ABB Industrial IT Development Center, India

Introduction
Did you know that ABB:
- Has embarked on a mission to create one single Industrial IT architecture for it’s entire range of technologies and products
- It invented the world’s fastest control and protection system for HVDC Light™ and SVC Light™
- And invented a cost effective high precision robot controller that allows cutting precision down to 0.1mm.

These and many other innovations are enabling our customers to rationally improve their businesses and increase competitiveness.

With over six thousand scientists and Engineers in our divisions and Corporate Research Centers we are working hard to invent new technologies, which will ensure a continuing and successful partnership with our customers.

The fresh and innovative thinking arising from our synergies with over seventy universities and research institutes is an important factor in keeping ABB as a world technology leader.

We are currently working on R&D projects in business areas and Corporate Research Programs. Those research programs are aggregated in five technology areas:
- Automation device technologies
- Advanced manufacturing and engineering technologies
- Industrial IT & software applications
- Power technologies
- Oil and Gas technologies

In addition we work also in Nanotechnologies. A part of our R&D projects are so called high impact, high risk projects or exploratory research in “fuzzy front-end”.

Our work is organized via research labs in business areas and Corporate Research Centers. Currently we have about 1000 researchers and scientists working in Corporate Research Centers. We have research centers located in Sweden, Switzerland, Germany, Norway, Finland, Italy, two in the US, and the latest addition is the Indian center, which is our first Research center in Asia.

Our international position offers our researchers and scientists unique opportunities to international work experiences and colleagues in a friendly research environment.
## Contents

1. About ABB
   1.1 Putting customers at the core of the company

2. R&D in ABB
   2.1 Growing ABB's intellectual capital
   2.2 Making Breakthroughs happen
   2.3 Delivering Value

3. Industrial IT
   3.1 Industrial IT Architecture
   3.2 Why Industrial IT
   3.3 Industrial IT building blocks
   3.4 Putting the pieces together

4. ABB Industrial IT Development Center, Bangalore
   4.1 Supporting ABB's strategic goals
   4.2 Concept and responsibilities
   4.3 Destination Bangalore
   4.4 Mission 16
      4.4.1 Industrial IT enabling and certification of selected product lines
      4.4.2 Product responsibility for specific, software rich products such as 3rd party interfaces
      4.4.3 Partnering with our BAs, developing and testing new software-based concepts and products
      4.4.4 Leverage the cost & quality advantage of Indian software skills
      4.4.5 Building on established processes and tools
      4.4.6 Object Oriented Analysis & Design (OOAD)
      4.4.7 An iterative approach to software development

5. The ABB Gate Model for project delivery

6. Conclusion
Introduction

ABB’s vision to be ‘The Value Creator’ starts by being close to the customer. Working closely with its customers, understanding their business needs and market conditions, ABB is committed to ensure their success through quality excellence in our products and service offerings and through innovative solutions, which combine world class technologies, proven global expertise and strong local insight. ABB believes that by ensuring its customers’ success it will, in turn, be able to create value for all its stakeholders - customers, shareholders, employees and the communities in which it operates.

The challenge for customers in today’s fast changing, globalized and networked world is not only how to keep pace with advances in technology and the speed of information, but how to tap into those advances to become more competitive. This is where ABB creates value for them. The organization strives to combine its expert knowledge of their markets, their business and their business processes – what ABB calls ‘domain competence’ gained over decades of experience across industries in over 100 countries – with world class products, solutions and services.

To deliver increased shareholder value, ABB believes that it needs to constantly challenge itself to do the right things smarter, faster and cheaper. In doing so, it creates an exciting, competitive, fast paced environment for its employees, where there is great opportunity and reward for innovation and success. Employees of ABB create value for themselves, both in terms of job satisfaction and financially by contributing to the success of the group and its shareholders.
2.1 Growing ABB’s Intellectual Capital

As a technology leader, ABB’s efforts and investment in research and development lies at the heart of ABB’s intellectual capital. By harnessing the outstanding ideas that are born out of these efforts and the domain expertise ABB continues to lead the world by bringing in new technologies for the networked business environment.

2.2 Making Breakthroughs happen

ABB spends over eight percent of its revenues on research and development - high levels by any standard for the business it is in. This investment because we believe it is the foundation for the company’s future growth and profitability.

Investments in R & D makes gears the company to be competitive, develop innovative solutions and make technological breakthroughs that change the rules of the game in industries in which it operates, while creating value for its customers and ultimately its shareholders.
Breakthroughs are exciting yet challenging - more so because they cannot be planned. ABB nurtures an environment in which new ideas can be born and realised. The ABB Management plays a vital role - it guides the thinking of researchers, sets ambitious goals, and stimulates people to innovate. It provides funding required for original research (or high-risk research) that is a potential commercial success. Incidentally 20 percent of ABB’s corporate resources are allocated to exploration, experimentation and pre-studies. At ABB, awarding researches is as important as investments itself. ABB believes in setting targets that stretch peoples’ imaginations; understanding the valuable lessons to be learned from making mistakes; and recognizing people with both financial and non-financial rewards when they succeed.

2.3 Delivering Value

While the company aims to excel in all its R&D efforts, the ultimate goal is to add value to customers, which is measurable. ABB’s continued attention to value creation through R&D is supported by several measurement systems. Obvious in this regard is the number of patents and invention disclosures, which again showed a good increase in 1999.

Since January 1999 the ABB has looked at the correlation between innovation and annual performance in terms of revenues or return on investment (and many more parameters) of various business areas within the ABB Group.

The results were as expected - R&D played a significant role in creating business, while opening new avenues for ABB. The organisation’s systematic approach in creating world-leading technologies has laid the foundation for its future growth - backed by a dynamic team of goal-oriented and fast-acting professionals and dedicated scientists and engineers who make it all happen.
ABB Corporate Research Center carries out its development work at centers located in Finland, Germany, Switzerland, Sweden, Singapore and U.S.A. Recognizing the availability of software engineering skills in India, a new Industrial IT development center was established in India. The center is dedicated to the development of products and solutions that will further ABB’s business strategy - Industrial IT.

ABB is committed to a program for product evolution and development and market positioning under the “Industrial IT” umbrella. This initiative is geared toward increasing standardization of ABB products and systems as the “building blocks” of complex solutions, while building in functionality that will allow multiple products to interact as components, seamless with real-time automation and information systems.

Industrial IT has come to symbolize virtually every business action ABB will take going forward. It is a vision and we need to be aware that for this vision to turn into reality a successful strategy with aggressive goals must be in place. Far more important, however, is the long-term commitment from ABB to three critical factors that will differentiate Industrial IT from its imitators:
3. Industrial IT

- A robust family of compatible and reusable products that will serve as the “knowledge components” for Industrial IT solutions.
- A powerful and open architecture for enabling each component as part of a real-time automation and information solution.
- Deployment of ABB’s vast domain industry expertise through a customer-focused organization serving key client industries.

3.2 Why Industrial IT?

In pursuing its commitment to Industrial IT, ABB did some hard thinking about what it can really offer its customers. The verdict - ABB’s most valuables “product” isn’t sold in a box any longer. Enter the era of knowledge-based solutions.

ABB motors, drives, robots, instrumentation, controls, protection and power systems operate in more plants than any that of any other supplier. While ABB is proud of its record, its most exciting success has come when ABB looked beyond a customer’s plant or process, to integrate systems that influence a multifaceted business enterprise - spanning marketing, design, manufacturing, quality, finance, fulfillment, logistics, and similar processes.

In other words the dynamic real-time interaction of processes and systems that guide them is what ABB has chosen to call Industrial IT.
3.2 Why Industrial IT?

In its simplest form, an open control system that automatically configures and re-ranges hundreds of plant instruments to the real-time needs of a new production run could characterize Industrial IT. But it could be much more...

Imagine, for example, that each physical plant device is associated with a dynamic, living software entity – carrying with it not only configuration data but control software, purchase and cost information, maintenance records, mechanical drawings, and networking information. Next, imagine that the same approach applied to products — endowing each batch, barrel, or box with a dynamic set of real-time characteristics.

Now, consider the impact if distributed plant devices inherit functionality from the environment in which they operated - new devices would be configured not by host control strategies, but as a direct result of the business setting in which they were deployed. Process transmitters and valves would inherit the range information required for the current “recipe.”

Motors and drives would adjust their control set points as a function of current line speeds. Robots and manufacturing cells could be moved from one task to another – retrieving new control software as they “recognize” the new process and its requirements.
Just as these devices could automatically inherit characteristics from their surroundings, they could also report information and influence operations in other parts of the enterprise. Through the integration of diverse systems for manufacturing, sales pursuit and enterprise logistics, the vision of real-time “e-Productivity” could be stretched all the way from procurement of the most basic raw materials to delivery of highly-customized finished products.

This enterprise arena, spanning ABB tools for production, asset life-cycle management and real-time collaboration defines the Industrial IT Value Chain.

3.3 Industrial IT building blocks

To ensure deployment of the required tools for every link in the Industrial IT value chain, ABB has defined more than 30 functional technology categories that will comprise the Industrial IT portfolio – and our ongoing development focus. Each of these categories corresponds to an Industrial IT Product Suite – to be filled with pre-engineered, reusable building blocks.

Components – whether hardware, software, or service-based – must achieve three distinctions in order to join the Industrial IT portfolio:

The products must be standard and available for use by business units across ABB, without additional engineering.

The products must take advantage of the Aspect Objects™ Architecture (see below) – ABB’s dynamic platform for real-time integration.
3.3 Industrial IT building blocks

Products must be tested and certified for compliance to the ABB Industrial IT Enabled technology standard. Furthering the commitment to the use of compatible and reusable technologies, the Industrial IT strategy incorporates within it a common descriptive approach for naming products based on their product suites. This will replace the stylised trademarks currently applied.

A few Examples . . .

- **Design**\textsuperscript{IT} – Tools to assist in design of primary equipment, process trains, plants, and supporting systems.

- **Operate**\textsuperscript{IT} – Tools to facilitate interaction between automation systems and human operators.

- **Produce**\textsuperscript{IT} – Tools to improve the planning, scheduling, and manufacturing of finished products.

- **Protect**\textsuperscript{IT} – Tools to protect against faults in the operation of equipment and facilities, and ensure personnel safety.

- **Optimize**\textsuperscript{IT} – Tools for tuning, improving, or optimizing of productive systems or end products.
• **Collaborate**\textsuperscript{IT} – Tools to facilitate real-time, eBusiness interaction among suppliers, manufacturers, and end customers.

• **Support**\textsuperscript{IT} – Tools to help install, commission, maintain, and extend the useful lifecycle of business assets.

• **Sustain**\textsuperscript{IT} – Tools for achieving environmental improvement, reducing energy consumption, etc.

To facilitate real-time integration of the Industrial IT building blocks, ABB has developed a powerful enterprise architecture called Aspect Objects\textsuperscript{TM}. Based on the Microsoft Component Object Model (COM), this platform considers the myriad of enterprise objects (plant devices, machines, materials, and products) as the building blocks that make up a complete business scenario.
3.4 Putting the pieces together

Although the various objects and their associated software may reside on multiple networks or computers, each object carries with it an integral collection of characteristics or *aspects* such as configuration, efficiency, maintenance status, mechanical and electrical drawings, etc. A click on any object icon opens up a wide range of context-sensitive, *real-time* information.

An Industrial IT “system” is created by dynamically linking a series of distributed objects and their real-time characteristics, as software clients. Drawing from a vast library of dynamic enterprise objects, the Industrial IT architect will deploy real-time, *repeatable* automation scenarios to fit a wide variety of business objectives. Just as one would browse the files in a PC directory, the user will be able to browse and configure multiple structures of enterprise assets, assigning each structure to the most productive and profitable task at hand.
4.1 Supporting ABB’s strategic goal

ABB’s strategic shift in to more knowledge-based and service business has increased the need for using information technology in its product portfolio to maintain its leadership in the technology front. Today, ABB has thousands of people engaged in software development for products, making them more efficient, increasing their uptime, communicate with other products or even monitor their own operation. In short making smarter products. In R&D, ABB focuses not only on the software itself, but also on the ways of creating software. Our goal is to improve the quality of our software products and reduce the time and cost of development.

ABB has chosen Industrial IT as the foundation for its future growth strategy. This means that all its products and systems offerings will have to conform to the Industrial IT architecture. A whole range of software and hardware interfaces need to be developed, tested and certified before these products and systems are declared Industrial IT-enabled. The ABB Industrial IT Development Center will focus this development activity as its core theme. As a part of corporate research center, it is a vision to be one of the major centers of software development in this area within ABB.

4.2 Concepts & Responsibilities

A core team of ABB people, highly qualified and competent in software development, system architecture and with the needs of broad experience of ABB’s products and applications will be work as a team to offer skills and expertise for software related activities for the entire ABB group.
The development center will provide Industrial IT competence and will have the responsibility for making selected product lines Industrial IT-compatible and to certify Industrial IT compatibility for its range of products. Imparting education on Industrial-IT-enabled product lines will also be part of the responsibility.

For specific products, in which software is an integral part (like 3rd party interfaces), the center will have product responsibility for development and maintenance as well. The center will also leverage on its domain, product and market knowledge to develop layered products and solutions to cater to the needs of industry (in partnership with ABB’s business area organizations).

The center will also provide maintenance support for phased out software products with a large installed base.

The center will build and maintain business relations and efficient procedures for defining and subcontracting software development packages to a limited number of high quality software service providers located in India.

The software subcontracting business will be continuously evaluated with respect to key parameters such as quality, time and cost efficiency. As a partner to our BAs the center will also develop and test new software based concepts and products and build relations with leading software institutions in India.
4.3 Destination Bangalore

A recent survey found that almost two out of five fortune 500 companies currently outsource some percentage of their software needs from India. Nonetheless, the benefits of always going offshore can be hard to realize. The development of custom software is different from most other business activities, since it requires an in-depth understanding of the products and systems and the way software applications support them.

Also, the field of software engineering is relatively new and procedures for quality control and project management, though developing fast, have yet to evolve fully. Without discipline and focused management of offshore relationships, the overseas sponsor can squander away the cost and time benefit of outsourcing. The Industrial IT Development Center plays a vital role in the area of managing the outsourced partner in India and ensures full benefit from the outsourcing model for the ABB Group.

In terms of process maturity, India offers the highest number of software companies certified as SEI CMM Level 5. Many of these companies are headquartered at Bangalore. The Industrial IT Development Center, working in close coordination with some of these companies is able to offer the best practices in this field of activity.

The ABB operations at Bangalore set up in 1984 is now an important manufacturing and engineering center for ABB in India. The Industrial IT Development Center, being co-located in Bangalore has the natural advantage of proximity to the quality infrastructure and resources of ABB.
4.4 Mission

4.4.1 Industrial IT enabling and certification of selected product lines

With this as the primary focus area of the center, the center will engage in software development activity aimed at migrating of ABB products and systems to the Industrial IT architecture. The center will also support ABB Group in testing products conformance to Industrial IT standards and will certify and declare successfully tested products as Industrial IT enabled.

4.4.2 Product responsibility for specific, software rich products such as 3rd party interfaces

In the open system environment, customers insist on total connectivity between the installed automation and control products and systems to achieve integrated plant management.

To achieve this integration, an interface between ABB and other third party systems (for which there are no standard interfaces) is required. This is an area where the Industrial IT Software Development Center will play a key role by developing such interfaces and maintaining a suite of interfaces across several products.

The idea is also to standardize such interfaces as far as possible and to be able to reuse components and building blocks for such development, thereby providing high-quality, cost-efficient software development for the ABB Group.
4.3 Partnering with our BAs, developing and testing new software-based concepts and products

ABB currently has a vast range of products, which are increasingly becoming intelligent with embedded controls and software-based design. Industrial IT Development Center will partner with the Business Areas to develop whole or part of such design and development efforts in line with the concerned BA’s priorities.

4.4.4 Leverage the cost & quality advantage of Indian software skills

The cost and quality advantage that India has in the software development area is now a well known fact. Industrial IT Development Center, Bangalore will leverage this advantage and would it available to ABB group by having a single point coordination responsibility with software development partner companies in India.

This will ensure that the software development partner understands the development environment, tunes in to the ABB Industrial IT architecture as the common umbrella for all development, has faster decision and clarification channels locally and is able to interact closely during the entire life-cycle of software development.

ABB’s overseas indentor through this center will be able to ascertain the partner company’s competence profile and access Indian software vendor’s suitability matrix, leverage on umbrella agreements with selected partners and bank on the center’s own domain experts for review and testing of the software products.
4.4.5 Building on established processes and tools

The entire activity chain in the Industrial IT Development Center is built around software development life cycle processes. The focus on process conformity ensures that the activities are consistent, repeatable and predictable to a large extent.

The process is scalable from the simplest form of development assignment to the most complex software projects. The software engineering process is customized for ABB’s needs from Rational Unified Process and will be implemented in some cases with the rational tools for software engineering.

4.4.6 Object Oriented Analysis & Design (OOAD)

One of the areas where the center is expected to pivotal role is to leverage ABB’s domain knowledge to add value in refining the Requirement Specifications and carry-out the System Analysis and development of software architecture design by using Object Oriented Analysis and Design methods.

Industrial IT architecture draws heavily from the object oriented approach. If the object level architecture for the system to be developed is not well conceptualized by visual modeling techniques and patterns, it would be difficult to standardize the architectural design methodologies across different outsourcing partners, and the benefits of re-usable components would be few. Therefore the center would follow and develop the basic tenets of Industrial IT set of objects and make them available to partners for further implementation.
The System Analysis and architecture design starts with identification of users and use cases. Use case models also present a good benchmark for configuration management, project planning, monitoring and control through the iterative phases of development.

The Use Case models are represented through class diagrams; sequence and/or activity diagrams based on UML (Unified Modeling Language) notation. This standard has been adopted by the center in line with current trends in object oriented design.

4.4.7 An iterative approach to software development

The process adopted by the center is an iterative model and follows an incremental development process, in that the software is not released in one big bang for testing at the end of the construction phase but is, instead, developed, tested and validated through all the development phases. Projects vary in how much of this ceremony they have.

High ceremony projects have a lot of paper deliverables, formal meetings, and formal sign-offs. Low ceremony projects might have an informal inception phase and limited iteration construction phase. The process is important in every work that we do. But applicability of a component of that process is dependent on the decision of the project team.

The development process follows four stages: inception, elaboration, construction and transition. The construction phase consists of several iterations, in which each iteration produces a subset of the requirements of the project. During inception, the business rationale for the project is established and the scope is decided. This is the stage when the project sponsor approves and commits to go ahead.
In elaboration phase, more detailed requirements are elicited to develop the Use Case model and baseline the requirements for change management. A high level system analysis and design is done to arrive at the Use Case realization of analysis and design models to baseline architecture and create the plan for construction.

The concentration will be on the work necessary to move the product from the development environment to end domain, which is the Transition Phase. This work may include beta testing, parallel operation with legacy systems, performance optimization, and user training.

The work held in abeyance during the development phase may be taken up later for development and scheduled for forthcoming releases. However, the product release at the Transition Phase is benchmarked as baseline version for life cycle management.
Most of the work to be done in the Industrial IT Development Center may be categorized under Technology Development projects (TD). These projects evaluate or develop technology to be used in existing or future products and systems of ABB (typically in the area of R&D).

ABB has developed a procedure based on a gate approach that ensures projects are driven by business objectives and are executed with full management accountability. This approach is called the ABB Gate Model.

It structures investments into phases in order to minimize the risk. It also provides defined management checkpoints, called gates, where go/no-go decisions are made.

A gate is a defined point where major business decisions are taken relevant to a project. Are we ready to proceed and does it make economic and strategic sense to proceed with the project work? This procedure ensures active involvement of management and that the project work is synchronized and all necessary tasks are completed before the next step, e.g. start development or release the product, is undertaken.
5 The ABB Gate Model for project delivery

The ABB Gate Model is structured in three layers. The business decision layer describes the gates themselves and deals with the commercial viability of projects. The project management layer describes the tasks between the gates and deals with the time schedule of projects.

The Execution Layer describes the actual project work and deals with the processes in the project.

The result is higher transparency in and visibility of projects within the organization. The system will also nurture result-orientation within the project management teams.

6 Conclusion

ABB is committed to Industrial IT technology development and ultimately create value for the customers, employees, society and shareholders. ABB Corporate Research nurtures the Industrial IT Development Center at Bangalore to deliver customer-oriented Industrial IT products/solutions and get higher returns on investment.
R&D Fact Sheet
> 6,000 scientists and engineers
> 10 Corporate Research Centers in Europe and U. S.
> 1,000 in Corporate Research Centers

R&D Vision
> Create high return on investments
> Develop protected leading positions in technologies and core competencies required for our future growth and profitability
> Become the leading R& D organization in our industry

R&D Mission
> Dynamic and vital source for technology based innovation in ABB
> Spearhead for technological breakthroughs in ABB-relevant areas
> The link between ABB and outside scientific community
  > Monitoring the most recent developments in the science and technology world outside ABB
  > The attractive recruiting agent for high calibre technical

R&D Priorities
Result orientation
Breakthroughs & innovation
Standards & platforms
Intellectual property
External co- operation