



# INTEL EDGE INSIGHTS SOFTWARE

## RAPID DEPLOYMENT OF ANALYTICS PIPELINES

Industrial Solutions Division, Intel



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# INTEL EDGE INSIGHTS SOFTWARE WORKSHOP

## TODAY'S SCHEDULE

Intel Industrial Developer Program

Intel Vision for Industrial Workloads and Applications

Intel Computer Vision Deep Learning with OpenVINO\*

Building and Deploying Visual Industrial Solutions on the Edge Insights Software Stack

Building and Deploying Time Series Industrial Solution on Edge Insights Software





# VISION FOR INDUSTRIAL IOT





**THE ECONOMY IS POWERED  
BY THE INDUSTRIAL SECTOR**

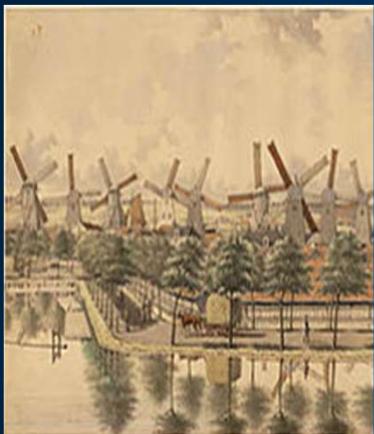
**THE INDUSTRIAL PC IS ITS DIGITAL FOUNDATION**

The economic impact of factory IoT applications forecast to reach **\$1.2 Trillion** by 2025<sup>1</sup>

1) McKinsey & Company, The Internet Of Things: Mapping The Value Beyond The Hype. [Link](#)

# INDUSTRIAL REVOLUTION 4.0

1<sup>ST</sup>



1760'S

Steam, Water  
Mechanized  
Production

2<sup>ND</sup>



1860'S

Electrification, Oil,  
Mass Production

3<sup>RD</sup>



LATE 1900'S

Invention of the  
Electronic Systems

4<sup>TH</sup>



NOW

Invention of the  
computerized network

# INTEL TECHNOLOGY FOR INDUSTRIAL IOT/INDUSTRY 4.0



## Open Platform

built with interfaces and APIs that enable integration with legacy systems and devices and with platforms from multiple vendors.



## Interoperability

is designed into IA CPUs to offer backward compatibility to help SW and application reuse thus reducing development time and resources.



## Performance at the Edge

that enables near-real-time analytics, local decision making, and tighter process controls.



## Advanced Security

for trusted data from edge to cloud and protection from costly attacks.



## Scalability

for varying levels of gateway performance, with a broad range of support from Intel® Quark™, Intel® Atom™, Intel® Core™ and Intel® Xeon® processor D and E families.



## Manageability

for secure remote upgrades and services.



## Faster, More Flexible Deployment

with a platform that supports your choice of operating systems and ecosystem applications.

# INTEL IS PARTNERING WITH THE ECOSYSTEM

# ECOSYSTEM PARTNERS



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# MANUFACTURING'S NATURE IS CHANGING



ANALOG  
OPERATED  
INDUSTRY

INSTRUCTION  
OPERATED  
INDUSTRY

SOFTWARE  
OPERATED  
INDUSTRY

DATA  
OPERATED  
INDUSTRY

# WHAT IS AN INDUSTRIAL PC?



RUGGEDIZED DESIGN  
WIDER OPERATING TEMPERATURE  
EXPANSION OPTIONS  
DUST/WATER /IMMERSION-PROOF  
ENHANCED EMI FILTERING  
INDUSTRIAL GRADE COMPONENTS

TYPICALLY LASTS 7-10 YEARS  
**PURPOSE BUILT FOR A FACTORY**

Photo source: Intel® IoT Solutions Alliance Solution Directory

Internet of Things Group



# INDUSTRIAL MANUFACTURERS REQUIRE INDUSTRIAL COMPUTE TODAY



The plant floor is a source of, and is powered by, data



Factories function more efficiently to reduce costs



Manufacturing flexibility matches consumer demands



Equipment management to improve quality

## Optimized Production

An oil & gas refiner utilizes data collected through IPCs in the refinery & commodity market prices to now create a daily refining plan (was weekly)

## Product Defect Detection

A manufacturer is using an IPC to detect product quality issues immediately – at the machine!

## On-Demand Manufacturing

A FMCG company adjusts its mass-market production to switch products without line switching to match its digital strategy & grow revenue

## Predictive Maintenance

Semiconductor maker monitors vibrations on equipment fans to predict fan failures – realizes higher equipment reliability & higher product yield



# CASE STUDY: REPLACING LEGACY FACTORY IPC

A beverage company upgraded to Microsoft® Windows 10, maintaining its existing I/O cards and completing the transition in less than half the time estimated to create a custom solution.

A manufacturing company migrated its operations to a new, more reliable SCADA system while retaining their existing application software.

# INDUSTRIAL EDGE COMPUTE IS TRANSFORMING

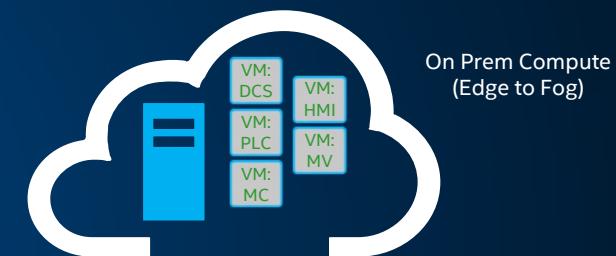
FROM THIS...

PROPRIETARY, SPECIALIZED, MONOLITHIC



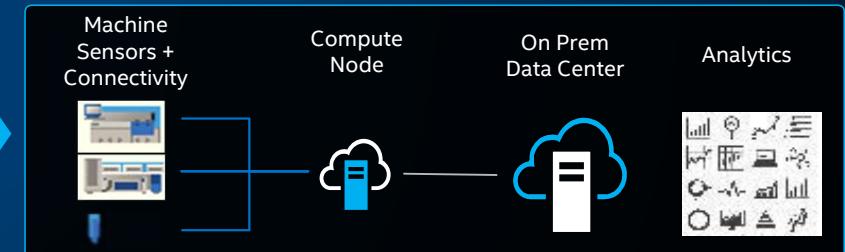
TO THIS...

VIRTUALIZED, OPEN, INTEROPERABLE



Control

Analytics



ENABLED BY TECHNICAL PILLARS OF TRANSFORMATION

VIRTUALIZATION

SECURITY

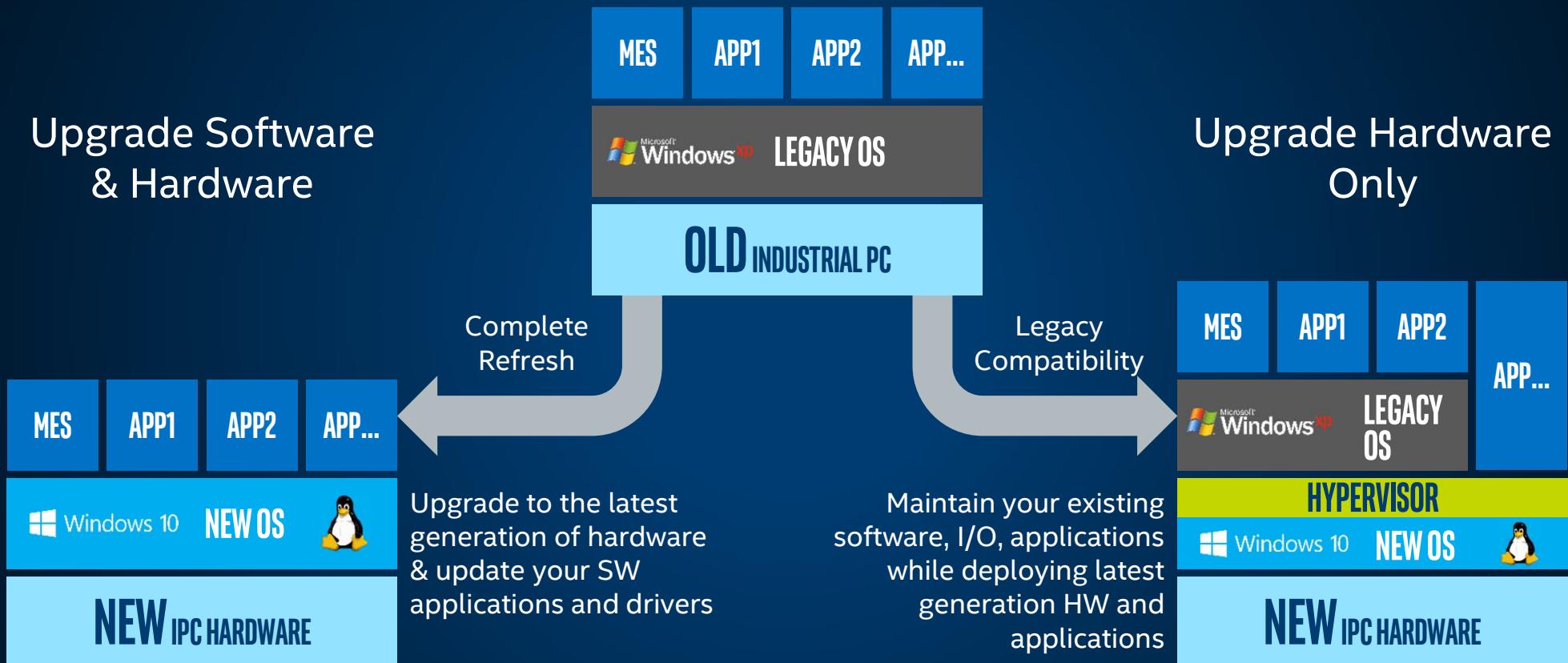
SAFETY

ANALYTICS (A)

MACHINE VISION

REAL TIME

# TWO PATHS TO UPGRADE YOUR INDUSTRIAL PC



\* Other names and brands may be claimed as the property of others.

## PRODUCTION

Control & Automation  
Improve Yield  
Reduce Downtime  
Optimization

## QUALITY

Quality Management  
Process Control

## INVENTORY

Supply Chain Tracking  
Location Sensors



## MAINTENANCE

Scheduled Downtime  
Augmented by Sensor-based Monitoring

## SAFETY

Worker Safety Program  
Safety Tracked Offline

## REGULATORY

System Compliance  
Operational Conditions

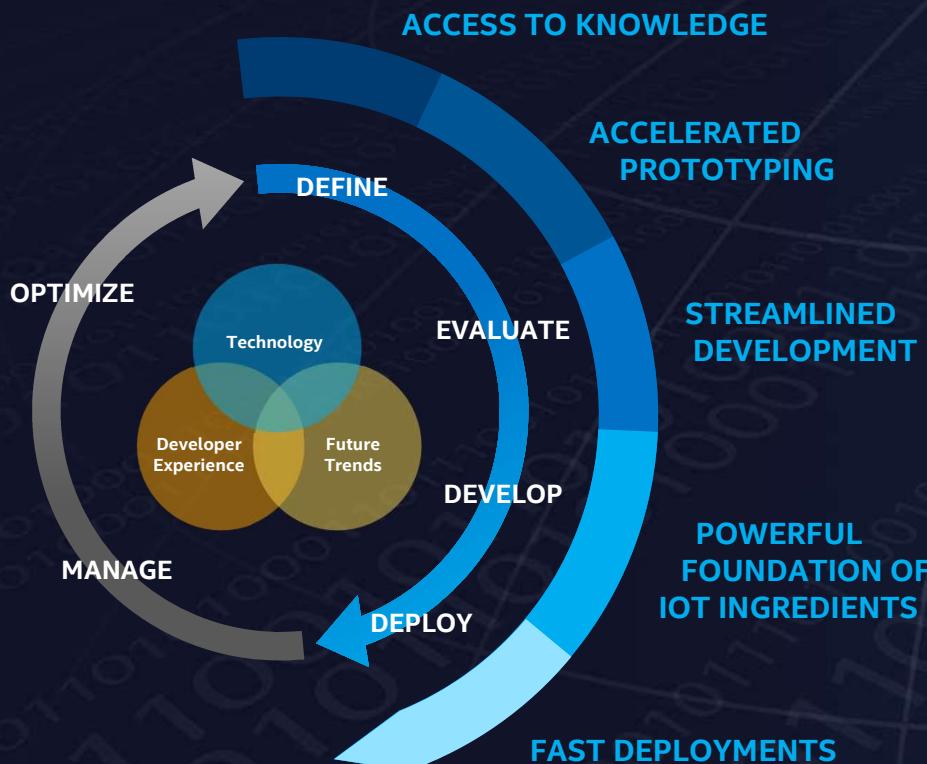


# THE INTEL DEVELOPER PROGRAM



# ENABLING NEW DEVELOPER OPPORTUNITIES

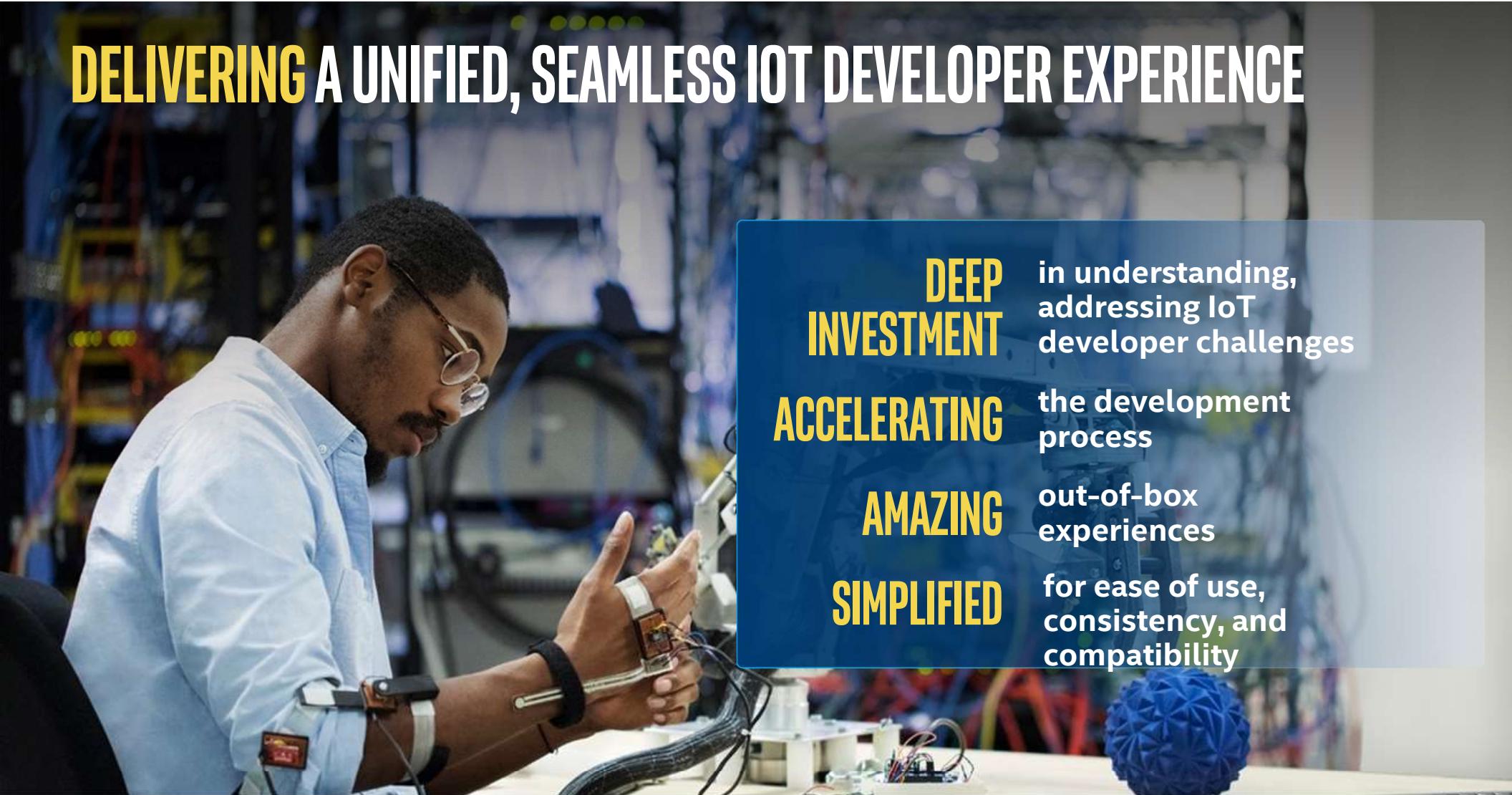
## The Developer's Journey



## What Intel Brings

- Common and seamless Developer experience
- Start to finish technologies for robust solutions
- Simplified path to develop and deploy products, systems, solutions
- Reusability, extensibility, portability, future proof

# DELIVERING A UNIFIED, SEAMLESS IOT DEVELOPER EXPERIENCE

A photograph of a Black man with a mustache, wearing a light blue button-down shirt and safety glasses, working on a piece of electronic equipment. He is wearing a black wristband and a white smartwatch. The background is a blurred industrial or factory environment with various equipment and shelving.

**DEEP  
INVESTMENT**  
**ACCELERATING**  
**AMAZING**  
**SIMPLIFIED**

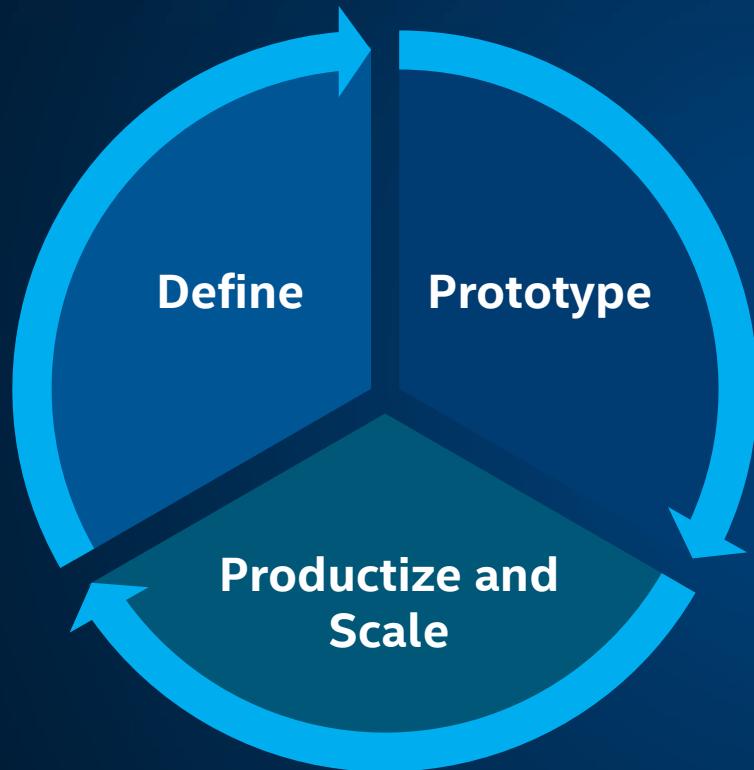
in understanding,  
addressing IoT  
developer challenges

the development  
process

out-of-box  
experiences

for ease of use,  
consistency, and  
compatibility

# ENGAGING THROUGH ALL PHASES OF DEVELOPMENT



## EVENTS

Virtual/Tradeshows  
(Global IoT DevFest)



## WORKSHOPS

Hands-On Training



## PROMOTION

Showcase Reference Implementations  
IoT Innovators sharing Expertise



## ENGAGEMENTS

ISV Engagement  
App Enablement  
Architecture Conversion

INTEL DEVELOPER ZONE FOR IOT:

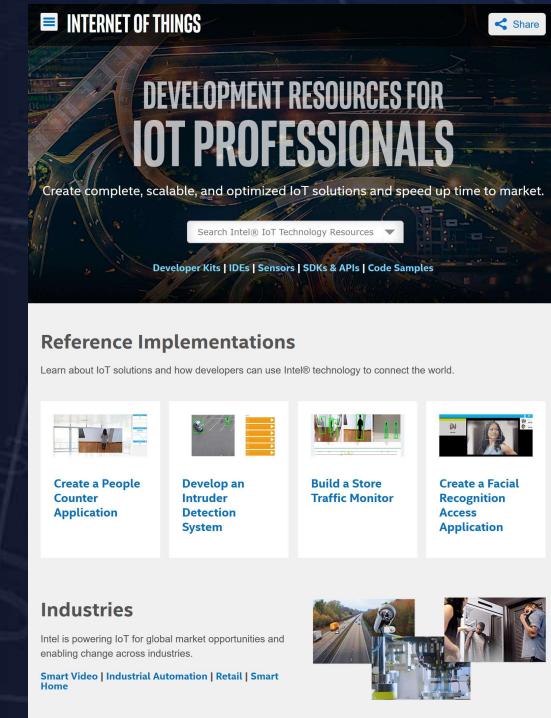
# CENTRAL RESOURCE FOR E2E SOLUTION SUPPORT

Training, How-Tos,  
Documentation, Forums, Support

Development Kits, SDKs, Libraries, Sensor  
Drivers, APIs, Tools

Code Samples and Tutorials,  
End-to-End Reference Implementations

Guides for Productization and  
Commercialization



[software.intel.com/iot](http://software.intel.com/iot)



# DEFECT DETECTION DEMO

Software and Services Group  
IoT Developer Relations, Intel

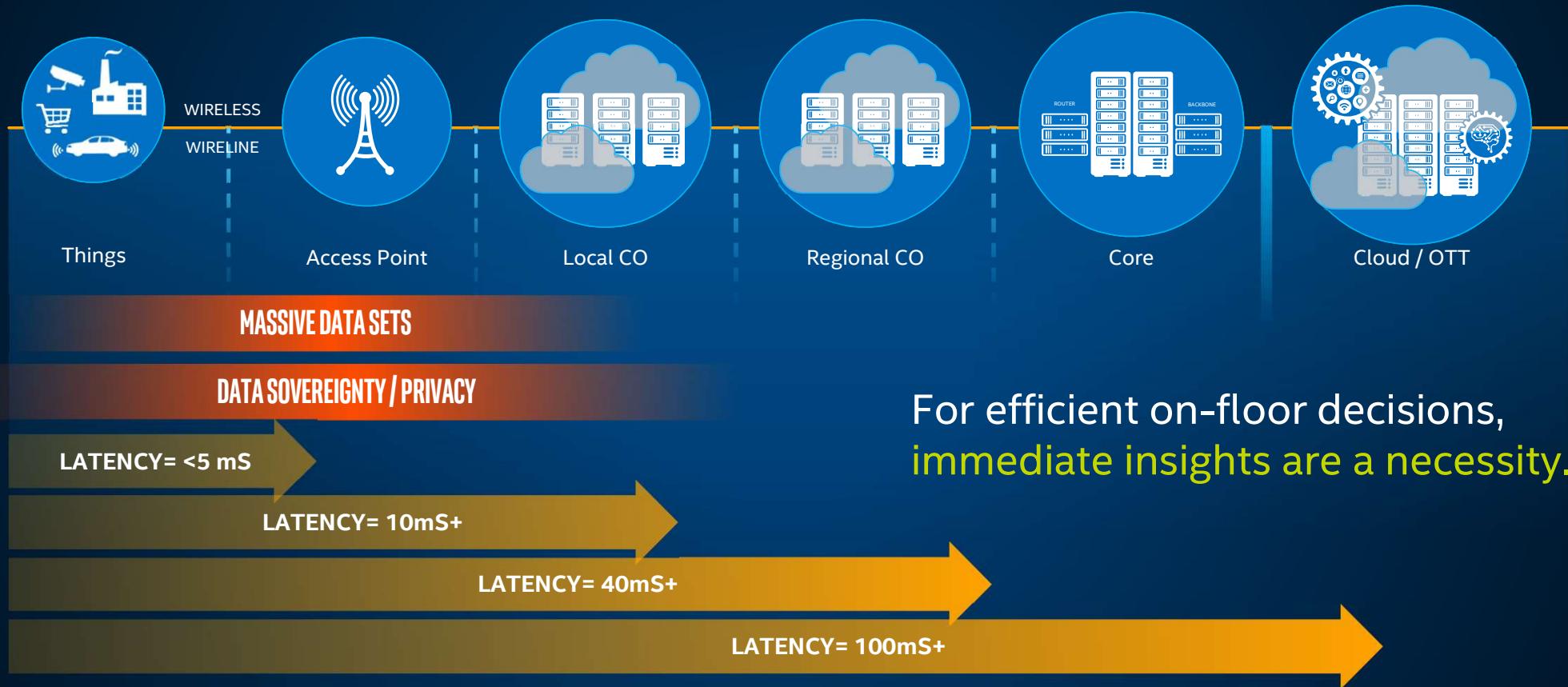




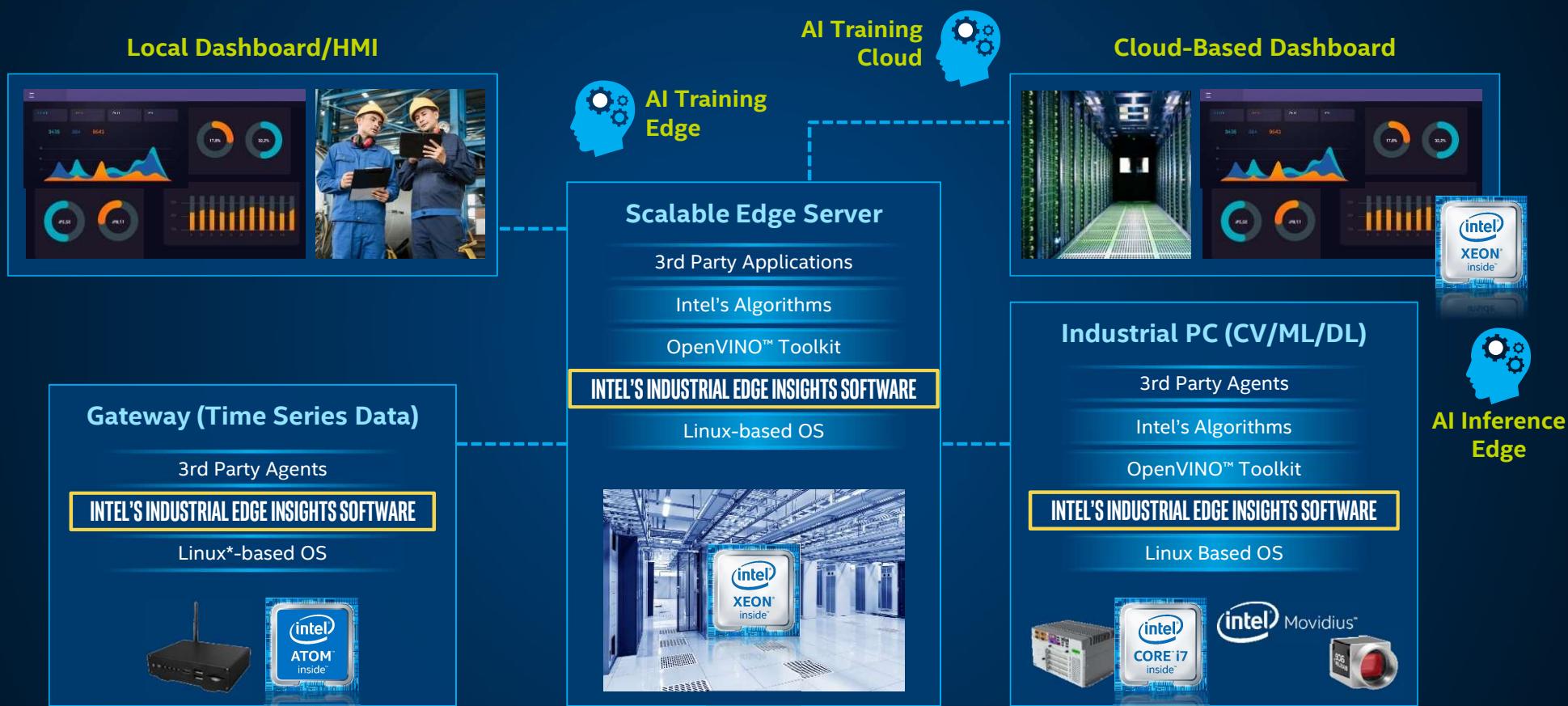
# INTEL EDGE INSIGHTS SOFTWARE RAPID DEPLOYMENT OF ANALYTICS PIPELINES

Industrial Solutions Division, Intel

# LATENCY, BANDWIDTH, SECURITY DRIVE ANALYTICS TO THE EDGE



# ANALYTICS PIPELINES FOR SMART MANUFACTURING



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# INTEL'S INDUSTRIAL EDGE INSIGHTS SOFTWARE (EIS)

ACCELERATES DATA ANALYTICS AND AI AT THE EDGE

## WHAT is EIS?

Edge Insights Software ("EIS") is modular, product validated software that enables extraction of data (time series, image/video, audio<sup>1</sup>) at the edge, allowing it to be securely communicated across different protocols and different Operating Systems, managed cohesively, and analyzed quickly



DATA INGESTION, PROCESSING, STORAGE;  
APP AND DEVICE LIFE CYCLE MANAGEMENT



SECURITY AND NEAR REAL-TIME



RUN AI ANALYTICS THROUGH INTEL  
DEVELOPED OR 3RD PARTY ALGORITHMS

## Who NEEDS it?

SI s OEMs ISVs CSPs

- ✓ Quicker to deployment
- ✓ Quicker to productization and time to market
- ✓ Downloadable today with signed license

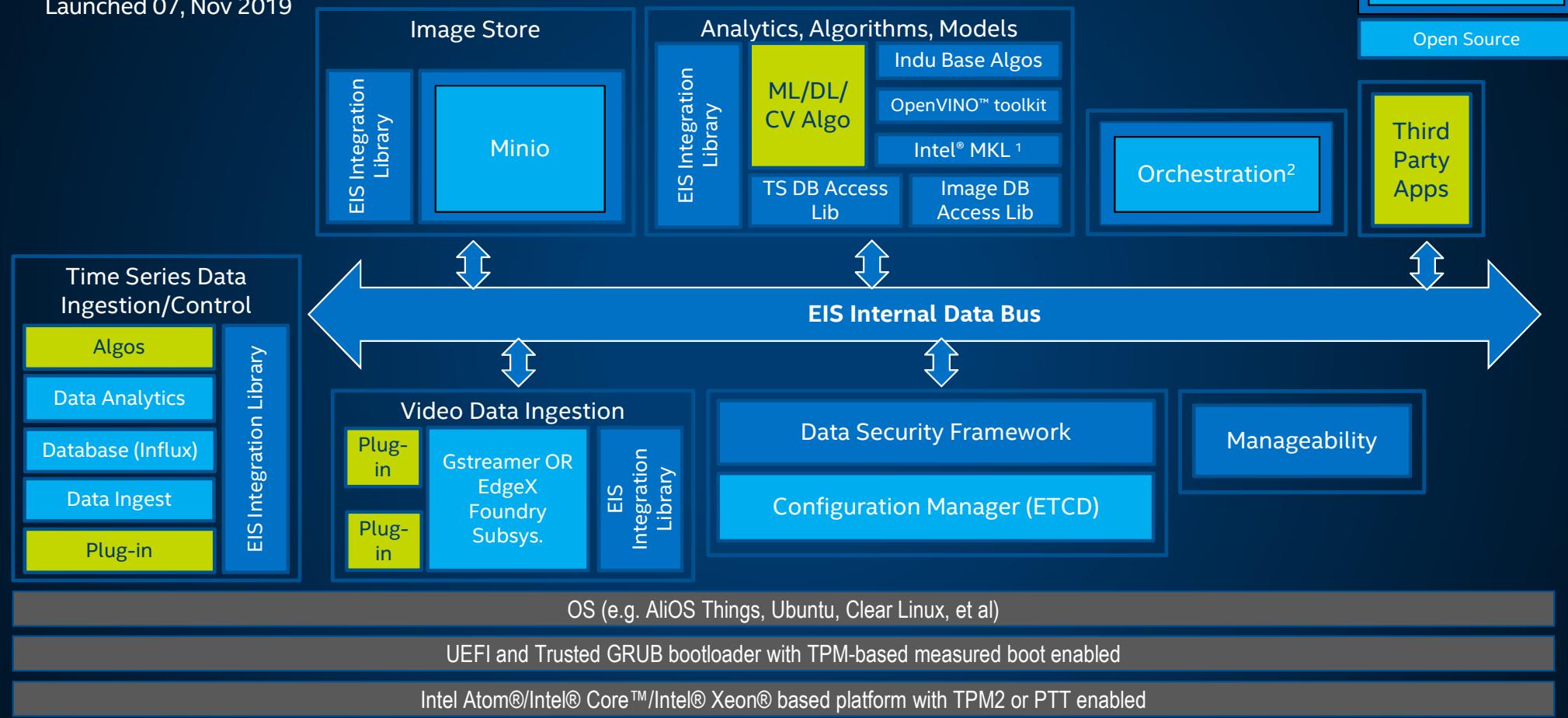
Save OXMs, SIs and CSPs 100s ~1000s engineering hours to let them do what differentiates them

For more information, visit [Intel EIS webpage](#)

- 1&2: Targeted for a future Industrial Edge Insights Software release
- Other names and brands may be claimed as the property of others.

# EDGE INSIGHTS SOFTWARE 2.X ARCHITECTURE

Launched 07, Nov 2019



IOTG-ISD 1. Intel® Math Kernel Library (Intel® MKL)

2. Targeted for a future Industrial Edge Insights software release

Intel Confidential

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# INTEL'S INDUSTRIAL EDGE INSIGHTS SOFTWARE (EIS) FEATURES

## EIS provides:

- Modular message/data bus for machine, video, and audio\* workloads
- Containerized ingredients for image processing, storage, and analytics
- Support for industrial optimized inference and training at the Edge
- Support for various operating systems (e.g. Linux\*, AliOS\*, etc.)
- Connectors for easy usage of Intel® Media Software Development Kit (Intel® Media SDK), OpenVINO™ toolkit, and Intel® Math Kernel Library (Intel® MKL)
- Optimized for Intel's CPU, GPU, FPGA, and VPU portfolio with hardware ranging from Gateways, Industrial PCs (IPCs), to Edge Servers
- **\$0 binary distribution (OBL) to Intel's ecosystem partners**



SECURITY



REAL TIME



AI

Optimized on  
Intel® Architecture-Based  
Platforms



Intel® Vision Accelerator  
Design Products &  
AI in Production/  
Developer Kits

OpenVINO™

1. Targeted for a future Industrial Edge Insights software release

• Other names and brands may be claimed as the property of others.

# INDUSTRIAL CUSTOMERS SEEK ANSWERS ....



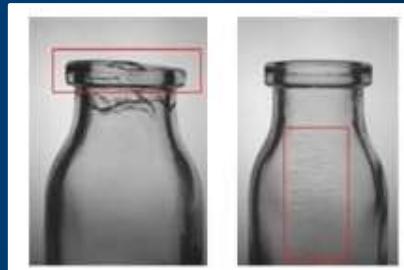
How can I  
meet rising requirement  
on **PRODUCT QUALITY?**



How can I better  
**PREDICT AND REDUCE  
DOWNTIME?**



How can I **OPTIMIZE  
FACTORY OPERATION**  
for higher throughput?



How can I leverage  
Latest technology for  
**BETTER BUSINESS OUTCOMES?**

How can I **STAND OUT IN COMPETITION** in my industry?

# THE ANSWER LIES IN INSIGHTS FROM DATA ANALYTICS

Insights are generated from basic/operational analytics to more advanced analytics.

## THE PATH TO DEEPER INSIGHT



**AI**  
IS THE DRIVING FORCE



# DATA ANALYTICS HELP TO REDUCE DOWNTIME, IMPROVE PRODUCT QUALITY, OPTIMIZE OPERATION

Unleash the values of all data types including vision data and non-vision data at the edge for truly smart and connected industrial environment



## PEOPLE

- Worker safety
- Worker behavior

## MACHINE

- Predictive maintenance
- Robotics Pick and Place

## MATERIAL

- Product defect detection
- Raw material appearance inspection
- Asset management

## PROCESS

- Factory operation optimization
- Optimization of raw material utilization
- Predictive Analytics

## ENVIRONMENT

- Temperature optimization
- Humidity optimization

Structured Data

Time series

Image

Video

Text

Audio

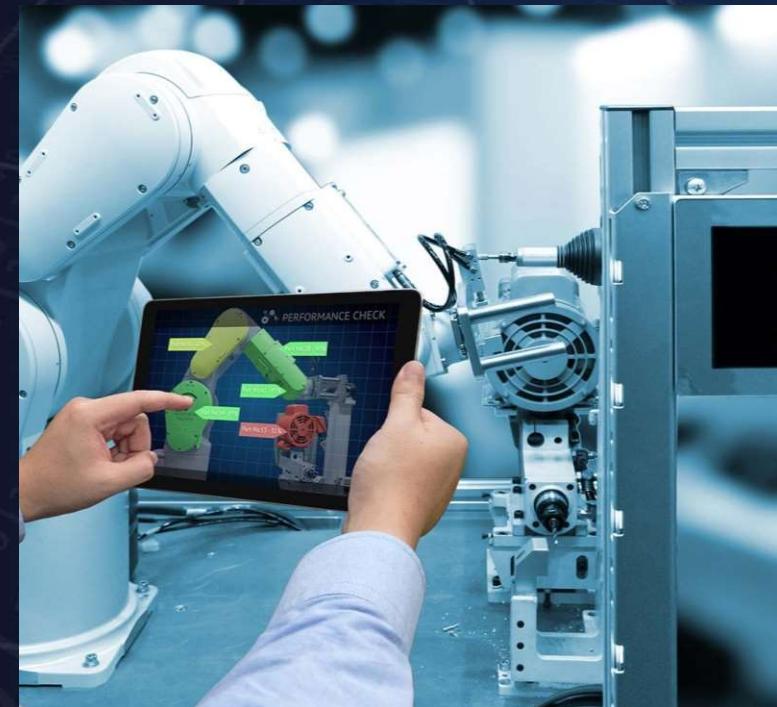
# TRANSFORMATION IN THE INDUSTRIAL MARKET

Smart factory is one of the outcomes of Industry 4.0.

It employs artificial intelligence, robotics, analytics, workload consolidation, and IoT to transform raw data into immediate (near real-time) **insights**.

The benefits of smart factories are many<sup>1</sup>:

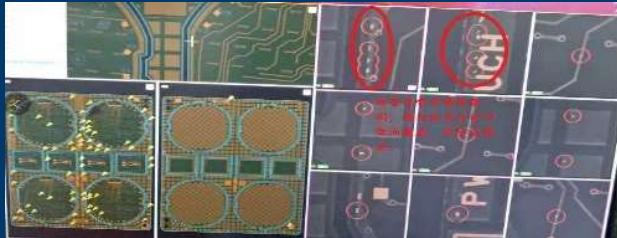
- Leaner process
- Maximum flexibility
- Improved predictability
- Increased agility
- Proven productivity



1. "Smart Factory and Its Benefits on Manufacturing Industry," Infinite Uptime August 21, 2018 <https://infinite-upptime.com/blog/smart-factory-benefits-manufacturing/>

# INDUSTRIAL EDGE INSIGHTS PLATFORM USE CASES

## DEFECT DETECTION



Package, part, or surface defects detection using AI and vision technology

- Inline quality control/assurance
- Reduce production losses and cost
- Reduce customer returns

## PREDICTIVE ANALYTICS



Predicting future outcomes based on historical data

- Predict product quality
- Predict equipment maintenance
- Prevent costly maintenance
- Predict yield fluctuation

## MANUFACTURING PRODUCTIVITY



Identifying opportunities/processes to improve on

- Monitor and improve factory production efficiency
- Monitor and identify production line constraints
- Monitor worker safety

APPLICABLE FOR BROWNFIELD AND GREENFIELD SITES AND INFRASTRUCTURES

# JWIPC RRK: EDGE INSIGHTS RFP READY KIT



## AI-Ready AIO Gateways/Industrial PCs

- Intel's Industrial Edge Insights Software
- Intel® OpenVINO™ toolkit
- AliOS Things\* and Link Edge\* Ready
- Intel® Atom™, Intel® Core™, Intel® Xeon™ Processors
- Fan or Fanless, Rugged Configurations
- 2-4x PCIe\* (Altera® or Intel® Movidius™ technology)
- 2-4x COM 6x USB3.0
- 2.5" HDD Hot Plug
- 2-4x Ethernet (PoE)
- Ubuntu\*, CentOS\*, Windows\*, or Yocto\* Ready<sup>1</sup>

1- OpenVINO™ Toolkit OS Support: CentOS\* 7.4 (64 bit), Ubuntu\* 16.04.3 LTS (64 bit), Microsoft Windows\* 10 (64 bit), Yocto Project\* version Poky Jethro v2.0.3 (64 bit)

\* Other names and brands may be claimed as the property of others.



# IEI TANK-870-Q170



The IOT Client Foundational Kit will provide **manageability**, **performance**, and a **scalable rapid path to market** solution that will support advanced **computer vision** and **deep learning** usages.

[http://eshop.usa.ieeworld.com/usa/items.php?CA=2&sub\\_CA=24](http://eshop.usa.ieeworld.com/usa/items.php?CA=2&sub_CA=24)

<https://software.intel.com/en-us/blogs/2018/06/13/introducing-the-tank-aiot-developer-kit>

## PCIE SLOTS THAT WILL SUPPORT HDDL-F (FPGA) AND HDDL-RC (MYRIAD X)

Core i5  
Fanless  
8GB of RAM  
1TB HDD  
2x PCIe x8  
Dual LAN with TSN support  
WIFI  
I/O Ports: 4x USB 3.0, 4 x USB 2.0, 4x RS-232, 2x RS-232/485, 8-bit DIO, 1x Line-out, 1x Mic-in  
Operating Temp: -20°C~60°C

# VISION ACCELERATION KIT + HDDL-R

## POWERED BY IEI\*

- Specialized Processors designed for high-performance machine vision at low power
- 8 VPUs x 16 SHAVE cores (Streaming Hybrid Architecture Vector Engine)
- Supports multiple network topologies (GoogLeNet, ResNet, etc.)
- Two Memory Banks (DDR4, 8GB in total)
- Preinstalled Intel® Distribution of OpenVINO™ toolkit
- Get started quickly with samples



TANK-870-Q170



# IEI\* TANK AIOT DEVELOPER KIT

- High-performance computer vision Applications
- Industrialized Design
- Intel® Core™ or Intel® Xeon™ Spec.
- Extendible with PCIe\* AI Accelerators
- Preloaded with the Intel® Distribution of OpenVINO™ toolkit



# INTEL INGREDIENTS IN INDUSTRIAL AUTOMATION

Data Center

Compute Performance  
I/O intensive



Factory server

Compute Performance  
I/O intensive



Industrial PC

Compute Performance  
Visualization/ UX  
RT Perf



PLC/PAC

I/O intensive  
Form Factor Sensitive  
RT Perf



HMI

Compute Performance  
Visualization/ UX  
Form Factor Sensitive



Remote IO

I/O intensive  
RT Perf



Robots

Compute Performance  
I/O intensive  
RT Perf



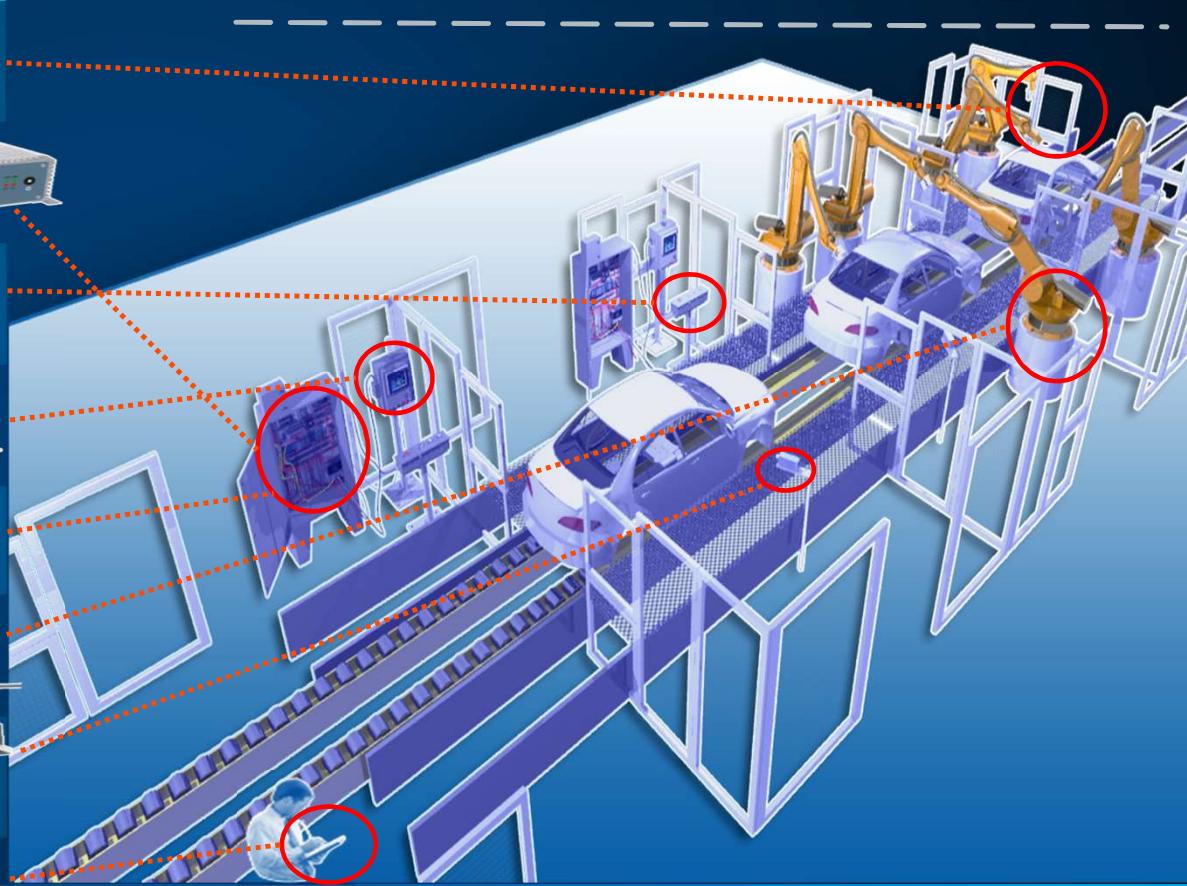
Machine visions

Compute Performance  
Form Factor Sensitive



Mobile workforce

Visualization/ UX  
Form Factor Sensitive



# VERIFIED SWAPPABLE IPC READY TO RUN



**ADLINK TECHNOLOGY, INC.**  
PRODUCTS: RK-630/IMB-M43-C236 RK-630/IMB-M43H  
LEARN MORE:  
<https://www.adlinktech.com/>



**ARBOR**  
PRODUCTS: FPC-7903  
LEARN MORE:  
<https://www.arbor-technology.com/>



**AXIOMTEK CO., LTD**  
PRODUCTS: IPC962-511-FL IPC962-512-FL  
LEARN MORE: <http://www.axiomtek.com/>



**DFI INC.**  
PRODUCTS: KU173 SD631  
LEARN MORE: <http://www.dfi.com/>



**IBASE TECHNOLOGY INC.**  
PRODUCTS: CMI203-991 AMI222  
LEARN MORE: <https://www.ibase.com.tw/>



**IEI INTEGRATION CORP.** PRODUCTS:  
TANK-870AI TANK-870e-H110 LEARN MORE: <https://www.ieeworld.com/>



**LEX COMPUTECH CO., LTD.**  
PRODUCTS: CI170A  
LEARN MORE: <http://www.lex.com.tw/>



**NEXCOM INTERNATIONAL CO., LTD**  
PRODUCTS: NIFE300P2E LEARN MORE: <http://www.nexcom.com/>



**QUANMAX INC.**  
PRODUCTS: RAK-400 LEARN MORE: <http://www.quanmax.com/>

Photo source: Intel® IoT Solutions Alliance Solution Directory





# MIGRATE TO A NEW INDUSTRIAL PC TODAY

Avoid Obsolescence, Improve Security  
and Be Prepared for the Future

A photograph of two men in a factory. The man on the left is older, wearing a blue hard hat, safety glasses, and a light blue button-down shirt. He has a white beard and is gesturing with his right hand. The man on the right is younger, wearing a white hard hat, a dark blue tie, and a light blue dress shirt. He is holding a silver laptop in his hands and looking at it. They are standing in front of a large, complex piece of industrial machinery, possibly a conveyor belt or processing unit, with various pipes and metal components. The background shows more of the factory's interior, with other equipment and structural elements.

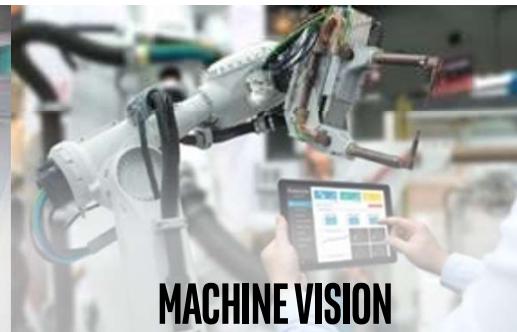
**OPENVINO® AND INTEL® MEDIA SDK\***



EMERGENCY RESPONSE



FINANCIAL SERVICES



MACHINE VISION



CITIES/TRANSPORTATION

# VIDEO BASED ANALYTICS

## USING COMPUTER VISION AND DEEP LEARNING IS GROWING RAPIDLY



AUTONOMOUS VEHICLES



RESPONSIVE RETAIL



MANUFACTURING



PUBLIC SECTOR

# INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT

Take your computer vision solutions to a new level with deep learning inference intelligence.



## What it is

A toolkit to accelerate development of **high performance computer vision & deep learning inference into vision/AI applications** used from edge to cloud. It enables deep learning on hardware accelerators and easy deployment across multiple types of Intel® platforms.

## Who needs this product?

- Computer vision, deep learning software developers
- Data scientists
- OEMs, ISVs, System Integrators

## Usages

Security surveillance, robotics, retail, healthcare, AI, office automation, transportation, non-vision use cases (speech, text) & more.



**HIGH PERFORMANCE, PERFORM AI AT THE EDGE**

**STREAMLINED & OPTIMIZED DEEP LEARNING INFERENCE**

**HETEROGENEOUS, CROSS-PLATFORM FLEXIBILITY**

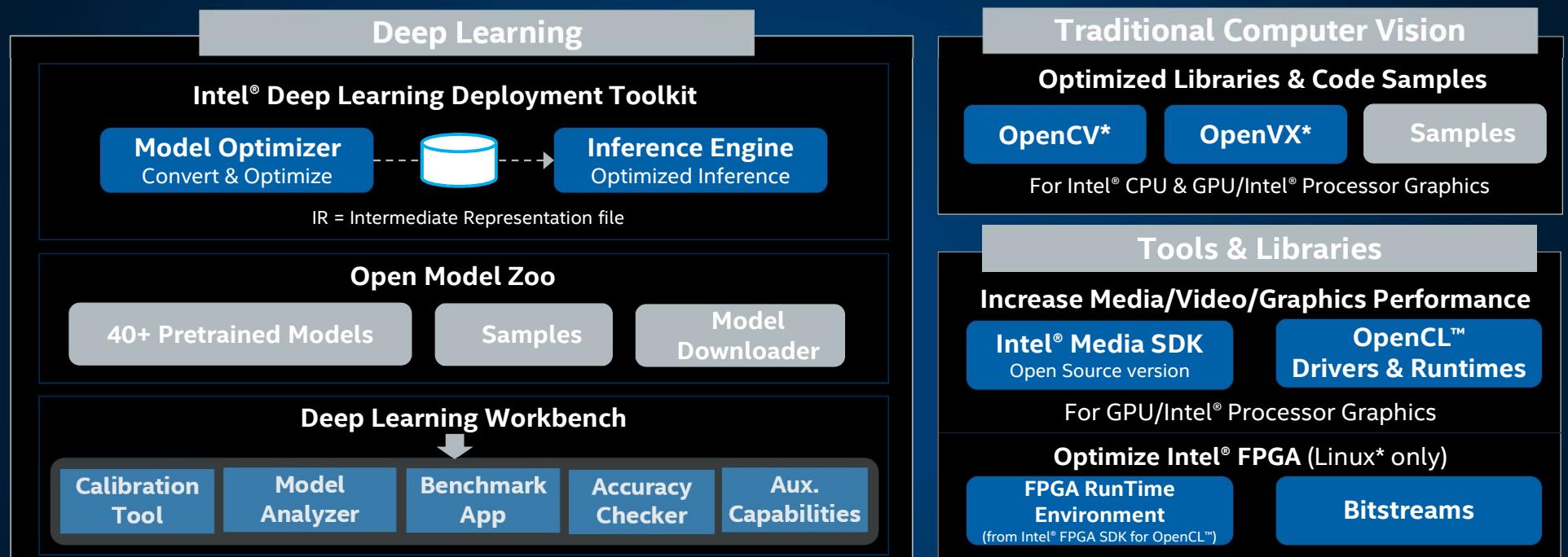
**Free Download ▶ [software.intel.com/openvino-toolkit](http://software.intel.com/openvino-toolkit)**

**Open Source version ▶ [01.org/openvinotoolkit](http://01.org/openvinotoolkit)**

Latest version is 2019 R1



# WHAT'S INSIDE INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT



**OS Support:** CentOS\* 7.4 (64 bit), Ubuntu\* 16.04.3 LTS (64 bit), Microsoft Windows\* 10 (64 bit), Yocto Project\* version Poky Jethro v2.0.3 (64 bit), macOS\* 10.13 & 10.14 (64 bit)

Intel® Architecture-Based Platforms Support



Intel® Vision Accelerator Design Products & AI in Production/Developer Kits

An open source version is available at [01.org/openvino/toolkit](http://01.org/openvino/toolkit) (some deep learning functions support Intel CPU/GPU only).

OpenVX and the OpenVX logo are trademarks of the Khronos Group Inc.  
OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos



# BENEFITS OF INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT

MAXIMIZE THE POWER OF INTEL® PROCESSORS: CPU, GPU/INTEL® PROCESSOR GRAPHICS, FPGA,VPU



## ACCELERATE PERFORMANCE

Access Intel computer vision accelerators.  
Speed code performance.  
Supports heterogeneous execution.



## INTEGRATE DEEP LEARNING

Unleash CNN-based deep learning inference using a common API, 40+ pretrained models, & computer vision algorithms. Validated on more than 100 public/custom models.



## SPEED DEVELOPMENT

Reduce time using a library of optimized OpenCV\* & OpenVX\* functions, & 15+ samples.  
Develop once, deploy for current & future Intel-based devices.



## INNOVATE & CUSTOMIZE

Use OpenCL™ kernels/tools to add your own unique code. Customize layers without the overhead of frameworks.

**Deep learning revenue** is estimated to grow from \$655M in 2016 to **\$35B** by 2025<sup>1</sup>.

<sup>1</sup>Tractica 2Q 2017

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# INTEL AS BEST CHOICE FOR VISION SOLUTIONS

Deliver High Performance Computer Vision & Deep Learning  
Transform Data & Results into Artificial Intelligence

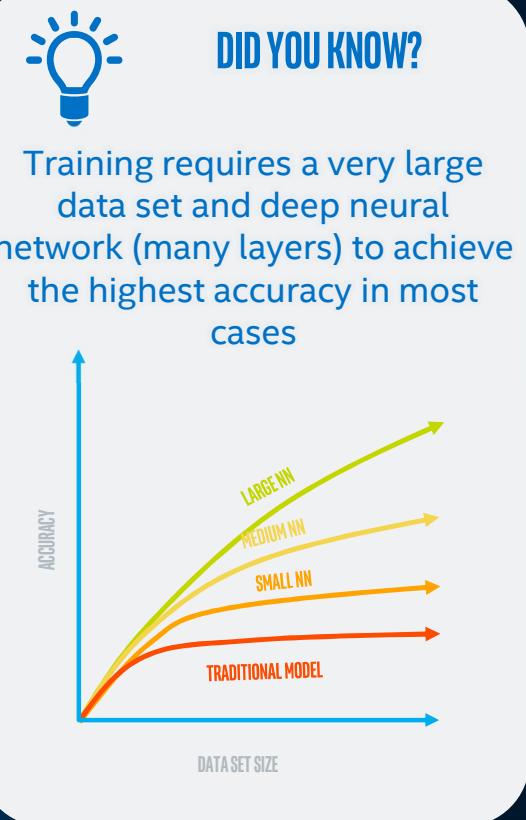
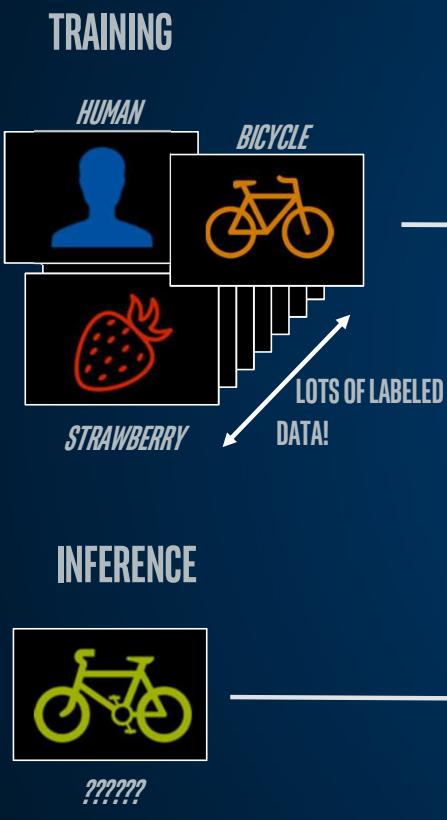
**Intel offers the broadest portfolio of hardware and software that help you**

- Accelerate workloads for a wide range of solutions and vertical use cases
- Increase application performance through Intel accelerators and flexible heterogeneous architectures<sup>1</sup> (CPU, CPU w/integrated graphics (GPU), FPGA, and Vision Processing Units (VPU))
- Drive power, cost and development efficiencies to designs and applications for cameras, gateways, network video recorders, and servers
- Enable deep learning capabilities for smarter, faster analytics—transform data into artificial intelligence for competitive advantage



<sup>1</sup>Certain technical specifications and select processors/skus apply. See [product site](#) for more details.

# DEEP LEARNING: TRAINING VS. INFERENCE



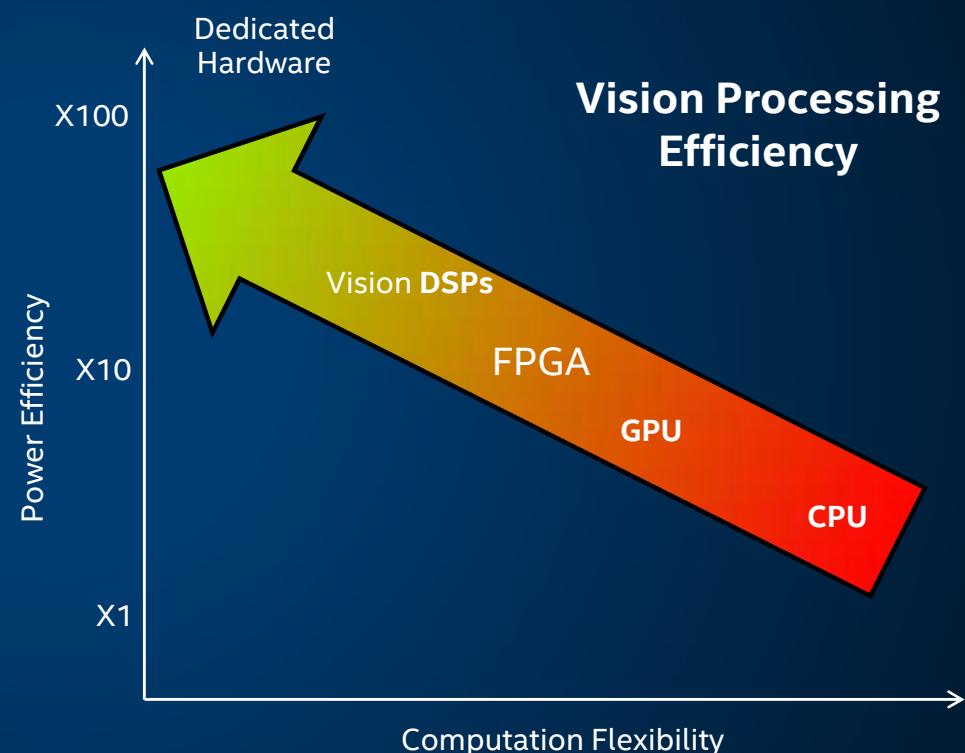
# CHOOSING THE “RIGHT” HARDWARE

## Power/Performance Efficiency Varies

- Running the right workload on the right piece of hardware → higher efficiency
- Hardware acceleration is a must
- Heterogeneous computing?

## Tradeoffs

- Power/performance
- Price
- Software flexibility, portability



# Intel Computer Vision Portfolio

## EXPERIENCES



## TOOLS

Intel® Parallel Studio XE  
Intel® System Studio  
Intel® SDK for OpenCL™ Applications

Intel® Media SDK / Media Server Studio  
Intel® Distribution of OpenVINO™ toolkit

## FRAMEWORKS



theano



## LIBRARIES

Intel® Data  
Analytics  
Acceleration  
Library

Intel®  
Distribution for python

Intel® Math Kernel Library

Intel® Nervana™ Graph



Movidius Stack

## HARDWARE



Compute

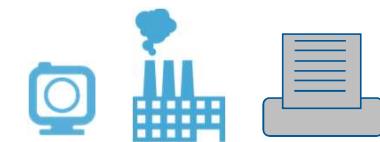
Memory & Storage



Networking



Visual Intelligence



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OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos



# WHAT'S INSIDE THE INTEL DISTRIBUTION VS OPEN SOURCE VERSION

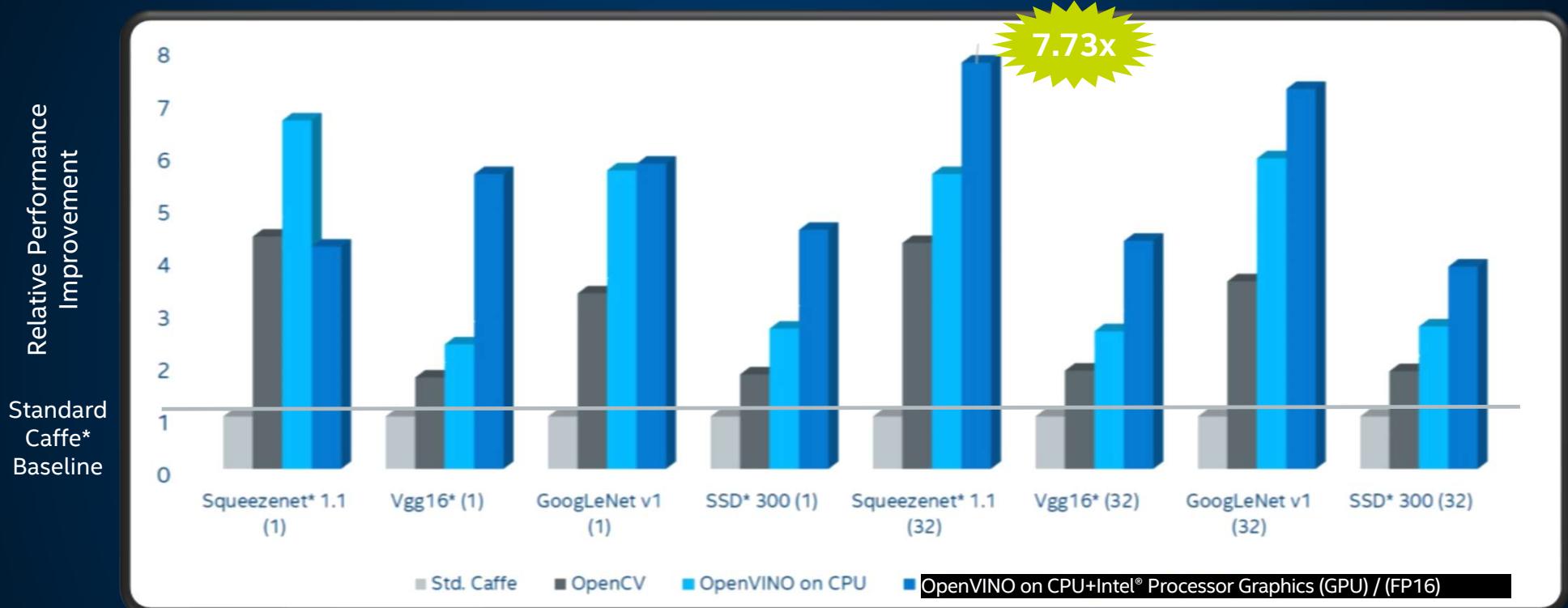
Tool/Component	Intel® Distribution of OpenVINO™ toolkit	OpenVINO™ toolkit (open source)	Open Source Directory
Installer (including necessary drivers)	✓		
<b>Intel® Deep Learning Deployment toolkit</b>	✓	✓	
Model Optimizer	✓	✓	<a href="#">/opencv/dldt/tree/2018/model-optimizer</a>
Inference Engine	✓	✓	<a href="#">/opencv/dldt/tree/2018/inference-engine</a>
Intel CPU plug-in	✓ Intel® Math Kernel Library (Intel® MKL) only <sup>1</sup>	✓ BLAS, Intel® MKL <sup>1</sup> , jit (Intel MKL)	<a href="#">/opencv/dldt/tree/2019/inference-engine</a>
Intel GPU (Intel® Processor Graphics) plug-in	✓	✓	<a href="#">/opencv/dldt/tree/2019/inference-engine</a>
Heterogeneous plug-in	✓	✓	<a href="#">/opencv/dldt/tree/2019/inference-engine</a>
<b>Intel GNA plug-in</b>		✓	<a href="#">/opencv/dldt/tree/2019/inference-engine</a>
Intel® FPGA plug-in	✓		
<b>Intel® Neural Compute Stick (1 &amp; 2) VPU plug-in</b>	✓	✓	<a href="#">/opencv/dldt/tree/2019/inference-engine</a> 
Intel® Vision Accelerator based on Movidius plug-in	✓		
40+ Pretrained Models - incl. Model Zoo (IR models that run in IE + open sources models)	✓	✓	<a href="https://github.com/opencv/open_model_zoo">https://github.com/opencv/open_model_zoo</a>
Samples (APIs)	✓	✓	<a href="#">/opencv/dldt/tree/2018/inference-engine</a>
Demos	✓	✓	<a href="https://github.com/opencv/open_model_zoo">https://github.com/opencv/open_model_zoo</a>
<b>Traditional Computer Vision</b>			
OpenCV*	✓	✓	<a href="https://github.com/opencv/opencv">https://github.com/opencv/opencv</a>
OpenVX (with samples)	✓		
Intel® Media SDK	✓	✓ <sup>2</sup>	<a href="https://github.com/Intel-Media-SDK/MediaSDK">https://github.com/Intel-Media-SDK/MediaSDK</a>
OpenCL™ Drivers & Runtimes	✓	✓ <sup>2</sup>	<a href="https://github.com/intel/compute-runtime">https://github.com/intel/compute-runtime</a>
FPGA RunTime Environment, Deep Learning Acceleration & Bitstreams (Linux* only)	✓		

<sup>1</sup>Intel MKL is not open source but does provide the best performance

<sup>2</sup>Refer to readme file for validated versions



# INCREASE DEEP LEARNING WORKLOAD PERFORMANCE ON PUBLIC MODELS



Fast Results on Intel Hardware, even before using Accelerators

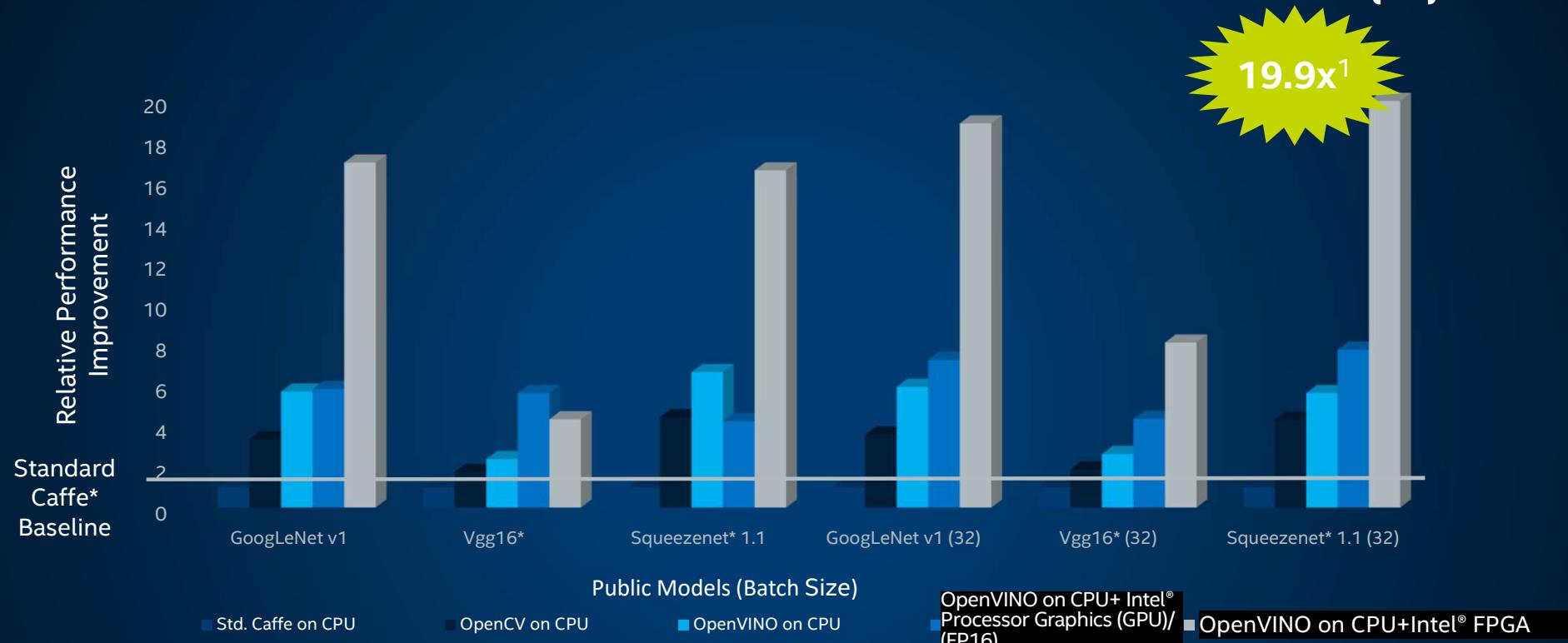
<sup>1</sup>Depending on workload, quality/resolution for FP16 may be marginally impacted. A performance/quality tradeoff from FP32 to FP16 can affect accuracy; customers are encouraged to experiment to find what works best for their situation. The benchmark results reported in this deck may need to be revised as additional testing is conducted. Performance results are based on testing as of April 10, 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure. For more complete information about performance and benchmark results, visit [www.intel.com/benchmarks](http://www.intel.com/benchmarks).

**Configuration:** Testing by Intel as of April 10, 2018. Intel® Core™ i7-6700K CPU @ 2.90GHz fixed, GPU GT2 @ 1.00GHz fixed Internal ONLY testing, Test v312.30 – Ubuntu\* 16.04, OpenVINO™ 2018 RC4. Tests were based on various parameters such as model used (these are public), batch size, and other factors. Different models can be accelerated with different Intel hardware solutions, yet use the same Intel software tools.

Intel's compilers may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include SSE2, SSE3, and SSSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this fixed product are intended for use with Intel microprocessors. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice. Notice revision #20110804



## INCREASE DEEP LEARNING WORKLOAD PERFORMANCE ON PUBLIC MODELS: COMPARISON OF FRAMES PER SECOND (FPS)



Get an even Bigger Performance Boost with Intel® FPGA

<sup>1</sup>Depending on workload, quality/resolution for FP16 may be marginally impacted. A performance/quality tradeoff from FP32 to FP16 can affect accuracy; customers are encouraged to experiment to find what works best for their situation. Performance results are based on testing as of June 13, 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure. For more complete information about performance and benchmark results, visit [www.intel.com/benchmarks](http://www.intel.com/benchmarks). Configuration: Testing by Intel as of June 13, 2018. Intel® Core™ i7-6700K CPU @ 2.90GHz fixed, GPU GT2 @ 1.00GHz fixed Internal ONLY testing, Test v3.15.21 – Ubuntu\* 16.04, OpenVINO 2018 RC4, Intel® Arria® 10 FPGA 1150GX. Tests were based on various parameters such as model used (these are public), batch size, and other factors. Different models can be accelerated with different Intel hardware solutions, yet use the same Intel software tools.

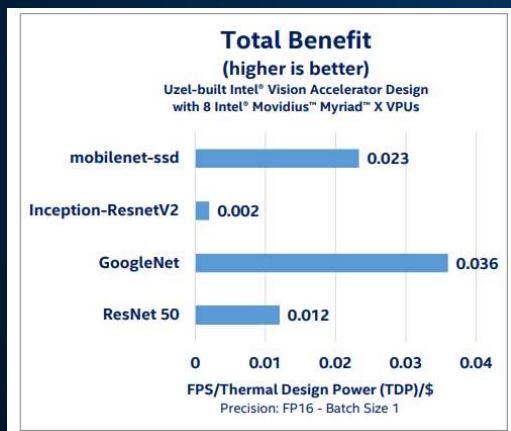
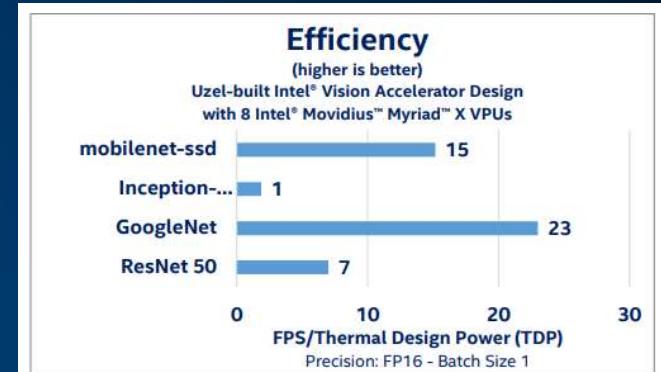
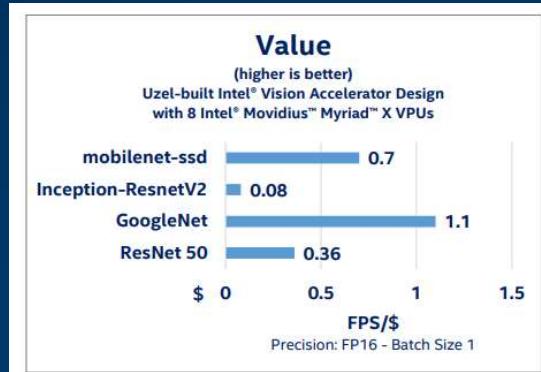
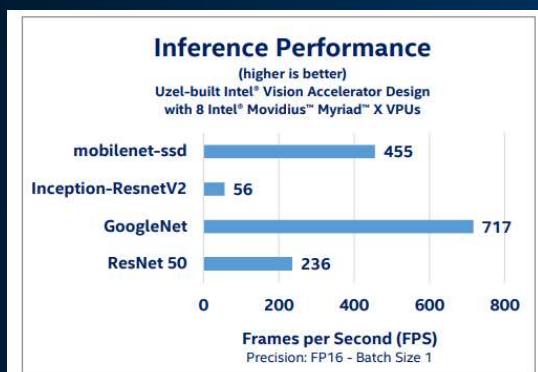
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# NEW BENCHMARKS FOR HDDL ACCELERATORS - JUNE 2019

INCREASE DEEP LEARNING MODEL PERFORMANCE WITH INTEL® MOVIDIUS™ VPU & INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT

LOCATION: [INTEL® DISTRIBUTION OF OPENVINO™ TOOLKIT PRODUCT SITE](#) > HARDWARE > PERFORMANCE BENCHMARKS



Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Learn more at [intel.com](#), or from the OEM or retailer. Performance results are based on testing as of March 29, 2019 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information, see [Performance Benchmark Test Disclosure](#).

CONFIGURATIONS: Testing by Intel as of March 29, 2019. See slide 59 for configuration details.

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Notice revision #20110804



# SPEED DEPLOYMENT WITH PRETRAINED MODELS & SAMPLES

## Pretrained Models in Intel® Distribution of OpenVINO™ toolkit

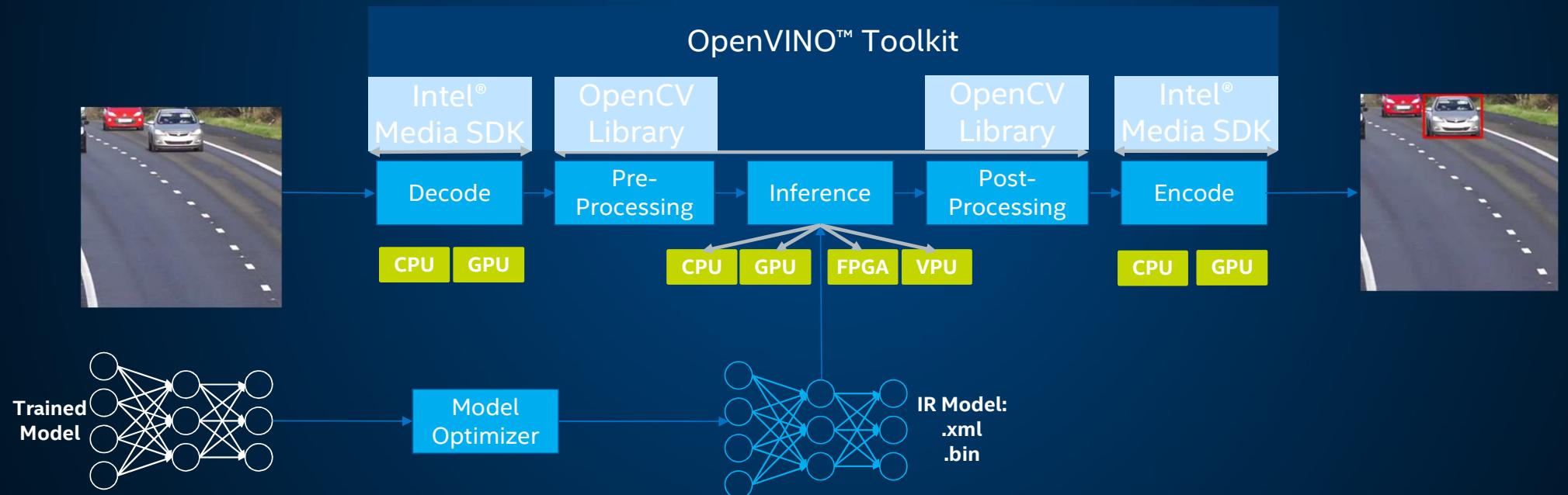
- Age & Gender
- Face Detection—standard & enhanced
- Head Position
- Human Detection—eye-level & high-angle detection
- Detect People, Vehicles & Bikes
- License Plate Detection: small & front facing
- Vehicle Metadata
- Human Pose Estimation
- Action recognition – encoder &
- Text Detection & Recognition
- Vehicle Detection
- Retail Environment
- Pedestrian Detection
- Pedestrian & Vehicle Detection
- Person Attributes Recognition Crossroad
- Emotion Recognition
- Identify Someone from Different Videos—standard & enhanced
- Facial Landmarks
- Gaze estimation
- Identify Roadside objects
- Advanced Roadside Identification
- Person Detection & Action Recognition
- Person Re-identification—ultra small/ultra fast
- Face Re-identification
- Landmarks Regression
- Smart Classroom Use Cases
- Single image Super Resolution (3 models)
- Instance segmentation
- and more...

## Binary Models

- Face Detection Binary
- Pedestrian Detection Binary
- Vehicle Detection Binary
- ResNet50 Binary

# WORKFLOW OF APPLYING OPENVINO IN CV APPLICATIONS, ACCELERATE STREAMING PERFORMANCE

Using Intel® Media SDK and the OpenVINO™ toolkit together enables customers to build high performance, intelligent vision solutions.



# INTEL® MEDIA SDK

## API to Access Intel® Quick Sync Video: Hardware Accelerated Encoding, Decoding, and Processing

- H.265 (HEVC)
- H.264 (AVC)
- MPEG-2 and more
- Resize, scale, deinterlace
- Color conversion, composition
- Denoise, sharpen, and more

## Benefits

- Outstanding performance
- Rich API to tune encoding pipeline
- Future proofed: support new processor without code changes

## Targeting Digital Security and Surveillance, Connected Car Applications, and More



Smart Camera

Car Infotainment and  
Cluster Display

using



and

Embedded Linux\*



Intel Atom®, Pentium®, and Celeron®<sup>1</sup>

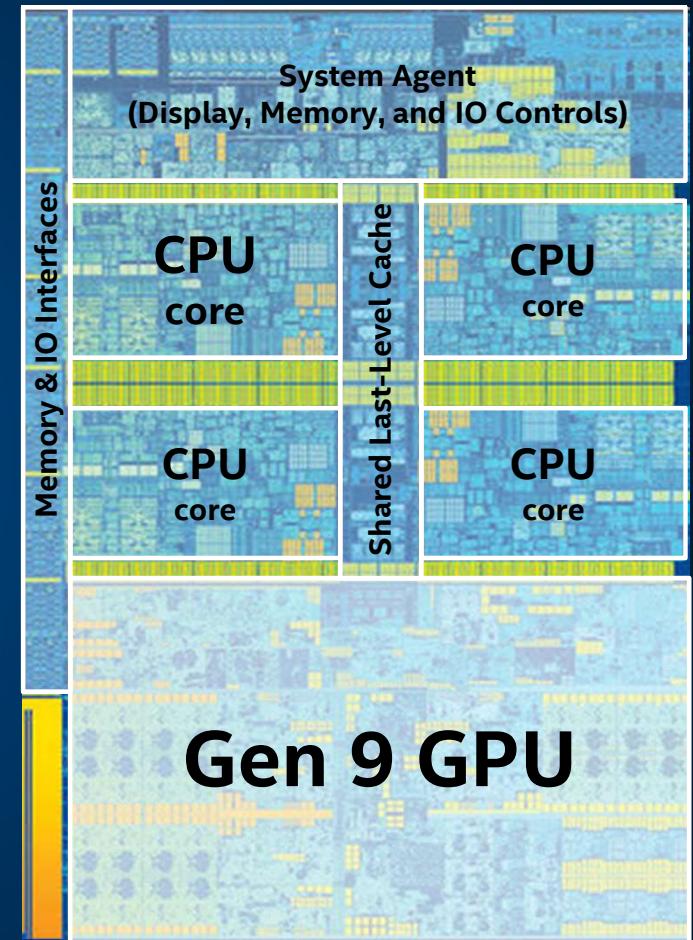
<sup>1</sup> Intel® Celeron® Processor N3350, Intel® Pentium® Processor N4200, Intel Atom® E3930, E3940, E3950 processors

# INTEL INTEGRATED GRAPHICS

**Gen** is the internal name for Intel's on-die GPU solution. It's a hardware ingredient with various configurations.

- Intel® Core™ Processors include Gen hardware.
- Gen GPUs can be used for graphics and also as general compute resources.
- Libraries contained in the Intel® Distribution of OpenVINO™ toolkit (and many others) support Gen offload using OpenCL™.

*6<sup>th</sup> Generation Intel® Core™ i7 (Skylake) Processor*



# PUTTING IT ALL TOGETHER

A major challenge is to get all these tool and libraries to work together in the best possible way to minimize development time and optimize system power/performance.

A good way to abstract that workload is using an end-to-end pipeline

## Computer Vision



## Deep Learning



## Media



SDKs



Optimized CV  
Capabilities  
of



Intel® Deep Learning  
Deployment Toolkit



Intel® Media SDK

Tools

Compiler, Analyzers, Debuggers



OpenCL™ SDK

Libraries

IPP



OpenCL™ MKL-DNN



Intel® MKL  
DAAL



python™  
Intel distribution



# CALL TO ACTION AND RESOURCES

Download ▶

[Free Intel® Distribution of OpenVINO™ toolkit](#)

Get started quickly with:

- [Developer resources](#)
- [Online webinars, tool how-tos & quick tips](#)
- [Hands-on developer workshops](#)

Support

- Connect with Intel engineers & computer vision experts at the public [Community Forum](#)

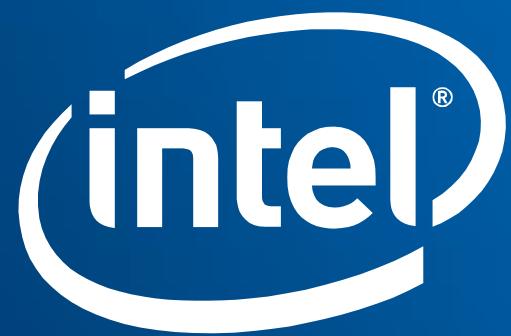


Select Intel customers may contact their Intel representative for issues beyond forum support.



THANK YOU





# INTEL INDUSTRIAL EDGE INSIGHTS SOFTWARE

A SOFTWARE STACK FOR RAPID DEPLOYMENT OF TIME SERIES AND VIDEO ANALYTICS

## CUSTOMERS / PARTNERS

**It provides validated and tested smart manufacturing software ingredients** for fast development and deployment and rapid time-to-market

**It provides optimized video and time-series data ingestion and an analytics framework** on a single platform that is validated and tested by Intel

**It is a \$0 license to use and distribute**, which helps our partners to scale their business with minimum development investment

## END USERS

**Products with the software ingredients provide end users with incredible advanced insights and analytics to perform tasks such as:**

- Detecting defects using AI, ML, and DL
- Performing predictive analytics
- Enhancing their productivity and scale
- Optimizing their industrial processes
- Reducing maintenance and upkeep cost