PUZZLE-A001

EPYC Embedded 3000 Family

www.ieiworld.com

IEI PUZZLE Series Products

Aiming to The Future with Next Generation Network Appliance

Proprietary Network Appliance

A Proprietary network appliance is a specialized electronic device that plugs into a network that is optimized for one specialized network purpose like switching, routing, protecting in a network environment. Proprietary network appliances include as Router, Load Balance, Bandwidth Management, Gateway security, WAN Optimization, application delivery controller (ADC), Next Generation Firewall (NGFW), Unified Threat Management (UTM), Intrusion detection system (IDS).

uCPE (Universal Customer Premise Equipment)

uCPE consists of virtual network functions (VNFs) running on a standard operating system hosted on an open server with NFV technology.

Now with NFV technology, we can create several virtual machine and install these VNFs in a x86 or ARM based uCPE. VNFs could include popular software services such as a virtual firewall, virtual load-balancing, or other software-defined wide area network (SD-WAN)service. Besiads with NFV Orchestration, uCPU could be an Edge computing or an AI inference computing systems.

Breakthrough Performance, Dependability and Security for the Next Generation of Networking Infrastructure

Equipped with a next-gen AMD EPYC™ Embedded 3000 CPU (up to 8 cores, 16 threads, turbo Core up to 3.1 GHz) with up to 128G Dual-channels DDR4 RAM, the PUZZLE-A001 enables lightning-fast multi-tasking with low power consumption with four port 10GbE SFP+ and eight ports of 1GbE (Broadcom 5740) configuration. With a hardware secure multitenancy, the PUZZLE-A001 also provides Secure Root of Trust, Secure Memory Encryption, Secure Encrypted Virtualization to boost system performance while processing the safety of sensitive data. Integrated four ports 10GbE support lightning-fast throughput for bandwidth-demanding tasks.

PUZZLE-A001 supports AMD EPYC™ Embedded 3000 Family

AMD EPYC™ Embedded 3000 processors leverage AMD's advanced "Zen" architecture deliver up to a 52% improvement in instructions per clock (IPC) compared to legacy architectures. AMD EPYC™ Embedded 3000 Series processors leverage an onboard AMD Secure Processor off loading encryption and decryption operations as well as executing for Crypto Co-processing that encrypts data before it feeds to the I/O, complemented with Hardware Validated Boot capabilities to ensure systems are booted from trusted software.

Outstanding Performance for Wide Applications

High Performance "Zen" Cores	Large Memory	Flexible Integrated I/O	
Wide range of core counts satisfying various industry needs	Rich memory density	Industry leading Ethernet connectivity	Extensible capacity
Up to 8 cores,16 Threads	4 DDR4 Socket Dual-Channel Up to 128GB	4 10GbE Ethernet 8 1GbE Ethernet	2 Standard PCIe 1 Network module

Advanced Security Features

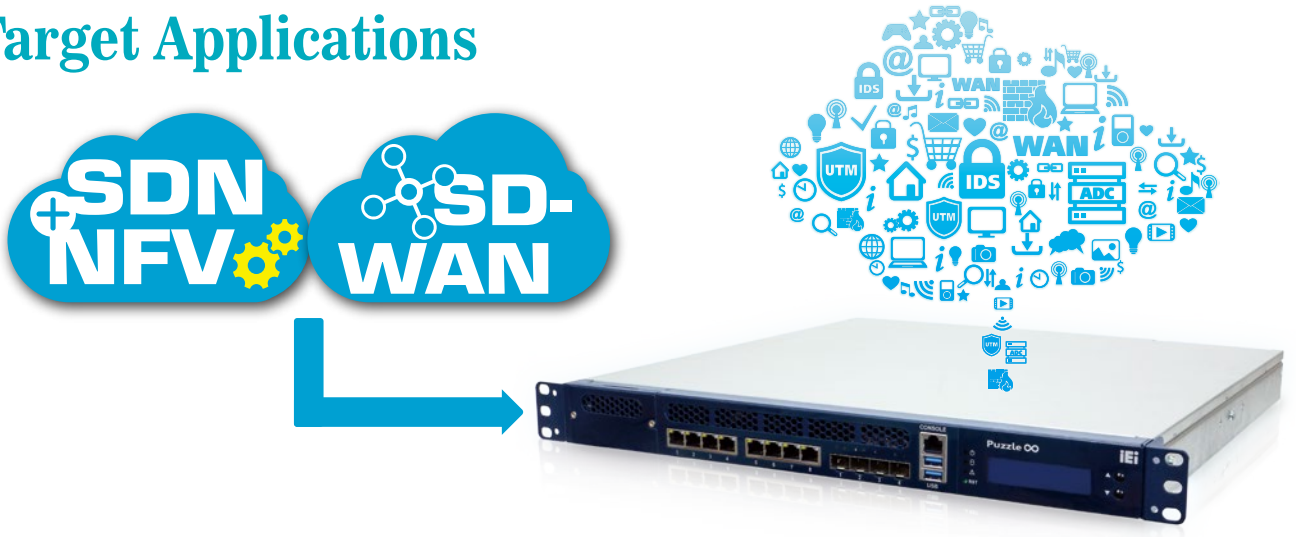
AMD EPYC™ Embedded 3000 processors feature an onboard AMD Secure Processor for Crypto Co-processing that encrypts data before it feeds to the I/O, complemented with Hardware Validated Boot capabilities to ensure systems are booted from trusted software, with one-time programmable (OTP) capabilities enabling system designers' unique configuration.

Advanced capabilities include Secure Memory Encryption (SME) for defending against unauthorized memory access, and Secure Encrypted Virtualization (SEV) for securely isolating hypervisors and virtual machines (VMs) – with no application code changes required.

Secure Root-of-Trust Technology	Secure Run Technology	Secure Move Technology
Boot to secure coprocessor	Data & software at work	Private - hybrid - public

Secure Memory Encryption (SME)	Secure Encrypted Virtualization (SEV)
Protects data against memory hacks and scrapes	encrypts and isolates virtual machines

Target Applications



PUZZLE-A001 enable advanced NFV and SDN capabilities for service providers' next-generation networking infrastructure, spanning from the enterprise to the data center.

uCPE (Universal Customer Premise Equipment)

Highly parallelized CPU ideal for Network Function Virtualization (NFV) and Software Defined Network (SDN)

Proprietary Network Appliance

- Security for business critical network data
- HW encrypted multi-tenant security
- High I/O for network connectivity
- Memory capacity for large traffic datasets

Unified Threat Management (UTM)

Unified threat management or UTM is a single network appliance for all-inclusive security functions, such as network firewall, intrusion detection/prevention system (IDS/IPS), anti-virus gateway, anti-spam gateway, VPN, content filtering, load balancing, data loss prevention and appliance monitoring.

UTM appliances offer cost-effective, all-in-one security ideal for small/medium businesses, remote offices and retail networks.

Intrusion Detection System (IDS)

An intrusion detection system (IDS) is a device that monitors a network or systems for malicious activity or policy violations. Any malicious activity or violation is typically reported either to an administrator or collected centrally using a security information and event management (SIEM) system. A SIEM system combines outputs from multiple sources, and uses alarm filtering techniques to distinguish malicious activity from false alarms.

Next Generation Firewall (NGFW)

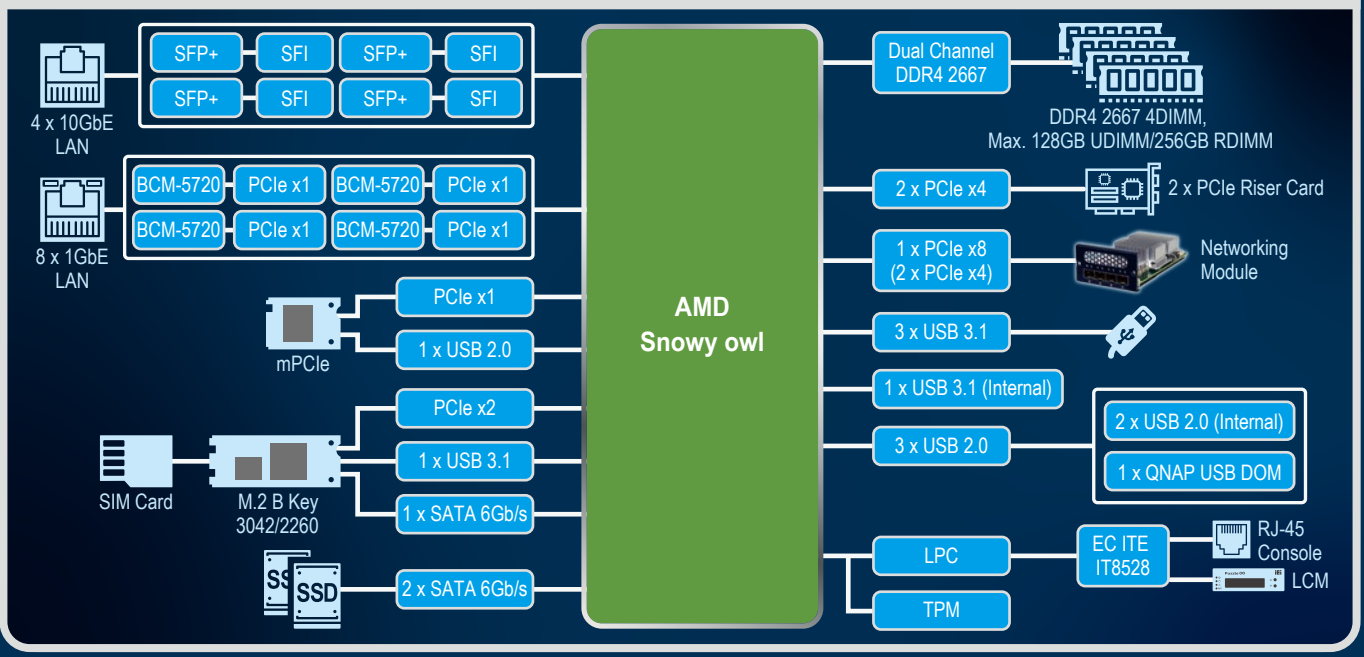
Both NGFW and traditional firewalls aim to serve the same purpose of protecting an organization's network and data assets, but the most important differences between traditional and next-generation firewalls is that NGFW offer a deep-packet inspection function that goes beyond simple port and protocol inspection by inspecting the data carried in network packets.

Application Delivery Controller

An application delivery controller (ADC) is a computer network device to improve the performance of web applications in a datacenter and it also could be a part of an application delivery network (ADN). In order to deal with the increasing of Internet traffic, application delivery controller (ADC) also provide load balancing, and support multi-tenancy for deployment at data centers and a large number of sessions with a fast transaction rate.

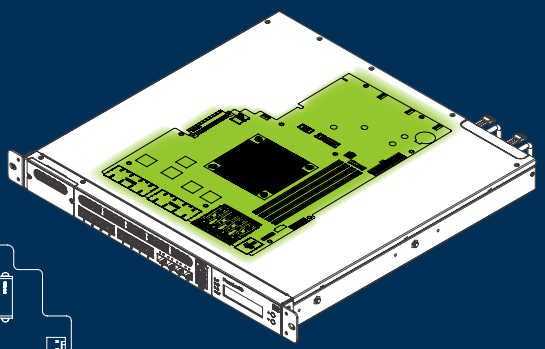
PUZZLE-A001 1U AMD Snowy Owl

PUZZLE-A001 System Block Diagram



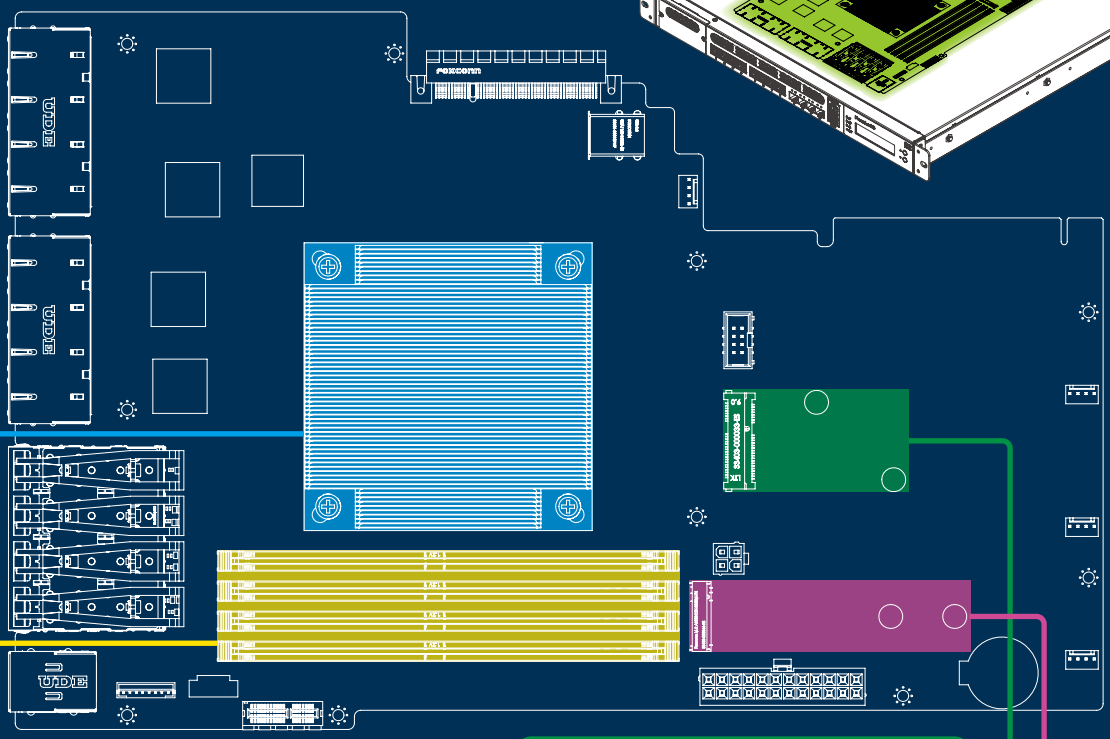
PUZZLE-A001

Support Various Expansion Card



AMD EPYC™ Embedded 3000 processors leverage AMD's advanced "Zen" architecture

4 x 288-pin DIMM DDR4 slots support 2666MHz UDIMM/ RDIMM



PCIe mini slots support USB 2.0

M.2 Key B for 3G, 4G, LTE Card

PUZZLE-A001

Support Various Expansion Card

Standard PCIe Slots

- Puzzle-A001 support two PCIe x4.
- Support smart NIC cards and accelerator cards including CPU accelerator, GPU accelerator, FPGA accelerator and VPU accelerator

System Fan

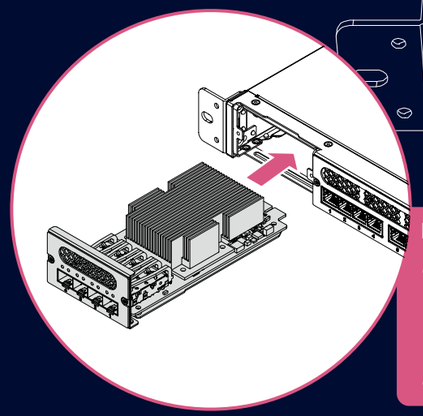
System Fan

300W Redundant Power Supply

Hot-swappable redundant power supply to ensure maximum system

Tow 2.5” SSD/HDD Bays

- Support RAID 0/1
- Cable-less design



IEI PuIM Network Module Slot

- IEI PuIM Network Module slot support 8 lanes of PCIe Gen3 signal form CPU or PCH. The PCIe lanes could be configured to two PCIe x4 or four PCIe x2
- Support smart NIC via PuIM Network Module

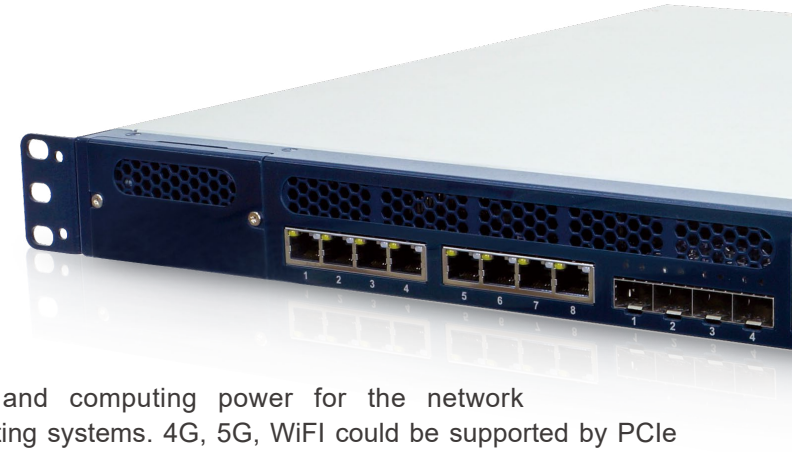
Eight 1GbE

Four 10GbE SFP+

Console & USB 3.1

LCM Indicator

PUZZLE-A001 Potential with Two PCIe x4 Slots



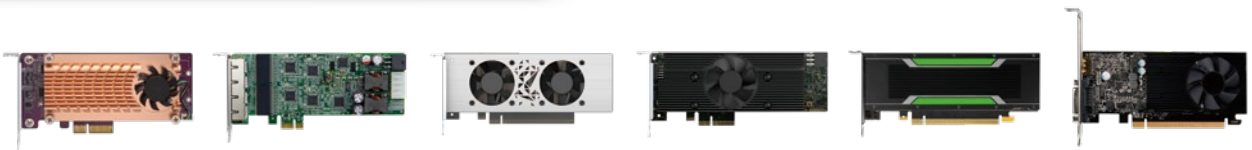
The PUZZLE-A001 features two PCIe (Gen3 x4) slots, allowing for installing full height, 200mm length Standard PCIe card, such us single/dual-port 10GbE NICs to accelerate applications that demand higher bandwidth such as virtualization, media workflows, and backup/ restoration tasks for an ever-growing amount of data.

Besides, expansion Card provides extra functions and computing power for the network appliance, Edge computing and AI inference, computing systems. 4G, 5G, WiFI could be supported by PCIe mini card or M.2 card. Adding a Smart NIC card will increase the performance of system and get specific network functions. Adding accelerator cards like GPU card, FPGA card and VPU card will provide extra performance for a Edge Computing or an AI Inference Computing system.

Two PCIe x4 Expansion Slots

Standard PCIe Slots

- PUZZLE-A001 support two PCIe x4 slots.
- Support full height, 200mm length Standard PCIe card.
  - **AI Accelerating Card:** VPU, FPGA, GPU card…etc.
  - **High Speed:** 10GbE card, Fiber card
  - **I/O Card:** Serial port card, USB card, LAN card…etc.
  - **Wireless Card:** WiFi card, mobile wireless card…etc.
  - **Storage Card:** SAS, RAID card

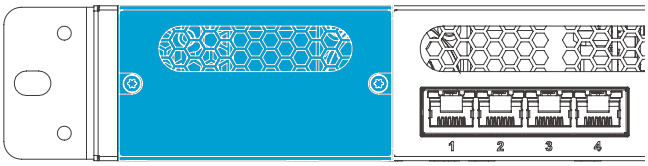


P/N	QNAP QM2-2P-384 QM2-2P-344	IEI GPOE-4P-R10 GPOE-2P-R10	IEI Mustang-F100-A10	IEI Mustang-V100-MX8	GP GPU	GT1030
Description	Dual M.2 PCIe SSD expansion card	2-port/4-port PoE card	FPGA card	VPU card	Inferencing accelerator card	GPU card
Form Factor/ Interface	Low-Profile PCIe 3.0 x8	Low-Profile PCIe x1	Low-Profile PCIe 3.0 x8	Low-Profile PCIe 2.0 x4	Low-Profile PCIe Gen3 x16	Low-Profile PCIe Gen3 x4

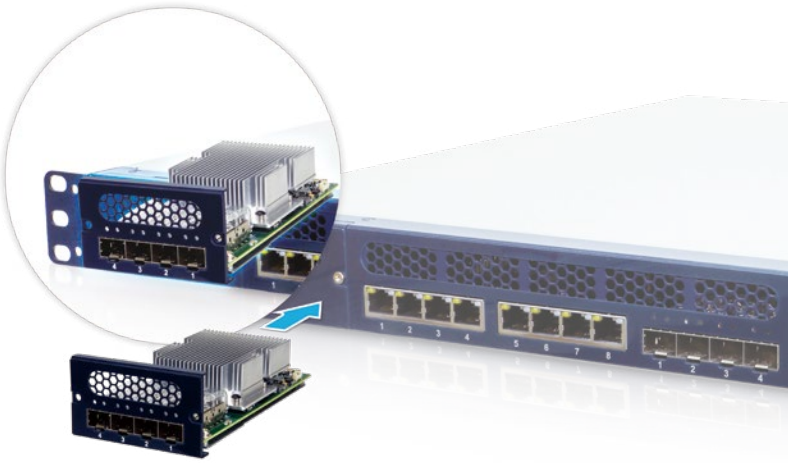
One Network Module Expansion Slots

IEI PulM Network Module Slot

- IEI PulM Network Module slots support 8 lanes of PCIe Gen3 signal which is form CPU and PCH. The PCIe from CPU could be configured into two PCIe x4
- Support smart NIC via PulM Network Module



PUZZLE-A001 Slot PCIe Signals	(One PCIe x8 + Two PCIe x4)
Supported Networking Module	PulM-10G4SF-XL710 PulM-10G4SF-MLX PulM-25G2SF-MLX

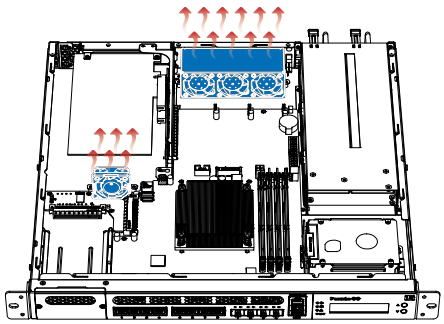


The PulM networking module marked with "**A**" must be installed into the slot with an "**A**" mark; so does the "**B**" module.

NOTE: *All marks are printed on the PCB board.*

P/N	PulM-25G2SF-MLX	PulM-10G4SF-XL710	PulM-10G4SF-MLX (Mellanox)
NIC Brand	Mellanox	Intel	Mellanox
Form Factor Interface	Dual ports 25GbE SFP28	Quad ports 10GbE SFP+	Quad ports 10GbE SFP+
Description	PCIe 3.0 x8	PCIe 3.0 x8	2 x PCIe 3.0 x4

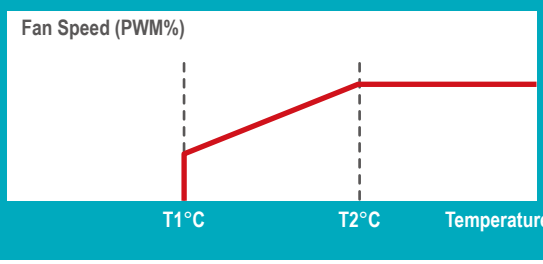
Smart Fan Operation



Users can define CPU fan and system fan speed and temperature profile in the BIOS menu. When the system is in idle or running less demanding tasks, smart fan is able to bring down the level of noise produced by rotating fans. The adjustable settings allow the Puzzle-A002 to be quieter during operation while extending the fan's lifespan, enhancing system stability and durability.

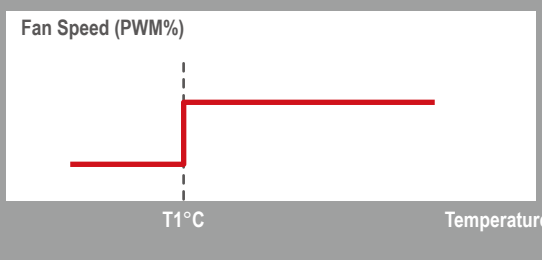
Puzzle Series

With fan speed and temperature trigger settings set, the fan speed can change seamlessly according to temperature readings.



Traditional System

Traditional system fan operation is detected by system's ON (fan at full speed) and OFF statuses.



Protecting Integrity and Authenticity of PUZZLE-A001

PUZZLE-A001 support TPM (Trusted Platform Module) which offers a broad portfolio of standardized security controllers to protect the integrity and authenticity of systems. With a secured key store and support for a variety of encryption algorithms, TPM security chips provide robust protection for critical data and processes through their rich functionality.

What is a TPM?

Trusted Platform Module (TPM) is an international standard for a secure cryptoprocessors that can securely store critical data such as passwords, certificates and encryption keys. TPM is a dedicated microcontroller designed to secure hardware by integrating cryptographic keys into devices and is used for secured crypto processes within computing devices as well as for secured storage of critical data. TPMs are typically used in business laptops, routers and embedded and IoT devices. The technical TPM specification was written by an industry consortium called Trusted Computing Group (TCG).

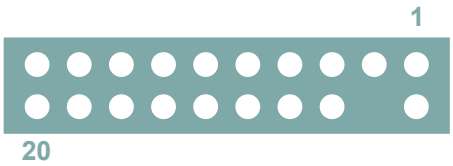
H/W Features

Solution / Features	Infineon SLB9660 TT1.2	SLB9665TT2.0
		
Secure Startup	Root of Trust Measurement of early boot devices	
Anti H/W Attack	Sensors and active shield	
TSS API Support	MS-CAPI/PKCS#11, #12	
H/W Certification	EAL 4	
Management Tool Function	1. TPM management 2. File & Folder En/De-cryption 3. Personal secure drive 4. Secure Email 5. Key transferring 6. Security policy configuration	
Market Segment	Complete TPM1.2/2.0 function	
TCG Specification	TCG 1.2/2.0 compliant trusted platform module	
Interface	Low pin count	
Software Structure	TCG software stack 1.2 complaint	
Cryptographic Accelerator	HAS-1/RSA algorithm	

Ordering Information

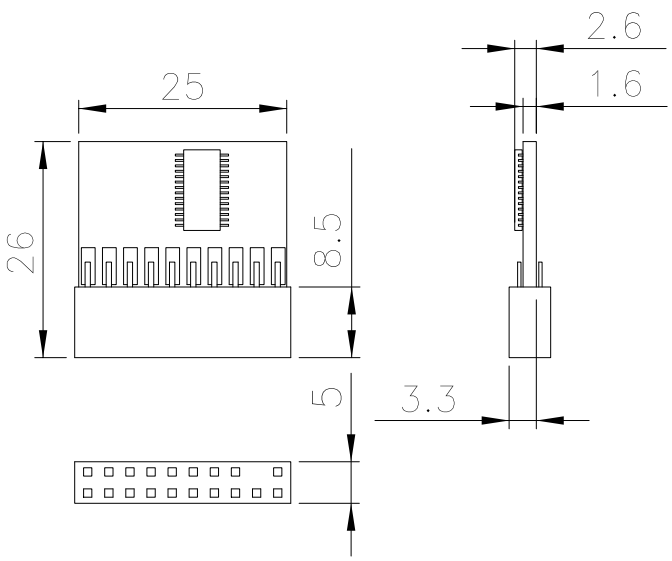
Part No.	Description
TPM-IN01-R20	20-pin Infineon TPM1.2 module, software management tool, firmware v4.4
TPM-IN02-R20	20-pin Infineon TPM2.0 module, software management tool, firmware v5.5

Pin Assignment



Pin	Singnal	Pin	Singnal	Pin	Singnal	Pin	Singnal
1	LCLK	6	VCC5	11	LAD0#	16	SERIRQ
2	GND	7	LAD3#	12	GND	17	GND
3	LFRAME#	8	LAD2#	13	SCL	18	CLKRUN#
4	KEYWAY	9	VCC3	14	SDA	19	LPCPD#
5	LRST#	10	LAD1#	15	SB3V	20	LDRQ#

Dimensions (mm)



PUZZLE Software Introduction

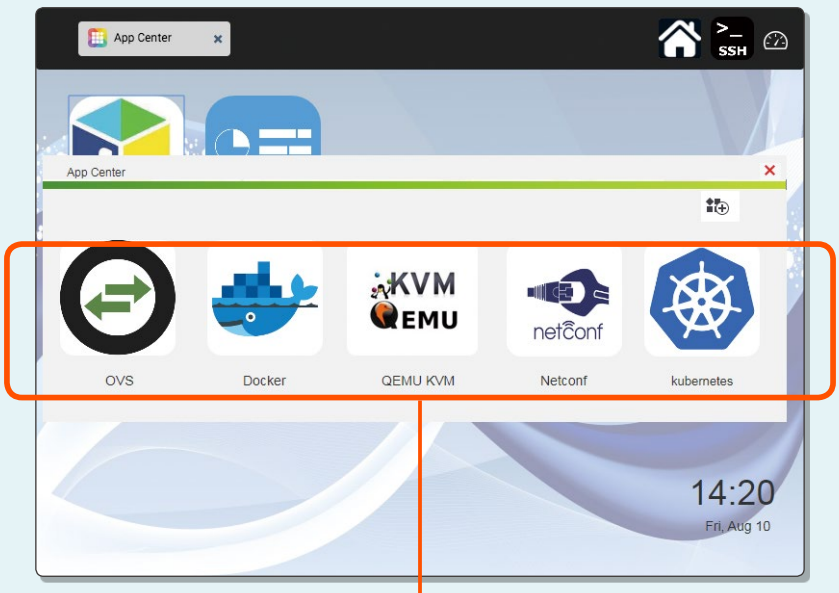
PUZZLE Finder Software AP

Use your PC/Laptop as a development environment.

After installing Ubuntu 16.04 on your PUZZLE, you can install the PUZZLE Finder application on your PC/Laptop. PUZZLE Finder can help users quickly develop environment and network applications, and allow them to perform PUZZLE system management, resource monitoring, version maintenance, software installation, software update and gaining information of CPU, memory, Internet, etc.

Easy to Install

The APP center provides the most popular and configured applications.



Eliminate cumbersome installation steps; choose the APP you want to install. The APP can be downloaded and automatically installed. You can immediately enjoy the benefits of the software.

Utilize Virtual Technology, Create Unlimited Value

Docker containerization unlocks the potential for Dev and Ops. Freedom of choice, agile operations and integrated security for legacy and cloud-native applications. Implement Docker Lightweight Micro Services on the IEI PUZZLE.

Install the Open vSwitch (OVS) can implement domain cutting, QoS, data monitoring, and support openFlow.

Provide a more efficient Linux virtualization solution. Enhance the efficiency of virtualization by enhancing the operating mode of the CPU through QEMU-KVM.

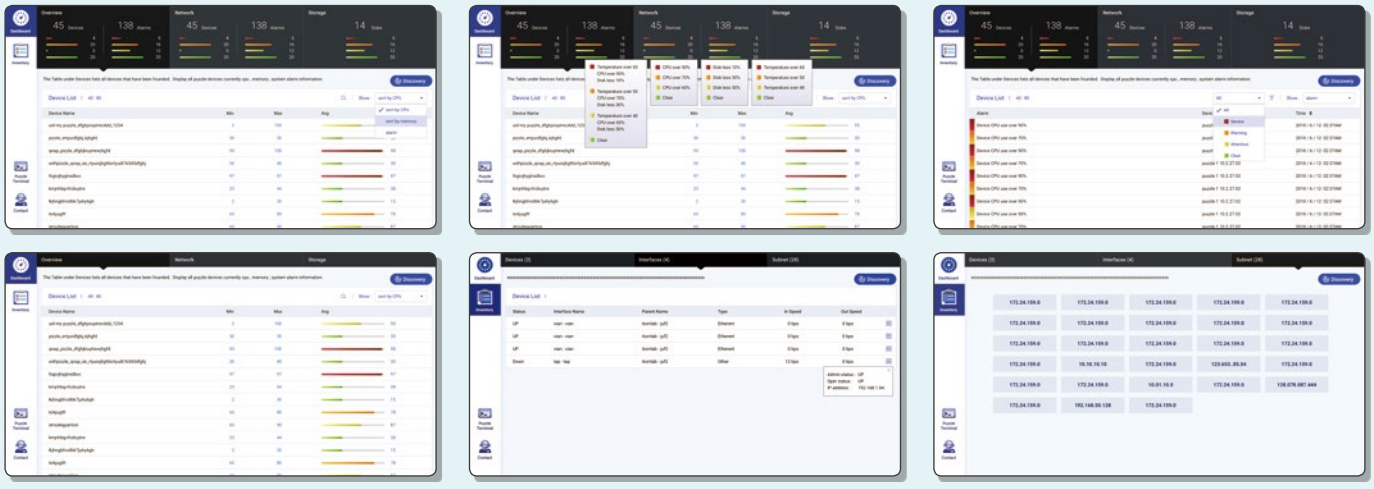
Automate network configuration with Netconf; accelerate network equipment and services in enterprise in order to lower the cost.

Kubernetes is a system that helps us automate the deployment, expansion, and management of containerized applications.

PUZZLE System Status Monitoring

Graphical user interface allows you to easily get an overview of the PUZZLE system and monitor resource status of each PUZZLE system you have.

User Interface



PUZZLE Series Technology

Virtualization is the process of creating a software-based, or virtual, representation of something, such as virtual applications, servers, storage and networks. Network functions virtualization or NFV is a network architecture concept that uses the technologies of IT virtualization to virtualize entire classes of network node functions into building blocks that may connect, or chain together, to create communication services.

PUZZLE Series Ecosystem

PUZZLE is about the uCPE consists of software virtual network functions (VNFs) running on a standard operating system hosted on an open server. An ideal uCPE deployment supports a multi-vendor multi-component construction and enables rapid development as well as open multi-vendor systems.

User Space

FD.io, OPNFV, OpenFastPath, OvS, DPDK, OpenDataPlane

Kernel Space

ubuntu, OpenWrt, Linux KVM, docker

Hardware

Intel, MARVELL, BROADCOM, CAVIUM, AQUANTIA, Mellanox, NXP

PUZZLE Series is Ready for Next Generation Network

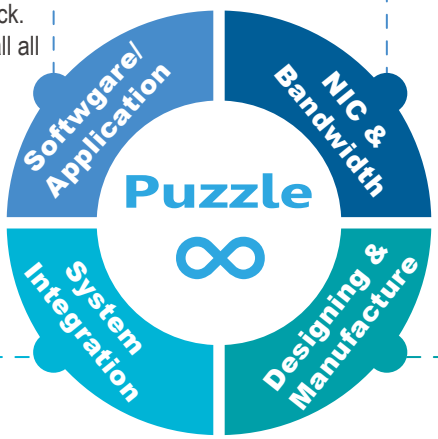
The following picture completely shows the components of the PUZZLE series. Choose the right components from CPU, NIC, software, manufacturing side, and fit them together. You will create a perfect network appliance.

Software/ Application

On the left hand side, it shows the S/W support from IEI. IEI will help customers to get device driver, application, other NFV basic software, DPDK, OvS, VPP, OpenDaylight and OpenStack. IEI will also help customers to deploy and install all of the software and build up their own NFV solutions.

openstack. OvS Open vSwitch Device Driver .io Application

OPEN DAYLIGHT DPDK



NIC & Bandwidth

On the upper side, it shows the network connection ability of the PUZZLE series. IEI provides four brands of NIC from Aquantia, Intel, Broadcom, Mellanox, and with 1G, 2.5G, 5G, 10G or 25G different kinds of speed.

AQUANTIA BROADCOM intel Mellanox

10/100Mb, 1G, 2.5G, 5G, 10G 25G, 100G

System Integration

On the right hand side, it shows the computing ability of the PUZZLE series.

IEI implements 5 major CPU brands, including Intel, AMD, Marvell, NXP, Cavium, and 3 kinds of accelerator cards for edge computing or AI computing .

intel NVIDIA MARVELL intel FPGA

AMD NXP Movidius CAVIUM

Designing & Manufacture

On the bottom side, it shows ARMOR Link cross IEI cross QNAP.

Most of network appliances are about network security. Some of the customers care about where the network appliance is designed and made. Therefore, we provide you two choices, design and manufacture in Taiwan or in China. QNAP factory is in New Taipei City, Taiwan, and ARMOR Link factory is located in Shanghai, China.

ARMOR Link × iEi × QNAP

PUZZLE-A001

1U Rackmount Network Appliance with AMD EPYC™ Embedded 3000 series processor, 1 NMS & 2 PCIe x4 slots

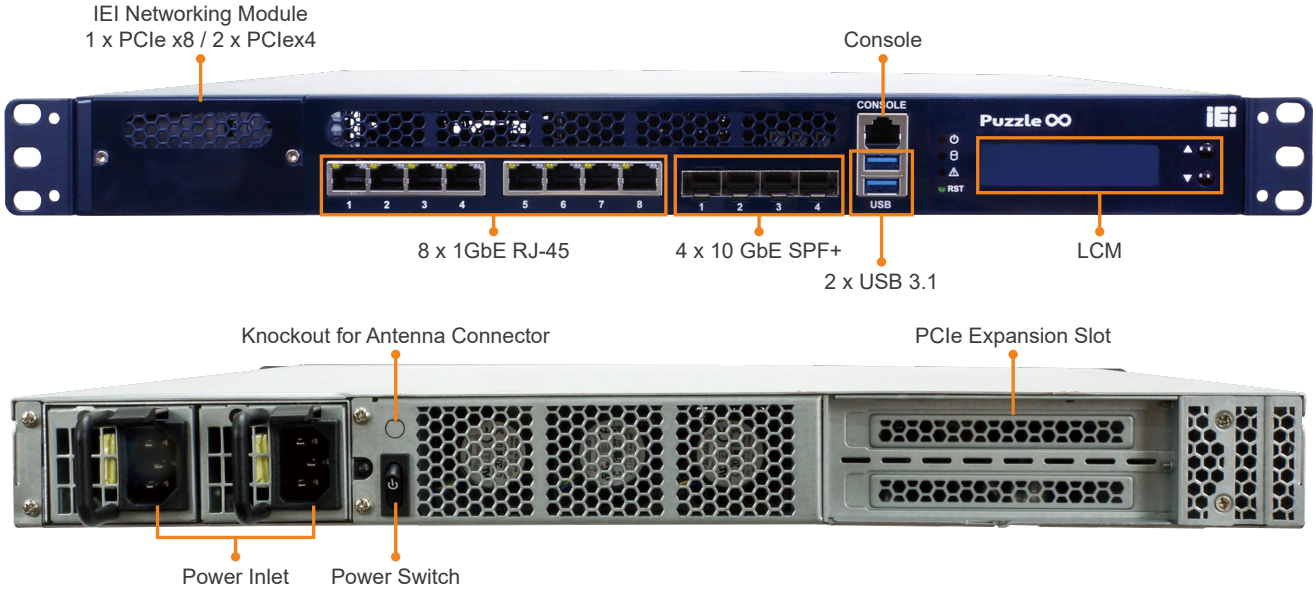
Features

- AMD EPYC™ Embedded 3000 series processor High-Performance CPU System on Chip
- Support 8 x GbE RJ-45 via BCM 5720, 4 x 10 GbE SFP+ and IEI Networking Module
- 2 x 288-pin DIMM, 2 x DDR4 2666 MHz, UDIMM Up to 64GB / RDIMM Up to 128GB
- 1 x RJ-45 Console, 2 x USB 3.1 Gen 1 (5Gb/s), LCM
- 2 x 2.5” SATA drive bay, 1 x M.2 B-Key (SATA, USB 3.1 Gen 1 (5Gb/s)),1 x PCIe mini card (PCIe, USB 2.0)
- Support two PCIe x4 slots
- Redundant PSUs

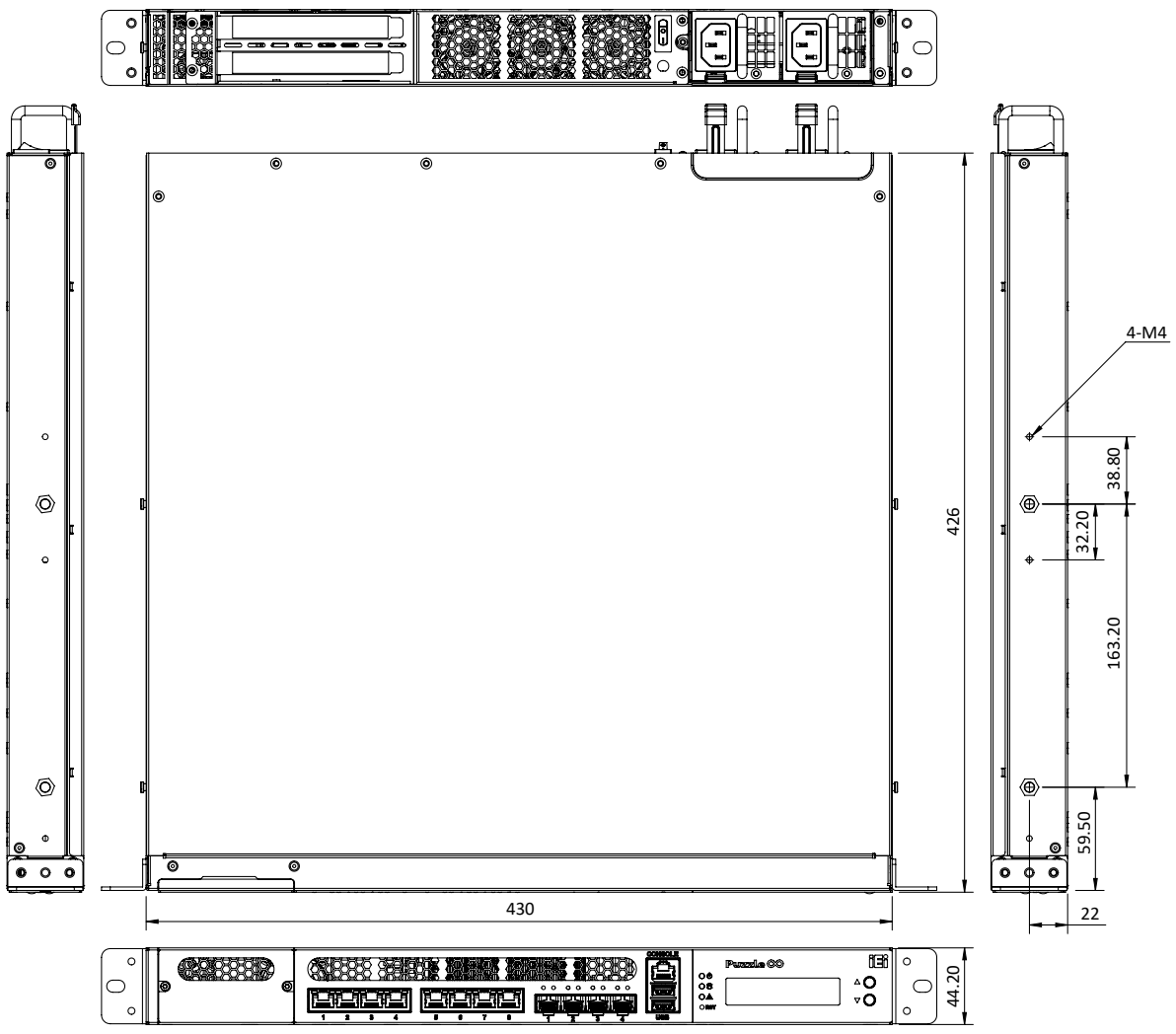
Specifications

		PUZZLE-A001-SO2	PUZZLE-A001-SO3
Platform	Form Factor	1U	
	CPU	AMD EPYC™ Embedded 3201 processor, 8C/8T, up to 3.10 GHz	AMD EPYC™ Embedded 3151 processor, 4C/8T, up to 2.90 GHz
	Chipset	Integrated in CPU	
Memory	Memory Technology	4 x DDR4 2666 MHz ECC or non-ECC UDIMM Support RDIMM	
	Memory Capacity	UDIMM Up to 64GB / RDIMM Up to 128GB	
	Memory Socket	4 x 288-pin DIMM	
Network and Security	Network acceleration and Security function	• Secure Processor for Crypto Co-processing • Secure Memory Encryption (SME) • Secure Encrypted Virtualization (SEV) • Integrated crypto acceleration supporting the IPsec protocol	
	TPM	1 x TPM 2.0 Pin header	
Networking	Ethernat IC	1 GbE NIC: Broadcom® BCM5720	
	Ethernat Port	8 x 1GbE RJ-45 LAN ports, 4 x 10 GbE SPF+	
	Network Module Slot	1 x Networking Module Slot	
Expension slot	PCIe slot	2 x PCIe x4 slot	
	PCIe mini card slot	1 x PCIe mini card (PCIe, USB2.0)	
	M.2	1 x M.2 B key (SATA & USB 3.1 Gen 1 (5Gb/s))	
Storage	Storage	2 x 2.5" SATA HDD/SSD bay	
	eMMC	N/A	
	SD card	N/A	
External I/O	USB 3.1	2 x USB 3.1 Gen 1 (5Gb/s)	
	Console	1 x RJ-45	
Internal I/O	M.2	1 x M.2 B key (SATA & USB 3.1 Gen 1 (5Gb/s))	
	HDMI	N/A	
	USB 3.1	1 x USB 3.1 Gen 1 (5Gb/s)	
	USB 2.0	4 x USB 2.0	
Power and Mechanical	Power Switch	1 x Power Switch	
	Reset Button	1 x Reset Button	
	Power Input	100 V ~ 240 V	
	Type/Watt	Redundant Power 300W	
		90V ~ 264V AC	
	Processor Cooling	1 x Passive CPU Heatsink	
	System Cooling	4 x Cooling Fans with Smart Fan	
	Antenna Port	1 x Antenna port	
Physical and Environmental	Storage Temperature	-10°C ~ 50°C	
	Operating Temperature	0 ~ 40°C (32 ~ 104°F)	
	Operating Humidity	5% ~ 90% non-condensing	
	Dimensions (W x H x D) (mm)	430 x 426 x 44.2	
	Weight	7kg	
OS and Certifications	Certification	CE / FCC	
	Operating System	Linux Ubuntu 18.04.04	
Indicators	LCM	LCM, 2 buttons	
	LED	1 x Power LED, 1 x Storage LED, 1 x Alert LED	

I/O Interface



Dimensions (Unit: mm)



Ordering Information

Part No.	Description
PUZZLE-A001-SO2/16G/R-R10	1U Rackmount Network Appliance with AMD EPYC™ Embedded 3201 processor, 16GB DDR4, two 256GB SSD, four 10 GbE SFP+, eight 1GbE, one PulM, two PCIe expansion, Redundant Power, RoHS
PUZZLE-A001-SO3/16G/R-R10	1U Rackmount Network Appliance with AMD EPYC™ Embedded 3151 processor, 16GB DDR4, two 256GB SSD, four 10 GbE SFP+, eight 1GbE, one PulM, two PCIe expansion, Redundant Power, RoHS

Packing List

	PUZZLE-A001-SO2/16G/R	PUZZLE-A001-SO3/16G/R
Power cord	1	1
Heatsink	1	1
Rack mounting ears	2	2
SCREW for Rack mounting ears	6	6
USB to console cable	1	1
RS232 to console cable	Option	Option
Slide rail	Option	Option

Options

Item	Part No.	Description
Slide rail	RAIL-B02	New rail kit for new 1U & 2U NAS: TVS-471U, 1253U, etc
USB to console cable	32013-004000-100-RS	ROUND CABLE; LAN CABLE; FTDI Console Cable; 2; 1800MM; (A)USB A TYPE 4P MALE+PCB:FTDI_FT232RL; (B)RJ-45 8P8C; RoHS
RS232 to console cable	32005-005100-100-RS	ROUND CABLE; RS-232/422/485; PUZZLE RS-232 Cable; 2; 500MM; 24AWG; (A) D-SUB 9P MALE+#4-40 Screw; (B)RJ-45 PLUG 8P8C; ONE PCS PKG; TC&C; RoHS

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