Performance Evaluation and Applications Projects

2021 / 2022

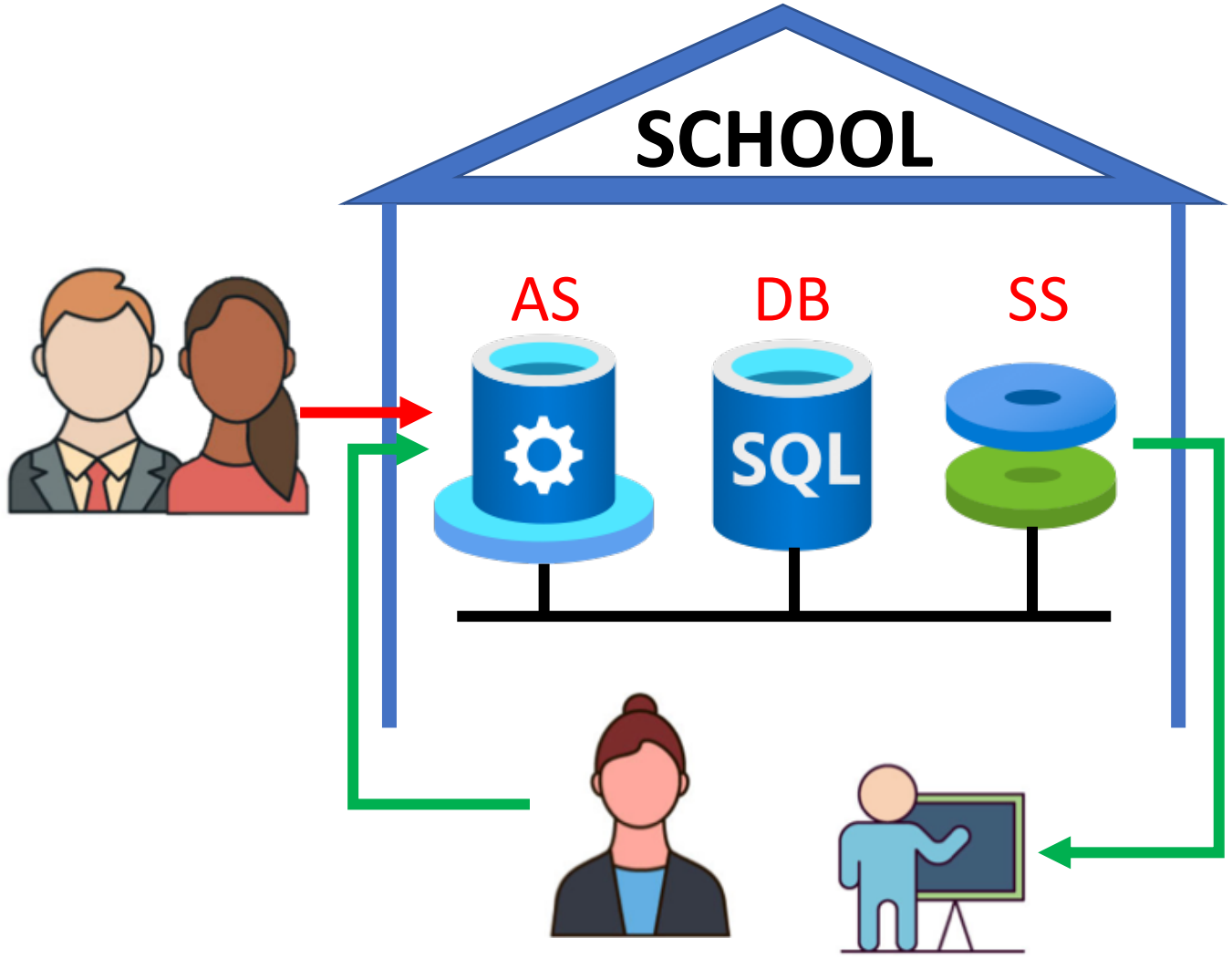
Project Type A

For students with ID (Codice Persona) ending with :
00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95

The information system of a school

It is composed by:

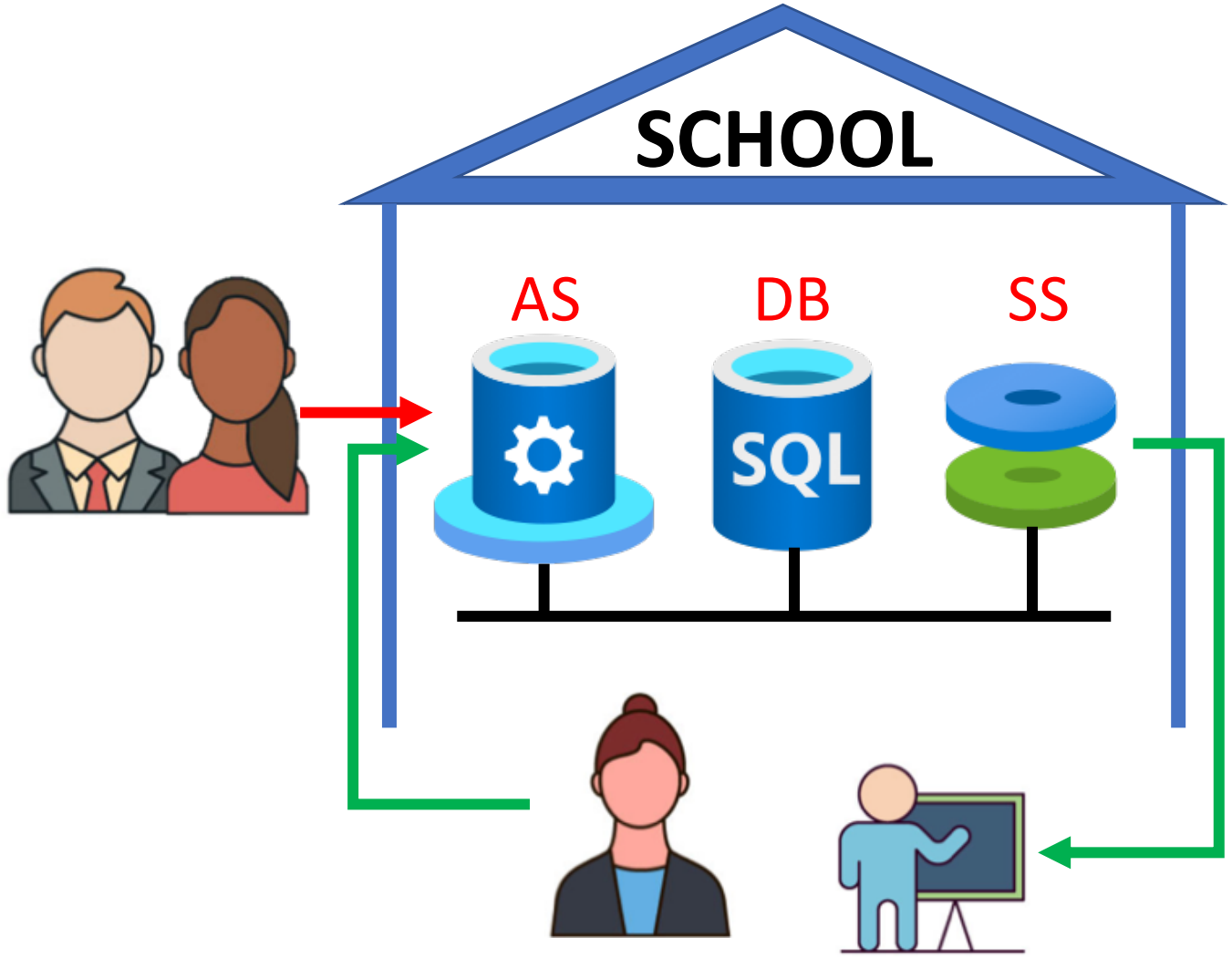
- An Application Server (AS)
- A DBMS (DB)
- A Storage Server (SS)



The information system of a school

It is used by:

- N_T teachers / administration staff
- Parents and external visitors, sending requests at rate λP.
- Teachers / administration have a think time respectively of Z_T.



Version A1

For students with ID (Codice Persona) ending with :
00, 20, 40, 60, 80

Considering the following parameters, compute the system response time, and the throughput for the teachers/administration staff.

The service times for the DB for requests coming from the teachers should be determined studying the corresponding trace (measured in seconds).

λ_P	N_T	Z_T
150 req./hour	150	10 min.

	AS	DB	SS
P	1 sec.	0.8 sec.	2 sec.
T	0.75 sec.	`Trace11.txt`	1.75 sec.

Version A2

For students with ID (Codice Persona) ending with :
05, 25, 45, 65, 85

Considering the following parameters, compute the response time for the parents, and the system throughput.

The service times for the SS for requests coming from the parents should be determined studying the corresponding trace (measured in seconds).

λ_P	N_T	Z_T
150 req./hour	100	15 min.

	AS	DB	SS
P	1 sec.	0.8 sec.	`Trace21.txt`
T	0.75 sec.	1 sec.	1.75 sec.

Version A3

For students with ID (Codice Persona) ending with :
10, 30, 50, 70, 90

Considering the following parameters, compute the system response time, and the throughput for the teachers/administration staff.

The service times for the DB for requests coming from the parents should be determined studying the corresponding trace (measured in seconds).

λ_P	N_T	Z_T
150 req./hour	75	20 min.

	AS	DB	SS
P	1 sec.	`Trace31.txt`	2 sec.
T	0.75 sec.	1 sec.	1.75 sec.

Version A4

For students with ID (Codice Persona) ending with :
15, 35, 55, 75, 95

Considering the following parameters, compute the response time for the parents, and the throughput for the teachers/administration staff.

The service times for the SS for requests coming from the teachers should be determined studying the corresponding trace (measured in seconds).

λ_P	N_T	Z_T
150 req./hour	120	12 min.

	AS	DB	SS
P	1 sec.	0.8 sec.	2 sec.
T	0.75 sec.	1 sec	`Trace41.txt`

Project Type B

For students with ID (Codice Persona) ending with :
01, 06, 11, 16, 21, 26, 31, 36, 41, 46, 51, 56, 61, 66, 71, 76, 81, 86, 91, 96

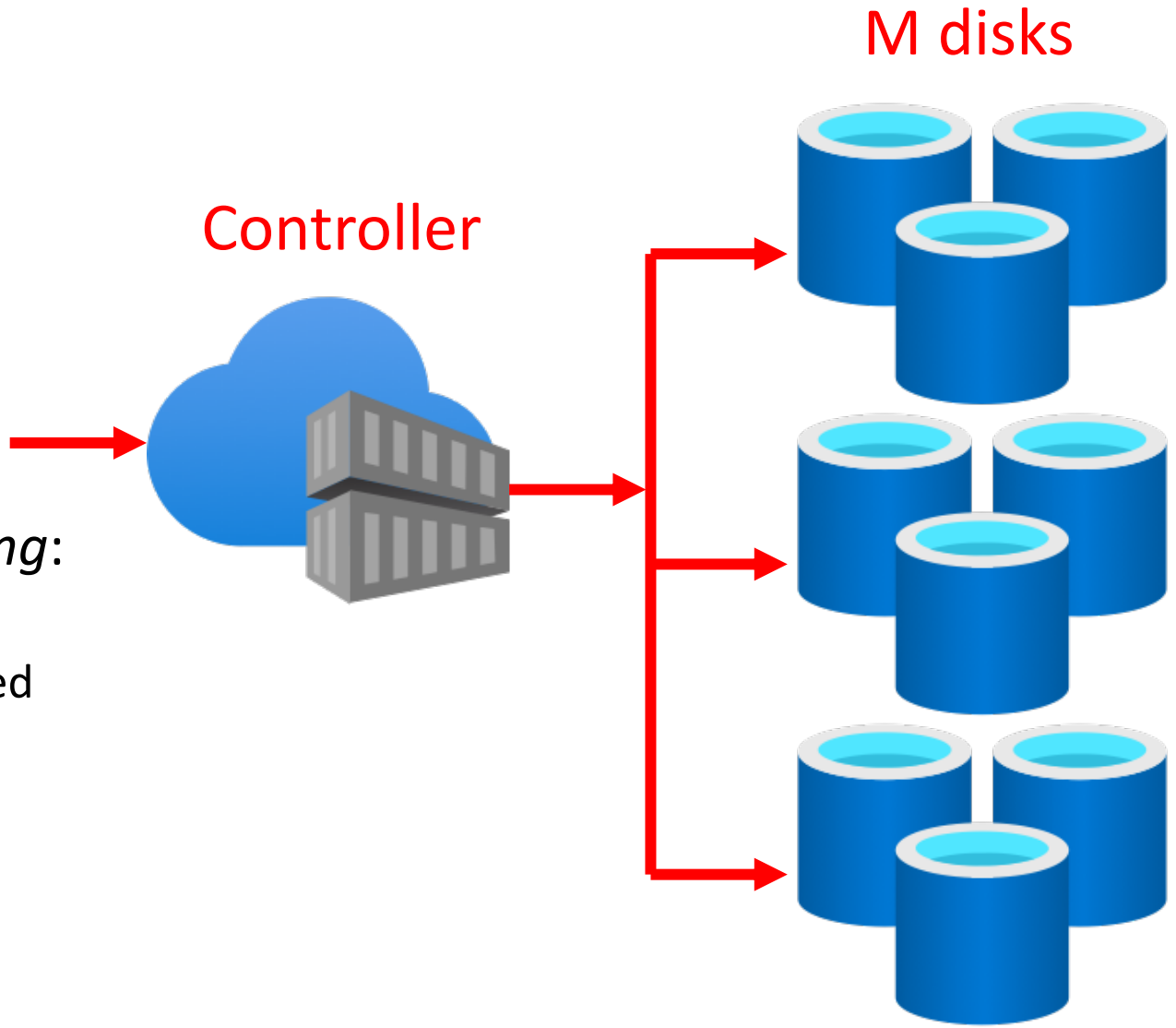
A cloud storage

It is composed by:

- A controller
- *M* disks

Each file is stored with *erasure coding*:

- It is split into *K* data chunks
- Another *N*-*K* coding chunks are added to improve reliability
- The file can be reconstructed when *K* out of *N* chunks are available
- We always have $K < N < M$



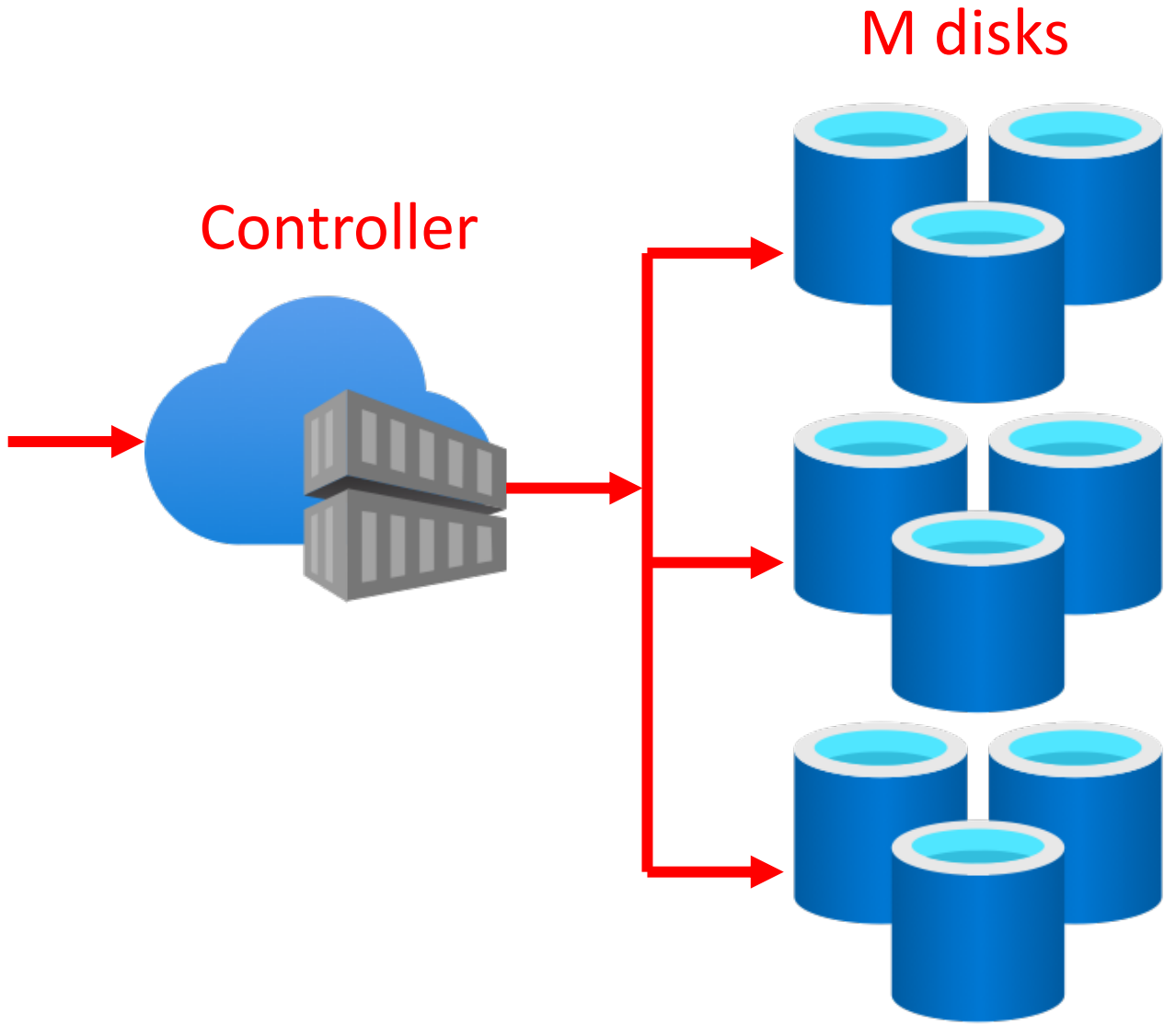
A cloud storage

Two types of requests are considered:

- *Write (rate λ_W)* requests write *N* chunks on *N* randomly chosen disks among the *M* available. They terminate only when all chunks have been written.
- *Read (rate λ_R)* requests access only *K* randomly chosen disks out of the *M* available.

We are interested in modelling only perfectly functioning disks and do not consider failure.

We also suppose that read and write operations takes the same time on both the controller and the disks.



Version B1

For students with ID (Codice Persona) ending with :
01, 21, 41, 61, 81

Considering the following parameters, compute the average utilization of the disks, and the system response time.

The service times for the disks should be determined studying the corresponding trace (measured in milli-seconds): `Trace15.txt`

All other timings can be considered exponentially distributed.

λ_R	λ_W
300 req./sec.	80 req./sec.

$\mu_{Controller}$	K	N	M
1000 req./sec.	5	8	10

Version B2

For students with ID (Codice Persona) ending with :
06, 26, 46, 66, 86

Considering the following parameters, compute the average utilization of the controller, and the system response time.

The service times for the disks should be determined studying the corresponding trace (measured in milli-seconds): `Trace25.txt`

All other timings can be considered exponentially distributed.

λ_R	λ_W
200 req./sec.	50 req./sec.

$\mu_{Controller}$	K	N	M
1000 req./sec.	6	10	20

Version B3

For students with ID (Codice Persona) ending with :
11, 31, 51, 71, 91

Considering the following parameters, compute the response time for read and write requests.

The service times for the disks should be determined studying the corresponding trace (measured in milli-seconds): `Trace35.txt`

All other timings can be considered exponentially distributed.

λ_R	λ_W
300 req./sec.	80 req./sec.

$\mu_{Controller}$	K	N	M
1200 req./sec.	6	8	12

Version B4

For students with ID (Codice Persona) ending with :
16, 36, 56, 76, 96

Considering the following parameters, compute the response time for read and write requests.

The service times for the disks should be determined studying the corresponding trace (measured in milli-seconds): `Trace45.txt`

All other timings can be considered exponentially distributed.

λ_R	λ_W
200 req./sec.	100 req./sec.

$\mu_{Controller}$	K	N	M
800 req./sec.	3	5	10

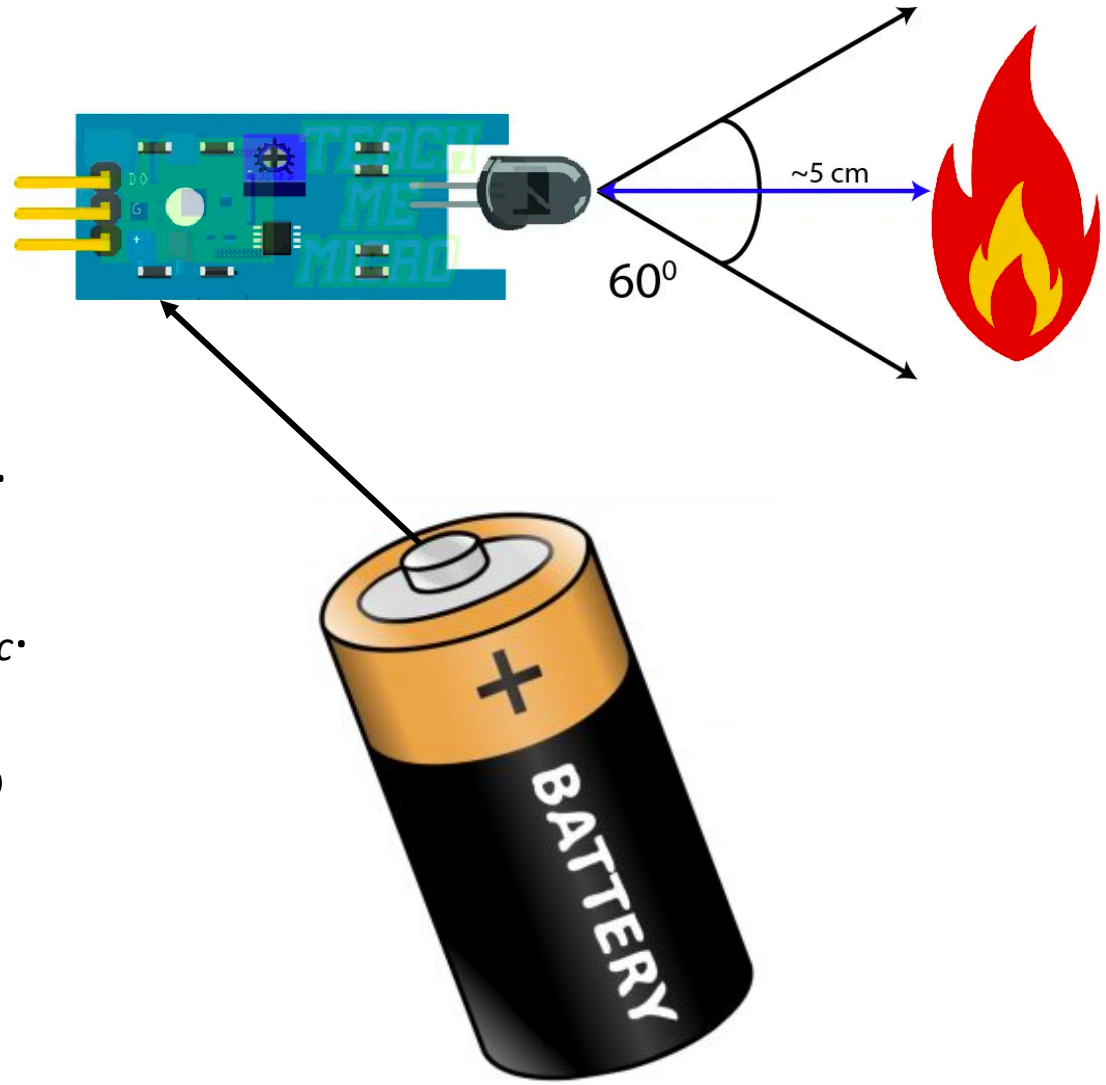
Project Type C

For students with ID (Codice Persona) ending with :
02, 07, 12, 17, 22, 27, 32, 37, 42, 47, 52, 57, 62, 67, 72, 77, 82, 87, 92, 97

A sensing device

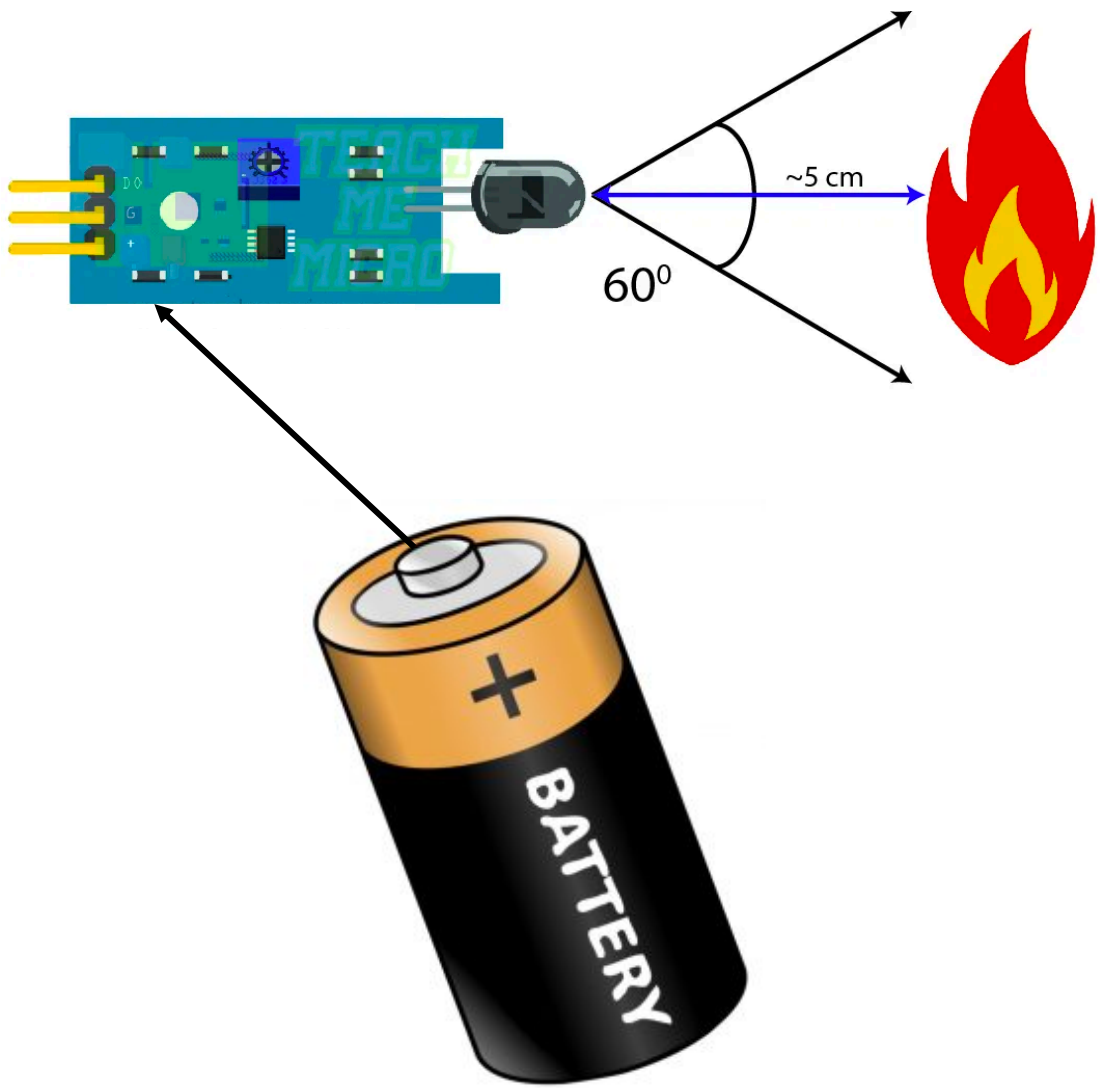
A sensor has the following characteristics

- It switches from on to off, at rate μ_{off} returns on at rate μ_{on}, to save its battery.
- When on, it senses events at rate μ_{sen}.
- Sensed events are processed at rate μ_{proc}.
- Processed event trigger an action with probability p_{act}, otherwise they return to the on state.
- Actions require a random time X_{act}, then the sensor returns to its on state.



A sensing device

- Except for the action X_{act}, all other timings can be considered exponentially distributed.
- Depending on the state, the sensor has a different energy consumption:
  - $\mathcal{E}_{off}$ when off.
  - $\mathcal{E}_{on}$ when on and not processing.
  - $\mathcal{E}_{proc}$ when processing.
  - $\mathcal{E}_{act}$ when acting.



Version C1

For students with ID (Codice Persona) ending with :
02, 22, 42, 62, 82

Considering the following parameters, compute the average energy consumption and the on frequency.

The duration of X_{act} should be determined studying the corresponding trace (measured in seconds): `Trace13.txt`

p_{act}
0.1

μ_{on}	μ_{off}	μ_{sen}	μ_{proc}
0.1 $sec.^{-1}$	1	3	5

ε_{on}	ε_{off}	ε_{proc}	ε_{act}
1 mW	0.1 mW	5 mW	50 mW

Version C2

For students with ID (Codice Persona) ending with :
07, 27, 47, 67, 87

Considering the following parameters, compute the average energy consumption and the processing frequency.

The duration of X_{act} should be determined studying the corresponding trace (measured in seconds): `Trace23.txt`

p_{act}
0.2

μ_{on}	μ_{off}	μ_{sen}	μ_{proc}
0.1 $sec.^{-1}$	1	3	3

ε_{on}	ε_{off}	ε_{proc}	ε_{act}
1 mW	0.1 mW	5 mW	50 mW

Version C3

For students with ID (Codice Persona) ending with :
12, 32, 52, 72, 92

Considering the following parameters, compute the average energy consumption and the action frequency.

The duration of X_{act} should be determined studying the corresponding trace (measured in seconds): `Trace33.txt`

p_{act}
0.05

μ_{on}	μ_{off}	μ_{sen}	μ_{proc}
0.1 $sec.^{-1}$	2	4	5

ε_{on}	ε_{off}	ε_{proc}	ε_{act}
1 mW	0.1 mW	5 mW	200 mW

Version C4

For students with ID (Codice Persona) ending with :
17, 37, 57, 77, 97

Considering the following parameters, compute the average energy consumption and the off frequency.

The duration of X_{act} should be determined studying the corresponding trace (measured in seconds): `Trace43.txt`

p_{act}
0.15

μ_{on}	μ_{off}	μ_{sen}	μ_{proc}
0.1 $sec.^{-1}$	1	3	0.5

ε_{on}	ε_{off}	ε_{proc}	ε_{act}
1.5 mW	0.1 mW	10 mW	50 mW

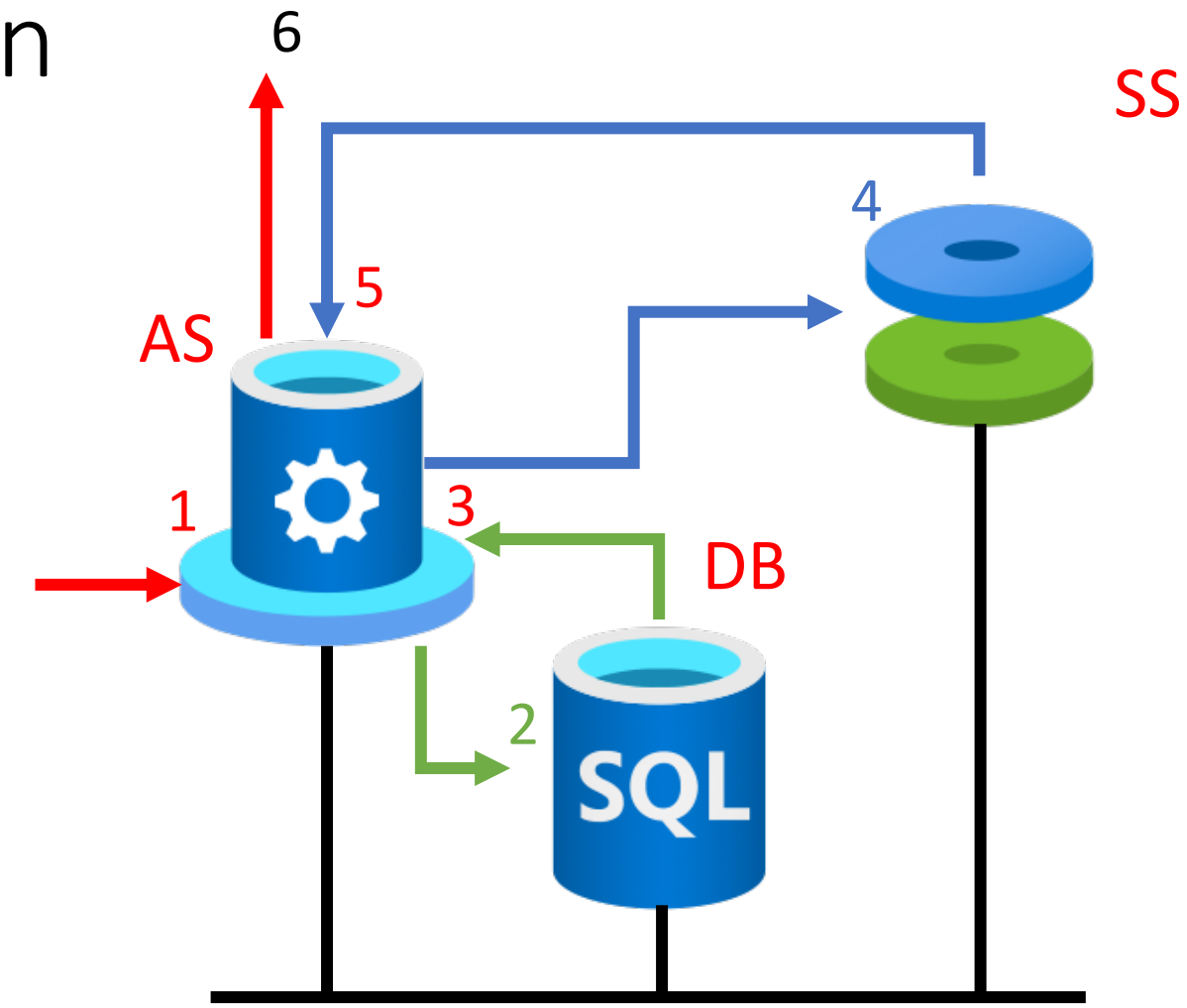
Project Type D

For students with ID (Codice Persona) ending with :
03, 08, 13, 18, 23, 28, 33, 38, 43, 48, 53, 58, 63, 68, 73, 78, 83, 88, 93, 98

A three tier application

It is composed by:

- An Application Server (AS)
- A DBMS (DB)
- A Storage Server (SS)

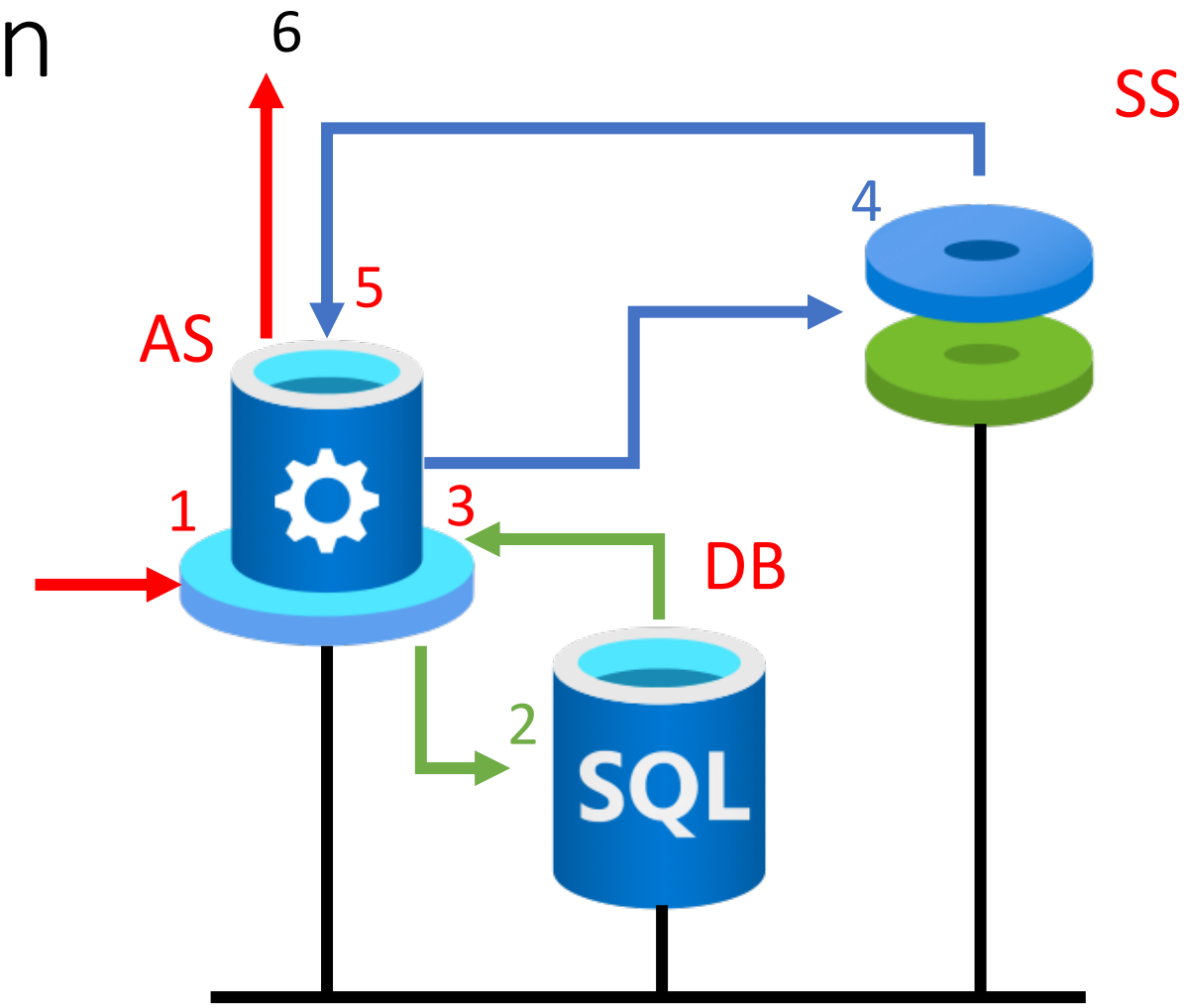


A three tier application

Requests arrive from outside according to a Poisson process of rate λ.

The are served first by the AS, next by the DB, then by the AS again, followed by the SS, and finally by the AS for a third time.

Each passage through the AS is characterized by a different service time.



Version D1

For students with
ID (Codice Persona)
ending with :
03, 23, 43, 63, 83

Considering the following parameters, compute the system response time, and the utilization of the AS.

The service times for the DB should be determined studying the corresponding trace (measured in seconds).

λ
10 req./min.

Pass	AS	DB	SS
1	1 sec.	`Trace14.txt`	
2	0.75 sec.		1.75 sec.
3	2 sec.		

Version D2

For students with ID (Codice Persona) ending with :
08, 28, 48, 68, 88

Considering the following parameters, compute the system response time, and the utilization of the DB.

The service times for the SS should be determined studying the corresponding trace (measured in seconds).

λ
8 req./min.

Pass	AS	DB	SS
1	1 sec.	0.8 sec.	
2	0.75 sec.		`Trace24.txt`
3	2 sec.		

Version D3

For students with ID (Codice Persona) ending with :
13, 33, 53, 73, 93

Considering the following parameters, compute the system response time, and the utilization of the SS.

The service times for the AS during the first visit should be determined studying the corresponding trace (measured in seconds).

λ
7.5 req./min.

Pass	AS	DB	SS
1	1 sec.	0.8 sec.	
2	`Trace34.txt`		1.75 sec.
3	2 sec.		

Version D4

For students with ID (Codice Persona) ending with :
18, 38, 58, 78, 98

Considering the following parameters, compute the system response time, and the throughput of the AS.

The service times for the AS during the third visit should be determined studying the corresponding trace (measured in seconds).

λ
9 req./min.

Pass	AS	DB	SS
1	1 sec.	0.8 sec.	
2	0.75 sec.		1.75 sec.
3	`Trace44.txt`		

Project Type E

For students with ID (Codice Persona) ending with :
04, 09, 14, 19, 24, 29, 34, 39, 44, 49, 54, 59, 64, 69, 74, 79, 84, 89, 94, 99

Warehouse of an on-line electronic shop

N employees work in a warehouse. They:

- Access the information system to read the next order.
- Go in the shelves for searching the product
- Go to the packing station for packing the product
- Go to the delivery station to send the product
- Repeat these steps

Warehouse of an on-line electronic shop

- Packing and Delivery stations allow respectively at most K_P and K_D employees at the same time: if the capacity is exceeded, not admitted workers have to wait in the previous station after having finished their service. To avoid congestion, service at the previous station is blocked.
- All workers have their own PC terminal, and the space in the shelves is large enough to allow parallel product search. All stations can then be considered infinite servers.

Version E1

For students with
ID (Codice Persona)
ending with :
04, 24, 44, 64, 84

Considering the following parameters, compute the system throughput and the blocking probability at the shelves.

The duration of the access at the information system should be determined studying the corresponding trace (measured in minutes). All other timings can be considered exponentially distributed, with their average given below.

N	K_P	K_D
10	4	2

I.S.	Shelves	Packing	Delivery
`Trace12.txt`	5 min.	10 min.	3 min.

Version E2

For students with ID (Codice Persona) ending with :
09, 29, 49, 69, 89

Considering the following parameters, compute the system throughput and the blocking probability at the packing station.

The duration of the access at delivery station should be determined studying the corresponding trace (measured in minutes). All other timings can be considered exponentially distributed, with their average given below.

N	K_P	K_D
8	3	2

I.S.	Shelves	Packing	Delivery
1 min.	5 min.	8 min.	`Trace22.txt`

Version E3

For students with ID (Codice Persona) ending with :
14, 34, 54, 74, 94

Considering the following parameters, compute the system throughput and the average time spent at the packing station.

The duration of the access at the information system should be determined studying the corresponding trace (measured in minutes). All other timings can be considered exponentially distributed, with their average given below.

N	K_P	K_D
12	5	3

I.S.	Shelves	Packing	Delivery
`Trace32.txt`	6 min.	10 min.	3 min.

Version E4

For students with ID (Codice Persona) ending with :
19, 39, 59, 79, 99

Considering the following parameters, compute the system throughput and the average time spent in the shelves.

The duration of the access at delivery station should be determined studying the corresponding trace (measured in minutes). All other timings can be considered exponentially distributed, with their average given below.

N	K_P	K_D
15	6	4

I.S.	Shelves	Packing	Delivery
2 min.	8 min.	10 min.	`Trace42.txt`