VAS Experts

Stingray Service Gateway

Advanced DPI Solution

- Analysis
- Control
- Management

Content

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About VAS Experts

VAS Experts is a telecom software developer. Since 2013 we have built trust of more than 1100 providers in Russia, CIS and Europe that are using our Stingray Service Gateway.

Our team has over 20 years work experience in telecommunication software development and wide knowledge in technologies.

10M+ users

More than 30 Tbps

Latest Installations:

- Lebanon
- Cyprus
- Turkey
- Moldova
- Nicaragua
- Argentina

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Our products

Deep Packet Inspection
BRAS / BNG
CG-NAT
QoE Analytics

Key Features

Subscriber Management

- QoS Traffic policing
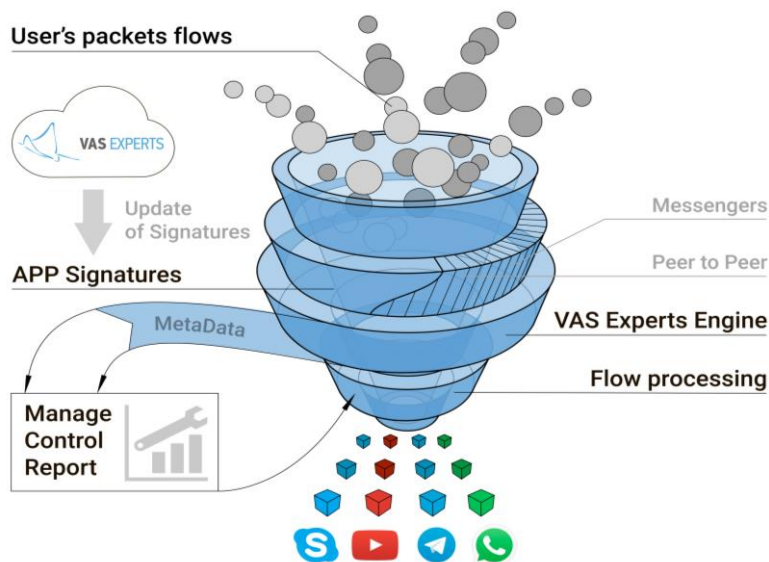- Block/Allow lists
- BNG, CG-NAT

Analytics

- IoT, DDoS, BotNet
- NetFlow, Interception
- QoE metrics

VAS for ISP

- Subscriber's profiling and marketing campaigns
- Parental control
- Mini-Firewall

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Own DPI Engine

User's packets flows
VAS EXPERTS
Update of Signatures
APP Signatures
MetaData
Manage Control Report
Messengers
Peer to Peer
VAS Experts Engine
Flow processing

VAS Experts DPI can compete with

- Sandvine
- Allot
- Cisco SCE

- A10 Network
- Ericsson SE

History

2013 – DPI
2016 – CG-NAT
2017 – L3 BNG DualStack IPv4/IPv6
2018 – Lawful Interception
2019 – L2 BNG DualStack IPv4/IPv6
2020 – Mobile Networks Support
2021 - Border

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Investment Protection

Our SSG software system can be installed on any server hardware and migrated to another server in the future with a license upgrade option. So you can just expand the license depending on the emerging tasks and save on the purchase of additional hardware.

License:

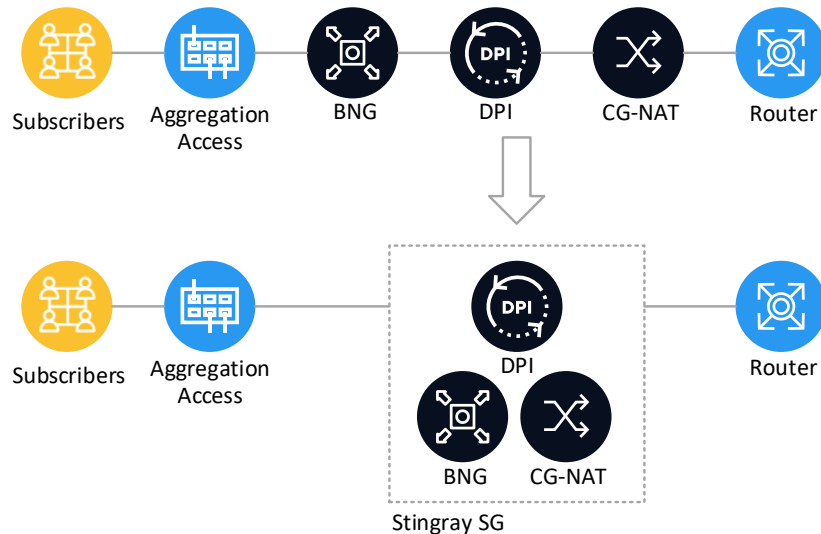- Upgrade
- Merge
- Split
- Transfer

License Manager:

- Reservation
- Oversubscription
- VAS (additional services)
- Testing
- Virtualization

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Multi-functionality

Installed on a regular x86 server, the multifunctional SSG platform replaces a set of disparate network equipment.

This simplifies administration, maintenance, and scaling processes.

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Perfomance per platform

FEATURE	SSG-6	SSG-20	SSG-40	SSG-80	SSG-100	SSG-120
Performance, Gbps	6	20	40	80	100	120
Number of subscribers	400 K	2 M	4 M	8 M	10 M	12 M
Maximum number of session	4 M	16 M	32 M	64 M	80 M	96 M
Number of new sessions	100 K	250 K	350 K	400 K	500 K	600 K
Ports	2x10GbE SFP+	4x10GbE SFP+	8x10GbE SFP+	16x10GbE SFP+	16x10GbE SFP+ 6x25GbE SFP28 6x40GbE QSFP	20x10GbE SFP+ 8x25GbE SFP28 8x40GbE QSFP 2x100GbE QSFP28
Latency (average value), μc	30					
Platform	1U, 19"					
Application protocols	6000+					

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Redundancy

– Hash IPsrc/IPdst balancing
in Link Aggregation Group

– Spare SSG on the alternative route

– Special low license price for Spare SSG

SSG

Router

SSG 1

Router

LAG

LAG

SSG N

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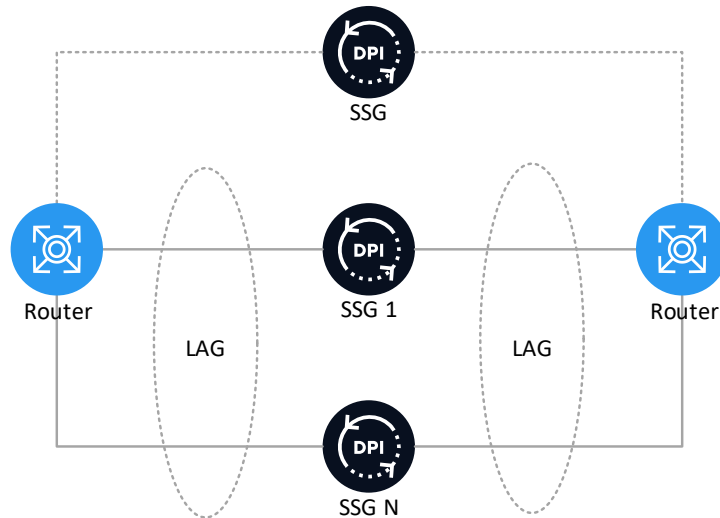
Platform scalability

– Support of 100Gbps links
with using load balancer

– Ability to scale up to 3.84 Tbps

10 Gbps — SSG 1 — 10 Gbps

100 Gbps — Load Balancer

100 Gbps — Load Balancer

10 Gbps — SSG N — 10 Gbps

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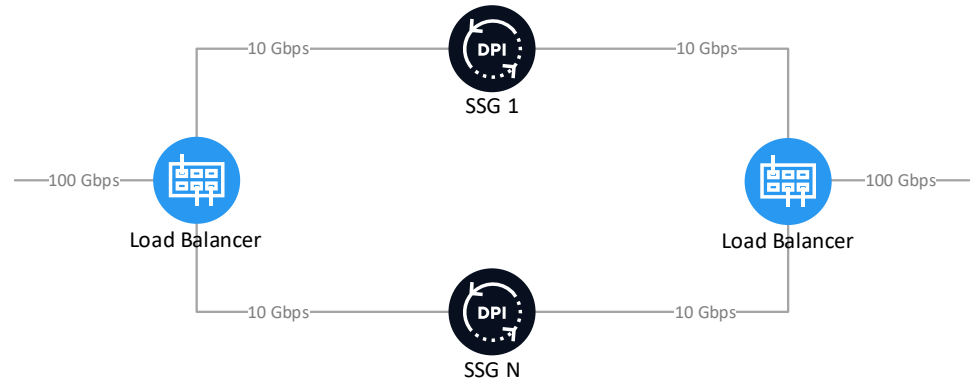
Platform Architecture

Vertical scalability with multiprocessor systems up to **400 Gbps** on a single unit.
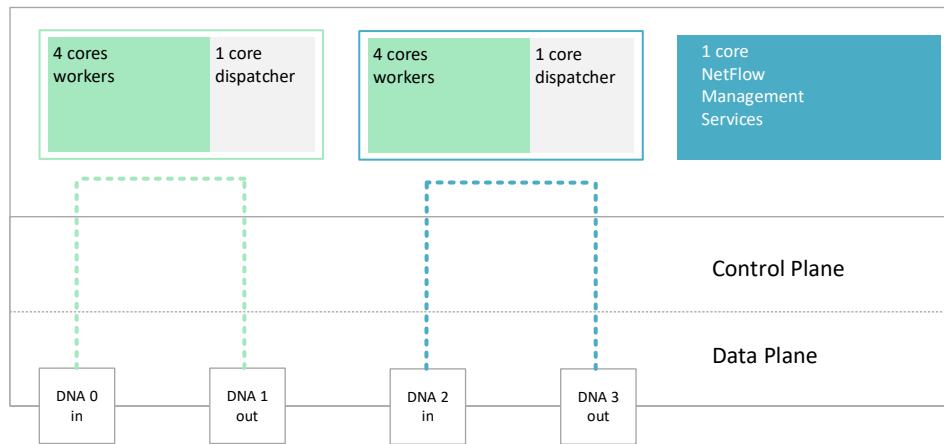
Hardware Factors

- x86 servers
- High performance
- Soft limits
- Scalability
- Available platform
- Self-upgrade
- Continuous growth

Data Plane

- DPDK – Direct NIC Access technology

Control Plane

- CentOS 8

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Solution Architecture

– Modes L2/L3 BNG support

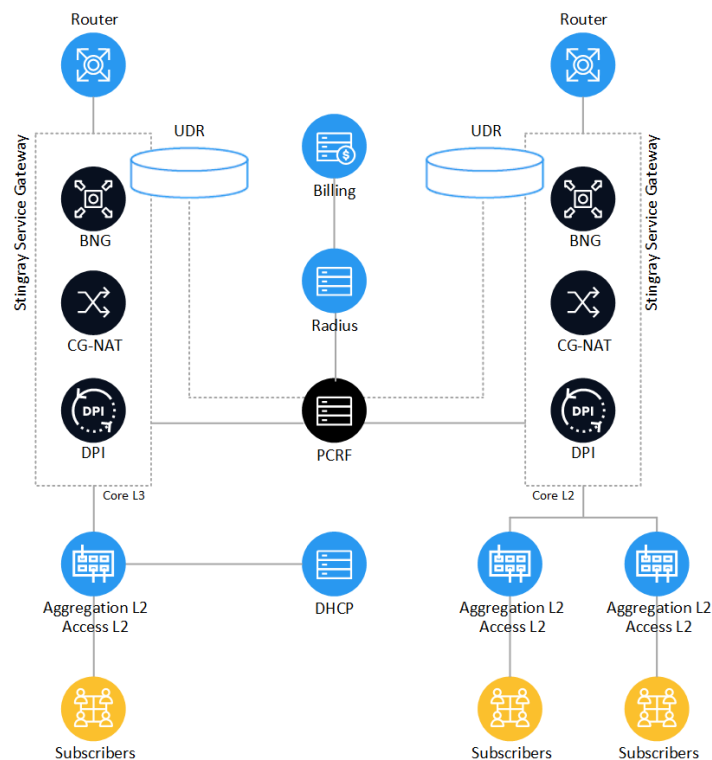– Combine on the platform BRAS/CG-NAT/DPI/ URL-Filtering

– Full RADIUS (CoA) support

– High availability with PCRF

– Hot start from local UDR

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BRAS operating modes

SSH-managed BNG L3 IPoE	IP and tariff plans preloading. In case of dynamic IP distribution a Radius monitor or complete implementation of Radius is needed	
Radius-managed BNG L3 IPoE	Authorization via Radius-server for the subscribers who already have an IP	Supporting VLAN/Q-in-Q tags
BNG L2 DHCP Relay agent	Subscriber authorization via MAC-address at Radius-server. A DHCP-server is used for IP distribution	ARP proxy, ARP authorization, supporting VLAN/Q-in-Q tags
BNG L2 DHCP Radius Proxy	Subscriber authorization via MAC-address at Radius-server. Instead of DHCP-server a Radius-server is used. DHCP is replaced by combining FastDPI + FasrPCRF	Option 82 in the DHCP request, ARP proxy, ARP authorization, supporting VLAN/Q-in-Q tags
BNG L2 PPPoE	PAP, CHAP, MS-CHAPv2, MAC-address authorization protocols are supported	Supporting VLAN/Q-in-Q tags

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BNG Characteristics

- The combination of L2 (PPPoE, DHCP) and L3 modes (IPoE)

- Implementing traffic termination (PPPoE, Q-in-Q, VLAN)

- Multi-user support (one Login is multiple IP)

- Dual Stack IPv4/IPv6

- White list support based on hostname or URL, including *.domain mask

- Prioritization Video, Online games, Web traffic

- Traffic coloring (VLAN, IP, MPLS) and work with already colored traffic

- Mini-Firewall

- Increasing the speed of local resources or peer-to-peer networks regardless of the speed of the tariff plan

PCRF
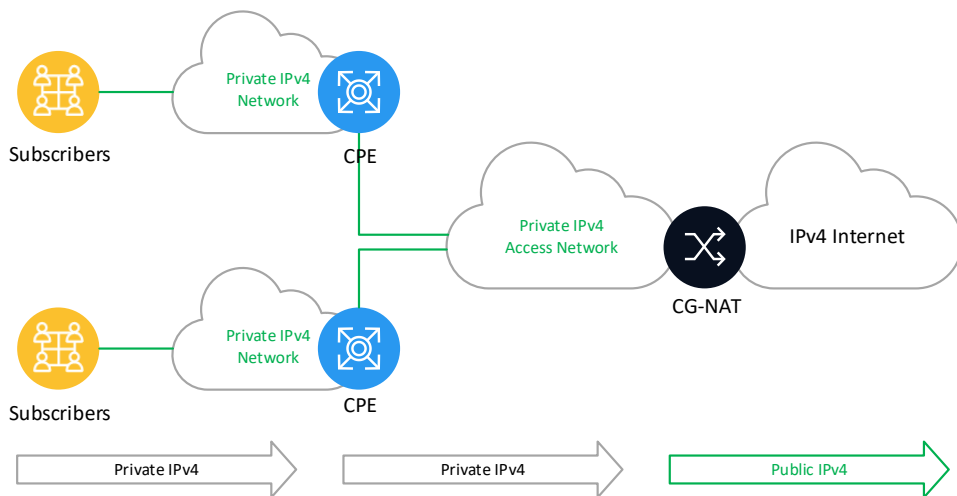
Proxying requests between BNG and Radius server

Dynamic management of policies and services of subscribers by Radius (CoA)

Synchronize multiple BNG operations and provide redundancy

Using separate accounting for AS or protocols

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CG-NAT Characteristics

- **NAT flows export** – text file or NetFlow v10

Private IPv4
Network

Subscribers

CPE

Private IPv4
Access Network

IPv4 Internet

CG-NAT

Private IPv4
Network

Subscribers

CPE

Private IPv4

Private IPv4

Public IPv4

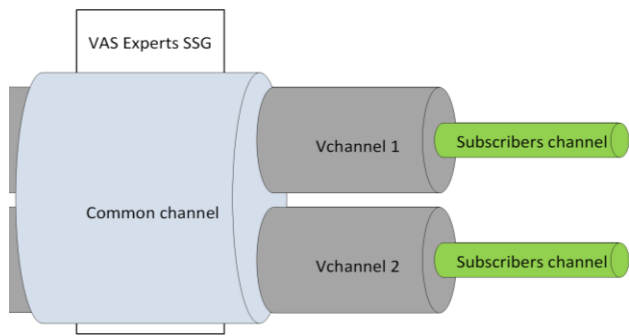- **Full Cone** – Provides transparent operation of peer-to-peer protocols (torrents, games)

- **Paired IP address pooling** – Subscriber sessions are tied to a single external IP address for the subscriber

- **Hairpinning** – Inside NAT Subscribers communicate with each other without address translation.

- **Limits** – there is a limit of TCP and UDP connections for each pool of IP addresses

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Flexible tariff plans

Task:

1) Outbound Torrent Limit

2) Maximum speed on local resources

3) Increase speed to:

– Messengers and SIP

– HTTP, HTTPS, QIUC

– Game services

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Vchannel 1 — Subscribers channel

Common channel

Vchannel 2 — Subscribers channel

Classes (cs):

cs0 dns, icmp
(e.g. World of tanks)
cs1 http, https, quic
cs3 default

cs4 viber, whatsapp, skype, sip
cs5 AS local IP, peering
cs6 tcp_unknown
cs7 Bittorrent

htb_inbound_root=rate 50mbit
htb_inbound_class0=rate 20mbit ceil 50mbit
htb_inbound_class1=rate 1mbit ceil 50mbit
htb_inbound_class2=rate 8bit ceil 50mbit
htb_inbound_class3=rate 8bit ceil 50mbit
htb_inbound_class4=rate 8bit ceil 1mbit
htb_inbound_class5=rate 100mbit static
htb_inbound_class6=rate 8bit ceil 50mbit
htb_inbound_class7=rate 8bit ceil 50mbit

htb_root=rate 50mbit
htb_class0=rate 20mbit ceil 50mbit
htb_class1=rate 1mbit ceil 50mbit
htb_class2=rate 8bit ceil 50mbit
htb_class3=rate 8bit ceil 50mbit
htb_class4=rate 8bit ceil 1mbit
htb_class5=rate 100mbit static
htb_class6=rate 8bit ceil 5mbit
htb_class7=rate 8bit ceil 5mbit

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IPv6

Problems

Old equipment:

- CPE
- TV
- SIP phones
- Gaming and TV set-top boxes

Advantages of IPv6:

- No CPE NAT
- Improved P2P
- Access to home resources (NAS)

We recommend Dual Stack: private IPv4 + public IPv6

Why now is the time?

Implementation takes a long time (experience, equipment replacement, CPE) = 3 years,

**Suddenly you will need it urgently - you won't manage**

— IOT IPv6 only devices

— Professionals (admins, webmasters) - access to ipv6 resources (internal / corporate networks)

— Corporate: communication branches, redundancy uplink

— New network standards

— Retention of subscribers (a few other ipv6 providers)

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Option: Bypass Support

Bypass allows to ensure the network operability incase of installation of the system in series or asymmetrically, in the following situations:

- Equipment malfunction

- Software errors

- Preventive maintenance

- Power cut

Internal bypass produced by Silicom

Silicom Network Card

In → Out

DPI
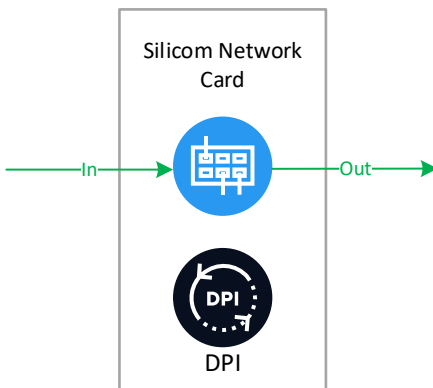
External bypass by any manufacturer managed by DPI

DPI

Management

In → Out

External Bypass

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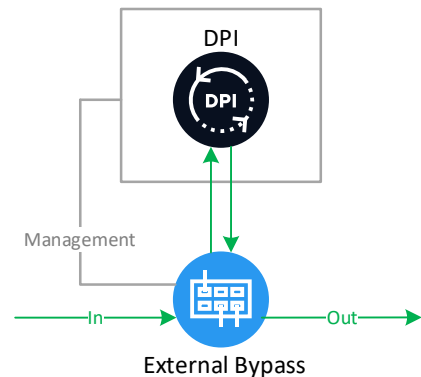
Option: Filtering by blocklist

Characteristic	Description
Using your own operator list	Yes
Using centralized private operator's list for a cluster of servers	Yes
Connection Diagrams Support	In-line, asymmetric, mirroring
Ability to control filtering by specific users and subnets for the organization of filtering services for downstream operators	Yes
Traffic blocking http/https	Yes
Blocking https by SNI, CN	Yes
Redirect support for http to info page	Yes
Ability to collect statistics on blocked pages	Yes
Ability to monitor loading lists and filtering work	Yes
Maximum list size	Up to 4 billion URL

Filtration allows you to block a specific URL for the http protocol from a page hosted, including social networks such as Facebook, YouTube, Wikipedia and resources considered extremist.

Blocklisting by category is supported and it is possible to use a combination of categories. Categorized lists are loaded automatically.

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Option: Filtering by blocklist

DESCRIPTION	CHARACTERISTIC
✓	Using your own operator list
✓	Using centralized private operator's list for a cluster of servers
In-line, asymmetric, mirroring	Connection Diagrams Support
✓	Ability to control filtering by specific users and subnets for the organization of filtering services for downstream operators
✓	Traffic blocking http/https
✓	Blocking https by SNI, CN
✓	Redirect support for http to info page
✓	Ability to collect statistics on blocked pages
✓	Ability to monitor loading lists and filtering work
Up to 4 billion URL	Maximum list size

Filtration allows you to block a specific URL for the http protocol from a page hosted, including social networks such as Facebook, YouTube, Wikipedia and resources considered extremist.

Blacklisting by category is supported and it is possible to use a combination of categories. Categorized lists are loaded automatically.

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Option: Analytics

NetFlow analytical information/ is **provided** for the following characteristics:

1. Distribution of the band for application protocols

2. Distribution of the band to autonomous systems (AS)

3. Downloading summary information of billing by class for each subscriber

4. Downloading Full NetFlow by subscribers

All specified modes can work simultaneously.

Using aggregate information for billing by classes for each subscriber allows you to separately rate sip, skype and bittorrent traffic.

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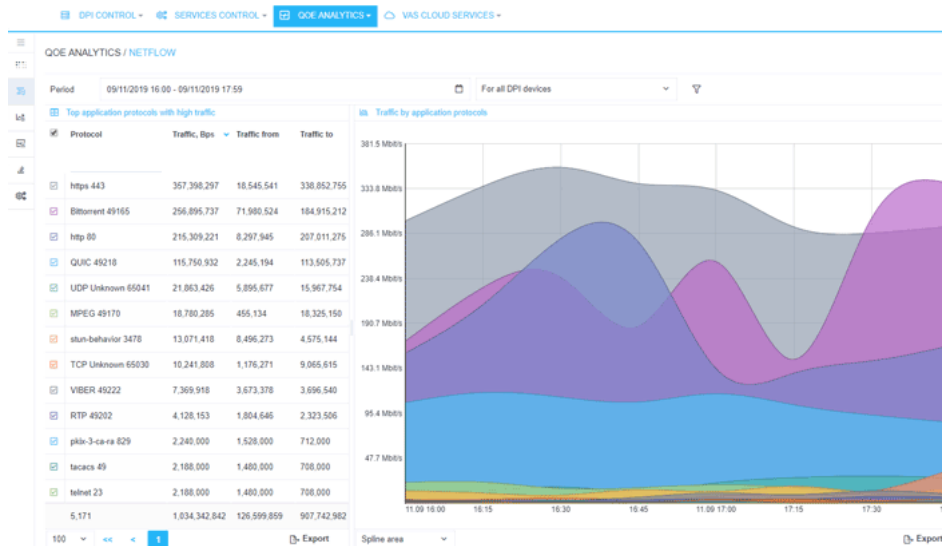
Option: Traffic prioritization

By direction

- Registered AS
- Customized AS

By the Uplink

- VLAN
- Pair of physical ports

Per user

- IP
- Login

By protocol / application

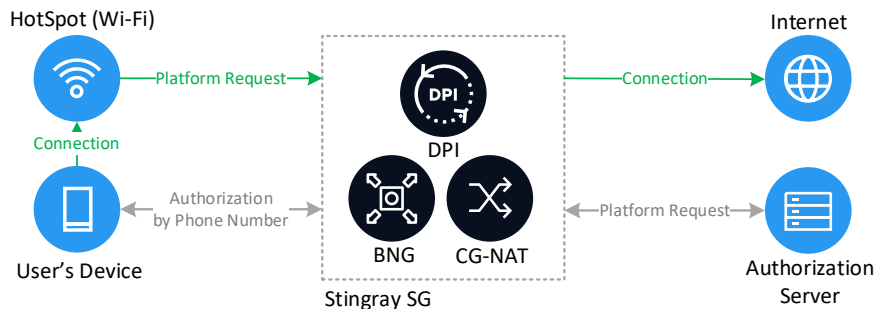|	
Web	**HTTP**
Emule	**HTTPS**
	Edonkey2000
Skype	**Skype**
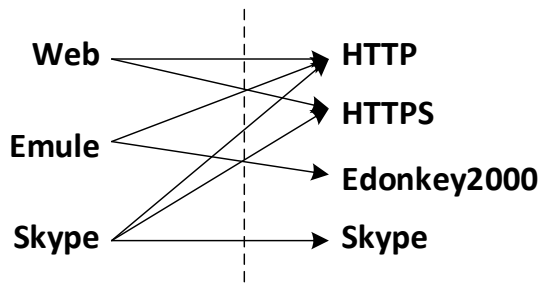
Before QoS

After QoS

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Option: Allow list and Captive portal

The Allow List makes it possible to limit the sites and pages available to the subscriber and to redirect the subscriber to the specified page when trying to go outside this list.

Use cases:

Subscriber blocking in case of low balance, with the possibility of payment via authorized payment systems

Organization of user identification in WiFi networks, provision of certain user actions in a WiFi network to provide access.
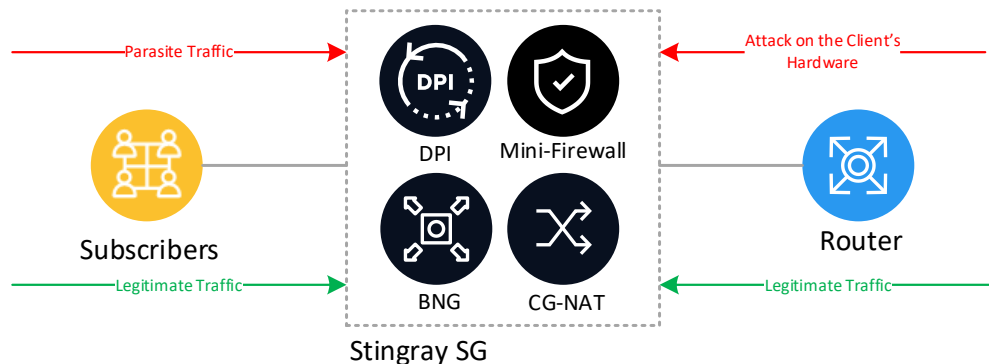

HotSpot (Wi-Fi)

Platform Request

Connection

User's Device

Authorization by Phone Number

DPI

BNG   CG-NAT

Stingray SG

Connection

Internet

Platform Request

Authorization Server

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Option: Mini Firewall

The tasks are:

- Preventing hacking of user devices by system ports
- Blocking malicious activity from the subscriber - SPAM, BotNet

Recommendations:

- Utilize statistics from QoE module in user's account
- Announcement to the client warning him of his problem and offer antivirus service

Parasite Traffic

Attack on the Client's Hardware

DPI   Mini-Firewall

Subscribers

BNG   CG-NAT

Router

Legitimate Traffic

Legitimate Traffic

Stingray SG

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Option: DDOS attacks protection

1. Protection against TCP SYN Flood

- Detects an attack on exceeding a specified threshold of requests not confirmed by the client SYN

- Independently, instead of the protected site, responds to SYN requests

- Organizes a TCP session with the protected site after confirmation of the request by the client.

Depending on the settings, Stingray SG may be activated manually, automatically or to be in constant protection mode against this type of attack.

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Option: DDOS attacks protection

2. Fragmented UDP Flood Protection

This type of attack is carried out by fragmented UDP packets, usually of a short size.
The attacked platform is forced to spend a lot of resources for assembling and analyzing them.

For protection, protocols that are irrelevant for the protected site are dropped or hard-limited by the bandwidth.

3. Protection (LOIC, etc.) based on Turing test (Human Detection)

When the limit value of requests is exceeded, protection is activated and the user must enter information from the CAPTCHA to confirm that he is not a part of the botnet.

After that access to the site will be allowed. This test determines who the user of the system is – a person or a computer.

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Option: Inserting ads into web-pages

ISP's interest is calculated per click/impression. It is handled in operator's personal account and doesn't need additional settings.

– Advertisement placement and subscriber notification

– Earning from every click

– Conducting and monitoring of marketing campaigns

– Black and white lists

– AdBlock on the network level

Formats

- Desktop and mobile

- Interactive

- Fullscreen

- Heading

- Native advertising

- Video

- Menu and filling out the form

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Operating scheme for Ads

Advantages

- Activation in a click
- Automatic billing
- Thoughtful targeting
- Quick implementation

DPI

BNG

CG-NAT

Stingray SG

GUI

VAS Cloud

Marketing

ADS Aggregator

Billing

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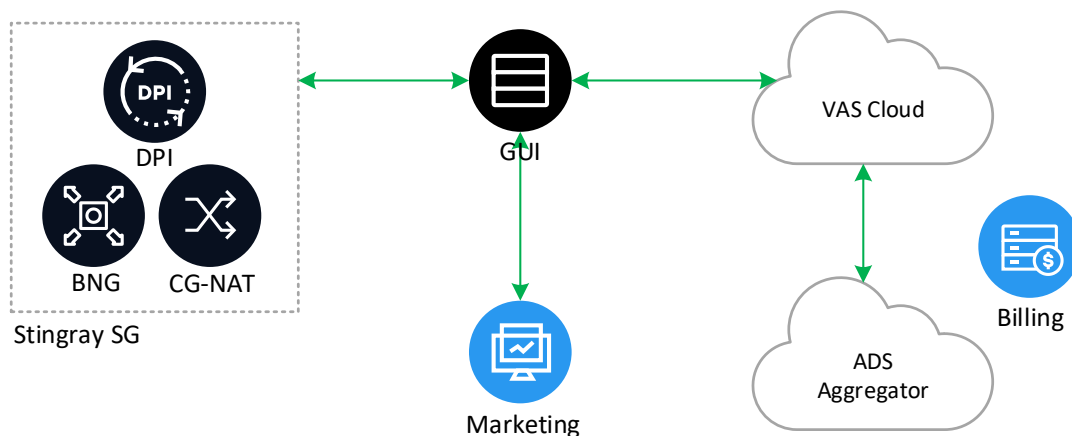
DPI licensing

| ENTRY	FLTR	BRAS	BASE	COMPLETE	OPTIONS
✓	✓	✓	✓	✓	Bypass support
✓	✓	Optional	✓	✓	Filtering by black list
✗	✓	✓	✓	✓	Statistics gathering and analysis on protocols and trends
✗	✓	Optional	✓	✓	Traffic prioritization depending on a protocol
✗	✓	✓	✓	✓	Lawful interception (LI)
✗	✗	✓	✓	✓	Subscriber notification and marketing campaigns
✗	✗	Optional	✓	✓	Optimization of the external access channels usage
✗	✗	✓	✗	✓	Channel allocation between subscribers for IPv4 and IPV6
✗	✗	Optional	✗	✓	Ads blocking and replacing it
✗	✗	✓	✗	✓	Whitelist and Captive Portal support

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DPI licensing

ENTRY	FLTR	BRAS	BASE	COMPLETE	OPTIONS
✕	✕	Optional	✕	✓	Mini-Firewall for blocking on certain ports
✕	✕	Optional	✕	✓	Protection against DOS and DDOS attacks
✕	✕	Optional	✕	✓	CG-NAT - Network Address Translation
✕	✕	✓	✕	✓	BRAS L2 (PPPoE, Q-in-Q, VLAN), BRAS L3 (IPoE), support for the RADIUS with Change of Authorization (CoA) feature enabled
✕	✕	✓	✕	✓	BRAS IPv6, support for the RADIUS with Change of Authorization (CoA) feature enabled
✓	✓	✓	✓	✓	One-year subscription for updates

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Quality of Experience module

QoE is a software product responsible for statistic gathering and viewing subscribers' perception of services.

The statistics is transferred to special metrics which allow to define users' experience. It provides the operator with information about what kind of problems does he or she encounter.

The data obtained allows the operator to take action and to improve the services quality. The result is increasing customer loyalty.

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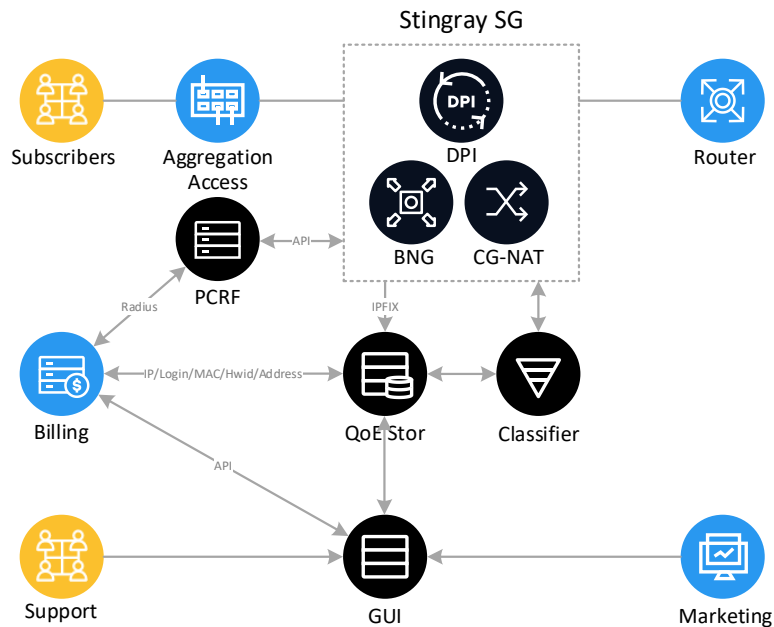
QoE metrics

1. Round-trip-time (RTT);

2. Indicators of retries number;

3. The number of sessions, devices, agents, IP-addresses per subscriber;

4. Traffic distribution by application and transport protocols;

5. Traffic distribution by autonomous system (AS) numbers;

6. Clickstream for each subscriber.

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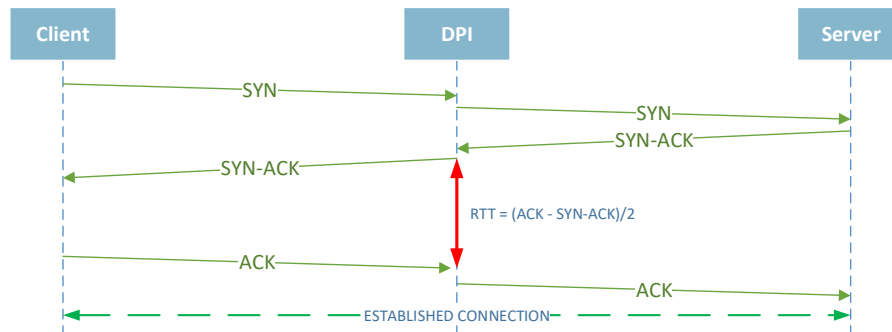
How to use QoE metrics?

Sales and Marketing

- Upselling new service, Wi-Fi equipment, traffic plans

- Work with outflow and analysis of the causes of outflow in the past

- Target advertising with using subscriber profiling

Technical and Support departments

- Deep troubleshooting and monitoring with using Round Trip Time and TCP retransmitting

- Identification of problems with client terminal equipment, WiFi router, access switch and aggregation

- Search for optimal peering points and connections to higher providers

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Graphical user interface

1. Access restriction by role

2. Managing several DPI: monitoring and configuration

3. White and Black lists

4. Managing subscriber tariff plans

5. Creating of NAT-pools

6. HotSpot and Clickwrap option control

7. Work with statistics

8. API support for integration with external systems.

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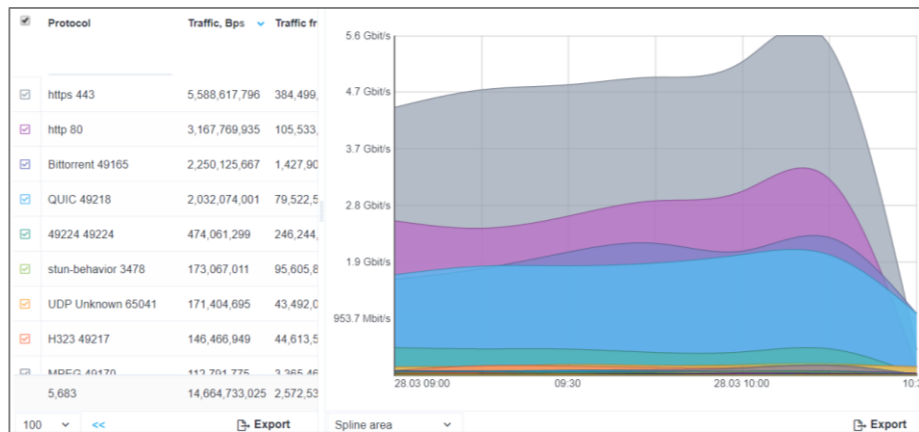
QoE Licensing

LITE	STANDARD	OPTIONS
✓	✓	NetFlow statistics collector with re-export support
✓	✓	API support for integration with external systems
✓	✓	Full NetFlow and ClickStream statistics visualization
✓	✓	Built-in reports of Full NetFlow-based TOP: high RTT, by traffic volume, by number of re-requests, by application protocols, by AS, by subscribers AS, by access switches and aggregation
✓	✓	Built-in ClickStream-based TOP reports: URLs, hosts, subscribers, devices, IP resources
✓	✓	Exporting reports using *.xlsx, .*csv, *.pdf and *.png formats
✓	✗	Reports on web resources categories, updating the list of categories
✓	✗	Full NetFlow and ClickStream reports with detailed information per user
✓	✗	Setting up triggers and actions on events, sending reports by email
✓	✗	DDoS and BotNet detection

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Development directions

- Routing. BGP, OSPF protocols support

- Various IPv6 prefix length support
  (currently /64 only)

- Diameter protocol support
  (Gx, Gy, Gz interfaces)

- Subscriber quota management

- Signatures SDK and definition by SNI (HTTPS)
  and hostname (HTTP) as a service

- Configurable WEB-resources classifier

- MITM mechanism implementation

BGP Border

BRAS

SD-WAN

DPI

IoT

DDoS

BotNet
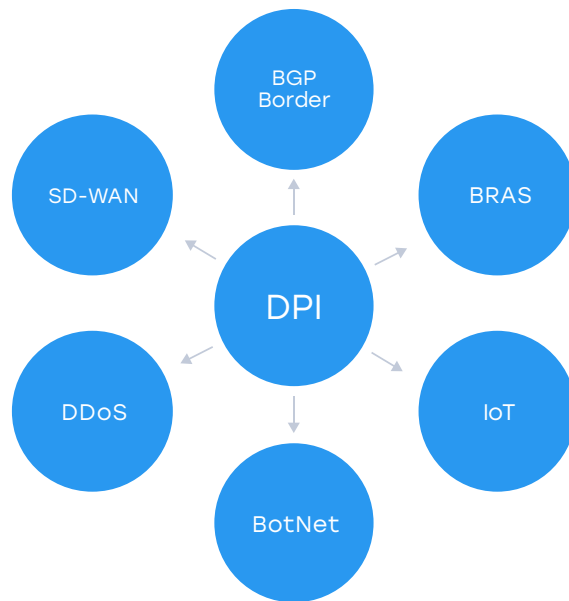
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QoE module

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