ADLINK
Leading EDGE COMPUTING

Use Case: Application Delivery Controller (ADC)

An Ideal Computing Platform for Application Delivery Controller in the Cloud Era



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How to build a computing platform for application delivery controller in the cloud era efficiently?



Table of Contents

1. Introduction P1
2. The challenges faced to application delivery equipment in cloud era P2
3. Computing Platform CSA-7200 from ADLINK Technology P4
4. The Introduction of ANS Application Delivery Controller from High-Galaxy P6
5. CSA-7200 Powers High-Galaxy ANS P8
6. Conclusion P9
7. Open Compute Carrier-grade Edge Reference Architecture (OCCERA) P10

1. Introduction

With the popularity of cloud computing, more and more companies are moving their applications to cloud in order to improve the resource utilization of IT equipment, as well as to reduce the cost of investment, operation and maintenance. The cloud computing brings not only more opportunities but also more challenges to the enterprise. The inherent security issue of cloud computing, and the response speed of cloud-based application are two important matters that the enterprise must take into consideration in a cloud-based application deployment. In this background, the real value of an application delivery network begins to emerge. Through deploying a fast, secure and stable access channel between the user and application server, the application delivery network can not only ensure the speed and stability, but also the security of cloud-based application access. As a key component of the application delivery network, the application delivery controller, can improve the resource utilization and reliability of an application server deployed in a data center, as well as enhance the user access experience of a cloud-based application.

This article will first discusses the challenges faced by an application delivery controller in cloud computing. After that, the ANS application delivery controller from High-Galaxy is taken as an example to explain how the CSA-7200 product helps High-Galaxy to deal with a serial of challenges, and speeds the introduction of a industry-leading could delivery product.

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2. The challenges faced to application delivery equipment in cloud era

NFV support and high availability

The computing performance of a virtualized server will decline in cloud computing when compared with a physically server. The application delivery controller need consolidate multiple virtual servers, or even multiple virtual servers in multiple data centers, providing a unified access experience for the cloud services. In cloud computing, on the one hand in order to improve the response speed for user accessing, the cloud applications are required to be deployed at multiple data centers with different physical locations. This requires an application delivery controller to support multiple kinds of load balancing, including server load balancing, link load balancing and global load balancing. On the other hand in order to improve the usage efficiency of cloud computing resources, a cloud-based application need support dynamically scalable based on the actual number of visits, therefore, the application delivery controller itself shall also support NFV and cluster-based deployment mode. The computing resource used by the application delivery controller can be adjusted dynamically according to the real-time application visits. The multiple virtual application delivery controllers in a cluster shall be managed in harmony, so that the processing capability of the whole system can be expanded as needed, at the same time to archive redundant backup and load balancing among these multiple virtual application delivery controllers.

SDN support and intelligent flow forwarding

SDN is achieving more and more widely usage in data center, and its main philosophy is to decouple the data forwarding and control strategy, making it easy to control the data flow forwarding through software programing. In philosophy, the application delivery network share some common architecture with SDN. It main philosophy is to decouple the business logic and application delivery, achieving the business delivery management through programming the application delivery controller. Therefore there is an imperative trend to combine the application delivery controller with SDN technology in a cloud-based application delivery network. On the one hand, the SDN transformation in data center requires that the application delivery controller add SDN support to realize the separation of data forwarding and control logic, proving a more flexible service programming control. On the other hand, the introduction of SDN increases the transparency of the application delivery process, making it easier to implement the data flow forwarding based service type or data type. At the same time, a finer data traffic statistics can be supported, facilitating the visualization analysis and management of service traffics.

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SLL offloading and Application Acceleration

In cloud computing, in order to ensure the security of sensitive data transferring between the user and application server, SLL has been more widely used. A core function of the application delivery controller is SSL offloading. Through transferring the encryption and decryption process from application server to application delivery controller, the performance pressure on back-end application server can be reduced, and the response speed of customer accessing can be improved in return. This requires the application delivery controller can perform the operation of SSL encryption and decryption efficiently.
In addition, to improve the user experience of cloud-based application, TCP connection multiplexing, HTTP compression and Web acceleration based on dynamic content caching have achieved widely usage in application delivery controller.



Multiple-level Security Protection System

There is another important issue that application delivery controller must address is how to ensure the security of the user access process without affecting the user experience. First of all, the application delivery server shall have the ability to handle high-throughput big data flow, and deal with the common DDoS attacks to provide a fundamental stabilization mechanism for the cloud-based application accessing. Secondly, the application delivery controller shall be able to distinguish attacks from normal traffic data flow through feature recognition, and even application detection using flow status, and then provide security functions such as DDoS defense, content filtering, web application firewall, access control list, and network address translation, ensuring the normal operation of the cloud services. Some vendors also implements vulnerability detection on their application delivery controllers, and support the potential risk detection of the cloud-based services through regularly scanning.

In summary, the application delivery controller locates in the key position of the cloud computing network. In addition to the powerful processing capability needed by high-throughput big data, it shall also support the latest cloud computing technology like NFV and SDN. In order to achieve the SSL offloading and web application acceleration, the application delivery controller shall be equipped with additional hardware acceleration engine to handle the data encryption/decryption and compression/decompression operations that are very computing intensive. In order to ensure application security, the application delivery controller shall provide not only powerful packet processing capability, but also outstanding feature matching capability, which are the foundation to implement web firewall and guard against various malicious attacks.

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3. Computing Platform CSA-7200 from ADLINK Technology

CSA-7200 is next-generation high-end computing platform from ADLINK technology that was built on a Open Compute Carrier-grade Edge Reference Architecture (OCCERA) (See Appendix for more). Through the integration of those features required by next-generation of application delivery controller in a computing platform with open architecture, CSA-7200 can assist application delivery vendors to build application delivery controllers that can face the challenges introduced by cloud computing.



The Hardware Features of CSA-7200

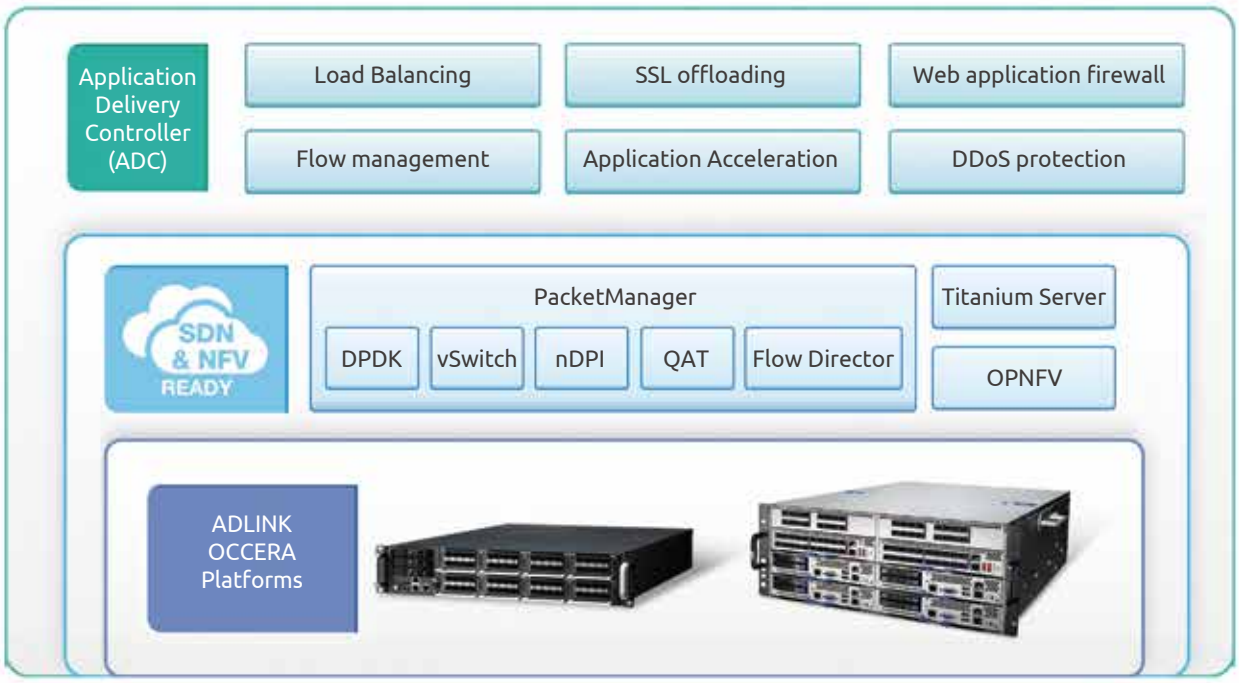
CSA-7200 is designed for next-generation of network computing equipment. It is equipped with dual high-performance Intel® Xeon® E5 processors, can support up-to 64 SFP+ ports through eight network IO expansion cards to meet the extreme demand for network IO density. The main characteristics of CSA-7200 are summarized as follows:

- Supports dual Intel® Xeon® E5 v3/v4 processor, supports 12x DDR memory slots with maximum 192G memory, supports 3x 2.5" hot-swappable SATA disk bays, totally providing a strong parallel computing capability.
- Supports up-to 8 PCI Express expansion slot on its front panel, which can be used to expand various network interfaces. 64xSFP+ ports can be achieved at most to meet the requirements for high-throughput and high-bandwidth application delivery scenarios.
- Supports advanced LAN bypass features, and the LAN bypass modes of various network interfaces in chassis power-up and power-off can be configured independently, helping to improve the high-reliability of application delivery controllers.
- Supports a standard PCIe x8 Gen 3 slot, which can be used to expand various hardware acceleration cards like Intel® QAT and FPGA, implementing the SSL encryption/de-encryption and HTTP compression/de-compression based on hardware.
- Supports IPMI 2.0 specification and Serial Over LAN, and the operation status of motherboard, PSUs and fans can be monitored via standard protocols, facilitating the maintenance and management of the chassis deployed in cloud.
- Support intelligent fan speeding and dynamic power management based on Intel® Node Manager technology to reduce the power consumption, consequently achieving energy saving.

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CSA-7200: Application Ready Intelligent Platform

On CSA-7200, ADLINK technology developed PacketManager software for network packets processing, which packages DPDK, vSwitch, nDPI and the supporting stacks for flow director and Intel QAT. PacketManager can help the user to simplify the development of DPI, flow classification, traffic filtering, load balancing, and encryption functions on CSA-7200. In order to simplify the NFV deployment task, ADLINK technology also integrated and validated OPNFV and Wind River Titanium Server on CSA-7200. The PacketManager and NFV middle-ware make CSA-7200 become an application ready intelligent platform, and they on the one hand optimizes the computing performance of CSA-7200, and on the other hand provides a rich set of features for building cloud-based application. The CSA-7200 computing platform allows the user to develop an application delivery controller and introduce it to the market more quickly.

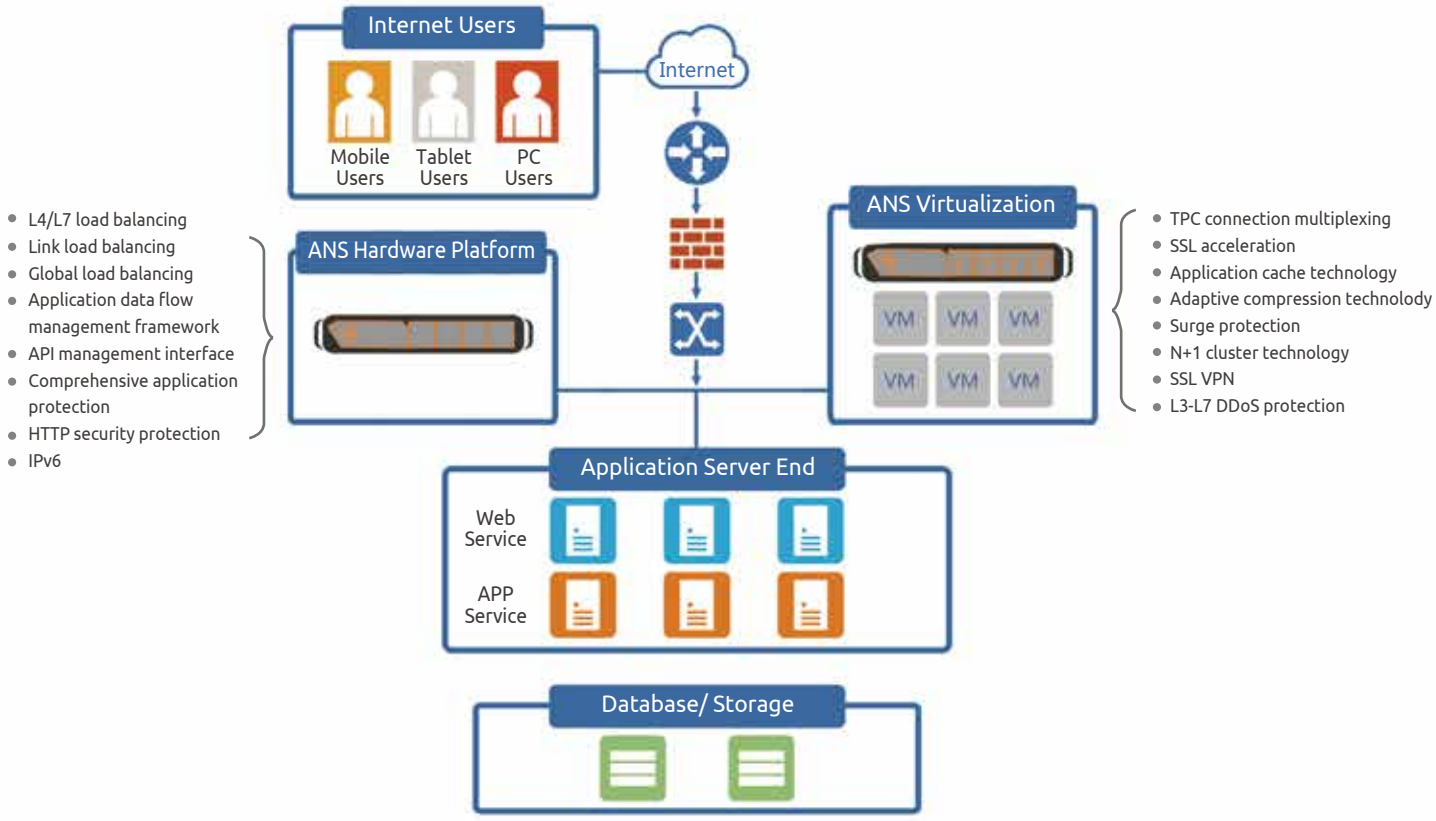


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4. The Introduction of ANS Application Delivery Controller from High-Galaxy

The ANS application delivery controller (hereafter referred to as ASN) is a flow management and service assurance product that integrates application delivery, application acceleration, and security protection. The main functionalities of ASN includes L4-L7 load balancing, content switching, SSL encryption/decryption, dynamic content caching, IPSec/SSL VPN, web firewall, surge protection, which can assure the reliability, stability, continuity and safety of application delivery service.

ANS provides a comprehensive and effective optimization for application delivery while simplifying the overall architecture of data center. Furthermore, the performance of ANS is not reduced with addition of more features, and it eliminates the complexity introduced by multiple products from multiple vendors, and removes the performance penalty introduced by the extra interaction between multiple equipment. ANS supports both physical and virtualized deployments, can meet the construction requirements of both traditional and cloud data centers, providing a comprehensive application delivery capabilities.



Multi-core parallel processing engine: Improve the processing performance of network throughput effectively

The processor of ANS is a parallel network flow processing engine based on multi-core technology. The CPU0 runs common application management service, and the other CPU cores runs L4-L7 network flow processing engine.
The memory sharing mechanism between multiple cores is used to reduce the communication delay between multiple cores, increase the parallel processing efficiency, and archive zero-interruption, zero-lock, zero-copy and zero-scheduling. The input data flow from network interfaces are distributed to different L4-L7 data flow processing engines through hardware RSS, achieving high-speed high-efficiency L7 flow forwarding. Combined with the parallel multi-core operation mechanism of ANS, i.e., various vCPUs run concurrently in collaboration with each other, ANS can increase the processing capability of network throughput, and provide reliable traffic protection for the high concurrency of cloud application accessing.

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Virtualization Technology: Reduced Resource Usage and Flexibility

ANS supports virtualization deployment in a cloud environment and performs network application delivery using virtualized software in a mainstream virtual machine environment (e.g. VMware, KVM, Hyper-V). ANS supports private cloud, public cloud, and hybrid cloud, implementing on-demand deployment, resilient computing, and automated licensing for multi-tenant environments. ANS virtualization products provide the functionalities of traditional high-end network equipment in the form of virtual machines. The virtual equipment can be deployed more quickly and easily in cloud data centers and scaled as required due to changing demands.

High Performance and High Availability: Meet Business Requirements in a Variety of Complex Scenarios



ANS equipment supports 5Gbps to 120Gbps data throughput for L7 processing. The virtualized equipment can support 10Mbps to 30Gbps data. These ultra-high data processing capabilities meet the business requirements of cloud service providers in a variety of complex scenarios. The ANS application delivery controller supports common HA modes including Active-Standby and Active-Active. When a heart-beat failure is detected or a condition is met that triggers a switchover, the data flow on the abnormal equipment will be transferred over to ensure uninterrupted operation of the application. The cluster mode of the ANS supports aggregation of up to 32 ANS units, providing industry-leading high-availability and scalability to meet customer requirements for configuration on demand, making it ideal for usage in various of business scenarios.

Application Acceleration Optimization: Enhance the User Access Experience

The ANS application delivery controller is equipped with advanced flow management technology and can reduce the resource usage of the server via a variety of optimization technologies such as SLL acceleration and offloading, application caching, and TCP buffering. Furthermore, a dedicated hardware acceleration card can be used to provide high-performance SSL encryption/decryption and HTTP compression/de-compression.

Application-Oriented Protection: Stop Web-Based Attacks Effectively

The ANS supports in-depth analysis and fine-grained control of web application traffic. Web-based application services can be protected by deploying and configuring the ANS, which includes a feature library for common web attacks from the Open Web Application Security Project (OWASP). Common web attacks can be filtered and prevented by simply matching the data flow against the feature library. At the same time, comprehensive management of data flow based on user policies and rules is supported and users can match and handle data flows differently depending on various parameters in the HTTP header. For example, the publishing and browsing behaviors in a micro-blog can be identified and processed to block access to malicious websites through URL matching, thus making surfing the web more secure.

Powerful Attack Detection Capability: Provides All-Around Protection for Applications

The ANS can combine multiple techniques such as protocol analysis, pattern recognition, statistics thresholds, abnormal traffic monitoring, and self-learning to accurately detect and block all kinds of malicious network attacks, including common aggressive behaviors such as overflow attacks, WebCGI attacks, DDoS attacks, Trojans, and other system vulnerabilities. The ANS is built with a professional attack rule repository to prevent common aggressive attacks. The rule repository is continually updated in a cooperative test mode with a professional security platform, therefore ensuring that the ANS is equipped with comprehensive, accurate and effective detection capability against a wide range of attacks.

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5. CSA-7200 Powers High-Galaxy ANS

The High-Galaxy ANS is equipped with professional application acceleration and security, provides a comprehensive application delivery solution for the user, including global load balancing, multi-link load balancing, and server load balancing. As an industrial-leading application delivery provider, High-Galaxy pays great attention to the underlying computing platform in order to ensure an ideal combination of functionality and performance. After comparing several products from different vendors, High-Galaxy ultimately selected the ADLINK CSA-7200 as the computing platform for the ANS. The following table summarizes the main considerations of High-Galaxy in its decision making process.

Requirements for Computing Platform Proposed by ANS	How the CSA-7200 meets the requirements
Support for parallel processing, powerful packet processing performance	Features dual Intel® Xeon® processor E5-2600 v3/v4 and integrates Intel® DPDK with ADLINK PacketManager software to optimize the runtime environment, providing 10 times the data processing capability in traditional usage model.
Supports interfaces with ultra-high throughput, including 40G and 100G optical interfaces	Uses modular I/O design, allowing the user to select different network I/O cards to deploy the required number of interfaces and bandwidth throughput (e.g. 100G/40G high-speed ports can be supported or alternatively up-to 64x 10G ports can be implemented).
Supports intelligent data distribution and flow control based on application level protocols	Supports the latest Intel® virtualization technologies such as VT-x, VT-d, and VT-c in hardware design. Integrates validated virtualization management platforms such as OPNFV and Wind River® Titanium Server® facilitating NFV deployment.
Supports intelligent data distribution and flow control based on application level protocols	Supports RSS in hardware design, allowing load balancing of inlet data flow to multi-cores of the processor. Integrates DPDK OVS and nDPI with ADLINK PacketManager, providing an application development framework for SDN and DPI to achieve intelligent forwarding of data flow.
Supports hardware-assisted encryption/ de-encryption and compression/ de-compression, supports high-speed cache	Supports a variety of hardware accelerators via a PCIe expansion slot to facilitate hardware-assisted encryption/de-encryption and compression/ de-compression. Supports SDD in both PCIe and M.2 interfaces for high-speed caching.
High availability, fully guarantee of hardware stability	Supports redundant power supply units, hot-swappable storage drives, advanced LAN bypass to achieve carrier-grade high availability. Strict quality verification to ensure the stability and reliability of shipped products.

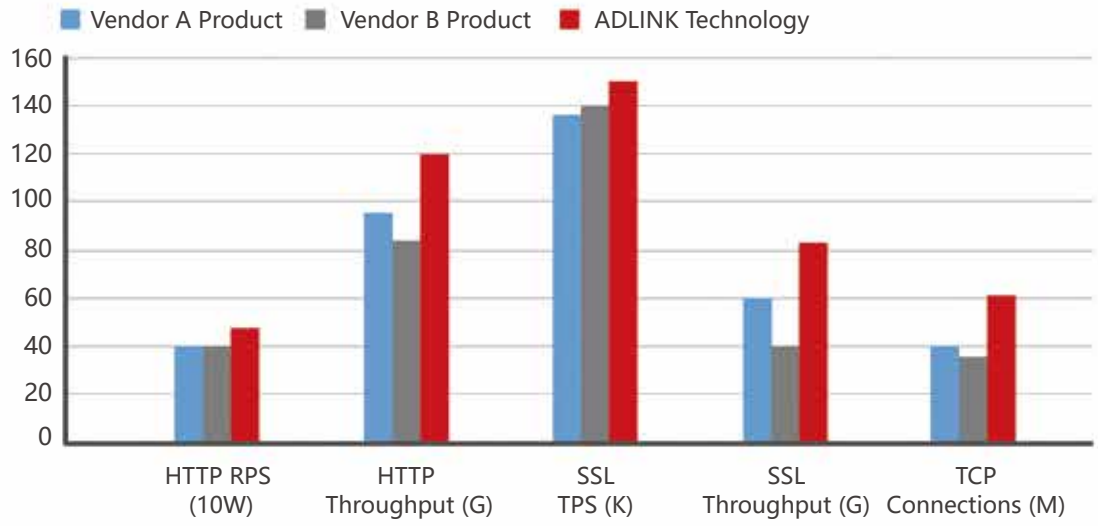
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Performance Enhancements of ANS Powered by CSA-7200

The following table and figure compares some of the key performance indexes of High-Galaxy ANS software running on different vendor's products, including HTTPS RPS, HTTP throughput, SSL TPS, SSL throughput, and TCP connections. It readily apparent that the CSA-7200 boosts the performance of the High-Galaxy ANS significantly when compared with the two similar products from other vendors.

Vendor/Product

Performance Indexes	Vendor A Product	Vendor B Product	ADLINK Technology CSA-7200
HTTP RPS	4,000,000	4,000,000	4,600,000
HTTP Throughput	95Gbps	84Gbps	120Gbps
SSL TPS	135K	140K	150K
SSL Throughput	60Gbps	40G	84G
TCP Connections	40M	35M	58M



6. Conclusion

Application delivery controllers evolved from traditional load balancing products. They combine the functionalities of server load balancing, link load balancing, global load balancing, application acceleration and optimization, and application security in an integrated product, and meet the requirements of product evolution to NFV and SDN in a cloud data center. The CSA-7200 is a next generation computing platform from ADLINK technology that is designed and built on the OCCERA. It integrates the special requirements of next generation of application delivery controllers into an open computing platform and enables network equipment vendors to quickly build application delivery controllers that meet today's cloud computing requirements. Outstanding quality and after-sales support set the CSA-7200 apart from its competitors, making it High-Galaxy's first choice for its latest ANS application delivery controller and allowing to perform its tasks efficiently and comprehensively.

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7. Open Compute Carrier-grade Edge Reference Architecture (OCCERA)

OCCERA, the new industrial IOT architecture for commercial off-the-shelf (COTS) platforms features a design aimed at optimizing performance, cost and space requirements for the next generation of industrial IOT solutions. ADLINK's OCCERA industrial-grade platform is designed to support the native virtualization requirements for software-defined networking (SDN) and network function virtualization (NFV), while integrating a wide range of the latest hardware acceleration technologies to boost the processing of network packets and video streams. All this functionality is offered on an open, modular computing architecture, allowing users to redefine resource allocation for cloud computing applications.

The strategy behind OCCERA platforms is to introduce the latest data center technology to industrial telecom computing. The OCCERA implies the main characteristics of the platform: modular design, industrial carrier-grade features, and cloud-oriented design.

OCCERA adopts an innovative modular design for upgraded scalability and flexibility. Customers can choose from different functional modules (compute, switch, storage, and IO modules) depending on their specific application requirements to build a highly tailored computing platform. The hybrid design allows customers to mix and match between 1/4 and 1/2-width slot compute nodes in order to scale the number of independent systems with different processing capacities in the platform, as needed.

OCCERA adopts industrial-grade design for higher density, rich I/O capacity, PCIe backplane throughput, and lower latency. All modules offer redundancy and hot-plugging. In addition, IO modules support advanced LAN bypass features, and – in order to meet the high bandwidth requirements of future 5G networks – each computing module is designed to support dual 64G bandwidth, with even higher bandwidth support available through expansion IO cards.

OCCERA is designed for industrial cloud computing with native virtualization for SDN/NFV. For SDN, OCCERA switch modules use larger TCAM tables to implement L2/L3/L4 fast packet forwarding using OpenFlow. For NFV, OCCERA switch modules and network cards support hardware-accelerated processing for NVGRE and VXLAN tunnel protocols. OCCERA designs also integrate a wide range of the latest hardware acceleration technologies to boost the processing of network packets and video streams.

ADLINK's OCCERA is a delivery system for the latest telecom, networking security, and intelligent video surveillance services. The platform offers a complete solution, with optimized stacks, high throughput, and an expanding partner ecosystem for mix-and-match hardware and software configurations. OCCERA provides computing modules based on Intel® Core™/Xeon® and other processor-based boards, switch modules, storage modules and IO modules, and can be easily customized and scaled based on customer needs. OCCERA platforms provide variety of rack-mount form factors, like 2U, 4U and many others, truly scalable from rack mount to rack scale, enabling different computing capacity for different stages of a project.

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ADLINK is a Premier Member of the Intel® Internet of Things Solutions Alliance and is active in several standards organizations, including PCI Industrial Computer Manufacturers Group (PICMG), PXI Systems Alliance (PXISA), and Standardization Group for Embedded Technologies (SGeT).

ADLINK is a global company with headquarters in Taiwan and manufacturing in Taiwan and China; R&D and integration in Taiwan, China, the US, and Germany; and an extensive network of worldwide sales and support offices. ADLINK is ISO-9001, ISO-14001, ISO-13485 and TL9000 certified and is publicly traded on the TAIEX Taiwan Stock Exchange (stock code: 6166).

About the Intel® Internet of Things Solutions Alliance

ADLINK Technology is a Premier member of the IntelR Internet of Things Solutions Alliance. From modular components to market-ready systems, Intel and the 400+ global member companies of the IntelR Internet of Things Solutions Alliance provide scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics. Close collaboration with Intel and each other enables Alliance members to innovate with the latest technologies, helping developers deliver first-in-market solutions.

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