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Global Software Development at Siemens

Corporate Development Center

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When it comes to research, products, and customer projects at Siemens, software is playing an increasingly important role. To ensure that the company benefits as much as possible from close cooperation among software specialists, experts in the Siemens sectors, and researchers, Corporate Technology took over responsibility for the Corporate Development Center in 2009. Since then, the Center, with its more than 3,000 employees and three clusters — Central Eastern Europe, India, and China — has been part of Corporate Technology.



Practically every Siemens product and every service the company provides operates on the basis of software. Many programs are tailor-made to meet special requirements. Here, Corporate Technology has internal solution providers in the form of Corporate Development Center experts. In close coordination with the Siemens sectors, these specialists develop and test software for new products and services, which they integrate into customer projects and later service or expand. This process relies on

software experts at a large number of locations in Europe, India, and China, each of which focuses on its own specific areas. As a globally operating organization, the Development Center is thus able to develop solutions that are optimally tailored to customers' local requirements. In addition, to ensure that development is closely interlocked with the company's business interests, the Development Center's organization also focuses on activities at each of Siemens' Sectors.

Corporate Development Center Locations: Producing Software for a World of Applications



Central and Eastern Europe

The Development Center Central Eastern Europe (CT DC CEE) works closely with about 900 software specialists at 16 locations in Austria, the Czech Republic, Germany, Romania, Slovakia, and Turkey. CT DC CEE accepts assignments from all the Siemens Sectors, although the emphasis is on Central Europe and the rapidly growing markets in eastern Europe. Due to its presence at various European locations, CT DC CEE is a strong partner when it comes to local infrastructure projects, such as smart power grids or the development of industrial communications infrastructures.



India

The Development Center India (CT DC India) employs approximately 2,300 men and women at five locations — and the number of employees is growing. Most of them work in Bangalore, the largest IT region in the world. Additional offices are located in Pune, Calcutta, Chennai (Madras), and Gurgaon. One of India's great strengths — the very high number of young, highly-trained IT specialists it produces — is therefore also contributing to Siemens' success. Software engineers at Indian DC locations develop software for all of Siemens' Sectors.



China

The Development Center China, which has its headquarters in Beijing, has locations in Nanjing and Shanghai. For the last six years, around 50 software specialists at DC China have been focusing on programs for cost-efficient products destined for the huge Chinese market. The Siemens sectors can find appropriate contacts here when they want to adapt products in line with the special conditions of the Chinese market — and not only when it comes to language. Individual program features also need to meet the requirements of this emerging market. With these S.M.A.R.T. products (Simple, Maintenance-friendly, Affordable, Reliable and Timely-to-market), Siemens is developing solutions that are highly dependable, easy to use, robust, and inexpensive.





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Maximizing Synergies in Software Development

What advantages does a major software development organization like the Development Center (DC) offer Siemens?

Achatz: It enables us to generate extensive synergies in the software development area. And we can do so across all organizational barriers. The issues addressed here include software architecture, configuration management, and quality standards. As a global organization, the DC can work with many local facilities to develop solutions optimally tailored to the needs of our customers. Moreover, it is large — it has over 3,000 employees — and individual locations can focus on specific issues. As a result, the DC supports the Group-wide accumulation of knowledge and expertise. What's more, it does so not only in terms of technologies for software development but also with regard to methods and applications. The DC also offers employees a very attractive working environment that smaller business units can't provide — for example, through its monthly colloquia and customized training programs.

What are some of your current development topics?

Nowotny: We're now working with the Energy Sector on solutions for smart power grids and on the further development of network control systems capable of meeting the demands associated with such grids. We're focusing here on using software to optimize the management of energy generation and distribution as a means of enhancing environmental compatibility. We're thus contributing to the transformation of

Siemens into a company that provides green infrastructure. We're also working with other Siemens Sectors on important current issues — for example, industrial automation systems with high safety requirements and the presentation and intelligent evaluation of medical data. Work on key developments for the Group is a source of great employee motivation.

Höfner: We're also addressing so many exciting issues in India that it's hard to single out just one. However, let me mention one minor topic. We're currently helping to develop a software program that monitors fire safety in the Airbus A380. In general, it's software that makes product intelligence possible to begin with — as is the case with smart grids and building management systems. In other areas, you need to process huge amounts of data for things like simulating a beating heart or merging simultaneous images from a magnetic resonance unit and a positron emission scanner in a single device such as the MR-PET Biograph mMR. We're involved in all of these activities.

Why is your international focus on Central and Eastern Europe (CEE), India and China?

Achatz: Global software development requires locations for "nearshoring" — in other words, working in places close to where products are developed — as well as locations for offshoring. We take care of the former with our facilities in CEE, while the latter is accomplished in China and India. In any case, you also need to maintain a presence in the rapidly growing markets

of India and China in order to gain better local access and be able to recruit the best minds.

Are there synergies between software development work in China, India, and CEE?

Nowotny: Our goal is to deliver top-quality software and to this end we tap the experience of the more than 3,000 employees throughout the DC. That's what was behind the establishment of the Center in the first place — to combine our software development expertise rather than building it up independently in the different Siemens Sectors.

Höfner: A development manager in a Sector starts out with a product business strategy and then decides where the required software should be developed. Some things can be done through nearshoring and some with offshoring in places like India. Both have their strengths — and we can offer both. Another goal is to make it possible to plan software development — and for this you need to achieve a certain critical mass, which in turn attracts top talents. In other words, it's easier for us as DC to recruit skilled staff than it would be for an individual business unit, especially in India. We're able to establish the right expertise while our size offers potential employees better career opportunities.

Nowotny: After examining the DC-wide recruiting process, we took steps to harmonize it in terms of employee requirement profiles, training methods, and further education. We will also examine other key processes such as dealing with orders, which in our case means how we create new software.

Do software development teams at Siemens compete with one another or with external providers for orders?

Höfner: Siemens has a coordinated overall strategy for meeting the software requirements of its Sectors as effectively as possible. So in that sense there's no internal competition. Of course, Corporate Technology competes in a general sense, and its rivals include external partners. We have to always be good enough to ensure that our services are in demand.

How is a software development order usually processed?

Höfner: It's hard to give a general answer to that question. Depending on what our partners at the business units request, we can offer the entire range of product development, including requirements engineering, in other words, the formulation of software requirements. We can also provide individual specialized services such as software tests, or simply take care of software coding.

How do you ensure that software quality and the quality of the development process meet the highest demands?

Nowotny: Our demanding quality standards must be met throughout the entire organization. The important thing is to know exactly what the customer needs and to ensure all employees understand that quality is the key to success. To this end, we regularly conduct customer surveys and we've also defined key performance indicators that are continually re-

viewed. Internal audits enable us to constantly improve our processes, which also undergo external evaluations on the basis of internationally defined standards. For instance, the CMMI Level 3 standard is a requirement for all software developments at Siemens.

For a long time, high employee turnover was a problem in India. Is this still the case?

Höfner: No, it's no longer a problem — our fluctuation rate is now relatively low. With a turnover of seven percent in 2010 as compared to an industry average of more than 15 percent, we're best in class. We're an attractive employer that offers exciting opportunities. We train our employees well and offer them career opportunities throughout the entire Group. Low employee turnover is important because along with software engineering skills, our people also need to have domain knowledge — in other words, application expertise. They need to know about the products and systems that Siemens produces — from industrial facilities, control systems, and power distribution to medical image processing systems.

How do you recruit the best software developers in local markets?

Höfner: As I just said, we offer a very attractive working environment. Siemens has a very high brand value in India, which makes it easier for the company to recruit the best minds. We also have close ties to universities, research institutes, and the R&D community.

What's your advice to students interested in software?

Höfner: I would tell them to study computer science and focus on software engineering. While we do have a lot of physicists, chemists, and medical doctors working for us, our core area of expertise is software. It's easier for me to teach a computer scientist about the domain than a chemist about software development.

What do you think software development will be like in your region in ten years?

Höfner: There's practically no way to predict that because things are developing so quickly. Two things seem clear to me though: I come from a generation of "digital immigrants." In other words, we moved into the digital world, as opposed to today's "digital natives" who were born into it. Their behavior and ways of working will have a huge impact on the software of the future, but it's very difficult to say at this point just what that impact will be.

Nowotny: I would also mention another point. The amount of software contained in all products will continue to increase. Take cars, for instance. There's going to be a lot more software in a future energy smart grid that uses electric vehicles as energy storage units than there is in the individual systems of today. Other important issues are cloud computing, the Internet of things, and virtualization. These processes are only just starting. Our long-term goal remains "zero-defect software." We still don't know if we're going to achieve it in ten years, but we do know we're going to try.

When it comes to developing efficient and powerful technologies, Siemens is an international pioneer. This is not only true of the Energy and Industry Sectors, but also of the Healthcare Sector. The software installed in the associated solutions plays a key role in enabling Siemens to distinguish its activities from those of the competition.



From left to right: The DC develops software for testing switchgear control technology, 4-D ultrasound systems, and optimizing electricity trading on the market.

Solutions for All Requirements

CT DC Industry: Siemens' Simatic automation system represents one of the Industry Sector's most important milestones. In fact, the impact that Simatic has had on a wide range of industrial processes is virtually unmatched by any other technology.

The Simatic success story began in 1958, when Siemens launched its first fully wired electronic regulation and control systems under the name Simatic. Today, Simatic controllers and the Totally Integrated Automation (TIA) software concept that is based on them offer solutions to almost all conceivable tasks in industrial automation — whether in transport and traffic technology, or in manufacturing facilities. In some situations, they are supported by software from Corporate Technology's DC Industry Development Center.

DC Cluster Industry and its software developments are also closely interlocked with the activities of the Industry Sector's business units. The expertise of software specialists at CT DC extends from communication networks for industrial applications and energy management to the control of production processes, sophisticated fire protection systems, traffic management systems, and train control equipment.

The cluster's software portfolio is therefore also wide-ranging — and not just as far as topics are concerned. Its products and services cross national borders. The Industrial Automation Systems business unit, for instance, has established a global, 50-person development team at CT DC India. This team develops software for user interfaces, helps to formulate functional descrip-

tions, and is responsible for the development of operating systems and applications.

Around 10,000 kilometers away, the Development Center Central Eastern Europe (CT DC CEE) certifies automation components from Siemens and external manufacturers in its accredited Profinet CompetenceCenter and Profinet Test Laboratory in Prague. CEE also operates an Engineering Center in Zilina (Slovakia) together with the Railway Automation business unit. Here, experts create hardware and software configurations for various rail systems, such as switches, control systems, and train control systems.

CT DC Energy: The Energy Sector is a global leader with efficient solutions for power plants and power transmission. Its portfolio also covers the world's most powerful gas turbine. These days, however, software is an increasingly important part of these complex systems — for example, when it comes to feeding the maximum possible amount of energy from decentralized, renewable resources into the grid.

The solution to this problem is the "smart grid" — an intelligent grid that can be managed in a flexible manner. The smart grid represents the symbiosis of an energy system with information and communications technology. As a result, the energy flows within the grid are not only more transparent but are also easier to control. At the same time, automation is becoming increasingly widespread in the power infrastructure. Thanks to this development, it is easier to integrate and manage decentralized power

sources such as wind, sun, and biogas. The result will be a stable, intelligent power grid that features energy stores and boasts a low-CO₂ power mix. This would not be possible without a range of software applications.

Among other things, CEE develops new applications for power companies. The largest utility in the Benelux countries, the Electrabel Group, now negotiates its electricity contracts with the help of a software tool developed by CT DC CEE. The tool, which bears the name "jROS" (joint Resource Optimization and Scheduler), incorporates many parameters that are relevant to electricity trading. The parameters, which it also harmonizes, can, for example, include data on the amount of power produced by various sources over a large geographical area or the effects of weather conditions.

In addition, the utility company can use the software to lower the costs of generating electricity. It can do so, for example, by planning generation and reserves, by reducing fuel consumption using the most efficient operating mode, and by optimally exploiting the energy provided by cogeneration facilities or hydroelectric stations. The software, which is currently in use at many utilities in Europe, is being continually updated by CEE in response to the needs of different customers.

Programmers at CT DC India also work on software for the Energy business. For example, they are developing Wind Power Supervisor (WPS). Operators of wind farms can use this solution to monitor their Siemens wind turbines remotely and identify and repair any impending

faults at an early stage. At the same time, they can also use WPS to save the operational data generated by the entire wind farm, analyze its interrelations, and infer ways to increase the efficiency of individual turbines. For instance, the air currents and turbulences at the center of a wind farm are different from those at its periphery. Using WPS, turbines and their operating parameters can be individually adapted to their locations and thus optimized. The software is already being used in many wind farms that rely on Siemens turbines.

Software specialists in India are also working on solutions for modern power plants that are operated using web-based control technology. The first such control system in the world, the SPPA-T3000, was to a large extent developed by experts at DC India, who introduced it in 2005. The system permits the operation of a power plant and provides an overview of its status. It enables the customer to quickly spot if a problem has arisen so that countermeasures can be taken immediately via the Web. At present, almost 900 power plants around the world regulate their operation with the help of the SPPA-T3000 system.

Particularly interesting results are being produced by the Development Center in China. The focus here is on ways to tailor the functions of individual programs so that they are suitable for emerging markets. In this case, the solutions are especially reliable, easy to use, robust, and, above all, economical.

Many of the complex and expensive functions used elsewhere — such as fulfilling specific

western industry standards — are simply not required for power grids in China. That's why DC China supports Siemens Energy Sector in developing suitably adapted software for Chinese power grids.

What's more, IT experts at DC China have also developed an integrated management system for operating power plants. With the WebBFS system, for instance, operators can manage their facilities' work procedures online. DC China tailored the software in line with the needs of the Chinese market in terms of language, usability, and safety regulations. And it has done so with resounding success. Several customers in China are already using this software.

CT DC Healthcare: Given the fact that populations almost everywhere are experiencing widespread aging, keeping healthcare costs under control while boosting the quality of treatment is quite a challenge. It requires modern healthcare solutions ranging from laboratory diagnostics to imaging systems and comprehensive information technology. Siemens Healthcare is the only supplier worldwide to comprehensively cover such an integrated approach in its portfolio. Due to the consistent work processes involved, the solutions are all very impressive — regardless of whether the issue is magnetic resonance tomographs (MRT), diagnostic laboratories, or tools for controlling clinical or administrative processes. Here too, software is a vital element when it comes to ensuring an appropriate level of quality and efficiency — as are the programs of the DC Healthcare Cluster.



Software solutions for healthcare are a specialized area of the Development Center in India. New diagnostic software such as Syngo.via makes it possible to evaluate clinical images from MRI, CT, or PET-CT systems faster and in more detail than was previously possible. In the case of a heart examination, for example, the coronary arteries are automatically segmented, highlighted, and displayed on a monitor using intelligent algorithms.

Experts at CT DC CEE also work for the Healthcare Sector. Toyon, an ultrasound imaging software, which makes it possible to visualize and evaluate ultrasound examinations for echocardiography, is a major hit. With this software, the Siemens ultrasound system Acuson SC2000 is capable of realizing 4-D visualizations in real time. At present, roughly 400 of these ultrasound systems are in use at locations around the world.

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