From intelligent Edge to Intelligent Cloud

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IOT: The challenge

50 Billion CONNECTED Devices
2,300 EXABYTES Of IP

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IOT enabling transformation

Sensing
Tracking
Prediction

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Top Three Business Priorities:

1. **Faster Time to Insight**
2. **Cost Reduction**
3. **New Innovations New Capabilities**

**Q: What is your organization’s most important 12 month IT goal?**

- Respond faster to business needs: 34%
- Reduce costs: 22%
- Expand/deploy new capacity: 17%
- Improve reliability and availability: 15%
- Improve security: 10%
- Other: 2%

Source: Gartner (September 2016); 451 Research (2016); Q: What is your organization’s most important 12 month IT goal? (N=798)

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3 phases of IoT

Connected

smart

autonomous
Top Challenges for Enterprise IT

**More compute with greater efficiency**

IT must transform the business with new compute, storage, & network capabilities with greater efficiencies.

**Deploy hybrid cloud**

IT must leverage agility and efficiency of hybrid and multi cloud environment.

**Faster time to insight**

IT must extract better insight from data faster with higher ROI.

**Security without compromise**

IT must remain in control of all data so as to protect the enterprise and its people.

Delivering solutions to enable the digital transformation

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Finding the Optimal Cloud...

It’s a Balancing Act

Business

Ecosystem

Technical

Workload Placement Decision Factors

Business Considerations

- Agility/Time to market
- Legal/Regulatory
- Total cost of ownership

Ecosystem Considerations

- Mature SaaS offerings
- CSP services
- Cloud expertise accessibility

Technical Considerations

- Performance
- Integration
- Data Size
- Security

Source: Intel Internal. DCG Q42016
Configureable Cloud

Technology Trends

- 5G
- Internet of Things
- Network Transformation (SDN/NFV)

New Applications

- Virtual Reality (VR)
- Augmented Reality (AR)
- Artificial Intelligence
- Video & Speech Processing
- Big Data Analytics
- Packet processing
- Security

New Workloads

- Virtual Reality (VR)
- Augmented Reality (AR)
- Artificial Intelligence
- Video & Speech Processing
- Big Data Analytics
- Packet processing
- Security

Data Center

CAGR = 42%

Future of Computing

- Single architecture for all compute, network and storage acceleration needs
- Scale-out for hyperscale cloud
- Power efficiency
- Flexible, multi-function accelerator

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FPGAs As Reconfigurable Accelerators

Modern Data Center Facts

- 3-5 year Life Cycle
- High CAPEX and OPEX
- Requirement to support rapid scale-out
- Flexibility to adapt to rapidly changing workloads

FPGAs Maximize ROI

- One Architecture efficiently implements many workloads
- Application flexibility
- Reconfiguration in µs
- Power efficient

Alternative Accelerators

<table>
<thead>
<tr>
<th></th>
<th>GPU</th>
<th>Network Processor</th>
<th>FPGA</th>
</tr>
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<tbody>
<tr>
<td>Throughput</td>
<td>✓ High</td>
<td>✓ High</td>
<td>✓ High</td>
</tr>
<tr>
<td>Latency</td>
<td>High</td>
<td>✓ Low</td>
<td>✓ Low</td>
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<tr>
<td>Power</td>
<td>High</td>
<td>✓ Low</td>
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<tr>
<td>General computing</td>
<td>✓ Yes</td>
<td>No</td>
<td>✓ Yes</td>
</tr>
</tbody>
</table>

FPGA provides optimal networking & compute combination

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Why build your IOT solutions with Intel

cost savings with scalability

streamlined manageability and analytics

multilayered, end-to-end security

End-to-end interoperability to scale applications and services

Seamless data management and analytics from thing to network to cloud

A chain of trust rooted in the hardware and linked throughout the software

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Taking advantage of Optimized Solutions
Powered by Intel

Compute
Intel® Xeon® processor family
Intel® FPGA acceleration

Intel® Xeon®
Hyper-Threading
Intel® OPA
Intel® AVX 512
Intel® QAT
DDR4 Memory Speed

Security
Intel® TXT w/ OTA
Intel® AES-NI
Intel® Secure Key + RDSEED
Intel® Supervisor Mode Access Prevention (SMAP)

Solid State Drives
Intel® architecture-based storage and solid state drives

Ecosystem Enabling
Intel® Cloud Builders
Open Programmable Acceleration Engine (OPAE)

Software
Open Attestation SDK
Intel® Data Center Manager: KVM gateway
Intel® Node Manager
Intel® Service Assurance Administrator

Ecosystem Enabling
Intel® Storage Builders
Integrated Software Vendors
Open standards/ open source contributions

Storage Accelerators & SoCs
Intel® Architecture
Virtualization Technologies (Intel® VT)

Ecosystem Enabling
Intel® Architecture
Virtualization Technologies (Intel® VT)

Intel® Architecture
Virtualization Technologies (Intel® VT)

Intel® Open Network
Network Builders

Network Acceleration
Communications chipset
Intel® Ethernet CNAs

Network
Intel® Ethernet

Ecosystem Enabling
Intel® Cloud Builders
Open Programmable Acceleration Engine (OPAE)

Software
Intel® QuickAssist APIs
Data Plane Development Kit

Network
Network

Ecosystem Enabling
Intel® Cloud Builders
Open Programmable Acceleration Engine (OPAE)

Software
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Data Plane Development Kit

Ecosystem Enabling
Intel® Cloud Builders
Open Programmable Acceleration Engine (OPAE)

Software
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Data Plane Development Kit

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The Future of Manufacturing is Happening Now at Intel

Integrated Manufacturing Line  Advanced Analytics  Machine Learning

5 billion DATA POINTS PER DAY PER FACTORY

- Increased uptime
- Accelerated output
- Higher yield
- Lower mean time to repair

Big Data Delivers Year-Over-Year Gains in Uptime and Output

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Workloads are more than artificial intelligence (AI).

Some critical algorithms haven’t even been developed yet.

System designs will need to change down the road.

Intel powers hundreds of level 4 and level 5 test vehicles.

Autonomous vehicles need a car-to-cloud solution.

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Building the Best Autonomous Brain

**SENSE**
The vehicle collects sensor data to "see" its surroundings

**FUSE**
Data is correlated and fused to create a model of the environment

**DECEDE**
The vehicle decides how to proceed

**Perception**

**Strategy**

**Action**
SuStained by Intelligent cloud and connectivity

MODEL TRAINING
ENDPOINT MANAGEMENT
BIG DATA & STATISTICAL ANALYTICS
DATA FORMATTING
ANNOTATION
DATASET MANAGEMENT
DATA AGGREGATION

REAL TIME HD MAP UPDATES
CAR-TO-CAR COMMUNICATION
ANOMALY NOTIFICATION
CROWD SOURCED DATA DISTRIBUTION
PUBLIC AND PRIVATE DATA SECURITY

MODEL INFERENC
TRAJECTORY ENUMERATION
PATH PLANNING
ENVIRONMENT MONITORING
SENSOR PROCESSING
SENSOR FUSION

Intel® IOT Platform

SuStained by Intelligent cloud and connectivity

INFERNCCE

TRAINING

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Intel® Artificial intelligence portfolio

**Librarys**
- Intel® Python Distribution
- Intel® Data Analytics Acceleration Library (DAAL)
- Intel® Nervana™ Graph
- Intel® Math Kernel Library (MKL, MKL-DNN)

**Platforms**
- Intel® Nervana™ Cloud & System
- Intel® Nervana™ Deep Learning Studio
- Intel® Computer Vision SDK
- Movidius™ Technology

**Hardware**
- Compute (CPU, FPGA, Asics)
- Memory & Storage
- Networking

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*Future
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Intel® Artificial intelligence portfolio with Microsoft

Intel Optimization on Azure Services and Cognitive APIs

Platforms
- Intel® Nervana™ Cloud & System
- Intel® Nervana™ Deep Learning Studio
- Intel® Computer Vision SDK
- Movidius™ Technology
- Intel® Saffron

Frameworks
- Spark
- TensorFlow
- CNTK
- Caffe
- MxNet
- Theano
- Chainer

Libraries
- Intel® Python Distribution
- Intel® Data Analytics Acceleration Library (DAAL)
- Intel® Nervana™ Graph*
- Intel® Math Kernel Library (MKL, MKL-DNN)

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Thank YOU

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