



FTTH Solutions

for innovative
optical networks

20 years experience in FTTH technology

HUBER+SUHNER Bktel develops and produces active and passive components for modern FTTH and HFC broadband networks. Our products enable the realization of fiber optic network structures that provide future-oriented data, telephony and TV services.

With more than 20 years of experience in the research and development of fiber optic network equipment as well as production at our headquarter in Hückelhoven, Germany, HUBER+SUHNER Bktel is a partner you can rely on.

[FTTH solutions overview | page 4](#)

[Fiber to the home - Products designed for the future | page 6](#)

[Network architectures | page 8](#)

[Customer Premises Equipment | page 10](#)

[RF Video Overlay](#)

- [Optical Transmission | page 11](#)
- [Optical Amplification | page 12](#)
- [Optical Splitting | page 15](#)

[Network Management | page 17](#)

[Video Overlay Provisioning of Network Termination Units | page 18](#)

[Our services | page 19](#)

Fiber-to-the-Home: The Ultimate Solution

The dominant role of FTTH (Fibre-to-the-home) topologies in the creation of next generation access networks is widely acknowledged. With a virtually unlimited bandwidth and the ability to transmit a large number of services in parallel, the performance is unattainable for competing technologies. As a leading company in the network industry HUBER+SUHNER Bktel offers a comprehensive portfolio of products, from headend to network infrastructure up to the end customer equipment.

The advantage of Optical Ethernet

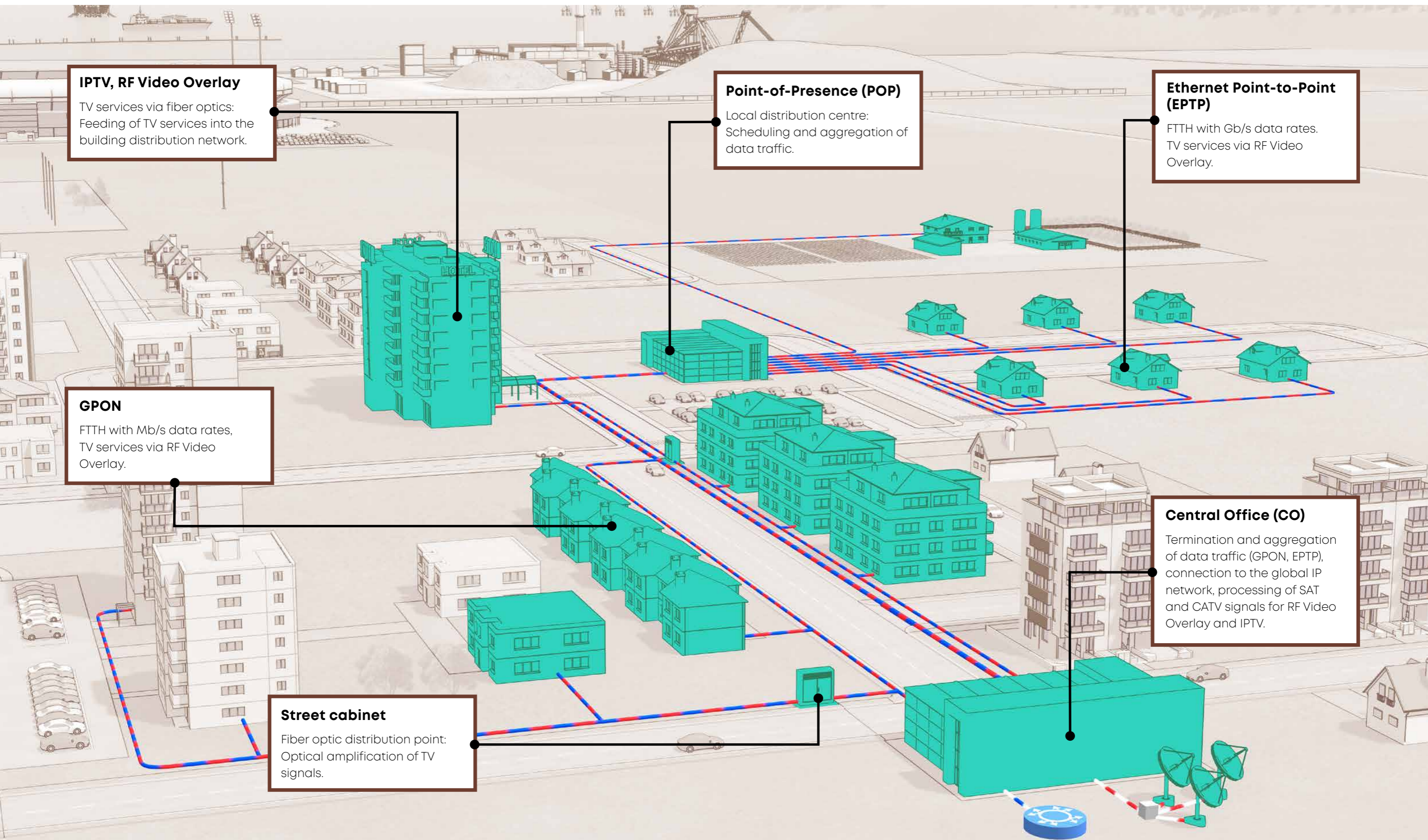
The topology and the used protocols are decisive factors in the design of FTTH networks. Although supporting all common technologies for point-to-point and point-to-multipoint networks, HUBER+SUHNER Bktel sees the merits of optical point-to-point Ethernet networks in the ease of handling with respect to design and maintenance, excellent scalability and the transmission capacity, which can be simply adapted to the needs of each customer and upgraded to multiple Gigabit Ethernet data rates in up- and downstream.

RF Video Overlay

IPTV and Streaming Video Services can take up a considerable portion of the available capacity of the entire FttH network and thereby reduce the available bandwidth for data services at the end customers connection. RF Video Overlay systems are a practical way to relieve your network from these TV services, enabling you to provide future proof broadband offerings without any impairments. The TV signal is separated from the data stream and fed parallel into the optical network. It will be transmitted either on a separate optical fiber or by using three wavelengths on the same fiber. By integrating different CATV and SAT signals, a comprehensive TV programme bouquet can be assembled. Independent of the connection of the end users the overlay solution can be implemented in any FTTH topology. Our components can also be used explicitly in point-to-multipoint FTTH network solutions such as xPON (GPON, 10GPON, GSPON, NGPON2).



FTTH solutions overview



Fiber to the Home

Connecting today and beyond

HUBER+SUHNER BKtel has developed an extensive product line especially for FTTH network technology. This product line is based on the technically matured network topology of the Optical Ethernet and broadcast video distribution (RF Video Overlay). This allows the design of cost-effective fiber access networks that offer high performance and guarantee optimum reliability.

Our comprehensive product portfolio offers optical transmitters, optical amplifiers and passive optical components such as splitters and WDM filters for RF Video Overlay as well as a series of customer premises equipment units. The equipment is designed with a future proof system concept and a unified management system. Interoperability with all major metro access switches present in the market, as demonstrated in numerous projects, show seamless integration in turnkey FTTH systems. A complete management solution including autoprovisioning and remote firmware upgrade is available.



XON1300 Series - designed for living rooms

Multigigabit FTTH: EPtP with up to 2.5 Gb/s

Our FTTH concept is based on a clear separation of the optical network termination device and the Residential Home Gateway (RHG). Depending on the individual provider's demand a preselected RHG, or a subscriber chosen router, which provides the latest hardware for VoIP, WIFI, IPTV and other media services, can be connected to the XON1300 to enable the Home Network (LAN) with a ultra high speed Internet access supporting Multigigabit with up to 2.5 Gb/s.



RF Video Overlay: Multiple options for TV services

All CPEs from HUBER+SUHNER BKtel are prepared for RF Video Overlay. The kind of signals transmitted by the RF Video Overlay can come from a whole range of different sources. The classical approach is the transmission of cable television (CATV) consisting of analog and digital cable TV (DVB-C, DVB-C2). However, also terrestrial digital TV (DVB-T, DVB-T2) and satellite TV (DVB-S, DVB-S2) can be provided. Moreover digital terrestrial or cable TV in combination with satellite TV services can be offered simultaneously even as an Open Access video system with two different video service providers. The output signals of RF Video Overlay solutions are inherently compatible with standard TV or today's HD TV sets, assuming that it is equipped with an appropriate tuner or uses an external Set Top Box. The attached table shows the enormous DVB data rate capacity of the different RF Video Overlay options: The RF Video Overlay system offers between 3 and 7 Gb/s of video broadcast transmission capacity, which is equivalent to hundreds of TV channels.

RF video Overlay solution	No. of M TV channels (PAL, NTSC)	No. of QAM256 channels (DVB-C)	No. of QAM64 channels (DVB-T)	No. of 8-PSK channels (DVB-S)	DVB total data (Gb/s)
CATV	35	59	-	-	3,04
DVB-C	-	94	-	-	4,85
DVB-T	-	-	94	-	2,98
CATV+1xDVB-S(2)	35	59	-	25	5,54
DVB-C+1xDVB-S(2)	-	94	-	25	7,35
DVB-T+1xDVB-S(2)	-	-	94	25	5,48

Notes:
 CATV: average number of TV channels
 AM-TV: Transmission usually with 36 FM radio channels
 DVB-T: QAM64 and 31.688 Mbit/s in 8 MHz and 7/8 FEC rate
 DVB-C: QAM256 with 6.8 MSym/s and 188/204 FEC rate
 DVB-S(2): L-band 950.2200 MHz with 8-PSK and 36 MSym/s, 9/10 BCH-LDPC and 188/204 RS FEC 188/204 FEC rate

Offload IP traffic

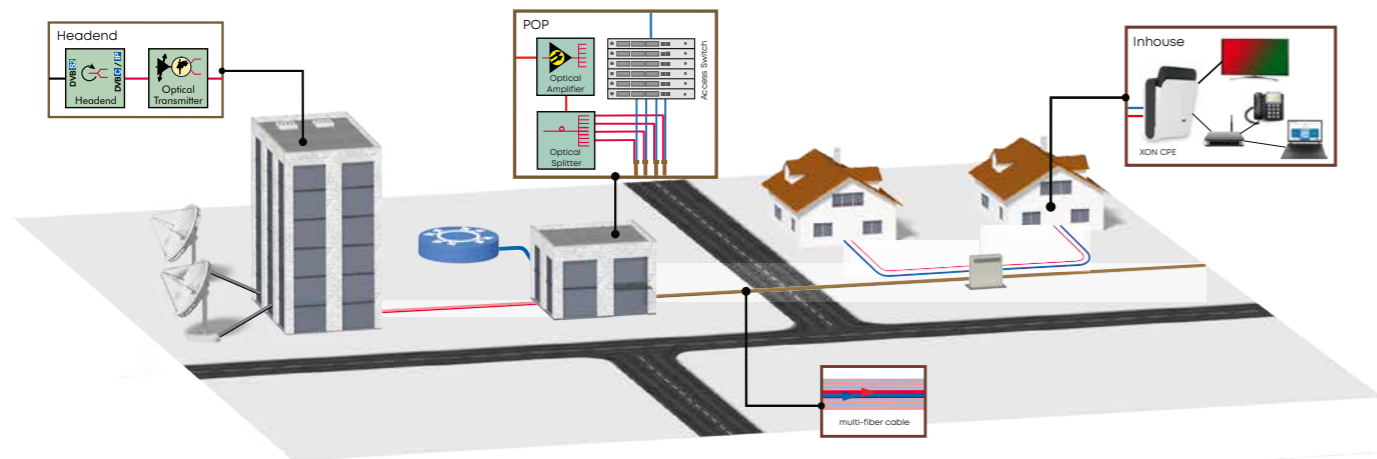
The advantages are obvious: IP traffic is not blocked by TV content, thus reducing complexity and the required capacity. The network operator can offer its end customers an extremely wide variety of cable TV channels together with satellite services as required. The subscribers' TV service can be kept as it was or even enhanced depending on the service on offer.

FTTH network architectures

Optical Ethernet and RF Video Overlay: Two broadband connections to your customer

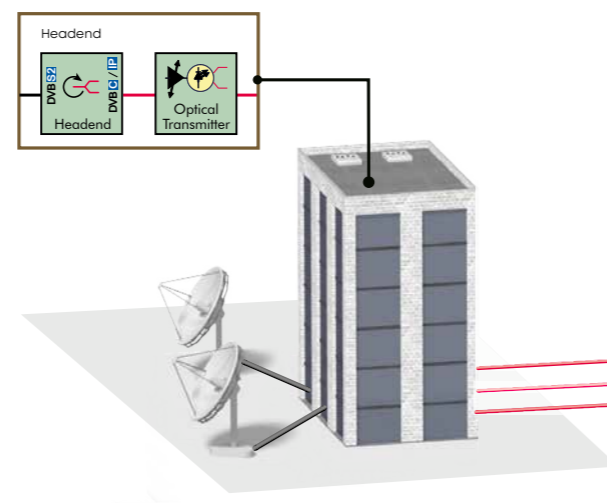
Optical access networks based on point-to-point Ethernet offer a standardized environment with equipment available from several vendors. Since a well known technology is used these networks are easy to plan and manage. Scalability is excellent and data rates can be adapted to the requirements of the individual customer. Gigabit Ethernet (1 Gb/s and 2.5 Gb/s) is technically feasible.

Broadband video connectivity over optical fiber based on standards set by the cable-TV industry provides a bandwidth equivalent to several Gb/s.



The figure above illustrates the set up of a modern FTTH network with its key elements: The POP (the Point of Presence, which can be installed in a building or an outdoor cabinet containing active and passive equipment) and the fiber optic feeder and drop cables. In case of point to point FTTH each subscriber has a dedicated fiber connection from the POP to his premises. At the POP service providers have access to the FTTH network in order to launch their services.

Fig. 1 and Fig. 2 display two general architectures used for point-to-point FTTH networks with RF Video Overlay. Fig. 1 shows the deployment of two separate fibers, one dedicated for data, one for the RF video. Fig. 2 shows the network based only on one fiber. In this case the two services are multiplexed on 3 different optical wavelengths: 1550 nm for RF Video Overlay and 1490 nm/1310 nm for the bidirectional data connection.



Ethernet Point-to-Point Topology (EPTP) Two-Fiber-Solution

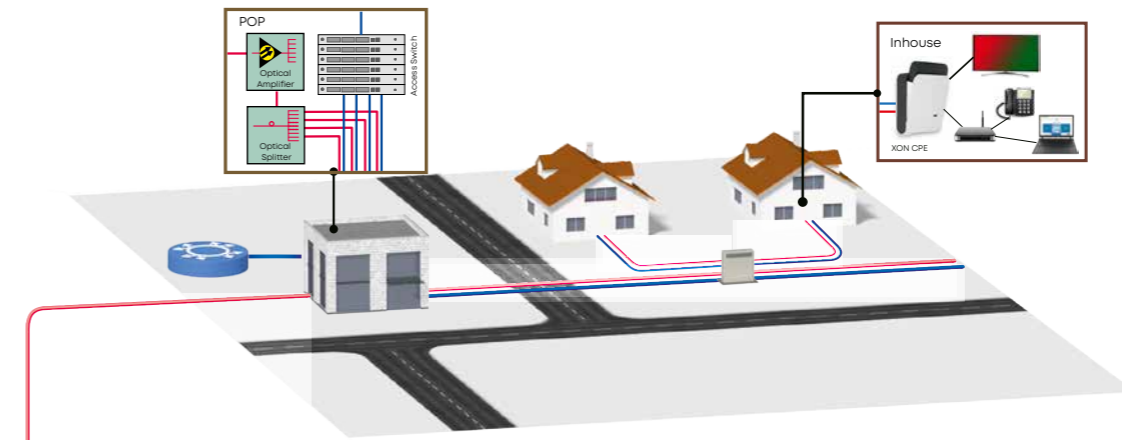


Fig. 1. The two-fiber solution for point-to-point FTTH networks: A separate fiber for data/telephony and TV-video

Ethernet Point-to-Point Topology (EPTP) One-Fiber-Solution

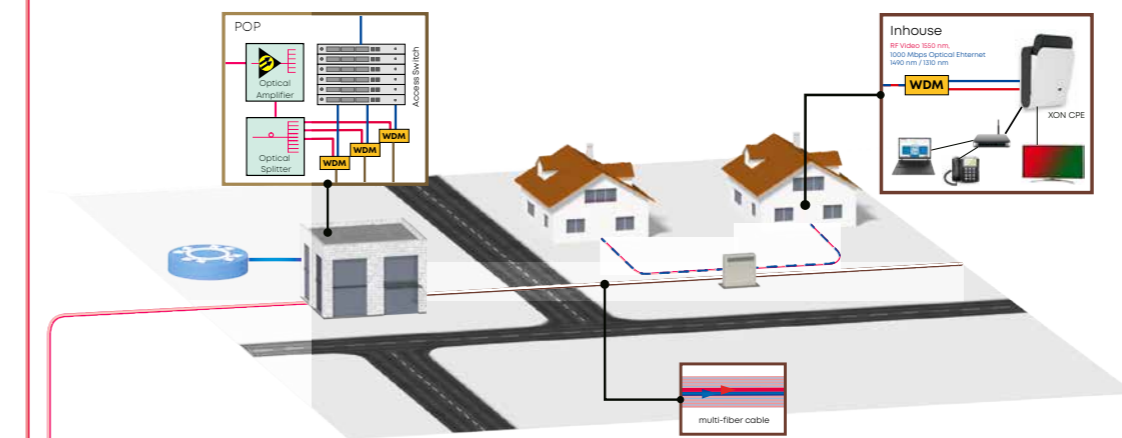
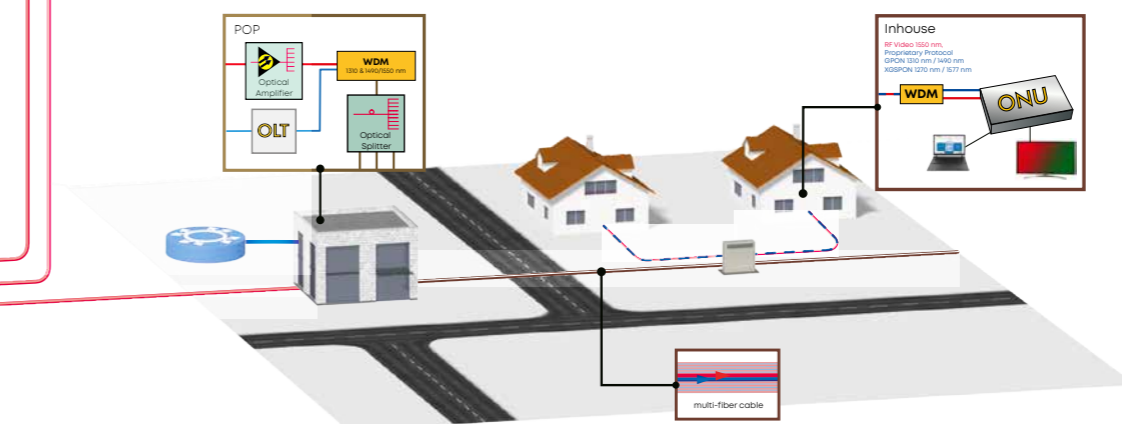


Fig.2. The one-fiber solution decreases the required fiber deployment by a factor of two, so that installation costs decrease dramatically. Port-density in the POP stays the same so that potentially only half of the POPs are needed.

PON and RF Video Overlay

Also point-to-multipoint FTTH networks such as GPON and XGSPON can integrate RF Video Overlay.



The RF Video Overlay can be realized in point-to-multipoint architectures. HUBER+SUHNER Bktel offers a complete range of active equipment to support this application.

Customer premises equipment

Modern and functional

The XON1300 is a member of the XON CPE family. This family of products addresses the main challenges currently existing in the FTTH industry: Small footprint, low power consumption and reduced equipment and operational cost, especially in the installation and maintenance process. Acting as full managed CPE devices, the XON1300 fit into all FTTH network concepts. OAM, TR069 and SNMP make it possible to efficiently supervise the fibre link and the status of the CPE.

Smart system concept: True end-customer self installation

The XON1300 housing allows a self installation and a self connection of the CPE by the untrained end-customer. Thanks to the well-designed sliding mechanism, the XON1300 can easily be inserted in the passive fiber termination unit XON30.W, which furthermore offers a sophisticated fiber management. This allows a flexible usage of gas blocker, optical couplers and standard splice holders. The XON30.W eases installation and fits into all FTTH application scenarios.



Key features

XON1300 Full IP managed Switch:

- TR-069 Autoprovisioning
- Multigigabit WAN interface with up to 2.5 Gb/s
- 4 x 1000 Base-T LAN port
- IEEE802.1Q VLAN handling
- Quality of Service / Class of Service
- Bandwidth Control
- Remote Diagnostics via SNMP
- Ultra low noise CATV receiver

General Technical Data:

- Size: 48 x 150 x 150 mm (XON30.W)
- Weight: < 500g (XON1300.SC)
- Power Supply: 6V DC
- Power Consumption: < 4.5W (XON1300.SC)

Available units

- XON1300.SC (One- or Two-Fiber-Solution available): Managed Switch + CATV receiver
- XON1300.S: Managed Switch
- XON1300.C: CATV Receiver
- XON1300.C-WDM: CATV + PON WDM
- XON1300.P: Passive network termination
- XON1300.P-WDM: Passive network termination + PON WDM

RF Video Overlay

Optical transmission

A key component of an RF Video Overlay system is the optical transmitter which converts the electrical TV signal into an optical modulated signal. The optical wavelength is generally chosen in the range of 1550 nm because optical amplifiers with high performance are available for this wavelength. We offer a range of optical transmitters: The high end external modulated type is required for extended networks with large distances to be covered. Direct modulated transmitters are only useful for short distances and their usage is therefore restricted to small networks with locally available CATV or satellite TV feeds.

External modulated transmitter

- 1550 nm high performance Optical BC (broadcast) Transmitter for FTTH networks
- Bandwidth ESxE12 (CATV): 47 ... 1218 MHz
ESxE33 (CATV + SAT): 70 ... 862 MHz CATV 950 ... 3250 MHz SAT-TV
- Long distance > 100 km
- SBS threshold adjustment ESxE12 (CATV): up to +19 dBm for 65 km fiber
ESxE33 (CATV + SAT): up to +15 dBm for 40 km fiber
- Automatic Gain Control (AGC)
- Up to 2 x 13 dBm optical output power
- Redundant powering
- Element controller NECxE integrated



Direct modulated, amplified optical transmitter

- RF Video Overlay with 1550 nm wavelength in FTTH networks providing very high optical budget (GPON compatible)
- Bandwidth 1218 MHz
- Optical output power 8 dBm or 16 x 21 dBm
- Up to 10 km distance
- Element Controller NECxE-E integrated
- Redundant powering



RF Video Overlay

Optical amplification

The optical amplifier, the second key component, is required in order to recover the optical signal level after transmission over long fiber distances (inline amplifier, EDFA) or in order to boost its level for the final distribution (YEDFA) to a large number of end users.

Optical amplifier (EDFA)

- Optical amplification of CATV and SAT signals in FTTH networks, 1540 – 1560 nm
- Adjustable output power
- Constant Output Power Mode and Constant Gain Mode
- Redundant powering
- Supervision of optical input level, optical output level, pump laser current, module temperature and powering
- Integrated element controller



OVxEnxxx

High power optical amplifier (YEDFA)

- RF Video Overlay in FTTH networks, used as booster amplifier on the last mile
- Optional: WDM filter at each output for multiplexing of G(E)PON, XG(S)-PON and 10G-EPON IP signals
- Amplification of CATV and SAT signals in FTTH networks, 1545 – 1563 nm
- Integrated pre-amplifier
- Adjustable output power
- Redundant powering
- Supervision of optical input level, optical output level, pump laser current, module temperature and powering
- Integrated element controller



OVxEnnxxx(-IPX)

Available versions

- 16 x 17 dBm (SC/APC or LC/APC) in 1 RU*
- 32 x 17 dBm (LC/APC) in 1 RU*
- 64 x 17 dBm (LC/APC) in 2 RU*
- 8 x 21 dBm (LC/APC) in 1 RU*
- 16 x 21 dBm (LC/APC) in 1 RU*

* RU = Rack Unit

High power optical amplifier with integrated optical input switch (YEDFA)

- RF Video Overlay in FTTH networks, used as booster amplifier on the last mile
- Optical switch for nominal and redundant optical input signal (input signal redundancy)
- Optional: WDM filter at each output for multiplexing of G(E)PON, XG(S)-PON and 10G-EPON IP signals
- Amplification of CATV and SAT signals in FTTH networks, 1545 – 1563 nm
- Integrated pre-amplifier
- Adjustable output power
- Redundant powering
- Supervision of optical input level, optical output level, pump laser current, module temperature and powering
- Integrated element controller



OVSxEnnxxx(-IPX)

Available versions:

- 32 x 20 dBm (LC/APC)
- 64 x 19 dBm (LC/APC)

Optical amplifier for outdoor applications (EDFA)

- Optical amplification of CATV and SAT signals in FTTH networks, 1540 – 1560 nm
- Adjustable output power
- Constant Output Power Mode and Constant Gain Mode
- Redundant powering
- Supervision of optical input level, optical output level, pump laser current, module temperature and powering
- Integrated element controller
- Outdoor hardened device



KOAxEnxxx

Available versions:

- 4 x 17 dBm (LC/APC)
- 8 x 17 dBm (LC/APC)

RF Video Overlay

Optical amplification

Optical amplifier for outdoor applications (YEDFA)

- RF Video Overlay in FTTH networks, used as booster amplifier on the last mile
- Optical switch for nominal and redundant optical input signal (input signal redundancy)
- Optional: WDM filter at each output for multiplexing of G(E)PON, XG(S)-PON and 10G-EPON IP signals
- Amplification of CATV and SAT signals in FTTH networks, 1545 – 1563 nm
- Integrated pre-amplifier
- Adjustable output power
- Redundant powering
- Supervision of optical input level, optical output level, pump laser current, module temperature and powering
- Integrated element controller
- Outdoor hardened device
- Option for optical input switch (KOAS type)



KOAxEnnxxx(-IPX)

Available versions:

- 32 x 17.0 dBm LC/APC) in 2 RU*
- 16 x 20.0 dBm (LC/APC) in 2 RU*
- 8 x 20.0 dBm (LC/APC) in 1 RU*

Optical MDU amplifier

- Optical booster amplifier for in- or intra-building extension of FTTH RF video or CATV broadcast networks
- Compact, low cost, high-performance EDFA
- 4 output ports, 14.5 dBm optical power each
- Constant Output Power Mode
- RF monitor port
- 1x SC/APC in, 4 xSC/APC out
- Solid metal housing with fiber management unit, wall mountable
- Designed for installation in multiple dwelling units (MDU)



XOA4145

* RU = Rack Unit

RF Video Overlay

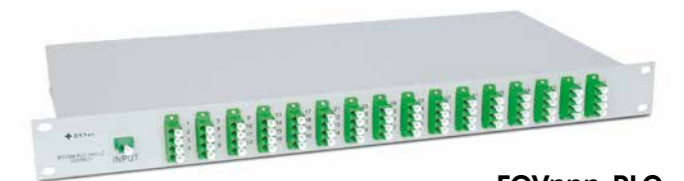
Optical power splitting

Passive optical power splitting

The third key component is selected from a portfolio of passive optical splitters and optical wavelength division multiplexers (WDM). These components are required for splitting optical power in order to supply adequate optical signal level to the end user or to combine or separate the different optical wavelengths on a fiber optic link.

Optical splitter

- RF Video Overlay in FTTH networks
- Up to 64 output ports available in 1 or 2 RU
- Optical connector: SC/APC or LC/APC
- Insertion loss < 19.7 dB
- Uniformity < 1.6 dB
- Wavelength range: 1260 -1650 nm



FOVnnn-PLC

16 x 1310 & 1490 & 1610 / 1550 nm WDM array in 19" housing

- 16 x 1310 & 1490 & 1610 / 1550 nm WDM
- 16 SC/APC RF Video In
- 16 SC/PC GPON/GEAPON In/Out
- 16 LC/APC combined RF Video + GPON/GEAPON In/Out
- Insertion loss RF Video: <1.0 dB
- Insertion loss GPON/GEAPON: <0.6 dB
- 1 RU

Also available with 8 WDMs



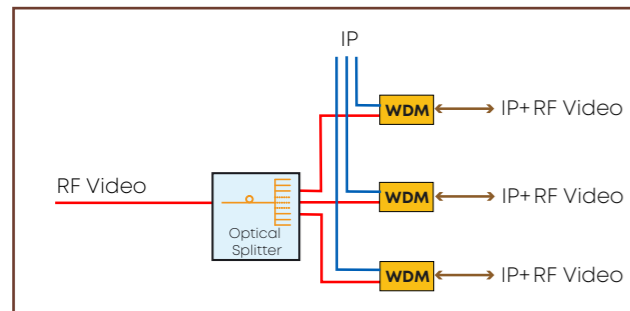
FWM016-OLT

RF Video Overlay

Optical power splitting

Optical splitter + integrated WDM array

- IP and RF Video Overlay in FTTH networks over one fiber:
1310 & 1490 & 1610 nm IP / 1550 nm RF Video
- 1 Input port RF Video
- 1 RU*



Available versions:

FOV016-PLC-IP

- 16 In/Out ports IP (MPO APC)
- 16 combined RF Video and IP In/Out ports (SC/APC) Insertion loss < 15 dB
- Uniformity < 1.9 dB

FOV032-PLC-IP

- 32 In/Out ports IP (MPO APC)
- 32 combined RF Video and IP In/Out ports (SC/APC)
- Insertion loss < 18 dB
- Uniformity < 1.9 dB

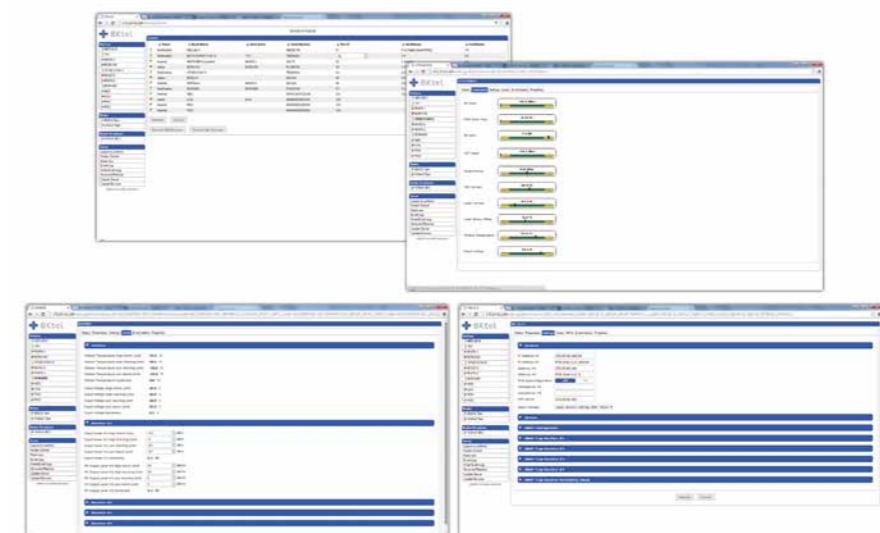
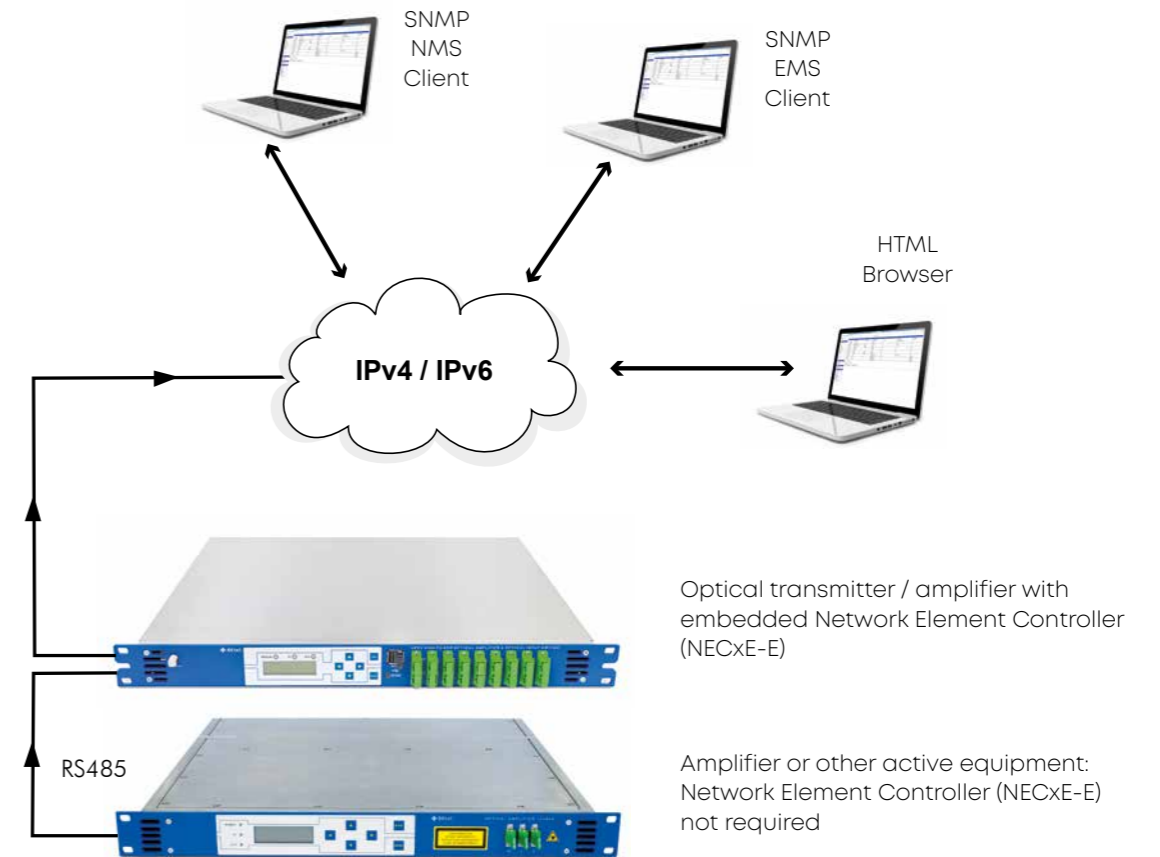
FOV064-PLC-IP

- 64 In/Out ports IP (MPO APC)
- 64 combined RF Video and IP In/Out ports (LC APC)
- Insertion loss < 20.7 dB
- Uniformity < 2 d

* RU = Rack Unit

Network management

For monitoring, control and configuration of the active equipment the new Network Element Controller (NECxE-E) integrated in optical transmitters or optical amplifiers is available. The NECxE-E is equipped with an extended security engine for HTTPS connections from any webbrowser. The remote SNMPv3 interface allows controlling and monitoring of all active components and provides the interface to a higher level Umbrella Management System, such as the BKTEL® CABLEwatch EMS.

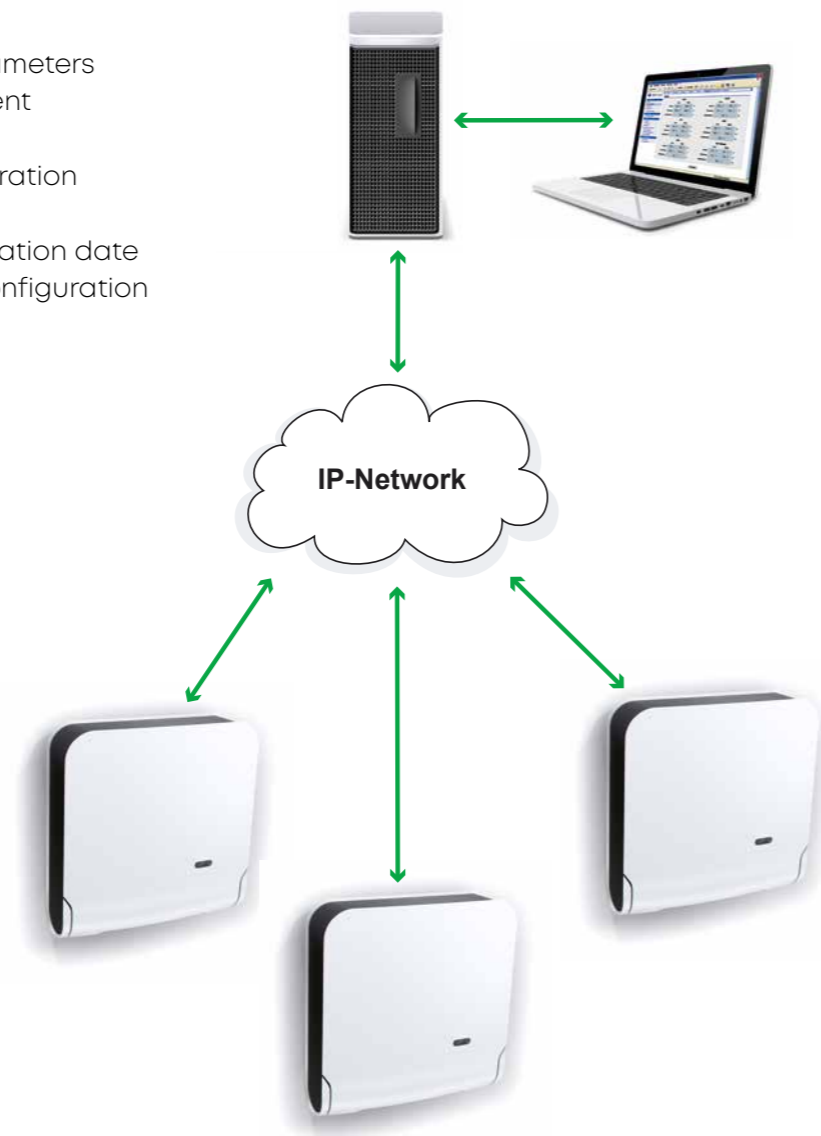


BENOS - Provisioning of network termination units

To complete a FTTH network HUBER+SUHNER Bktel offers the BKTEL® Enhanced Network Operating System (BENOS). BENOS is a software solution that automates the remote configuration process of all CPEs in FTTH networks without any customer hardware assignment. Based on TR069, it allocates the subscribed services and provides each connected CPE device with the corresponding configuration parameters. The software system is especially designed for the operation with BKTEL®'s XON product family.

Remote configuration

- Configuration of all device parameters
- Automatic firmware management for each device type
- Fully automated device configuration
- Pre-configuration of devices
- Definition of configuration activation date
- Support default and working configuration



Remote Monitoring:

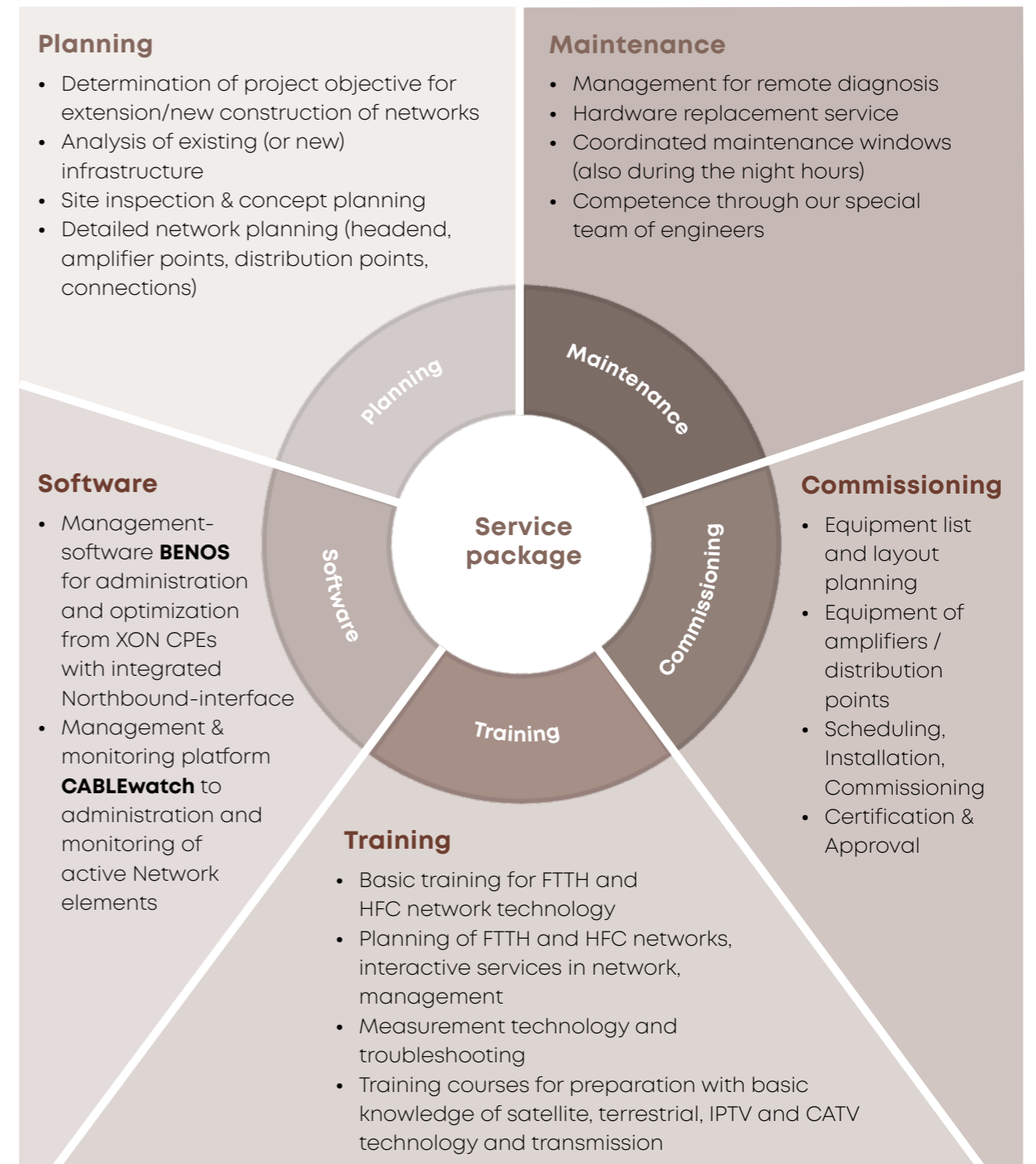
- CPE status
- Port status
- Packet counters
- Optical Input Power of the CATV Receiver
- Device Parameters
- Duing GASP

Our services

From planning to training

In addition to technical advice we offer support for planning and commissioning of your network. Our comprehensive service package includes accompanying consulting as well as training in transmission technology, its handling, introduction to monitoring software, acceptance and commissioning.

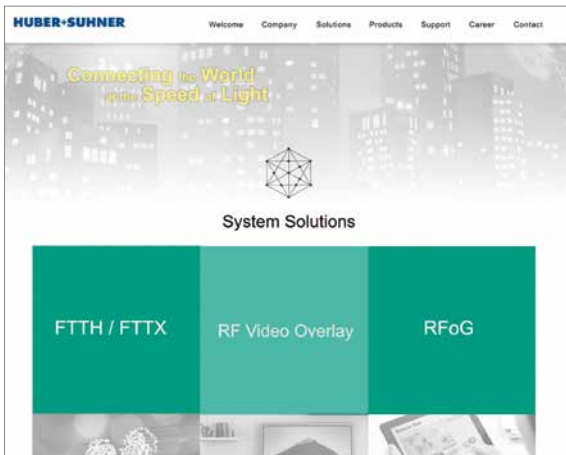
We remain available for you for optimisation or retrofitting consultation after installation or during operation.



You have questions?

Visit our website. You will find a lot of information about FTTH, Video Overlay and other network solutions as well as an overview of our product range:

Network solution:



Futureproof with Fiber-to-the-home:

<https://www.bktel.com/systems-solutions.htm>



Our product range:

<https://www.bktel.com/products.htm>

HUBER+SUHNER Bktel GmbH

Benzstrasse 4

41836 Hueckelhoven-Baal, Germany

Phone: +49 (0) 24 33 / 91 22-0

sales.bktel@hubersuhner.com

hubersuhner.com

bktel.com