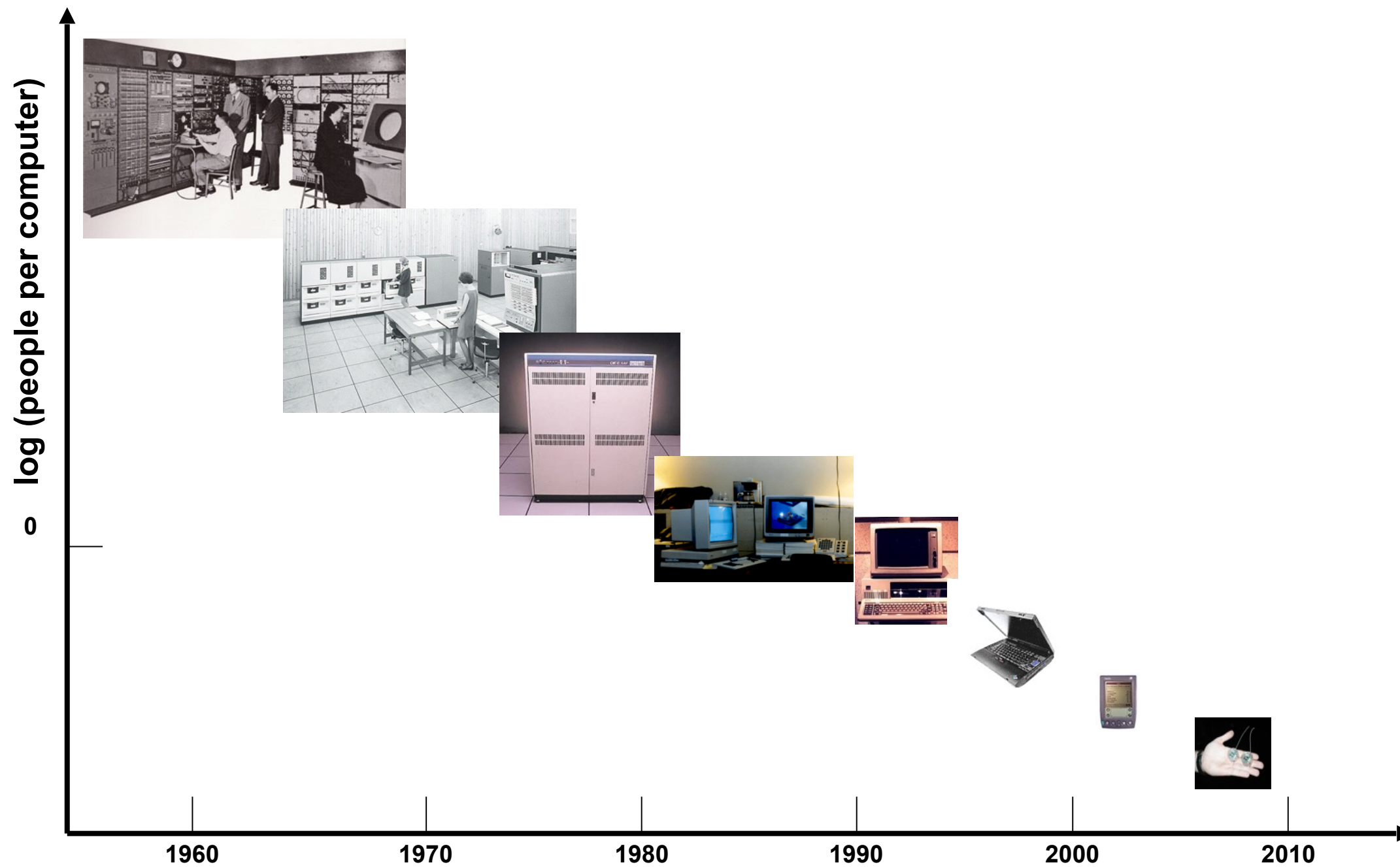




# Vision for IoT



[Culler:2004]

# IoT definition

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- **Wikipedia**: The Internet of Things (IoT) refers to **uniquely identifiable objects** and their virtual representations in an **Internet-like structure**.

[[http://en.wikipedia.org/wiki/Internet\\_of\\_things](http://en.wikipedia.org/wiki/Internet_of_things) - 21-Jun-2014]

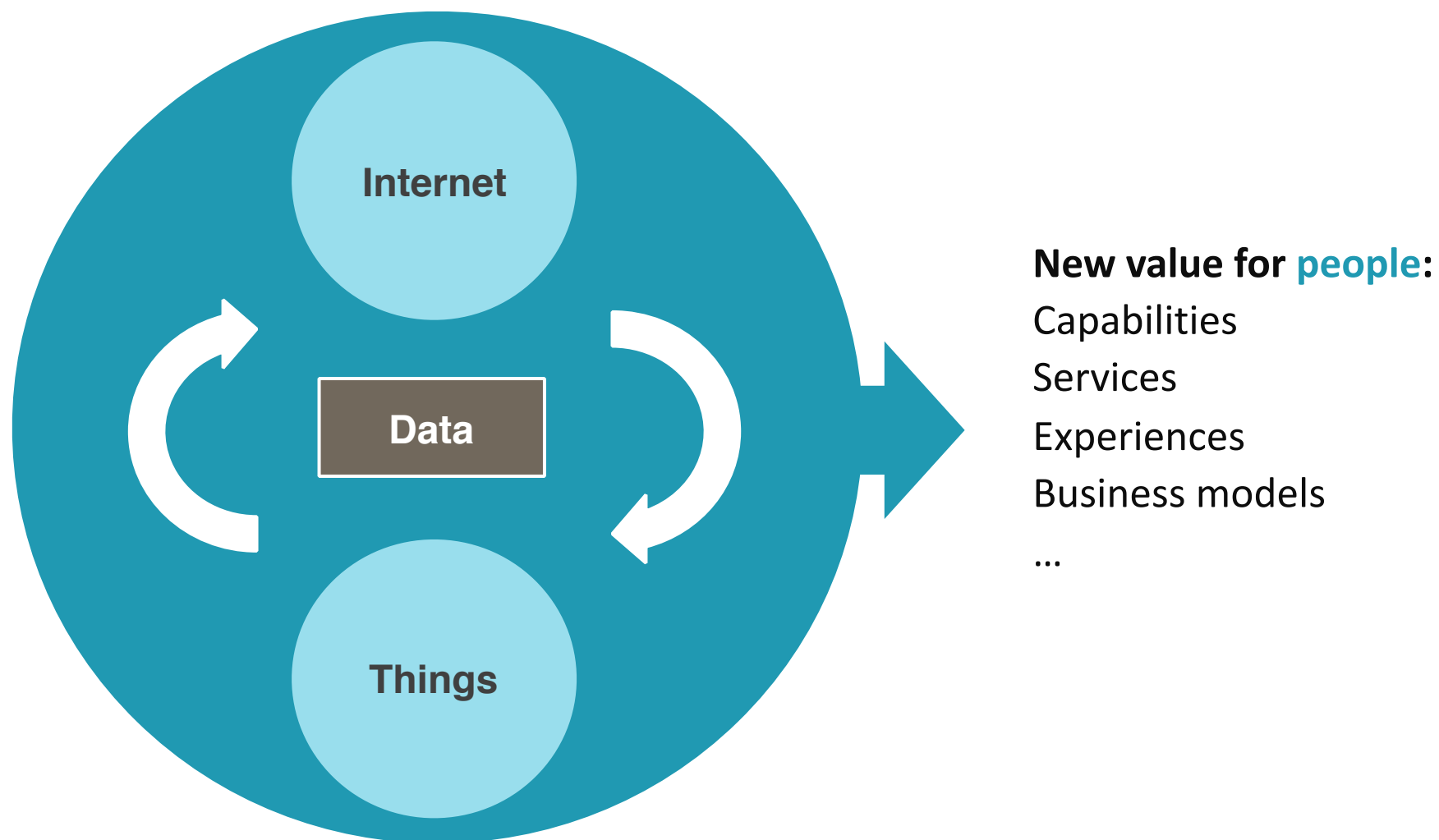
- **Cisco**: The Internet of Things (IoT) is the network of physical objects accessed through the Internet, as **defined by technology analysts and visionaries**. These objects contain **embedded technology to interact** with internal states or the external environment. In other words, when objects can sense and communicate, it changes how and where decisions are made, and who makes them.

[<http://www.cisco.com/web/solutions/trends/iot/overview.html> - 21-Jun-2014]

# What is IoT

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- The IoT is more than connecting things to the internet, it's about bridging the physical and digital worlds **to create value for people**



# What is IoT ?

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Internet + **Things** + Data

# Things

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These **nodes** are highly constrained in terms of

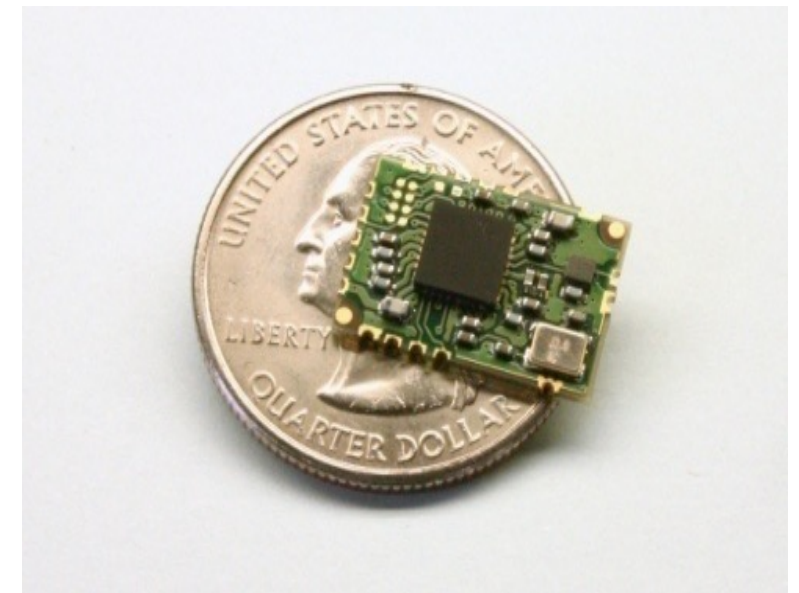
Physical size

CPU power

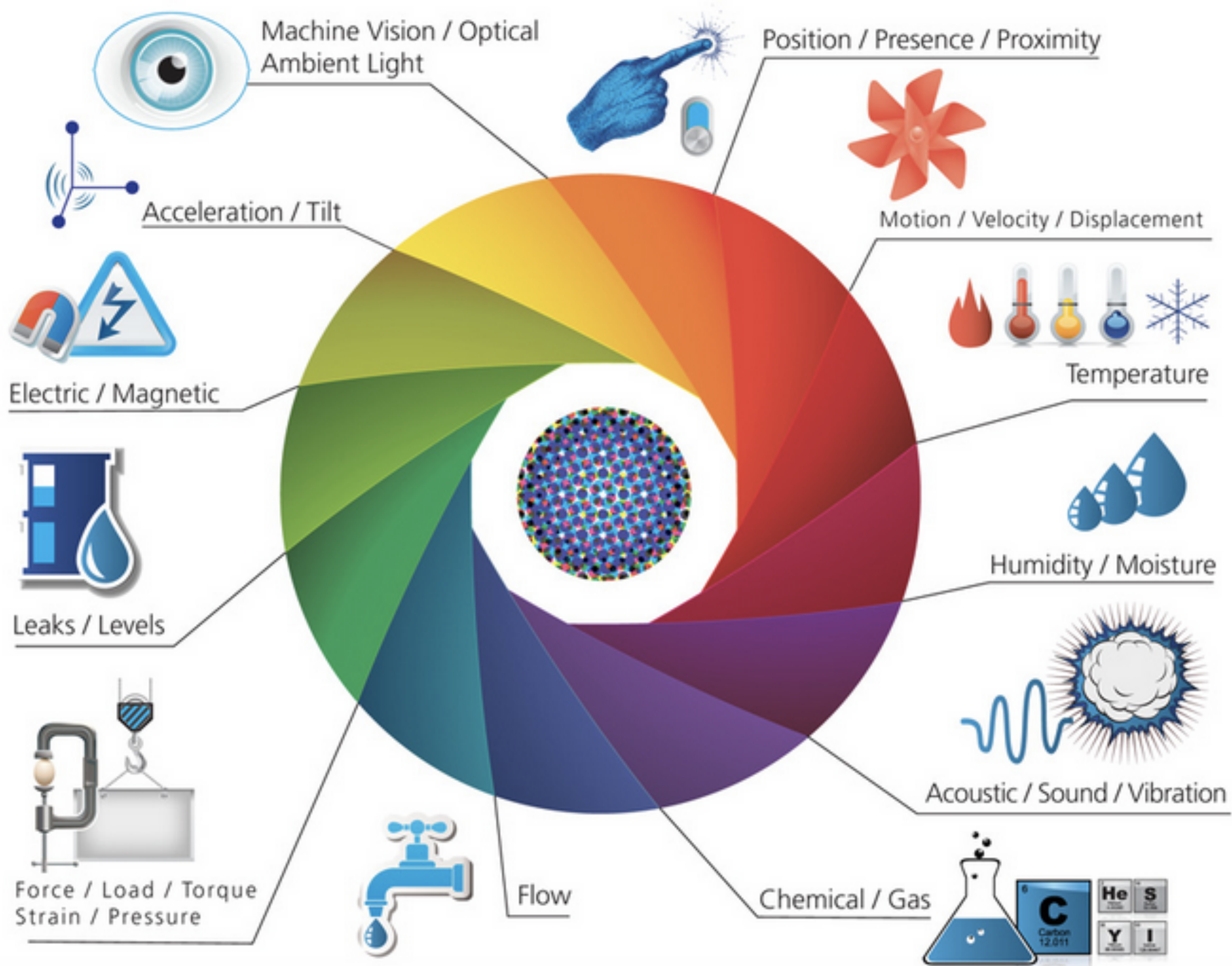
Memory (few tens of kilobytes)

Bandwidth (Maximum of 250 KB/s, lower rates the norm)

Power consumption is critical, if battery powered then energy efficiency is paramount





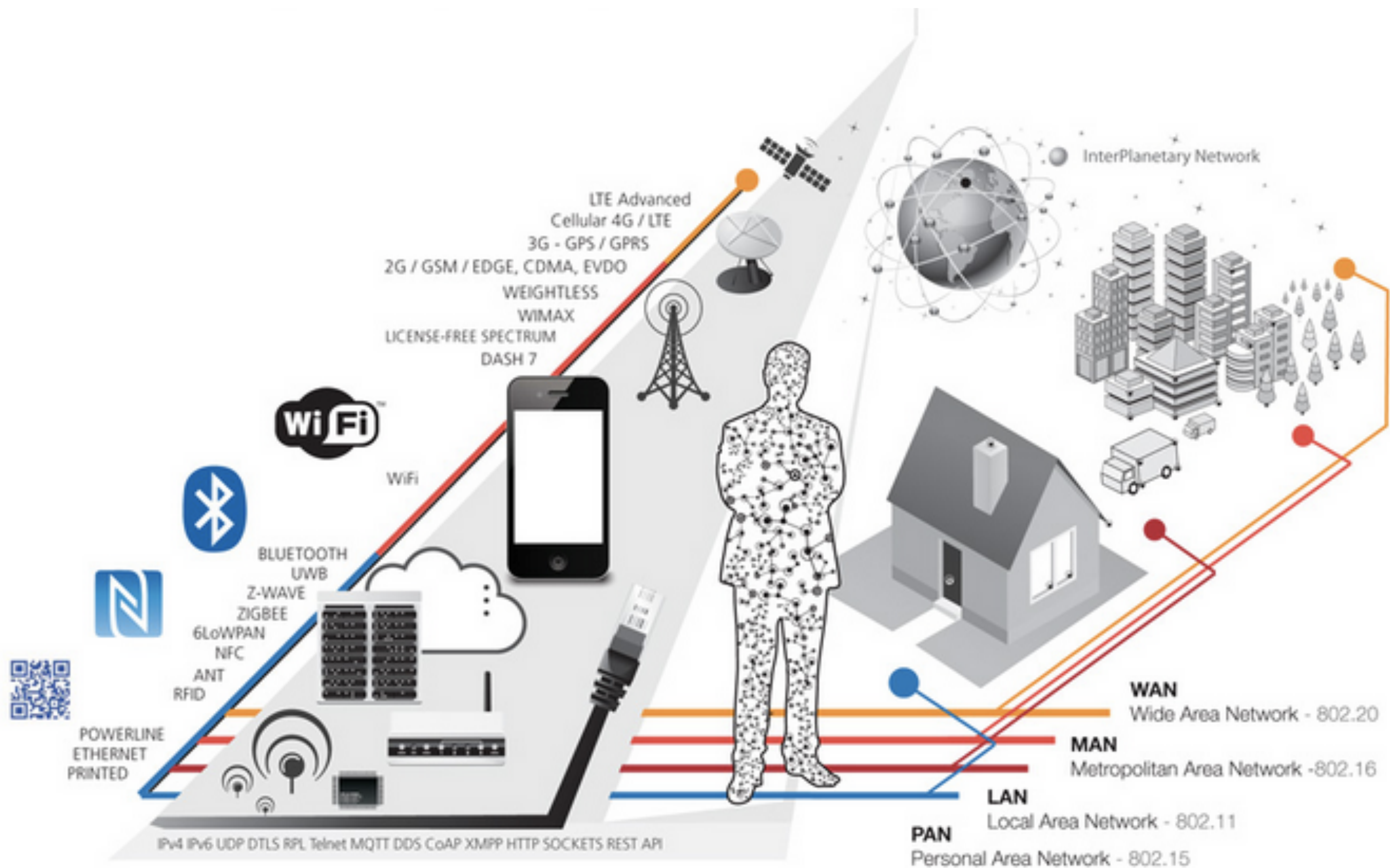


# What is IoT ?

---

**Internet** + Things + Data





# All Our Lightbulbs Will Have IP Addresses

By Adrian Covert on May 20, 2011 at 12:00 PM

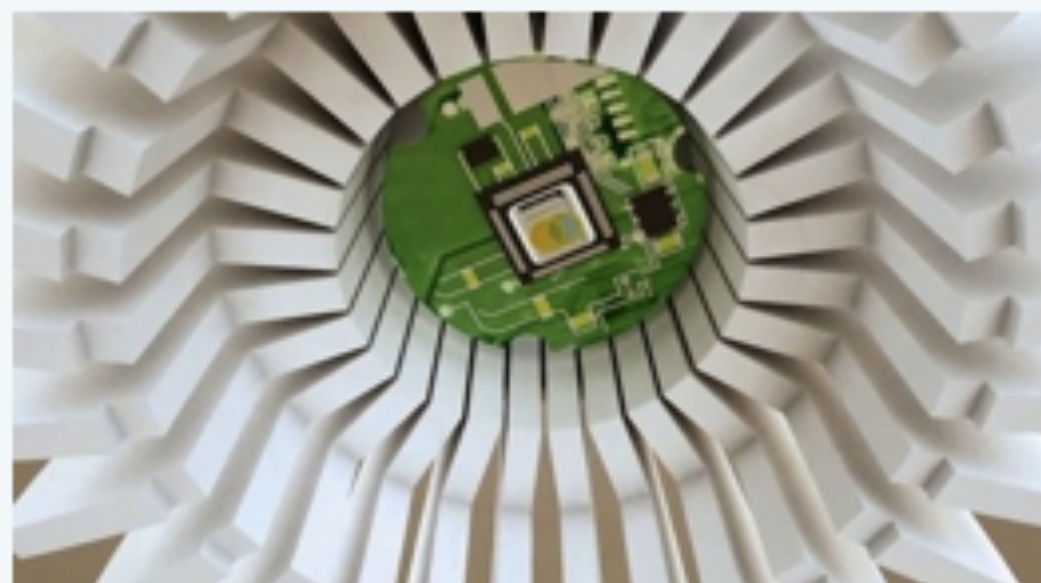
 Like

 Tweet

6

 +1

0



When we remarked that home automation technology was a reason **we needed IPv6 technology**, we weren't kidding. If Netherlands-based NXP has it their way, we'll all be using networked LED lightbulbs, each with their own IPv6 address.

According to Fast Company, this GreenChip technology operates on the 802.15.4 wireless protocol, which means it doesn't use the same bandwidth as 802.11 wi-fi gadgets. Cool.

But what do you do with networked bulbs? Automate your home, of course.

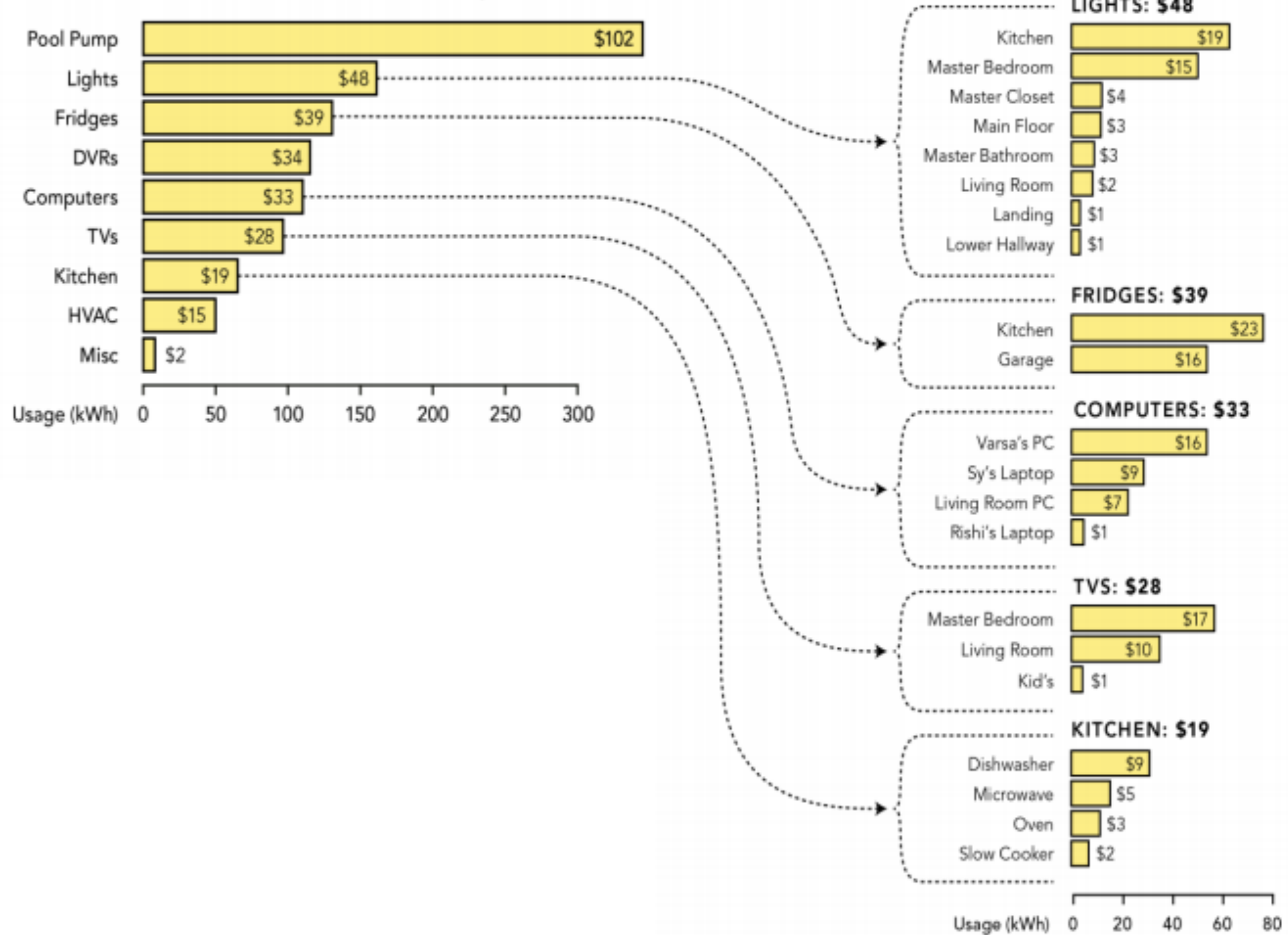
“ You'll also be able to control mood lighting “states” with a remote control, or via your iPad, as if you were a theatre lighting designer; you'll be able to quickly and easily incorporate movement sensing automated lighting, that could even turn on dimly if it detects you're stumbling to the bathroom at midnight; and you'll be able to download apps to hone and polish your home's lighting energy needs so that you end up with a smaller power bill.

# What is IoT ?

---

Internet + Things + **Data**

# ELECTRICITY: \$319





These **things** are starting to talk to each other and develop their own intelligence. Imagine a scenario where.....

This is communicated to your **alarm clock**, which allows you 5 extra minutes of sleep.



...your **meeting** was pushed back 45 minutes.



...your **car** knows it will need gas to make it to the train station. Fill-ups usually take 5 minutes.



...there was an accident on your **driving route** causing a 15 minute detour.



...your **train** is running 20 minutes behind schedule.



And signals your **car** to start in 5 minutes to melt the ice accumulated in overnight snow storms.



And signals your **coffee maker** to turn on 5 minutes late as well.

# What does that mean in size?

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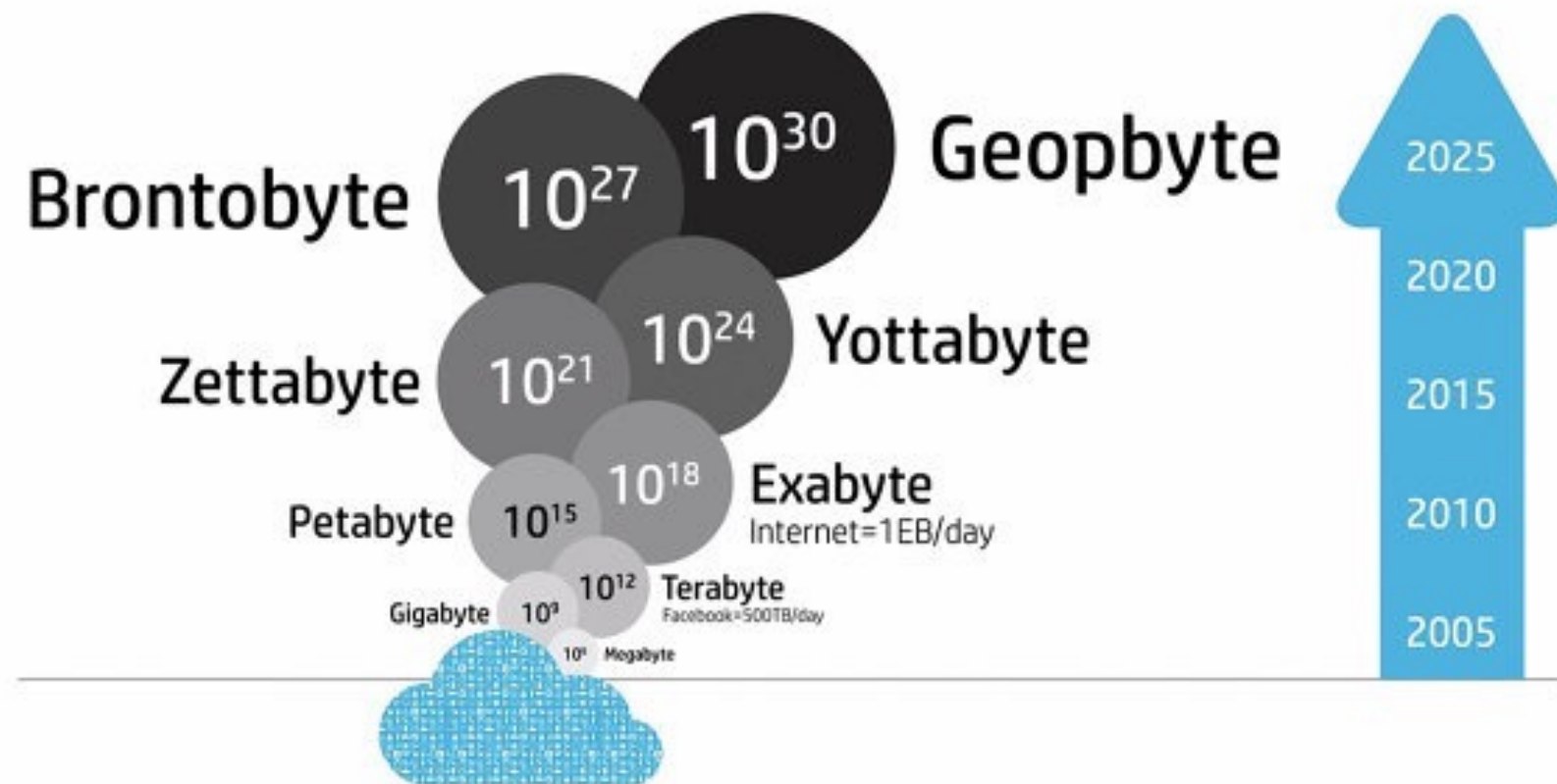
Not gigabytes

Most likely not a few terabytes

Possibly not 10's of terabytes

Probably 100's of terabytes

Definitely petabytes





# Impacts of IoT

- Economic impact
- Social impact
- Educational impact

# Economic impact

## BIG DATA

### IBM Scores Weather Data Deal and Starts Internet of Things Unit

By STEVE LOHR MARCH 31, 2015 12:01 AM 10 Comments

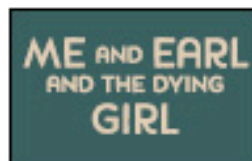
Email

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Tweet

Save

More



Analyzing weather data and energy consumption can **keep the lights on.** Energy and utility companies say weather causes

**70%** of power outages.\*

\*Source: Climate Central, April 10 2014, data from 2003-2012



[ibm.com/ibmandweather](http://ibm.com/ibmandweather)

IBM | The Weather Company

IBM announced a partnership with the Weather Company, whose data powers weather apps for Apple, Google, Microsoft and others.

Data partnerships are a key ingredient in IBM's long-term strategy, and the company is announcing a big one on Tuesday with the [Weather Company](#).

For IBM, the deal represents another close link with a leading data supplier for special access and joint development. Last fall, it forged a [similar arrangement with Twitter](#), the social network, whose tweets of 140 characters or fewer are a global wellspring of

# Economic impact

## Intel launches Internet of Vending Machines

M2M Alexander Sword 10:05, May 5 2015



Connected and 'intelligent' vending machines do more than you think.

Intel has built a vending gateway based on its Internet of Things ([IoT](#)) platform.

# Economic impact

**A developed Internet of Things in Kenya  
will enable a 25 percent economic growth**

Written by [Odipo Riaga](#) ✓



89  
SHARES



**ODIPO RIAGA**  
6 days ago

Posted: April 30,  
2015 at 8:50 pm

# Social impact

- Water quality
- Air quality
- Traffic monitoring
- .....



# Social impact





# Social impact



# Educational impact

- CS curriculum
- Hands-on at low cost
- Multidisciplinary
- Research papers

# Thanks!

**Marco Zennaro**  
**T/ICT4D Laboratory**  
**The Abdus Salam International Centre**  
**for Theoretical Physics**  
**Trieste-Italy**

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