



Operator Logo

# ZXHN F660 Product Description





## ZXHN F660 Product Description

Version	Date	Author	Reviewer	Notes
V1.0	2014/2/17	Liu BaoQuan	Liu Feng	Not open to the Third Party
V1.1	2014/7/9	Liu BaoQuan	Liu Feng	Not open to the Third Party

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# 1 Overview

## 1.1 Product Positioning

The ZXHN F660, a GPON optical network terminal (ONT) for home users, is designed for the fiber to the home (FTTH) scenarios, supports desktop mounting and wall mounting. The ZXHN F660 complies with the ITU-T G.984 standard, provides 2.488 Gbps downlink and 1.244 Gbps uplink at network side, and provides 4GE ports, two Phone ports, one 802.11b/g/n(2\*2 @2.4GHz) Wi-Fi interface with two External antennas, one USB port at user side. Home users can easily access voice services, video services and many other kinds of high-speed broadband services by the ZXHN F660's rich interfaces.

Figure 1-1 The ZXHN F660

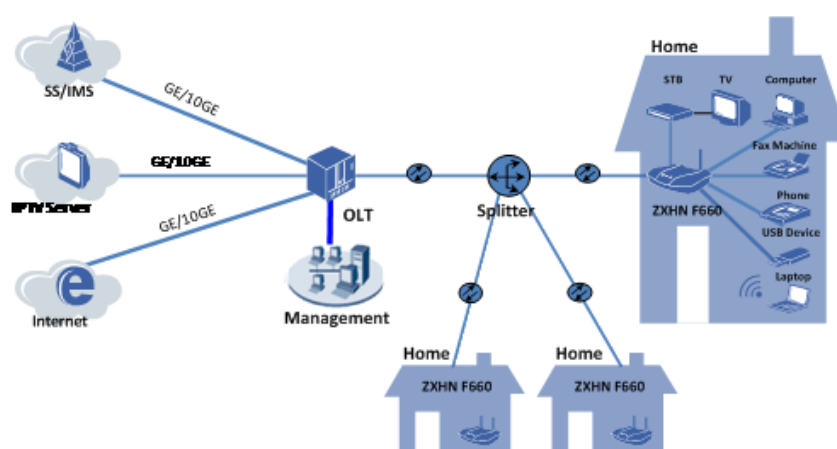


ZXHN F660 with External Antenna

## 1.2 Network Applications

As a GPON ONT designed for the FTTH scenarios, the ZXHN F660 provides four 10/100/1000M network interfaces, two Phone interfaces, one 802.11b/g/n(2\*2 @2.4GHz) Wi-Fi interface and one USB interface for home users. See Figure 1-2 for the application scenario of the ZXHN F660:

Figure 1-2 Application Scenario of the ZXHN F660



## 2 Highlights

### 2.1 High Reliability

- The full-service access capability featuring high bandwidth, high performance, high reliability, and easy operation, administration and maintenance (OMCI/TR-069) meets the continuously changing requirements of the customer, protects the legacy investment, and enhances the value of the operator's network.
- The highly reliable heat dissipation design guarantees its stable operation.
- The dual image ensures uninterrupted services during software downloading or upgrading, thereby enhancing software reliability.



- The highly reliable lightning protection design provides lightning and surge protection of 4 kV for the adapter, 1.5 kV for the Phone interfaces, and 1.5 kV for the Ethernet ports.

## 2.2 Rich Interfaces at User Side

- Provides four GE ports, two Phone ports, one Wi-Fi and one USB port at user side to meet the demands of multiple terminal equipment access
- Users can access the PC, IPTV STB, tablet, laptop, smart phone, phone, fax and other terminal equipment based on personal preferences, to fully enjoy all kinds of Internet services

## 2.3 Convenient and Secure Wi-Fi Access

- Users can build a convenient and secure wireless LAN, and access the Internet flexibly and reliably
- Complies with the IEEE 802.11b/g/n(2\*2 @2.4GHz) standard, provides high-speed Wi-Fi access function
- Supports shared key authentication, WEP authentication, WPA-PSK, WPA2-PSK, WPA2-Enterprise and both mixed-mode security authentication, and ensure safe and reliable home Wi-Fi access

## 2.4 USB File Storage and Sharing Services

- Sharing photos, music, video and other documents through the USB Interface, which can connect to a USB storage device. Family members can free share by this function.
- USB Host interface, in line with the 2.0 specification
- Supports the FAT, FAT32, NTFS partition format and most of the storage devices on the market

## 2.5 Eco-Friendly Design

- Automatically switches to energy-saving mode according to traffic status and busy/idle status of the port.
- Complies with CE, RoHS and WEEE standards.

## 2.6 Convenient Installation and Management

- Flexible installation mode: on the desktop, on the wall, or in the information box
- Remote batch upgrade, fault analysis, port loopback, link detection via the OMCI
- Software upgrading and management via the EMS/OLT
- Software upgrading and management via TR069
- WEB management
- Off-link & batch configuration

# 3 Hardware Features

## 3.1 Device Interfaces

The ZXHN F660's device interfaces as shown in Figure 3-1, include one optical interface at network side, four 10/100/1000M Ethernet interfaces, two Phone interfaces, Wi-Fi and one USB interface at user side, one Power interface

Figure 3-1 The Rear Panel of the ZXHN F660



## ZXHN F660 with External Antenna

Table 3-1 Description of the ZXHN F660's Interfaces

Device Interface	Description
PON(PON)	SC/APC interface for fiber connection. Fully compliant to ITU-T G.984.x GPON standards
Phone	Supports two Phone interfaces with RJ-11 connector
LAN	Supports four 10/100/1000 Base-T Ethernet interfaces with RJ-45 connector Supports half /Full Duplex and flow control, auto negotiation or manual configuration Supports MDI/MDIX auto-sensing
Power	12V Power Input Interface +12V DC (via external AC/DC adapter: 90 - 240V, 50/60Hz AC input, 12V DC output )
USB	Support USB host interface, 2.0 standard

## 3.2 Device Buttons

The ZXHN F660's device Buttons as shown in Figure 3-1 and Figure 3-2 includes one reset button, one power button, one Wi-Fi button and one WPS button.

Table 3-2 Description of the ZXHN F660's Buttons

Device Button	Description
Reset	When the device is powered on, press the button for 1 second to restart the device. The user setting information is not lost. When the device is powered on, press the button for more than 5 seconds to restore the device to the factory default settings.
ON/OFF	Power on/off Press the button (ON), the device is turned on Press the button again (OFF), the button pops, and the device is turned off

Device Button	Description
Wi-Fi	Wi-Fi on/off
WPS	Start WPS processes

### 3.3 LED Indicators

Figure 3-2 LED Indicators of the ZXHN F660



Table 3-3 Description of the ZXHN F660's LED Indicators

LED Indicator	Definition	Color	LED Indicator
Power	Power supply status indicator	Green	OFF: The ZXHN F660 is powered off. Constantly ON: The ZXHN F660 is powered on.
PON	PON status indicator	Green	OFF: The ZXHN F660 has not started the registration process. Constantly ON: The ZXHN F660 has completed the registration process. Flashing: The ZXHN F660 is registering.
LOS	Optical signal status indicator	Red	OFF: The receiving optical power is normal. Constantly ON: The optical module of the PON interface is powered off. Flashing: The receiving optical power is lower than the receive sensitivity of the optical receiver.

LED Indicator	Definition	Color	LED Indicator
Internet	Internet status indicator	Green	<p>OFF: The ZXHN F660 is not powered on or ethernet connection does not exist.</p> <p>Constantly ON: The internet connection has been established (routing connection has the correct IP address or bridge link is normal);</p> <p>Flashing: The data is transmitted via internet connection.</p>
LAN1 LAN2 LAN3 LAN4	Ethernet interface status indicator	Green	<p>OFF: The ZXHN F660 is not powered on or the Ethernet interface is not connected to any terminal device.</p> <p>Constantly ON: The Ethernet interface is connected but no data is transmitted via the Ethernet interface.</p> <p>Flashing: The data is transmitted via the Ethernet interface.</p>
Phone1 Phone2	Phone status indicator	Green	<p>OFF: The ZXHN F660 is not powered on or unable to register on the soft switch/IMS.</p> <p>Constantly on: The ZXHN F660 has registered on the soft switch/IMS but no service flow is being transmitted.</p> <p>Flashing: Data is being transmitted.</p>
Wi-Fi	Wi-Fi interface status indicator	Green	<p>OFF: The ZXHN F660 is not powered on or the WLAN interface is forbidden.</p> <p>Constantly ON: The WLAN interface has been started.</p> <p>Flashing: There is data transmission via the WLAN interface.</p>
WPS	WPS status indicator	Green or multiple colors	<p>Yellow LED flashing: The ZXHN F660 is performing code matching.</p> <p>Red LED flashing: The ZXHN F660 detects session overlapping.</p> <p>Green LED constantly ON: Code matching successful.</p>

LED Indicator	Definition	Color	LED Indicator
USB	USB interface status indicator	Green	OFF: The ZXHN F660 is not powered on or the USB interface is not connected. Constantly ON: The USB interface is connected and works in Host mode, but no data is transmitted via the USB interface. Flashing: There is data transmission via the USB interface.

## 4 Functions

### 4.1 GPON Function

- ITU-T G.984 compatible
- Flexible mapping between GEM port and T-CONT
- Priority level queuing and scheduling of the upstream traffic
- AES-128 encryption
- FEC
- Five types of T-CONT
- Upstream traffic classification based on VLAN ID and 802.1p
- Multicast GEM port
- SN, password, and SN+password authentication
- Auto-restart and recovery in power supply failure

#### 4.1.1 Bandwidth Allocation

- Static bandwidth allocation
  - Adopts static bandwidth allocation mechanism in compliance with ITU-T G.983.1
- Dynamic bandwidth allocation (DBA)
  - Adopts fair DBA policy for the same CoS services during traffic congestion
  - Dynamic bandwidth status report mode complies with ITU-T G.984.3

#### 4.1.2 GEM Adaptation

- GEM mode
- GEM frame mapping to GTC payload
- Ethernet data frame mapping to GEM frame; Ethernet frame mapping into GEM ports based on VLAN, CoS, or VLAN+CoS

#### 4.1.3 T-CONT

- Five types of T-CONT
- T-CONT as the basic unit of the upstream service
- T-CONT allocation based on the user and CoS; mapping to T-CONT queue based on the CoS value or GEM port
- T-CONT queue scheduling mode of WRR, SP, or WRR+SP

#### 4.1.4 Operation and Maintenance

- Physical layer operations and maintenance (PLOAM) defined in ITU-T G.984.3
- OMCI defined in ITU-T G.984.4 \G.988 and OMCI extension

### 4.1.5 Optical Link Monitoring and Diagnosis

- The optical module diagnostic monitoring interface monitors the parameters including operating temperature of the optical module, supply voltage, bias current, transmission power, receiving power, etc.
- ONT long-time light emitting detection and auto shutdown.
- Turn on or off the power supply of the optical transmitter under the control of the OLT.

## 4.2 Wi-Fi Function

The Wi-Fi function provides an easy, convenient, flexible, and low-cost method for the users to access the internet via the wireless LAN network. The Wi-Fi function complies with IEEE802.11n (2x2) and offers a maximum PHY layer link rate of 300 Mb/s.

- Frequency: 2.4 GHz
- IEEE802.11b, IEEE802.11g, and IEEE802.11n compliant
- Auto and manual channel selection
- Auto and manual rate control
- Transmission power control
- Four SSIDs
- Maximum 32 users
- SSID broadcast enabling/disabling function
- Access control based on MAC address
- Shared key authentication and 128-bit WEP authentication
- WPA-PSK, WPA2-PSK, WPA-PSK + WPA2-PSK and WPA2-Enterprise security authentication



- WPS
- WMM
- Maximum TX power up to 100mW
- Two External antennas

### 4.3 VoIP Function

- SIP and H.248 compliant
- Support in-band DTMF tone sending/receiving and out-band DTMF signaling with RTP, as per RFC2833
- 32ms echo cancellation
- G.711 a/u law, G.729, and G.722 coding/encoding algorithm
- Voice Activity Detectors (VAD) and Comfort Noise Generation (CNG)
- T.30 fax: fax transparent transmission (uncontrolled, RTCP control, and SS control)
- T.38 fax
- Supplementary services: caller ID display, call waiting, call forwarding, call transfer, three way calling, etc

### 4.4 USB Function

- One USB host interface
- Full-speed and high-speed USB 2.0 interface
- USB fast file backup, fast recovery.

## 4.5 Data Forwarding Function

### 4.5.1 MAC Address Function

- MAC address learning
- MAC address aging
- MAC address learning enable/disable
- MAC address learning limit
- MAC address binding to a user port. Only controls the input side of the port.
- Anti-MAC transferring (spoofing)
  - Forbids the MAC addresses learned from a user port to be transferred to other user port before aging.
  - Forbids the MAC addresses learned from uplink port to be transferred to the user port.
- MAC filtering
  - Both the source and destination MAC addresses support the blacklist and the whitelist function.

### 4.5.2 VLAN Function

- IEEE 802.1q VLAN with the VLAN ID from 1 to 4094
- VLAN tagging/untagging on the user port
- VLAN overwrite function on the user port
- 1:1 mapping between the user port (physical port or logical port) and VLAN
- VLAN-based data forwarding
- VLAN-based packet filtering

- VLAN untagged mode, tagged mode and double tagged mode
- VLAN tag
  - Adds S-Tag to the untagged or priority tagged frames from the user port as per the needs.
  - Adds C-Tag and S-Tag to the untagged or priority tagged frames from the user port as per the needs.

## 4.6 QoS Function

- Service flow rate limit based on the user port, service flow, and GEM port
- Upstream service flow classification based on the physical port and source MAC address, destination MAC address, VLAN ID, VLAN priority level (IEEE802.1D), Ethernet type (such as IP, PPPoE, ARP/RARP), destination IP address, source IP address, IP protocol type (TCP, UDP, ICMP, IGMP), IP DSCP, and TCP/UDP
- Ethernet priority level tagging of the upstream services based on the DSCP value
- Ingress rate limit
- Egress shaping

## 4.7 Multicast Function

- IGMP v1/v2 Snooping
- Multicast group per LAN port is 256
- Fast leave time, which is the time since user terminal sends an IGMP leave message to the ONU equipment stops the multicast data packet, is less than 20ms.
- Support MVLAN

## 4.8 L3 Function

- Data forwarding and routing
  - Bridging, routing, or hybrid mode (bridging and routing)
  - Static routing
  - RIP v1/v2 dynamic routing
- Address management
- DHCP Server/Client
- PPPoE Client/Pass Through
- DNS Client/Relay
- SNTP client
- NAT
- ALG function: achieves H.323, SIP, FTP, SNMP, SMTP, Netmeeting, PPTP, L2TP, IPSec, RTSP private network traversal function; provides separate switches for each ALG function.

## 4.9 IPv6 Function

- IPv6 protocol packets transparent transmission
- IPv4/IPv6 Dual Stack (Only support Internet and IPTV application, but not support VoIP and TR069 application.)
- IGMP protocol packets transparent transmission
- MLD v1 and MLD snooping
- IPv6 DS-Lite

- IPv6 address management
  - SLAAC allocation mode on LAN side
  - DHCPv6 on LAN side
  - SLAAC on WAN side
  - DHCPv6 on WAN side
  - DHCPv6-PD on WAN side
  - PPPoE+DHCPv6 on WAN side
  - PPPoE+SLAAC on WAN side

## 4.10 Management Function

- OMCI management
- TR-069 management
- WEB management
- Management via the OLT on the EMS
- Built-in capability for remote management with standard compliance, including the full range FCAPS functions like supervision, monitoring, and maintenance.
- Port loopback detection
- Performing MIB operation via the OMCI, including the create, delete, and get-next commands
- Remote software download, activation, and reboot via the OMCI
- Dual image, version download, upgrading detection, and auto rollback

## 4.11 Security Function

- Traffic filtering based on UNI, VLAN ID, 802.1p, UNI + 802.1p, VLAN + 802.1p
- Multicast , unicast and broadcast flow attack protection
- MAC address limiting based on each UNI or single ONT
- Broadcast packet rate limit
- Anti-DoS attack
- MAC filtering

### 4.11.1 Data Security of the GPON Interface

Because the GPON system works in broadcast mode in the downstream direction, the malicious users can easily intercept and attack other users' messages. To enhance data security of the user, the GPON downstream provides AES-128 encryption.

### 4.11.2 Traffic Suppression

- Broadcast storm suppression
  - When the broadcast traffic including the unknown unicast and multicast traffic exceeds the threshold that the user sets, the broadcast traffic will be discarded till the traffic is lowered to a reasonable range, thereby avoiding network congestion and ensuring normal operation of the network services.

## 4.12 Alarm Function

- Dying gasp
- Receiving optical power too high
- Receiving optical power too low

- Transmission optical power too high
- Transmission optical power too low
- Port loopback alarm
- Loss of signal
- Loss of frame
- Signal degradation alarm
- Loss of GEM channel delineation

## 4.13 Performance Statistic Function

### 4.13.1 Statistic of Ethernet Port Performance Parameter

- Frames transmitted
- Single collision frames
- Multiple collision frames
- Bytes transmitted
- Unicast frames
- Multicast frames
- Broadcast frames
- Pause frames transmitted
- Collision frames transmitted (half duplex mode)
- Frames received
- Bytes received

- Frame check sequence errors
- Verification errors
- Jumbo frames
- Unicast frames received
- Multicast frames received
- Broadcast frames received
- Runt frames received
- Ethernet frames dropped (from UNI to NNI and vice versa)

## 5 Technical Indices and Parameters

### 5.1 Physical Structure, Environmental and Electrical Indices

Table 5-1 Specifications and Environmental Indices of the ZXHN F660

Parameter	Nominal Value
Net dimensions	44mm (H) x220mm(W)x160mm (D)
Net weight	0.38kg
Typical Power consumption	<10 W
Noise	Null
Heat dissipation mode	Natural heat dissipation
Power supply	Rated 12 V DC (through the external AC/DC adapter)
Installation	Horizontal, Wall mounted
Operating environment	0°C–40°C
Relative humidity	5%–95%
Atmospheric pressure	70 kPa–106 kPa



Parameter	Nominal Value
MTTR	30 mins

## 5.2 Interface Indices and Parameters

Table 5-2 GPON Interface Indices of the ZXHN F660

Parameter	Nominal Value
Connector type	SC/APC
Number of PON	1
Fiber type	Single-mode fiber
Wavelength	Transmitting end: 1310 nm (PON interface) Receiving end: 1490 nm (PON interface)
Compliance standard of the PON interface	ITU-T 984.x
Receiving rate of the optical interface	2.488 Gbps
Transmitting rate of the optical interface	1.244 Gbps
Transmission wavelength range	1290 nm–1330 nm
Root-mean-square spectral width of the transmitting end	Less than 1 nm (-20 dB spectral width)
Output optical power	Minimum 0.5 dBm, maximum 5 dBm
Optical power of the transmitter in output OFF status	Less than -45 dBm
Extinction ratio	More than 10 dB
Receive range	1480 nm–1500 nm
Receive sensitivity	-28 dBm
Saturation optical power of the receiver	-8 dBm
Splitting ratio	1:64
Length of the optical link	20 km

## 5.3 Key Technical Indices

Table 5-3 Key Technical Indices of the ZXHN F660

Parameter	Nominal Value
Capacity of the MAC address table	9K
Capacity of the multicast table	1K
IGMP join delay	< 10 ms (single channel)
IGMP leave delay	< 10 ms (single channel)
Startup time	90s (default)
T-CONT	8
GEM Port	32

## 6 Standard Compliance

Table 6-1 Standard Compliance of the ZXHN F660

Standard	Description
ITU-T G.984.1	General characteristics for Gigabit-capable Passive Optical Networks (GPON)
ITU-T G.984.2	Gigabit-capable passive optical networks (GPON): Physical media dependent (PMD) layer specification
ITU-T G.984.3	Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification
ITU-T G.984.4	Gigabit-capable Passive Optical Networks (G-PON): ONT management and control interface specification
ITU-T G.984.5	Gigabit-capable Passive Optical Networks (G-PON): Enhancement band
Broadband Forum TR-101	Migration to Ethernet-Based DSL Aggregation, April 2006
Broadband Forum TR-156	Using GPON Access in the context of TR-101, December 2008
IEEE Std 802.1D-2004	Media Access Control (MAC) Bridges

Standard	Description
IEEE Std 802.1Q-2005	Virtual Bridged Local Area Networks
IEEE Std 802.1ad-2005	IEEE Standards for Local and Metropolitan Area Networks —Virtual Bridged Local Area Networks—Revision—Amendment 4: Provider Bridges
IEEE 802.3-2005	IEEE Standard for Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications (Includes: IEEE Std 802.3ae-2002, IEEE Std 802.3af-2003, IEEE Std 802.3ah-2004, IEEE Std 802.3aj-2003, IEEE Std 802.3ak-2004)(Revision of IEEE 802.3-2002)
IEEE 802.1X-2004	IEEE Standards for Local and Metropolitan Area Networks: Port-Based Network Access Control
ITU-T Y.1291	An architectural framework for support of Quality of Service in packet networks
ITU-T H.248.1 V2	Gateway control protocol: Version 2
ITU-T H.248.1 v3	Gateway control protocol: Version 3
YD/T 1292-2003	Technical specification for media gateway control protocol based on H.248
IETF RFC3261	SIP: Session Initiation Protocol
IETF RFC1112	Host extensions for IP multicasting
IETF RFC2236	Internet Group Management Protocol, Version 2
IETF RFC 3376	Internet Group Management Protocol, Version 3
SFF-8472	Specification for Diagnostic Monitoring Interface for Optical Transceivers (Rev 10.3 Dec.1, 2007)
ITU_T K.21	Resistibility of Telecommunication Equipment Installed in Customer Premises to Overvoltages and Overcurrents
IEC/TS 61000-3-4	Limits - Limitation of Emission of Harmonic Currents in Low-Voltage Power Supply Systems for Equipment with Rated Current Greater Than 16 A First Edition

Standard	Description
EN60950	Information technology equipment. Safety, General requirements
UL60950	General Requirements for Information. Technology Equipment

## 7 Glossary

Table 7-1 Glossaries of the ZXHN F660

Acronym	Full Name
ACL	Access Control List
AES	Advanced Encryption Standard
Alloc-ID	Allocation Identifier
AN	Access Network
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
CAC	Channel Access Control
CAPEX	Capital Expenditure
CATV	Community Antenna Television
CDR	Call Detail Record
CLI	Command Line Interface
COS	Class of Service
CVLAN	Customers VLAN
DBA	Dynamic Bandwidth Allocation
EMS	Element Management System
EPON	Ethernet Passive Optical Network
FE	Fast Ethernet
FEC	Forward Error Correction
FTP	File Transfer Protocol
FTTB	Fiber to the Building
FTTB/C	Fiber to the Building/Curb

<b>Acronym</b>	<b>Full Name</b>
FTTC	Fiber to the Curb
FTTCab	Fiber to the Cabinet
FTTH	Fiber to the Home
GE	Gigabits Ethernet
GFP	Generic Framing Procedure
GPON	Gigabit-capable Passive Optical Networks
IMS	IP Multimedia Sublayer
IP	Internet Protocol
IPTV	Internet Protocol Television
ITU	International Telecommunication Union
L2	Layer 2
L3	Layer 3
LACP	Link Aggregation Protocol
LAN	Local Area Network
MAC	Media Access Control
MDU	Multi-Dwelling Unit
MIB	Management Information Base
NGN	Next Generation Network
NE	Network Element
NMS	Network Management System
OAM	Operations, Administration and Maintenance
ODN	Optical Distribution Network
OLT	Optical Line Termination
ONT	Optical Network Terminal
ONU	Optical Network Unit
OPEX	operational expenditure
PON	Passive Optical Network
PHONE	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RARP	Reverse Address Resolution Protocol

<b>Acronym</b>	<b>Full Name</b>
RR	Round Robin
SCB	Single Copy Broadcast
SFP	Small Form-Factor Pluggable
SLA	Service Level Authentication
SN	Serial Number
SNMP	Simple Network Management Protocol
SP	Service Priority
SP	Strict Priority
SS	Soft Switch
STB	Set Top Box
STP	Spanning Tree Protocol
SVLAN	Service VLAN
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UNI	User Network Interface
VLAN	Virtual Local Area Network
VoD	Video on Demand
VoIP	Voice over Internet Protocol
WEEE	Waste Electrical and Electronic Equipment
WPS	Wi-Fi Protected Setup
WRR	Weight Round Robin