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Nexans aids telecom operators and their equipment suppliers to deploy strategies for high-performance broadband

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Synopsis

This Report shows how two special cables (Enhanced XDSL Copper and FTTX Fiber-Optic Micro Cables) developed by Nexans for urban broadband infrastructure can help operators and their equipment suppliers to deploy their short and long-term strategies efficiently and cost-effectively.

It opens with a review of how broadband is proliferating worldwide, generating new customer expectations in terms of data speeds and value-added services; then analyses existing XDSL and FTTX infrastructures, and explains the need for upward evolution. The historical and strategic development of operators is traced through three key phases, with fiber moving steadily closer to the home. Nexans Enhanced XDSL Copper Cable is introduced, and its superior performance is proven through tests and benefits. FTTX Fiber-Optic Micro Cables adds a further dimension to existing infrastructure, while remaining easy and extremely fast to deploy. A typical installation is explained and benefits are reviewed, including "progressive deployment" to rationally improve the service offer and increase geographical reach.

The conclusion reemphasizes the alignment of Nexans strategies with those of its customers, and concludes that cable quality is an essential criteria for meeting their strategic objectives.

1. The proliferation of broadband and its consequences

Broadband has continued to proliferate worldwide, with broadband connections now outnumbering dial-up connections in many countries. In fact, in the US, broadband penetration among active Internet users recently reached 55.47%. Broadband continues to be driven by PC applications, as new appliances arrive on the marketplace, like video-phones, networked gaming consoles and home security devices.

Although the vast majority of voice calls will still originate and terminate on the PSTN (Public Switched Telephony Network) because of overall sound quality and reliability, there has been a recent surge of VoIP (Voice over Internet Protocol). The latter will continue to increase significantly among consumers and businesses, putting pressure on traditional fixed line operators to upgrade broadband service. Meanwhile, mobile use is still booming with two billion cellular subscriptions worldwide. The mobile world and the broadband network will continue to merge.

Service offerings are also growing by leaps and bounds. For example more than two-thirds of all online purchases are made by broadband users, who spend 34% more per purchase. Moreover, Internet users with high-speed connections are the most likely to bank online. As to work connectivity, in the US, 80% of workers enjoy high-speed connections to the Internet, and home users are rapidly following this trend because of home-working options and the wide range of entertainment available online.

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The recreation room has long since been replaced by the multimedia center, offering music and video on demand, live television over wire and fiber, high-definition transmission, and home-to-home videoconferencing.

Broadband is thus rapidly evolving due to customer expectations concerning data speeds, reliability and value-added services. This has repercussions on the cable infrastructure, itself. Not only must it satisfy today's needs, it must respond to tomorrow's promises. That is why Nexans is striving to help telecom operators and their equipment suppliers deploy their broadband strategies through a host of XDSL and FTTX products, among them two new generations of cable products: enhanced XDSL copper, and fiber-optic micro cables.

2. Existing XDSL and FTTX infrastructures

Information about the market

Various forms of XDSL already reach nearly 100 million subscribers worldwide, with half a million people choosing it every week. European Union countries constitute the largest regional XDSL population, with Germany standing first with six million subscribers, followed by France, Italy, the UK, Spain, the Netherlands, Belgium, Sweden, Switzerland and Denmark. Western Europe and Asia Pacific lead growth rates (approx. 25%), followed by North America; however developing areas in Southeast Asia are also showing exceptionally high rates of growth (15%).

The various FTTX fiber offerings count just over a half million subscribers in the EU, and there are about 100 major players presently conducting some 140 projects. Concerning fiber infrastructure, most European deployment is based on Active Ethernet fiber solutions (instead of Passive Optical Networks/PONs). Aside from lower capital expenditure (CAPEX) and operating expenditure (OPEX), active networks provide a dedicated "pipe" to each subscriber, and can serve a virtually unlimited number of subscribers over an 80 km distance. As for growth potential, experts predict between 1.5 million to 3.5 million new broadband subscribers by 2008.

Going back to the XDSL situation, when operators originally deployed their copper cable infrastructure, it was to provide a public service: analogue voice telephony at 1MHz frequency. Even today, Plain Old Telephone Service or POTS still manages to generate between 20 to 25 Euros of revenue per subscriber each month.
Although dial-up modem capacity rose from 14.4 kbs to 56 kbs during the nineties, telephony changed radically from 2000 onwards, both from the point of view of operator constraints and new subscriber expectations. Incumbent Local Exchange Carriers (ILECs) already faced new competition from Competitive Local Exchange Carriers (CLECS), but by 2003, mobile services were eating deeply into all fixed-line revenues, with some subscribers eliminating their home lines completely. Meanwhile, customers became gluttons for speed, and were sorely tempted by CATV providers offering Triple Play[1] for only a nominal increase in their subscriptions.

Both carriers and operators understood that the only way to keep old customers, capture new customers and open the way to even higher levels of service (home wireless applications? Quadruple Play?) is to continue the evolution from 20th century analogue "phoniness"[2] to 21st century digital "virtuality" by upgrading both the copper and the fiber networks. The stakes are high, since a superior broadband offer can easily double average monthly revenue per line (to 30-50 €).

[1] Triple Play includes Television (high-definition, video on demand and multi TV channels), Fast Internet, and Analogue Voice on the already installed coax cable.
[2] The word "phony" derives from "telephone," due to the tinny voice quality on early handsets. M. McLuhan.

3. Operator's strategic development

Strategic development from a 20th century to a 21st century service offer has gone through three key phases:

The first phase was the implantation of basic analogue telephony service on conventional copper infrastructure, which consisted of indoor copper switching cables and outdoor copper cables. Apart from voice, this phase was adequate to provide "narrowband" access to the Internet. The upper limit to data transfer is a 56 kbit/s line using a 56 kbit/s modem. However, government regulations limit the output power of modems in such way as to reduce throughput to about 50 kbit/s. Many users worldwide are still restricted to traditional dialup connections.

The second phase was the upgrading of the operator's offer to deploy XDSL broadband services supported by an all copper infrastructure. This required the installation of indoor XDSL copper cables. According to the desired data rate, ADSL could deliver from 1.5 to 6.1 Mbit/s to distances between 2.7 and 5.5 km.

The third phase addresses the challenge of new services like Triple Play and extends coverage in terms of bandwidth and distance to the subscriber. Even as recently as three years ago, XDSL was merely a way of introducing fast Internet services (512 Kbits/s). However, today, operator strategies have evolved. They want to get better performance from their existing infrastructures so that they can support either faster Internet Service (2 Mbits/s) or a bundle of services, and guarantee high Quality of Service (QoS). This requires a special care at the level of indoor equipment cables & outside plant cables to get the best performance from aDSL2. ADSL2+ provides downstream data rates of 25 Mbits/s for loops up to 2.5 km. VDSL (Very High Speed Digital Subscriber Lines) delivers from 1.5 to 9 Mbits/s up to 5.5 km, or 13 to 55 Mbps up to approximately 1.4 km.

Furthermore, advanced ADSL solutions are very complementary to FTTX solutions, especially when fiber-optic micro cables can be deployed quickly and cost-efficiently in existing ducts. Separately or combined, advanced copper and fiber make it possible to deliver higher speeds farther away from Central Office and closer to the customer. Operators who can offer more bandwidth and services at far greater distances are the ones who are going to win new customers, and strengthen their business offer.

4. The Nexans solution: Enhanced XDSL copper cable

Bearing in mind the axiom "the longer the line, the lower the data rate," it does not matter what the Central Office Digital Subscriber Line Access Multiplexer (DSLAM) is capable of delivering in terms of bit rates, if the outside plant is unable to deliver farther downstream to the customer. On this depends consistent QoS, high bit rates ,the number of services available to subscribers (bearing in mind that fewer services equal less revenue), and optimized geographical coverage.[3]

Nexans has brought a Copper Enhanced XDSL cable solution to operators & Telecom OEMs to enable them to get the best from their copper cable infrastructure by allowing them to extend distances from Central Offices to distant nodes. This means that subscribers who were too far away to receive basic ADSL or advanced Triple Play services can now do so. Or for a given subscriber at a given distance from the Central Office, to increase the Data Rate meaning that this subscriber is now eligible to faster Internet or more Services

During a one-year test program, Nexans duplicated a one to five km outside plant installation to demonstrate two things: first, the correlation between the copper cable used and the XDSL service performance levels; and secondly, the superior performance (in terms of reach and data rates) of enhanced cables over current analogue voice cables.

5. Test results and benefits

The test results were conclusive. The superior performance of Enhanced XDSL cables allows operators and their DSLAM equipment suppliers to significantly increase data rates and geographical reach. This translates into more services available for more potential customers and better Quality of Service for all customers.

In the other test which compared regular POTS cables and Enhanced XDSL cables (both indoor and outdoor), demonstration is made of:

- up to 50% more services for customers located within a 2.5 kilometer radius, and a better Quality of Service to the subscriber
- - and reach extension the reach by some 40% also means the availability of broadband for significantly more subscribers.

Moreover, enhanced XDSL cables indoors combined with standard POTS cables outdoors (compared with POTS both indoors and outdoors) greatly reduced the discrepancy between subscribers. Now, all of them become potentially eligible for Triple Play services.

The Nexans Copper Enhanced XDSL cables also offer other advantages to both operators and equipment suppliers:

- High availability and steady source of supply
- Excellent EMC performance within a "busy" environment
- Easy installation because of standard size and special sheaths
- Fire-reaction and fire-resistance for indoor safety
- Compatibility with other transmission systems
- Future headroom for tomorrow's needs (quadruple play, wireless convergence)

[3] Note that doubling the radius of outside plant quadruples the area of coverage ($\pi \times \mathbf{r^2} = \mathbf{A}$); thus, multiplying the potential customer base by a factor of four (subject to population distribution, of course).

6. The Nexans solution: Fiber-optic micro cables

As mentioned earlier (section 3), fiber solutions are complementary to enhanced copper. When conventional all-copper ADSL is deployed it reaches to about 5.5 km. If operators wish to increase data speeds so as to offer Triple Play to existing customers, they need to deploy ADSL2+ which is unfortunately limited to 2.5 km. The best solution is to use fiber to move the DSLAM out of the Central Office via a passive substation to an outside cabinet (curb) located about 2.5 km away from subscribers.

This cabinet containing active equipment (the DSLAM) then links up with the existing local copper loop to upgrade the service level. The same solution can also be used to extend conventional ADSL far beyond the existing customer base, or to upgrade to VDSL over longer distances. Incidentally, VDSL is the ideal technology for delivering Multi Channels TV or High Definition TV. The ultimate solution, however, would be to have an all-fiber infrastructure that would reach from Central Office right into the multi-dwelling apartment bloc or home (FTTH).

Why are traditional 144 fiber cables in 50 mm loose tubes not a good solution for making this extension? Because conventional installations are already under-optimized (some ducts are empty). Also, they provide little flexibility when it comes to progressively adding new cables to meet upgrades or accommodate new subscribers. The best solution would be to fill this existing physical network (i.e. the ducts) with micro fiber-optic cables offering equal performance, especially if these smaller cables could be blown into place without requiring the tearing up of sidewalks.

Nexans has developed a new generation of fiber-optic micro cables that can add up to 10 cables (of 96 fibers each) to an existing fiber network without extra engineering. These compact cables have sufficient stiffness and a low friction co-efficient due to a special know how at the level of the sheath. This makes them easy to blow individually into a confined space, like a 10 mm mini-duct. They have the same capacity and connectivity as conventional fiber cables, but can be deployed faster and over longer distances in metropolitan environment.

Over the years, Nexans has steadily improved the installation speed for its micro cables. Second generation B-lite (quality Blue) could be installed in a first kilometer within 15 minutes; while the new third generation B-lite (quality Green) cable can be installed in two full kilometers in under an hour. This means that the Operators can deploy faster & farther but also in a optimum way in irregular ducts paths prevalent in the metropolitan context. Micro cables are also highly water resistant; manhole being often submerged.

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&

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7. How micro cable is installed

The different phases :

- First, a survey has to be conducted to prepare a new ducting layout or to assess how existing ducts can be fully exploited. This involves the mapping of old and new ducts in terms of capacity and ideal "occupation rate," bearing in mind that more micro cables can be easily added at a later date. In other words, there is no need for a complete installation, as with traditional fiber cables.

- Then bundles of multiple micro-ducts are blown into the loose tube(s), often more micro-ducts than are currently needed, to accommodate future expansion. At this phase, the infrastructure is being prepared for "progressive deployment."

- Next, sufficient micro cables are blown into the micro-ducts according to subscriber area and desired coverage.

- The micro ducts are removed from the main ducts where the interconnection nodes are going to be which will eventually convey the signals to the subscriber premises (via copper or eventually fiber).

- A few meters of the outer sheath is carefully removed ("cable aperture")

- Finally, bundle selection is carried out, individual fibers are extracted, and fiber connections are made via a simple splicing box (e.g. using Nexans' FiberArt solution).

Duct cables

8. Micro cable benefits

Fiber-optic micro cables provide operators with a way to optimize the occupation rate (i.e. the number of cables in an existing duct), while providing their networks with maximum flexibility. Since there is progressive deployment, Capital Expenditure can therefore always be in line with current earnings. In other words CAPEX can be easily adjusted to actual revenue per user (RPU). There is a strong push-pull factor here, as well, with technology doing the pushing, and demand doing the pulling. As RPU rises, new capacity can be deployed rapidly; as new capacity is deployed, additional customers buy into the system.

This progressive deployment solution should have an especially strong appeal for those operators who want to geographically improve their broadband and service offer in metropolitan surroundings, without having to massively deploy optical fiber.

Fiber-optic micro cables have other clear benefits:

- Lower costs through the use of existing ducting infrastructure
- Efficiency by optimizing the duct occupation rate
- Responsiveness of fiber count to exact customer needs
- Faster time-to-market due to quick cable installation
- Short-term return on investment
- Strengthening of total network reliability

8. Conclusion

Nexans has developed its XDSL and FTTX strategies to contribute to the operator's own broadband strategy. The Group want to enable them to get the performance they need and deserve from their cable infrastructure.

Upgrading their broadband offer to meet the expectations of long-time and new subscribers strongly depends on the quality of the cables and cabling solutions, which can only be achieved through innovation, leading edge technologies and product performance.

As a truly global expert, with a strong local presence and technological leadership, Nexans is strongly positioned to achieve these goals.