Network
Automation

White Paper

Automated MDF

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The Distribution Frame is the last piece of the telecom infrastructure to be automated. Automating the Distribution Frame will reduce operative costs and enable efficient delivery of new services. Network Automation, the leader in this field, works with world-class partners to install Automated Distribution Frames as an integral part of the access framework of fixed networks around the world.

Automated MDF

Automating the last mile

Executive Summary:

The Distribution Frame is the last piece of the telecom infrastructure to be automated. Automating the Distribution Frame will reduce operative costs and enable efficient delivery of new services The demands made by IP and broadband deployment and the need to stay competitive at all times in an increasingly competitive market emphasize the need for Automated MDF's, or ADF's. The elimination of manual activities in service provisioning and maintenance processes is a key improvement to establish full end-to-end process control and enabling higher customer satisfaction. It also facilitates optimum and just-in-time use of all existing copper based core assets for operators.

Just-in-time-delivery means that end user needs can be fulfilled instantly without a need for drastic over dimensioned service organisation

The NeXa ADF from Network Automation creates compelling business cases for the progressive operator. It provides not only a quick financial return but also significant long-term improvements to sustainable development and security. Less manual input (and travel), and more automation cater for meeting future challenges and sharpen competitiveness in this segment of the telecom industry.

The NeXa product exists today and has been tested, verified and deployed. It is applicable to all network strategies under discussion today among fixed line operators. It increases shareholder values because it makes better use of existing assets and optimizes the deployment of manual labour within a foreseeable future.

Traditional

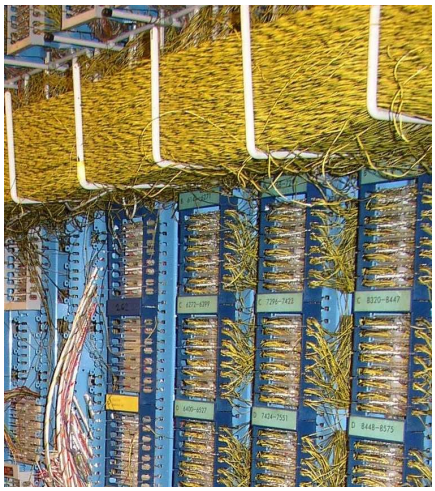
Automated - No more manual intervention

Contents:

Background

The telephone network has undergone a dramatic change during the last 25-30 years, becoming increasingly automated and digitalized. From an easily understood, albeit gigantic machine, providing telephony for several hundreds of millions of people, it has metamorphosed into an integrated telecom system targeting many different kinds of telecommunication services to billions of users. This puts an enormous stress on operators who are forced to manage the complexities of interrelated systems every second of the day. Quality, speed and costs must be controlled, at the same time as new services must be offered in cutthroat competition with rival service providers.

From the start of the digitalization period at the end of the 70's most parts of the telecommunication network has been upgraded to match the increasing demands. Technologies as well as processes have undergone constant changes, with one significant exception. The access framework in the fixed network – the connectivity network between the end user and the main telephone exchange – to all extents and purposes still relies upon the same routines and equipment it did 50 years ago. There are two main reasons for this. One is a lack of incentive and the other is the nature of the technical challenge involved with improving it.



Same routines and equipment as 50 years ago

Until 5-10 years ago there have been no substantial profits to be made introducing new technology in this area, mainly due to the relatively low frequency of changes to this part of the network, compared to other parts. This means that the fundamental incentive to develop appropriate technology and processes has not existed. This fact in combination with major engineering and technical challenges has led to a lack of development of suitable products automating connectivity.

After the rapid start of development and deployment of IP and broadband related services it has become evident that the situation must change. If not, the operators will face an unreasonable OPEX burden and experience a rapid decrease in quality and Communication Providers will not be able to offer cost-effective services in this increasingly competitive market. In addition, outmoded processes and antiquated telecom equipment will prevent the progressive operator from improving its sustainable development to lower the environmental impact of operations.

The volume of work required to make any significant change in the access network is discouraging. Today a medium-sized operator is forced to implement millions of changes in its access infrastructure every year. This is due to the need to continuously update broadband services and to carry out maintenance operations. The volume of these changes (churn) has dramatically increased and churn-rate continuous to rise all over the world. Today we see figures of 50% and more (even up to 100% in certain areas). The work order cost, with associated travel costs, is an increasing burden to be managed by the operator.

This increasing churn rate provides a compelling incentive for change. The main components of the access network are the copper cables themselves and their termination equipment. Copper has existed since the telephone network was built. For many years this asset has been viewed as old-fashioned

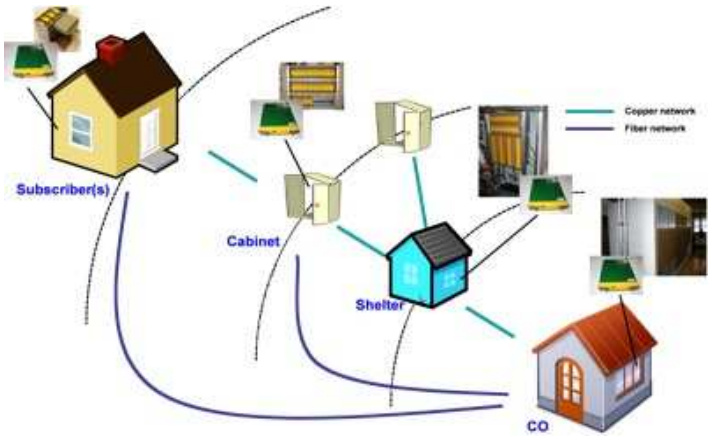
and soon to be replaced by fibre. But why replace something that already exists and has proven to have a seemingly inexhaustible potential for development? Recently it has become evident that technology is moving as fast in copper as in fibre. Today we see speeds of up to 100Mbit and more in new xDSL developments. As a consequence of the costs involved in infrastructure build-out, copper will not be replaced within the foreseeable future, but will instead be utilized by new technologies (e.g. xDSL) that are more efficient and provide increasingly competitive services.

The trend is that xDSL development progress to enable higher speed and better quality on the copper network. This leaves the copper termination equipment (MDF) as the only network component yet to be updated.

The MDF is a simple access network device, in existence since the very beginning of the telephone network allowing the operator to manually make changes whenever necessary. With the trend on increasing functionality driven by increasing competition, this manual process at the MDFs becomes the bottleneck and single biggest cost driver for the operator.

Traditionally an increase in functionality requires a retrofit of all the equipment. With an ADF the new development can be implemented gradually with a controlled migration, thereby reducing the need for initial volume investments

On its way from the customer to the main telephone exchange the end users copper line is connected to several of these termination devices, MDFs. Every time a change has to be made, manual intervention is required and in worst case could be required in several points in the access network,



The copper line is connected to several termination devices (MDFs)

During the last 5-10 years several attempts have been made to develop products that automate MDF's. Products capable of meeting existing infrastructural requirements at the same time as they allow technical innovations to continue delivering ever higher speeds in the copper network. Dramatic reductions of operating costs as well as ease of installation and maintenance are fundamental requirements for these new products and these benefits are essential if an attractive business case is to be made for telecom operators.

To stay competitive in today's world operators must control costs while simultaneously remaining competitive with regards to new service offerings and speed to market. There is also a limit to the investments that can be made within a short timescale to meet these demands.

With an active MDF (ADF) deployed, the last remaining manual component in the telecom infrastructure can be automated. The unique advantage of an ADF is that it allows operators to dynamically implement technical development in the network independently. An automatic activation process allows a greater variety of equipment targeting the individual needs. For example increasing speed over copper lines by using a provisioning process targeting individual needs rather than all end users as a group. This way previously made investments can be protected in an optimal way.

What factors influence the development of an ADF and what will be important to the success of such an endeavour in both the short and long run? The following discussion illustrates these questions using the example of NeXa, an ADF developed by Network Automation.

ADF in General

It is obvious that there are many challenges to be overcome in the development of an ADF. It must be robust, reliable, affordable and flexible, provide a multitude of functions and have an extremely long life. To develop such a system, all of today's technical, production and logistic tools must be employed combined with a comprehensive understanding of how the legacy network actually works in the harsh environment it must contend with.

Advanced programming capabilities paired with the knowledge of how copper cables are actually terminated in different countries is an example of the skills required. In some countries lightning protection is more important then in others, while the quality of copper differs between countries, impacting the transmission parameters and performance. Such knowledge base is a fundamental cornerstone in developing an ADF.

Development criteria for an ADF

- To work seamlessly in harsh environments
- Be reliable, robust and fault tolerant
- Have minimum power consumption
- Be applicable to both in-door and out-door use
- Be modular to be configured in all kinds of sizes
- Be remotely controlled in any OSS infrastructure
- Have seamless and cost efficient installation
- Be transparent to the physical copper lines
- Be future proof, modular and upgradable

Historically alternative solutions have been proposed, from traditional robotic solutions to innovative new technology. The most comprehensive and fit-for-purpose solution to the problem is to provide connectivity with the characteristics as close to the cable and traditional MDFs as possible. In the NeXa solution this has been implemented in a unique combination of mechanical components and advanced software controls.

If an ADF product is to be competitive it must meet the criteria indicated in the text box. The ADF is a network component that is going to live for 20 years or more. Since the rest of the network is facing accelerating technology trends in all areas, the ADF must sufficiently adapt to future requirements, both in its conceptual foundations as well as the way it has been implemented.

NeXa, the ADF solution from Network Automation, is the result of many years of research into different technologies and widespread markets. During the last 4-5 years different approaches have been painstakingly investigated to find a technical solution that meets both the requirements outlined above and the needs of operators in today's telecom environment. The mechatronic technology chosen, has proven to be superior to all other alternatives available today and for a foreseeable future. The NeXa system has undergone extensive and exhaustive trials verifying its fit-for-purpose. Operational and production experience has as much as possible has been built into the product already in its design.

Advantages with an ADF

- Dramatically lower OPEX
- Improved cash flow
- Free up cash for other investments
- Revenue from recycling of old MDF copper
- Less space needed means less rental cost
- Very good environmental effects
- Allow Zero touch process
- Allow fraud control over all connections
- Improved time to market for new services
- Transfer of customer between platforms

More details of the NeXa System, its features and benefits are presented below. NeXa has used the criteria outlined above to meet and exceed the requirements of today's telecom operators.

NeXa in More Detail

The NeXa system is composed of a number of separate components that can be combined to create individual solutions adapted for seamless integration with a wide variety of different sites.

After many years of trials, customer input and evaluations, all the required components to create network and countrywide installations, as well as uniquely customized individual sites, are at hand.

The main components of the NeXa system are designed to work in all the applicable environments, whether in a Street Cabinets or Central Office.

The NeXa system is supported by methods and tools developed to facilitate the implementation process, from site survey and configuration to installation, testing and verification. The availability of these methods and tools are facilitating an easy and straight-forward deployment. All phases of both installation and day-to-day operation have been comprehensively documented from hardware installation to OSS integration.

Network Automation use a Business Model allowing the company to focus on its core business to provide a cost efficient ADF while facilitating services to be provided by local partners.

NeXa in a Street Cabinet (SC) solution

To deliver such a complex system in a live environment demands total control of the complete chain from order to handover. Most of today's existing MDF sites are extremely complex due to the fact that

they have been in existence for a very long time and has evolved rather than developed into the current situation. In many cases data that documents this evolution has degenerated over time.

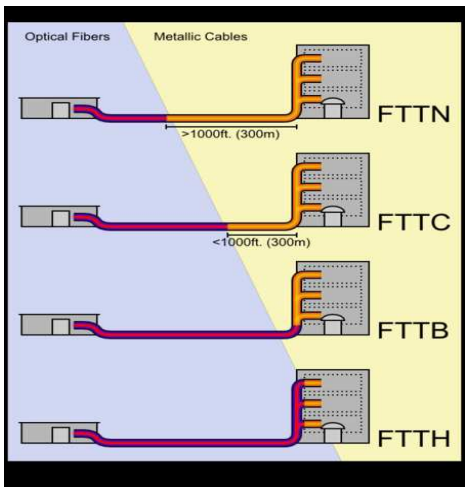
NeXa in a Central Office (CO) solution

One of the fundamental ideas behind the NeXa system is to enable replacement and transfer without service interruption. This delivers additional benefits such as freeing up space which can be used for other purposes as well as releasing large amounts of copper, aggregated over the years, from the old MDF. These factors are important components of a complete Business Case.

Some examples of possible scenarios are presented below, each of which emphasizes different aspects of the benefits delivered in some important applications.

Scenarios

To exemplify the benefits, mainly functional and financial, the scenarios outlined below will focus on some of the applications under discussion today with the leading fixed network operators, covering in-door as well as out-door usage. The scenarios are also examples of the main strategies that can be adopted to evolve the fixed networks today. Interestingly, the ADF fits in independent of where the operator has its focus. Here this is discussed in terms of what is commonly known as fibre to the node (FTTE), cabinet (FTTC) or building (FTTB) even though there are of course many more aspects in a network strategy.



The fibre deployment in these scenarios increases the needs for an ADF since the cost of maintaining the copper network is higher the more distributed the connections are managed.

- Scenario 1; FTTE - Central Office replacement (centralized upgrades, e.g. TDM to IP)
- Scenario 2; FTTC – Street Cabinet placement (extending the fibre network closer to the user)
- Scenario 3; FTTB – In-building placement (even closer to the user, bringing up speeds)
- Scenario 4; Network migration / Transfer engineering
- Scenario 5; Network consolidation

General assumptions

In order to create viable scenarios in general and business cases in particular, there are some fundamental assumptions that must be understood - common for all scenarios;

- *Knowing the accurate cost situation*; Cost, in terms of OPEX, today mainly consists of manpower and it is rising due to an increasing workload, complexity and the degradation of data. This is mainly due to the rapid change of the customer configurations in the existing MDFs (originating mainly from broadband and LLU churn)[1]. An understanding of this is fundamental if the situation is to be changed.
- *What is the configuration of the preferred situation?* It is important to decide which costs should disappear when work is automated and which processes and systems are still needed.
- *Risk Analysis if nothing is done*; Churn and unit costs must be based on, not only on today's figures, but also on projections about tomorrow. What will be the result if nothing is done?

Important questions to answer

- What is the strategic horizon for future investments and upgrades of the network?
- Is it likely that technology related to the access network will be changed during the lifetime of an ADF? If so, how will "replacement" be effected?
- Is it important to have the flexibility to meet various market demands over time and to avoid massive investments every time to meet these demands?
- Is it important to reduce travel and power consumption, (environmental impact)?
- What are the main incentives for an ADF; lower operational costs? Less space needed?, increased flexibility?, improved quality? Avoidance of fraud? Copper re-cycling? Less power need? Different operators see different advantages accruing from an ADF, depending on the market situation.
- And of course fundamental assumptions such as; churn today/tomorrow, manpower costs, travel costs, network data, support costs, quality as seen from the customer's point of view, etc..
- Can an outsourcing offering be used thus reducing the need for capital expenditure?

[1] Additionally, in a customer configuration change (jumpering) the old jumper wire is always left behind, incrementally adding to the copper assets in the MDF. This must not be forgotten in a BC where the MDF is replaced with NeXa.

Appendix 1

Scenario 1; FTTE - Central Office replacement (centralized upgrades, e.g. TDM to IP)

This first scenario has in fact 3 slightly different versions. Either only the MDF part of the network is considered for an upgrade or the ADF installation is used as a vital support for a switch replacement (which in most cases today is a PSTN / Broadband service platform with or without IP as a core). The third version only differs in scope or magnitude; in a countrywide project with hundreds or thousands of COs to be replaced, the ADF is probably the key to succeeding with quality and costs under control.

Version 1;

An operator considers modernizing its CO environment. The MDF will be replaced to enable automation of service provisioning. The idea is to focus on the financial benefits and to implement a zero touch process in the organisation to support this.

Incentives; Zero touch processes, improve operational performance, speed to market

Assumptions; With a cost base of 30 Euro per jumper and a churn level of 25% the payback period is guaranteed to be less then 4 years. If all other costs – such as back-office, travel and the potential revenues (e.g. less space needed and the copper from the old MDF) - are included, the payback period is even shorter. If provided as an outsourcing offer, capex spending can be totally avoided and the related activities can be linked to a pre-defined OPEX reduction plan.

Benefits; always accurate data, dramatically lower cost, quick financial return from OPEX, less space needed and revenue from dismantling the old MDF.

Version 2;

In this version the operator is also planning to upgrade the switch in the CO site. By using the internal and external scanning features in NeXa the quick and secure installation and replacement of the MDF is added with a fault proof transfer of the subscribers from the legacy platform to the new service platform – independent of service (POTS or broadband). Saving cost, quality and time.

Central Office placement of NeXa

Version 3;

This alternative version of the scenario is for an operator planning to replace complete service infrastructure and move to IP. In this version the ADF will support bulk transfer in a way that is practically impossible with manual labour only. Adding all the other benefits in the two previous versions creates an excellent Business Case and makes it possible to carry out such a huge task within a reasonable timeframe.

Scenario 2; FTTC – Street Cabinet placement (extending the fibre network closer to the user)

An operator has decided to extend the network, bringing it closer to the customer, via fibre to the curb and then use existing copper for the remaining part. This is a scenario where it is important to keep the investments and the operational costs under control.

There is an interesting version of this, where the operator will extend the network with street cabinets connected to a CO where NeXa already has been installed.

Version 1;

Extending the fibre network closer to the customer may impose an increase in OPEX. There are two obvious ways to avoid this. One is to equip all customers with xDSL to minimize the need for travel, while the other is to use an ADF to switch between correctly dimensioned xDSL ports. With current pricing it is financially not viable to equip all ports with xDSL for the following reasons;

- *More expensive*. To invest in 100% xDSL is almost 50% more expensive then to use 50% xDSL together with NeXa.
- *Shorter life cycle*. When the operator needs to upgrade the xDSL technology this must be done for all the lines simultaneously and therefore the same investment must be repeated. This means that over the life cycle of a NeXa system the total investment is higher using the 100% approach. Maybe up to 3-4 times depending of course on the pace of technical development.
- *Higher energy consumption.* 100% xDSL requires almost double the amount of energy compared with 50% xDSL combined with NeXa.

Incentives; Offer high speed services, manage OPEX/CAPEX, to minimize environmental impact, zero touch, increased security and higher flexibility in the ability to manage future technical developments.

Benefits; all benefits from scenario 1 +, smaller increments on the deployment, excellent business case

Street Cabinet placement of NeXa

Version 2;

Alternatively the operator might have already invested in an ADF in the CO (scenario 1), and now wants to extend the network using street cabinets. The advantage of having an existing NeXa installation is of course that 1) all customer configuration data is accurate, 2) the migration to the cabinets can be made seamlessly.

Scenario 3; FTTB – In-building placement (fibre even closer to the user)

The operator has decided to get as close to the customer as possible using fibre, while still using the copper loop for the last part. The scenario is similar to number 2, but with even smaller ADF's, making the Business Case even more important.

Network Automation has developed a very small and cost efficient version of the NeXa system for this purpose. This system has been developed to cater for those leading European operators whose strategies is to get as close to the end-user as possible. Its small physical size and intelligent functions for connecting and controlling the copper lines address a fundamental part of the way these operators perceive that networks will evolve in the future.

Incentives: as for scenario 2, but with even more emphasis on cost and capex control, higher speeds.

Benefits; As for scenario 2.

In-building placement of NeXa

Scenario 4; Network migration

An operator needs to move customers to a new service platform for parts or the entirety of the network, and has decided to focus on controlling cost, quality and speed during transfer. The difference between this scenario and scenario 1/version 3 is that this is a combination of FTTE, FTTC and FTTB.

By calculating the Business Case effects from using different scenarios in different parts of the network, an optimized total Business Case can be made. The drivers and the benefits are of course the same as for the previous scenarios.

Scenario 5; Network consolidation

An ADF can also be used to concentrate the number of switch elements an operator has. The deployment of NeXa will allow an operator to make this very time consuming and costly exercise smooth and efficient. After the concentration, all sites are equipped with an ADF which makes the migration almost pay for the ADF installation.

This creates a Business Case for a consolidation exercise includes auditing, the addition of new MDFs, labour for installation and migration, and documentation. All this added together means that it is very attractive to use an ADF such as NeXa instead.

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