



# Homework 10

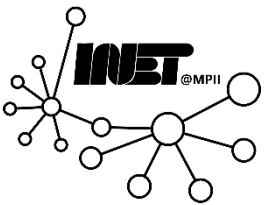
State, RSVP, Indirection and MQTT



# Get the Slides here



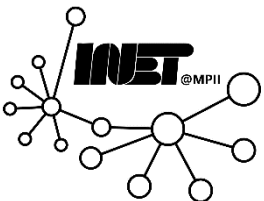
# link



# Homework Overview



- Soft State and Hard State
- RSVP
- Indirection and virtualization
- MQTT



# Question 1 (Soft State / Hard State)



Scooters can be rented by using a smartphone app, called “SaarScooters”. The managers decided that they need an advantage with regard to the other scooter rental services. This is why customers are only charged while they ride a scooter. Reserving a scooter is necessary before renting it, but customers don't have to pay for the time while the scooter is reserved. However, reservations don't last forever, as that wouldn't be profitable. So, customers can reserve a scooter only for a limited amount of time: 2 minutes. If the scooter is not claimed during that time, the reservation expires and the scooter becomes again available for all the customers. If the customer starts using the scooter, the reservation process is suspended. After the scooter is returned, it becomes immediately available for all the other customers.



# Question 1 (a)



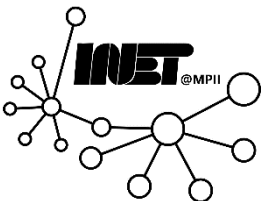
Provide a state diagram that shows only the states where a scooter is **available** or **reserved** (i.e., 2 states). Indicate for each of the two states whether it is a soft state or a hard state and why.



# Question 1 (a)



Provide a state diagram that shows only the states where a scooter is **available** or **reserved** (i.e., 2 states). **Indicate** for each of the two states **whether it is a soft state or a hard state and why**.



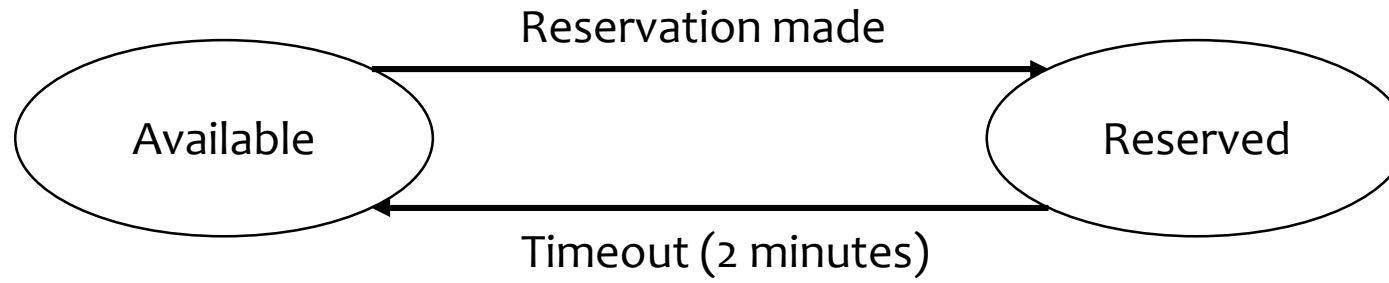
# Question 1 (a)



Scooters can be rented by using a smartphone app, called “SaarScooters”. The managers decided that they need an advantage with regard to the other scooter rental services. This is why customers are only charged while they ride a scooter. Reserving a scooter is necessary before renting it, but customers don't have to pay for the time while the scooter is reserved. However, reservations don't last forever, as that wouldn't be profitable. So, **customers can reserve a scooter only for a limited amount of time: 2 minutes**. If the scooter is not claimed during that time, the **reservation expires** and the scooter becomes again **available** for all the customers. If the customer starts using the scooter, the reservation process is suspended. After the scooter is returned, it becomes immediately available for all the other customers.

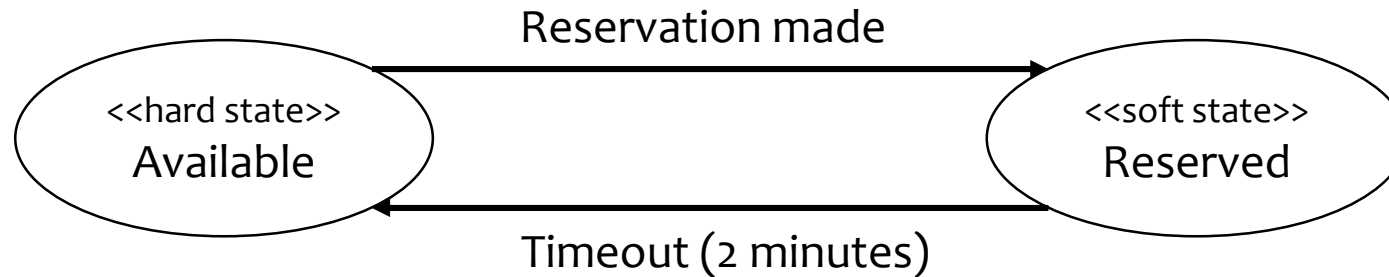


# Question 1 (a)



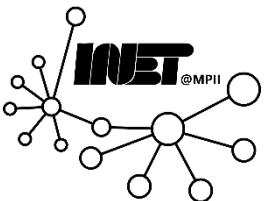


# Question 1 (a)



→ Available is a hard-state, because it can only be changed by a reservation request

→ Reserved is a soft-state, because it has a timeout



# Question 1 (b)



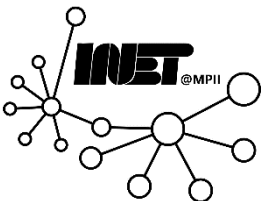
Augment your state diagram with the information about the current usage of a scooter. That is, add a third state where the scooter is used. Indicate whether this third state is a soft state or a hard state and why.



# Question 1 (b)



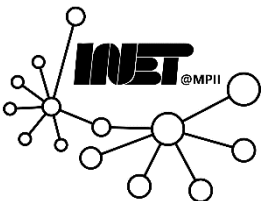
Augment your state diagram with the information about the current usage of a scooter. That is, **add a third state where the scooter is used**. Indicate whether this third state is a soft state or a hard state and why.



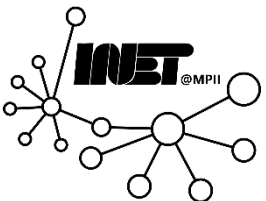
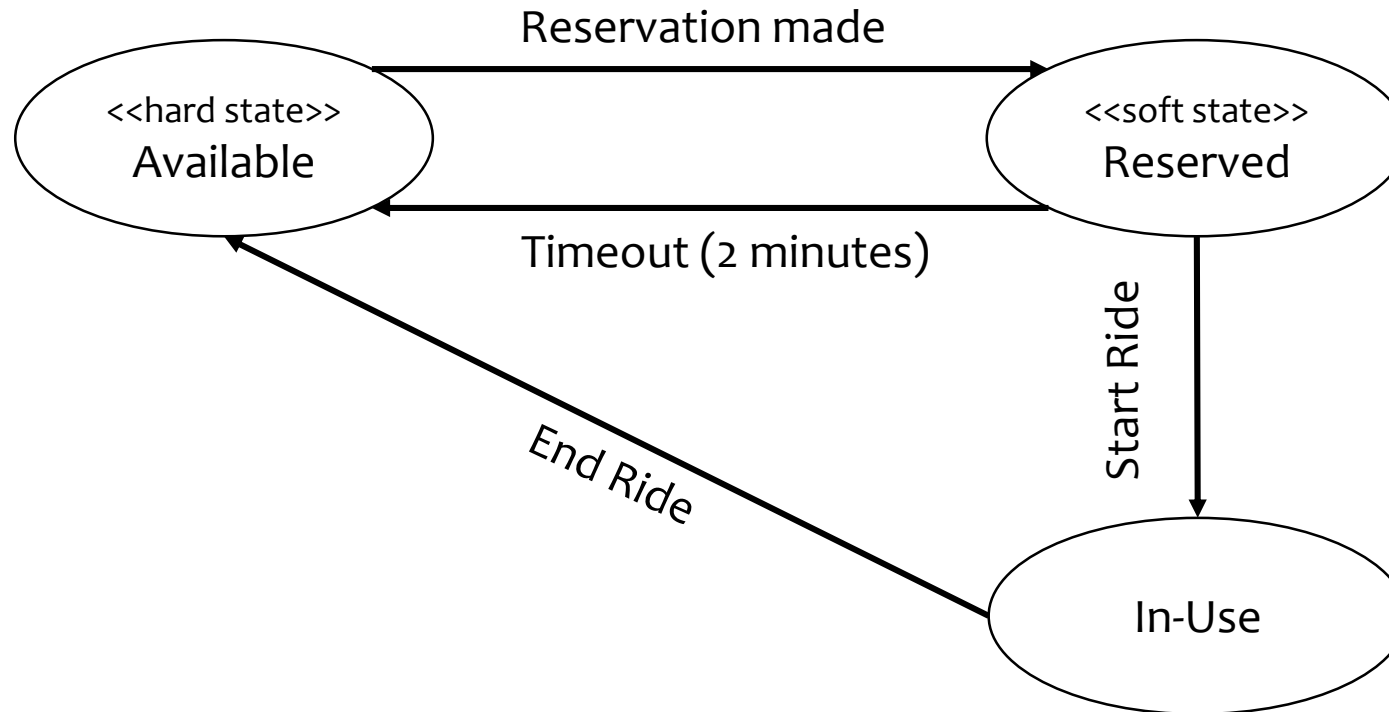
# Question 1 (b)



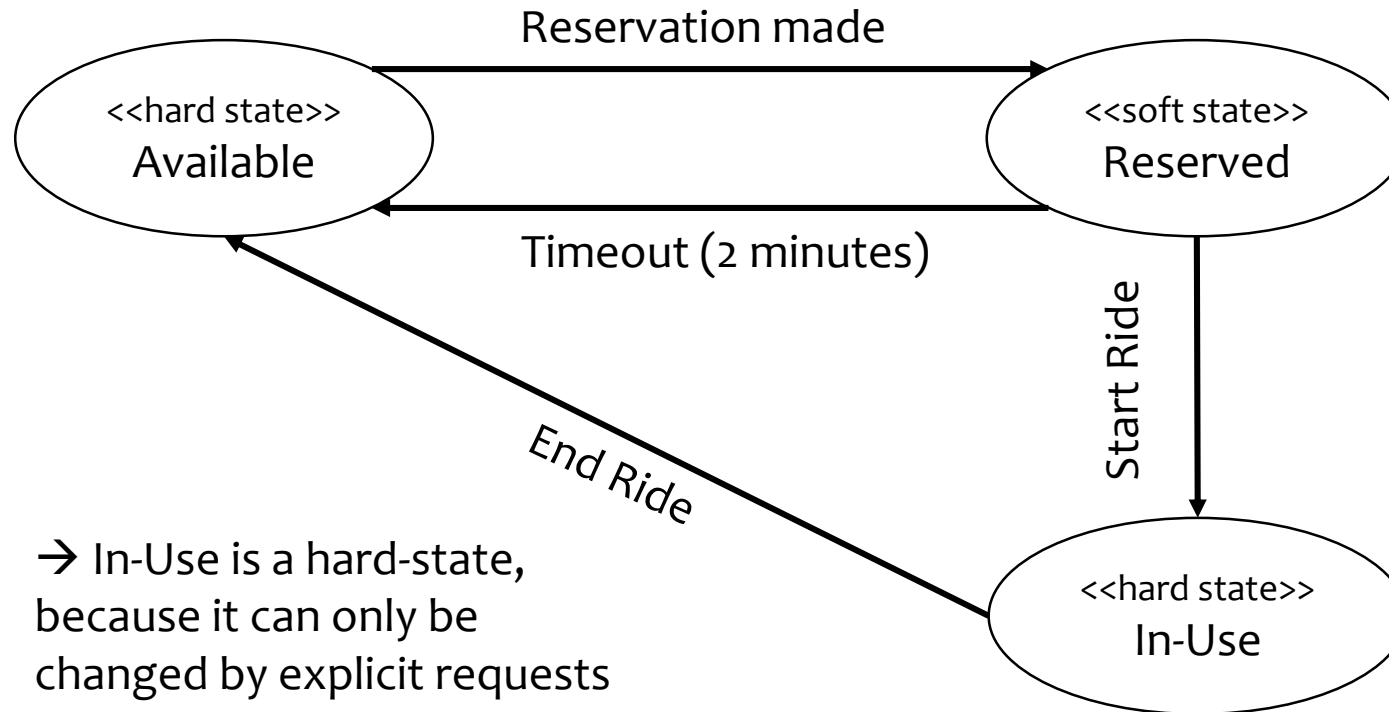
Scooters can be rented by using a smartphone app, called “SaarScooters”. The managers decided that they need an advantage with regard to the other scooter rental services. This is why customers are only charged while they ride a scooter. Reserving a scooter is necessary before renting it, but customers don't have to pay for the time while the scooter is reserved. However, reservations don't last forever, as that wouldn't be profitable. So, **customers can reserve a scooter only for a limited amount of time: 2 minutes**. If the scooter is not claimed during that time, the **reservation expires** and the scooter becomes again **available** for all the customers. **If the customer starts using the scooter, the reservation process is suspended**. After the scooter is returned, it becomes immediately available for all the other customers.



# Question 1 (b)



# Question 1 (b)



→ In-Use is a hard-state, because it can only be changed by explicit requests

# Question 1 (c)



Your manager says they would have used either only soft or only hard states for making the diagram simpler.

Use your expertise to argue (3-5 Sentences) about the pros and cons (if there are any) of using only soft or only hard states.

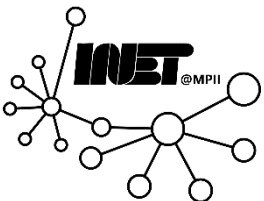


# Question 1 (c)



Your manager says they would have used either only soft or only hard states for making the diagram simpler.

Use your expertise to argue (3-5 Sentences) about the pros and cons (if there are any) of using only soft or only hard states.





# Question 1 (c)



Your manager says they would have used either only soft or only hard states for making the diagram simpler.

Use your expertise to argue (3-5 Sentences) about the **pros and cons** (if there are any) of **using only soft or only hard states**.



# Question 1 (c)

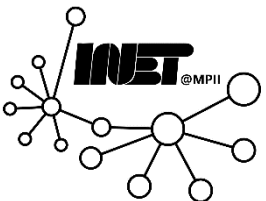


**Cons: Only Soft-States**

**Cons: Only Hard-States**

**Pros: Only Soft-States**

**Pros: Only Hard-States**



# Question 1 (c)



## Cons: Only Soft-States

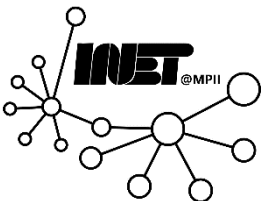
- “In-Use” needs a timeout with periodic refreshes

## Pros: Only Soft-States

- No stuck states (robustness)
- Easier error recovery
- Easier to reason/analyse

## Cons: Only Hard-States

## Pros: Only Hard-States



# Question 1 (c)



## Cons: Only Soft-States

- “In-Use” needs a timeout with periodic refreshes

## Pros: Only Soft-States

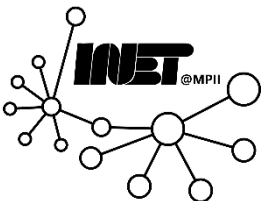
- No stuck states (robustness)
- Easier error recovery
- Easier to reason/analyse

## Cons: Only Hard-States

- Reservations would need to be canceled explicitly
- Potential of stuck states

## Pros: Only Hard-States

- Less client to network signaling
- Less message overhead
- Potentially greater consistency



# Question 1 (c)



## Cons: Only Soft-States

- “In-Use” needs a timeout with periodic refreshes

## Pros: Only Soft-States

- No stuck states (robustness)
- Easier error recovery
- Easier to reason/analyse

## Cons: Only Hard-States

- Reservations would need to be canceled explicitly
- Potential of stuck states

## Pros: Only Hard-States

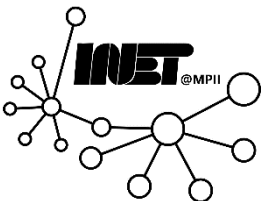
- Less client to network signaling
- Less message overhead
- Potentially greater consistency

→ Variants with only soft or only hard states would make usage more inconvenient for the user or provisioning more costly for the provider

# Question 1d)



Angered by your last answer (because you were right and they were not), your manager says that they are **still losing money due to “SaarScooters” free reservations**. Your manager says you should do your job and fix the issue, by changing or adding only *one* rule in the rental process.



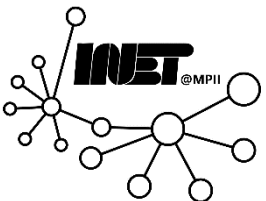
# Question 1d)



Angered by your last answer (because you were right and they were not), your manager says that they are **still losing money due to “SaarScooters” free reservations**. Your manager says you should do your job and fix the issue, by changing or adding only *one* rule in the rental process.

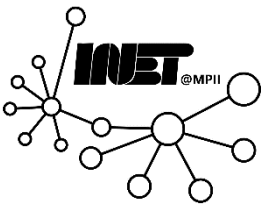
⇒ Customers pay for *using* but not for *blocking* resources

⇒ Make reservations have a cost





# Questions?





## Question 2) RSVP



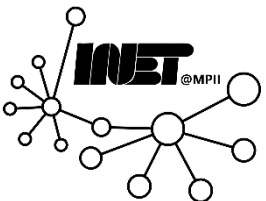
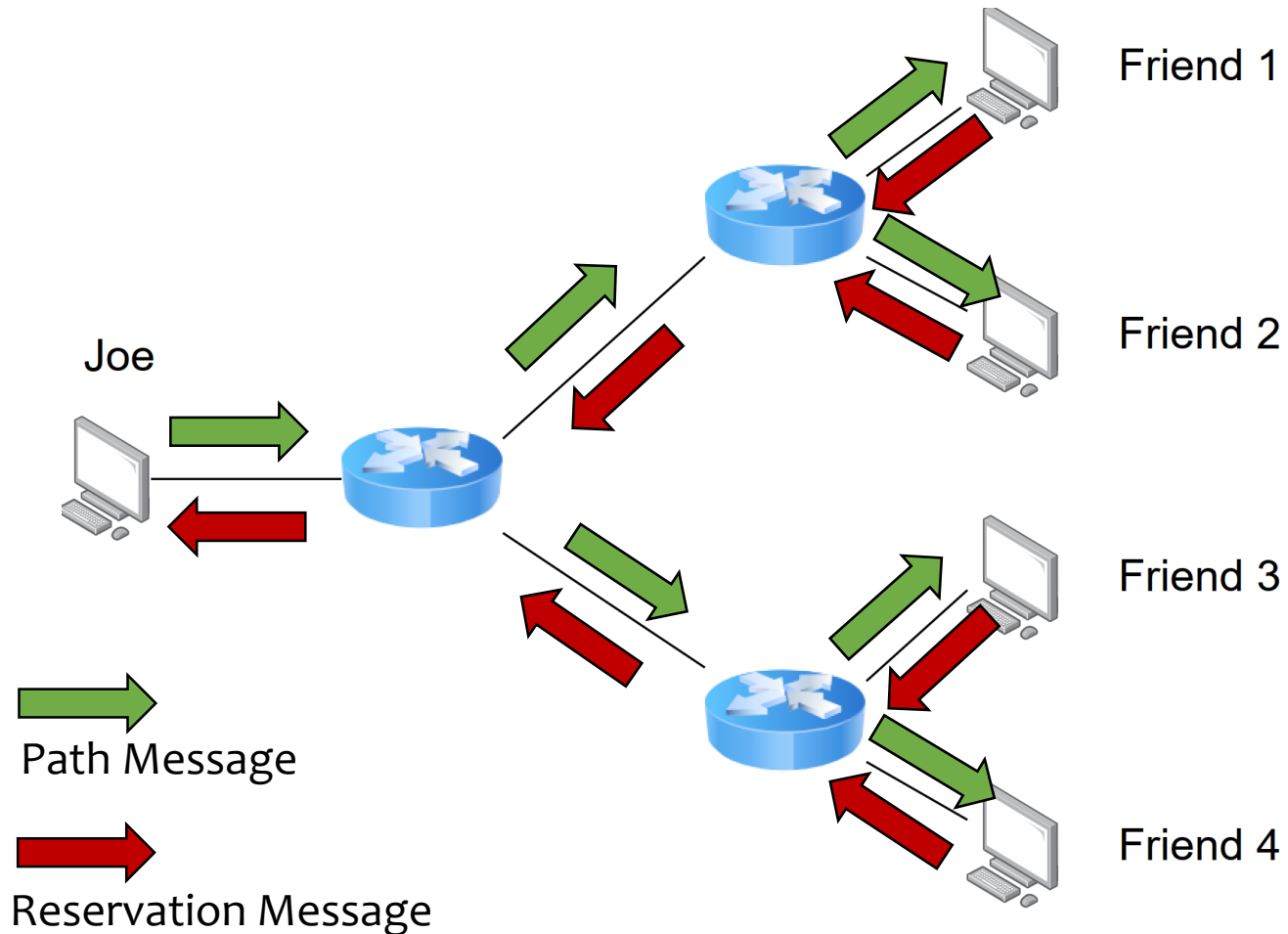
Joe is streaming his Minecraft playthrough for his friends. He doesn't know, but the streaming service uses RSVP. Show on the provided Figure the flow of the Path and Reservation messages.



# Question 2) RSVP

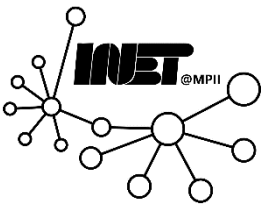


Show on the provided Figure the flow of the Path and Reservation messages.





# Questions?



# Question 3 (a) Indirection and Virtualization



In Unicasting, we have one sender and one receiver. Whereas in multicasting, there is one source and multiple destinations.

Compare multicasts with multiple unicasts. Provide an application for each.



# Question 3 (a) Indirection and Virtualization



In **Unicasting**, we have **one sender** and **one receiver**.

Whereas in multicasting, there is one source and multiple destinations.

Compare multicasts with multiple unicasts. Provide an application for each.



# Question 3 (a) Indirection and Virtualization



In **Unicasting**, we have **one sender** and **one receiver**.

Whereas in **multicasting**, there is **one source** and **multiple destinations**.

Compare multicasts with multiple unicasts. Provide an application for each.



# Question 3 (a) Indirection and Virtualization



In **Unicasting**, we have **one sender** and **one receiver**.  
Whereas in **multicasting**, there is **one source** and **multiple destinations**.

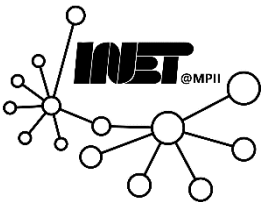
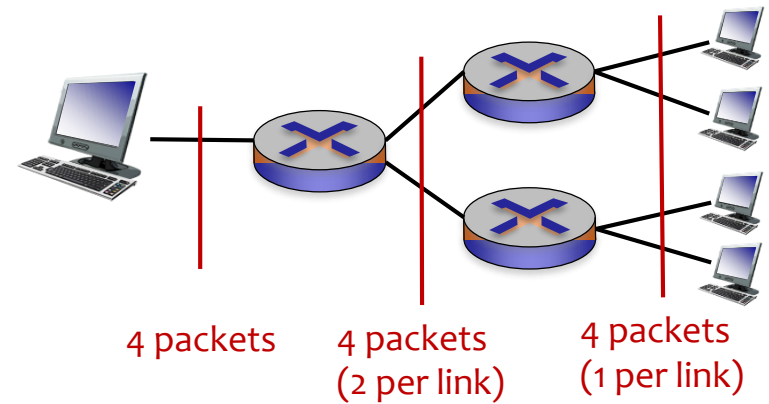
**Compare multicasts with multiple unicasts. Provide an application for each.**



# Question 3 (a) Indirection and Virtualization



Multiple Unicasts	Multicast

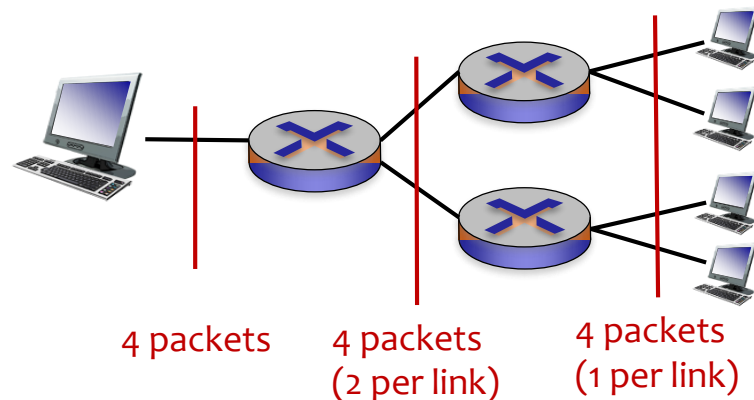




# Question 3 (a) Indirection and Virtualization



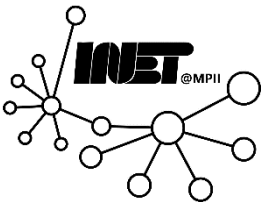
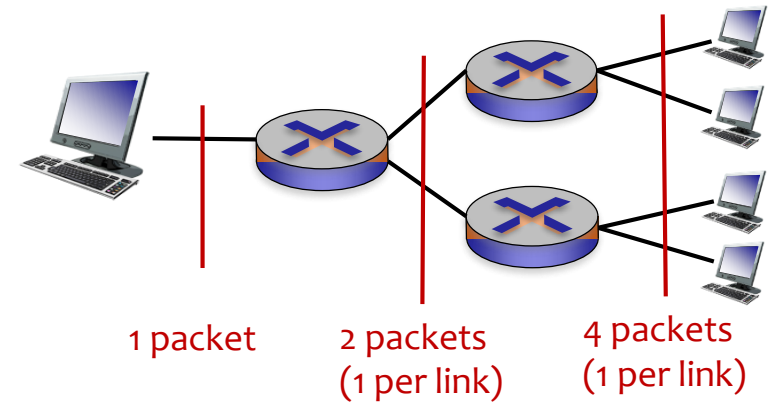
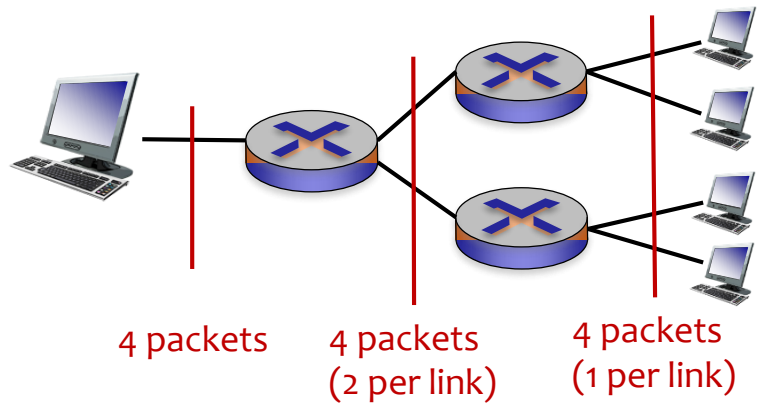
Multiple Unicasts	Multicast
- Source has to transmit packet once per receiver	
- Does not require group management	
- More traffic	
- Generating many packets at the source, might introduce delay between first and last packet	



# Question 3 (a) Indirection and Virtualization



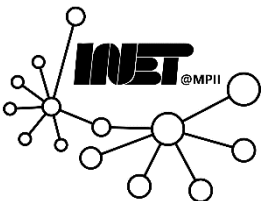
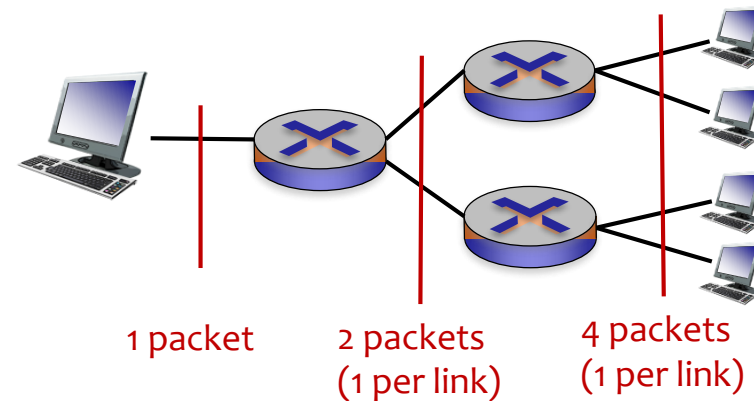
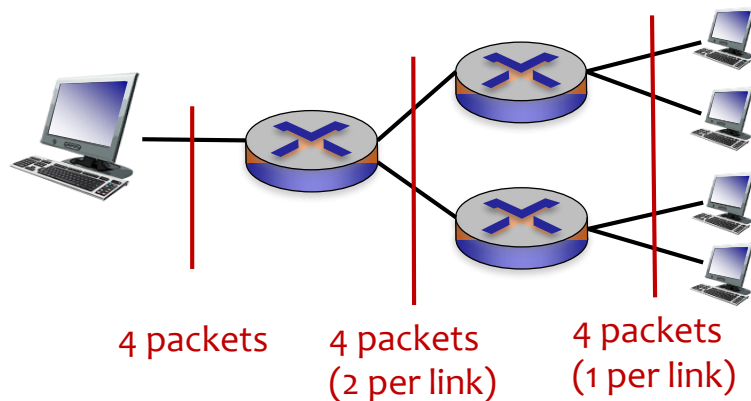
Multiple Unicasts	Multicast
- Source has to transmit packet once per receiver	
- Does not require group management	
- More traffic	
- Generating many packets at the source, might introduce delay between first and last packet	
<b>Application:</b> Sending E-Mail to multiple receivers	



# Question 3 (a) Indirection and Virtualization



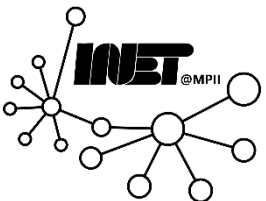
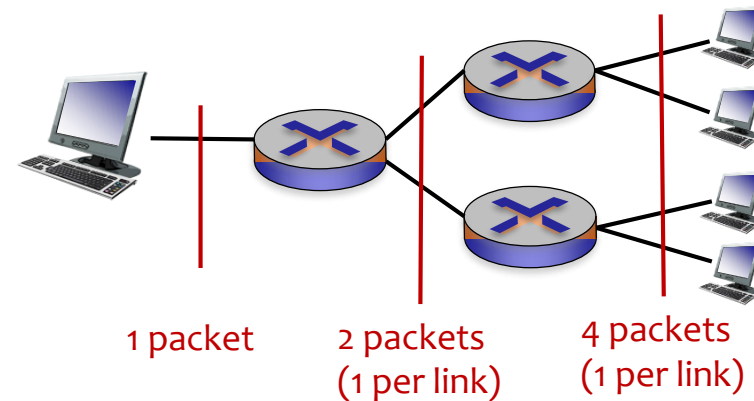
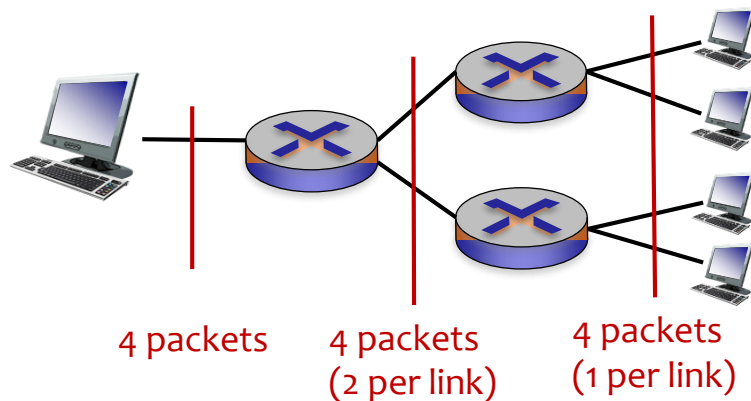
Multiple Unicasts	Multicast
- Source has to transmit packet once per receiver	- Source only transmits one packet
- Does not require group management	- Packet is replicated in the routers
- More traffic	- Requires a multicast group
- Generating many packets at the source, might introduce delay between first and last packet	- Less traffic because duplication on demand
<b>Application:</b> Sending E-Mail to multiple receivers	



# Question 3 (a) Indirection and Virtualization



Multiple Unicasts	Multicast
- Source has to transmit packet once per receiver	- Source only transmits one packet
- Does not require group management	- Packet is replicated in the routers
- More traffic	- Requires a multicast group
- Generating many packets at the source, might introduce delay between first and last packet	- Less traffic because duplication on demand
<b>Application:</b> Sending E-Mail to multiple receivers	<b>Application:</b> Video Conferencing

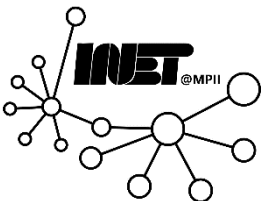
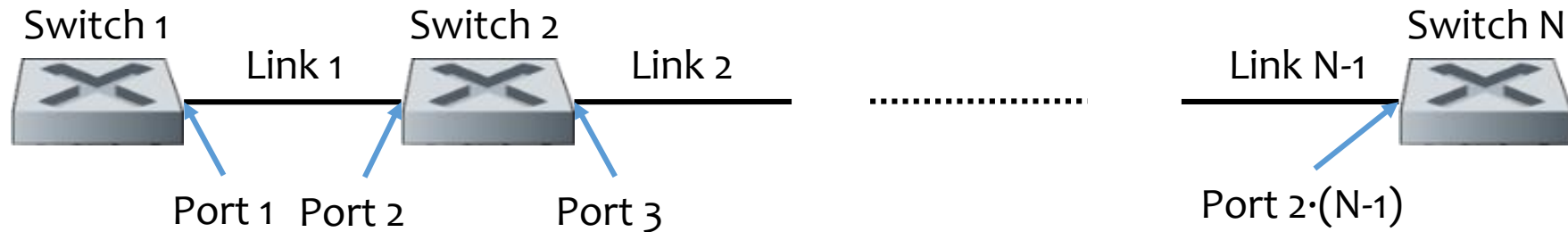


# Question 3 (b) Indirection and Virtualization



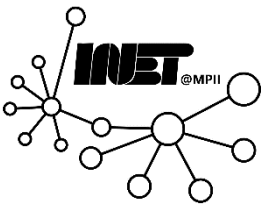
Suppose that  $N$  switches, supporting the 802.11Q tagging protocol, are to be connected via a trunking protocol. How many VLANs can be configured on each switch? What is the minimum number of ports needed to connect all the switches if we have configured  $K$  VLANs on them and why?

- 12-bit VLAN ID field ( $2^{12}=4096$  Values)
- $N-1$  Trunk links to connect all  $N$  switches
- $2 \cdot (N-1)$  port





# Questions?



# Question 4 MQTT



## Code Demo

