

Richly functional, high speed network gives Denmark's second largest city a first class engine for growth



The City of Aarhus in Denmark has provided its community with a basis for improved local services and economic growth, by installing a high-performance infrastructure based entirely on Cisco Systems' solutions. Cost savings and productivity gains within the Council are being matched by the creation of new educational and other resources that will continue to enhance the quality of life in Aarhus.

CHALLENGE

Located in East Jutland, Aarhus is Denmark's second largest city with approximately 300,000 inhabitants. It is a modern, vibrant city whose leaders are committed to creating an environment in which residents, businesses and public institutions can thrive.

In today's society, technology is likely to play a central role in any such vision, a fact that was appreciated by the City's leaders. Aarhus already had an active business community and a rich cultural and educational life. What it needed now was a high-speed communications infrastructure that would be accessible to everyone and, by transforming the way in which people worked and learned, would give Aarhus a fast-track highway to future growth.

In 2003, the City of Aarhus announced a competition to find an innovative, practical and cost-effective communications solution that most closely matched its long-term vision. Six vendors qualified to enter the competition, including Cisco Gold partner Netdesign.

SOLUTION

When the City issued its requirements to the bidders, the document contained surprisingly few specifics. The City requested a network that could bring together its 1,500 institutions – local government buildings, schools and kindergartens, libraries and old people's homes – and potentially deliver new services to businesses and residents. It had to be high-speed and able to support the future introduction of new technologies such as wireless and IP telephony.

Executive Summary

Customer Name

- City of Aarhus, Denmark

Industry

- Public sector – local government

Challenge

- The City of Aarhus needed a communications infrastructure that would transform the way in which people worked and managed their lives

Solution

- A redundant fibre optic ring with 60 Points of Presence offers high-speed links throughout the metropolitan area
- A range of high-performance Cisco Catalyst Switches and Modular Access Routers provide a reliable, secure platform that supports flexible working and is being used to deploy new technologies such as wireless and IP telephony

Business Value

- The network has provided 1,500 public institutions and SOHOs with reliable, high-speed links – to the Internet, to each other, and to centralised applications and databases
- New ways of working are improving efficiency, saving time and money, and allowing the Council to enhance and automate its services to citizens

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Louise Gade
 Lord Mayor
 Municipality of Aarhus

Beyond that, the bidders were free to design the solutions that they believed would most benefit the City, based on different budgets and scenarios. The winning design, built entirely on Cisco Systems' technology, was developed by Netdesign. It proposed a fibre backbone with around 60 Points of Presence (POPs) that would cover the entire metropolitan area from the start – not just the areas or locations which had been specified. This met the City leaders' key objective that the network should benefit everyone in the municipality.

The core of the network, powered by Cisco Catalyst 6509 Switches, opens up a wealth of functionality and opportunities to the City.

- **Performance:** the City's 142 fibre optic connections operate at 1Gbps, while 1,382 sites with copper wire connections run at speeds of up to 2.3Mbps
- **Reliability:** the ring structure has no single point of failure and its redundant design offers 99.995 per cent uptime in the backbone.
- **Convergence:** as well as almost limitless capacity for growth, the network offers built-in support for converged voice, data and video applications running end to end

The new infrastructure was installed between November 2003 and November 2004. It is delivered to the City as a fully outsourced, managed service that is also supplier-independent because Netdesign does not offer services such as Internet access or telephony. This will enable fair competition among service providers, helping to ensure that the City obtains the right products at the best prices.

BUSINESS VALUE

By connecting the City's offices and some 30,000 public employees, the network has started to transform internal communications and administrative functions. Previously, with a mixture of legacy systems operating at the departmental level, breakdowns in service had become a regular occurrence. Today, the high availability of the new network is making the City's public institutions more efficient and municipal staff more productive. At the same time, the regular stream of complaints about slow response times on the network has dropped to zero in view of its now excellent performance levels.

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Flemming Nielsen
Manager of IT and Organisation
Municipality of Aarhus

Council employees are also enjoying improved access to information and services which, in turn, is delivering other benefits. One of the City's goals, for example, was to reverse the growth in paper-based document handling by introducing an electronic document management system (DMS). The new infrastructure, with its high bandwidth and City-wide reach, provided an ideal platform for this type of centralised application. It enabled Aarhus to introduce a DMS based on Lotus Notes that is currently being used by around 7,000 City employees. The application, which allows users to share data for the first time, will gradually be extended to more employees. Already, however, the creation of a central database has greatly improved efficiency.

“Because we have broken down the technology barriers between different departments, it's now possible for employees to find information that wasn't readily available before,” says Flemming Nielsen, Manager of IT and Organisation for the Municipality of Aarhus. “Online document sharing is saving time, and therefore money, as well as improving our services to citizens.”



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Not surprisingly, the City decided to take advantage of its new, high-speed platform to introduce more centralised applications, such as the bespoke financial and human resources systems based on SAP that are currently being developed. Process automation is also gathering momentum, spurred by the national government’s requirement for all public authorities to automate their internal purchasing systems by spring 2005.

With its new infrastructure, the City of Aarhus had no difficulty in meeting this requirement. It has deployed a dedicated application that handles all aspects of purchasing online, including details of approved buyers, agreements between those buyers and the City, and agreed pricing and other terms. After only a few months, the time and cost savings were already significant, as Flemming Nielsen explains:

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All network users, including schools and libraries, are benefiting from faster and more reliable Internet access. This is bringing valuable learning resources to students and older citizens alike. Better network performance has also opened doors to new ways of using information and resources. Aarhus’ libraries, for example, have introduced BIBCAST, an application that is allowing them to transfer historical materials on to video which can then be streamed to users in other locations across the network.

At its conception, Aarhus Nettet was the most comprehensive network of its kind in Denmark. An important element of the City leaders’ vision for the future is the ability of their new infrastructure to offer a rich platform for ongoing development. The Council is already using it to introduce online services to citizens. Hosted externally, these will simplify and automate the vast majority of interactions that most local residents and businesses have with their Council. In the longer term, it is hoped that Aarhus Nettet will encourage independent vendors to offer new services to the community, thereby stimulating the local economy and enhancing people’s quality of life.

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pupils in our schools as well as for the public at large, using the Internet services of our public libraries,” says Louise Gade, Lord Mayor, Municipality of Aarhus.

In addition to reducing the network operating costs of the municipal authority, the infrastructure represents, in a sense, an ‘information highway’ covering the entire municipal region, potentially delivering high capacity and new services to the local business community as well as to the citizens of Aarhus – facilitated by private Internet Service Providers.

A dynamic and flexible environment

The City was quick to exploit the potential of its new infrastructure to support advanced technologies. It has, for example, deployed a wireless solution in Aarhus City Hall that provides 70 access points in meeting rooms and other parts of the building. The first priority was to provide visitors to City Hall with wireless Internet access from their laptops, and to make it easier for the IT department to deploy temporary network links during conferences and other special events.

“Wireless access to the network will encourage mobile working and allow staff to collaborate more effectively during meetings. This is part of the council’s strategy to support new ways of working and help to create a more dynamic and flexible environment.”

Flemming Nielsen
Manager of IT and Organisation
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The Council now plans to provide employees with wireless access to their internal network. “Wireless access to the network will encourage mobile working and allow staff to collaborate more effectively during meetings,” says Flemming Nielsen. “This is part of the Council’s strategy to support new ways of working and help to create a more dynamic and flexible environment.”

The City’s new infrastructure has built-in support for converged, multimedia applications. This means that technology such as IP telephony, already being piloted in a number of locations, can be deployed without upgrades and integrated easily. The Council sees cost savings – both in capital and operational expenditure – as the main benefit of IP telephony, which it plans to introduce gradually.

“This was a long-term investment so we couldn’t afford to find ourselves in a technological cul de sac. The new Cisco-based infrastructure gives us a high capacity environment that will scale even further if necessary, and offers us a wide range of possibilities in terms of new technologies and ways of serving our citizens.”

Flemming Nielsen
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High-speed connections between Aarhus’ public institutions have made it possible to streamline other IT services. The City has started to consolidate some of its 600 servers, in the social services department and among its schools. The endgame is to merge all the remaining servers into one data centre to generate economies of scale and further improve communications.

The management of Aarhus Nettet has been outsourced on an initial eight-year contract that brings the City significant financial benefits. Firstly, the size of its capital investment is greatly reduced and secondly, the City requires fewer in-house IT resources and skills to support the network. As a result in-house IT specialists are able to concentrate their energies on strategic development and implementation. In the longer term, the fact that Aarhus does not own the infrastructure means that it is protected from the effects of obsolescence and technological advances.

“This was a long-term investment so we couldn’t afford to find ourselves in a technological cul de sac,” Flemming Nielsen concludes. “The new Cisco-based infrastructure gives us a high capacity environment that will scale even further if necessary, and offers us a wide range of possibilities in terms of new technologies and ways of serving our citizens.”

TECHNOLOGY BLUEPRINT

Aarhus Nettet was designed as a fibre-based ring structure with no single point of failure. Three Cisco Catalyst 6509 Switches in the core create an intelligent and secure platform for the delivery of converged services end to end, currently at speeds of 1Gbps for fibre links and up to 2.3Mbps for copper wire connections with additional capacity built-in, if required. This, combined with the provision of additional 'dark' fibre, offers the City of Aarhus nearly 100 per cent availability and redundancy with virtually unlimited performance potential.

To allow different methods of connection the network has two cores, each with a similar construction: one to support 142 locations where fibre connections are available, the other supporting 1,382 locations with Copper Data Distribution Interface (CDDI) connections.

The network contains 58 Cisco Catalyst 3550 12G Series switches in the distribution rings, 140 Cisco Catalyst 3550 24 SMI Series switches at the locations where fibre links are provided, and 1,300 Cisco 1751 Modular Access Routers at sites with CDDI connections.

Some homeworkers use Cisco 1751 Modular Access Routers that are equipped with a four-port switch module, where one port provides secure access to the Aarhus network. Another port is available to employees and their families to access the Internet for personal use. This provision of secure remote access is one element in Cisco's Self-Defending Network, a solution the company has developed to encompass all the major security requirements within the government sector.

An ATM (Asynchronous Transfer Mode) backbone consisting of 20 Cisco Catalyst 8510 Multiservice Switch Routers provides a single platform that integrates multiservice ATM switching with wire-speed multiprotocol routing for Gigabit Ethernet. Digital Subscriber Line Access Multiplexer (DSLAM) capabilities ensure that the City's network users can obtain multiple high-speed connections simultaneously to services via Asynchronous Digital Subscriber Line (ADSL). DSLAM facilities for locations with CDDI connections are provided by 20 Cisco 6510 Service Selection Gateway solutions.

One centralised Internet connection for the whole network allows the Cisco partner Netdesign, which supplies and manages the infrastructure, to monitor traffic and ensure that security remains tight. The key security components consist of two Cisco Catalyst 6506 Switches equipped with Cisco Firewall Services Modules and Cisco Catalyst 6500 Series Intrusion Detection System Services Modules.

For added security, the network is divided into several different Multiprotocol Label Switching Virtual Private Networks (MPLS VPNs) which are assigned to individual applications such as wireless or different user groups such as schools. All connections between any two VPNs go through the firewall, extending the stringent security at the network perimeter to its internal communications. Together, these security measures form another part of the Cisco Self-Defending Network: the need for tight admission control to authenticate all users and devices.



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