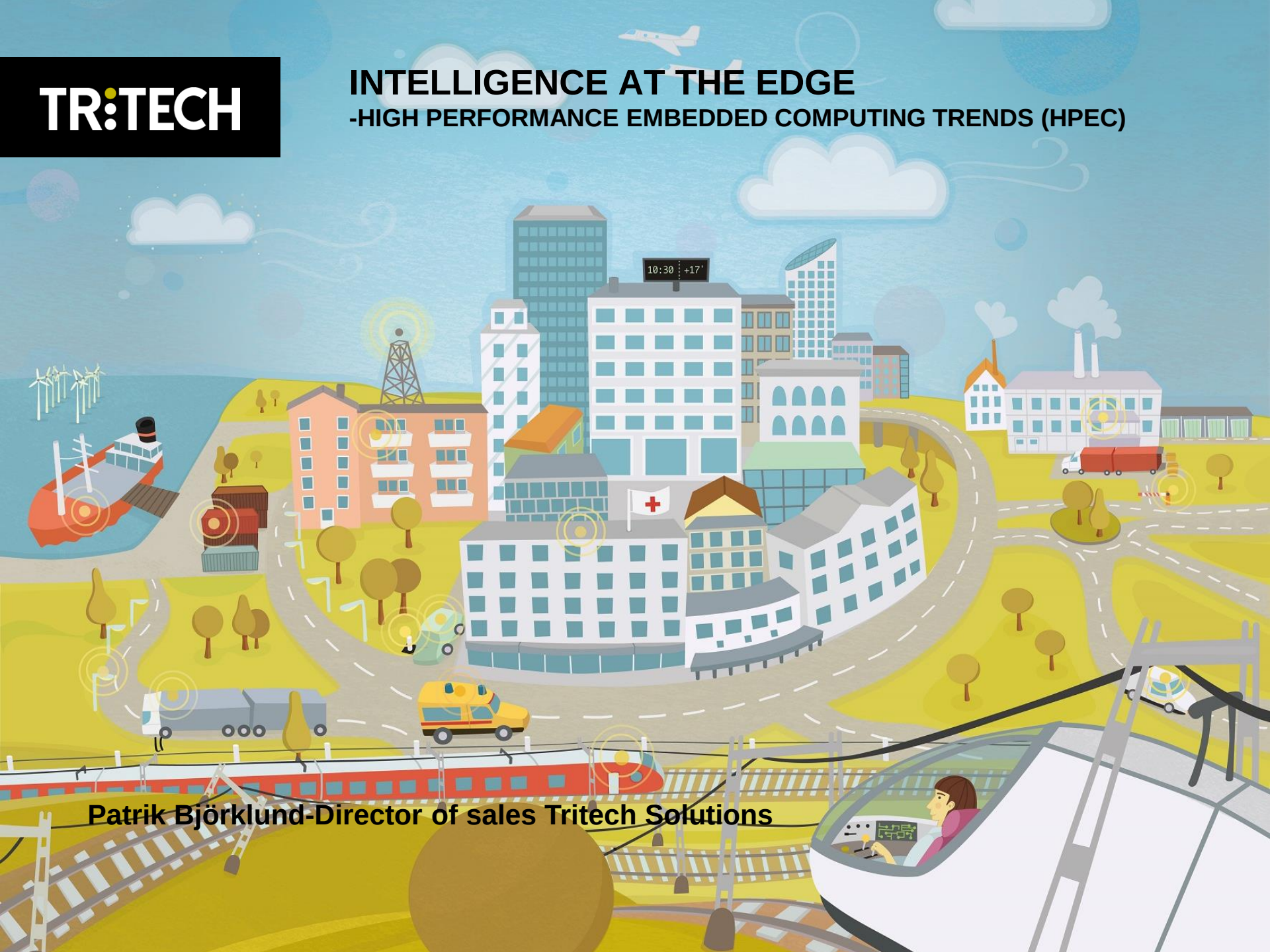
TR:TECH

INTELLIGENCE AT THE EDGE

-HIGH PERFORMANCE EMBEDDED COMPUTING TRENDS (HPEC)

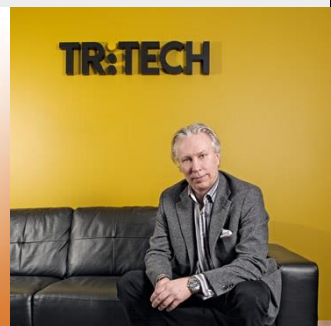


Patrik Björklund-Director of sales Tritech Solutions

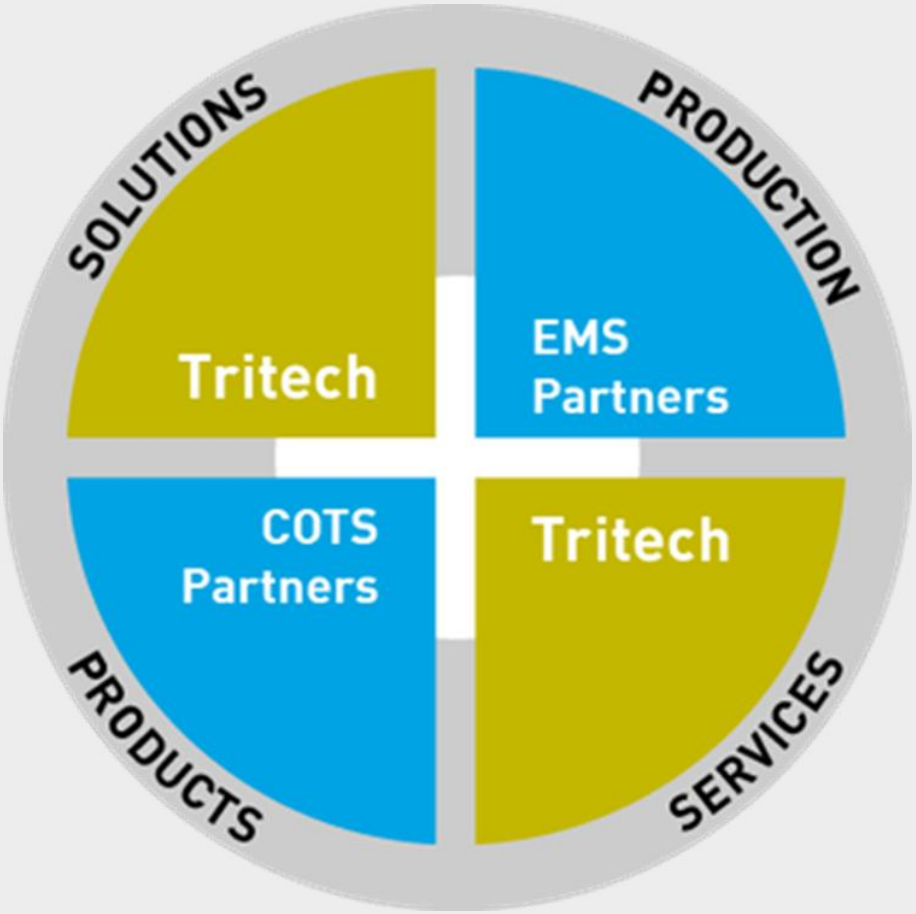
WE ARE TRITECH

- Embedded products, solutions and engineering services for the intelligent systems and industrial IoT-markets
- Offices in Stockholm, Gothenburg and Helsinki.
- Approx. 125 employees
- Turnover forecast 160 MSEK
- More than 600 products designed for customers since start up
- Partnerships with major technology and COTS vendors

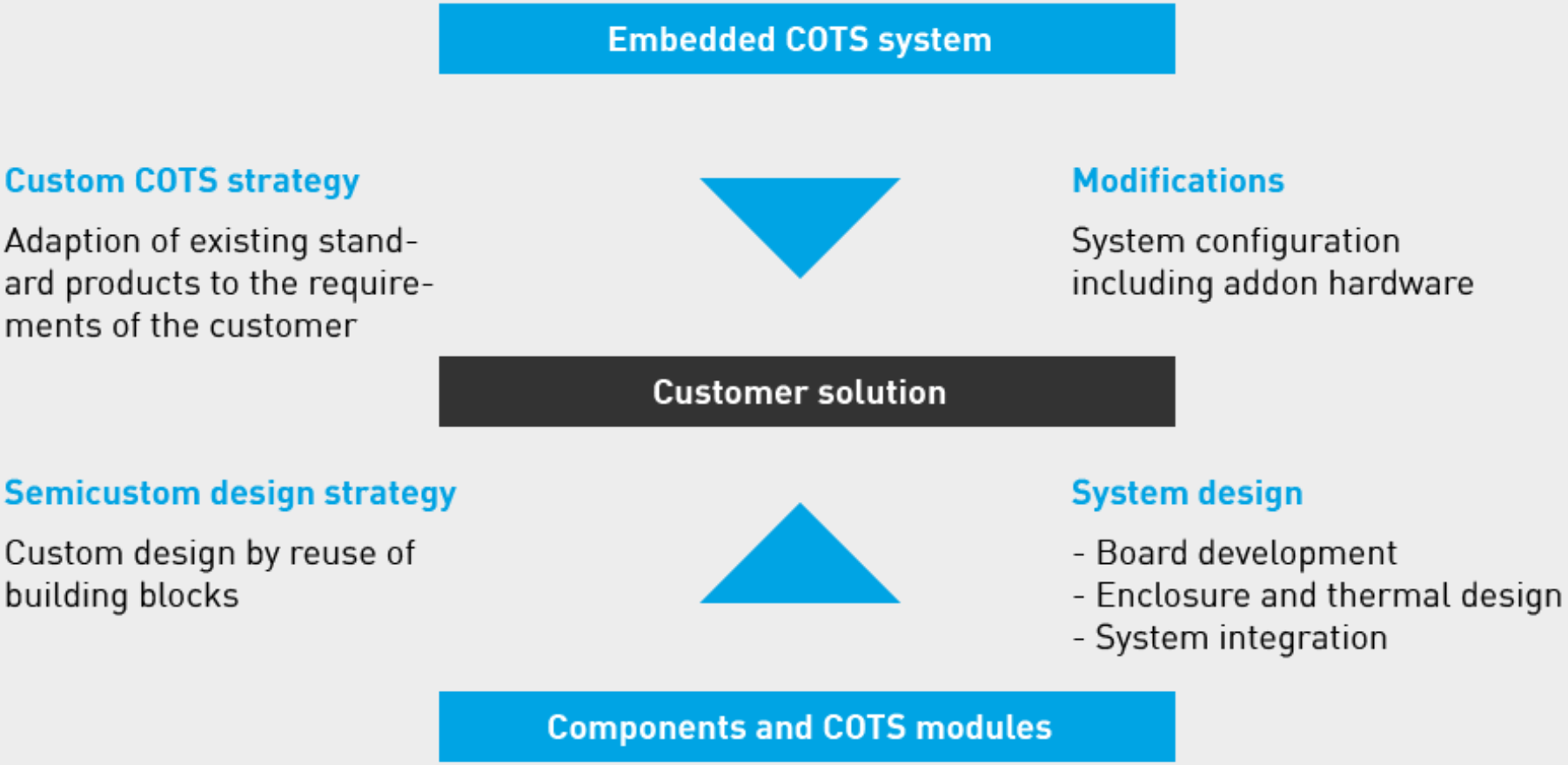


INTEGRATED SOLUTIONS BUSINESS MODEL



SOLUTIONS BASED ON CUSTOMIZATION OF COTS BUILDING BLOCKS

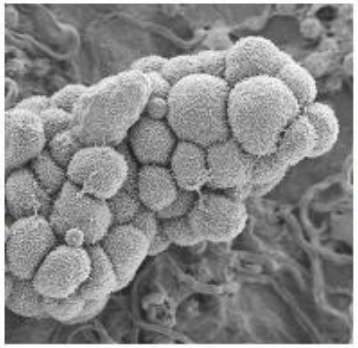


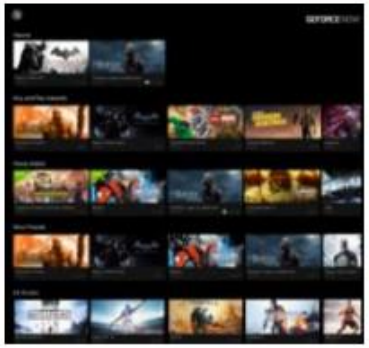
DRIVERS FOR HIGH PERFORMANCE IN EMBEDDED

- Fog and edge computing
- Autonomous vehicles
- Intelligent machine vision
- Medical imaging
- Real time video applications
- Military

FROM CLOUD TO VEHICLES

DEEP LEARNING EVERYWHERE





INTERNET & CLOUD

Image Classification
Speech Recognition
Language Translation
Language Processing
Sentiment Analysis
Recommendation

MEDICINE & BIOLOGY

Cancer Cell Detection
Diabetic Grading
Drug Discovery

MEDIA & ENTERTAINMENT

Video Captioning
Video Search
Real Time Translation

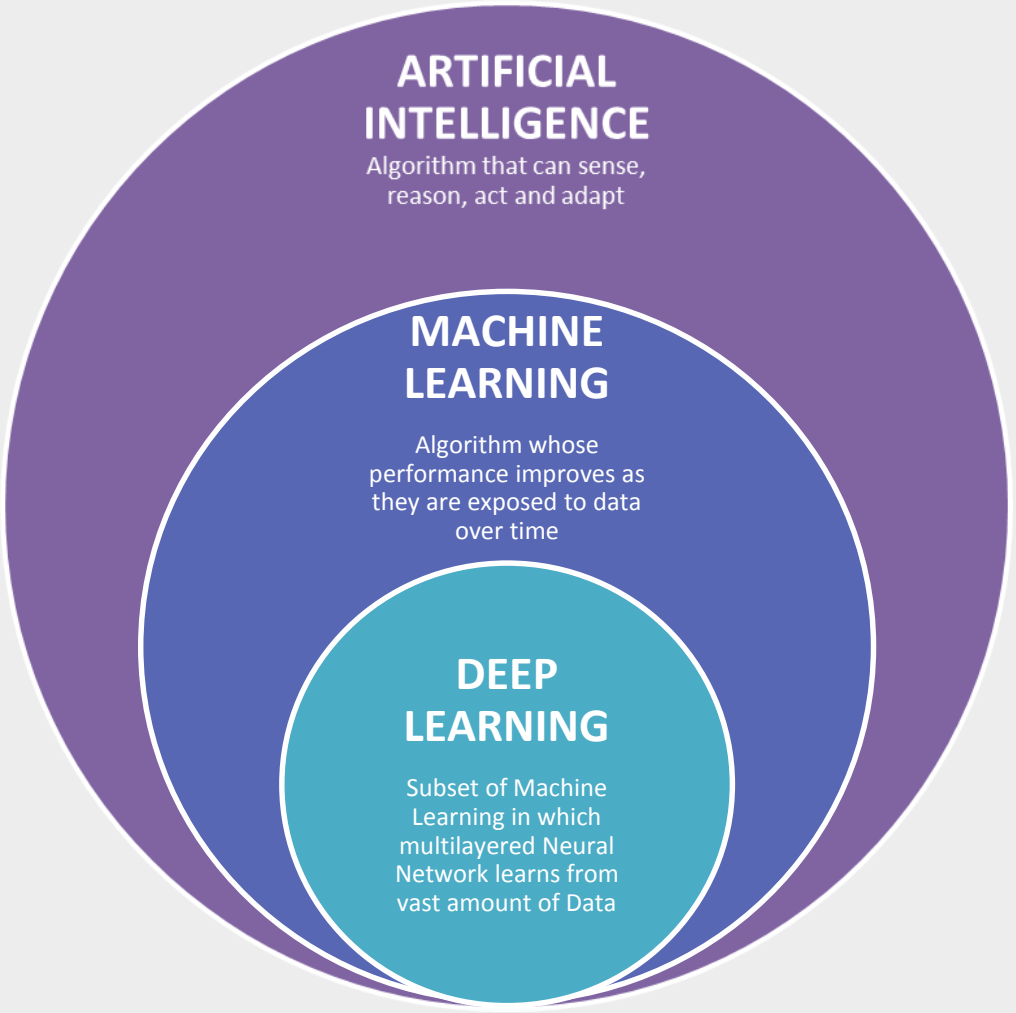
SECURITY & DEFENSE

Face Detection
Video Surveillance
Satellite Imagery

AUTONOMOUS MACHINES

Pedestrian Detection
Lane Tracking
Recognize Traffic Sign

ARTIFICIAL DEEP NEURAL NETWORKS - DEEP LEARNING



GROWING SOFTWARE ECOSYSTEM

Deep Learning Frameworks

Caffe

Microsoft CNTK

DEEPLEARNING4J

dmlc mxnet

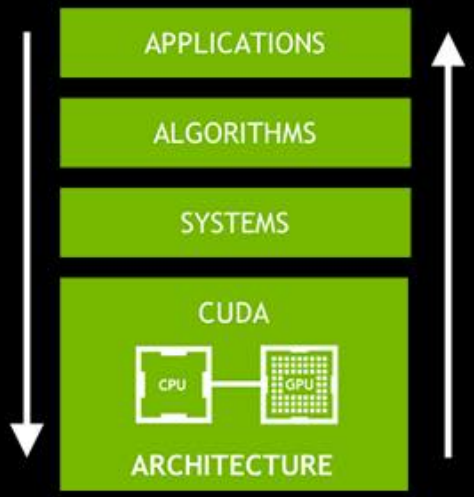
TensorFlow

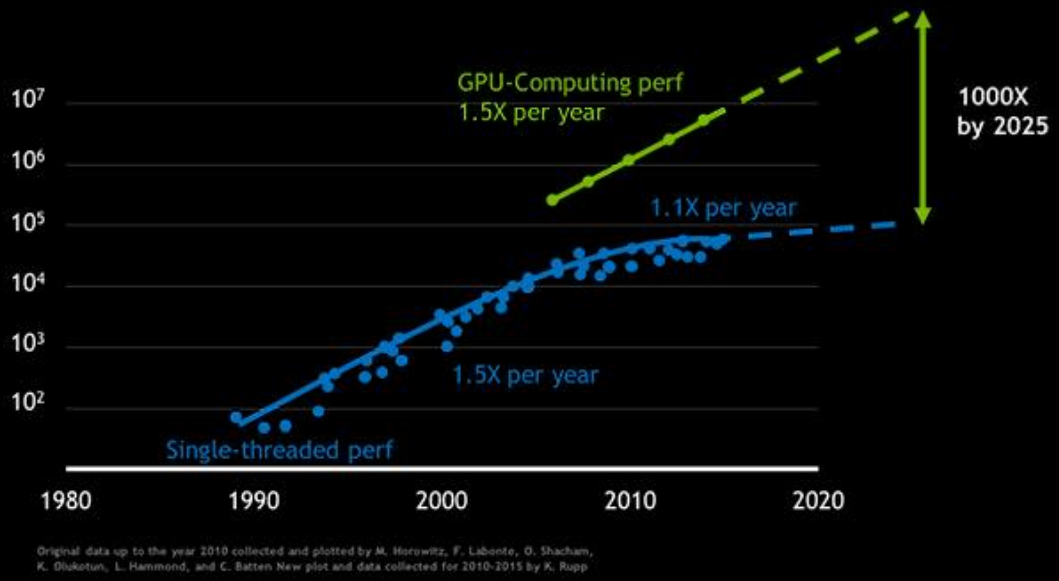
theano

torch

WHY MOVE TO HETEREGENOUS COMPUTING?

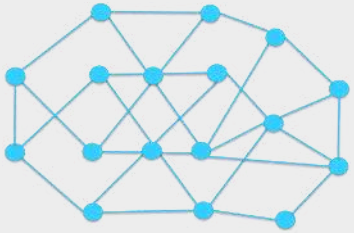
RISE OF GPU COMPUTING





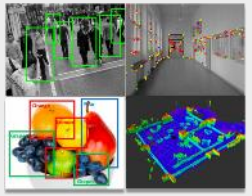
Source: Nvidia

TYPICAL TRAINING AND INFERENCE SCENARIO



Create your model with Caffe or TensorFlow

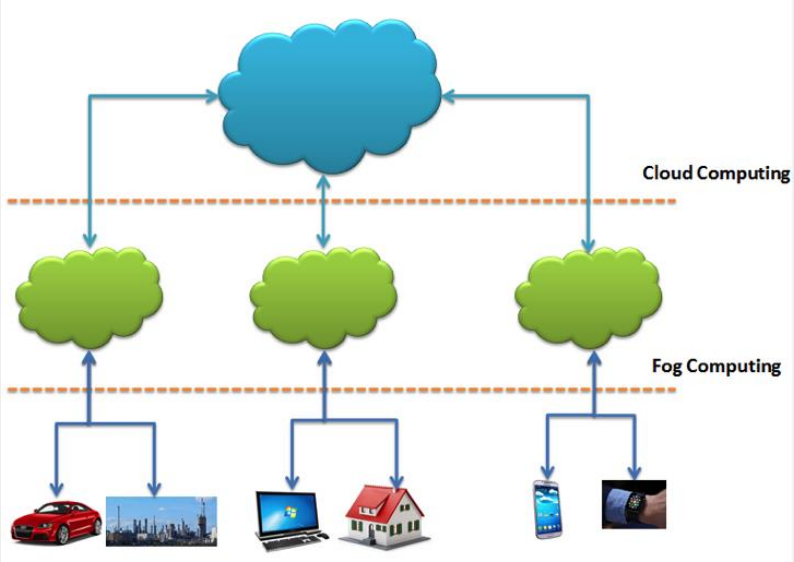
Train Your Model in the Cloud



Deploy it in the Field

FOG AND EDGE COMPUTING

- Industrial, smart city, automotive and media transport applications drive new network requirements.
  - Intelligent endpoints
  - Gateways and edgerouters.
  - Embedded datacenters/microservers.

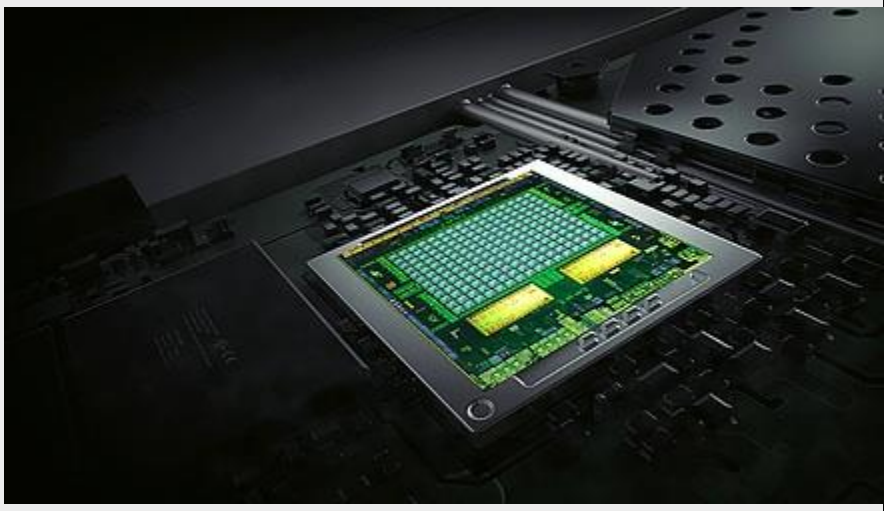


WHAT HARDWARE TECHNOLOGY IS NEEDED?

- PC gaming/professional workstation
- Server/datacenter

EMBEDDING SUCH TECHNOLOGY HAS CHALLENGES

- SWaP considerations
  - Size
  - Weight and
  - Power
- Thermal management
- Temperature range
- Revision control
- Product lifecycle
- Custom-design is expensive and complex



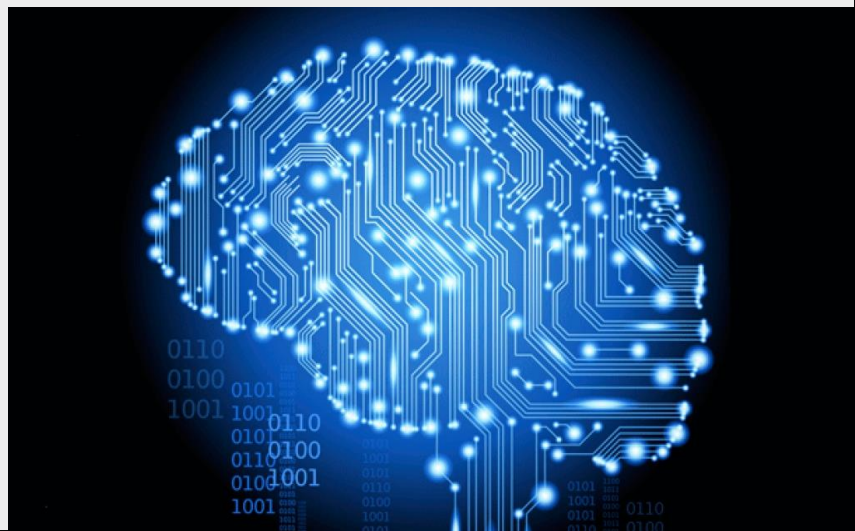
HIGH PERFORMANCE COTS OPTIONS

- Building blocks such as
  - Computer on modules
  - Motherboards
  - Blades/backplanes
  - GPU cards and modules
  - FPGA solutions
  - Storage subsystems

- Application-ready systems such as
  - Rackmount computers
  - Network appliances
  - Box computers

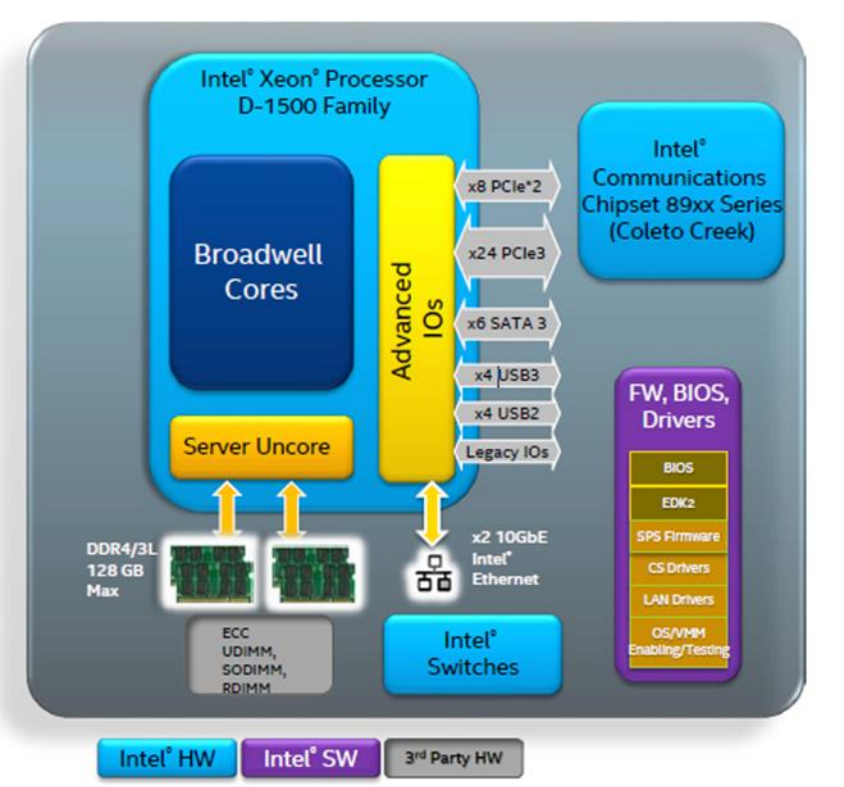
HPEC TRENDS FOR ”SEMI-CUSTOM” DESIGN

- New COM Express standard for servertechnology, type 7
- Type 6 still mainstream
- Faster storage with NVMe
- Embedded discrete GPUs - MXM modules
- Mini PCIe/mSATA moving to M.2 connector
- Early adoption of 10 Gb ethernet
- Widespread adoption of USB 3.0 and PCIe 3.0



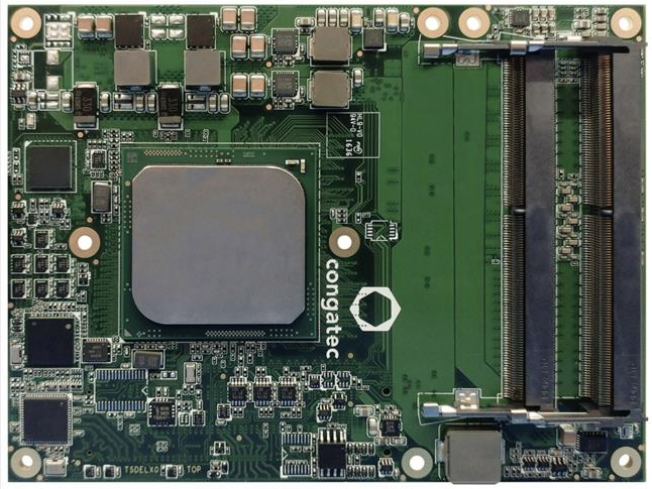
INTEL XEON D FITS DEMANDING FOG APPLICATIONS

- CPU
  - Up to 16C BDW Intel® Xeon® XMT (14 nm)
  - Targeted TDP ~19-65 W
  - Intel® Xeon® Features
  - Industrial temp options
  - Functional safety IEC 61508 support option
- Memory
  - Two Memory Channels, two DIMMS/channel
  - DDR3L/DDR4
  - 128 GB Max Capacity
- Integrated IOs
  - x24 PCIe 3.0, x8 PCIe 2.0
  - x6 SATA3
  - x4 USB 3.0, x4 USB 2.0
  - x2 10 GbE Intel® Ethernet
- Platform highlights
  - Intel® Advanced Vector Extensions 2 (AVX2)
  - Intel® Cache Monitoring Technology (CMT)
  - Intel® Cache Allocation Technology (CAT)
  - Memory Bandwidth Monitoring (MBM)
  - Intel® Virtualization Technology
  - Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI)
  - Intel® Secure Key Instructions
- Storage/Network Features
  - Storage/Network Environment (Reliability, Temp, Availability)
  - Validated with external Crypto accelerator (Coleto Creek)
  - Non-Transparent Bridging (NTB), Asynchronous DRAM self-refresh (ADR), Intel® QuickData Technology



COM EXPRESS TYPE 7 – SERVER ON MODULE

- Xeon D and Atom (Denverton) incl. industrial temp options
- Changes when compared to Type 6
  - No graphics, no audio
  - 4x 10 Gigabit Ethernet with complete set of sideband signals (including SDT pins to enable hardware based precision timing)
  - Introduce eSPI as future replacement for LPC
  - 32 PCI Express Lanes
  - Reduction to 2x SATA in favors of PCIe for NVMe storage interface
  - Reduction to 4x USB 3.0 and no additional 4x UBS 2.0 ports
- Added interfaces
  - 8 PCIe (32 lanes now)
  - 4x 10G Ethernet
    - with SDP
  - NC-SI
  - eSPI shared with LPC



TR:TECH

We turn technology into business.

TYPE 7 VS TYPE 6 OVERVIEW

COM Express Type 6

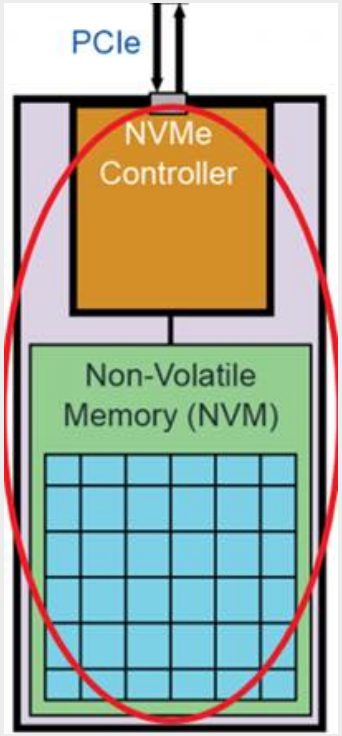
Gigabit Ethernet	USB 3.0 0-3
LPC	
SATA 0-3	PCIe 6-7
HDA	DDI 0-2
USB 2.0 0-7	
ExpressCard	
PCIe 0-5	PEG
GPIO / SDIO	
LVDS / eDP	
SER 0-1 / CAN	
SPI & I2C	
Power	Power

COM Express Type 7

Gigabit Ethernet	USB 3.0 0-3
LPC / eSPI	
SATA 0-1	10GBaseKR 0-3
USB 2.0 0-3	
PCIe 0-15	
GPIO / SDIO	PCIe 16-31
SER 0-1 / CAN	
SPI & I2C	
Power	Power

STORAGE MOVING FROM SATA TO NVME

- SATA speed limited to 6Gbit/s.
- With PCI Express the max. theoretical bandwidth of the host interface is increased to 4GB/s with an x4 Gen3 link.
- Initial adoption in server/datacom and video.
- 3DXPoint (Intel Optane/Micron QuantX) in early stage
- SATA performance still good enough for most embedded applications.
- Native NVMe is supported in the latest Intel Core BIOS.



M.2 (NGFF) REPLACING MINI PCIE AND MSATA

- Smaller and more flexible
- Defines several pinouts and dimensions
- 2242, 2280 mainstream for storage
- 67 pins with 0,5 mm pitch different socket types, keys, for:
  - Connectivity
  - WWAN / SSD / Others
  - SSD Drives
- Both NVMe and SATA widely available for storage

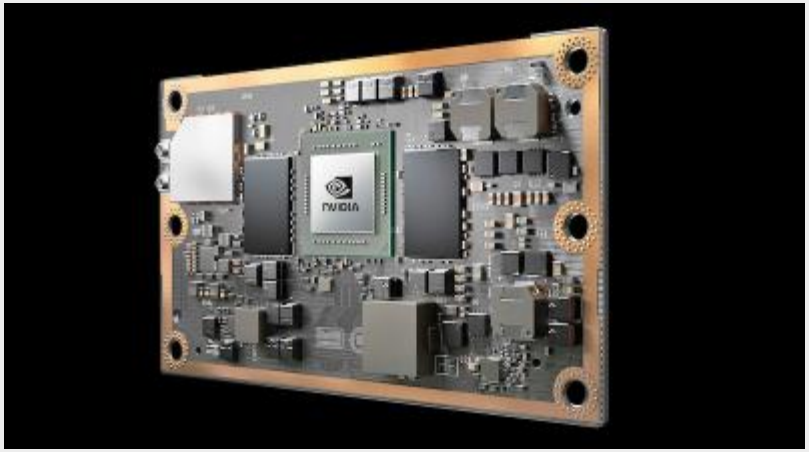
DISCRETE GPU TECHNOLOGY FOR EMBEDDED

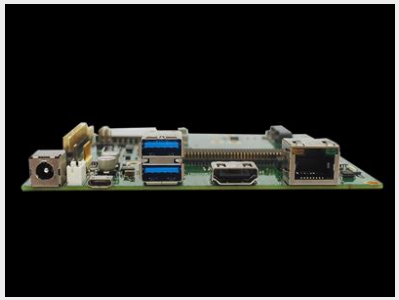
- MXM (3.1) modules are suitable for carrierboard/COM module projects
- VPX/XMC/Compact PCI serial variants are available
- Up to Nvidia GTX1080 available
- Extended lifecycle and revision control supported
- Wide temp options on some SKUs
- Conduction cooling solutions possible on some SKUs

HPEC BOX COMPUTER EXAMPLE

- High performance 7th gen Xeon and Core i 7 CPUs, C236 chipset
- Nvidia GTX 1050 GPU
- 10 GbE plus multiple PoE/PoE+ ports
- USB 3.0, PCIe 3.0 supported
- 32 isolated DIO
- 3 SIM for WiFi/3G/4G/ LTE/GPS/GPRS/UMTS
- Vehicle power with 80V surge protection
- -20 + 60C op. temp range
- Anti shock, anti vibration

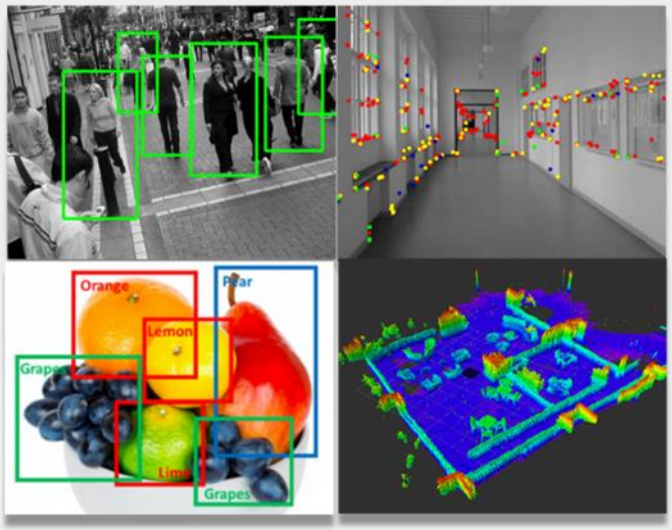
ENTRY EDGE AI SOLUTIONS – NVIDIA JETSON





- Nvidia SOM with Tegra TX1 or TX2 SOC
- Multicore ARM CPU with Nvidia GPU
- Off the shelf carriers and boxes available
- Custom carriers designed based on Nvidias SOM spec
- Ideal solution for lower performance requirements while still using CUDA and Nvidia SW ecosystem

ENTRY EDGE AI SOLUTIONS – AAEON AI CORE



- Mini PCIe module based on Movidius/Intel Myriad 2 VPU
- Verified with Aaeon SBCs and box PCs, and UP maker boards
- Works in any mini PCIe slot in x86 based systems
- Low cost and low TDP (1W) solution for smart vision applications
- Supports Caffee and Tensorflow.

TRITECH PARTNERS FEATURED

congatec

- COM Express type 7 and 6 modules

aetina

- Industrial, embedded GPU cards and modules, Jetson Tegra TX1/2 solutions

Vecow

- Embedded, rugged. wide temp box computers for HPEC applications incl. GPGPU

AAEON

- AI Core VPU module, SBCs, box PCs