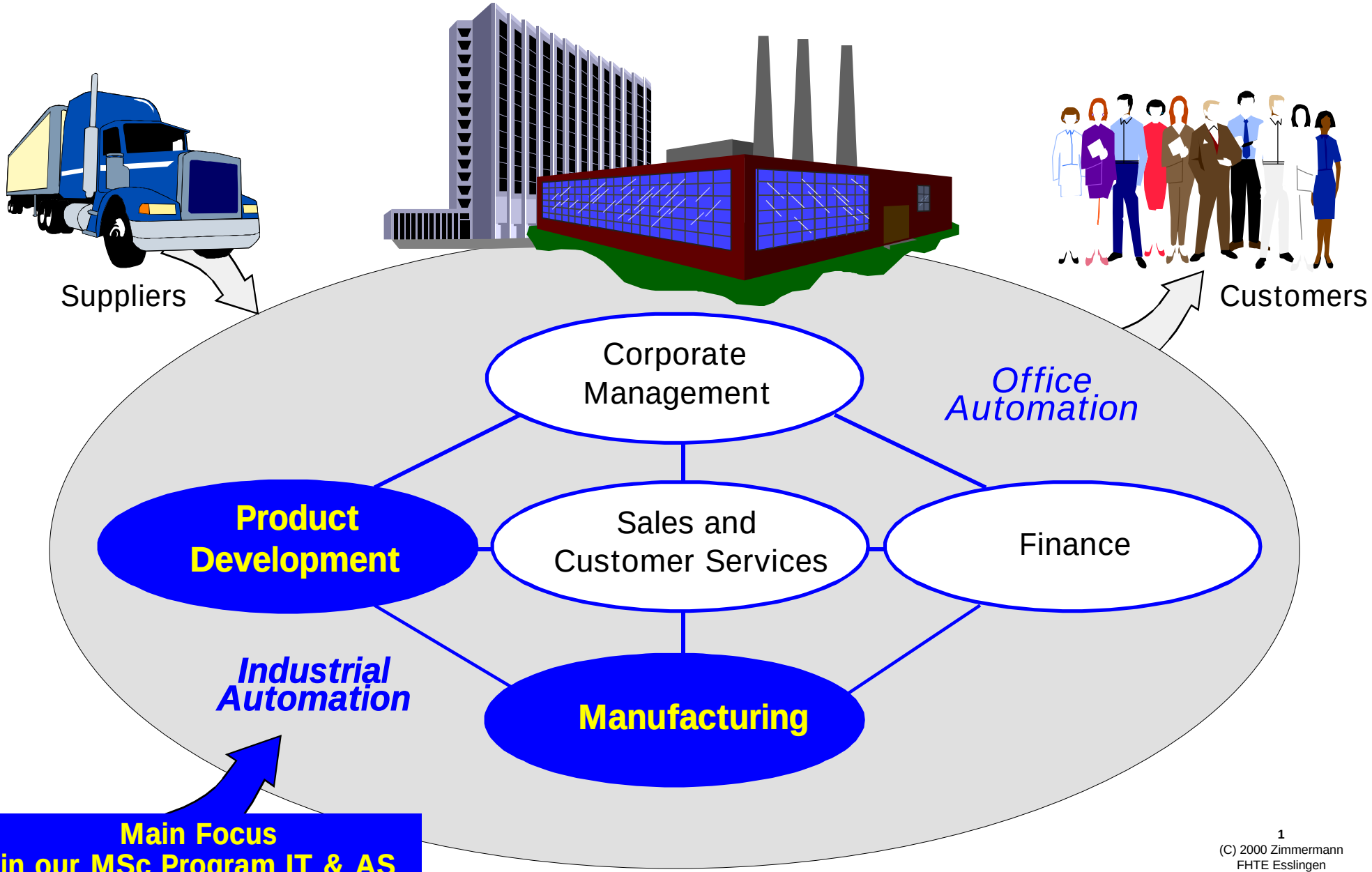
Information Technology and Automation Systems in Industrial Applications



Information Technology and Automation Systems in a Networked Enterprise

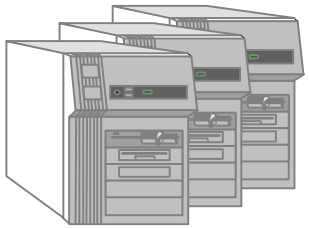
Office Automation

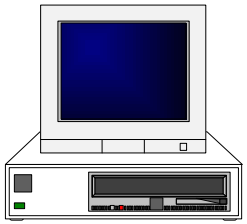
Enterprise Resource Planning Accounting and Reporting

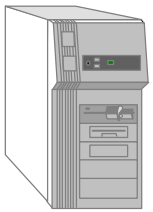
Engineering Applications Development and Simulation Tools

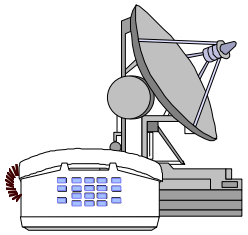
Intra- and Internet Services Infosystems E-Commerce Communication

Office Applications Workflow Management





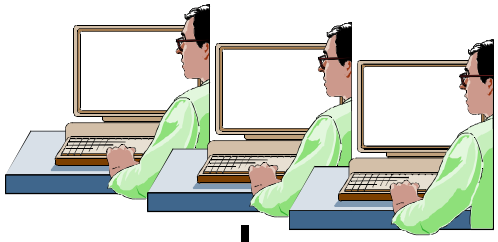


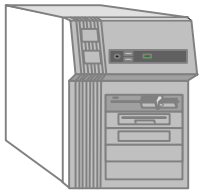


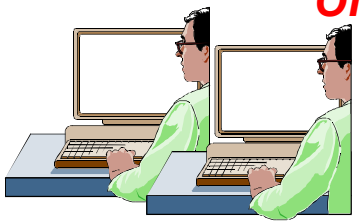
Office Network

Industrial Automation

Manufacturing Supervisory Control and Data Aquisition

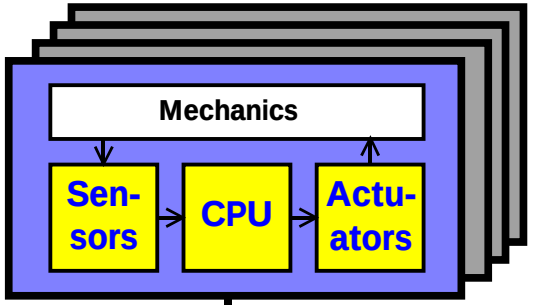






Factory Network

Manufacturing Lines Process Control



Embedded Systems PLCs Robots

Field Bus Network

Merging Worlds: Information Technology and Automation Systems

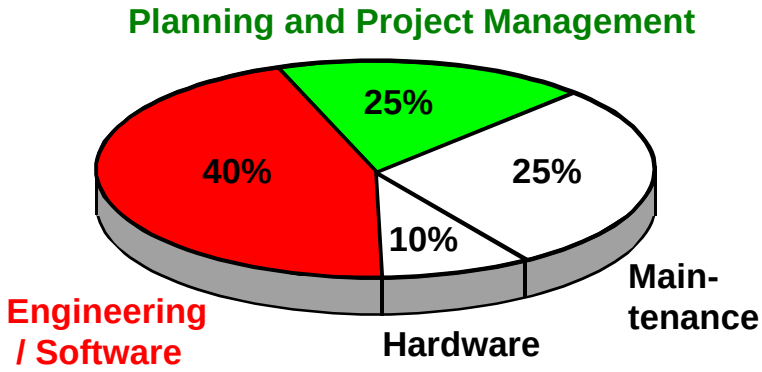
Office meets Factory

Office software standard technology used in automation systems:

- Desktop operating systems like Windows NT or Linux used in real time control apps
- Desktop software technology like software components (RMI, Corba, DCOM, OPC) or data bases (Oracle, Access, mySQL) used in automation systems
- C + + and Java used for embedded control software and real time apps
- Ethernet substitutes high reliable real time fieldbus networks
- Internet goes Embedded: TCP/IP protocol for inter-device communication and HTTP based web browsers for visualization and user interfaces in process control and monitoring apps
- Image and signal processing used in automatic product testing
- Voice and video communication poses real time demands for office networks

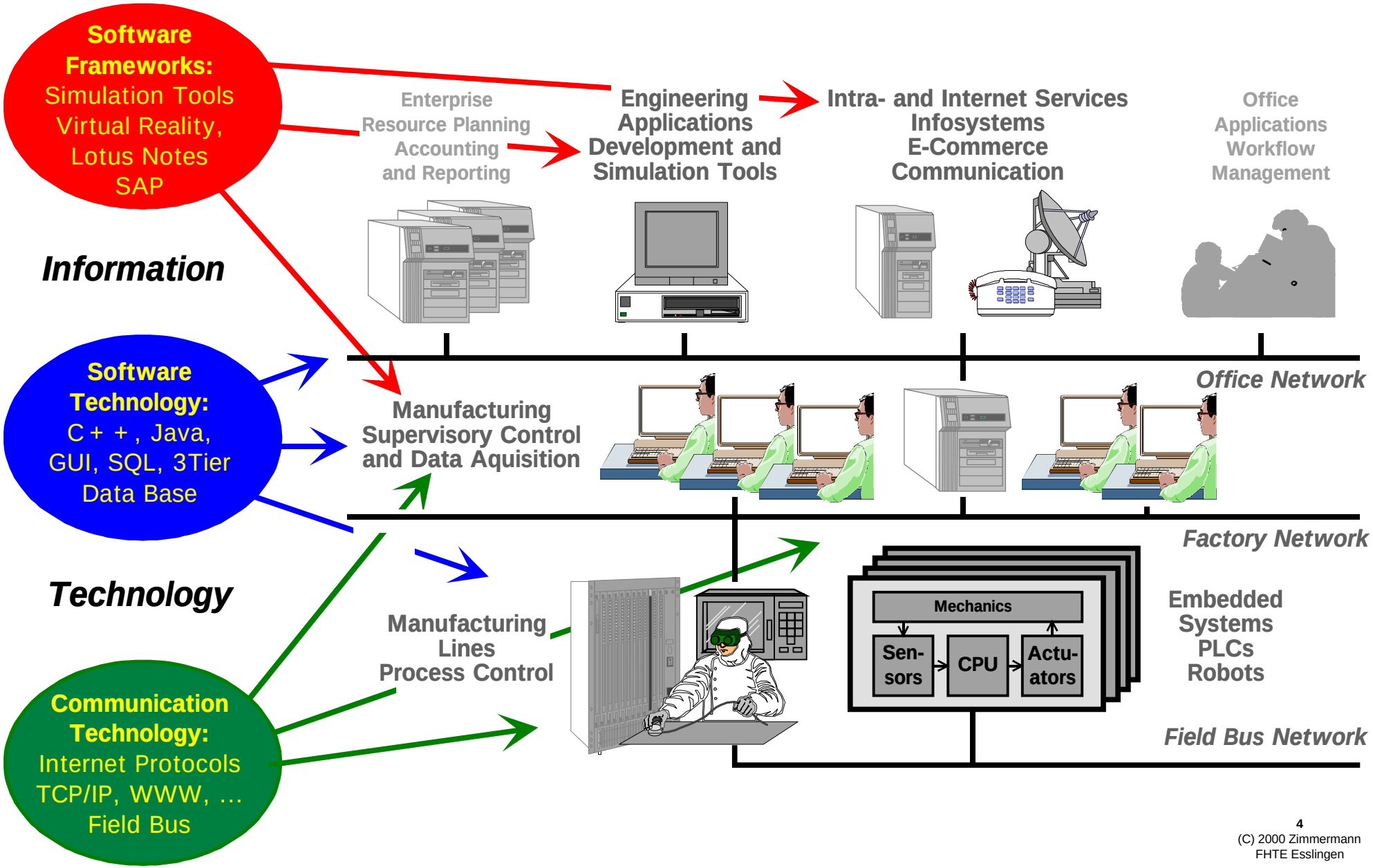
Engineering defines Pace and Cost

- Engineers need knowledge from both worlds and hands-on experience
- Globally-acting enterprises require use of standard technologies throughout the world

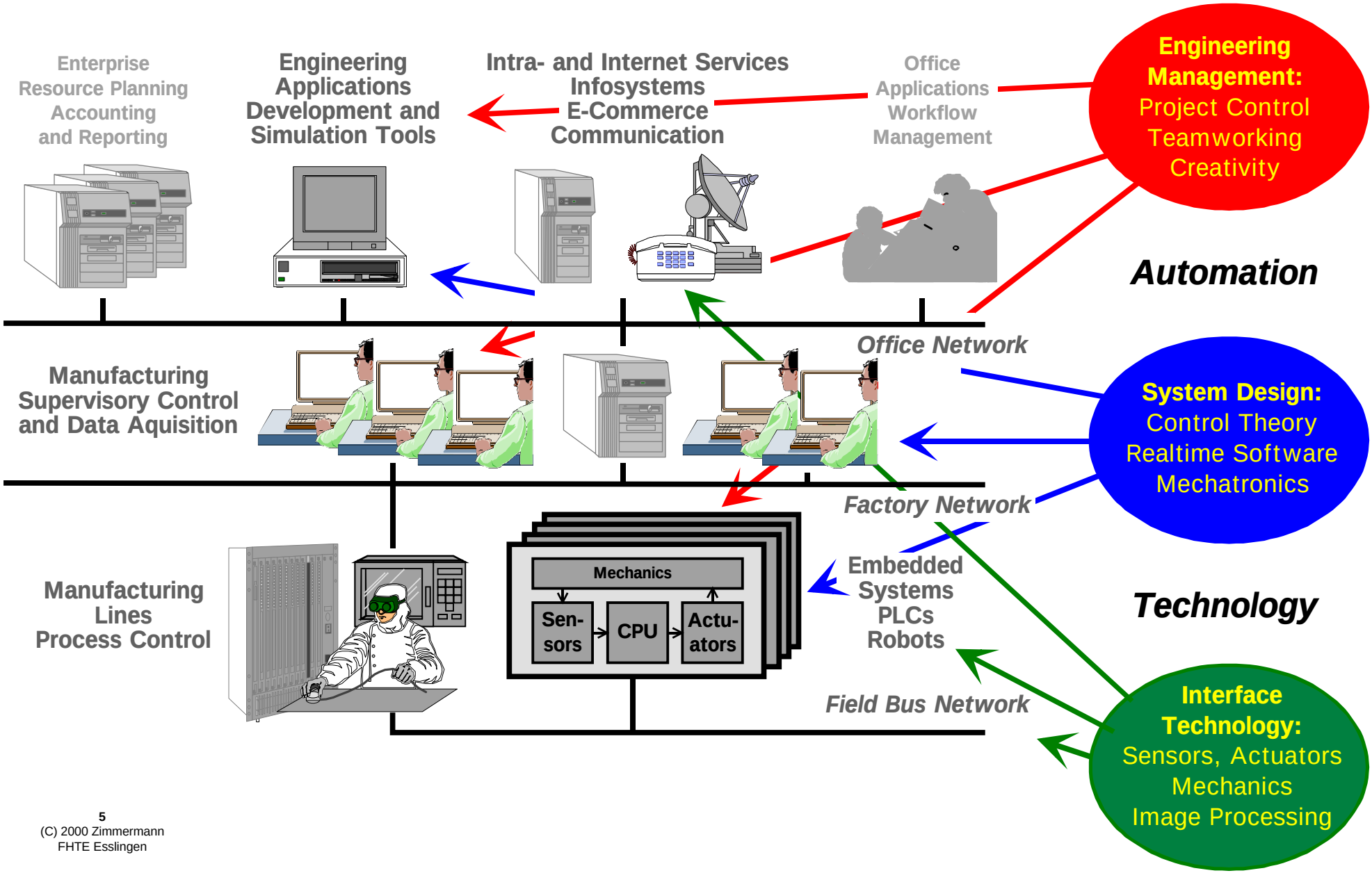


Typical Cost of Industrial Projects
(source: Siemens)

Information Technology in Industrial Applications



Automation Systems Technology in Industrial Applications



How IT and AS Technologies Map to Course Modules

Subject	Module	Engineering Management	System Design	Software Technologies	Software Applications	Communication Technologies	Interface Technologies
Global Engineering	Quality Management	X					
	Creativity	X					
System Design	System Development Process		X				
	Data Flow Design Methods		X				
	Control Flow Design Methods		X	X		X	
	Safety and Reliability		X		X		X
	System Test		X	X			
Information Technology	Computer Networks					X	
	Distributed Processing		X	X	X	X	
	Client Server Technology		X	X	X		
	Graphical User Interfaces			X	X		
	Multimedia			X	X		
	Virtual Reality			X	X		
	Image Processing		X				
	Data Base Technology			X			
Automation Systems	Mechatronic Systems and Interfaces		X				X
	Micro Mechanical Systems		X				X
	Programmable Logic Controllers				X		X
	Field Busses					X	
	Sensors						X
	Actuators						X
	Power Converters						X
	Robotics - Foundations		X				X
	Robotics - Mechanical Components						X
Project	Application Project: Autonomous Garbage Collecting Robot	X	X	X	X	X	X

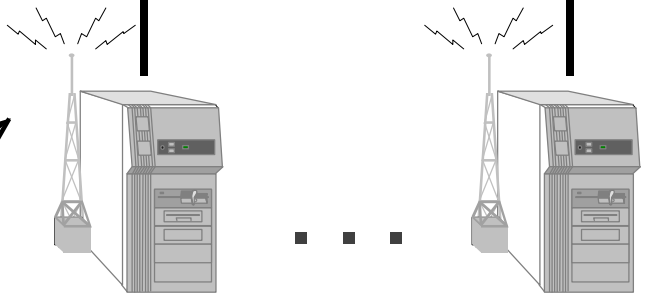
Hands-On and Team Work Experience: Autonomous Garbage Collection Robot

Database Server

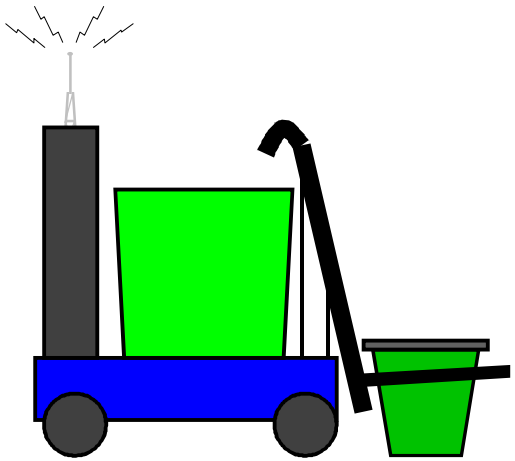
Administrators Workstation
Job Coordination
and
Scheduling

Network

Wireless Communication



Floor Base Stations
Long Range
Navigation Control



Mobile Robot
Short Range
Navigation
Control System
Position Sensing
Electrical Drives

MSc Project Idea:
Design a mobile robot system to empty waste paper baskets

Project Goal:
Apply IT & AS theory to a real world development project
Practice interdisciplinary teamwork in a real life engineering situation

Hints for presenting slides 1-3:

Slide 1:

- Goal of the MSc IA program: Train students for jobs in engineering and engineering management in **industry**. We do **not** focus on careers in **research**, even if a Ph.D. may be the next step in the student's career, it will always be focused towards the industry, not research. Become a „Bill Gates" (famous engineer) not an „Einstein" (famous scientist).
- Successful engineers, especially successful engineering managers must have knowledge out of at least technical fields:

1. The implementation technology for their products, which in our course is typically software and computers, and
2. the application field, which in our course is industrial automation, i.e. automation of technical systems like production lines.

- Many courses, especially those with a so called scientific focus, only deal with 1 but forget to deal with 2. The result is that these students are fit for science and research, but not fit for industry and management.
- **MSc IA** concentrates on **industrial automation**. Our IT technology can be applied to office automation as well as to industrial automation. However, for successful **office automation** you need complementary knowledge in office workflows, sales and marketing. This is the **focus in** our **MBA program**. **Manufacturing technologies**, which are still strongly oriented towards mechanical engineering, are the major **focus of** our **MSc AE program**.

Slide 2, 3 (upper half):

- Industrial companies are usually divided in an „office floor", i.e. planning, accounting, sales, marketing and development, an a „factory floor", i.e. manufacturing. Manufacturing can be further subdivided in manufacturing management and control and in real ‚manufacturing'.
- Some years ago, „office" and „factory" were different worlds with different technologies and even different languages. Today, from a technical standpoint, office and factory merge more and more (**„Office meets factory"**)
- Use the keywords in the upper half of slide 3 to explain slide 2.

Slide 3 (lower half):

- Cost structure of industrial projects: Automation is key for cost reduction, in future we need not only automation in manufacturing (this reduces only the„Hardware" share in diagram), but also in engineering (because this already today is the major share!)
- People from countries like India or China always ask, why do we need automation technology, labor is cheap in our countries? Our answer is:
- In a global world the usage of technology also is global. Why do companies in India or China use computers for accounting or writing simple letters, why do they use fax or email? There are so many people, who could write manually … Technologies used in US, Europe and Japan today will be used in India or China tomorrow!
- Many advanced technologies, like e.g. computer boards, cannot be manufactured with old, i.e. manual, technologies.

Hints for presenting slides 4-7:

Slides 4,5,6:

- Explain which technologies will be covered by our courses. Show students that we cover 3 fields:

1. Engineering management aspects like project planning and top level system design
2. IT technologies, like software and network technology, as the implementation know-how („how to make it“)
3. AS technologies, as the application field, where IT is applied („what to make“)

Slide 6 is only meant as a help for the presentator and a reference for the student, it is not meant to be discussed as a slide.

Slide 7:

- A major strength of industry focused master programs, and especially a major strength of German Universities of Applied Sciences like the FHTE, are „case studies“, i.e. not only theory, but practical „hands-on“ experience. The MSc IA structure is

- 1st semester: Major focus is on theory (many lectures), with some embedded case studies.
- 2nd semester: Major focus is on a big case study („the robot project“), with accompanying theory (some lectures). In this project, however, the technical solution is not in the foreground, we focus on non-technical aspects like project management, planning, reporting and teamwork.
- 3rd semester: Complete focus on a single case study: The student’s master’s thesis. This is where the students show their ability to combine advanced technical solutions with excellent engineering management capabilities.