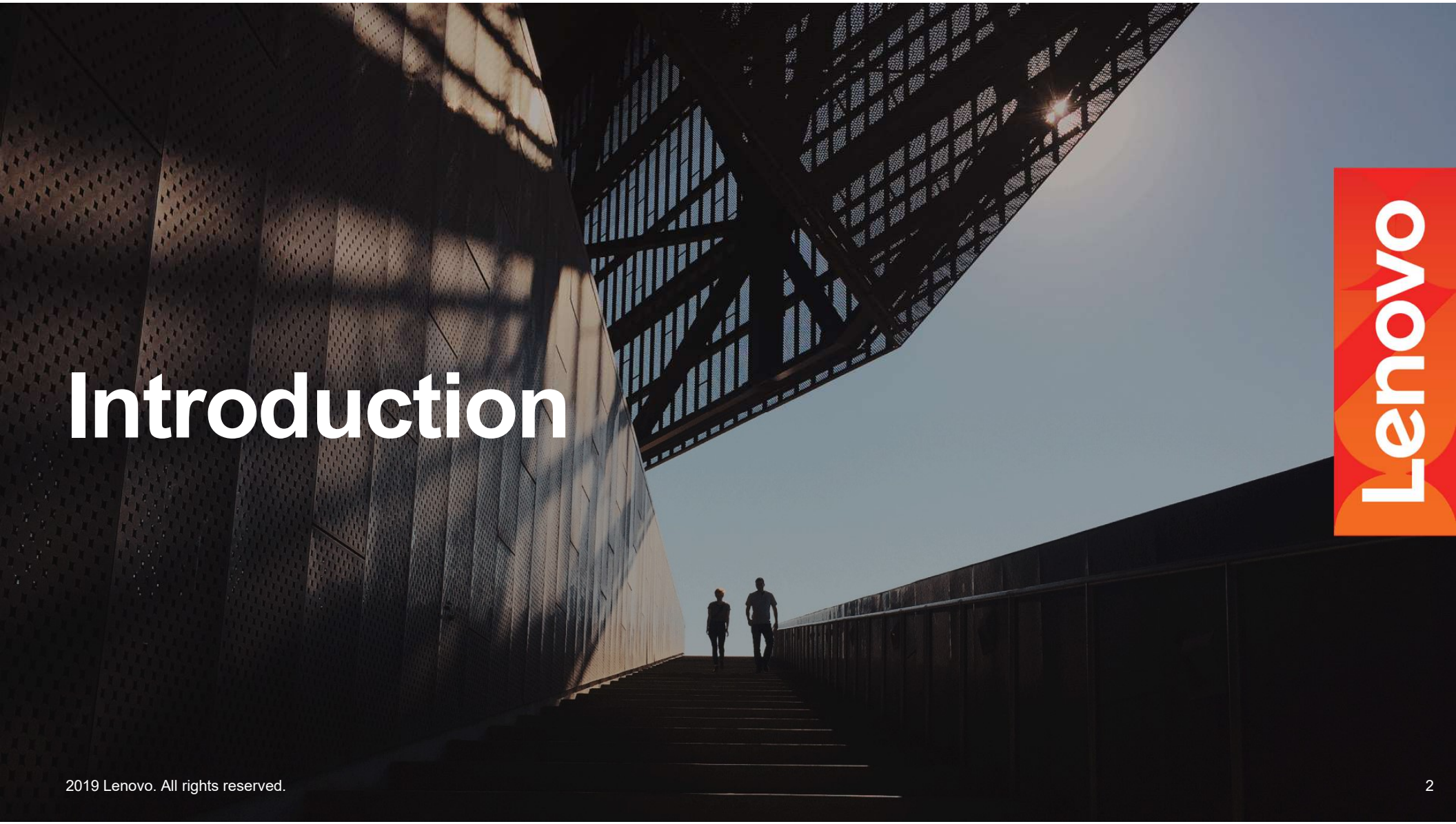
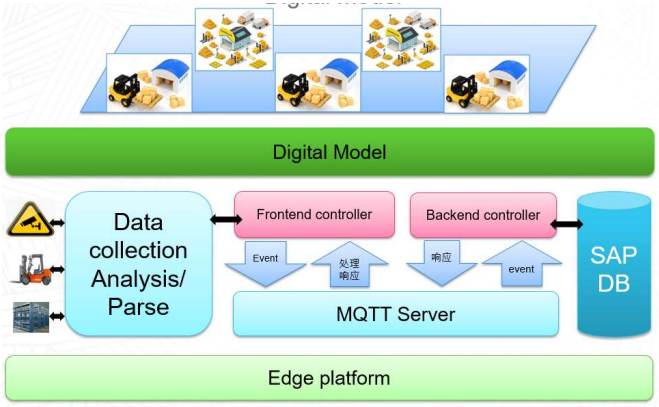


Lenovo Edge IOT - Video Orchestrated Freight Management

Mobile World Congress Barcelona - **Intel booth** - Hall 3, booth 3E31

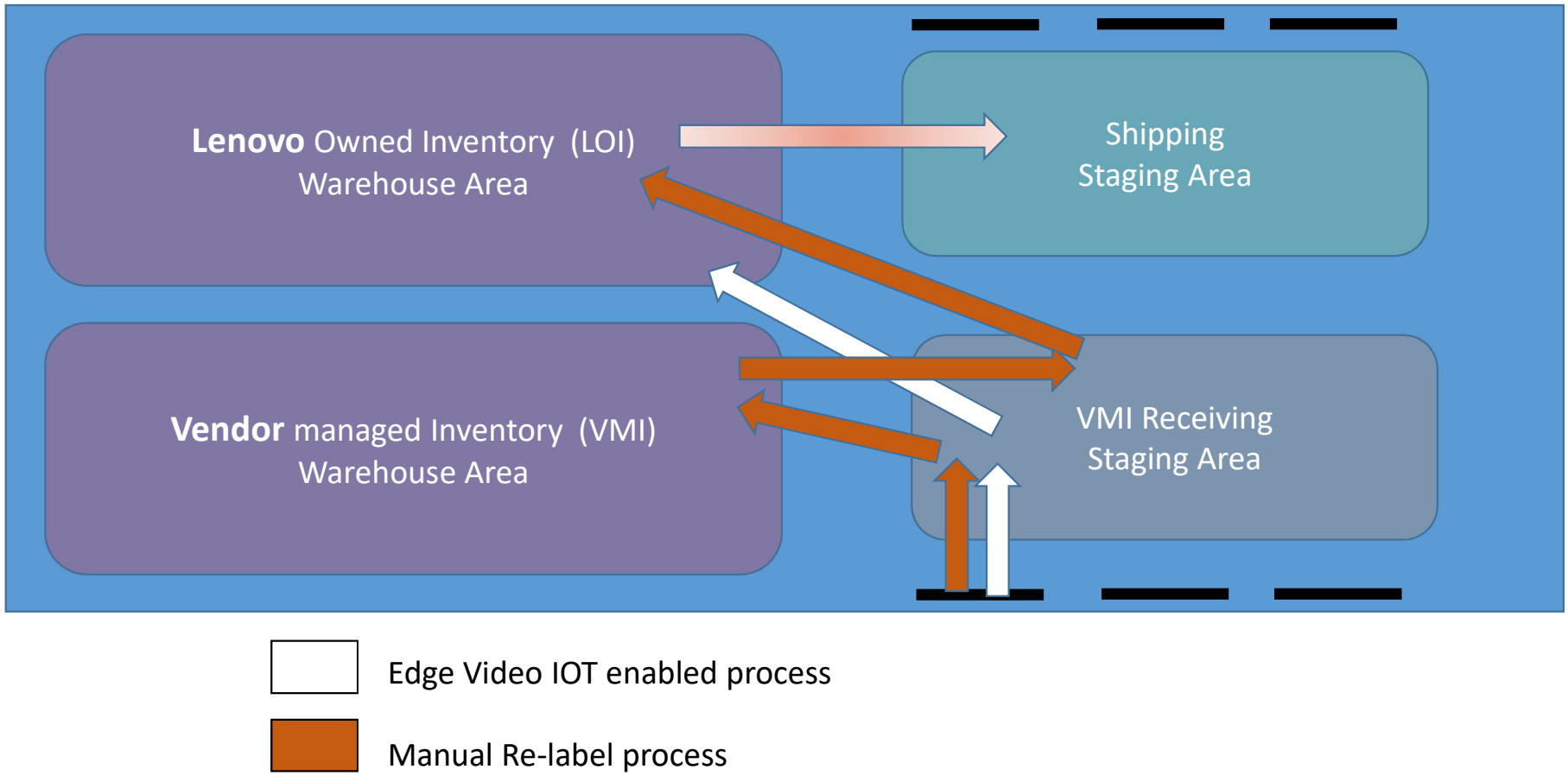
Lenovo is #5
Gartner 2018
High Tech
Supply Chain

- Receiving Automation
- Directed Put-Away
- Digital Model



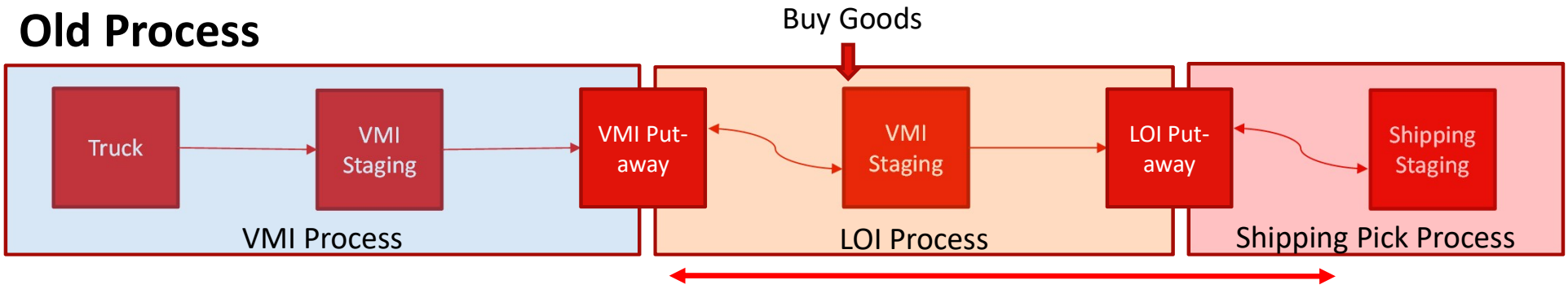
https://www.gartner.com/doc/3886964/-gartner-supply-chain-top

Warehouse Movement Simulation

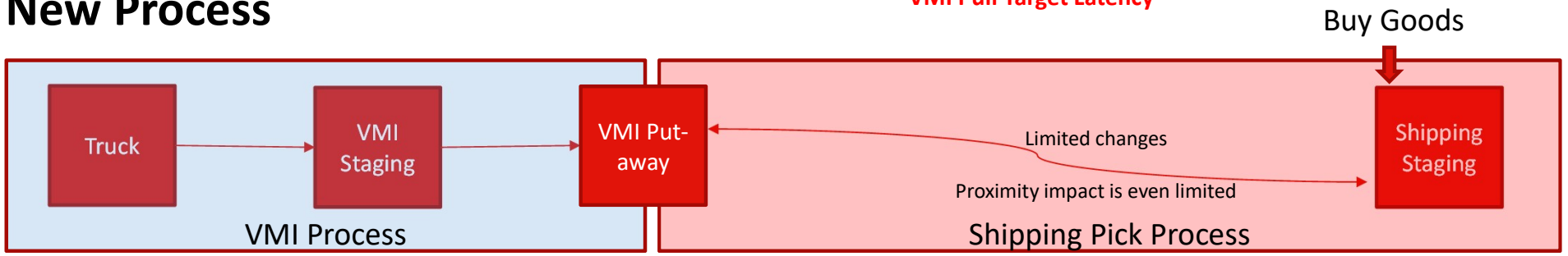


Process Changes – Estimated 2 year return of Equity!

Old Process



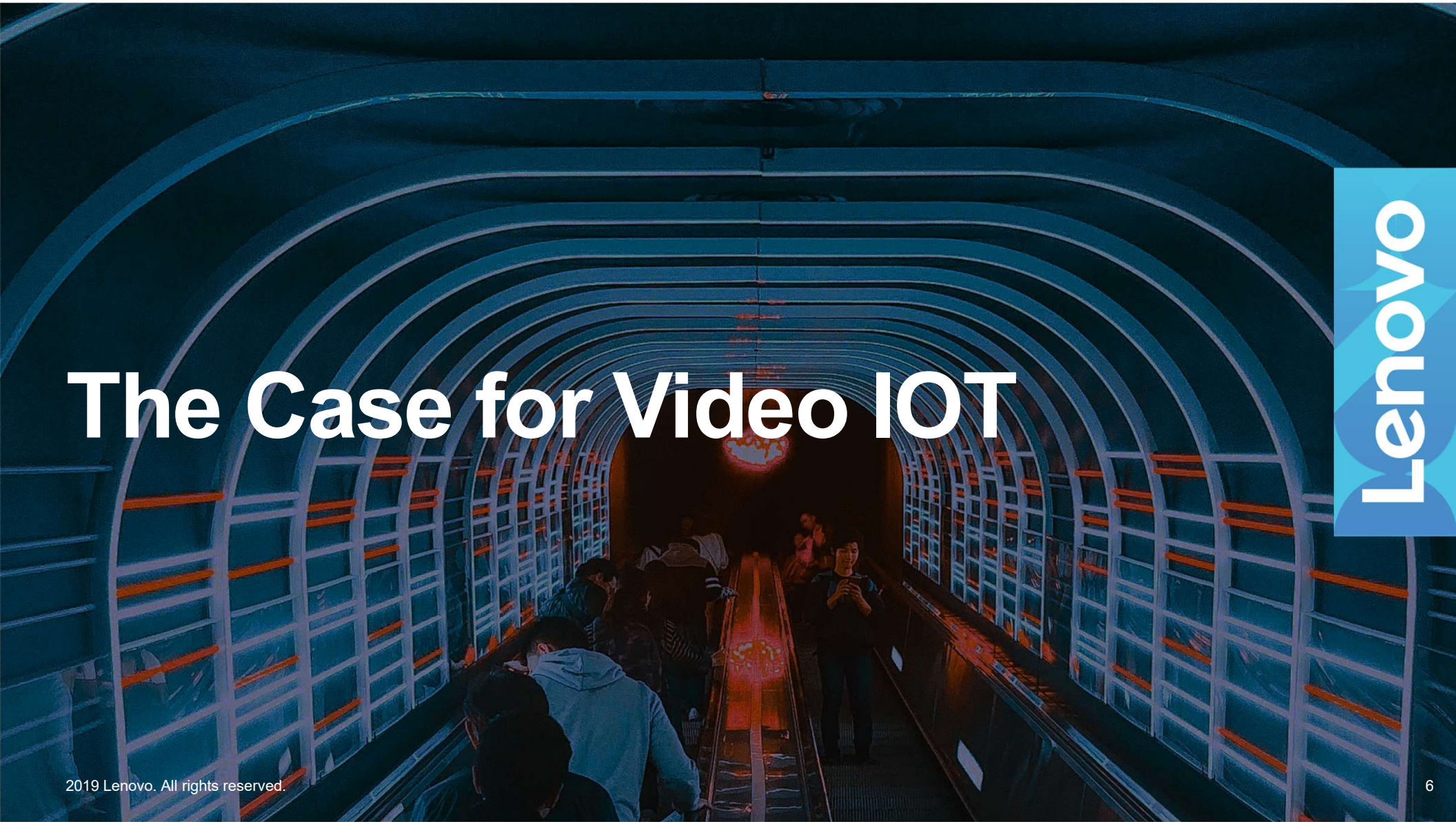
New Process



Savings Sources

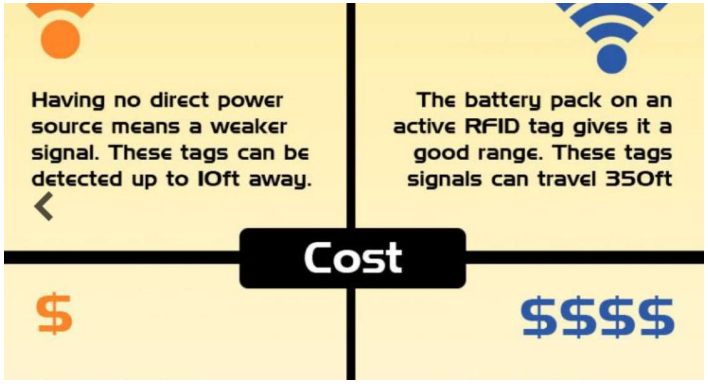
- **Receive to Ship latency – value of cash investment in inventory**
- **Warehouse traffic congestion and handling – personnel expenses**
- **Space savings by combining the same product in different categories (VMI/LOI)**

VMI = Vendor Managed Inventory **LOI = Lenovo Owned Inventory**

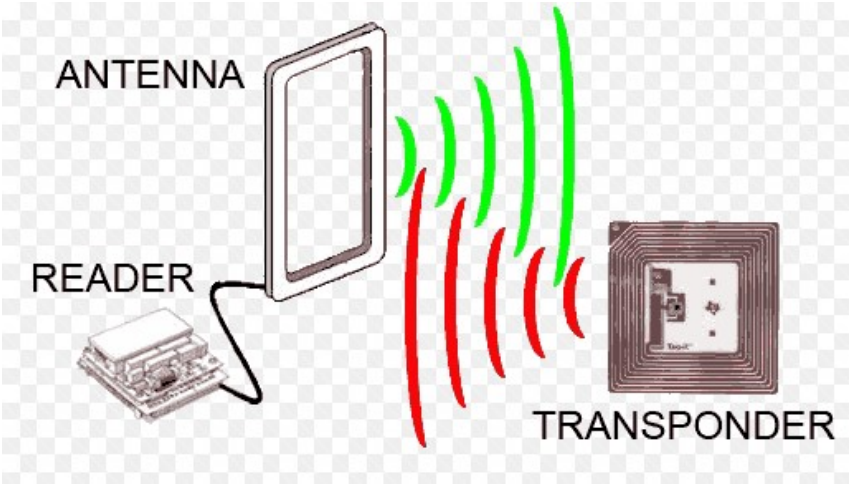


The Case for Video IOT

RFID - The Benefits and Hassles



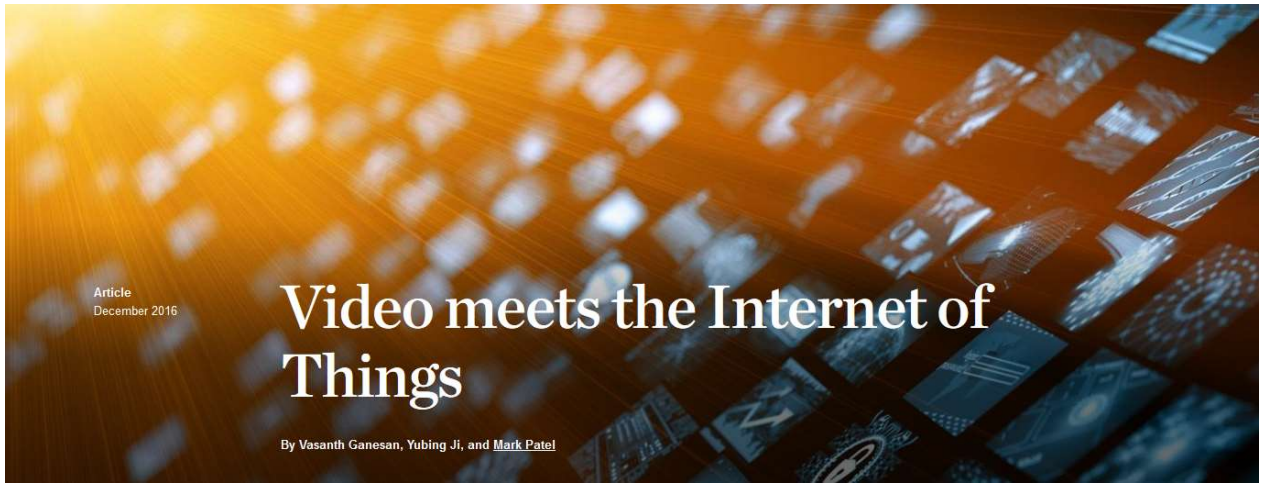
RFID



Why Video IOT?

- Data Rich Sensor
  - Humans easily process the collected data
  - Data includes most everything a human would see
  - AI analysis makes it actionable with the skills/precision of a IT
- Really cost effective per unit
  - Recognition
  - Serialized with paper/labeling
- Environmentally friendly
- Individual unit / Serialization is easily disabled
- Flexible
  - Data potentially created with no special provisions
  - Limited movement restrictions

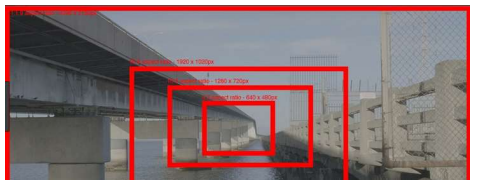
* Clip art may be copyright respective owners

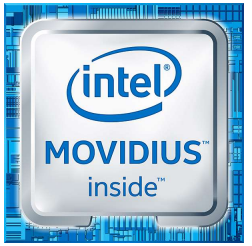


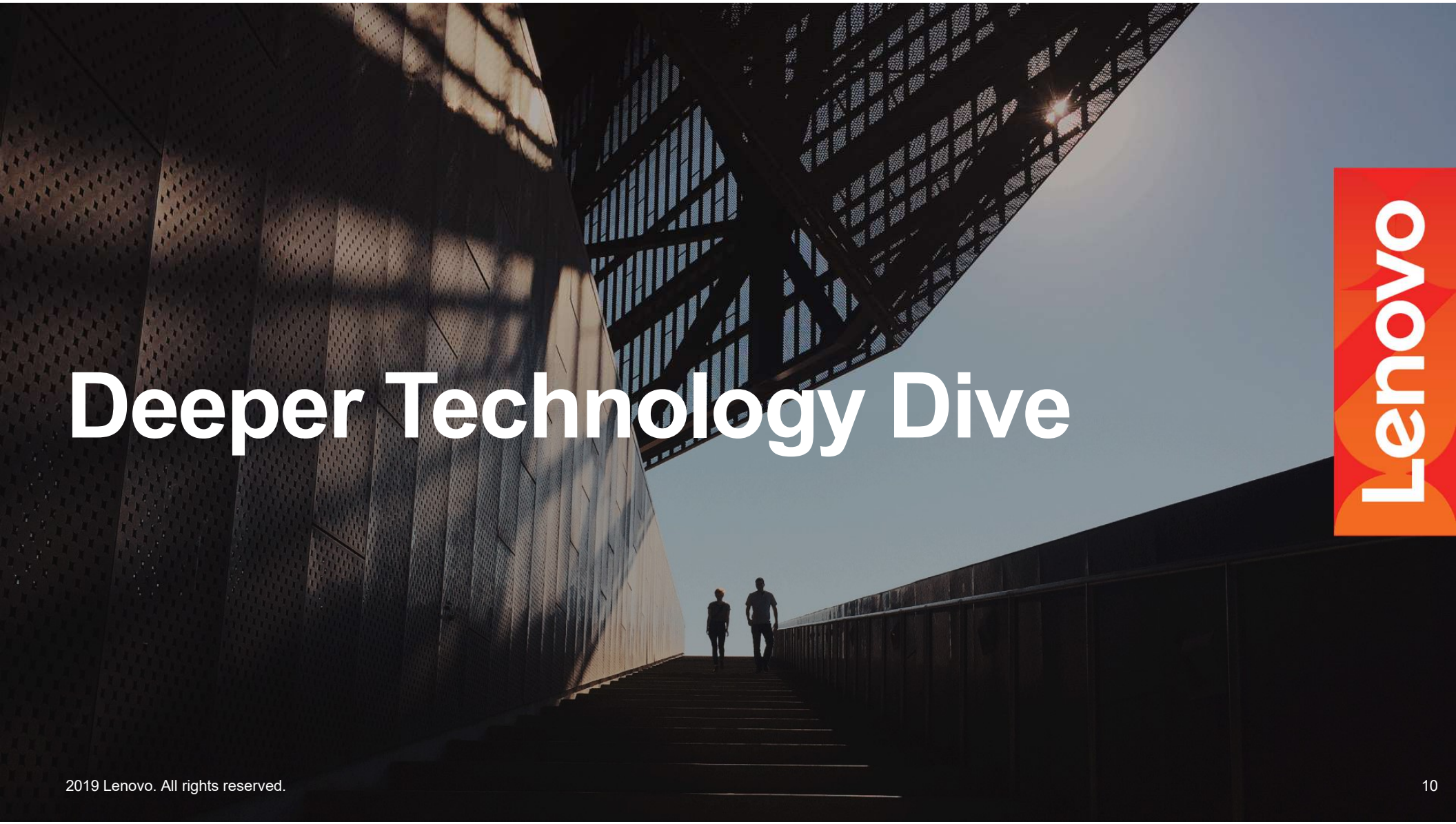
https://www.mckinsey.com/industries/high-tech/our-insights/video-meets-the-internet-of-things

Key Industry Trends Enable Video IOT

- **UHD (4k) cameras** are getting CHEAP (relatively)
- **Internet of Things (IOT)**
  - Frameworks supported by every cloud provider
  - Huge market to gather data from everything
- **Artificial Intelligence (AI)**
  - Analysis draw conclusions and optimize on disparate items
  - Intel – Movidius Convolutional Neural Networks (CNNs)
- **Edge processing and analysis**
  - Cloud providers of IOT frameworks rush to edge processing
    - Geophysical Data Security
    - Network bandwidth
      - Consolidate, interpret and filter the data
      - Latency
      - Enable new IOT sensors – like Video
- **5G Edge Data Orchestration**
  - Edge data bandwidth/ latency to support UHD video







New Class of Compact Servers for the Edge

PC Tiny

SE350 IoT Edge Server

1U Rack Server

ThinkSystem SE350 Edge Server

Purpose built IoT/Edge server

- 4-16 Xeon D cores with up to 256 GB memory
- PCIe slot for GPU AI inferencing or additional NIC
- Broad wired and wireless connectivity
- Up to 16TB+ of SSD storage
- Enhanced security, tamper detection, & encryption

VESA mount

3 nodes stacked

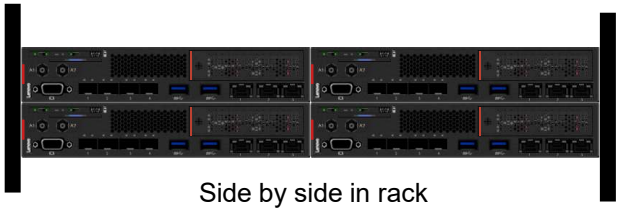
Brings compute wherever it's needed

- Small and flexible to go anywhere
- Rugged design handles 0-55C, dust, and vibration
- Hang on wall, stack on a shelf, mount in a rack
- Telco NEBS and -48V variants
- Fits in a Fedex box; easy deploy and repair

DIN and Wall mount

Best of the cloud, at every site

- Flexible design allows for standardization across sites
- Hyper-converged stacks provide reliability & lower TCO
- Low touch deployment features to simplify roll out
- ThinkSystem focus on reliability and security



Side by side in rack

INTEL® Movidius™

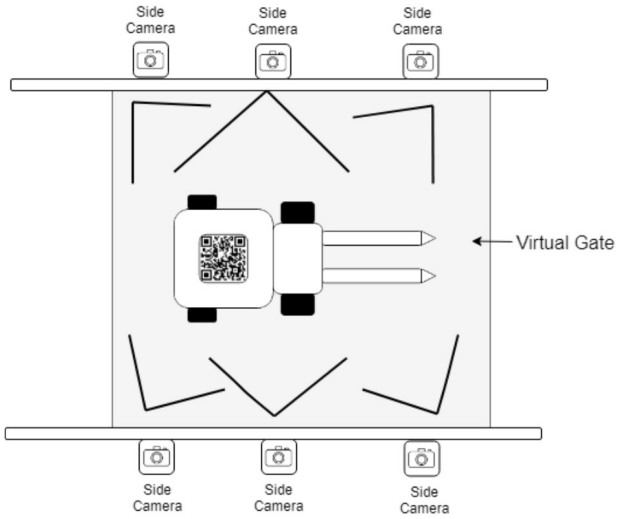
LOW POWER EDGE ACCELERATION FOR DEEP LEARNING INFERENCE AND COMPUTER VISION

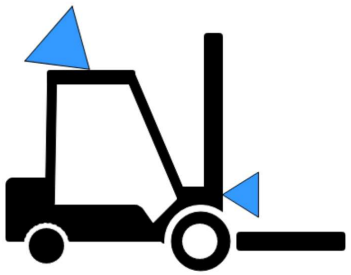
KEY TECHNOLOGY ATTRIBUTES

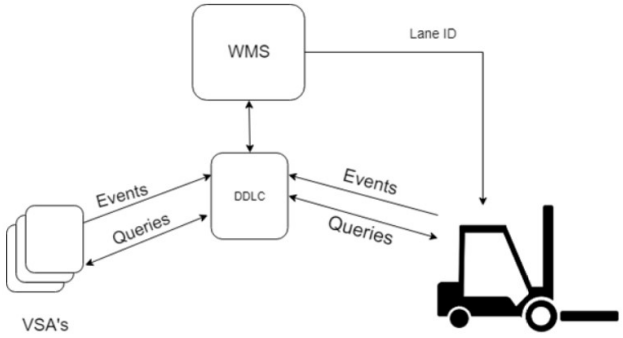
- On-device AI for immediate response, reliability, privacy, and reduced network bandwidth
- Optimized hardware and programmable engines for Sensing, Perception & AI
- Power and performance levels “Right Sized” to meet demanding workloads for edge devices
- Comprehensive Software Development Kit for application differentiation

Solution Component Overview

- AI Training
- Downscale images for Movidius object recognition
  - Using NCS development kit / OpenVINO
  - Leveraging Caffe
  - CNN shape is custom to Movidius
  - MobileNetSSD Object Detection Models
- Decode the region of interest with libdmtx
- Multi-camera data fusion for forklift dispositioning
- MQTT messages interconnect the processes / applications
- Warehouse management system (WMS) provides the freight content and location
- Distributed, scalable Windows and Linux solution







5G & Factory Automation/Industrial IoT (IIoT)

- **Automated Smart Factory**
  - **increasingly mobile** assets require powerful wireless communications
  - Application connectivity requirements around **latency and reliability.**
- **Artificial Intelligence + 4K/8K Video + 5G URLLC (Wireless)**
- **5G (NR, LTE) Advantage -** *Ocado is Amazon competitor*
  - Ocado found 802.11xx lacking and choose 4G LTE LAA (Licensed Assisted Access) for wireless communication.
  - 5G NR provides an even more flexible lower latency higher reliability & high bandwidth, wireless communication backbone for smart factories.

4G LAA + AI + Mobile Robots + Air Traffic Controller SW

https://twitter.com/theeconomist/status/1014388636832403456?lang=en

Please visit the Demo in the Intel Booth

Mobile World Congress Barcelona – Intel Booth - Hall 3 Booth 3E31

Pro-forma results

- 50% less VMI freight movement
- Eliminates manual touches
- Reduces carrying cost by 80%
- Eliminates staging/segregation space by about 30%
- Estimated 2 year return of Equity (ROE)

Come see us in the Intel Booth!

thanks.

MWC '19

Lenovo