CSC358 Tutorial 6

Shuhao Liu (TA)

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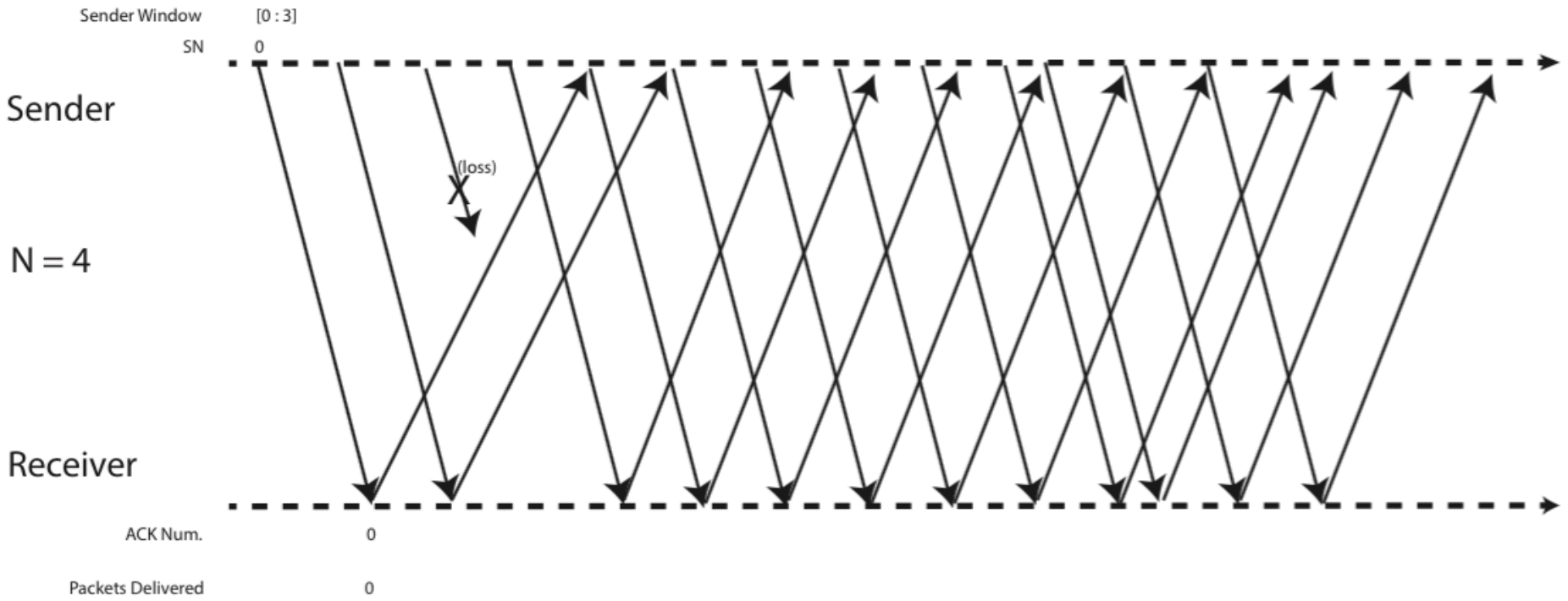
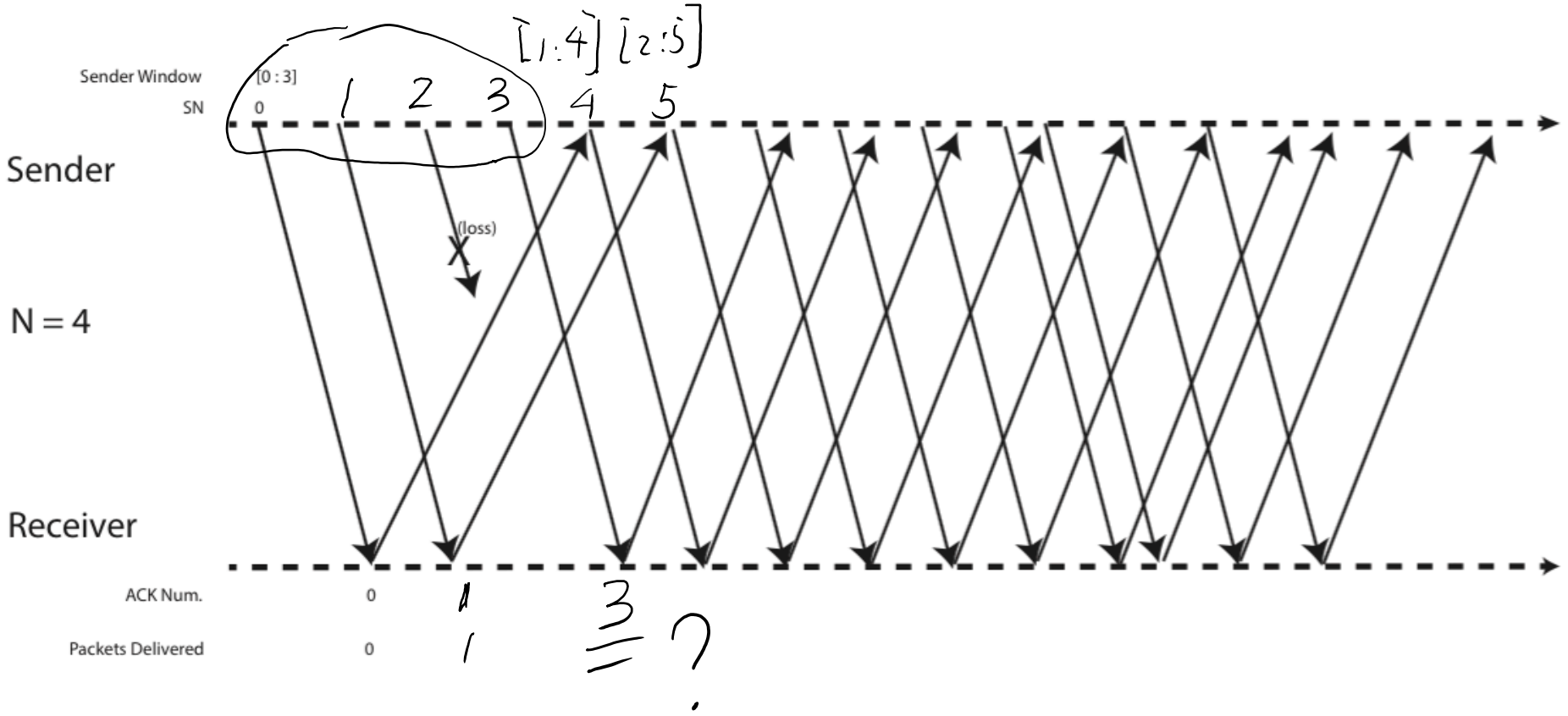
Agenda

- Problem 1, Assignment 3 Discussion
- Tutorial Problem 1: Stop-and-wait ARQ
- Tutorial Problem 2: Alternating-bit Protocol
- Tutorial Problem 3: Transport Protocol Design

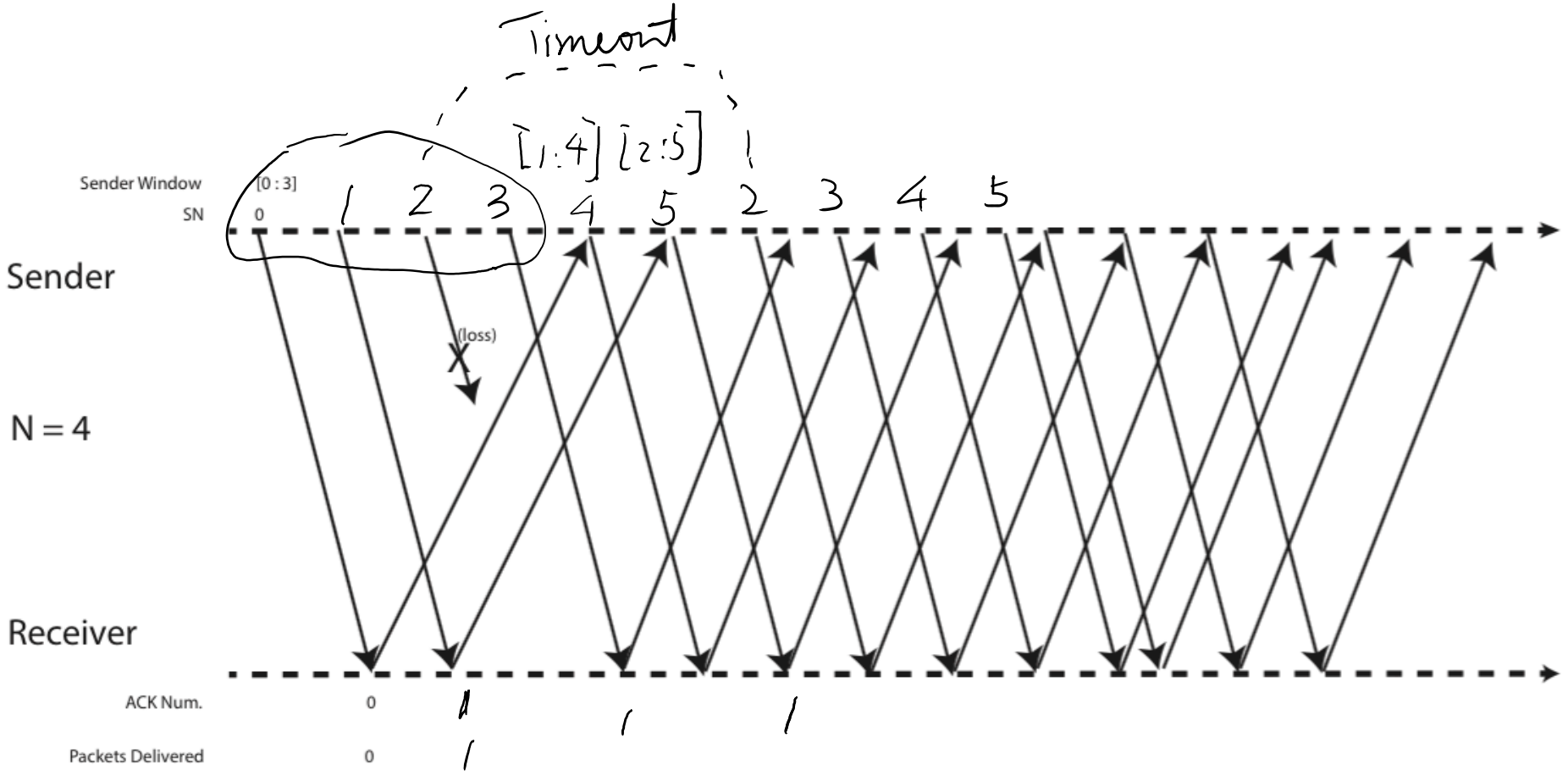
A3-1: Go-back-N = 4



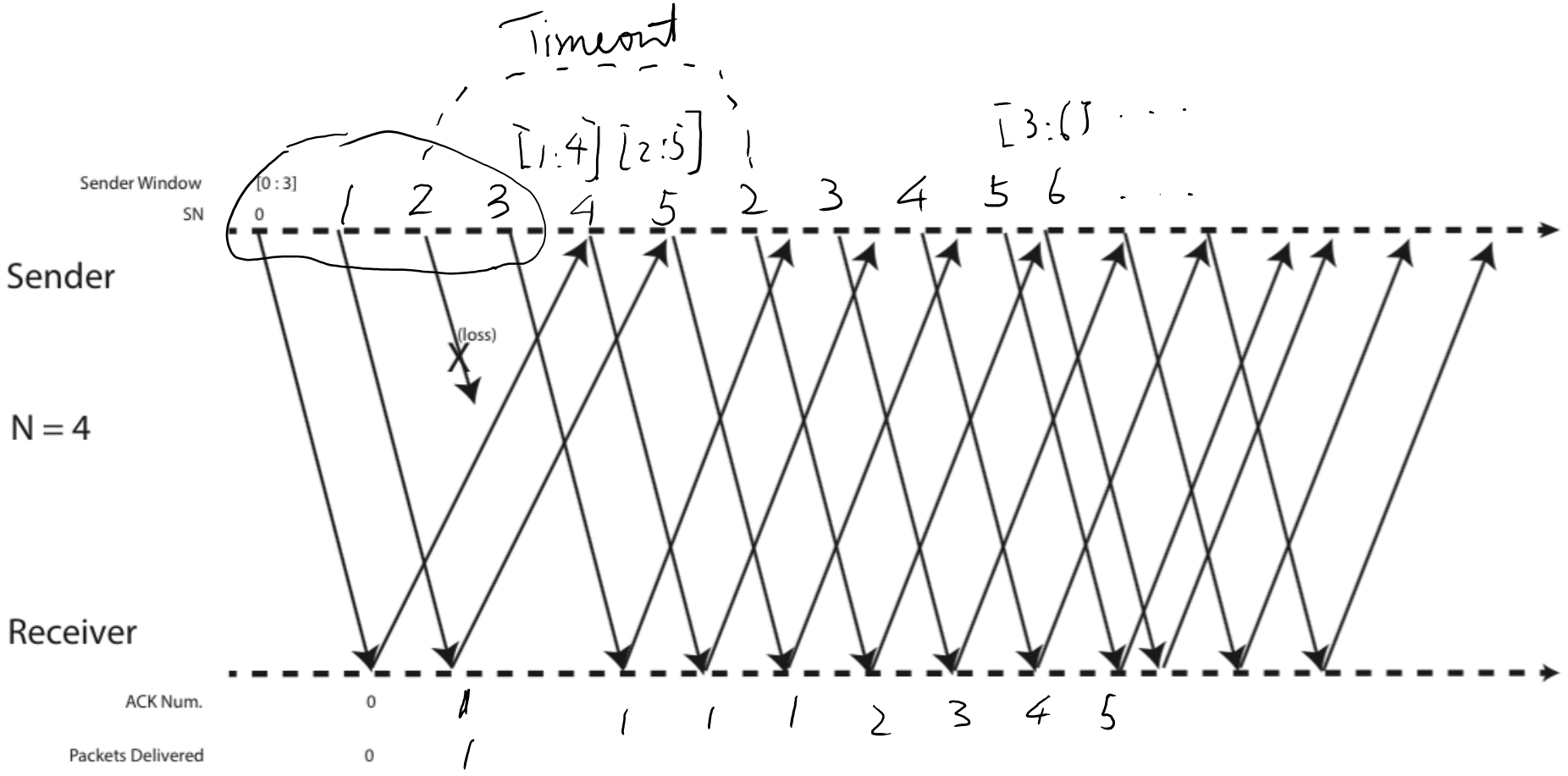
A3-1: Go-back-N


Sender Window
[0 : 3]
SN
0
1
2
3
4
5
[1:4]
[2:5]
Sender
(loss)
N = 4
Receiver
ACK Num.
0
1
3
=
?
Packets Delivered
0
1

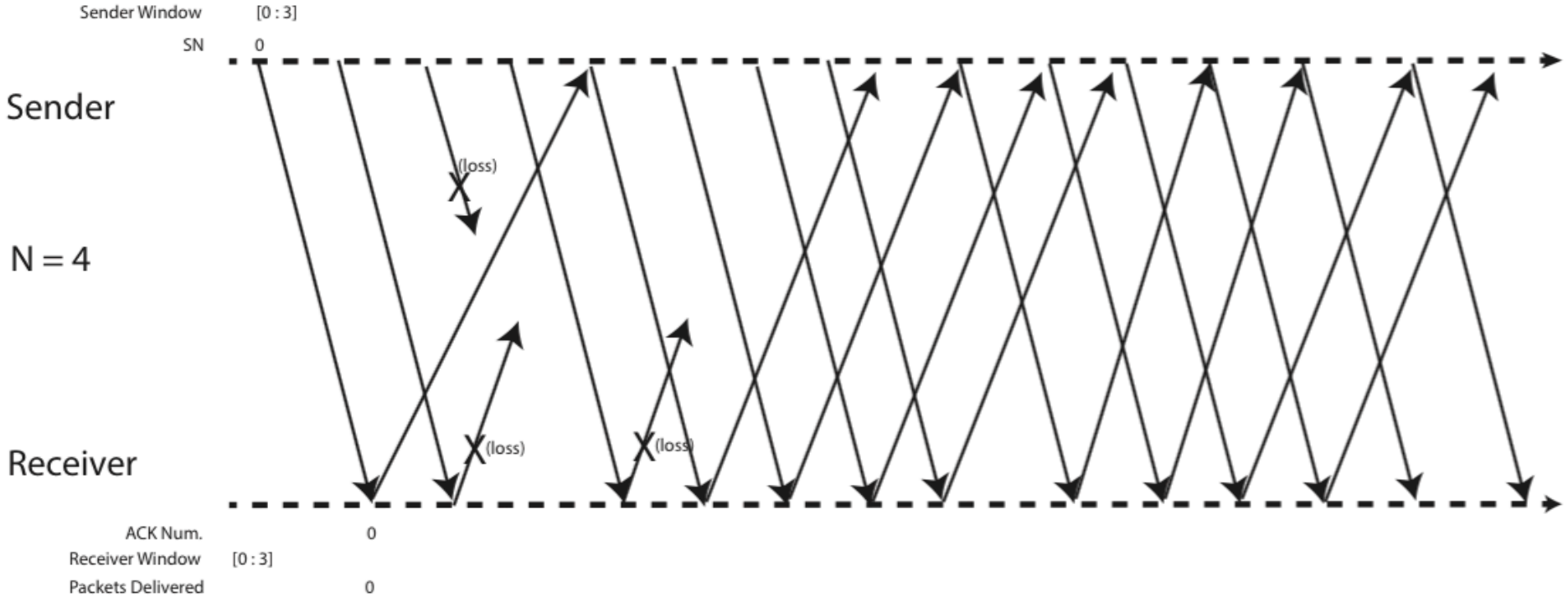
A3-1: Go-back-N


Timeout
[1:4] [2:5]
Sender Window
[0 : 3]
SN
0
1 2 3 4 5 2 3 4 5
Sender
(loss)
N = 4
Receiver
ACK Num.
0
Packets Delivered
0

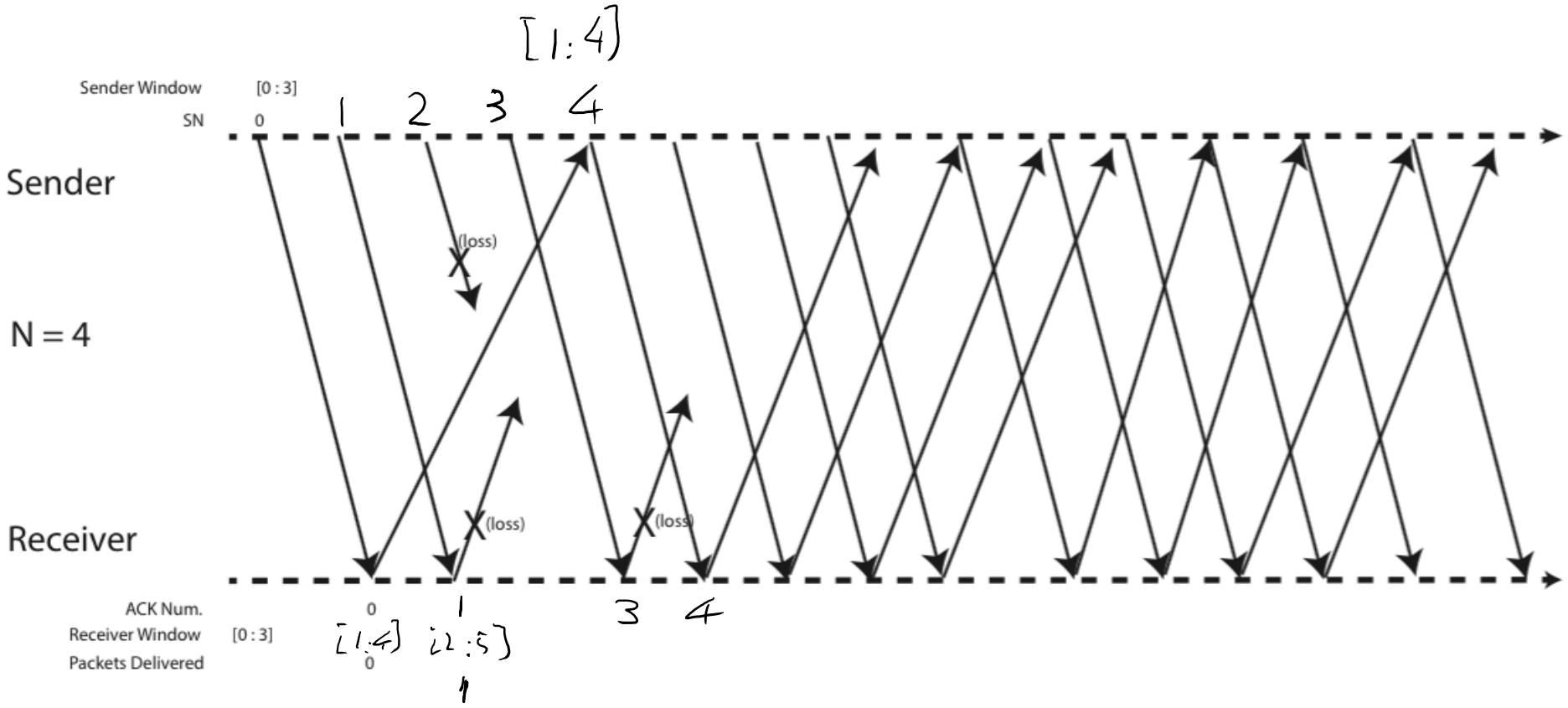
A3-1: Go-back-N


Timeout
[1:4] [2:5]
[3:6] . . .
Sender Window
[0 : 3]
SN
0 1 2 3 4 5 2 3 4 5 6 . . .
Sender
(loss)
N = 4
Receiver
ACK Num.
0 1 1 1 1 2 3 4 5
Packets Delivered
0 1

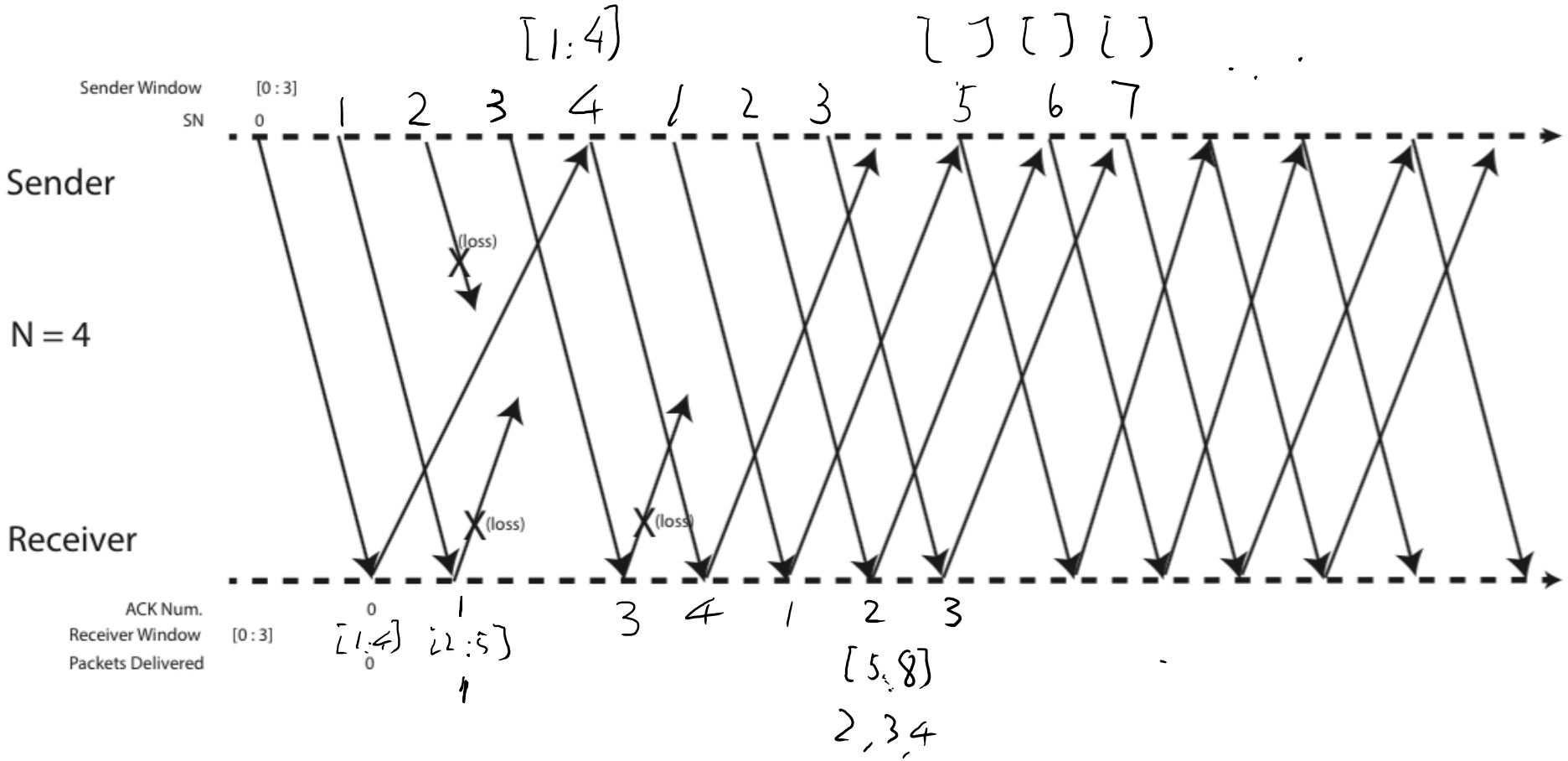
A3-1: Selective Repeat



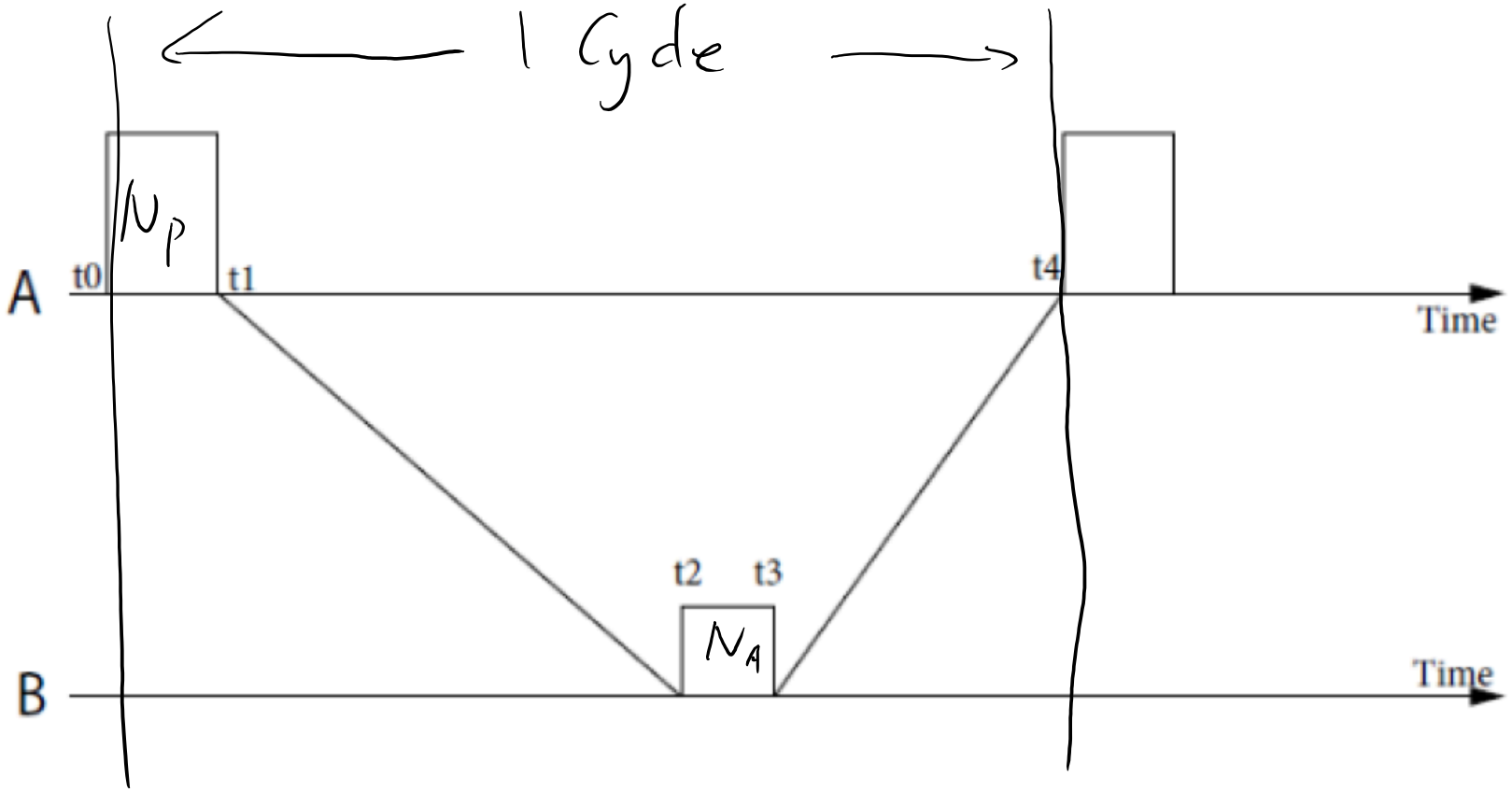
A3-1: Selective Repeat



A3-1: Selective Repeat

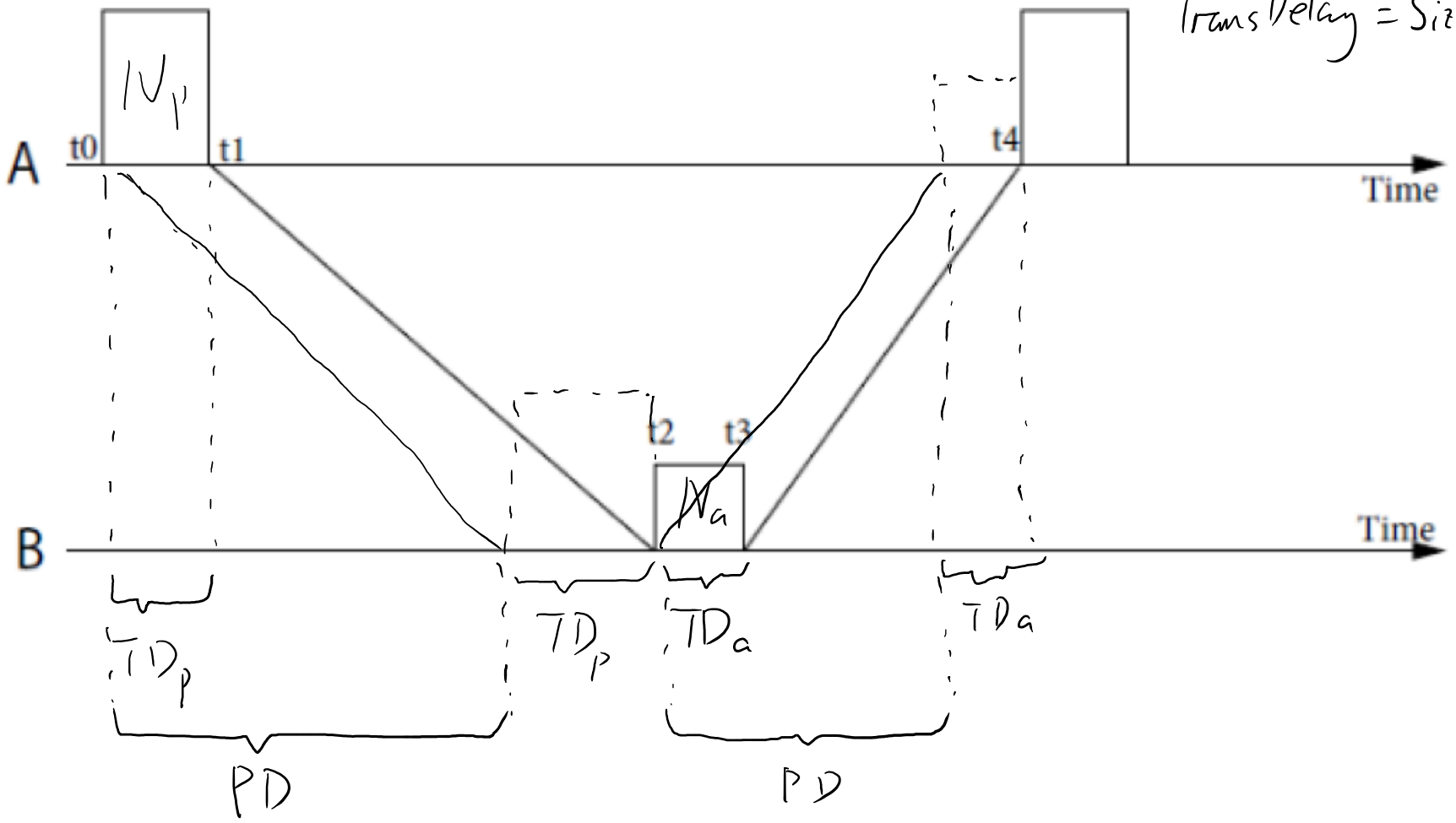


Tut 6: P1 solution



Prop Delay = d_{AB}/C

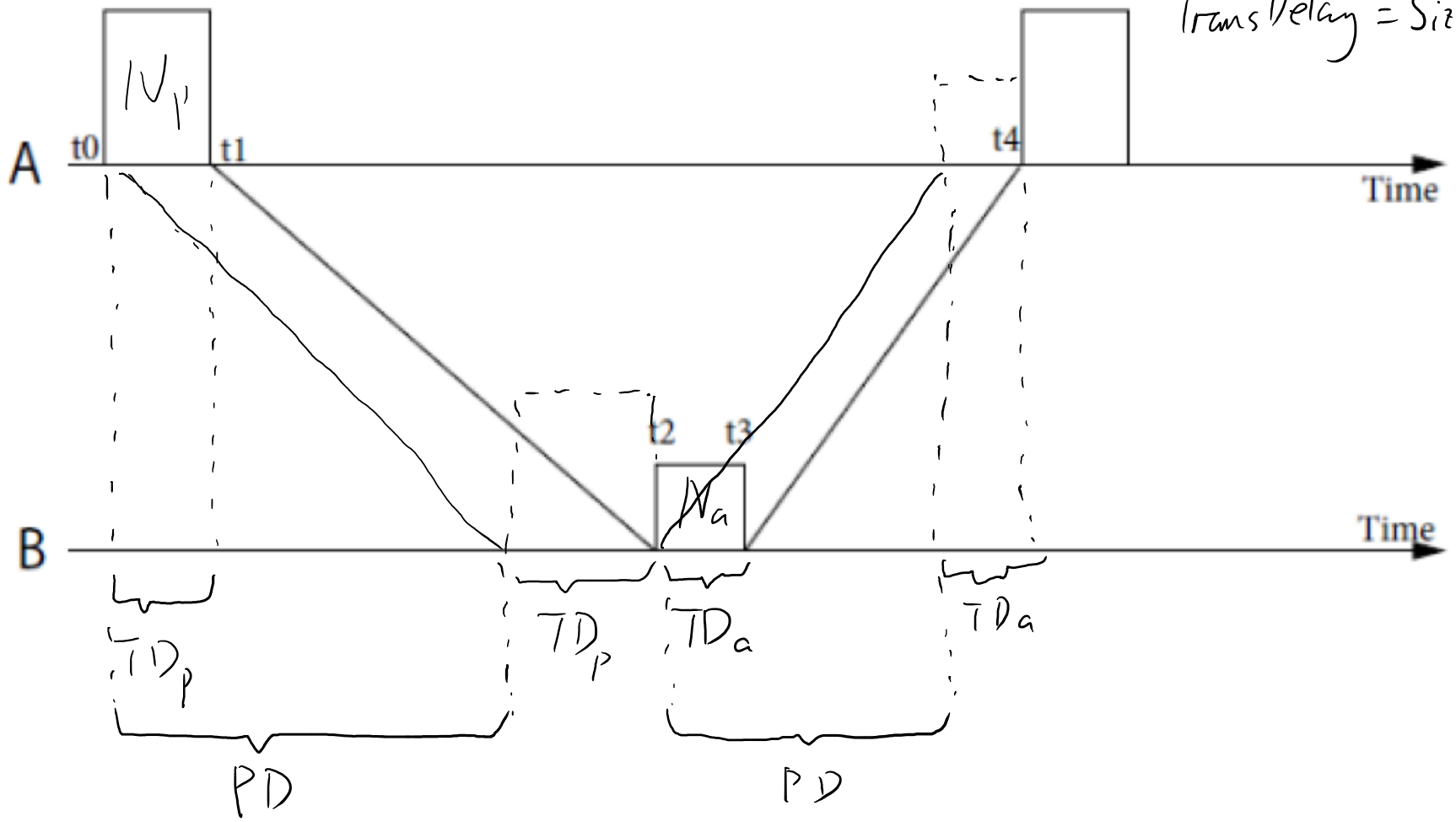
Trans Delay = Size / R



a → g

Prop Delay = d_{AB}/C

Trans Delay = Size / R



a) $t_1 = t_0 + N_p/R$

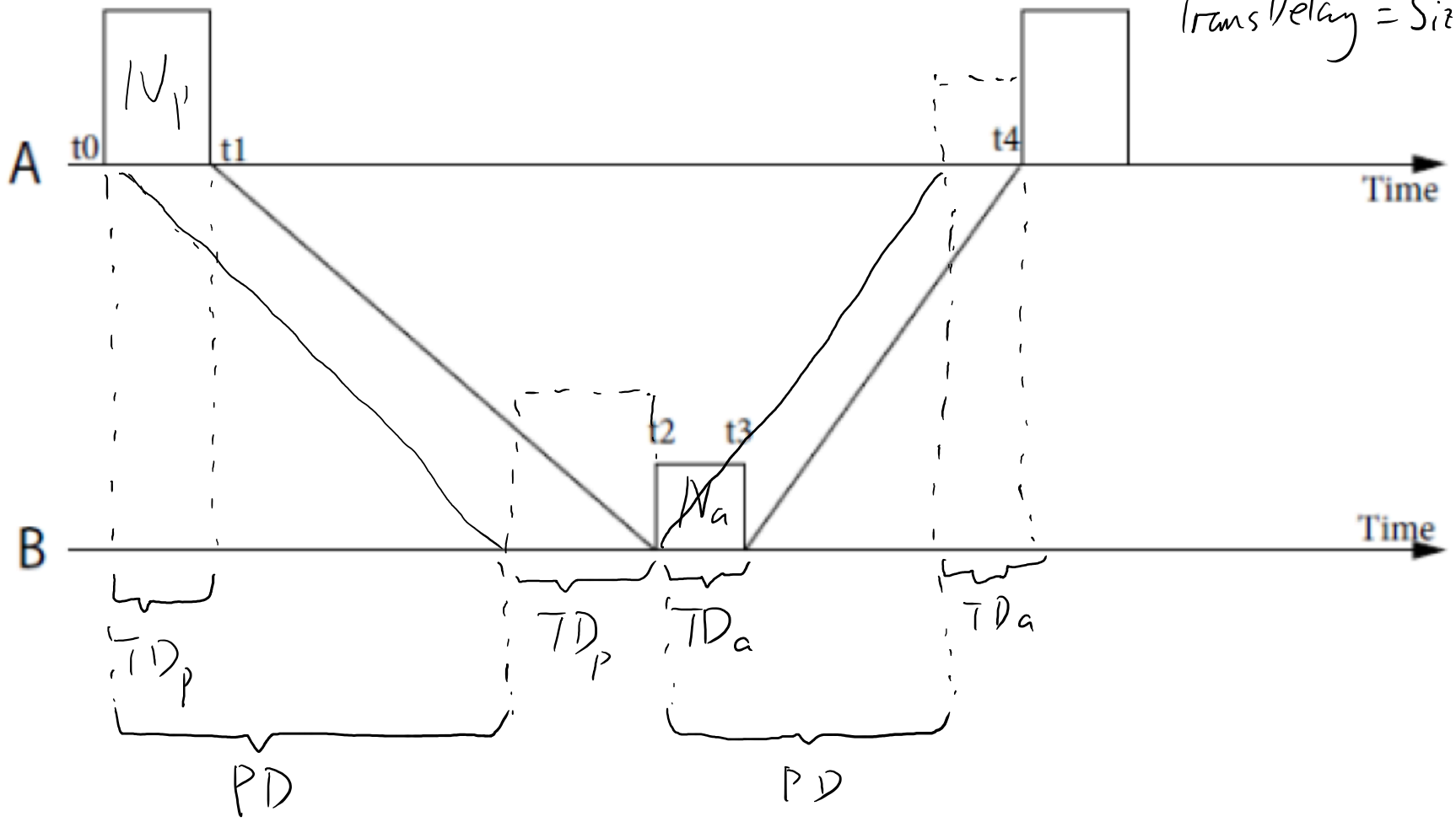
b) $t_2 = t_1 + d_{AB}/C = t_0 + N_p/R + d_{AB}/C$

c) $t_3 = t_2 + N_a/R = t_0 + N_p/R + d_{AB}/C + N_a/R$

a → g

Prop Delay = d_{AB}/C

Trans Delay = Size / R



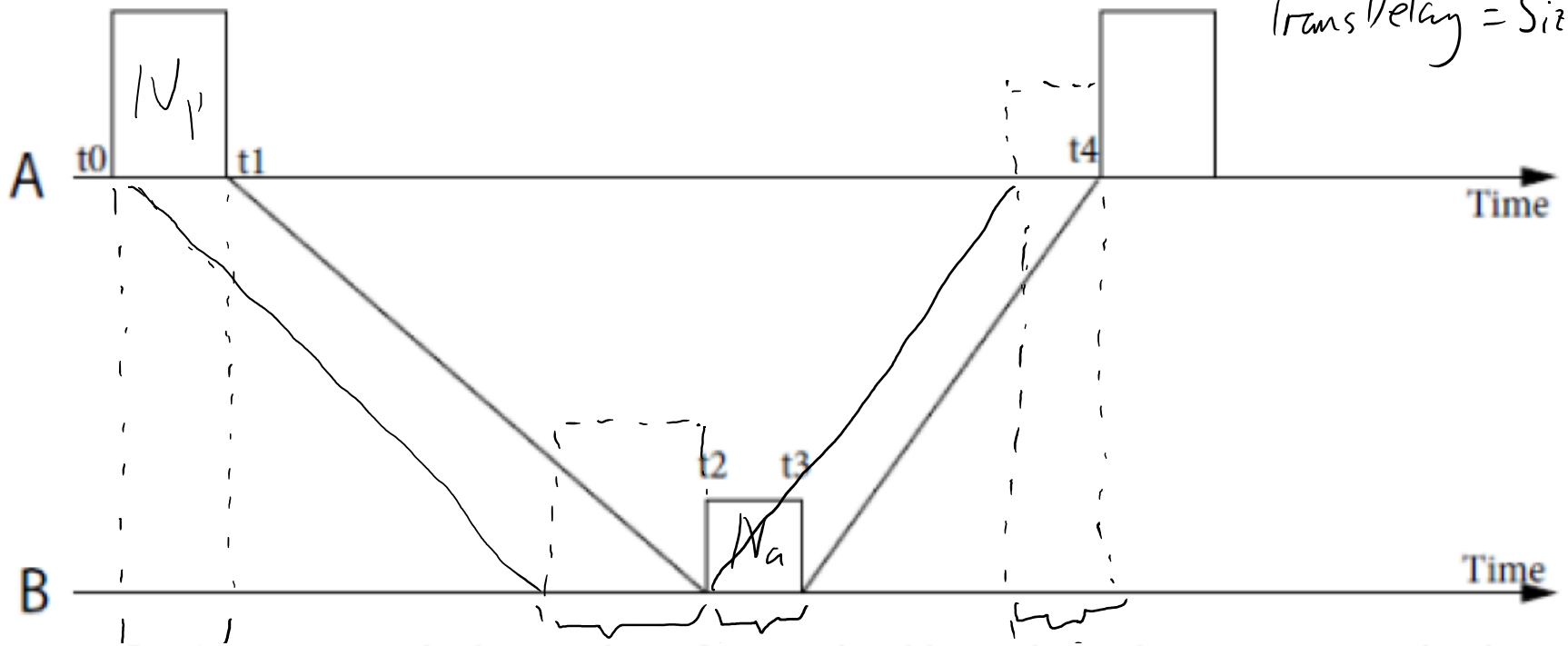
d) $t_4 = t_3 + d_{AB}/C = t_0 + N_p/R + d_{AB}/C + N_a/R + d_{AB}/C = t_0 + (N_p + N_a)/R + 2d_{AB}/C$

e) $T_{ct} = t_4 - t_0 = (N_p + N_a)/R + 2d_{AB}/C$

a → g

Prop Delay = d_{AB}/C

Trans Delay = Size / R

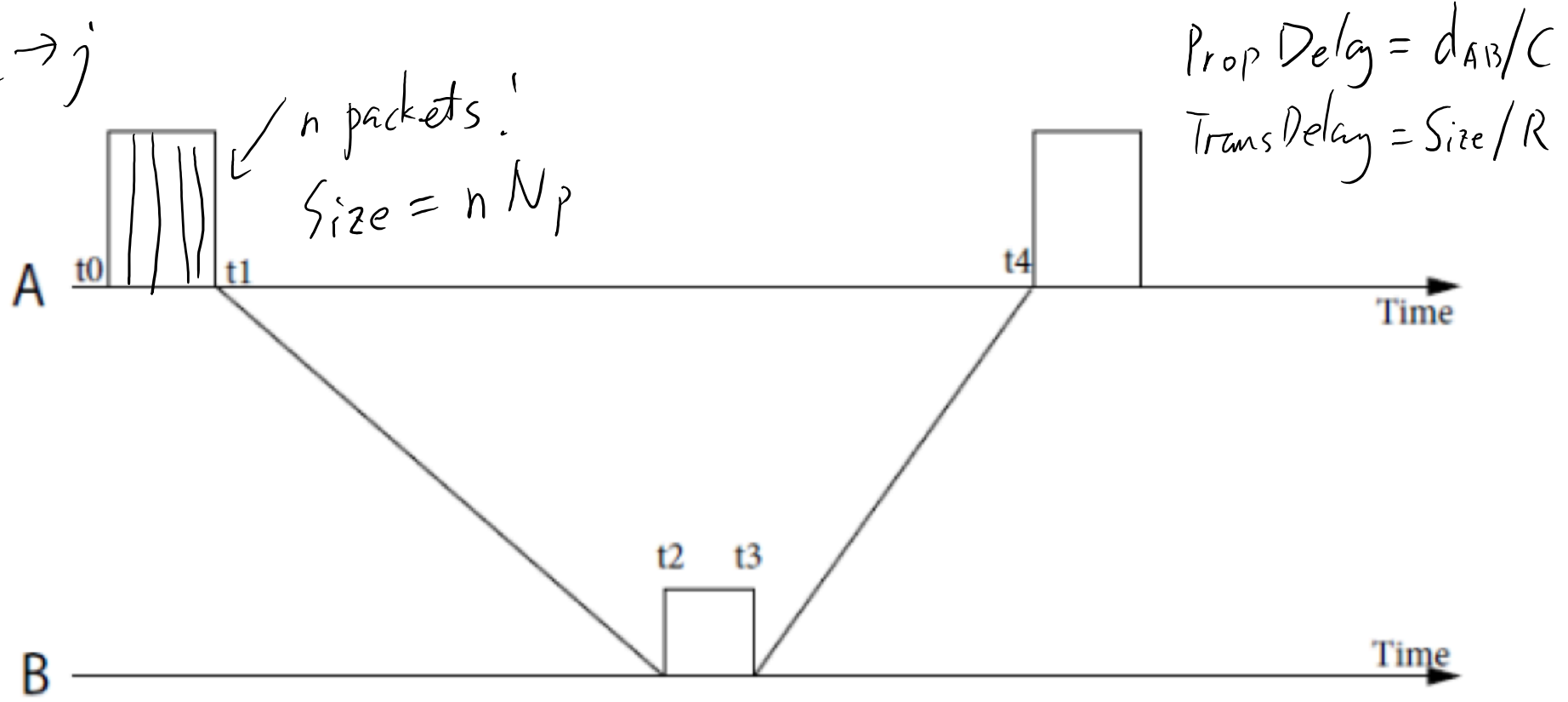


f) Average rate is the number of transmitted bytes in packet per communication time:

$$R_A = \frac{N_p}{T_{ct}} = \frac{N_p}{(Np + Na)/R + 2dAB/C}$$

g) Link utilization is link active time (packet transmission time) over the communication time

$$U_L = \frac{N_P/R}{T_{ct}} = \frac{N_p/R}{(Np + Na)/R + 2dAB/C}$$



f) Average rate is the number of transmitted bytes in packet per communication time:

$$R_A = \frac{N_p}{T_{ct}} = \frac{N_p}{(Np + Na)/R + 2dAB/C}$$

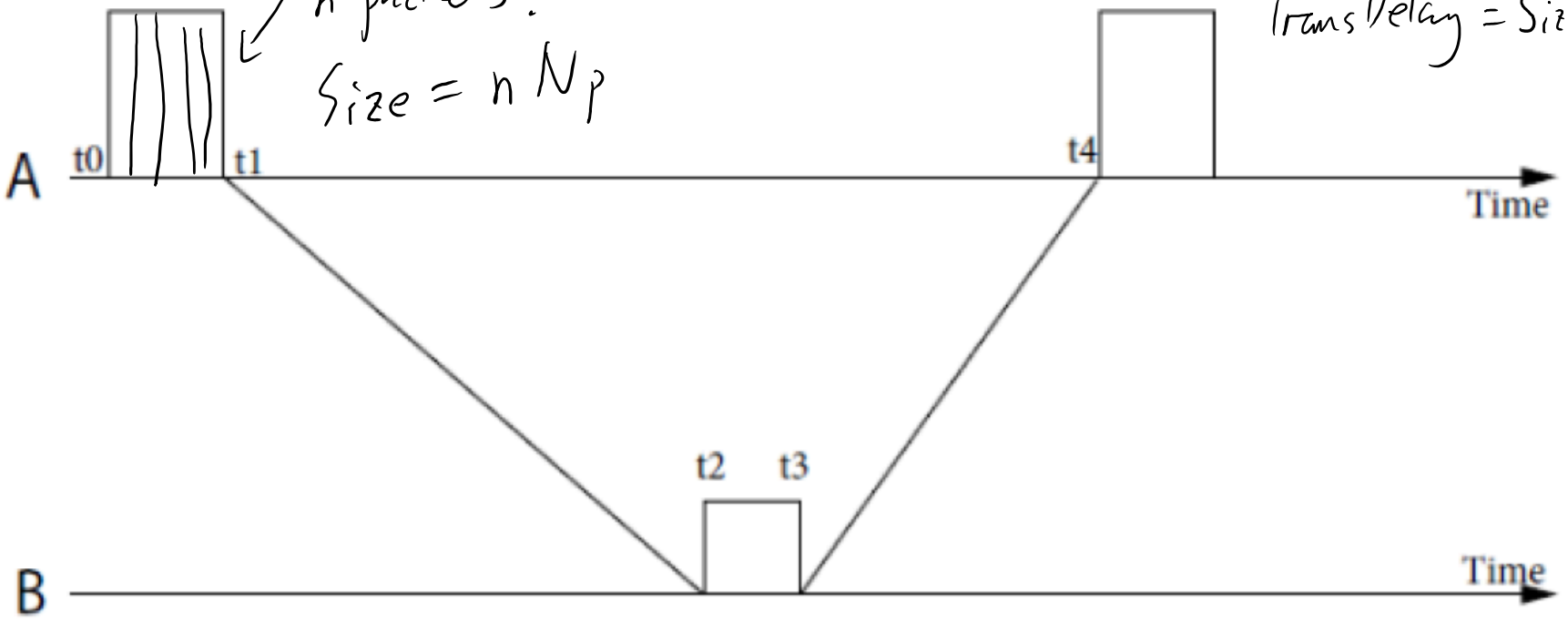
g) Link utilization is link active time (packet transmission time) over the communication time

$$U_L = \frac{N_P/R}{T_{ct}} = \frac{N_p/R}{(Np + Na)/R + 2dAB/C}$$

h → j

Prop Delay = d_{AB}/C

Trans Delay = Size / R



f) Average rate is the number of transmitted bytes in packet per communication time:

$$R_n = \frac{nN_p}{(nN_p + N_a)/R + 2\frac{d_{AB}}{C}}$$

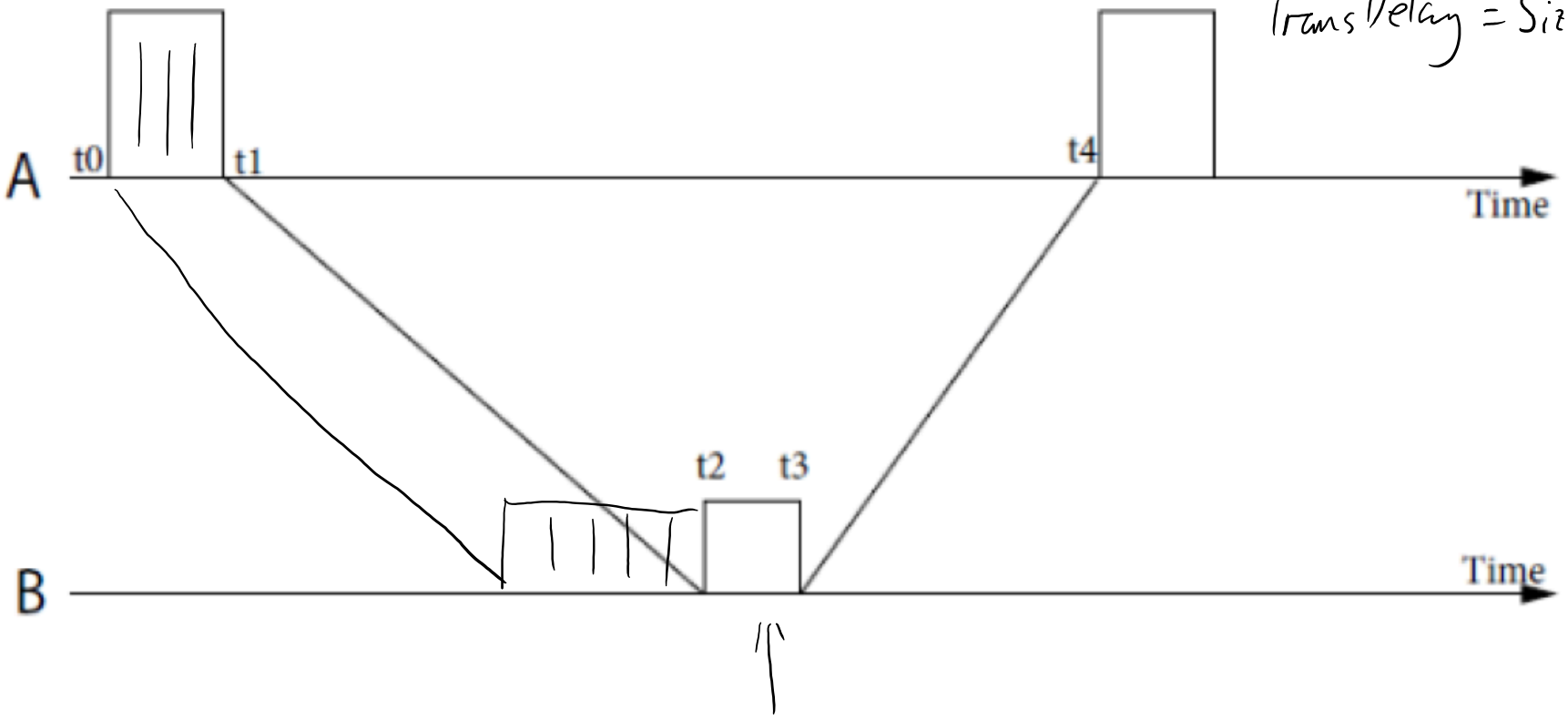
g) Link utilization is link active time (packet transmission time) over the communication time

$$U_n = \frac{nN_p/R}{(nN_p + N_a)/R + 2\frac{d_{AB}}{C}}$$

k

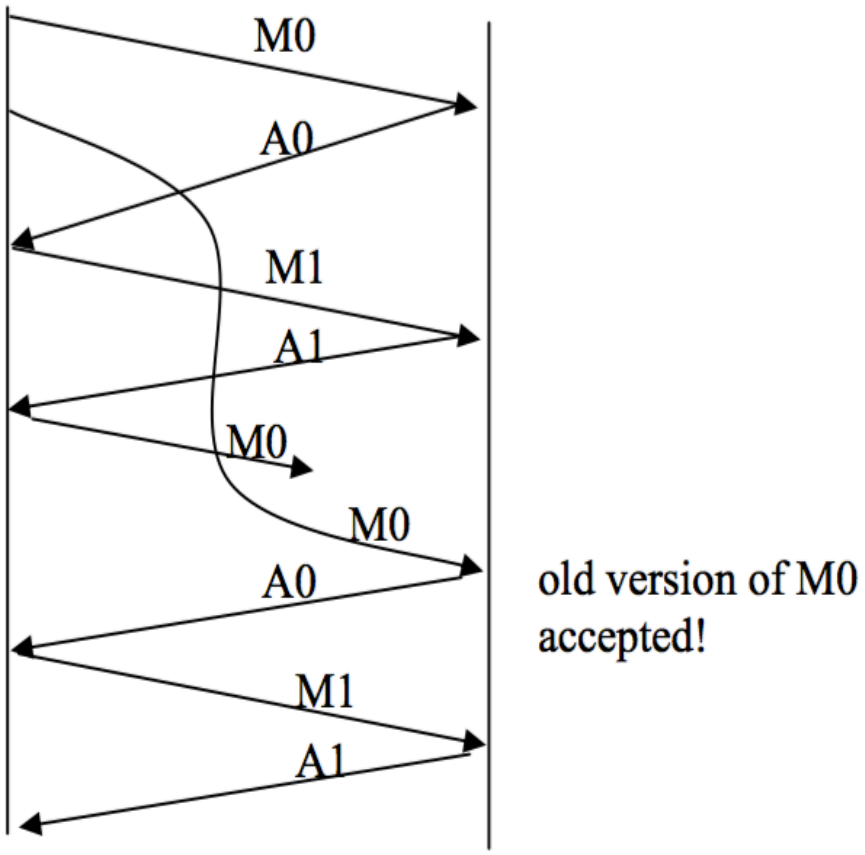
Prop Delay = d_{AB}/C

Trans Delay = Size / R



The last ACK matters!

Tut 6: P2 solution



- Binary-coded sequence number
- Cannot differentiate the 1st, 3rd, 5th… message
- Works well if no out-of-order packets

Tut 6: P3 Notes

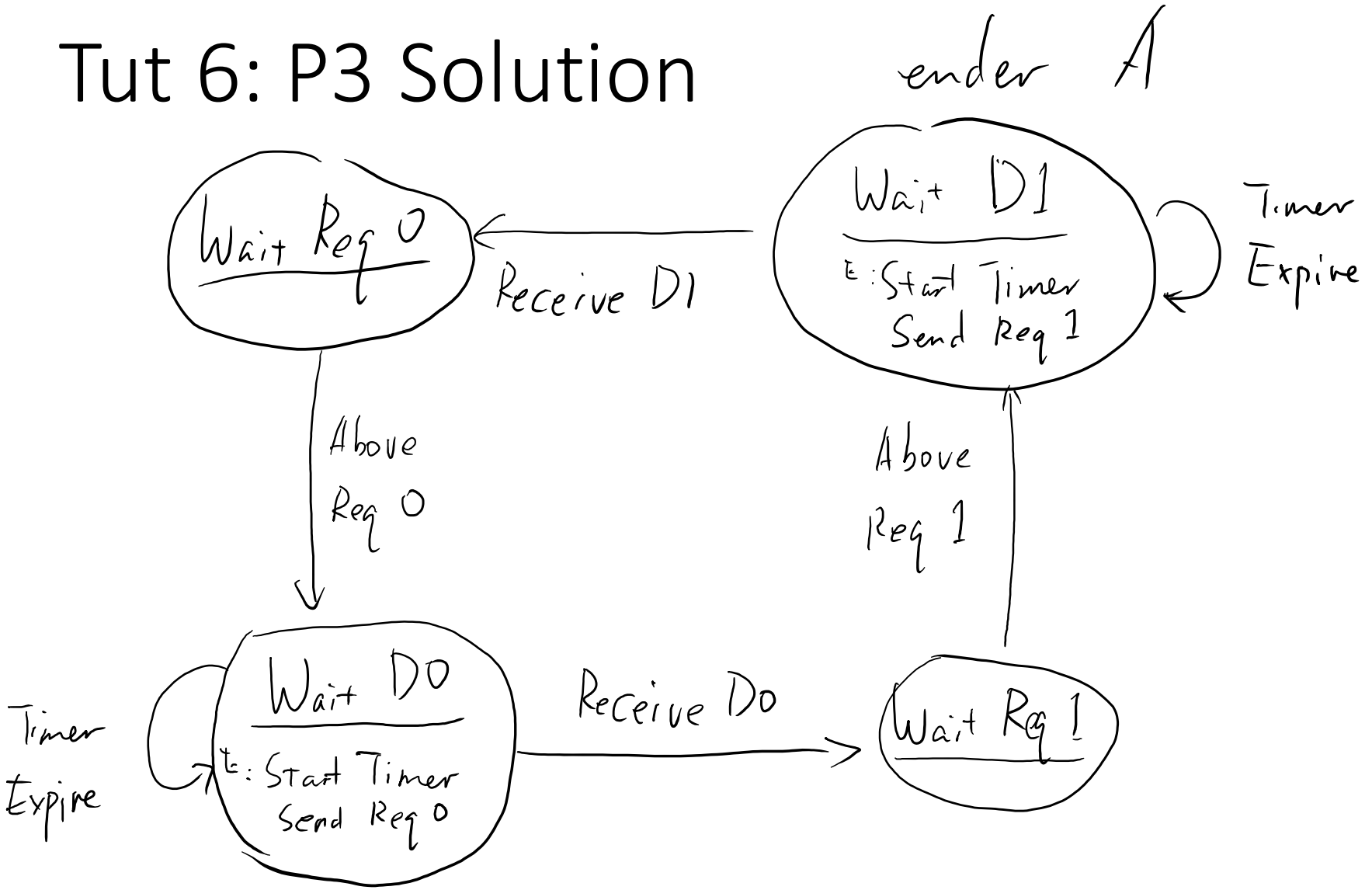
- A → B (request) lossy
- B→ A (data response) lossless
- Delay: unknown & variable

- As long as B gets the request, A will receive the corresponding data response eventually.
- We don’t know if feedback mechanism works…

Tut 6: P3 Solution

- A has to blindly resend the request if the reply is not received.
- Duplicated requests might be generated.
- B might receive duplicated requests, then A might receive duplicated data.
- We need a sequence number (1 bit).

Tut 6: P3 Solution



Tut 6: P3 Solution

Receiver B