IEI PUZZLE Series Products

Aiming to The Future with Next Generation Network Appliance

IEI PUZZLE series is the next generation product of network appliance which includes a broad portfolio of x86-based and ARM-based network platform built with the latest generation Intel, AMD, Marvell, NXP or Cavium processors, and Aquantia, Intel, Broadcom, Mellanox network interface controllers. These products are built for proprietary network appliance and uCPE (Universal Customer Premise Equipment).

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.

PUZZLE is Ready for Proprietary Network Appliance

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.

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.

Wireless Gateway

A wireless gateway routes packets from a wireless LAN to another network, wired or wireless WAN. It may be implemented as software or hardware or combination of both. Wireless gateways combine the functions of a wireless access point, a router, and often provide firewall functions as well. They provide network address translation (NAT) functionality, so multiple user can use the internet with a single public IP. It also acts like a dynamic host configuration protocol (DHCP) to assign IPs automatically to devices connected to the network.

WAN Optimization

WAN optimization or WAN acceleration is a collection of techniques to enhance the efficiency of data flow across a wide area network (WAN). The goal of WAN optimization is to speed up the data transfer, to reduce latency and insure bandwidth of access to critical applications and information. The most common industrial WAN connection is from branch to headquarters.
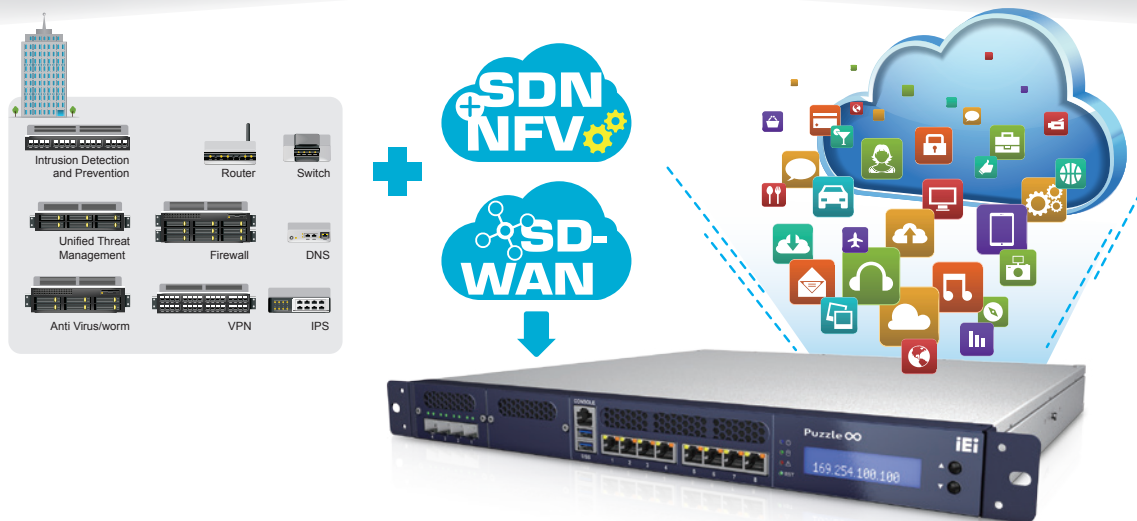
Next Generation Firewall (NGFW)

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.

PUZZLE's uCPE Application

In a virtual CPE (vCPE) model, all the network functions can be consolidated using software-based virtual network functions (VNFs) running on top of a single universal CPE (uCPE) appliance. The VNFs may reside inside an on-site hardware device, in an enterprise data center, or in the cloud. Both businesses and service providers can easily operate IEI PUZZLE series.
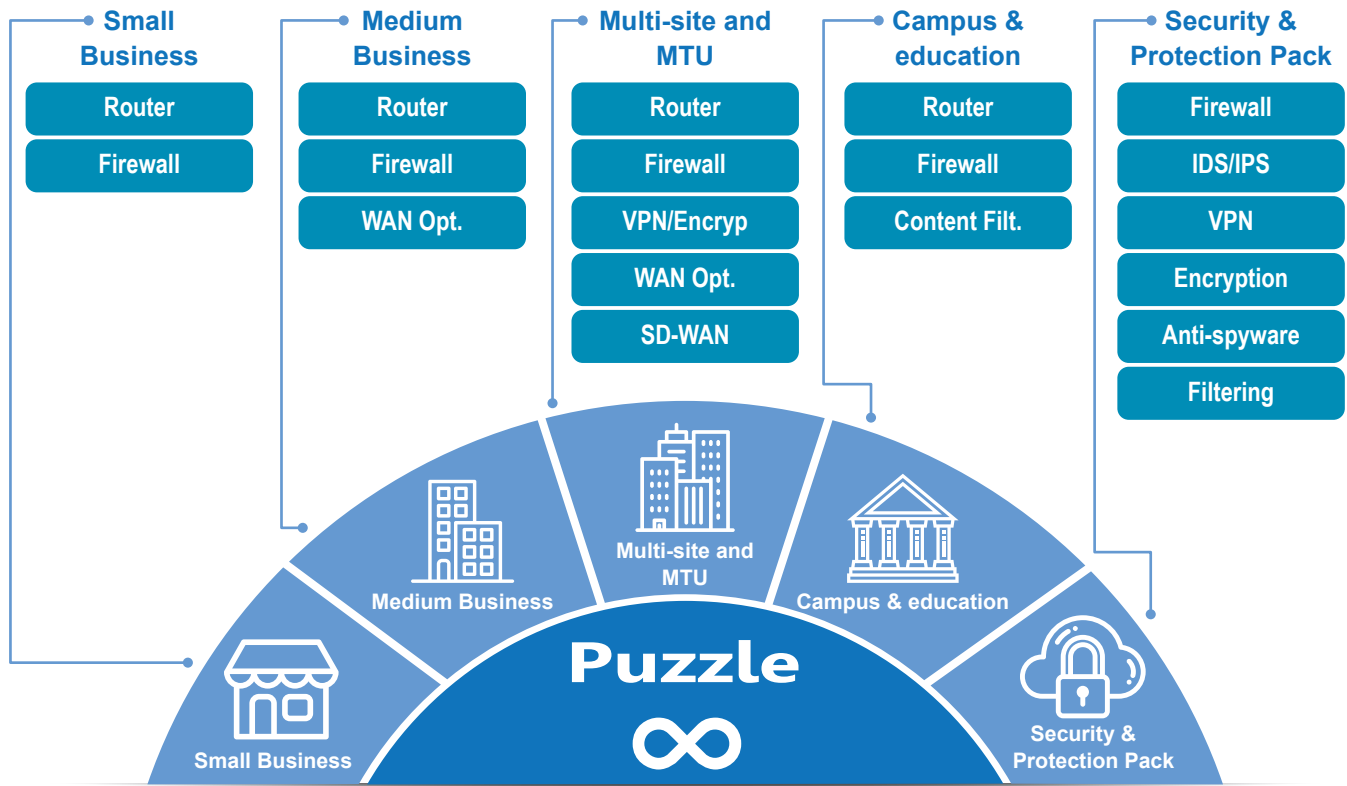
PUZZLE Designed for Every Environment

The PUZZLE series can be used in different environment, from small company to global corporations. Firewall and router are software that is basically used in uCPE, and are ones of the most important software with high usage. Each kind of software is built based on network security and communication system to avoid external attacks. By using SD-WAN (Software-Defined WAN), the problem of insufficient performance and security can be solved at the same time. With simple and easy-to-use programming functions, central device management can be achieved to provide enterprises a full line of protection.

PUZZLE designed for SMB or enterprise application environment

One of the commercially viable applications for NFV is the area of Universal Customer Premise Equipment (uCPE). The PUZZLE series uCPE allows customer service providers to offer their SMB or enterprise functions as VNFs more commonly on a purpose-built device running at the customer premises. Generally, the most applicable enterprise services managed in uCPE include router, firewall, WAN optimization, and SD-WAN.

Puzzle ∞

Small Business	Medium Business	Multi-site and MTU	Campus & education	Security & Protection Pack
Router	Router	Router	Router	Firewall
Firewall	Firewall	Firewall	Firewall	IDS/IPS
	WAN Opt.	VPN/Encryp	Content Filt.	VPN
		WAN Opt.		Encryption
		SD-WAN		Anti-spyware
				Filtering

Medium Business · Multi-site and MTU · Campus & education · Small Business · Security & Protection Pack

SD-WAN Application

Basic SD-WAN Operation

SD-WAN

Branch Site
Dynamic Multipath Optimization

Wireless WAN

Internet

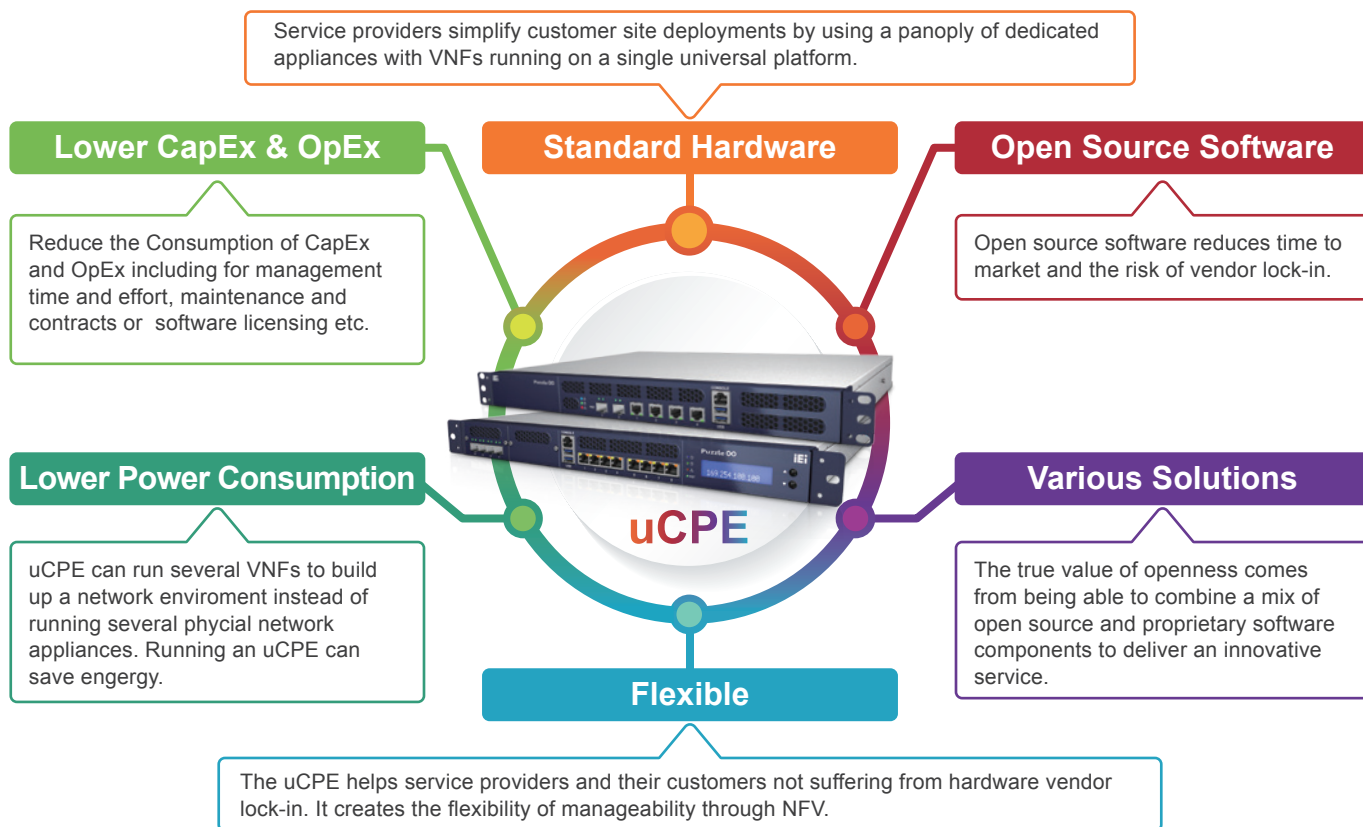Cloud Services

Private MPLS

SD-WAN

Data Center

SD-WAN services revenues will see a compound annual growth rate (CAGR) of 69.6% and reach $8.00 billion in 2021

uCPE in Telecom & Network Operators

Now a day, Telecom & Network Operators can build network services by deploying VNFs on a uCPE. There are several Advantage of uCPE, that is why uCPEs become more and more popular.
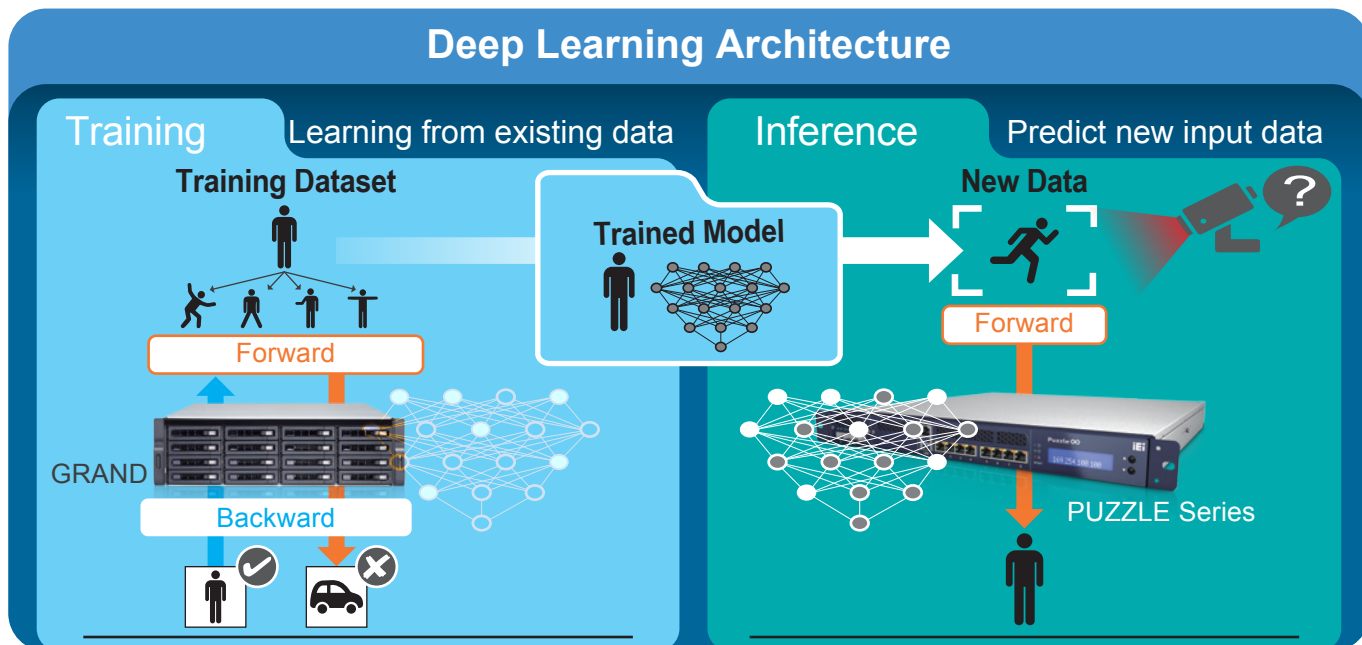
This model allows Telecom & Network Operators to deploy services more quickly and with more flexibility and save a lot of money.

Service providers simplify customer site deployments by using a panoply of dedicated appliances with VNFs running on a single universal platform.

Lower CapEx & OpEx

Reduce the Consumption of CapEx and OpEx including for management time and effort, maintenance and contracts or software licensing etc.

Standard Hardware

Open Source Software

Open source software reduces time to market and the risk of vendor lock-in.

Lower Power Consumption

uCPE can run several VNFs to build up a network enviroment instead of running several phycial network appliances. Running an uCPE can save engergy.

uCPE

Various Solutions

The true value of openness comes from being able to combine a mix of open source and proprietary software components to deliver an innovative service.

Flexible

The uCPE helps service providers and their customers not suffering from hardware vendor lock-in. It creates the flexibility of manageability through NFV.

Edge Computing & AI Inference Computing

How Does Deep Learning Work?

Deep learning is a machine learning technique that can learn useful representations of features directly from images, test and sound. There are two phases, training and inference. The training servers designed for AI creates patterns and algorithms from the dataset, and each layer of data is assigned some random weights and your classifier runs a forward pass through the data, predicting the class labels and scores using those weights, after the training model is built, that will be applied into systems that are able to predict the result, this is what inference systems do.

Deep Learning Architecture

Training — Learning from existing data

Training Dataset

Forward

GRAND

Backward

Trained Model

Inference — Predict new input data
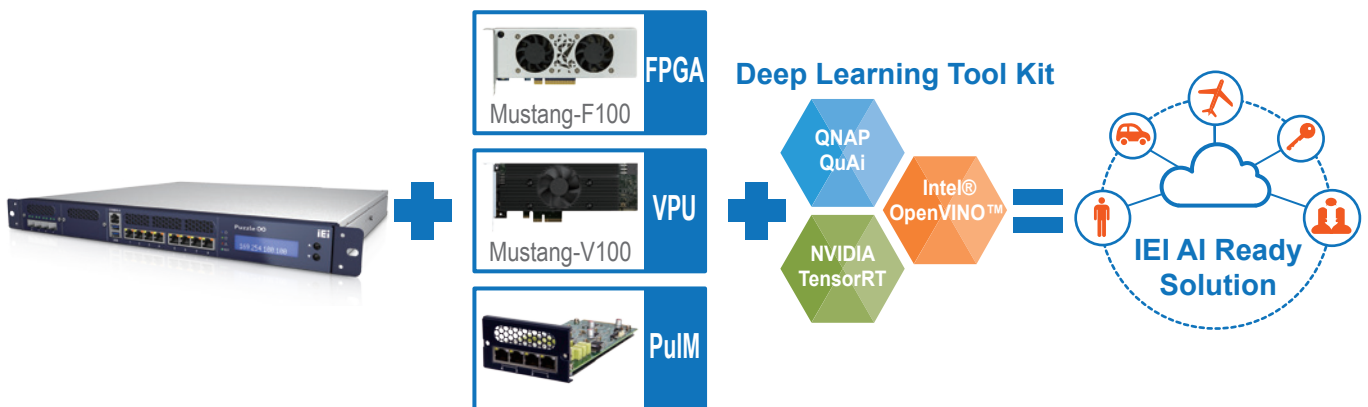
New Data

Forward

PUZZLE Series

Achieving AI with IEI Deep Learning Solution

The most likely markets to adopt AI technologies, will be medicine, biology, media, security, defense and transportation. Each market faces a variety of challenges, for example, in transportation traffic flow prediction, heavily depends on historical and real-time traffic data collected from various sensor sources, including inductive loops, radars, cameras, etc. It is difficult to find a safe and reliable hardware for the kind of harsh and strict environment.

Therefore, IEI introduces the PUZZLE series which is specifically designed not only for network appliance but also for edge computing and AI inference system, and features modularized, rich interconnectivity, and powerful computing capability. For instance, the PUZZLE-IN001 is equipped with workstation-class Intel® C246 chipset, cutting edge technology, 8 GbE and two network module slots which support 25GbE, 10GbE interface for transport huge amount of data. In addition, various add-on card interfaces such as PCIe 3.0 slots, PCIe Mini card slot and M.2 slot are provided for customers to add acceleration cards like VPU, FPGA, GPU cards to increase the computing power. IEI PUZZLE series is perfect to be used as AI inference systems or edge computing systems.

IEI AI Ready Solution Accelerates your AI Initiative

PUZZLE series are AI hardware ready system ideal for deep learning inference computing to help you get faster, deeper insights into your customers and your business. IEI's PUZZLE series support graphics cards, Intel FPGA acceleration card, and Intel VPU acceleration card and provide additional computational power and end-to-end solution to help run your tasks more efficiently. With the NVIDIA TensorRT, QNAP QuAi,and Intel OpenVINO AI development toolkit, it help you deploy your solutions faster than ever.
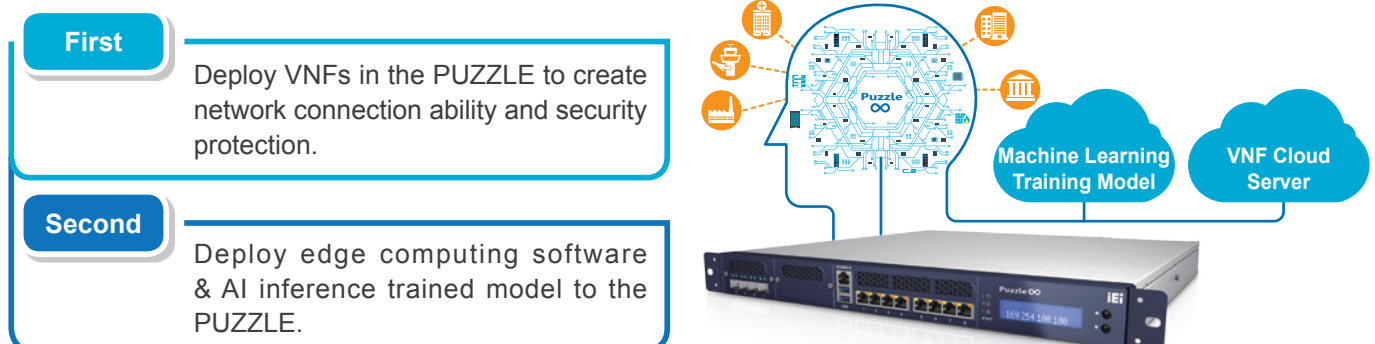

What is an NFV Orchestration?

Network functions virtualization (NFV) Orchestration (or NFV Orchestration) is used to coordinate the resources and networks needed to set up cloud-based services and applications. This process uses a variety of virtualization software and industry standard hardware. Cloud service providers or global telecom operators use NFV orchestration to quickly deploy services, or virtual network functions (VNFs), using cloud software rather than specialized hardware networks.

With NFV Orchestration technology, we can remotely and quickly deploy VNFs, edge computing software and AI inference trained model into the uCPU-based IEI PUZZLE series products.

There are only two steps to create an edge computing or AI inference computing system with the PUZZLE series.

First — Deploy VNFs in the PUZZLE to create network connection ability and security protection.

Second — Deploy edge computing software & AI inference trained model to the PUZZLE.
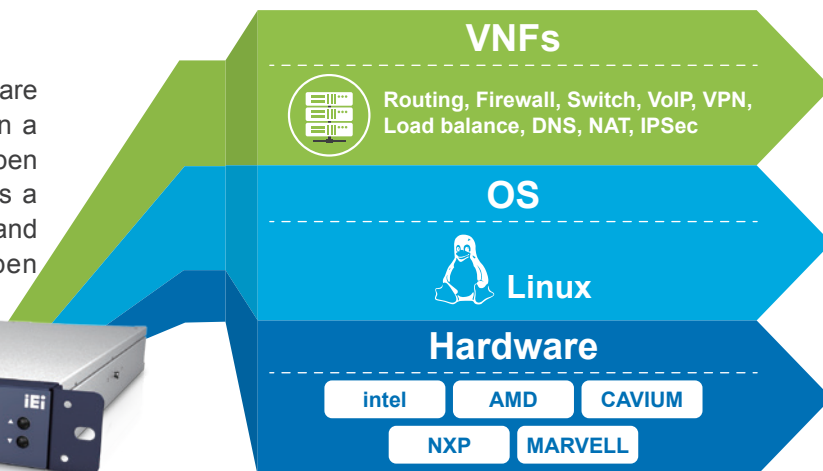
PUZZLE Series Technology

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.

VNFs

Routing, Firewall, Switch, VoIP, VPN, Load balance, DNS, NAT, IPSec

OS

Linux

Hardware

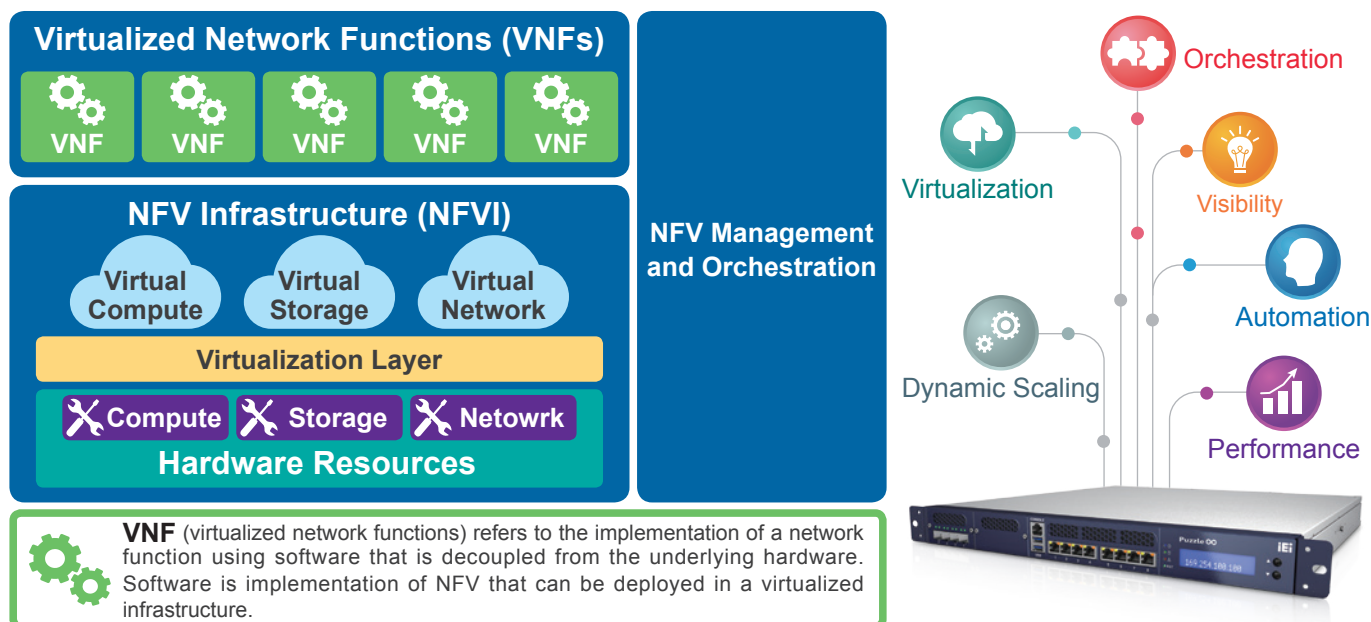intel | AMD | CAVIUM
NXP | MARVELL

Universal CPE (uCPE) is one of the most compelling use cases of Network Function Virtualization (NFV) currently attracting the interest of hosted service providers. uCPE provides a remotely manageable platform on which hosted service providers can easily deploy, modify or delete VNFs over Wide Area Networks (WAN).

The PUZZLE system can provide an open universal customer premises equipment (uCPE) solution that offers real-time software-defined wide-area network (SD-WAN) services that support both Intel x86 and ARM architectures with any additional virtual network functions (VNF) services.
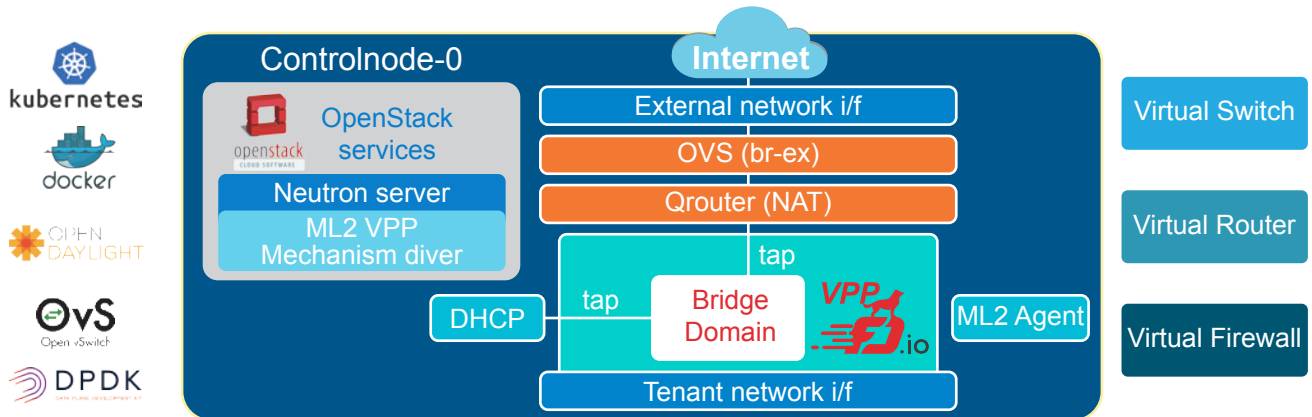
What is NFV?

Advantages of NFV on the PUZZLE's series

NFV (Network Functions Virtualization) is network architecture concepts that using IT virtualization related technologies, to virtualize entire classes of network node functions into building blocks that may be connected, or chained, together to create communication services. Is to take your traditional hardware network devices (routers, switches, firewalls, etc.) and deploy them virtually, like computer running as a virtual machine.

Virtualized Network Functions (VNFs)

VNF | VNF | VNF | VNF | VNF

NFV Infrastructure (NFVI)

Virtual Compute | Virtual Storage | Virtual Network

Virtualization Layer

Compute | Storage | Netowrk

Hardware Resources

NFV Management and Orchestration

Orchestration

Virtualization

Visibility

Automation

Dynamic Scaling

Performance

VNF (virtualized network functions) refers to the implementation of a network function using software that is decoupled from the underlying hardware. Software is implementation of NFV that can be deployed in a virtualized infrastructure.

Support NFV Technology

IEI uCPEs have been verified with NFV (Network Functions Virtualization) software testing tools based on open source. With the test and verification, IEI uCPEs are ready to implement DPDK (Data Plan Development Kit), OVS (Open vSwitch), or VPP (Vector Packet Processing), which can be installed on OpenStake to create virtual machines and containers. Once the virtual machines and containers are created, it can be easily to deploy VNFs (Virtual Network Functions) and to create vFirewall, vRouter, vSwitch, and SD-WAN as needed.

What is SD-WAN?

The software-defined wide-area network (SD-WAN) is specific application of software-defined networking (SDN) technology adds app-layer intelligence and service chaining in WAN connections within enterprise networks, including headquarter, branch offices and data centers. SD-WAN connectivity can be delivered as service using software orchestration.

SD-WAN is appealing because it is a replacement for traditional WAN routers and supports transport technologies like MPLS, Internet, and LTE. SD-WAN also allows load sharing of traffic across multiple WAN connections making it more efficient.
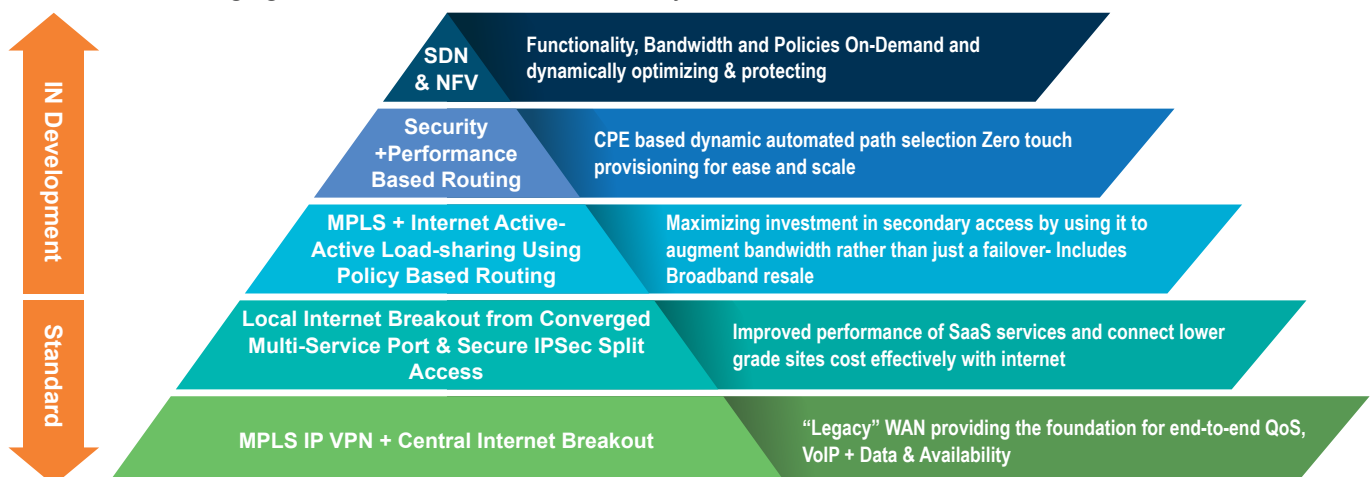
SD-WAN Benefits of PUZZLE's Series

One of the main benefits that most enterprises deploy SD-WAN is that it can reduce their WAN costs by up to 90 percent because it supplements or replaces dedicated private WAN networks, which usually are MPLS, with regular broadband connectivity.

That same cost-benefit can be applied to SD-WAN as a Service. By using this, enterprises can get the flexibility and cost savings of SD-WAN and at the same time minimize the headache of managing the infrastructure and connectivity.

SD-WAN Basic Architecture

The common point between SD-WAN and hybrid WAN is to combine multiple external connections. For example: Internet, Wireless network. But the difference between SD-WAN is that: Automated management network,Programmable. And traffic can be automatically and dynamically transferred based on network status, security, and application service quality requirements.

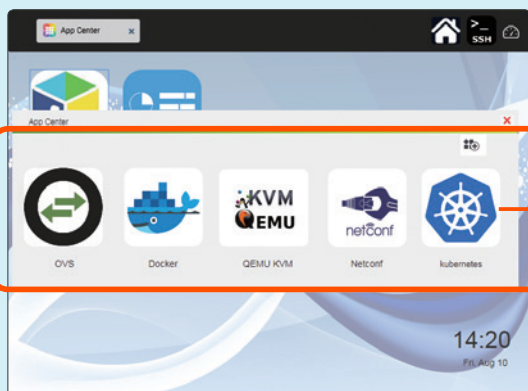# PUZZLE Software Introduction

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.
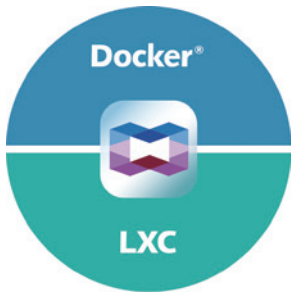
USB/RS232

CONSOLE

Easy to Install

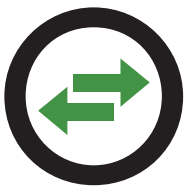The APP center provides the most popular and configured applications.

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

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PUZZLE & PulM Series Introduction

IEI PUZZLE Series for Network Appliances

IEI PUZZLE series includes x86-based and ARM-based product solutions. x86 systems adapt Intel or AMD CPU; ARM-based systems adapt Marvell, NXP or Cavium SoC. Each CPU & SoC has its own advantage for network appliances. For example, Intel is the most popular chip maker and provides complete driver support; AMD provides high performance; ARM-based SoC provides special HW offload for networking function such as packet processor and datapath acceleration.

It is easy to choose the right network appliance or uCPE solution from IEI PUZZLE series.

IEI PUZZLE Series – Processer Options

	X86		ARM		
Brand	**Intel**	**AMD**	**MARVELL**	**NXP**	**CAVIUM**
Platform	Coffee Lake C246, H310	EPYC 3000 R-Series SoC	Armada 8040 Armada 7040	QorIQ® LS2088	OCTEON CN8300
Advantage	● Most popular ● Stability ● Complete driver support ● Easy to develop	● High core count ● High performance ● Secure encrypted virtualization ● Secure memory encryption	● Quad Cortex-A72 cores ● Packet processor ● 10GbE integrated ● Low cost	● Eight to four Cortex-A72 cores ● Packet processor ● Datapath acceleration ● 10GbE integrated	● Up to 24 Cortex-A72 cores ● Packet processor ● HW offload for networking ● 10GbE integrated ● Low cost

IEI PUZZLE Series – Smart NIC Option

Smart NIC is getting more and more important. It not only increases the performance of system but also provides special functions like virtualization technology and packet processing. It is ideal for users want to, for instance, build up a network server with virtual machine and provide storage function.

Mellanox would be a better choice for the solution.

Offload Function		Mellanox	Intel	BROADCOM	AQUANTIA
CPU Offload	LSO	Y	Y	Y	Y
	TSO	Y	Y	Y	
	RSS	Y	Y	Y	Y
	HDS	Y		Y	Y
	MSI-X	Y	Y		Y
Storage Offload	iWARP		Y		
	iSER	Y	Y		
	VEPA		Y	Y	
	NFS RDMA	Y	Y		
	uDAPL	Y			
Virtualization Support	VxLAN	Y	Y		
	NetQueue	Y		Y	
	GENEVE	Y			
	IEEE 802.1Qbg	Y	Y		
	SR-IOV	Y	Y	Y	

IEI 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
OPEN DAYLIGHT
DPDK
.io

Device Driver   **Application**

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   intel   BROADCOM.   Mellanox TECHNOLOGIES

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 an Intel company   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 ∞