WHITE PAPER

ADX Active Digital Cross-Connect

A Space in Time

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Mobile operators in Europe are being squeezed on several fronts, not least of which is space. Explosive growth from popular voice services has forced them to continuously increase the capacity of their backhaul networks consisting largely of leased lines that connect to terminating multiplexers. Increasingly, space is becoming precious – and expensive – real estate in remote cabinets housing this equipment.

For many operators, acquiring additional space is not an option either because of the associated cost of leasing expensive housing cabinets or because of public opposition to new cabinets on roofs and in other areas. Clearly, the answer for these operators is to make better use of existing space. One quick and cost-efficient solution is to deploy space-saving technology, such as ADC KRONE's compact active digital cross-connect (ADX), which reduces the amount of 2 Mbps leased line cables in the exchange while, at the same time, increasing flexibility through efficient multiplexing.

Numerous GSM (Global Service for Mobile Communication) operators in Europe offering 2G (second-generation) circuit-switched mobile services recognise a need to solve their space dilemma sooner than later. Demand for their voice-centric service continues to grow exponentially. In fact, penetration into large markets such as Germany, France, Italy and the United Kingdom now exceeds 80 percent, with the Nordic countries approaching the 100 percent mark.

Voice remains the killer application

Even if new broadband mobile data services, available over packet-switched 3G (third-generation) networks, eventually capture a larger share of the average revenue per user (APRU), voice is, and will remain, a killer application. Teenagers, craftsmen, business people and just about everyone on the go have come to appreciate the ability to make and receive calls from virtually anywhere on the planet, at any time. Consequently, networks carrying this traffic will only grow – not shrink.

Such growth, of course, has created networking challenges for mobile operators. Arguably one of the biggest they face is backhaul. This is the part of the network that includes the cellular base station at the edge, the base station controller or radio network controller, and all other layer 1-3 transport, aggregation and switching elements in the access and metro networks, excluding the core switching network. The infrastructure connecting all these sites generally comprise 2 Mbps E1 leased lines but also includes point-to-point microwave; it can be expensive to operate and difficult to scale if not efficiently designed and managed. Today, for example, E1 lines account for as much as 25 percent of some mobile operators' operating expenses.

TDM has its advantages

To provide their 2G services, GSM mobile phone operators have built backhaul networks based on TDM (Time Division Multiplex) technology. TDM-based networks, using SDH (Synchronous Digital Hierarchy) in their core, have long served as standard transport platforms for cellular traffic. SDH is optimised to handle bulk voice circuits with maximum uptime, minimal delay and guaranteed service continuity.

Early GSM operators chose TDM because of its many advantages. The technology is proven and relatively simple, enabling operators at any given time to know what traffic is going over the links. Moreover, TDM-based networks are ubiquitous. As such, they allow under used links to be shared through aggregation. An essential part of any GSM network transport design, aggregation allows for more efficient use of the transport bandwidth and simplifies network management.

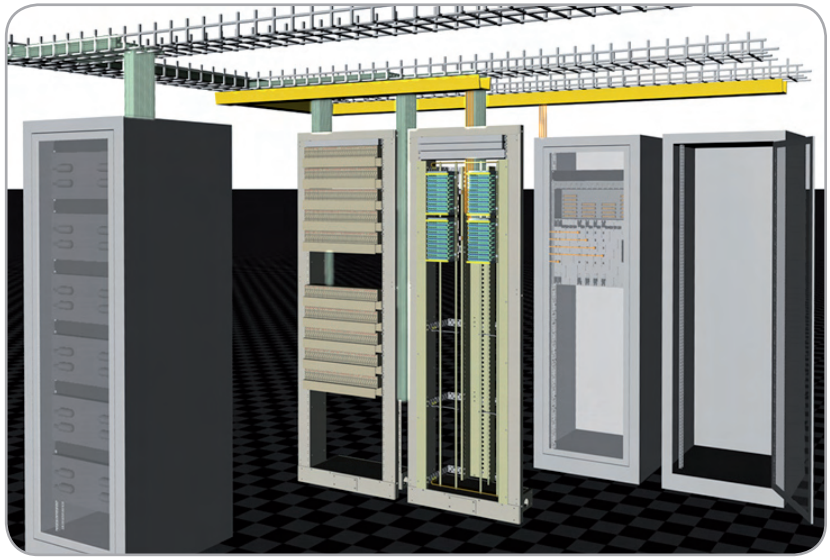
Generally speaking, aggregation occurs where there is dense concentration of traffic from multiple radio cell sites, typically at the controller sites and the mobile switching centre (MSC). As voice traffic increases, and this has been the case in Europe and nearly all GSM markets around the world, the quantity of backhaul links rises exponentially. Aggregation of traffic invariably leads to lower opex (operating expenses).

TDM-based networks can deliver significant cost reductions providing that the multiple traffic streams are aggregated intelligently. A TDM multiplexer, for example, can merge several E1 leased lines to carry traffic over an STM-1 link (Synchronous Transfer Module), which becomes cost-effective.

Time division multiplexing requires fewer switching ports and less expensive equipment. For example, an STM-1 port costs less than a 63x E1 port card on a switch. Also, using higher speed modules allows for higher port density in the same device. The elimination of all these costs helps reduce capex (capital expenses).

Operators can deal with increased uncertainty by using technology that offers high flexibility and scalability, and provides a cost-effective route to grow their networks. The ADX Active Digital Cross-Connect from ADC KRONE is a smart way to tackle a complex issue in the backhaul network by overcoming space restrictions in distribution cabinets. Its compact design fits into all profile rod or rack-mount systems, reducing space by 50 percent to 80 percent. Equally important, the system can eliminate huge bundles of copper cable running to distribution frames.

The ADX brings together two traditionally separated worlds by combining the cross-connect flexibility and transparent test access of a DDF (Digital Distribution Frame) with the switching capability of a multiplexer.



The ADX 100 shown in a "cable gainer" application; eliminates large bundles of copper cable.

Dealing with unknowns

Certainly, mobile operators face significant unknowns as they plan how to transport growing volumes of traffic over the next four to six years. One is the challenge created by new 3G services, requiring high bandwidth at low cost. Another involves the radio access, which is evolving to encompass a much broader set of technologies, making new demands on the transport network of the future.

At the same time, mobile operators can no longer predict, with any degree of certainty, their future backhaul requirements, as those requirements will constantly change in unforeseeable ways. Today, they no longer have a firm, predictable base to plan their capacity and technology requirements.

Given all this, mobile operators need to develop a transport solution that adapts to their changing needs in a flexible, cost-efficient way. This process begins with the identification of key backhaul segments and focus on the areas to be optimised within each network segment. All phases in the network's lifecycle, from planning and implementation to maintenance and upgrades need to take these factors into account.

In one unit, the system combines a very compact SDH add/drop multiplexer (ADM), up to 64 accessible E1 ports, optional STM-1 aggregation ports, E1 cross-connect and a DDF. It complies with SDH standards and supports operation and administration features required for successful integration into an existing transport network.

The ADX, which resides at the edge of the remote exchange, is designed to perform various tasks. For instance, it allows all incoming E1s to be aggregated into one piece of equipment and then fed into the E1 routers. If some or all of the E1 traffic must be redirected through to a specific router, this can be done remotely, shortening the amount of time required to make service changes. In addition, the ADX multiplexes all E1 lines into a single fibre, which then connects directly to an SDH multiplexer as a fibre pair rather than as a bundle of 63 copper pairs. This unique feature offers substantial space saving.

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Size does matter

The size of the ADX itself is ideal for remote sites with tight space restrictions. The system fits into the slot typically used for the copper distribution frame block.

The ADX is available in three compact models: the ADX 100 mounts on profile rods, includes the STM-1 card, and supports eight interface cards with eight E1 ports each; the ADX 200 mounts in a 19-inch rack, is one rack unit high and supports four interface card slots (up to 32 E1 interfaces); the ADX 201 mounts in a 19-inch rack, is two rack units high and supports eight interface card slots and up to 64 E1 interfaces.

Technical specifications

	ADX100	ADX200	ADX201
Height	244 mm	44 mm	88 mm
Width	140 mm	450 mm	450 mm
Depth	120 mm	180 mm	180 mm
Weight	1.7 Kg (excluding interface cards)	1.7 Kg (excluding interface cards)	2.5 Kg (excluding interface cards)
Power Consumption	6.5 W (excluding interface cards)	6.5 W (excluding interface cards)	6.5 W (excluding interface cards)

The maximum power consumption when IFCs and SFPs are inserted is < 14 W.

In addition to its space-saving design, the ADX has several other advantages. For instance, the ADX is designed to run on low energy. Because the product uses little energy, it also creates little heat, requiring fewer ventilators and fewer climatisation control elements. Lower power consumption means lower power costs and thus lower opex.

Moreover, the ADX supports E1 unframed transport and is transparent for framed E1 signals. It also supports the ability to perform nonintrusive monitoring of any connection at the E1 level, similar to the conventional distribution frames. Monitoring is possible on the test access output or any other E1 port.

The ADX cross-connect functionality offers any-to-any non-blocking connectivity and eliminates the need for manual jumpering. Dispatching technicians to manually move or change jumper cables in remote sites is a huge cost factor. The reduced need for technician intervention also reduces opportunities for human error.

At the same time, the ADX increases flexibility by allowing service assignment changes to be done remotely. At the same time, record-keeping for these changes is moved from technicians maintaining physical records to the network management system automatically compiling this data.

Lower opex and capex = lower TCO

In summary, the ADX is designed to meet the growing bandwidth needs of mobile operators for their voice-centric services. The product enables more flexible assignment of E1 leased lines inside edge network applications through uniquely integrated E1 cross-connect functionality. It also optimises capacity through STM-1 connections. The net result is lower capex and opex, and thus lower TCO (total cost of ownership).

Clearly at a time when mobile operators are challenged to predict future transport demands on their networks, the availability of technology such as the ADX, which offers calculable functionality and costs, promises much-needed relief.

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