Blue Pill or Red Pill, The Matrix (1999), Lana & Lilly Wachowski
https://youtu.be/zE7PKRjrid4?t=57


HUBBLE UNVEILS ITS MOST COLORFUL VIEW OF THE UNIVERSE
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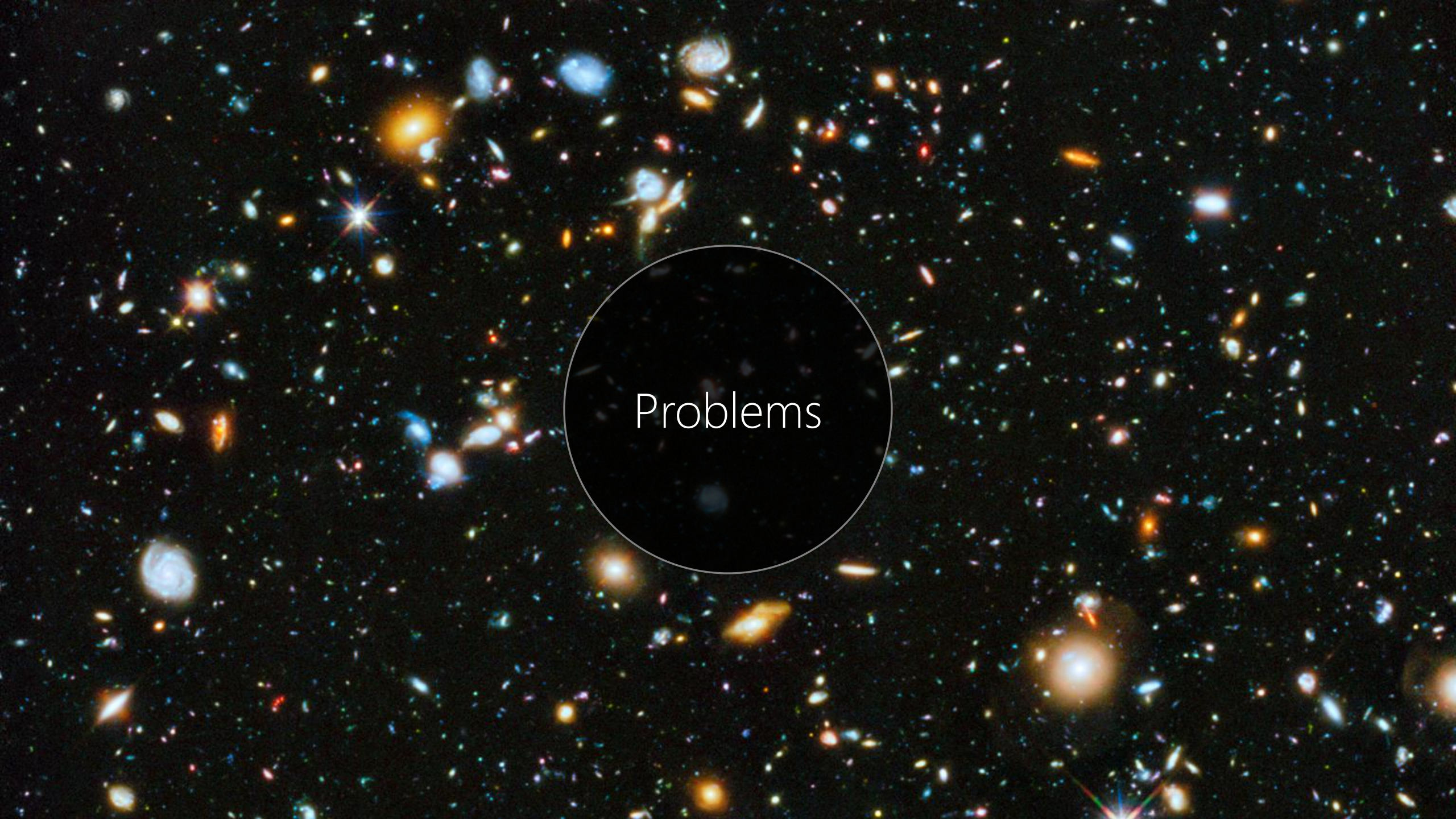
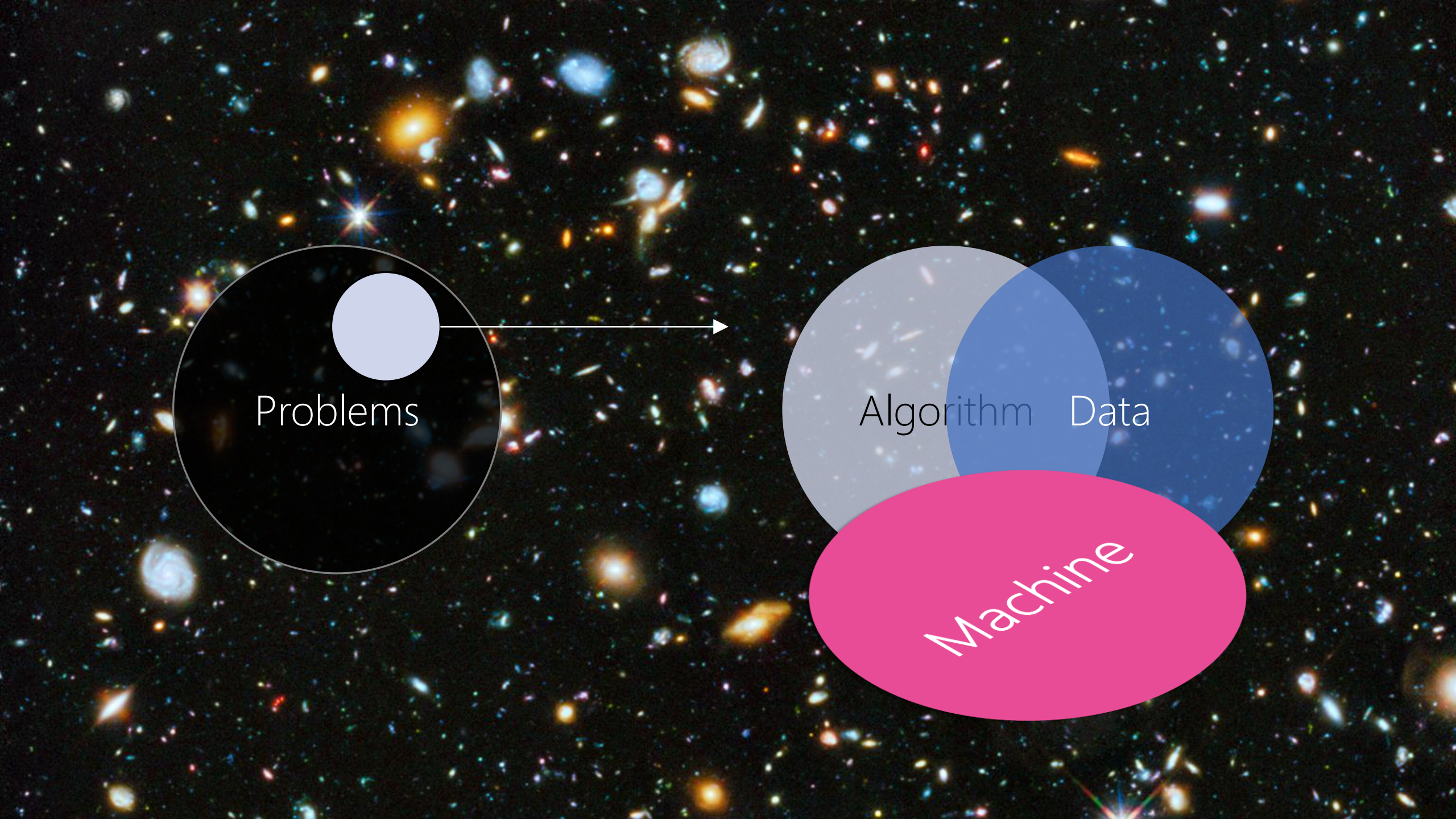
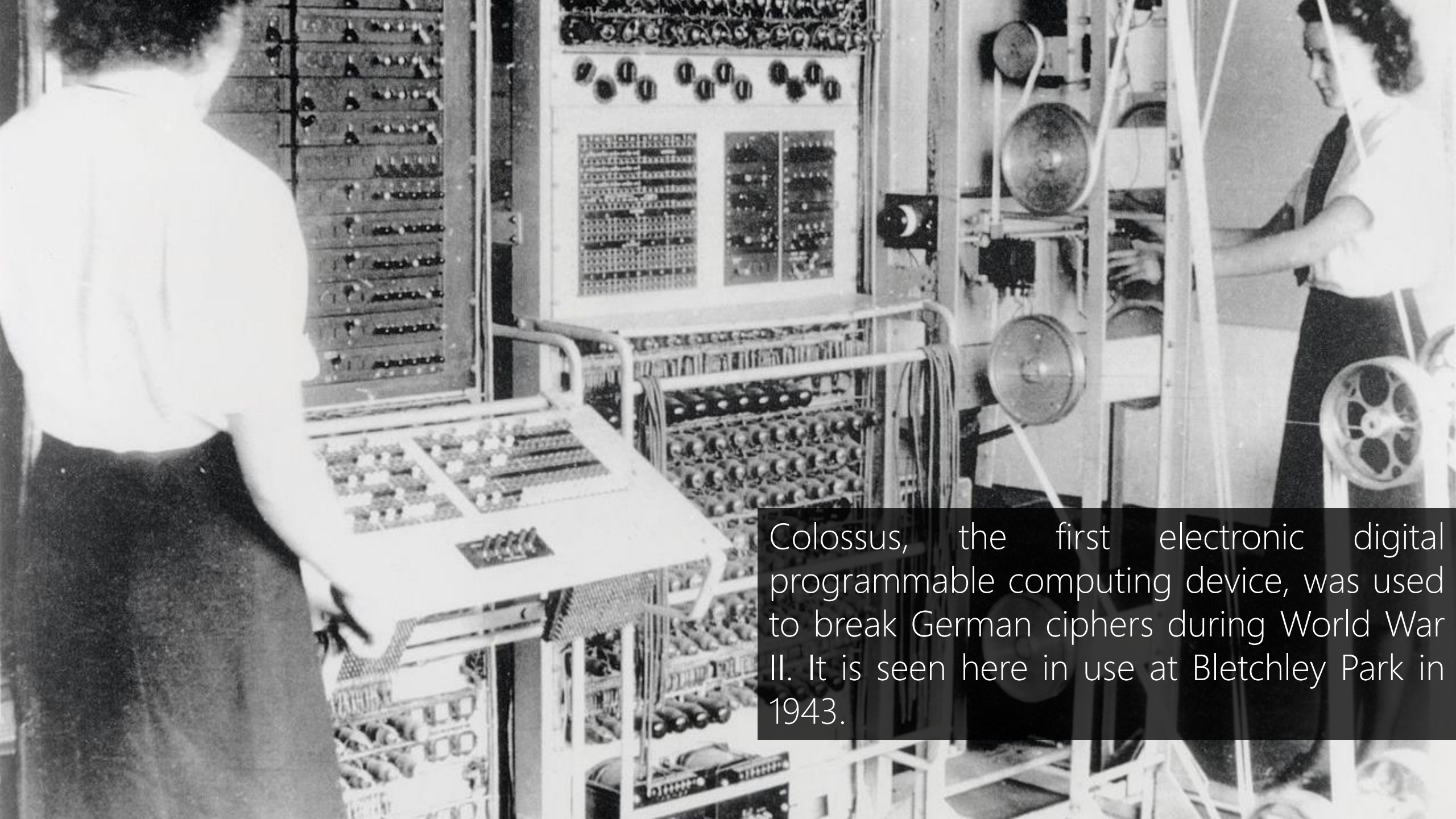
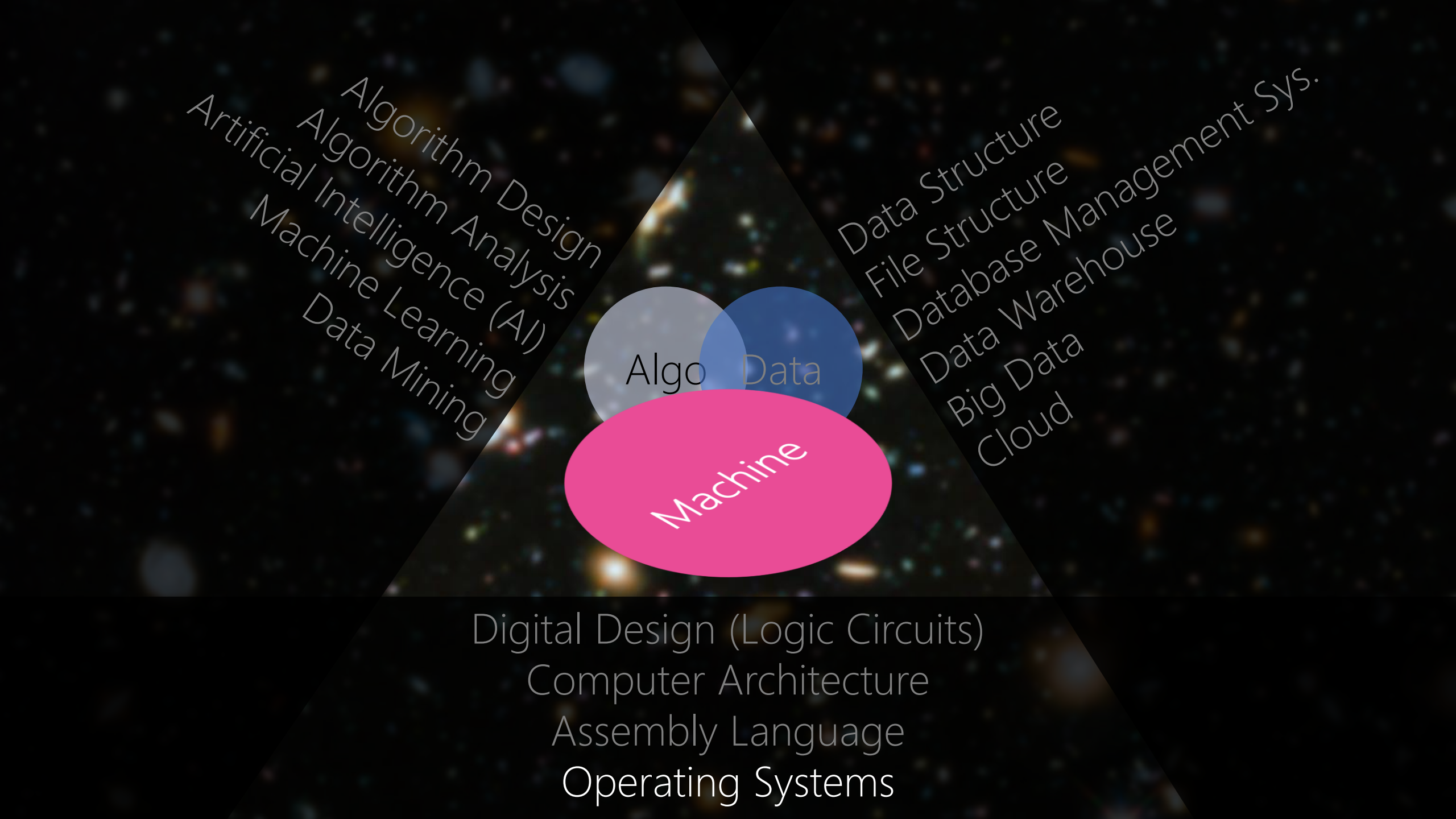
https://hubblesite.org/contents/media/videos/2014/27/766-Video.html


Problems


Problems
Algorithm
Data
Machine



Colossus, the first electronic digital programmable computing device, was used to break German ciphers during World War II. It is seen here in use at Bletchley Park in 1943.


Algorithm Design
Algorithm Analysis
Artificial Intelligence (AI)
Machine Learning
Data Mining
Data Structure
File Structure
Database Management Sys.
Data Warehouse
Big Data
Cloud
Algo
Data
Machine
Digital Design (Logic Circuits)
Computer Architecture
Assembly Language
Operating Systems

John von Neumann

(/vɒn ˈnɔɪmən/)

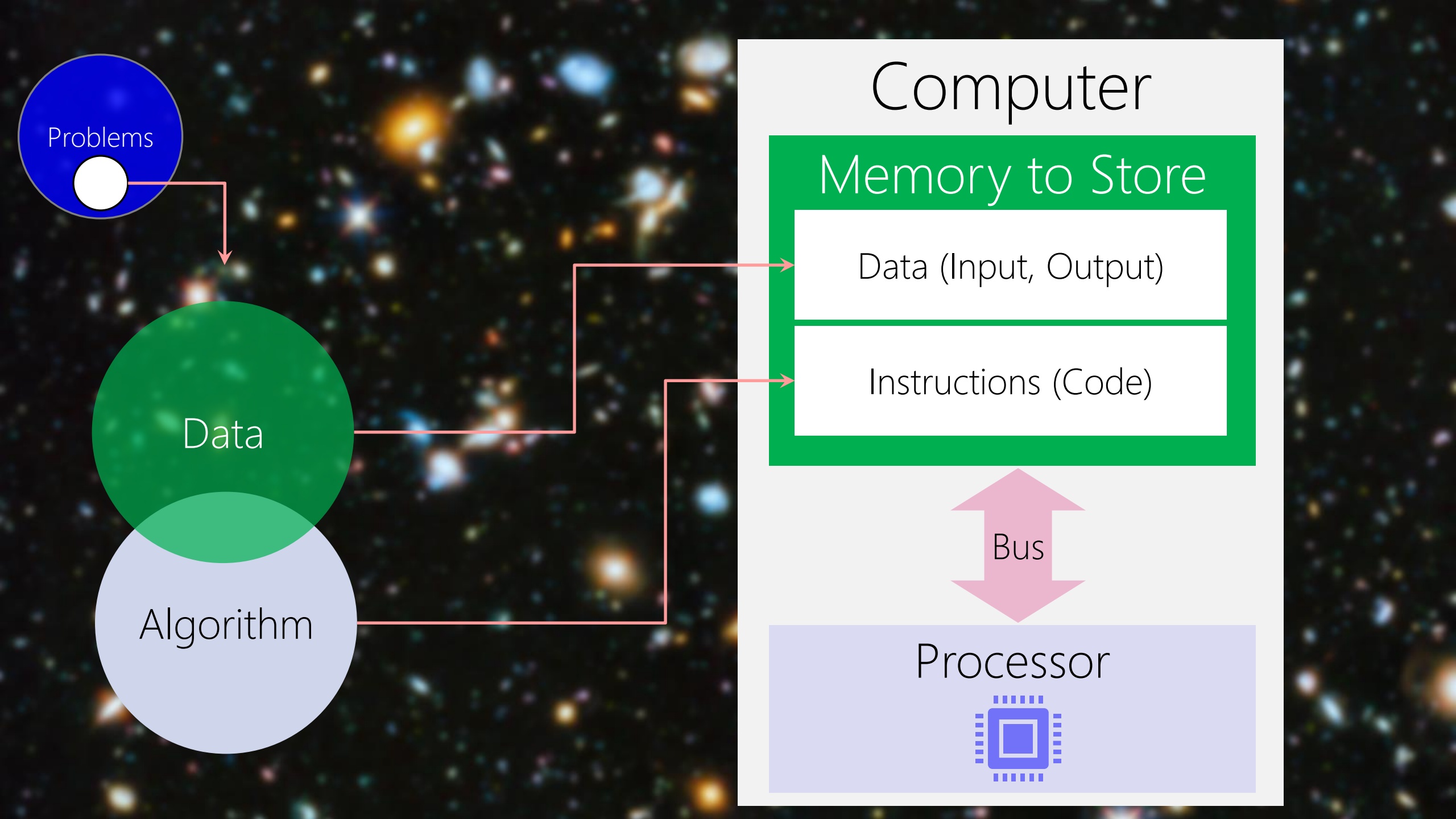
1903 –1957

Mathematician, Physicist, Computer Scientist, Engineer

Polymath

He integrated pure and applied sciences. He made major contributions to many fields, including:

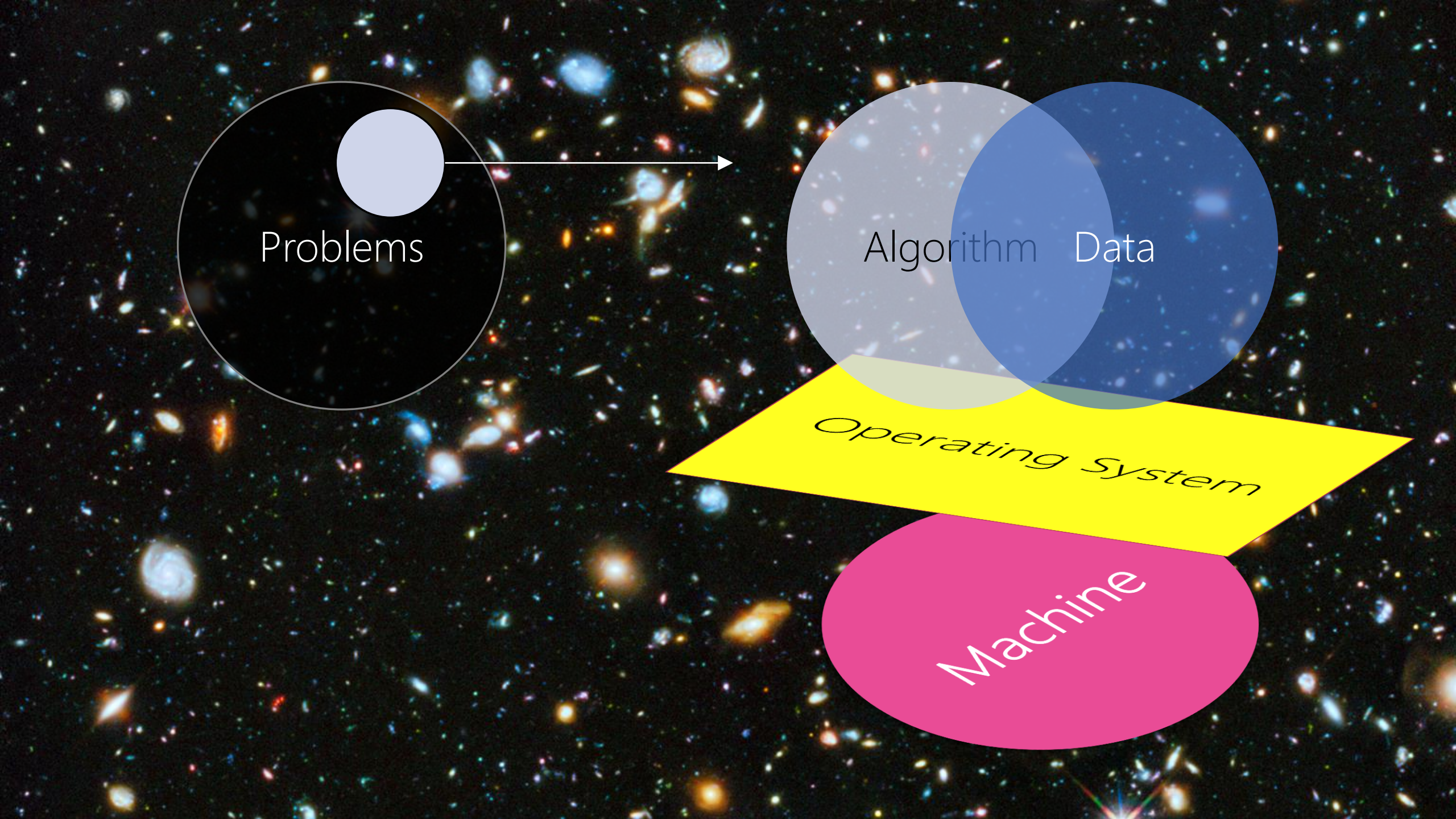
- Mathematics
- Physics
- Economics (game theory)
- Computing
- Statistics

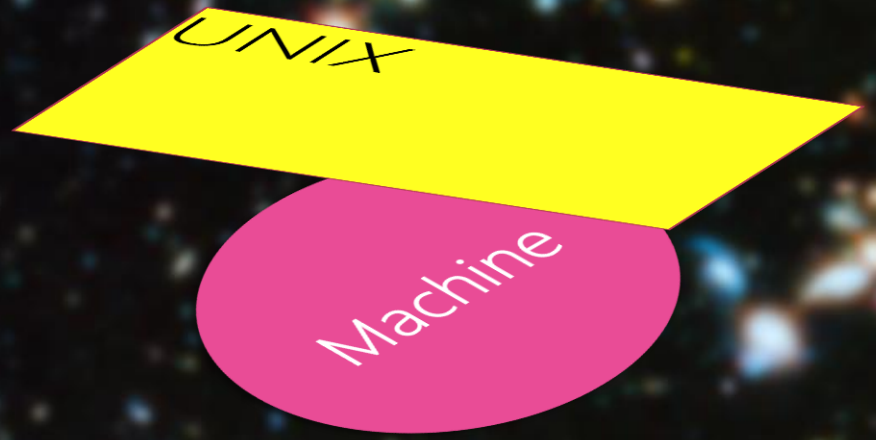

Problems
Data
Algorithm
Computer
Memory to Store
Data (Input, Output)
Instructions (Code)
Bus
Processor

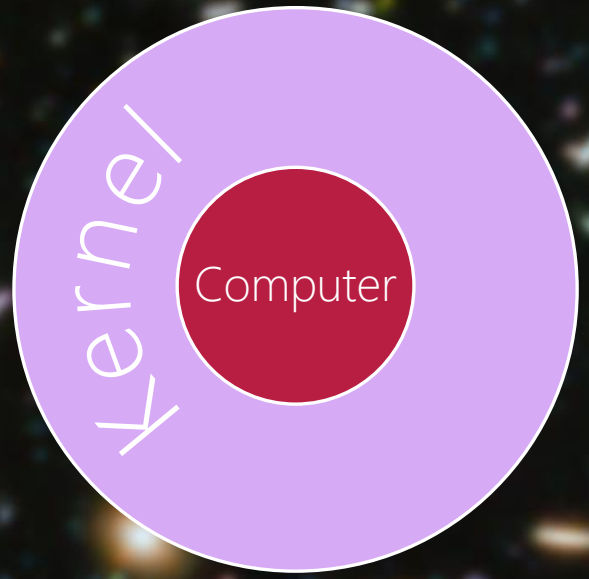
Dennis MacAlistair Ritchie
Kenneth Lane Thompson
AT&T Bell Lab, 1972, GE 645

Operating System

A program for programs!
System-level Program


Problems
Algorithm
Data
operating system
Machine





Computer

Memory

Kernel: Device Manager

Kernel: Memory Manager

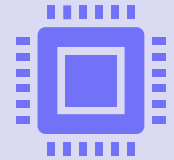
Kernel: File Manager

Kernel: Network Manager

Kernel: Process Manager

Bus

Processor



Storage Device == String of Bytes == File

`fcntl.h: create(), open(): O_CREAT, O_EXCL, O_APPEND, ...`

`unistd.h: read(), write(), lseek(), close()`

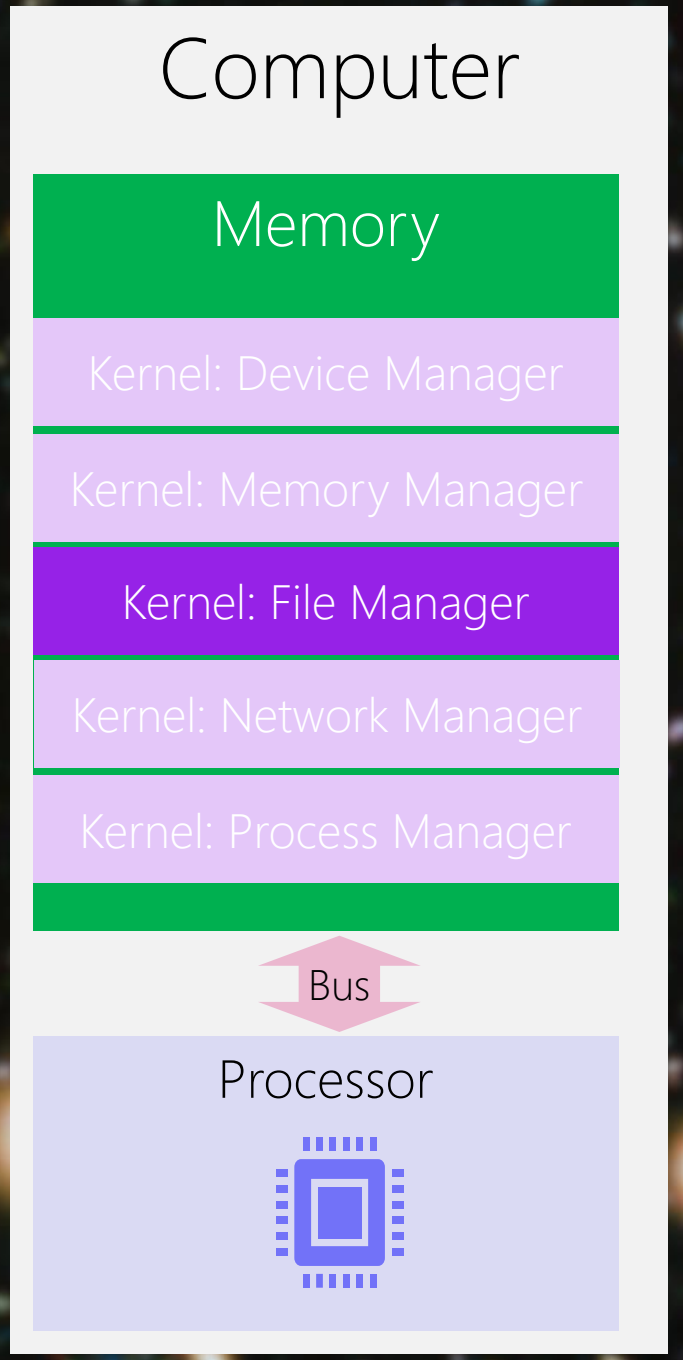
File Descriptor: Standard FDs, `dup()` vs. `open()`

I/O Redirection

Storage File System:

i-Node, Data Blocks, Groups, Partitions, Files, Directories, Deleting/Moving/Copying

Fragmentation

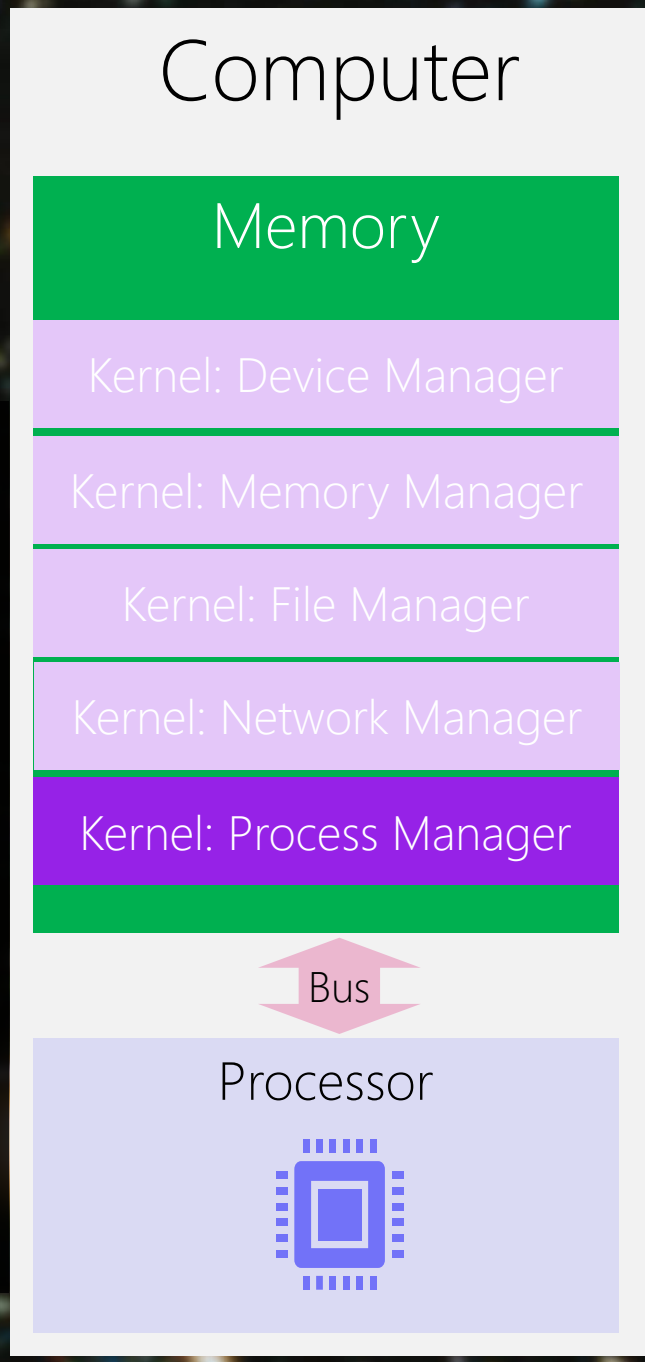


Bootstrapping a program: `main()`, memory layout and the segments: cs, ds, bss, ss,
Stack and return addresses
Heap and dynamic allocation
Process Identifier: `getpid()`
Process Termination, Exit Status, Normal vs. Abnormal Exit

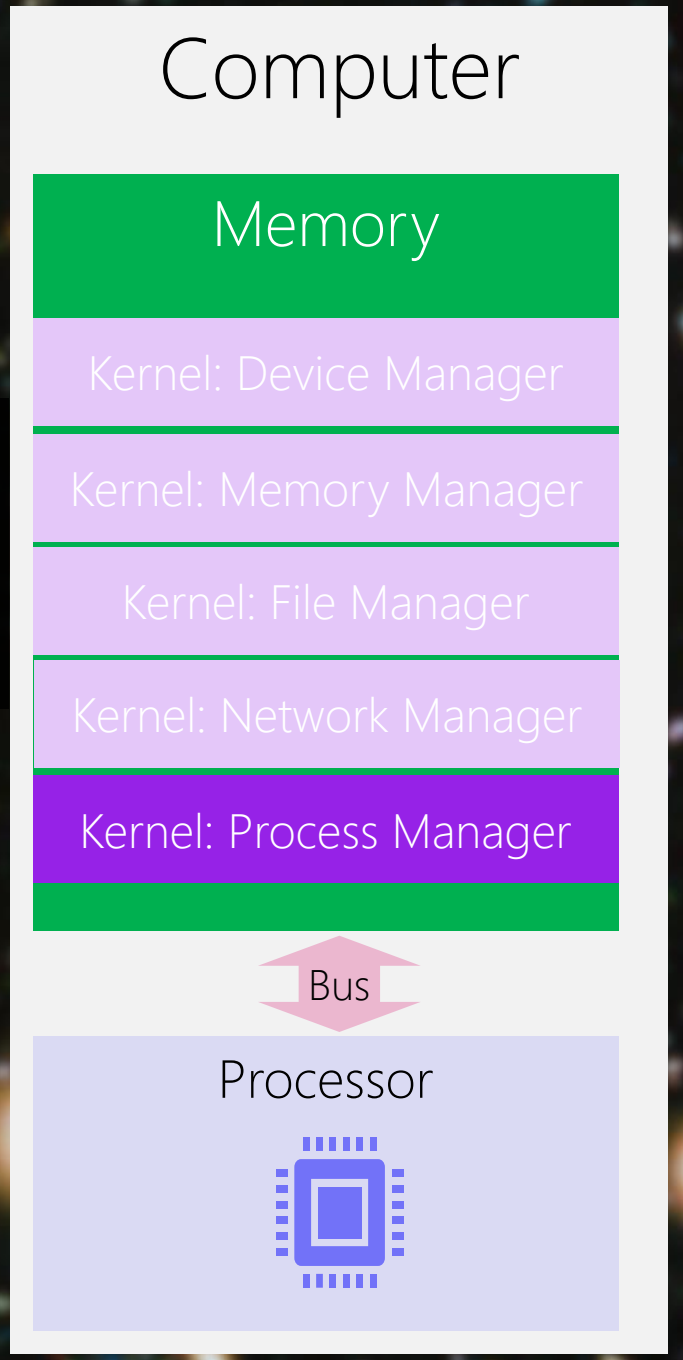
Multiprocessing:
Why? Processor Sharing/Scheduling, `fork()`, parent vs. child, Orphan, Zombie, `wait()`
Child generation models
Grandchild, Multiple children

`fork()` vs. `exec()`

Process Life Cycle: Program, Ready, Run, Blocked, Terminated



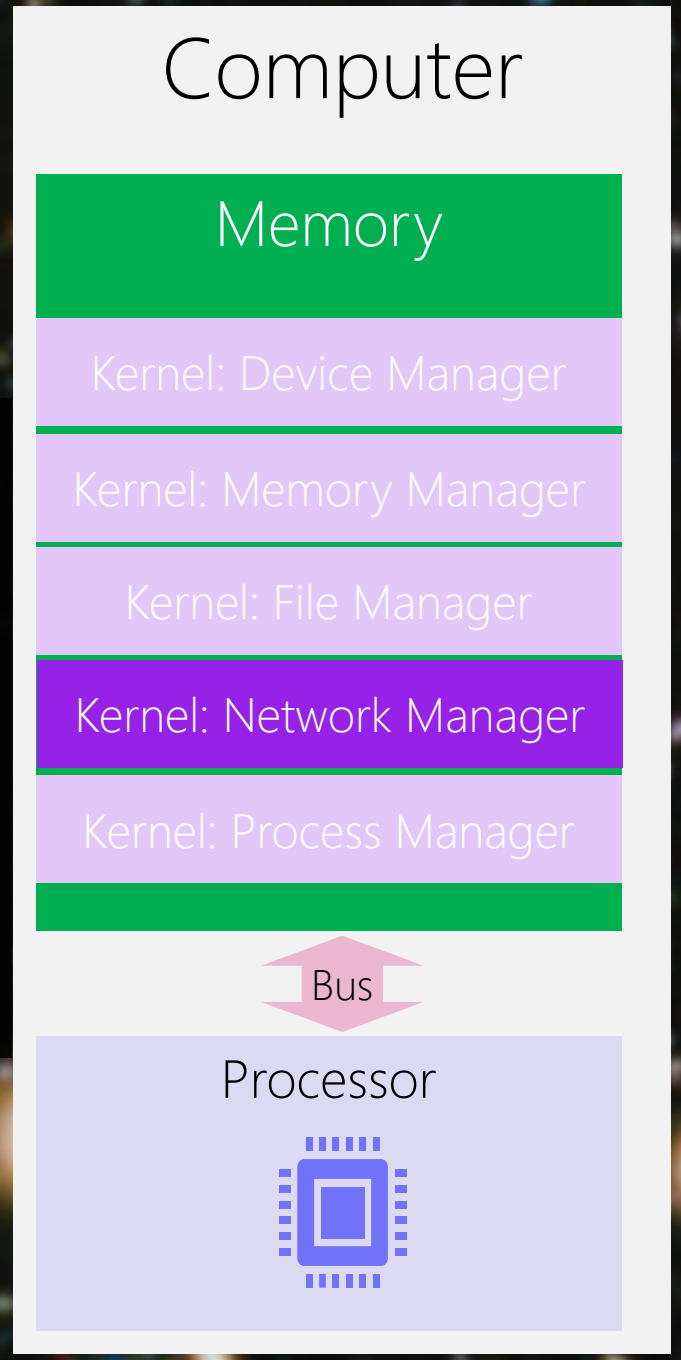
Inter-Process Communication (IPC)
One way parent to child
Two way but harsh: signaling, `kill()`, signal handling, default action, ignoring, ...
Two way but normal: Sharing a single file, unnamed file: `pipe()`, named file: `FIFO`,
Synchronized: Producer-Consumer



Network Inter-Process Communication (IPC)
Network Protocol: TCP/IP, UDP, TCP, IP, PORT

UDP: shoot a mail
Sender-Receiver: `socket(), bind(), sendto(), recvfrom()`

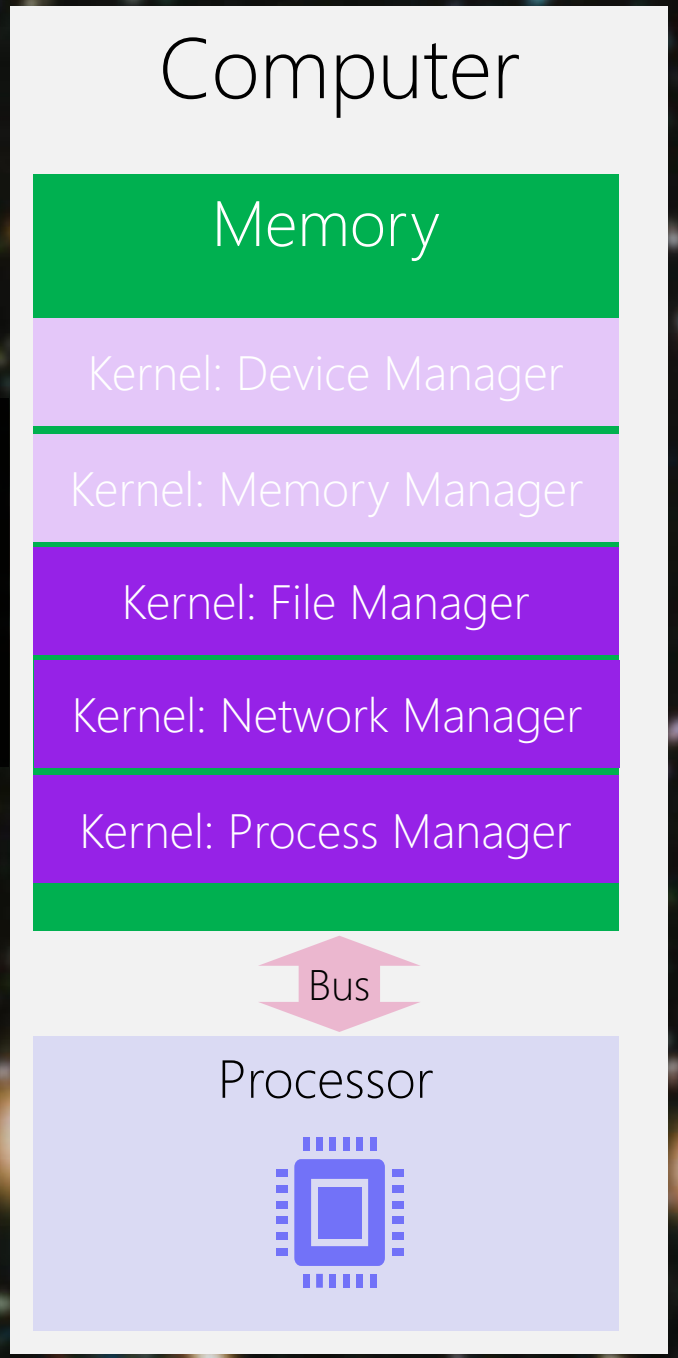
TCP: a phone call
The Server: `socket(), bind(), listen(), accept(), recv(), send()`
Clients: `socket(), bind(), connect(), send(), recv()`

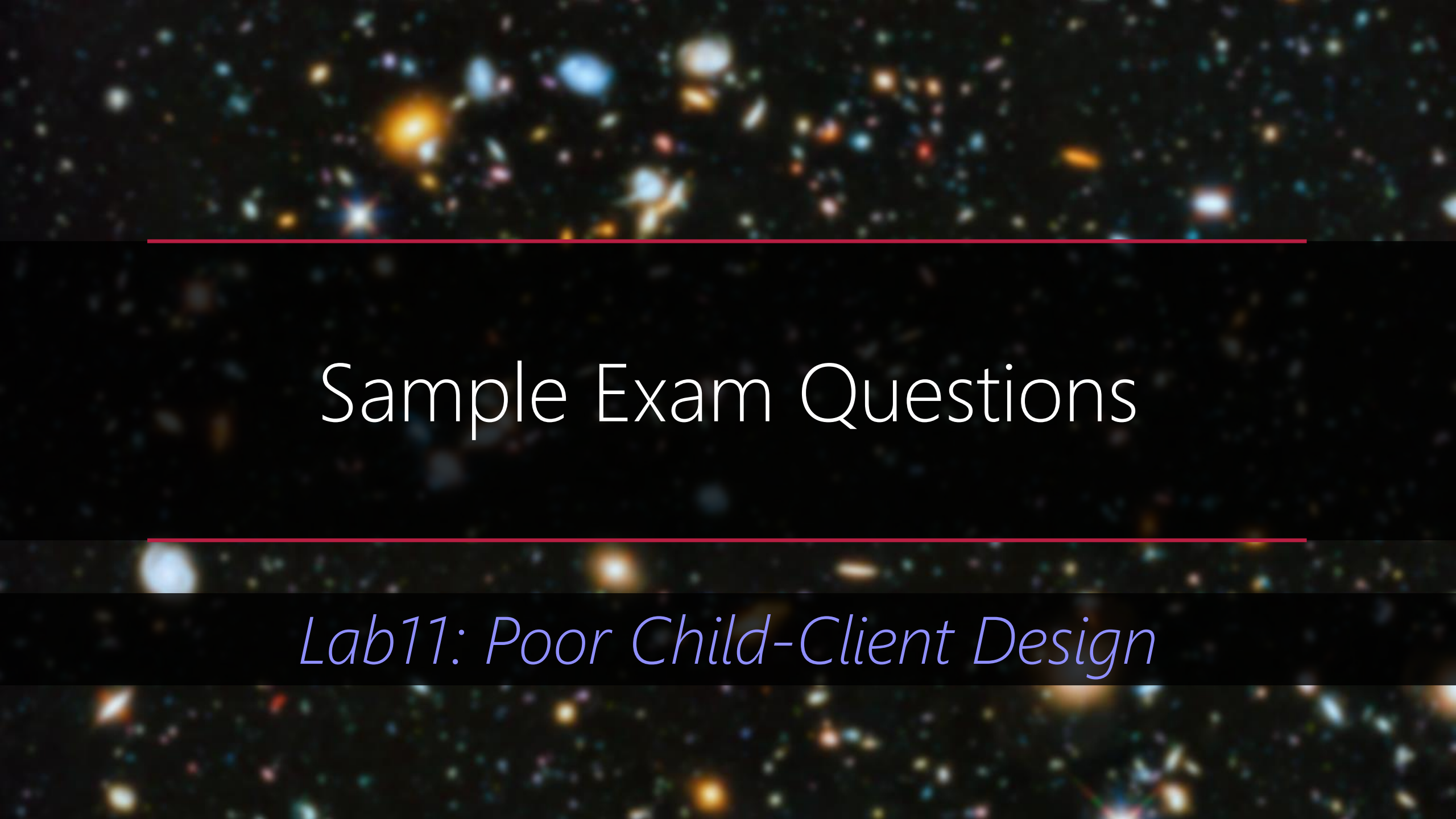


Design Patterns

Daemon: Active/Passive, Background, Memory-resident
Daemonize: Orphan child with logfile

Shared Library: Daemon Library, Web Service





Sample Exam Questions

Lab11: Poor Child-Client Design

University of Windsor

Hossein Fani 364

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