

Padavan f/w???ASUS????????????, ??Linux-based kernel(????BusyBox solution), ???f/w????????GUI??. Padavan f/w????????????
????MIPS-based CPU solution?, ?????ARM-based CPU??.

Link: <https://code.google.com/p/rt-n56u/>

????????, ?????Padavan????N56U?RT3662 solution????????, ???f/w????????Padavan f/w:

????: dlina, aria, base????f/w, ?????????, ???changelog?Padavan f/w????????????????????:

????????, Padavan f/w????????????, ?????????(Hardware Acceleration)???, ???RT3xxx ASIC driver??????????
??:

????Padavan f/w????GUI??. ?????????????????????:

GUI?????, ??????Padavan f/w???QoS??, ?????????, ???Monitoring????????????.

Hardware Components

?N56U????, ?????: RT3662F SoC, DDR2 RAM buffer, 802.11n 2.4GHz RF PHY?1Gb/s ASIC Switch logic.

????PCB????????IC????, RT3662F??SoC????????, ?????MIPS-based CPU??, SoC????????????, ?????????
SoC????????????:

????????, ?????PCIe lane????2.4GHz?802.11n Wireless PHY(RF/BBP/MAC): RT3092. ???(PHY port
linking)????Realtek?Switch chip: RTL8367M, SoC?Switch???host-bus???1Gb/s. RT3662??SoC????????
Frame Engine??, Frame Engine?SoC???NPU????, NPU??traffic??SoC?, ??fast-path????ASIC????, ?????cpu
port?slow-path??CPU?handle, ?????????(900~950Mbps).

??traffic??fast-path?, ?????packet????ASIC????, ??! wireless traffic????ASIC????, ?????CPU
loading. ?Frame Engine?????????: PPE(Packet Processing Engine). ?????????????ASIC????, PPE????NPU?
?, ??????????ethernet packet. PPE????????:

ASIC?PPE????????, ???f/w???driver??, driver?????????????????????. ?PPE????????IPv4 packet???, ???PPPoE
????(without MPPE), ?????????, PPE????WAN???, ?????????PPPoE????????(Internet). PPE????????1Gb/s??
?. PPE???H/W QoS???, ?Padavan f/w????????QoS module??, ?????module???software-based, PPE?QoS????
????.

Wireless??SoC????, ?????????(5GHz), ?????2.4GHz????????2.4GHz Wireless PHY(RT3092), ???Wireless??
traffic????PPE?, !!! Wireless?Wired?????????????. ?????CPU??handle, ?????????, ?????wireless clients,
???multi-threading????(N65U????????, ?????????????).

N56U????128MB?DDR2-800 RAM, ??????, ?????RAM????, ???USB Application, ??caching????????RAM
buffer, ???CPU loading.

CPU???SoC???, ?????????, CPU????????, OS?????, packet???, ???debug?..RT3662????MIPS-based CPU:
74Kc, clock?500MHz, ?????????????single-thread CPU, ???FPU.

CPU?????, ??????, ???300M????????, ??????! ?????????VPN, ?????????software-based, ?????????CPU??, ??
RT3662?74Kc, ??????(74Kf), ??????, ?????????VPN?????, ?MPPE???, ?????CPU loading.

Padavan System

???Padavan???, ?????????GUI??. ?????context menu.

????????: VPN, Monitor, Wireless, LAN/WAN, Firewall. ??????????. ??????????:
?????(Russia)????????(English)

Network Map?????dashboard, ?????????, ?????????????????.

????????GUI????????, ??WAN?(Inbound)????????(Administrative traffic), ???f/w?????port range.

????????, ???f/w?????????User??GUI, ??User????????, ??????????????????. ??????, ??????????????, 2????????
GUI????????, ?????????????, ??????.

AP??????Padavan????????: Wireless Router Mode (Default) ? Access Point Mode (AP)

????????Router Mode, ??????L2????,????L3/L4????????, ??IP routing, NAT, DHCP?. ?AP mode????L2 Bridge,
????L2?????. ??????, SPI Firewall, Routing?NAT????????.

????????, ?PC client??DHCP???, ???Router??Router/NAT??AP/Bridge mode????????.

?Router/NAT mode????, PC client??DHCP??(UDP, 67-68, ??), ???Router????????????IP??client, ???DHCP
Server????????DHCP??, ???????Router mode?Router????; ??, ?Router????AP/Bridge/Transparent mode
??, ???client??DHCP????????DHCP Server, ?DHCP Server????????????, ???DHCP???

AiDisk & USB Application

AiDisk????????, ??USB Application?????, ??????N56U??USB?????. ?????, ?????????????, ??????????, ??????
CPU time.

????????, ?????????????????, ???cached?????????:

??????USB Drive??N56U????????(Add-in Storage)?FTP?????, CPU?????????????:

????????, ?????????cached memory?????, CPU????????????(CPU Usage). ???SanDisk?????16GB????, ???
4~9MB??, ??????????????:

??USB Application???, Padavan?????RBAC, ??????/?/?????, ??????????????:

Padavan??USB????????????, ?????FTP??:

Padavan????????USB????????: USB Printer????????3G/4G(LTE) USB????Wireless WAN??:

???Padavan?????(USB Storage)????????, ??????????????:

Note(s):

1. Padavan??NTFS????????(File System).
2. ?????500GB USB Drive??N56U??FTP?????I/O??:

????, ???CPU???. I/O??15~22MB??, ?????, ??Administrative Traffic????PPE??.

[UPDATED, 201402131744] How to use Transmission?

?Padavan?????????:Transmission, ?????????BitTorrent??P2P??, ???magnet???. ???????Padavan????
BitTorrent??P2P????????USB????(?????). ?????????????transmission????:

????????, ??Torrent Transmission??, ???Incoming Port(inbound)????WebUI????????RPC Port:

???SPI Firewall?????(Transmission)??:

?System Log?Port Forwardinh????, ??????????:

????????Port forwarding??DNAT??, ???SPI Firewall?????????????????. ??PRC Port??Public IP??WebUI, ??
?????????????:

????????????????BitTorrent?????????. ?????System Info?CPU monitor?????????:

?WebUI?????????, ??CPU?????????????:

????CPU????????, ?torrent(s)????, ?????????, ???CPU loading?????, ??????????.
Transmission????????????GUI????, ??UI????????, ??????????:

Software-based VPN

VPN Server?VPN Client????VPN????, ?????VPN???:

?????, ?????????PPTP??L2TP, OpenVPN?????. ??VPN????software-based, ?????CPU?????:

VPN?CPU????, N56U????ASIC??VPN????, ??Padavan????, ?????????, ?????, ???x86 CPU??NAS??
????(ex: SYNOLOGY, QNAP, etc...).

MPPE encryption is software processed by router CPU and is very hard, max 24-25Mbit/s. PPTP w/o MPPE
~170Mbit/s

?! ?????, ?????, ?????????, ?????????.

[UPDATED, 201402181941] How to setup the PPTP Server?

??VPN????Remote Network?Local Network????????LAN?, ?????????tunnel?????. ?Padavan????VPN????,
PPTP????????, ??PPTP?????. ???PPTP????, ??????????:

????????????????, ?????MPPE-128?, ?????????CPU loading?????. ?????????, ??????????:

????????VPN client??IP??, ?????LAN????????, ?????????Allocate Subnet for VPN Tunnel????, ???VPN
client?????

????, client????????????PPTP VPN?Padavan?, ?System Log?????????:

??MPPE-128????tunnel. ?????, Routing table????, ?????????VPN client?routing:

?client?, Routing table????????: routing????????(Mertic)??:

?VPN????????????session?, ?????IP??:

VPN????Routing table????default route(0.0.0.0/0)????(Metric?), ?????????default route, ?????
PPTP tunnel?????. Ralink RT3662????????VPN????(enc/dec)?, ???CPU loadingk???:

???MPPE-128??tunnel?, ?????????, ?????????, ??CPU loading?????. PPTP????, ?????????, ?????
????(>100M), ??????????. Padavan??VPN??software-based, ?????????, ?????????

???, ???????????.

Resource Monitoring

Padavan????f/w????Monitor: CPU?Memory. ???Monitor????????????????, ?????????????????! ???????????
?????CPU???????????

CPU Usage??????:

Memory Usage??????:

?????f/w????, Traffic Monitor?????, ?????????????????, ???????????:

Wireless 2.4/5GHz

Padavan?????????: 2.4GHz?5GHz. ???Guest, Bridge, Filter, RADIUS??????????:

?Guest AP?????Guest?, ????LAN?????Guest????(????). ????Captive Portal?, ??????Guest?????
?.

Isolation between Guest AP and LAN: ?????????LAN???.
Set AP Clients Isolated: ?Guest???? (Guest????????).
??Bridge?????AP?AP????????, Pradavan??????????:

????WDS????Server-Client????, ??????????Mesh?, ?????????AP Load-balancing, ?????????????????, ??????

Padavan?????RADIUS????????, ??????RADIUS Server???, ????Windows Server, ?????AP???, ?????
RADIUS Client?????.

???RADIUS?, ??????????RADIUS??????:

??Padavan???QoS?, ???Wireless???QoS????????, ???WMM?(802.11e)???

?Padavan?????, ??????????(Priority), ??????????(Queue)???, ??????????, ??????QoS?????
(?????). ????FortoGate??DSCP(?COS)??????:

?????(Ethernet)????802.1P?????WMM QoS????COS??:

?????UBNT??WMM QoS?????????: UniFi - How is QoS and prioritization handled?

<http://community.ubnt.com/t5/UniFi-Frequently-Asked-Questions/UniFi-How-is-QoS-and-prioritization-handled/ta-p/412487>

?????????BE(Best Effort), ?????????, ???, ??????FIFO(?traffic???, ??Administrative Traffic).
??DSCP, COS, TOS??QoS?????????MIS?????, ???????????????. ?Padavan????, ??????????????WMM QoS?
?. DSCP, COS, TOS?..., ??????(Hardware-based), ?????L2 switch????NPU???switch logic?????H/W QoS?. ?RT3662F SoC?Fame
Engine??????:

??SoC???5GHz?????2.4GHz?PHY(RF/BBP/MAC), ??ADC/DAC=>MAC?, ?????(packet)?????????????AP/NP logic??, CPU(MIPS
74Kc)????????, ??CPU??????????:

5GHz?2.4GHz WiFi traffic?????CPU?, ??????????loading, ??????????, PPE?????????traffic???CPU?. ???2.4GHz WiFi client??FTP???, ?
??CPU loading??????????:

?WAN?????Hardware offload NAT/Routing IPv4?????, ??????????WLAN?PPE??:

?Wireless client?AP(Padavan)???????, ?????????! CPU(MIPS 74Kc)?????????????????. ???, ??????WLAN???offload?NPU?????????traffic?? WAN??(inbound), ??NAT(DNAT)??????PPE??:

?N56U???????SoC???????Wireless PHY(RF\BBP\MAC)????(Dual-band)??, ?????2.4GHz PHY(RT3092)??traffic, ????????????? (BBP)?ADC/DAC?????MAC????????, ?????TCP/IP stack????????????2.4GHz PHY??, ?????SoC?CPU(MIPS 74Kc)????????(AP/NP), ????? 5GHz?2.4GHz????, CPU????????????, ??Frame Engine??PPE????????(Ethernet)?IPv4????????, ??????????. ?????N65U?2.4GHz PHY?? ??:

????RT3092(RF/BBP/MAC)??RT3352, ?SoC??RF3883F(MIPS 74Kc, 500MHz), ?????????????! RT3352?RT3883F????????, ??SoC. RT3352????2.4GHz?Wireless??, ?N56U?RT3662+2.4GHz PHY(RF/BBP/MAC), 2.4GHz????????RT3352???, ???????CPU(MIPS 24Kc, 400MHz), ???????CPU??2.4GHz????????, ?????CPU(Main CPU; RT3883F)??, RT3352????????(Co-processor), ?????????CPU???????? ? . RT3883F+RT3352????CPU??, ??RT3352??2.4GHz????????, ?RT3883F??5GHZ????.

LAN&WAN Configuration

Padavan?LAN?WAN??????f/w??????, ??????????. Padavan?WAN????????????????, ??PPPoE??????VPN??:

?IPoE(?IPv4????)?PPPoE??, ?????????????PPE????, ?????! VPN?????????????. PPPoE??PPE????SoC????????, ???????sessions????, ?????????????PPE????.

PPTP and L2TP cannot HW_NAT offloaded for RT3662. Only IPv4/IPv6 and PPPoE (up to 900Mbit/s) => IPv6? ??????

????LAN?WAN?traffic, ??????, ?????NPU?????????. ???LAN????????, ???????L2?(forwarding), ?????SoC, ???switch logic????? frame(???), ???routing????????????switch logic???SoC????, ?Padavan?????LAN=>WAN???. ?????(Internet)?????LAN???IP range(Private IPs), ?????????????table??public IP??Private IP????, ??NAT??, ?????Fortinet??????NAT?????:

??????192.168.1.0/24????????????Public IP: 172.20.120.14??NAT????, ?????????????????! ??(Header)?Source??192.168.1.x/24?? 172.20.120.14(Src Port?????LAN?IP?Src Port)????, ?????????, ???SNAT(Source-NAT); ?????????Public IP, ???Gateway??Public IP? routing. ??????, ??????built-int Sniffer?????packet??, ??????????:

?????NAT??????table size?????, ?????????????, ??????????. N56U?????RT3662F SoC, ?????????, ?????????????NAT??, ???????~8?? sessions; ??????????: P2P, ?????.. ?SoC??Frame Engine, ???PPE????????TCP?UDP????(????), ?????ASIC?H/W NAT??, ?Padavan? WAN?????????????:

?Hardware offload NAT/Routing IPv4?????Disable?????H/W NAT, ??????NAT??????fast-path, ???????slow-path??CPU????, ????? ?ASIC?H/W NAT????3~4???. ??????H/W NAT??, ??System Log?????????:

??????, ???H/W NAT????????????????????, ???H/W NAT????(LAN=>WAN):

????Downlink????????, ?????????, ???; ??????CPU??, ?CPU Load????????????, ?????????????, ??????. ???H/W NAT???????? (LAN=>WAN):

Downlink????????, ??????CPU?I/O?????, ??H/W NAT????Frame Engine?PPE????????, ?????????????, ?????????I/O??, ??????

debug????????H/W NAT. ???FGT200B?N56U???Traffic Monitor, ???CPU?H/W Acceleration????????(LAN=>WAN):

?????Jumbo frame, ?FTP?????, PPE????????????????; ?FGT200B?CPU??traffic????????, ???CPU?????(100%), GUI??????
????.

[UPDATED, 201402140031] PPE vs. QoS vs. Non-QoS

?????f/w??QoS??Non-QoS?PPE??????, ?QoS??????, ???????????????:

??FTP?????, ?????????, ?????:

????PPE????????, ??CPU loading????, GUI????????. ?????QoS??CPU????, ???QoS?, ?????QoS????, ???????200Mbps??, ??
??100~150Mbps????(Internet), ?????????(>200Mbps), CPU loading??100%, ??GUI????????.

Note(s):

????????, ??100(?)~150Mbps??CPU????????????????GUI?????

(????????...!!)

??SNAT????????, ???(Reversed)????, ??NAT??table????Client????, ??????. ??, ?????N56U????client????, ???FTP(20, 21)
?, ?????, ?????????????????client, ?Padavan????Port Forwarding????.

????N56U????client, ???FTP????(21), ?????WAN?Public IP, ??WAN IP????client????, ???FTP?, ??port????, ?
WAN IP??LAN client????FTP port. ?System Log?Port Forwarding????????:

????Fortinet????, ??Port Forwarding:

????????172.20.120.14??Public IP, ?????192.168.1.110????, ?????????????client???. Port Forwarding?????,
172.20.120.14<==>192.168.1.110????????80 port??Web?. ?????172.20.120.14, ??80 port??, ??Port Forwarding????
192.168.1.110, packet?header??DST(??)????, ?????????NAT?, ???DNAT(Destination NAT), ?????Public IP????port(fixed
port)??LAN????client IP, ?????, ?????Static NAT. ?????, ?????built-int Sniffer????packet?, ?????????:

????client????, ???port?Public IP???, ???DMZ(Demilitarized Zone).

????client??DMZ, ?????, ?????WAN IP????client. ?????????, Administrative Traffic??Port Forwarding(DNAT)??, ?????
??DMZ???. ?????:

Administrative Traffic => Manual DNAT Traffic => DMZ Traffic

??System Log????, ??Port Forwarding table????????:

????????port????, 192.168.1.1:21?10.2.150.190:21, ?????DNAT?????????????. ?????????, ??Administrative?192.168.1.1??
????, ???DNAT????????10.2.150.190:21.

????????USB Application????????, ?????(Service), ???FTP(21), Padavan????????DNAT????192.168.1.1:21?Administrative?IP??
??USB Drive, ?????Manual Port Forwarding????Port????client IP, ?????Port?(Port Conflict). ?????Manual Port
Forwarding?client????, ?????????port????Router Service????; ?????, ???10.2.150.190:21, ?192.168.1.1:21?FTP
?Router Service????:

Padavan??DDNS?????PPPoE??ISP??DHCP??IP??Domain Name???. ???????DDNS??:

?Padavan??LAN??MTU????????16K, ???IPv4????????1500bytes??Jumbo Frame:

????MTU??16K, ??????client????Jumbo Frame?, ??????LAN????I/O??(?????).

?????LAN=>WAN?????, ???f/w????(issue), ??????????. ??, RTL8367M????16KB?MTU??, ??RT3662F?SoC?????:

????, ??????????, SoC????4KB?MTU??packet. ??client????4KB?Jumbo Frame????LAN=>WAN?????????. ??Jumbo Frame?
???, ??client????IPv4????????(1500bytes).

Note(s): Administrative Traffic?packet??Jumbo Frame, ??????USB Application??, ??client??Jumbo Frame.

??WAN??LAN?????Router(N56U)??IP?, ?????????(??), ??????????. ??WAN IP????, ??????0.0.0.0/0?Default Route, ?????
????Gateway. ?System Log?Routing Table????:

10.2.129.0/24??192.168.1.0/24??WAN??LAN????; 127.0.0.0????loopback, ????. ??????(DST)????, ??????
default(0.0.0.0/0)??10.2.192.100?Gateway(UG)????, ??????iface????WAN?eth3??, br0??Port1~4?LAN.
????????Gateway??, ??LAN????, ??LAN????Router, ??????192.168.2.0/24. ??Padavan????, ??????Padavan????
?, ??????Gateway(UG, 10.2.129.100)??, ??????(Unreachable). ?Route????, ?????:

??192.168.2.0/24????192.168.1.101?Gateway(UG), ??System Log?Routing Table????:

?????, ??????192.168.2.0/24????Gateway(UG, 192.168.1.101)????. ??????, ??????(Unreachable)????.

Padavan??STP(Spanning Tree Protocol)????, ??????L2 loop????(??).

???, ??????

IPv6 Connection

?IPv4?, IP????8????32?????????. ??????, ??????, ??????:

??IPv4????????, IPv6?????. ??????; ??, ??????, ??????:

IPv6??8?16????128?????????. ??????, ??????(8001.0DB8.AC10.FE01:). IPv6????(prefix)????(network prefix)??
ID(interface identifier). ??client??IPv6????, ??Unicast??:

network prefix?routing prefix?subnet id??, ?interface id????client????, ??????. subnet id?????????.
?????LAN????IPv6????: 1234:5678:9012:0200::/56, /56?routing prefix, network prefix=64. ??8????.

1. ??subnet id?64 - 56 = 8, ?????????.
2. ?????: ??subnet id??16????????(:200:).
3. ??subnet id?????????. :200: => 0000 0010 0000 0000
4. ??subnet id????????([?] ?????): 0000 0010 [0000 0000]

5. ????????, e.g., [0000 0001]~[0000 0008]?8??=>0000 0010 [0000 0001]~0000 0010 [0000 0008] => 201~208
6. ??????, ??????IPv6?: 1234:5678:9012:201::~~1234:5678:9012:208::
7. ?subnet id????, ??network prefix(/64): 1234:5678:9012:201::/64~1234:5678:9012:208::/64
 ??, ??????8?IPv6??(1234:5678:9012:201::/64~1234:5678:9012:208::/64).

Padavan????IPv6???, ??????IPv6??, ??IPv6?????:

??DHCPv6????IP?: SLAAC?Stateful?DHCPv6??

SLAAC?Stateful DHCPv6????header????flag???(M, O flags).

DHCPv6?????, ?????IP???, ??????SLAAC?????IPv6??WAN????Native Static, ?????IP??LAN????, ??????
 (IPv6?Subnet mask?, ??prefix?).

????PPPoE????Tunnel?IPv6??.

??IPv6?H/W offloading????bug?, ??????, ??????CPU(MIPS 74Kc)?handle.

[UPDATED, 201402141253] How to setup IPv6-over-IPv4 tunnel with Tunnel Broker?

?????IP????, ?????PPPoE??, ???IPv6??Tunnel Broker????IPv4 tunnel?IPv6????IPv6??, ?????????????(Dual-stack).

????client???, ??????Tunnel Broker?????tunnel; ??????????IPv6?????tunnel, ??????????IPv6?????. Padavan?IPv6??
 ?IPv6-over-IPv4 tunnel?Tunnel Broker?IPv6????:

??Padavan?IPv6 with Tunnel Broker?, ?????Tunnel Broker????????, ???HE?tunnel?:

????????, ??????5?tunnel. ???N56U??, ??????.

????tunnel?, ?????????, ??????, ??, ??, IPv6 DNS????LAN????:

?Routed IPv6 Prefixes?????: ???(autoconfig, Routed /64)????(Routed /48). ??Padavan?????. ??????????IPv6?
 ?, ??LAN?????. ??/48?????subnet id???, ??routing prefix, ?network prefix??routing prefix??subnet id(64 - 48 = 16).

????2001:470:cdcf:/48, network prefix?64, ??subnet id(16)?, ???subnet id????????????.

1. 2001:470:cdcf:[0000]::/48, subnet id????, ????????, ??????: 2001:470:cdcf:[0001]::/48
2. ?????subnet id????, ?????(/48)??/64: 2001:470:cdcf:[0001]::/64
3. 2001:470:cdcf:[0001]::/64?????IPv6???, ??????Padavan?IPv6???

????????Padavan?IPv6???, ?????Tunnel Broker?????WAN????:

?????MTU???, ???HE????????(Default: 1480):

?????LAN?IPv6????, ??LAN????:

????LAN?????, ??2001:470:cdcf:1::/64??, LAN IPv6 Address????Unicast??(2001:470:cdcf:1::1), ???LAN??Gateway, ???LAN??
 ??(Prefix, 64), ??????????. ??Network Map????????:

????????????Padavan??IPv6????, ???FGT80C??IPv6????:

?client??tracert??:

?????, ???Padavan??IPv6??, ??????(ICMP).

SPI Firewall (Stateful Packet Inspection Firewall)

Padavan????SPI Firewall?, ??Firewall?????, ??Filter(Port, MAC, URL), DoS, SYN Flood Prevention?

SPI??Stateful Packet Inspection, ??traffic?(Inbound/Outbound)??(Firewall)????, ??????,??SRC, DST, SRC_Port, DST_Port, Protocol(TCP/UDP/ICMP, etc)?..., ??????(Packet Inspection), SPI?????

SPI????(??packet), ?????(??)?????. ?????(Packet Inspection)????SPI, ???????(pattern-matching, ex: White-list), ???(Content Inspection; basic or complete content)?, ??????

?????, ?????:

????(Inspection)????, ?????L3/L4 NPU??..., CPU????ASIC????, ??????

?Padavan????Firewall Inspection, ?????SPI?, ??????. Padavan??SPI Firewall????iptables????, ?????(Allow)?? (Block):

DoS Attacks Protection????wiki:

<http://zh.wikipedia.org/wiki/%E9%98%BB%E6%96%AD%E6%9C%8D%E5%8A%A1%E6%94%BB%E5%87%BB>

SYN Flood Attack(DoS, ?????)????wiki:

http://zh.wikipedia.org/wiki/SYN_flood

?Netfilter????VPN????ALG????, ???NAT Loopback. ?????: Maximum Connections; ???PPE????sessions?, ???, ???

??URL, MAC, LAN to WAN filter????; MAC Filter????L2????(MAC???L3????).

Note(s):

1. ?iptables??, ???linux command????: ??Administration?Console?SSH?CLI?, ???GUI?Console:

iptables -L -v -n