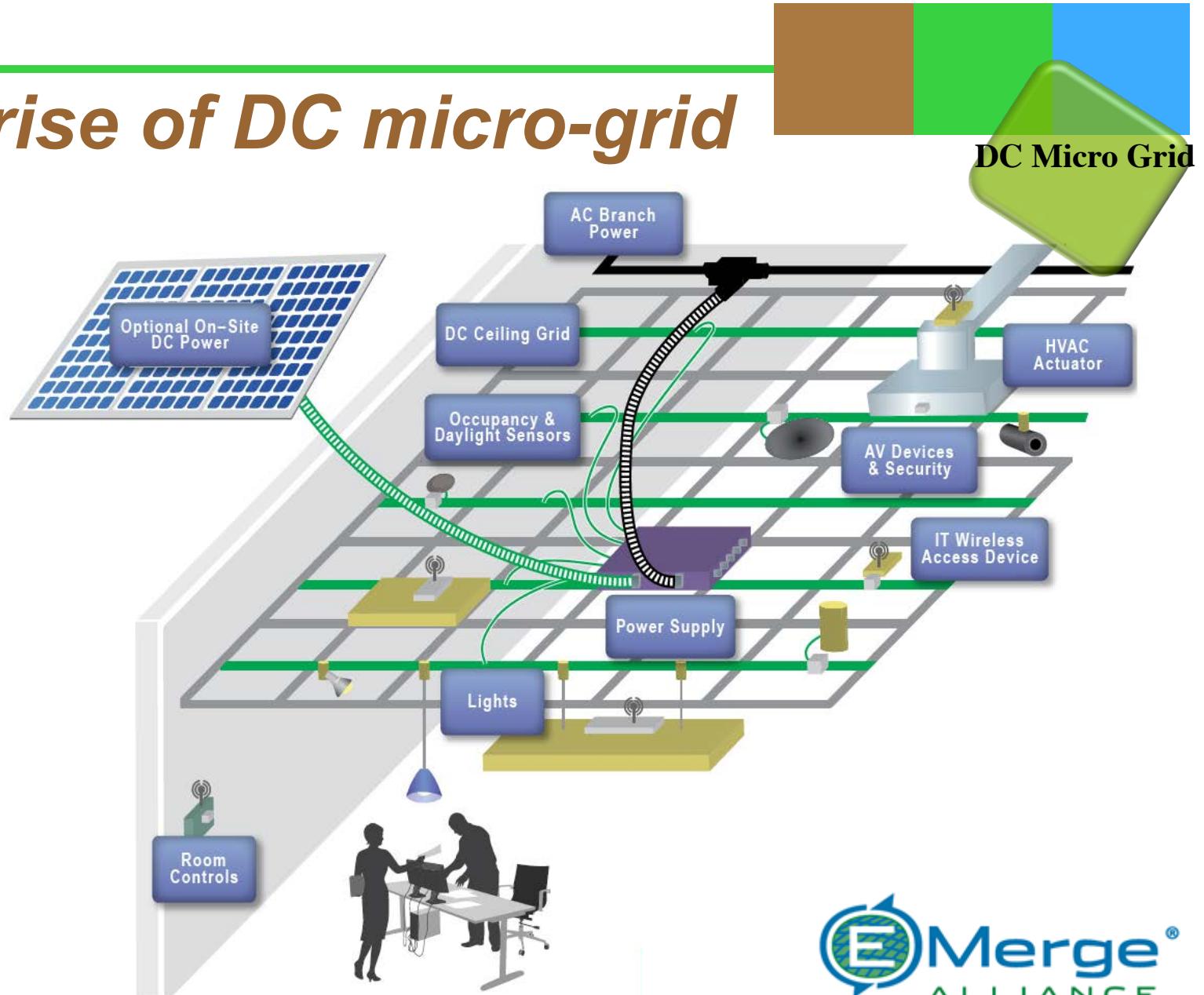


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Source: GE

# *The rise of DC micro-grid*



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ALLIANCE

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# *The rise of green movement...*

green

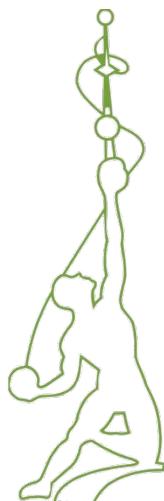


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# *The 5<sup>th</sup> Fuel*



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Energy crisis and rising energy cost are two important factors affecting today's businesses. In order to fulfill the rising demand, more power generation plants are being planned and the cost thereof is recovered from consumers in form of higher energy costs





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Conventional energy sources like coal & oil are getting exhausted faster than expected and alternative sources of power turn out to be more costly.



## *Did you know?*



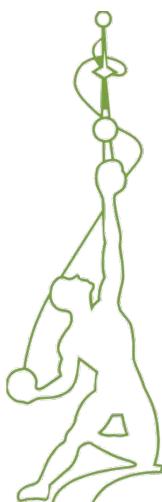
There is a renewable-energy resource that is perfectly clean, remarkably cheap, surprisingly abundant and immediately available.



## *Did you know?*



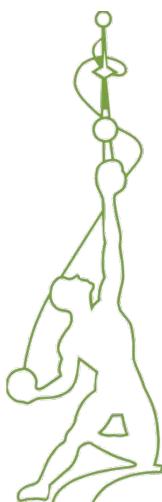
It has potential to reduce the carbon emissions that threaten our planet, our dependency on oil imports that threaten our economy, and energy costs that threaten our wallets.



## *Did you know?*



It does not pollute, does not depend on weather, does not inflate prices and does not take a decade to build.





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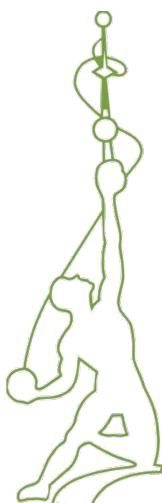
This miracle resource is better known across the world by the distinctively boring name of

***“Energy Efficiency”.***





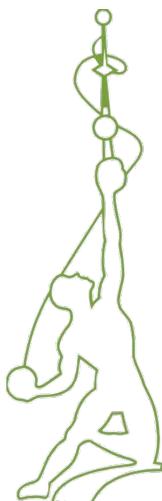
It turns out that it is much less expensive, less destructive and less time-intensive to ***reduce demand*** through efficiency than to ***increase supply*** through new drilling or new power plants.





---

Energy Efficiency is appropriately considered today as the “*5<sup>th</sup> Fuel*” to serve our increasing energy requirements.





---

Energy Efficiency has today become the largest energy source. It is bigger than wind, solar, hydroelectric power and bio-fuels combined. The utilization of this “*5<sup>th</sup> Fuel*” is clean, possible and profitable.





---

As they say, a penny saved is penny earned.

In power context, it is well know fact that

*One unit (of electricity i.e. KWh)  
saved is equivalent to  
2.5 to 3 units generated.*





Energy use is  
a big challenge  
for ours and the  
next Generations!



# *Key Economic & Social Driver*



- ⇒ The Key Economic & Social Driver for “SMART GRID” Initiatives Globally is nothing but “*Energy Efficiency*”.
- ⇒ “Smart Grid Technology” is Integration of IT, Communication and Power Technologies.
- ⇒ Governments worldwide are mandating improved Energy Efficiency, requiring an investment in the new Smart grid and Smart Energy Management Structure.
- ⇒ *The goal is to create a smart grid that will change the way power is deployed for sustainable energy around the world.*



***It will transform the way we use  
Energy***



Carbon  
footprint

Buildings have a very large environmental footprint.

There is a huge business opportunity in reducing that footprint

*The smart n green buildings...*



## Low Impact Buildings: Key Themes



Retrofit



Integrating  
Sustainable  
Infrastructure

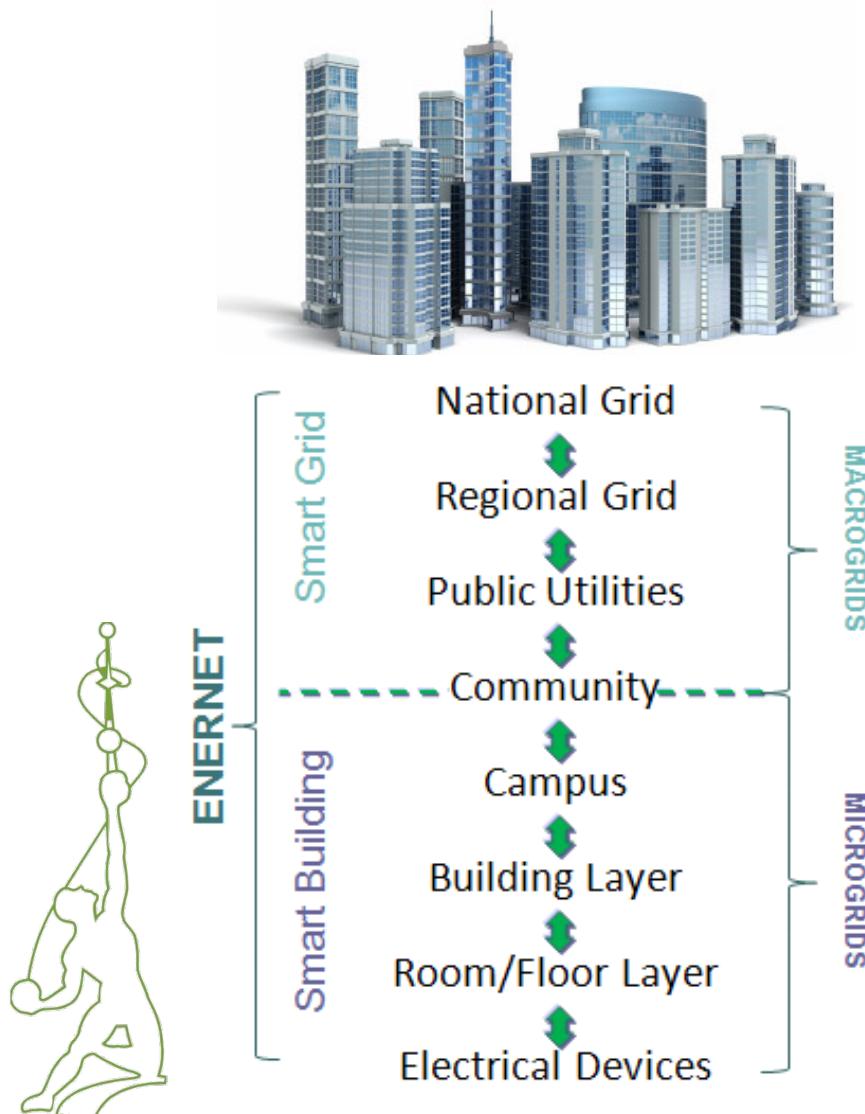
Future  
Climate

Building  
Performance



# Microgrid Networks Are Emerging

Microgrids are like scalable networks

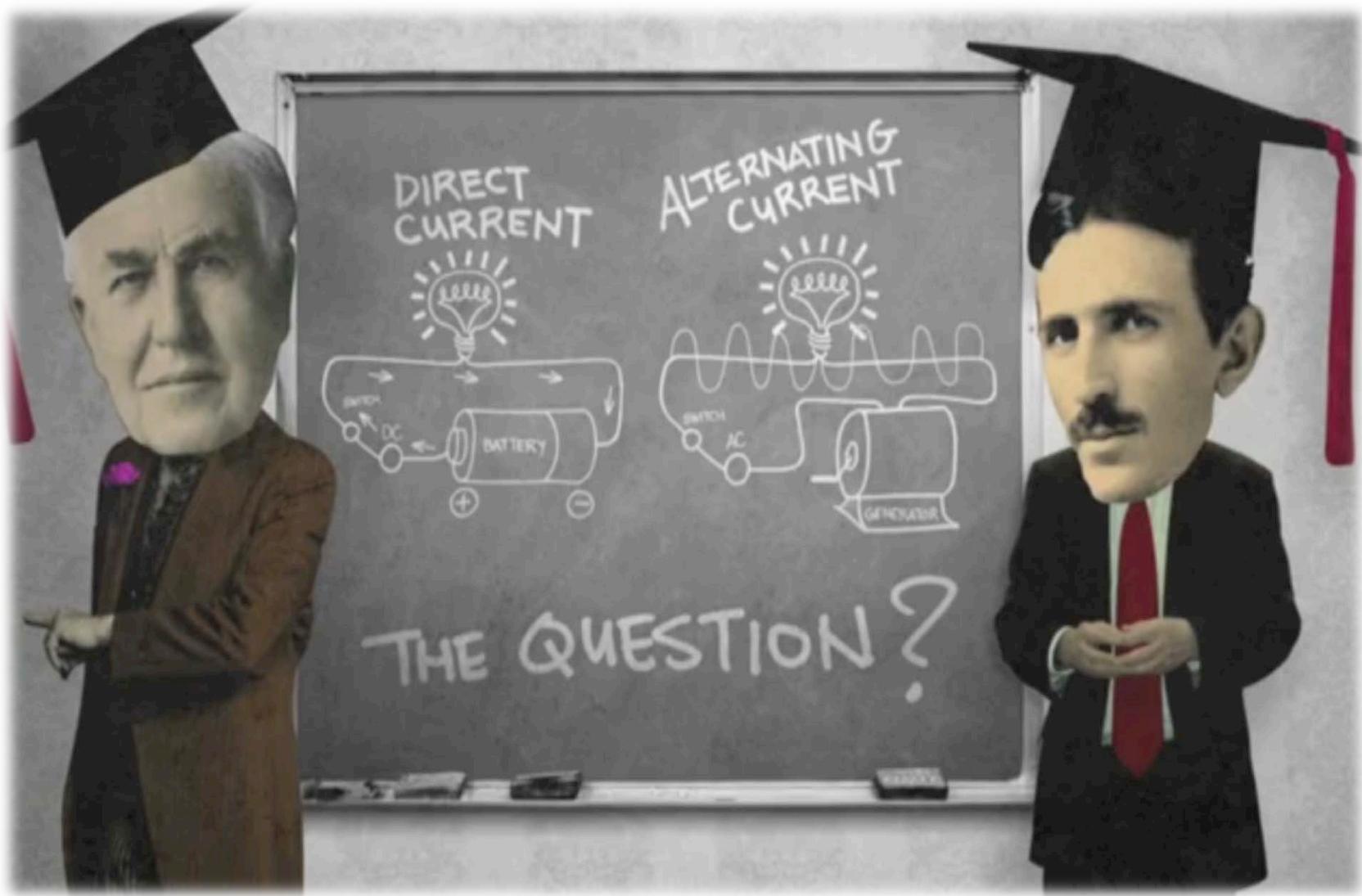


## Benefits:

- ⇒ **Autonomy**
- ⇒ **Stability/Reliability**
- ⇒ **Compatibility**
- ⇒ **Flexibility**
- ⇒ **Scalability**
- ⇒ **Efficiency**
- ⇒ **Economics**
- ⇒ **Peer-to-peer connectivity**

1890's

AC **OR** DC



# DC

DIRECT CURRENT

The flow of electricity is in one direction only. The system operates at the same voltage level throughout and is not as efficient for high-voltage, long distance transmission.

Direct current runs through:



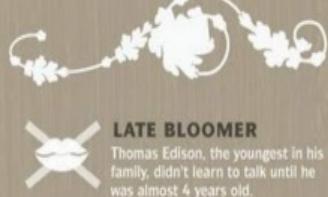
Battery-Powered Devices

Fuel and Solar Cells

Light Emitting Diodes

"[TESLA'S] IDEAS ARE SPLENDID, BUT THEY ARE UTTERLY IMPRACTICAL."

- THOMAS EDISON



### LATE BLOOMER

Thomas Edison, the youngest in his family, didn't learn to talk until he was almost 4 years old.

### FALLING OUT

Edison promised Tesla a generous reward if he could smooth out his direct current system. The young engineer took on the assignment and ended up saving Edison more than \$100,000 (millions of dollars by today's standards). When Tesla asked for his rightful compensation, Edison declined to pay him. Tesla resigned shortly after, and the elder inventor spent the rest of his life campaigning to discredit his counterpart.

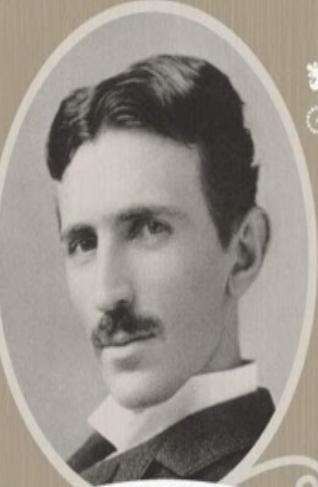
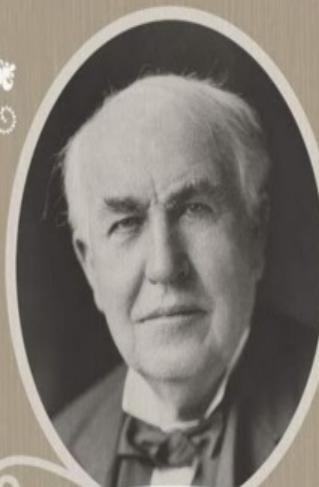


### EDISON FRIES AN ELEPHANT

In order to prove the dangers of Tesla's alternating current, Thomas Edison staged a highly publicized electrocution of the three-ton elephant known as "Topsy." She died instantly after being shocked with a 6,500-volt AC charge.

# THE CURRENT WAR

THE TALE OF AN EARLY TECH RIVALRY



THOMAS EDISON

NIKOLA TESLA

VS.

You would have never found two geniuses so spiteful of each other beyond turn-of-the-century inventors Nikola Tesla and Thomas Edison. They worked together—and hated each other. Let's compare their life, achievements, and embittered battles.

1847 BORN 1856

Milan, Ohio BIRTHPLACE Smiljan, Croatia

Wizard of Menlo Park NICKNAME Wizard of the West

Home-schooled and self-taught EDUCATION Studied math, physics, and mechanics at The Polytechnic Institute at Gratz

Mass communication and business FORTE Electromagnetism and electromechanical engineering

Trial and error METHOD Getting inspired and seeing the invention in his mind in detail before fully constructing it

### DC (Direct Current) WAR OF CURRENTS: ELECTRICAL TRANSMISSION IDEA AC (Alternating Current)

Incandescent light bulb; phonograph; cement making technology; motion picture camera; DC motors and electric power

### NOTABLE INVENTIONS

1,093 NUMBER OF US PATENTS 112

0 NUMBER OF NOBEL PRIZES WON 0

1 NUMBER OF ELEPHANTS ELECTROCUTED 0

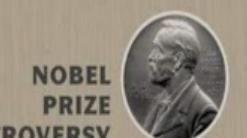
1931—Passed away peacefully in his New Jersey home, surrounded by friends and family

DEATH 1943—Died lonely and in debt in Room 3327 at the New Yorker Hotel

Tesla coil - resonant transformer circuit; radio transmitter; fluorescent light; AC motors and electric power generation system

In 2007, Con Edison ended 125 years of direct current electricity service that began when Thomas Edison opened his power station in 1882.

It changed to only provide alternating current.



NOBEL PRIZE CONTROVERSY

In 1915, both Edison and Tesla were to receive Nobel Prizes for their strides in physics, but ultimately, neither won. It is rumored to have been caused by their animosity towards each other and refusal to share the coveted award.

# AC

ALTERNATING CURRENT

Electric charge periodically reverses direction and is transmitted to customers by a transformer that could handle much higher voltages.

Alternating current runs through:



Car Motors



Radio Signals



Appliances

"IF EDISON HAD A NEEDLE TO FIND IN A HAYSTACK, HE WOULD PROCEED AT ONCE... UNTIL HE FOUND THE OBJECT OF HIS SEARCH. I WAS A SORRY WITNESS OF SUCH DOINGS, KNOWING THAT A LITTLE THEORY AND CALCULATION WOULD HAVE SAVED HIM 90 PERCENT OF HIS LABOR."

- NIKOLA TESLA



### WAR OF CURRENTS OFFICIALLY SETTLED

In 2007, Con Edison ended 125 years of direct current electricity service that began when Thomas Edison opened his power station in 1882. It changed to only provide alternating current.

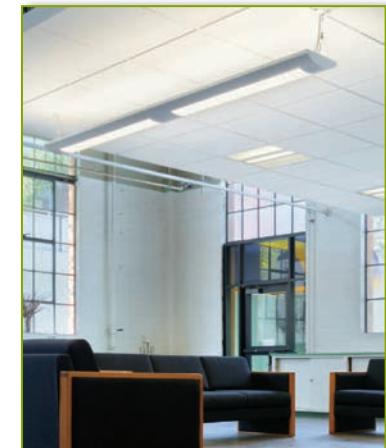
# Dramatic Increase in DC Power Use

The use of DC power is often hidden



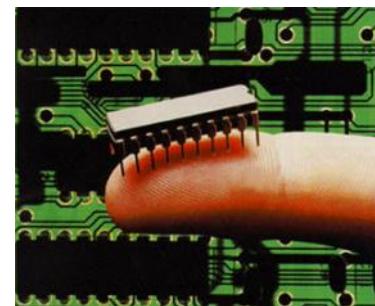
**Up to 80%**  
of Electric Load  
Comes from DC-  
Electronically Powered  
Devices

- Most equipment requires AC power conversion to DC
- Distributed generation natively produces DC power.
- Electricity is stored and/or delivered as DC
- DC Distribution improves energy efficiency & reliability
- DC reduces charging times for hybrid/electric vehicles



# DC Power Distribution Drivers

Solid-state IC technology has changed the game



**5-20%**

Energy is wasted in  
unnecessary ac-dc power  
conversions

- Improved power electronics allows simple DC -DC conversions to replace more complex AC-DC and DC-AC inversions
- The evolution of DC power architectures and power electronic devices simplifies dc power delivery systems.
- DC power distribution simplifies the use of micro-grids for distributed energy generation & storage integration, operation, & improved performance.



# DC Microgrids Can Help In Buildings

Microgrids are for buildings not just 'Smart' grids

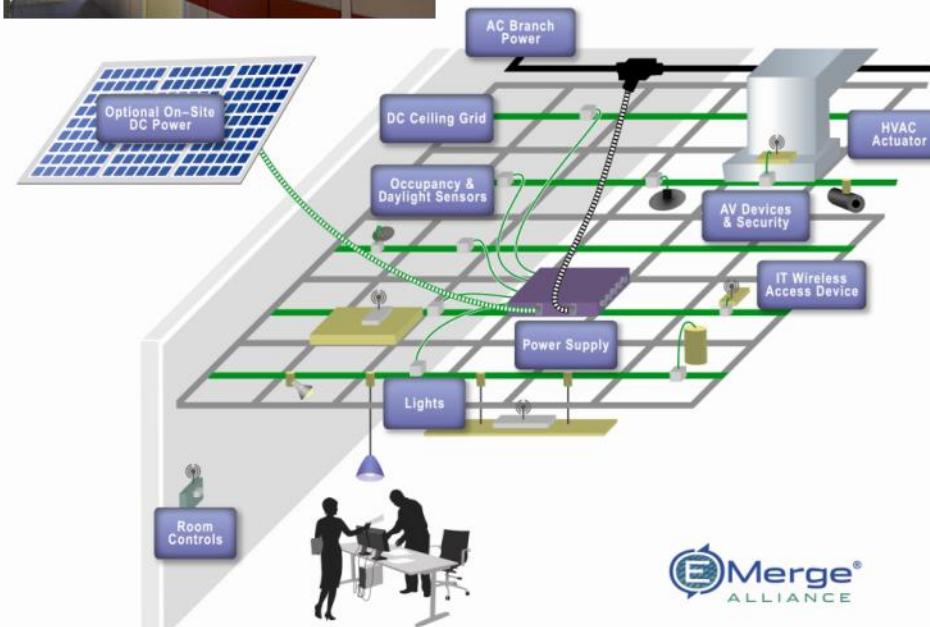
DC Power Standards



# Hybrid AC/DC Buildings Are the 1st Step

## A 'Net Zero' future starts now

Design  
Strategies



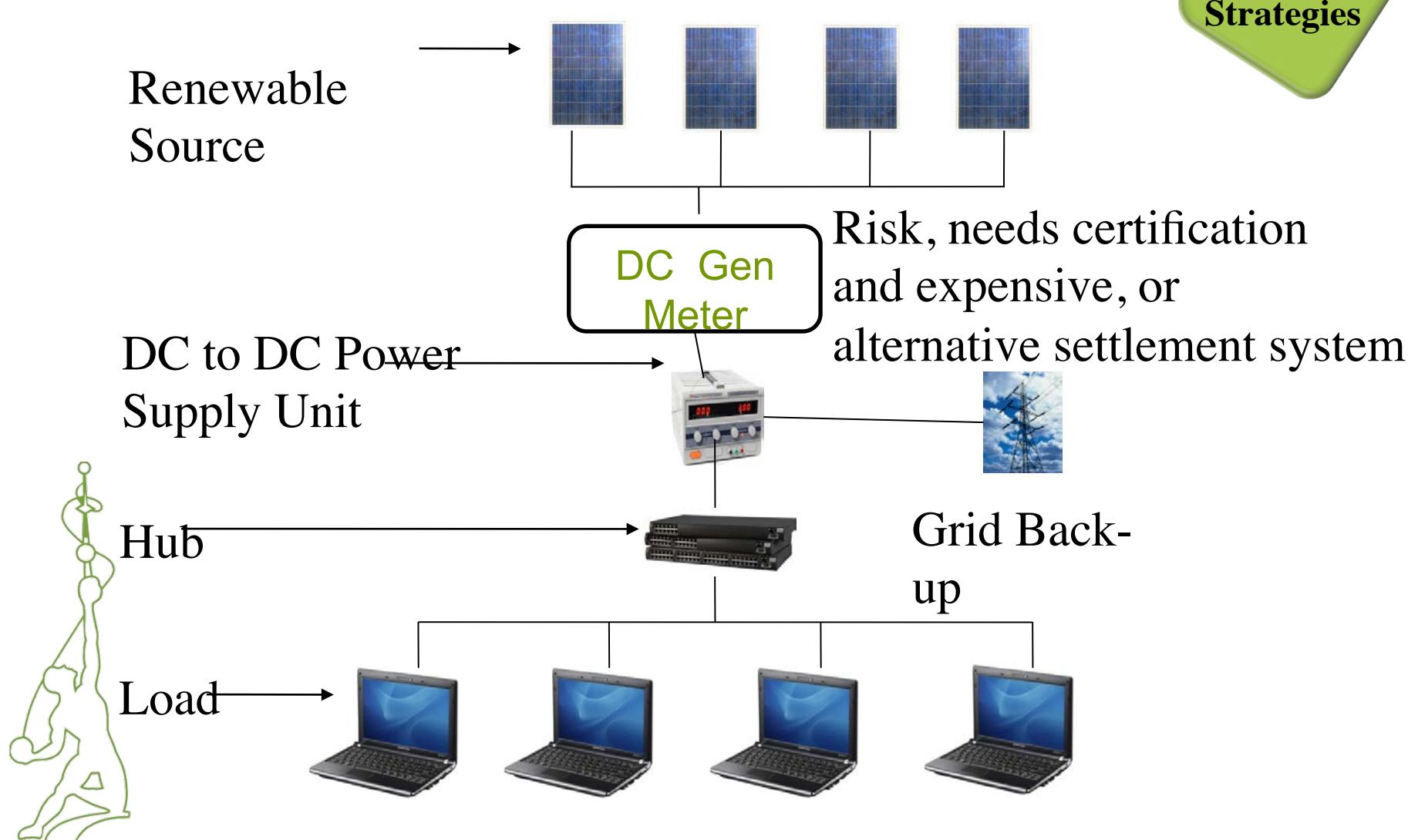
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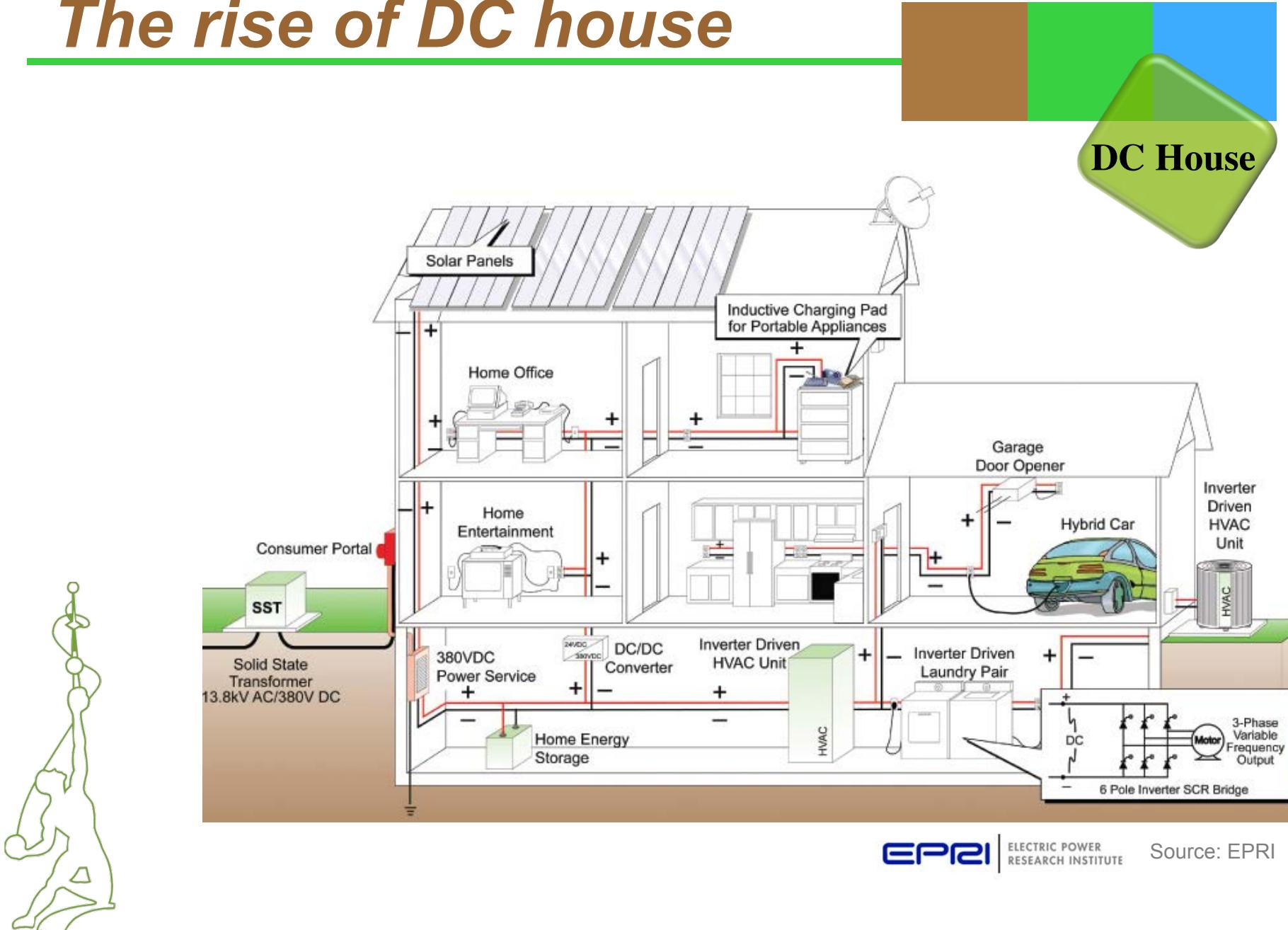
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# *Smart DC System for ICT Networks*



# The rise of DC house



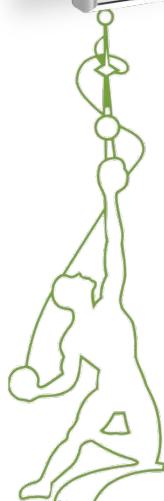
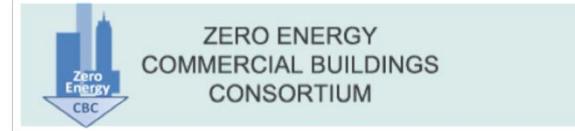
EPRI  
ELECTRIC POWER  
RESEARCH INSTITUTE

Source: EPRI

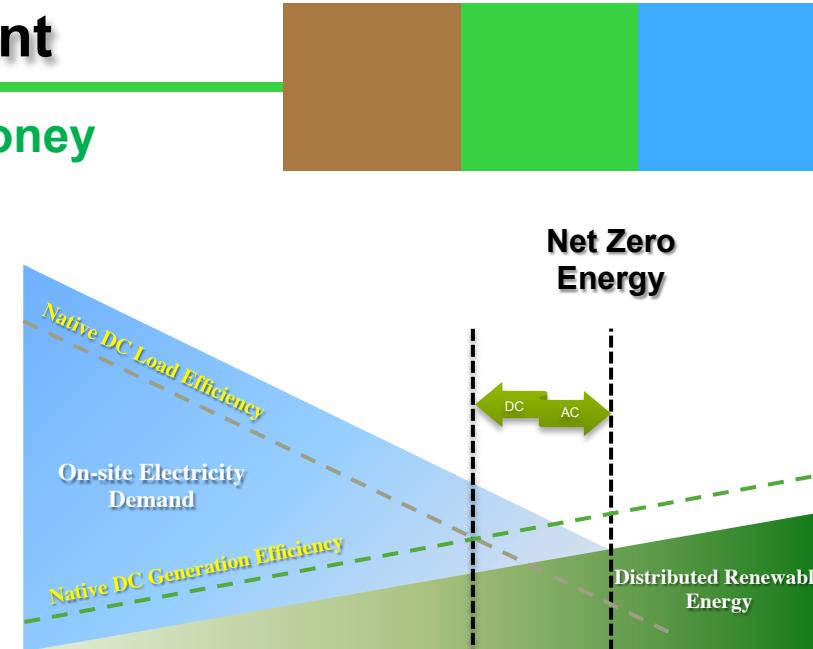
# DC Accelerates Net Zero Attainment

The right approach can save time and money

1. **Integrated design** and operations planning
2. **Site renewable** strategies get optimized using dc
3. **Energy Storage** in dc allow Grid independence
4. **System Intelligence** control, monitor, verify



- 2013: Begin DC Microgrid Demonstrations
- 2030: All new commercial buildings
- 2040: 50% of commercial building stock
- 2050: All commercial buildings



***"DC power would fundamentally change the way power is distributed in commercial buildings..."***



# *Towards a DC Century*



over 1 trillion kwh of energy are wasted annually through inefficient inverters and AC/DC adaptors. This is set to rise as the number of low power DC devices increase exponentially, e.g. the number of connected devices is expected to rise from 6bn to 50bn by 2020, as we use more computers, mobile devices and gadgets. Furthermore, lighting is going through a revolution, with new availability of efficient DC LED solutions.



# *Towards a DC Century*



To power this through AC/DC adaptors is both wasteful and annoying, particularly as adaptors are bulky, mains sockets are in the wrong place or in short supply, and it prevents plugging them in directly to local renewable energy supplies, such as PV, Batteries, CHP and Fuel cells, which are all sources of DC.



# **Towards a DC Century**



The current model is unsustainable, and is why many groups have been working for several years to rethink the axiom of power and electricity consumption to develop Smart DC technology that works at variable voltages over a *Smart DC Network*, providing efficient power to household lighting, Smart Hubs, Smart DC sockets for computers, and *smart power integration*.



# *Towards a DC Century*



We believe this could help reduce electricity bills by up to a third, and significantly reduce grid peak demand through powering devices efficiently from off-grid or off-peak resources, and through smart control and advice.



# Towards a DC Century



Systems can also be designed to ensure - '**No home is left behind**', in adopting low cost renewable energy solutions, whether they are houses or flats in urban spaces. We can also develop solutions for hotels, student accommodation and small offices.



# *Towards a DC Century*



Need to develop a range of **Home Energy solutions** that provide smart energy monitoring, easy to install microgeneration and storage, and provide efficient power via smart DC Hubs, DC micronets which can re-use household wiring to power home lighting or provide smart DC sockets for appliances.



# Towards a DC Century



vision is to *change the way we produce and consume electricity in homes*. Specifically through focusing on the "*Longtail*" of energy consumption - using advanced monitoring and control to reduce high load appliance use, and through using *smart DC micronets* to reduce the inefficiencies of trillions of DC/low power lighting and electronic devices being powered from the grid via AC/DC adaptors.





# *Extreme Example*





- “IoT”, a concept that originally sounded like something out of sci-fi movie -- the "Internet of Things" -- is, in fact, a reality, and one that is bound to become even more widespread.
  
- It is believed that the Internet of Things, or the ability for consumer devices and appliances to communicate with one another via Web access and a complex system of embedded sensors, will *"enable a wide range of new applications and services while raising many new challenges"*.





- Promising to be the most disruptive technology since the World Wide Web, the Internet of Things is predicted to result in up to 100 billion Internet-connected objects by 2020.
- Relying on embedded computing and sensors, and driven by smartphone and tablet adoption, IoT shall witness an explosion of new uses by consumers and enterprises alike.



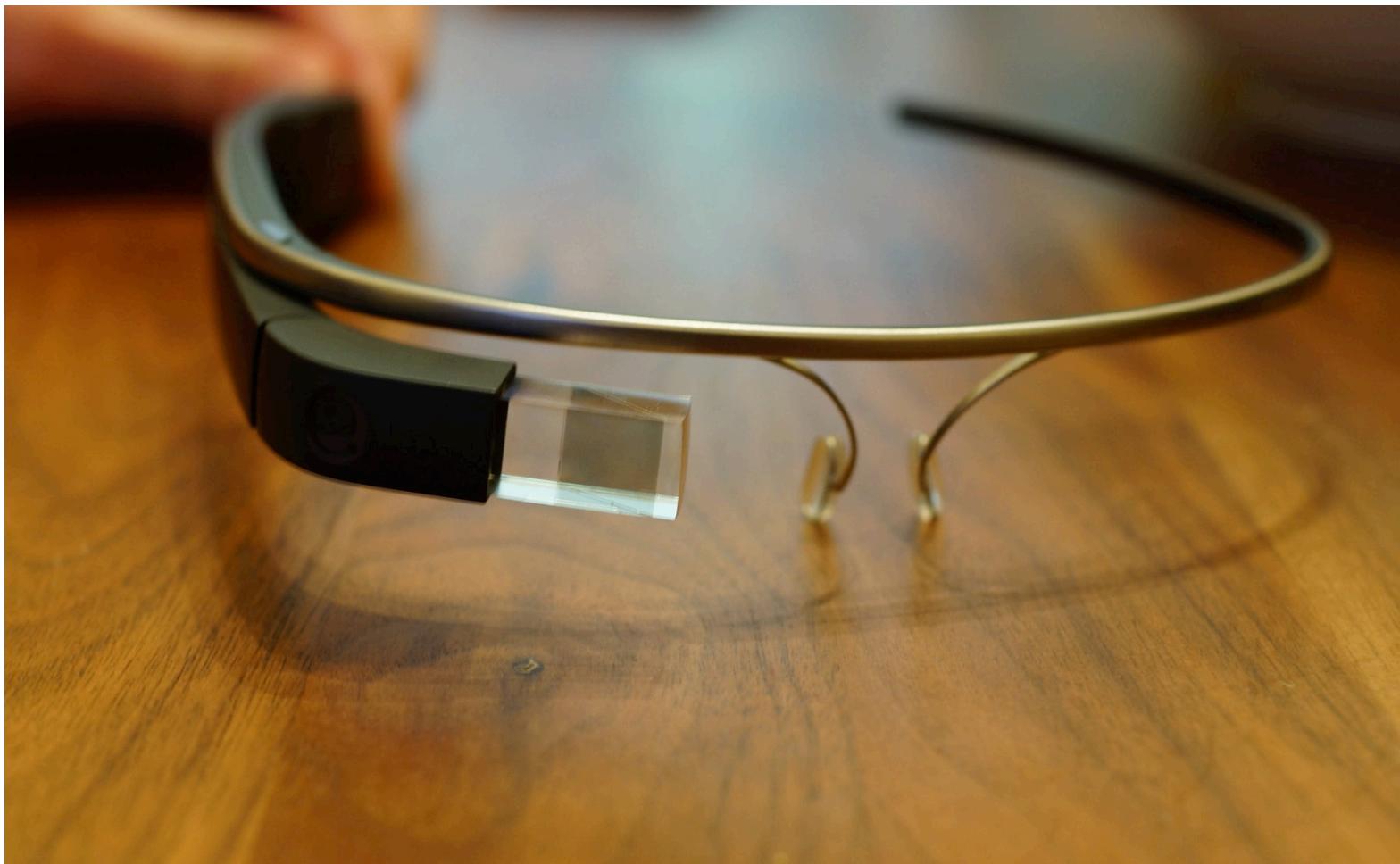
# The Internet of Things (IoT):

## *Most Disruptive Technology of the decade...*

- Disruptive technology, is the bearer of tremendous opportunity and equally, a harbinger of obsolescence.
- Technology's impact on society and business is substantial, if not underestimated.
- Though product cycle times are accelerating, the underlying technologies unfold over many years.
- Within each trend there are multiple enabling technologies, all at various stages of maturity and adoption.



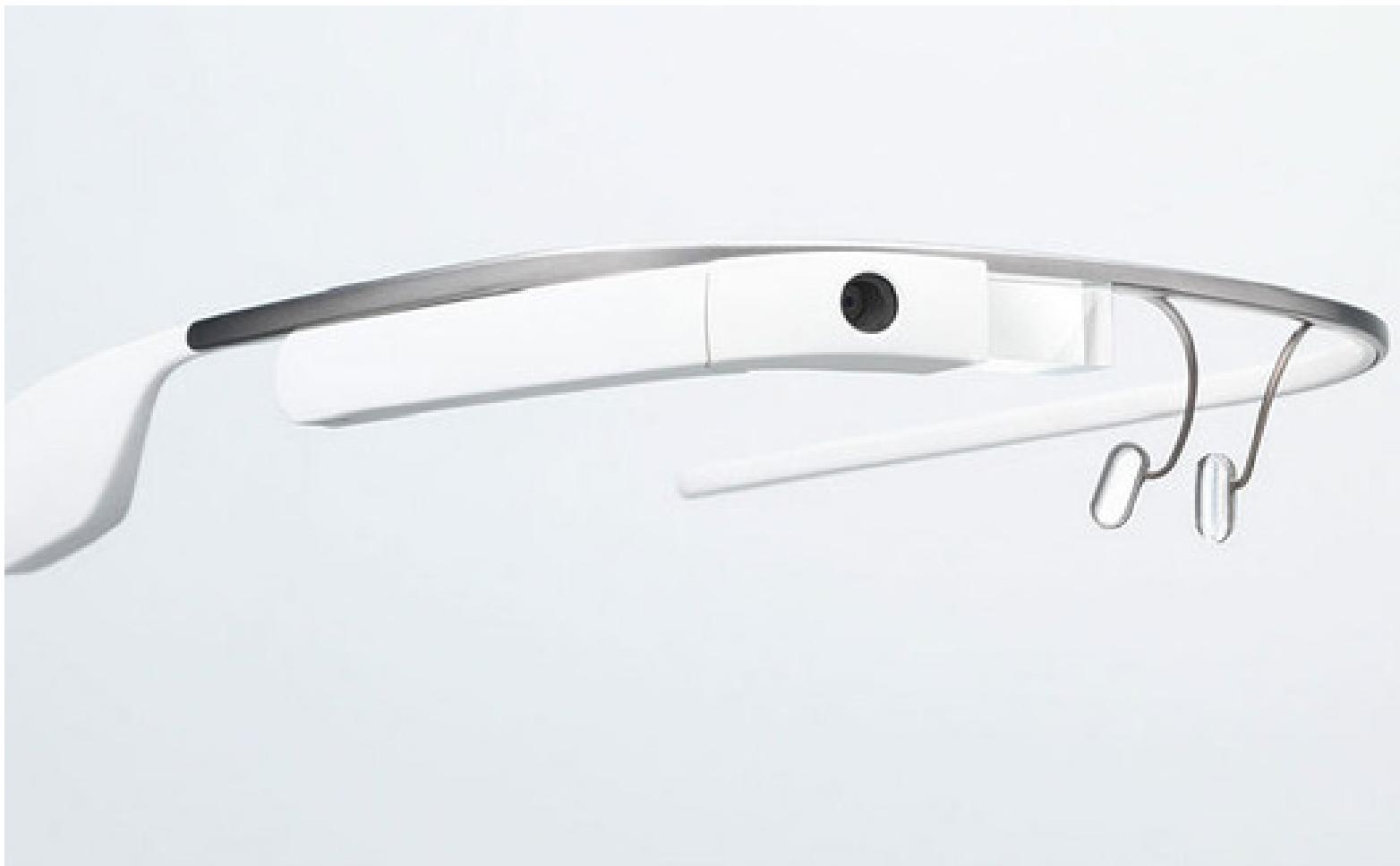
# **“Google Glasses”**



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# **“Google Glasses”**



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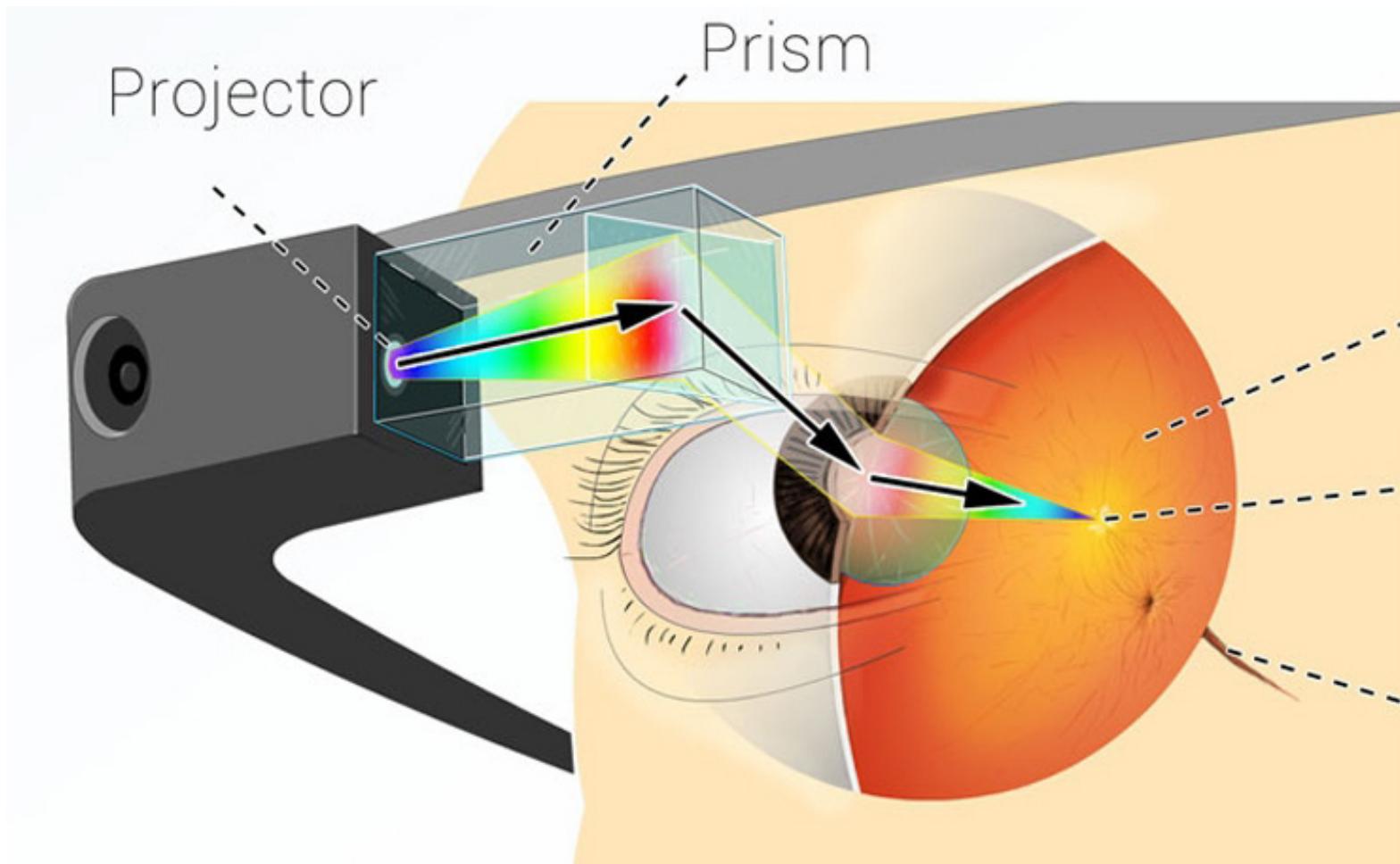
# **“Google Glasses”**



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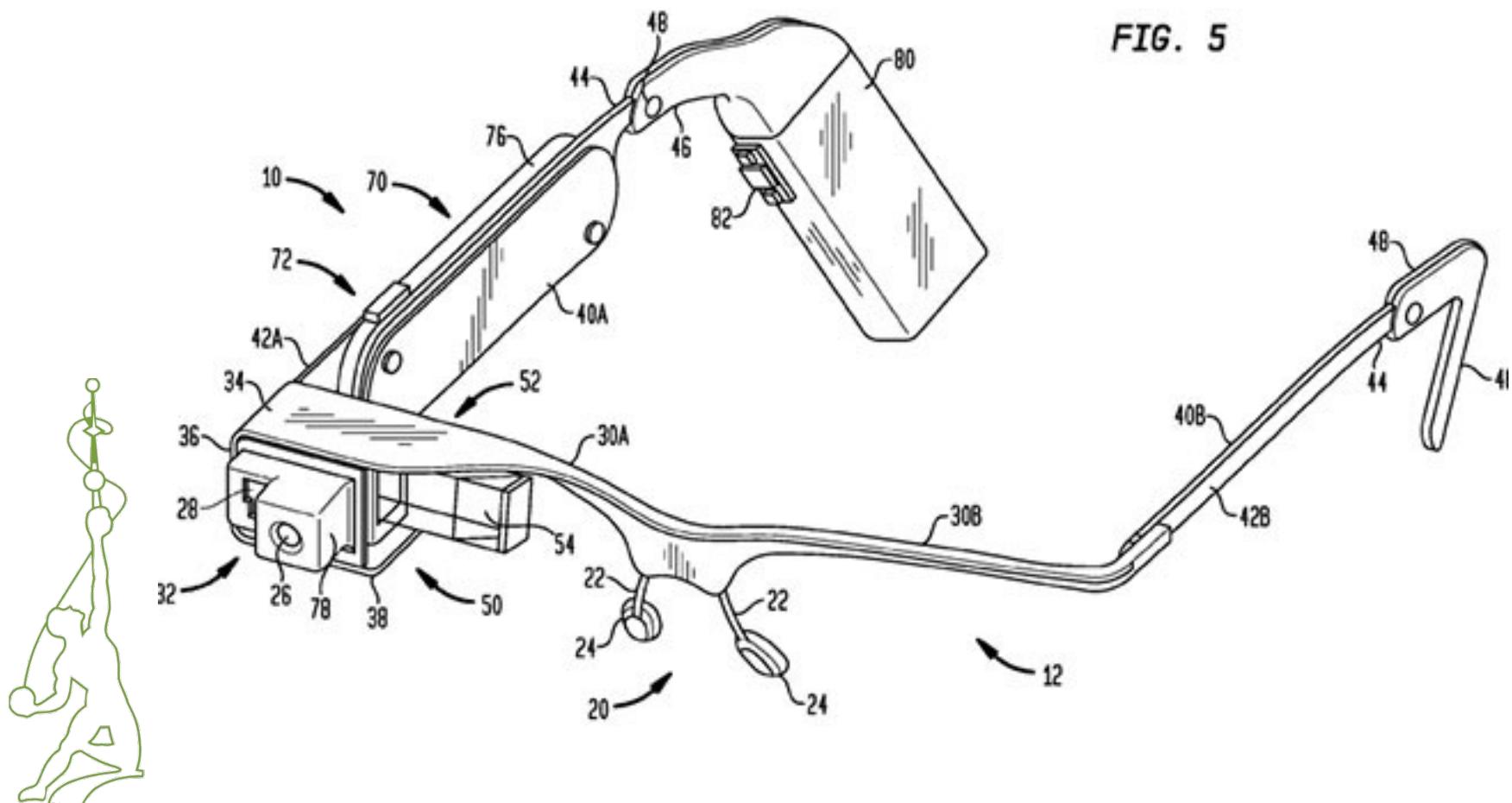
# **“Google Glasses”**



# **“Google Glasses”**



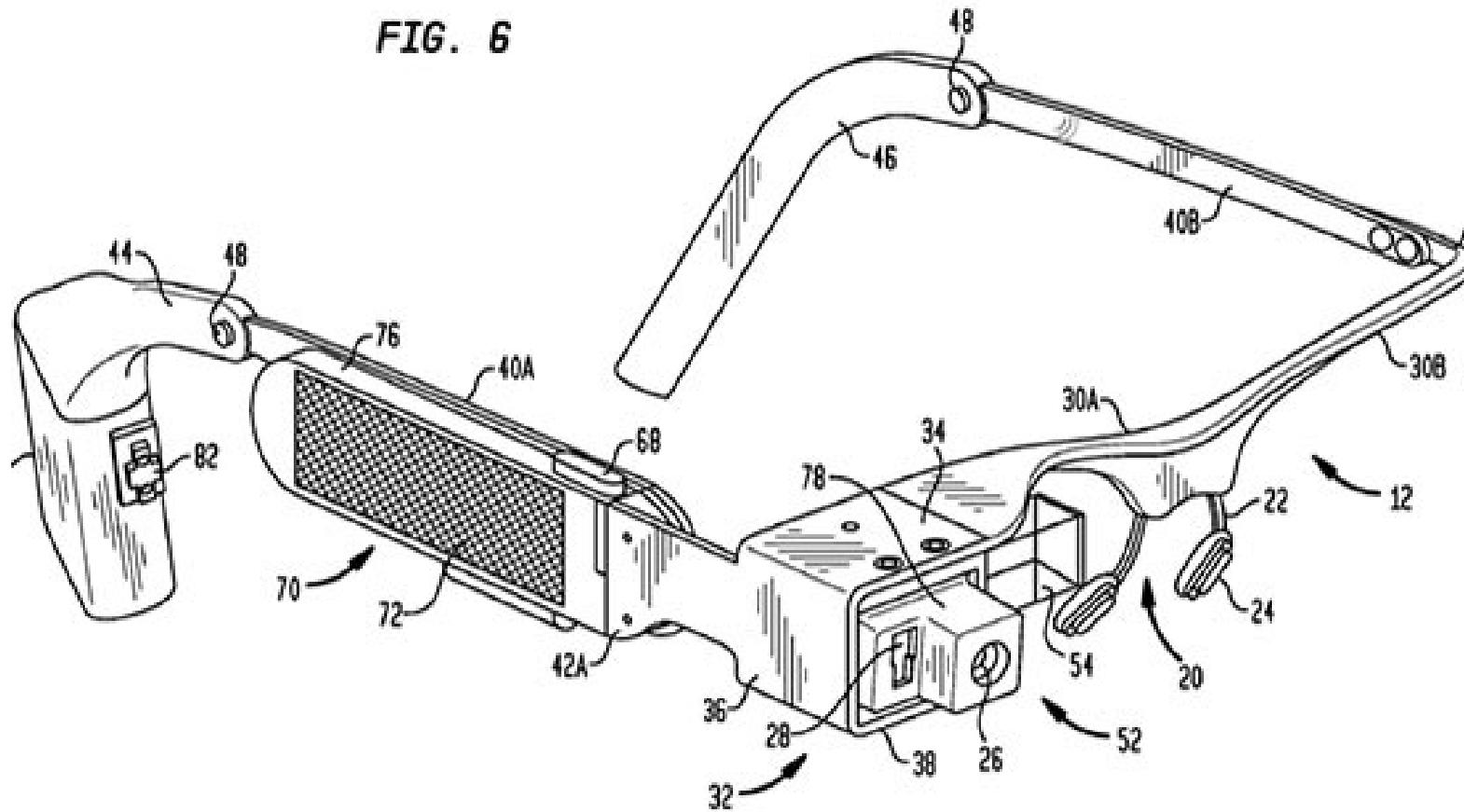
FIG. 5



# “Google Glasses”



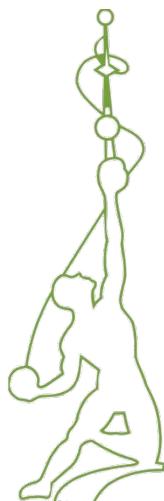
FIG. 6



# **“Driverless Cars”**



# **“Driverless Cars”**

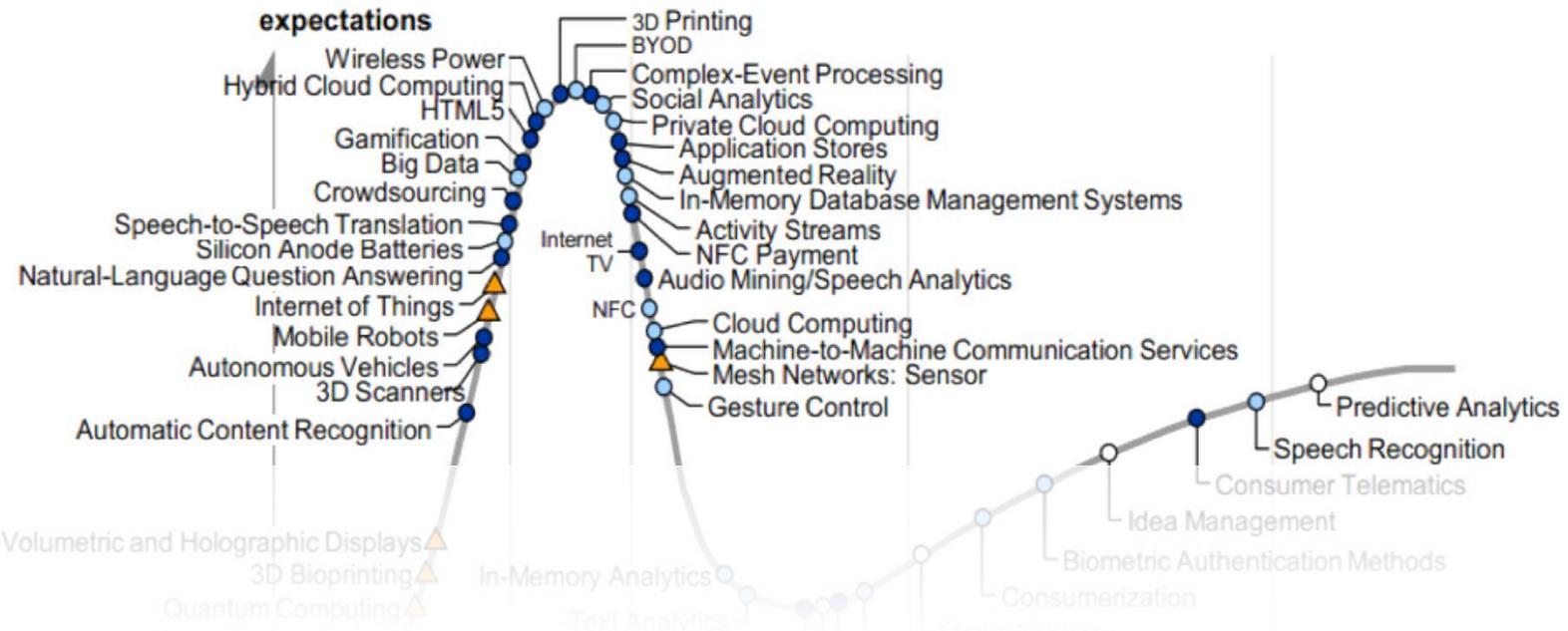


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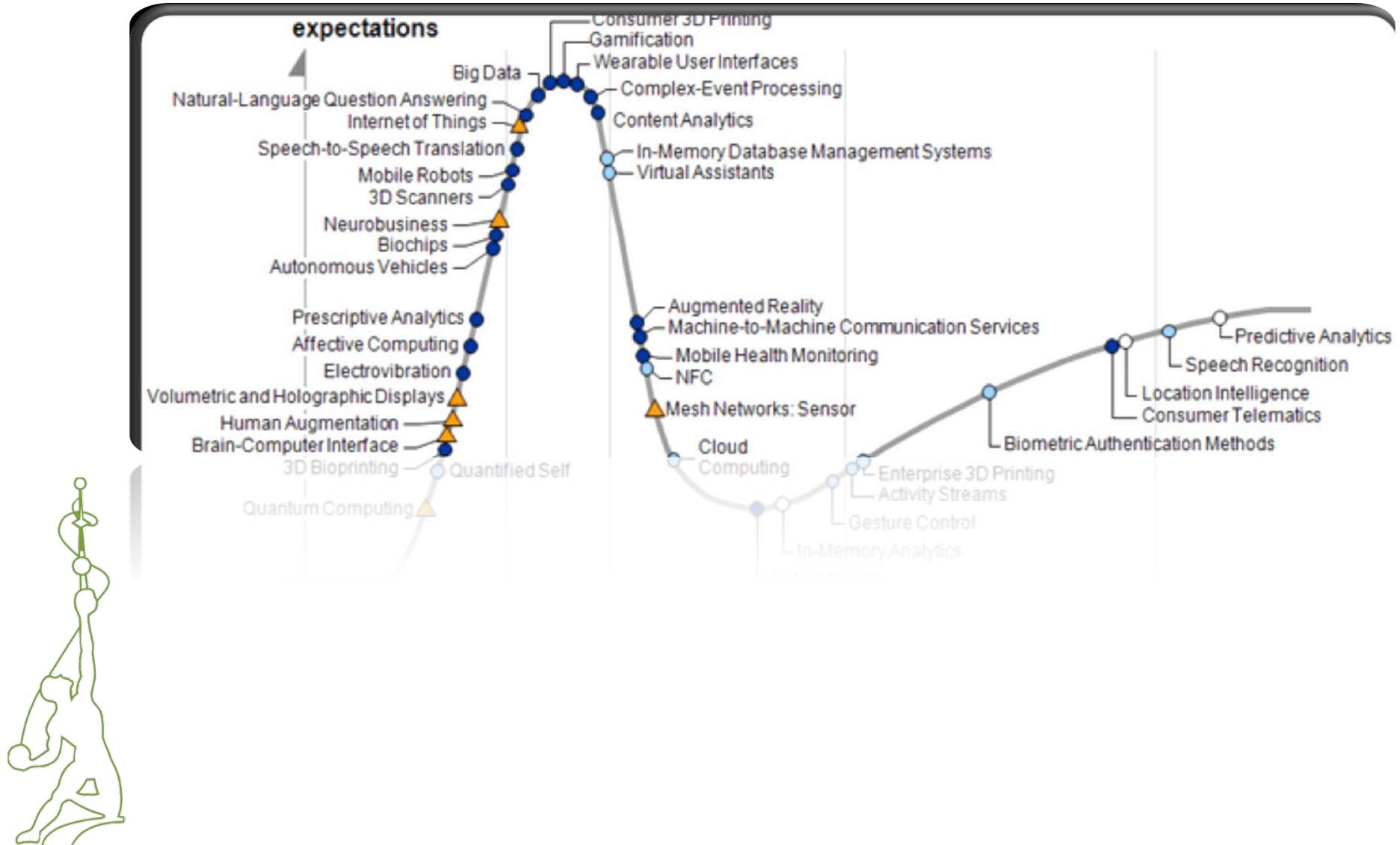
# Gartner Hype Cycle

## Emerging Technologies Hype Cycle 2012



# Gartner Hype Cycle

As of July 2013



# M2M... to ... IoT:



- ⇒ M2M essentially was, and, in the industrial parlance *is*, still application-specific machine-to-machine communication with very definite functionality and expectations, with a controlled mode of communication.
- ⇒ While IoT could be termed as its next avatar, it is going to see a whole set of new avatars in next few years and decades.



# M2M... to ... IoT:



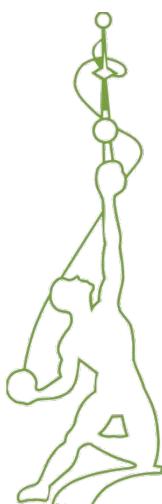
- ⇒ IoT is about “Connected Intelligence”, a sort of “universal global neural network” in the cloud.
  
- ⇒ The IoT comprises of smart machines interacting and communicating with other machines, objects, environments and infrastructures.



# **M2M... to ... IoT:**



huge volumes of data are being generated, and that data is being processed into useful actions that can “command and control” things to make our lives much easier and safer—and to reduce our impact on the environment.



# M2M... to ... IoT:

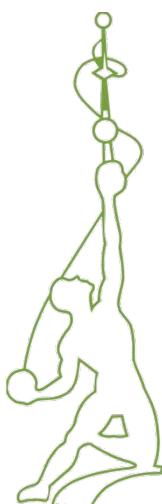


The developments in the last few decades in the pervasive embedded processing and revolutions in communication and sensors technologies have catapulted the homogenous M2M networks into heterogeneous global neural networks of “aware” and interconnected devices with unique IDs, interacting with other machines/objects, infrastructure, and the physical environment.

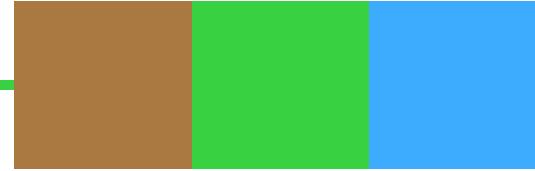




*Internet of Things is all about  
“heterogeneous” and “aware”  
devices interacting to simplify  
people’s life in some way or the  
other.*



# *Defining the IoT Systems:*



- ⇒ Some define it as a vague generalized glossy scenario of Smart Buildings, Smart City, Smart Lighting, Smart Grid, Smart Health and Industrial Automation Systems & Solutions.
- ⇒ Some other define IoT as telemetry-like services over cellular network.
- ⇒ Another group defines it as a One Box Solution for each Home..



# Vague Generalized & Glossy:



Building Automation



Smart City



Smart Lighting



Smart Grid



Smart Health



Industrial Automation



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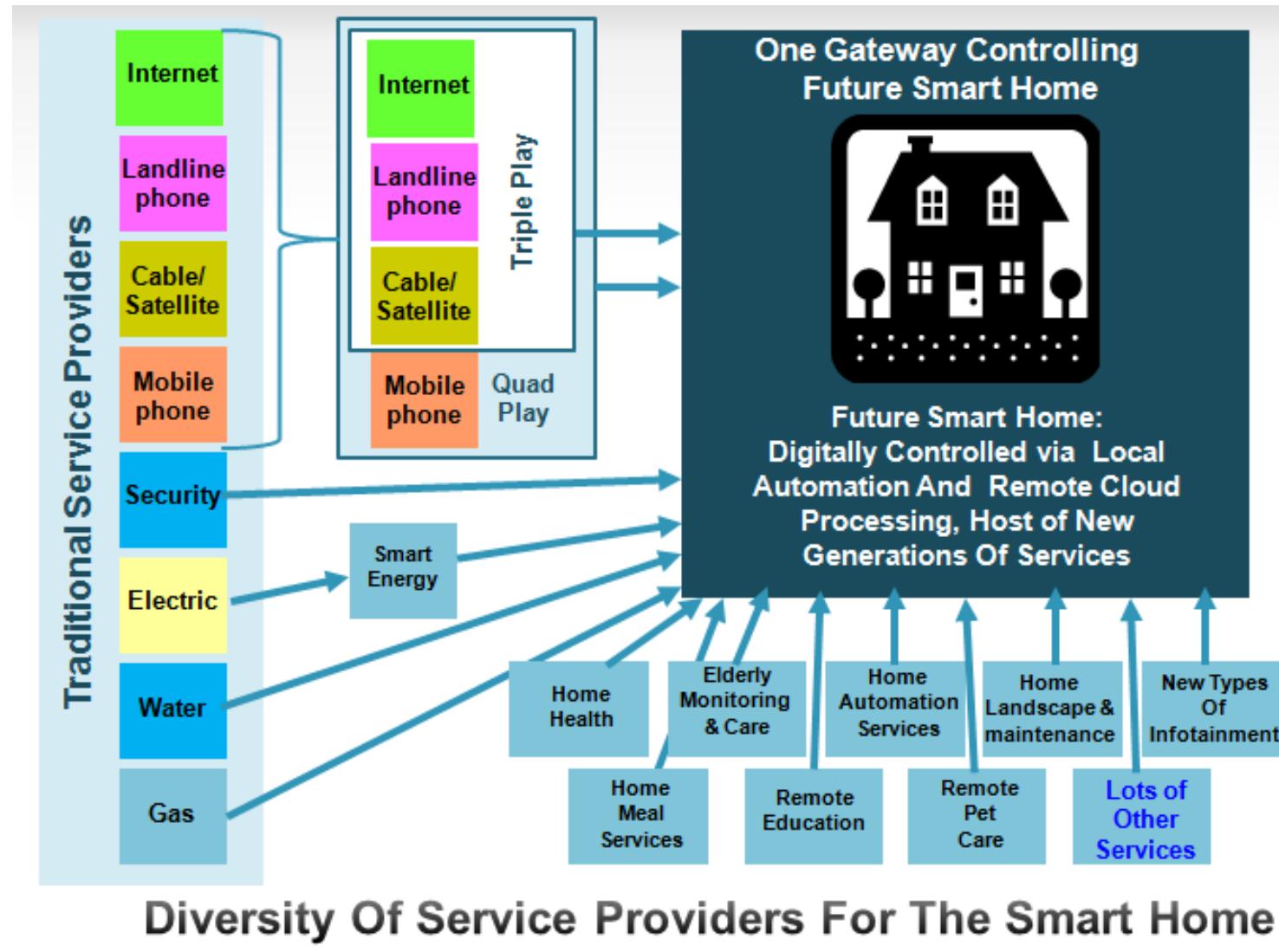
# IoT on the SIM...



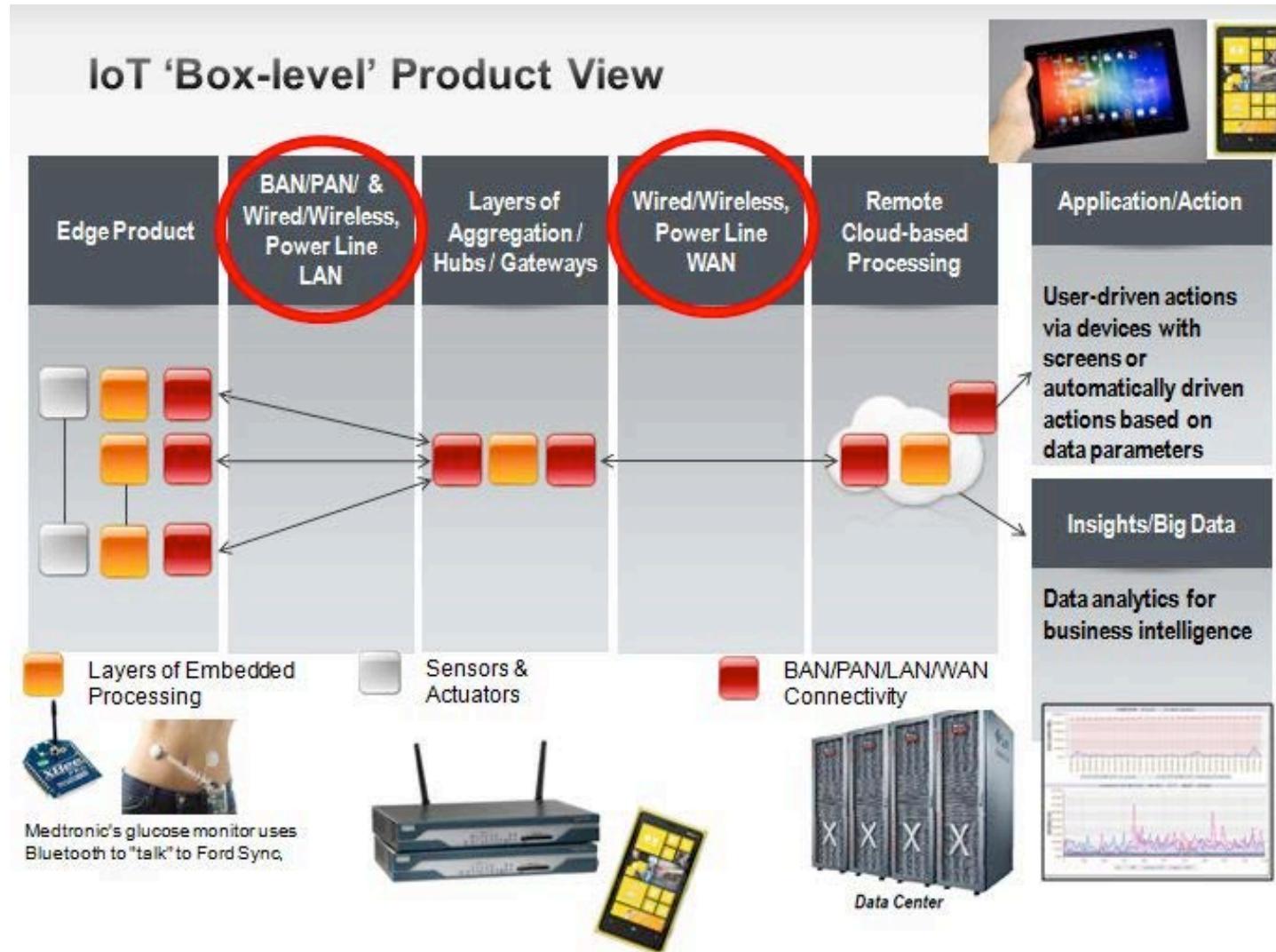
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# IoT thru “One Box”:



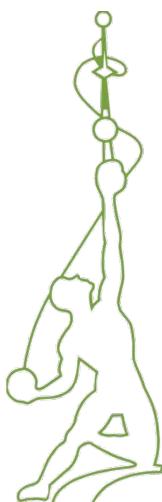
# Box Level Approach to IoT:



# Use Cases of IoT Systems:



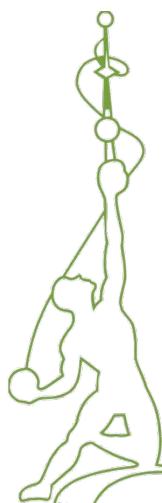
- ⇒ Machine-to-machine communication
- ⇒ Machine-to-infrastructure communication
- ⇒ Machine to environment communications
- ⇒ Tele-health: remote or real-time pervasive monitoring of patients, diagnosis and drug delivery
- ⇒ Continuous monitoring of, and firmware upgrades for, vehicles
- ⇒ Asset tracking of goods on the move



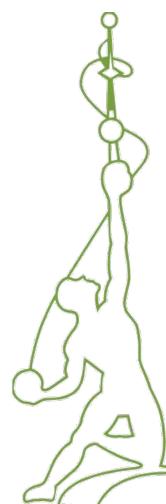
# Use Cases of IoT Systems:



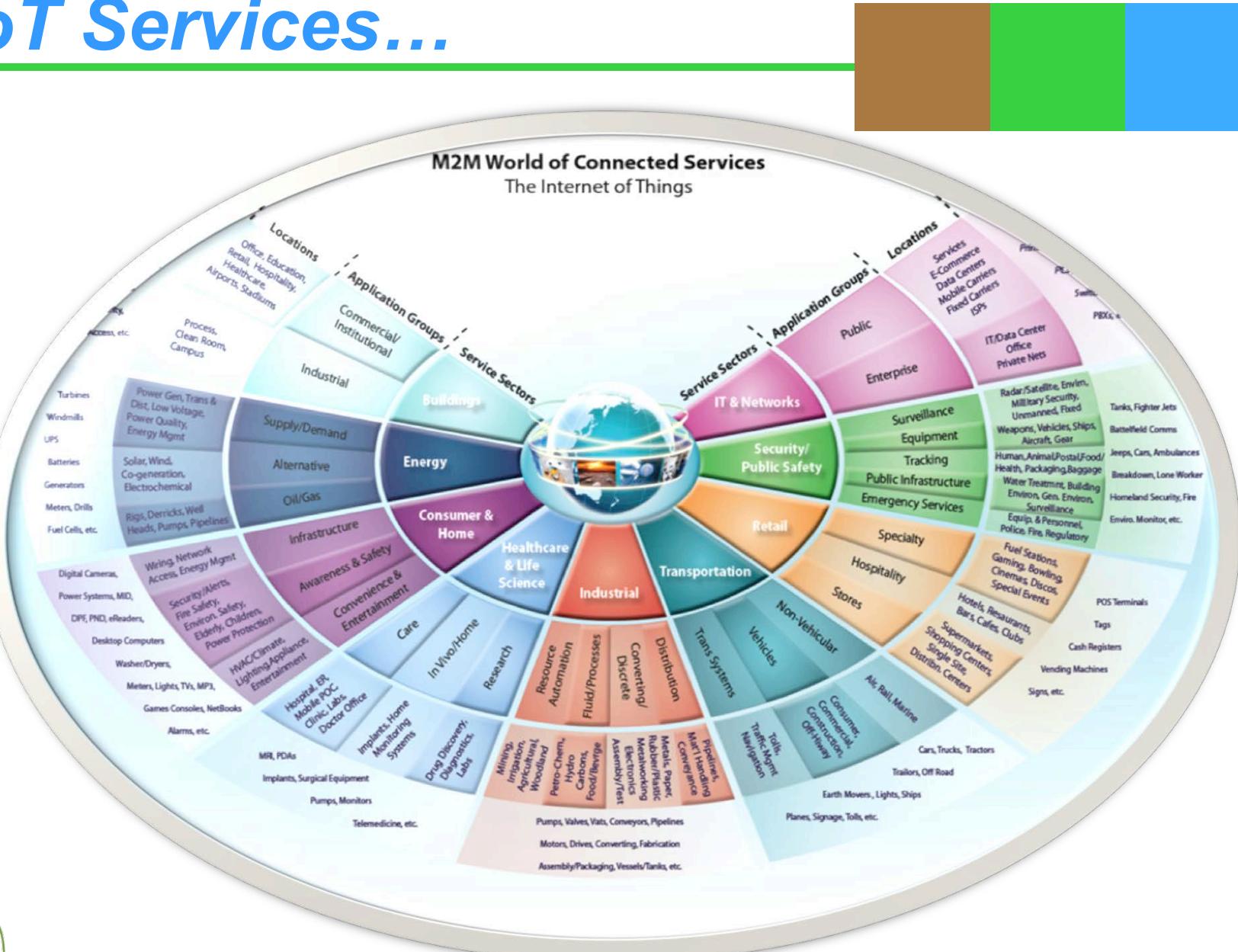
- ⇒ Automatic traffic management
- ⇒ Remote security and control
- ⇒ Environmental monitoring and control
- ⇒ Home and industrial building automation
- ⇒ “Smart” applications, including cities, water, agriculture, buildings, grid, meters, broadband, cars, appliances, tags, animal farming and the environment, to name a few...
- ⇒ And lots of other innovative services....



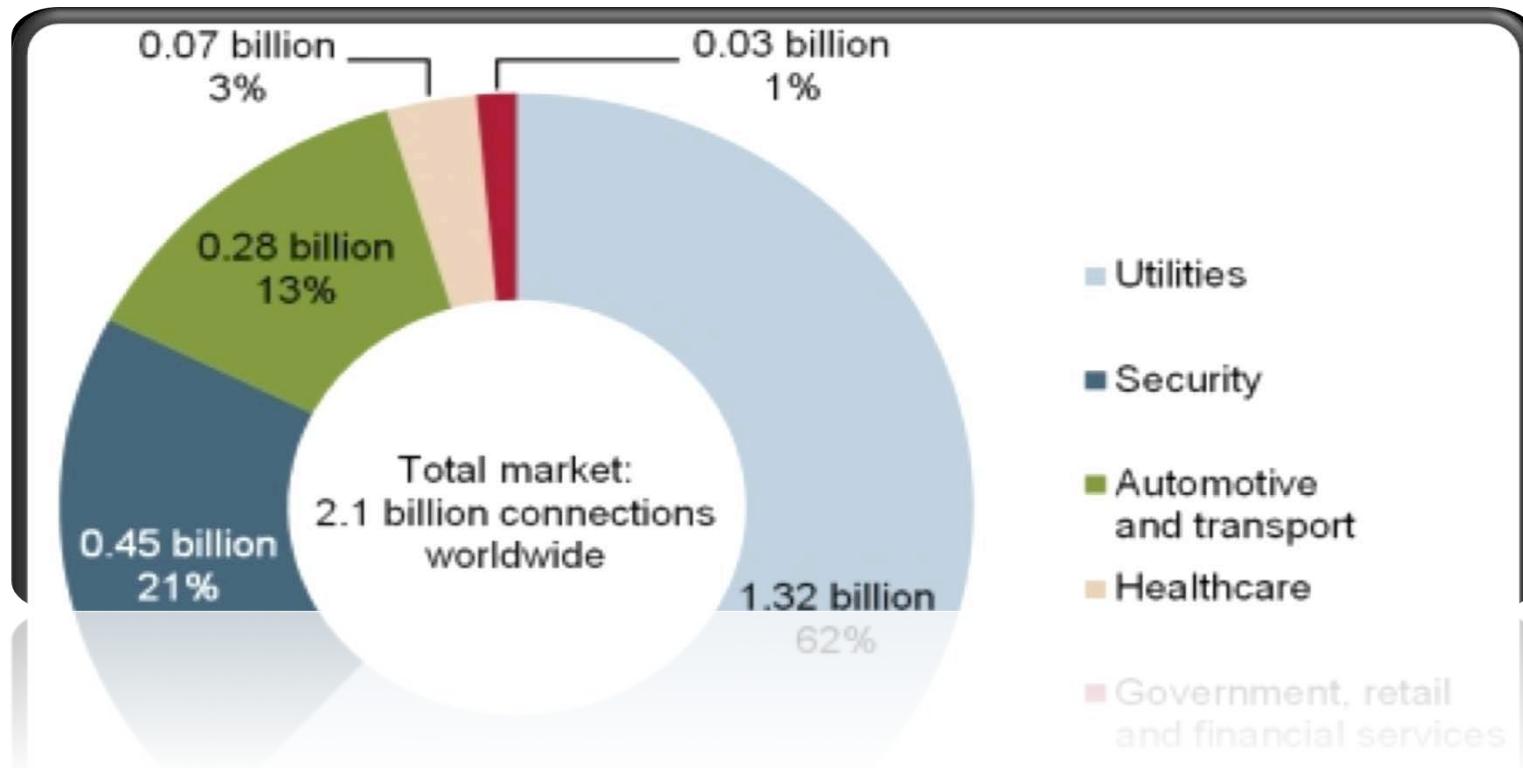
# *Applications of IoT Systems:*



# IoT Services...



# *IoT: Segment wise Market Shares....*



# IoT: Network of All Networks



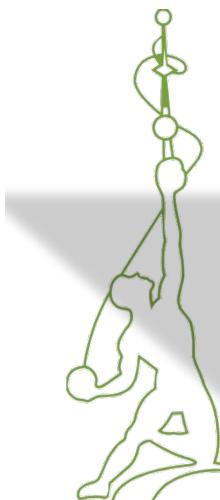
## INTERNET of THINGS

It's the *Network of All Networks*, which will be connected through the **Largest Control Data Network in the World**

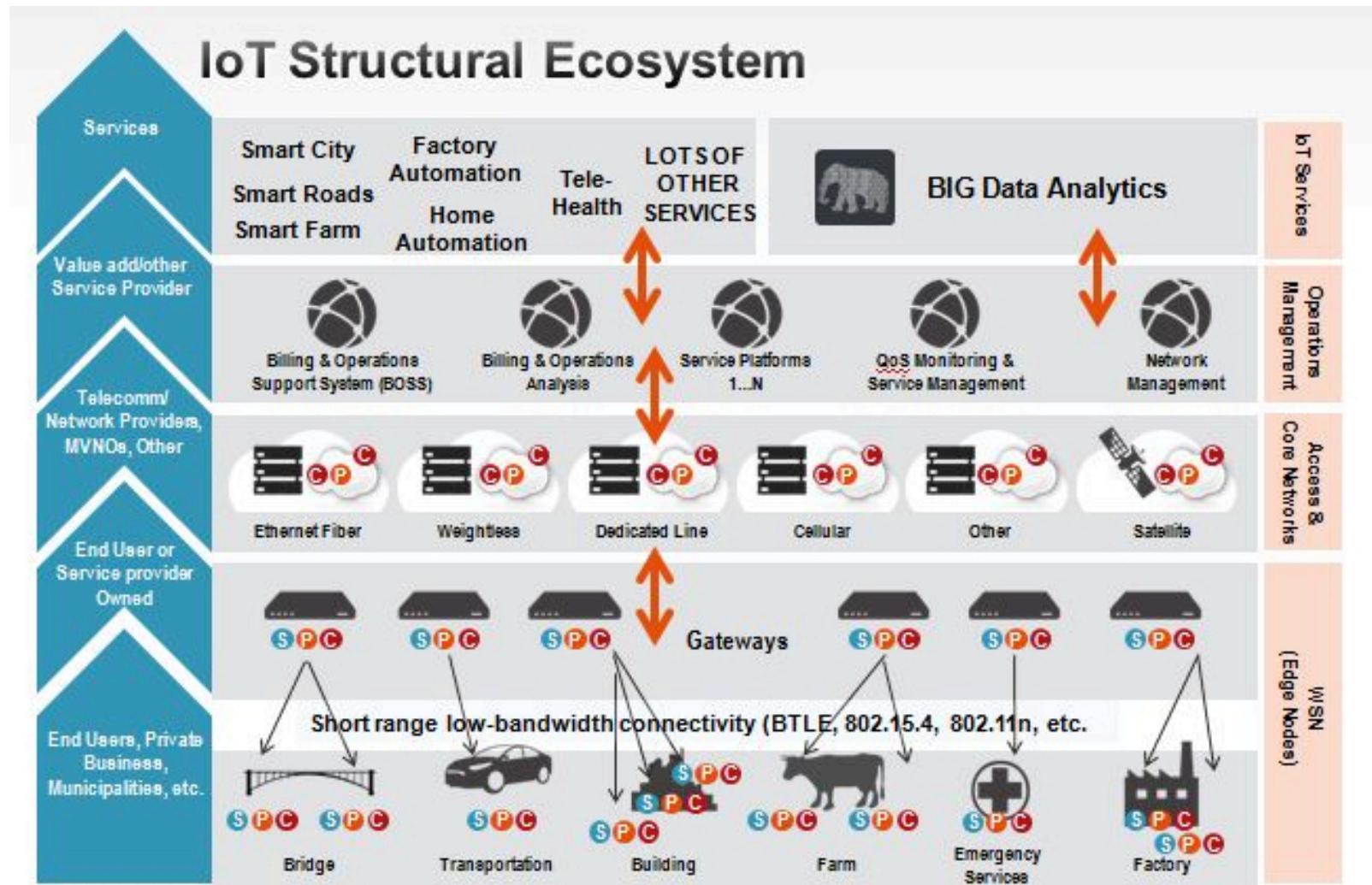
It's all about the service layer infrastructure, because ...

**It's ALL About the Services**

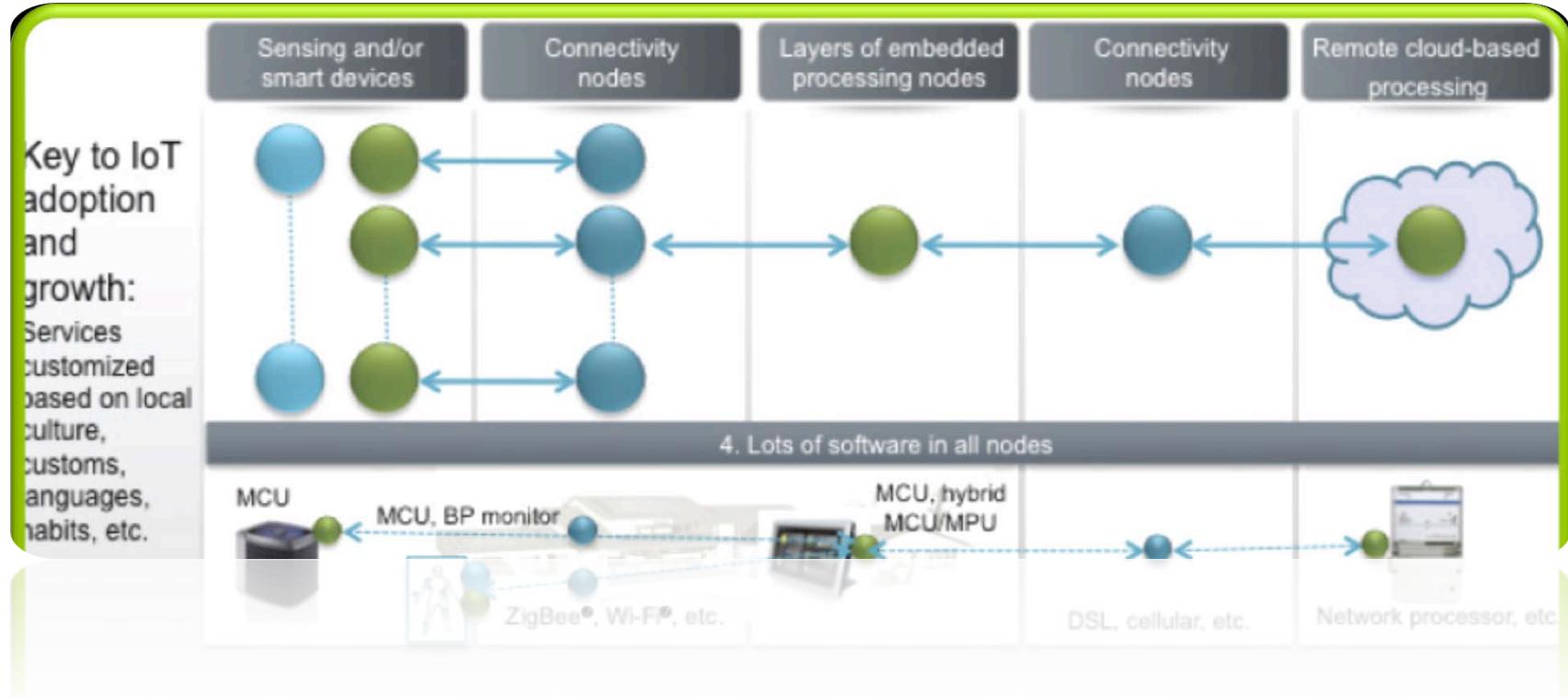
Rolling out the IoT is like rolling out the largest control data network in the world



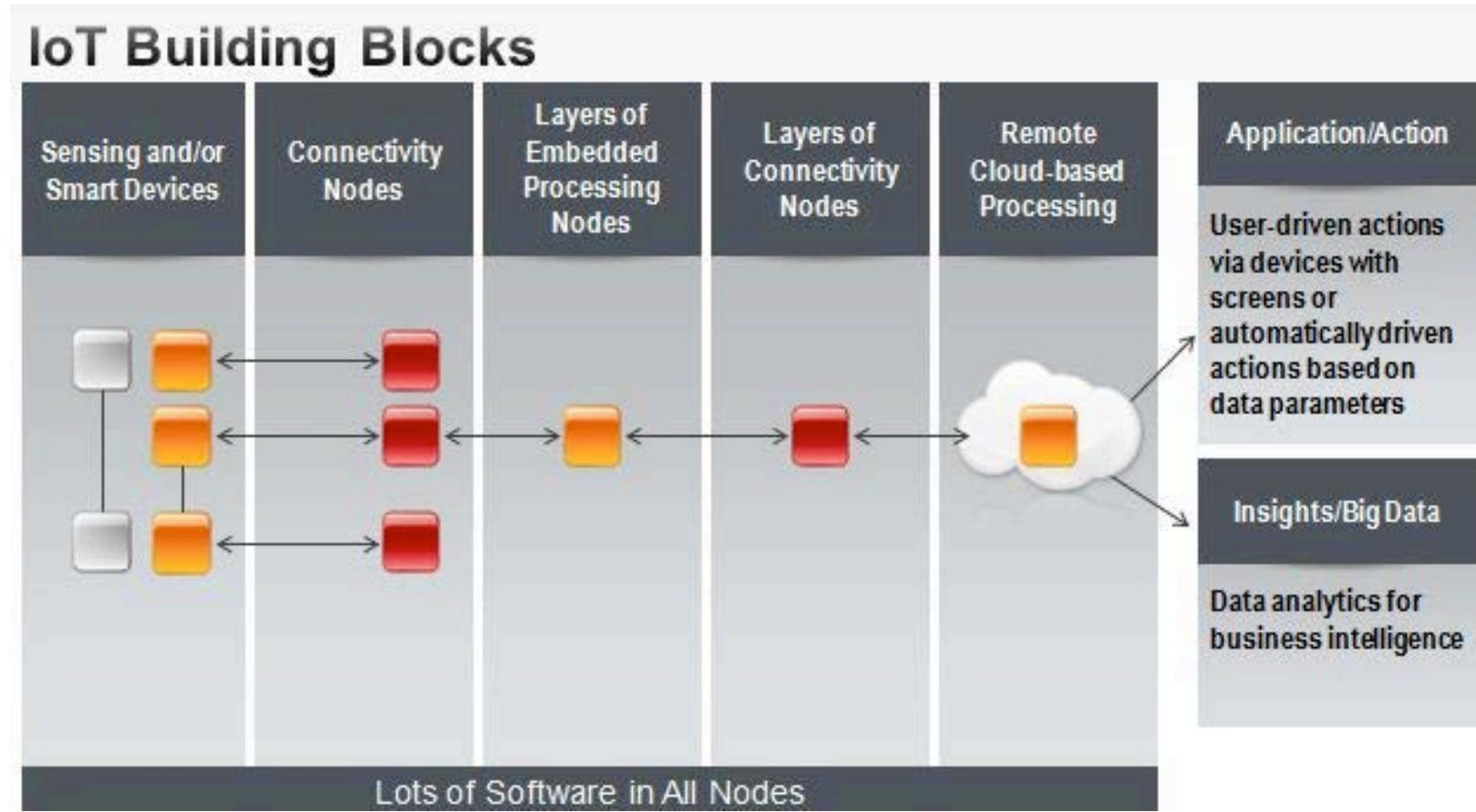
# IoT Structural Ecosystem:



# Functional View of Internet of Things Technologies



# Key Components of IoT:



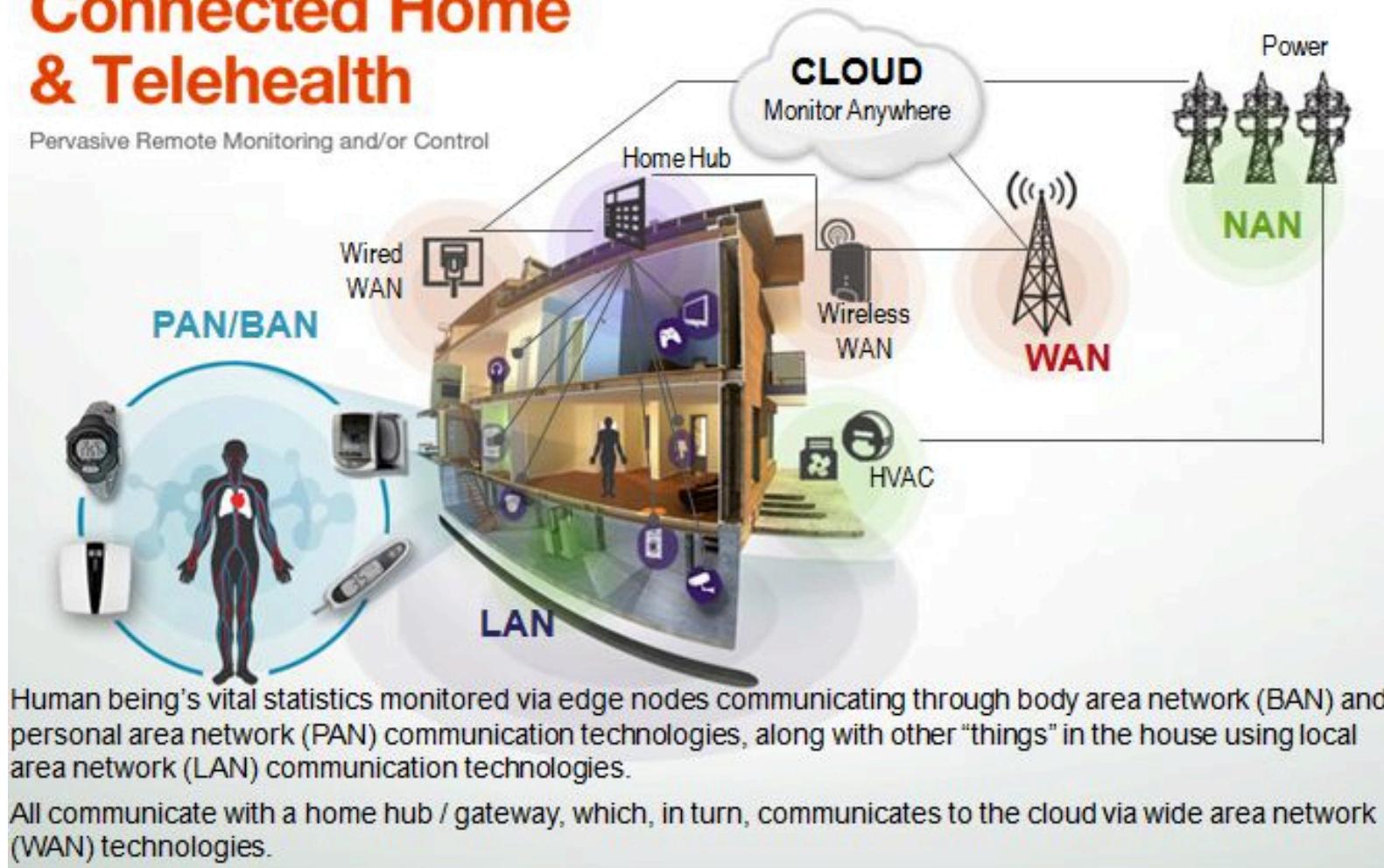
# An example:



Example

## Connected Home & Telehealth

Pervasive Remote Monitoring and/or Control



# Most Crucial Block of IoT:



## Edge Node Products

There are as many types of edge node as there are applications, however all could/would include:

- An MCU
- Sensors and actuators
- Integrated modem chip (connectivity)
- Energy source

For the initial rollout, these nodes need to be:

- Very small
- Low cost
- Low power
- Low complexity
- Industrial grade and robust

In the near future, think of edge nodes similar to the spider robot (tiny spider-sized robots that are able to search buildings and identify occupants)



Medtronic's glucose monitor uses Bluetooth to "talk" to Ford Sync.



# New expectations from IoT:



## Context Awareness Using Emotion Sensing: The Way It Works

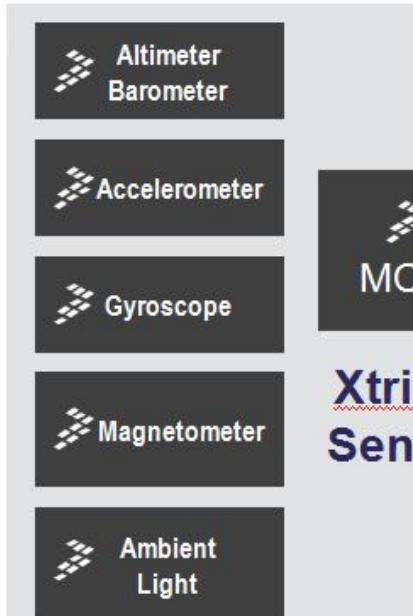


# Meeting the expectations from IoT:

## *Sensor Fusion*



### Sensor Fusion Enables Context Awareness



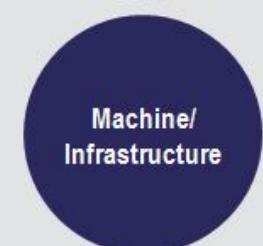
Combinatory  
Sensing  
Data

#### Context Awareness

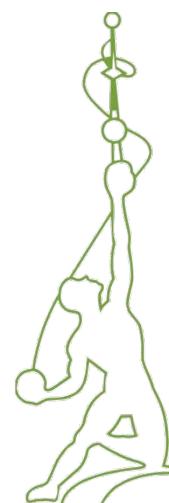
Motion  
Reaction  
Emotion  
Posture  
Biometrics



Trajectory  
Impact  
Velocity  
Power  
Feedback



Location  
Altitude  
Temperature  
Humidity  
Light  
Sound



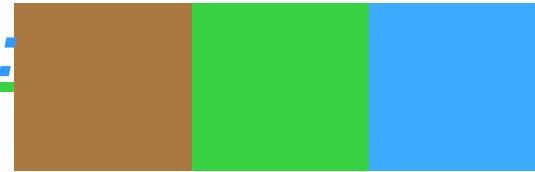
## Key Components of IoT:



- ⇒ Sensing Nodes,
- ⇒ Local Embedded Processing Nodes,
- ⇒ Connectivity Nodes,
- ⇒ Software to automate tasks and enable new “Classes of Services”
- ⇒ Remote Embedded Processing Nodes,
- ⇒ and last but not the least **“Full Security”** across the **“Signal Path”**.

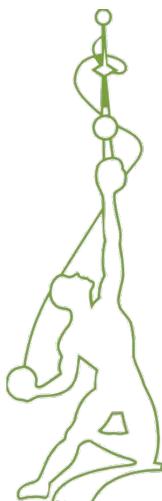


## Maturity Stage of IoT Components:



To give IoT the required momentum, device management platforms, cloud computing and big data sciences in the virtual world are already flourishing and well geared up to meet the expectations of the designers.

But, the physical world needs to catch up. The wireless and networking technologies need to mature very fast; we need innovative approaches in deployment of large sensor (and actuator) networks.



## Maturity Stage of IoT Components:



Bringing the “Internet of Things” to life requires a comprehensive systems approach, inclusive of intelligent processing and sensing technology, connectivity, software and services, along with a leading ecosystem of partners.

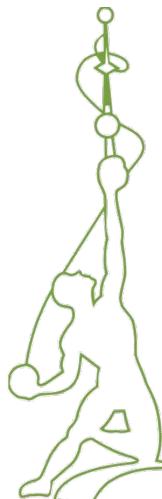


## Hurdles in fast growth of IoT:



The IoT value chain is perhaps the most diverse and complicated value chain of any industry or consortium that exists in the world.

In fact, the gold rush to IoT is so pervasive that if you combine much of the value chain of most industry trade associations, standards bodies, the ecosystem partners of trade associations and standards bodies, and then add in the different technology providers feeding those industries, you get close to understanding the scope of the task.



## Hurdles in fast growth of IoT:



*In this absolutely heterogeneous scenario, coming up with a common harmonized standards is a major hurdle.*

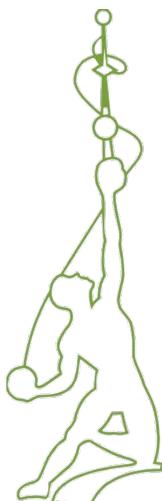


## Hurdles in fast growth of IoT:



The other hurdle is – viable and acceptable business models of services based on the IoT.

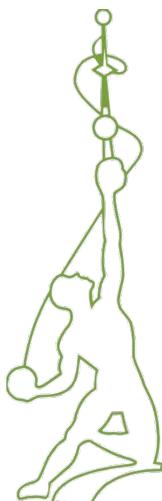
Convergence of the multitude of stakeholders of the IoT ecosystem to common business models and standards is a major imperative for the wide acceptance of the IoT wave by the masses.



## Hurdles in fast growth of IoT:



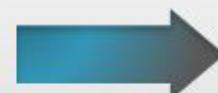
*We need to see acceleration and a maturing of common standards, more cross-sector collaboration and creative approaches to business models.*



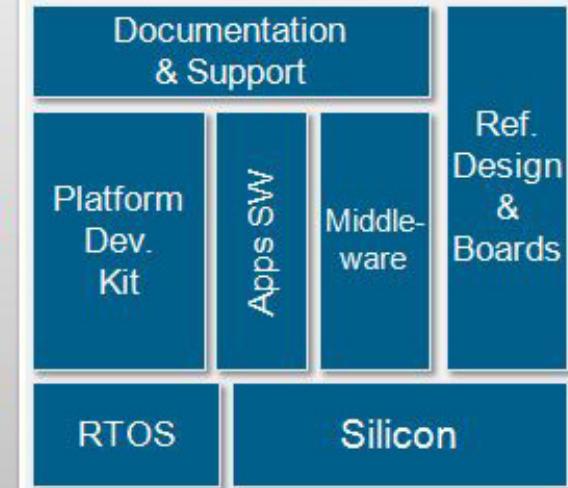
# Hurdles in fast growth of IoT:



*It is difficult for innovation to happen across disjointed platforms & technologies.*

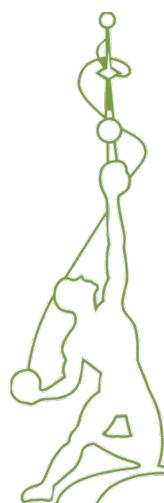


The way it should be



No one company can do it all. This can only happen when an open ecosystem contributes to the overall solution.

*Creating the opportunity for ecosystem partners to work across common open platforms facilitates faster innovation.*





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# Standards organizations.....

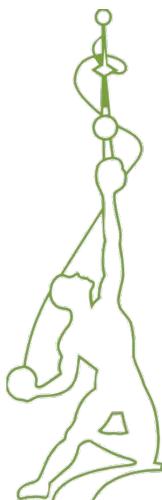


# Standards organizations.....



## *Standardization bodies & fora influencing Standardization activities:*

- ⇒ International Electrotechnical Commission (IEC)
- ⇒ National Institute for Standards and Technologies (NIST).
- ⇒ Smart Grid Interoperability Panel (SGIP)
- ⇒ European Smart Grid Coordination Group (SG-CG)
- ⇒ European Smart Meter Coordination Group (SM-CG)
- ⇒ Institute of Electrical and Electronics Engineers (IEEE)
- ⇒ Internet Engineering Task Force (IETF)
- ⇒ International Organization for Standardization (ISO) and joint ISO/IEC activities
- ⇒ European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC)



# Standards organizations.....



*Standardization bodies & fora influencing  
Standardization activities:*

- ⇒ European Telecommunications Standards Institute (ETSI)
- ⇒ International Telecommunication Union (ITU)
- ⇒ Deutsche Kommission für Elektrotechnik (DKE)
- ⇒ Deutsches Institut für Normung (DIN), Normungsausschuß Automobil (NAAutomobil)
- ⇒ SESKO
- ⇒ International Council on Large Electric Systems (CIGRE)
- ⇒ Organization for the Advancement of Structured Information Standards (OASIS)
- ⇒ UCA International Users Group (UCAlug)
- ⇒ Society of Automotive Engineers (SAE) .....



**M-Bus**

**M-Bus**  
wireless



**dlms**

device  
language  
message  
specification



**OPENmeter**  
Open Public Extended Network Metering

**G3-PLC**™  
Alliance



**KNX**®

**EMerge**®  
ALLIANCE

**USNAP**™  
ALLIANCE

**PRIME**  
ALLIANCE

**HOMEPLUG**®  
ALLIANCE

**Bluetooth**®

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**MoCA**.

Multimedia over Coax Alliance

**HGI** Home  
Gateway  
Initiative

**dlna** CERTIFIED

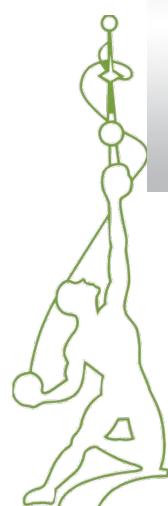
**HomePNA**

**6LoWPAN**

THE WIRELESS EMBEDDED INTERNET

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# *Enabling technologies n protocols....*



device  
language  
message  
specification



communication  
technologies



Multimedia over Coax Alliance



**6LoWPAN**

THE WIRELESS EMBEDDED INTERNET

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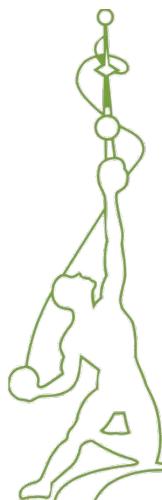
# *Enabling technologies n protocols....*

*Industry Alliances & Fora Influencing the  
“Smart” grid, buildings & homes standardization:*

communication  
technologies

- |           |             |              |
|-----------|-------------|--------------|
| ⇒ ZigBee  | ⇒ OSGP      | ⇒ HGI        |
| ⇒ 6LoWPAN | ⇒ Openmeter | ⇒ DLNA       |
| ⇒ M-Bus   | ⇒ IPSO      | ⇒ HPNA       |
| ⇒ WM-Bus  | ⇒ M2M       | ⇒ MoCA       |
| ⇒ PRIME   | ⇒ IoT       | ⇒ HomePlug   |
| ⇒ G3      | ⇒ KNX       | ⇒ USNAP      |
| ⇒ DLMS    | ⇒ W-KNX     | ⇒ Weightless |

*Plus many many more....*



## ***Challenges in fast growth of IoT:***



The standards in question are related to the communications nodes and the interactions of these nodes at each segment of this system, from the edge nodes, all the way to the cloud.

It also would then include service and business models associated with services created.

It's a given that ubiquitous access to the cloud, IP and the web paradigm will help hide some of the complexities of the systems for the users, and would allow simpler lower cost solutions down the road.



## Challenges in fast growth of IoT:

The challenges that inhibit the IoT-related standards and hence a robust rollout of IoT services are:

- ⇒ Security and privacy issues (Note that security and privacy measure are a lot of times at odds with each other)
- ⇒ Endless IoT applications
- ⇒ Endless potential types of edge node technologies, and the interface to the communication nodes (e.g. Sensors and use cases integration into Telco services)
- ⇒ High fragmentation of today's IoT connectivity solutions



## Challenges in fast growth of IoT:

The challenges that inhibit the IoT-related standards and hence a robust rollout of IoT services are:

- ⇒ Lots of legacy systems that will now be a part of IPv6 network, with no (or minimal) existing “co-existence” and interoperability plans
- ⇒ Partnerships, between heterogeneous and diverse industries, and defining the associated business models involving multiple stakeholders and service providers of some of those legacy systems in number
- ⇒ Management and provisioning of the various networked devices, applications, and services, and the network capacity planning that comes with it



## Challenges in fast growth of IoT:

The challenges that inhibit the IoT-related standards and hence a robust rollout of IoT services are:

- ⇒ Regulatory issues that will hinder deployments on a worldwide basis
- ⇒ Special needs of “industrial grade” product rollouts, with long lasting requirements in the field, that require future proofing of any standard recommended
- ⇒ Slow development of the IoT services market, partially due to lack of future proof standards etc.



# *The Way Forward:*



Changing  
Perspective



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## Solving the Challenges:



**Every true IoT application or solution  
needs cross-domain expertise.**

YES, I strongly believe it to be the main competence and skill set to develop successful and reliable IoT products, systems and/or solutions.

*Internet, per se, has been considered the forte and playing field of software professionals.*

But, IoT brings new challenges in the way of sensor fusion, communication technologies and energy/power management of the edge nodes.



## Competencies Needed:



**Unless, a designer can design most optimized edge nodes and communication nodes, the solution shall not pass the acid test of reliable and sustained performance in the field deployment environment.**



# Competencies Needed:



- ⇒ Basic electronics fundamentals, including but not limited to sensors, analog, power, RF and various compliance issues in hardware design.
- ⇒ In depth understanding of the different communication technologies, protocols and standards, particularly relevant to the domains relevant to their applications.
- ⇒ Understanding of security, privacy and socio-ethical implications of the solutions, services and applications they are trying to develop.

*Embedded processing, data analytics and other software skills are already considered as a must.*



# *an engineer defined*



An engineer is a person who passes as an exacting expert on the basis of being able to turn out with prolific fortitude infinite strings of incomprehensible formulae calculated with micrometric precision from the vague assumptions which are based on debatable figures taken from inconclusive experiments carried out with instruments of problematic accuracy by persons of doubtful reliability and questionable mentality for the avowed purpose of annoying and confounding a hopeless chimerical group of fanatics referred to all too frequently, as engineers.....



# **INNOVATION:**



Every body is harping about

**INNOVATION!!!**

Some say, Innovation is the KEY to India's rise in Electronics on the Global Arena.



*But, HOW DO WE INNOVATE WITHOUT  
the "COMPETENCE TO INNOVATE"???*

## *Challenges & Opportunities :*



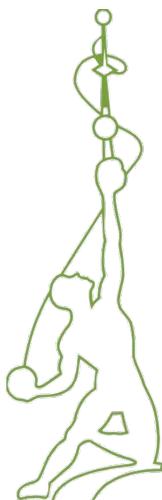
Remember? In Seventies, Eighties & even first half of Nineties, our engineers went abroad for further studies to build up the **COMPETENCE**. Since during those days we did not have ecosystem in place to utilize their competence, they stayed there and contributed to the International “**Electronics System Design & Manufacturing**” Ecosystem. Today, Indian Design Engineers are very well recognized & respected the world over for their **“COMPETENCE TO INNOVATE”**.



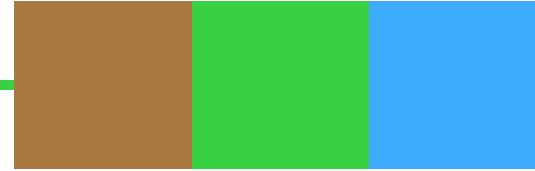
## *Challenges & Opportunities :*



*But, the present generation! Alas, they want to INNOVATE and become ENTERPRENURES in a hurry. The Industry Leaders, VCs and even the Government, all are harping about INNOVATION & ENTERPRENURESHIP.*



## *Challenges & Opportunities :*



Nobody ever focuses on building the COMPETENCE. INDIA is nowhere on the “PATENT FILING” SCALE. It is because; our DESIGN ENGINEERS or the so-called INNOVATORS do not have the competence to do the kind of research that leads to PATENTS. They are a very COMPLECENT breed that stay very happy being part of the “Design or Innovation Ecosystem”. To them it really does not matter whether they themselves Innovate or not; they are satisfied doing the “Soft Skills” jobs, as long as they are well paid. The values of today’s generation have reached an unprecedented LOW. Their gratification comes from commercial and financial success and NOT from having led a meaningful life and contribution to their chosen field, leaving aside the Society or Nation.



## *Challenges & Opportunities :*



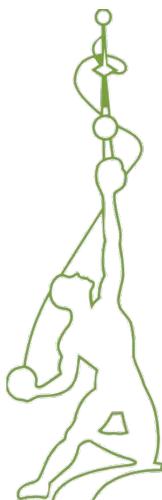
A latest study conducted by Deloitte and the US Council on Competitiveness has revealed that INDIA is ranked Second behind China in Manufacturing Competitiveness and will only narrow the gap over next few years. “India’s rich talent pool of scientists, researchers, and engineers as well as its large, well-educated English-speaking workforce and democratic regime make it an attractive destination for manufacturers”.



## *Challenges & Opportunities :*



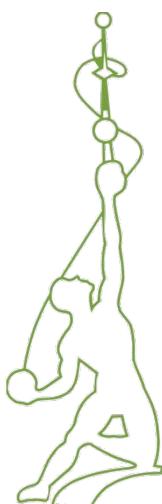
Research and development capabilities paired with engineering, software, and technology integration abilities are essential ingredients for manufacturing enterprises.



## *Challenges & Opportunities :*



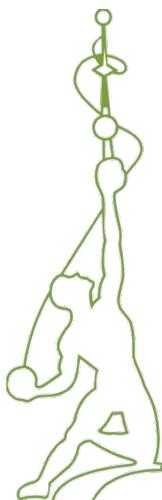
India is today viewed as a country with the capability to design, develop and manufacture innovative products for sale in local as well as global markets.



## *Challenges & Opportunities :*



These factors explain, in part, India's rise from a low-cost, back office location to a country that is well positioned to be an active participant in the entire value chain as well as it now being viewed as an integral part of the global manufacturing enterprise and location strategy of most of the Conglomerates with global footprints.

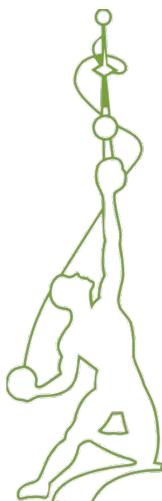


## *Challenges & Opportunities :*



***Being the skeptic that I am.....***

*I am inclined to express my reservations  
that these trends, perceptions &  
expectations of the world may NOT be  
TRUE & VALID for our ELECTRONICS  
INDUSTRY.*



## *Challenges & Opportunities :*



*To make our Electronics Industry be a Significant Contributor to this Manufacturing Competitiveness of INDIA, we need to build up a comprehensive “Indigenous Eco-System” to cater to the Local as well as Global NEEDS. For this, we need to build up “Sustainable Development” Mechanism and True Technical Competence in our Engineers, Design Houses & EMS Companies to meet the ever growing & changing needs & expectations of the Society.*



## *Challenges & Opportunities :*



One of the major challenges in the field of Electronic Design & Manufacturing is Identification of the gaps in skill sets available in Indian Engineers/Design Engineers and the need of the Industry to offer a comprehensive Electronics Manufacturing Eco-System to the Global Electronics Industry.



## *Challenges & Opportunities :*



*Some of the major Gap Areas in design skills in Indian Design Engineers are:*

- ⇒ Hardcore & Comprehensive Product/ System design
- ⇒ Hardware Design
- ⇒ RF, Analog & Mixed Signal Designs
- ⇒ Reliability & Compliances issues in design



## *Challenges & Opportunities :*



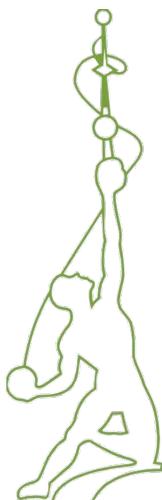
Another challenge, that we are facing is that today's Indian "So called Design Engineers" are not actually doing any Design at all, rather they are interested in only getting paid for "soft Skills" & quickly move on to managerial cadre.



## *Challenges & Opportunities :*



*They are not ready to work in the proverbial “Trench” for 15-20-30 years and become “specialist”/“designers” in any particular domain with in Electronics.*



## *Challenges & Opportunities :*



To meet the global expectations from India, another crucial link in the “**Electronics Manufacturing Eco-System**” is our **DESIGN HOUSES**.

Most of our Design Houses are merely Design Implementers.



As in civil engineering, we have Architects & Contractors; our design houses are performing the roles of Contractors and are happy & complacent in merely meeting the customers' specifications of the products.

## *Challenges & Opportunities :*



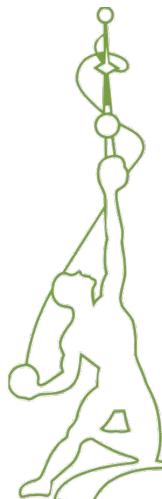
*May be, it is because a contractor makes more money than an Architect.*



## *Challenges & Opportunities :*



The Mindset of **Indian Design Houses** has still not changed, in spite of tremendous pressure from the **ESDM Ecosystem** to play a more comprehensive & inclusive role for enabling India as a preferred partner of the global manufacturing enterprise and location strategy for most of the Conglomerates with global footprints.



# *The Way Forward:*



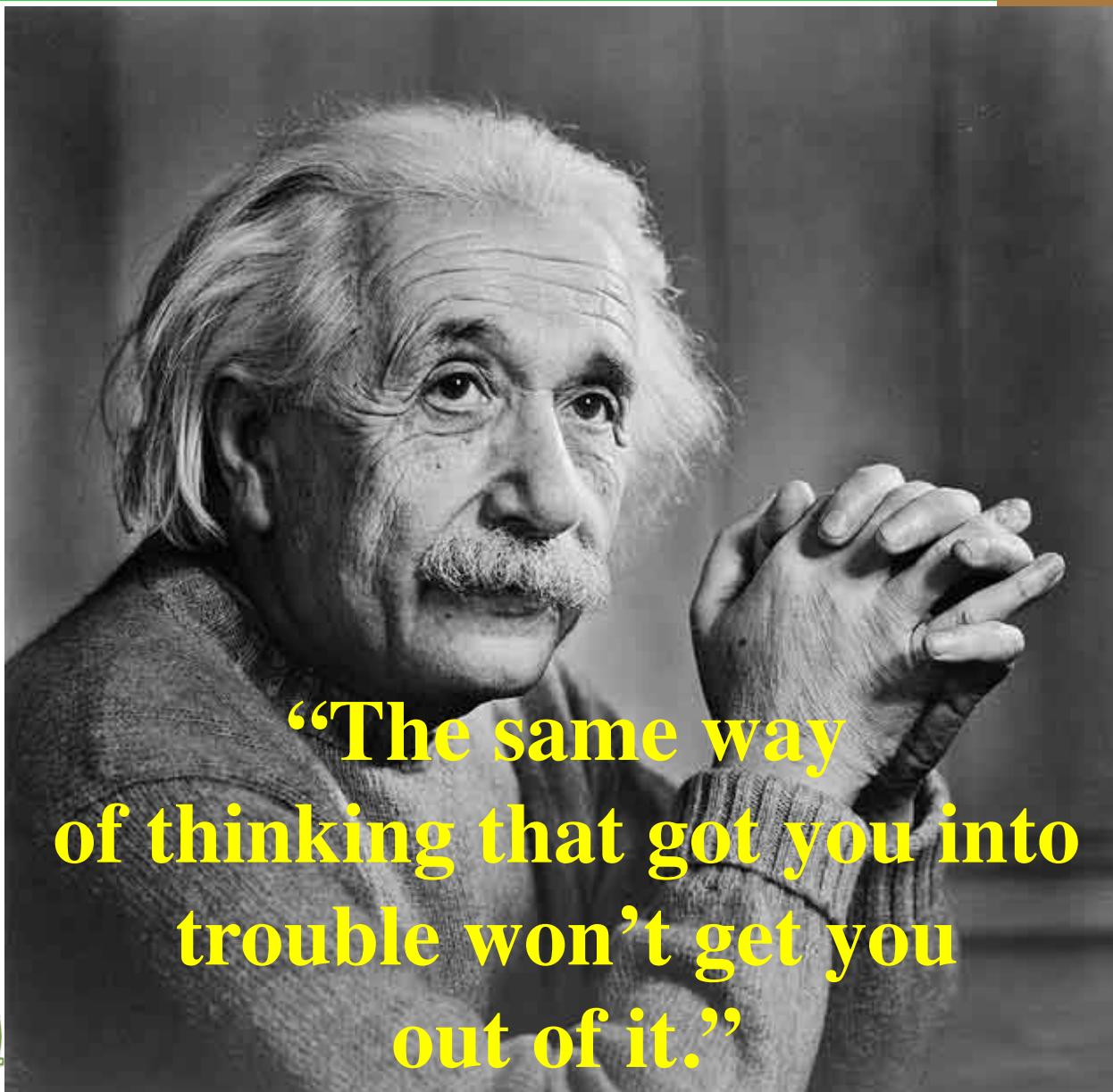
Technology  
Roadmap



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# The Way Forward:



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Changing  
Perspective

**“The same way  
of thinking that got you into  
trouble won’t get you  
out of it.”**

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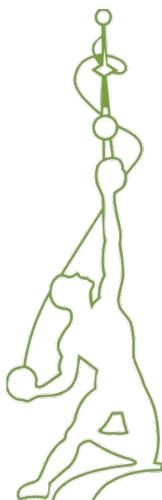
## *The Way Forward:*



We need to –

FIRST BUILD UP THE  
**COMPETENCE**

BEFORE WE FOCUS ON  
**INNOVATION**



## *The Way Forward:*



Today, this becomes the most imperative approach to follow if we are serious, as a nation and as an industry to build up our Leadership in the Global Arena. Without building up the said competence, none of our plans & government's policies will reap the desired results.



## *The Way Forward:*



For this, we need an “**Inclusive Education System**”, which, rather than simply following an age-old curriculum/syllabi revised every five to ten years, keeps pace with “**industry needs**” and somehow delivers well trained & groomed engineers to the industry to meet ever changing global design needs in different fields within Electronics.



## The Way Forward:



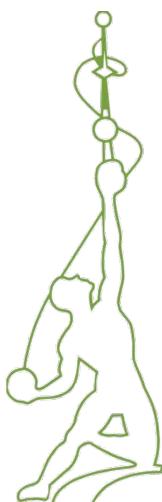
*We need, as a society to make change in the values of our young generation's mindset, so that our engineers like to stay in design line and not move to managerial line in a hurry.*



## *The Way Forward:*



*It is high time our design houses took upon themselves the responsibility of being the **DESIGN ARCHITECTS** and not merely **Design Implementers**. The Design Houses must start building domain expertise in their respective fields and try to be the “**FRIEND, PHILOSOPHER & GUIDE**” to their customers.*



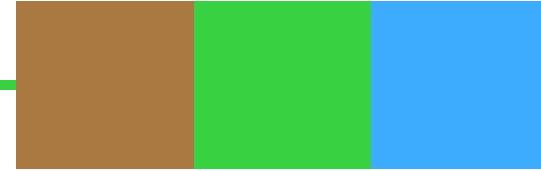
## *The Way Forward:*



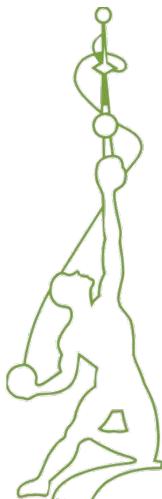
*If we want India to remain a key participant in global supply chain and a hot destination for design & manufacturing of electronic products, then, Indian electronics needs to be prepared to meet the new environmental and social impositions and yet offer quality and a competitive price.*



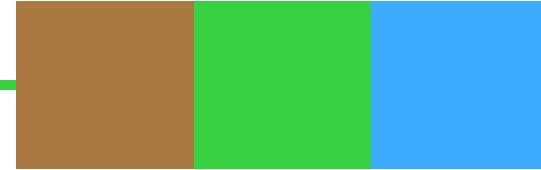
## *The Way Forward:*



Our Electronics Industry has to believe in & ENSURE the Principle of **Sustainable Development**, which makes us responsible and accountable to “*Meeting the needs of the present generation without compromising the ability of future generations to meet their needs*”.



# The Way Forward:



*Environment and Social considerations have influenced business environment of the Global Electronics Sector, bringing to fore some new Regulations & Compliances to be practiced by the members of all the ECO-SYSTEMS, including but not limited to:*

- ⇒ Restriction on Hazardous Substances (“The RoHS Regulations”)
- ⇒ Waste Electrical & Electronic Equipment (“The WEEE Regulations”)
- ⇒ Ozone Depleting Substances (Regulation & Control) Rule (ODS rule), 2000 –*Montreal Protocol*



## *The Way Forward:*



To meet such Challenges, compliances and obligations, we have to merely add a touch of *GREEN* to our outlook to each aspect of the Electronics Design & Manufacturing Eco-System. We need to explore ways to make our DESIGNS, SYSTEMS, and PRODUCTS & PROCESSES Eco-Friendly and Carbon-Neutral to make our WORLD a little more *GREEN*.



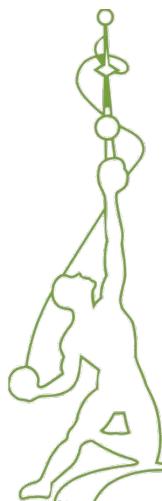
overcoming active non-action



# How to Stimulate Purposeful Action-Taking

by

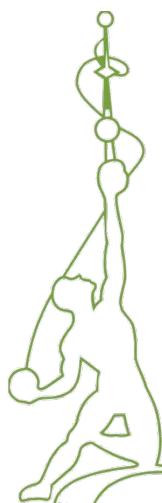
## Design Engineers



# question



Can you think of any instance in the last 3 years, when you saw an opportunity of doing something that would be of significant value to your company but, for whatever reason, you did not pursue it? You either did not get started, or you gave up because of difficulties .... whatever.

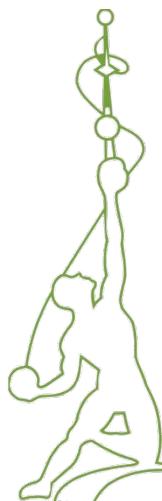


# why design engineers



## do not take action?

- “I knew what to do, I knew how to do it, but I just could not get started. I hesitated, debated, worried ... but never got going”.
- “I took on too much. In the meeting, we were in a state of euphoria, and I volunteered for too many projects. I simply could not do them all”.
- “The company was not ready. The senior people said the right things, but there was no commitment, no support. I finally gave up”.



# the challenge



*Design engineers are not paid to make the inevitable happen...*



*They are paid to make happen, what otherwise won't happen...*

# eight Lessons about

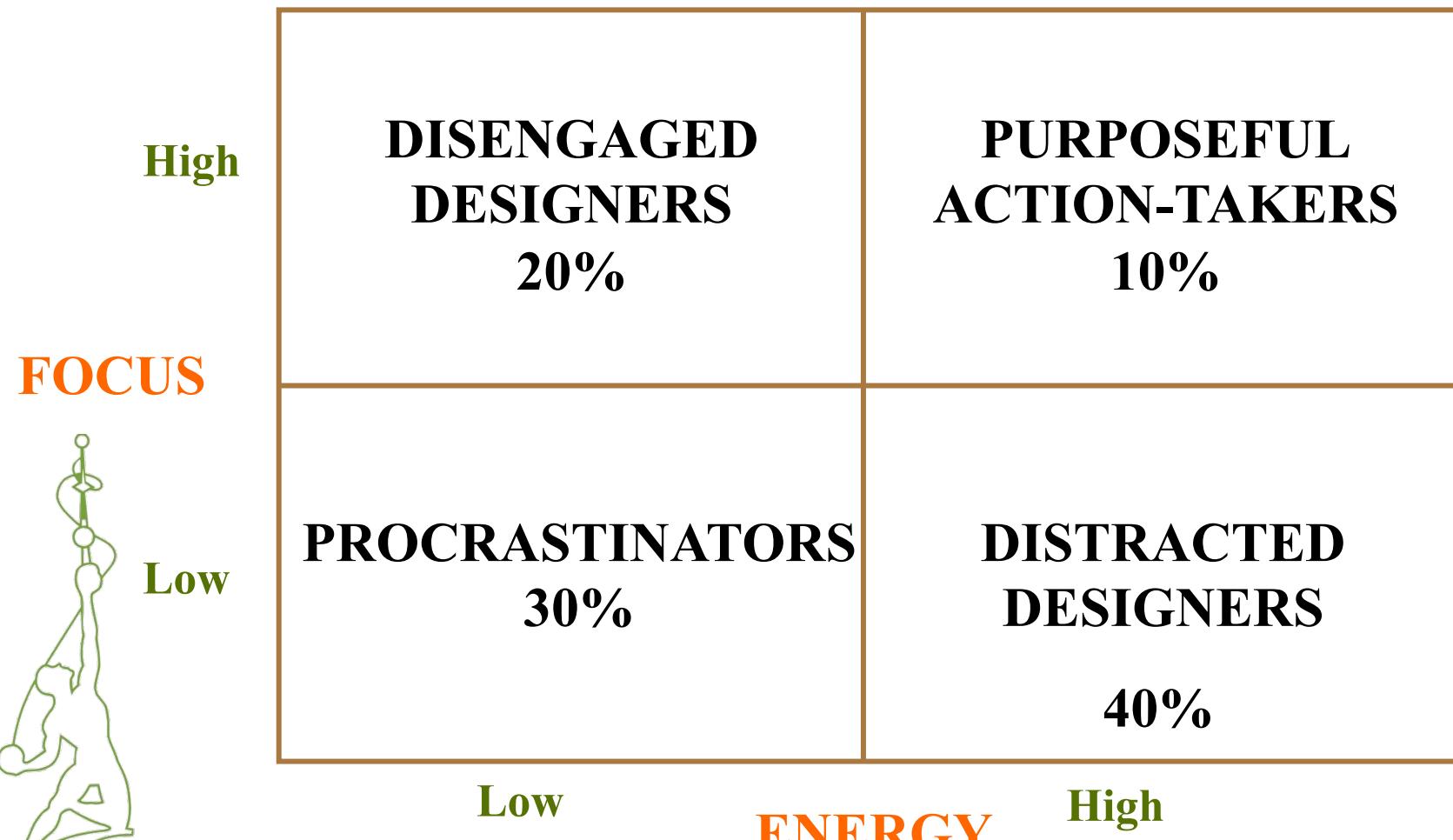


## Action-Taking

- Only 10% designers take purposeful action



# design engineers' behaviours



# the requirement for Focus



- **Vivid Mental Picture**
  - visualize the intention
  - visualize the process, including obstacles
  
- **Deep Personal Commitment**
  - The rational and the emotional must come together
  - Confront doubts, anxieties and conflicts



# the requirements for energy

---



- **Cognitive Attachment**
  - **Clear, ambitious goals**
  - **Self confidence**
  
- **Emotional Force**
  - **Positive task-related feelings**
  - **Absence of negative task related feelings**



# eight Lessons about



## Action-Taking

- Only 10% designers take purposeful action
- Busyness is the central hazard to purposeful action



# eight lessons about



## Action-Taking

- Only 10% designers take purposeful action
- Busyness is the central hazard to purposeful action
- Purposeful action requires active management of demands, constraints and choices



# the traps of Non-Action



Overwhelming  
Demands

Unexplored  
Choices

Insurmountable  
Constraints



# overcoming the trap of



## Overwhelming Demands

- Develop an explicit personal agenda
- Slow down: reduce, prioritize, organize demands
- Structure contact time
- Manage expectations
- Consciously build social networks



**overcoming the trap of**



## **Insurmountable Constraints**

- Map relevant constraints
- Be willing to accept trade-offs
- Selectively break rules
- Learn to tolerate conflicts and ambiguity



# overcoming the trap of



## Unexplored Choices

- Become aware of choices
- Expand the space for action
- Build personal knowledge and skills
- Learn to enjoy the freedom to act

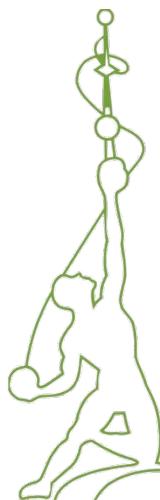


# eight Lessons about



## Action-Taking

- Only 10% designers take purposeful action
- Busyness is the central hazard to purposeful action
- Purposeful action requires active management of demands, constraints and choices
- Will power, not motivation, drives purposeful action



# The Two Worlds



**Outside-in**

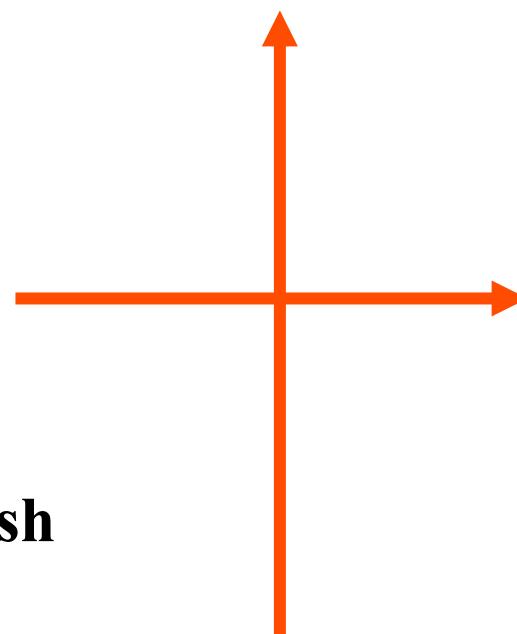
Motivation



**The world of wish**

**Inside out**

Volition



**The world of will**

**CROSSING THE RUBICON**

# eight Lessons about ....



- Only 10% designers take purposeful action
- Busyness is the central hazard to purposeful action
- Purposeful action requires active management of demands, constraints and choices
- Willpower, not motivation, drives purposeful action
- The foremost task of leaders is to engage their own willpower
- Willpower is not a personality trait
- Leadership can help people access their willpower
- Organizational energy drives collective action

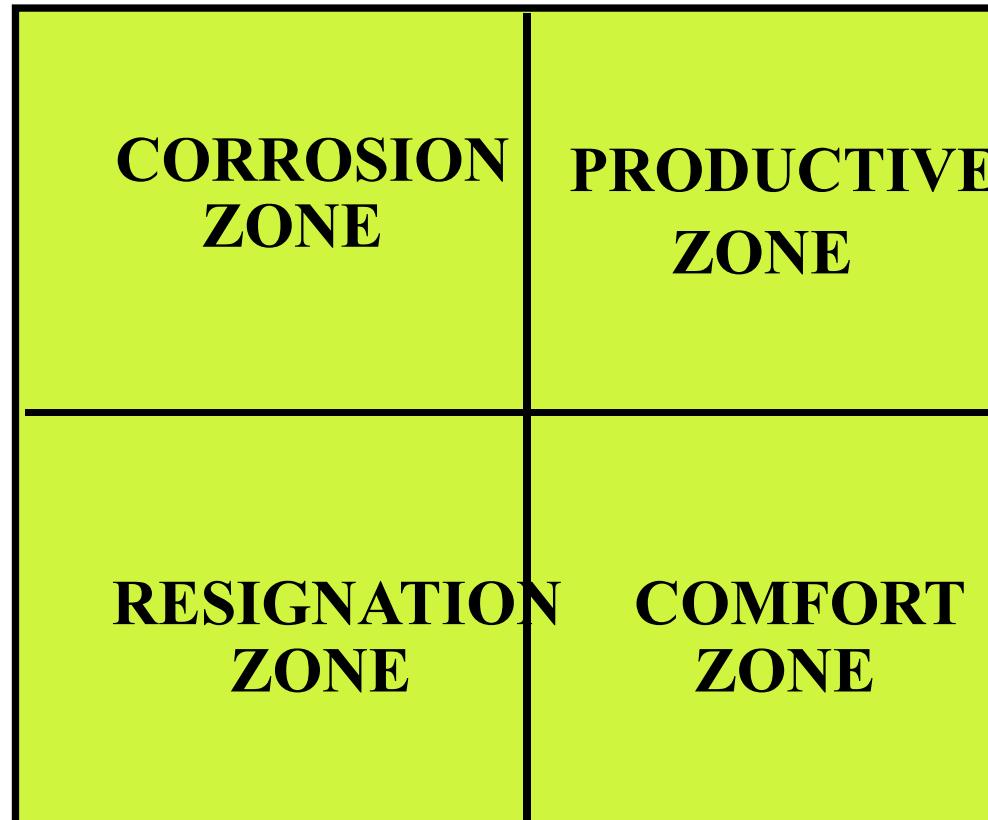


# marshalling organizational energy



## for Collective Action

*high*  
Intensity of  
Organizational  
Energy  
*low*

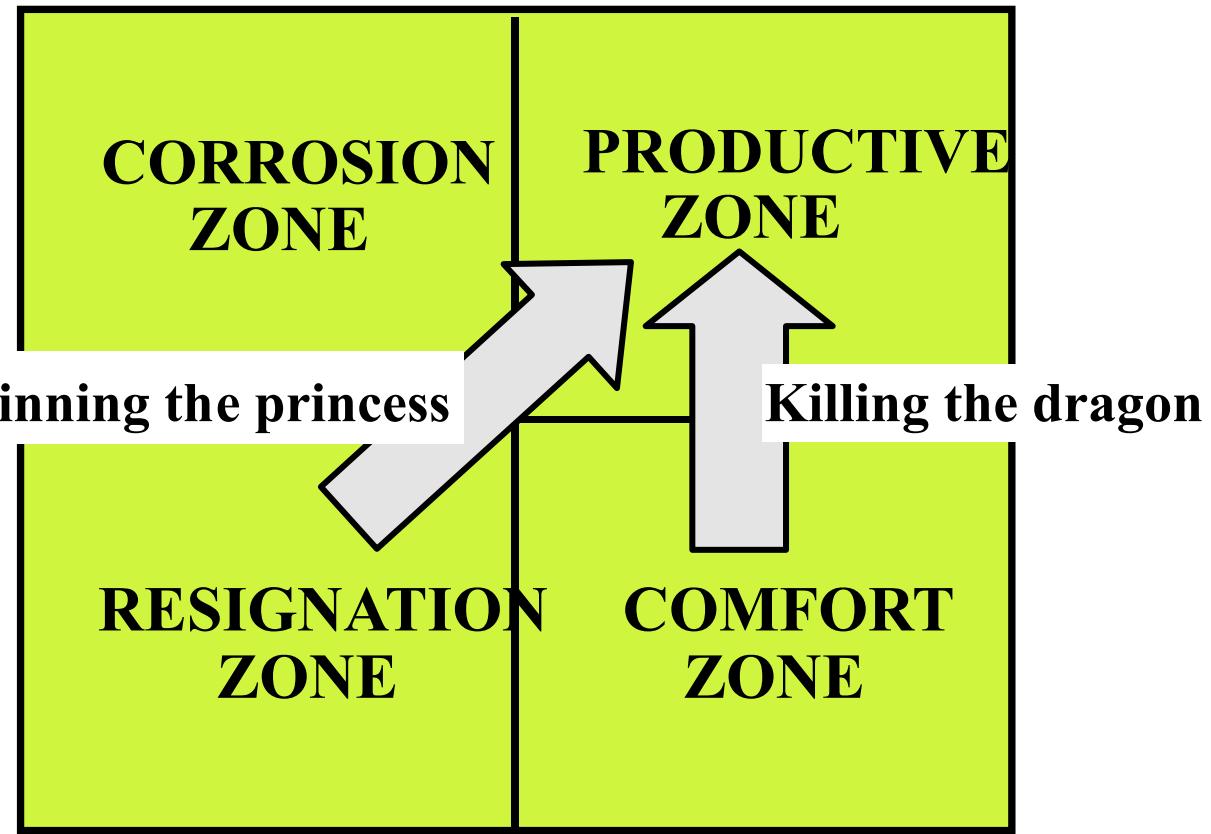


*Destructive      Constructive*  
Nature of Organizational Energy

# unleashing Organizational Energy



Intensity of  
Organizational  
Energy



*Destructive      Constructive*  
Nature of Organizational Energy

# Facilitating purposeful

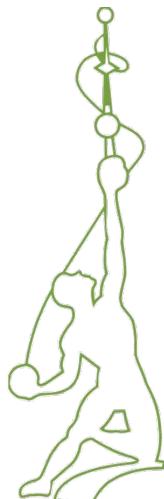
Action-taking

*If you want to build a ship,*

*don't drum up the men to go to the forest*

*to gather wood, saw it, and nail the planks together.*

*Instead, teach them the desire for the sea.*



Antoine de Saint-Exupéry

*the INDIAN imperative today...*



# Innovation led Design

# Design led Manufacturing



*For self reliance in electronics*

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*design is our religion*

*&*

*we are fanatically religious*



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# Another view of the near Future

