

Architecture & Applications

- Application Architectures
 - Application Perspective
 - Complex Applications
 - Generic Application Architectures
 - Use of Application Architectures
 - Application Types
- Batch/Data Processing Systems
 - Input-process-output
- Transaction Processing Systems
 - Transaction processing middleware
 - Information Systems Architecture
 - Resource Allocation Systems
 - Resource Allocation Architecture
 - E-Commerce System Architecture
- Event Processing Systems
 - Editing Systems
 - Editing System Architecture
 - Information and Resource Management Systems
- Language Processing Systems (Compilers)
 - Language Processing Components
- Conclusion

Application Architectures

Application Perspective

- So far had architectural perspectives on issues such as overall control, distribution and system structuring
- Now an alternative approach: architectures from an application perspective, i.e.: various application types
 - Two fundamental models of business systems
 - * Batch processing
 - * Transaction processing
 - Event processing systems

- Language processing systems

Complex Applications

- Follow a hybrid architectural model:
 - Different parts of the application structured in different ways
 - Different architecture models for individual subsystems
- Integrated within an overall system architecture

Generic Application Architectures

- Application systems are designed to meet an organisational need
- As businesses have much in common, their application systems also tend to have a common architecture that reflects the application requirements
- A generic architecture is configured and adapted to create a system that meets specific requirements

Use of Application Architectures

- As a starting point for architectural design
- As a design checklist
- As a way of organising the work of the development
- As a means of assessing components for reuse
- As a vocabulary for talking about application types

Application Types

- Data Processing Applications
 - Data driven application that process data in branches without explicit user intervention during the processing
 - * Billing systems; payroll systems
- Transaction processing applications
 - Data centred applications that process user requests and update information in a system database
 - * E-commerce systems; reservation systems
- Event processing systems

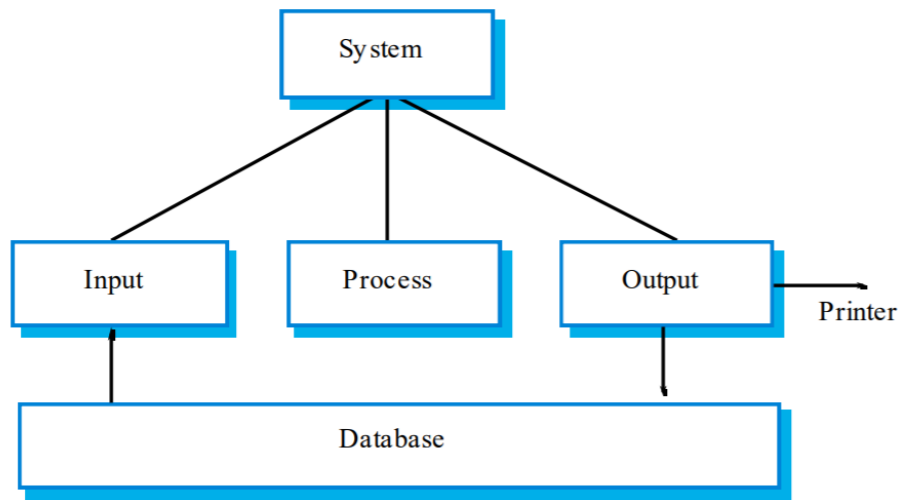
- Applications where system actions depend on interpreting events from the system's environment
 - * Games; word processors; real-time systems
- Language processing systems
 - Applications where the users' intentions are specified in a formal language that is processed and interpreted by the system
 - * Compilers, command interpreters

Batch/Data Processing Systems

- Data-centred systems where the databases used are usually orders of magnitude larger than the software itself
- Data is input and output in batches
 - Input - a set of customer numbers and associated readings of an electricity meter
 - Output - a corresponding set of bills, one for each customer number
- Data processing systems usually have an **input->process->output** structure

Input-process-output

- Input component reads data from a file or database, checks if validity and queues the valid data for processing
- Process component takes a transaction from the queue (input), performs computations and creates a new record with the results of the computation
- Output component reads these records, formats them accordingly and writes them to the database or sends them to a printer



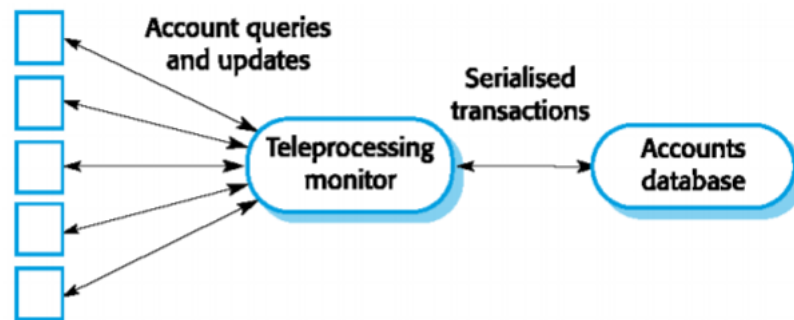
Transaction Processing Systems

- Process user requests for information from a database or or requests to update the the database
- From a user perspective a transaction is:
 - Any coherent sequence of operations that satisfies a goal
 - For example - find the times of flight from London to Paris
- Users make asynchronous requests for service which are then processed by a transaction manager



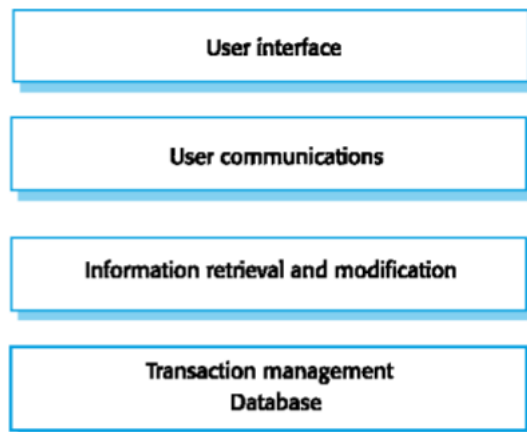
Transaction processing middleware

- Transaction management middleware or teleprocessing monitors handle communications with different terminal types (e.g.: ATMs and counter terminals), serialises data and sends it for processing
- Query processing takes place in the system database and results are sent back through the transaction manager to the user's terminal



Information Systems Architecture

- Information systems have a generic architecture that can be organised as a **layered architecture**
- Layers include
 - The user interface
 - User communications
 - Information retrieval
 - System database



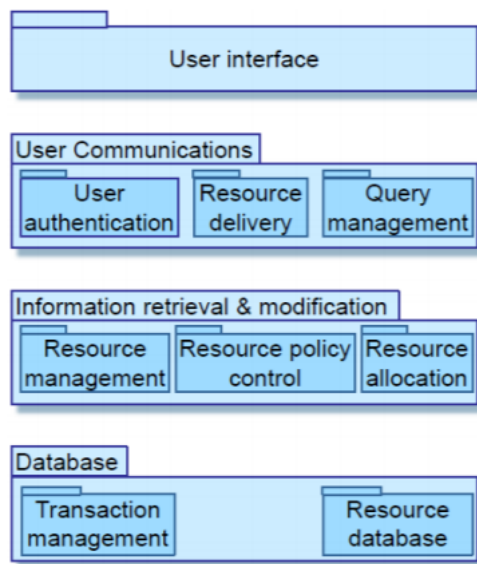
Resource Allocation Systems

- Systems that manage a fixed amount of some resource (football game tickets, books in a bookshop, etc) and allocate this to users
- Example of resource allocation systems
 - Timetabling systems where the resource being allocated is a time period

- Library systems where the resource being managed is books and other items for loan
- Air traffic control systems where the resource being managed is the airspace

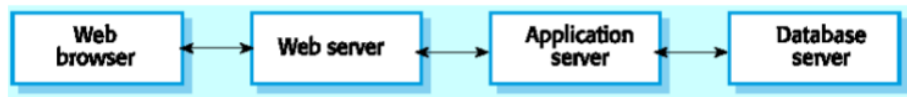
Resource Allocation Architecture

- Resource allocation systems are layered systems that include
 - A resource database
 - A rule set describing how resources are allocated
 - A resource manager
 - A resource allocator
 - User authentication
 - Query management
 - Resource delivery component
 - User interface



E-Commerce System Architecture

- E-commerce systems are Internet-based resource management systems that accept electronic orders for goods or services
- Usually organised using a multi-tier architecture with application layers associated with each tier



Event Processing Systems

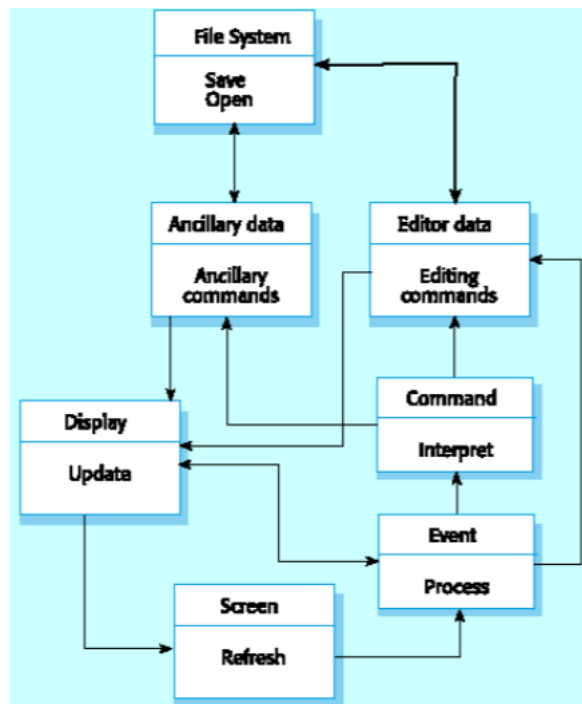
- These systems respond to events in the system's environment
- Their key characteristic is that event timing is unpredictable so the architecture has to be organised to handle this
- Many common systems such as word processors, games, etc. are event processing systems

Editing Systems

- Common type of event processing system
- Editing system characteristics
 - Single user systems
 - Must provide rapid feedback to user actions
 - Organised around long transactions so may include recovery facilities

Editing System Architecture

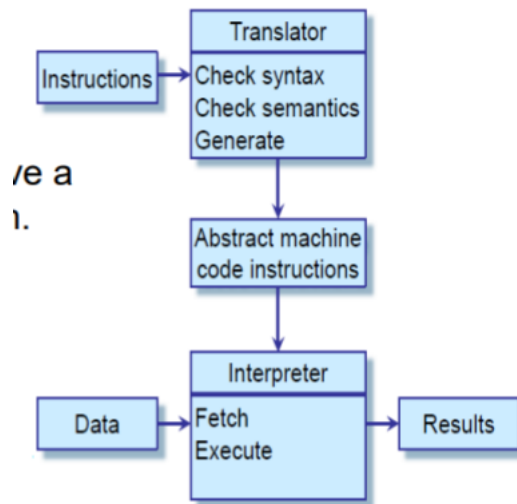
- Editing systems are naturally object-oriented
 - Screen - monitors screen memory and detects events
 - Event - recognises events and passes them for processing
 - Command - executes a user command
 - Editor data - manages the editor data structure
 - Ancillary data - manages other data such as styles & preferences
 - File system - manages file I/O
 - Display - updates the screen display



Information and Resource Management Systems

Language Processing Systems (Compilers)

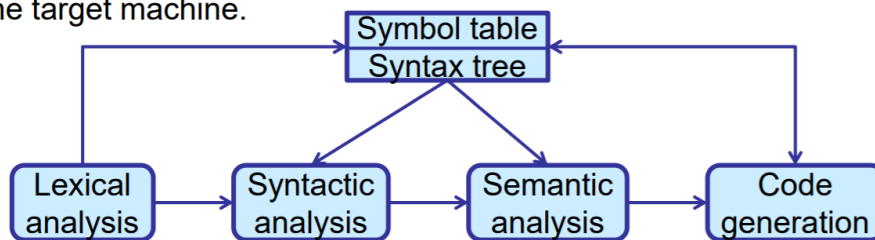
- Input a natural or artificial language and generate another representation
 - Programming language to machine code
- May interpret code and execute it
- Used when the easiest way to solve a problem is implement an algorithm
- Als used for domain-specific languages
 - What is that?



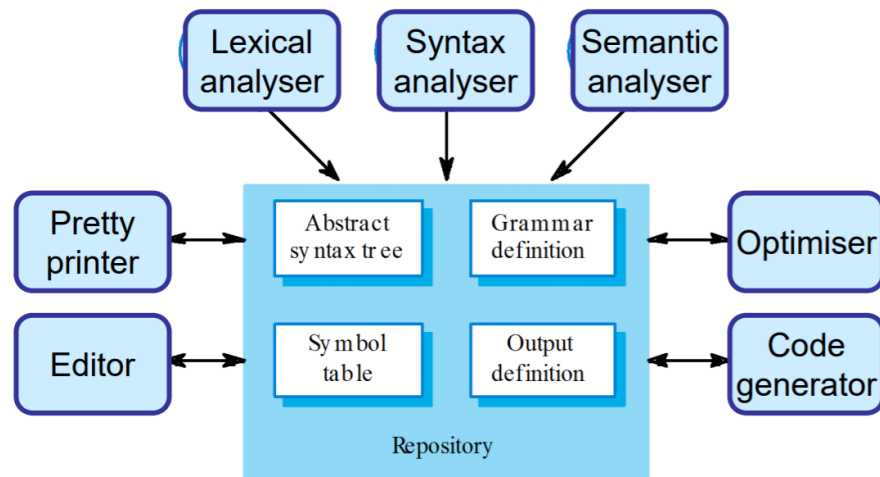
Language Processing Components

- Lexical analyser (tokenizer, scanner) - produces tokens: the words in the language, e.g.: variable names, operators, etc,
- Symbol table - stores the words
- Syntax analyser - parses tokens to produce a syntax tree, checks that tokens conform to the rules of the language
- Syntax tree - stores the program
- Semantic analyser - check aspects not related to syntactic form, e.g.: type correctness
- Code generator - transform and optimise the syntax tree into instructions for the target machine
 - Can think of it as a python filter process

the target machine.



Can also think of it as a Repository model of a compiler, where the repository handles the syntax definition and symbol table, output definition etc - as follows:



Conclusion

- Generic models of application architectures help us understand and compare applications
- Important classes of application are data processing systems, transaction processing systems, event processing systems and language processing system
 - Or a combination
- Data processing systems operate in batch mode and have an **input -> process -> output structure**.
- Transaction processing systems allow information in a database to be remotely accessed and modified by multiple users
- Event processing systems respond to events in the environment
- Language processing systems translate texts from one language to another and may interpret the specified instructions
- Typescript -> Javascript