Microsoft's Office

The Information Technology business is the most dynamic sector on the planet. Nowhere else are future directions less clear. Continually changing markets, tasks and products bring with them new work strategies and workplace requirements.

'Futureproof' buildings are, therefore, called for, especially when the customer is the world's leading software company.

A building made of air, ie *completely* without walls, would be the ideal solution; what has been built, in record time, is the next best thing: a US$ 70 million state-of-the-art campus featuring the most modern technology available – perfect for shifting walls, perspectives, horizons and paradigms.

To ensure harmony across the board, the customer entrusted most of the building technology to one pair of hands – ABB. In just twelve months, ABB conceived and installed:

- Ventilation systems
- Monitoring, measurement and control technology
- The building control and management system
- The cooling water system
- Combined heating and power plant with dual redundant, non-interruptible power supply for, amongst other things, two computer centers
- A high-speed data and communications network with around 10,000 ports

A comfortable workplace by employees for employees

Top priority was given to providing complete room configuration capability and mobility for 1450 employees spread over 32,000 m^2 in 14 separate buildings. Projects and teams in Microsoft change more often than in most other companies, so the internal structure is always in flux; on average two thirds of the employees make an internal move annually. So it has to be possible to install and remove walls on the 1.35 m window raster without having to reconfigure data or utilities connections.

That the highest achievable standards are provided throughout the huge 182,000 m^3 campus room is essential, not

Equipping Microsoft's new Munich headquarters was a challenging, high-profile project which not only set new standards in many key areas but also provides an excellent reference for ABB.

Besides having the latest Information Technology installed, the headquarters features modern building technology in all its forms: high flexibility for furnishings and office configuration, high-capacity communications, and optimum data security and user comfort.

And the cooperation between ABB and Microsoft has not stopped with the planning and realization of the project. Under the terms of a 15-year energy provision contract, ABB Energiesysteme GmbH will supply all the energy – power, heat and cooling – the headquarters requires, leaving the customer to concentrate on his core business.

The Munich headquarters campus

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only to reassure customers, but also to provide the employees with the best possible working climate. After all, successful IT specialists are much sought after and any job relocations should be *within* the company. To accomplish this, the employees were fully consulted at each decisive design stage and their ideas included in the planning process. And the results are there to be seen:

At first sight, the campus looks simple and functional, but closer inspection reveals a treasure trove of details in color, form and materials. The extensive complex is inviting, with two semi-circular main buildings, nine wings and three further buildings, open courtyards and attractively designed corridors.

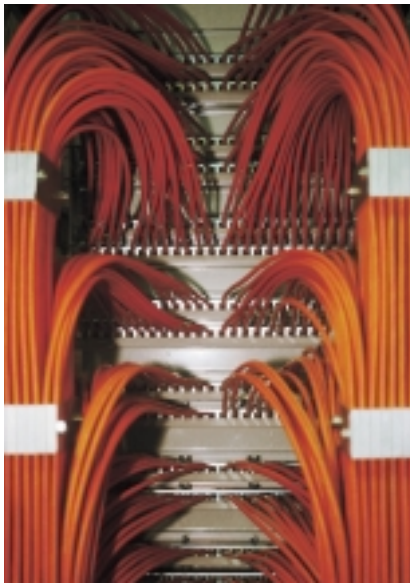
USH is the internal abbreviation for the new headquarters. It might be thought to stand for 'University South-west of Heavensgate', a place to think, communicate, and develop new solutions and strategies, but in fact it is a shortened form of the rather less pronounceable German name for the area – Unterschleissheim, near Munich.
A perfect location – close to the city, airport, trains, highway, and of course, sitting squarely on the data superhighway.

However, life on the campus is anything but virtual reality. A kickboard is the optimal means of transport. Favorite meeting places are the 'Casino' (a restaurant), the fitness room or perhaps one of the cafes. In spite of e-banking, there is an on-campus bank.

The campus has been conceived not only to unite previously scattered units, but also to provide accommodation for partner companies. Apart from training, marketing, sales and providing the national Microsoft portal, the complex provides 24-hour support to larger customers through 'Premier Support' agreements.

Well connected

A company's computer center is usually treated like a security vault – locked and hidden from sight. Not so on this campus. On passing through the inviting foyer, the visitor is confronted by a huge window into the main computer center – the huge processing power and vast memory storage a thing of pride, not something to be hidden away. Underfoot, glass floor panels reveal the building's nervous system – neatly bundled cables speeding data to all corners of the campus and to the world beyond.



For once, the ABB data network specialists can display their neat handiwork to the world – a real life 'demo'. Peter Stock, Microsoft Facility Manager, says "It's not just a gag, transparency is a part of our company philosophy".

The glass floor panels give but a glimpse of the complex high capacity data network installed by ABB. Reliability is paramount, but speed and future expandability are also important. All this is guaranteed by 400 km of copper wire (ITT Cannon, RJ 45) with a 250 MHz bandwidth and 5 km of new-generation glass fiber cable with a 48 fiber core (Siecor, MTRJ connector standard, single- and multimode).

Two brains are better than one

Where most concerns have one computer center, the Microsoft campus has two. These run synchronously and in parallel and can take over from each other in the case of failure. They are located in separate buildings, have completely independent power supplies and are joined by a redundant glass fiber backbone.

A total of 25 indoor climate units condition the air in these computing facilities – cooling, removing dust and humidifying or dehumidifying as required. Each unit has a separate coolant connection. To ensure constant room climate even during a breakdown, the units in the more critical rooms are configured redundantly.

The units function autonomously and are connected by their own bus. Should

a breakdown occur, the switch to standby units is directed locally.

Air is blown in through the false floor. It streams through the racks and is removed above for reprocessing by the climate units. The main computer center uses outside air to maintain overpressure and thus keep dust out.

What is unusual about the data network is that the manufacturer (ITT Industries NS & S) provides a performance guarantee without limit of time. Only certified companies, like ABB Gebäudetechnik AG, are qualified to install these specially structured cable systems.

In the employee areas the approximately 10,000 ports are located in recessed stowage; the generous cabling allows easy local relocation and reconfiguration, making wireless networking unnecessary.

We are sailing

Reconfiguration flexibility is reflected throughout the technology in the buildings. For example, in the ceiling-mounted movable 'climate sails'. Each of the 1600 1.25 by 1.00 m sails includes, amongst other things, all heating and climate elements for the particular workplace. The sail can be flipped down to make all parts easily accessible for maintenance.

The cooling capacity is sufficient to remove all heat generated by persons and computer equipment. Fresh air intake provides the necessary air change.

But the trick about the climate control is this: the individual workplace regulation of temperature, lighting and incoming sunlight is fully integrated into the building management system (with Microsoft Windows CE as a platform) and can be controlled from each PC; it is even accessible via the Internet. Employees could, for instance, log on from home and switch on the heating for a comfortable climate the minute they walk in the office door!

A sail hangs over e*ach* workplace, 22 cm below the ceiling. This saves height and at the same time avoids having to install the usual false ceiling. Each sail contains the illumination sources and is designed to optimize room acoustics.

A further aspect of the sails is the radiated energy balance between the sail and warm surfaces in the area, which causes gentle air movement. This convective scheme elegantly avoids the higher-speed air currents characteristic of conventional ventilation and, apart from raising less dust during heating periods, is perceived as being 'fresher' and more comfortable.

All I need is the air that I breathe

Offices and neighboring spaces are mechanically ventilated using 100% outside air. This air is filtered (to class EU 7) and pre-heated in a heat exchanger to the required 20°C. On the exhaust side, a further filter (EU 3) is installed to keep the heat-exchanger clean. Silencers are installed before and after the intake and exhaust fans.

In the building itself, the air is distributed via vertical and horizontal shafts. The air is brought from channels

in the corridor's false ceiling into the workplaces via the sails. This means the air distribution is flexible enough to follow the room reconfiguration. The exhaust air is removed through silencers in the false ceiling.

The amount of air provided is determined by DIN Standard 1946 Part 2. This foresees 6 m^3/hm^2 or about 70 m^3/hm^2 per person, an amount which covers any heating requirements as well as cooling of 12 W/m^2.

Heating and cooling are accomplished mainly by the sails, which are connected to a four-channel fluid system. The sail has 16/18°C and 33/28°C cold and hot water in/out connections, respectively. A valve switches between hot and cold water and a further valve regulates the quantity accordingly to provide the optimal climate. The sail cooling and heating performance is 96 W/m^3 and 122 W/m^3, respectively.

The primary cycle temperatures are:

- Summer: 8/14°C
- Winter: 8/14°C or, when using outside air and no refrigeration, 12/18 °C

Whenever possible, outside air is passed through the external cooling towers and used to condition the indoor air, which avoids having to switch on the refrigeration compressors. In winter, this results in the cooling water being slightly warmer than when it is artificially refrigerated. The main cooling load calculations for the entire year are based on this cooling mode.

The main loads are served thus:

- Climate sails: 16/18°C
- Computer climate units: 12/18°C
- Room ventilation and climate: 8/14°C

Fast commissioning

All the volume flows to the main loads are dynamically controlled. This speeds up load balance configuration during installation and allows commissioning of the system in just a few days.

The cold water for the sails is distributed in a conduit in the corridor. Each façade of the building has a channel with branches, each branch serving two room axes. Two sails can therefore be connected to one control group via flexible metal pipes.

The highest precision was necessary when mounting and connecting the sails; engineers had to develop their own special equipment. To achieve the millimeter accuracy needed, six laser devices were employed.

The computer-supported planning which was used to avoid 'collisions' between different groups of installers paid off: precise and systematic planning on a per-building and per-floor basis avoided cost-intensive conflicts of interest and expensive re-planning, and allowed accurate materials forecasting.

This was a boon for the future facility management: all data could be transferred directly into the building management system because the computer-assisted planning 'forced' the builders to adhere to the worked-out plan. Thus, absolutely identical connections are to be found everywhere. This, in turn, allowed a high degree of prefabrication, with attendant cost-savings.

1300-kW cooling for 182,000 m^3

The generation of the cooling energy forms part of the energy provision contract with ABB. 1300 kW of cooling capacity is installed, comprising an

800-kW absorption refrigeration system to handle the base load and a 500-kW compressor for peaks. A main pump group guarantees a constant temperature and pressure.

Cooling energy use is measured by the contractor's heat meter. This may also be read, via the building management system, by the building user, Microsoft. Bypasses on each floor permit future installation of more meters, with remote reading, should they be required.

Ventilation

Some parts of the campus are particularly well served with high-quality indoor air. The semi-circular 'Casino' (a rather smart 300 person self-service restaurant) on the ground floor is supplied with a massive 24,000 m^3/h. The combined heating and power plant in the cellar is supplied with 23,900 m^3/h and the conference and learning center receives 20,500 m^3/h. The heat recovery here is based on the regenerative principle with a rotary heat-exchanger. To further increase air quality, especially in the winter months, an air humidifying unit has been installed.

The layout complies with DIN Standard 1946 Part 2, with the air being completely changed six times hourly – providing so much air that the windows do not have to be opened. This corresponds to a fresh air volume per person of 60 m^3/h or 18 m^3/m^2h. Partial dehumidifying or cooling is possible in the summer months or between seasons, depending on the condition of the outside air.

Making a grand entrance

The architecturally impressive, two-storey high foyer requires only 11,000 m^3/h, but the climate in this 'entrée' to the campus deserves special attention – not least because of its large south-facing, and thus sunny, glass façade.

The air handling is basically the same as in the office spaces – fresh air is gently brought in at floor level, care being taken to mix it with the warmer air already present. Exhaust air exits via three columns at roof height which have been cleverly integrated into the foyer architecture. In addition, electrically controlled shutters provide shade when necessary. Underfloor convectors cover seasonal heating needs.

Going underground

One of the many technical highlights of the campus is the system for removing fumes in the huge 638-car underground garage. Here 14 fans each provide 14,000 m^3/h air removal or 29,000 m^3/h smoke removal capacity. They are rated at 6 m^3/hm^2 in normal operation, ten

times as much in smoke removal mode, and will withstand 300°C for 60 minutes. The garage is divided into seven areas, each with two such fans and an automatic fire protection door. Usually, one of the fans runs on a low setting, occasionally swapping with the second; in smoke removal mode both run at top speed. Outside air enters via apertures in the building.

During construction, another of the four elements caused a lot of headaches – water. Following an unusually wet spell, the water table in the neighboring Erdinger Moos rose and caused the underground garages to flood! "Between flooding and enduring temperatures under –20°C, it was a real challenge to keep to the already tight deadlines without humming and hawing," says ABB Munich boss Georg Kress, "Microsoft is a demanding customer!"

But in one respect Bill Gates' company is treated like any other ABB customer – strict fulfillment of deadlines is assured, as is highest value and quality.

Meeting the deadlines in this case required intensive cooperation and continual fine-tuning between all parties concerned. The final Microsoft room plan, and thus other configuration plans, such as the sail locations, was decided just three months before the move-in date. This necessitated much quick thinking and it was paramount to always present one ABB face to the customer, who, after all, only wants to have his campus – not to hear problems, and those from a confusing array of organizations.

The main ABB partner was FOM Future Office Management GmbH (Heidelberg) and G. A. Müller Hausbau GmbH (Waghäusel), who together, under the name USH 2000 GbR, built the campus.

Expand contract

The future energy needs of the campus will be supplied by ABB under a 15-year contract. A formula taking into account heating oil prices and other factors is used to make cost amendments as time goes on; there is no lock-in.

Contracting is an important business. ABB builds, delivers, runs and maintains equipment, and delivers heating, cooling and power. Such solutions are popular with customers as they do not involve them in capital investments; ABB provides the financing (several million US$ in this case). ABB Energiesysteme GmbH in Essen, a relatively new ABB company, directs this business throughout Germany, and it is in Essen that the threads come together – online. The combined heating and power plant in Unterschleissheim, for example, is controlled from there, although it is hundreds of kilometers away.

"This demanding, standard-setting project was excellent proof to us that, especially with complex installations, the best solution is to appoint one, technically expert company to lead and oversee the project," says Thomas Bruder, board member of ABB Gebäudetechnik AG, Mannheim.

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