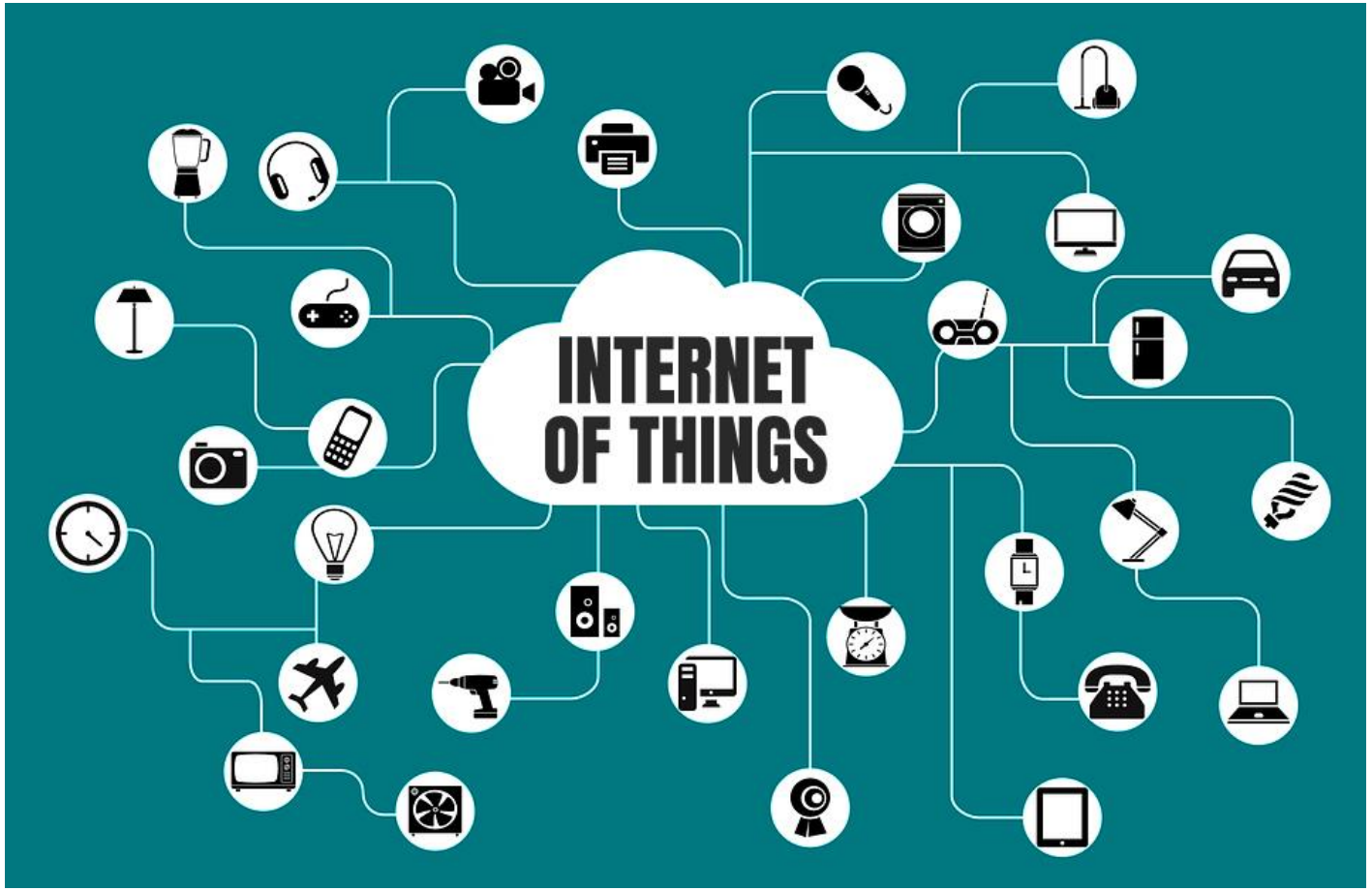
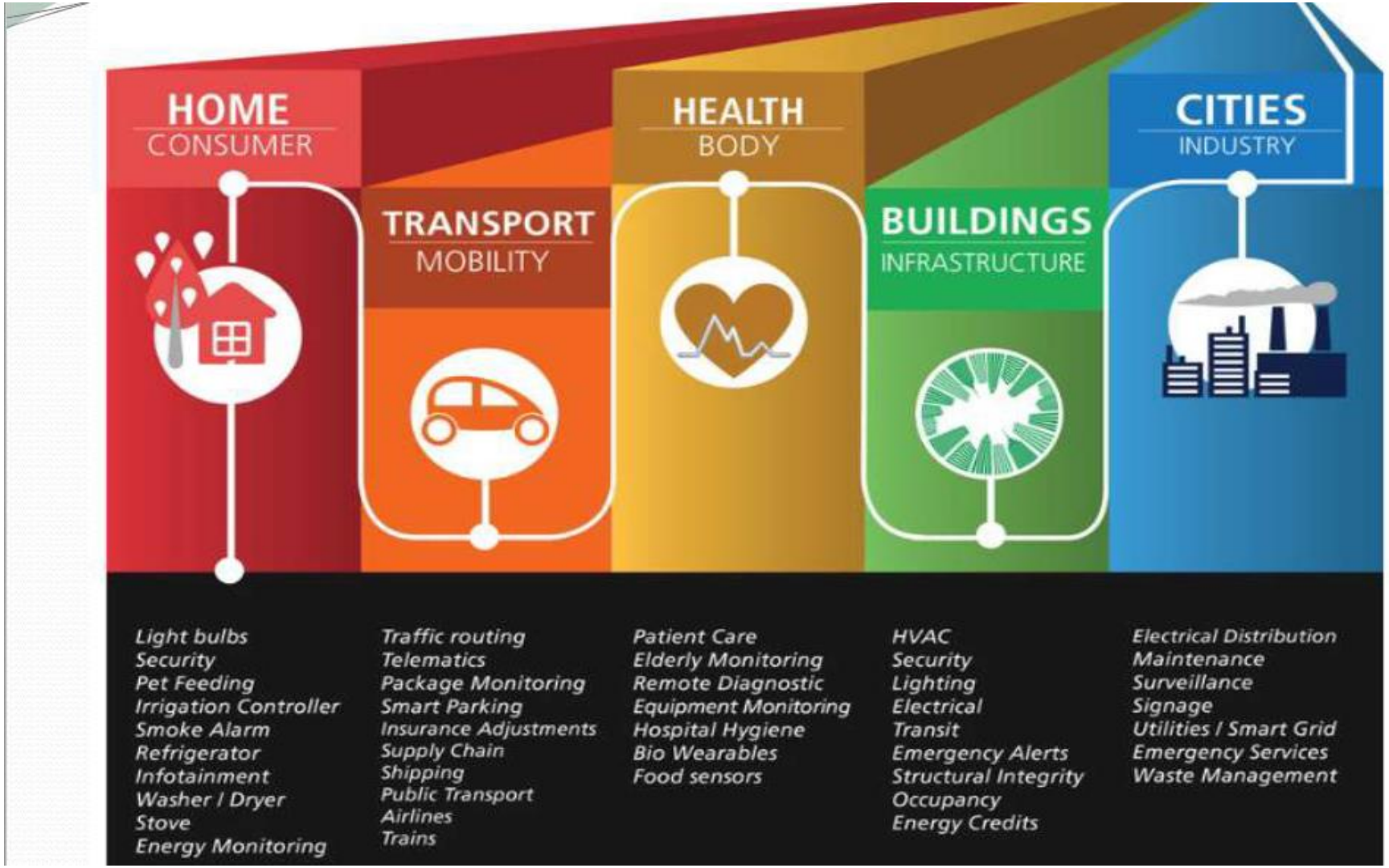
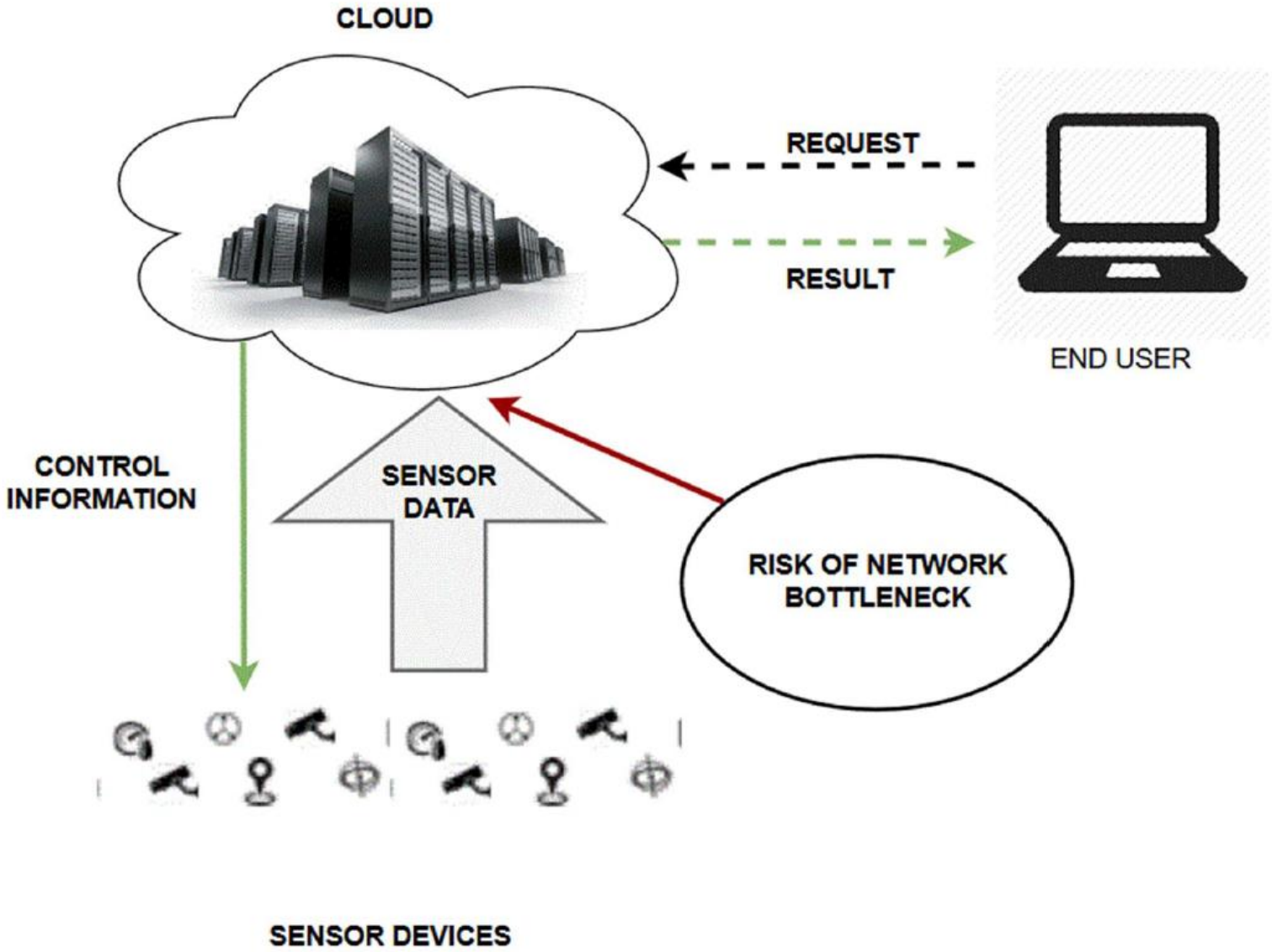
Internet of Things



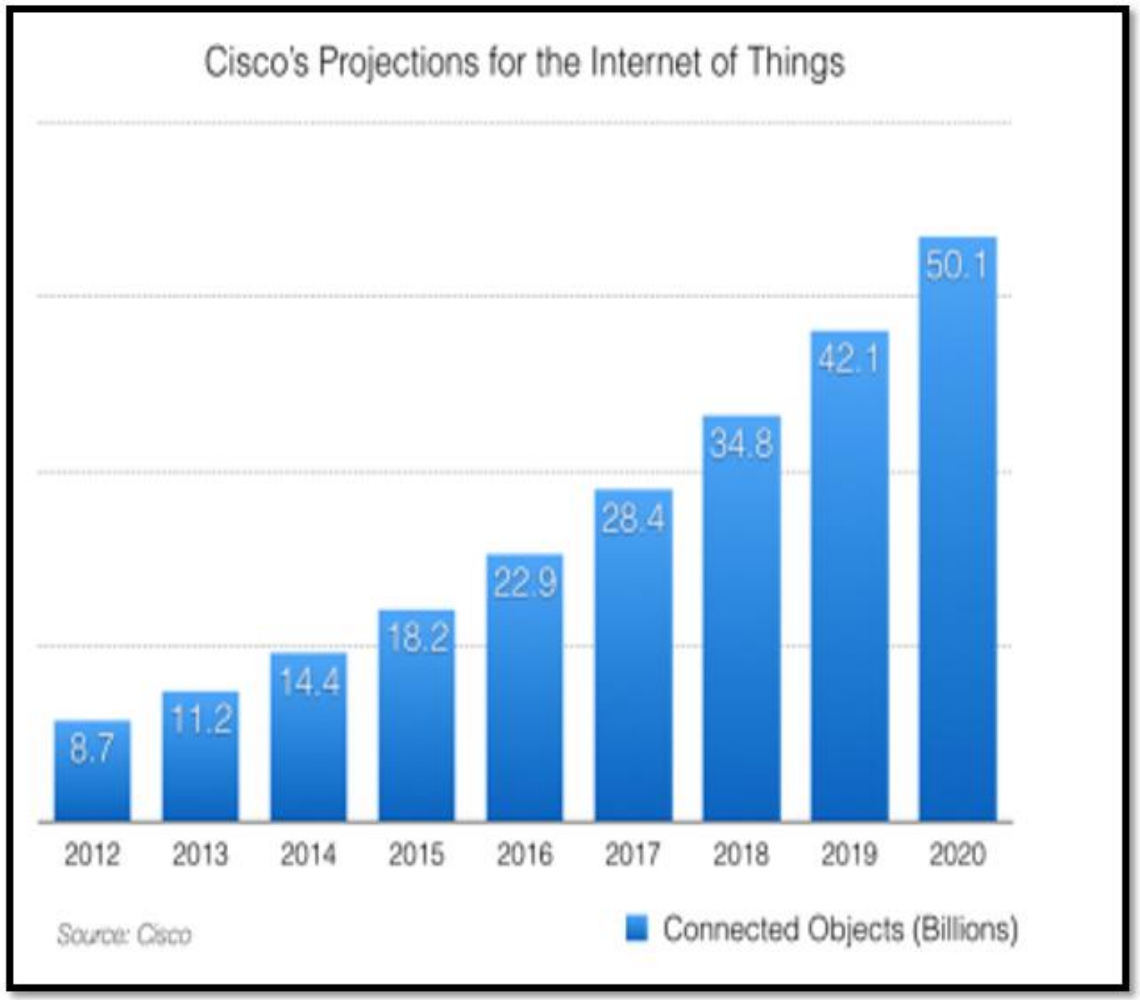
IoT is Everywhere



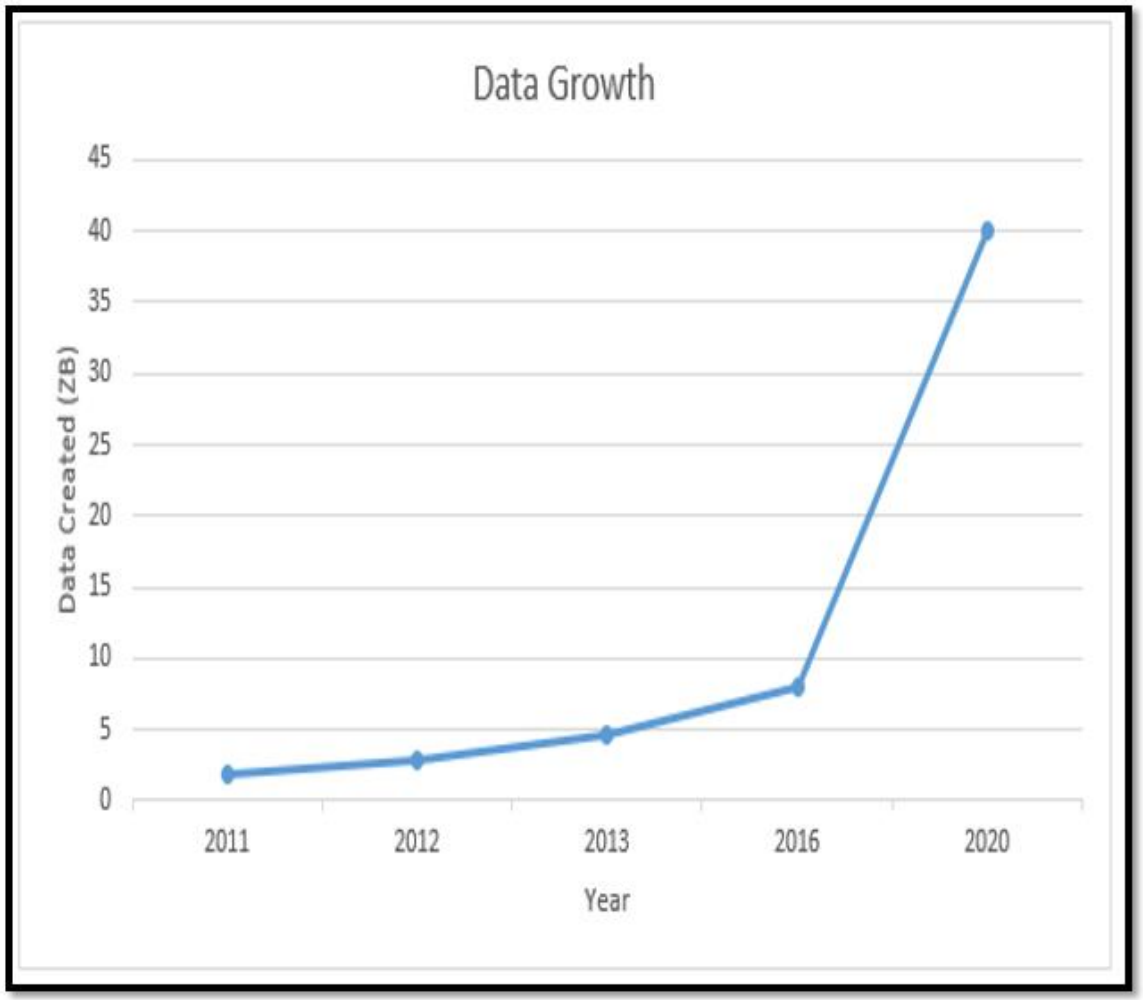
The Cloud


CLOUD
REQUEST
RESULT
END USER
CONTROL INFORMATION
SENSOR DATA
RISK OF NETWORK BOTTLENECK
SENSOR DEVICES

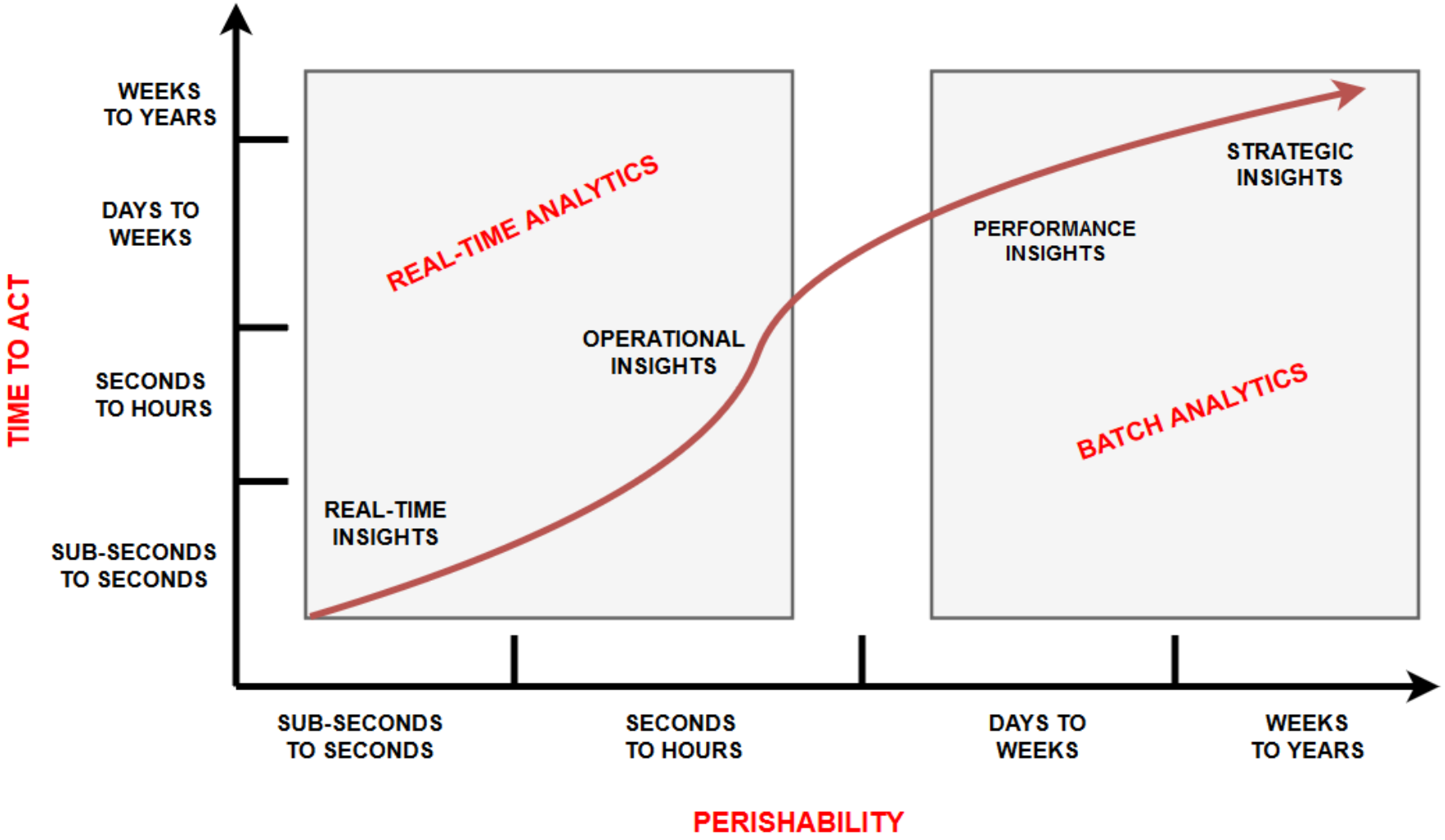
IoT & Big Data



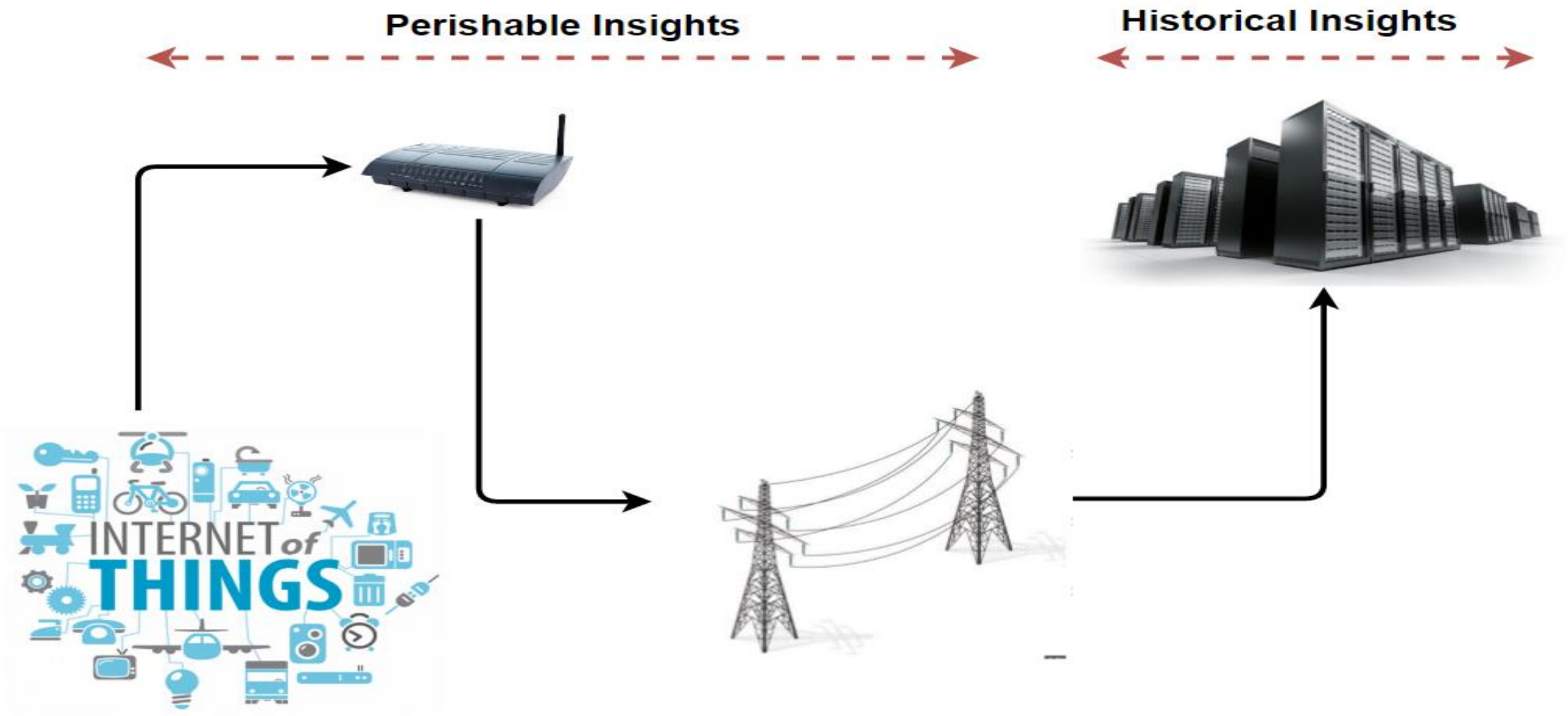
[1]



Real-Time Processing

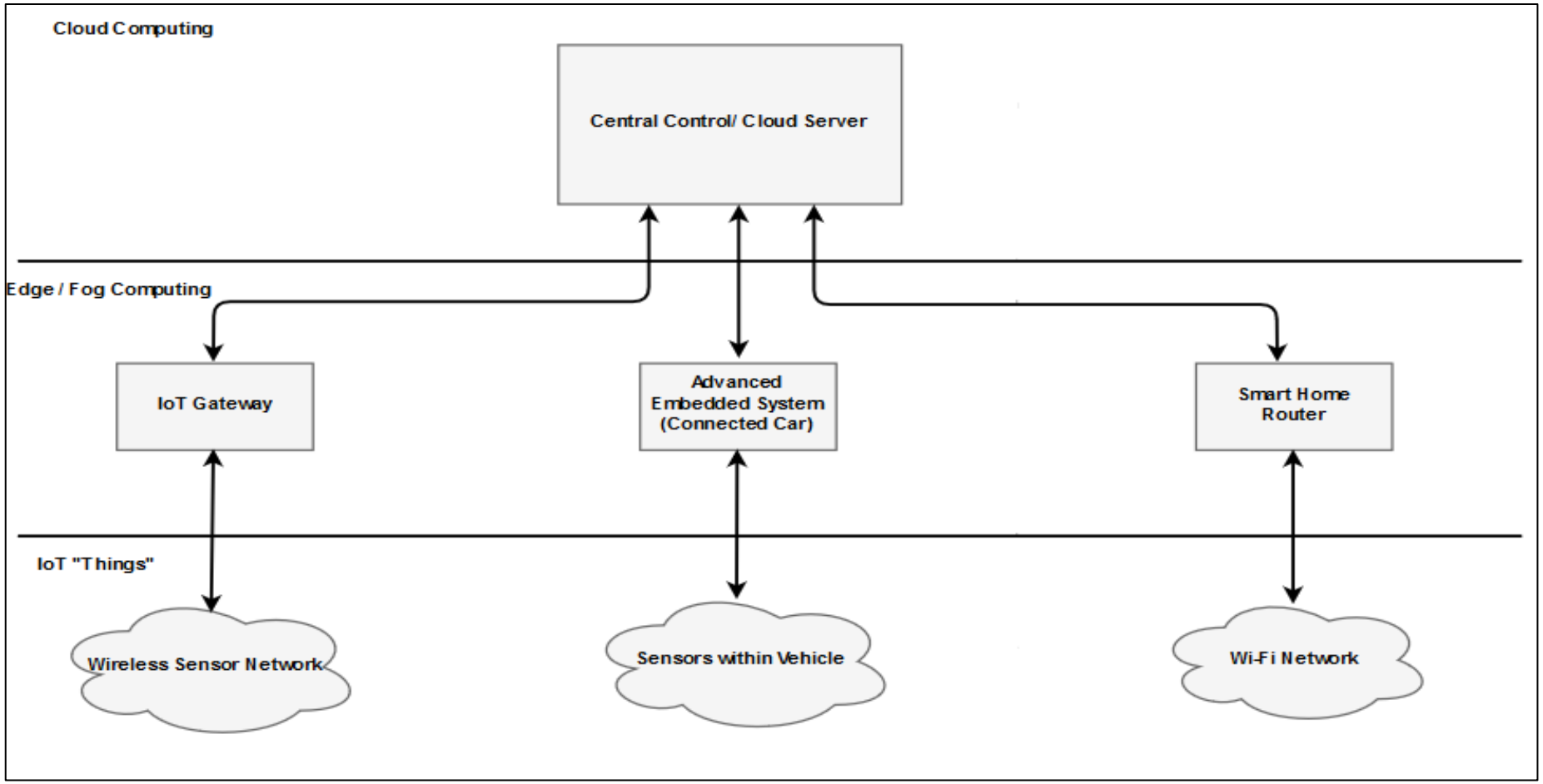


Typical IoT Data Transmission

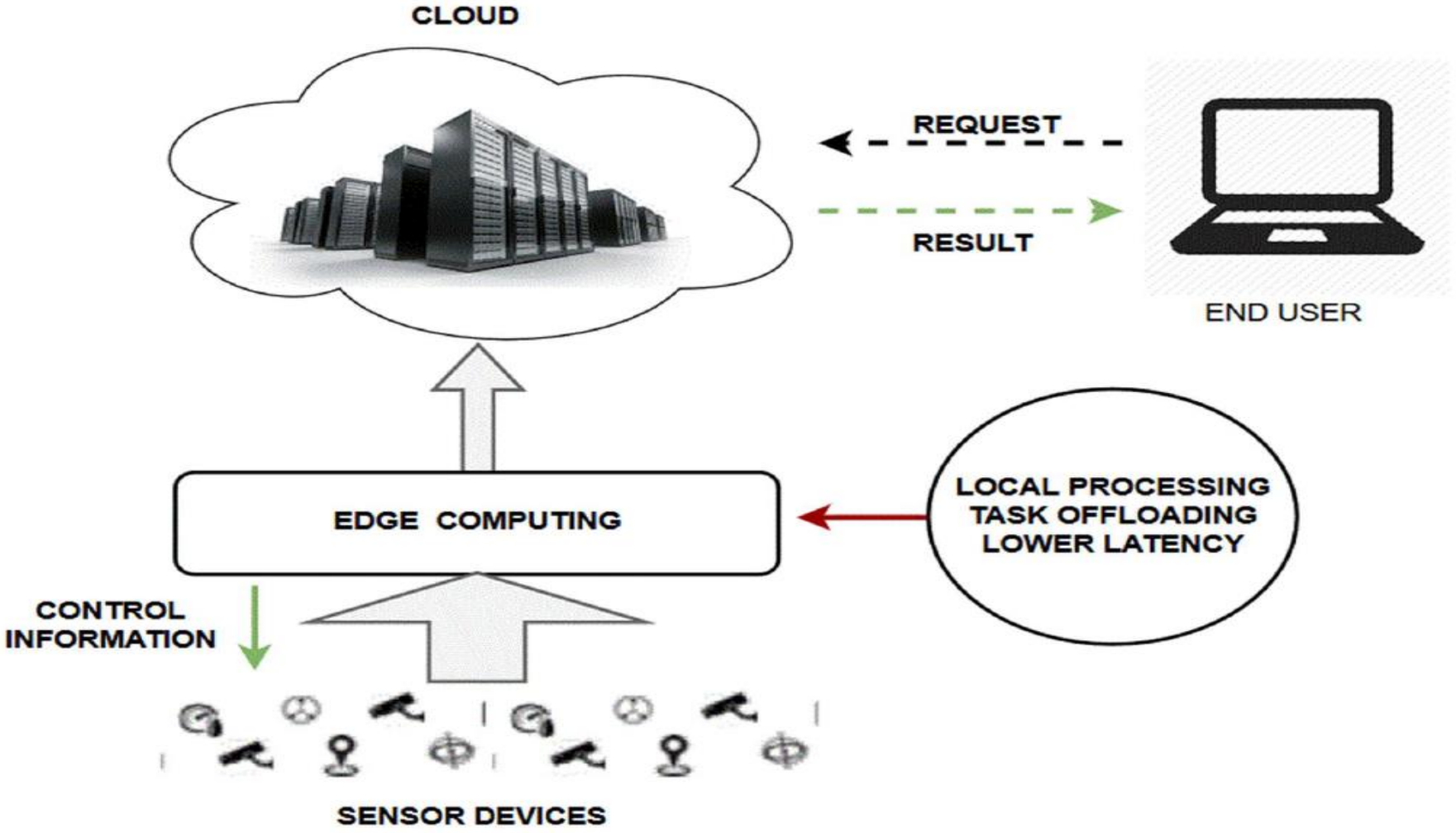


The Answer?

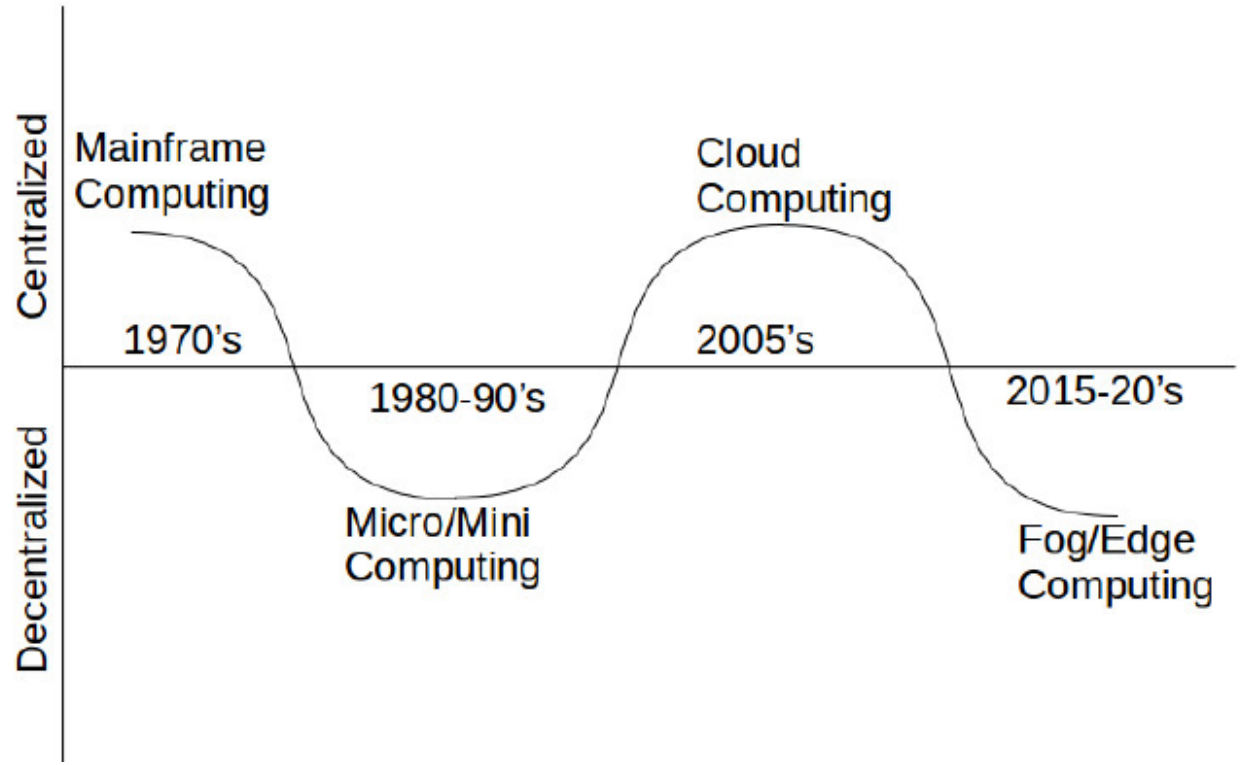
- Edge Analytics & Fog Computing



Edge Analytics



Edge computing is optimization of cloud, to move the compute close to the source of data, to **the edge**



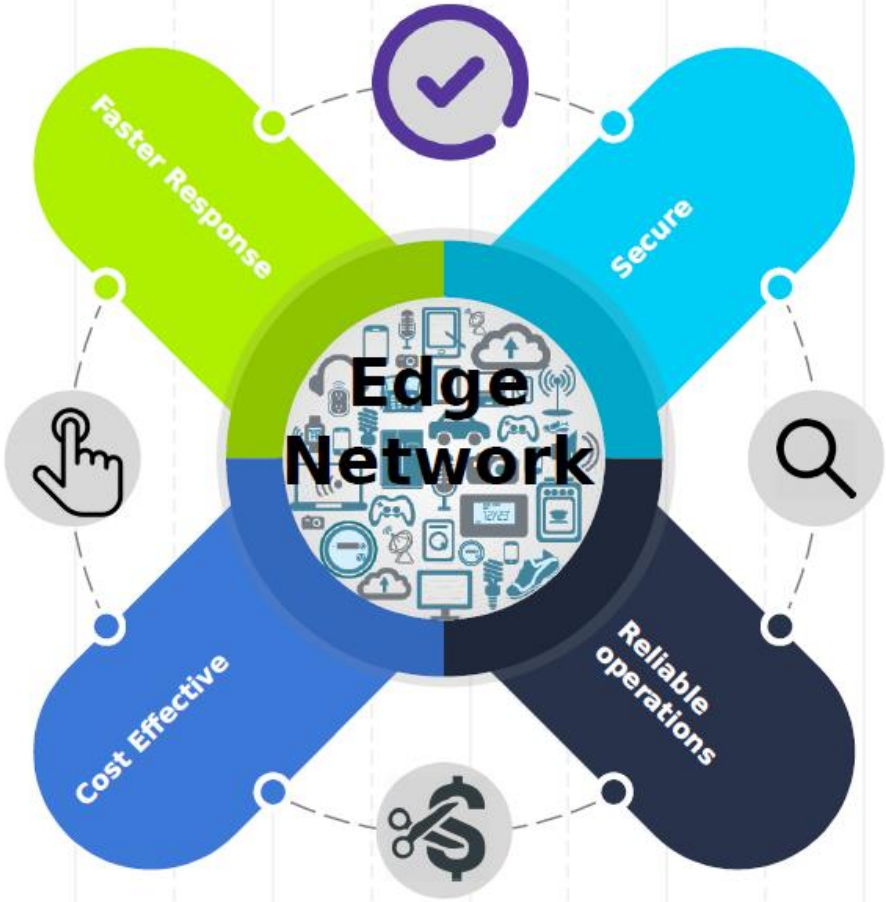
Edge Benefits

Faster Response

- Operating at the source of data
- Faster response time for triggers

Cost Effective

- No need to transport everything to cloud
- No recurring cost



Secure

- Locally stored
- No theft during transport
- Compliance maintained

Reliable Operations

- Can work without connectivity.

When Edge can be the Solution

- REAL TIME CONSTRAINT
- INTERMITTENT NETWORK
- NEED FOR LOCAL PROCESSING
- BANDWITH CONSTRAINT
- MAKING BIG DATA SMALLER
- STRONG CYBER-SECURITY CONSTRAINT

Latency can be reason for failure

- Health care
- Financial transactions

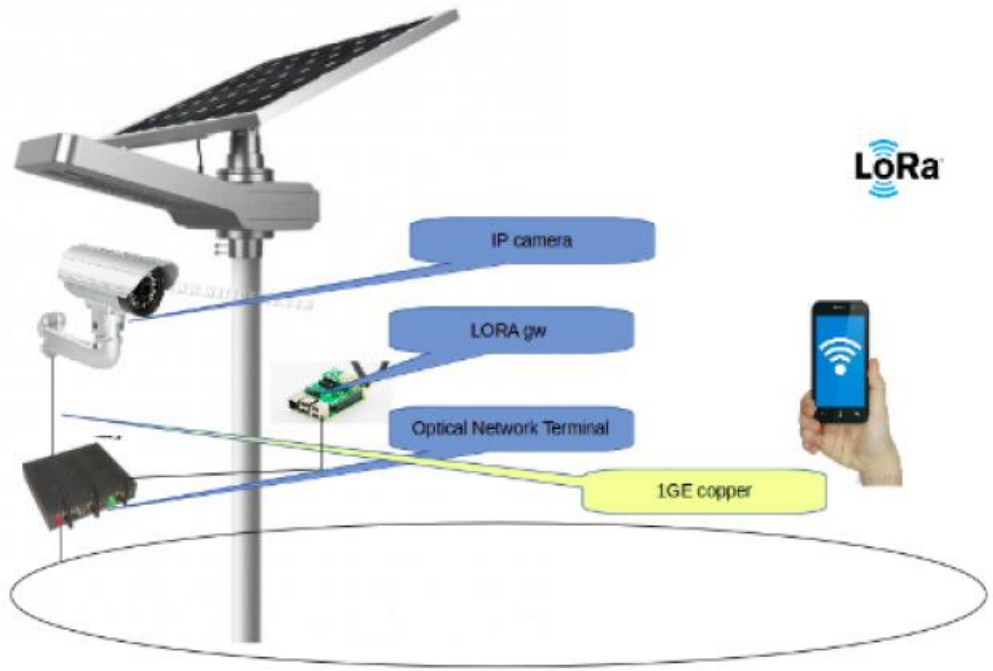
It’s pretty obvious that ingesting data to a distant cloud isn’t a realistic option.

Use Case : Surveillance

Generate significant amount of data

- Smart Surveillance system

It’s pretty obvious that ingesting data to a distant cloud isn’t a realistic option.



Use Case: Too much Data

Business case

- Smarthome secutiy camera recording 24h/24
- Data volume = 42Go/day after H.264 compression

Objective

- Reduce bandwith impact
- Clean/sample data for cloud
- Do not loose any incident data
- Alert even without Internet

Result

- Reduced to 10Go/day max
- More definition when movement.
- SMS alert always available

Use Case: Cars are Super Computers

Business case

- Device plugged to the CAN and ODB buses
- Live Capture of all electric signals from the car
- Use of exogenous data (weather, driver's behaviors…)

Objective

- Predict a battery failure live (while driving)
- Organize maintenance operations directly with the garage
- Then expand the business case to other possible failures

Result

- Live prediction of battery failure
- Automatic alert to be transmitted to the garage, then SMS sent to the driveR

Downside of Edge

- ADDITIONAL DIRECT COST / DEVICE
- HW FOOTPRINT OF AGENTS
- MORE SOFTWARE = MORE BUGS

Maintenance Criticality

Post deployment, Monitoring and Managing Edge Infrastructure becomes a **nightmare** as deployments are:

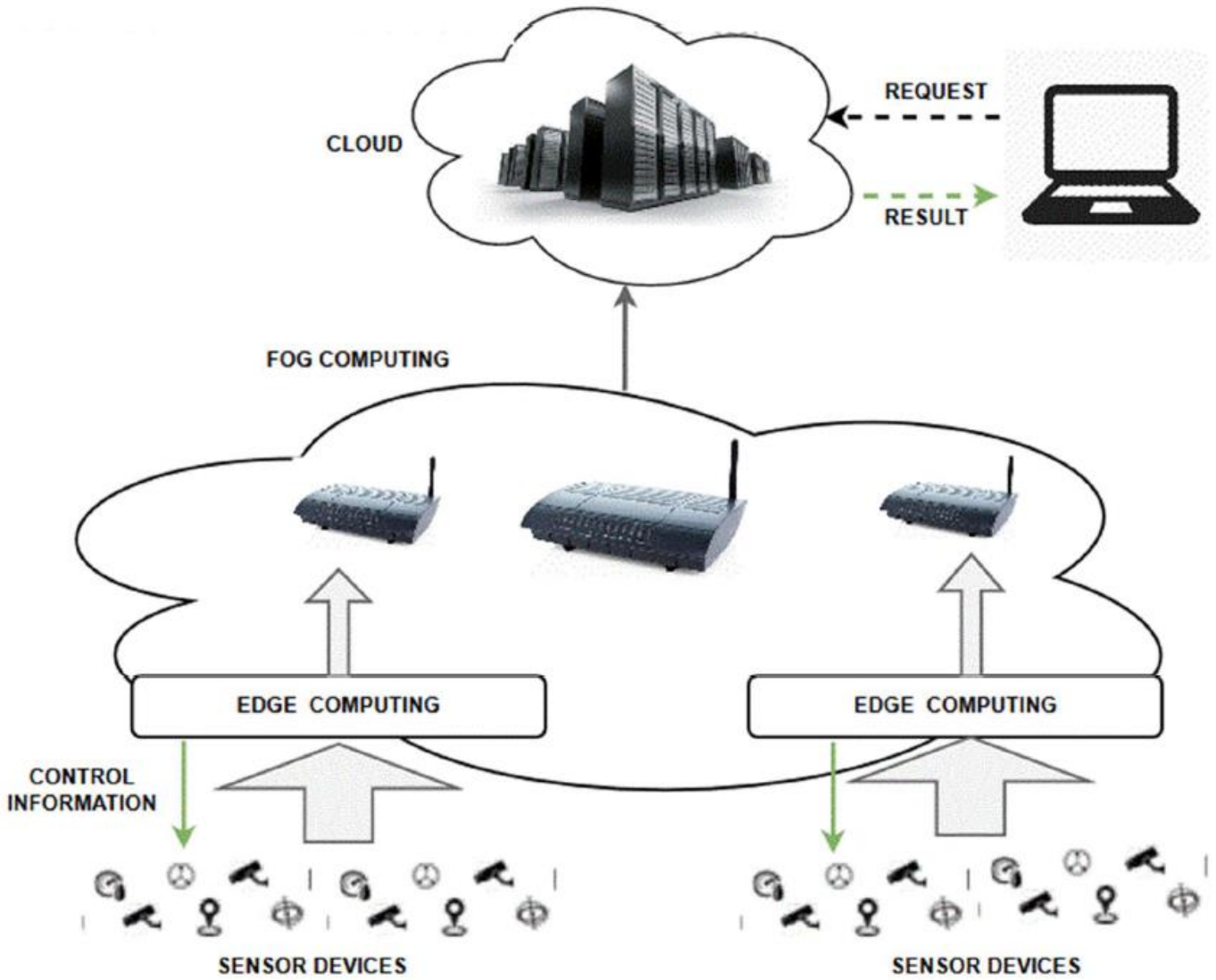
Complex

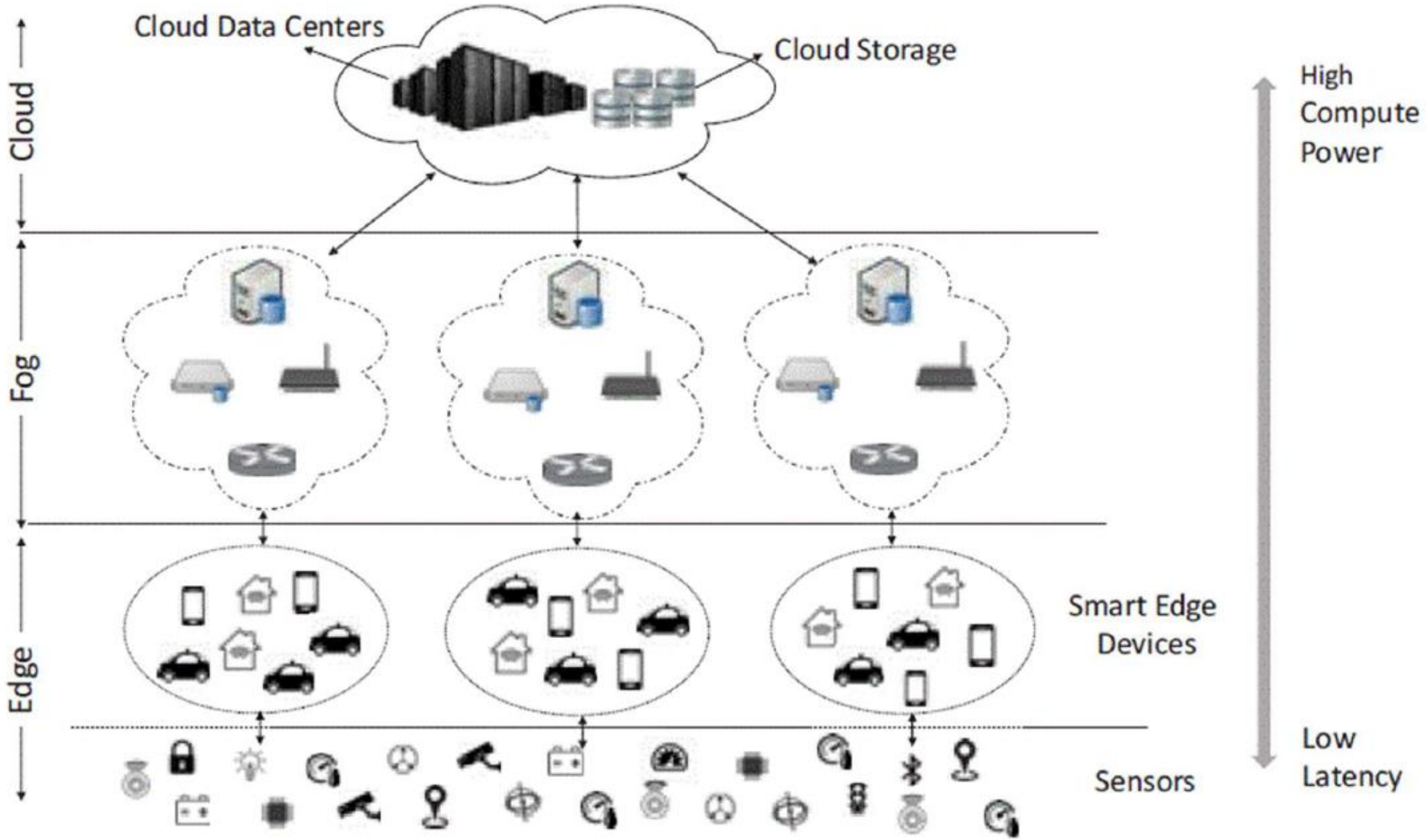
Open to environment

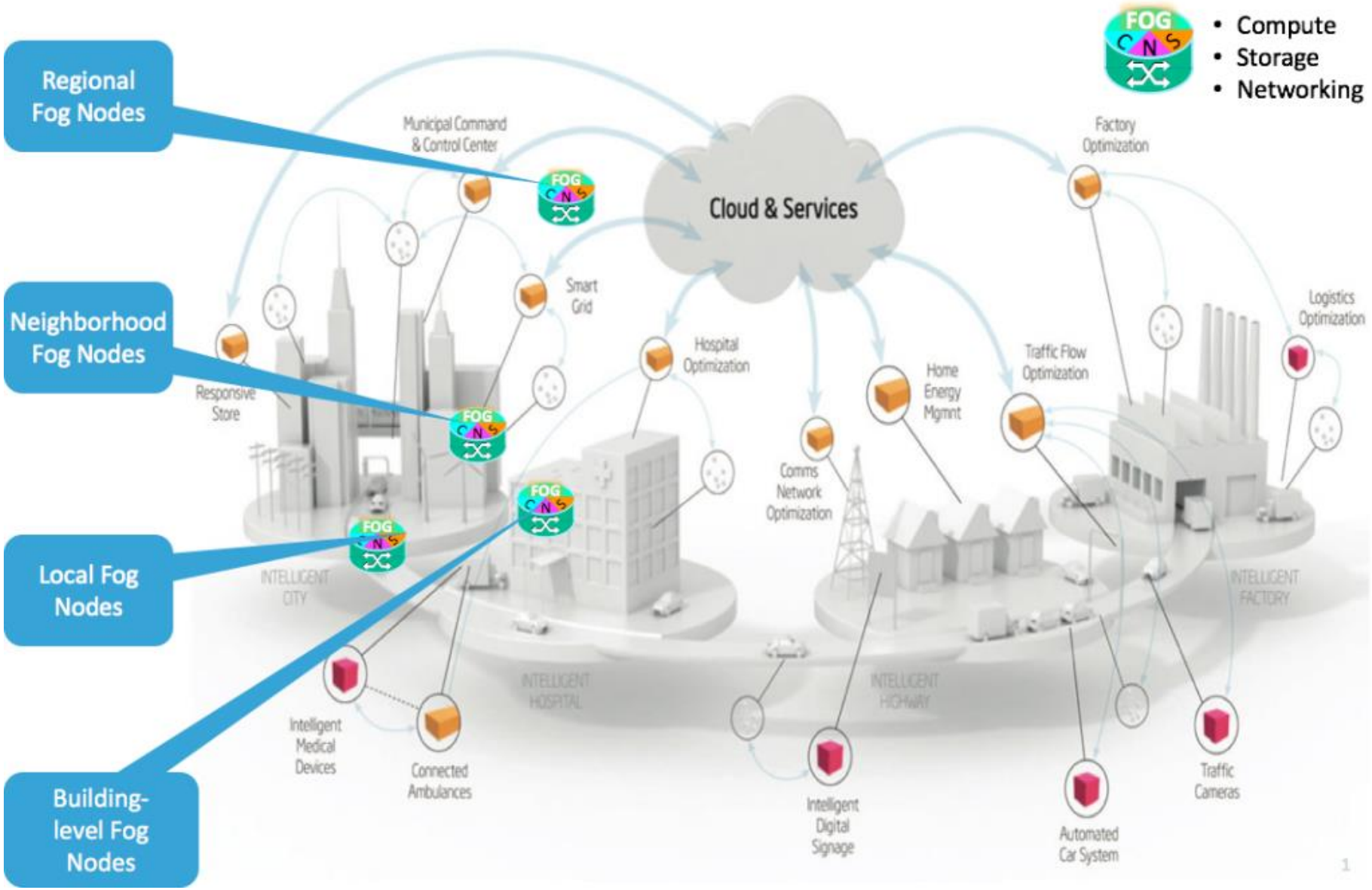
Remotely located

Price sensitive/no redundancy

Fog Computing

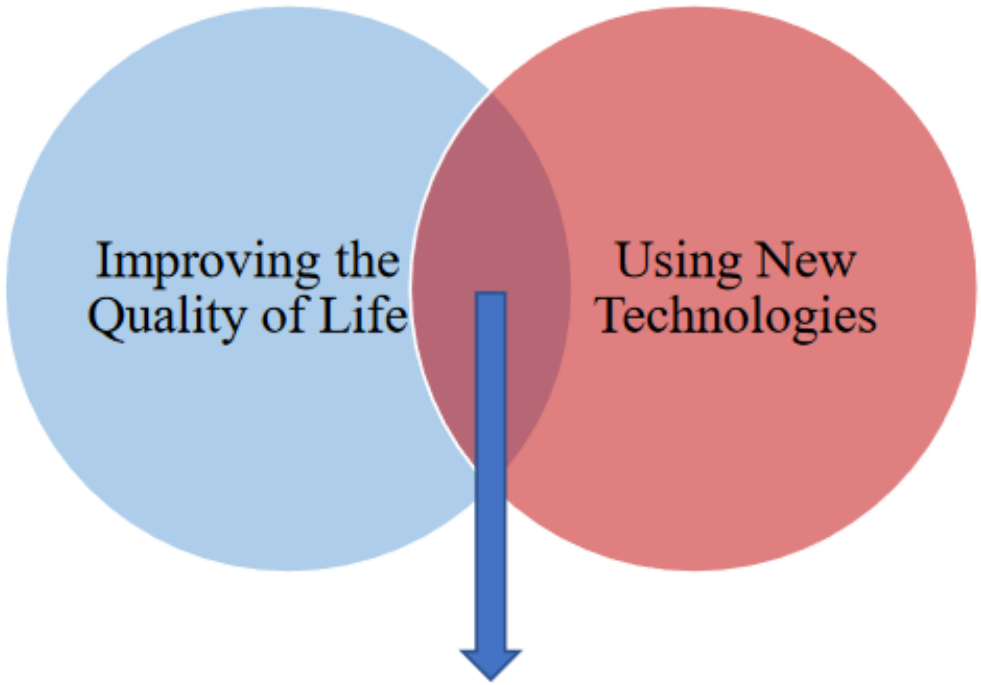



Cloud Data Centers
Cloud Storage
Cloud
Fog
Edge
Smart Edge Devices
Sensors
High Compute Power
Low Latency


Regional Fog Nodes
Neighborhood Fog Nodes
Local Fog Nodes
Building-level Fog Nodes
FOG
• Compute
• Storage
• Networking
Cloud & Services
Municipal Command & Control Center
Smart Grid
Responsive Store
Hospital Optimization
Home Energy Mgmnt
Comms Network Optimization
Traffic Flow Optimization
Factory Optimization
Logistics Optimization
INTELLIGENT CITY
INTELLIGENT HOSPITAL
INTELLIGENT HIGHWAY
INTELLIGENT FACTORY
Intelligent Medical Devices
Connected Ambulances
Intelligent Digital Signage
Automated Car System
Traffic Cameras

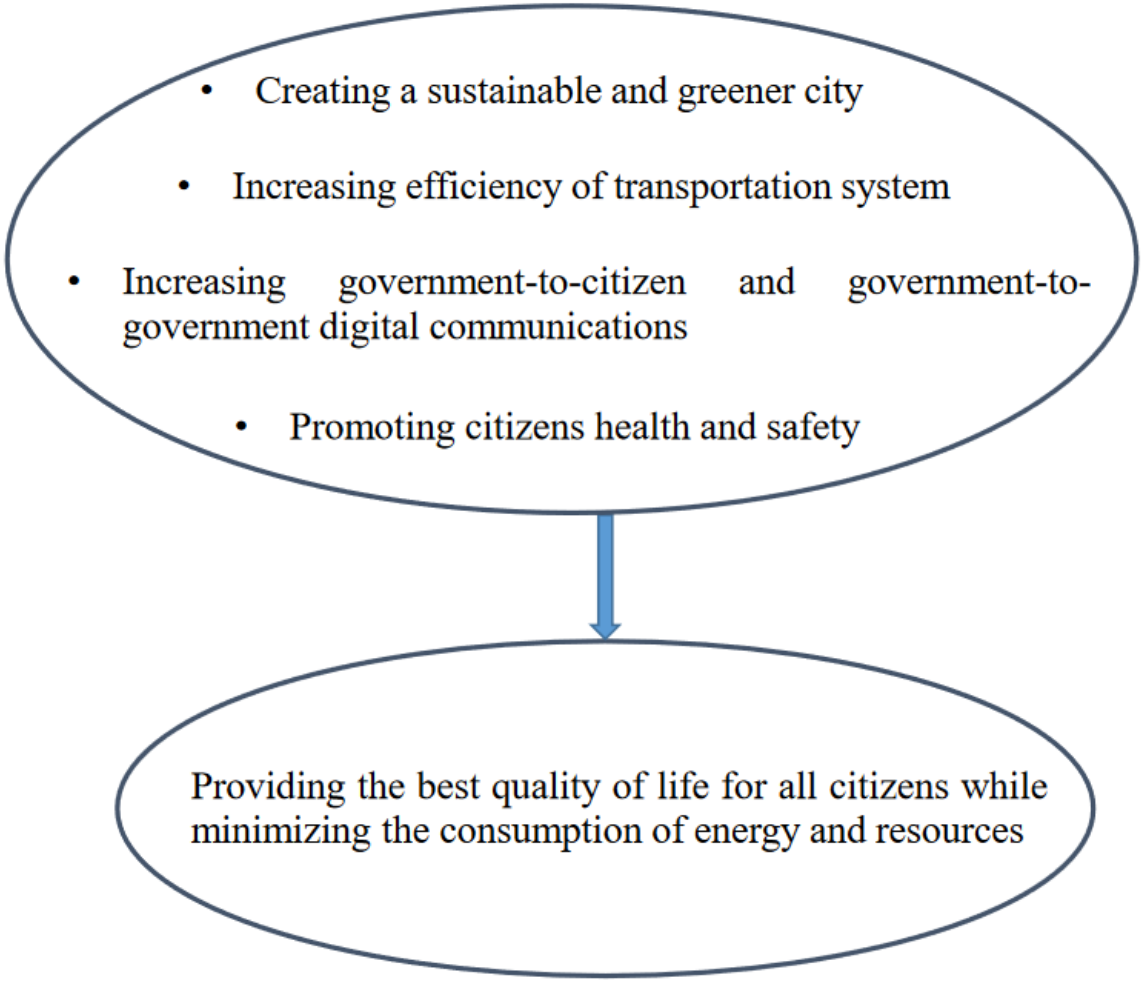
Smart Cities

Smart City Definitions



A city that uses technologies to make life easier for its citizens

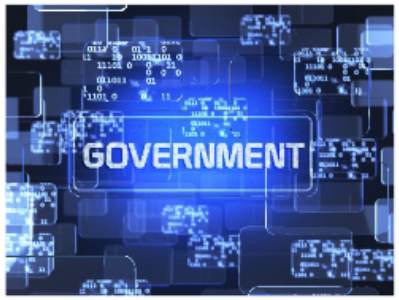
Smart City Objectives



Smart Urban Services

- Smart waste
- Smart lighting
- Smart parks and gardens

Smart Government



- Smart administration services
- Smart payment
- Smart parks and gardens
- Smart business services

Smart Buildings

Smart infrastructure

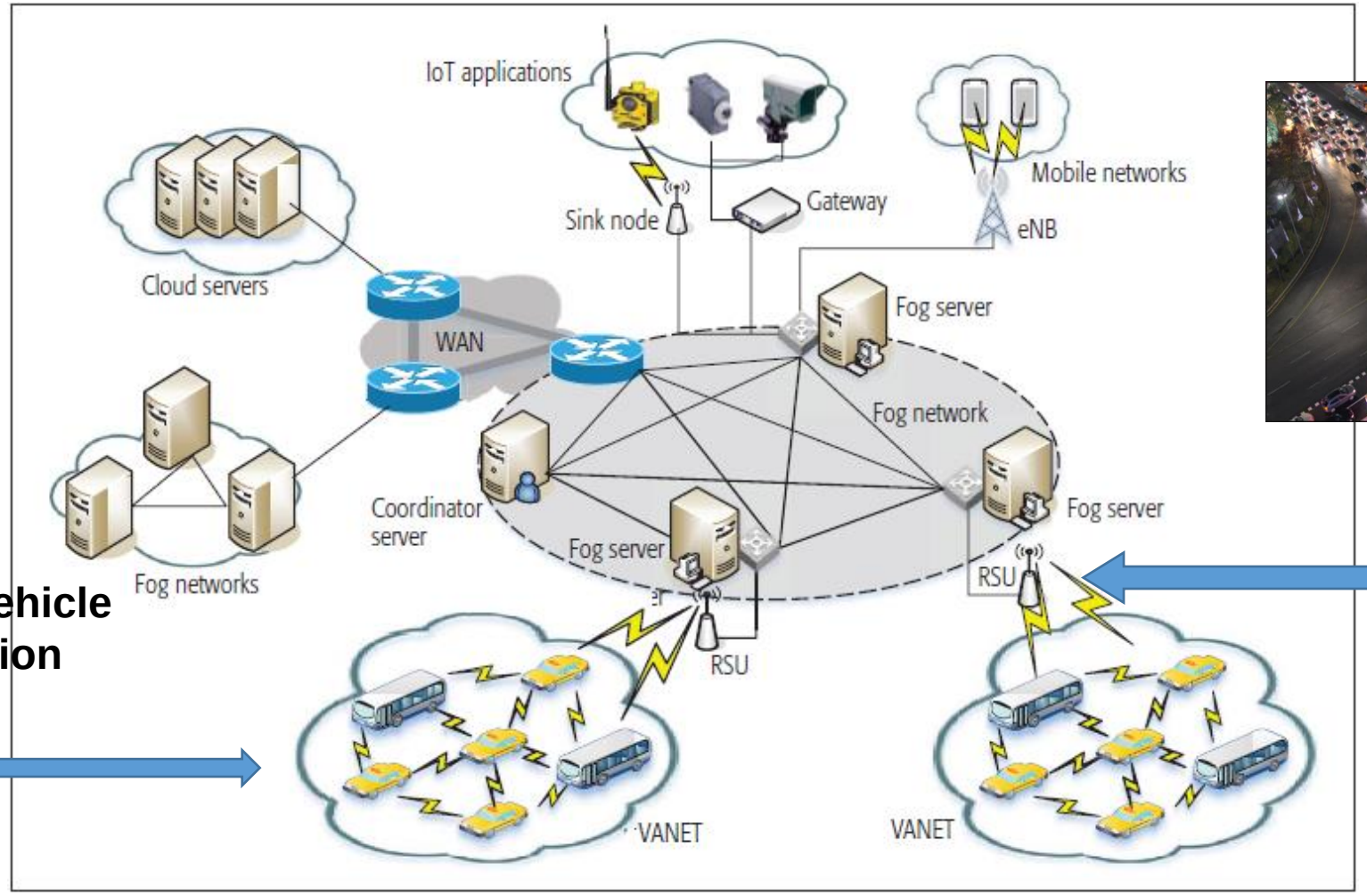
Smart Environment

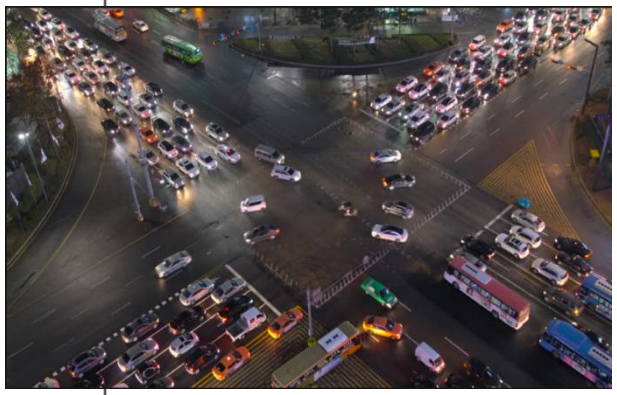
- Smart environmental monitoring
- Electrical cars and charging stations
- Renewable energy

Smart Mobility

- Smart parking
- Smart traffic light
- Smart bike
- Driverless buses/cars
- Smart electric and hybrid cars
- Smart active transport

Vehicle-to-Vehicle(V2V) & Vehicle-to-Infrastructure(V2I)





What is the Role of the RSU?

Vehicle-To-Vehicle Communication (V2V)

Vehicle-To-Infrastructure Communication (V2X)

Internet of Vehicles