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Application Architectures

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slides taken from prof. edwin blake

OUTLINE

Application Architectures

Batch/Data processing systems

Transaction processing systems

- Information and resource management systems

Event processing systems

Language processing systems

Conclusion

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 team.
- As a means of assessing components for reuse.
- As a vocabulary for talking about application types.

Application types

Data processing applications

- Data driven applications that process data in batches 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

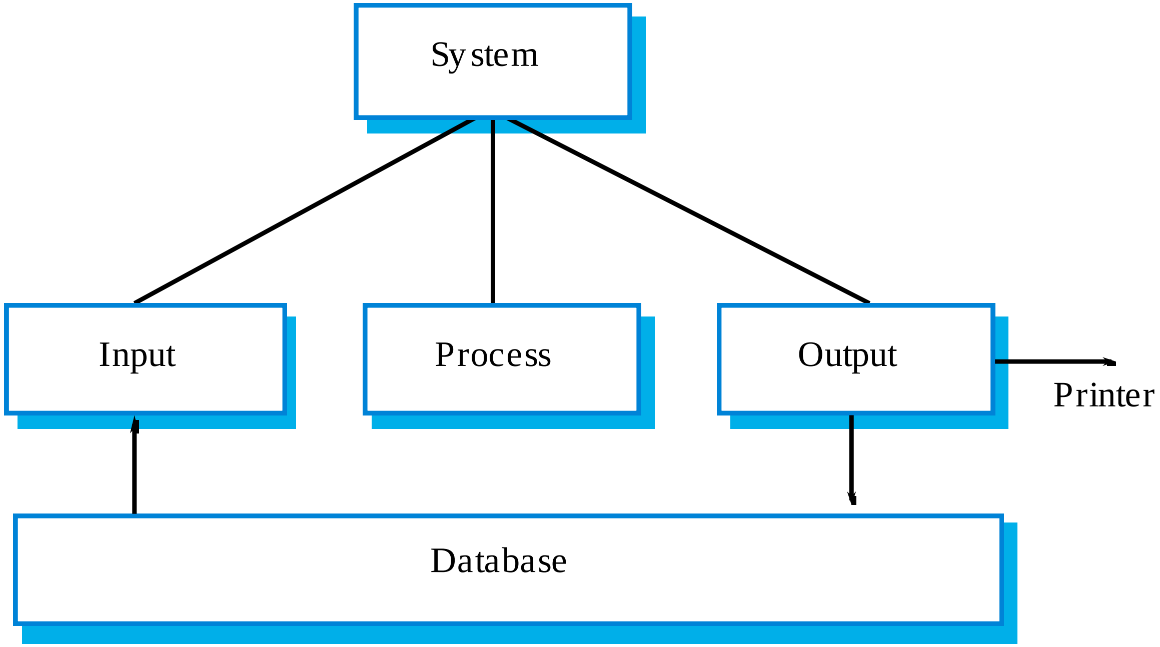
- Data-centred systems where the databases used are usually orders of magnitude larger than the software itself.
- Data is input and output in batches
  - Input: A set of customer numbers and associated readings of an electricity meter;
  - Output: A corresponding set of bills, one for each customer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

Input-process-output

input component reads data from a file or database, checks its validity and queues the valid data for processing.

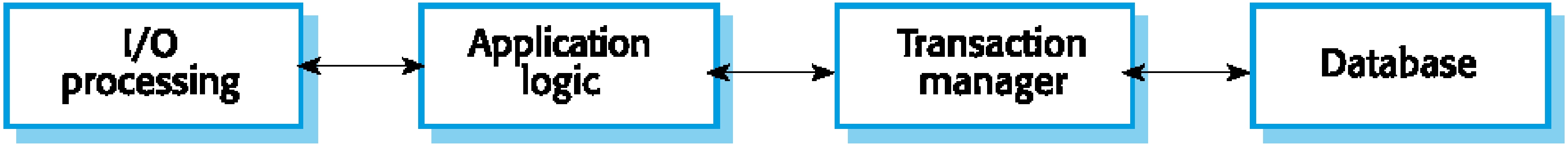
process component takes a transaction from the queue (input), performs computations and creates a new record with the results of the computation.

output component reads these records, formats them accordingly and writes them to the database or sends them to a printer.



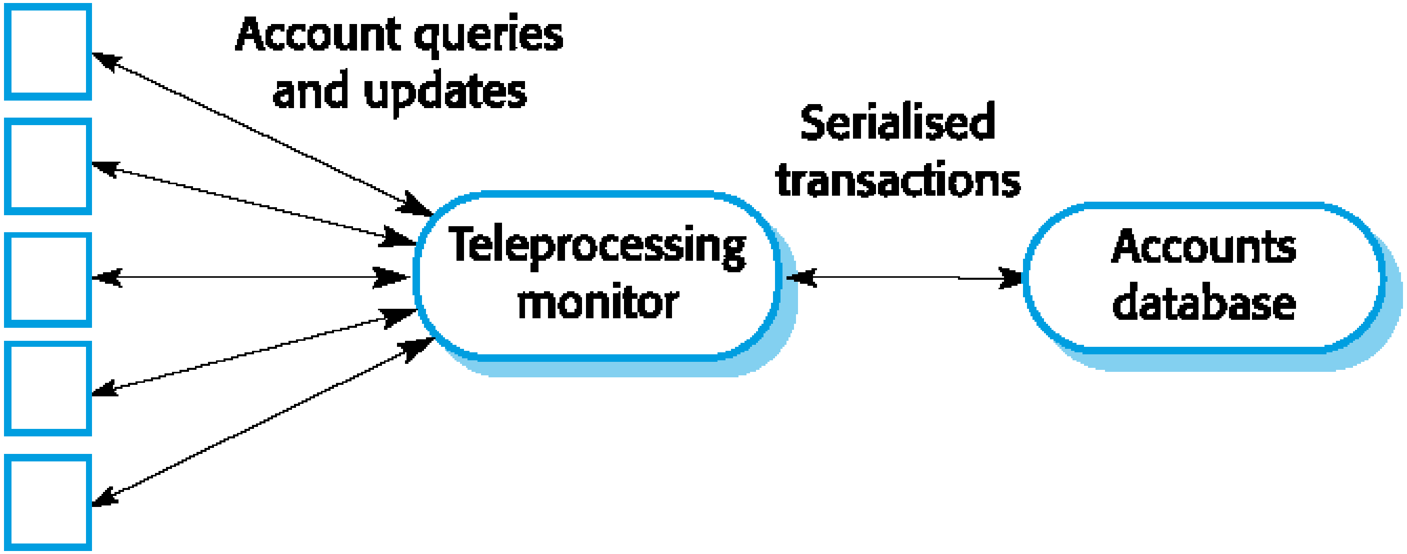
Transaction processing systems

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



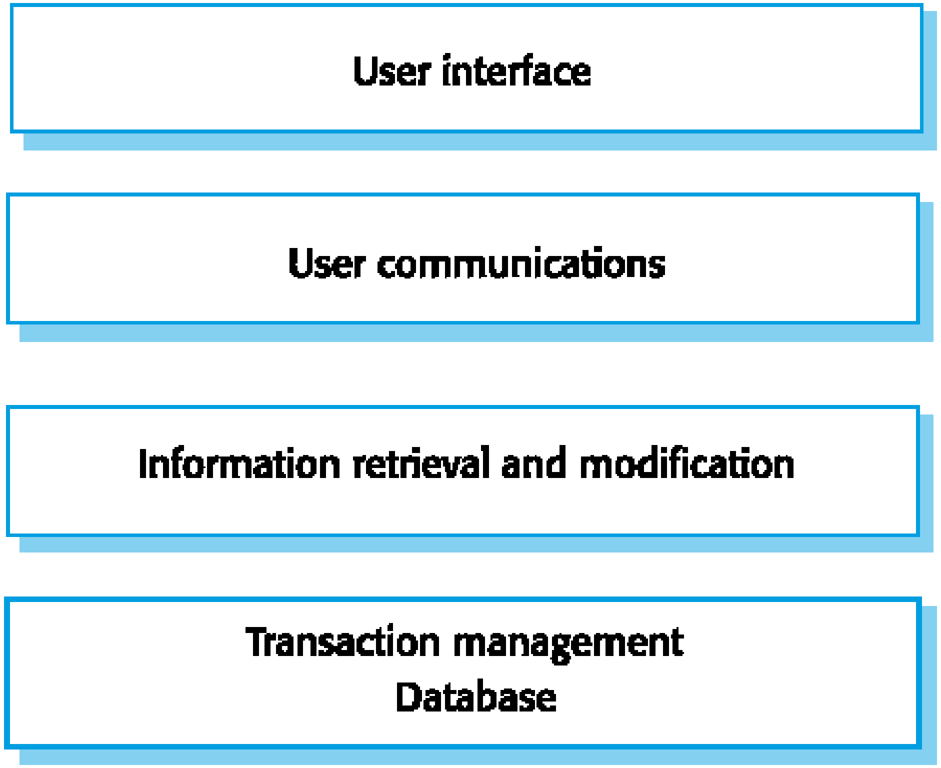
Transaction processing middleware

- 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



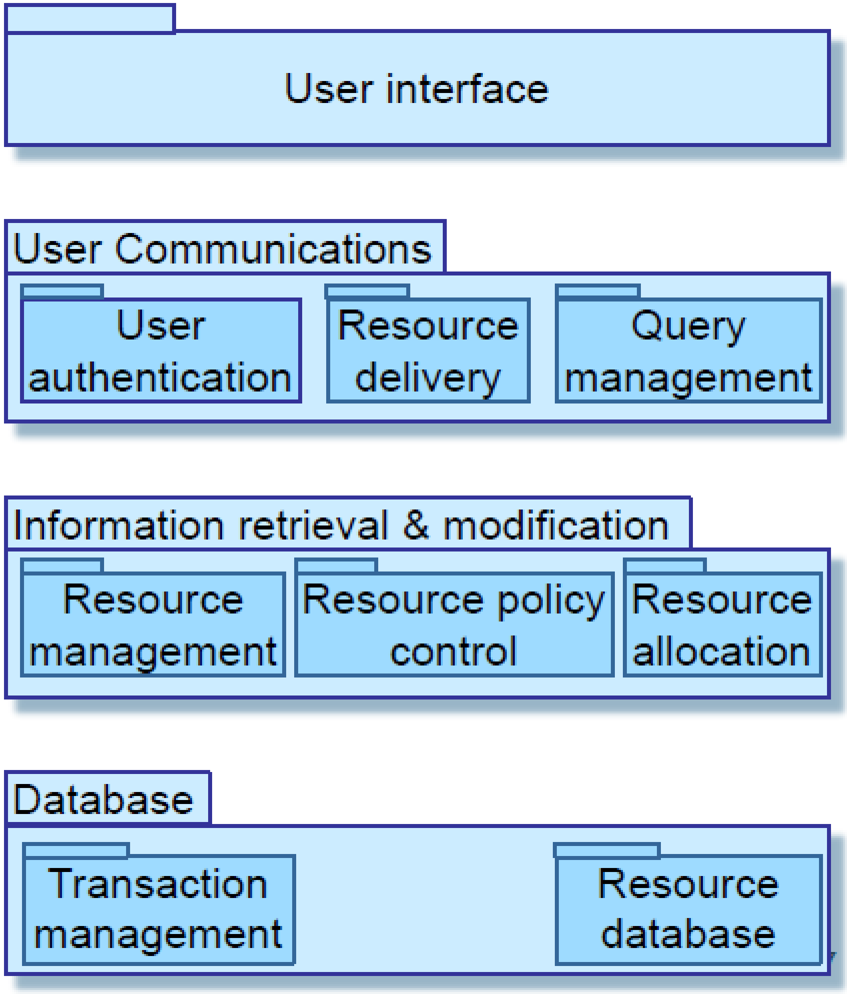
Resource allocation systems

- Systems that manage a fixed amount of some resource (football game tickets, books in a bookshop, etc.) and allocate this to users.
- Examples 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

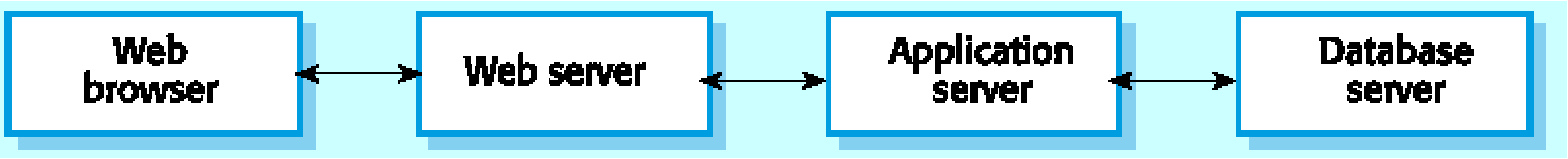
Resource allocation systems are **layered systems** that include:

- 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.

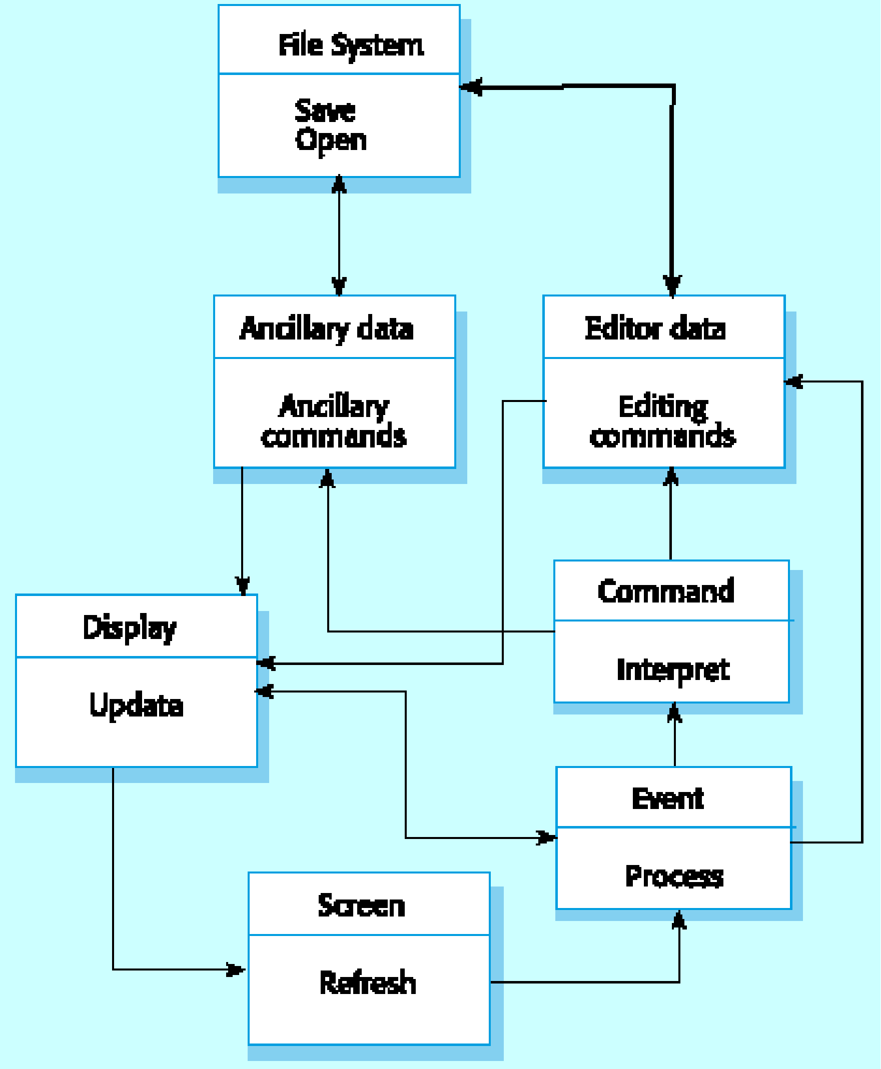
Editing systems

- 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

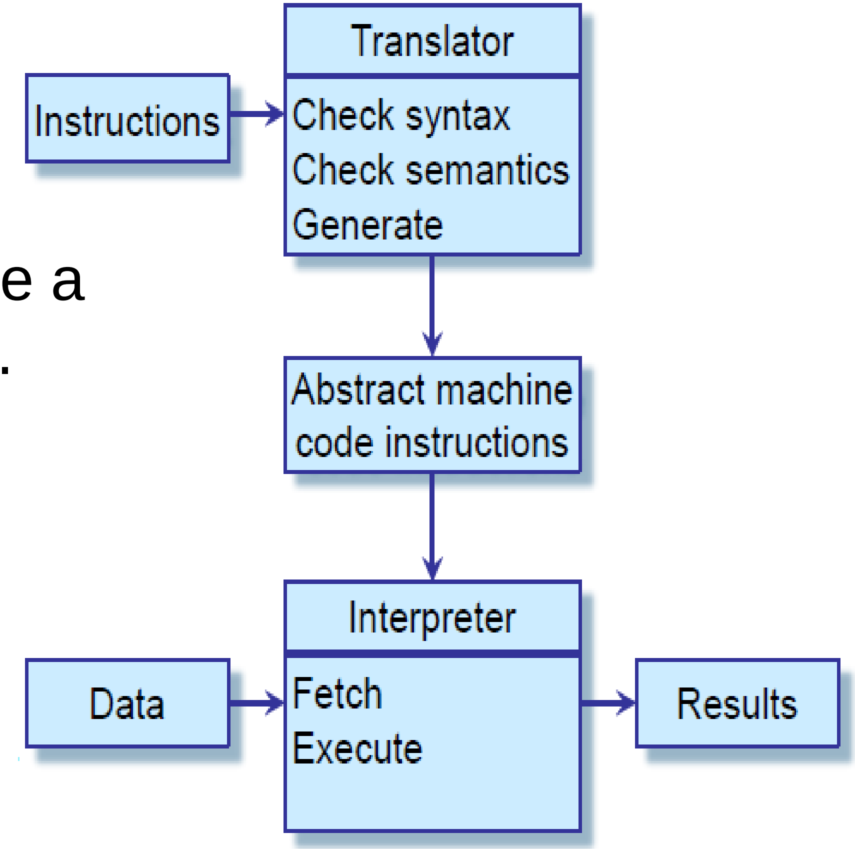
Editing systems are naturally object-oriented:

- **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.



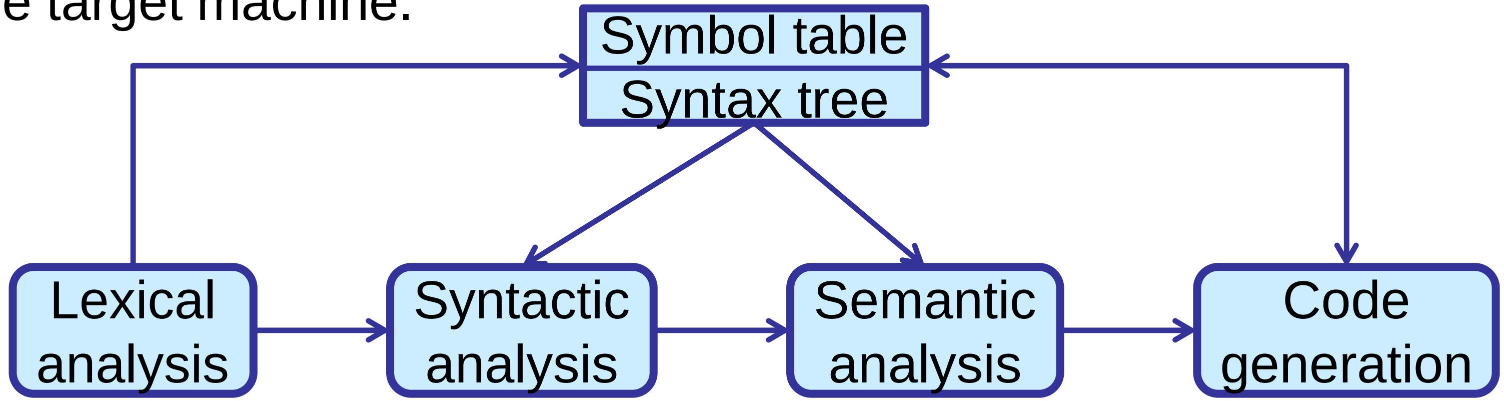
Language processing systems (Compilers)

- 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.
- Also used for domain-specific languages

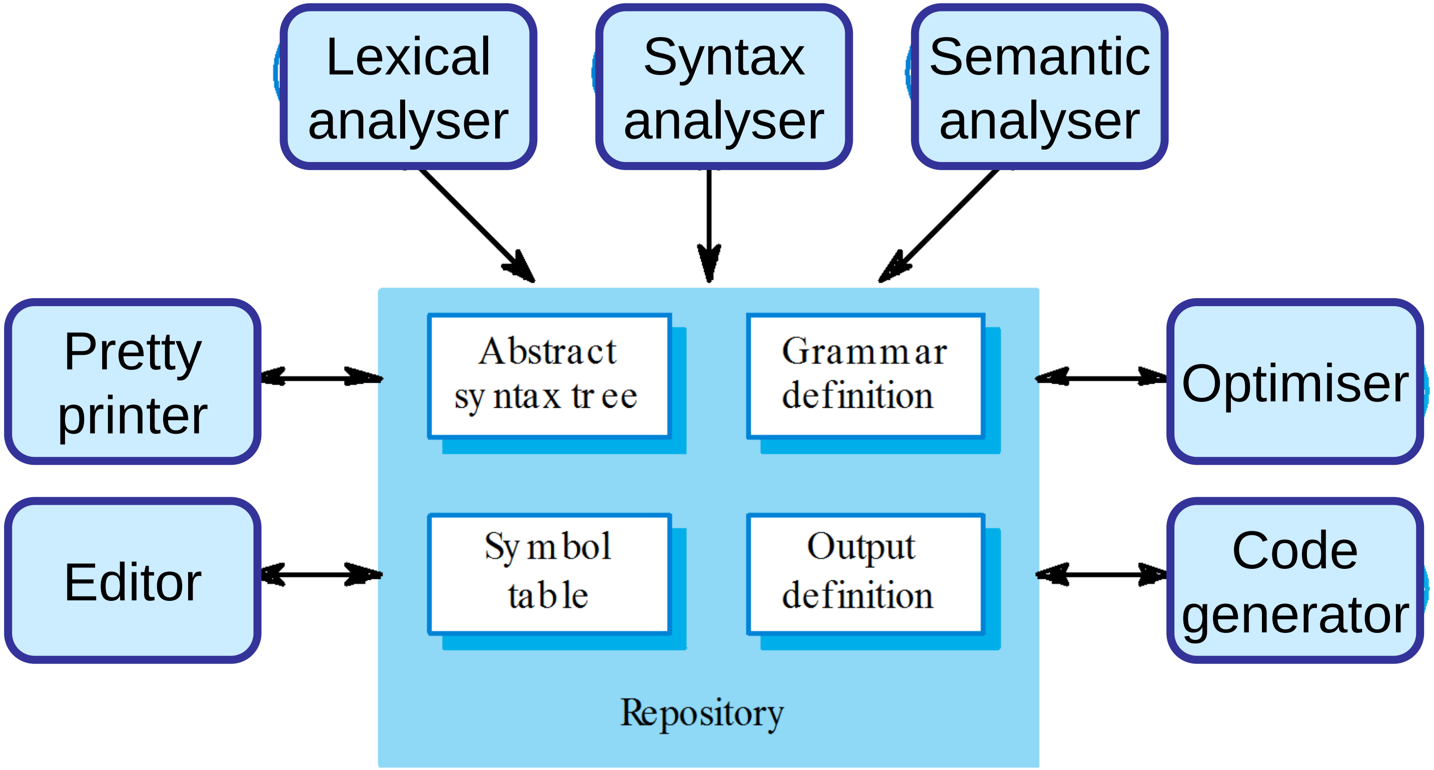


Language processing components

- 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.



Repository model of a compiler



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.