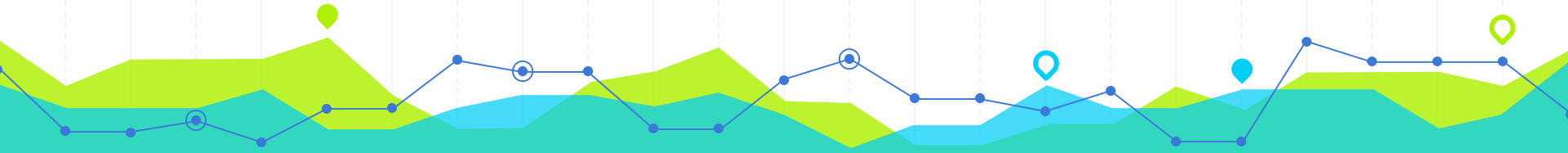

EDGE & FOG COMPUTING: A USE CASE PERSPECTIVE

City Surveillance

But ...


Aikaan Labs Retweeted
Chetan kumar s @chetansk · Feb 15
@maharashtra
But who is going to stare at all these 10000 cameras !!
5,625 more CCTV cameras to keep watch on Mumbai
5,625 more CCTV cameras to keep watch on Mumbai
State cabinet gives nod to expanding 4,717-camera network; focus on slums, arterial roads, bylanes and coast
hindustantimes.com
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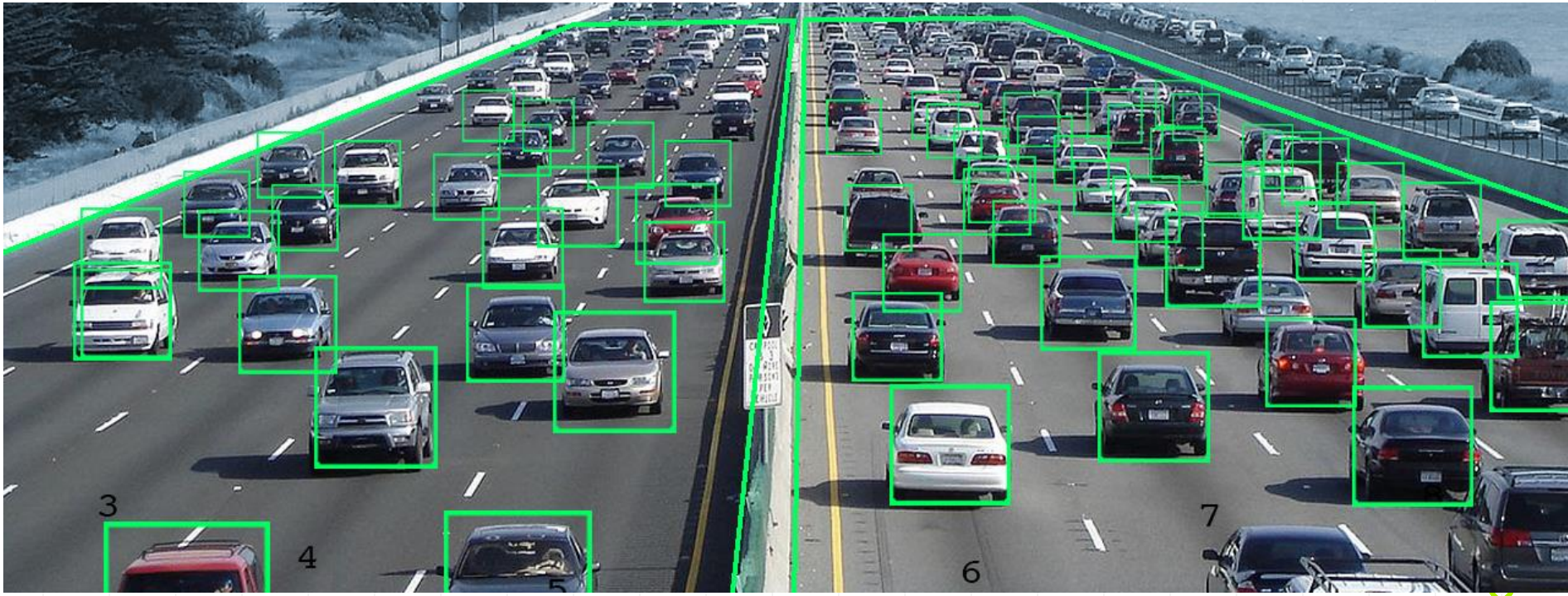
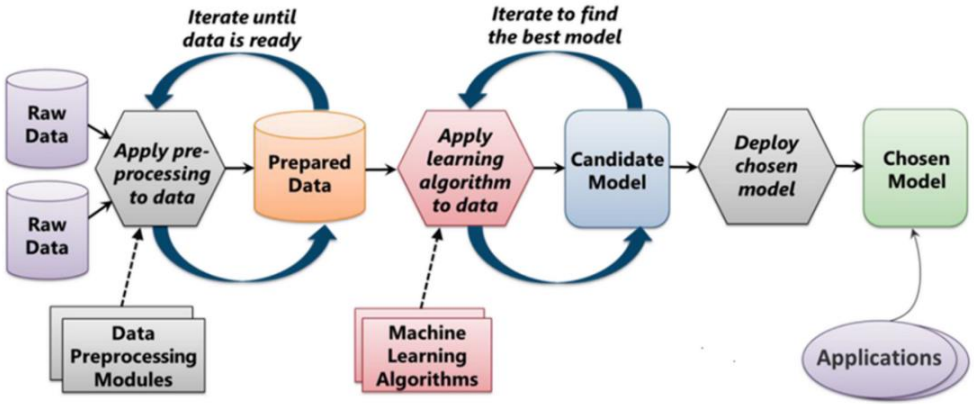
Use Computer Vision and Machine Learning



Machine learning is DATA, DATA, and DATA

The Machine Learning Process



From "Introduction to Microsoft Azure" by David Chappell

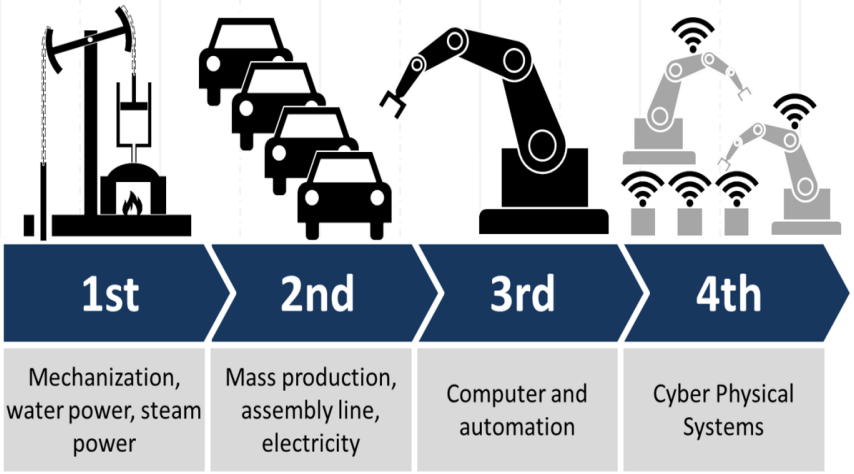
Simple bandwidth calculation for HD video

Speed requirement	Data consumed in a day	Data consumed in month
SD Video: **3Mbps**	SD Video: **32GB**	SD Video: **960GB**
HD Video: **5Mbps**	HD Video: **54GB**	HD Video: **1720GB**

17TB by 10 cameras for a month

Applications that require Autonomy

- Completing tasks with little or no human interaction
  - Self Driving Cars
  - Industry 4.0
- It's pretty obvious that ingesting data to a distant cloud isn't a realistic option.



Applications that can't tolerate Latency

- 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.

Mission Critical Industrial Automation

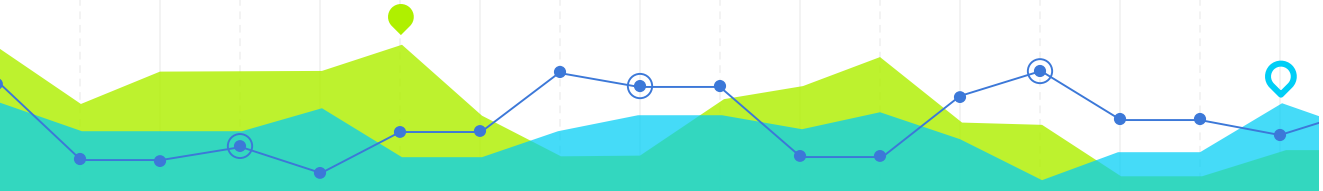
From ITU-T working group on IoT and M2M communication for industrial automation

Service	End-to-End Latency	Jitter
Factory automation - Motion Control	1 ms	1 µs
Factory automation	10 ms	100 µs
Process automation –Remote Control	50 ms	20 ms
Process automation Monitoring	50 ms	20 ms
Audio-visual interaction	[10 ms]	[TBC]
Remote control	[5 ms]	[TBC]
Mobile Robotics and Vehicles	[TBC]	[TBC]

Latency to cloud server

Round trip is twice the latency,

so if a machine has to shutdown, it takes 60ms! (assuming your server is in Mumbai)



Region	Latency
US-East (Virginia)	217 ms
US East (Ohio)	235 ms
US-West (California)	261 ms
US-West (Oregon)	250 ms
Canada (Central)	224 ms
Europe (Ireland)	154 ms
Europe (London)	153 ms
Europe (Frankfurt)	156 ms
Europe (Paris)	141 ms
Europe (Stockholm)	175 ms
Asia Pacific (Mumbai)	29 ms
Asia Pacific (Osaka-Local)	118 ms
Asia Pacific (Seoul)	147 ms
Asia Pacific (Singapore)	49 ms
Asia Pacific (Sydney)	294 ms
Asia Pacific (Tokyo)	228 ms
South America (São Paulo)	342 ms
China (Beijing)	298 ms
China (Ningxia)	368 ms
AWS GovCloud (US-East)	235 ms
AWS GovCloud (US)	253 ms

WHY

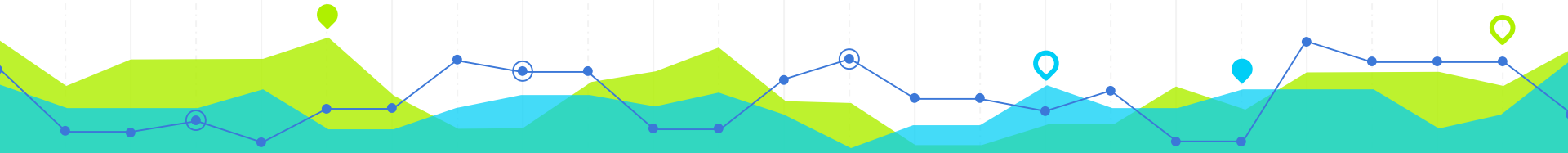
care about Edge Computing ?

Three laws which call for Edge & Fog computing in IoT:

1. ***Law of Physics*** - *Act Locally.*

2. ***Law of Economics*** - *Pre-processing reduces cost.*

3. ***Law of Land*** - *Data should stay locally.*



What does the market say ?

50%

Enterprise data will be produced and processed **outside** traditional **data centers and clouds** by 2022 - up from about 10 percent currently

80%

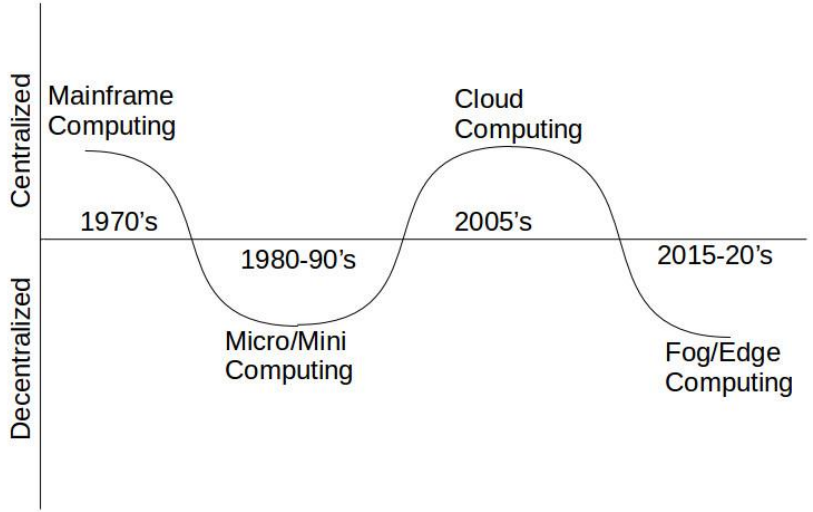
of enterprises would have **shut down** their traditional **data centres** by 2025, versus 10 percent in 2018 According to Gartner

WHAT

is Edge Computing ?

Edge Computing

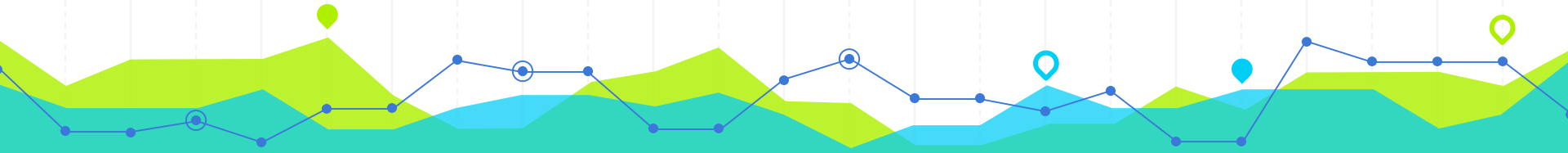
- Edge computing is optimization of cloud, to move the compute close to the source of data, to **the edge**



Can You Answer

- Edge Computing - The delivery of computing capabilities to the logical extremes of a network in order to improve the performance, operating cost and reliability of applications and services.
- Fog Computing - A distributed computing concept where compute and data storage resource, as well as applications and their data, are positioned in the most optimal place between the user and Cloud with the goal of improving performance and redundancy

--https://github.com/lf-edge/glossary/blob/master/edge-glossary.md



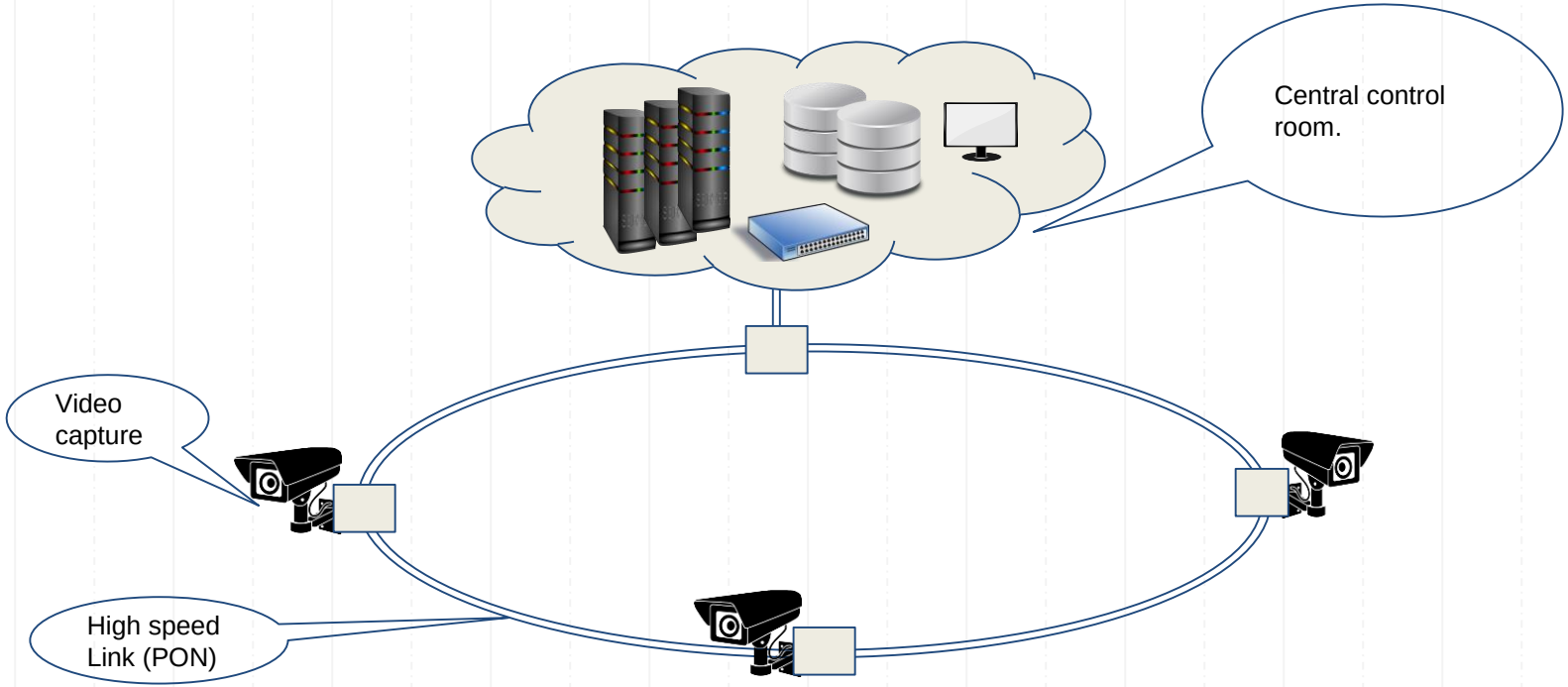
Few use-cases we worked with !

Keep it simple !

Smart Surveillance Use-Case

- An industrial township, around 3.2 sq Km
- Smart surveillance for
  - Mobility management
  - Citizen safety
- A network of cameras
  - 200+ (existing and planned) IP cameras
  - Optical PON link, connecting all cameras to command control
  - Moving from manual to automated surveillance

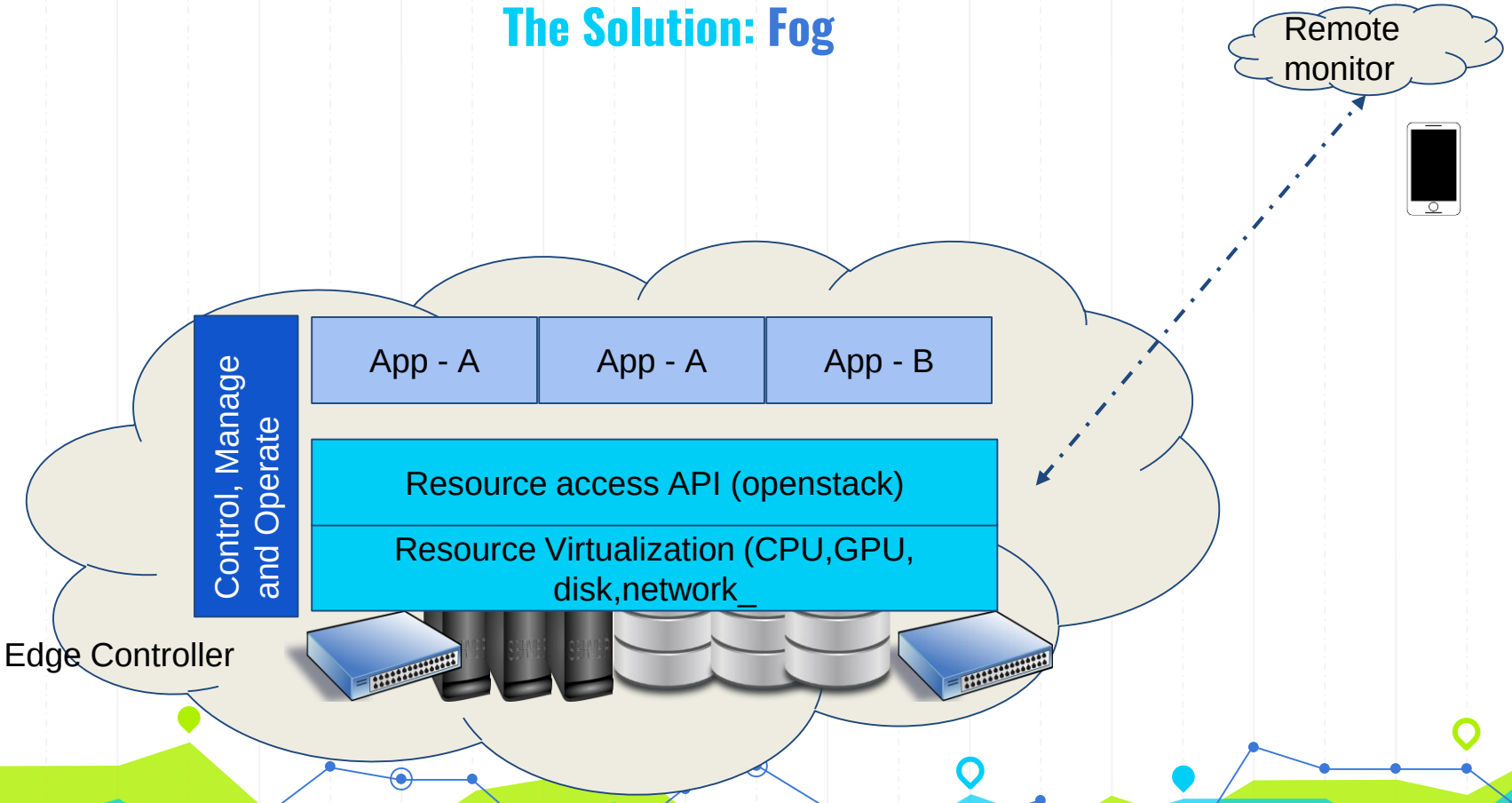
Smart Surveillance Use-Case



The Need

- Must support video analytics software at the central station
- Must be able to support multi-vendor applications
- Must isolate multi-vendor application
- Must be easy for vendor to run their instance of applications

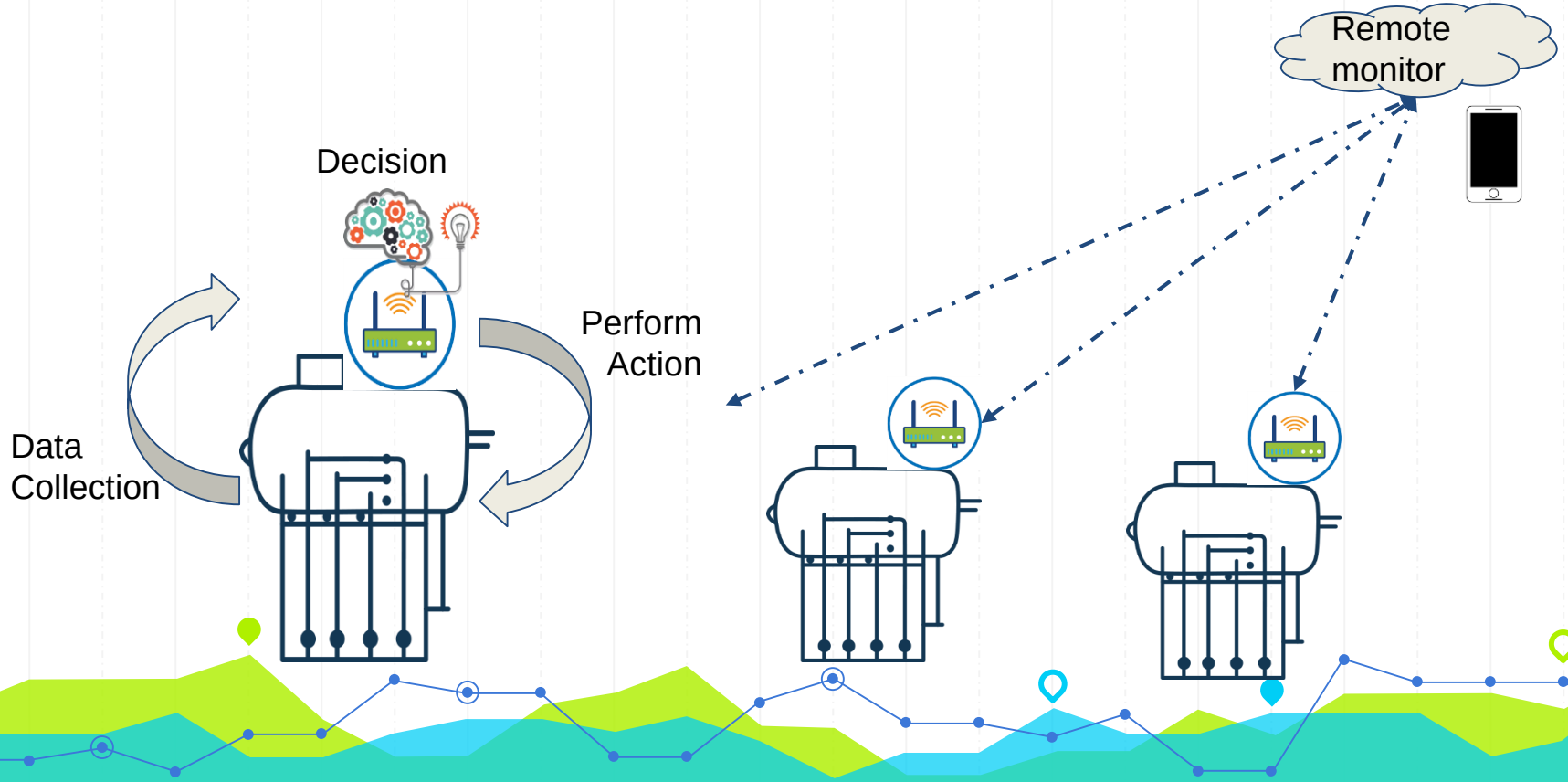
The Solution: Fog



Optimization for Steam Boilers

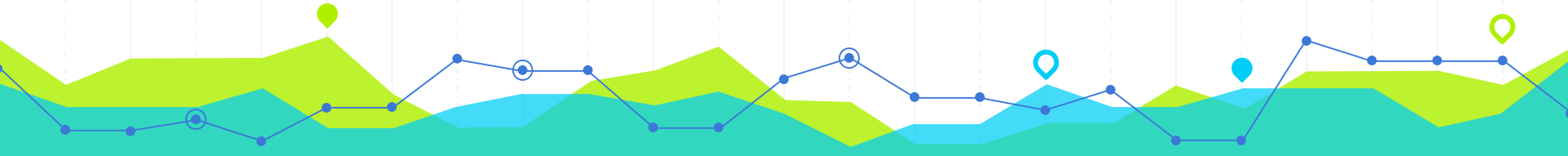
- Steam boiler vendor wants to optimize the operation
- A better operated boiler can help save upto 15% cost
- However:
  - The data collection, processing and control must be done quick !
  - Pushing data to cloud might delay the operations

The Solution: Edge Computing



The Challenges

- Remote connectivity and debugging
  - Identifying the devices and connecting to them
- Model, Firmware, Data upgrade !
  - Typically, video analytics requires ML model updates
  - Some of gateways need firmware upgrades
- Lack of personnel to manage the devices (both edge and fog)
  - Complexity of systems
  - Technical barrier



THANKS!

Any questions?

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