SWCON201
Opensource & Software
Development Methods and Tools

Design by Figures

Department of
Software Convergence

경희대학교
KYUNG HEE UNIVERSITY

Contents

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- Class
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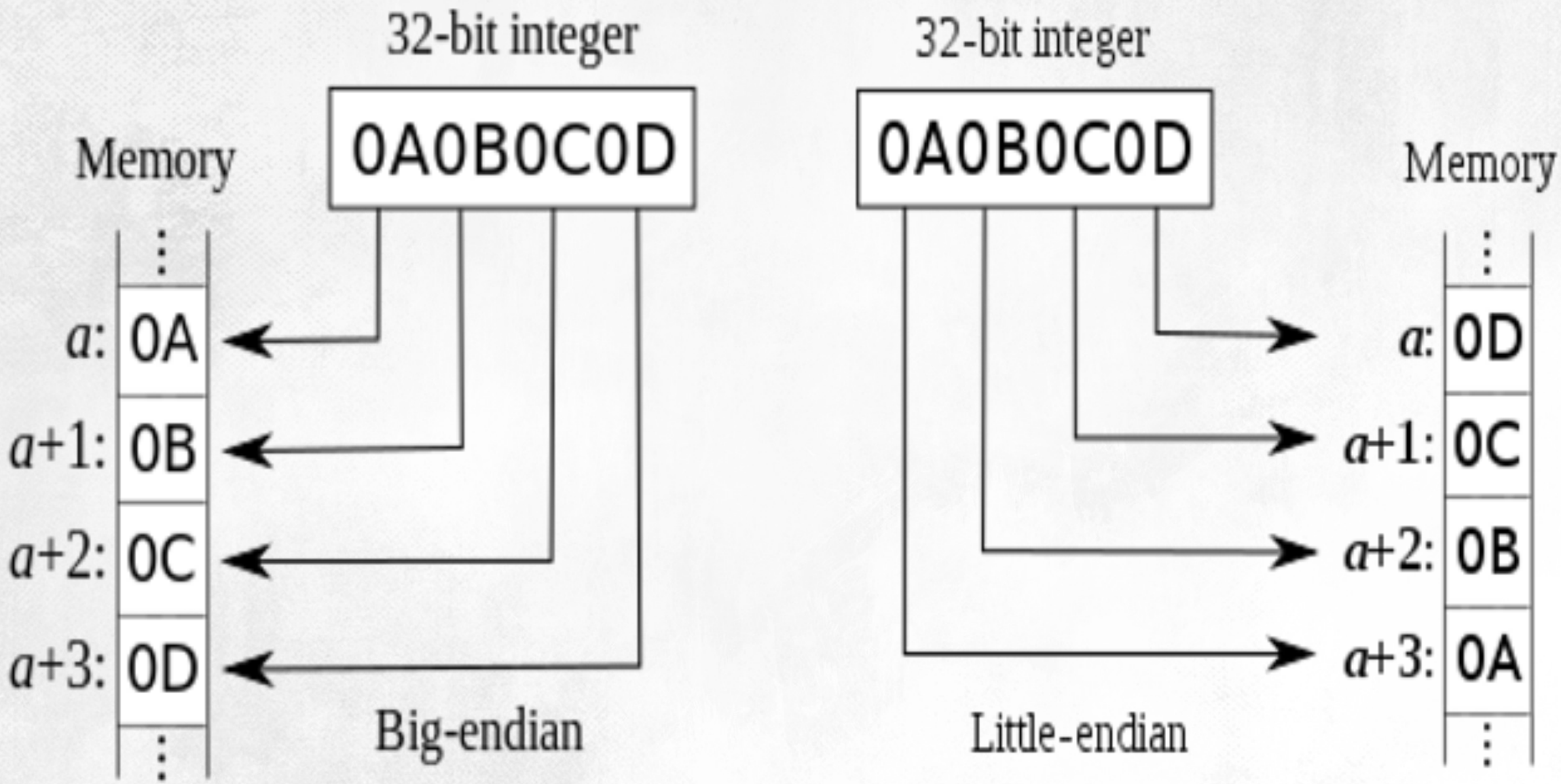
- Reference
- Homework

Agenda

- Drawing figures in SW development:
  - When did you?
  - What kind of figures?
  - What purpose?
  - What tools?

Structure of Data (Multiple-Byte operation)



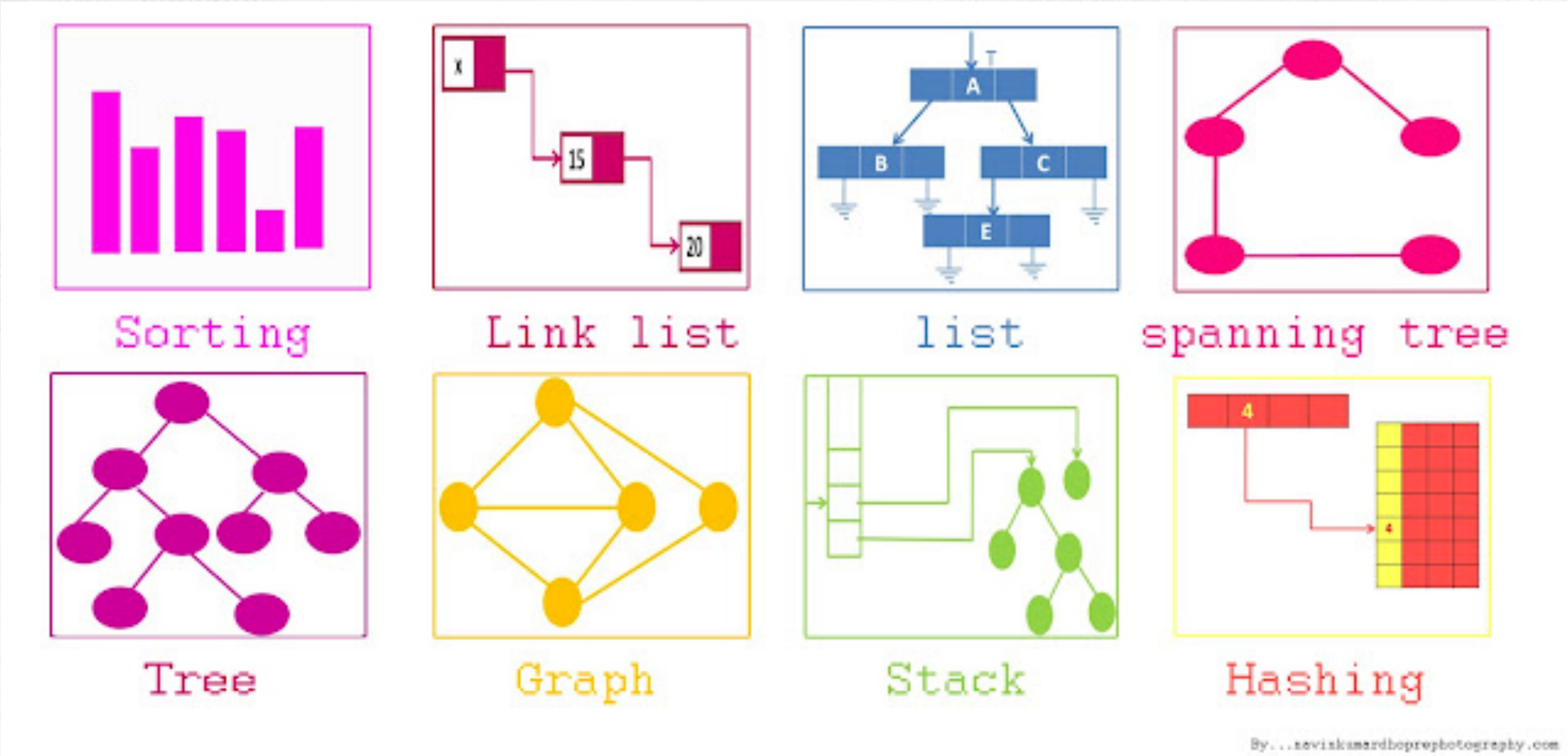
Reference: https://en.wikipedia.org/wiki/Endianness

Structure of Data (Data Structure)

- Data structure is a particular way of organizing data in a computer so that it can be used efficiently
- Data structures can implement one or more particular abstract data types (ADT), which are the means of specifying the contract of operations and their complexity

Reference: http://dnavinkumar.blogspot.com/p/blog-page.html

Structure of Data (Data Structure)



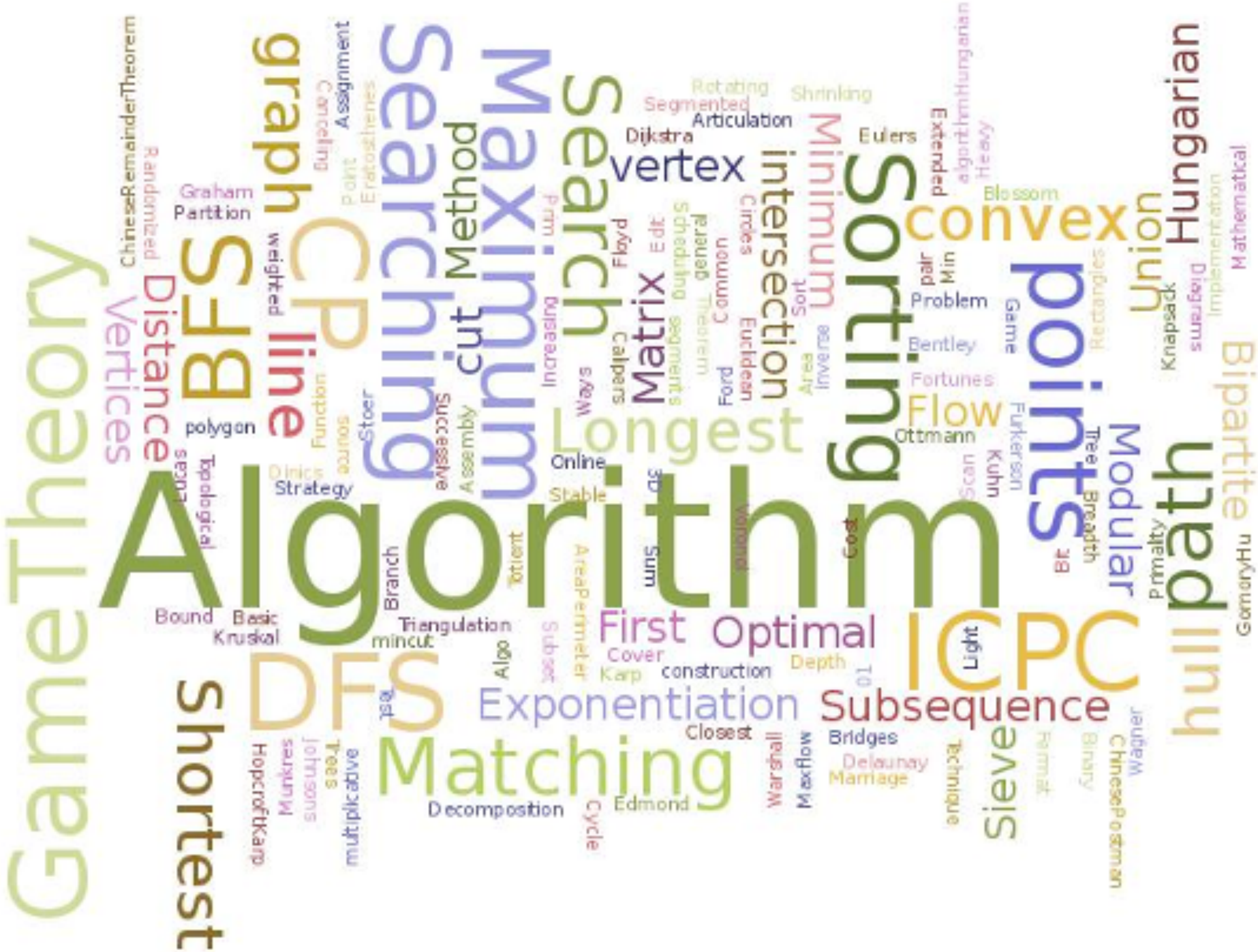
Reference: http://dnavinkumar.blogspot.com/p/blog-page.html

Processing of Data (Algorithm)

- Algorithm (/ˈælɡərɪðəm/ AL-gə-ridh-əm) is an unambiguous specification of how to solve a class of problems
- Algorithms can perform calculation, data processing and automated reasoning tasks

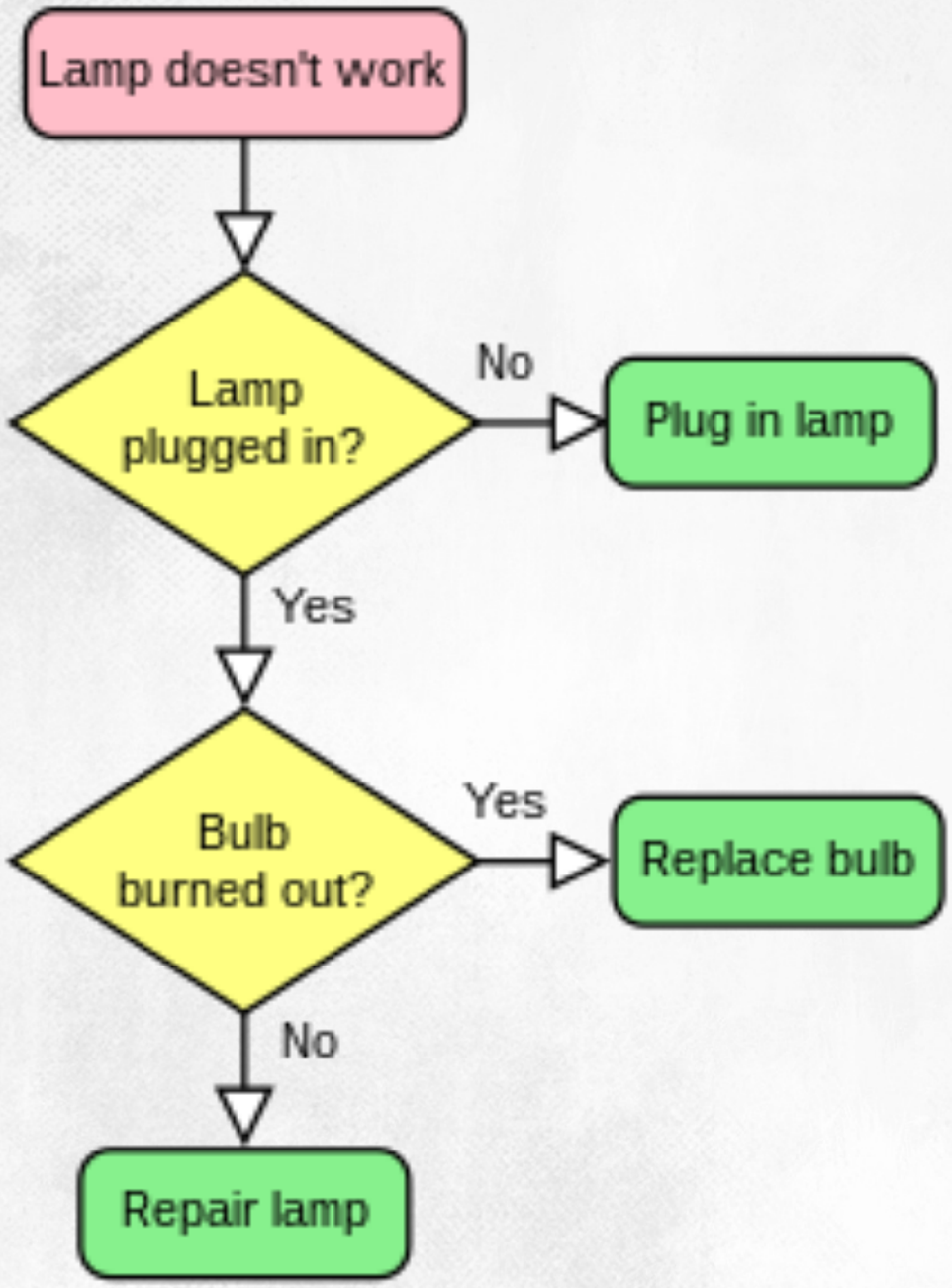
Reference: https://en.wikipedia.org/wiki/Algorithm

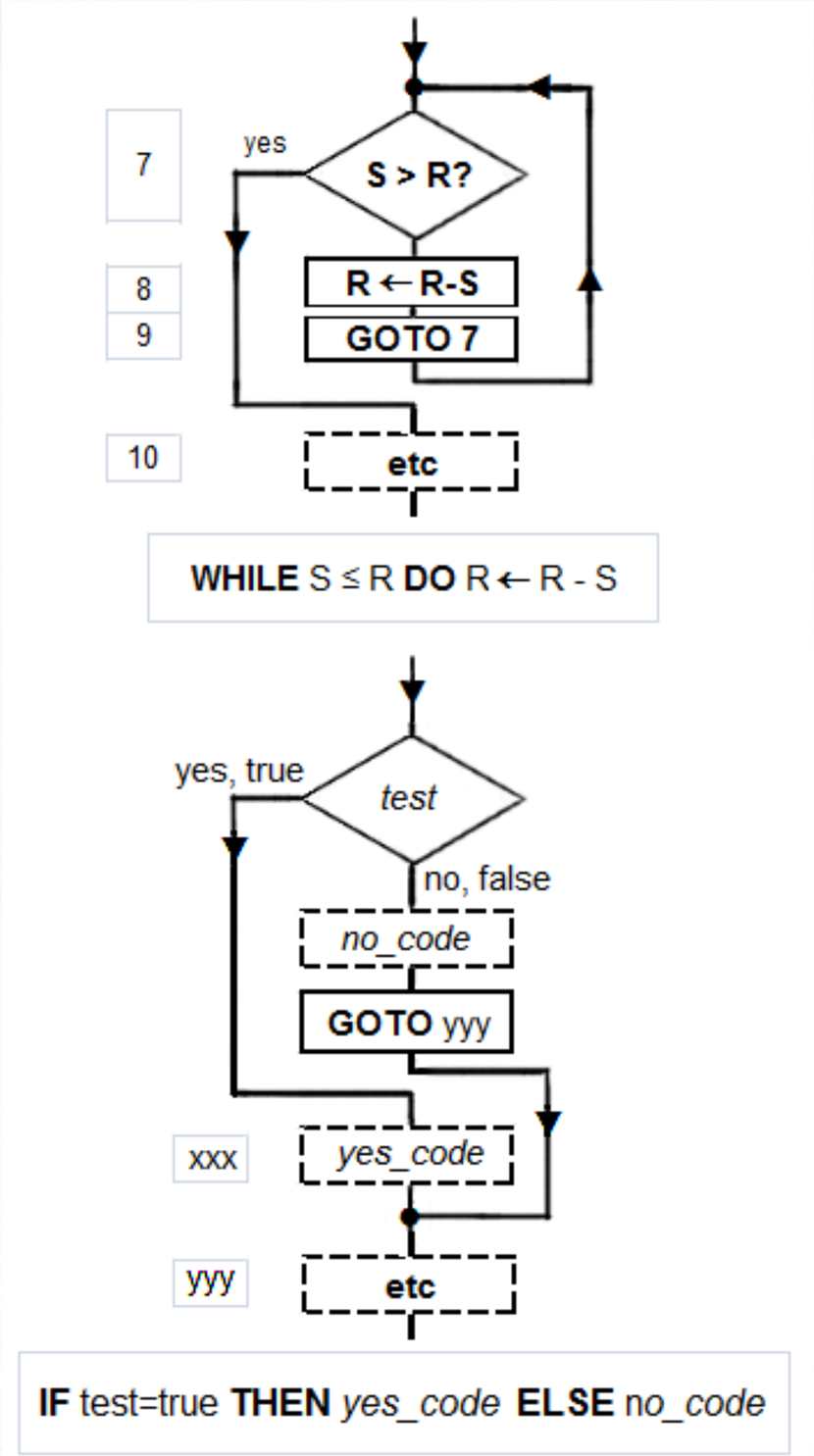
Processing of Data (Algorithm)



Reference: https://www.geeksforgeeks.org/top-algorithms-and-data-structures-for-competitive-programming

Representation of Algorithm (Flow-chart)





Reference: https://en.wikipedia.org/wiki/Flowchart

Representation of Algorithm (Flow-chart)

- A flowchart is a type of diagram that represents a workflow or process. A flowchart can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task.
- The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem.
- Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.

Reference: https://en.wikipedia.org/wiki/Flowchart

Representation of Algorithm (Pseudo-code)

```
algorithm ford-fulkerson is
    input: Graph G with flow capacity c,
           source node s,
           sink node t
    output: Flow f such that f is maximal from s to t

    (Note that f(u,v) is the flow from node u to node v, and c(u,v) is the flow capacity from node u to node v)

    for each edge (u, v) in G_E do
        f(u, v) ← 0
        f(v, u) ← 0

    while there exists a path p from s to t in the residual network G_f do
        let c_f be the flow capacity of the residual network G_f
        c_f(p) ← min{c_f(u, v) | (u, v) in p}
        for each edge (u, v) in p do
            f(u, v) ←  f(u, v) + c_f(p)
            f(v, u) ← -f(u, v)

    return f
```

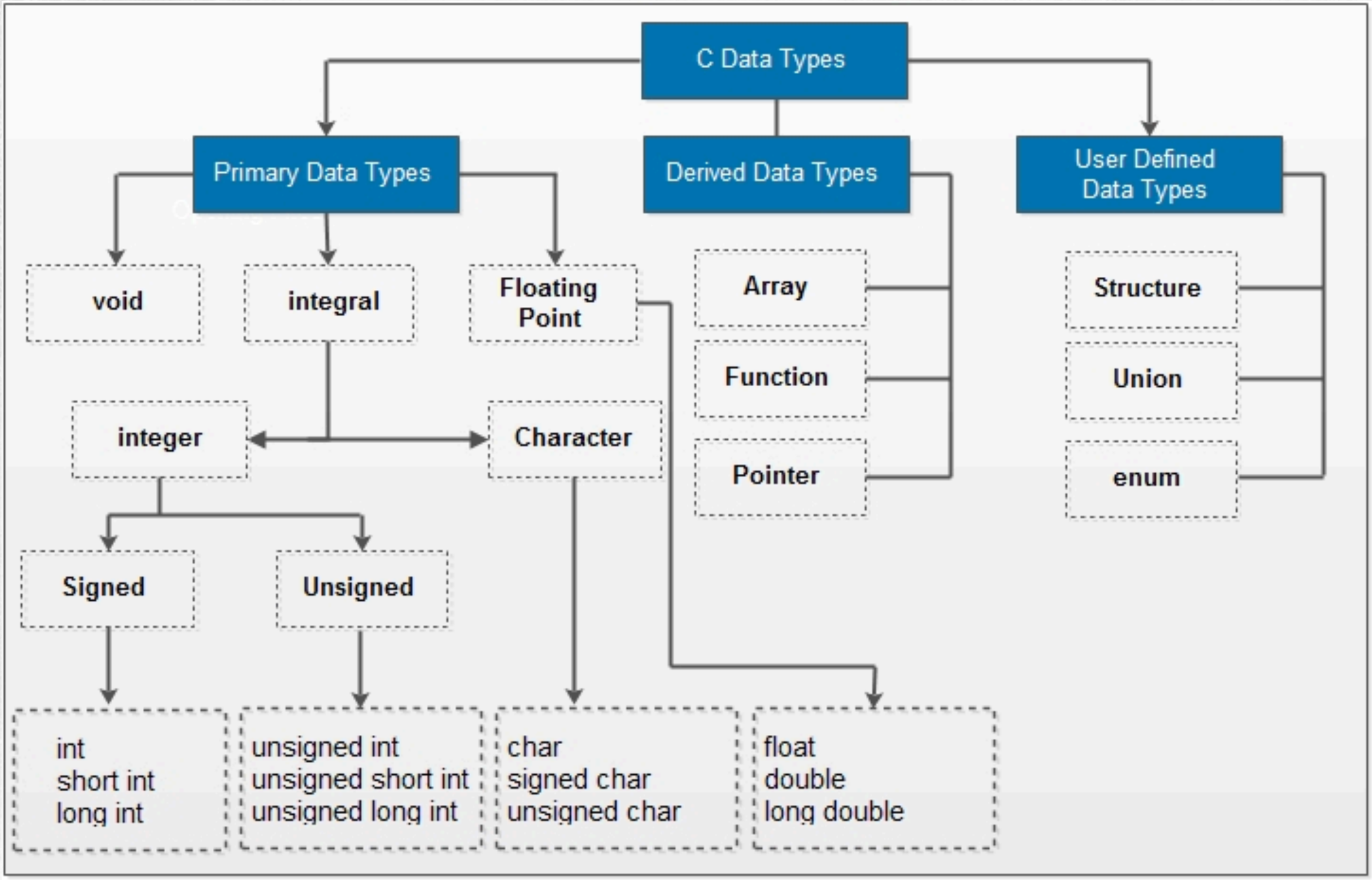

Reference: https://en.wikipedia.org/wiki/Pseudocode

Representation of Algorithm (Pseudo-code)

- Pseudocode is a plain language description of the steps in an algorithm or another system.
- Pseudocode often uses structural conventions of a normal programming language, but is intended for human reading rather than machine reading.
- It typically omits details that are essential for machine understanding of the algorithm, such as variable declarations and language-specific code.
- The purpose of using pseudocode is that it is easier for people to understand than conventional programming language code, and that it is an efficient and environment-independent description of the key principles of an algorithm.
- It is commonly used in textbooks and scientific publications to document algorithms and in planning of software and other algorithms.

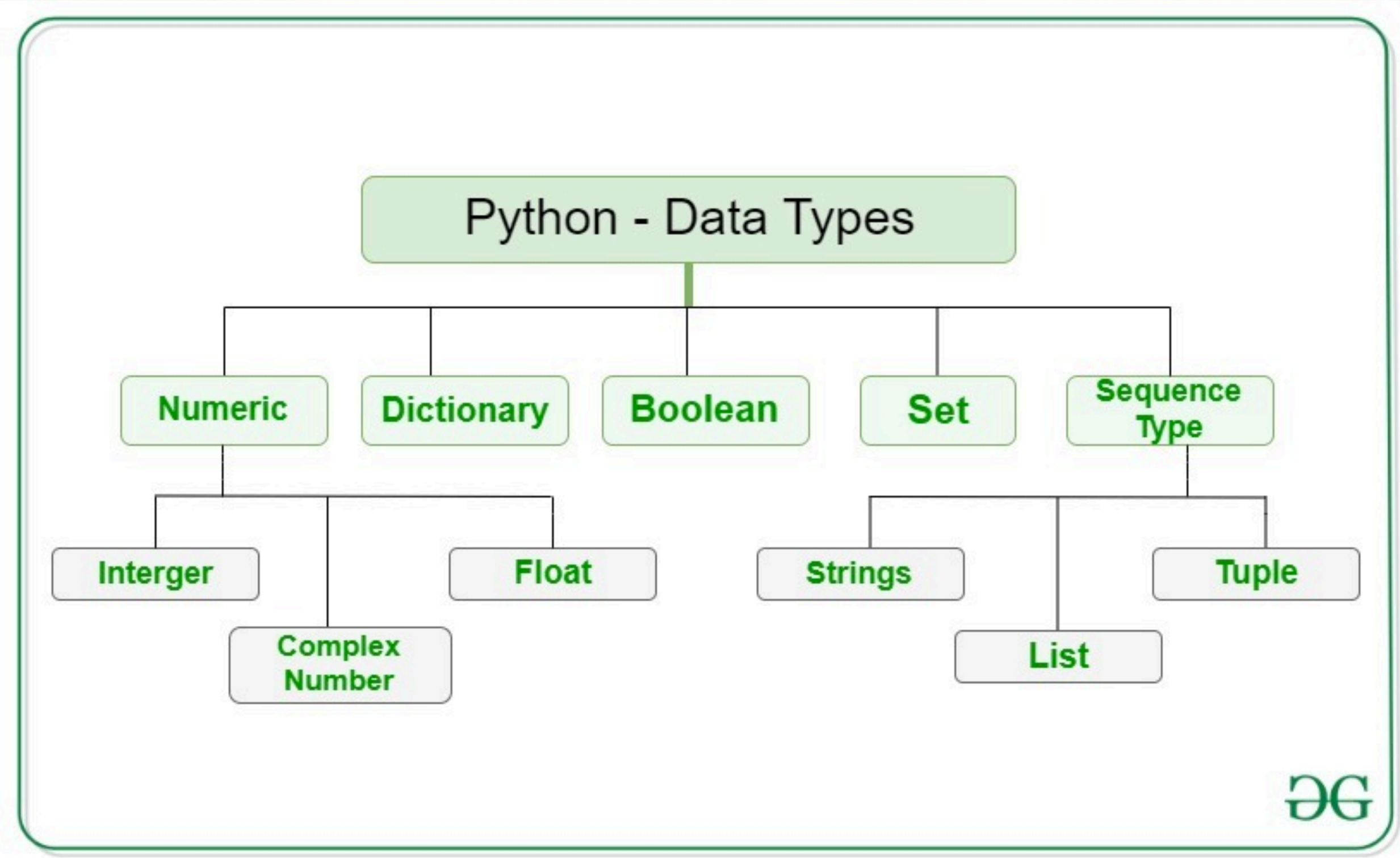
Reference: https://en.wikipedia.org/wiki/Pseudocode

Data Types in C



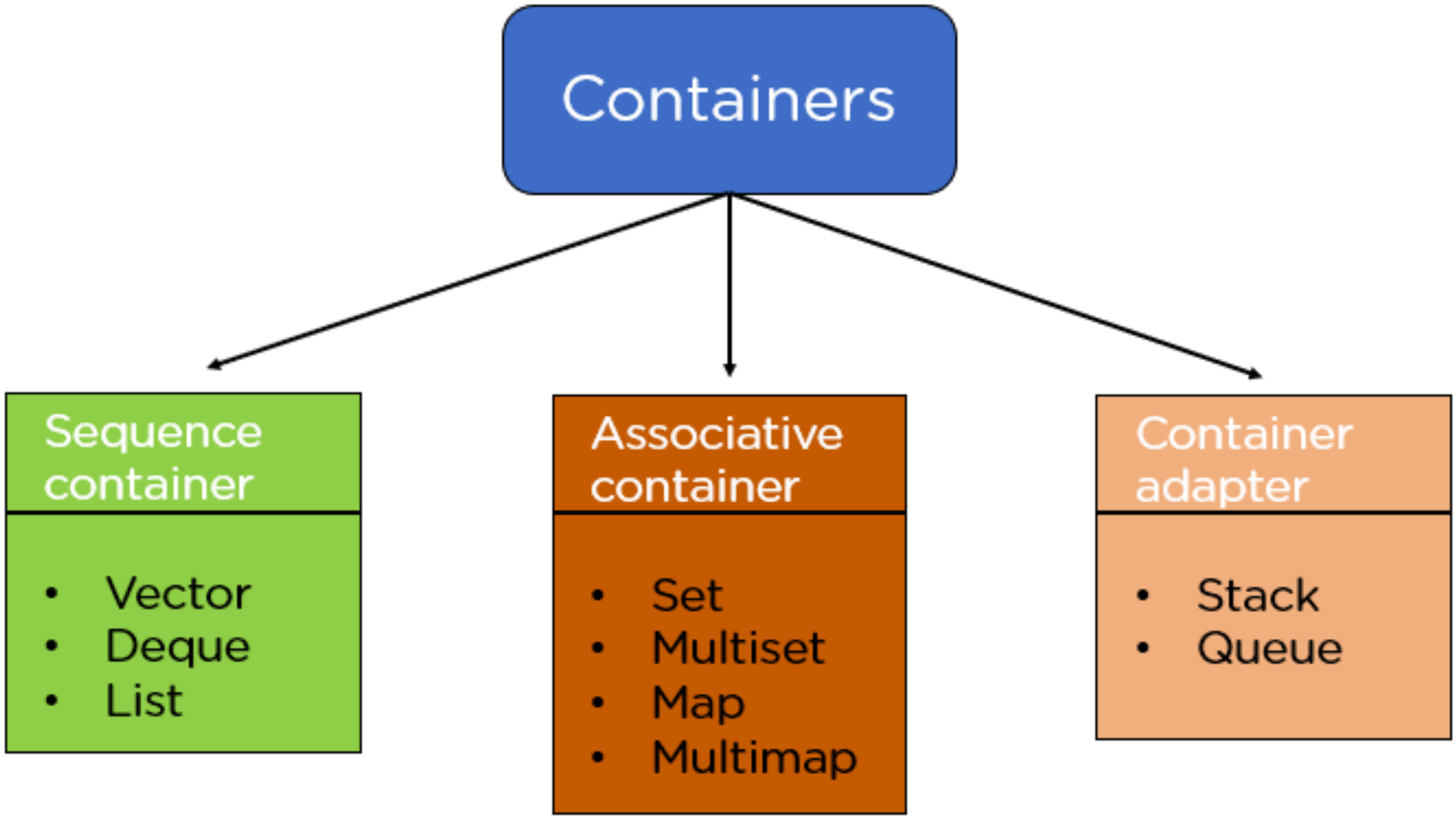
Reference: https://ecomputernotes.com/what-is-c/types-and-variables/data-types-in-c

Data Types in Python (data structure & algorithm)



Reference: https://www.geeksforgeeks.org/python-data-types/

STL Containers in C++ (data structure & algorithm)



Reference: https://www.simplilearn.com/tutorials/cpp-tutorial/cpp-standard-template-library

STL Containers in C++ (data structure)

std:: Sequence Containers

array<T, size>

fixed-size array

#include <array>

```
std::array<int,6> a {1,2,3,4,5,6};
cout << a.size();     // 6
cout << a[2];         // 3
a[0] = 7;             // 1st element ⇒ 7
```

contiguous memory; random access; fast linear traversal

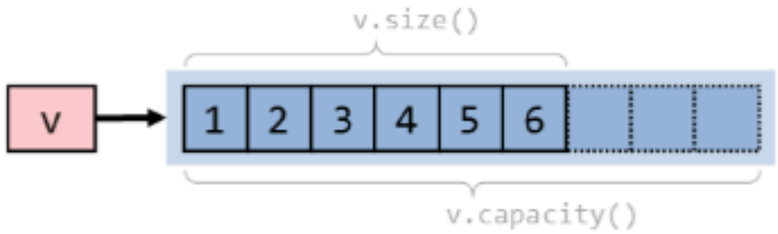
vector<T>

dynamic array

C++'s "default" container

#include <vector>

```
std::vector<int> v {1,2,3,4,5,6};
v.reserve(9);
cout << v.capacity();      // 9
cout << v.size();          // 6
v.push_back(7);            // appends '7'
v.insert(v.begin(), 0);    // prepends '0'
v.pop_back();              // removes last
v.erase(v.begin()+2);      // removes 3rd
v.resize(20, 0);           // size ⇒ 20
```



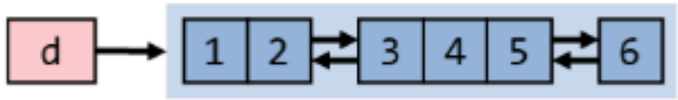
contiguous memory; random access;
fast linear traversal; fast insertion/deletion at the ends

deque<T>

double-ended queue

#include <deque>

```
std::deque<int> d {1,2,3,4,5,6};
// same operations as vector
// plus fast growth/deletion at front
d.push_front(-1);   // prepends '-1'
d.pop_front();      // removes 1st
```



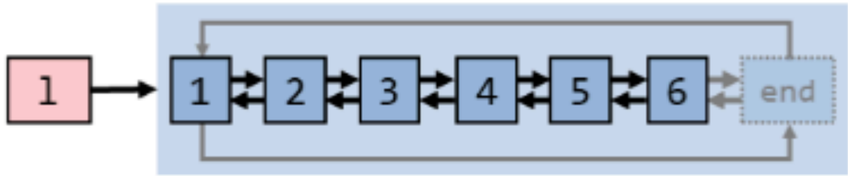
fast insertion/deletion at both ends

list<T>

doubly-linked list

#include <list>

```
std::list<int> l {1,5,6};
std::list<int> k {2,3,4};
// O(1) splice of k into l:
l.splice(l.begin()+1, std::move(k))
// some special member function algorithms:
l.reverse();
l.sort();
```



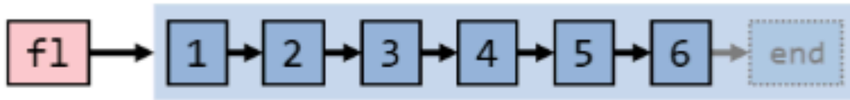
fast splicing; many operations without copy/move of elements

forward_list<T>

singly-linked list

#include <forward_list>

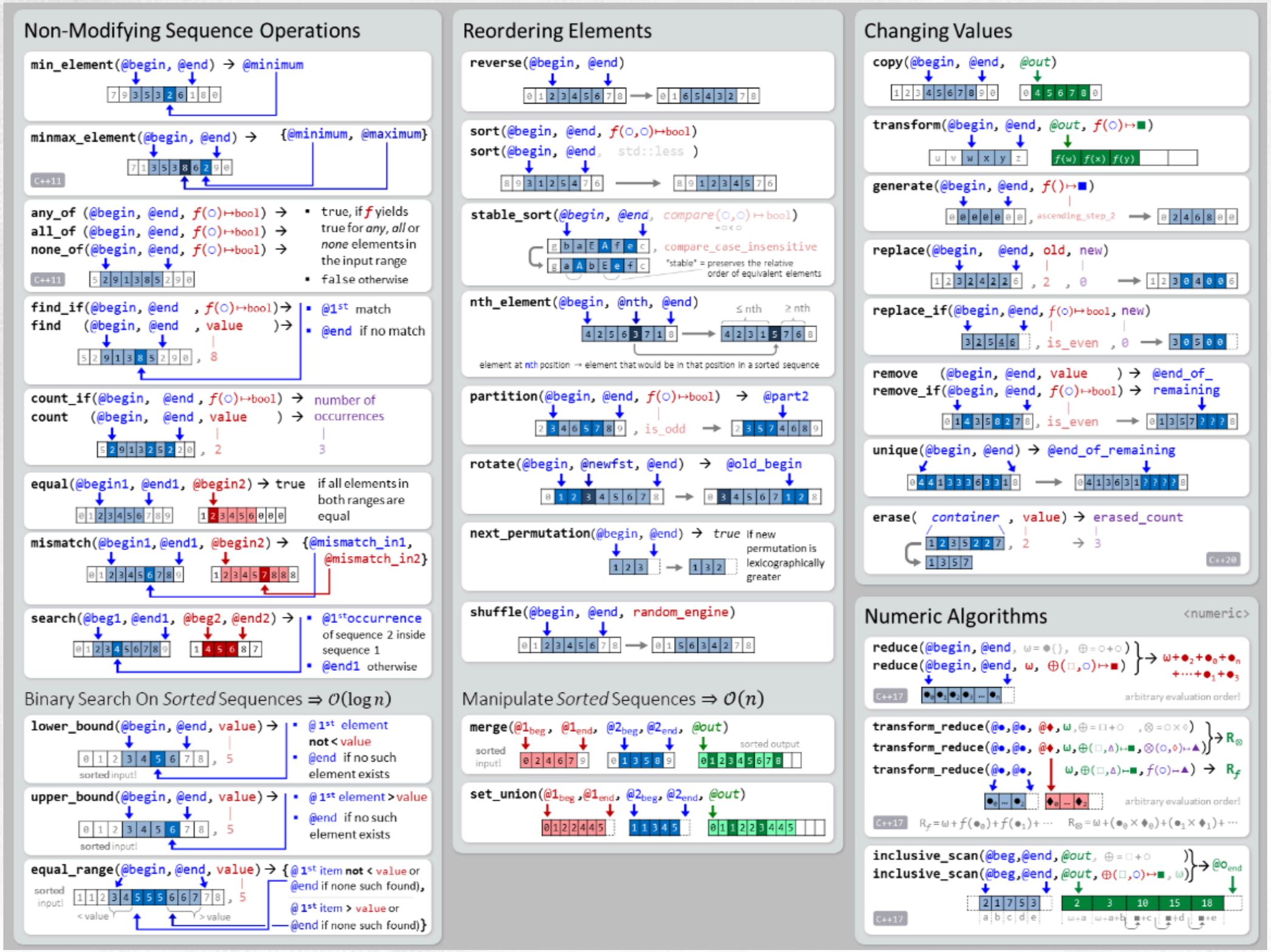
```
std::forward_list<int> fl {2,2,4,5,6};
fl.erase_after(begin(fl));
fl.insert_after(begin(fl), 3);
fl.insert_after(before_begin(fl), 1);
```



lower memory overhead than std::list; only forward traversal

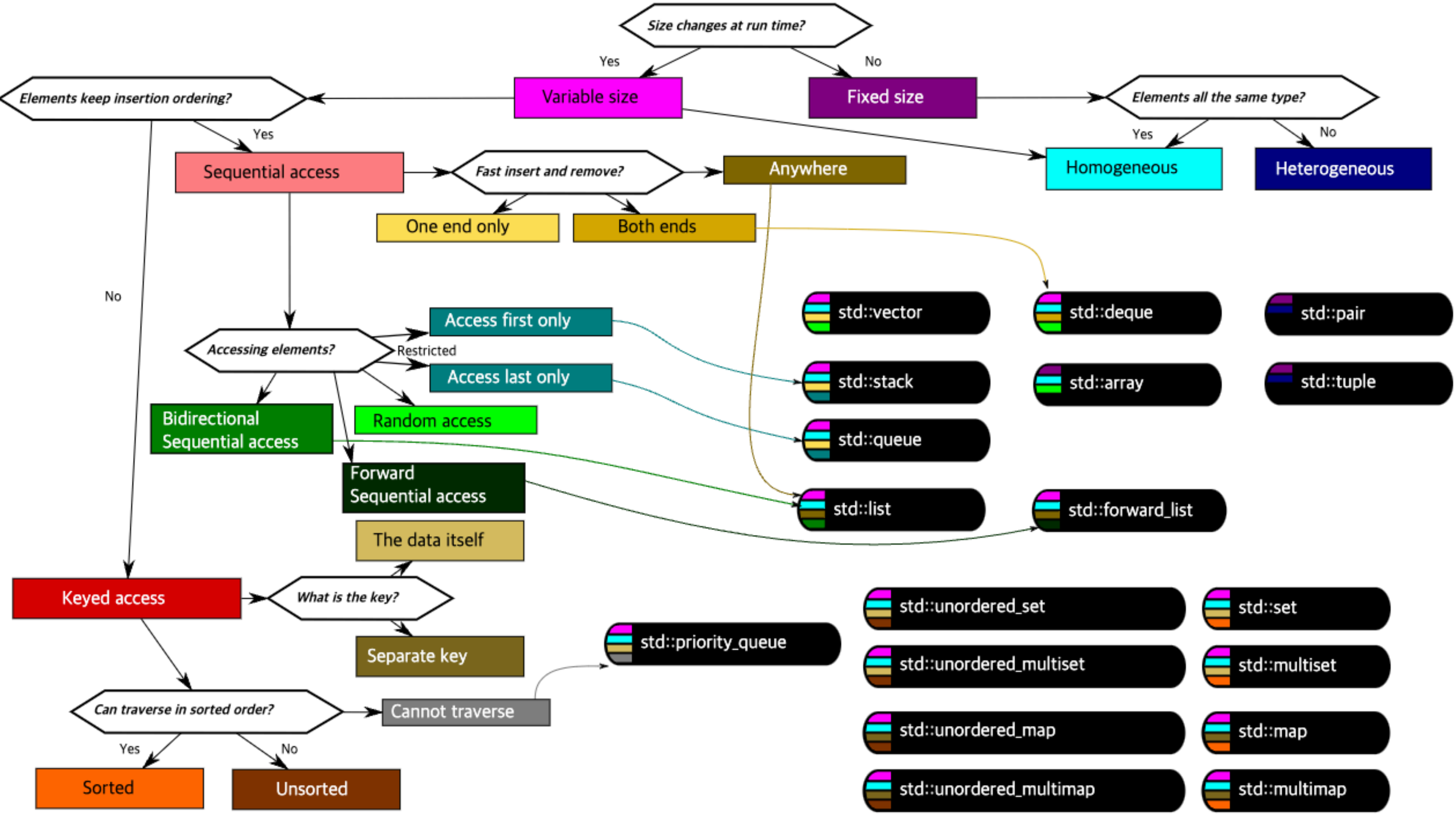
Reference: https://hackingcpp.com/cpp/cheat_sheets.html#hfold3a

STL Containers in C++ (algorithm)



Reference: https://hackingcpp.com/cpp/cheat_sheets.html#hfold3a

STL Containers in C++ (characteristics)



Reference: https://plasmahh.projectiwear.org/cce_clean.svg

Organized collection of Data (Database)

- Database is an organized collection of data
- A relational database, more restrictively, is a collection of schemas, tables, queries, reports, views, and other elements

Reference: https://en.wikipedia.org/wiki/Database

Organized collection of Data (Database)

- Relational model
- Entity-relationship model

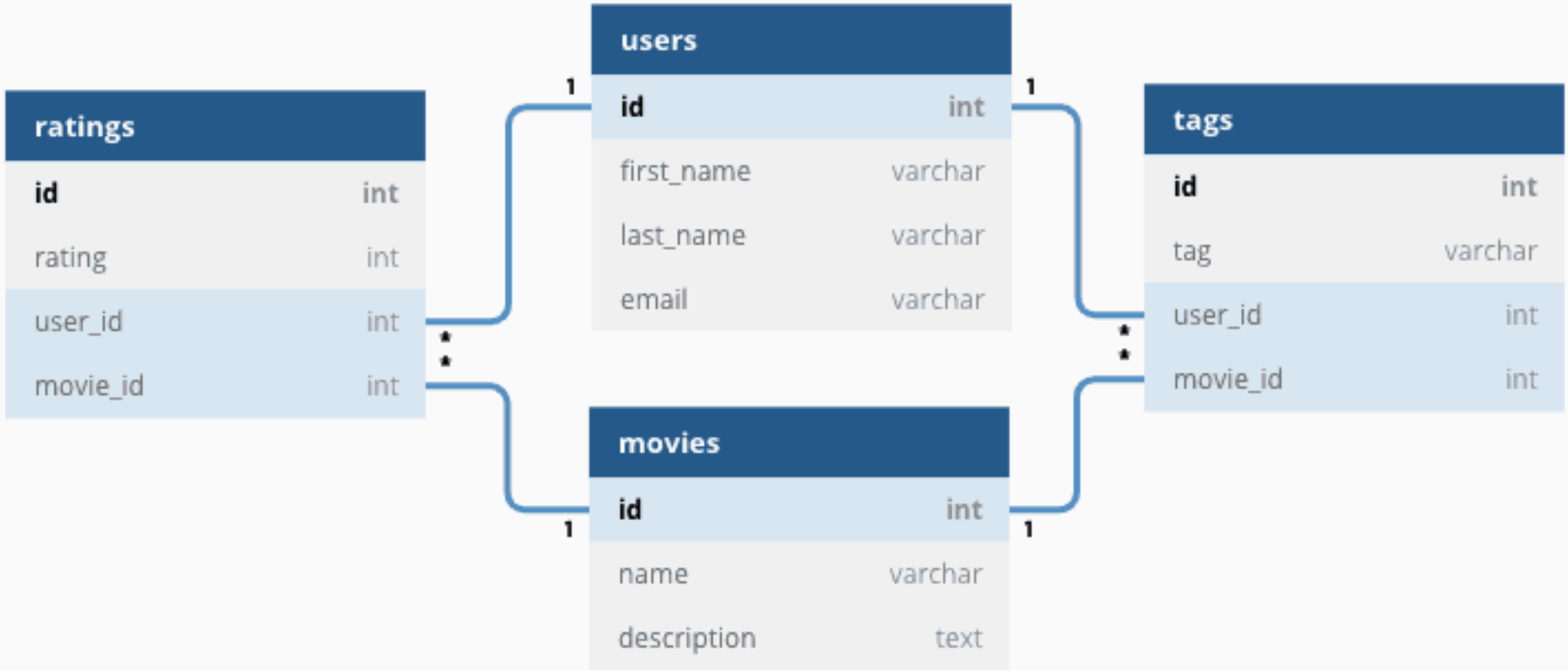
Reference: https://en.wikipedia.org/wiki/Database

Relational Database model

- An approach to managing data using a structure and language consistent with first-order predicate logic, first described in 1969 by Edgar F. Codd, where all data is represented in terms of tuples, grouped into relations
- A database organized in terms of the relational model is a relational database

Reference: https://en.wikipedia.org/wiki/Relational_model

Relational Database model



Reference: https://www.heavy.ai/technical-glossary/relational-database

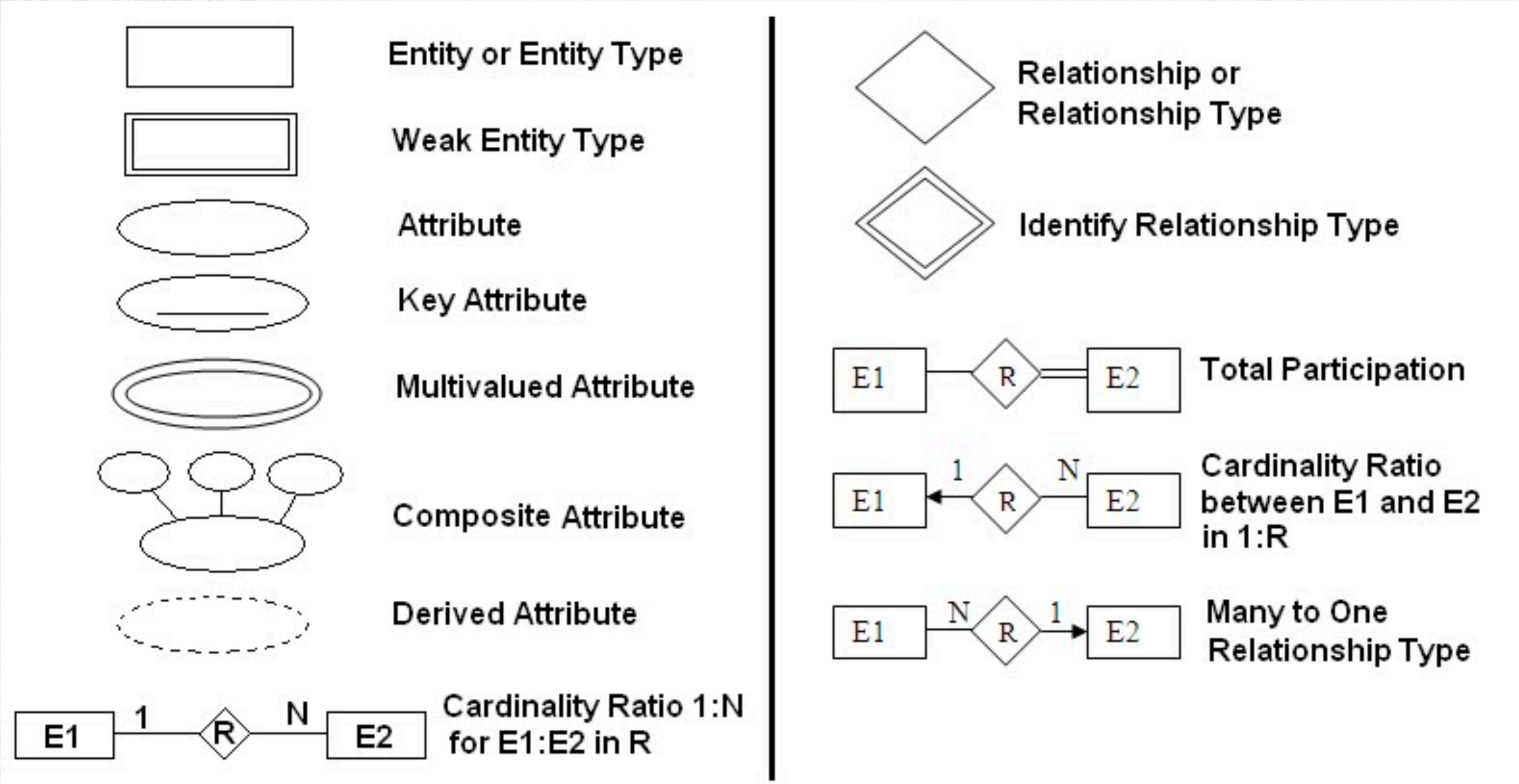
Entity-relationship model

- ER model describes interrelated things of interest in a specific domain of knowledge
- A basic ER model is composed of entity types (which classify the things of interest) and specifies relationships that can exist between instances of those entity types

Reference: https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model

Entity-relationship model

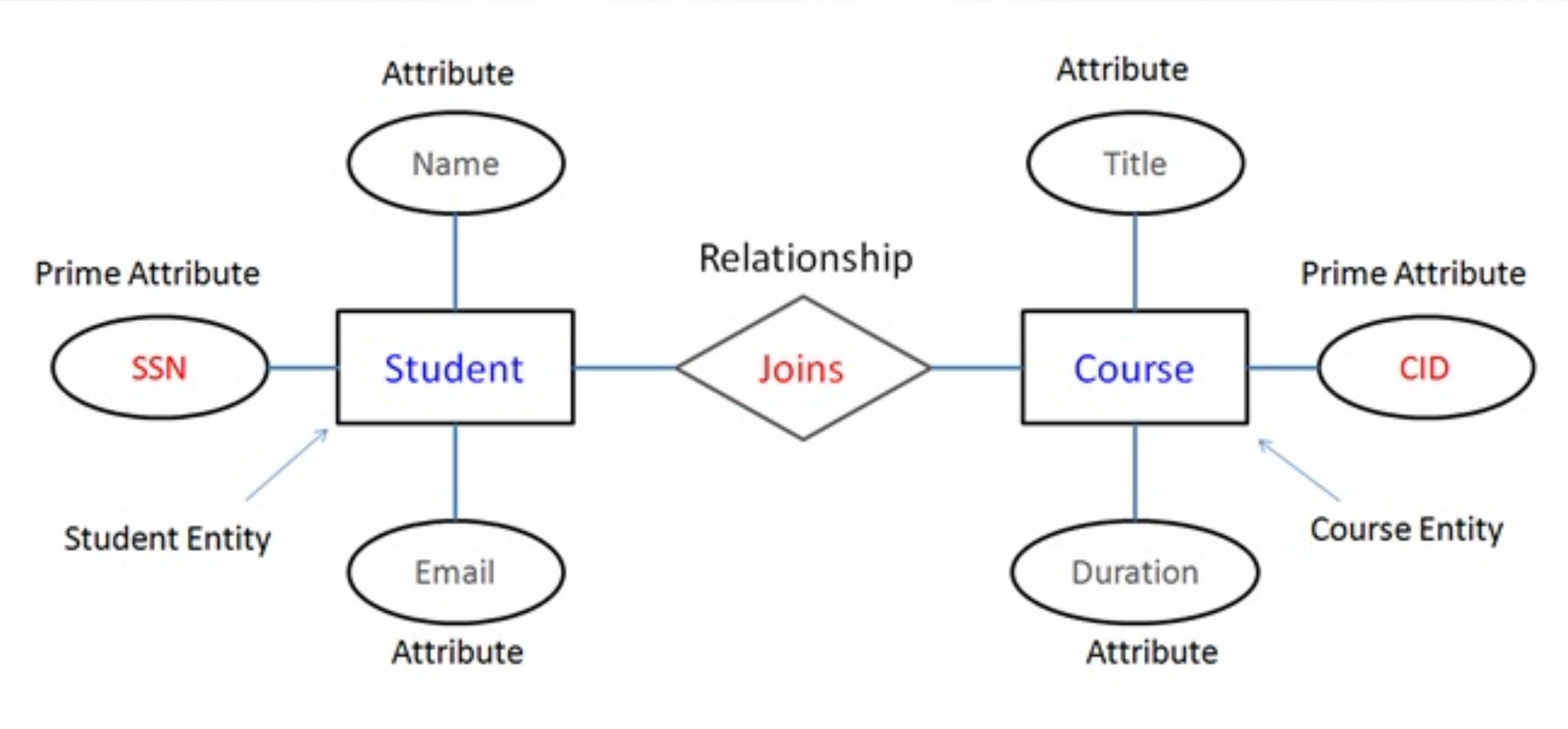
- Entity Relationship Diagram (ERD) symbols



Reference: https://sites.google.com/site/merasemester/dbm/chapter-3

Entity-relationship model

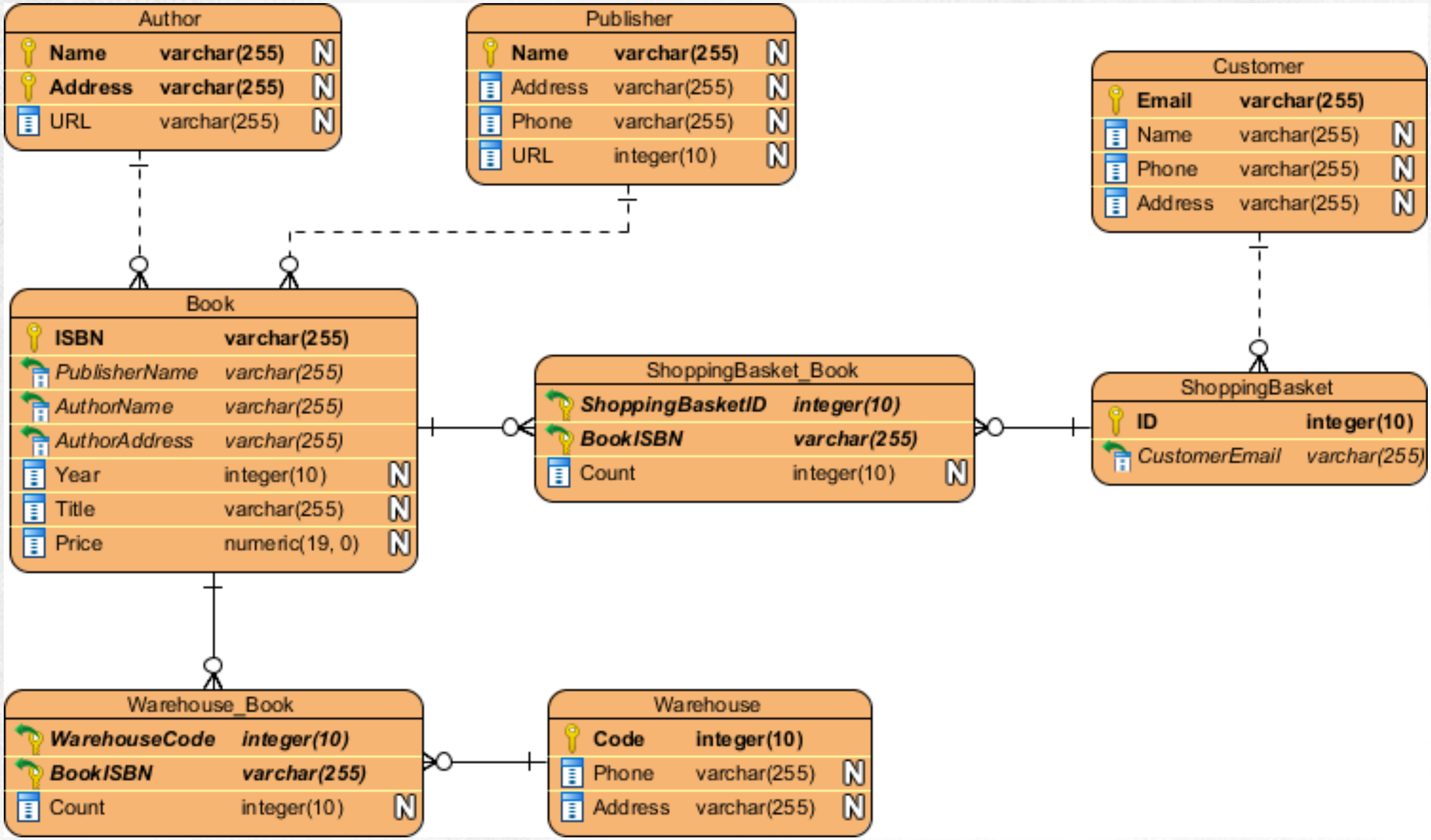
- Entity Relationship Diagram (ERD)



Reference: https://www.learncomputerscienceonline.com/entity-relationship-diagram/

Entity-relationship model

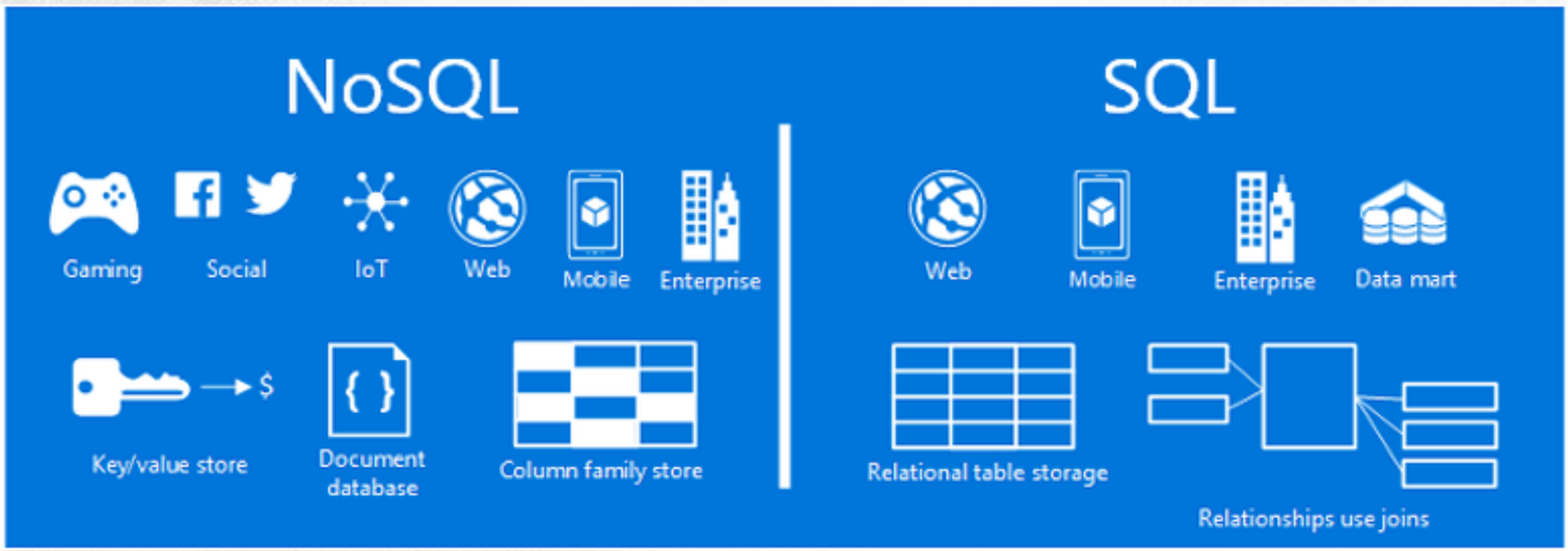
- Entity Relationship Diagram (ERD)



Reference: https://www.visual-paradigm.com/guide/data-modeling/what-is-entity-relationship-diagram/

SQL and NoSQL Database

- SQL : Structured Query Language (table based)
- NoSQL : No or Not-only SQL



Reference: https://en.wikipedia.org/wiki/Object_database

SQL (Structured Query Language) Example

다음 예에서는 세 개의 코드 예를 보여 줍니다. 첫 번째 코드 예에서는 **AdventureWorks2012** 데이터베이스의 `*` 테이블에서 모든 행(WHERE 절이 지정되지 않음) 및 모든 열(`Product` 사용)을 반환합니다.

SQL 복사

```sql
USE AdventureWorks2012;
GO
SELECT *
FROM Production.Product
ORDER BY Name ASC;
-- Alternate way.
USE AdventureWorks2012;
GO
SELECT p.*
FROM Production.Product AS p
ORDER BY Name ASC;
GO
```

다음 예에서는 제품 라인이 `Product`이고 제조에 필요한 기간이 `R`일보다 작은 `4`에 대한 행만 반환합니다.

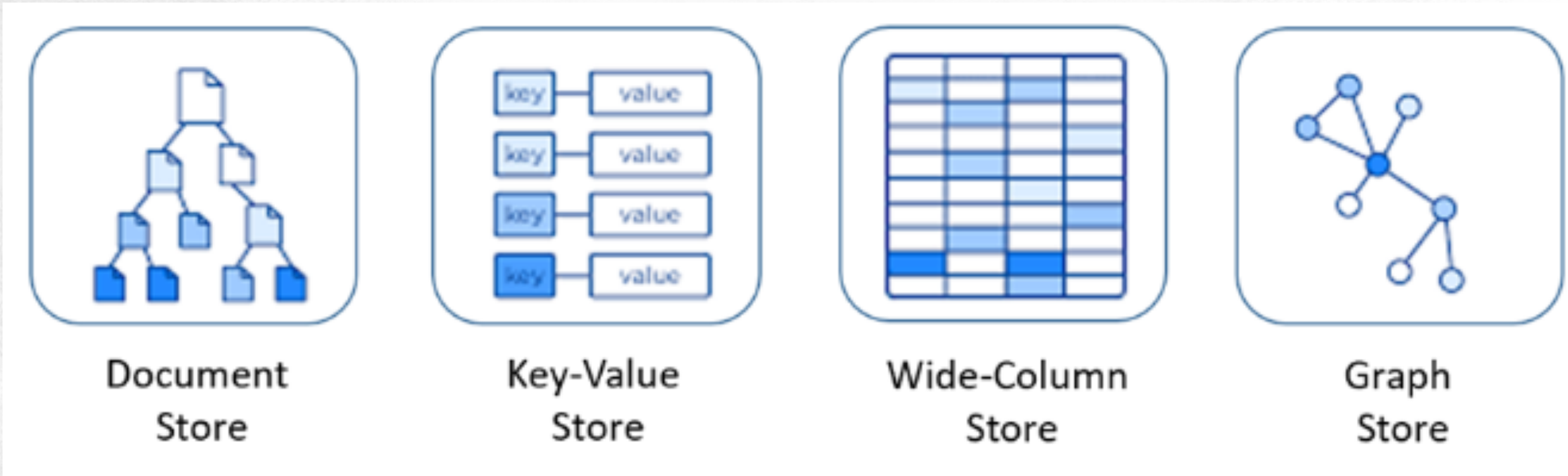
SQL 복사

```sql
USE AdventureWorks2012;
GO
SELECT Name, ProductNumber, ListPrice AS Price
FROM Production.Product
WHERE ProductLine = 'R'
AND DaysToManufacture < 4
ORDER BY Name ASC;
GO
```


Reference: https://docs.microsoft.com/ko-kr/sql/t-sql/queries/select-examples-transact-sql?view=sql-server-ver15

NoSQL Data Model

- NoSQL은 고성능 비관계형 데이터 저장소를 나타내고, 사용 편의성, 확장성, 복원력 및 가용성 특성에 탁월함
- 정규화된 데이터의 테이블을 조인하는 대신, NoSQL은 구조화되지 않은 데이터 또는 반구조화된 데이터를 Key-Value 쌍(pair) 또는 JSON 문서에 저장하는 경우가 많음



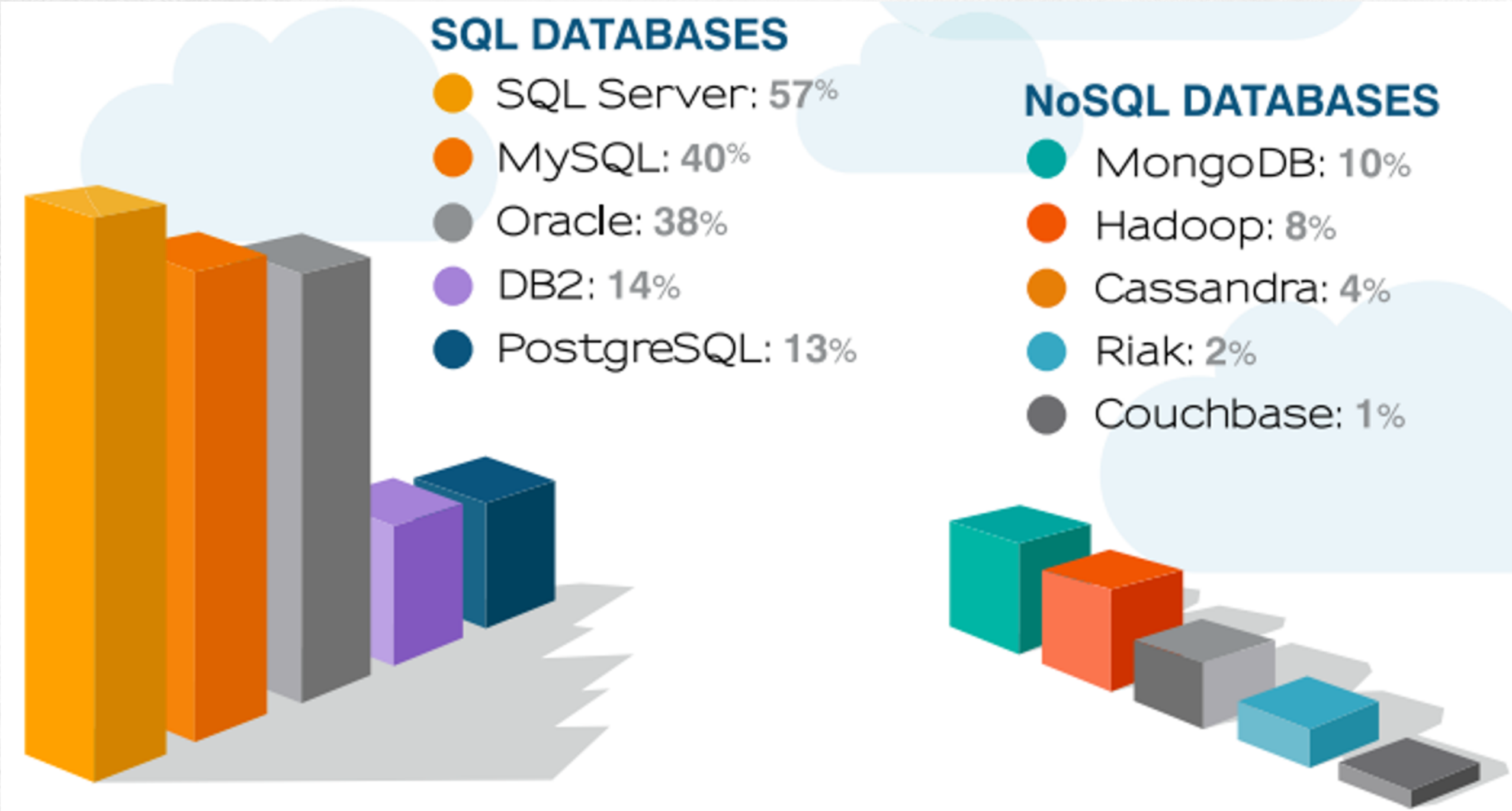
Reference: https://learn.microsoft.com/ko-kr/dotnet/architecture/cloud-native/relational-vs-nosql-data

SQL vs NoSQL

	NoSQL	SQL
Model	Non-relational	Relational
	Stores data in JSON documents, key/value pairs, wide column stores, or graphs	Stores data in a table
Data	Offers flexibility as not every record needs to store the same properties	Great for solutions where every record has the same properties
	New properties can be added on the fly	Adding a new property may require altering schemas or backfilling data
	Relationships are often captured by denormalizing data and presenting it in a single record	Relationships are often captured in a using joins to resolve references across tables
	Good for semi-structured data	Good for structured data
Schema	Dynamic or flexible schemas	Strict schema
	Database is schema-agnostic and the schema is dictated by the application. This allows for agility and highly iterative development	Schema must be maintained and kept in sync between application and database
Transactions	ACID transaction support varies per solution	Supports ACID transactions
Consistency	Consistency varies per solution, some solutions have tunable consistency	Strong consistency supported
Scale	Scales well horizontally	Scales well vertically

Reference: https://en.wikipedia.org/wiki/Object_database

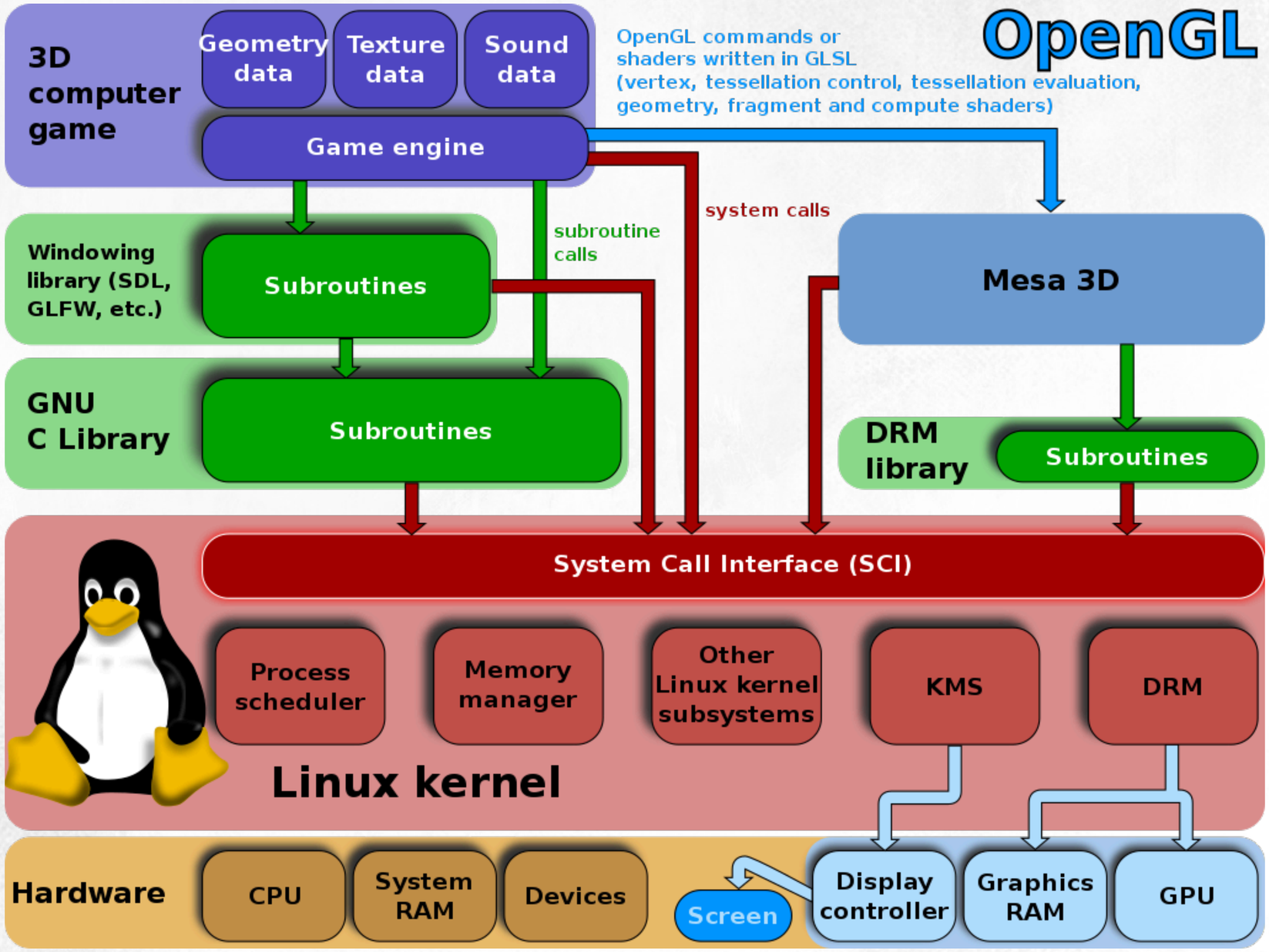
SQL and NoSQL Databases



Reference: https://brunch.co.kr/@kooslab/181

Software Block Diagram

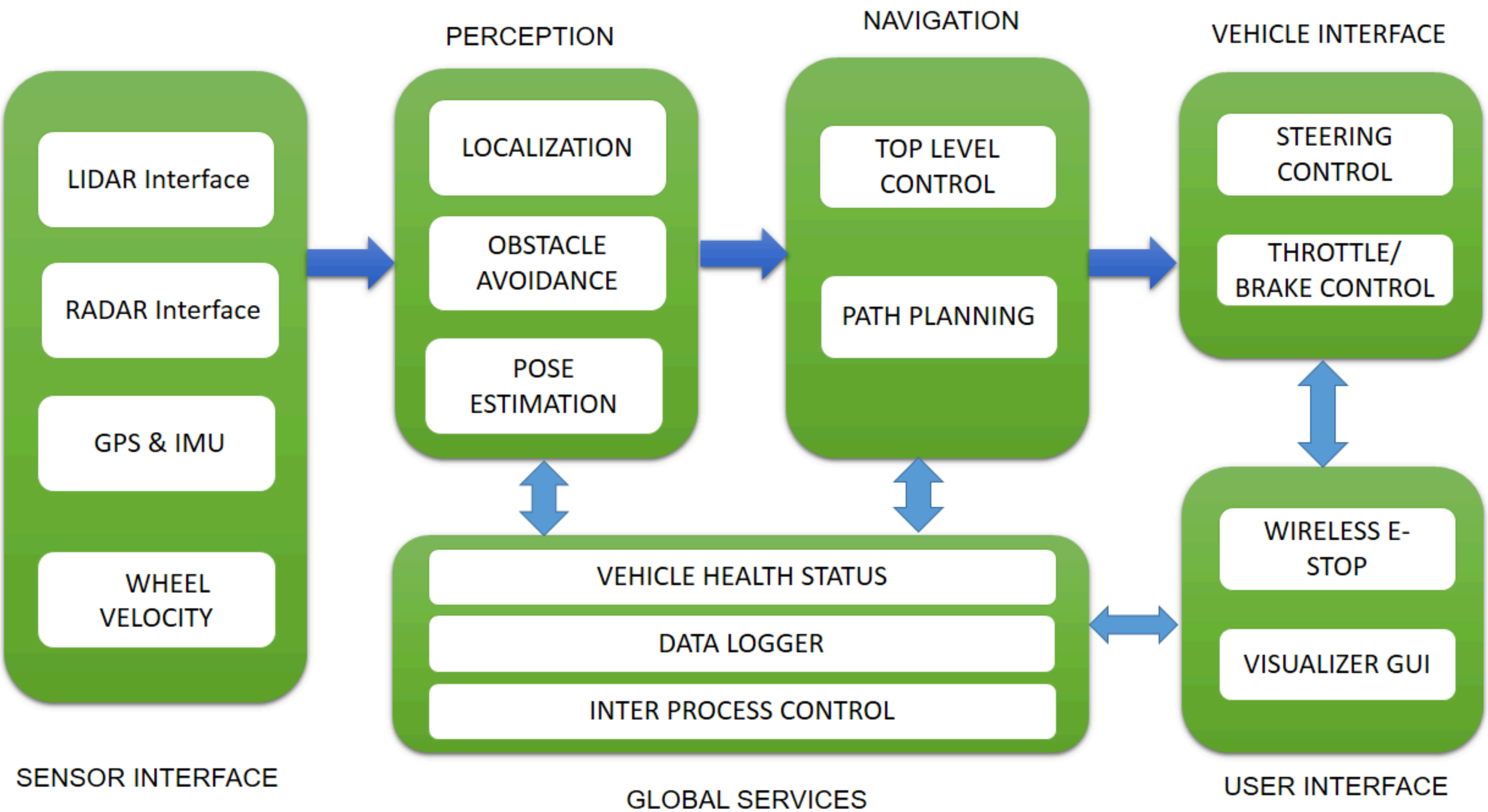
- Diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks



Reference: https://en.wikipedia.org/wiki/Block_diagram

Software Block Diagram

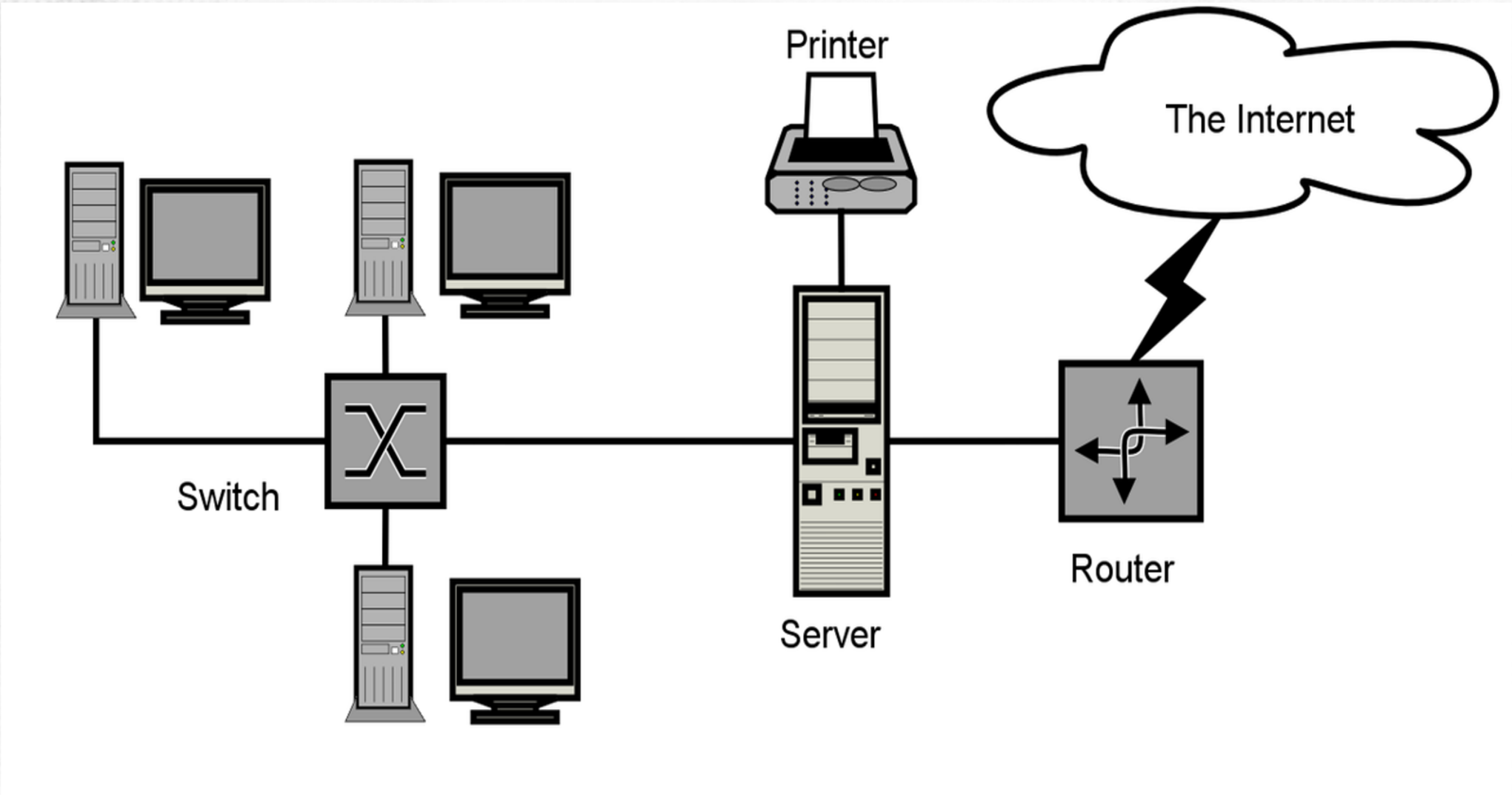
- Software block diagram of self-driving cars



Reference: https://learning.oreilly.com/library/view/ros-programming-building/9781788627436/91d5a01e-2d99-4749-9e7c-bf661f4a1e71.xhtml

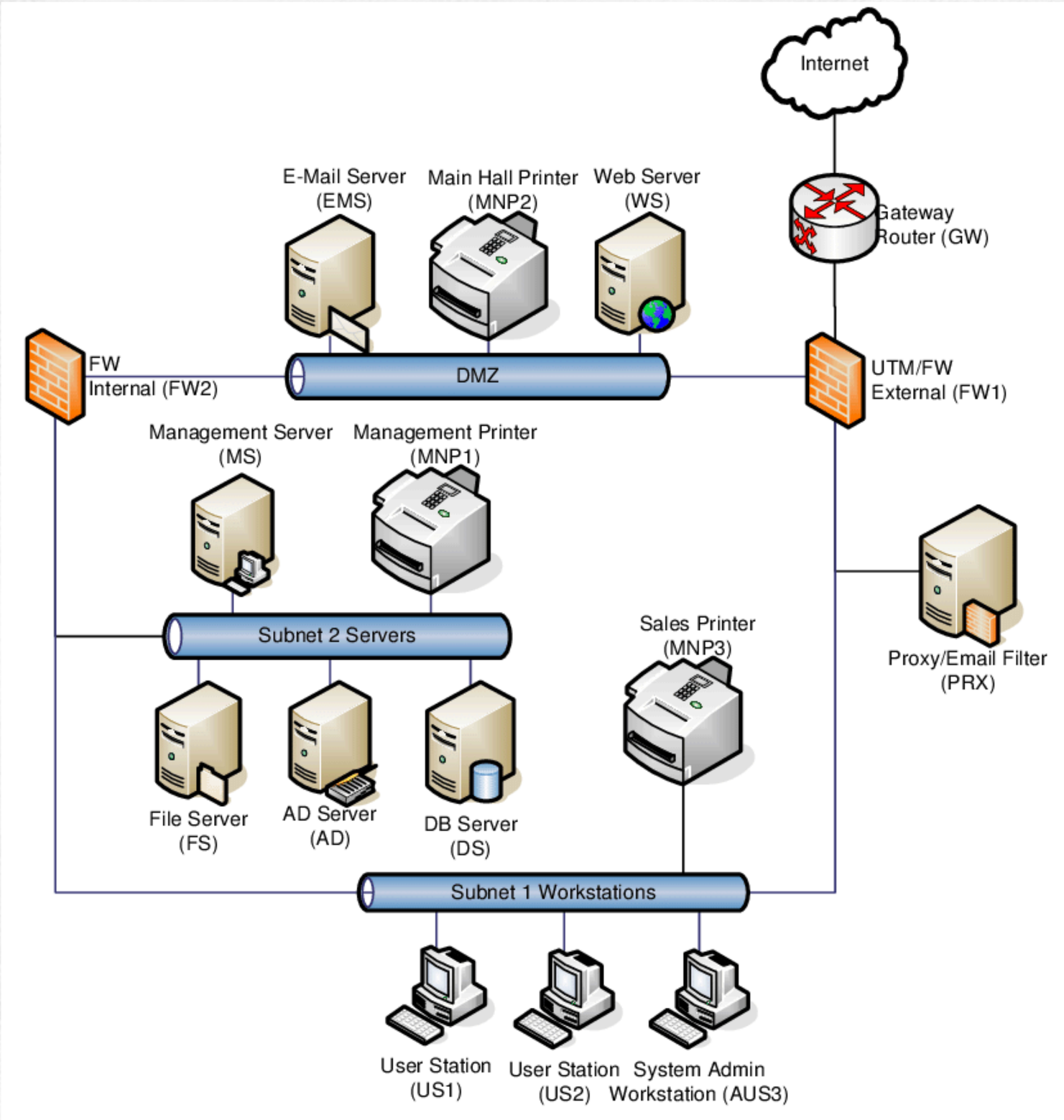
Computer Network Diagram

- Computer network diagram is a schematic depicting the nodes and connections amongst nodes in a computer network or, more generally, any telecommunications network.



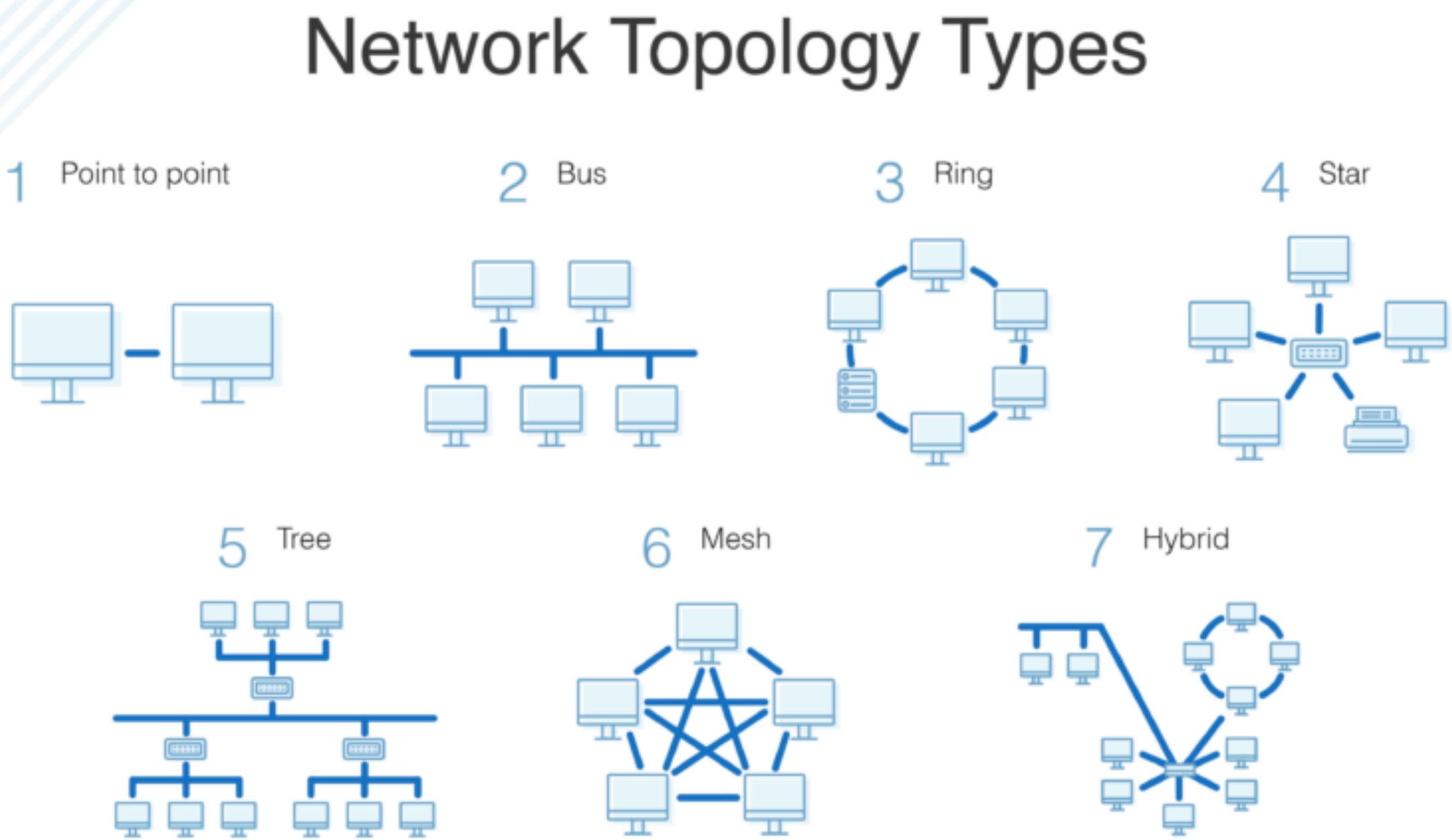
Reference: https://en.wikipedia.org/wiki/Computer_network_diagram

Computer Network Diagram



Reference: https://www.researchgate.net/figure/The-Test-Network-Diagram_fig2_303382654

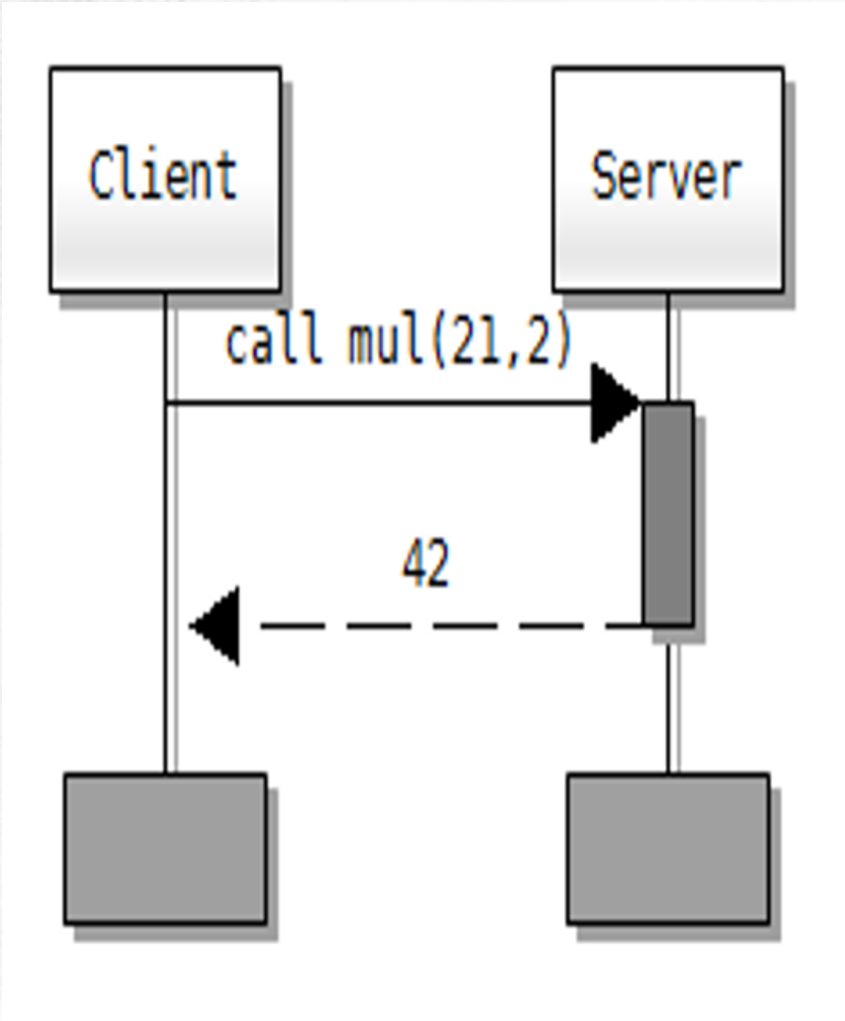
Computer Network Diagram

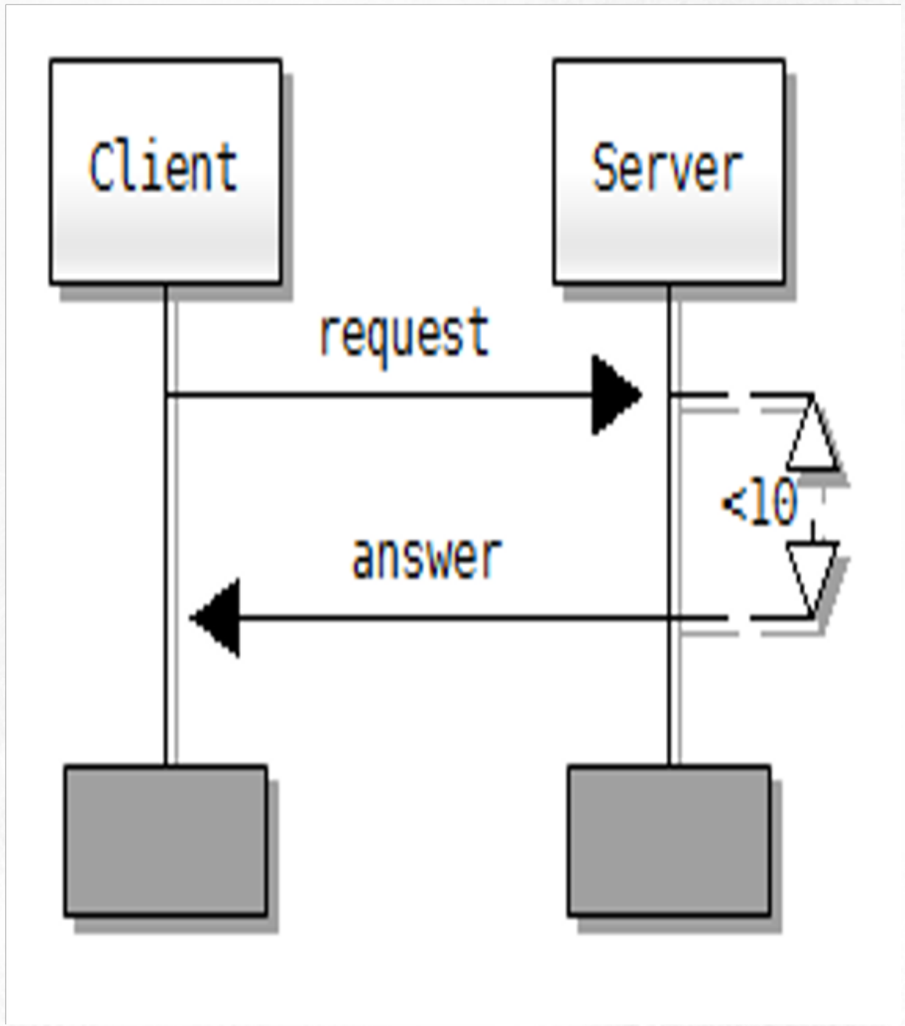


Reference: https://www.dnsstuff.com/what-is-network-topology

Message Sequence Chart

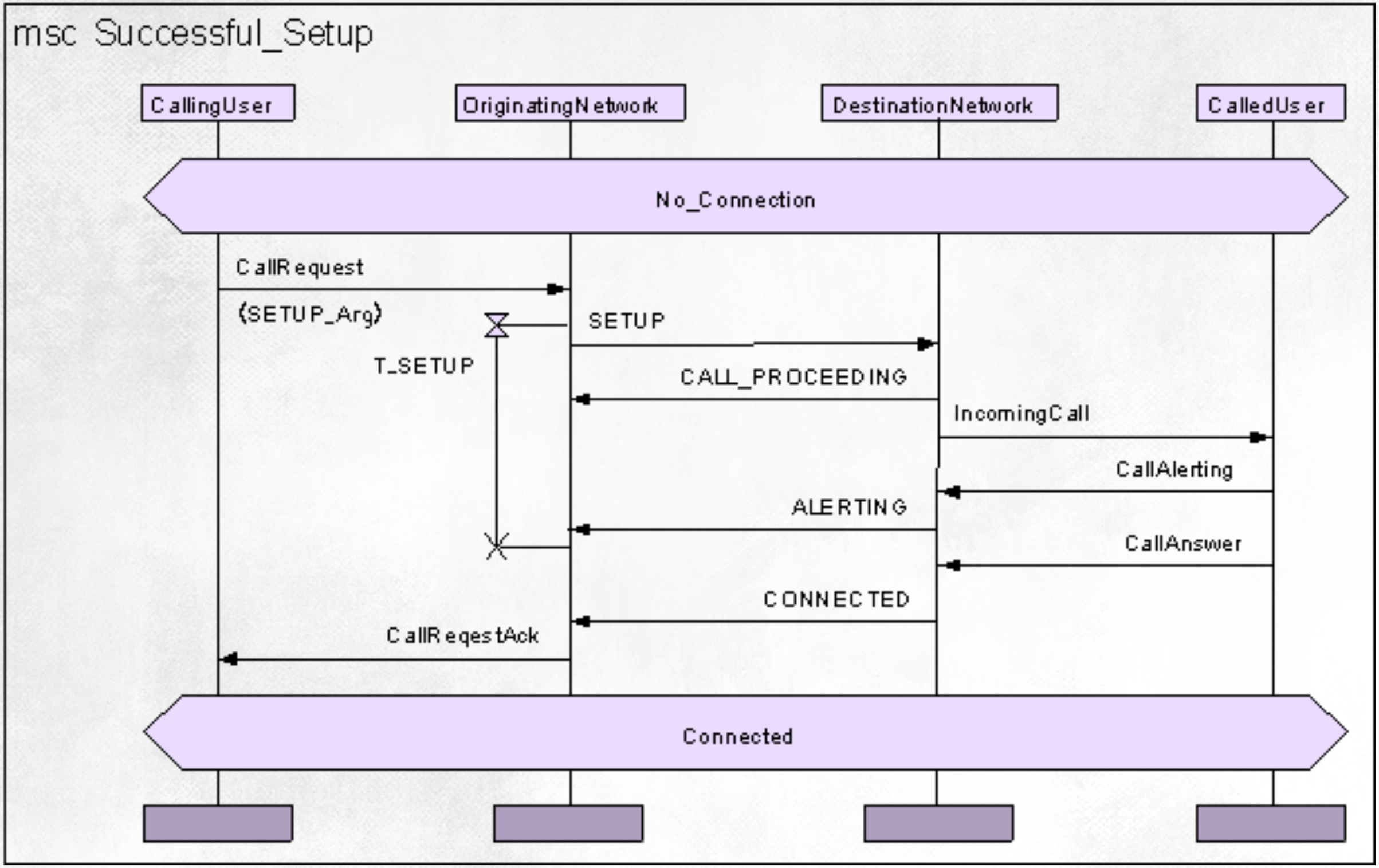
- Provide a trace language for the specification and description of the communication behaviour of system components and their environment by means of message interchange





Reference: https://en.wikipedia.org/wiki/Message_sequence_chart

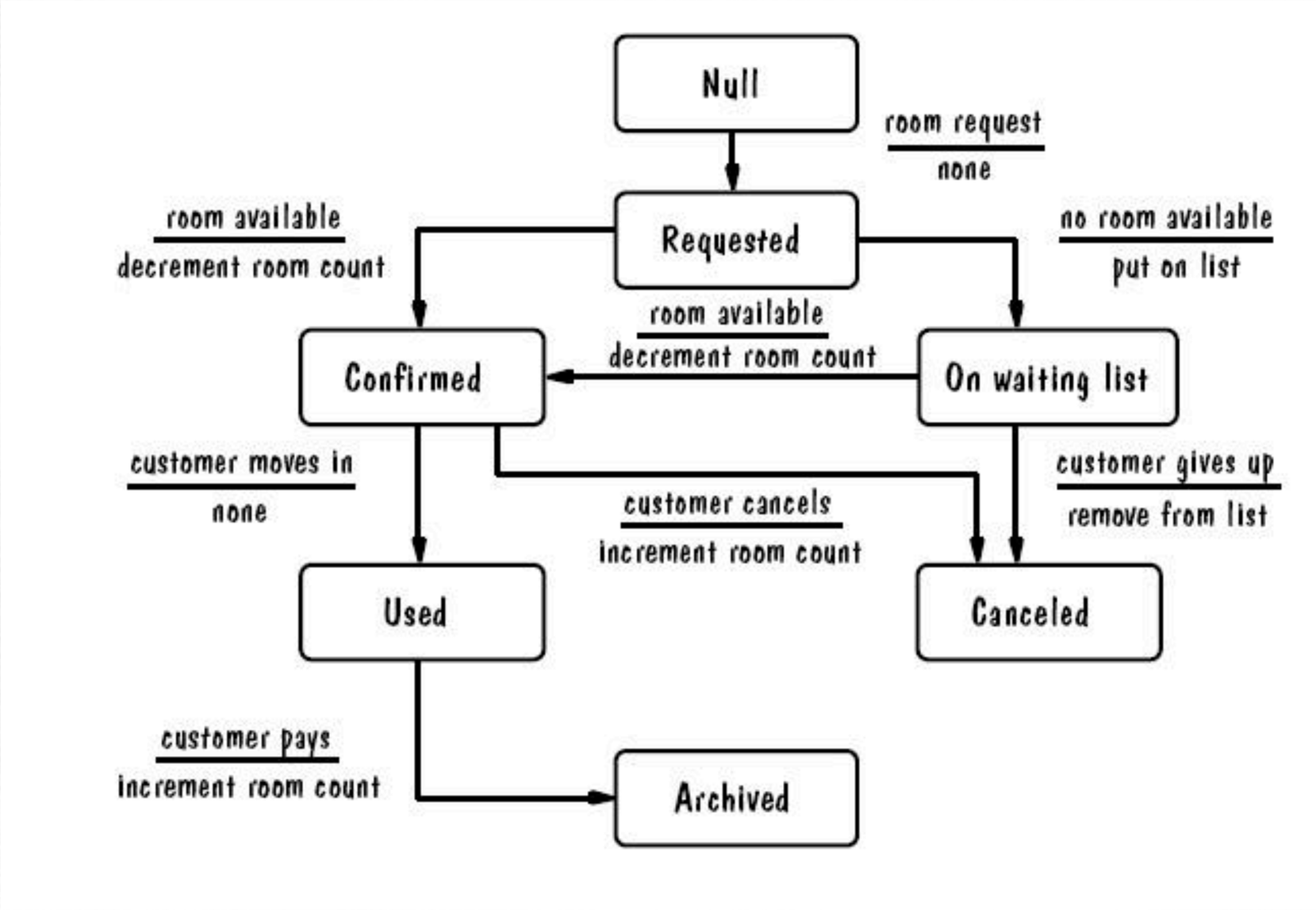
Message Sequence Chart (example)



Reference: https://portal.etsi.org/CTI/ApproachToTesting/SpecLanguages/MSC.htm

State Transition Diagram

- State diagram is a type of diagram used in computer science and related fields to describe the behavior of systems
- State diagrams require that the system described is composed of a finite number of states



Reference: https://en.wikipedia.org/wiki/State_diagram

Figures in Patent (view references)

US 20080141051A1

(19) United States
(12) Patent Application Publication
Lee et al.
(10) Pub. No.: US 2008/0141051 A1
(43) Pub. Date: Jun. 12, 2008

(54) APPARATUS AND METHOD FOR CONTROLLING POWER IN A COMMUNICATION SYSTEM

(75) Inventors: Sung-Won Lee, Seongnam-si (KR); Young-Ky Kim, Seoul (KR); Dae-Seok Kim, Seoul (KR); Joon-Ho Park, Seongnam-si (KR)

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DOCKET CLERK
P.O. DRAWER 800889
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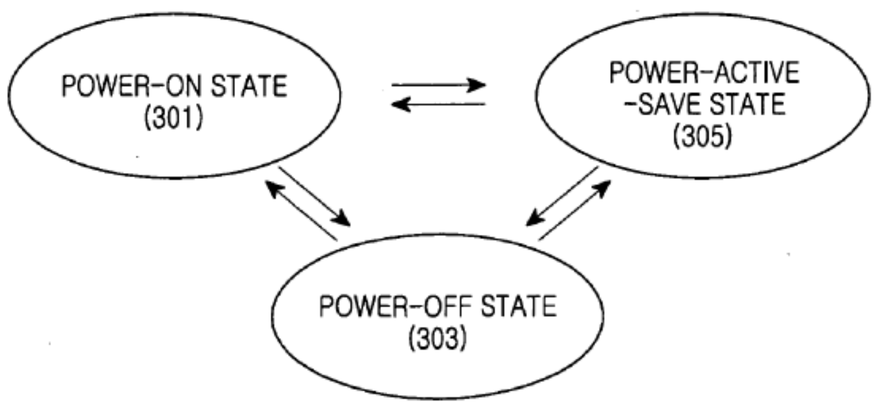
(57) ABSTRACT

A power control apparatus of a user terminal in a communication system. A transmission module transmits a signal, a reception module receives a signal, and a power supply module performs power supply to modules included in the user terminal under a predetermined control. A control module controls an operation of the power supply module to transition from a Power-ON state to a Power-Active-SAVE state upon detecting a first event causing a transition from the Power-ON state to the Power-Active-SAVE state, and to supply limited power to the control module, the transmission module and the reception module among the modules included in the user terminal.



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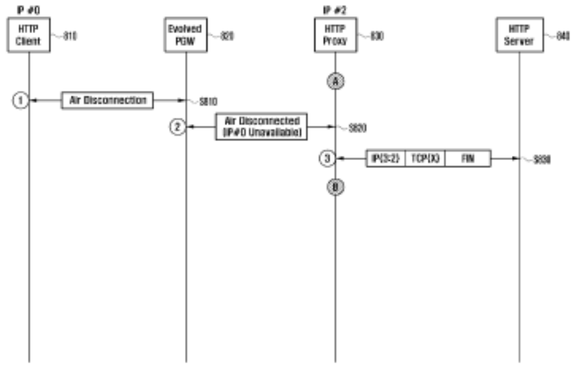
(54) **Apparatus and method for reducing transmission delay of HTTP protocol and processing load of HTTP server in wireless communications network**

(57) A method and apparatus for managing and controlling wireless connection of a HyperText Transfer Protocol (HTTP) proxy device in a wireless communication network are provided. The method includesreceiving one of information indicating a wireless connection deactivation of an HTTP client performing HTTP communication and information indicating a change in an Internet Protocol (IP) address of the HTTP client from a predetermined node of the wireless communication network; and deactivating a connection with an HTTP server if the received information indicates the wireless connection deactivation of an HTTP client performing the HTTP communication; and maintaining a connection with an HTTP server if the received information indicates the change in the Internet Protocol (IP) address of the HTTP client.

FIG. 8



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Drawing Tools

- Microsoft visio (Windows)
  https://products.office.com/ko-kr/visio/flowchart-software?tab=tabs-1

- LibreOffice Draw (Linux/MacOS/Windows)
  https://www.libreoffice.org/discover/draw/

- Dia Diagram Editor (Windows)
  http://dia-installer.de/

- Draw.io (Web based)
  https://www.draw.io/

Microsoft Visio (commercial)

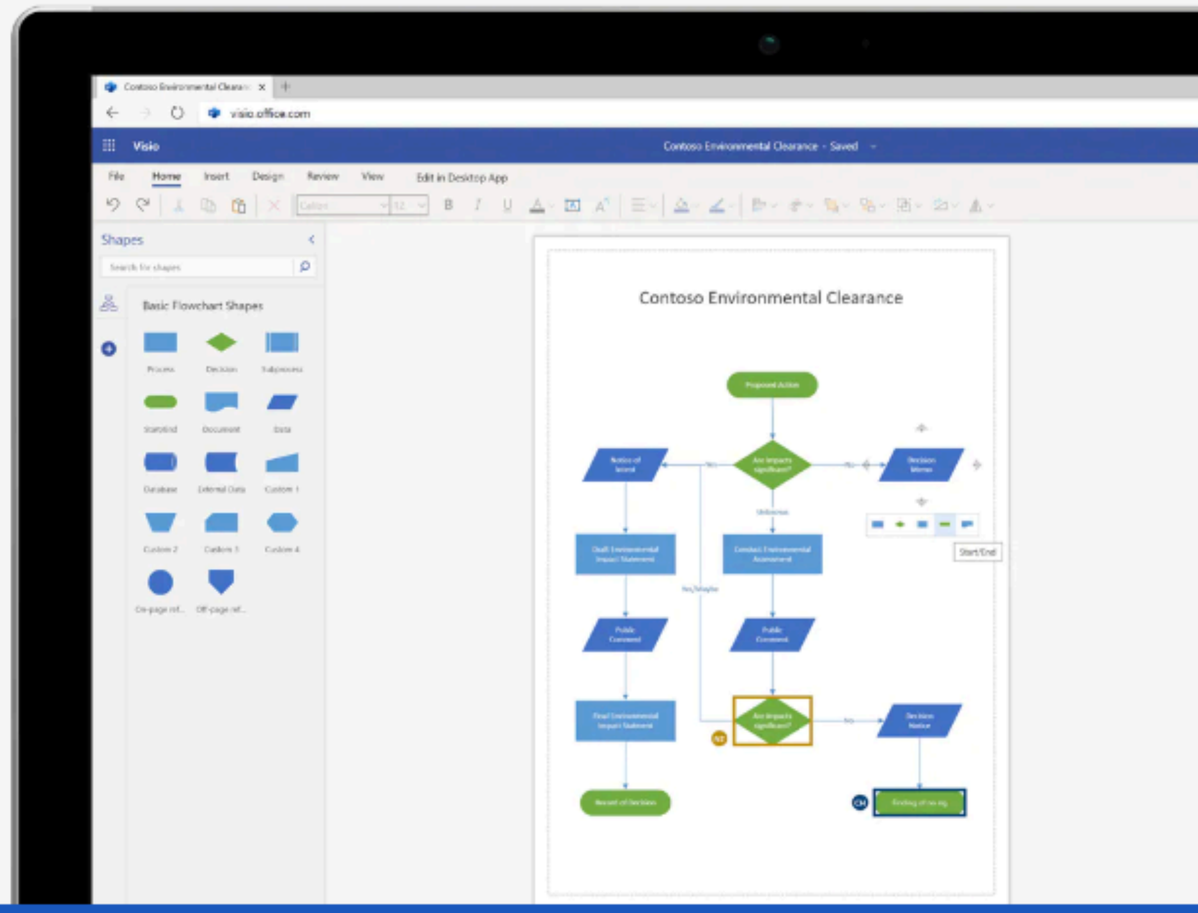
Microsoft | Microsoft 365 Visio 플랜 및 가격 기능 리소스 Microsoft 전체 검색 로그인

더 적은 수고, 더 나은 결과. Microsoft 365로 IT 투자의 효과를 극대화하세요. 자세한 정보 >

Visio

언제 어디서든 시각적으로 작업하세요.

플랜 및 가격 보기 로그인



데이터 사용 및 시각화 방법을 전환하여 최고의 아이디어에 생동감을 불어넣으세요. 바로 사용할 수 있는 다양한 서식 파일과 사용자 지정 가능한 수많은 도형이 제공되는 Visio에서 쉽고 재미있게 강력한 시각적 개체를 만드세요.

Reference: https://www.microsoft.com/ko-kr/microsoft-365/visio/flowchart-software

LibreOffice Draw (opensource)

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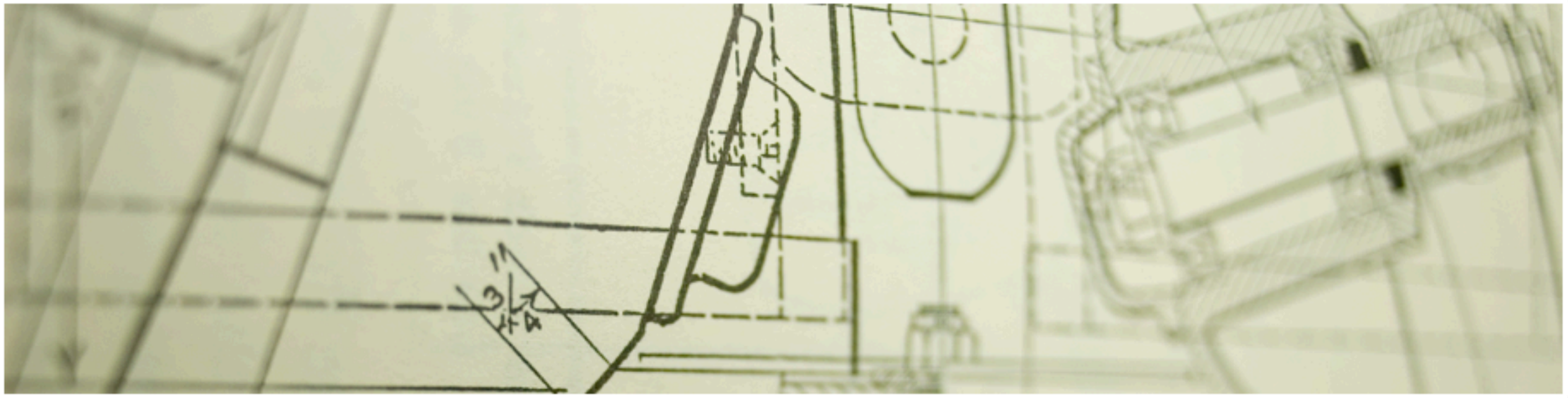

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Dia Diagram Editor

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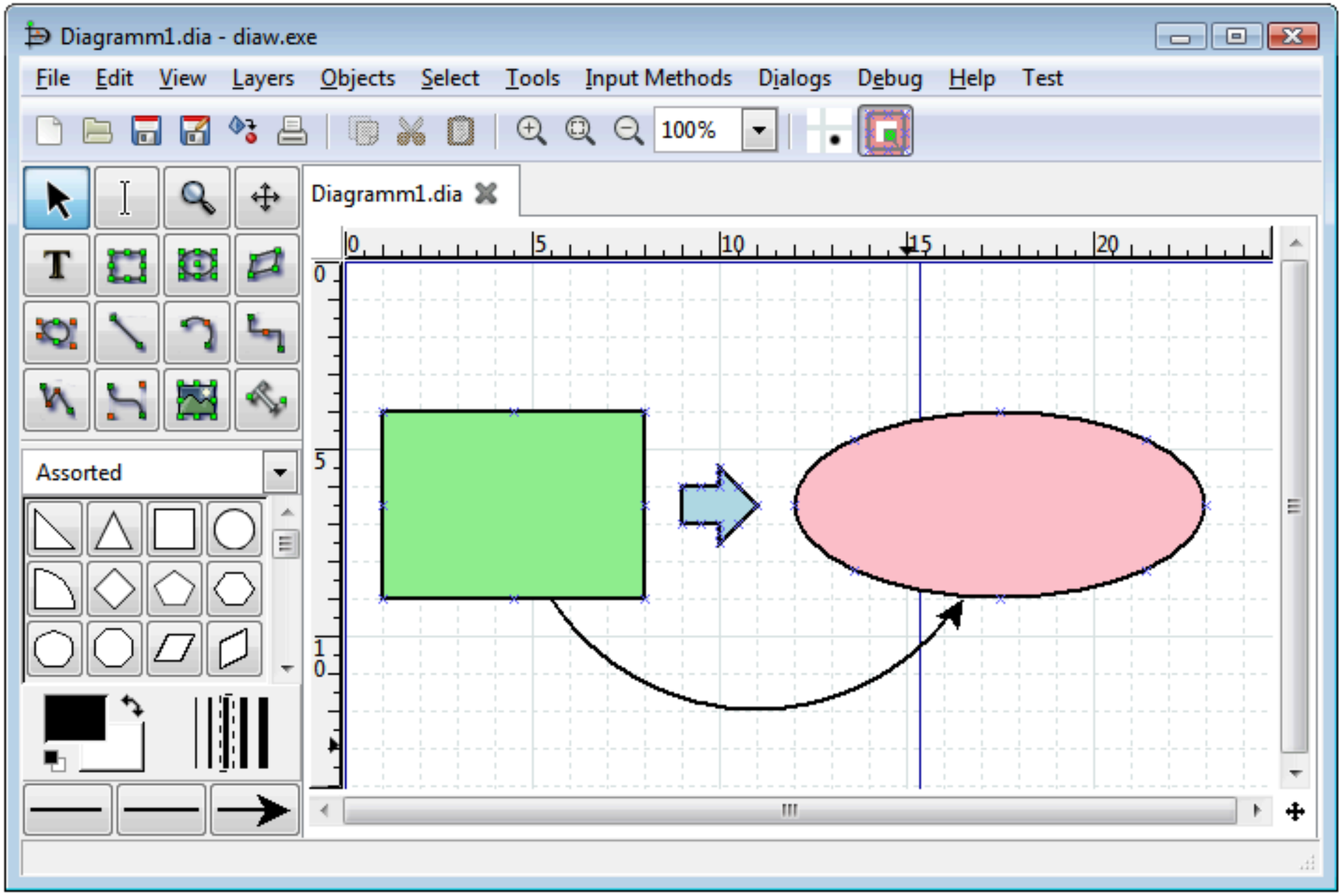

More screenshots.

Summary

- Drawing for better understanding
- Recommended for better communication

  (important than beautiful documents)

Reference

- Courses:
  - Data Structure
  - Algorithm
  - Database
  - Software Engineering
  - Computer Network

Homework

- Install one of the recommended software
- Drawing a picture for the one of your previous software developments work
  - Have no previous software development work?
  - Then, just imagine your some thing ....

Thank you

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