HoloWAN®

HoloWAN High Precision WAN Emulators

Exceptional Performance, Easy to Use, cost-effective.
Enulates: Bandwidth, Latency, Packet loss,
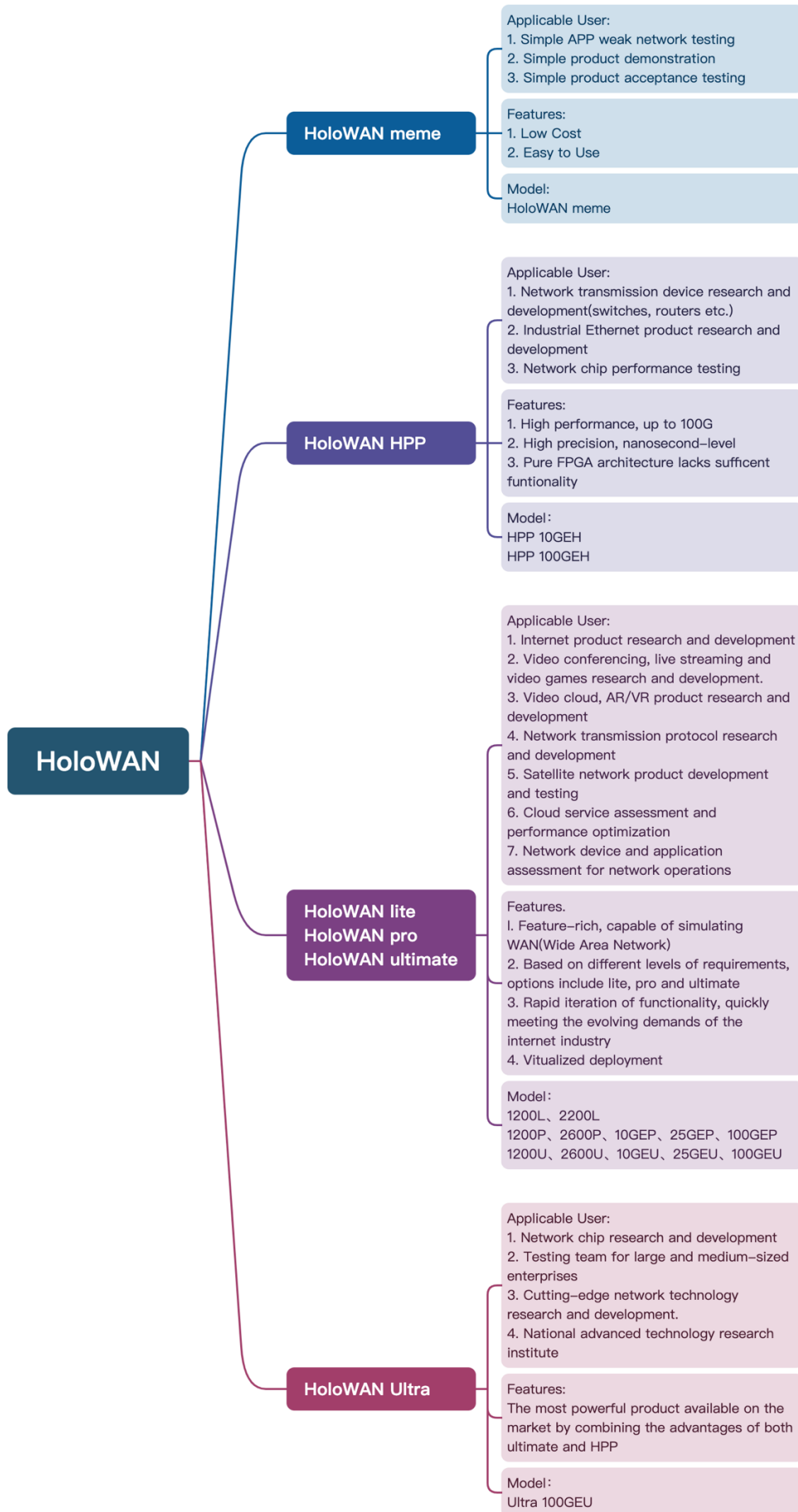jitter,Other impairments.

Recruit global agency

WAN Emulator

Product Comparison Sheets

HoloWAN Product Matrix :

HoloWAN

HoloWAN meme

Applicable User:
1. Simple APP weak network testing
2. Simple product demonstration
3. Simple product acceptance testing

Features:
1. Low Cost
2. Easy to Use

Model:
HoloWAN meme

HoloWAN HPP

Applicable User:
1. Network transmission device research and development(switches, routers etc.)
2. Industrial Ethernet product research and development
3. Network chip performance testing

Features:
1. High performance, up to 100G
2. High precision, nanosecond–level
3. Pure FPGA architecture lacks sufficent funtionality

Model：
HPP 10GEH
HPP 100GEH

HoloWAN lite
HoloWAN pro
HoloWAN ultimate

Applicable User:
1. Internet product research and development
2. Video conferencing, live streaming and video games research and development.
3. Video cloud, AR/VR product research and development
4. Network transmission protocol research and development
5. Satellite network product development and testing
6. Cloud service assessment and performance optimization
7. Network device and application assessment for network operations

Features.
l. Feature–rich, capable of simulating WAN(Wide Area Network)
2. Based on different levels of requirements, options include lite, pro and ultimate
3. Rapid iteration of functionality, quickly meeting the evolving demands of the internet industry
4. Vitualized deployment

Model：
1200L、2200L
1200P、2600P、10GEP、25GEP、100GEP
1200U、2600U、10GEU、25GEU、100GEU

HoloWAN Ultra

Applicable User:
1. Network chip research and development
2. Testing team for large and medium–sized enterprises
3. Cutting-edge network technology research and development.
4. National advanced technology research institute

Features:
The most powerful product available on the market by combining the advantages of both ultimate and HPP

Model：
Ultra 100GEU

HoloWAN Model Comparison :

Function/ Model		HoloWAN meme	HoloWAN Lite	HoloWAN Pro	HoloWAN Ultimate	HoloWAN Hpp	HoloWAN Ultra
Functionality Set		meme	lite	pro	ultimate	hpp	ultra
Basic Network Data Template		✗	✓	✓	✓	✗	✓
Frame Overhead		✓	✓	✓	✓	✗	✓
Background Utilization		✗	✓	✓	✓	✗	✓
MTU		✗	✓	✓	✓	✗	✓
Bandwidth limitation	Fixed	✓	✓	✓	✓	✓	✓
	Jitter	✗	✗	✗	✓	✗	✓
	Token Bucket	✗	✗	✗	✓	✗	✓
Queue Depth	Simple	✓	✓	✓	✓	✗	✓
	Drop Tail	✓	✓	✓	✓	✗	✓
	RED	✗	✗	✗	✓	✗	✓
Corruption	Bit Error	✗	✓	✓	✓	✗	✓
	Packet Error	✗	✓	✓	✓	✗	✓
	Bit Error Range	✗	✗	✗	✓	✗	✓
	Single	✗	✗	✗	✗	✓	✓
	Burst	✗	✗	✗	✗	✓	✓
	Cycle	✗	✗	✗	✗	✓	✓
	Random	✗	✗	✗	✗	✓	✓
Delay & Delay Jitter	Constant	✓	✓	✓	✓	✓	✓
	Uniform	✓	✓	✓	✓	✗	✓
	Normal	✗	✗	✓	✓	✗	✓
	Jitter	✗	✗	✗	✓	✗	✓
	Custom	✗	✗	✗	✓	✗	✓
	Gamma	✗	✗	✗	✓	✗	✓
	Accumulate&Burst	✗	✗	✗	✓	✗	✓
	Step	✗	✗	✗	✗	✓	✓
Loss	Random	✓	✓	✓	✓	✓	✓
	Cycle	✗	✗	✓	✓	✓	✓
	Burst	✗	✗	✓	✓	✓	✓
	Jitter	✗	✗	✗	✓	✗	✓
	Gilbert Elliott	✗	✗	✗	✓	✗	✓
	4 State Markov	✗	✗	✗	✓	✗	✓
	Poisson	✗	✗	✗	✗	✓	✓
	Single	✗	✗	✗	✗	✓	✓

Functionality Set		meme	lite	pro	ultimate	hpp	ultra
Modify	**Normal**	✗	✗	✓	✓	✗	✓
	Random	✗	✗	✓	✓	✓	✓
	Cycle	✗	✗	✓	✓	✗	✓
Reordering Jitter	**Random**	✗	✓	✓	✓	✗	✓
	Jitter	✗	✗	✓	✓	✗	✓
	Cycle	✗	✗	✗	✓	✓	✓
	Single	✗	✗	✗	✗	✓	✓
Duplication Jitter	**Random**	✗	✓	✓	✓	✓	✓
	Jitter	✗	✗	✓	✓	✗	✓
	Single	✗	✗	✗	✗	✓	✓
	Burst	✗	✗	✗	✗	✓	✓
	Cycle	✗	✗	✗	✗	✓	✓
Classification Rule	**IPv4 or IPv6 Address**	✗	✗	✓	✓	✓	✓
	MAC Address	✗	✗	✓	✓	✓	✓
	RAW 1-Byte offsets	✗	✗	✗	✓	✓	✓
	RAW 4-Byte offsets	✗	✗	✗	✓	∂	✓
	TCP/UDP/SCTP Port	✗	✗	✓	✓	✓	✓
	Combination Rule	✗	✗	✗	∂ ✓	✓	✓
	VLAN	✗	✗	✓	✓	✗	✓
	MPLS Lable	✗	✗	✓	✓	✗	✓
	PPPoE	✗	✗	✗	✓	✗	✓
	Tunnel (GRE)	✗	✗	✗	✓	✗	✓
Packet Capture Analysis, comparing packets before and after impairments, and displaying the impairments process on a Gantt chart		✗	✗	✓	✓	✗	✓
GRE Tunnel		✗	✗	✗	✓	✗	✓
Network Scenario Replay Visualization		✗	✗	✓	✓	✗	✓
Network Scenario Database Update		✗	✗	✗	✓	✗	✓
Frequency of Replay Parameter Changes		✗	✗	0.1s	0.1s	✗	0.1s
Network Scenario Recording&Playback		✗	✗	Delay , Loss	Bandwidth , Delay , Loss	✗	Bandwidth , Delay , Loss

HoloWAN has 6 series based on functionality :

● HoloWAN meme

HoloWAN meme can simulate a simple network link between a pair of physical network ports without classifying packets. It can introduce simple impairments to packets, such as bandwidth limitation, delay, normal distribution jitter delay and random packet loss.

HoloWAN meme provides a low-cost solution for small-scale projects development and testing. With HoloWAN meme, you can quickly simulate basic network conditions for application development and client demonstrations.

HoloWAN meme Model List :

HoloWAN meme: Provides one 100M Engine ,100Mbps bidirectional line-rate forwarding performance, maximum bandwidth support of 100Mbps.

● HoloWAN Lite

HoloWAN Lite can simulate a simple network link between a pair of physical network ports without classifying packets. All packets passing through HoloWAN lite will be processed with the same impairments.

HoloWAN Lite offers an unprecedented low-cost solution while ensuring simulation accuracy. It provides a simple and user-friendly experience, delivering exceptional cost-effectiveness.

HoloWAN Lite Model List :

HoloWAN 1200L: Provides one 1000M Engine , 100Mbps bidirectional line-rate forwarding performance, maximum bandwidth support of 1000Mbps.

HoloWAN 2200L: Provides one 1000M Engine , 1000Mbps bidirectional line-rate forwarding performance.

● HoloWAN Pro

HoloWAN Pro can simulate 15 simple network link between a pair of physical network ports. The packets can be classified based on packet characteristics such as IP address, MAC address, VLAN ID, MPLS label, TCP or UDP port numbers, and directed to different virtual links with different impairments.

HoloWAN Pro offers more flexible control methods for bandwidth, delay, and packet loss. Additionally, it incorporates packet capture and analysis processes, enable complete transparency in the network impairment process.

HoloWAN Pro is an internationally leading high-end WAN Network emulator. It features high precision, high performance, flexible deployment, and easy usability. If you are looking to build a network environment for research and development purposes, HoloWAN pro is the ideal choice.

HoloWAN Pro Model List :

HoloWAN 1200P: Provides one 1000M Engine , 100Mbps bidirectional line-rate forwarding performance, maximum bandwidth support of 1000Mbps.

HoloWAN 2600P: Provides three 1000M Engine , 1000Mbps bidirectional line-rate forwarding performance.

HoloWAN 10GEP: Provides one 10G Engine , Maximum bandwidth support of 10Gbps.

HoloWAN 24GEP: Provides 24 1000M Engine , Maximum bandwidth support of 1000Mbps.

HoloWAN 25GEP: Provides two 25G Engine , Maximum bandwidth support of 25Gbps.

● HoloWAN Ultimate

HoloWAN Ultimate builds upon the features of HoloWAN Pro by adding more sophisticated packet classification rules. It also supports packet modification, advanced jitter control, engine configuration export/import, network scenario recording and playback, visualization of scenario playback process, and many access for research institutions and includes three years of professional technical services.

The HoloWAN team maintains ongoing technical collaboration with leading enterprises in the field, continuously iterating the functionality of HoloWAN. All the latest cutting-edge features developed will be promptly updated in HoloWAN Ultimate.

HoloWAN Ultimate Model List :

HoloWAN 1200U: Provides one 1000M Engine , 100Mbps bidirectional line-rate forwarding performance, maximum bandwidth support of 1000Mbps.

HoloWAN 2600U: Provides three 1000M Engine , 1000Mbps bidirectional line-rate forwarding performance.

HoloWAN 10GEU: Provides one 10G Engine , Maximum bandwidth support of 10Gbps.

HoloWAN 24GEU: Provides 24 1000M Engine , Maximum bandwidth support of 1000Mbps.

HoloWAN 25GEU: Provides two 25G Engine , Maximum bandwidth support of 25Gbps.

● HoloWAN HPP

The HoloWAN HPP is an ultra - high - performance and ultra - high - precision network impairment device implemented purely with FPGA. Its delay accuracy reaches the nanosecond level, and the maximum bandwidth can be as high as 100Gbps. There are significant differences in the functions of the HoloWAN HPP compared with those of Lite, Pro, and Ultimate.

HoloWAN HPP Model List :

HoloWAN 10GEH : Provides four 10G Engine , 10Gbps bidirectional line-rate forwarding performance, Be downward compatible with 1G.

HoloWAN 25GEH : Provides two 25G Engine , 25Gbps bidirectional line-rate forwarding performance, Be downward compatible with 10G.

HoloWAN 100GEH: Provides a maximum of two 100G engine , 100Gbps bidirectional line-rate forwarding performance, Be downward compatible with 40G/25G/10G.

● HoloWAN Ultra

HoloWAN Ultra combines the technologies of HoloWAN HPP and HoloWAN Ultimate. It offers both the ultra-high-performance and ultra-high-precision impairments provided by HoloWAN HPP and the

complex impairment processing provided by HoloWAN Ultimate in the same path. HoloWAN Ultra is an internationally leading comprehensive network impairment solution.

HoloWAN Ultra Model List :

HoloWAN 100GEHU : Provides a maximum of two 100G engine，100Gbps bidirectional line-rate forwarding performance, Be downward compatible with 40G/25G/10G.

HoloWAN Application scenarios :

- **simulate wireless networks,such as 2G、3G、4G、5G**

Wireless network technologies, such as 2G, 3G, 4G, 5G, WiFi, are often plagued by network issues like latency and jitter, packet loss and network congestion. HoloWAN can simulate these network impairments to construct complex network environments, allowing for the testing of wireless applications' adaptability and stability in real-world network conditions.

- **Simulating satellite networks**

Satellite networks typically have limited bandwidth, latency exceeding 500 milliseconds, and a bit error rate as high as 1×10^{-6}, posing significant challenges to the protocols and programs operating within them. In response, HoloWAN has been specially designed to better simulate the high latency and high bit error rate of satellite networks. HoloWAN is used to test satellite network protocols and programs with the aim of optimizing them.

- **Telecom Network Simulation**

Telecommunication operators use HoloWAN HPP to simulate nanosecond-level network latency and high-precision packet loss in order to test and optimize high-speed network technologies such as 5G. Moreover, HoloWAN HPP can construct a bandwidth of up to 100Gbps, simulating complex backbone networks. This allows operators to analyze the performance of their products in high-speed backbone networks and optimize product performance to ensure stable and efficient operation.

- **Development and Testing of Network Equipment and Protocols**

HoloWAN HPP can accurately simulate ultra-high bandwidth and precise latency in a laboratory environment, helping to test the performance of network devices and protocols in high-speed network environments. HoloWAN HPP can also accurately simulate key damages such as packet tampering, packet loss, and bit errors, allowing developers to optimize algorithms against these damages and ensure the stability of products and protocols in actual use.

- **Evaluating the required network bandwidth**

Using HoloWAN, one can simulate various degrees of network impairments such as bandwidth limitations, latency and jitter even in a network with good conditions. This helps you to more accurately assess the performance and stability of applications under a variety of network conditions and to determine the minimum bandwidth required to maintain stable operation of the applications.

- **Network Authentication**

Using HoloWAN to simulate bandwidth constraints, latency, jitter, packet loss and other conditions allows for comprehensive and in-depth testing of various network devices and deployment strategies. Helps to assess the performance of different network devices and solutions in various network environments, thereby enabling informed decisions on the optimal selection and deployment of network equipment.

- **Product testing**

Using HoloWAN to simulate real-world Wide Area Network conditions allows for the testing of network accelerators, application delivery devices, compression devices, WAN optimization appliances, flow control equipment, network behavior monitoring devices, and network security equipment. This ensures that these devices can operate stably and efficiently in actual WAN environments.

- **Application testing**

During the development of C/S or B/S systems, such as financial systems, stock trading platforms, online banking, and medical management systems, HoloWAN is used to simulate a real-world Wide

Area Network environment to test the systems. This allows for the evaluation of system performance in the face of latency, packet loss, and network congestion, and facilitates the adjustment of algorithms and strategies in both server and client-side systems.

- **AI System Testing**

I When testing systems such as distributed AI and machine learning, cloud computing and edge computing, IoT and smart devices, autonomous driving and AI technology, remote medicine and teleoperated surgery, HoloWAN HPP can construct a bandwidth of up to 100Gbps and introduce nanosecond-level delay, high-precision packet loss, and bit errors in high-speed networks to ensure that AI systems can run stably in real high-speed networks.

- **Big Data Application Testing**

HoloWAN HPP has ultra-high data stream processing capabilities, capable of accurately simulating key network issues such as changing network latency and packet loss, enabling big data analytics, cloud computing, and other big data transmission applications to undergo comprehensive testing under nearly real network conditions, ensuring the performance of applications in actual network environments.

- **Financial System Testing**

Financial markets such as stocks and foreign exchanges are highly dynamic and rapidly changing. High-frequency trading algorithms can automatically execute massive orders at the microsecond level, and minimal delay can significantly affect trading results. Using HoloWAN HPP to simulate bandwidth limitations, latency, packet loss, and bit errors, the financial system can be tested. This ensures that the financial system can operate efficiently and stably in any network environment, safeguarding customer assets.

- **Military and Defense System Testing**

In modern military communication and control systems, high-precision time synchronization and accurate network condition simulation are key elements in military system testing. By using HoloWAN HPP to simulate nanosecond-level delay, packet loss, and bit errors, a comprehensive test can be

conducted on military and defense systems. This not only improves the accuracy and efficiency of tactical decision-making, but also ensures the robustness and reliability of the communication system in complex and hostile environments.

- **Disaster Recovery and Backup System Testing**

HoloWAN Ultra is used to conduct key tests on disaster recovery and backup systems by simulating different network environments. For instance, the simulation of changing network bandwidth and latency tests the backup speed and recovery time of the system; network congestion and other failures are simulated to check the fault tolerance and redundancy strategy of backup and recovery systems; the network environment in disaster situations is simulated to test and evaluate the effectiveness of disaster recovery plans.

- **Scientific Research and Large-scale Scientific Facility Testing**

Some large-scale scientific facilities, such as particle accelerators and astronomical observation facilities, require precise time synchronization and rapid data processing. HoloWAN Ultra supports simulating a bandwidth of up to 100Gbps in the laboratory and introducing nanosecond-level delay, high-precision packet loss, and bit errors in the network to ensure the accuracy of large-scale scientific facilities operating in real high-speed networks.

- **Distributed AI and Machine Learning Testing**

In distributed computing environments, the training and inference of AI models often rely on rapid data exchange between multiple nodes. HoloWAN Ultra is used to construct ultra-high bandwidth, nanosecond-level delay, and high-precision packet loss to test AI and machine learning models, helping to optimize the model's training and inference process, and ensuring that the model's training and deployment can be efficiently carried out in a real network environment.

- **AI Real-time Data Stream Analysis**

In specific areas such as financial market analysis and network security monitoring, AI systems need to perform fast and accurate analysis on massive real-time data, and small changes in network latency can affect this. HoloWAN Ultra is used to simulate high bandwidth and delay jitter, testing whether AI

systems can run quickly and efficiently under different delays, and accurately analyze real-time data.

- **Website Testing**

Before launching a website platform, use HoloWAN to construct impairments such as latency, jitter and packet loss to conduct in-depth testing of the website platform. Simulate various network conditions such as slow network connection speeds to assess the stability of the website, so that prevent potential network issues that may arise when the website is deployed in a real-world wide area network.

- **Real-time audio and video applications**

HoloWAN is utilized to emulate authentic network conditions for testing real-time audio and video network applications, such as video conferencing, live streaming, online gaming, Voice over IP (VoIP), Video over IP, and video surveillance. The testing assesses the resilience of these audio and video applications to packet loss and disorder, as well as their ability to automatically modify sending strategies when confronted with suboptimal network conditions.

- **Product demonstration**

When you need to demonstrate to your customers how your product operates in actual network conditions, bring along HoloWAN. It will showcase your device's stable operation and efficient processing capabilities across a variety of complex network environments. This will assist you in presenting your product's powerful features and exceptional performance in the most direct and intuitive manner.

Contact Us :

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