IEEE P802.3cg 10SPE AD HOC MEETING

Two proposals for priority based PLCA

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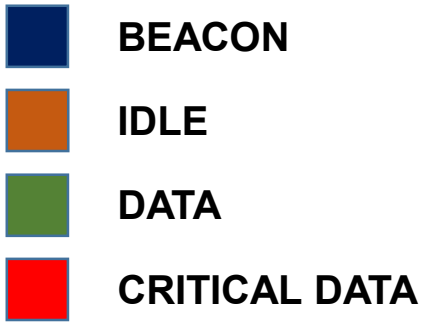
1. Priority issues have been discussed for comment #573, but it deals with OSI layer 2
2. However, IEEE P802.3cg 10SPE should only deal with the OSI layer 1, not the upper layers
3. Our two proposals try to apply the priority method to the OSI layer 1 :
    1) Single node priority method
    2) Multiple nodes priority method
4. Using the above two methods, we can have frequent transmission opportunities for higher priority nodes in the OSI layer 1
5. Those two methods can be optional functions as a supplement of priority mechanism for PLCA



Encoding Signal

(e.g. 4B/5B Encoding)

Table 147–1—4B/5B Encoding *(continued)*

Name	4B	5B	Special function
D	1101	11011	—
E	1110	11100	—
F	1111	11101	—
I	N/A	11111	SILENCE
J	N/A	11000	SYNC
K	N/A	10001	ESDERR
T	N/A	01101	ESD

1. Objectives

1) Only one node has high priority and the others have equally low priority.
2) All nodes should have a certain time of IDLE if they are given a transmission opportunity.
3) Any encoding signal should be used to detect the transmission request of the high priority node (e.g. Table 147-1 - 4B/5B Encoding).
4) If the node having the transmission opportunity detects the priority signal (encoding signal), the node waits for a certain time (until the transmission of the high priority node is completed) and resumes transmission.

BEACON

IDLE

DATA

CRITICAL DATA

Encoding Signal

(e.g. 4B/5B Encoding)

Table 147–1—4B/5B Encoding *(continued)*

Name	4B	5B	Special function
D	1101	11011	—
E	1110	11100	—
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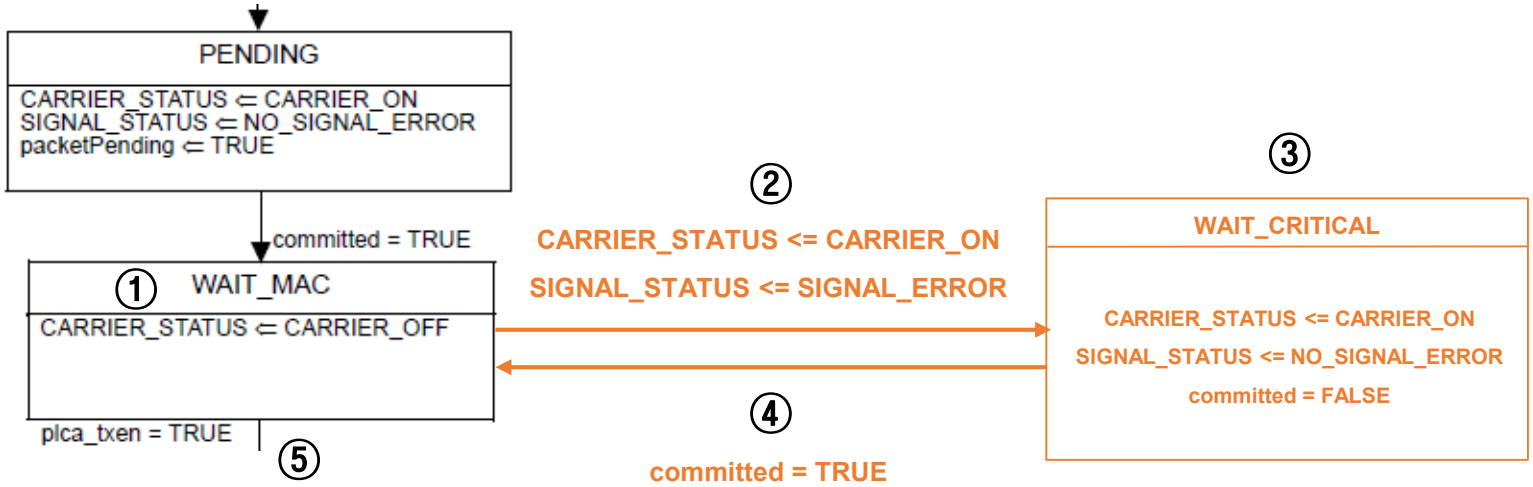
T	N/A	01101	ESD

2. Approaches

1) Each node is given sequential transmission opoortunities like the operation of the existing PLCA.
2) Supposed that node 3 is the only node with the high priority in this scenario.
3) As shown in the figure above, node 1 has an IDLE time before transmission, but CRITICAL DATA transmission request of node 3 occurs at the corresponding IDLE time.
4) Node 3 receives the transmission opportunity and transmits CRITICAL DATA preferentially.
5) Node 1 waits until the transmission of CRITICAL DATA is completed, and then starts transmission with a certain time of IDLE.
6) If there is no CRITICAL DATA transmission request, the PLCA transmission scheme is maintained.

Figure 148-5 PLCA DATA state Diagram



3. Need to be added

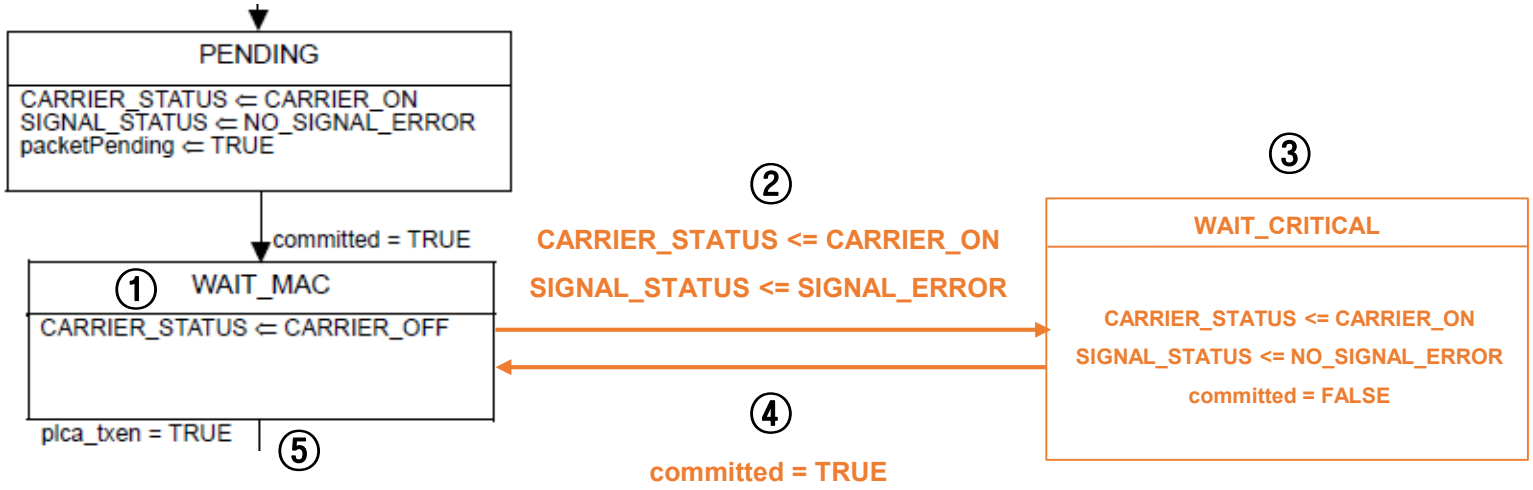
- Figure 148-5 shows the state diagram of the operation of the node with the transmission opportunity.
- For **single node priority method**, the node having the existing transmission opportunity is deprived of the transmission opportunity at the idle time, waits for the completion of the transmission of the CRITICAL DATA, and then starts transmission.

① WAIT_MAC = IDLE time

② When an encoding signal is received, the CARRIER_STATUS is in the CARRIER_ON state to transmit CRITICAL DATA and the signal status forces the SIGNAL_ERROR state to enter WAIT_CRITICAL.

CARRIER_ON && SIGNAL_ERROR == CRITICAL DATA transmission

Figure 148-5 PLCA DATA state Diagram



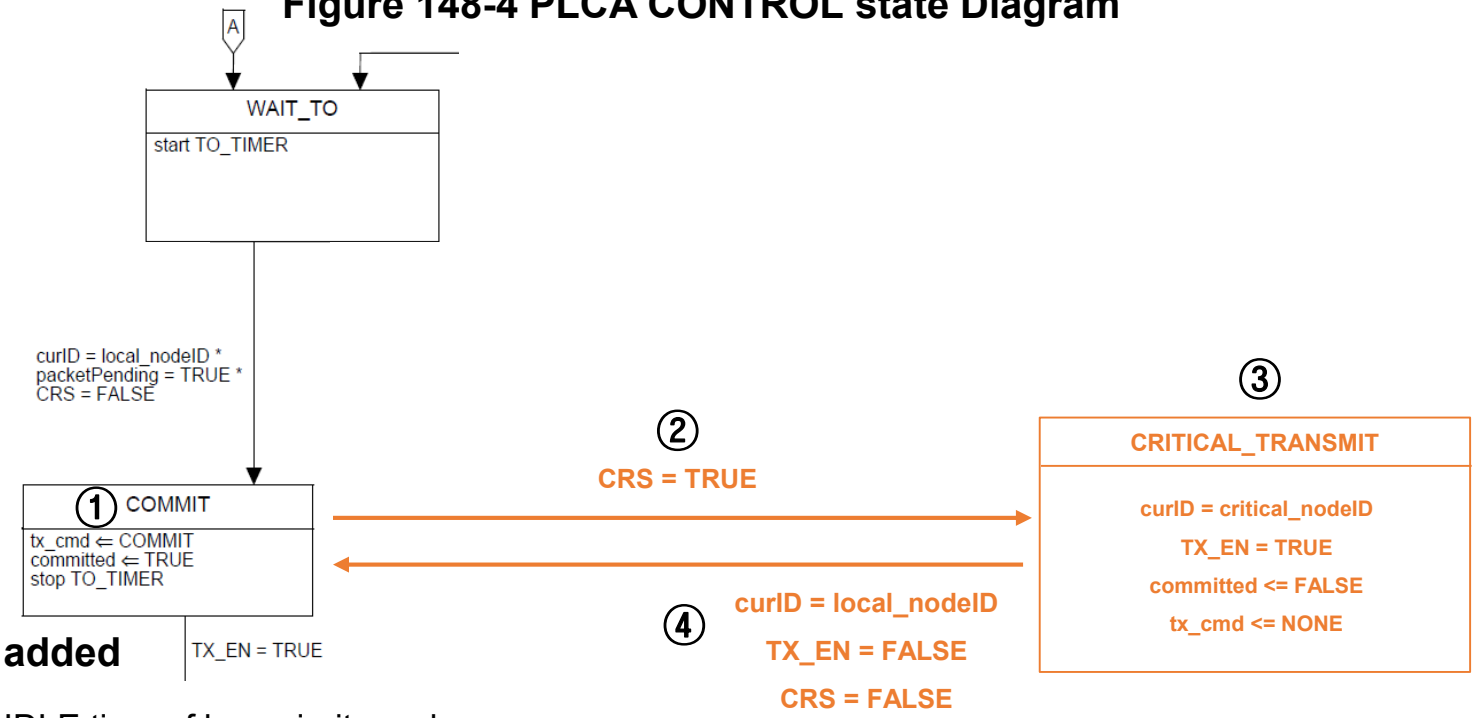
3. Need to be added (continued)

③ After entering the WAIT_CRITICAL state (CRITICAL DATA transmission), the state of the node having the transmission opportunity recognizes the transmission of the CRITICAL DATA through CARRIER_STATUS <= CARRIER_ON and waits (committed = FALSE).

④ After CRITICAL DATA transmission is completed, the waiting node acquires the transmission opportunity again (committed = TRUE).

⑤ The waiting node have an IDLE time and start to transmit DATA.

Figure 148-4 PLCA CONTROL state Diagram



3. Need to be added

① It is IDLE time of low priority nodes.

② An encoding signal has been detected (CRS = TRUE).

③ The transmission opportunity is passed to the node that generated the encoding signal (curID = critical_nodeID**).** The node with the previous transmission opportunity stores the transmission sequence number via the local_nodeID variable.

④ When the transmission of the critical data is finished, the transmission opportunity is returned to the original node (curID = local_nodeID) and the PLCA transmission cycle is continued.

1. **Objectives**
    1) Assign different priorities to different nodes by giving them more transmission opportunities.
    2) Nodes with a lower number have higher priorities (e.g. priority of node #0 > #1 > #2…).

2. **Approaches**
    1) Suppose that the N nodes in the LAN.
    2) Two kinds of cycles are used in our approaches.
        - They are Main-cycles and Sub-cycles.
            - (ex) N = 3, { (012) (010) } (except BEACON).
            - (ex) N = 4, { (0123) (0120) (0101) } (except BEACON).
            - (ex) N = 5, { (01234) (01230) (01201) (01010) } (except BEACON).
        - As you can see in examples above, the Main-cycles are depicted in big parentheses and Sub-cycles are depicted in small parentheses.
        - Each time a Sub-cycle proceeds one by one, the transmission opportunities of the lower priorities nodes disappears, and the nodes with higher priorities have that opportunities.

Comparison of transmission opportunity efficiency with existing PLCA :

An example through the sum of the number of transmission opportunities of node #1 and node #2

- S1 = The sum of transmission opportunities of node #0 and node #1 in one cycle of the existing PLCA
  - If N > 2, S1 = 2 * (N – 1) slots
- S2 = The sum of transmission opportunities of node #0 and node #1 in the Main-Cycle of the proposal
  - If N = 3, S2 = 5 * N – 11 (+ 1) = 5 * N – 10 = 5 slots (An exception not covered by the formula below)
  - If N > 3, S2 = [(5 * N) – 11] slots
- The efficiency is calculated as follows :
  - lim n -> ∞ (S2 / S1) = lim n -> ∞ {(5 * N – 11) / [2 * (N – 1)]} = 2.5

- Node #0 and node #1 have transmission opportunities of about 2.5 times as much as those of the existing PLCA.

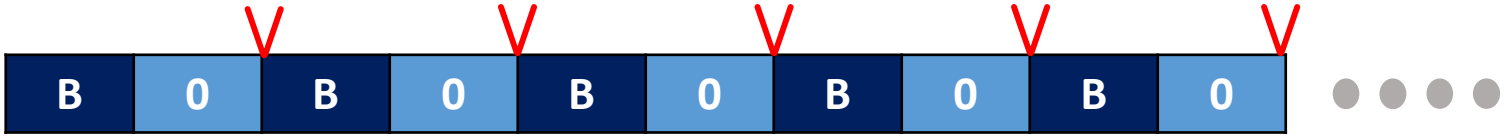
➢ **If there are fewer than 3 nodes on the LAN, use the existing PLCA**

Example :

Number of nodes = N

N = 1

V : The point at which one cycle ends

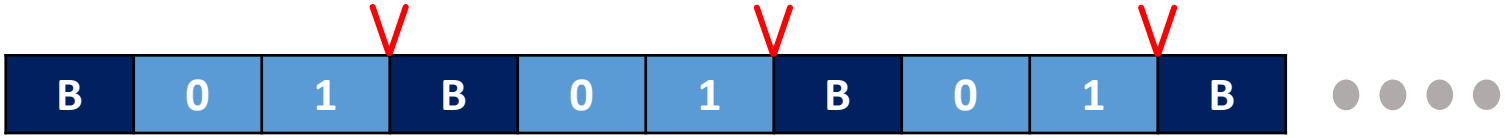


Example :

Number of nodes = N

N = 2

V : The point at which one cycle ends



- **B means BEACON, the numbers mean the node ID.**
- **In case of N < 3, it can be said that only one node has a transmission opportunity or a maximum of two nodes alternate, so that a sufficient transmission opportunity is guaranteed.**

➢ **If there are three or more nodes on the LAN, use multiple nodes priority method.**

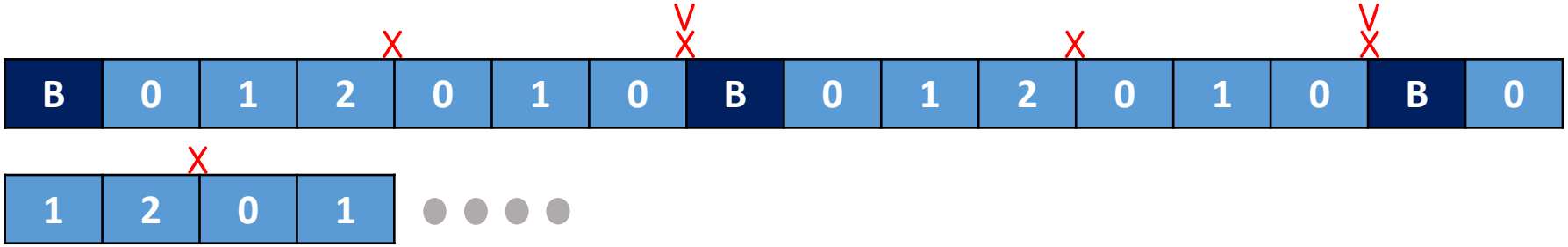
Example :

Number of nodes = N

N = 3

V : The point at which one Main-Cycle ends

X : The point at which one Sub-Cycle ends



- **First, BEACON is transmitted and N * (N – 1) time slot cycles are started.**
  - **One such cycle is called Main-Cycle.**
- **Since the node #2 has the lowest priority, there is no transmission opportunity time slot assigned to the node #2 in the next Sub-Cycle.**
- **In the last Sub-Cycle, only the node #0 and node #1 have been granted the transmission opportunity, so the Main-Cycle is ended and the BEACON is transmitted again to restart the Main-Cycle.**

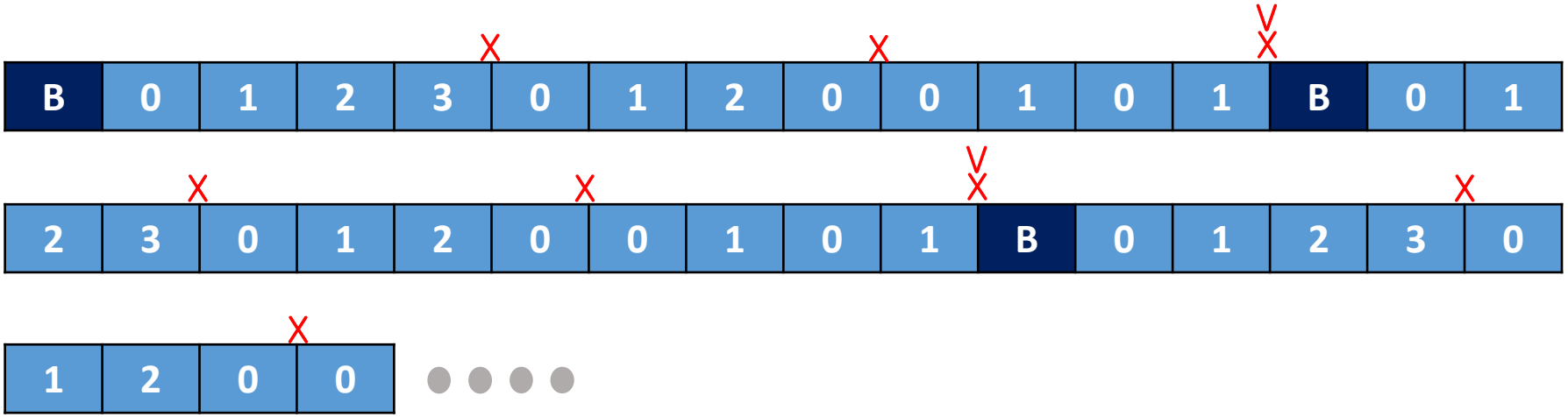
Example :

Number of nodes = N

N = 4

V : The point at which one MAIN-CYCLE ends

X : The point at which one SUB-CYCLE ends

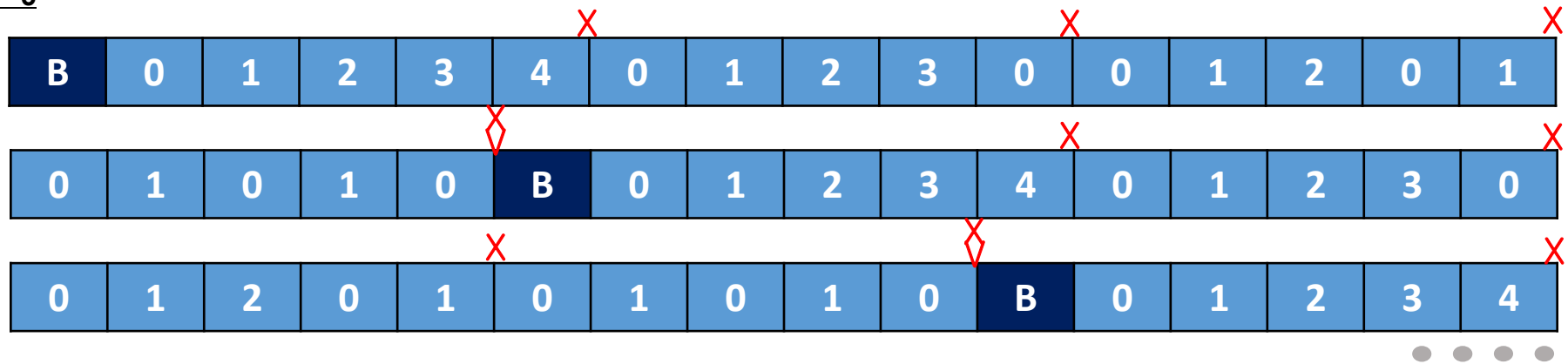


- **As described above, the Main-Cycle is made up of a total [4 * (4 - 1) = 12] time slots, and each Sub-Cycle consists of 4 time slots.**

Example :

Number of nodes = N

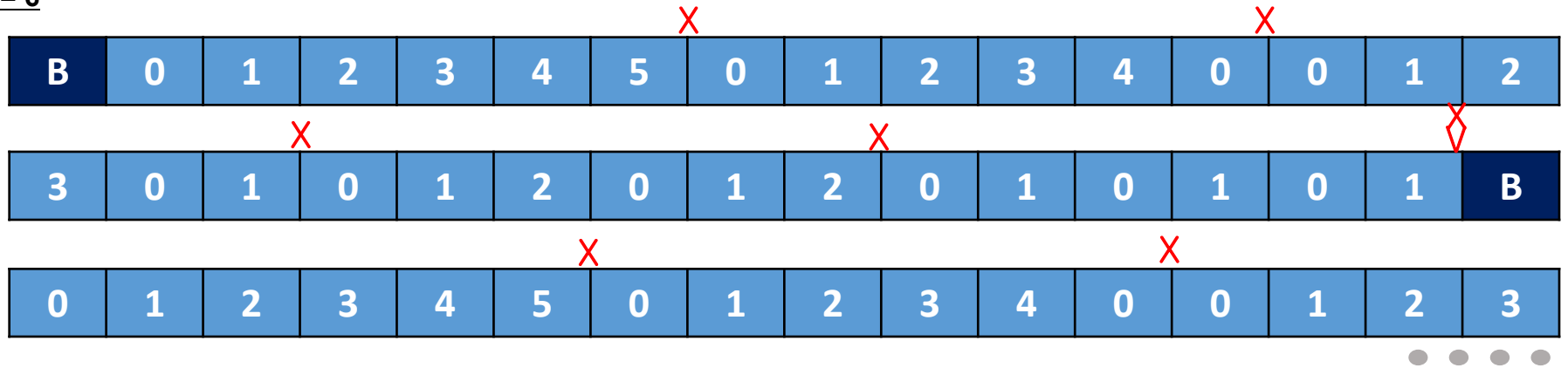
N = 5



Example :

Number of nodes = N

N = 6



THANK YOU !