

Development of Information Systems

21 October 2009
Lecture 1

Course Introduction

- Topic: Developing, designing, and analyzing *Information Systems*
- Prerequisites
 - 1-02-113: Introduction to Information Systems Engineering (may be taken at the same time)
 - 1-02-111: Introduction to Computer Science
 - 1-02-122: Technical English (expected)
- Instructor: Michael May
 - M.S., Ph.D. University of Pennsylvania, Philadelphia

October 21, 2009

ISE 323: Information Systems Engineering 1

2

Course Administrivia

- Lecture
 - Meets Wednesdays 2pm-5pm
 - Number of Lectures: 14
 - Lecture schedule is in the Syllabus on Telem
- Targil
 - Meets Sundays 11am-1pm
 - Number of Review/Lab sessions: 14
- Text Books
 - Peretz Shoval. *Planning, Analysis, and Design of Information Systems*, volumes 1-3. The Open University of Israel, 1998.
 - Peretz Shoval. *Analysis and Design of Information Systems - Combining Processes and Objects*. The Open University of Israel, 2004.
 - Floyd J. Fowler. *Improving Survey Questions: Design and Evaluation*, volume 38 of Applied Social Research Methods Series. Sage Publications, 1995.
 - Zahir Irani and Peter Love, editors. *Evaluating Information Systems*. Elsevier, first edition, 2008.

October 21, 2009

ISE 323: Information Systems Engineering 1

3

In Class

- Attendance is recommended
 - Attendance will be taken from time to time
 - Not attending will not directly affect your grade
 - It will likely affect your grade in other ways
- Decorum is required
 - Talking or disturbing class will not be tolerated
 - I turn off my cell phone for class – **YOU SHOULD TOO**
 - If you must talk – **LEAVE CLASS**

October 21, 2009

ISE 323: Information Systems Engineering 1

4

Grading

- Components of the course
 - Quizzes – 4% (four total, drop the lowest)
 - Assignments – 36%
 - Final Exam – 60%

October 21, 2009

ISE 323: Information Systems Engineering 1

5

Targilim

- Targil will consist of:
 - Exercising what we learned
 - Asking/Answering questions
 - Working on Assignments
- No grade for anything done during Targil

October 21, 2009

ISE 323: Information Systems Engineering 1

6

Assignments

- Four major assignments over the course of the semester
 - May work in groups of up to 3 students
- Will cover roughly:
 1. Design and execute questionnaires and interviews about an existing information system
 2. Prepare a list of potential approaches based on market research and a justification for each
 3. Prepare an RFP for a new or improved system
 4. Produce DFDs using FHD, identify transactions, and produce a database schema and GUI based on them

October 21, 2009

ISE 323: Information Systems Engineering 1

7

Exams

- Final examination in February
 - Worth 60% of the grade
 - Everything we learned
 - Everything you should have read

October 21, 2009

ISE 323: Information Systems Engineering 1

8

Let's begin...



October 21, 2009

ISE 323: Information Systems Engineering 1

9

Goals for this course

- Information Systems Engineering is very broad
 - The name of the degree program is הנדסת מערכות מידע, so is the name of the course
 - We will touch on material that you will/have been learning in other classes
 - We will try to glue it all together into a coherent story
- Information Systems Engineering is a jumble
 - A bit of software engineering
 - A bit of social sciences and psychology
 - A bit of human-computer interface
 - A bit of database design
 - A bit of business and process management
 - A bit of economics

October 21, 2009

ISE 323: Information Systems Engineering 1

10

The real goal for this course:

- You just got hired at a big company as part of the IS/IT staff
- Your boss sends you to the Widget Department
- The Widget Department manager says:

"We need a new system to manage orders for our widgets.
We have 100 employees, 100 types of widgets, and 500 customers from all economic sectors: education, government, health care, military, civil.
We need it done in 6 months and have a budget of XXX shekels.
We need a detailed time table of what you will do and when you will do it.
Oh, and we haven't quite decided all of the features we want yet..."
- **Where do you start? How do you proceed?**

October 21, 2009

ISE 323: Information Systems Engineering 1

11

The real goal for this course

- Information Systems Engineering is the science of applying theoretical knowledge to practice
 - There are many different ways to solve every problem
 - Know your options
 - Know what works better in what situation
 - Have the social, mental, and technological tools to get the job done
- Learn from the experiences of others
 - ISE theory often plays catch-up to practice
 - That's not bad – it means that innovation is not dead
 - Practical experience in the field will help you immensely – this course should help you hit the ground running

October 21, 2009

ISE 323: Information Systems Engineering 1

12

Topics for Today

- Organizational Information Systems
 - What is an Information System?
 - Attributes of information
 - Attributes of information at the organizational level
 - Types of organizational information systems
- Approaches in Developing Information Systems
 - Life Cycle of an information system
 - Overview of the fundamental phases in development
- Source: Shoval98 1.1-1.2

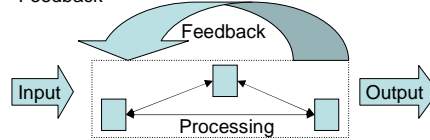
October 21, 2009

ISE 323: Information Systems Engineering 1

13

What is an Information System?

- An Information System is a *collection of smaller systems which work together for a common goal*
 - Can be digital, analog, or even manual
- They are used for keeping track of data and information
- The four most important parts: Input, Output, Processing, Feedback



October 21, 2009

ISE 323: Information Systems Engineering 1

14

Computerized Info Systems

- Computerized Information Systems are based on many parts:
 - People - users
 - Tools - devices the system uses
 - Data Sources
 - Collection by data input processes
 - Data Checking
 - Data Storage
 - Data processing
 - Processes - input, data management/processing, output

October 21, 2009

ISE 323: Information Systems Engineering 1

15

College Information System

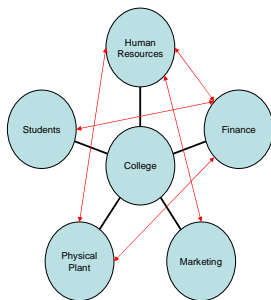
- Human Resources System
 - Lecturers, Professors, Staff, Maintenance Staff
- Financial System
 - Salaries, Scholarships, Tuition
- Marketing System
 - Advertisements, Open Houses
- Physical Plant
 - Buildings, Computers, Library, Lawns and green spaces
- Student System
 - Grades, Degrees granted, Debts, Course Registration

October 21, 2009

ISE 323: Information Systems Engineering 1

16

College Information System

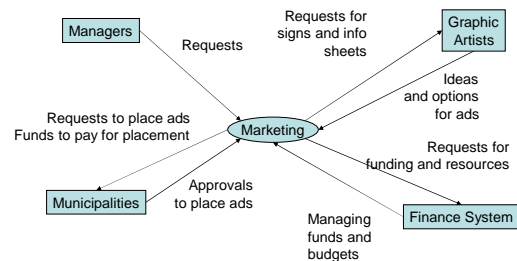


October 21, 2009

ISE 323: Information Systems Engineering 1

17

Connections to the outside



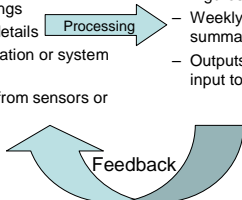
October 21, 2009

ISE 323: Information Systems Engineering 1

18

IS translate Data into Information

- **Data:**
 - Raw data
 - Readings from machines or tools
 - Lists of things
 - Personal details
 - Log information or system history
 - Readings from sensors or equipment
- **Information**
 - Summaries
 - Reports
 - Figures, Graphs, Diagrams
 - Weekly, monthly, quarterly summaries
 - Outputs which are used as input to other systems



October 21, 2009

ISE 323: Information Systems Engineering 1

19

Describing Data/Information

- **Data Quality**
 - Completeness
 - Accuracy
 - Update period
- **Export method**
 - Reason for export (manual, automatic)
 - Period
 - Timeliness
 - Response time for export
- **Size, Access method**
 - Level of detail
 - Scope
 - Retention term
 - Size
 - Method of transfer



October 21, 2009

ISE 323: Information Systems Engineering 1

20

So what?

- These categories let us discuss and compare information needs
- When designing a system, **context is critical**
- What kind of data will the system process?
- What are the requirements for the storage, retrieval, and processing of the data?
- Example: A system to manage a store's orders and billing unit has radically different needs than a system to manage a college's student information system

October 21, 2009

ISE 323: Information Systems Engineering 1

21

Example: Data attributes

- For a college student information system
- **Quality:**
 - Completeness
 - Ideally 100%
 - But more realistic - 95%
 - Some missing fields
 - Accuracy
 - Students change over time
 - Someone gets married, changes their name
 - Grades should be perfect...
 - Update Period
 - Grades - Per semester
 - Degrees - Per year?
- It matters because:
 - How much time do we spend doing checks on inputs?
 - How may read/write threads do we need to worry about
 - How often do we do backups?



October 21, 2009

ISE 323: Information Systems Engineering 1

22

Example: Data attributes

- **Size, Access Method**
 - Level of Details
 - Per student, per course, per degree program
 - Scope
 - Data connected to students
 - Don't worry about: student height, marital status, etc.
 - Retention Term
 - Degrees granted forever
 - Final exam booklets - 6 months
 - Library borrowing record - until the student leaves
 - Size
 - Are we storing text, pictures, video?
 - Method of transfer
 - Paper? Fax? Email?
 - Do we need scanners? OCR?
 - Do we need automated email parsing?

October 21, 2009

ISE 323: Information Systems Engineering 1

23

Example: Data attributes

- **Data Export:**
 - Reason for export:
 - Course registration lists
 - Grade sheet production
 - Period
 - Output daily? Once per semester?
 - Timeliness
 - How long does it take to produce the report?
 - Not just compute time, but human time too
 - 1 minute? 1 hour? 1 day? 1 week?
 - Grades which are sent out need to be ready by mailing date

October 21, 2009

ISE 323: Information Systems Engineering 1

24

IS work in Organizations

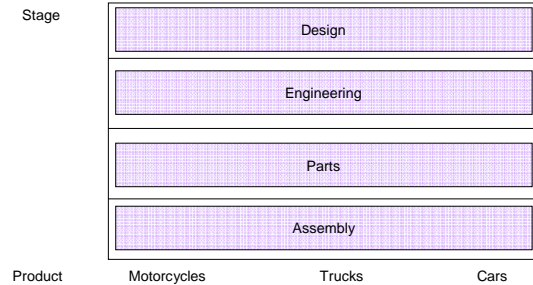
- There are many kinds of organizational structures
 - Many theories and ideas for how to organize
 - Purity is the exception, not the rule
 - Change is the rule
- Some ideas from the book:
 - Functional Organization
 - Product Organization
 - Matrix Organization
 - Hybrid Organization

October 21, 2009

ISE 323: Information Systems Engineering 1

25

Functional Organization

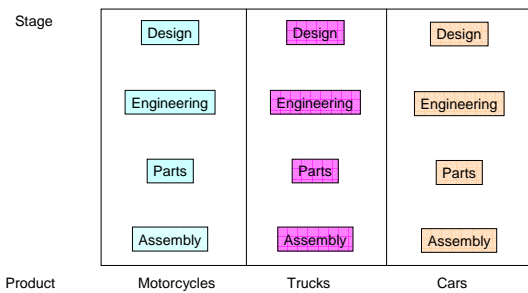


October 21, 2009

ISE 323: Information Systems Engineering 1

26

Product Organization

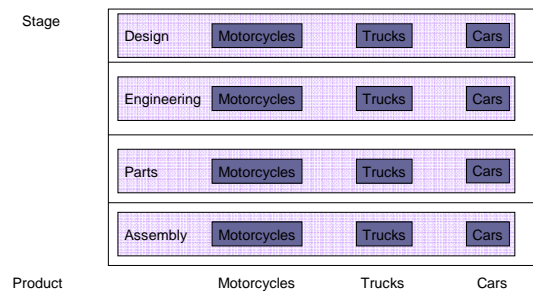


October 21, 2009

ISE 323: Information Systems Engineering 1

27

Matrix Organization

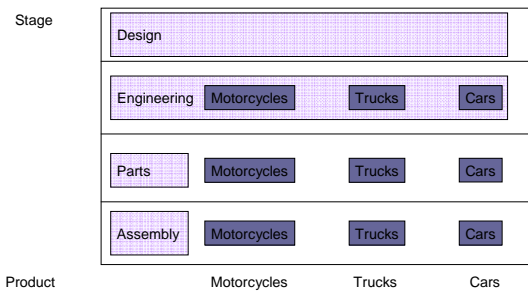


October 21, 2009

ISE 323: Information Systems Engineering 1

28

Hybrid Organization



October 21, 2009

ISE 323: Information Systems Engineering 1

29

IS Serve a Variety of Users

- **Ordinary users:**
 - Simple and well designed interfaces
 - Very few bugs
 - Tasks they can understand
 - Documentation
 - At the expense of...
- **Workers:**
 - Low level and specific information about what they are doing
- **Middle managers:**
 - Track worker's progress
 - Track division progress with ability to drill down
- **Senior managers and executives:**
 - Summaries of progress
 - Quarterly or semi-annual reports
 - Projections
- **Sophistication Users:**
 - Will tolerate bad interfaces
 - Will put up with bugs
 - Complex tools
 - Documentation?
 - Want it now, even if it's not 100%

October 21, 2009

ISE 323: Information Systems Engineering 1

30

Problems and Users

- Each type of user has different problems and desires from and Information System:
 - **Workers:**
 - Deal with structured problems
 - Want structured data to help get their job done
 - Several known solutions to choose from
 - Ex. Make sure widgets are produced on time and with max 1% faults
 - **Middle Managers:**
 - Semi-structured problems
 - Indications and data give hints, but there isn't "one solution" – a variety of options and tradeoffs
 - Ex. Increase sales by 10% and lower costs by 5% for next year
 - **Senior Managers:**
 - Largely unstructured problems
 - No one really knows the answer – data provide a starting point
 - Ex. Use the company's dominance in the widget market to expand into the dongle market over the next 3 years

October 21, 2009

ISE 323: Information Systems Engineering 1

31

Systems and Users

- Different users, different goals → Different types of information systems
- Book outlines seven paradigms for information system
 - Finding a pure one is hard, but recognizing the categories can help

- מערכת עיבוד תנועות – Transaction Processing System
- מערכת מידע ניהולי - Management Information System
- מערכת תומכת החלטות- Decision Support System
- מערכת מידע להנהלה הבכירה – Executive Information System
- מערכת עובדי ידע – Knowledge Work System
- מערכת מידע משרדית – Office Information System
- מערכת מומחה – Expert System

October 21, 2009

ISE 323: Information Systems Engineering 1

32

Systems Paradigms

- **Transaction Processing System**
 - Processes daily transactions in a company and system
 - Ex. Database of all sales and returns in a store
- **Management Information System**
 - Produces higher level reports for middle management
 - Ex. Data Warehouse which reports on sales in all the branches of a chain
- **Decision Support System**
 - Collects information and offers help in resolving "What If" situations
 - Models Scenarios and goal seeking
 - Ex. Business Intelligence tools for producing projections
- **Executive Information System**
 - Very high level information and summaries, ignores details
 - Ex. "Executive Dashboard"
- **Knowledge Work System**
 - Specialized systems for individual goals and specialties
 - Ex. CAD tools for architects
- **Office Information System**
 - Manages the office, tracking calls, emails
 - Ex. MS Outlook, Exchange
- **Expert System**
 - Basic artificial intelligence system to make decisions
 - Ex. Scheduling system for jobs

October 21, 2009

ISE 323: Information Systems Engineering 1

33

Some Buzzword Paradigms

- **Enterprise Resource Planning (ERP)**
 - Tracking inventories, raw materials, orders
 - Helps enterprise produce reports
 - Scheduling for future work
- **Customer Relationship Management (CRM)**
 - Organizes information about customers – contacts, addresses, emails
 - Track orders and preferences per customer
 - Improve customer service by personalizing it
- **Content Management System (CMS)**
 - For enterprises with a lot of multimedia items
 - Stores, tracks, and indexes them
 - Speed up retrieval and availability
- **Business Intelligence (BI)**
 - Creates reports about a company's past and projections for the future
 - Unifies data from all over to produce non-obvious results
- **Storage Area Network (SAN)**
 - Networked file storage and retrieval
 - Backups and data distribution for greater availability

October 21, 2009

ISE 323: Information Systems Engineering 1

34

So Far

- **Organizational Information Systems**
 - What is an Information System?
 - Attributes of information
 - Attributes of information at the organizational level
 - Types of organizational information systems
- **Approaches in Developing Information Systems**
 - Life Cycle of an information system
 - Overview of the fundamental phases in development

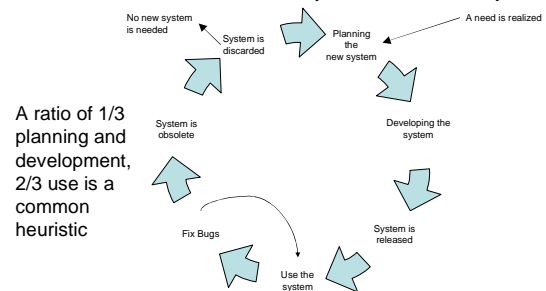
October 21, 2009

ISE 323: Information Systems Engineering 1

35

Life Cycle of an Info System

- Like all creatures, information systems have a Life Cycle



October 21, 2009

ISE 323: Information Systems Engineering 1

36

Software Development Life Cycle

- Software is developed in a *software development life cycle*
 - Many different steps, many with interchangeable names
- The book calls the phases:
 1. **Initializing the system** – recognizing a need
 2. **Checking the current state** – What's here now? What's missing?
 3. **Gather requirements/Feasibility study** – what should the system do? Is it feasible to do?
 4. **Specification and Analysis** – examine what is needed, develop the plans in a careful, scientific manner
 5. **Designing the system** – design the interfaces and behavior of the system
 6. **Developing the system** – Code it or build it
 7. **Deployment** – Installation, integration with other systems, training

October 21, 2009

ISE 323: Information Systems Engineering 1

37

SDLC Patterns

- So many phases – how you do perform them well and in an organization manner?
- Many answers to that question – the most common are called Software Development Life Cycle Patterns
 - Many similarities to what you will learn in a Software Engineering course
 - We'll talk a bit about a bunch of patterns
- The ones in the book are of mainly historical nature, but some are still in use in different versions
 - 1998 is a lifetime ago in software engineering

October 21, 2009

ISE 323: Information Systems Engineering 1

38

SDLC Patterns

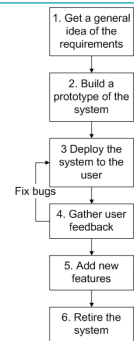
- Build and Fix
- Waterfall
- Prototyping
- Incremental
- Spiral
- Rapid Software Development

October 21, 2009

ISE 323: Information Systems Engineering 1

39

Build and Fix



- **Advantages**
 - It's the default way a lot of people think
 - Quick movement from request to working product
 - No intense debates and meetings
 - Good if the requirements are obvious or well understood
 - Early prototypes
- **Minuses**
 - Rough design, may change radically between cycles
 - Adding features may cause fundamental redesign of existing parts – no master plan
 - Developer may not really know what is needed and make series of mistakes
 - System is never really finished

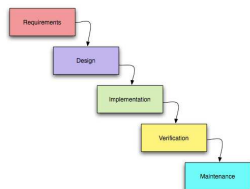
October 21, 2009

ISE 323: Information Systems Engineering 1

40

Waterfall Model

- Waterfall is a more structured approach
 - Legacy from the 70s
- Meant for large, integrated systems with diverse and dispersed development
 - Still popular (in modified forms) among big developers where change is not acceptable
- Work divided into phases
 - Each phase ends with a document as an output which describes the conclusions
 - Each phase starts with a check of the previous step's output – that becomes the input for the next phase



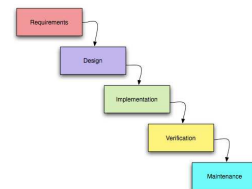
October 21, 2009

ISE 323: Information Systems Engineering 1

41

Waterfall Model

- **Advantages**
 - Structured design so phases can be scheduled more easily
 - Phases are generally non-reentrant, so teams can work independently
 - Spec is a contract
- **Disadvantages**
 - Much slower
 - Ends up with significant overhead to start anything
 - Changes are not allowed in later steps
 - The system is output only at the very end, nothing works until then



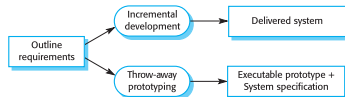
October 21, 2009

ISE 323: Information Systems Engineering 1

42

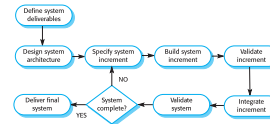
Prototype Phases

- Prototypes can help development in a few ways
 - It's not a full story, but a common element – a pattern
- Can serve two purposes
 - Let the user try out ideas early
 - Discover requirements
- Two kinds:
 - Throw away
 - Evolutionary - Incremental



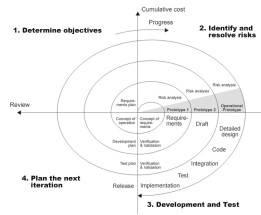
Incremental

- Break the work into phases of development
 - Build each part separately
 - Release versions as they are ready
- Advantages
 - Produces working pieces earlier on
 - Smaller steps to work on at once
- Disadvantages
 - Adding new parts may break the old ones
 - Big picture?



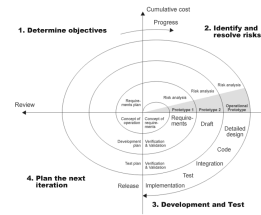
Spiral Development

- A development pattern where risks are taken into account
 - Works incrementally
- At each increment, perform a risk analysis
 - What could go wrong?
 - What can we do to solve it?
 - Is it worth continuing?
- If the risks are coverable, the next stage is planned
- May use waterfall as the final development pattern, or something else



Spiral Development

- Advantages
 - Explicitly takes risk into account
 - Requires frequent examination about feasibility and potential cost
- Disadvantages
 - Complicated to perform
 - Requires management to buy into it
 - "We already sunk how much money into it?"
 - Make sure solutions are real
- The development model actually used may affect as well



Times change

- Software changed
 - Not just for massive, one time projects
 - Now everybody can code
 - But they still need management
 - Because of rapidly changing business environments, businesses have to respond to new opportunities and competition.
 - This requires software and rapid development and delivery is not often the most critical requirement for software systems.
 - Businesses may be willing to accept lower quality software if rapid delivery of essential functionality is possible.
- So software development patterns must change
 - Requirements change
 - Customers change their minds
 - Technology updates
 - Programmers have a turnover rate
 - A good project can be man-months, not man-years

What do we need?

- Software needs to come out faster
- Because of the changing environment, it is often impossible to arrive at a stable, consistent set of system requirements.
 - Therefore a waterfall model of development is impractical and an approach to development based on iterative specification and delivery is the only way to deliver software quickly.
- Developers must be able to deal with change
- Must avoid the pitfalls
 - Function creep
 - No testing
 - Bad documentation
- Address social issues
 - People do the coding

Rapid Software Development

- Commonly called *Agile Methods*
 - Return to the incremental pattern
- Important characteristics:
 - The processes of specification, design and implementation are concurrent. There is no detailed specification and design documentation is minimized.
 - The system is developed in a series of increments. End users evaluate each increment and make proposals for later increments.
 - System user interfaces are usually developed using an interactive development system.

October 21, 2009

ISE 323: Information Systems Engineering 1

49

Rapid Software Development

- **Advantages**
 - **Accelerated delivery of customer services.** Each increment delivers the highest priority functionality to the customer.
 - **User engagement with the system.** Users have to be involved in the development which means the system is more likely to meet their requirements and the users are more committed to the system.
- **Disadvantages**
 - **Management problems**
 - Progress can be hard to judge and problems hard to find because there is no documentation to demonstrate what has been done.
 - **Contractual problems**
 - The normal contract may include a specification; without a specification, different forms of contract have to be used.
 - **Validation problems**
 - Without a specification, what is the system being tested against?
 - **Maintenance problems**
 - Continual change tends to corrupt software structure making it more expensive to change and evolve to meet new requirements.

October 21, 2009

ISE 323: Information Systems Engineering 1

50

Agile Methods Principles

- **Customer involvement**
 - The customer should be closely involved throughout the development process. Their role is to provide and prioritize new system requirements and to evaluate iterations of the system
- **Incremental delivery**
 - The software is specified in increments with the customer specifying the requirements to be included in each increment
- **People not process**
 - The skills of the development team should be recognized and exploited. The team should be left to develop their own ways of working without prescriptive processes
- **Embrace change**
 - Expect the system requirements to change, so design the system to accommodate these changes
- **Maintain Simplicity**
 - Focus on simplicity in both the software being developed and in the development process. Wherever possible, actively work to eliminate complexity from the system

October 21, 2009

ISE 323: Information Systems Engineering 1

51

Software patterns in summary

- Many different approaches
 - Constantly evolving with practice
- You can mix and match to see what works
 - Purity is exception, not the norm
- A course on software engineering will talk more about this

October 21, 2009

ISE 323: Information Systems Engineering 1

52

So Far

- Organizational Information Systems
 - What is an Information System?
 - Attributes of information
 - Attributes of information at the organizational level
 - Types of organizational information systems
- Approaches in Developing Information Systems
 - Life Cycle of an information system
 - Overview of the fundamental phases in development

October 21, 2009

ISE 323: Information Systems Engineering 1

53

Methodologies and Techniques

- Development principles help guide development
 - Are based on technical and managerial experience
- Israeli government and MethodA developed MethodA (מפת"א), in the 1980s
 - It's been updated since, now it's an online repository
 - Mostly forms, processes, and best practices
 - Required for many government and military projects
- All processes are based on methods, techniques, and tools
 - Method – a task to be performed at a particular phase to accomplish some goal
 - Technique – a way of accomplishing a method's goals
 - Methodology – a collection of methods and techniques to get things done
 - Tools – something to help you accomplish a goal:
 - CASE, development environments, testing harnesses, documentation
- We'll talk about **ADISSA**

October 21, 2009

ISE 323: Information Systems Engineering 1

54

ADISSA's Phases in Development

- There are eight fundamental phases in system development

- There is some gray area between them

- Other methodologies will have different names and breakups

Step	Stage	Sub-Stage	Whom
1	Initialization	Existing State	Customer
2	Preliminary specification	Preliminary Specification	Customer
3	Feasibility Study	Feasibility Study Request for Proposals Receiving Proposals from suppliers Decision about supplier Contract and development plan	Customer
4	System Analysis	Data Dictionaries Database Diagrams	Developer
5	System Design	User Interface design Input/Output specifications	Developer
6	Construction	Coding Code Documentation Acceptance tests Quality Assurance Testing documents	Developer
7	Deployment	User training Support training Data import from old system Pilot	Developer and Customer
8	Fixing and Support	Turning it on	Customer/Developer

October 21, 2009

ISE 323: Information Systems Engineering 1

55

Phases 1-3

1. Initialization Phase

- First thoughts about what the problem is.
- Thoughts about what the desired solution is.
- Done by experts in the problem space, not necessarily the developers or computer people.

2. Preliminary Specification

- Bring in the technical experts to discuss the initial requirements
- Develop a functional (not technical) idea of what the solution should do.
- Create a detailed or general design document to guide the development of the new system.

3. Feasibility Study

- More detailed thought about what is technically required.
- Decision of whether to buy an existing product, develop it in house, or contract it out to a third party.
- May create a detailed Request for Proposals (RFP) which details what is wanted to send to potential suppliers.
- Suppliers who respond will have their responses weighed and decided from use a cost-benefit analysis.

October 21, 2009

ISE 323: Information Systems Engineering 1

56

Phases 4-6

4. System Analysis

- Detailed technical specification of what is needed.
- Making the data flow diagrams (DFD) for modeling how data move around the system.
- Data dictionary which describes all of the data input, information created, and storage properties for them.
- May make a prototype here to help (Optional)

5. System Design

- Specify development of the required technical artifacts.
- Specify exactly how to build the input and output processes.
- Specify exactly how to build the interfaces, windows, and programs.
- Use an evolutionary prototype (Optional)

6. Construction

- Actually build the system, the databases, the processes.
- Do basic testing.
- Do sanity testing.
- Do acceptance testing.

October 21, 2009

ISE 323: Information Systems Engineering 1

57

Phases 7-8

7. Deployment

- Get the system up and working in the production environment.
- Train the users, support staff
- Import existing data from the old system (if there is any).
- Integrate the new system with the old.
 - Do a one time switch out of the old system. Just throw the old one in the trash one morning.
 - Work with both together. Get people used to the new one slowly.
 - Incremental integration. Get people used to the new one in jumps and starts
 - Pilot. Start the new system on just a few computers and get feedback before putting the new one in production

8. Using it and Support

October 21, 2009

ISE 323: Information Systems Engineering 1

58

Conclusion

• Organizational Information Systems

- What is an Information System?
- Attributes of information
- Attributes of information at the organizational level
- Types of organizational information systems

• Approaches in Developing Information Systems

- Life Cycle of an information system
- Overview of the fundamental phases in development

October 21, 2009

ISE 323: Information Systems Engineering 1

59

מילים באנגלית

- accuracy דיוק
- scope רחיק פסק
- timeliness זמנות
- reason for export הסיבה לייצוא
- cycle מחזור
- method of transfer הדרך להעברת
- information system מערכת מידע
- feedback משוב
- retention שמירה
- item פריט
- update עדכון
- period פרק זמן
- detail פרט
- pilot פילוט
- test בדיקה
- completeness שלמות
- period תקופה
- process, procedure הליך

October 21, 2009

ISE 323: Information Systems Engineering 1

60