

Stingray Service Gateway

BNG – Broadband Network Gateway

BRAS – Broadband Remote Access Server

CG-NAT – Carrier Grade NAT

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About VAS Experts

VAS Experts is a telecom software developer. Since 2013, we have completed **over 2000 installations** worldwide.

Our team has **over 25 years work experience** in telecommunication software development and wide knowledge in technologies.

20M+
users

More than
35 Tbps

Latest Installations:

- Middle East
- CIS
- South America
- Europe
- Africa
- Asia-Pacific



Our products

Stingray Service Gateway (SSG) — multifunctional platform for traffic management

For Internet service providers:



DPI

QoS-based traffic management,
filtering by black and white lists



BNG/BRAS

Scalable and Cost-Effective
Software Gateway



AntiDDoS

Protecting the operator's network
from cyberattacks



QoE analytics

Traffic Monitoring and Analysis
System



CG-NAT

Providing transparent network
address and protocol translation



VEOS

Operating system

Our products

Stingray Service Gateway (SSG) — multifunctional platform for traffic management

For mobile operators:



PGW

An intelligent gateway that provides traffic control within the EPC architecture



PCEF

Flexible pricing based on various conditions in accordance with PCRF requirements



EPDGC

Solution for launching Wi-Fi Calling (VoWiFi)

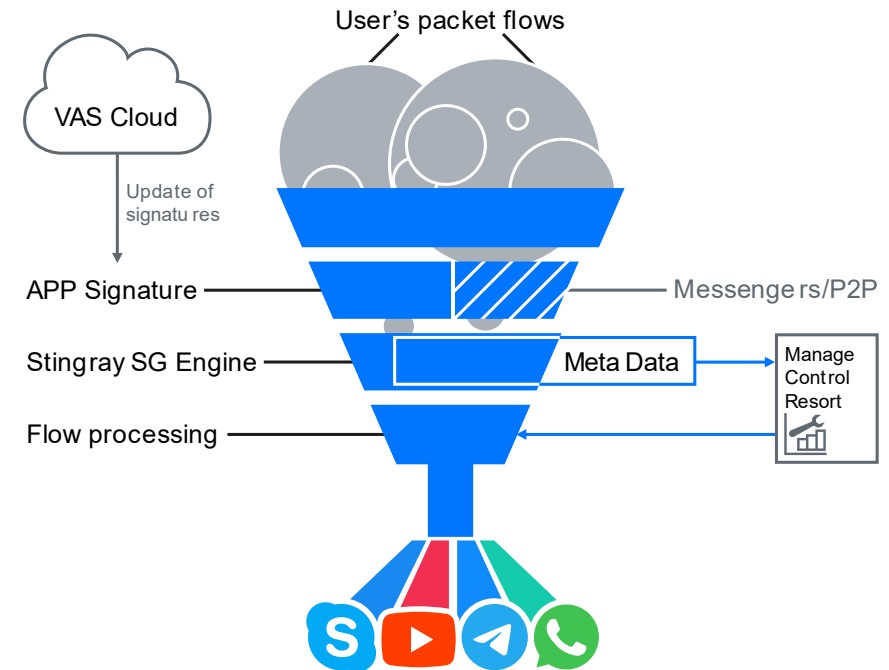
Own DPI Engine

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, LBS
- 2021 — Border Router
- 2022 — VAS Cloud Services
- 2023 — VEOS, On-Stick, EPDG
- 2024 — PCEF, Diameter
- 2025 — PGW, AntiDDoS

Stingray SG can compete with:

Sandvine	Cisco SCE	Cisco ASR	MikroTik
Allot	A10 Network	Juniper MX	Huawei NE



Success Story: Sandvine Replacement

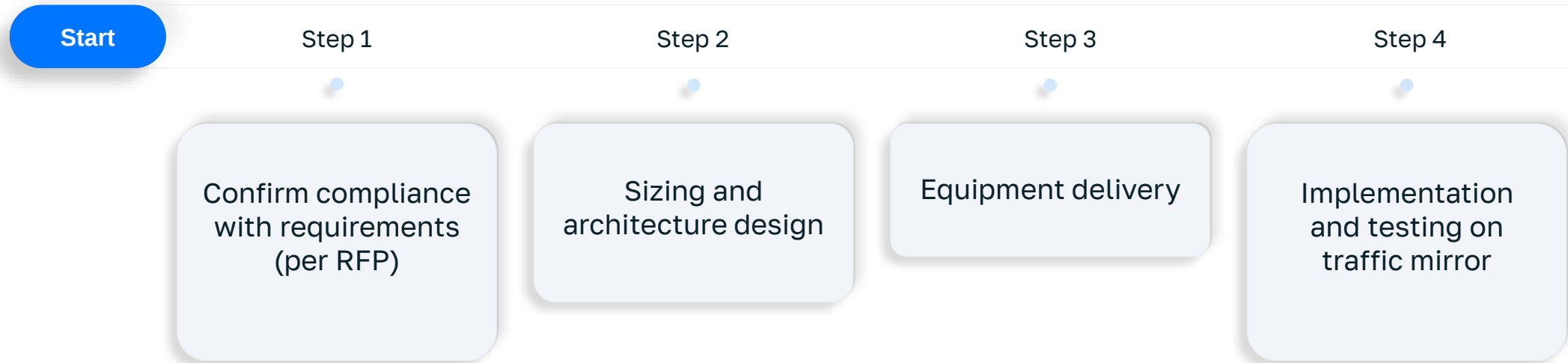
Client

- Wired and wireless ISP from the Middle East
- Cloud Computing services
- MVNO
- Around 100 000 subscribers in general

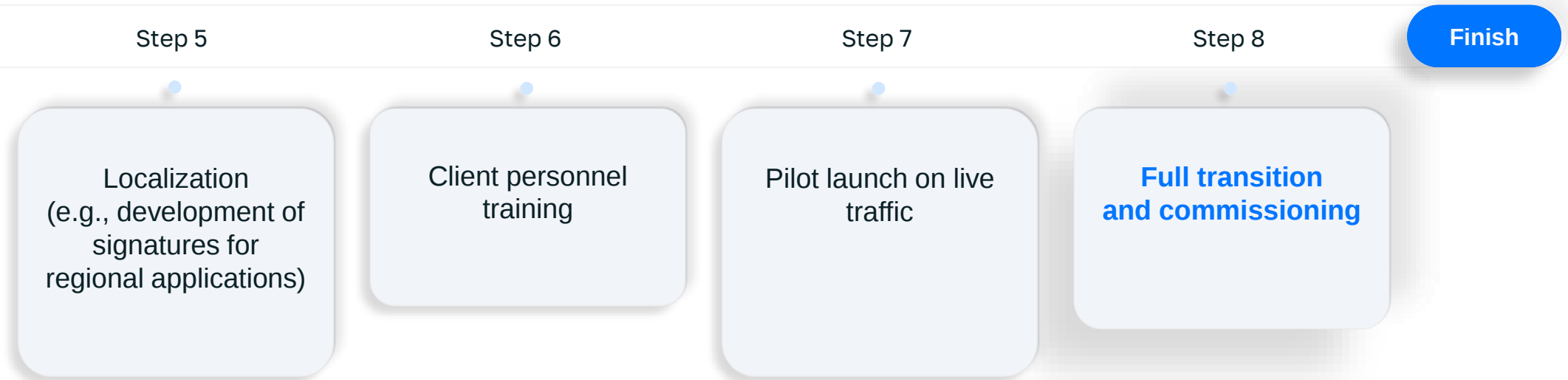
Goals

-  Sandvine DPI replacement
-  Infrastructure scale up
-  Analytics improvement

Success Story: Sandvine Replacement



Success Story: Sandvine Replacement



Success Story: Key Results

More than 100 new cloud and embedded signatures created for popular regional services

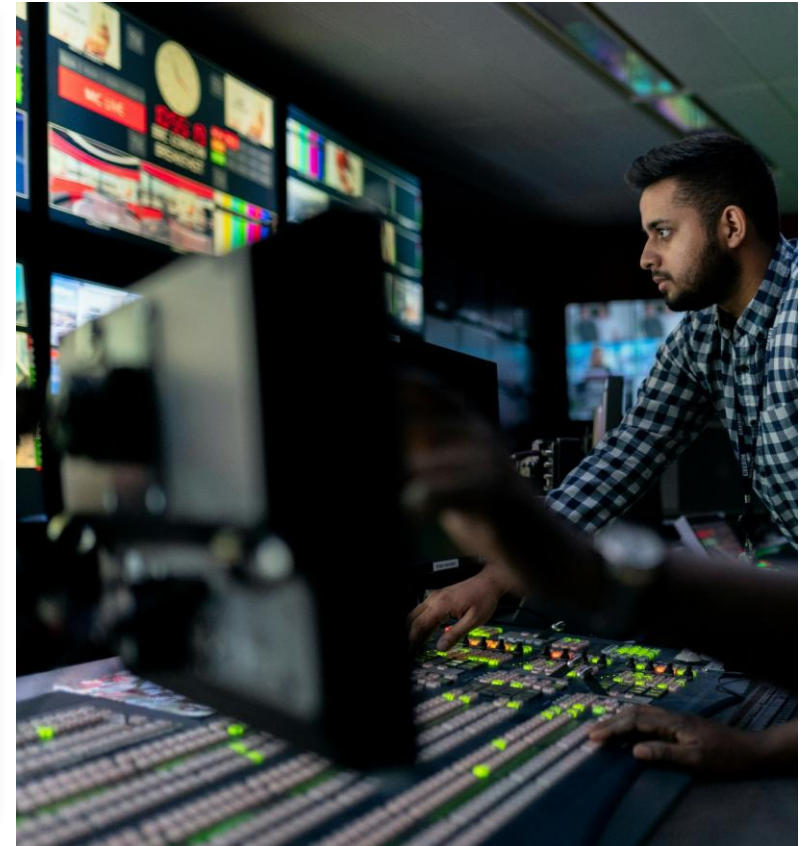
Additionally, the client independently added over 500 custom protocols via GUI

Added ability to edit protocol groups: add new, rename standard, change their composition

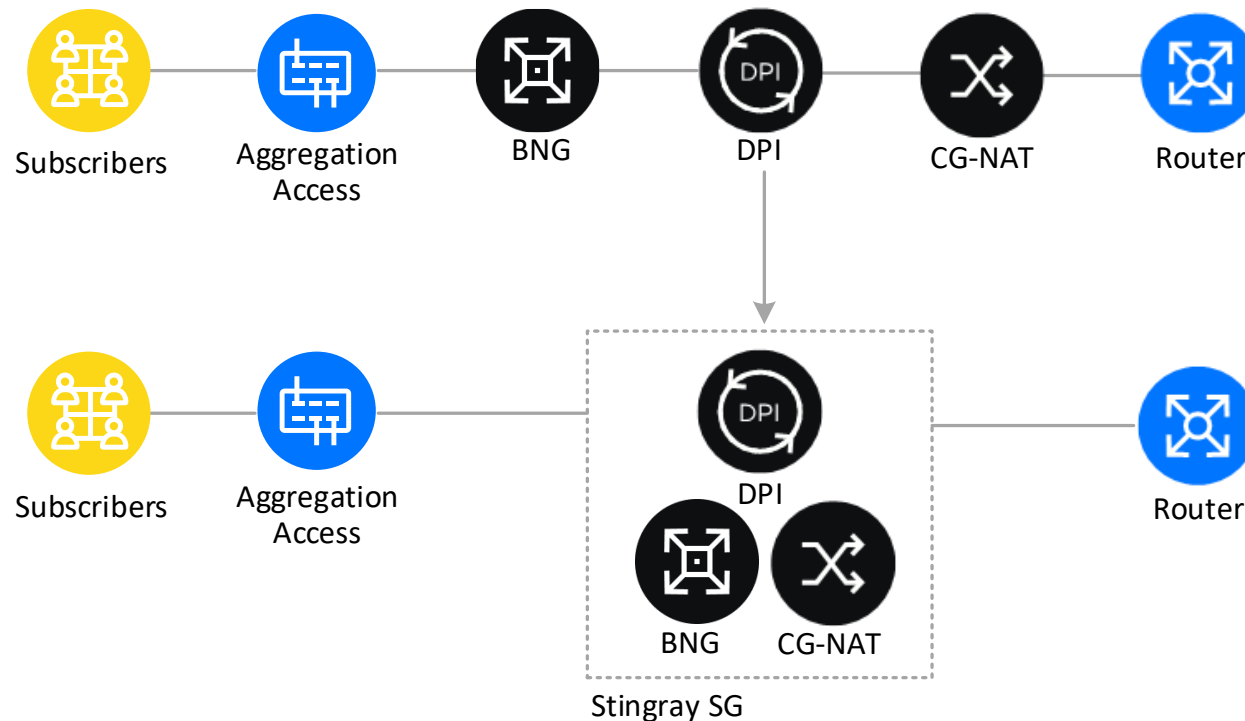
Developed VoIP reports detailing subscribers, applications, and minutes

QoE reports adapted to customer needs, including automated distribution

Successful migration preserving all critical parameters and improving analytics



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.

Features of the Stingray Platform

Operating system

- VEOS is a proprietary operating system with support for VAS Experts

Network interfaces

- Intel and NVIDIA (Mellanox) 10/25/40/100G NICs
- DPDK (Direct NIC Access technology)

Factors

- | | |
|-----------------------|---------------------|
| — Available platforms | — Soft limit |
| — x86 servers | — Scalability |
| — High performance | — Hands-On Upgrade |
| | — Continuous growth |

Up to 192 physical CPU cores.

Load distribution across CPU cores enables vertical scaling of **up to 400 Gbps full duplex** per server.

Support for operation in virtualized environments. **Telco Cloud** enables fast scaling in an operator's cloud on standard hardware. Stingray solutions can be deployed as **VNFs** in Telco Cloud.

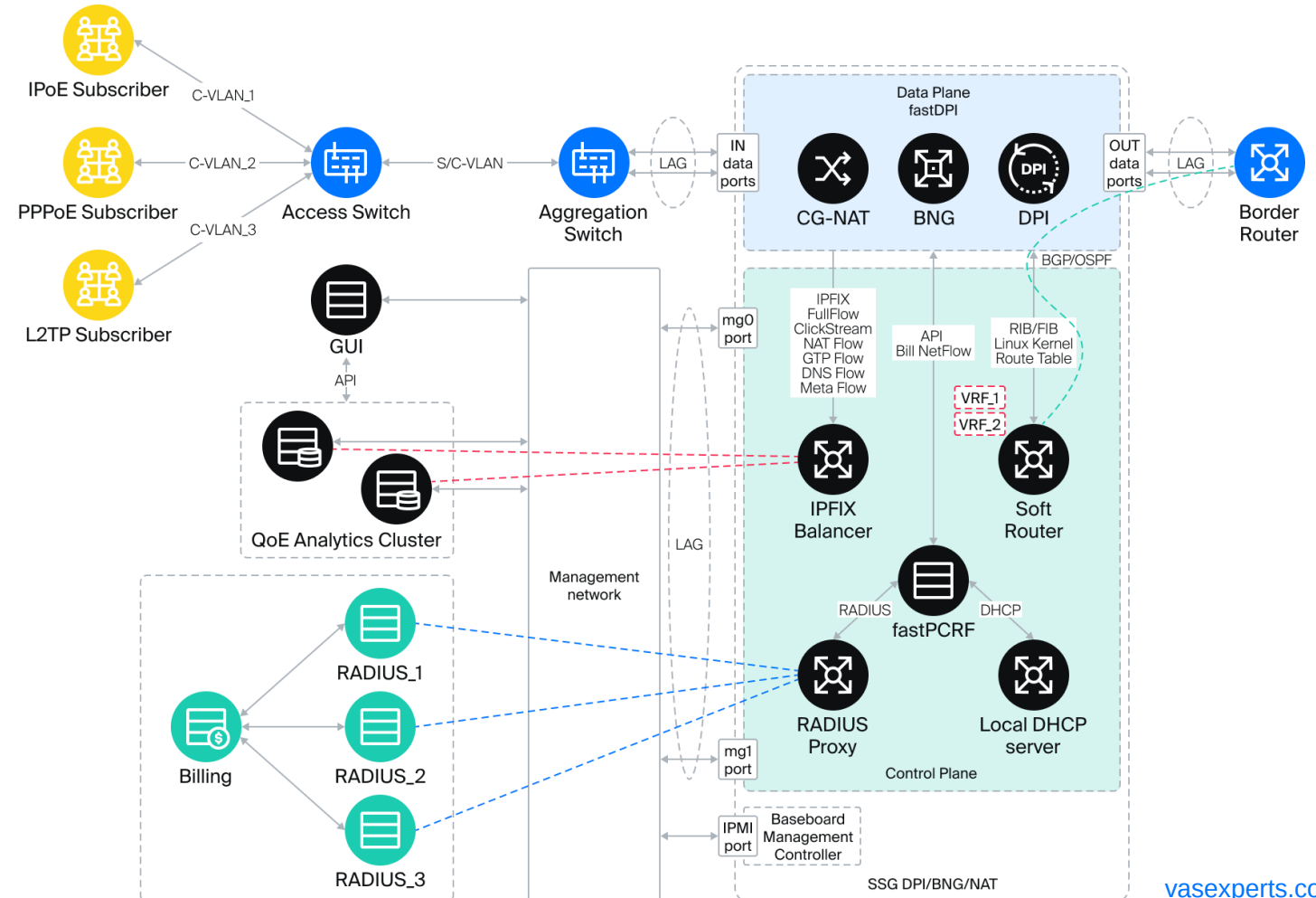
Performance Per Platform

FEATURE	SSG-40	SSG-80	SSG-120	SSG-240	SSG-360
Performance, Gbps	40G	80G	120G	240G	360G
Number of subscribers (2Mbps per subscriber)	20K	40K	60K	120K	180K
Maximum number of session	40M	80M	120M	240M	360M
Ports, GbE	6x10G	12x10G	20x10G	16x25G 8x100G	10x100G
	4x25G	6x25G	8x25G		
	4x40G	6x40G	8x40G		
	2x100G	4x100G	4x100G		
Latency (average value), microseconds	30				
Platform	1U-2U, 19", AC/DC 2xPSU, N+1 Fan				

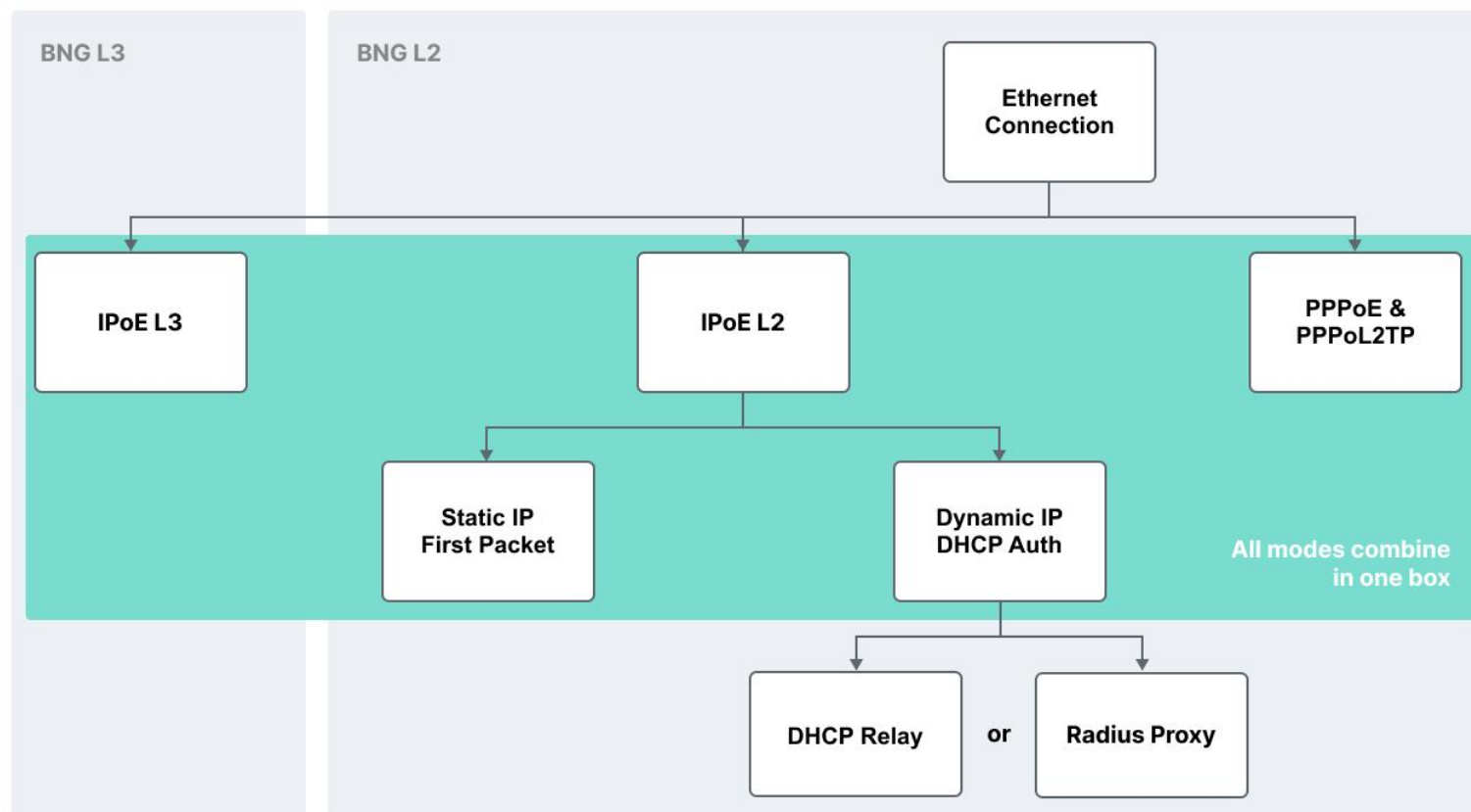


Solution Architecture

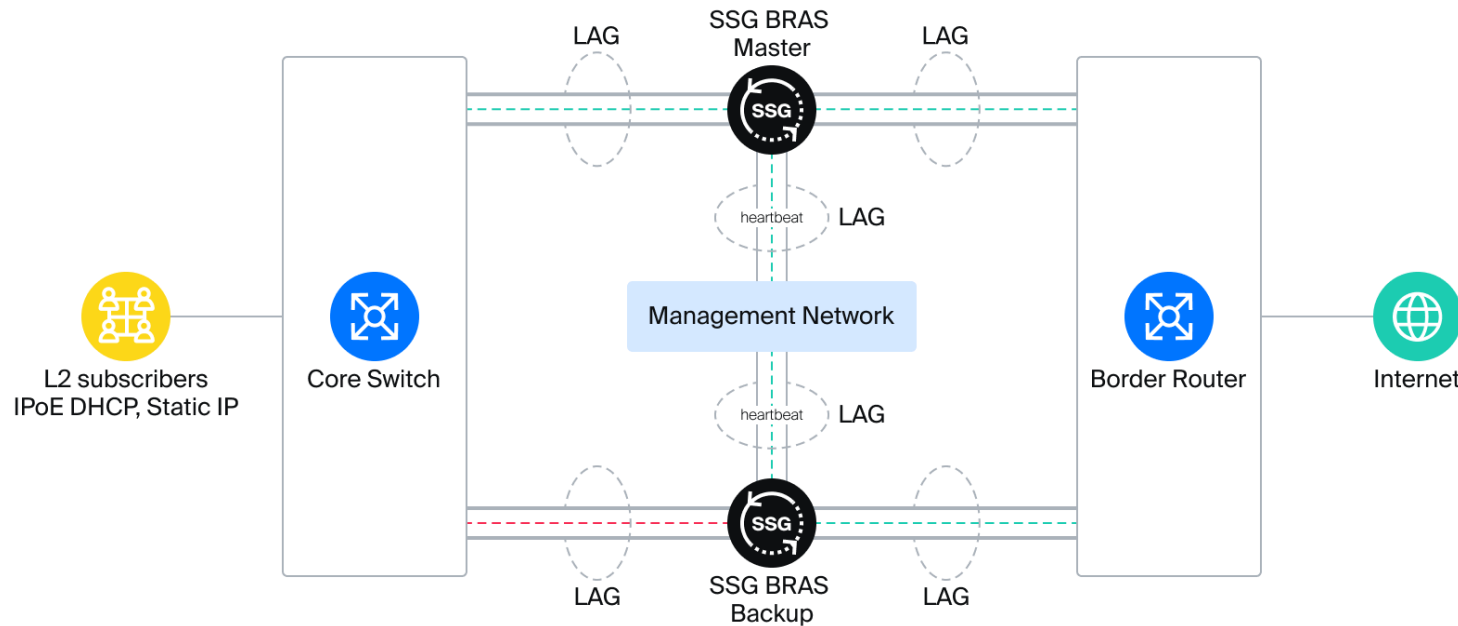
- IPoE Static, IPoE DHCP, PPPoE, L2TP;
- Dual Stack (IPv4/IPv6);
- DHCP Relay or DHCP Proxy;
- DHCP Local Server (IPv4/IPv6);
- CUPS: Separation of Control Plane and Data Plane;
- RADIUS Proxy for load balancing and integration with any billing system;
- IPFIX balancer for distribution and duplication of IPFIX to different receivers.



Operating Modes



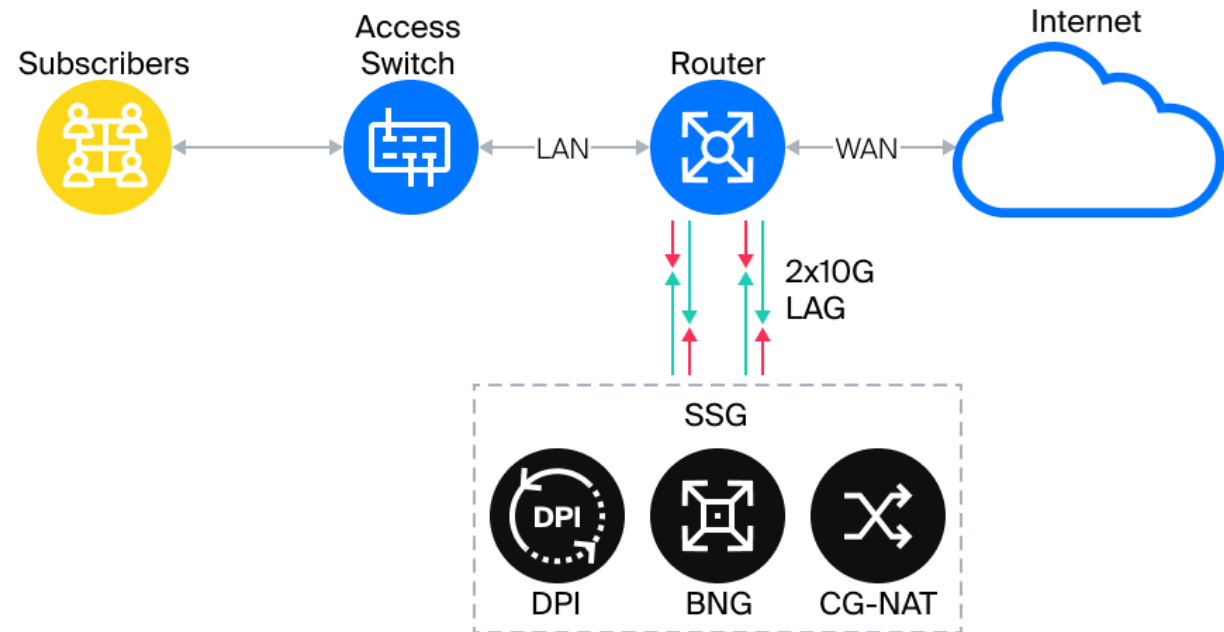
BNG IPoE redundancy



- Options: Active-Active and Active-Standby
- Synchronization of policing and service profiles
- Automatic failover to backup
- Special pricing for backup license
- Redundancy of platform components

Deployment scheme. Connectivity. Monitoring

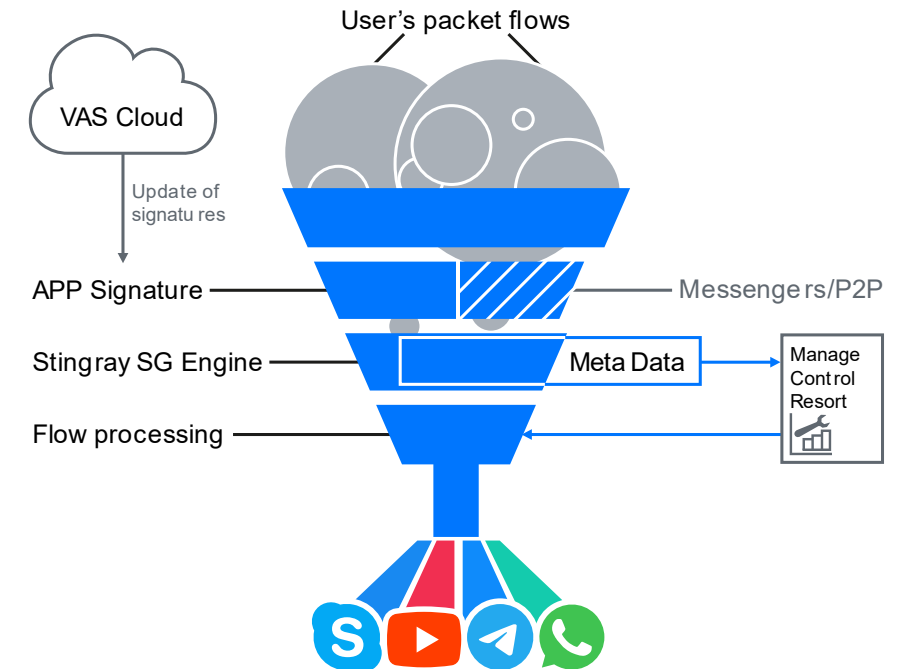
- Support for BGP, OSPF, VRF, ECMP
- In-line connection with LAG
- On-Stick connection with LAG
- Monitoring via SNMP and Syslog
- TACACS+ integration
- Administration via CLI and GUI



On-Stick installation with port aggregation (LAG) saves physical ports in the network core router.

What is the role of DPI in the core of a BNG?

- Support for multi-user mode (one login – multiple IPs)
- Whitelists with support for hostname, URL, and *.domain wildcard masking
- Traffic prioritization for video, online games, and web traffic
- HTTP redirect
- Local policing profiles with QoS and transmission of absolute values via RADIUS
- QoS at subscriber level and vChannel (VLAN, CIDR)
- IPFIX-format statistics
- Acceleration of access to local resources, IX or specific services (messaging, social networks) outside the tariff plan
- Traffic marking (VLAN, IP, MPLS) and processing of already marked traffic
- Mini-Firewall service for improved network security



Policing levels

Per Session

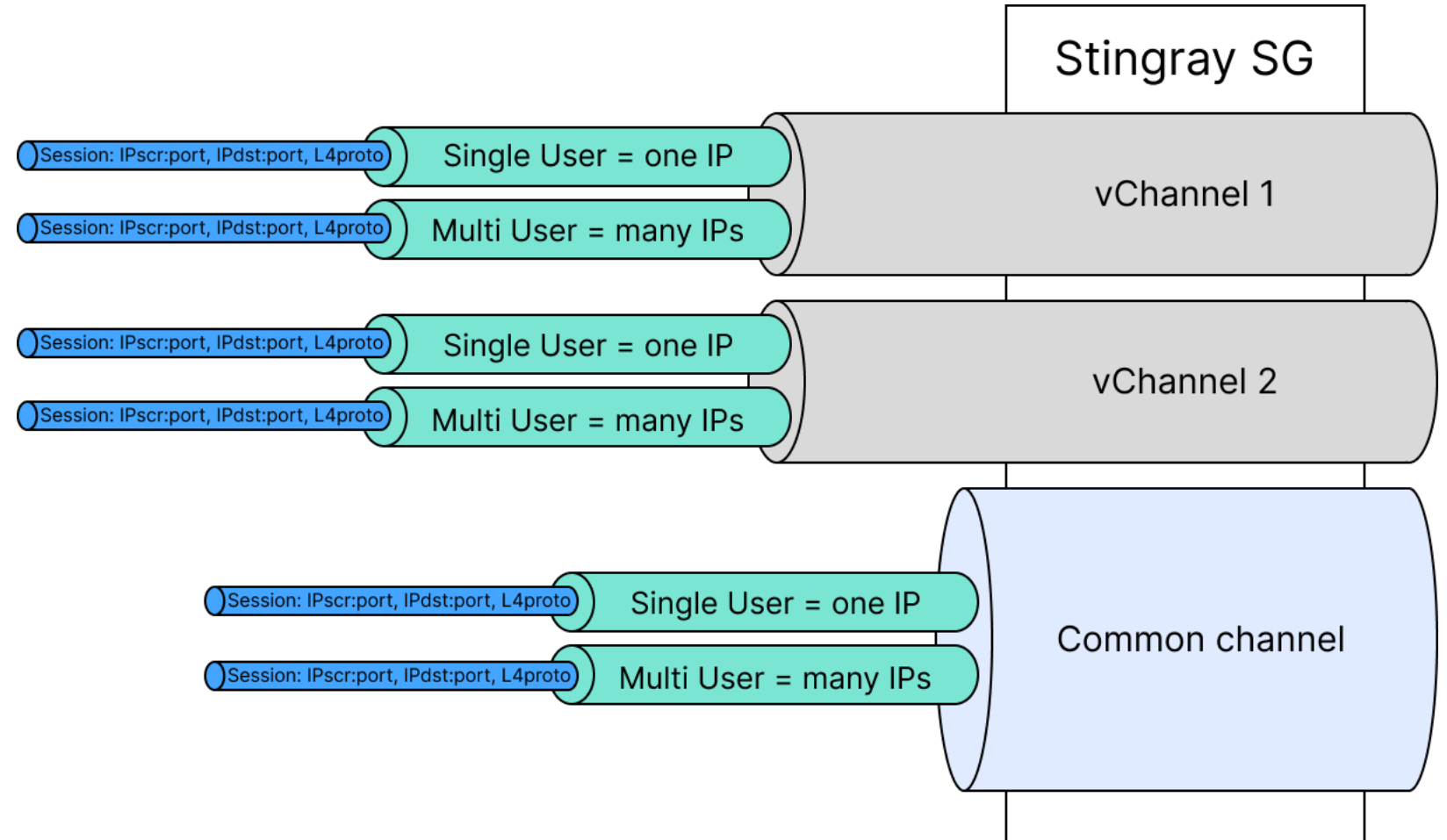
Per session control

Per Subscriber

Prioritized speed limit per subscriber

Per Channel

Channel rate control for congestion management

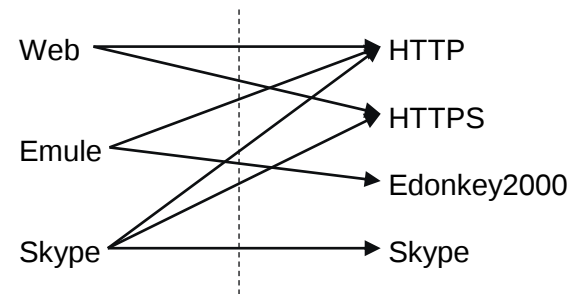


Traffic Prioritization

By direction

- Registered AS
- Customized AS

By protocol / application



Before QoS



After QoS



Flexible Tariff Plans – Policing per IP/Login

Task

- 1) Outbound Torrent Limit
- 2) Maximum speed on local resources
- 3) Increase speed to:
 - Messengers and SIP
 - Web resources: HTTP, HTTPS, QIUC
 - Game services

Use cases:

1. Time schedule tariff plans
2. High speed to local recourses
3. Increasing subscribers QoE
4. Throughput is shared between IPv4/IPv6 connections

Classes (cs):

cs0 dns, icmp (e.g. World of tanks)
cs1 http, https, quic
cs2 viber, whatsapp, skype, sip
cs3 default

cs4 reserved
cs5 AS local IP, peering
cs6 tcp_unknown, udp_unknown
cs7 Bittorrent

htb_inbound_root=rate 50mbit

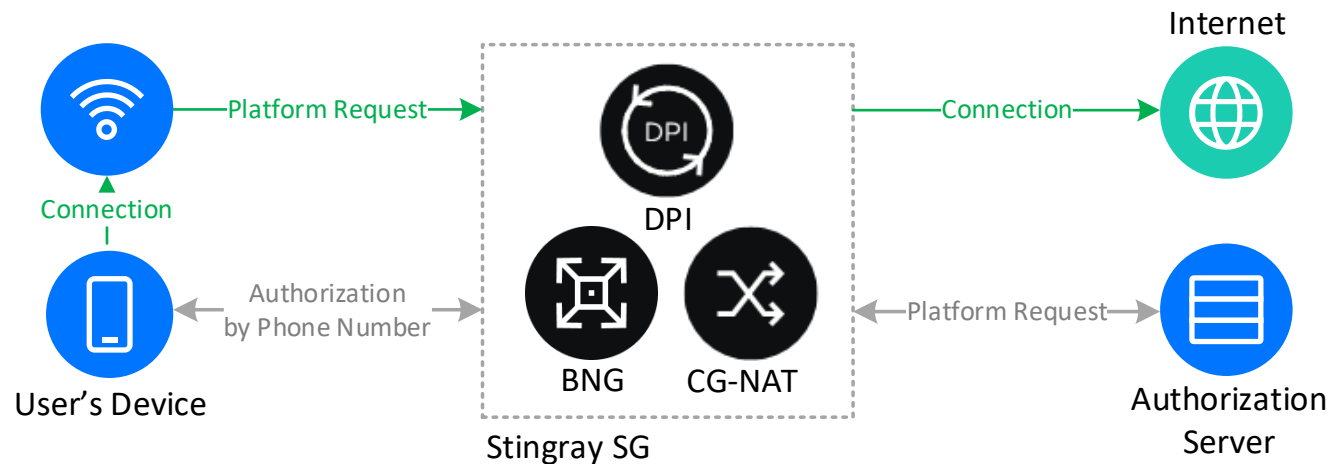
htb_inbound_class0=rate 20mbit ceil 50mbit
htb_inbound_class1=rate 1mbit ceil 50mbit
htb_inbound_class2=rate 1mbit ceil 50mbit
htb_inbound_class3=rate 8bit ceil 50mbit
htb_inbound_class4=rate 8bit ceil 1mbit
htb_inbound_class5=rate 100mbit static
htb_inbound_class6=rate 8bit ceil 50mbit
htb_inbound_class7=rate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

htb_root=rate 50mbit

htb_class0=rate 20mbit ceil 50mbit
htb_class1=rate 1mbit ceil 50mbit
htb_class2=rate 1mbit 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

Allow List and Redirect to Captive Portal

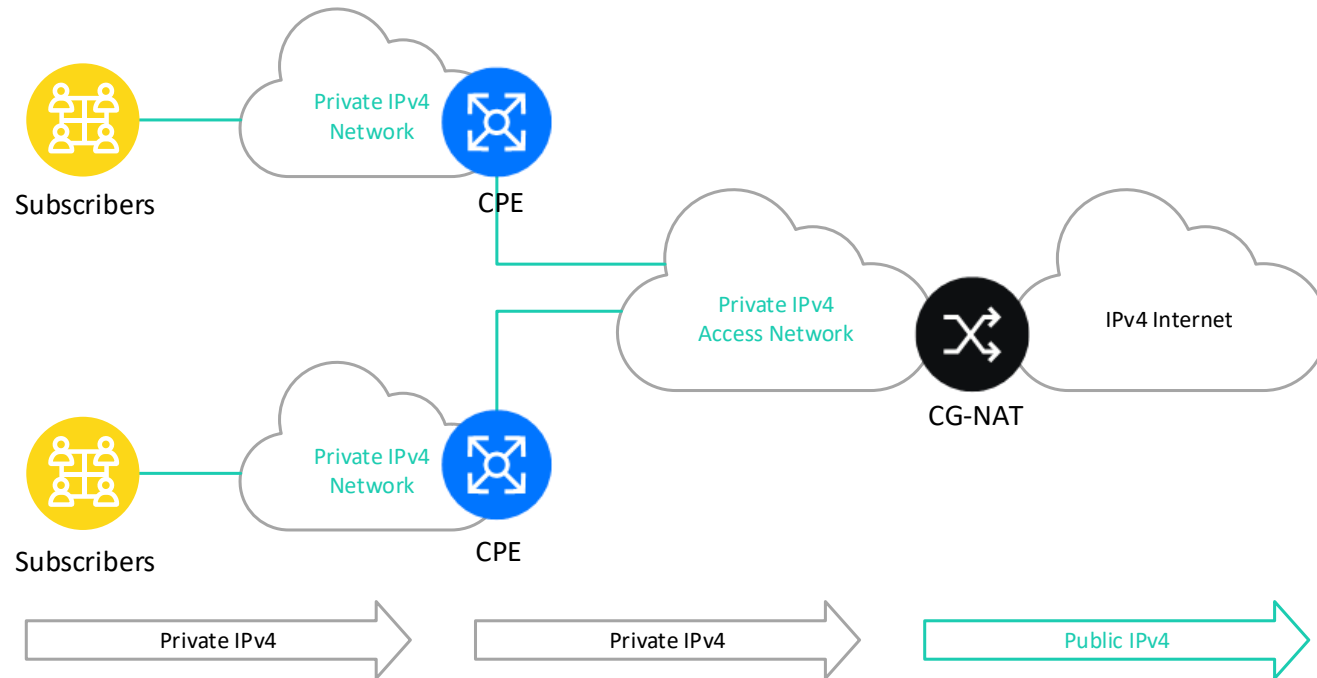
The Allow List makes it possible to limit the sites and pages available to the subscriber and to redirect the subscriber to the specified page when trying to go outside this list.



Use cases:

1. Subscriber blocking in case of low balance, with the possibility of payment via authorized payment systems.
2. Organization of user identification in Public Wi-Fi HotSpot, provision of certain user actions in a Wi-Fi network to provide access.

CG-NAT and NAT 1:1



- **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
- **NAT flows export** — text file or IPFIX (NetFlow v10)

Additional BNG options

1. Filtering By Blocklist and Categories

Filtration allows to block a specific URL for the HTTP protocol from a page.

Blocklist by category is supported and it is possible to use a combination of categories. Categorized lists are loaded automatically from VAS Cloud.

2. Mini Firewall – blocking specific TCP/UDP ports

Preventing hacking of user devices by system ports

Blocking malicious activity from the subscriber — SPAM, BotNet

3. DDOS Attacks Protection

Protection against TCP SYN Flood and UDP Flood. Also, mitigation of websites.

4. Subscriber Notification in Browser

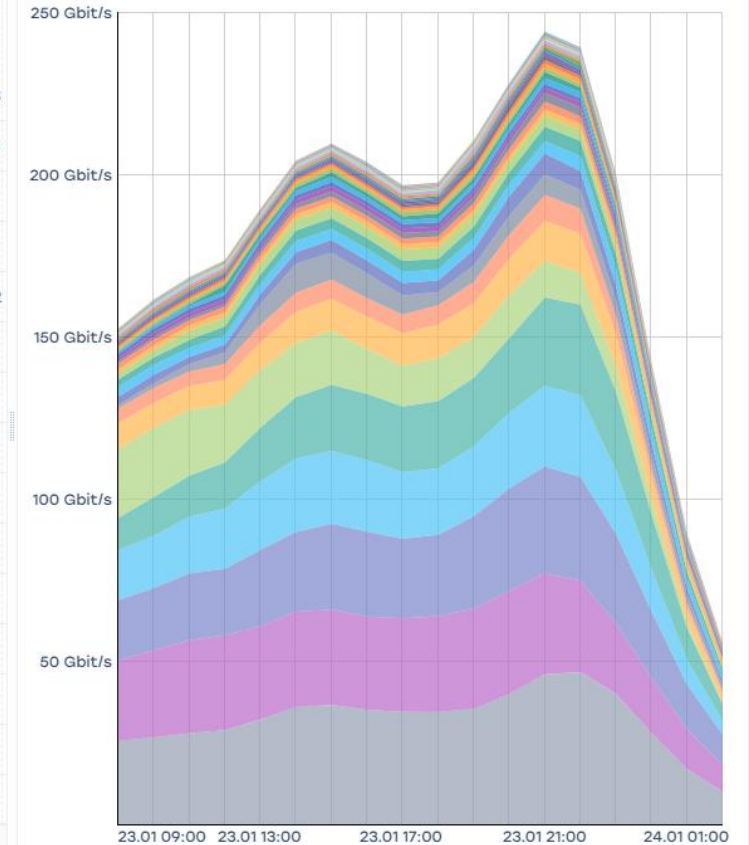
Customization of notifications by HTTP Redirect in a certain period of time and day of the week. Possibility to run several campaigns simultaneously

Analytics

SSG recognize all traffic and generate statistics by IPFIX (NetFlow v10):

1. Distribution of the band for application protocols
2. Distribution of the band to autonomous systems (AS)
3. Billing NetFlow – converted to Accounting
4. Full NetFlow – IPDR by each flow

☒	Protocol	Group	Traffic	Traffic
	Filter			
☒	tiktok 49264	Video, pictures	34,656,205,61	2,301,284,873
☒	youtube 49227	Video, pictures	27,543,142,911	1,332,700,996
☒	https 443	Web browsing	25,099,189,954	2,716,677,923
☒	http 80	Web browsing	20,122,865,281	990,400,701
☒	netflix 49263	Video, pictures	19,230,789,792	1,008,864,482
☒	fortnite epic 49280	Gaming	13,919,355,017	467,373,401
☒	instagram 49266	Social networks	9,466,406,097	216,686,005
☒	facebook_video 49241	Video, pictures	5,618,589,875	188,273,560
☒	twitch 49265	Video, pictures	5,134,396,807	335,608,801
☒	udp unknown 65041	Unknown	3,966,260,605	1,836,133,549
☒	telegram 49224	Instant messengers	3,514,382,562	246,259,307
☒	quic 49218	Web browsing	3,368,569,530	286,677,905
☒	bittorrent 49165	P2P	2,999,358,513	821,370,224
☒	google_play 54313	Application servers	1,856,532,022	154,022,306
☒	whatsapp 49223	Instant messengers	1,769,536,134	254,226,257
	5,836			



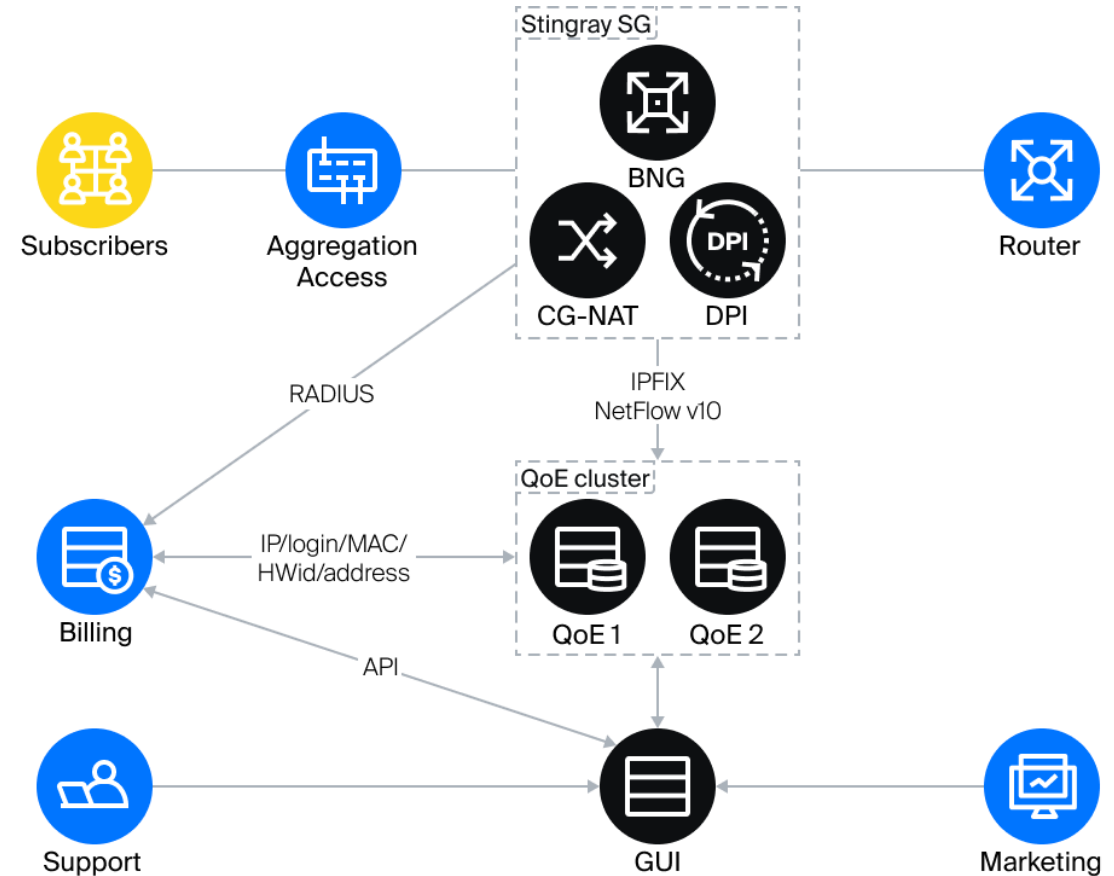
QoE Stor and GUI components are used to work with statistics

Quality Of Experience Module

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

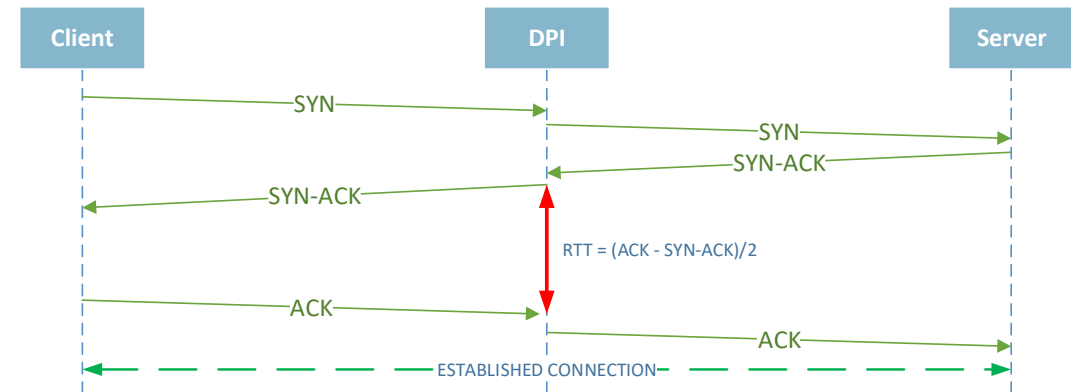
The statistics are transferred to special metrics which allow to define users' experience. It provides the operator with information about what kind of problems does he or she encounter.

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



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 (URL, Hostname, IP)



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
- Antivirus for sale



Technical and Support departments

- Deep troubleshooting and monitoring with using Round Trip Time and TCP retransmitting
- Identification of problems with client terminal equipment, Wi-Fi router, access switch and aggregation
- Search for optimal peering points and connections to higher providers

How To Use QoE Metrics?



Retention of subscriber base

- Identifying degradation in subscriber service quality and responding promptly
- Working with potential churn and analyzing the reasons for past churn
- Automating surveys after a master visit to a subscriber



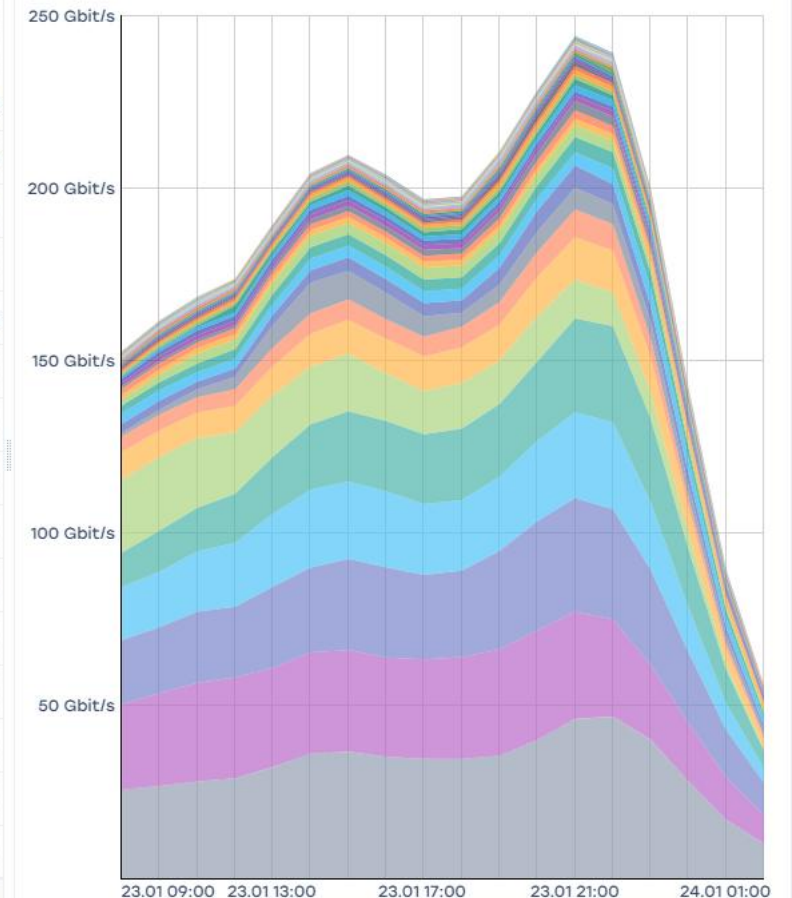
Increasing loyalty

- Conducting marketing campaigns on new tariffs, services, and offers, taking into account the interests of subscribers
- Providing information on channel utilization and quality via the subscriber's personal cabinet
- Notifications about BotNet activity in the network (relevant for IoT)
- Notification of a virus activity

Graphical User Interface

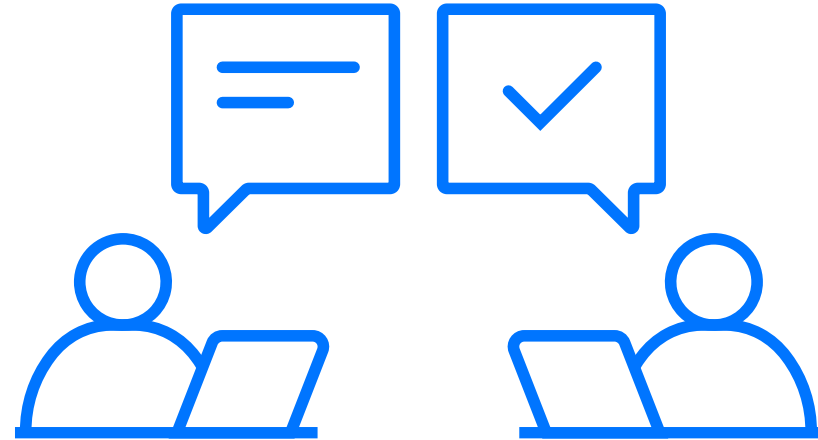
1. Restricting access by role
2. Logging user actions
3. Managing multiple SSG functions: monitoring and configuration
4. Service management
5. Creating tariff plans
6. Creating NAT pools
7. Working with QoE analytics
8. API integration

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☒	whatsapp 49223	Instant messengers	1,769,536,134	254,226,257
	5,836			



Support at every stage

1. Providing a test version for verifying functionality
2. Offering implementation support and consulting at every stage
3. Providing three levels of support: Next Business Day, 8x5, and 24x7
4. Allowing 24x7 call registration via email and phone



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