

Advanced Internet Technology  
in the Interests of Society Laboratory



## **How the Internet of Things Works and Where is it Headed?**

Department of Engineering Science  
(EE Program)

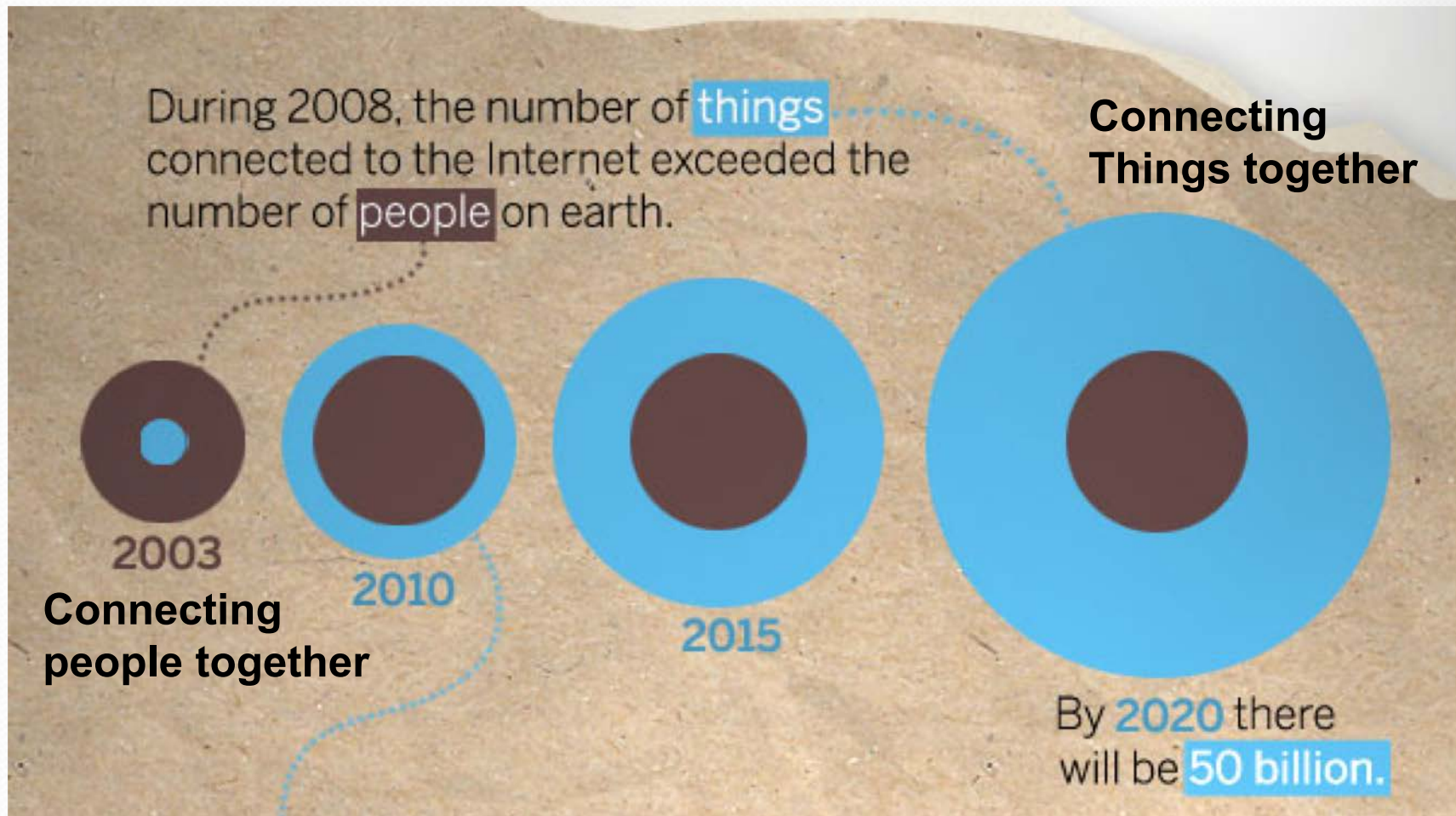
SSU Osher Lifelong Learning Institute Science Club,  
October 2019

# Outline

- How do we **define** the Internet-of-Things
- How the IoTs is **positioned** in the future
- IoT business opportunities & **Benefits** of IoT
- The **dark side** of IoT



# Changing Trends in Communications



Sources: Cisco IBSG, Jim Cicconi, AT&T, Steve Leibson, Computer History Museum, CNN, University of Michigan, Fraunhofer

Image Courtesy: : CISCO

# Today's Communication Systems: Connecting Machines Together



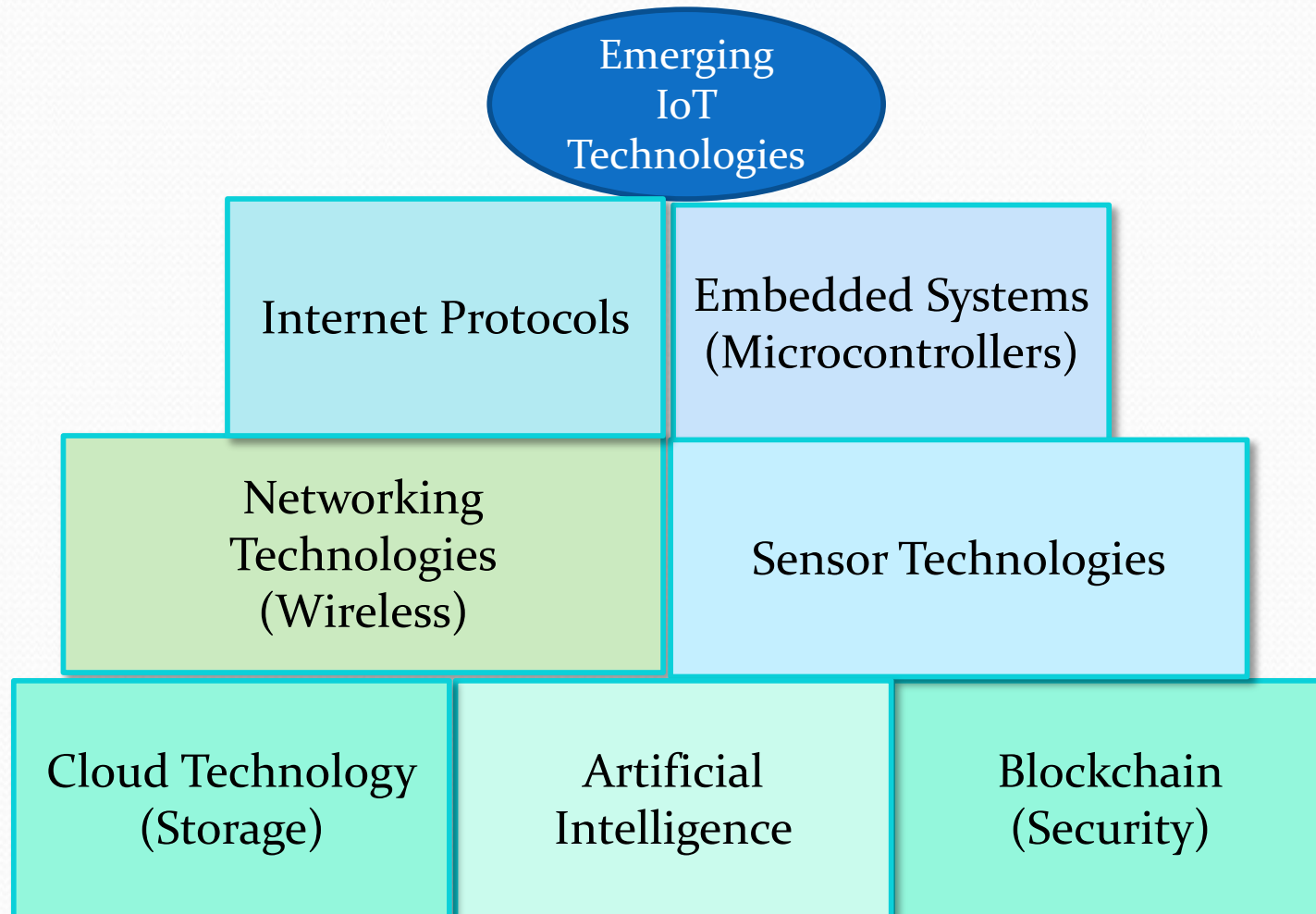
Human-to-Things Communications!



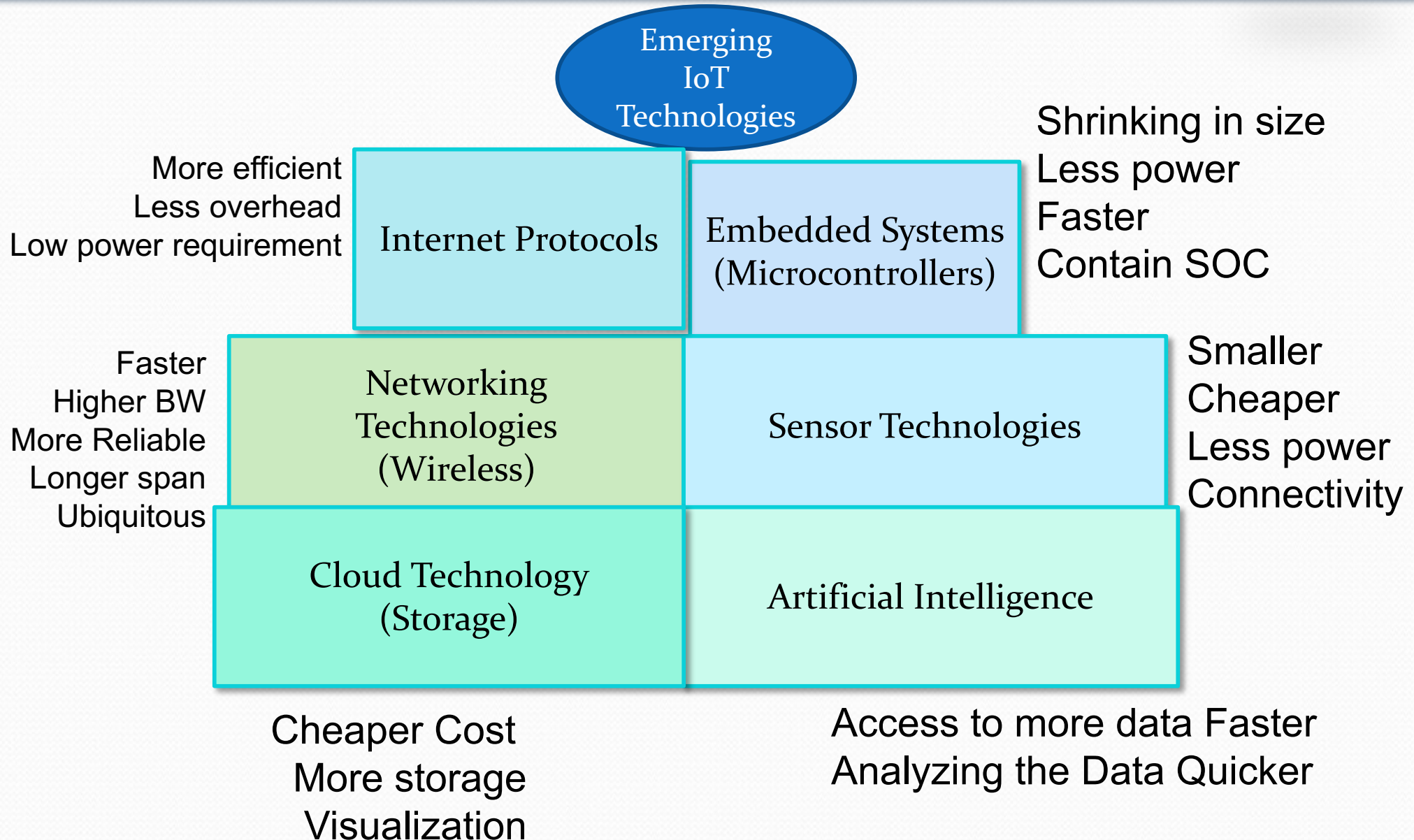
Things-To-Things Communications

Any **TIME**, Any **PLACE** + Any **DEVICE**

# New Enabling Technologies in Digital Society



# New Enabling Technologies in Digital Society



# Internet-of-Things (IoT) – A Definition

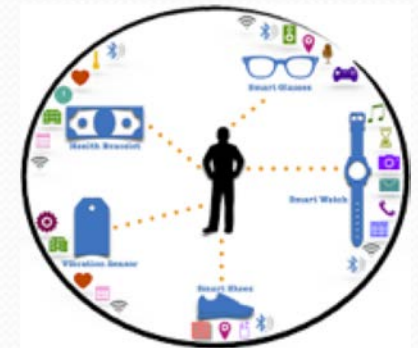
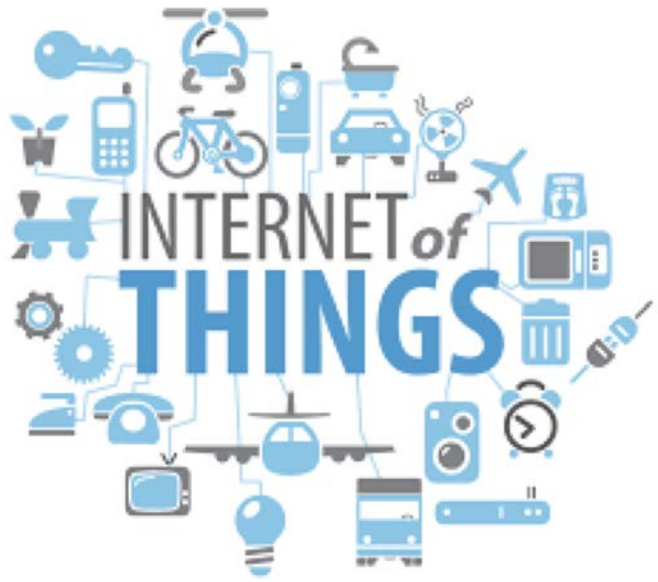


The set of  
**technologies and solutions**  
that enable integration of  
**real world data and**  
**services**  
into the existing  
**information networking**  
**technologies**



**IoT** is an evolution of the Machine to Machine (M2M) market.

# What Exactly Is IoT?





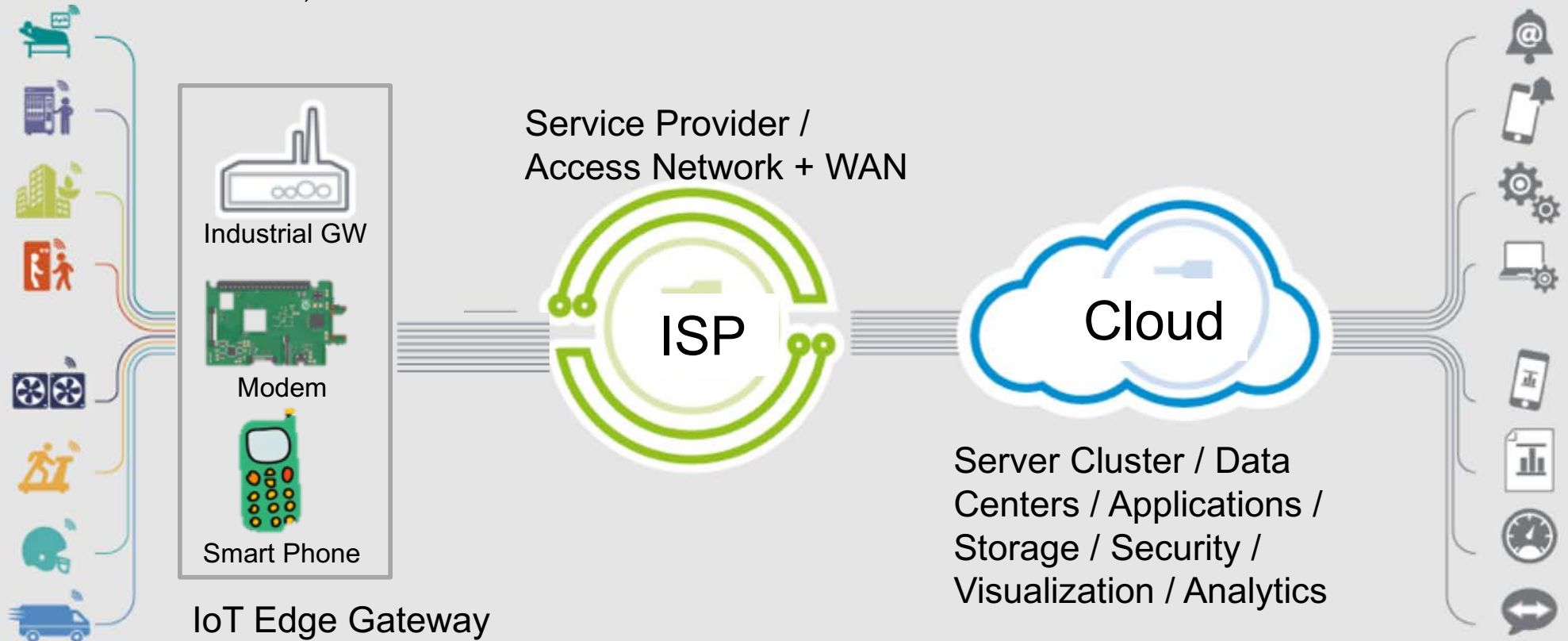
# What is IoT?




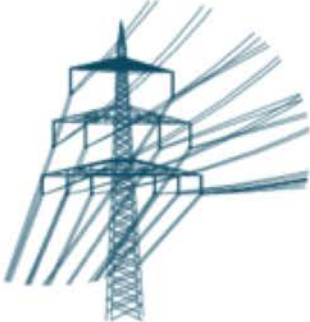






# The IoT Eco-System – High-Level Architecture

**IoT Field Devices/  
Connected Things /  
Sensors & Actuators  
(Industrial/Home/Wearable)**

**Connected devices  
connecting  
Remote Users**



# Most Common Applications of IoT Over the Past Decade

<p>Transport &amp; Logistics</p>  <p>Fleet management, Goods tracking</p>	<p>Utilities</p>  <p>Smart metering, Smart grid management</p>	<p>Smart cities</p>  <p>Parking sensors, Waste management, etc.</p>	<p>Smart building</p>  <p>Smoke detector, Home automation</p>
<p>Consumers</p>  <p>Wearables Kids/senior tracker</p>	<p>Industrial</p>  <p>Process monitoring &amp; control, Maintenance monitoring</p>	<p>Environment</p>  <p>Food monitoring/alerts, Environmental monitoring</p>	<p>Agriculture</p>  <p>Climate/agriculture monitoring, Livestock tracking</p>

# Most Common Applications of IoT Over the Past Decade

Transport &  
Logistics



Utilities



Smart cities



Smart building



Video.....

[https://www.youtube.com/watch?time\\_continue=149&v=NjYTzvAVozo](https://www.youtube.com/watch?time_continue=149&v=NjYTzvAVozo)



Wearables  
Kids/senior tracker



Process monitoring &  
control,  
Maintenance monitoring



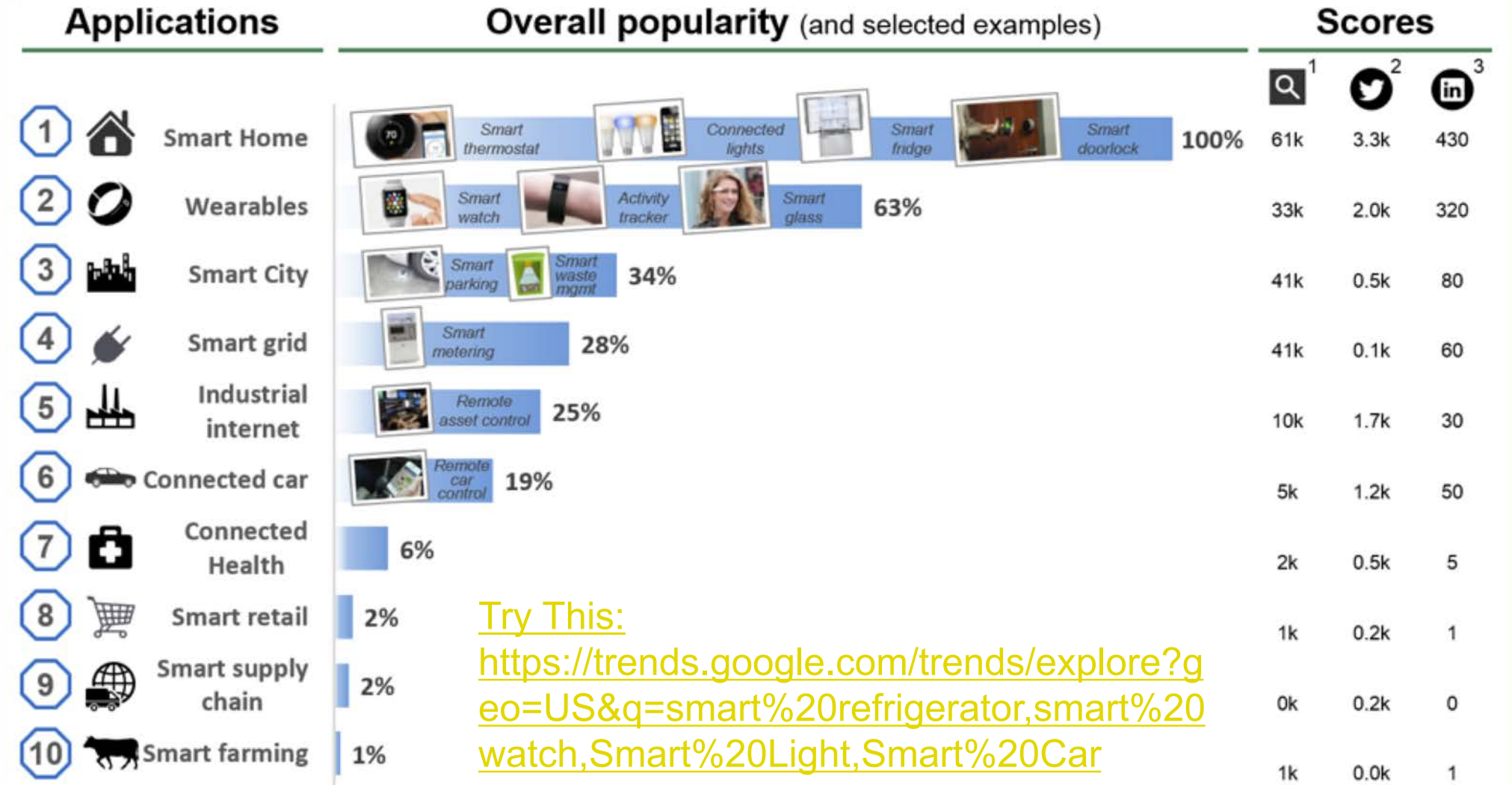
Food monitoring/alerts,  
Environmental monitoring



Climate/agriculture  
monitoring,  
Livestock tracking

# IoT Applications

IoT Analytics – Quantifying the connected world



Try This:  
<https://trends.google.com/trends/explore?geo=US&q=smart%20refrigerator,smart%20watch,Smart%20Light,Smart%20Car>

1. Monthly worldwide Google searches for the application 2. Monthly Tweets containing the application name and #IOT 3. Monthly LinkedIn Posts that include the application name. All metrics valid for Q4/2014.

Sources: Google, Twitter, LinkedIn, IoT Analytics

## Trends in IoT industry

Gathering information about everything everyone does: houses, transport, medicine, education and many other things



IoT and  
Machine Learning



IoT and Blockchains

IoT and Big Data

## Trends in IoT industry



IoT and Big Data

Machine learning is needed to make better predictions about the outcome of different situations.

IoT and Machine Learning



IoT and Blockchains

## Trends in IoT industry



IoT and Big Data



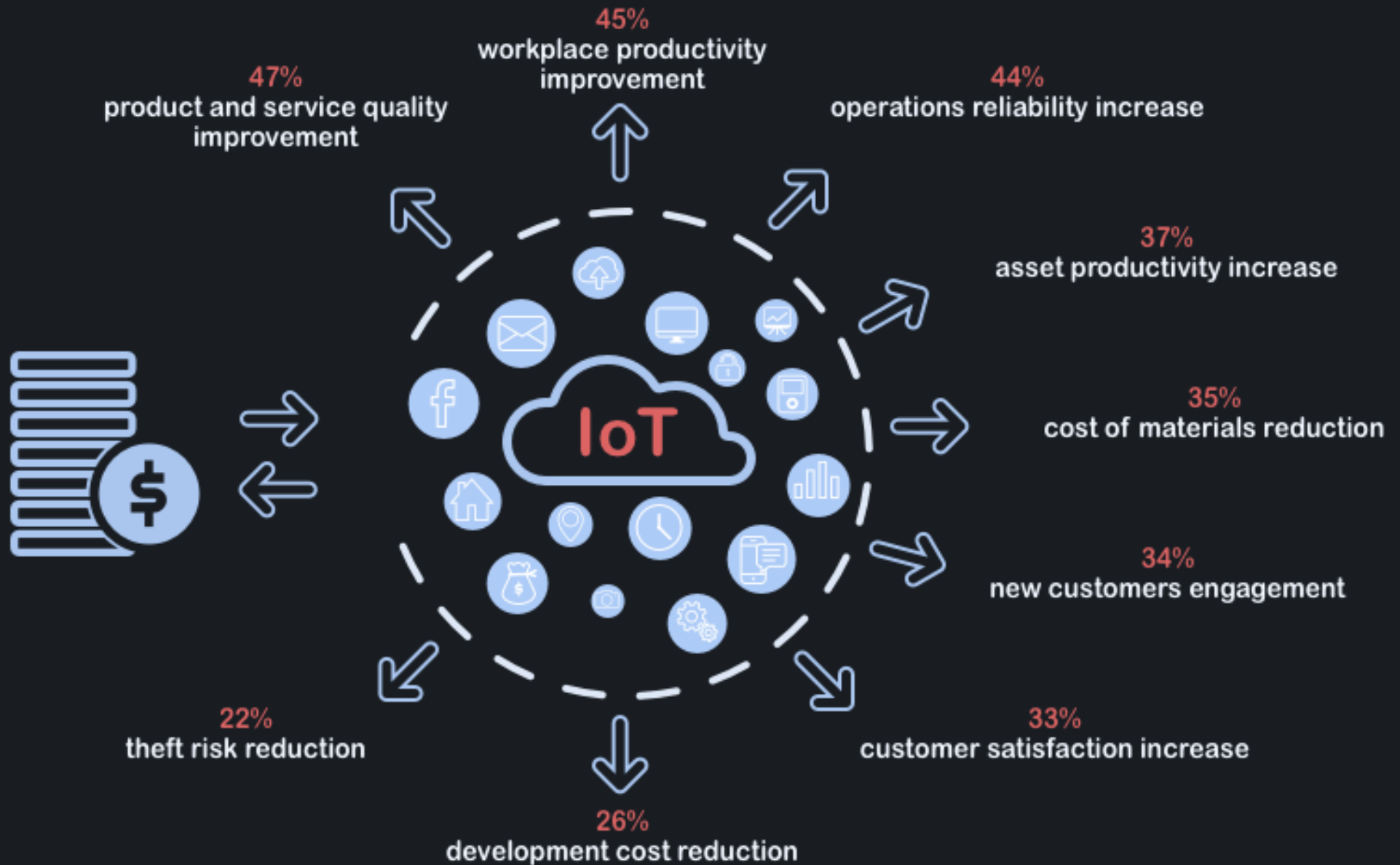
IoT and  
Machine Learning

The IoT approach is new and old security technologies cannot be applied. Some say the answer is Blockchain. This method is secure, transparent and efficient.

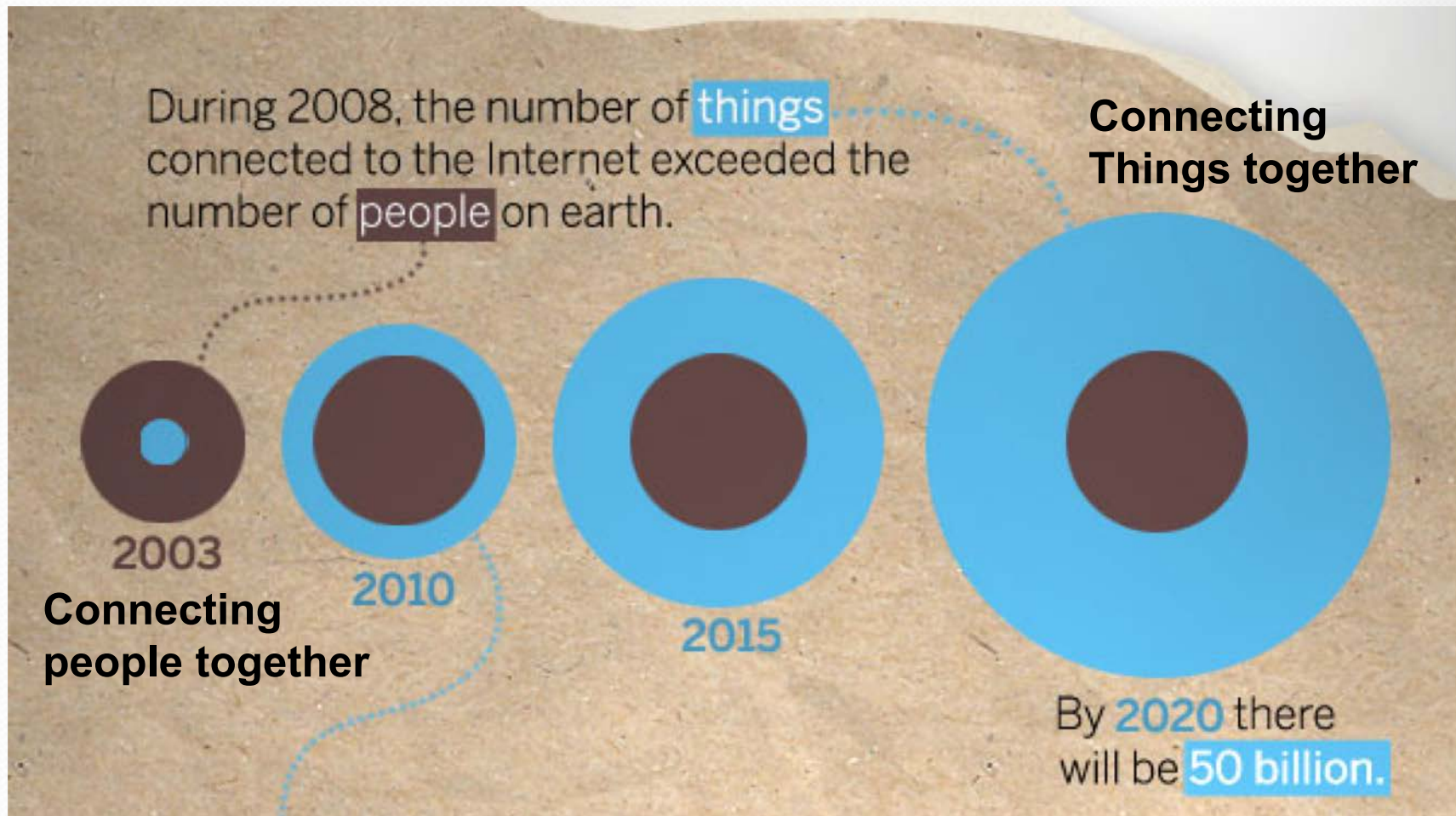
IoT and Blockchains



# IoT Trends in 2019 – IoT Benefits!



# It is all about connectivity.....



Sources: Cisco IBSG, Jim Cicconi, AT&T, Steve Leibson, Computer History Museum, CNN, University of Michigan, Fraunhofer

Image Courtesy: : CISCO

# Power of Data A True Story.....

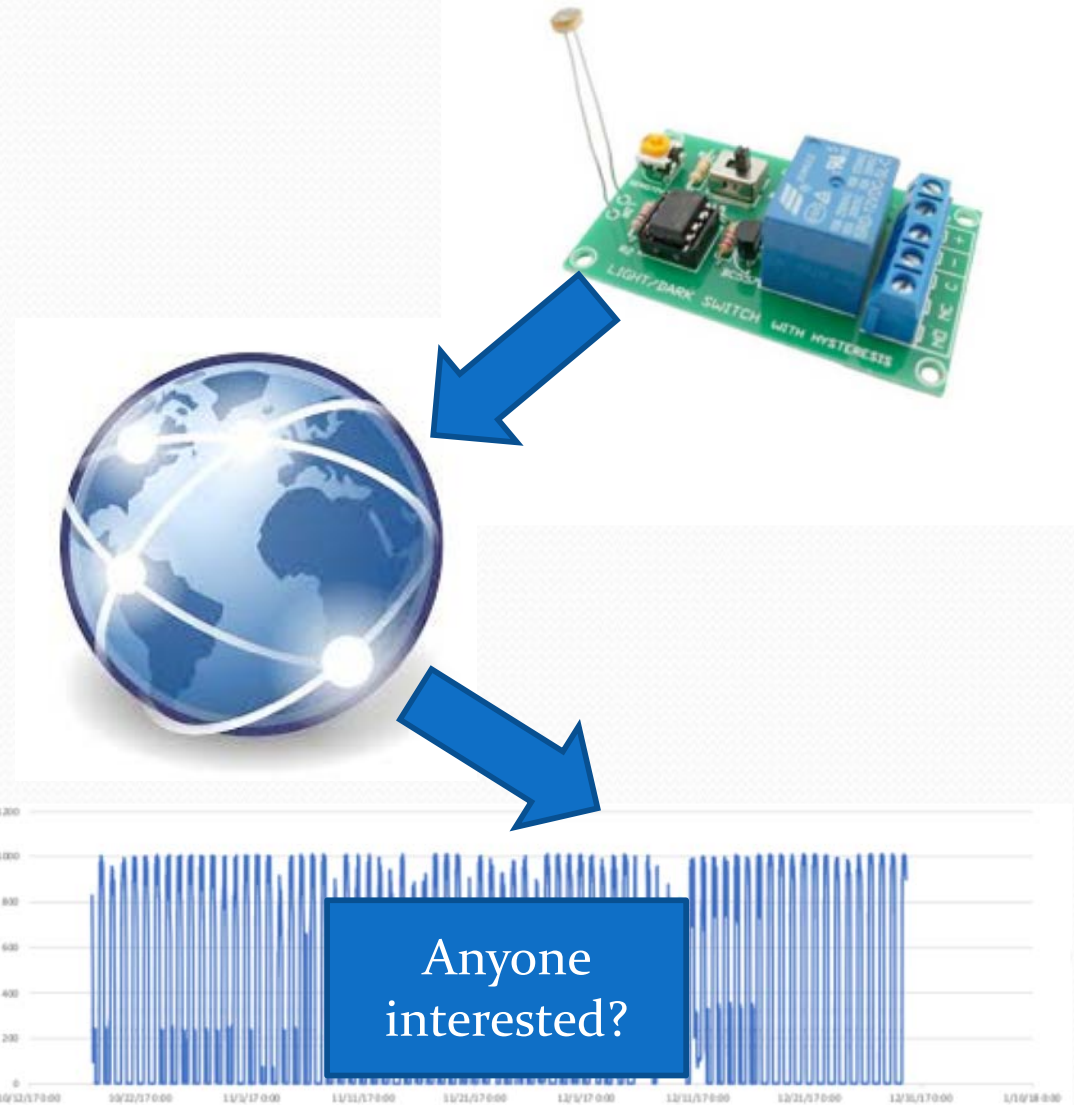


# My Brother

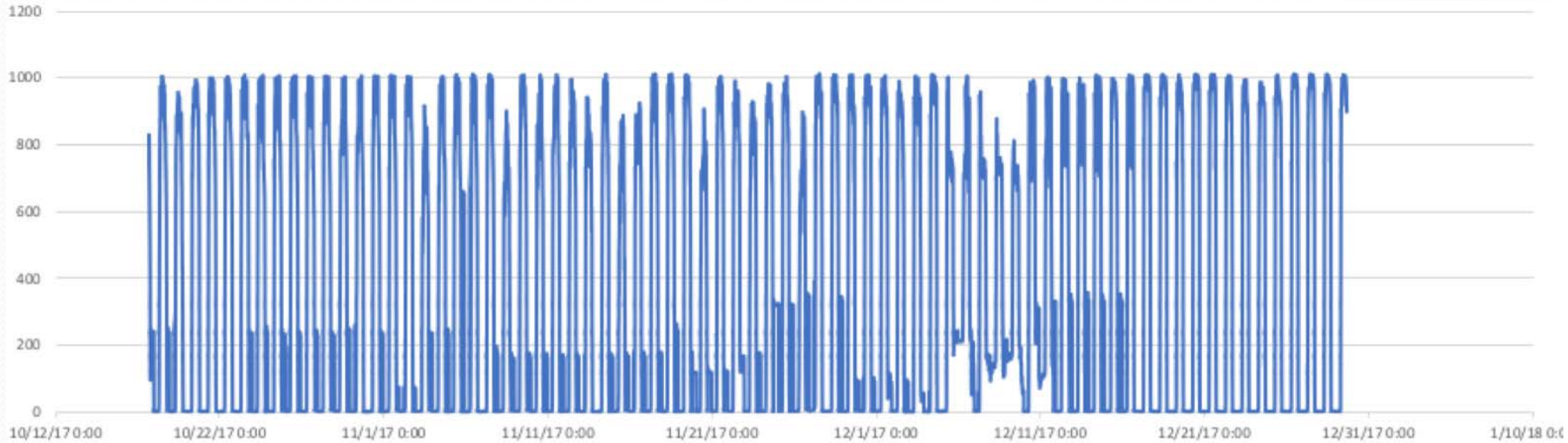
Physician, Lives alone in a small Apt. in Dallas TX



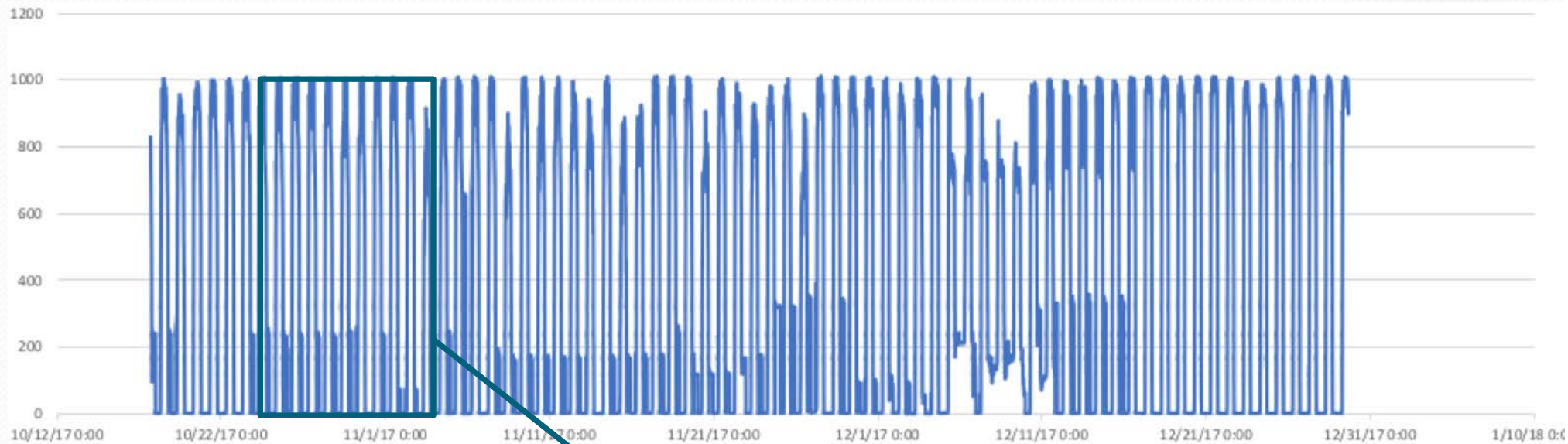
## My Light Sensor



# Light Detector Results – My Big Data

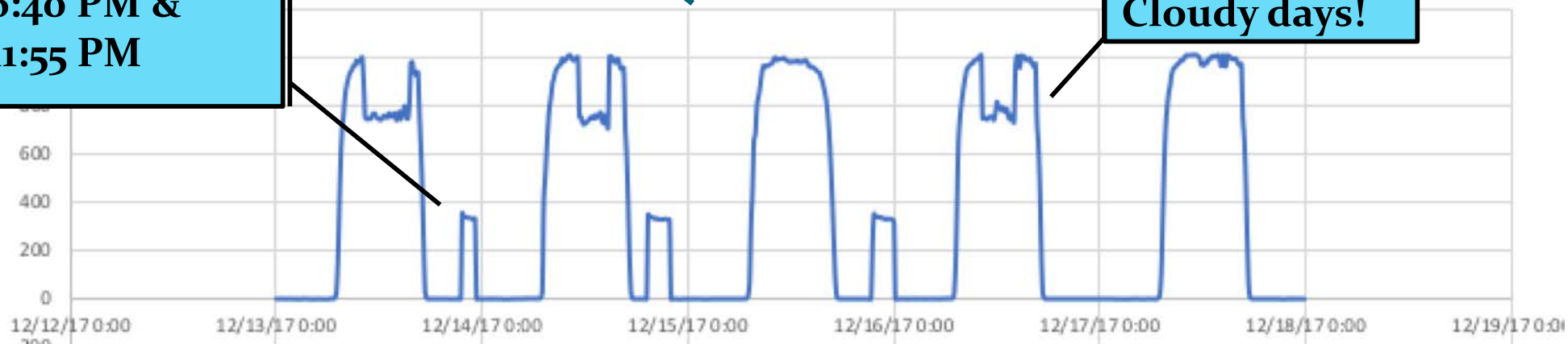


# Light Detector Results

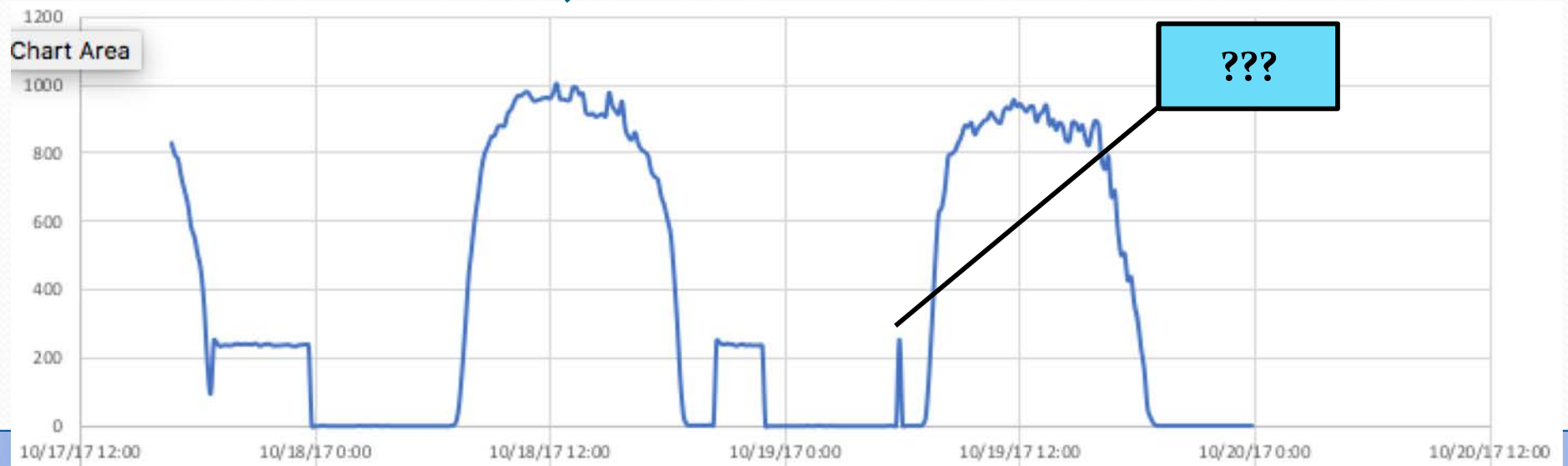


6:40 PM &  
11:55 PM

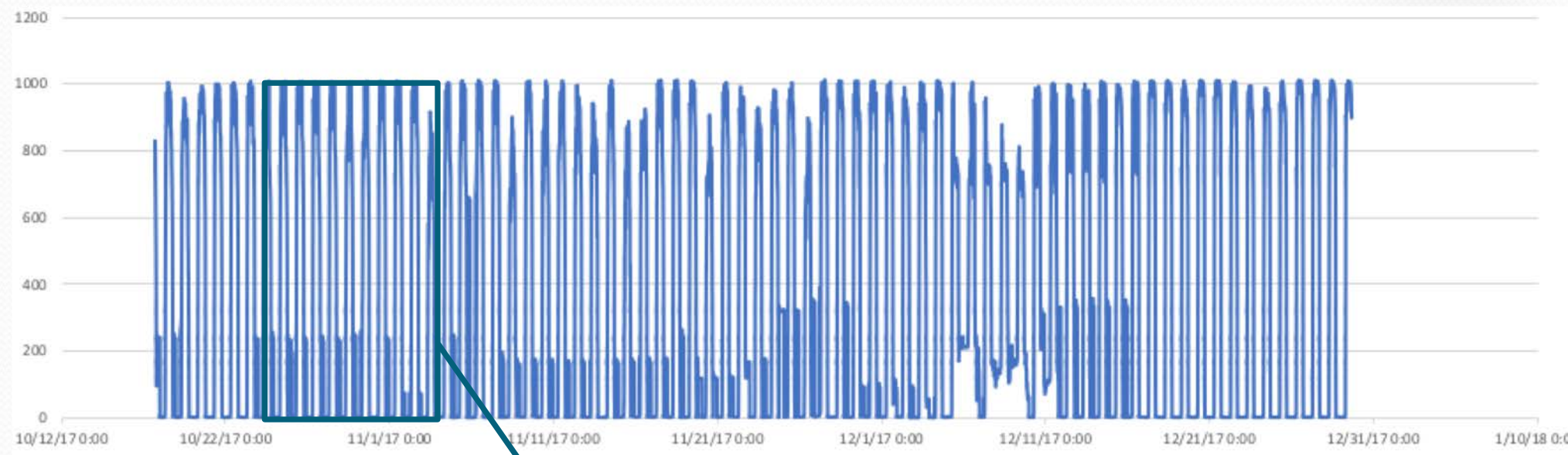
Sunrise;  
Sunset;  
Cloudy days!



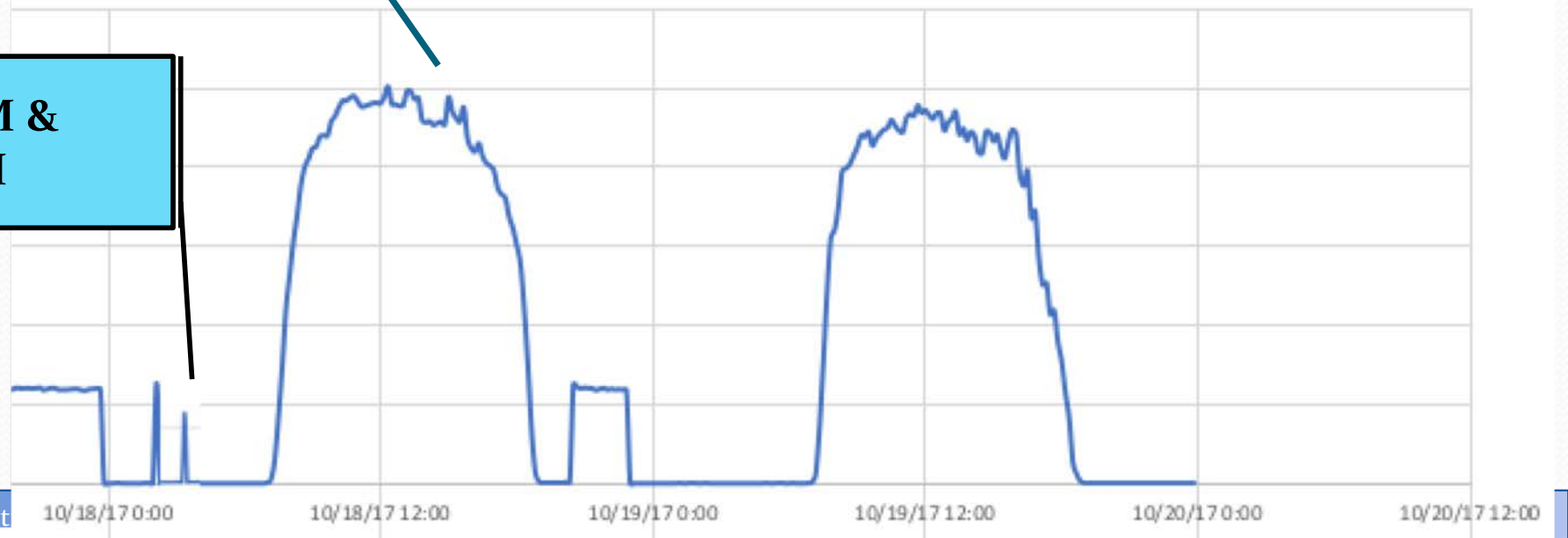
# Light Detector Results



# Light Detector Results

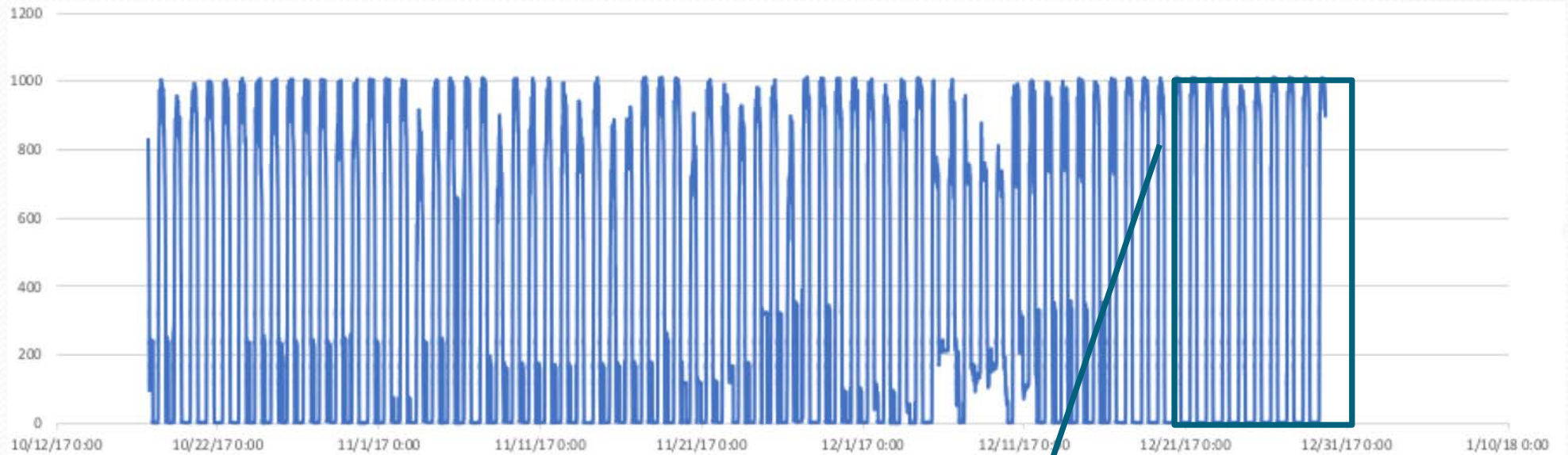


**3:40 AM &  
3:55 AM**

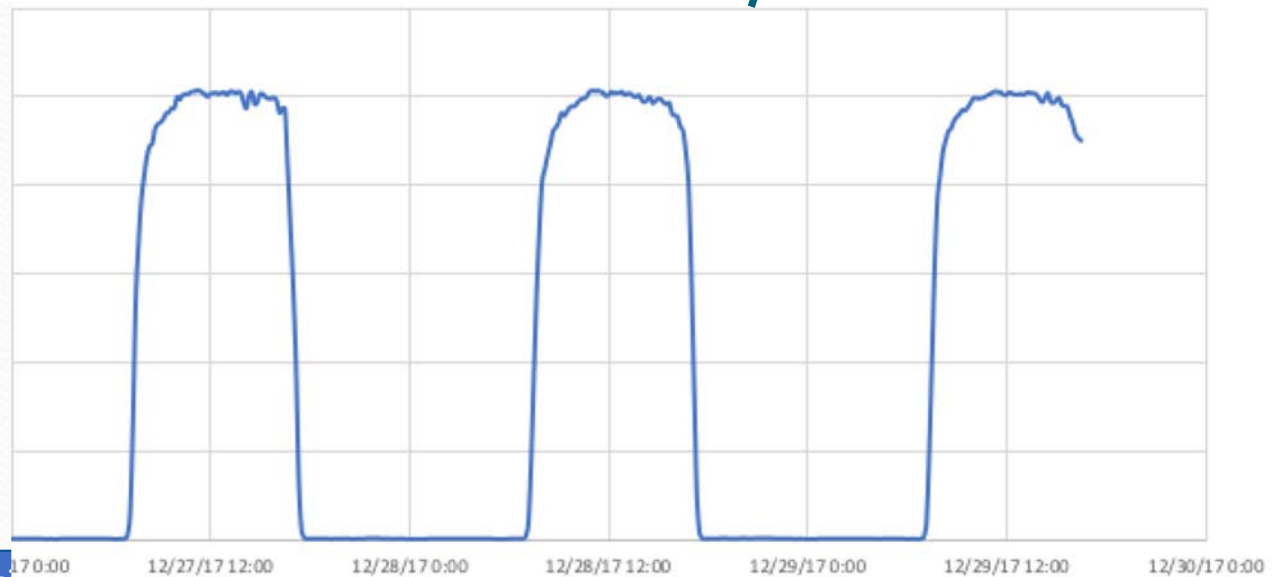




# Light Detector – Last Thanksgiving!



Last Year A Week  
After  
Thanksgiving!



# Light Detector Results

## What we can tell:

When he usually gets up  
When he usually sleeps  
When he usually comes home  
Is he alone or not

...

If he has overactive bladder at night

....

When do we expect him to be home!



## Azo Bladder Control - 54 Capsules

 **\$31.58** from 50+ stores

★★★★★ 248 product reviews

Dietary Supplement. Go less. Worry less. Help

Azo · Sleep Support · Supplements · Capsule ·

Other options: 72 Capsules (\$16)

# IoT Benefits Can Come With a Dark Side.....



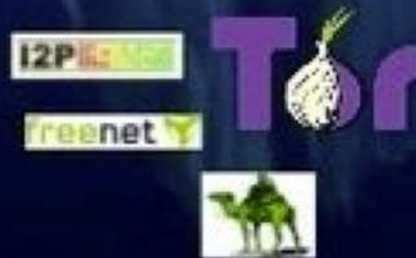
## Surface Web

<10% of Internet  
- Indexed Internet

Government,  
Private  
networks,  
Research, etc.

## Deep Web

>90% of Internet  
- Unindexed Internet



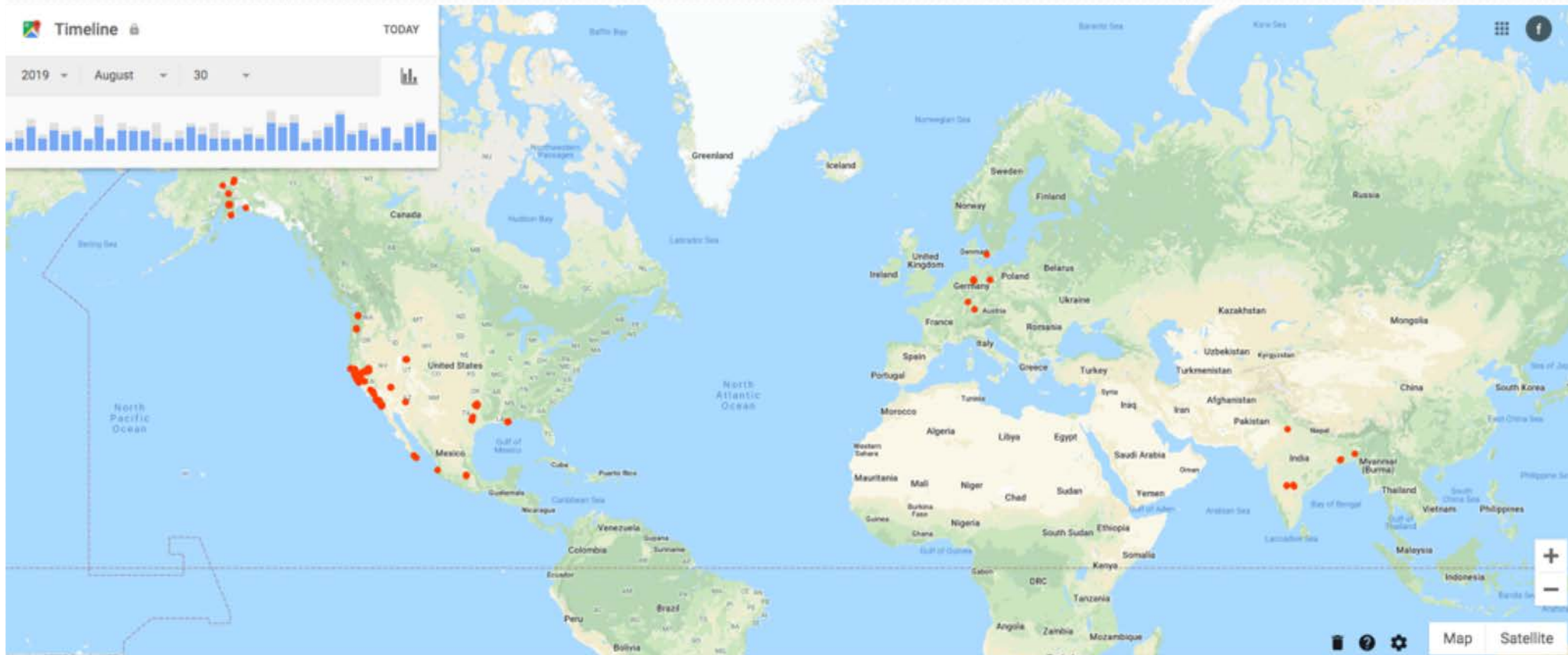
## Dark Web (Darknet)

- Subset of Deep Web  
- Hidden Services

- Security – is your device secure?
  - Identity theft & loss of properties
- Ownership – who owns the data?
  - Manipulation and control
- Software Transparency – what are the policies?
  - Privacy issues

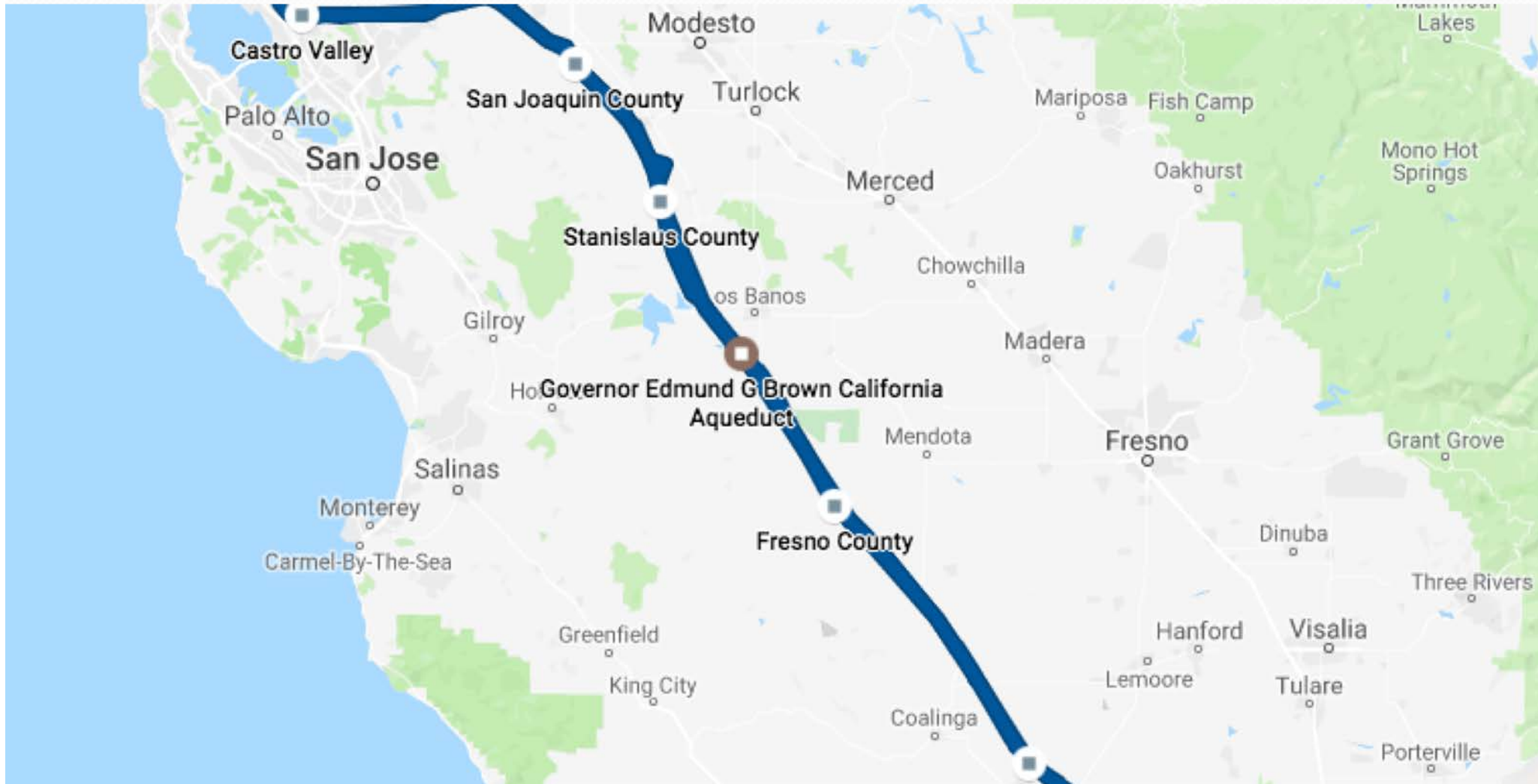


## What does your phone know about you?



<https://www.google.com/maps/timeline?pb>

# Google Timeline



<https://www.google.com/maps/timeline?pb=!1m2!1m1!1s2019-05-10>

## Google to face mass action over claims it accessed 4 MILLION iPhone users' data

Published time: 2 Oct, 2019 14:11

Edited time: 3 Oct, 2019 07:16

[Get short URL](#)



<https://www.rt.com/news/470058-google-iphone-privacy-data-legal/>

Interested to learn more?  
Take this course.....

# OLLI WINTER 2020 COURSE: The Good & Evil of the Internet and Why You Should Know About Them





## HOW DOES **BLOCKCHAIN** WORK



1 A wants to send money to B

2 The transaction is represented online as a block

3 The block is broadcasted to every party in the network



4 The network approves the transaction

5 The block is added to the existing blockchain in a transparent and unalterable way

6 The transaction is complete

