IF1210 Algoritma dan Pemrograman 1

Pengantar Dunia Pemrograman

Tim Pengajar IF1210

Sekolah Teknik Elektro dan Informatika

Tujuan

- Mahasiswa dapat memahami:
  - Apa itu pemrograman komputer
  - Paradigma pemrograman
  - Bahasa pemrograman
  - Berbagai hal terkait pemrograman (lingkungan, pemroses, dll.)
  - Pemrograman vs *software engineering*

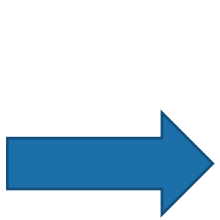
Pemrograman

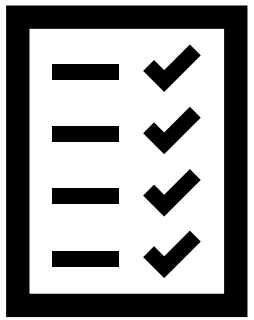
Pemrograman [komputer] adalah proses untuk memformulasi persoalan komputasi menjadi program [komputer]

Pemrograman tidak hanya ***coding***

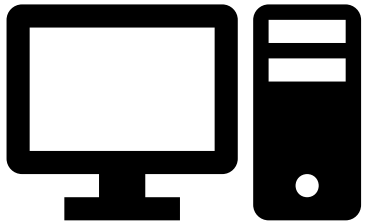
Pemrograman adalah analisis persoalan (membuat spesifikasi), implementasi (*coding*), *testing*, *debugging*

problem



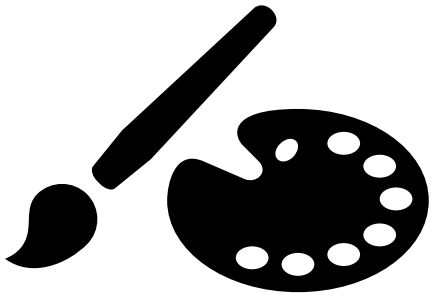


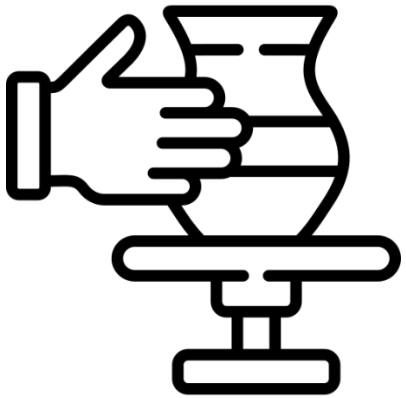
specification



computer program

Programming: art/craft/engineering?





Kegiatan Pemrograman

Analisis persoalan, membuat spesifikasi, menyusun algoritma

***Program writing* (*coding*)**, yaitu implementasi pada bahasa pemrograman tertentu

Program execution *(observation, debugging, testing)*

Program reading

Program correctness* and *complexity analysis

Program maintenance

Belajar Pemrograman = Belajar Bahasa Pemrograman??

- Ada **RIBUAN** bahasa pemrograman di dunia saat ini!!
- Tidak mungkin semua bahasa pemrograman dipelajari di kuliah

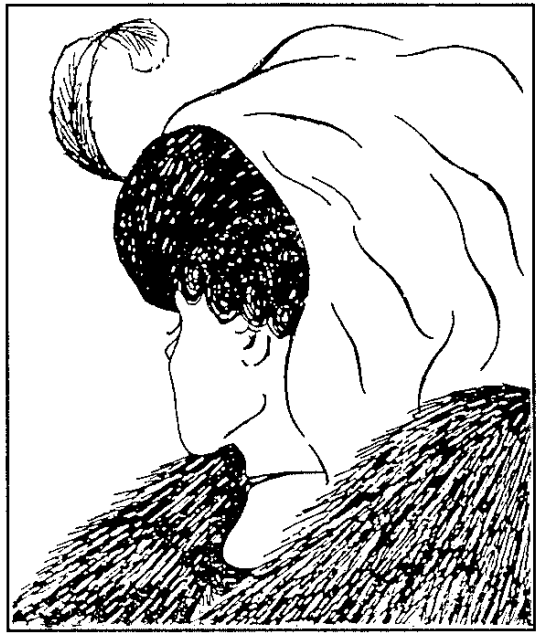
Belajar **pemrograman** =
belajar **pola pikir komputasional** + **paradigma pemrograman**

Belajar memrogram ≠ belajar bahasa pemrograman

Paradigma Pemrograman

Paradigma Pemrograman

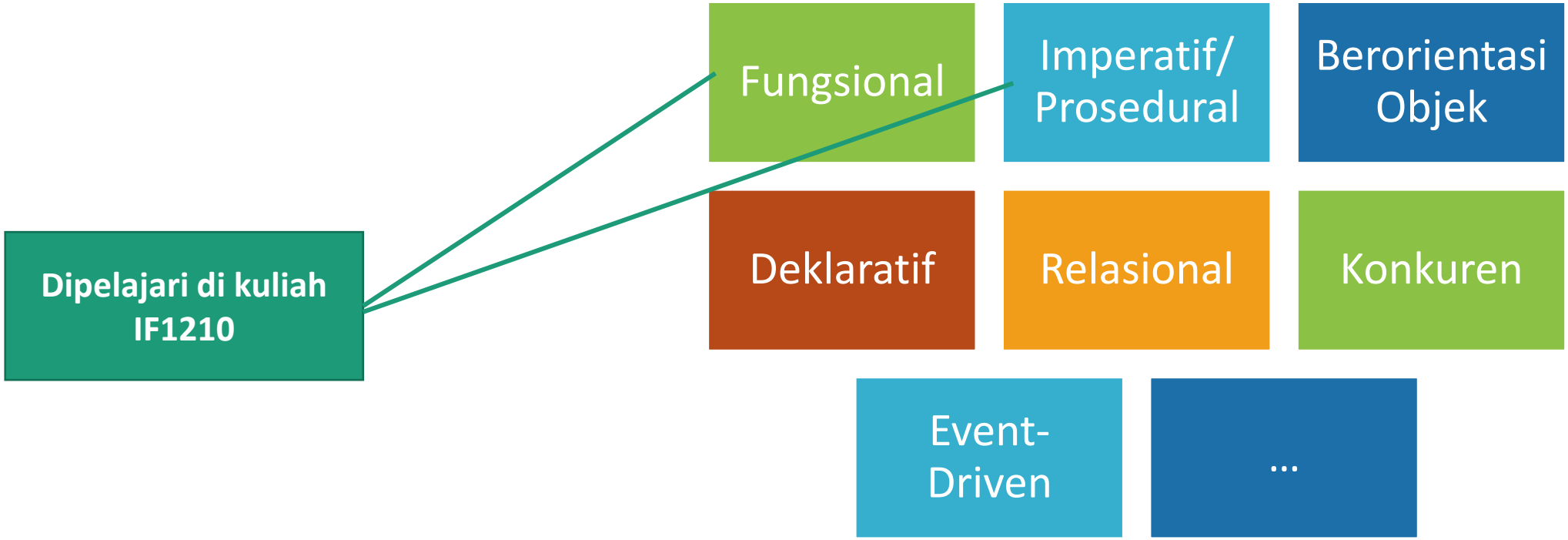
- **Paradigma** [pemrograman] adalah sudut pandang penyelesaian persoalan dengan [program]
- Setiap persoalan menggiring kita pada **pendekatan khusus** untuk pemecahannya
- Paradigma memberikan strategi analisis khusus pemecahan masalah
- Jenis persoalan tertentu dapat dipecahkan dengan baik dengan paradigma tertentu



What do you see?
By shifting perspective you might see an old woman or a young woman.

Paradigma Pemrograman

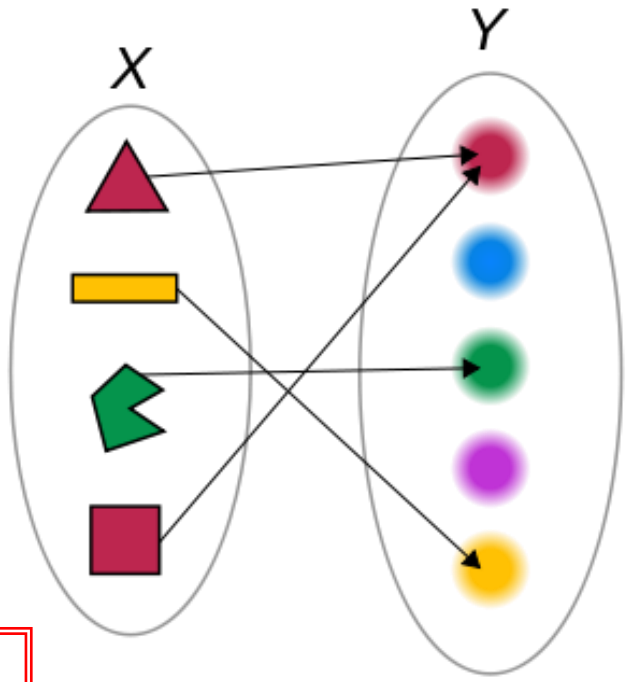
Jenis **paradigma pemrograman** yang dikenal:



Berikut ini diperkenalkan beberapa di antaranya…

Paradigma Fungsional

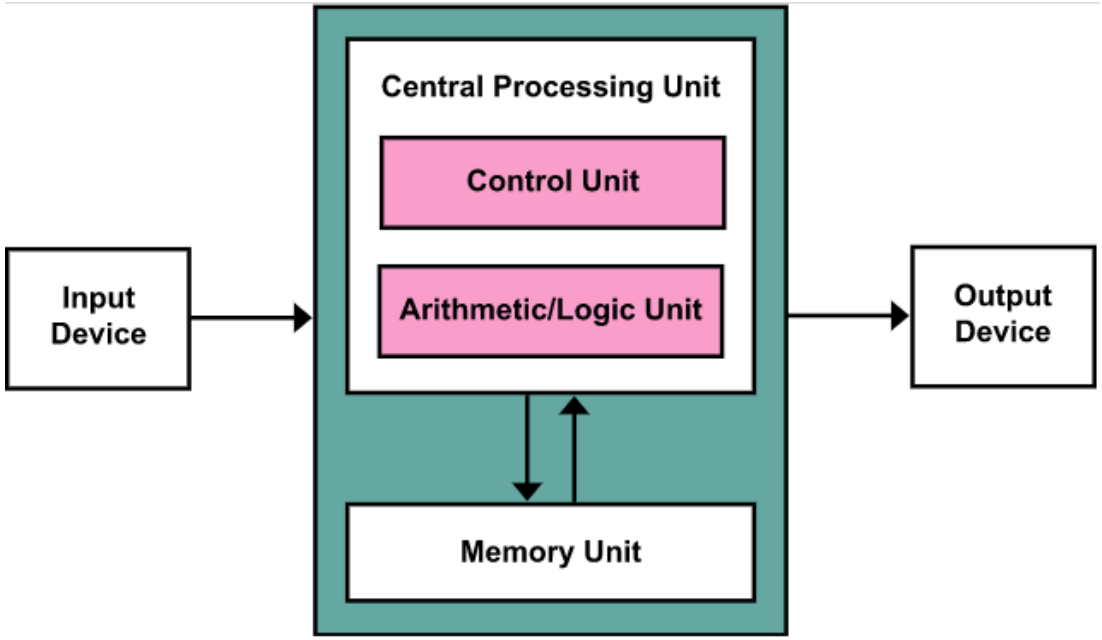
- Didasari oleh konsep pemetaan dan **fungsi** di matematika
- Pemrogram mengasumsikan bahwa ada **fungsi-fungsi** yang terdefinisi
- Penyelesaian masalah didasari atas **aplikasi dari fungsi-fungsi**



Paradigma Imperatif/Prosedural

- Didasari oleh konsep mesin Von Neumann (*stored program concept*)
- Program didasari oleh **strukturisasi informasi** di dalam memori dan **manipulasi** dari informasi yang disimpan tersebut

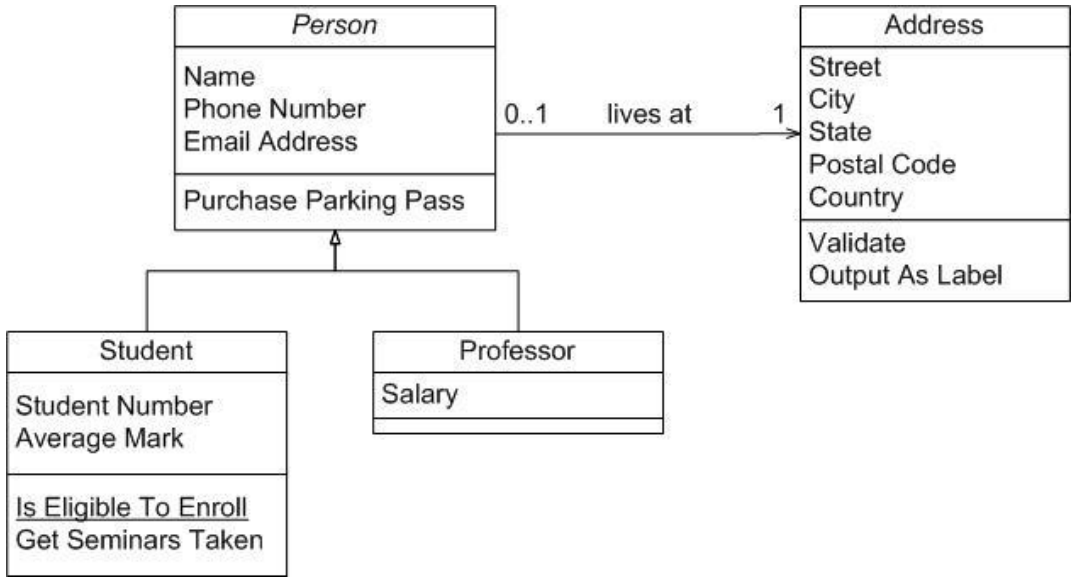
Program = Algoritma + Struktur Data



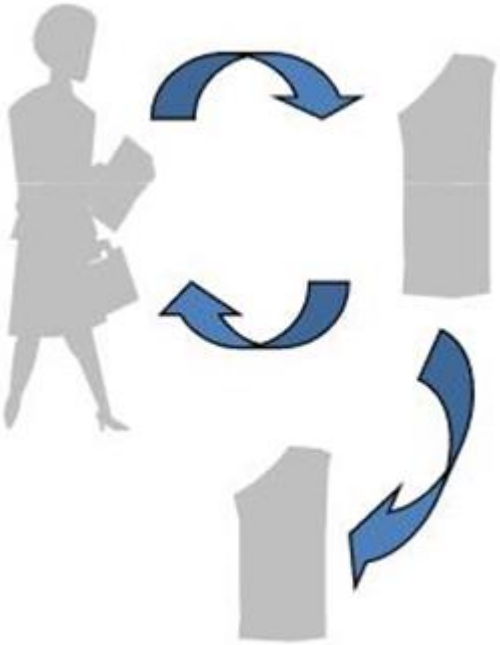
Skema arsitektur mesin Von Neumann

Paradigma Berorientasi Objek

- Didasari oleh **konsep objek**
- Sebuah objek mempunyai **atribut** (kumpulan sifat) dan mempunyai **kelakuan** (kumpulan reaksi, metoda)
- **Kelas** adalah cetak biru dari objek-objek dengan atribut dan kelakuan yang sama



Paradigma Prosedural



Withdraw, deposit, transfer

Paradigma Berorientasi Objek

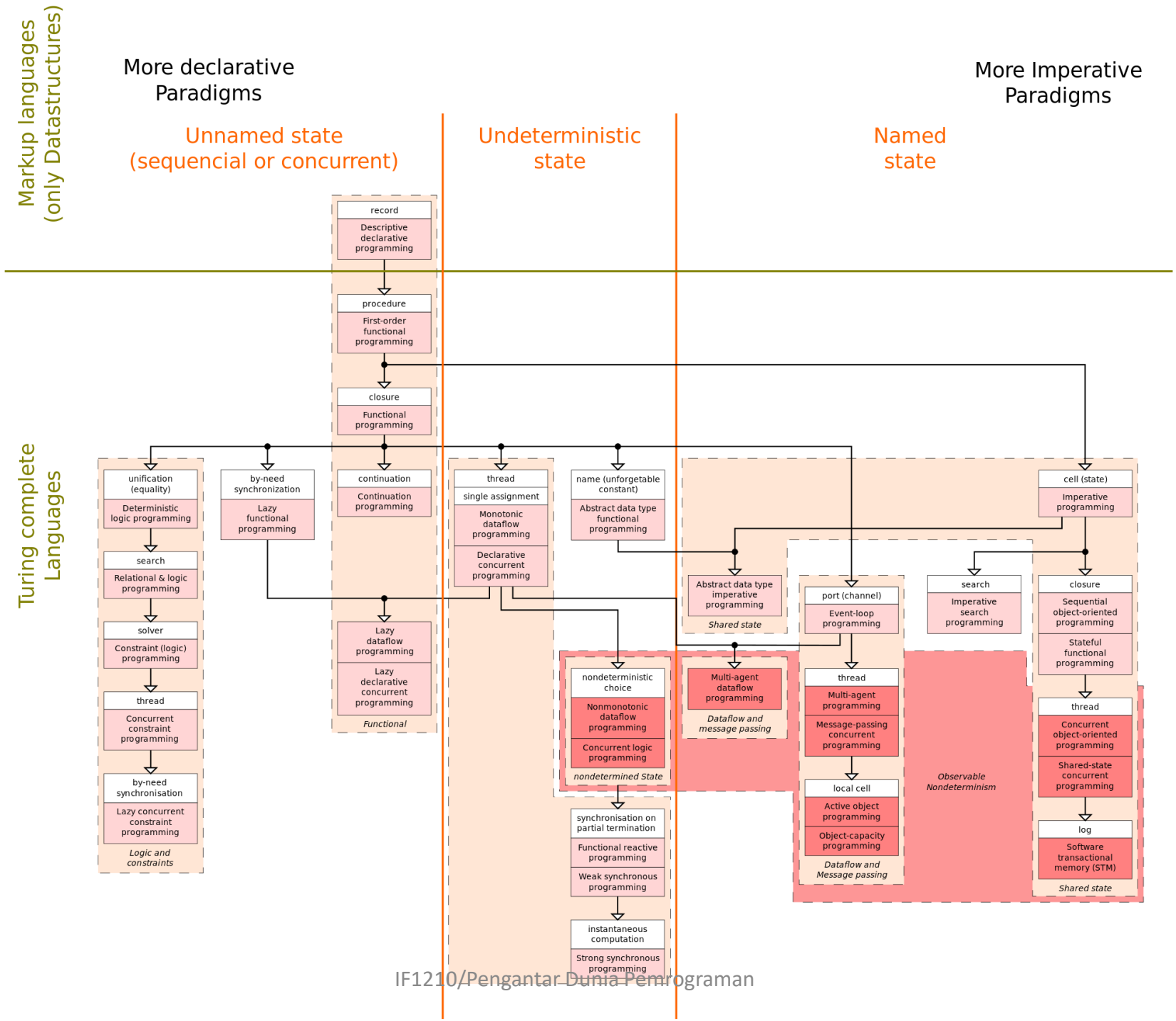
Customer, money, account

Paradigma Deklaratif

Paradigma Relasional

Paradigma konkuren

Paradigma Event-Driven


Markup languages (only Datastructures)
Turing complete Languages
More declarative Paradigms
More Imperative Paradigms
Unnamed state (sequencial or concurrent)
Undeterministic state
Named state
record
Descriptive declarative programming
procedure
First-order functional programming
closure
Functional programming
unification (equality)
Deterministic logic programming
search
Relational & logic programming
solver
Constraint (logic) programming
thread
Concurrent constraint programming
by-need synchronisation
Lazy concurrent constraint programming
Logic and constraints
by-need synchronization
Lazy functional programming
continuation
Continuation programming
Lazy dataflow programming
Lazy declarative concurrent programming
Functional
thread
single assignment
Monotonic dataflow programming
Declarative concurrent programming
name (unforgetable constant)
Abstract data type functional programming
nondeterministic choice
Nonmonotonic dataflow programming
Concurrent logic programming
nondetermined State
synchronisation on partial termination
Functional reactive programming
Weak synchronous programming
instantaneous computation
Strong synchronous programming
Abstract data type imperative programming
Shared state
Multi-agent dataflow programming
Dataflow and message passing
port (channel)
Event-loop programming
thread
Multi-agent programming
Message-passing concurrent programming
local cell
Active object programming
Object-capacity programming
Dataflow and Message passing
search
Imperative search programming
Observable Nondeterminism
cell (state)
Imperative programming
closure
Sequential object-oriented programming
Stateful functional programming
thread
Concurrent object-oriented programming
Shared-state concurrent programming
log
Software transactional memory (STM)
Shared state

Paradigma fungsional

- Haskell, LISP, Scheme, Erlang, Scala, Miranda, …

Paradigma Prosedural

- Basic, C, Pascal, Ada, Fortran, COBOL, …

Paradigma berorientasi objek

- Eiffel, SmallTalk, Java, C++, C#, …

Paradigma relasional

- SQL

Paradigma deklaratif

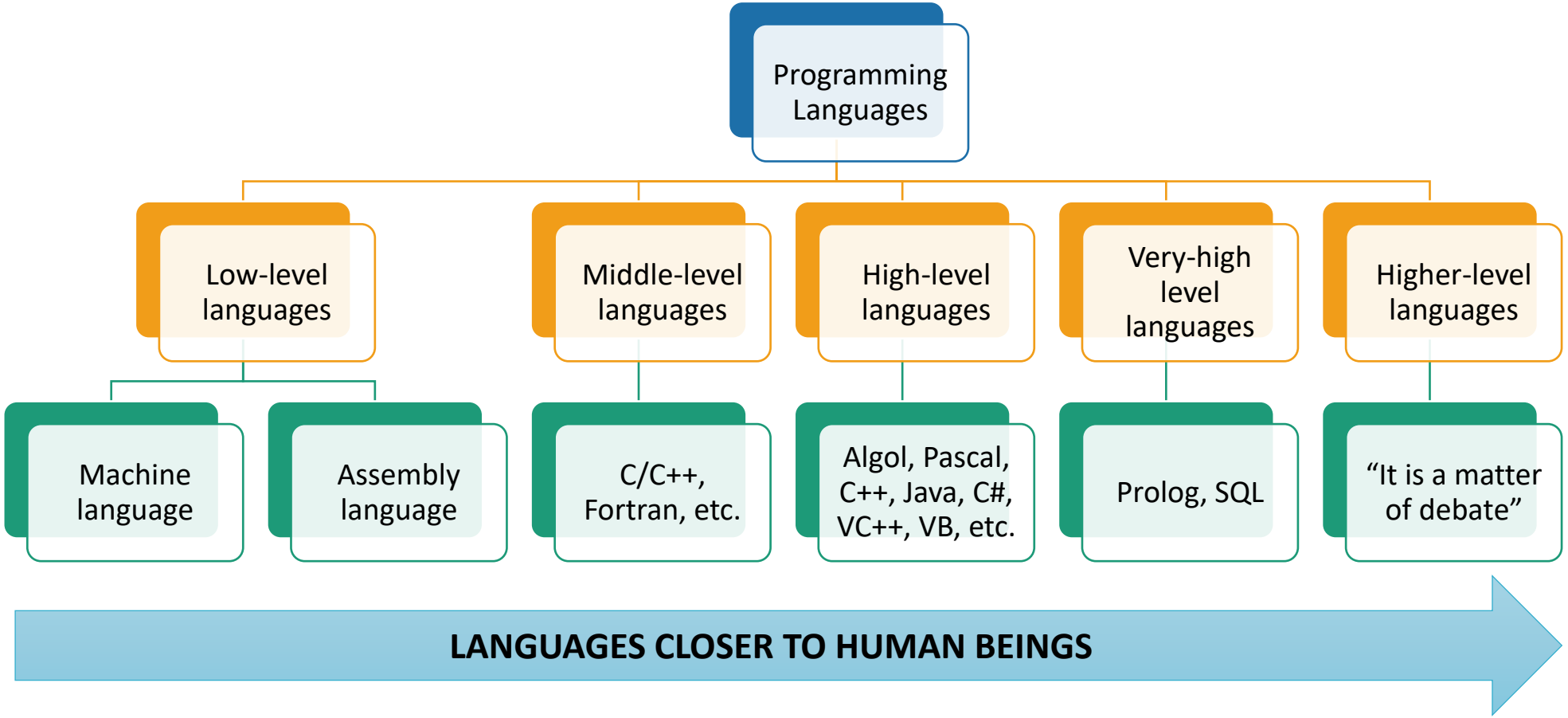
- Prolog

Multi-paradigm

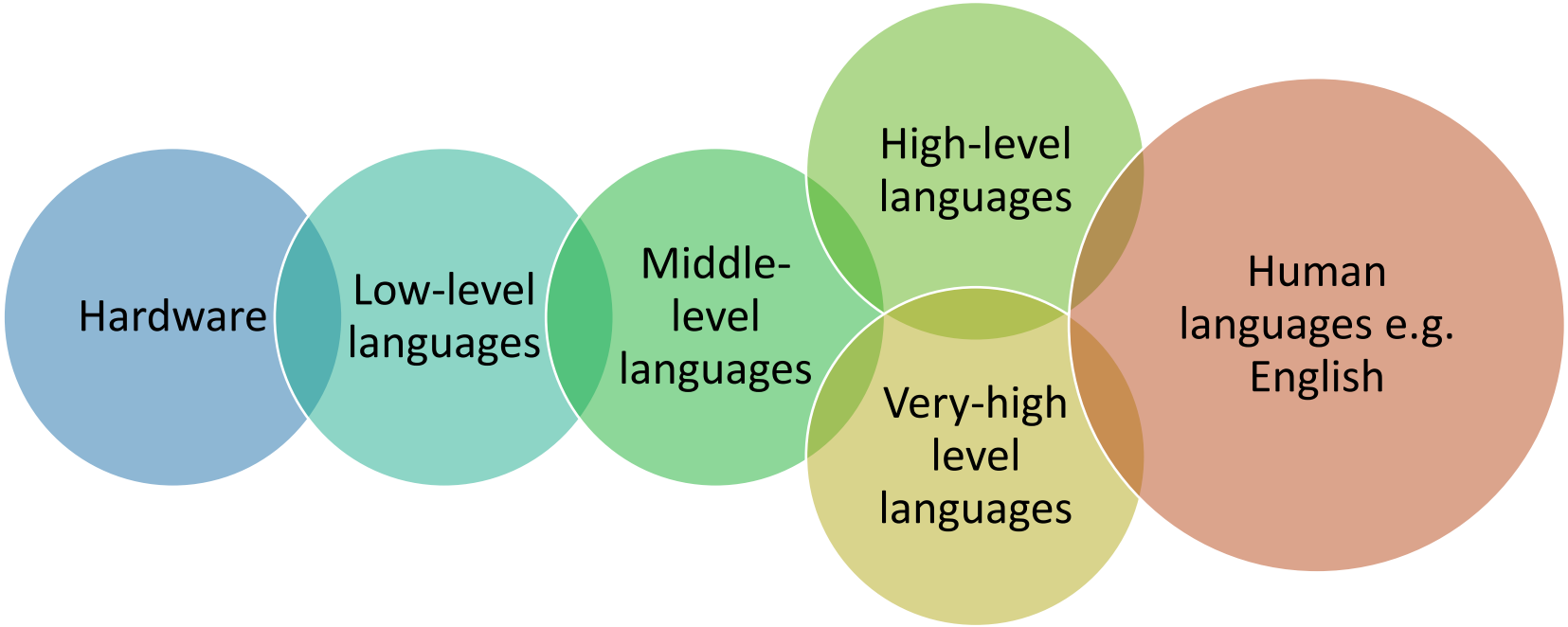
- Java, Python

Bahasa Pemrograman

Taksonomi Bahasa Pemrograman

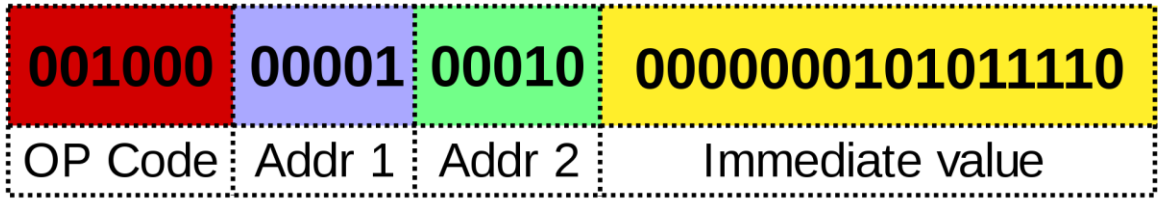


Overlapping of Languages



Machine Language

MIPS32 Add Immediate Instruction



Machine code

Equivalent mnemonic: **addi $r1 , $r2 , 350**

Efficient code for the machine

Fast processing

Hardware/ machine dependent

Tedious and error prone

Difficult to use or debug, to understand

Assembly Language

Language Code (Machine) (16-BIT INSTRUCTION SET)	*Assembly Language Code (Equivalent)*			
1000000100100101	LOAD	R1	5	
1000000101000101	LOAD	R2	5	
1010000100000110	ADD	R0	R1	R2
1000001000000110	SAVE	R0	6	
1111111111111111	HALT			

- Efficient code for the machine
- Fast processing
- Easier to understand, to debug, to modify compared to machine language
- Need at translator for the execution of the program
- Hardware/machine dependent
- Used for specific applications

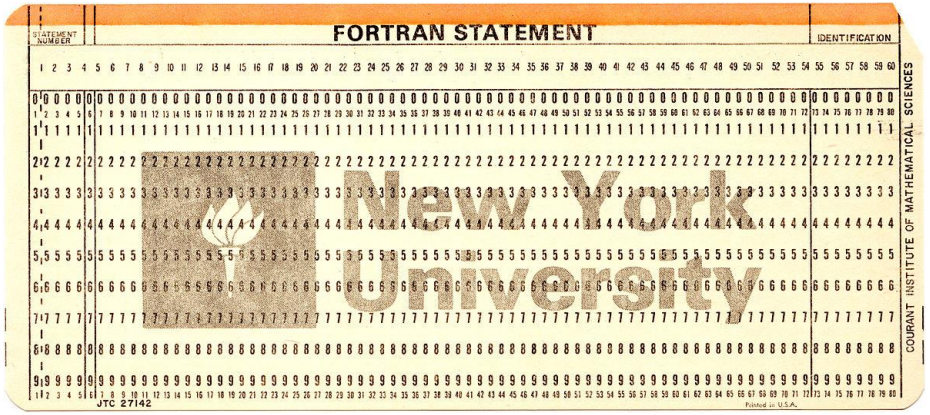
Middle-Level Languages

Bridge the gap of high-level and low-level languages

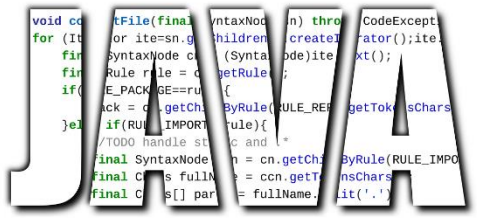
Need more technical skills compared to the high-level language

Providing a small set of controlling and data-manipulating instructions

THE C PROGRAMMING LANGUAGE



High Level Languages



Problem-oriented languages

Easy to use, to understand, to debug

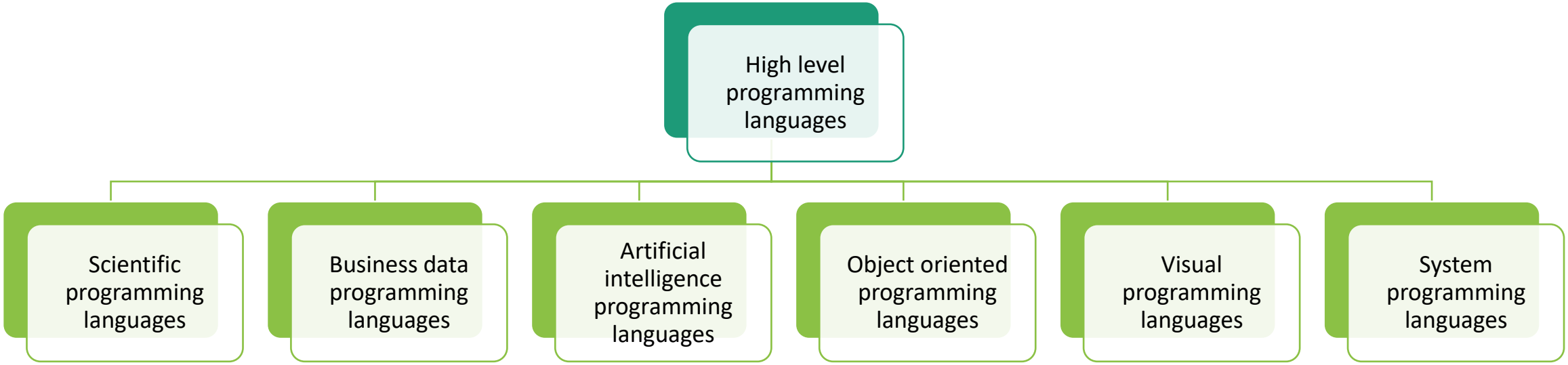
Portable, machine independent

User friendly, easy to write programs

Need a translator to machine level

Less efficient

High Level Programming Languages



Very High Level Languages

4GL, mostly non procedural

the users and the developers to describe the results they need

Multiply the numbers A and B

And put the result into C

Examples:

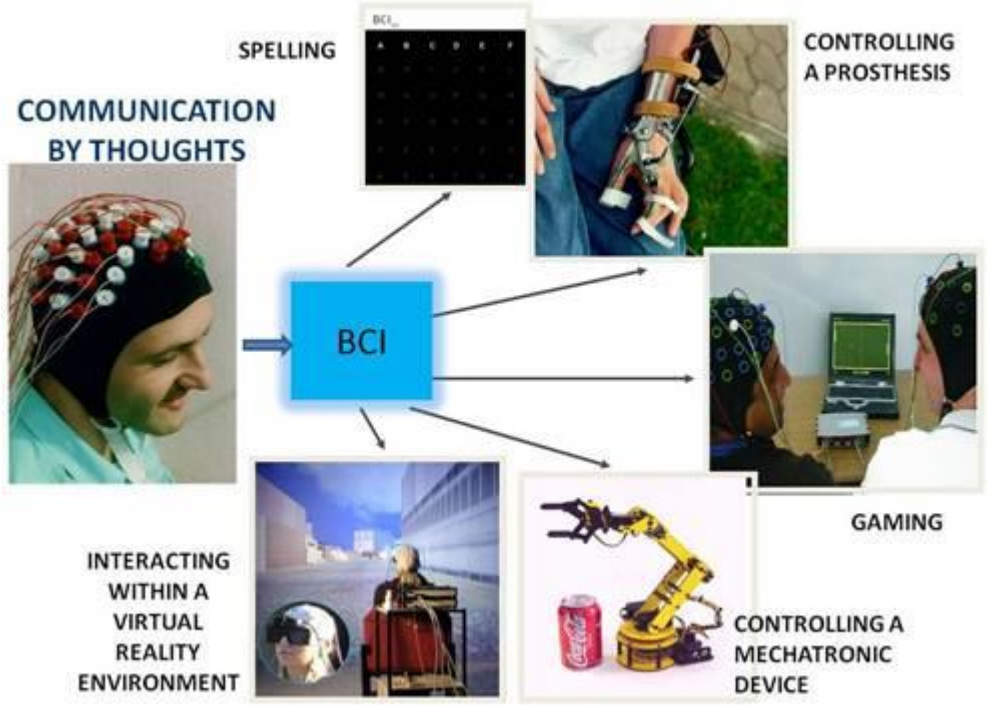
Wolfram Mathematica

Oracle 4GE

Higher Level Prog. Languages???

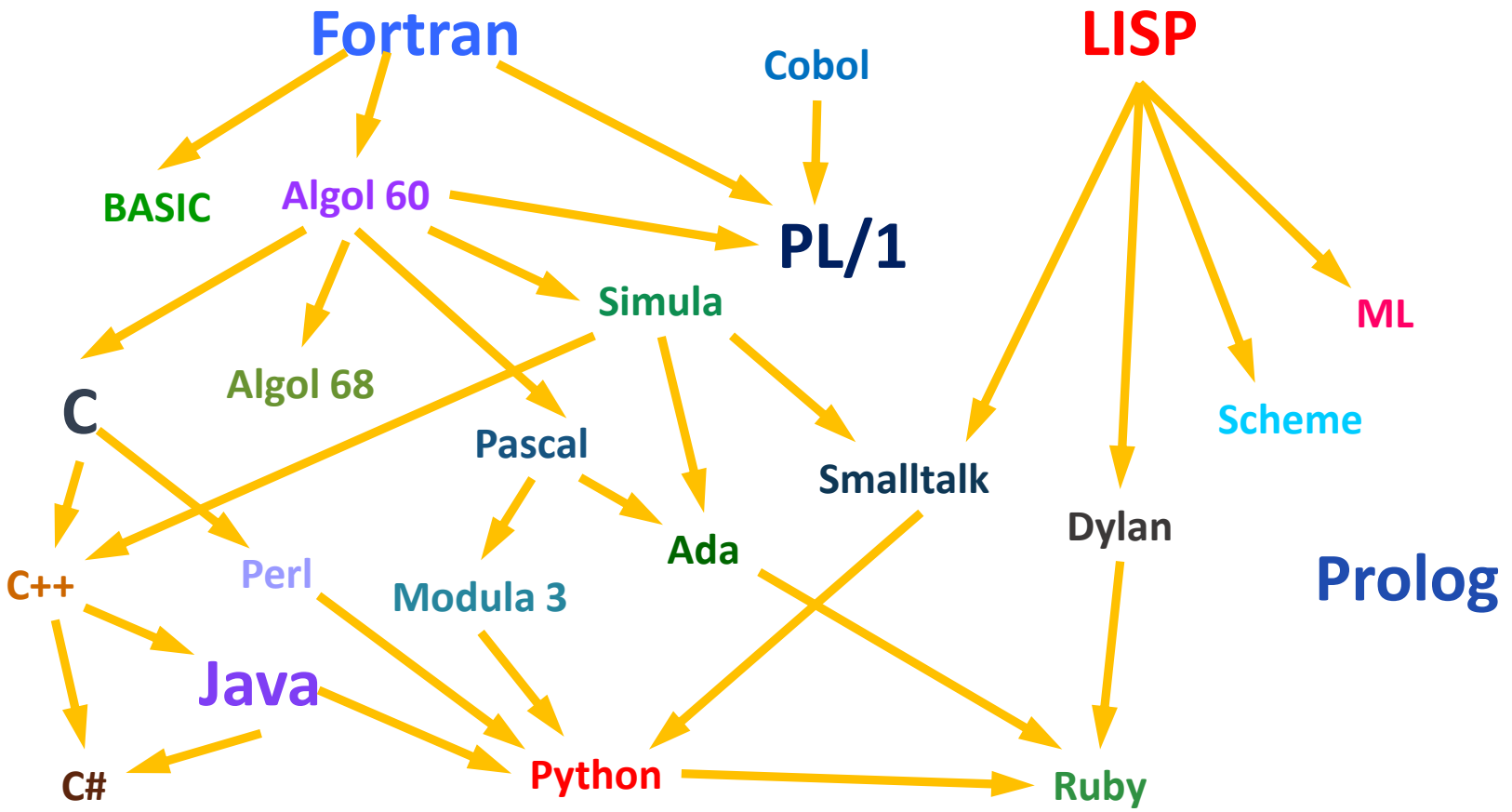
5GL → yet to come

Interface between human being and machine to permit effective use of natural language and image



Brain Computer Interface

Intermezzo…
A family tree of languages



Intermezzo

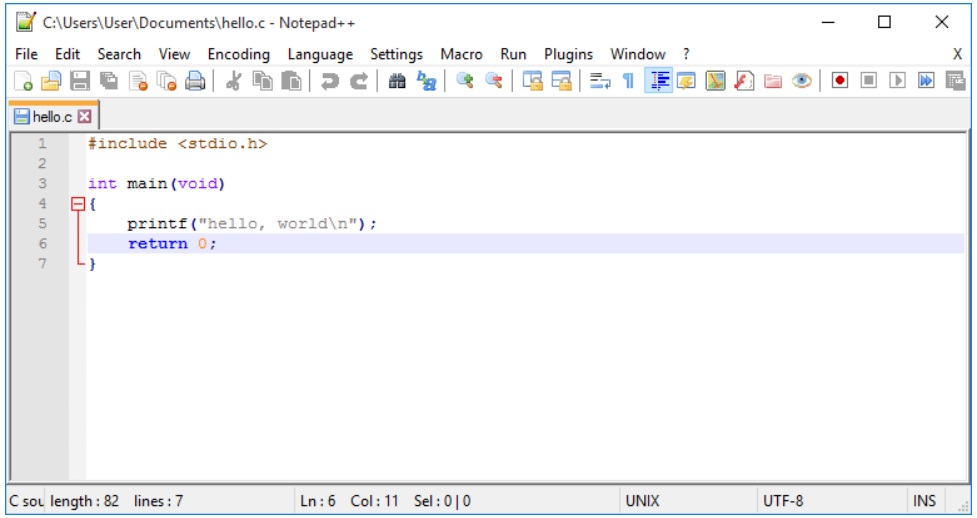
- Bahasa pemrograman **Pascal** diberi nama berdasarkan matematikawan dan filosofer Perancis, Blaise Pascal
- Bahasa pemrograman **Ada** diberi nama berdasarkan Ada Lovelace
- Bahasa pemrograman **C** merupakan pengembangan dari bahasa pemrograman **B**
- Bahasa **Java** asalnya diberi nama *Oak* (dari pohon ek yang berdiri di depan kantor pembuatnya), lalu diubah menjadi *Green*, lalu baru menjadi *Java* (dari *Java coffee*, yang banyak diminum oleh para pembuatnya)
- Nama Bahasa **Python** adalah *tribute* ke grup pelawak Britania, Monty Python.
  - *Therefore: "An important goal of Python's developers is keeping it fun to use"*

Aspek-Aspek Lain Pemrograman

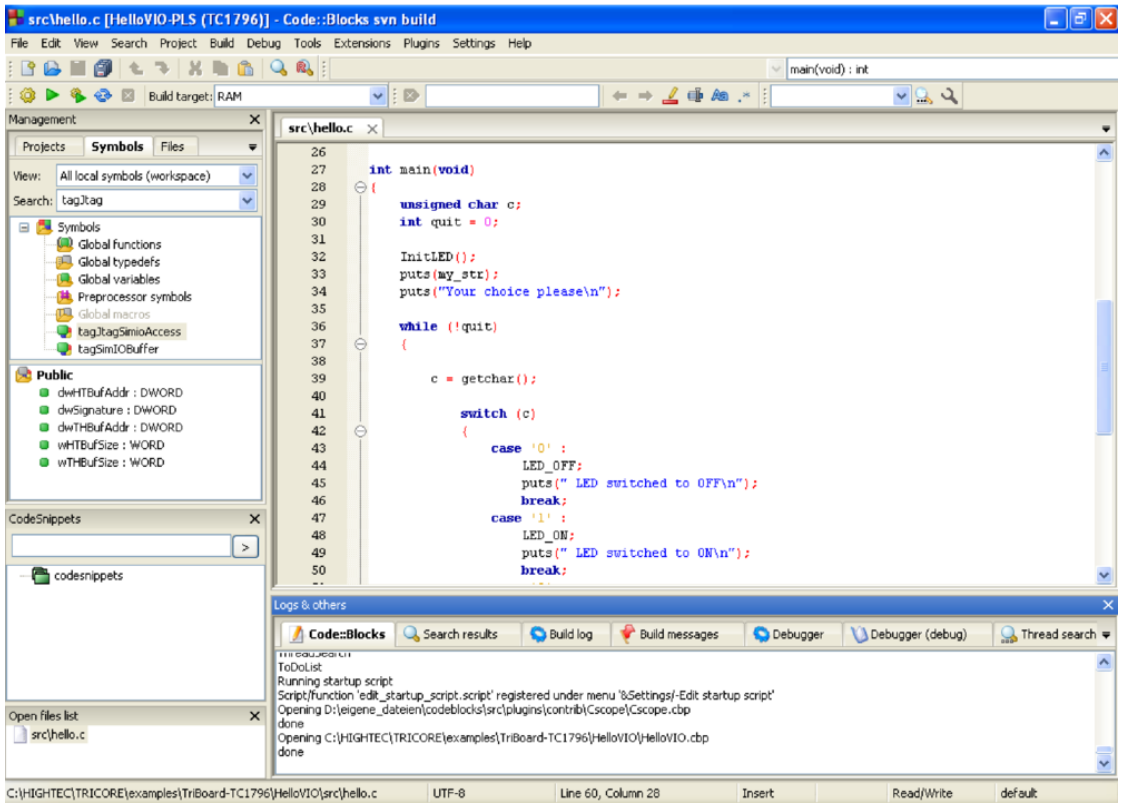
Artefak utama

Source code [+dokumentasi]

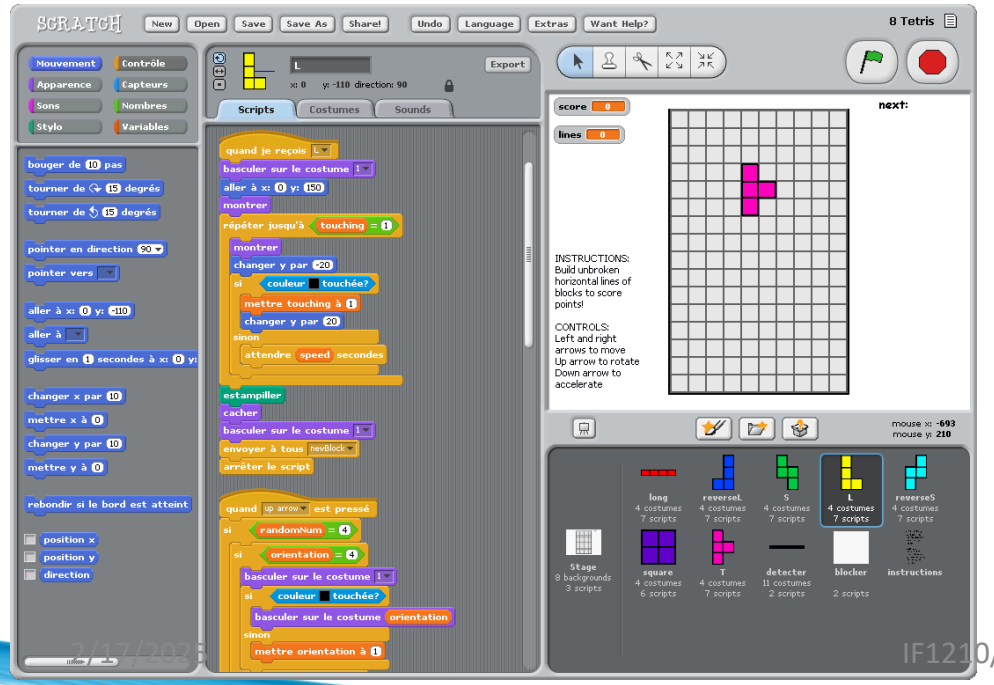
Lingkungan Pemrograman: Editor Source Code



Text editor

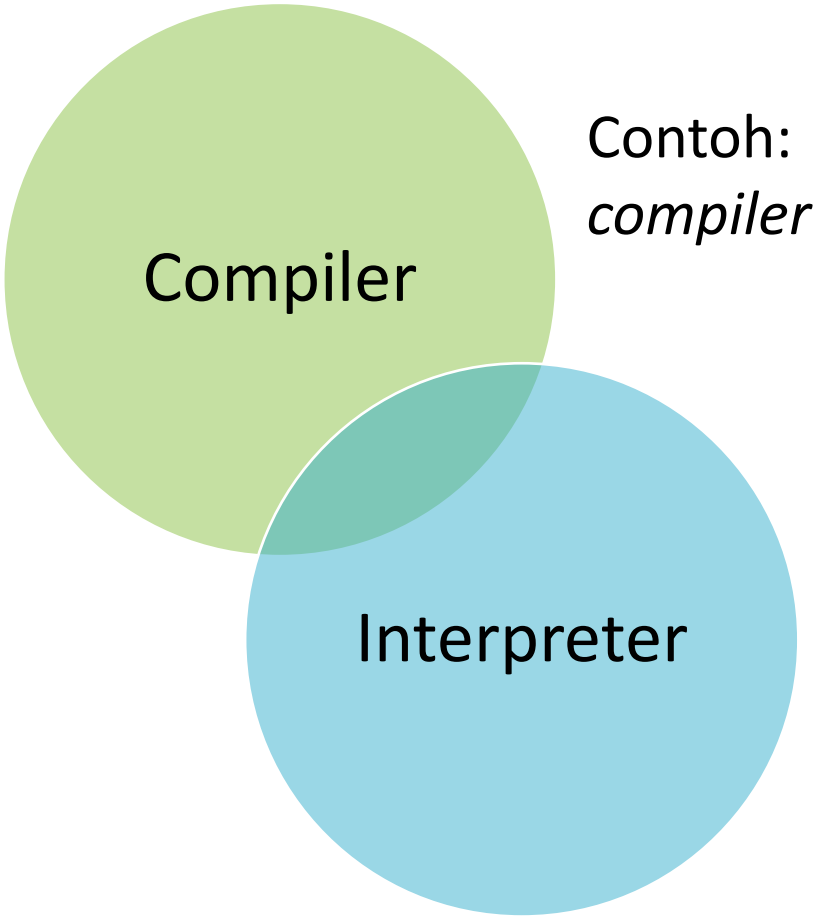


Contoh IDE: Code::Blocks



Visual programming

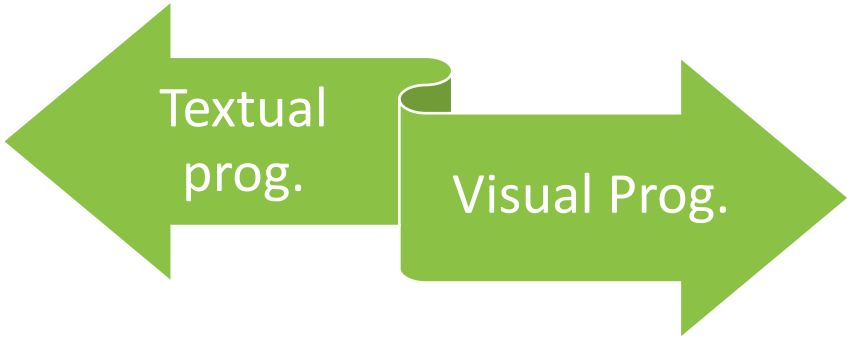
Lingkungan Pemrograman: Pemroses Bahasa

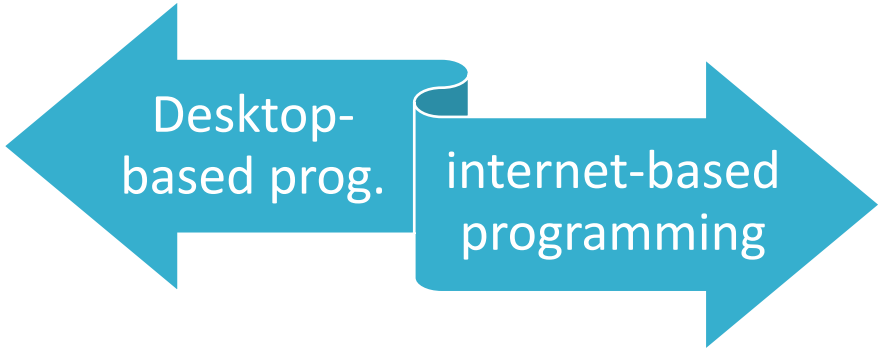


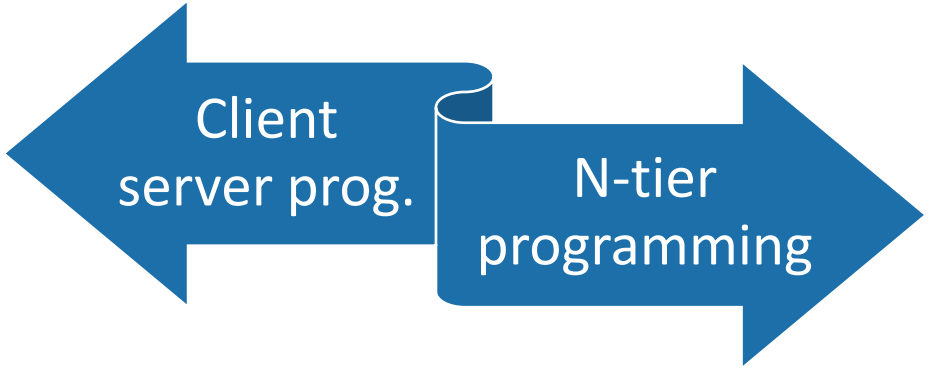
Contoh:
compiler Pascal, *compiler* C

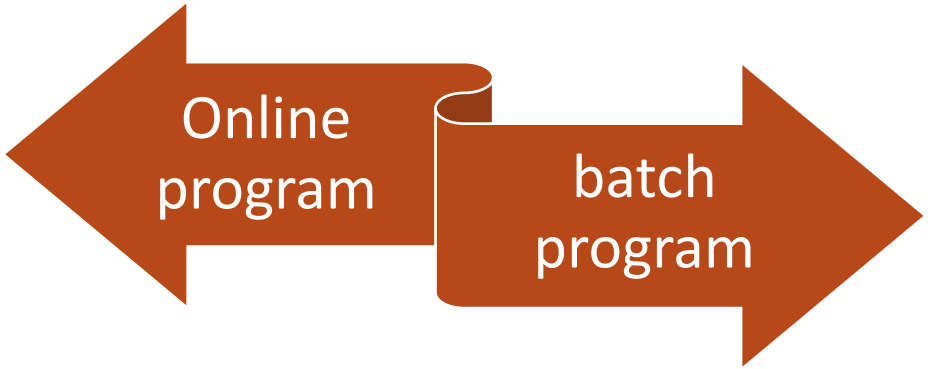
Contoh:
interpreter Python, interpreter Haskell

Berbagai Area Pemrograman









Skala program [relative]

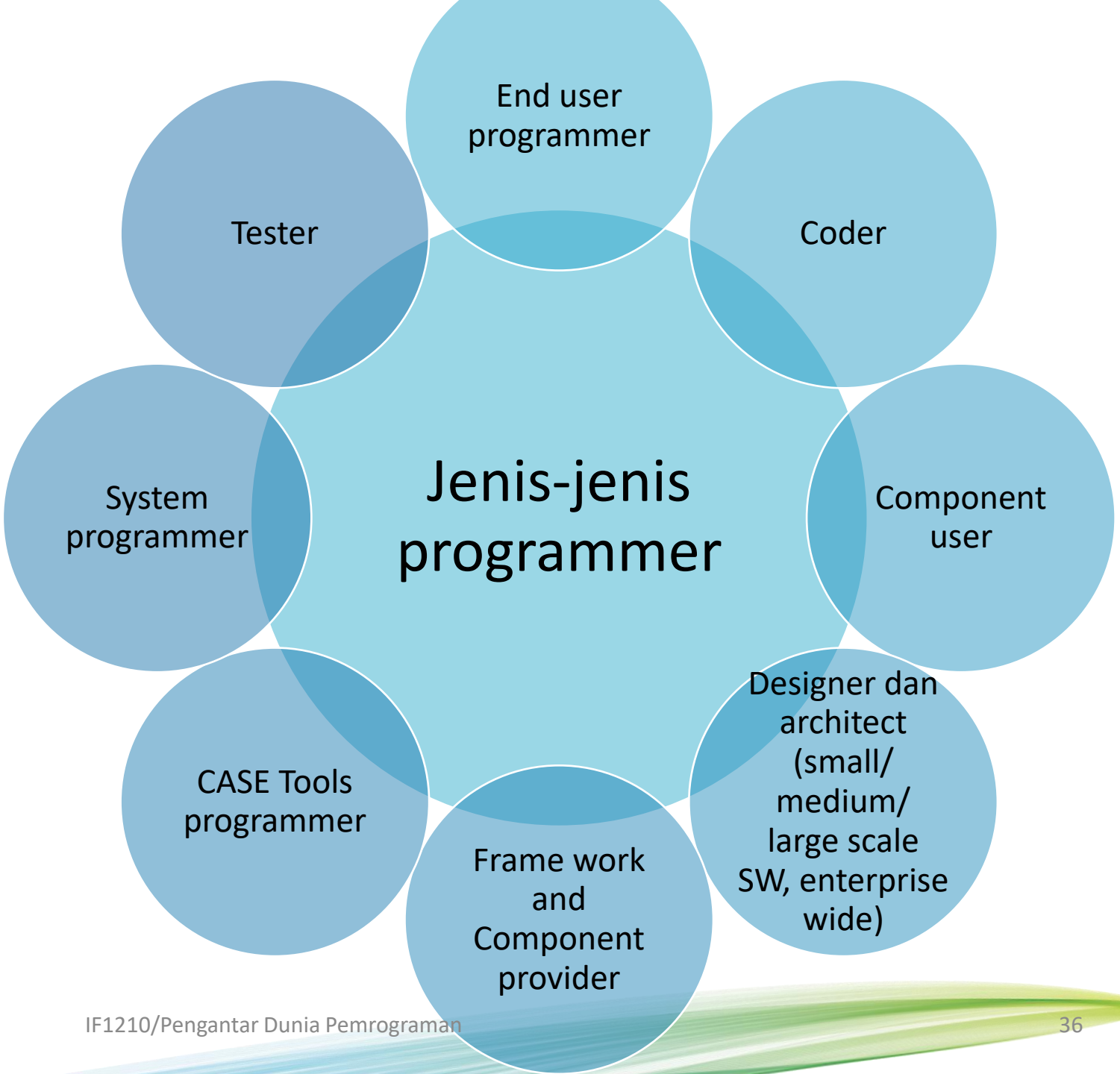
- Program skala kecil
- Program sedang
- Program besar

Kompleksitas program

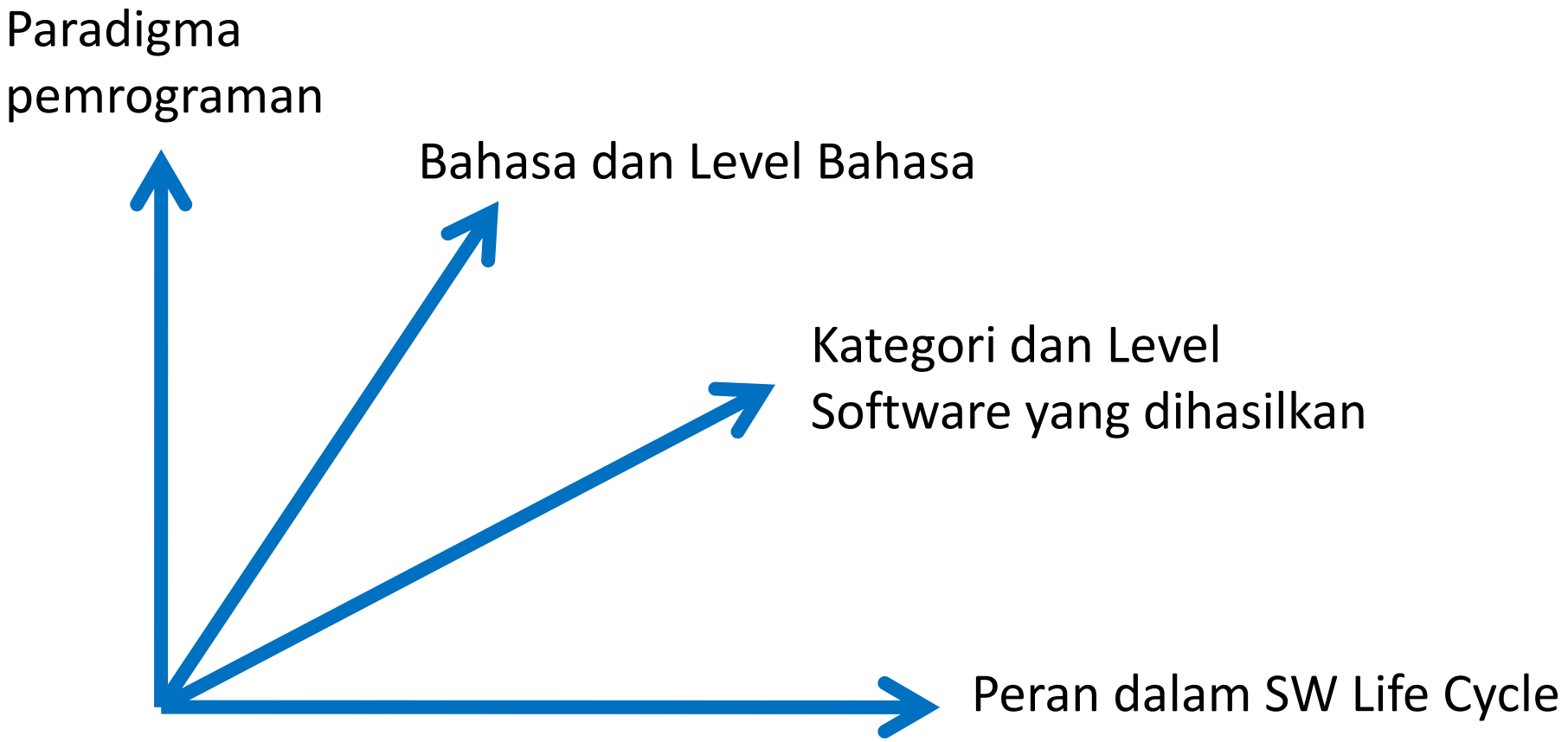
- Algoritma dasar
- Algoritma lanjut
  - Dynamic programming
  - Branch and bound
  - Advanced search
  - Advanced data structure

Kategori Persoalan Pemrograman

- mudah dikerjakan (*tractable*) dengan solusi yang efisien dalam waktu yang wajar
- tidak mudah dikerjakan (*intractable*)
- dapat diselesaikan dengan pendekatan tetapi tidak optimal (*solvable aproximately, but not optimally*)
- belum memiliki solusi yang efisien
- tidak dapat diselesaikan (*not solvable)*


Jenis-jenis programmer
End user programmer
Coder
Component user
Designer dan architect (small/ medium/ large scale SW, enterprise wide)
Frame work and Component provider
CASE Tools programmer
System programmer
Tester

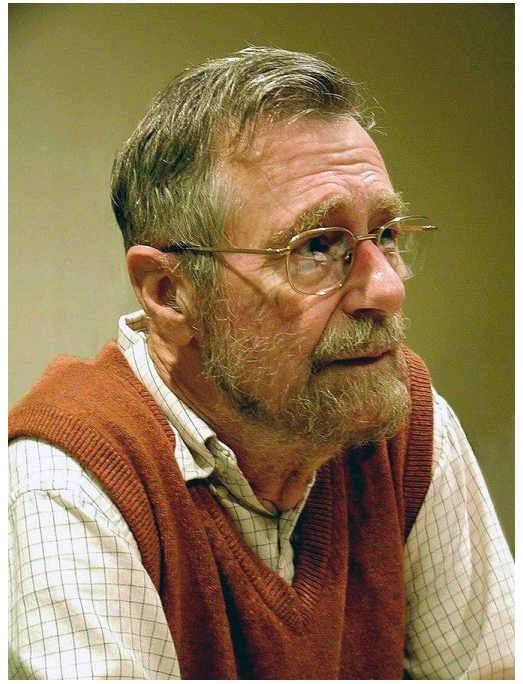
Taksonomi Programmer



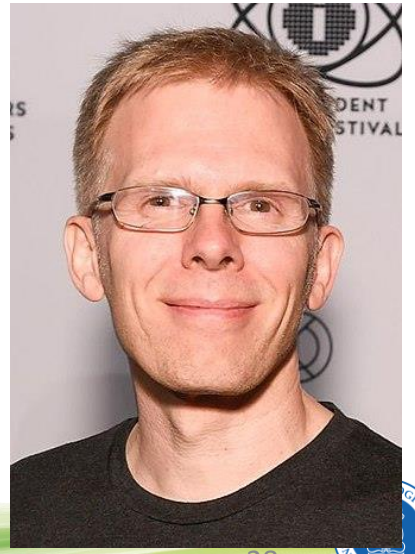
Level Programmer ☺

- Dead Programmer:
  - Dijkstra, Kay
- Successful Programmer:
  - Gates, Carmack, DHH
- Famous Programmer
- Working Programmer
- Average Programmer
- Amateur Programmer
- Unknown Programmer
- Bad Programmer

David Heinemeier Hansson



Edsger Djikstra



John D. Carmack

https://blog.codinghorror.com/the-eight-levels-of-programmers/

Pemrograman dan Software Engineering

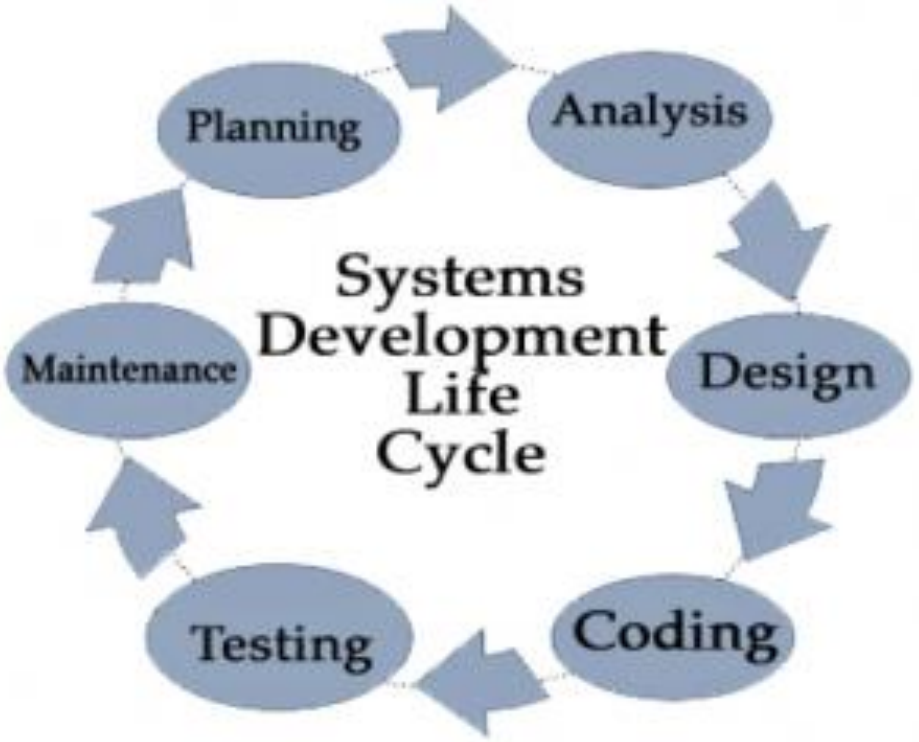
Definisi formal ***software engineering***:

> *"the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software"*
>
> IEEE Standard Glossary of Software Engineering Terminology," IEEE std 610.12-1990, 1990

Pemrograman adalah bagian dalam proses *software engineering* (rekayasa perangkat lunak)

Software Engineering Life Cycle

- Requirement analysis
- Software analysis and design
  - Kegiatan pemrograman: Analisis dan penentuan spesifikasi program
- Implementation (coding and debugging)
  - Kegiatan pemrograman: coding dan debugging
- Unit and component testing
  - Kegiatan pemrograman: testing
- Integration and System testing
- Maintenance

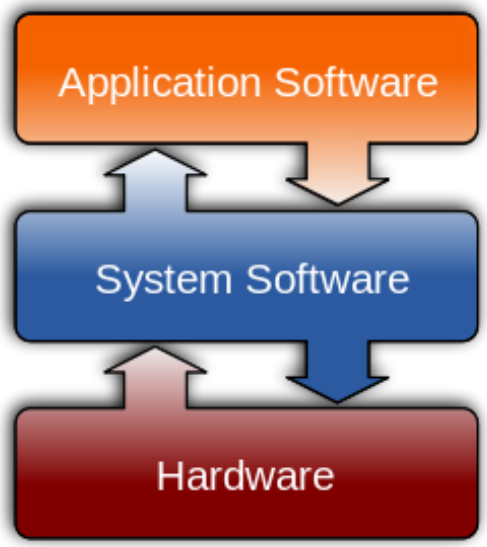


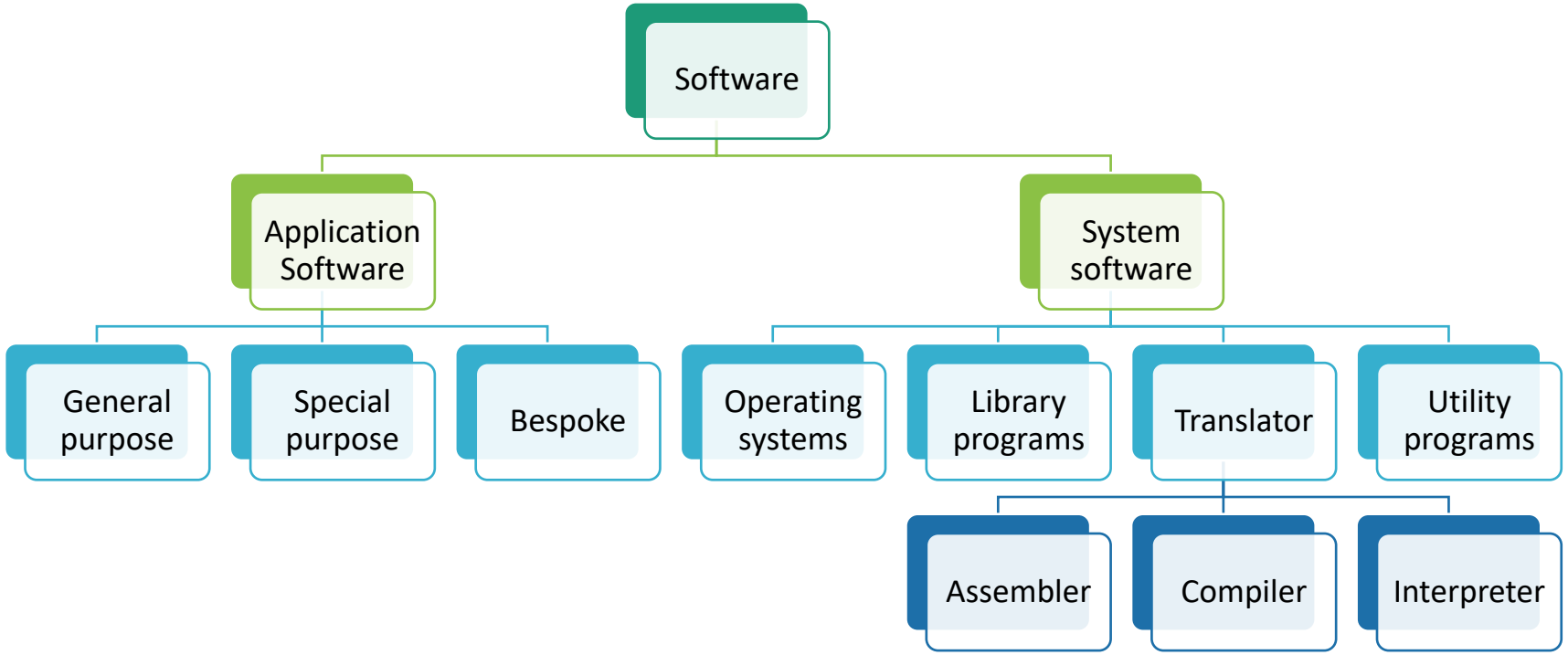
Software diibaratkan pencakar langit

VS

Program [kecil] diibaratkan rumah kecil

Kategori Software

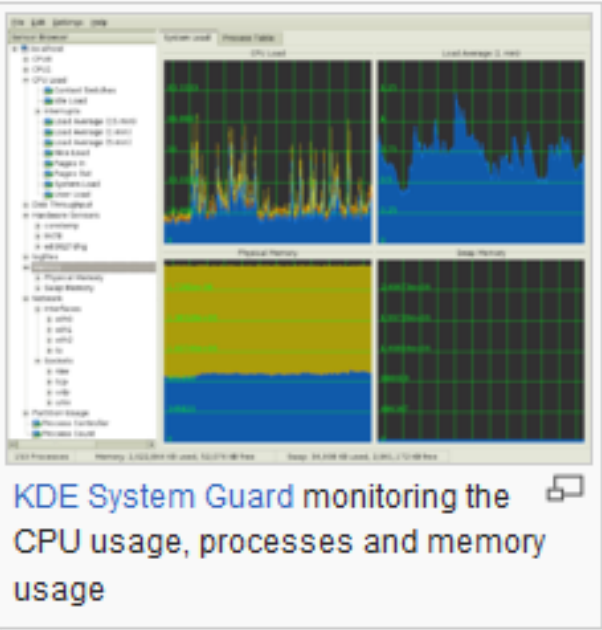




http://en.wikibooks.org/wiki/A-level_Computing/AQA/Computer_Components,_The_Stored_Program_Concept_and_the_Internet/Fundamentals_of_Computer_Systems/Classification_of_software

SYSTEM SOFTWARE

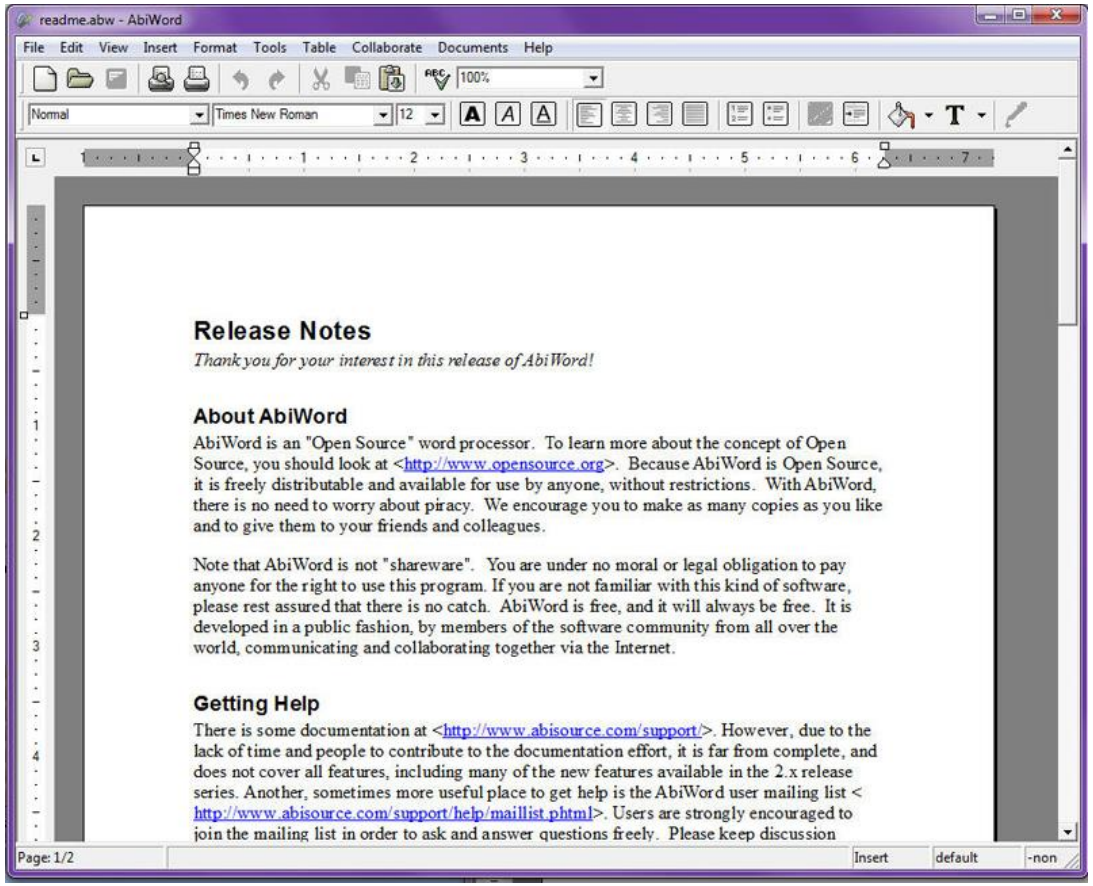
Xfce Graphical User Interface to a Linux operating system

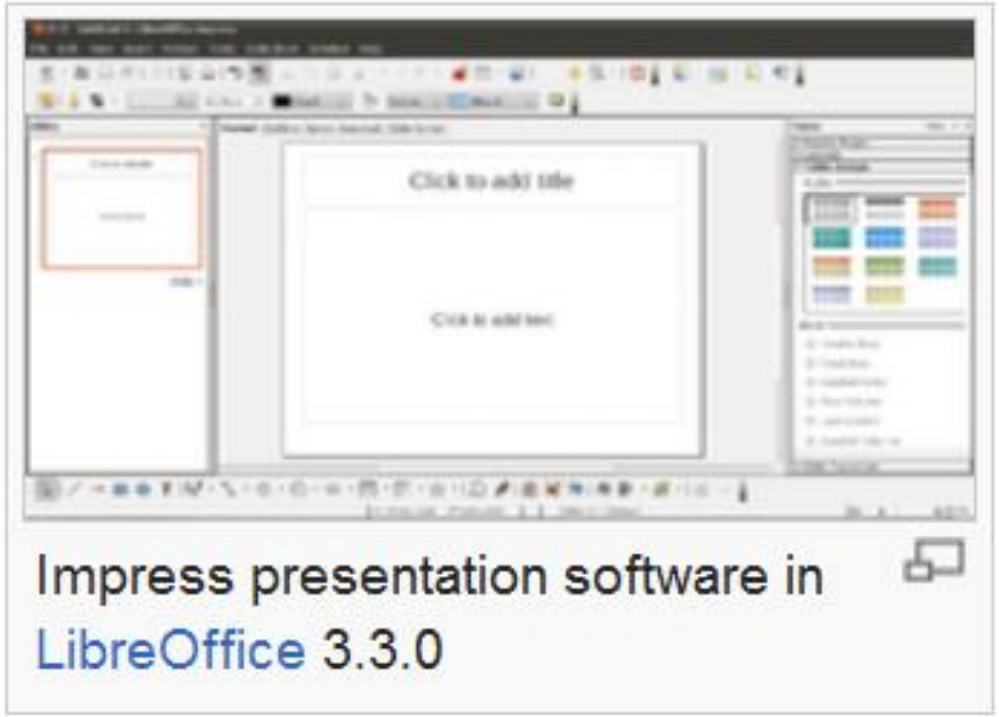


KDE System Guard monitoring the CPU usage, processes and memory usage

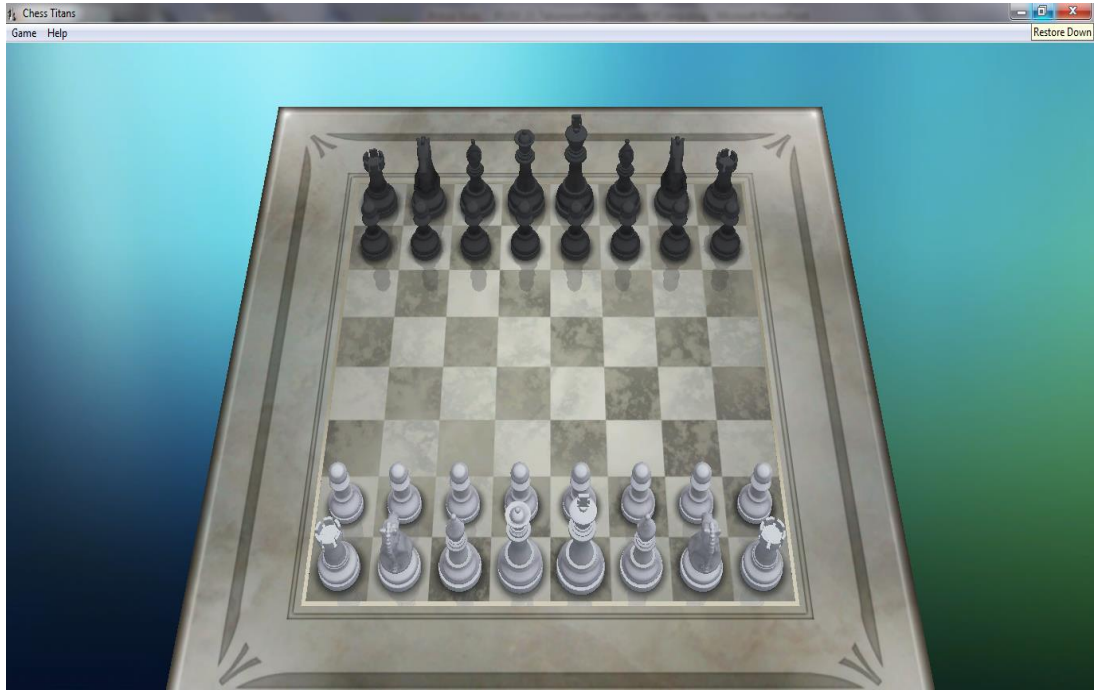
Illustration of an application which uses libvorbisfile to play an Ogg Vorbis media file

General Purpose Software





Special Purpose Software



Bespoke Software