NGE Solutions

Building the Next Generation Enterprises

PISA in the Classroom

Instructor's Guide

How to Use PISA to Support Courses:

- **Strategic IT Planning ("IS for Managers" -- Core MBA Course)**
- **SOA and Integrated Enterprise Architectures**
- **IS Analysis and Design**
- **IS Security, Controls and Governance**
- **Data Communications and Networks**

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Opening Comments

This document is written for IS instructors who are interested in using hands on exercises to augment IS/IT courses. The material is based on several courses that have been taught by using this tool. The material has benefited from the suggestions of other instructors and their students who have used it in their graduate and doctoral courses. The material contains instructor tips, sample project assignments and suggested deliverable reports. In particular, this work has been partially funded and strongly encouraged by the IBM Academic Initiative.

Contents

1. What is PISA?

PISA Overview

PISA (Planning, Integration, Security, and Administration) is an intelligent decision support tool for IT managers and planners. PISA attempts to capture the key attributes of an interactive consulting practice and provides a mixture of expert advice, decision support capabilities, and analysis tools to support management decisions in modern enterprises. The PISA Environment, conceptually shown in Figure 1, provides automated support for all stages of IT planning, integration and security projects (e.g., enterprise modeling, application planning, network planning, security planning, project planning, architecture analysis, solution evaluation).

PISA consists of a set of intelligent advisors that use inferences, best practices ("patterns"), and collaboration to develop enterprise models, enterprise application plans, computing platform plans, network plans, security plans, requirements' documents, architecture configurations, integrated solutions, and project plans. Each advisor solves one problem (e.g., the Network Advisor suggests a network configuration) and then collaborates with others through a common model. No advisor operates without the information provided by its predecessor. The model is refined and expanded as the advisors work to develop a solution. The answers produced by one advisor are used by others to produce yet more solutions based on additional interviews. The user may review the output of each advisor to ensure the solution is heading in the desired direction. Working with PISA is like consulting with a team of experts who collaborate with each other to solve your business problems. For example, the Network Advisor suggests a network configuration and then passes it over to the Security Advisor to secure it.
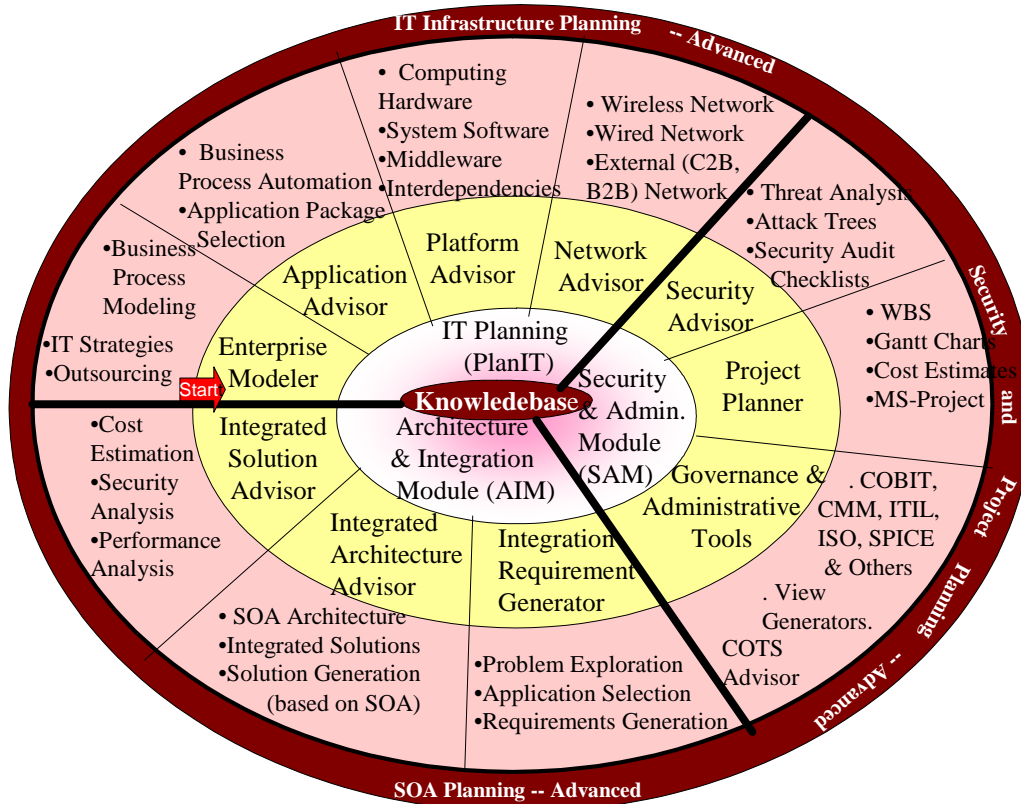

Figure 1: Conceptual View of PISA Environment

At the heart of PISA, as shown in Figure 1, is the knowledgebase (KB) that consists of an extensive patterns repository – it contains industry patterns, application patterns, network patterns, security patterns, requirements patterns, and SOA (Service Oriented Architecture) patterns. The knowledgebase also consists of a commercial-off-the-shelf (COTS) database and planning models that are created during user interviews. Thus more knowledge is accumulated in the KB. as the system is used. The KB is used by the PISA advisors that are segmented into three modules (see Figure 1):

- **PlanIT (Planner for IT)** concentrates on IT planning projects and develops a plan at the enterprise level.
- **SAM (Security and Administration Module)** provides security and administrative services for the entire PISA system.
- **Architecture and Integration Module (AIM)** focuses on how SOA can be used to architect and integrate the various components to form a functioning system. .

Each PISA advisor, as shown in the outer circle of Figure 1, supports a specific stage and collaborates with other advisors to produce plans. For example, the Network Advisor supports the network planning stage and collaborates with the Security Advisor to develop a security plan that includes a secure network. The outermost circle ("the PISA crust") represents the **Advanced Capabilities Module (ACM)** that accepts the outputs produced by the PISA basic advisors and then helps the users to invoke detailed simulation and analysis tools, if needed.

To understand the sequence in which these advisers are invoked, start from the Enterprise Modeler ("Start" arrow in Figure 1) and follow the circle clockwise. Specifically, the PlanIT advisors do the following: the Enterprise Modeler develops a model of an enterprise, the Application Advisor develops an Application plan, the Platform Advisor develops a computing platform plan, and the Network Advisor builds a network plan. The SAM advisors develop a security plan, a project plan, and provide other administrative services. The AIM advisors develop an architecture and integration approach. The advisors are not strictly sequential – you can invoke different advisors in different sequences to fit the type of project you are working on. However, some things have to be done in sequence. For example, you cannot secure network before developing a network plan (naturally!).   The PISA Control Panel guides you through what can be invoked at the appropriate stage.

The PISA Platform

PISA is a result of several years of consulting, university teaching, research management, strategic planning, and architecture assignments in different industry segments. During our consulting and research practice, we found that most IT problems in the digital age require a team of experts that collaborate with each other to solve real-life problems. Based on this observation, we developed a set of collaborative software based advisors that behave as a team of experts to develop IT plans with integration and security in mind. We tested PISA on some initial assignments and expanded it based on our experiences. We have also used PISA to support different IT courses.

The PISA platform, shown in Figure 2, is a Web-based system based on the Microsoft .NET Framework. All advisors are invoked from a controller that signs a user in, assigns a unique ID to the user, and manages user sessions. This allows each user to develop and store their own object model that is enriched as the user invokes different advisors. The object model (OM) is a set of XML documents that represents the results of the interviews as the user interacts with different

advisors. After being invoked, each advisor conducts its own interview, consults the object model to review the decisions made so far, makes inferences as much as possible, makes further decisions based on the user interview, extracts needed patterns from the patterns repository, and further enriches the object model. The object model is used as a basis for collaboration between the advisors.
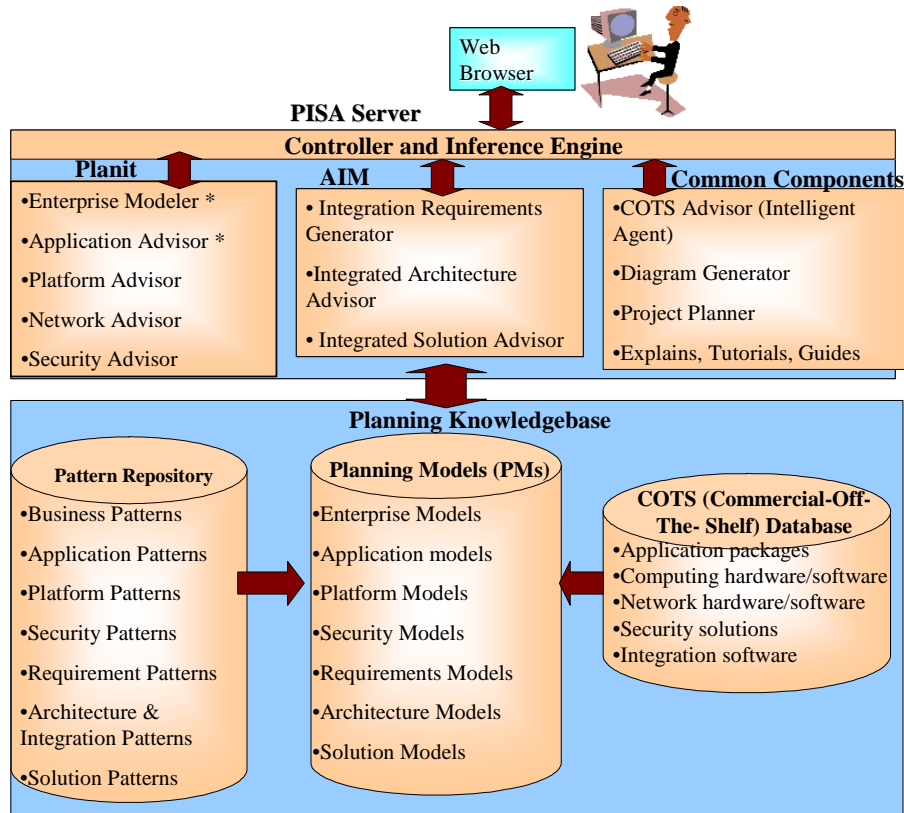
Figure 2: High Level Technical View of PISA

Typical Usage Scenarios

Although still in its development stages, PISA has been successfully used in more than 400 case studies and IT models in academic and industrial settings. In fact, PISA can be used to develop, secure and evaluate IT plans and integrated architectures for a wide range of real-life business situations. Table 1 illustrates a few business situations in terms of the following two broad factors:

- Business services (new or existing)
- Organizational units (new or existing)

As illustrated in this table, the PISA capabilities can be used in a wide range of practical situations that cover new or existing services for new or existing organizational units. Additional and innovative examples are envisioned as more experience with PISA accumulates.

In addition, PISA has been used to support the following academic courses:

- IS for managers (core MBA courses)

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- ▪ Network design courses
- ▪ IS security and auditing courses
- ▪ Systems analysis and design courses
- ▪ Enterprise architectures and integration using SOA courses

Table 1: Usage Scenarios for PISA

	Organizational Units (New)	Organizational Units (Existing)
Business Services (New)	S1: New services(s) for a new site Examples: • Setting up a new company (this means that new IT infrastructure is needed consisting of applications, networks, platforms, etc) • Setting up a new site or division of an existing company (e.g., setting up a new sales office overseas) • Setting up a SOHO (small office, home office)	S2: New services(s) for an existing site Examples: • Offering a new business service (e.g., consulting, hardware repair) at an existing site • Data exchange between companies (B2B) • B2B trade (e.g, Supply Chain, emarkets) between partners
Business Services (Existing)	S3: Existing automated services(s) for a new site Examples: • Outsourcing an existing application to a new company • Providing existing applications (e.g., CRM) at a new branch office • Supporting existing (updated) network services at a new site • Providing existing platform services (e.g., install servers) at a new site • Offering existing security services (e.g., firewalls, vulnerability analysis) at a new site	S4: Existing automated services(s) for an existing site Examples: • Migrating from existing system to an SOA-compliant architecture. • Integrating an application with several internal and external applications • Automating a manual BP • Documenting a current configuration. • Validating an existing platform, network and security plan

Important Suggestion: Before proceeding, please read the "PISA Overview" document to develop a conceptual understanding of the PISA environment. The overview document, less than 10 pages, can be found at the PISA website (www,ngepisa.com) in the 'Learn More' section. Extensive documentation about other capabilities of PISA can be found in the 'PISA Document' section of the PISA website.

2.   Why Use PISA in the Classroom?

It is very difficult to teach IS courses without good tools that allow the students to build different models and experiment with them to develop a better understanding. PISA fills this role very well -- it allows the students to create a model of a company and then, depending on the type of course, develop and experiment with an enterprise application plan, a computing platform plan, a network plan, a security plan, an architecture configuration and an integrated solution. So far, PISA has been used very effectively to support the following courses (more are being investigated -- suggestions and ideas are welcome):
- ▪ **Strategic IT Planning (or IS for Managers** typically taught as the core MBA course): The students build a model of a company and then build an IT plan for this company by using PISA. They learn a great deal by developing different plans and then comparing

and analyzing them against the plans they develop on their own. See Section 3 for sample assignments and student deliverables.

- **Information Security, Controls and Governance:** The students develop a model of a company, develop its application and network plan and then build a security solution by using the PISA Security Advisor (SA). They also use the Project Planner to develop an IT governance plan. In particular, they run different attack trees by using the SA and develop appropriate security solutions. They gain insights into security and governance by comparing and analyzing their own security solution with that generated by PISA. See Section 4 for sample assignments and student deliverables.

- **Computing Networks (Data Communications):** The students are first asked to design a network advisor and then compare and contrast their advisor with the PISA Network Advisor. They are also asked to survey the literature and find two more network advisors. They learn valuable lessons by comparing and analyzing the design of their own advisor with PISA and other advisors. The students, if needed, can also look at the NML (Network Markup Language) – an XML document -- used by PISA to describe the network plan generated. See Section 5 for sample assignments and student deliverables.

- **Systems Analysis and Design**: The students develop a model of a company, develop its application plan and then work with PISA-AIM to develop detailed requirements, architecture and integrated solution of chosen applications. For example, different groups in a class choose different application areas (e.g., procurement, CRM, supply chain management, and business intelligence) and then try to integrate their solutions. See Section 6 for sample assignments and student deliverables.

- **Service Oriented Architecture (SOA) and Integrated Enterprise Architectures**: An example of such a course is the "Architectures for Globally Integrated Enterprises" course that won the 'Best Course Proposed' Award from IBM in December 2007 (see www.ngesolutions.com/pisa/documents page to download the course description). The students develop model of a company, develop its application plan and then work with PISA-AIM to develop detailed SOA-based architecture and integrated solution of chosen applications. The students develop a multi-phase SOA architecture by using PISA by transitioning enterprise applications gradually to PISA.   See Section 7 for sample assignments and student deliverables.

In all these courses, the students work with the PISA Advisors first to learn how to use them and then compete with them by using "beat the advisor" exercises. See the following sidebar.

Playing Games and Having Fun with PISA

The students work with PISA by playing three different types of games:
- **Learn the advisors:** What are they doing, how are they doing it? This helps the students to learn the decision making processes. The typical assignment is to ask the students to solve a problem by hand, then solve it by using PISA and then analyze the results and explain the differences.
- **Beat the advisors:** Have an advisor solve a problem, then do better than it and justify your solution. This is the typical computer chess model. The students are typically asked to solve a problem by using PISA and find weaknesses in the recommended solution and do a better job.
- **Extend the advisors**: The students can take the XML documents generated by the PISA advisors and perform additional analysis by invoking additional tools. For example, students have taken the outputs generated by the Application Advisor and ported into workflow tools, fed the output produced by the Network Advisor into the OPNet network simulation tool, and ported the outputs of many advisors to invoke Excel worksheets for detailed calculations and return on invest (ROI) analysis. This assignment is typically given as extra credit or special study.

How PISA Can be Used in Classroom

The following figure shows a usage scenario for the PISA Environment for courses that require the students to build models, designs, and plans (henceforth referred to plans) in IT courses:

- Current Scenario: a) teachers look for projects that will best "test" the students understanding of the concepts, b) students develop the plans, and c) teachers grade the plans.

- Proposed Scenario: a) teachers use the PISA library of projects that can be customized by the teachers, b) students develop the plans by hand, c) students do a "self assessment" exercise to develop the plan by using PISA, and compare/contrast their plan against the output produced by PISA, d) teachers grade the assignment based on the assessment report.

Current Scenario

| a) Teachers look for Suitable projects | b) Students develop the plans manually | c) Teachers grade the plans models |

Proposed Scenario

| a) Teachers locate projects from PISA libraries | b) Students develop the plans manually | c) Students do Self-assessment Through PISA | d) Teachers grade the self-assessments |
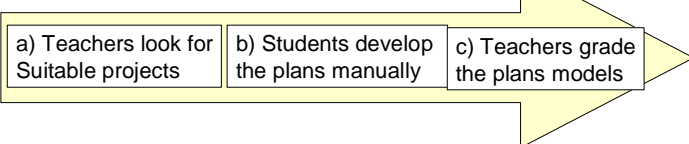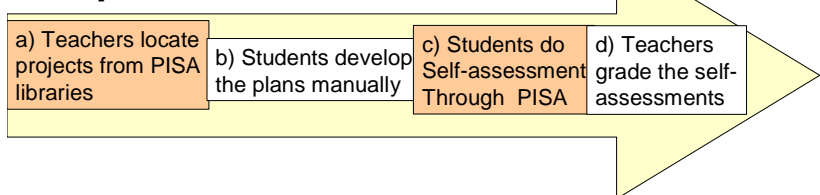
- Based on hundreds of experiments at different universities, the proposed PISA-based model significantly improves student learning. In addition, they have a great deal of fun by playing games against PISA and trying to beat PISA advisors.

3. Using PISA in Strategic IT Planning ("IS for Managers") MBA Course

3.1 Instructor Tips

This is the typical core IS course taught in several MBA programs under varying titles. I have used the Laudon and Laudon book ("Management Information Systems", Prentice Hall, latest edition) to teach this course for several years. I usually give the students several projects. -- PISA is used in one of them that concentrates on IS planning (see Section 3.2). In this project, the students develop a complete IS plan for a small to medium business (SMB). The project is divided in two parts: in part A, the students develop the plan by hand and in part B they develop the plan by using PISA and then compare/contrast their results with the results produced by PISA. They also create/experiment with different plans of a company of their choice and are asked to do a critical analysis of PISA results

The following is a sample project that I have used several times by changing the company information a bit, using a different company, etc. The students really enjoy this assignment and seem to have a lot of fun with it. The project is usually assigned towards the end of the term after they have gone through the material on IS strategies as well as technologies (Part 1 and 2 of Laudon and Laudon). This project can also be used with other MIS texts (obviously).

3.2 Project Assignment: IS Planning

Frank's Furniture Shop, Raleigh (NC), is a small store with big ideas**. Frank** started selling kitchen and bedroom furniture 2 years ago and wants to expand aggressively in the next 3 years. He currently has 30 employees in Raleigh and is partnering with a moving company that delivers the items. His plans are:

1. Next year he wants to acquire a small manufacturing shop so that he can design, build, sell, and repair custom built furniture. He also wants to open five furniture outlets, in different parts of the country, to sell his furniture. He expects to triple (triple what exactly ?) the size of his company next year.
2. In two years, Frank wants to diversify into a wide range of other products (e.g., living room and office furniture, paintings). He also wants to start partnering with retail stores and manufacturers. The parts and components will be brought from suppliers located overseas to his manufacturing site.

Frank is a good businessman but is not very technical. He keeps track of all information on a MS Word file and also uses an MS Excel spreadsheet occasionally. Currently, all communications are through phone but Frank is pursuing an MBA and is really intrigued by using IT for selling, purchasing and outsourcing. He is especially interested in integrating and automating the procurement processes (e-procurement) and supply chains to provide custom-built furniture quickly.

He has no idea what he is getting into. Besides his MBA, he has been attending management seminars on use of IT in business. He does not completely understand it but he is convinced that it is something very good (they wouldn't be teaching courses in this area if it was not good!). He simply cannot wait to put everything he is learning to work. His goal is to eventually become a

major digital corporation that will serve as a virtual store for multiple shops so that potential customers order a variety of products through him. He will receive the orders, and try to fill them, if he can. Otherwise, he will route the order to one of his business partners.

He knows about many failures (dot bombs) and wants to be aggressive but cautious. Basically, his goal is to double his business by using IT in an innovative manner. He also wants to make his operations more efficient and less expensive. He has too many ideas and needs help. He has hired your group to help him out.

PART A: Develop an IS Plan (60 Points)

Develop an IS plan for Frank that identifies the critical business processes, the enterprise applications that automate the business processes, the computing platforms on which these applications reside, and the networks that interconnect these platforms with each other and the end-users. Your deliverable is a report (5 to 10 pages) that contains the following information:

- A list of about 20 business processes (BPs) to be used by the company. You should also identify 5 BPs that are critical to the success of Frank. Use the CSF methodology for this purpose. Develop a conceptual diagram that shows how the critical BPs will interact with each other.
- Create a current view, 1 year view and 2 year view of an automation strategy that will show a BP automation schedule. This should show an increasing technology dependence view. This should also show what approach you will use for automation (buy, rent, outsource, build, reuse).
- Identify the enterprise applications that will be used to support the automation strategy. For each application, give a one line description, type of application (DSS, TPS,etc.), and how it will help the company (cost reduction, increase in sales, more efficient operation, other). Choose the appropriate commercially available packages for enterprise applications. For each, indicate the vendor, site name, with very rough cost.
- Develop a computer platform plan that shows the computers (type & computing power ????? and system software (e.g., operating system, utilities, web technologies) needed to support the enterprise applications.
- Show the network (LAN, WAN, wireless) that will interconnect the computers. This should include the interconnectivity devices and the suppliers.
- Supply an architecture diagram that includes Internet and web technologies in addition to the aforementioned technologies. This diagram should show the applications, the databases, other physical components, where they reside and how they are interconnected.

PART B: Hands on Experiments with a Computer Aided Planning Tool (40 Points)

Use a computer aided IS planning tool (PISA) to do the following:

- Develop the same plan developed in Part A by using PISA and then compare/contrast your results with the results produced by PISA.
- Create/experiment with IS plans of a company of your choice by using PISA.
- Develop a deliverable report by completing the "PISA Report Template". This report must include a critical analysis of PISA as a planning tool, a comparison/contrast of results produced by you versus those produced by PISA, main lessons learned, etc.
- **Extra Credit:** Use the Advanced Capabilities Module of PISA to develop more detailed models, do simulations and perform additional analysis.

The next two sections give information about using PISA and a suggested deliverable report template for PISA.

3.3 PISA Information

PISA (Planning, Integration, Security, and Administration) is an intelligent decision support environment for IT managers and planners. It consists of the following advisors that collaborate with each other to help small to medium businesses (SMBs):

- **Company Profile**: *Helps you develop a high level model of your organization*
- **Application Advisor**: *Helps in automation of business processes through application software*
- **Platform Advisor**: Recommends computing hardware and software needed to support the applications
- **Network Advisor**: Suggests a wireless/wired network configuration that interconnects the applications, users, and computing platforms
- **Security Advisor**: Analyses system vulnerabilities and recommends security solutions

To use this prototype, do the following:

- Visit the PISA home page (www.ngesolutions.com/pisa)
- Read the PISA Overview document (retrievable from PISA home page) before proceeding. The tool is self-contained. It includes an extensive 'Explain' capability that serves as an online tutorial. The Explain is accessed by clicking on the "?" button on any screen.
- The PISA demo works as an ASP (application service provider) – you do not need to install anything on your computer. Use the ASP site, ID and PW assigned to your team to access the system
- Create new profiles for each plan you generate. You can create as many profiles as you wish.
- Use the Enterprise Modeler to create a model of the company. Use approximations where needed.
- Use the Application Advisor to outline the applications used by the shop. For simplicity and speed, use ERP solutions but also use 'individual' solutions. .
- Use the Platform Advisor to develop the computing platforms (computing hardware/software) to be used by the shop. Use defaults but try to include wireless devices.
- Use the Network Advisor to create a network configuration. Show the diagram of the suggested network. To display the diagram, a Flash program may be downloaded to your computer, if not already there.
- Use the Security Advisor (SA) to analyze the security and develop security solutions. Take the simplest solutions. (why ?)
- Generate the consolidated report that summarizes the decision made by you.

3.4 PISA Report Template for IS Planning

Pease use the following framework for evaluating PISA

1. General Observations:

a Time taken to develop solution by hand for Project
b. Time taken to develop solution by using PISA for Project

c. Did PISA solve the problem completely, partially (in percentage), or more.

	Indicate if PISA solve the problem completely, partially (in percentage), or more	What is missing from PISA (not done or not done correctly/completely)
Enterprise model		
Enterprise application model		
Computing platforms model		
Network model		
Security model		
Project Plan		

2. Compare and contrast the results produced by you versus PISA. Were your results better than PISA? Use the following table to do the comparison and indicate which one is better and why

	Your Results	Results obtained through PISA
Enterprise model		
Enterprise application model		
Computing platforms model		
Network model		
Security model		
Project Plan		

Overall, what grade will you assign (out of 100) for the Project

- To your group:
- To PISA:

3. Strengths/weaknesses of the Tool

  a: Strengths of the Tool

    b.   Weaknesses of the Tool

    c. "Gee, I didn't know that!". Did you feel that and why while using this tool (specify)

4. Suggestions for Improvement:

5. Documentation evaluation (Explain Capabilities, short tutorials, and Overview Document)

6. Did you use any of the following "additional services"? Were they of any value? (You can find them by clicking on 'Tutorials' button in the top tool bar).

- Project Planner

- Business Portal (SMB Portal)

- Outsourcing Advisor

7. Overall, what was your assessment of the tool:

- In your view, is PISA an expert system, a decision support system, or both.

- Effort in using the tool: Low, Medium, High

- Accuracy of the results produced by the tool: Low, Medium, High

- In your future work, will you be inclined a tool like PISA: Yes, No, Maybe

- How useful was the tool for the exercise: Low, Medium, High

4.   Using PISA for "Information Security and Governance" Course

4.1 Instructor Tips

This is the typical information security course taught in several IS/IT programs. I have used the book (Umar, A, "Information Security and Auditing in the Digital Age", NGE Solutions, 2004) to teach this course for several years. PISA is used in the second project. The main idea is to have the students develop a complete security plan of a small to medium business (SMB). The following is a sample project that I have used several times by changing the company information a bit, using a different company, etc. This project can also be used with other security texts (obviously).

4.2: Information Security and Auditing Project (100 Points)

Part A: Management Approach (50 Points)

You have been asked to help a new company establish a complete security system. The company is a Dallas-based pharmaceutical firm, MRU (Medicines Are Us), that is trying to provide medicines to around 10 hospitals in different parts of the US. The company knows that it wants to allow hospitals to access and update their account information and purchase drugs via the Internet. The goal of the company security system is to provide excellent customer service with minimum cost. You are asked to prepare a proposal that will be presented to the company management (about 10 transparencies for presentation, 10 page report). The presentation will be made in class by your team and will be assessed by your peers as MRU managers.   You need to consider the following factors, among others:

- Security requirements (about 10)
- Security risks (about 5) and the possible impact
- A management approach (organizational structure, awareness policies, roles, responsibilities) based on standards such as ISO/British standard 7799
- An audit, control and governance approach to be used for the company based on frameworks such as COBIT, ITIL, SOX and others
- An overall security architecture illustrated through a diagram
- Key security technologies for authorization, authentication, cryptography
- Two detailed attack trees against two vital assets
- Others if appropriate

The following initial information is available about MRU:
- A corporate web site
- Customer database containing info about customers (Hospitals)
- Medication program that allows customers to view, update, and modify account info
- Drugs database containing investment data
- Other typical corporate applications and databases for payroll, account payable/receivable, etc.
- A corporate network that will operate in the building, connected to the Internet

Part B: Develop a Detailed Security Plan (50 Points)

You are supposed to prepare a security plan and solution for MRU that will be presented to the company management. You need to consider the following different technical as well as management aspects of your solution:

- Network security (including wireless and mobile users security) for the local as well as remote (including overseas) sites. Assume that the company is quite interested in exploring mobile users.
- Web security (protecting the web site, XML, and semantic web)
- Application security (e.g., database, applications, ecommerce)
- Audit checklist specifically for your company (you may modify the audit checklist in Chapter 15 to work for your company (a soft copy of this chapter will be posted).
- Security in emerging areas (e.g., social networking security, integrated system security, SOA security)
- IT Governance Frameworks: Choose one of the many IT Governance frameworks (e.g., COBIT, ITIL, SOX, CMM, SPICE) and analyze it for different business scenarios for the company you have chosen.
- Any other area of your specific interest (pick management, organizational, legal, and/or technical issue not listed)
- Business continuity planning and strategies

Self Assessment of the Proposed Security Solution. Evaluate your security solution by using a security design tool. You will be given access to a prototype of a tool (PISA) that will allow you to build a model of your company and then develop a security solution for the system. Do a critical analysis of the results produced by this tool versus yours (the information on PISA is given below). Also you should develop a better solution than one suggested by PISA (extra points).

4.3 PISA Information

PISA (Planning, Integration, Security, and Administration) is an intelligent decision support environment for IT managers and planners. It consists of the following advisors that collaborate with each other to help small to medium businesses (SMBs):

1. **Company Profile**: *Helps you develop a high level model of your organization*

2. **Application Advisor**: *Helps in automation of business processes through application software*

3. **Platform Advisor**: *Recommends computing hardware and software needed to support the applications*

4. **Network Advisor**: *Suggests a wireless/wired network configuration that interconnects the applications, users, and computing platforms*

5. **Security Advisor**: *Analyzes system vulnerabilities and recommends security solutions*

To use this prototype, do the following:
- Visit the PISA home page (www.ngesolutions.com/PISA)

- Read the PISA Overview document (retrievable from PISA home page) before proceeding. The tool is self-contained. It includes an extensive 'Explain' capability that serves as an online tutorial. The Explain is accessed by clicking on the "?" button on any screen.
- The PISA demo works as an ASP – you do not need to install anything on your computer. Use the ASP site, ID and PW assigned to your team to access the system
- Create new profiles for each plan you generate. You can create as many profiles as you wish.
- After logging on, create a new profile 'MRU' You may later create other profiles such as MRU1, MRU2, etc.
- Use the Enterprise Modeler to create a model of MRU. Use approximations where needed.
- Use the Application Advisor to outline the applications used by MRU. For simplicity and speed, use ERP solutions.
- Use the Platform Advisor to develop the computing platforms (computing hardware/software) to be used by MRU. Use defaults but try to include wireless devices.
- Use the Network Advisor to create a network configuration for MRU. Show the diagram of MRU network. To display the diagram, a Flash program may be downloaded to your computer, if not already there.
- Now use the Security Advisor (SA) to analyze the security of MRU and also develop security solutions. The SA allows you to do the following:
    1. Specify security requirements for different 'objects' (devices, programs, databases).
    2. Determine security solutions for the different objects
    3. Run some attack trees to evaluate the weaknesses in the system
    4. Analyze attack trees by turning some securities on/off
    5. Show the security diagram to review the security solutions
    6. Propose a security audit checklist

- You do not need to go beyond the security advisor for this exercise. Proceed at your own risk.

Deliverables (part of presentation/discussion)

- Printout of: a report from PISA showing the model built and the security solutions
- Critical analysis of the tool suggesting main strengths and areas of improvement. Use the suggested evaluation report in Attachment A to report your results.
- **Extra Credit:** Use the Advanced Capabilities Module of PISA to develop more detailed models, do simulations and perform additional analysis

4.4: PISA Evaluation Framework for Security

Please use the following framework for evaluating PISA. Use this as part of your presentation.

1. General Observations:

Did PISA help solve the MRU problem completely, partially (in percentage), or more for the following:

- Enterprise model and applications used by MRU
- Computing platforms used by MRU
- Network model of MRU
- Security solution, audit checklist, and attack tree analysis for MRU

2. Strengths of the Tool

3. Weaknesses of the Tool

4. Suggestions for Improvement:

5. Can you develop security solutions that are better than PISA ("Beat the Advisor"). Describe your results with justification by using the following table.

PISA Result	Your Result	Why do you think it is better?
1.		
2.		
3.		

5. Find some other tools that are similar to PISA-SA and compare contrast them with PISA

6. Overall, how useful was the tool for the exercise: L, M, H

5.   Using PISA for a "Networking" Course

5.1 Instructor Tips

This is the typical networking course taught in many IS/IT programs. I have used several different texts to teach this course for several years. PISA is used in the second project. In the first project the students develop a network design for a typical SMB corporation with a corporate site and two regional offices. As part of this exercise, they develop LANs at each site and a corporate WAN that interconnects the WANs. In the second project they generalize the network design problem into a "Network Advisor" that walks the user through a variety of decisions and suggests a network plan. The main idea is to have the students design a network expert system and then compare/contrast it with PISA Network Advisor plus additional network expert systems such as Cisco network designer.

Project1: Network Design

Note: This project is more oriented towards Wireless Network Design.

XYZMobile (this is a fictitious name, any collision with an actual company is accidental) was formed in 1995 by a small group of engineers to build, repair, and sell mobile devices. The initial business of the company was handsets and PDAs. With time, the company included wireless software into its product lines. In the 2000s, the company entered into business partnerships with numerous suppliers around the globe and acquired a startup company that builds desktops, laptops, and "network computers". XYZMobile also formed partnerships with numerous other computer hardware/software vendors and acquired several retail electronic stores that sell and service wireless network products. These stores also sell, market and service the XYZMobile products. At present, the company is thinking about providing technology solutions, consulting, and training services for mobile and wireless areas. The company management believes in controlled growth, i.e., systematically explore new markets and diversify by using new products and services after careful strategic analysis and evaluation of core competencies.

The company headquarters is in Atlanta with branch offices in the US, Europe and Asia. The company operates many regional offices (5 in the US, one in London, and one in Singapore). Each region supports between 5 to 10 local offices (some of these offices are stores, the others are marketing, training, consulting and support centers), with an average of 200 staff members per region.

Given the information below about regional offices, corporate headquarters, and wide area network, determine the overall network design for this company (using wireless as much as possible). Your design should include WLANs, WPANs, WLLs, cellular networks, and satellites.

Deliverable
A report, not to exceed 5 pages that proposes an overall wireless network design with clear justification. The overall network design should show the big picture of the Corporate network, with all interconnectivity devices (e.g., routers, gateways), a hardware and communication layout of the chain stores, the calculations to justify the results, and a list of assumptions, if any. Within each site, your proposal should show all the hardware and software needed with the number of LANs, number of servers, etc. on all floors. A very rough cost estimate for the whole network

(only network devices and network software, not the computer costs) should be also provided. Your report should include the following:

- Two or three diagrams that illustrate the proposed network (10 points)
- Explanation and justification of the proposed network with all calculations, assumptions, etc. (10 points)
- A network security solution that will secure the proposed network. You should show an overall security architecture illustrated through a diagram that clearly identifies the security approach to minimize the risks of privacy, integrity, authorization and authentication at corporate, regional and local levels. The material in Chapter 12 should help (10 points).
- Summary of the network devices to be purchased. You should use a table such as the following (10 points)

Site (e.g., Corporate, Regional, Local)	Device Type (e.g., Router)	Estimated cost (number x cost per unit)	Suggested supplier (give Web Link)

Corporate Headquarters

The corporate headquarters, a three floor 200 foot X 500 foot building, houses the IT department (first floor), administration and distribution (second floor) and marketing / corporate planning and management offices on the third floor. Each floor will have the office layout as shown in Figure 1. Each person in the office wants a desktop computer for local processing and access to the Internet. Each office room is assumed to be 10 feet x 10 feet and the workstations are assumed to be equally distributed in each area. You are to recommend a layout of the workstations (terminals or microcomputers) for the three floors of the headquarters.

Each room on the first floor should have access to the main computer located on the first floor as shown in Figure 1. Most work done on the first floor is word processing, accessing mainframe files, software development and technical support (planning, designing, installing and modifying the system hardware/software). On the second floor, the Administrative Department (payroll, AR/AP, order processing) is considering a LAN. They would like to:

- Allow the PCs to share fast printers.
- Be able to share and exchange information stored in databases in the corporate office.
- Be able to send/receive information from the mainframe in addition to other branch office PCs.
- Allow for growth so that in the future more devices could be supported on the second floor.

The third floor needs access to the mainframe and the Internet. They are "very" open to suggestions and recommendations.

Assume that corporate LAN traffic will increase dramatically in next several years.   You can assume that 2500 workstations will be in the building and each workstation will generate one message per second on the network and the message size can be assumed to be 10,000 bytes (100,000 bits).

The corporate office wants to provide cellular phone services in the corporate office and wants to evaluate how technologies such as Bluetooth or 802.11 could be used for this purpose. It also wants to support SMS for its employees.

The company also has a manufacturing building 1.5 miles from the corporate office. This one floor building houses 150 people who specialize in designing, building, and maintaining mobile devices and also wireless networks.

Regional Offices Information

Each regional office serves 5 to 10 local offices in the region. The regional managers want to use latest technologies and innovative applications in voice, data and images. Each regional office, a two floor 250 feet X 250 feet building, houses around 200 regional employees and supports marketing and customer support services. The following information should be considered while designing this network:

- Half of the people are technical support people who work on products in the region. Housed on the first floor, these people use a variety of tools and use the Internet heavily.
- The remainder people in regional office are managers, marketing types, consultants and administrative staff . These folks are "confined" to the second floor and are primarily used to desktop environments.
- Each region houses a minicomputer that has regional information and is connected to the "outside world".

Wide Area Network

The wireless WAN should be able to handle the estimated traffic. A planning task force has estimated the following daily communication traffic expected to go between the various offices of the corporation:

- 100,000 email messages per day between the corporate office and each business partner office (the company has 10 major business partners).
- 150,000 email messages per day between the corporate office and each regional office.
- 120,000 email messages per day between each regional office and local office.
- 30,000 file transfers per day from various Internet sites
- 80,000 web surfing requests per day
- 50,000 remote accesses to corporate databases per day from local and regional offices

Assume 10 hour day, 10 bits per byte and 5K bytes per message for email, 1 Meg for file transfers, 200K for web surfing, and 500 K per corporate database access. You should also assume Pareto's principle (i.e., 80% of the traffic is carried in 20% of the time).

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Floor 1 Layout

Floor 2 Layout

Floor 3 Layout
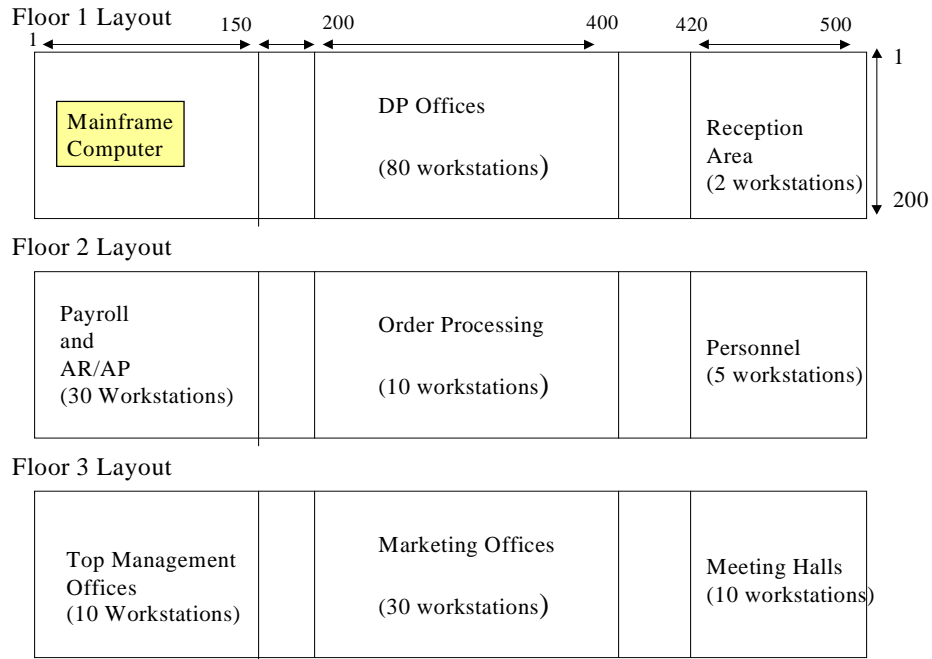
Figure 1: Corporate Office Layout   (the number at the top show dimensions in feet)

5.2 Project 2: Network Advisor (100 Points)

Generalize the network design problem stated in Project 1 into a Network Advisor ("Network Expert") that walks the user through a variety of decisions and suggests plausible solutions with emphasis on wireless. The Advisor is an expert system that suggests a network (wired/wireless) based on a set of factors. The factors may be the company size, type, applications being supported, physical site plan, etc. Potential users of the Advisor are corporate network planners trying to build a digital corporation. You should assume that the users do not know much about "deep networking" and wireless issues even though knowledgeable about general networking principles. The Advisor, if designed properly, could also be used by a telecom company, a communications equipment provider, or a student to learn about various wireless/wired systems.

The Network Advisor should prompt the users with a few questions (not to exceed 20) and at the end should be able to suggest a solution consisting of:
- The type of wireless/wired technologies to be used and justification for their use
- Network segments at different sites. This could be a LAN segment or a wireless cell supported by Ethernet, Wi-Fi, Bluetooth, WLL, or cellular network. You can decide how many users can be handled in each net segment
- Network Interconnectivity Devices (NIDs). These are the routers, access points, gateways, hubs, switches, etc. used to interconnect devices. The NIDs may provide connection between users in a net segment, between campuses, and between the internal networks and the outside world (public Internet).
- Approaches to deal with wireless impairments where applicable
- Frequencies in which the different wireless systems should operate
- Actual physical components (e.g., access points) with vendor names

Deliverables

A report describing Network Advisor design and how to use it. The report should show:
- Overall concept of the Network Advisor (1-2 pages).
- Comparison of the Network Advisor with an existing Network Designer (PISA Network Advisor).
- Find at least 2 more expert systems for network design. You will have to search the literature and the web to locate "best" competitors to Network Advisor (1-2 pages).
- One high level flow chart that describes the overall flow and points to lower level decisions and flowcharts. For each lower level decision, e.g., a wireless LAN design, show the logic that will be used to make final choices (e.g., 802.11, Bluetooth, FSO, UWB, home R/F). This information can be shown as a mixture of rules, flowcharts, decision tables, or any other appropriate tool (choose the most appropriate). You should represent this information as a simple Web application (static HTML) where the high level flow chart is the first page and each lower level decision is another Web page. The total application should not have more than 10 Web pages.
- A network markup language (NML), a variant of XML, that can be used to represent the network being designed.
- **Extra Credit:** Use the Advanced Capabilities Module of PISA (www.ngesolutions.com/pisa) to develop more detailed models, do simulations and perform additional analysis.

This document (around 10 pages) should be detailed enough so that an actual expert system can be developed from it.

Grade depends on the solutions covered (should cover WPANs to satellites), questions asked (fewer questions are better), and level of details provided for a solution (e.g., the vendor products to be used).

Additional Information

As stated previously, the decisions and choices about networks are based on the company size (no. of employees), workload (type of applications being supported), and physical site plan (no. of buildings, locations, etc.). The system can proceed with an interview in a variety of ways. A possible flow of the system is:

- First develop a network that is suitable for a small company (30-100 members in a small building). This should include internal network and provide connectivity to the general Internet.
- Now expand this to medium sized companies (200-500 people) that may have multiple sites (the sites may be on one location in a campus environment, in different states, or a mixture). This could be thought of as a collection of small company offices, each with 30-100 employees, that are interconnected through a wireless/wired network.
- Now expand it to larger (1000 to 5000) employees with local, national and international offices. This could be thought of as a collection of small and medium company offices that are interconnected through a wireless/wired network.

For experimentation, try the following scenarios:

- A small furniture manufacturing company (30 people) with 1 secretary, 5 professional staff, 2 designers , 10 manufacturing people, 3 manager types
- A university campus such as your campus
- An organization of your choice

At the minimum, you may need the following information from the user in the interview :
-   Number of employees and type of business (education, manufacturing, finance, etc.)
-   Number of workgroups -- a logical group such as a department (e.g., marketing department, design group) that does similar work activities. Some of these work groups can be inferred from company type (e.g., manufacturing department for a manufacturing company)
-   Number of sites (the geographical locations). A site may consist of one building or several buildings in close proximity (a campus). One or more workgroups may reside on a site.

An enterprise may consist of one or more sites. For example, a small company (30-50 employees) may consist of one site (one building) that may consist of   2-3 workgroups, each workgroup assigned to one network segment. A larger company may consist of several sites where the corporate site is a campus.

You will also have to determine some workload models. Different companies of different types may have different users in different work groups that are located in different parts of the network. These will reflect different workload models. This can be described in terms of following user profiles:
-   administrative and secretarial staff – mainly email activity

- professional staff (e.g., HR people, sales/marketing, engineering support): email activity, corporate applications, web surfing
- professional and development staff: email activity, FTPs, web surfing
- managerial staff: : email activity, web surfing
- For each group, you can make several assumptions in terms of traffic (arrival rate, average message size)

6.   Using PISA for an "Information Systems Analysis and Design" Course

6.1 Instructor Tips

This could be an IS analysis/design course that covers some architecture and integration issues or architecture/integration course. I have used the following additional texts (Umar, A., "eBusiness and Distributed Systems Handbook: Architecture and Integration Modules", NGE Solutions, 2004) in addition to the regular systems analysis and design texts (e.g., Satzinger, Jackson, and Burd, "*Systems Analysis and Design",* Course Technology) to teach these courses. A separate project, described below, allows the students to use PISA to develop IS plans, requirements and integrated architectures for a company. In this project the students use all advisors (PlanIT plus AIM) to develop a very comprehensive plan.

6.2 Project: Using Computer Aided Tools to Develop IS Plans and Develop Requirements of a Wireless Shop

Project Description

Walter's Wireless Shop (WWS), is an Atlanta-based small business owned by Walter, also known as Wally, who wants to exploit the opportunities in wireless communications. After getting his MBA, he started a device repair,   reselling, and distribution business. He has been doing very well and has opened several stores to expand his business. He currently has 50 employees and is partnering with others to strengthen business. His plans are:

- Next year acquire a small "manufacturing shop" so that he could design, tailor, sell, and repair brand new handsets and other mobile devices on a large scale. He expects to triple the size of his company next year.
- In two years, he wants to diversify into a wide range of related products (e.g., mobile device software, iPods, video games, and wireless networking hardware/software). He is partnering with retail stores and manufacturers in the neighborhood. The parts and components will be brought in from suppliers located in the Far East.

Walter is thinking big and wants to eventually become a major digital corporation that will serve as a store front for multiple shops so that potential customers order a variety of wireless products and services through him. WWS will receive the orders and try to fill them, if he can. Otherwise, he will route the order to one of his business partners. The company so far has not used information technology very much but knows that IT will play an important role in its growth. You have been hired to help develop an IT strategy and plan. He needs help with the following integration problem.

Experiments

This project will allow you to experiment with the PISA (Planning, Integration, Security and Administration) environment – an intelligent IT planning tool .

Experiment (1) is required (at least one member from each team must do this experiment). The other team members may choose anything from other experiments.

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Experiment1: Using PISA to Develop IT Plan for Wally

Use PISA to develop a complete IT plan for Wally's Shop, i.e., do the following by using PISA:
- Document your assumptions
- Develop a model of the company
- Develop an application plan (automation strategy, commercial packages)
- Determine the computing platforms needed
- Develop a network model
- Build a security solution
- Build a project plan, port it into MS Project and develop a PERT chart from it

Review the results produced by PISA and evaluate it against your solution. An evaluation report will be provided.

Experiment 2: Using PISA to Develop IT Plan for Another Company

Use the PISA tool to build a model of another company (pick one, you may choose RMO or other company models in the text) and analyze the results produced. Present your findings and evaluate the plusses/minuses, and suggest areas of improvement. Which problems does it solve and which ones it does not. Clearly discuss. An evaluation report will be provided.

Experiment 3: Analysis of Vertical Markets by Using PISA

We have looked at horizontal applications (e.g., marketing, sales, CRM, HR) that are common to all industry segments. However, each industry segment has unique applications (e.g., patient care is unique to healthcare). These applications are also known as *vertical applications*.

The purpose of this experiment is to expose you to a few vertical market applications in different industry segments (e.g., finance, manufacturing, healthcare, telecom). This assignment will also help you to understand business process modeling and requirement definition issues in a vertical application of your choice.

You need to pick one vertical application from an industry segment of your choice and then develop an understanding of its requirements by using the PISA environment. Specifically, you should use the PISA Application Repository (AR) to review and update/improve the 'Information Models' of the vertical application (Business Process) you have selected. For each application, the PISA AR contains :
- Overview paragraph plus a conceptual diagram
- Functional requirements
- One high level use case
- One high level class diagram with methods
- One SSD
- ERDs (for some apps)

Critically review this information and suggest improvements/enhancements based on the information available on the Internet.

Additional information about the PISA Environment and evaluation reports will be provided later.

Experiment 4: Integration Problem: Suppose that WWS wants to integrate its order processing application with front-end users and also with several backend systems. For front-end integration, several mobile devices are supposed to access the order processing system. For back-end integration, the order processing system needs to integrate with several inventory managers that exist within a large organization (regional and corporate inventories), at supplier sites and as part of a trading network. The main idea is to architect this system so that it can be integrated with many (ideally, any) back-end and external inventory and other related systems. Use PISA-AIM to develop the integrated architecture.

Experiment 5: Extra Credit: Use the Advanced Capabilities Module of PISA to develop more detailed models, do simulations and perform additional analysis

6.3 Using an Expert System Tool to Develop IT Plans and Requirements

PISA (Planning, Integration, Security & Administration) is an "Intelligent Decision Support Environment" that helps in developing IT plans and architectures. You will primarily work with PlanIT (Planner for IT) module of PISA in this assignment.

The main steps needed to complete this assignment are discussed below.

Step1: Getting Started

- Download the 'PISA Overview Document' from the PISA website (ngepisa.com) and browse through it before starting the exercise.
- Go to www.ngepisa.com and register. You will get an email to create a userID and PW.
- Use the ID-PW to logon to the system (ngecacit.com). Create a 'scenario' for the company and work through the system. It is designed to be self explanatory. Use the tutorials, guides and other help materials. For Help, click on '?' (it appears on every screen).

Step 2: Using PISA for Experiment 1 and 2

- **Make sure that you are using Internet Explorer – it does not work well with FireFox**
- Create a new scenario for the IT plan your chosen company.
- Use the Enterprise Modeler to create a model of the company. Use approximations where needed.
- Use the Application Advisor to outline the applications used by the shop. For simplicity and speed, use ERP solutions but also try 'individual' solutions.
- Use the Platform Advisor to develop the computing platforms (computing hardware/software) to be used by the shop. Use defaults but try to include wireless devices.
- Use the Network Advisor to create a network configuration. Show the diagram of the suggested network.
- Use the Security Advisor (SA) to analyze the security and develop security solutions. Take the simplest solutions by using defaults as much as possible.
- Use the Project Planner to generate a work breakdown structure and a project plan for the project.
- Generate the consolidated report that summarizes the decision made by you and review it. .

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- Complete the "PISA Evaluation Template" shown in Attachment A. Discuss the completed report in the final presentation.

Step 2: Using PISA for Experiment 3

- **Make sure that you are using Internet Explorer – it does not work well with FireFox**
- Create a new scenario for the vertical market company of your choice (e.g., healthcare)
- Use the Enterprise Modeler to create a model of the company. Use a small company with one site to keep it simple.
- In (**STEP 2: Business Function Selection and Outsourcing)**   of the enterprise modeler, click on the BF that you want to investigate. This will take you to the PISA Application Repository.
- Drill down on the BF to discover the business processes, etc by clicking on subparts.
- Most business processes have functional requirements and UML models. If you are interested in something that does not have UML diagrams, you have the choice of developing some or choosing another application.
- Prepare a report that shows the UML models created by PISA and your suggested improvements. If you developed your own, just discuss your own.

Step 3: Using PISA for Experiment 4

- **Make sure that you are using Internet Explorer – it does not work well with FireFox**
- Create a new scenario for the IT plan of the company of your choice.
- Use the Enterprise Modeler to create a model of the company. Use approximations where needed.
- Use the Application Advisor to outline the applications used by the shop. For simplicity and speed, use ERP solutions but also use 'individual' solutions.
- Invoke AIM (Architecture and Integration Module) to develop an integration solution.

Hints and Suggestions

- PISA is an early prototype. It has not gone through extensive quality control and usability tests.
- The tool is self-contained. It includes an extensive 'Explain' capability that serves as an online tutorial. The Explain is accessed by clicking **?** on the '?'   button on any screen.
- It is best first to create a rough model and then create a more detailed model.
- In case you get stuck, hit logout (top bar), log back in, and access the profile you were working on. You should be able to proceed without any problems (famous last words!).
- You may get an error 'Application Error'. This is mainly because the Web hosting site times out, or the advisor gets into trouble. In case of this error, click on 'home' (this will take you to the Control Panel from where you can proceed). In case, nothing else works, logout and restart the session with the profile you were using.
- In case of too many problems (show stoppers), send me an email.

6.4 PISA Evaluation Template

1. General Observations:

2. Did PISA develop the IT plan completely, partially (in percentage), or more.

	Indicate if PISA developed the plan completely, partially (in percentage), or more	What is missing from PISA (not done or not done correctly/completely)
Enterprise model		
Enterprise application model		
Computing platforms model		
Network model		
Security model		
Project Plan		

3. Strengths/Weaknesses of the Tool

4. Suggestions for Improvement:

<u>AIM Evaluation</u>

1. General Observations:

Did AIM solve the online purchasing problem completely, partially (in percentage), or more for the following:

- Problem exploration
- Requirements doc generation
- Architecture doc generation

2. Compare and contrast the results produced by you versus PISA. Were your results better than PISA?Justify if so. Use the following table to do the comparison

	Your Results	Results obtained through PISA
Business Problem Explorer		
Intelligent requirements generator		
Integrated Architecture Advisor		
Integrated Solution Advisor		

3. Strengths/Weaknesses of the Tool

3. Suggestions for Improvement:

<u>Overall Evaluation</u>

1. Critical analysis of PISA

2. Main lesson learned

3. Overall, how useful was the tool for the exercise: L, M, H

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8. Please attach the reports generated by PISA for examination .

7. Using PISA for an "Enterprise Architecture and Integration Using SOA" Course

7.1 Instructor Tips

This course can be an architecture and integration course with concentration on SOA. An example of such a course is the "Architectures for Globally Integrated Enterprises" course that won the 'Best Course Proposed' Award from IBM in December 2007 (see www.ngesolutions.com/pisa/documents page to download the course description). The students develop a model of a company, develop its application plan and then work with PISA-AIM to develop detailed SOA-based architecture and integrated solution of chosen applications. The students develop a multi-phase SOA architecture by using PISA by transitioning enterprise applications gradually to PISA (see below for sample assignments and student deliverables.

7.2 Project: SOA-based Integrated Architectures (100 Points)

Note to the Instructors: This example is somewhat telecom specific because this project was assigned to the Telecom Enng student at University of Pennsylvania. You can easily modify it to emphasize the non-telecom apps (e.g., CRM) in telecom or use a different industry segment (e.g., retail).

Mike's Mobile Shop (MMS), is a Chicago-based small telecom company owned by Mike, who wants to exploit the opportunities in telecommunications, especially wireless communications. Mike started a wireless device repairs,   reselling, and distribution business. He later expanded his business to a wireless service provider (like T-Mobile) that serves a small portion of Chicago population.   He currently has 80 employees and is partnering with others to strengthen business. He is acquiring a small cable company so that he can be the sole provider of cable plus wireless services in his area. He expects to double the size of his company next year by using business partners. He plans to have a corporate center in Chicago and two telecom service centers in different parts of Illinois and Michigan. He is thinking big and wants to eventually become a major virtual telecom corporation (vtelco) that will serve as a store front for multiple services so that potential customers order a variety of telecom services through him.

Mike wants to support a virtual enterprise. Basically, MMS will receive the orders and try to fill them, if it can. Otherwise, the company will route the order to one of its business partners. The company has heard about SOA but does know what it is and how it   can be used in the company growth. You have been hired to help develop an IT plan and a service oriented enterprise architecture that is based on the latest thinking in the field. He specifically needs help with developing IT plans, architectures and integration issues.

PART A: IT Planning by using SOA (40 Points)

Develop an SOA-based IT plan that shows how information systems can be used for this company. This view should concentrate on the type of enterprise applications that the company should use, what specifically will these applications do for the company, and how will the network and web technologies support them (at a high level).

Deliverable: A report showing an SOA-based IT plan to be used by the company. The plan (5 to 10 pages) should contain the following information (each bullet carries 6 points):

- A model of the enterprise that shows about 20 business processes (BPs) to be used by the company and where (what sites) these BPs will be performed.
- An application plan that shows the enterprise application packages (EAPs) that will automate the business processes. An EAP is a large grained Business Component (BC) that provides business services. Concentrate on modern C2B or B2B applications. Show the application plan as a matrix with BPs as columns and EAPs as rows.
- Computer communication platform plan that shows the computers and system software (e.g., operating system., middleware, etc) needed to support the applications and the network (LAN, WAN, wireless) needed to interconnect the computers. Produce a network diagram that shows the physical components, where will they reside and how they are interconnected.
- An overall architecture diagram based on SOA that shows all components (applications, databases, web technologies, computing platforms, and networks). In particular, show how the middleware services (e.g., RPC, RSQL), thin client versus thick client, classical web technologies (web servers, proxies) and semantic web (XML and RDF; http://www.w3.org/RDF/) will be used in this company.

PART B: SOA for Integrated Architectures (40 points).

The company wants to develop a web-based order processing system that the customers can use to order services (e.g., cable access) as well as products (e.g., cable modems, BTSs, access points). The system receives customer requests from web browsers and allows the customers to order telecom services/products and review order status. The system also allows the customers to report problems ("trouble ticket" management).

- Develop an SOA of the application that shows the middleware technology (e.g., RPCs, RSQL, Semantic We, XML) and platforms to be used for building the application (2 pages, one diagram, explain what choices you made and the reasons for your choice)
- Show where and how Web Services can be used in this SOA. Specifically, show WSDL (very high level) and a UDDI directory for the system.
- The company also wants to integrate its order processing application with front-end users and several Telecom applications. For front-end integration, several mobile devices are supposed to access the order processing system. For back-end integration, the order processing system needs to integrate with several systems (e.g., one for wireless and one for cable connection), at supplier sites and as part of a trading network. For example, if a user orders a line, the company may provide it itself or through another company. The main idea is to architect this system so that it can be integrated with many (ideally, any) back-end system.

Deliverable: A technical report that contains (each bullet carries 7 points):
- Overall SOA of order processing system based on Web Services and showing all the middleware technologies.
- An SOA-based integrated solution that shows your integration strategies (integration in place, data warehousing, or migration in this integration problem). Where and when will you use these strategies?
- Evaluate a particular architecture for performance, security and cost.
- Show how Web Services can be used as an eAI platform or an Enterprise Service Bus. Specifically, show WSDL (very high level) for the provisioning systems and a UDDI directory

with entries for the provisioning systems so that the order processing system can find the needed inventory system.

PART C: Decision Support for SOA (20 points).

Many companies are struggling with how to plan and integrate their IT systems while keeping up with new offerings in SOA, Web Services and the growing technology stack . Some tools are beginning to appear that can be used for this purpose. These tools (decision support systems) allow you to build model of a company, and then guide you through various stages of application planning, platform planning, network planning, security planning, and architecture/integration. Ideally, these tools should help you to quickly develop the solution for Part A and Part B. You should locate two such tools (you will be given access to one such tool that is currently in a prototype stage, you will have to choose another on your own). You will evaluate how these tools can be used to solve Part A and B and complete an evaluation form. This exercise will provide some valuable insights .

Extra Credit: Use the Advanced Capabilities Module of PISA-AIM (www.ngepisa.com) to develop more detailed models, do simulations and perform additional analysis. For example, develop a detailed return on investment (ROI) and total cost of ownership (TCO) for SOA by using ACM.

Hints:

You can make the following assumptions about integration of order processing with back-end provisioning systems:

- There may be 3 to 5 different types of provisioning systems depending on the type of telecom services needed (e.g., cellular, WiMax, Satellites, cable, PSTN).

- These systems may be based on different technologies and different vintages (e.g., at least one may be a very modern WS-enabled component-based system, another may be a very old monolithic legacy system, the others may be in-between).

- The most valuable part of the provisioning system is its "circuit database" that contains availability of different circuits in different geographical locations. Most suppliers provide some business logic, but WWS may choose to invoke its own business logic in some cases (Wally feels that given the circuit info, he can do a better job at finding the best telecom services for his customers). On the other hand, it is easier for Wally to remotely invoke predefined functions instead of his own.   You may need to provide for both (data only or function + data).

- The proposed solution approach should be flexible enough for future, yet unknown, situations. A possible way to handle this is to develop a solution that handles the current situation and then briefly discuss (one paragraph, at most) how this solution can handle future situations.

- Feel free to make assumptions – just state them clearly.

Attachment A: Enterprise Business Pattern for a Telecom Company

Different enterprises perform different business activities (business processes). An enterprise business pattern, shown in the following figure, captures an overall view of business activities in terms of

enterprise functional areas (e.g., procurement, corporate management, back-office operations), the major business processes in each functional area (e.g., purchasing and payment within procurement) and the key interactions between these processes. This figure shows the main business processes (BPs) of a telecom company. Although different telecom companies perform different activities, this pattern is a common sketch that can be customized by each telecom company.

Such high level views of businesses are of great practical value to identify business scenarios and to conduct quick sensitivity analysis such as the following: a) if one BP is eliminated, then what other BPs will be impacted, b) if an application package that supports a BP is replaced with another application, what other applications/BPs will be impacted, c) which application, if replaced, will have the most impact in terms of integration, d) which application is ?accessed by the customer, and e) if an application is outsourced, what applications will be impacted. These views also are the basis of building information systems architectures and network designs because different business processes may occur at different parts of a company – they need to be interconnected through networks.
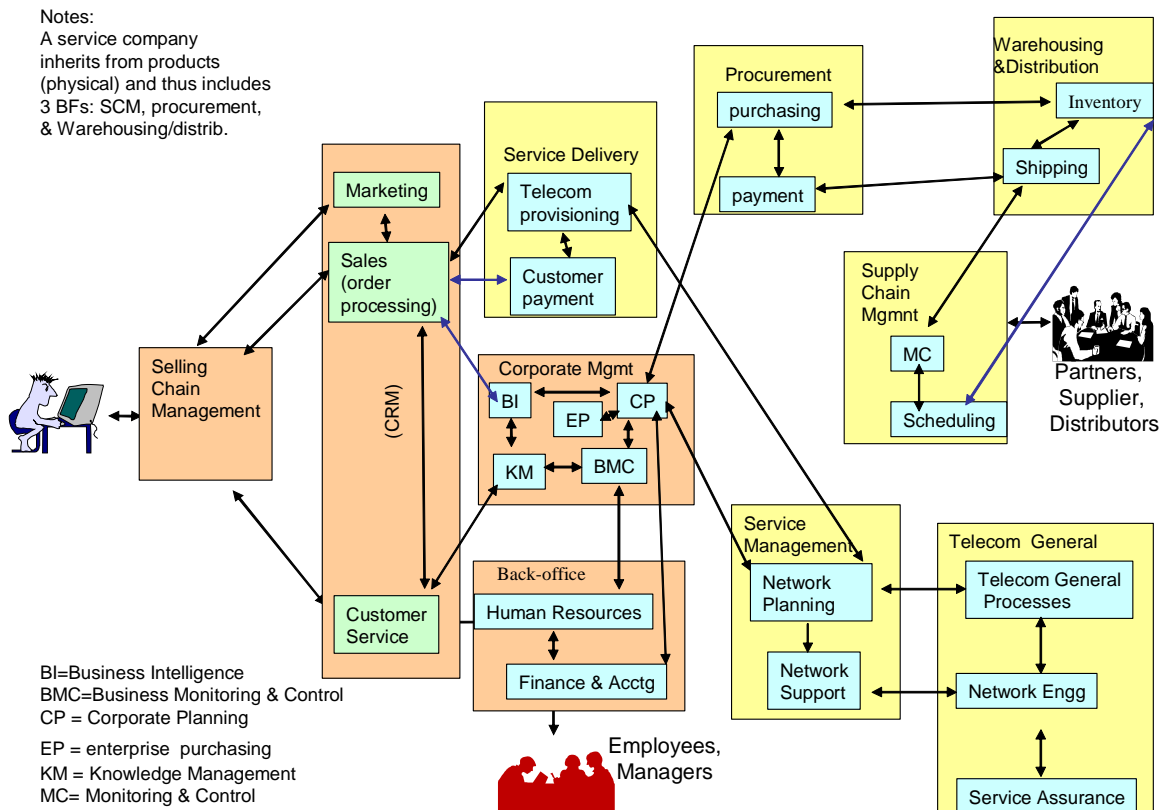
Figure 1: Enterprise Business Pattern for a Telecom Company

This pattern also helps in selection of enterprise application packages (EAPs) that automate the BPs. For example, PeopleSoft/Oracle provides application packages for human resources and finance/accounting and telecom companies provide OSSs (see Attachment B). Table 1 shows how some EAPs may support some BPs. Selecting the EAPs will help you determine what type computing platform services, including web, will be needed. For example, a .Net application would need .Net services.

	BP1	BP2	BP3	BP4
EAP1	x			
EAP2		x	X	
EAP3				X

Sources of Information on OSS Products:

- "TELECOM OSS ENCYCLOPEDIA", http://www.gii.co.jp/english/ie6502_telecom_oss.html
- Umar, A., "eBusiness and Distributed Systems Handbook: Management Module", NGE Solutions, May 2003

7.3 PISA Information - Using an Expert System Tool to Develop SOA-based and Integrated Architectures

Important Notes:
- This should not take more than 3 hours. At least one member of each group should do this.
- The deliverable is an evaluation report (2-3 pages, see report template below) and just say a few things (one slide max) about the key findings.

Overview

PISA (Planning, Integration, Security & Administration) environment is prototype of an expert system that supports two major phases:
- **IT Planning Phase:** develop a solution sketch at enterprise level, with rough estimates and separation of issues. This sketch is refined in the next phase.
- **Architecture and Integration Phase:** concentrate on more detailed issues of how specific components of the plan will fit together to form a functioning system by using SOA.

PISA supports these two phases, plus others, through two modules: PLANIT and AIM (Architecture and Integration Module). See the 'PISA Overview' document before proceeding.

Each PISA advisor can be used in two modes:
- **Express mode**: the advisor is an expert system (it has most of the knowledge), the user has no/little knowledge. You invoke this mode by simply pressing the 'Continue' key where available.
- **Explore mode**: the advisor is a decision support system, it has some knowledge and the user also has some knowledge. You use the advisor in a game playing format. This is done by selecting options, modifying results produced, etc.

A user can use one advisor in express mode and the other in explore depending on the problem and the background of the user. For example, a user who knows a great deal about networks but very little about enterprise applications may use the Network Advisor in explore and Application Advisor in the express mode. In the following assignment, you can use the advisors in any mode you want.

The Assignment (for Project 2A and 2C)- Estimated Time =   3 hours

Step 1: Start with a telecom company (TTS) and develop a complete IT plan for this company by using PISA planning tools. Produce a composite report (similar to Project2A) after working with the following PISA advisors (you may use the Express mode first and then use the Explore later):

- Enterprise Modeler
- Application Advisor
- Computing Platforms Advisor
- Network Advisor
- Security Advisor

 Step 2: Use AIM to develop a better understanding of how one application (suggested: purchasing, similar to Project2B) can be architected and integrated with other applications. To accomplish this, do the following (please keep in mind that AIM is in its very early prototype stage):

- Select the purchasing system by using Business Problem Explorer
- Develop a requirements document for purchasing by working through the Intelligent Requirements Generator. Use different options in the interviews to develop an understanding of the system (interfacing applications, etc).
- Develop an architecture document for online purchasing by working through the Intelligent Architecture Advisor. Run through various scenarios and options in the interview.
- Evaluate the selected architecture in terms of performance, cost, and security by using Integrated Solution Advisor and generate the consolidated report.

Step 3; Do a critical analysis of the results (reports) generated by PISA modules (PlanIT and AIM) and compare/contrast it with results produced manually by your group. Complete the following evaluation report to jot down your main findings.

How to get started:

- Download the 'PISA Overview Document' from Blackboard and browse through it before starting the exercise.
- Go to www.ngecacit.com and register. You will get an email to create a userID and PW.
- Use the ID-PW to logon to the system (ngecacit.com). Create a 'scenario' for the company and work through the system. It is designed to be self-explanatory. Use the tutorials, guides and other help materials. For Help, click on '?' (it appears on every screen).

Deliverables

- Critical analysis of PISA by your team as a potential IT Planning and Integration tool. .
- Completion of the "PISA Evaluation Template" shown later. The evaluation should compare/contrast results produced by you manually versus those produced by PISA.
- **Extra Credit:** Use the Advanced Capabilities Module of PISA to develop more detailed models, do simulations and perform additional analysis

Hints and Suggestions

- AIM is an early prototype. It has not gone through extensive quality control and usability tests.
- The tool is self-contained. It includes an extensive 'Explain' capability that serves as an online tutorial. The Explain is accessed by clic ? on the '?' button on any screen.
- It is best first to create a rough model and then refine it into a more detailed model.
- In case you get stuck, hit logout (top bar), log back in, and access the profile you were working on. You should be able to proceed without any problems (famous last words!).
- Better documentation is being created and will be available soon.
- In case of too many problems (show stoppers), send me an email. (and what happens ?)

7.4 PISA Evaluation Report

Please use the following framework for evaluating PISA and post it on Blackboard Dropbox.

PLANIT EVALUATION for PROJECT 2A

1. General Observations:

a Time taken to develop solution by hand (Project2A)   _____
b. Time taken to develop solution by using PlanIT (Project2A) _____

c. Did PlanIT solve the Project 2A problem completely, partially (in percentage), or more.

	Indicate if PlanIT solved the problem completely, partially (in percentage), or more	What is missing from PlanIT (not done or not done correctly/completely)
Enterprise model		
Enterprise application model		
Computing platforms model		
Network model		
Security model		

2. Compare and contrast the results produced by you versus PlanIT. Were your results better than PlanIT? Use the following table to do the comparison and indicate which one is better and why

	Your Results	Results obtained through PlanIT
Enterprise model		
Enterprise application model		
Computing platforms model		
Network model		
Security model		

3. Strengths/weaknesses of the Tool

   a: Strengths of the Tool

b. Weaknesses of the Tool

4. Suggestions for Improvement:

5. Documentation evaluation (Explain Capabilities and Overview Document)

6. Did you use any of the following 'additional services"? Were they of any value?

- Project Planner

- Outsourcing Advisor

7. Overall, how useful was the tool for the exercise: L, M, H

AIM Evaluation for Project 2B

1. General Observations:

a Time taken to develop solution by hand (Project2B) _____
b. Time taken to develop solution by using AIM (Project2B) _____

c. Did AIM solve the problem 2B completely, partially (in percentage), or more.

	Indicate if AIM solved the problem completely, partially (in percentage), or more	What is missing from AIM (not done or not done correctly/completely)
Business Problem Explorer		
Intelligent Requirement Generator		
Integration Architecture Advisor		
Integration Architecture Advisor		

2. Compare and contrast the results produced by you versus AIM. Were your results better than AIM? Use the following table to do the comparison and indicate which one is better and why

	Your Results	Results (Reports) obtained through AIM
Business Problem Explorer		
Intelligent Requirement Generator (Requirements Report)		
Integration Architecture Advisor (Architecture Report)		
Integration Solution Advisor (Cost estimates, security issues, performance estimates)		

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3. Strengths/weaknesses of the Tool

       a: Strengths of the Tool

       b. Weaknesses of the Tool

4. Suggestions for Improvement:

5. Documentation evaluation (Explain Capabilities and Overview Document)

6. Did you use any 'additional services' ? Which ones ?

7. Overall, how useful was the tool for the exercise: L, M, H