The Virtualized Infrastructure for Industrial Automation Based on Intel 12th Core Processor and Ubuntu

Jarry Chang, DFI
What’s DFI

Industrial Computer Solutions

- From Modules and Boards to Integrated Systems and Embedded Solutions.

- **Industrial Motherboards**

- **System-On-Modules**

- **Industrial Computers**

- **Industrial Panel PCs & Displays**

- **TGU171** (11th Generation Intel® Core™ Processors)

- **ADS310** (12th Generation Intel® Core™ Processors)
From Small To Large

Industrial Motherboards

System-On-Modules

Industrial Computers

Industrial Panel PCs & Displays
WORKLOAD CONSOLIDATION IN INDUSTRIAL IOT

Using Virtualization Technologies to Transform Operations for a More Efficient Industry
Differences between virtualization and containerization

Traditional Deployment

Visualized Deployment

Container Deployment
Workload Consolidation at the Edge

<table>
<thead>
<tr>
<th></th>
<th>VM</th>
<th>Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>App A</td>
<td></td>
<td></td>
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<tr>
<td>Bins/Libs</td>
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<tr>
<td>Guest OS</td>
<td></td>
<td>Docker*</td>
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<tr>
<td>Hypervisor</td>
<td></td>
<td>Host OS</td>
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<tr>
<td>Infrastructure</td>
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<td>Infrastructure</td>
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**Many Custom Devices**
- PLC
- HMI
- Visio
- Motio

**Expandable, High Performance Compute**

**LOWER COSTS, INCREASE YIELD AND FLEXIBILITY**
3C: Cloud, Container, Consolidation

Enterprise Level (ERP, BI)

Supervisory Level (MES)

Control Level (Automation System)

Device Level (Edge)
ENABLING TECHNOLOGIES – GFX VIRTUALIZATION

Introducing the main current virtualization technologies and emphasize the importance of Graphics SR-IOV.
SR-IOV (Single Root I/O Virtualization): NIC as Example

Isolation of PCIe resources for manageability and performance

Previously

<table>
<thead>
<tr>
<th>VM</th>
<th>VM</th>
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<tbody>
<tr>
<td>Layer 2 Virtual Switch</td>
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<tr>
<td>VMM</td>
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<tr>
<td>NIC</td>
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<tr>
<td>RX</td>
<td>TX</td>
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SR-IOV

<table>
<thead>
<tr>
<th>VM</th>
<th>VM</th>
<th>VM</th>
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<tbody>
<tr>
<td>VF Driver</td>
<td></td>
<td></td>
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<tr>
<td>VMM</td>
<td></td>
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<tr>
<td>NIC</td>
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<tr>
<td>Virtual Ethernet Bridge + Classifier</td>
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Virtual Function (VF) Driver

Virtual Function (VF) Physical Function (PF)
Graphics SR-IOV: Improving Graphic Virtualization

High-quality and high-performance with minimal software overhead

- The graphics virtualization infrastructure is exposed to system software by the Single Root I/O virtualization standard (SR-IOV), of the PCIe standard.
- PCIe interface allow multiple software stacks (VM) to each get their own "graphics device."
- Each VM can access fully accelerated graphics capabilities.
- Able to support up to 7 virtual functions.
ADL-S is The First Platform Supporting iGFX SR-IOV

SR-IOV VF Driver not be installed  
**28 FPS**

SR-IOV VF Driver installed  
**60 FPS**

Intel® Xe Graphics architecture, 4 Independent Displays, Up to 8K Display
THE DETAILS AND PERFORMANCE OF SR-IOV POC

The key points you need to know to make SR-IOV practical, and how to give full play to the advantages of Intel's new generation hardware platform (such as Alder Lake).
POC Architecture Based On Alder Lake-S

- Local Monitor: 15
- Remote Monitor: 7, 15

- 100M x upto 200 Monitors
- RJ45 Over 100M

- Ubuntu
  - (SR-IOV)
- Win10
  - (SR-IOV)
  - (No SR-IOV)
- QEMU / KVM Hypervisor
- Ubuntu 21.04
- DFI ADS310

- SR-IOV Performance Comparison
- AI Container
- App

- Performance Comparison
Refined For Industrial Automation Scenario

HDBaseT enables the use of a single category cable to meet all of industrial PC requirements, offering video & audio, Ethernet, controls, USB 2.0 and 100W power over 100m/328ft.

Wireless Display is easy to deploy in high places.

Slightly takes up Xe-GPU resources.

Up to 200 Monitors

There are still four 4K screens or one 8K one for general monitoring purposes, especially for AI applications.
Applicable To Retailer Scenario

Workload Consolidation, Again

- App
- Win10 (SR-IOV)
- Win10 (SR-IOV)
- Win10 (SR-IOV)
- Win10 (SR-IOV)

- Ubuntu 21.04
- QEMU / KVM Hypervisor

RJ45 Over 100M x 200 Devices
DFI ON INTEL GEN 12TH CORE PROCESSOR

When customers have needs, DFI's products is the worthiest of priority.
DFI's Products Are The Worthiest of Priority

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ECS43-ADS</td>
<td>Intel Q670E, up to 16 cores, ECC support (On specific SKU), 4x DDR4, 1x16, 2x4, 2 PCI, 6 USB 3.2 Gen2, up to 4 GbE LAN, 8-bit DIO</td>
</tr>
<tr>
<td>EC500-ADS</td>
<td>Intel Core, Intel Q670E, 2 HDMI/DVI + 1VGA, 3 M.2, PCIe/PCI expansion slots</td>
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<tr>
<td>EC510/511-ADS</td>
<td>Intel Core, Intel Q670E, PCIe/PCI expansion slots</td>
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<tr>
<td>ST102-ADS</td>
<td>Intel Alder Lake S, Intel Core CPU, SO-DIMM DDR4, 2 M.2 M &amp; 1 M.2 E key, 6 USB 3.2 Gen2, up to 4 GbE LAN</td>
</tr>
<tr>
<td>WM343-ADS</td>
<td>Intel Alder Lake S, up to 16 Cores, ECC support (On specific SKU), 4x DDR4, 1x16, 2x4, 2 PCI, 6 USB 3.2 Gen2, up to 4 GbE LAN, 8-bit DIO</td>
</tr>
<tr>
<td>WM120-ADS</td>
<td>Intel Alder Lake S, up to 16 Cores, ECC support (On specific SKU), 4x DDR4, 1x16, 2x4, 2 PCI, 6 USB 3.2 Gen2, up to 4 GbE LAN, 8-bit DIO</td>
</tr>
<tr>
<td>ADS310-R680E/Q670E</td>
<td>Intel Alder Lake S, up to 16 Cores, Intel R680E/Q670E, 4x DDR4, 1x16, 2x4, 2 PCI, 6 USB 3.2 Gen2, up to 4 GbE LAN</td>
</tr>
<tr>
<td>ADP553</td>
<td>Intel Alder Lake P, 6 core, 12<del>15W, 20</del>28W CPU option, Max 320GB DDR4/DDR5(TBC), 9~36VDC, fanless</td>
</tr>
<tr>
<td>ADP171/172</td>
<td>Intel Alder Lake S, Planning</td>
</tr>
<tr>
<td>ADPS68</td>
<td>Intel Alder Lake P platform, 4-ch SO-DIMM DDR4, Wide Voltage input 8.5V~20V, Type 6, R3.1</td>
</tr>
<tr>
<td>ADP9A2</td>
<td>Intel Alder Lake P platform, IBECC LPDDR4 onboard up to 16GB, 4 independent Display, Support SSD up to 1TB, dTPM, Type 6, R3.1</td>
</tr>
</tbody>
</table>
Last But Not The Least...

DFI EC70A-TGU Fanless Robust Embedded System Based on 11th Gen Intel® Core™ Processors

ECI Ready

Flexible I/O Configuration
Call To Action

• For Intel-related queries, please reach out to:
  Email: insidesaleslmapac@intel.com

• For Partner-related queries:
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  Sales and Quotation: https://www.dfi.com/contact/sales
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