Introduction to Information Systems

Data Science Education Program

Course Overview

Course Delivery

- There will be 9-week period where we will deliver:
  - 5 hours tutorial (3 sessions) each week with individual presentations
  - The INFO 102 course Schedule (March 2021) and class teaching schedule has been posted on the Moodle course web site
- Assignments (the details will be notified on Moodle):
  - There will be individual and team assignments with oral and PowerPoint presentations
  - There will be a final examination
  - The course requires student participation and discussion
    - A compulsory (graded) element of the course will be Moodle discussion topics following every class session
    - Students must respond to the topics and enter into a discussion around the topic on the Moodle forum
    - The contribution to the discussions will be moderated and graded
  - Assessment will include attendance and participation

Moodle


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Philip Moore
INFO 102
Participants
Badges
Competencies
Grades
General
25 February - 3 March
4 March - 10 March
11 March - 17 March
18 March - 24 March
25 March - 31 March
1 April - 7 April
8 April - 14 April
15 April - 21 April
22 April - 28 April
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by Zhili Zhao - Tuesday, 18 December 2018, 7:23 PM
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Weekly Topic Schedule

Class Schedule and Office Hours

Group A (Class 1 and 2)			
Monday	Wednesday	Thursday	Friday
T 10:30-12:10 Room 110 Feiyun building	**T** 16:30-18:10 Room 110 Feiyun building	**Office Hours** On-Line: 14:30 to 16:10	**T** 8:30-10:10 Room 110 Feiyun building

Group B (Class 3 and 4)			
Monday	Wednesday	Thursday	Friday
T 8:30-10:10 Room 110 Feiyun building	**T** 14:30-16:10 Room 110 Feiyun building	**Office Hours** On-Line: 14:30 to 16:10	**T** 10:30-12:10 Room 110 Feiyun building

The course Textbook

- The course is based on a set textbook which is available from the University Library:
  - ***Introduction to Information Systems*** **(Third Edition), Patricia Wallace, (2018).**
- The course textbook is required, and the chapters are essential for each weekly class are essential and set out the subjects and topic introduces in this course
- At the end of every chapter, you will find:
  - Key terms and concepts (which must be learned and understood)
  - Chapter review questions
  - Projects and discussion questions
  - Application exercises
  - Case studies
- There will be additional topics not included in the course textbook

Keywords and Concepts

- At the end of all the chapters you will find:
  - Essential keywords and concepts introduced in the chapter
- It is important that you read and understand the terms and concepts covered by the keywords and concepts
- Moreover: it is important to note:
  - The keywords and concepts have special meanings and general translations will not produce correct translations
  - It is important that general translation software (e.g., using a mobile phone) is not used to translate the keywords and concepts into Chinese!
  - The meanings are spelt out in the chapters!

Why study information systems?

An Historical Perspective

Historical Perspective

- There have been three social and economic revolutions:
  - The *agricultural* revolution
  - The *industrial* revolution
  - The *information* revolution
- In this course we are interested in the *information revolution* which describes:
  - The current economic, social, and technological trends are manifest following the Industrial Revolution
  - The information revolution was enabled by advances in semiconductor technology
  - This is reflected in the 'metal oxide semiconductor field effect transistor' (MOSFET) and the integrated circuit (IC) chipset with developments in data processing and data storage (*in memory* and *persistent* data storage)
  - These developments have resulted in the *Information Age* in the early 21st century

Information in Social and Economic Activity

- An important feature of the *information revolution* is the growing economic, social, and technological role of *data* and *information*
- Information-related activities are not restricted to the information Revolution
  - Information-related have existed, in one form or the other over many millennia in all human societies and institutions
  - The agricultural and industrial revolutions arrived when new informational inputs were produced by individual innovators, or by scientific and technical institutions
  - During the Information Revolution all these activities are experiencing continuous growth, while other information-oriented and data science activities are emerging

The Knowledge Economy

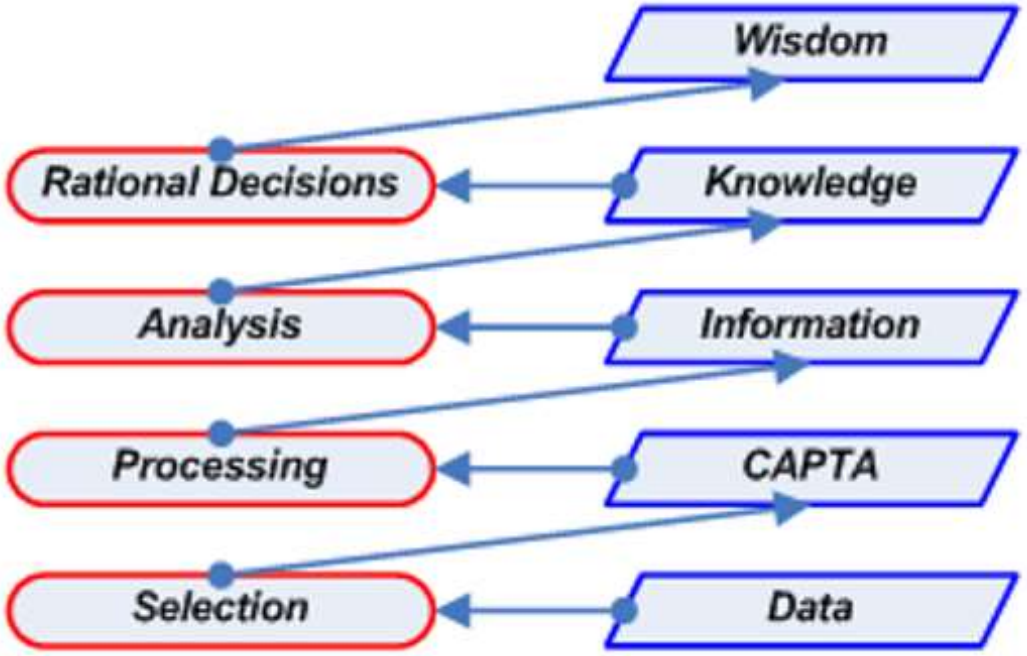
- The *knowledge economy* is an economic system in which:
  - The production of goods and services is based principally on knowledge-intensive activities that contribute to:
    - A rapid pace of advancement in technical and scientific innovation (and)
    - Accelerated obsolescence
- A key element of value is:
  - Increasing dependence on:
    - Human capital (and)
    - Intellectual property rights
  - These components are a vital for the source of:
    - Innovation in ideas, information, and practice

The Knowledge Economy

- Organisations are required to:
  - Employ (capitalise) the *knowledge* derived from *human capital* into commercial and production processes
  - Leverage the *intellectual capital* within an organisation
  - The goal is to *stimulate* the business development process
  - There is *less reliance* on physical input and natural resources
- A knowledge-based economy relies on:
  - The crucial role of *intangible assets* within the organisations' settings in facilitating effective and modern economic growth

The Knowledge Economy

- Information has been defined as:
  - Data processed
- The process of achieving knowledge needs:
  - Selection (CAPTA)
  - Analysis
  - The application of intelligence (rational input)
- The figure is a:
  - Conceptual model illustrating the progression of *data processing* from the *raw data* to *wisdom* (*rational decision-support*)



Shown is the intermediate stage (CAPTA) where an initial selection of relevant and useful raw data is implemented

Why Study Data Science and Information Systems?

- This brief historical overview demonstrates:
  - The growing importance and relevance of data and information
  - This applies to organisations and therefore individuals
  - An understanding of the historical perspective is essential when considering the future for individuals and organisations
- Information systems are fundamental to organisations in the future:
  - In the following slides I provide a brief overview of the technological developments related to computers and computer languages

Information Systems *vs* Manual Records

- There are significant benefits to be derived from computerised information systems over manual record keeping systems:

Advantages of Information Systems over Manual Record Keeping Systems	
Time saver	Operations on data may be done much faster
Space saver	Data may be stored compactly on disk
Corrector	Avoids many human errors (e.g., updating and retrieval of data)
Reliever	Reduces repetitive (and boring) work for humans
Organiser	Requires humans to develop organized model of data
Formatter	Rapid display of information in multiple formats
Centralizer	For multi-user systems, centralized control enables sharing of data with less redundancy and tighter security

Historical Developments in Computers (1)

- The *first-generation* computers were based on *vacuum tube* technology and were:
  - Physically very large
  - Compared to modern devices (e.g., a smartphine) they were very slow with miniscule data storage capacity and memory
  - Required a large amount of electrical power
  - Generated large amounts of heat
  - Were generally unreliable and could not be switched of as vacuum tubes would frequently fail (they ran continuously and required continuous monitoring day and night)
  - Required substantial (generally daily) maintenance
- As such the *first-generation* computers were limited in general to simple data processing

Historical Developments in Computers (2)

- The *second-generation* computers (introduced in 1959 with the release of the IBM 7090) used transistors (which replaced vacuum tubes):
- The result was:
  - A dramatic reduction in cost
  - Increasing speed, data storage capacity, and memory
  - A significant reduction in physical size
  - Reductions in terms of power consumption
  - Increased reliability with less maintenance
- The effect of these development made computers more practical for ‘real-world’ systems

Historical Developments in Computers (3)

- The *third-generation* computers (introduced in 1964 with the IBM 360) were the first computers to use *integrated circuits*
- An *integrated circuit* consists of a large number of electronic circuits *etched* onto a single semiconductor chip.
- This use of *microchips* led to an even more dramatic:
  - Reduction in cost
  - Reduction in size
  - Reduction in electrical power requirements
  - Improvements in reliability with reductions in maintenance
  - Increasing speed, data storage capacity, and memory

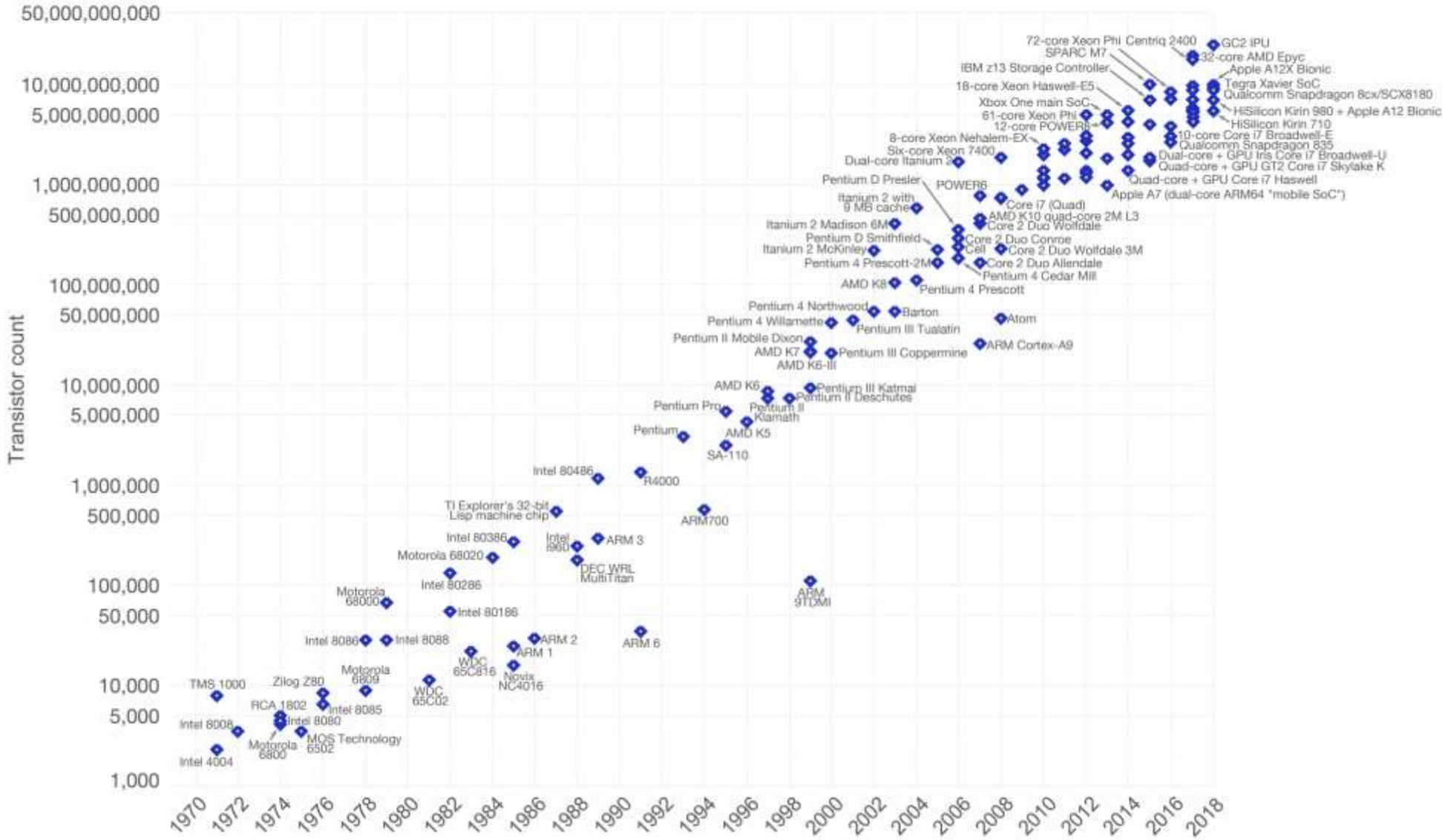
Historical Developments in Computers (4)

- By 1971 there were two important developments:
  - The first general purpose processor-on-chip (or *microprocessor*) was released:
    - This represented a major breakthrough in chip architecture
  - *Large-scale-integration* (LSI) had been achieved
    - This represented a major increase in chip density
    - While LSI led to size reductions, the primary goal was to speed up processing by reducing the distances that electrons had to travel
  - These advances led to what has been termed the *fourth generation* of computers
- By 1975 *very large-scale integration* (VLSI) was achieved:
  - VLSI enabled over 100,000 transistors to be packed onto a single chip
  - The following slide shows the development in chip technologies over time

Moore's Law – The number of transistors on integrated circuit chips (1971-2018)

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are linked to Moore's law.

Our World in Data



Five Generations of Computer Languages

- The following table shows the developments in computer and database languages with example program code
- The chronology for these developments is from approximately 1950 (computers were introduced shortly after the second world war) to the present day

Generation	Language Example	Sample of code for the same task
1	86 Machine code	Several pages of program code: e.g., 00000101 00000001 00000000
2	86 Assembler	Several pages of program code: e.g., ADD1 AX, 1
3	Pascal	2 pages of program code: e.g., **for** i := **to** n **do** writeln (names[i])
4	SQL	**select** name, size **from** Moon **where** planet = 'Saturn' **order by** size
5	Formal English	List the names and sizes of the moons of planet Saturn in order of size

Developments in Computer Languages

- The previous slide shows how the developments in computer languages:
  - Improved computer programming productivity
  - Reduced the human errors in the use of machine code
  - Led to the development of current high-level programming languages (e.g., Java, C, C++, etc)
- The majority of programming now uses high-level languages
  - There however remain cases where machine language is used where speed in mission critical
- In terms of database systems relational database systems use SQL
- The developments in web-based systems has led to the development of NoSQL for many Internet applications and systems

Developments in Computer Languages

- The brief overview of the development of computerisation identifies:
  - The ever-increasing need for an understanding of the fundamentals that drive data science, information science, and information systems
- The study of information systems is fundamental to an understanding of the developing data science landscape
- In the following slides I will:
  - Introduce digital processing
  - Address the question: ‘what is an information system’?
  - Introduce the subject and topics this course will address

Digital information processing

Digital Information Processing

- The ubiquitous and pervasive nature of computerised systems has resulted in digital information processing by both individuals and organisations
- This has led to a research into *Informatics* which is a:
  - Research field that considers the principles of *information science* to address problems in the use of data with information processing and the *engineering* of Information Systems (IS)
- The research field addresses interactions between humans and information with the design and development of *interfaces*, *technologies* and *systems*
- Research in this field studies the development, replacement, improvement, and general understanding of IS and how they function

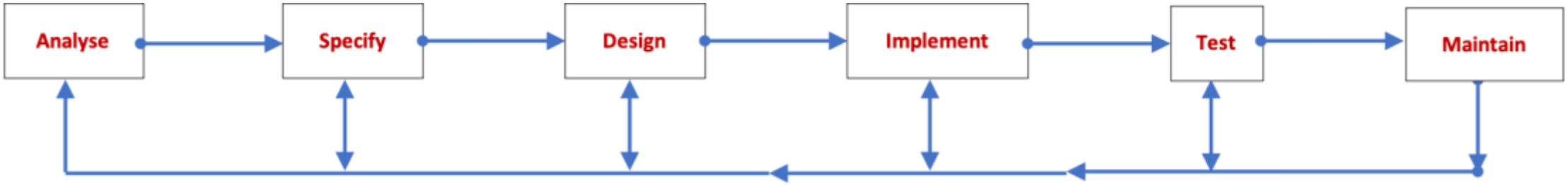
Information Science

- Information science is a research field which addresses:
  - The collection, analysis, classification, manipulation, storage, retrieval, movement, dissemination, and security of data and information
  - The study, application, use of knowledge in organizations along with the interactions between people, and organizations (and)
  - The use of any current existing IS to create, replace, improve, or understand how an IS functions.
- *Informatics* and *information science* has associations with computer science and addresses diverse topics which include:
  - Cognitive science, linguistics, mathematics, biology, and the social sciences along with the relationship between society and technology.

Design and Development of an Information System

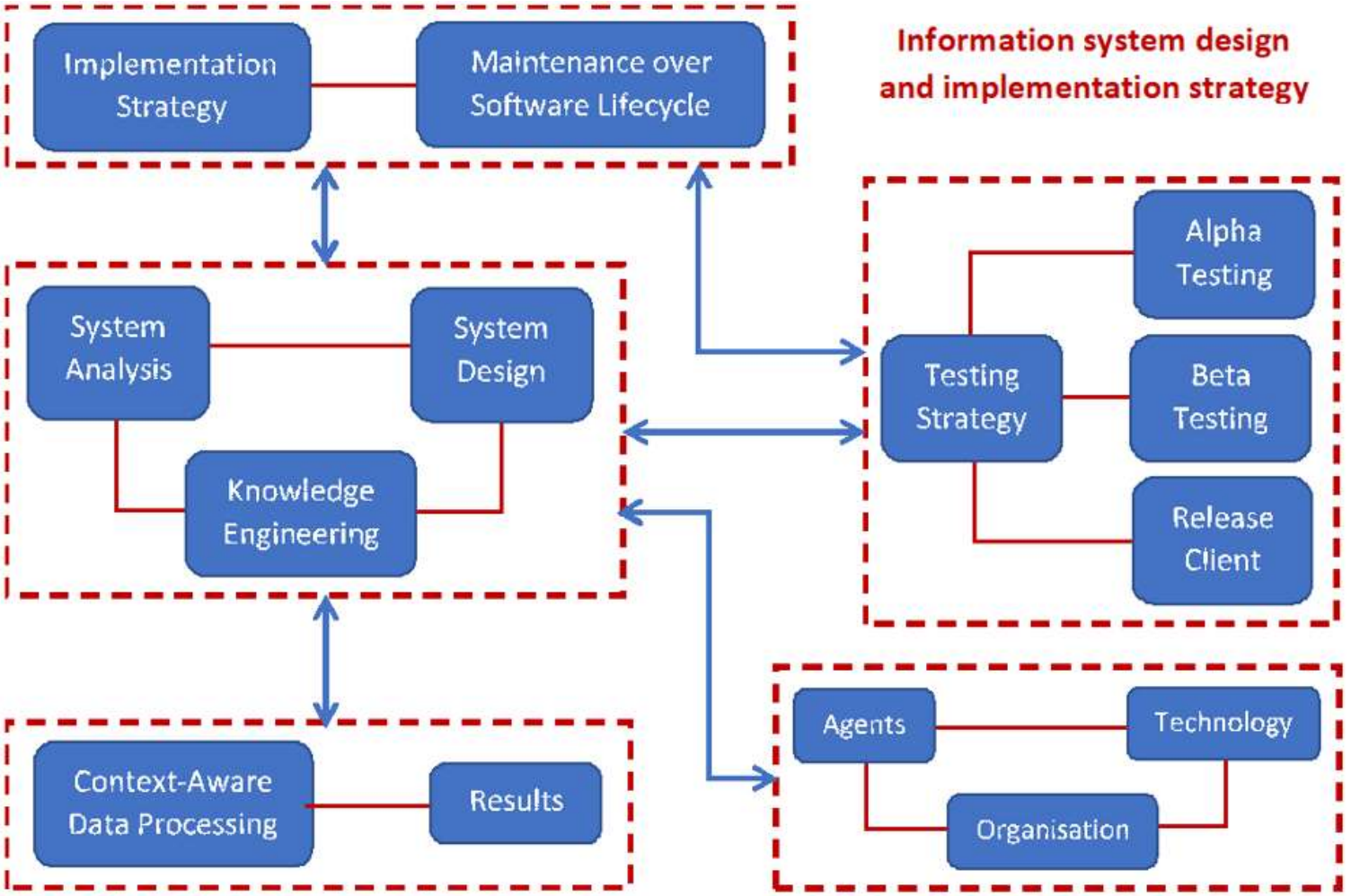
- Information systems are complex and the design and development of an IS requires an organised and strategic approach
- Such an approach will ideally use a modular approach to realised must include the following phases as shown in the following slide:
    1. Analyse
    2. Specify
    3. Design
    4. Implement
    5. Test
    6. Maintain

Design and Development of an Information System



- The figure shows the sequence and iterative nature of the design and development process
- There are many methods to implement such a process which will be introduced in this course
- The following slide shows an architectural framework for the design development, and maintenance strategy for an information system(s)

Information Systems Development Framework



What is an information system?

Information Systems

- There is an often-repeated mantra that `*information is power*'
- Data processing with data processed into information useful to users performs a vital function for organisations which include:
  - Commercial organisations
  - Governmental organisations
  - Non-profit organisations (charities)
  - Healthcare and health monitoring systems
  - Educational institutions
  - Social networks

Information Systems

- Furthermore, data processed into useful information plays a pivotal role in developing technologies and the impact of informatics research has been observed in diverse research fields which include:
  - Affective computing
  - Intelligent context-aware systems
  - Smart environments implemented in cloud-based systems which include the developing fog and edge computing systems
  - Robotics where the development of autonomous robots capable of path planning and `assistive' robotic systems pose significant societal challenges

Management Information Systems

- IS are (generally) created in an organisational context and are principally designed to provide decision-support within an organization
- There exists a large body of published research addressing the topic under the general heading of management information systems (MIS)
- A MIS is designed to enable effective and timely management decisions within an organizations which include: coordination, control, analysis, and presentation (often termed visualisation) of information in a human friendly format
- A MIS provides information in an appropriate format from a `*time-task*' function perspective

Management Information Systems

- Viewed from an IS perspective there are essentially three types of information:
  - *Operational* decisions: generally short-term day-to-day tasks such as account management and sales
  - *Tactical* decisions: generally medium-term tasks such as marketing and sales strategies
  - *Strategic* decisions: generally long-term decisions such as new product development with research and development, geopolitical change, and socio-economic developments)
- The following slide models the three decision levels and shows the range and nature of the supporting information

Information and Decision Support

Management Information

- Management information is (generally) *highly* structured for the operational decisions, *less* structured for the tactical decisions, and *least* structured for the strategic decisions
- However, the decision-levels and the range of information (structured <----> unstructured):
  - Is not discrete
  - It can be viewed in terms of a continuum with information shared between the decision-levels dependent of the topic under discussion

Management Information

- Viewed from the IS perspective:
  - The '*time-decision*' relationship is important for both the nature of the information and how it is used
- An additional consideration is:
  - The manner in which the information is presented along with the level of detail and granularity (or level of detail)
- Digital dashboards integrate:
  - Multiple IS
  - Dashboards enable summaries of key `real-time' metrics to facilitate informed decisions

Introduction to Info 102

Chapters to be Studied

Chapter	Subject
1	Information systems and people
2	Information systems and strategy
3	Information and communication technologies: the enterprise architecture
4	Databases and data warehouses
5	Information systems for the enterprise
6	The web, e-commerce, and m-commerce
7	Business intelligence and decision-making
8	Collaborating with technology
9	Knowledge management and e-learning
10	Ethics , privacy, and security
11	Systems development and procurement

Chapter #1

Information systems and people

Chapter #1 Topics

- Information systems in action:
  - Managing operations
  - Supporting customer interactions
  - Making decisions
  - Collaborating in teams
  - Gaining competitive advantage
  - Improving individual productivity
- The nature of information
  - What makes information valuable

Chapter #1 Topics

- The components of an information system
  - People / technology / processes / data
- Information systems throughout the organisation
  - Information systems in business
  - Information systems in non-profit organisations (charities) and government
  - inside the IT department
  - Improving your own productivity
- Promises, perils, and ethical issues
  - Privacy breaches and amplification effects
- The ethical factor
  - Ethical issues surrounding information systems

Chapter #2

Information systems and strategy

Chapter #2 Topics

- Porter's five competitive forces
  - Threats of new entrants
  - Power of buyers
  - Power of suppliers
  - Threat of substitutes
  - Rivalry among existing competitors
- Factors that affect how the five forces operate
  - Disruptive technology and innovation
  - Government policies and actions
  - Complementary services and products in the ecosystem
  - Environmental events and 'wildcards'

Chapter #2 Topics

- Value chain and strategic thinking
  - Extending the value chain from suppliers to the firm to customers
  - Benchmarking components of the value chain
  - The ethical factor: ethical responsibility in an environmental value chain
  - IT benchmarks
- Competitive strategies in business
  - The role of information systems in strategy
  - Information systems: run, grow, and transform the business

Chapter #2 Topics

- Information strategies and non-profit organisations
  - Fund raising / volunteering (non-profit organisations)
  - Information strategies and government
- Does it matter?
  - Spending on running, growing, and transformation

Chapter #3

Information and communications technologies: the enterprise architecture

Chapter #3 Topics

- The hardware
  - Input and output
  - Processing
  - Storage
- The software
  - Types of software
  - How is software created?

Chapter #3 Topics

- Networks and telecommunications
  - Transmission media and protocols
  - Types of networks
  - Network protocols
- The enterprise architecture
  - Trends in enterprise architectures
  - Guiding the architecture

Chapter #4

Databases and warehouses

Chapter #4 Topics

- The nature of information resources
  - Structured, unstructured, and semi-structured information
  - Metadata
  - The quality of information
- Managing information from filing cabinets to database
  - Tables, records, and fields
  - The rise and fall of file processing systems
  - Databases and database management software
- Developing and managing a relational database
  - Planning the data model
  - Accessing the database and retrieving information

Chapter #4 Topics

- The ethical factor:
  - ethical issues in database design: the case for ethnic identification
- Multiple databases and the challenge of integration
  - Shadow systems
  - Integration strategies and master data management
- Data warehouses and big data
  - Ownership issues
  - The challenge of big data
  - Strategic planning, business intelligence, and data mining
- The challenge of information management: the human element
  - Ownership issues
  - Databases without boundaries
  - Balancing stakeholders: information needs

Chapter #5

Information systems for the enterprise

Chapter #5 Topics

- Finance management
  - Components of financial management systems
  - Financial reporting, compliance, and transparency
- Human capital management (HCM)
  - Components of human capital management systems
  - HCM metrics
- Managing the supply chain
  - Supply chain fundamentals
  - Measuring performance in supply chains
  - Information systems and technology for supply chain management
  - The ethical factor: ethics and talent management

Chapter #5 Topics

- Customer relations management (CRM) systems
  - CRM goals and metrics
  - CRM strategies and technologies
- Enterprise resource planning (ERP): bringing it all together
  - ERP components
  - Integration strategies
  - Implementation issues

Chapter #6

The web, e-commerce, and m-commerce

Chapter #6 Topics

- Developing a web strategy
  - Choosing a goal
  - Naming the website
- Building the website
  - Website design
  - Software development strategies for the web
- E-commerce
  - The online transaction and e-commerce software
  - E-commerce security
  - E-commerce trust

Chapter #6 Topics

- Mobile devices and m-commerce
  - Why mobile matters
  - Designing websites and apps for mobile devices
  - M-commerce and mobile payments
- Marketing the website
  - Search engine optimisation
  - Web advertising
- Web 2.0 and beyond
  - Crowdsourcing and collective intelligence
  - Expanding data and sensory input: the ‘Internet of Things’ (IoT)
  - The learning web

Chapter #7

Business intelligence and decision-making

Chapter #7 Topics

- Levels of decision making
  - Levels: (a) operational, (b) strategic, and (c) tactical
- Source of business intelligence
  - Transactional databases
  - Data warehouses
  - Internal data sources
- The ethical factor: the ethics of tagging faces in photos
- Data mining and analytics
  - Analysing patterns, trends, and relationships
  - Simulating, optimising, and forecasting
  - Artificial intelligence

Chapter #7 Topics

- Web analytics
  - Web metrics
  - Analysing traffic and achieving success
- Putting it all together: dashboards, portals, and mashups
  - Dashboards
  - Portals
  - Mashups
  - Business intelligence: the human element

Chapter #8

Collaborating with technology

Chapter #8 Topics

- The evolution of collaborative technologies
  - Email, discussion forums, instant messaging and texting
  - Group discussion support systems (GDSS)
  - Web conferencing and Interactive video
  - Shared workspaces
- Web 2.0 collaborative technologies
  - Bogs and wikis
  - Social networking
  - Microblogging
  - Virtual worlds

Chapter #8 Topics

- Unified communications
  - Capabilities for unified communications
  - Universal dashboards
- The human element and collaborative technologies
  - Psychological characteristics of online environments
  - Managing online impressions
  - Group dynamics in virtual teams
  - Making virtual teams work
- The ethical factor:
  - Flash mobs and free speech: should police block mobile messaging services

Chapter #9

Knowledge management and e-learning

Chapter #9 Topics

- The nature of intellectual capital
  - Types of intellectual capital
  - Types of knowledge
  - Managing intellectual capital
- Knowledge management strategies and techniques
  - Identify the goal
  - Locate the sources
  - Capture the knowledge
  - Organise, share, and value knowledge
- Knowledge management pitfalls and promises
  - The human element: why share knowledge?
  - Incentives for knowledge sharing
  - Terminology hurdles and content issues
  - The semantic web
  - Practical tips for launching a knowledge management project

Chapter #9 Topics

- E-learning
  - Comparing e-learning approaches
- Creating an e-learning program
  - Course development
  - Learning objectives
  - Content authoring tools
  - Strategies to prevent cheating
  - Learning and management systems
- E-learning education
  - Differences between corporate and education e-learning
  - Comparing e-learning and classroom learning

Chapter #10

Ethics, privacy, and security

Chapter #10 Topics

- Ethics
  - Ethical frameworks
  - Ethics and the law
  - Ethical issues and information and communications technologies
- Information ethics
  - Intellectual property and digital rights management
  - plagiarism

Chapter #10 Topics

- Privacy
  - Trading privacy for convenience and freebies
  - Anonymity
  - Surveillance
  - The ‘right to be forgotten’
- Information security
  - Risk management
  - Identifying threats

Chapter #11

Systems development and procurement

Chapter #11 Topics

- Systems development lifecycle
  - Planning, analysis, design phase, development phase, testing phase, implementation, maintenance
- Software development strategies
  - Waterfall software development
  - Iterative methods
  - Agile methods
- The ethical factor:
  - Developing systems: that promote ethical decision-making and social responsibility
- Comparing software development approaches
  - Type of project
  - Organisational culture
  - Is Waterfall dead?

Chapter #11 Topics

- Software procurement: the ‘buy’ strategy
  - Pros and cons of build and buy
  - The procurement process
  - Adaptation and customisation
- The human element in software development and procurement
  - Cross-functional teams
  - The role of senior management
  - Working with consultants

Week #1 (T1) Review

- In this lecture I have:
  - Provided an overview of the INFO 102 course and introduce the Moodle discussion forum
  - Considered why the study Information Systems is important with an historical perspective
  - Introduced digital information processing and considered the nature of information systems
  - Introduce the required course textbook (Wallace) and the chapters to be studied with an overview of the subject areas and topics
- In the next two lecture we will begin our study with:
  - Chapter #1 (Information systems and people)
  - An introduction and overview of Belbin Roles