Nokia Unified Cable Access
Unlock capacity and cost savings in your cable access networks

Cable networks—like their telco network counterparts—are facing a major challenge in the form of exploding data traffic. Cable operators are being forced to invest heavily just to maintain performance levels. The hybrid fiber-coaxial (HFC) network has substantial latent capacity. However, legacy video and analog/RF transmission in the access network severely limit capacity and network flexibility. Additionally, the cable-specific equipment in the headend is expensive, occupies a lot of space and consumes a lot of power.

The Nokia Unified Cable Access solution solves the capacity, performance, agility and cost challenges faced by cable operators. Built on the Nokia Gainspeed portfolio of products and a virtualized Distributed Access Architecture (DAA), the solution eliminates cable-specific equipment from the headend, supports all cable access networks on a single, centrally controlled network, and provides unmatched flexibility in network architecture design. Headend functionality is virtualized and distributed to other parts of the network while preserving legacy edge quadrature amplitude modulation (EQAM) video assets and the existing coax connection to subscribers. Nokia’s Unified Cable Access solution enables operators to install more capacity, and extends IP/Ethernet closer to customers, improving service quality and future-proofing the network.

The cable challenge
Your hybrid fiber-coaxial (HFC) network was built for broadcast analog TV, not vast amounts of IP data traffic. Your HFC network still has vast coverage and the potential to provide more bandwidth to your customers, but increasing network capacity requires heavy investment in EQAM and cable modem termination system (CMTS) equipment. The capital expense, restricted physical space in headends, and inherent capacity and performance limitations of the analog/RF HFC network are significant constraints.

Converged Cable Access Platform (CCAP) was designed to alleviate some of these problems by integrating the physical EQAM and CMTS functions into a single device. However, that was before over-the-top (OTT) and IP video demand exploded and legacy video demand stagnated. Cable operators have sufficient EQAM infrastructure and don’t typically want to rip and replace it with CCAP, thus rendering CCAP a big CMTS and negating one of its main benefits. Perhaps most importantly, CCAP is only a stop-gap: the analog/RF constraints remain, and you leave power-hungry, cable-specific big iron devices in the headend. As you split your networks into smaller service groups, you are likely to face space limitations in your headends once again.

You need a solution that improves network capacity and performance while relieving the headend space and power burden; increases agility and simplifies operations while enabling new services; and leverages and unifies existing cable access networks while facilitating an elegant evolution to an all-fiber, all-IP future.

Unified cable access
Nokia’s Unified Cable Access solution delivers all of these benefits to you. Built on the Nokia Gainspeed portfolio of products, Nokia’s solution for unified cable access applies the principles of network functions virtualization (NFV) and software-defined networking (SDN) to the cable headend to create a virtualized Distributed Access Architecture (vDAA). Headend functionality is distributed to other parts of the network while preserving all legacy EQAM video assets and the existing coax connection to subscribers.
Nokia’s Unified Cable Access solution eliminates the constraint for you to choose between R-PHY and R-MACPHY approaches. Nokia’s virtual cable modem termination system (vCMTS), which includes the DOCSIS MAC, runs as an independent process anywhere in the network. You can even convert a Gainspeed cable access node from R-PHY to R-MACPHY, or vice versa, with a simple software configuration.

A central Access Controller manages the whole system and ensures that the new architecture is easily deployable in your existing network environment. Within the network, the controller looks like a CCAP in the headend/hub, but seamlessly integrates with the existing OSS/BSS. IP/Ethernet is extended all the way to the optical node, and the headend is digitized, shortening the analog/RF transmission length to only the “last mile” between the Access Node and the customer premises.

Furthermore, the architecture provides unified access, delivering any service across any access media—fiber or coaxial cable—in a single solution with central, transparent control of everything.
Benefits of unified cable access
Built around a vDAA, Nokia’s Unified Cable Access solution significantly reduces the amount of equipment required in the headend, thus enabling you to install more capacity and consolidate real estate. Less physical equipment means lower costs and simplified management. Our approach also extends IP/Ethernet all the way to the access node, which improves fiber efficiency by a factor of 10. Using an SDN controller in the data center increases agility and enables faster time-to-market for new services.

The Unified Cable Access solution provides unmatched flexibility for your cable network architecture. It is the only offering in the market that enables you to deploy the same physical node as an R-PHY or R-MACPHY device, and even switch from one mode to the other with a simple software configuration.

- Reduces headend footprint.
  - Frees up rack space and real-estate for capacity expansion or consolidation.
  - Lowers power consumption.
- Simplifies operations and increases agility by virtualizing functionality in a central controller.
  - Faster time to market for new services.
  - Easier capacity upgrades.
- Eliminates analog optics.
  - Lowers costs with standard digital optics.
  - Longer reach allows fiber-deep deployments and consolidation of hubs.
- Improves signal quality.
  - Fewer signal issues, customer service calls and truck-rolls.
  - Increased network performance, including DOCSIS 3.1 capacity.
- Enables maximal architecture flexibility.
  - Cable access nodes can be software-configured as either R-PHY or R-MACPHY.
  - Nodes can be changed between modes on the fly.
  - A single controller can concurrently manage all types of nodes.
- Extends IP all the way to the node.
  - Higher capacity to the node through increased fiber efficiency.
  - Supports full spectrum DOCSIS 3.1; Ready for Full-Duplex.
- Leverages existing video equipment.
  - Uses existing broadcast and narrowcast EQAMs.
  - Handles proprietary encryption.
  - Preserves the set top box (STB) installed base.
- Future-proofs the network.
  - Supports all cable access networks including HFC (R-PHY/R-MACPHY), passive optical networking (PON) and point-to-point Ethernet.
  - Enables an elegant evolution to an all-fiber, all-IP network.

In numbers. Comparing Nokia’s Unified Cable Access solution and a traditional CCAP solution, based on a typical head-end supporting 800 service groups:

8-fold reduction in power consumption.
7-fold reduction in rack space.
0 transmission distance limitations.
The Gainspeed product family for Unified Cable Access
Nokia Gainspeed Access Controller

The Nokia Gainspeed Access Controller is the “brain” that centralizes management of the Unified Cable Access solution. The Access Controller leverages SDN to virtualize the CCAP and centralize control and management of the entire Unified Cable Access solution.

Built on an industry-standard Linux OS, the Access Controller can be installed on commercial off-the-shelf (COTS) hardware anywhere within the operator’s network and can run on bare-metal servers or a virtual machine.

Operators can choose between a CLI and Web GUI for on-board system management, or leverage SNMP or NETCONF to configure and control the Access Controller from any third-party management application. From a single CLI, point-and-click interface, or programmatically using an SDN orchestrator, operators can configure and manage a large and widely deployed network of Access Nodes.

With full support for standard IPDR schemas and standard CableLabs, SCTE, IP networking and DOCSIS management information bases (MIBs), the solution easily integrates into existing billing and management systems.

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>• CLI and Web GUI for configuration and management.</td>
<td>• Centralized cloud-based management framework.</td>
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<td>• Customizable network dashboard to align the interface with operational workflows</td>
<td>• Simple and intuitive configuration and management of all attached network devices.</td>
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<td>• Centralized software license management.</td>
<td>• Instant access to the entire Unified Cable Access deployment including maintenance state, channel and network statistics and operational alarms/events.</td>
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<tr>
<td>• CCAP OSSI-based configuration and management framework.</td>
<td>• Seamless integration with existing OSS/BSS systems.</td>
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<td>• Geographic representation of nodes using Google Maps.</td>
<td>• Pay-as-you-grow pricing model with the use of flexible software licenses.</td>
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<td>• SSHv2, SSL for secure remote access.</td>
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<td>• Paired deployment for high-availability.</td>
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<tr>
<td>• Scales to support hundreds of Access Nodes per Access Controller instance.</td>
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Nokia Gainspeed Video Engine

The Nokia Gainspeed Video Engine, available in both a rack server (1RU)* and 14-blade chassis form factors, protects cable operators’ deployed EQAM investment and enables a smooth migration to IP video. It terminates RF video services in the hub, enabling Ethernet transport to Nokia Gainspeed Access Nodes.

The Video Engine seamlessly and transparently integrates into an operator’s existing video distribution network, and enables the operator to dramatically increase IP capacity without touching the existing QAM infrastructure.

Since video encryption and signaling are transparent to the Video Engine, it can be deployed in any market, regardless of the set top box or encryption type.

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<tr>
<td><strong>Digital and analog video services</strong></td>
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<tr>
<td>• Innovative, patented mechanism transforms existing QAM video line-up and set top box control to Ethernet.</td>
<td>• Preserve legacy analog and digital video services and set top box installed base.</td>
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<tr>
<td>• Transparent to the video distribution infrastructure and video EQAMs.</td>
<td>• No manual intervention required for set top boxes.</td>
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<td>• Works with any channel line-up.</td>
<td>• No change to content protection and encryption schemes.</td>
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<tr>
<td>• Works with any video encryption scheme (Cisco PowerKey, Arris DigiCipher and Privacy Mode, DVB Simulcrypt, etc.)</td>
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<tr>
<td>• Supports transparent transport for set top box out-of-band (OOB) control channels, as defined in SCTE-55-1 and SCTE-55-2, via circuit emulation.</td>
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<td><strong>IP multicast efficiency</strong></td>
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<tr>
<td>• Leverages standard IP multicast to create video streams once and replicate them to selected Access Nodes.</td>
<td>• Flexibly customize the size of the video service group.</td>
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<td>• Eliminates the need to manage a complex hierarchy of combiners, splitters and amplifiers.</td>
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<td><strong>Superior RF performance</strong></td>
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<tr>
<td>• Transports video services to Access Nodes as IP multicast packets instead of QAM/RF carriers.</td>
<td>• Dramatically improves Signal-to-Noise Ratio (SNR) and Carrier-to-Noise Ratio (CNR).</td>
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<td>• Greatly increases RF performance resulting in fewer drop-outs, improved end-user experience and reduced operator truck-rolls.</td>
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<tr>
<td><strong>Simple centralized management</strong></td>
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<tr>
<td>• Centralized management from the Nokia Gainspeed Access Controller.</td>
<td>• Remote configuration and management of one or many Video Engines increases operational agility.</td>
</tr>
<tr>
<td>• Choice of CLI or web GUI for on-board system management, or use SNMP or NETCONF to configure and control the Video Engine from any third-party management application.</td>
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Nokia Gainspeed Access Node SC-2D

Within the Unified Cable Access solution, the Gainspeed Access Node SC-2D is an essential element of the virtualized Distributed Access Architecture. The Access Node SC-2D performs cable-specific functions typically carried out in the CCAP. It can be software-configured as either a Remote-PHY device, handling RF modulation, or a Remote-MACPHY device, performing RF modulation and DOCSIS processing.

It enables operators to cost effectively add DOCSIS channels, splitting nodes and service groups. Cable operators can deliver services to all customers without adding equipment in congested hubs and head ends.

The Access Node SC-2D is the industry’s first Full Spectrum DOCSIS solution with support for up to 158 downstream channels, and it supports DOCSIS 3.1, making it ideal for high-capacity business and residential services.

Housed in an aluminum alloy die-cast enclosure, the Access Node SC-2D is designed to operate in harsh outdoor environments.

### Features

**Unmatched architecture flexibility**

- Software-defined universal “R-PHY/R-MACPHY” node.
- vCMTS Anywhere enables R-PHY and R-MACPHY on the same network.

**Benefits**

- Enables node to be changed from R-PHY to R-MACPHY with software configuration.
- Allows MSOs to deploy best implementation for each node’s specific use case.
- Ensures interoperability and investment protections.

**Improved RF performance and management**

- Flexible RF signal generation and detection in the node, supporting up to 1.2 GHz of spectrum.

**Benefits**

- Eliminates analog transmission between the hub and the node.
- Dramatically improves Signal-to-Noise Ratio (SNR) and Carrier-to-Noise Ratio (CNR).
- Fewer drop-outs, improved end-user experience and reduced operator truck-rolls.
- Auto gain adjustment simplifies installation, deployment, and maintenance.

**Increased fiber capacity and management**

- Industry’s first DOCSIS 3.1-ready platform.
- Supports up to 158 downstream and 12 upstream DOCSIS 3.0 channels.
- Ability to bond up to 128 downstream channels in a single bonding group.
- > 8 Gb/s of capacity to a single service group.

**Benefits**

- Operators can dramatically increase the service tiers in terms of both quality and capacity (> 1 Gb/s).
- DOCSIS 3.1 enables further scaling when needed.
- All-IP network reduces cost and complexity of analog in the network.
<table>
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<tr>
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<td><strong>Optimized fiber utilization</strong></td>
<td>• Multiple devices can share the same backhaul interface. • Supports additional sub-tended Access Node SC-2Ds, Wi-Fi APs and LTE backhaul, or point-of-service fiber drops. • Can cost effectively multiplex up to 80 wavelengths on a single fiber.</td>
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<td>• Standard 1 Gigabit and 10 Gigabit Ethernet interfaces. • Embedded Metro Ethernet switch and traffic manager.</td>
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<td><strong>Video transport (digital and analog)</strong></td>
<td>• Preserve legacy analog and digital video services and set top box installed base. • No manual intervention required for set top boxes.</td>
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<td>• Full spectrum output for 158 QAM channels at 6 MHz or 116 QAM channels at 8 MHz. • Remodulates incoming MPEG MPTS onto the appropriate downstream channel. • Supports transparent analog transport for set top box out-of-band control, HMS and NTSC/SECAM/PAL analog video programming. • Scales up to 240 MHz of analog video.</td>
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<td><strong>Flexible spectrum allocation</strong></td>
<td>• Simple modification of spectrum and channel plans improves operational and business agility. • Create fully customized channel plans. • Tune channel plans per service group.</td>
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<tr>
<td>• Virtual” combination of digital and analog video. • Simple point-and-click interface. • Support for up to 2 service groups per SC-2D.</td>
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<tr>
<td><strong>Simplified operations and management</strong></td>
<td>• Remote configuration and management of all Access Node SC-2Ds increases operational agility. • Connect to the device over Wi-Fi; no need for physical access to the device.</td>
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<tr>
<td>• Centralized management from the Nokia Gainspeed Access Controller. • Unique WLAN console.</td>
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Nokia, your partner for cable network transformation

Nokia is the world leader in fixed access technologies. We have 20+ years of broadband experience, and our equipment powers some of the most advanced fiber networks in the world.

Our solutions align with the major challenges facing cable networks today and allow cable operators to evolve services to leverage the cloud-enabled broadband networks of tomorrow.

Our field proven and award-winning solutions serve hundreds of cable and telecom operators around the world.
About Nokia
Nokia is a global leader in the technologies that connect people and things. Powered by the innovation of Bell Labs and Nokia Technologies, the company is at the forefront of creating and licensing the technologies that are increasingly at the heart of our connected lives.

With state-of-the-art software, hardware and services for any type of network, Nokia is uniquely positioned to help communication service providers, governments, and large enterprises deliver on the promise of 5G, the Cloud and the Internet of Things. http://nokia.com

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