Nokia Video Broadcast Optimizer

Release 26

The Nokia Video Broadcast Optimizer (VBO) delivers low-latency, high-quality video and audio for IPTV and over-the-top (OTT) platforms, reducing visual distortions, minimizing channel delays, and optimizing bandwidth.

Featuring hybrid-routed unicast and multicast with support for a wide range of video formats, profiles, and codecs on a unified platform, the Nokia VBO redefines live IP video streaming for IPTV and over-the-top (OTT) services. It is middleware-agnostic and CPE-independent, and synchronizes playback ensuring seamless integration with existing systems. It is compatible with standard CAS and DRM systems, and its built-in SimulCrypt AES 128 cipher provides enhanced content protection, reduced live latency and improved head end availability.

A key component of the Nokia content delivery network (CDN) for Live solution, the Nokia VBO works in tandem with the Nokia 7750 Service Router (SR) and advanced Nokia Bell Labs video technologies to transform linear broadcast TV. This groundbreaking solution is specifically designed to cater to both OTT and IPTV subscribers simultaneously, representing a major leap forward in the evolution of live entertainment streaming.

The Nokia VBO delivers the following capabilities:

- VBO client software library for ARM or Intel 32-bit or 64-bit processors that runs on set-top boxes (STBs), PCs and IP-connected devices; for example, SmartTV, smartphone or tablet and HDMI dongle with the Nokia VBO client integrated. It is pre-integrated in many leading commercial chipsets and their software development kits.
- VBO appliance provides video traffic re-wrapper and encryption (optional) that conditions video traffic for FCC/RET, video denting, IP routed unicast and multicast streaming

Nokia Video Broadcast Optimizer

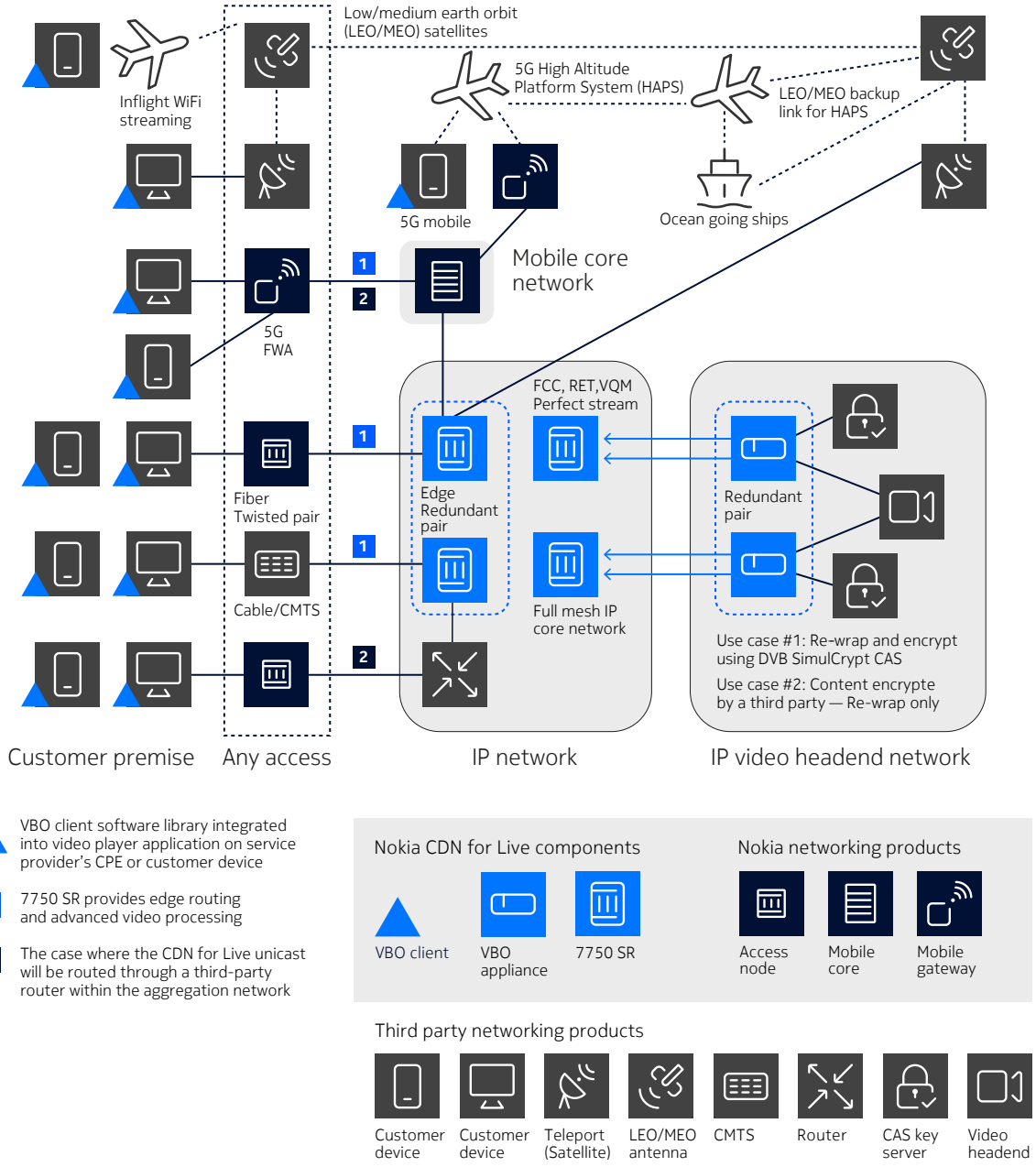
- Service discovery platform (SDP) for the operation of the service
- Video packets caching, replication and forwarding appliance for CDN for Live solution
- Client statistics counters, which provide valuable QoS and QoE information about the customer premises equipment (CPE) devices; combined with the CDN for Live appliance (FCC/RET) server statistics counters, the client statistics counters enable near-real-time, end-to-end network QoS and QoE monitoring and reporting
- SimulCrypt AES 128 cipher incorporated in the video headend VBO appliance (model: 5910 VBO-RC-X25) re-wrapper and cipher. The cipher supports a wide range of digital video broadcasting (DVB) SimulCrypt compliance key servers, Entitlement Control Message Generator (ECMG) and Entitlement Management Message Generator (EMMG)
- Enable Channel Playout by using content management system (CMS) and remotely or locally stored files contents (MPEG TS); for example, creating broadcast channels for movies, TV programs, sports, social media or advertisement channels from files

Nokia CDN for live IP video streaming

Figure 1 shows the network architecture for the Nokia CDN for live solution. The Nokia VBO appliance is deployed at the video headend or peering point where it supports redundancy and works in conjunction with the 7750 SR to enable service delivery and optimize the video format for transport and streaming over any access network and directly to end users.

The VBO client software library is located at the customer premise and can be integrated with the video player application or as a standalone module on managed service provider device (e.g. set top box), unmanaged device (e.g, smart TV) or a mobile phone.

Figure 1. Nokia CDN for live network architecture



The feature-rich Nokia 7750 SR provides a single video broadcast distribution platform, delivering high-performance edge and core routing for the IP network and enabling Fast Channel Change (FCC), Retransmission (RET), Perfect Stream, Video Quality Monitoring (VQM), enhanced QoS, multicast, and routed unicast streaming for both managed and unmanaged networks. For details on the the video processing capabilities of the 7750 SR, refer to the 7750 SR Extended Services Appliance (ESA) and Integrated Service Adapter (ISA) data sheets.

The 7750 SR, leveraging advanced Nokia Bell Labs-patented technologies, provides real-time, end-to-end monitoring and repair of packet impairments, from the video headend to subscriber end devices, ensuring seamless and instant video streaming with near-zero live latency from any distribution feed or peering point.

Features

- RET of lost or damaged packets (both unicast and multicast) at the application layer
- FCC supports routed unicast and multicast streaming
- Supports routed unicast and multicast streaming simultaneously under the same hardware and software platform
- Video denting (used in bandwidth-restricted networks or congested networks)
- IP video middleware-agnostic
- Standards-based (ETSI, DVB) independent of:
  - CAS
  - Network equipment manufacturer
- Open and vendor-supported integration toolkit for IP-connected devices
- Extensive operational statistics collection
- DVB/ETSI SimulCrypt standards interoperability with CAS key servers: ECMG and EMMG (from multiple vendors), and able to support multiple CAS simultaneously (e.g., multiple ECMs in the same MPEG transport stream)
- Scrambling modes supported:
  - Alliance for Telecommunications Industry Solutions IPTV Interoperability Forum Default Scrambling Algorithm (ATIS IIF IDSA)
  - Advanced Encryption Standard (AES) 128 Electronic Code Book (ECB) Clear End (CE)
  - AES 128 ECB Clear Begin (CB)
  - AES 128 ECB Leading
  - AES 128 ECB Tailing
  - AES 128 Cipher Block Chaining (CBC) CE
  - AES 128 CBC CB

Benefits

- Flexible, hierarchical deployment from edge and core to central office
- Removal or reduction of burst associated with typical channel change solutions and OTT streaming
- Highly scalable solution that can sustain both multicast-enabled and unicast-only networks and devices simultaneously, enabling seamless scaling
- Embedded appliance-based solution with low power and reduced carbon footprint
- Autonomously manages smooth transitions between routed unicast, multicast, and extended routed unicast modes, ensuring continuous playback and optimizing bandwidth and computational resource utilization over any access network
- Built-in DVB SimulCrypt cipher optimizes cost effectiveness and provides high availability. Using the VBO cipher, there is no loss of encrypted video services if there is any CAS server failure, cipher failover or video headend network failover.
- Valuable usage, performance and fault metrics
- The User Space Client Library, known for its maturity, reliability, and proven track record, can be seamlessly integrated into a variety of target operating systems and hardware. Examples include Linux OS, Android TV, Android Open

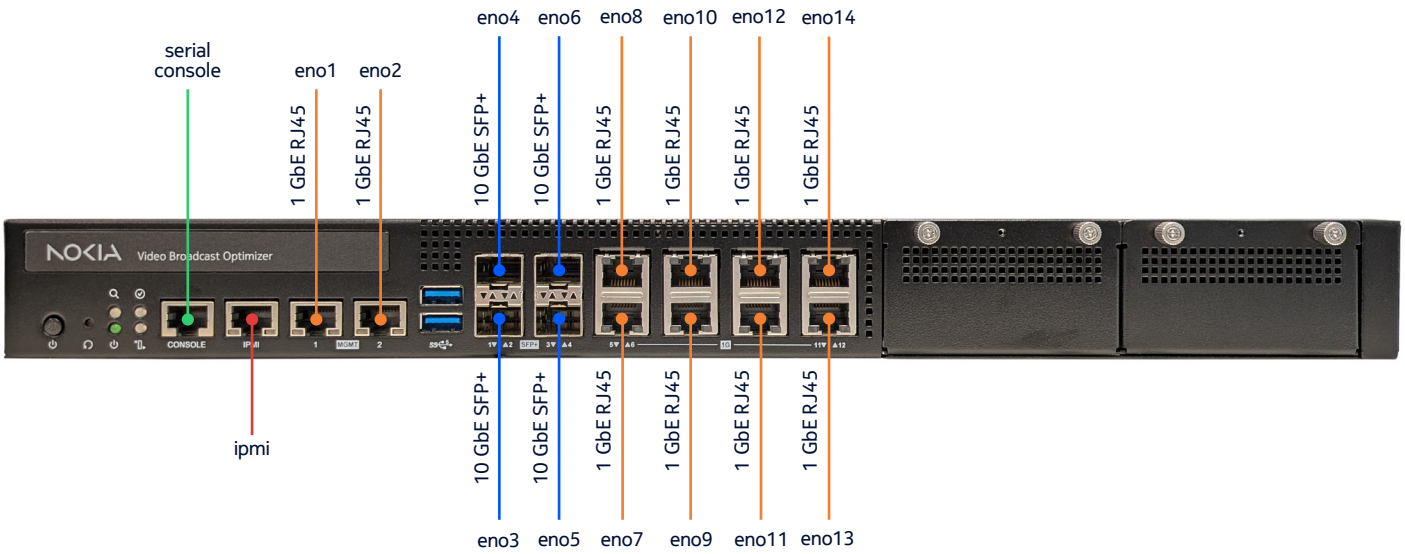
Source Project (AOSP), Tizen OS, webOS, RDK, and Raspberry Pi OS. The chosen operating system must support ARM or Intel 32-bit and or 64-bit client devices, including Set-Top Boxes (STB), Smart TVs, PCs, smartphones, tablets, or Raspberry Pi.

- Strengthens resilience against packet loss, localized congestion, and high round-trip times (RTTs), ensuring synchronization across all playback devices for uninterrupted streaming
- Achieving near-real-time live latency is possible for routed unicast-only or hybrid routed unicast and multicast streaming. The live latency closely resembles that of digital terrestrial television (DTT) or Direct-to-Home (DTH).

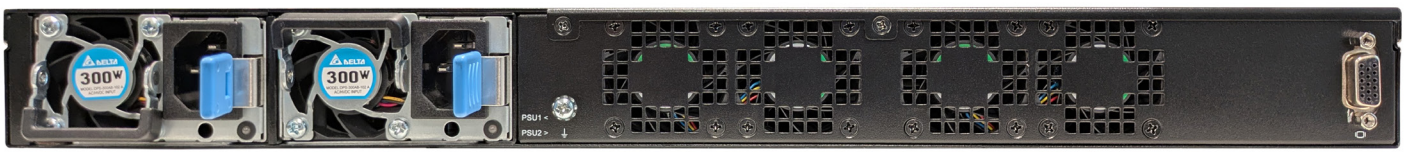
Figure 2: VBO appliance

Part numbers:

- 4 x 10GBase Ethernet (SFP+) and 8 x 10/100/1000BASE-T Gigabit Ethernet (GE) (RJ-45): 3HE30380AA
- Base software license: 3HE30388AA
- Scrambler base software license (optional): 3HE30387AA



Front panel view



Back panel view

Technical specifications

Protocols

- ETSI TS 102 034 V1.4
- IEEE 802.1AX-2008 Auto-detection of half/full duplex for electrical interfaces
- RFC 2250: MPEG-2 TS mapping in RTP
- RFC 3550: RTP RTCP protocol
- RFC 4585, RFC 4588: Retransmission
- Auto-detection of line speed
- Simple Network Management Protocol (SNMP) v2 and v3

SimulCrypt AES 128 cipher

- Advanced Encryption Standard (AES) (FIPS PUB 197)
- ATIS-0800001-v1 & v2 IPTV DRM Interoperability Requirements
- ATIS-0800006-v1& v2 IIF Default Scrambling Algorithm (IDSA) IPTV Interoperability Specification
- ATIS IPTV Standards Development via IPTV Interoperability Forum (IIF)
- ETSI TR 102 035 V1.1.1 (2002-04) Implementation guidelines of DVB SimulCrypt
- ETSI TS 100 289 V1.1.1 (2011-09) Support for use of the DVB Scrambling Algorithm version 3 within digital broadcasting systems
- ETSI TS 100 289 V1.2.1 (2014-03) Support for use of the DVB Scrambling Algorithm version 3 within digital broadcasting systems
- ETSI TS 101 197 V1.2.1 (2002-02) DVB SimulCrypt; HeadEnd Architecture and Synchronisation
- ETSI TS 103 197 V1.5.1 (2008-10) HeadEnd Implementation of DVB SimulCrypt

7750 SR: Video broadcast distribution platform

- Nokia 7750 SR ESA and ISA provides video packet processing and includes FCC, RET, Perfect Stream and VQM capabilities. Refer to the Nokia 7750 SR ESA and Nokia ISA data sheets for details.
- System support includes: 7750 SR-1, 7750 SR-1x,7750 SR-1s, 7750 SR-1se, 7750 SR-2s, 7750 SR-2se, 7750 SR-7s, 7750 SR-14s, 7750 SR-7, 7750 SR-12 and 7750 SR-12e

Re-wrapper/SimulCrypt Scrambler

- 1G interfaces
  - 2 x 1G ingress (bond mode =1, 4)
  - 2 x 1G egress (bond mode =1, 4)
  - SD, HD or Ultra-HD (UHD): 200 channels or 700 Mb/s ingress and egress
  - Picture-in-Picture (PiP): 350 channels or 700 Mb/s ingress and egress
- 10G interfaces
  - 2 x 10G ingress (bond mode =1, 4)
  - 2 x 10G egress (bond mode =1, 4)
  - SD, HD or UHD: 350 channels or 1200 Mb/s (1.2Gb/s) ingress and egress
  - PiP: 350 channels or 1,050 Mb/s ingress and egress
- 0.35 Mb/s to 30.5 Mb/s per channel

Client

- A POSIX (Portable Operating System Interface) embedded User Space Library (static or dynamic), will be integrated into ARM or Intel 32-bit or 64-bit CPE. Supported OS's are Linux OS, AOSP, Android TV, RDK, Tizen OS, webOS and other POSIX-compliant OS's. (Other OS support is available upon request).
- IP video middleware-agnostic and CAS- or DRM-agnostic VBO client library enables FCC, RET and routed unicast streaming in a multicast-deficient network or multicast streaming requests toward the CDN for Live servers

- Switches from unicast to multicast to complete the channel change in multicast-enabled networks or devices, or requests to extend unicast at nominal bitrate for very late Internet Group Management Protocol (IGMP) join or multicast-deficient networks or devices
- Able to support late IGMPv2 or v3 join
- Integration guidelines and CPE on-line support
- Reference design STBs, PC APP or IP-connected CPE device are available
- Enhanced interoperability client library is able to work together with an off-the-shelf media player (e.g., VLC media player, FFMPEG, gStreamer, or ExoPlayer) or other media players. Customization of the media player would improve the performance and security of the media player as well as content protection.

Equipment practice network processor unit

- Intel® Xeon® Processor D-2876NT 16 cores/32Threads, QAT and 2.0 GHz, TPM2.0 (Trusted Platform Module)
- Rocky Linux OS 8.9 base operating system
- Intelligent Platform Management Interface (PMI): IPMI v2.0 compliant with web interface

System memory

- 64 GB DDR4 ECC up to 2667 MHz

Ethernet ports

- 8 x copper 10/100/1000BASE-T, RJ-45
- 4 x 10G BASE Ethernet (SFP+) Fiber 10GE SFP+ cages

System I/O

- Serial port x 1
  - 1 x RJ-45 type console port
  - Supports up to 10 Mbaud; default setting 115,200 b/s 8-N-1
- 2 x USB 3.0 Standard-A female
- Management port 2 x GE RJ-45
- System internal storage

Accessories

- 2 x US and 2 x Europe power cable
- 4-post rack mount kit, rack mount brackets with handle

Mean time between failures (MTBF)

- 81903 hours without hard drive and fan included
- Solid state drive (SSD) MTBF: >1.5 million hours 24/7
- Fan life expectancy: 40,000 hrs.

Power

- Type: AC dual-redundant power supply units (hot swappable)
- Dual power supply rating: 100 V to 240 V AC at 50 Hz to 60 Hz, full range 300 W max.

Safety

- AS/NZS 62368.1
- CSA/UL 62368-1
- EN 62368-1
- IEC 62368-1 2nd and 3rd ed

Electromagnetic compatibility

- AS/NZS CISPR 32 Class A
- EN 55035
- EN 55032 Class A
- FCC Part 15 Class A
- ICES-003 Class A
- IEC CISPR 32 Class A
- IEC/EN 61000-3-2 Power Line Harmonics
- IEC/EN 61000-3-3 Voltage Fluctuations and Flicker
- IEC/EN 61000-4-2 ESD
- IEC/EN 61000-4-3 Radiated Immunity
- IEC/EN 61000-4-4 EFT
- IEC/EN 61000-4-5 Surge
- IEC/EN 61000-4-6 Conducted Immunity
- IEC/EN 61000-4-8 Power Frequency Magnetic Field

- IEC/EN 61000-4-11 Voltage Interruptions
- IEC/EN 61000-6-2 Industrial Environment EMC Immunity
- IEC/EN 61000-6-4 Industrial Environment
- EMC Emission
- VCCI Class A

Directives, regional approvals and certifications

- EU Directive 2011/65/EU Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (Recast) Directive (including Commission Delegated Directive (EU) 2015/863)
- EU Directive 2012/19/EU Waste Electrical and Electronic Equipment (WEEE)
- EU Directive 2014/30/EU Electromagnetic Compatibility (EMC)
- EU Directive 2014/35/EU Low Voltage Directive (LVD)
- CE Mark - Common Europe
- RCM Mark – Australia/ New Zealand
- VCCI Mark - Japan
- UKCA Mark - UK

Environmental

- Operating temperature: 0°C to 40°C (32°F to 104°F)
- Operating relative humidity: 5% to 85% non-condensing
- Vibration (operational; random): IEC 60068-2-64, 5 Hz to 500 Hz, 0.3 Grms
- Vibration (non-operational; sine): IEC 60068-2-6, 15 Hz to 500 Hz, 2G
- Shock (operational): IEC 60068-2-27, 10G, half sine, 11 ms duration

Mechanical

- Construction: Iron
- Mounting: 1U rackmount
- Dimensions:
  - Width: 438 mm (17.244 in)
  - Height: 43.7 mm (1.72 in)
  - Depth: 421.20 mm (16.582 in)
- Weight: 12 kg (26.46 lb)
- Country of manufacture: Netherlands, Europe

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs, which is celebrating 100 years of innovation.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland
Tel. +358 (0) 10 44 88 000

Document code: (May) CID205522