

ZyCAST

ZyXEL Communications Corporation - Vol. 3 Summer 2008



Access Technologies:

*How to get all that bandwidth
into customer homes
and businesses*

Beware of the bridged taps!

They can be a real nuisance!

Focus on VDSL2

at NetCologne in Germany

Green ZyXEL

ZyXEL products are born green

Meet Steen Garbers Enevoldsen:

"Playing with power!"

ZyXEL

How fast is fast enough?

// Peter Max



In this issue of ZyCAST, you will find news and technical information related to access technologies; the different technologies used for connecting end users to ISPs and Telco's fast backbone networks. Today these connections are typically based on fiber or by some type of Digital Subscriber Line (DSL) technology.

If cost is not an issue, then there is really no discussion: fiber is by far the most effective and future-proofed access technology. Without major issues, it can scale up from a modest few megabits to 100 megabits and further on to 1 gigabit and with 10 gigabits possible in the not so distant future. There is no real bandwidth limitation and when end users begin to demand very high bandwidths - and are willing to pay - the technology is readily available.

With VDSL2 technology, access based on traditional copper wiring will keep up with bandwidth demand for some years to come, fiber will also be the ultimate solution. Unless future DSL technology can squash even more bits through the same old cables.

What about wireless technologies?

They evolve fast but their growing popularity can also be what constricts the bandwidth and

thereby its 'usefulness', there is a limit on how many radio frequency bands can exist simultaneously in the air without disturbing each other. And wireless systems are not yet suited for high definition video and TV transmission.

We will, however, see a number of new architectures where fiber or DSL connections carry network services forward to advanced digital storage- and AV-systems in the home. These could also help with specialized access point or femtocells, creating a high-bandwidth wireless network suited for all kinds of mobile devices nearby.

ZyXEL Communications will be in the front line of this development, not the least with DSLAM systems that can handle all types of communications on the ISP/Telco side.

Best regards,
Peter Max

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Faster, faster, faster...

Broadband services have become an almost indispensable part of our daily life, in the same way as electricity, telephony and television. The technology is available to deliver broadband to any location but the challenge is to make it a sound and profitable business.

At today's technological level there is really no question that delivering broadband services to homes and businesses through fiber cabling is the optimal technology.

Fiber technology is under constant improvement and whatever capacity limitations we have today, they will be overcome tomorrow.

The only real concern with fiber cabling is the cost of digging new cabling and the investments in new equipment for

distribution and access. With millions of kilometres of well-functioning plain old copper telephone wiring already in place and leading into every home, it is logical to use advanced transmission technology to make use of this wiring for distribution of broadband over the "last mile" to the end-user, whether that is a home or a business.

Access technologies have developed significantly during recent, originating from the traditional modems of the eighties, through ISDN and ADSL and now further on to the current VDSL2 technology which can deliver bandwidths of up to 200 Mbps over traditional phone wiring.

In this article, we will provide an overview of the development and technology of xDSL and the different types of Digital Subscriber Line access technology.

DSL history

When speaking of DSL in general, the term is often prefixed with an 'x' to indicate that several types are in question. xDSL technology offers higher bandwidth compared to analogue modems and is typically 'always on'.

One of the major reasons why xDSL technology is so popular is because it makes use of the good old copper pairs (often called PSTN, Public Service Telephone Network, or POTS, Plain Old Telephone Systems) for the last-mile transmission of data between the subscriber and the exchange.

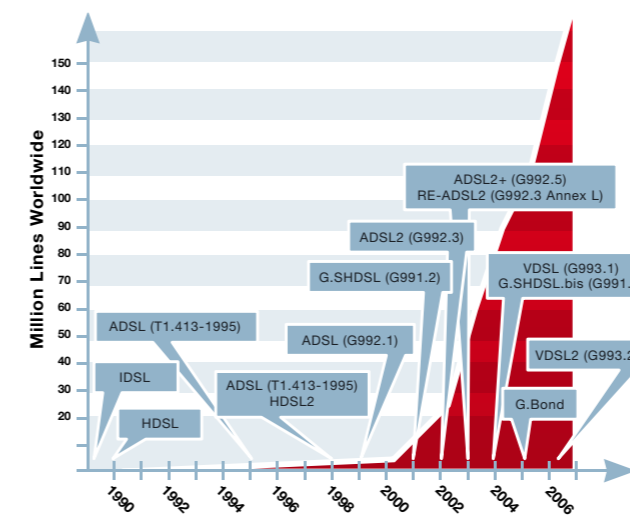


Figure 1: Historic overview of the evolution of DSL standards, and the global market penetration of DSL lines.

All the different types of xDSL technologies can be grouped into two basic families, which differ in terms of two interesting properties:

- Asymmetric bit rates (varying up- and downstream speeds) versus symmetric bit rates
- MCM (Multiple Carrier Modulation) versus SCM (Single Carrier Modulation) types of modulation technique

The asymmetric family (ADSL, ADSL2, ADSL2+, VDSL¹, and VDSL2) are all pass-band technologies, i.e. the lowest frequency in use is larger than 0 Hz (no use of the DC element), thus allowing base-band services like POTS or ISDN to co-exist on the same copper-pair. Furthermore the ADSL-family all use variants of the same MCM modulation technology,

DMT (Discrete Multi-Tone). With asymmetric transmission, the central office (COE, Central Office Equipment) side transceiver is different from customer premises transceiver (CPE, Customer Premises Equipment).

The symmetric DSL-family (IDSL², HDSL, SHDSL) are all base-band services, i.e. the lowest frequency in use is zero Hz (DC), and different variants of SCM are used (2B1Q, QAM, PAM...). Due to their symmetric properties and the fact that overlapped spectrum is used (upstream and downstream use the same frequencies, the central office side transceiver and the customer premises transceiver can be the same hardware type, so you can connect two CPE's back-to-back. Since VDSL2 is the main topic of this article, the symmetric types of xDSL will not be described in further detail.

ADSL

ADSL was developed by Stanford University and AT&T Bell Labs in the period from 1990 to 1992 when the first prototype was tested. After three years of field trials and revision, the first ADSL standard was issued by ANSI (American National Standards Institute) in 1995. ANSI released a second issue in 1998 which addressed ambiguities and omissions in the first edition to increase the interoperability between chipsets from different vendors.

In 1999, ITU (International Telecommunication Union) released the first international ADSL standard, largely based on the ANSI standards. This made for much better interoperability between chipsets, and the market began to see the first mass deployments of ADSL.

ADSL2 and ADSL2+

While ADSL has been a tremendous success with more than 60 million lines deployed worldwide, it suffered from a number of shortcomings and lack of features that needed addressing. The requests for a new ADSL standard were primarily for a longer reach, better link stability, and better diagnostic tools, as well as higher upstream bit rates.

1. The VDSL specification includes both a DMT/MCM, and a QAM/SCM modulation (i.e. base band) version, but only the MCM version is mandated.
 2. IDSL (based on ISDN) is arguably not really a DSL-technology in peoples mind due to the low bit rates, but is still mentioned since I see it as the starting point of digital services for the end-user.

2001 saw the development of ADSL2 which has an entirely new transceiver design. The underlying DMT modulation and the power spectral properties are the same as for ADSL, but the framing mechanism was revised and had support for PTM (Packet Transfer Mode), which enables a pure IP solution instead of the ATM layer from traditional ADSL systems.

To improve long-term link stability, ADSL2 introduced new On-Line Reconfiguration (OLR) tools that enables the system to adapt to changing loop conditions without interrupting the data flow. A novel DELT (Dual Ended Loop Testing) functionality called Loop diagnostics mode was introduced, enabling more accurate loop estimation.

To address the higher upstream bit rate requirement, ADSL2 introduced a new annex M where the annex A (ADSL over POTS) and annex B (ADSL over ISDN) sub carriers are combined, which in effect doubles the attainable upstream bit rate. In 2003, the annex L for ADSL2 was added to the standard and provides a better long reach performance.

In 2003, ITU also ratified the ADSL2+ standard in which the number of sub carriers was doubled, and thus increased the downstream attainable bit rate to approximately 25 Mbps on short loops.

VDSL

Work on VDSL started in 1995, when the need for higher bit rates was recognized. ANSI, ETSI and ITU had simultaneous projects, targeting a new standard capable of higher rates.

To ease the choice of basic technology, it was decided to facilitate a “VDSL Olympics” events run by British Telecom (UK) and Telcordia Technologies (USA). The purpose of these events was to ultimately decide which line coding technology to use for VDSL. The DMT version of VDSL outperformed the SCM version of VDSL and was thus adopted by IEEE and ANSI.

VDSL2

VDSL2 was ratified by ITU in February 2006, and is based on both the ADSL2(+) and VDSL specifications. DMT was chosen as the sole line code technology, making VDSL2 spectrally compatible with existing ADSL and ADSL2(+) deployments. Furthermore, VDSL2 supports multimode operation with ADSL2+.

Compared to VDSL, the scope of the VDSL2 specification is quite broad. It aims to increase the maximum attainable bit rate on short loops, as well as increasing the performance on longer loops, making it more widely useable compared to both ADSL2+ and VDSL.

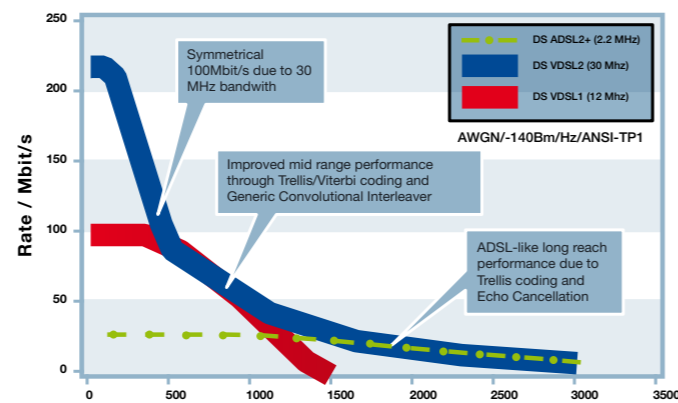


Figure 2: VDSL2 attainable downstream bit rates compared to ADSL2+ and VDSL (Source: DSL Forum)

VDSL2 technology

Where ADSL and ADSL2 can be considered as two-band systems (one frequency band used for upstream transmission and one frequency band for downstream), VDSL2 offers multiple up- and downstream bands.

For the western market, two primary band plans were defined in 2000:

- 997 – Optimized for symmetric services
- 998 – Optimized for asymmetric services

VDSL supports up to 12 MHz bandwidth, which in the VDSL2 specification is extended to 30 MHz bandwidth, enabling a net bit rate of 200 Mbps on short loops. VDSL2 is based on band plan 998, but the upper frequency limit is extended to 30 MHz and a new upstream band (US0) is introduced to increase the long reach capabilities of VDSL2.

Extending the upper frequency to 30 MHz makes room for one more set of US/DS bands: US3 and DS3. The frequency division between US3 and DS3 are still under discussion, but so far a proposal based on plan 998 has been adopted by most European countries.

Band plan and profiles

Within the band plans, a number of profiles are defined with various combinations of transmission power and allocated frequency bandwidth optimized to different deployment scenarios, e.g. FTTEX and FTTcab (Fiber To The Exchange and Fiber To The Cabinet/Curb).

Profiles 8a, 8b, 8c, 8d are designed for long reach applications with a maximum attainable net data rate of 50 Mbps. The difference between the 8a, 8b and 8d profiles is the maximum transmit power limitation, to address corresponding regional requirements. For all the 8x profiles, support for the US0 band is mandatory.

Profiles 12a and 12b use the US2 at full bandwidth band hence providing significantly higher upstream bit rates, compared to the 8x profiles. The maximum supported net data rate for profiles 12a and 12b is 68 Mbps. Support for US0 is optional for the 12x profiles.

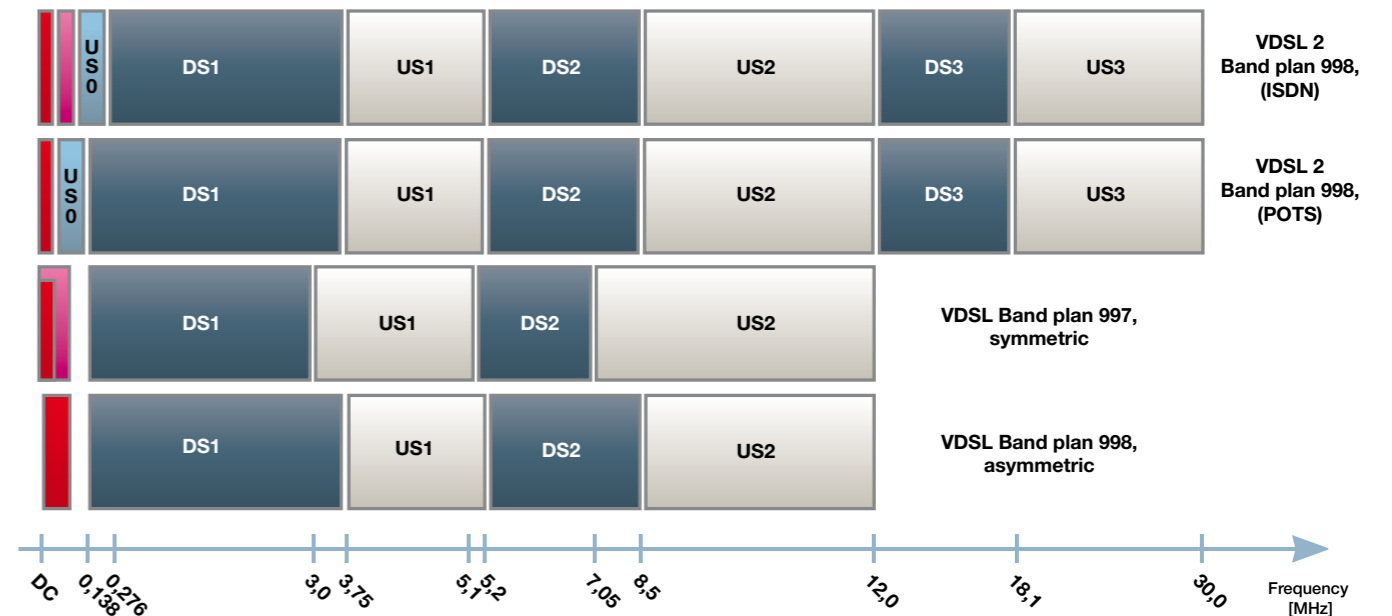


Figure 3: VDSL and VDSL2 band plans. The red colour relates to POTS and pink denotes ISDN base band service.



Profile 17a addresses a medium loop length scenario, such as FTTCab, by extending the frequency range to 17 MHz. The added bandwidth is used for the DS3 band and provides a higher downstream bit rate for a total of 100 Mbps downstream and 50 Mbps upstream. Since profile 17a is not meant for long-reach deployment, US0 is not supported.

Profile 30a is designed for short-loop deployments such as FTTB (Fiber To The Basement/Building), where the loop length does not exceed a few hundred meters. The full bandwidth of 30 MHz is used for this profile by including the US3 band and consequently providing up to 200 Mbps net data rate. The US0 band is not supported for profile 30a.

VDSL2 features

Here, a number of central features of VDSL2 technology are discussed.

Link stability/On-Line Reconfiguration

One of the major shortcomings of VDSL was the lack of basic OLR technologies from ADSL2. This was introduced in VDSL2, which support Seamless Rate Adaptation (SRA), Dynamic Rate Repartitioning (DRR) and bit swapping³, providing tools for a much better link stability.

Support for TEQ/Echo canceller

Sequence in initialization procedure was added to provide chipsets with the possibility to train any TEQ (time-domain equalizer), while echo cancellers provide a better loop reach performance. TEQ and EC algorithms significantly improve the performance on e.g. Broadcom chipsets.

RFI Notching and PSD Shaping

The DMT line coding technology makes it possible to enable notching of 16 arbitrary RF bands simultaneously. This is required in some regions to address potential RF interference from VDSL2 installations.

As in ADSL2(+), Transmit Spectrum Shaping (TSSi) is supported, making it possible to customize the PSD mask (Power Spectral Density) of a VDSL2 system. This is used to address regional requirements, and can also be used to minimize crosstalk in a mixed loop-length environment.

Extended frequency profiles

Extended frequency profiles provide the option for up to 200 Mbps net data rate for FTTB type of installations, as well as the introduction of a low-frequency US0 band to provide longer loop reach at FTTEEx type of installations.

'All Digital mode' (optional) is currently not supported by chipsets, but provides the potential for even better loop reach.

Coding and error correction

VDSL2 has mandatory support for Trellis coding (see ZyCLOpedia) and is mandatory is VDSL2, providing a coding gain of up to 3 dB. This provides a better loop reach performance, especially on medium-length loops. The 'Forward Error Correction' capabilities are also improved by supporting INP (Impulse Noise Protection) up to 16 symbols (INP=16 sym-

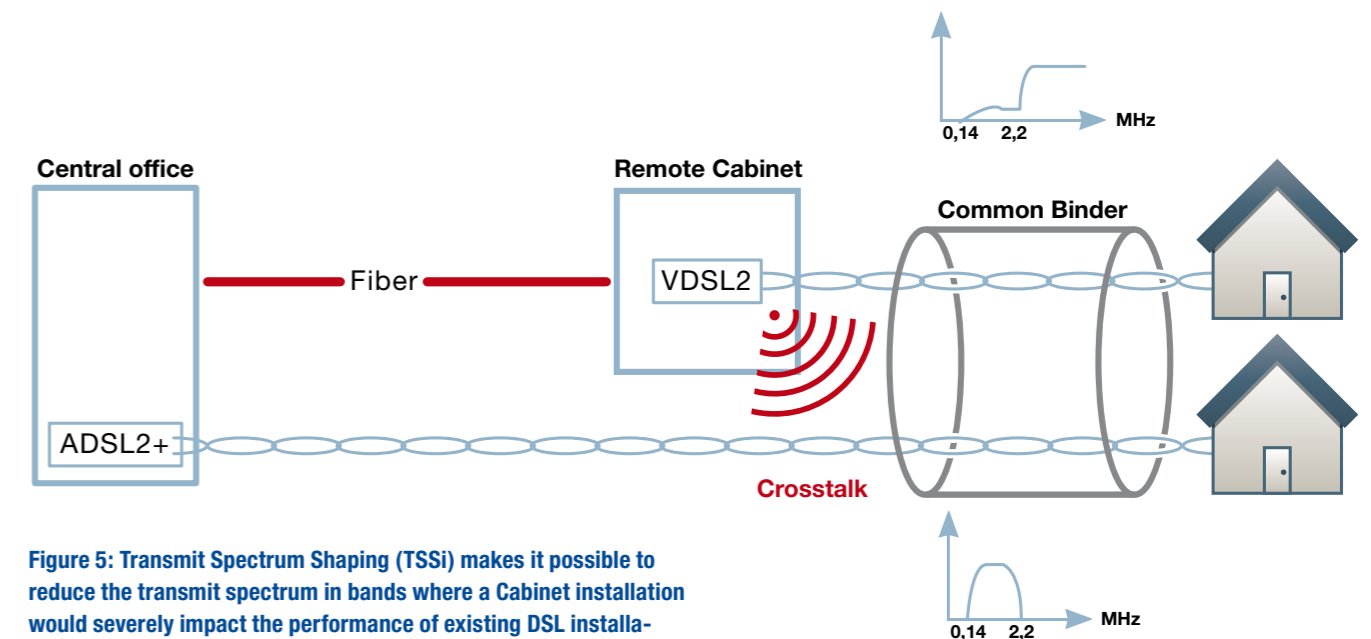


Figure 5: Transmit Spectrum Shaping (TSSi) makes it possible to reduce the transmit spectrum in bands where a Cabinet installation would severely impact the performance of existing DSL installations in same binder.

³ DRR and SRA were intended further study in the 2006 version of the VDSL2 specification, but were introduced with amendment 1 (April 2007). Full chipset support is expected during 2008.

VDSL2 deployment scenarios

bols, meaning errors due to transient noise of up to 2,75 ms duration can be corrected. As in ADSL2(+) a Loop Diagnostics mode is introduced, making it possible to do more accurate loop estimation and fault diagnosis.

Framing

The VDSL2 specification supports dual latency and dual bearer, facilitating triple-play types of configurations, where the service require a combination of strong impulse noise protection (low bit error rate) for IP-TV applications and low latency for gaming types of service.

New PTM Transport Convergence layer mean that ATM is no longer the base protocol on the last mile. This provides for more efficient use of the data rates, since the payload overhead is greatly reduced. Furthermore, it simplifies the backend, providing "pure Ethernet" all the way to the subscriber.

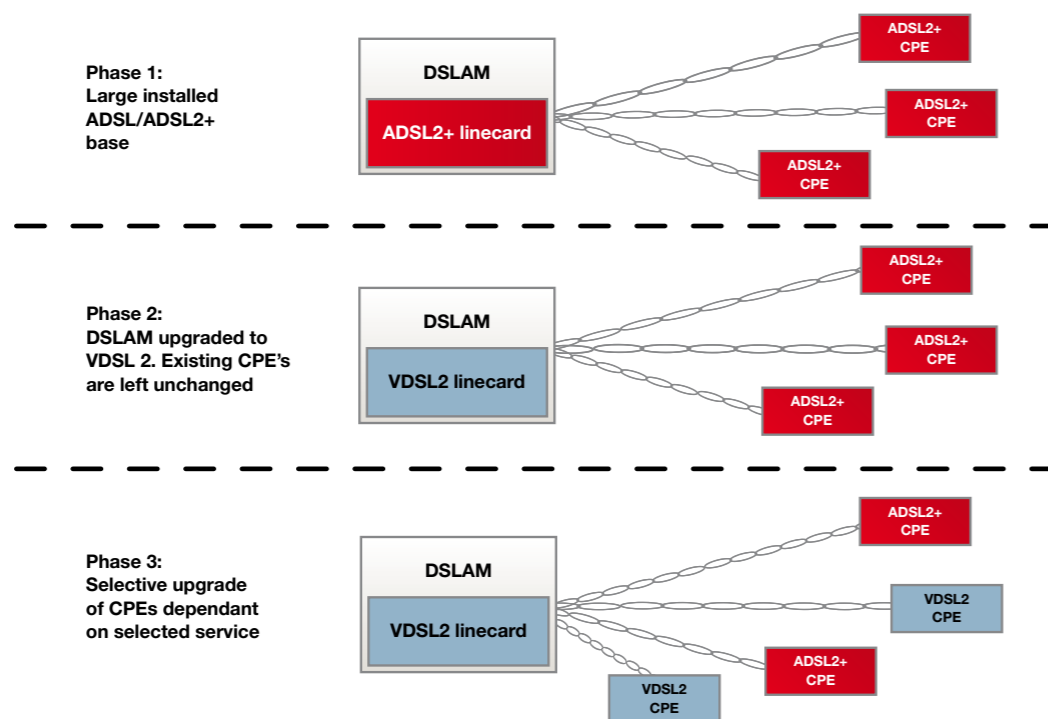
ADSL2+ Fallback

The fact that major parts of the ADSL2 specification are inherited by the VDSL2 specification, makes a big improvement to long reach performance compared to VDSL. Due to the analog similarities, it is relatively easy for VDSL2 chipsets to also support ADSL2+ fallback mode, making it much cheaper and easier for ISP's to start deploying VDSL2 in an environment where ADSL2+ products are already deployed.

Using the ADSL2+ fallback capabilities of the VDSL2 linecard, it is feasible to start exchanging the old ADSL2+ linecards on central offices connected to existing ADSL2+ customers, where the link will simply train into ADSL2+ mode (Figure 6, phase 2).

As new customers are connected, a VDSL2 CPE can be connected to the DSLAM, and existing customers opting for a new higher-rate service can be upgraded simply by exchanging the CPE to a new VDSL2 CPE, not needing a technician to visit the central office installation.

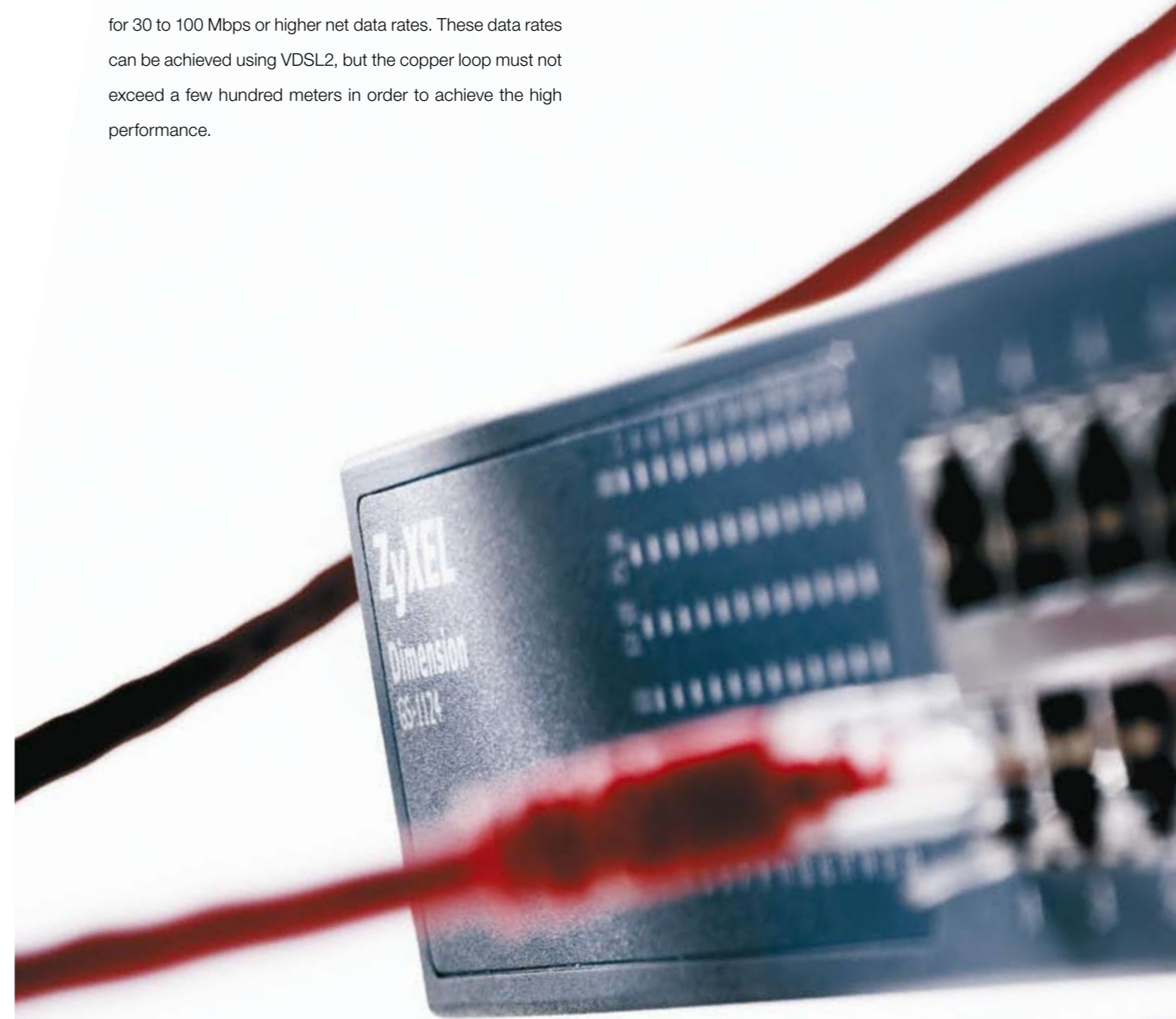
Figure 6: Phase-split deployment of VDSL2 in an ADSL2+ environment



Compared to ADSL, ADSL2, ADSL2+ and older xDSL standards, one of the innovative features of VDSL and VDSL2 are the profiles, which make the same technology suited for a number of different deployment scenarios.

Traditional xDSL are deployed from the central office, providing a net data rate of 0,5 to 25 Mbps. As the requirements for more bandwidth increases and technologies such as fiber challenge the xDSL role as last-mile medium, the need arises for 30 to 100 Mbps or higher net data rates. These data rates can be achieved using VDSL2, but the copper loop must not exceed a few hundred meters in order to achieve the high performance.

This in turn can be done by moving the DSLAM from the central office closer to the subscribers. The backhaul from the remote DSLAM to the aggregation network is usually taken care of using a fiber link, but the last stretch from the DSLAM to the customers is still based on traditional copper infrastructure. The benefit from this approach is that the cost of digging fibers to every house can be avoided, while "fiber-like" speeds are still achieved.



Fiber to the Exchange (FTTEx)

In densely populated areas the local loop length is sufficiently short to facilitate VDSL2 deployment from the central office. In FTTEx scenarios, VDSL2 is used, traditionally leveraging the copper loop all the way from the central office to the subscriber. The attainable bit rates are at 2500 meters similar to ADSL2+ bit rates. For VDSL2 to exhibit significantly better performance compared to ADSL2+ the local loop length should not exceed 1500-2000 meters in this scenario.

The profiles 8a-d and 12a-b are designed specifically for FTTEx deployments, offering best possible bit rates on longer loop lengths at the expense of lower possible bit rate on shorter loops. The choice between profile 8x and 12x depends on the type of service to be offered, and the actual loop environment. In a nutshell, 8x provides higher priority to extended-loop performance, where a 12x prioritizes the medium and short loop performance.

Fiber to the Cabinet (FTTCab)

Where a higher bit rate is required, for example rural areas where a neighborhood is located far from the central office exchange, an FTTCab solution can be used. This scenario is sometimes also called FTTC (Fiber To The Curb). In this case DSLAM is moved from the CO to the street cabinet, aggregating all the local copper loops. The backhaul from the cabinet to the CO is usually a fiber connection.

For this kind of deployment it is recommended to use profile 17a which offers a net data rate higher than 100 Mbps, or profile 30a, offering up to 200 Mbps.

In some cases, the street cabinet is not big enough to contain the DSLAM, or there is another reason to deploy an FTTCab solution outside the cabinet. Then, an outdoor version of the pizzabox is offered, which is environmentally hardened to protect against rain, snow, dust, etc.

Fiber to the Basement/Building (FTTB)

Apartment buildings can make use of the building's existing copper infrastructure to provide very high-speed internet services to the sub-tenders by installing a DSLAM in the basement. This scenario is typically called Fiber To The Basement or Fiber To The Building (FTTB). The use of profile 30a is recommended, provides as much as 100 Mbps symmetrical data rate on 0-300 meter copper.

For this kind of deployment, both pizzabox and chassis types of equipment can be used, depending on the number of VDSL2 lines required. This infrastructure is also often used by hotels to offer internet services to their guests.

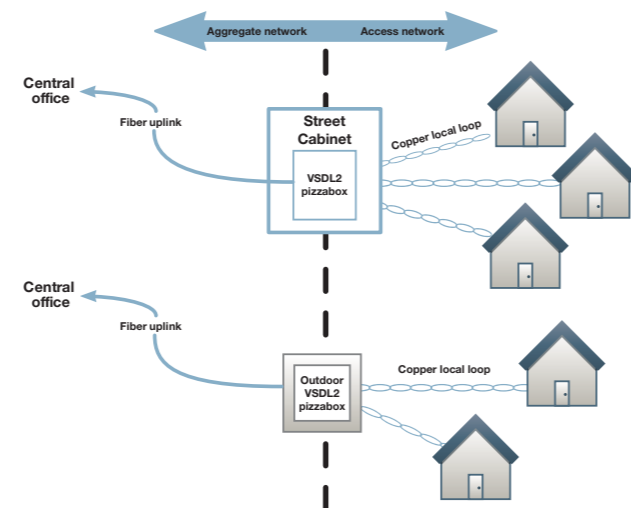


Figure 8: Here a fiber is used to connect a remote cabinet to the central office. From the cabinet, the last stretch to the subscribers consists of copper. A VDSL2 pizzabox (indoor or outdoor model) handles this last-mile connection.

Read more on xDSL technology in the ZyXEL White Papers:

- An introduction to VDSL2 and VDSL2 deployment options
- VDSL2 deployment considerations: Beware of the in-home bridged taps
- Dynamic adaptation to varying loop conditions
- xDSL Link quality: How to ensure a stable & error-free link for IPTV deployment.

These white papers can be downloaded from www.zyxel.dk/web/service_provider or can be sent via mail, by contacting Steen Garbers Enevoldsen on sge@zyxel.dk or phone +45 39 55 07 57

Beware of the bridged taps!

Ever increasing transmission speeds presents new challenges for those who deliver the bandwidth. When there are problems with actually delivering the theoretical obtainable bandwidth to a customer, consider looking for bridged taps.

Traditional telephone wiring (pots) is often the best and most economical way to deliver network access to private homes, home offices and small companies. With ADSL2+ and VDSL2 technologies, high bandwidths can normally be obtained easily, but in some cases problems arise and it can be really tricky to locate the cause.

It is quite common in POTS to have more than one tap to where a phone can be connected. In fact, there can be many of them and for each tap the length of wiring can impact the overall line attenuation and therefore the maximum obtainable transmission speed.

In general terms, a tap is any portion of a loop that is not in the direct talking path between the central office and the service user's terminating equipment.

The damping effect can be really serious, depending on the actual installation. For example, an installation with a 60 meter bridged tap can create a 22 dB notch in an ADSL downstream spectrum. An 18 meter bridged tap will have little impact on ADSL connections but some influence on ADSL2+ connections, while shorter bridged taps have no influence on either technology.

As the frequency increases to the 30 MHz profile of VDSL2 profile 30a connections, even a 1,5 meter bridged tap can have impact on the performance.

The conclusion is that with the high frequency spectrum used by VDSL2, these connections are highly vulnerable to even short lengths of bridged taps, especially when working with profile 17a and 30a connections. The use of a splitter can remove the effects of bridged taps but it is important to be sure to remove any wiring leftovers. For splitter-less installations, the in-house wiring shall be cut immediately after the CPE-terminating point.

You can find more technical information on the impact of bridged taps in the ZyXEL white paper "VDSL2 deployment considerations: Beware of the in-home Bridged taps!" which can be found on the Zyxel web site.



ZyXEL products may come in different colors but they are all born green

Protection of our environment may not be on top of the agenda at all Asian companies, but at ZyXEL Communication in Taiwan, it is a central part of the company strategy. ZyXEL recently received the CSR Award from Global View Magazine.

Awareness of environment protection issues is increasing all over the world. At the company headquarters in Taiwan, ZyXEL Communications, charismatic founder and Chairman, Dr. Shun-Yi Chu, has made protection of the environment an important part of the company strategy. This is reflected in every part of the company's design and production processes as well as in the operations in general, where energy use and waste reduction are main issues.

The work done at ZyXEL Communications was reviewed in the "Clean & Green Report 2007" in which ZyXEL came out as Asia's second best eco-friendly enterprise out of 582 reviewed. The all-encompassing environmental policy at ZyXEL is an integral part of central management policies. In addition to minimizing the CO2 waste in the company as a whole,

ZyXEL is also adhering to environment programs such as WEEE (Waste Electronics and Electrical Equipment), RoHS (Restriction of Hazardous Substances) and the new EuP (Eco-Design requirements for Energy-Using Products). ZyXEL even demands adherence to the same standards from its suppliers. ZyXEL has very close connections to Europe and to the Nordic countries in particular, as this is where a number of the product designs originate. The Nordic point of view and standards in terms of

environmental protection have had an important impact on the mind set at the company as a whole, according to Peter Max, General Manager for ZyXEL Communications Nordic.

The CSR (Corporate Social Responsibility) Award from Global View Magazine recognizes ZyXEL as a responsible global citizen. ZyXEL considers the local community, employees and children, along with environment and energy issues in its efforts to be a decent corporate citizen.

In fact, ZyXEL has contributed generously to local communities. The "Philanthropy Society" within the company helps the children of Hsinchu County who live in remote mountain villages to attend schools and raises their living standards, while the "Dr. Shun-Yi Chu Scholarship" founded by the Chairman, offers college students in the Hsinchu vicinity financial assistance for their academic pursuits.

Global View Magazine is a prestigious business publication in the Chinese-speaking world. Its CSR Award adopt the strict assessment standard of OEKOM Research AG, a German CSR research institute, to evaluate the social, environmental and financial performance of the candidates, in order to select the finalists in five product categories.

To ZyXEL, the coveted award is an honor as well as a further incentive for the company to maintain its pace and stride even further in the contribution to sustainability.



ZyXEL VDSL2 technology ensures high performance broadband connections:

Partnership ensures fast fiber-networks

German internet provider NetCologne has teamed up with ZyXEL to implement high-performance fiber networks with ZyXEL VDSL2 technology.

ZyXEL Communications has teamed up with German regional telecommunication company NetCologne in an innovative partnership to build a robust high-performance fiber-based network in Cologne. NetCologne is expanding its network activities and has chosen ZyXEL as its technology partner. This newly-established "CityNetCologne" network, which is under continual expansion by this regional carrier in Cologne, offers its customers internet connections with connection speeds of up to 100 Mbit/s. NetCologne's fiber network reach right into customers' locations and therefore achieves total independence from the so-called "last mile". This achieves a high level of flexibility which NetCologne customers profit from not only in terms of price/performance but also in service quality.

DSLAM and end-user clients

ZyXEL has supplied NetCologne with a complete hardware solution which includes mini DSLAMs and end-user clients. NetCologne has chosen to form a partnership with ZyXEL based on ZyXEL's long-standing experience with the VDSL2 technology.

ZyXEL's hardware solution is extremely flexible and can be easily expanded to meet customers' growing demands. Due

to the high speed requirement for the networks NetCologne is implementing, fast delivery is also a crucial issue which ZyXEL can fulfil. Optimal coordination and technical liaison on products are further criteria for NetCologne's choice of technology partner.

Front-line technology

Werner Hanf, Managing Director of NetCologne states: "CityNetCologne is a network which is unique in Germany. Today, comparable networks can only be found in a small number of European cities and in Asia. So it's a pleasure that we could realise this strategic cooperation with a company from Asia. ZyXEL supplies us with technology that has not previously been available in Germany."

Marcus Schanz, ZyXEL Deutschland GmbH's Managing Director, comments on the cooperation: "This is ZyXEL's first VDSL project of this kind and size in Germany. It presents us with an outstanding opportunity to implement our global technological know-how. Our strength in this technology puts us in a position to execute the specific demands of NetCologne in an extremely short period of time."

The new network has certainly pleased customers demanding more bandwidth for downloads, VoIP and IP-TV applications. NetCologne now plans to further expand the CityNetCologne network.



Success with Powerline technology

In-Stat Research have reported a 100 percent growth rate in 2007 for broadband Powerline networking equipment that uses traditional power lines as a networking platform with speeds of up to 200 Mbps. This clearly highlights the strong consumer demand for an easy way to view and share digital content.

ZyXEL has introduced a line of innovative HomePlug AV products, including the ZyXEL DMA-1100P - the industry's only digital media adapter with built-in Powerline technology - and the ZyXEL P-660HWP, a unique ADSL2+ gateway with built-in Powerline and Wi-Fi.

These products allow consumers to enjoy and share videos, photos, files and music with family and friends through ZyXEL's extended product portfolio, linking a series of home networking, storage and entertainment solutions on a single power outlet.

By connecting via ZyXEL's P-660HWP ADSL2+ gateway with built-in Powerline and Wi-Fi, or with the NBG318S HomePlug AV wireless router, consumers can create a fast and

secure network throughout the home with the help of a ZyXEL HomePlug AV Ethernet adapter, while guaranteeing immediate wireless access, via the ZyXEL PLA-450 HomePlug AV wireless access point.

Digital content can be stored, organized and backed-up on a ZyXEL NSA-220 network storage appliance, and streamed to the DMA1100P with built-in Powerline technology. With support for high definition Video (HD), USB 2.0 and audio HDMI connections to HDTV, the DMA-1100P allows users to send video, photos and music content from their PC's and storage devices directly to televisions throughout the home.

Hybrid Powerline adaptor

As an addition to the successful line of Powerline products based on HomePlug AV technology, ZyXEL has introduced the new PLA-402 v2 model variant. It has dual interfaces and can connect across a coax based wiring as well as electrical wiring, thus making use of an obsolete coax installation when IP-TV is introduced.

ZyXEL Chassis Switches:

Top quality and performance at the ZyXEL price point

ZyXEL products are known for excellent performance and rock solid quality that promises years of troublefree operation. Chassis switches are a new class of ZyXEL products where quality in every detail has been the very basis for the design. They are flexible and scalable, have redundancy and hot-swap functions built in and are targeted for use as core switch at SMB and SME, as well as distribution switch at large enterprises, TELCO, ISP and campus sites.

Not least, ZyXEL's chassis switches are priced very competitively and come with a life-long warranty and the service and support necessary for this class of products. ZyXEL's chassis switch products directly target the huge market opportunities opened up by the high price point of competing products.

The ZyXEL MS-7206 intelligent, multilayer modular LAN switches, are ideal for SMB or enterprise environments that require always-on availability of critical applications and the highest performance, hard QoS, strict security, scalability and granular bandwidth control.

MS-7206 comes with 6-slot chassis of two for load-sharing switch fabrics and four for switching I/O modules, support-

ing up to 192 Gigabit ports and 32 10 Gigabit ports. With dual-active switch fabrics, hot swappable I/O module and redundant power supply, MS-7206 realizes a most robust system architecture to fulfill the needs where require zero tolerance networks. The MS-7206 provides unparalleled investment protection for the enterprise with industry-leading scalability and a modular architecture providing flexibility based on the required switching capacity and port interface and density.

Key features:

- Intelligent L2/L3/L4 local switching
- Truly Non-Blocking 384G switching performance
- Dual active-active switching fabrics
- Hot swappable I/O modules
- Built-in OSPF, VRRP
- Up to 192 fully powered GbE PoE ports



VDSL2 24-port Linecard

ZyXEL has introduced a Broadcom-based VDSL2 linecard, VLC1324G-51. The linecard has 24 ports, and supports up to profile 17a, making it suitable for CO based deployments. The linecard is designed for use in the IES-5000, IES-5005 and IES-6000 MSAN with separated POTS chassis and splitter card (VSC1024-41). The VLC1324G-51 linecard aggregates the incoming traffic onto the backplane using two GbE interfaces. 48 ports version will be available in August 2008.



Future-proofing investment with dual-WAN CPE



ZyXEL has introduced a dual-WAN CPE that can help ISP's improve their business. Some ISP's already have a wide range of access-technologies in their product portfolio, but even more are looking into deploying emerging technologies such as VDSL2, WiMAX and different types of fiber-solutions (FTTx, active or passive).

One of the challenges with delivering many different access-technologies is the CPE. ISPs typically end up with several different CPE-models in the network, increasing not only the technical complexity but also the challenges with customer support, logistics and inventory management. In the end all of these things increase operational costs for an ISP.

ZyXEL's new Combo WAN product, called P2602HW-Fx, is equipped with two WAN interfaces; ADSL2+ and Ethernet. With this unit you can use the same hardware for ADSL2+ and all other access technologies that support Ethernet WAN (xPON, WiMAX, Fibre, VDSL2, Ethernet etc. with a simple media converter, i.e. a bridged modem) – simply change the WAN interface by using the physical switch on the backside of the Home Gateway. P2602HW-Fx has a very high performance of up to 200 Mbps throughput, supports many different kinds of QoS and also TR-069/104/64.

It's believed that the majority of deployments in 2008 will still be ADSL2+, but with an increased market share to VDSL2 and fiber. For an ISP the challenge is to be ready for this and a possible solution is to use a Dual-WAN CPE. When a customer migrates from ADSL2+ to VDSL2 or fiber (or any other technology for that matter), the ISP only needs to send out a 'dumb' and relatively cheap bridge-device terminating the physical connection from the CO-side and providing an Ethernet-interface towards the customer.

The customer's existing CPE will still be used for terminating the IP-connection, but via the Ethernet WAN-interface. The end-user's experience will in most cases be better than if they had to replace their current CPE due to both physical installation and customer-specific configurations like WLAN-settings etc. Depending on the deployment scenario, the added device can also be placed outside the customer's house/apartment and the only thing presented to the end-user is an Ethernet-connection in the wall where they connects their Ethernet WAN-interface.

All-weather VDSL2 switches

The new all-weather ZyXEL VDSL2 switches are almost indestructible and designed for troublefree operation in the rough Nordic climate for years and years. Their hermetically closed casing is intended for outdoor mounting, e.g. directly on a mast or an outside wall. The back of the casing acts as a big heat sink and therefore the units can function without any fans or other forced cooling, adding to their life span.

Constructed for operating in temperatures from minus 40 (!) to plus 60 degrees Celsius, these units will take anything a winter in northern Sweden, Norway or Finland can throw at them - and later work through the hottest summers.



The all-weather series of VDSL2 switches comprises of the 8-port VES-1608FC-54 and the 16-port VES-1616FC-54, both based on the newest Broadcom VDSL2 chipset.

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Subscribe to the free ZyFLASH electronic newsletter for Telco and ISP and keep your knowledge on ZyXEL products, technologies and services up-to-date. The ZyFLASH newsletter is distributed via email on a quarterly basis includes concise and essential news for you to browse.

For each article in ZyFLASH there will typically be a link to more information on ZyXEL's Nordic or international web sites, or a link to more technical information in a ZyXEL white paper or technical background.

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ZyXEL Zyflash

Welcome
Welcome to the first issue of the ZyFLASH (ISP/Telco) e-newsletter. At the same time we like to present our ISP/Telco **microsite** ([ISP/Telco website](http://www.zyxel.dk/web/service_provider)) with information about products, press, white papers and news.

Last month ZyXEL has participated at CeBIT, in Hannover and the Nordic team took the opportunity to not just help on our stand but also take a tour of the exhibition. The Digital Home is an obvious trend this year with all kinds of home networking and networked entertainment products causing this year - undoubtedly raising the demand for bandwidth to the home.

ZyXEL has already a broad series of Digital Home products, including new routers and a media player with Powerline (Gigaset) networking technology built in, making it easier for consumers to distribute and use the bandwidth. ZyXEL sees the Digital Home as one of the big drivers for Telco and ISP business the upcoming years, and will follow the market closely with a range of new products and technologies.

Happy reading!
The Nordic ISP/Telco team

Future-proofing your investment with Dual-WAN CPE
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Hybrid Powerline Adaptor for Coax (PLA-402 v2)
An addition to our successful line of products within Powerline

VDSL2 24-port Linecard
A new Broadcom based VDSL2 linecard is now available. The linecard

Read the ZyCAST ISP/Telco magazine
ZyCAST is ZyXEL's technical magazine for professionals in the



NEW FACE

// Steen Garbers Enevoldsen

Playing with power

At first glance, you could mistake Steen Garbers Enevoldsen for a typical nerdish engineer. Nothing could be further from the truth. Steen is very much a communications and network technology expert. Before joining the ZyXEL ranks he worked with the design of xDSL equipment for Intel and was active in xDSL standardization for Ericsson in Stockholm.

You may see Steen arriving at the ZyXEL Nordic office in Denmark dressed in black leather straddling his wild and powerful 1000 ccm Aprilia motorcycle. Steen and his bike are capable of reaching speeds of up to 300 km/h, but he promises that he is a very careful driver!

For Steen, his passion for technology doesn't stop when he leaves the ZyXEL office in the afternoon. In his own cellar he has established an advanced laboratory where he can experiment and test run ZyXEL technologies. Even his house will become an electronic showcase when he finishes his work with the new IHT intelligent home installation that will provide computer control over almost every electrical installation in the home.

Back in the living room, you may be invited to a very special cup of coffee. Steen roasts his own coffee beans, and he often likes to accompany a fresh brew with a whiskey from one of the famous Isle of Islay distilleries.

From my point of view

// Marius Rønningen, Nordic Business Development Manager

'Content is king' it is said. And for sure it's true that content is more and more what drives technology, rather than technology driving content. Knowing that tomorrow's access technologies will bring even more blazing speed to our internet browsing, television and video watching, music, digital photography and millions of other applications, most of it is readily accessible today.

What we want tomorrow will drive our need for bandwidth, whether it is for stationary devices in our homes and businesses, or mobile devices used for work, communications or plain fun wherever we are.

Just twenty years ago services like Facebook, MySpace, Flickr and YouTube would have sounded like science fiction. People would have wondered why we would ever want an online presence where family and friends minute-by-minute can follow our activities, see our photos and videos, and know what we are thinking ... well, almost. But it will come, just wait and see!

We produce and use content like never before in human history. We upload and share through a myriad of services. We have instant access to global real-time information. We

have videos, pictures and reports of tsunamis and cyclones available on the Internet even before the good people at CNN have had their morning coffee.

This is all available today - and the mobile broadband revolution is yet to come.

Existing VDSL2 and Next Generation DSL technologies, as well as Fiber To The Home (FTTH), are really useful technologies. But in a few years, billions of Internet users all over the world will have access to a new breed of small mobile devices that offer the power of today's bulky computers. These devices will probably be capable of communicating at higher speeds than available through today's wired broadband services.

Always on, always connected and always available! The applications are endless, from internet connectivity, voice and video to healthcare services and education.

Whatever will come, one thing is for sure: The world has changed forever - and will keep on doing so.

So don't look back and wonder how far we have come; look forward to what's coming! It will be like magic compared to what you see today!



Welcome to the ZyXEL Network Encyclopedia, which we hope will be your point of reference when it comes to networking terms and abbreviations. Here you will find short explanations for many of the terms and technologies mentioned in this edition of the ZyCAST magazine.

Term	Explanation
ADSL	Asymmetric Digital Subscriber Line.
ADSL2+	ADSL2+ extends the capability of basic ADSL by doubling the number of downstream bits. The data rates can be as high as 24 Mbit/s downstream and 1 Mbit/s upstream depending on the distance from the DSLAM to the customer's home. ADSL2+ is capable of doubling the frequency band of typical ADSL connections from 1.1 MHz to 2.2 MHz which doubles the downstream data rates. ADSL2+ allows port bonding where multiple ports are physically provisioned to the end user and the total bandwidth is equal to the sum of all provisioned ports. ADSL2+ port bonding is also known as g.998.x or g.Bond.
Bridged tap	A bridged tap is traditionally used in telephone installations (POTS) when cabling to make a single loop available at several termination points. Bridged taps in an access network can create notches at certain frequencies and have serious impact on network performance.
Broadcom	A vendor whose communications chipsets are used for linecards and Ethernet interfaces in general.
Chassis Switch	Chassis backbone – typically with redundant/doubled power and transmission technology - where a number of different types of linecards and service modules can be inserted and easily changed.
CPE	Customer Premises Equipment.
DMT	Discrete Multi Tone, a modulation technology used for ADSL.
DSL	Digital Subscriber Line.
EC	Echo Cancelling, used to separate different data streams sent using same frequency band in e.g. SHDSL systems.
EDFA	Erbium Doped Fibre Amplifiers (EDFA) are optical amplifiers which use a doped optical fibre as a gain medium to amplify an optical signal. Here a core of a silica fiber is doped with trivalent Erbium ions (Er+3), which can be efficiently pumped with a laser at 980 nm or at 1,480 nm, and exhibits gain the 1,550 nm region.
ETTH	Ethernet To The Home – another name for an active optical network.
ETTP	Ethernet To The Premises – Fiber cabling is terminated at the customers premises and distributed to The users via the customers private fiber based backbone.
FDD	Frequency Division Duplexing – upstream and downstream data is sent through separate frequency spectrums used in ADSL and VDSL2.
FTTB	Fiber To The Building or Fiber To The Basement – fiber cabling to an apartment building, residential area from where the network is carried forward using copper cabling, e.g. Cat5 cabling.
FTTC	Fiber To The Curb – fiber cabling terminated in a cabling closet on the curb.
FTTH	Fiber To The Home, fiber cabling run from the ISP to the home.
FTTN	Fiber To The Node –The fiber cabling is terminated at a point of presence up to 1.500 meter from the customers.
FTTP	Fiber To The Premises. Practically speaking the same as FTTB, but the network is carried onwards to the users via the buildings own fiber cabling.

Term	Explanation
g.998.x	Another term for ADSL2+ Port Bonding and g.Bond.
g.Bond	Another term for ADSL2+ Port Bonding and g.998.x.
GbE	Gigabit Ethernet.
HDTV High Definition tv	Three High Definition TV standards are currently defined by the International Telecommunication Union (ITU-R BT.709). They include 1080i (1,080 actively interlaced lines), 1080p (1,080 progressively scanned lines), and 720p (720 progressively scanned lines). All standards use a 16:9 aspect ratio.
Hot Swap	Technology where devices or modules can be exchanged while the unit is under power and in service. It is typically used in chassis switches, storage units (SAN) and the like.
IHT	Intelligent Home Technology.
MPEG-2	The Moving Picture Experts Group (MPEG) completed definition of MPEG-2 Video, MPEG-2 Audio, and Systems. The final approval of ISO/IEC 13818-1 (MPEG-2 Systems), ISO/IEC 13818-2 (MPEG-2Video and ISO/IEC 13818-3 (MPEG-2Audio) as International Standard (IS) was given by the 29th meeting of ISO/IEC JTC1/SC29/WG11 (MPEG) held in Singapore in November 1994. For more information: http://en.wikipedia.org/wiki/MPEG-2 .
MPEG-4	MPEG-4 is a standard used primarily to compress audio and visual (AV) digital data. Introduced in late 1998, it is the designation for a group of audio and video coding standards and related technology agreed upon by the ISO/IEC Moving Picture Experts Group (MPEG) under the formal standard ISO/IEC 14496. For more information: http://en.wikipedia.org/wiki/Mpeg-4 .
Multi Mode fiber	The same fiber core is used to both transmit and receive signals which are on separate frequencies. The multi mode fiber is more expensive than single mode fiber and does not offer as long distances.
OLR	On-Line Reconfiguration, a number of techniques employed by xDSL COE and CPE equipment to cope with varying noise conditions on the local loop.
OSPF	Open Shortest Path First protocol is a hierarchical interior gateway protocol for routing in Internet Protocol, using a link-state in the individual areas that make up the hierarchy. A computation is used to calculate the shortest path tree inside each area.
PoE	Power over Ethernet.
PON	Passive Optical Network.
POP	Point of Presence.
POTS	Plain Old Telephone Service, traditional copper-based phone cables.
Power over Ethernet	A technology where a switch can provide 48 volts with currents of up på 400 mA over standard Cat.3 and Cat.5 Ethernet cable for remote powering of networking devices, IP-telephones etc.
PSD	Power Spectral Density, illustrates the spectral content of a signal typically using a graph with amplitude on the Y-axis and frequency on the X-axis.
PSTN	Public Service Telephone Network – the traditional cobber-based telephone system.
PTM	Packet Transfer Mode.
QAM	Quadrature Amplitude Modulation, a type of modulation where both phase and amplitude of the signal is used to carry information.

Term	Explanation
QoS	Quality of Service. This technology can provide different priority to different users or data flows, or guarantee a certain level of performance to a data flow in accordance with requests from the application program or the internet service provider policy. Quality of Service guarantees are important.
QoS(cont.)	especially for real-time streaming multimedia applications, for example voice over IP and IP-TV.
Quadplay	Internet access, telephone, digital television and video-on-demand services
Set Top Box, STB	A Set Top Box is today typically a digital unit used for administering and controlling the rights to watch video content. The input signals can come from a fiber network, cable TV-network, antenna etc.
SFP	Small Form-Factor Pluggable optical and/or electrical connector.
Single Mode fiber	A single-mode optical fiber (SMF) is an optical fiber designed to carry only a single ray of light (mode). This ray of light often contains a variety of different wavelengths. Although the ray travels parallel to the length of the fiber, it is often called the transverse mode since its electromagnetic vibrations occur perpendicular to the length of the fiber. Single-mode optical fibers are also called monomode optical fibers, single-mode optical waveguides, or unimode fibers. Unlike multi-mode optical fibers, single mode fibers do not exhibit dispersion resulting from multiple spatial modes. Single mode fibers are also better at retaining the fidelity of each light pulse over long distances than are multi-mode fibers. For these reasons, single-mode fibers can have a higher bandwidth than multi-mode fibers.
SMB	Small and Medium Business.
SME	Small and Medium Enterprises.
SRA	Seamless Rate Adaptation, a technology where the DSL link speed constantly is adjusted according to the noise on the line. It is a part of the OLR technologies used in ADSL and VDSL2.
Trellis coding	Trellis coding is a convolutional code that improves the VDSL2 receivers ability to retrieve correct data from noisy QAM constellations.
Tripleplay	Internet access, telephone and digital television.
VDSL2	Very high-speed Digital Subscriber Line 2. Generation.
VES	VDSL2 Ethernet Switch – a switch combined with a VDSL2 modem.
VRRP	Virtual Router Redundancy Protocol is a non-proprietary redundancy protocol designed to increase the availability of the default gateway servicing hosts on the same subnet through the use of a virtual router.
WAN	Wide Area Network.
WDM	Wavelength-Division Multiplexing, a technology which multiplexes multiple optical carrier signals on a single optical fibre by using different wavelengths (colours) of laser light to carry different signals. This allows for a multiplication in capacity, in addition to making it possible to perform bidirectional communications over one strand of fiber.
WIMAX	Worldwide Interoperability for Microwave Access, is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access. It is a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL.
xDSL	Common denominator for any DSL-technology, e.g. ADSL, VDSL.
xPON	A common denominator for a number of PON-technologies, e.g. APON (ATM Passive Optical Network), BPON (Broadband PON), GPON (Gigabit PON), EPON or GEAPON (Ethernet PON) and 10GEAPON (10 Gigabit Ethernet PON).

Who is who?

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ZyXEL Communications A/S is part of Taiwanese ZyXEL Communications Corporation, wide-reaching producer of networking equipment for the IT industry, for private households, small, medium-sized and large companies and the biggest telecommunication providers. In 1989, ZyXEL initiated their production and analogous modems, and is now a leading global manufacturer of data communication, networking products and security products. Today, ZyXEL excels in products for the broadband, networking and wireless industries as well as products for network security. ZyXEL is the world's largest manufacturer of xDSL CPE and the second-largest router-supplier in Europe. ZyXEL has more than 2500 employees globally.