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**Protocol specification for
FA control network standard**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The Japan Electrical Manufacturers' Association with a draft of Industrial Standard prepared from the non-national standard, JEM 1479:2002, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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Contents

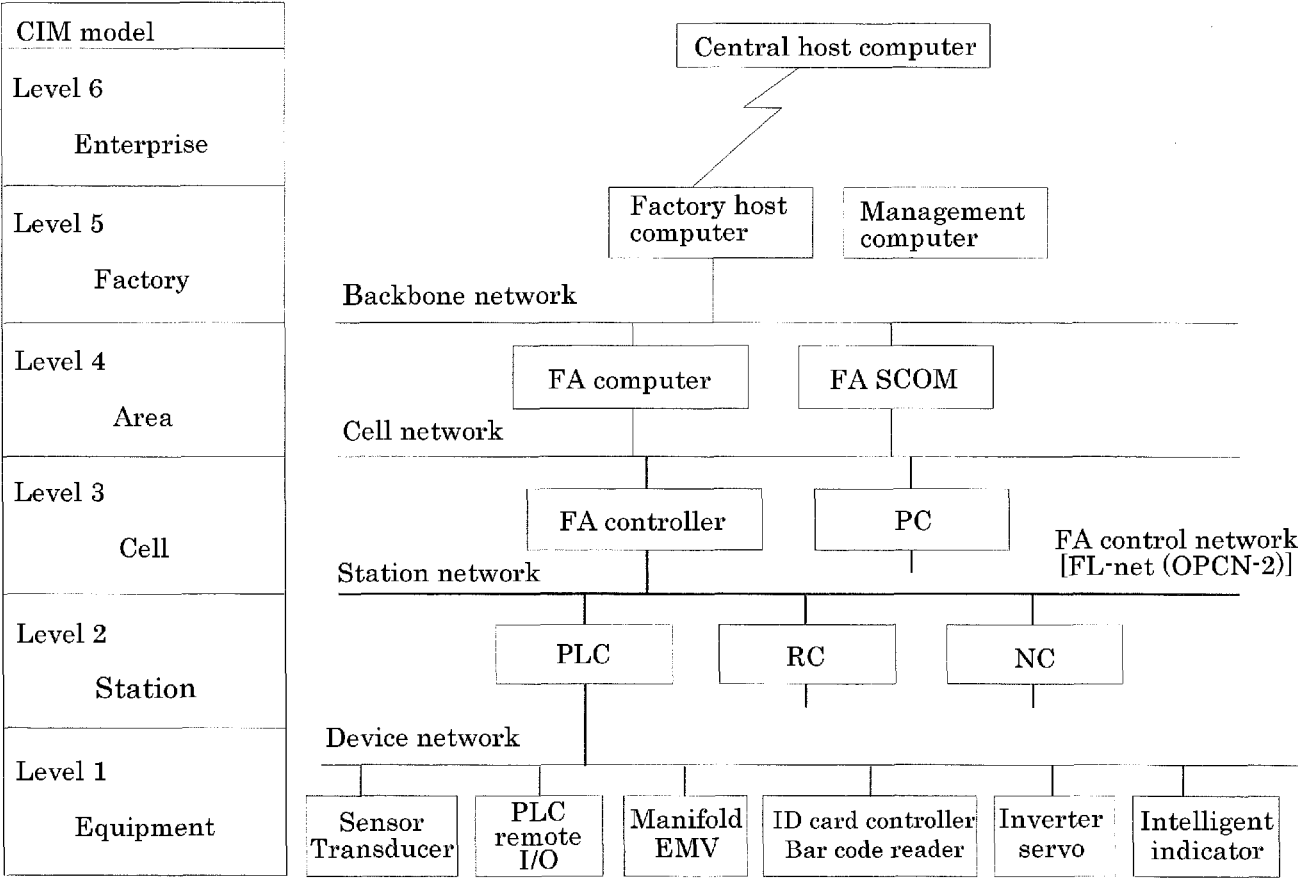
	Page
Introduction	1
1 Scope	2
2 Normative references	2
3 Definitions	3
3.1 Terms defined in JIS X 5003	3
3.2 Terms defined in JIS X 0001	3
3.3 Terms defined in JIS X 0005	3
3.4 Terms defined in JIS X 0009	3
3.5 Terms defined in JIS B 3500	4
3.6 Terms defined in this Standard	4
3.7 Notation used in this Standard	6
4 Abbreviations	6
5 Basic specifications	7
5.1 Relation between OSI basic reference model and FL-net (OPCN-2)	7
5.2 Number of connectable nodes	8
6 Services	8
6.1 Common memory	9
6.2 Message transmission	13
6.3 Network management service	31
6.4 Services by the lower layer	35
7 Functions	36
7.1 Node number	36
7.2 Protocol data unit	36
7.3 Byte order	38
7.4 Timers	39
8 Behavior	41
8.1 Transmission management	41
8.2 Node in-ring and out-ring	44
8.3 Data communication between nodes	47
9 FA link frame format	53
9.1 Header format	53
9.2 ACK header	68
9.3 User data	70
Annex 1 (informative) State transition diagram of FA link protocol	80
Annex 2 (informative) Log data	93

Protocol specification for FA control network standard

Introduction This Japanese Industrial Standard provides standard specifications for controller-level networks for efficiently executing data exchange between various control units in manufacturing systems of factory CIMs such as programmable logic controllers [hereafter referred to as “PLC” ⁽¹⁾], robot controllers (hereafter referred to as “RC”), numerical control units (hereafter referred to as “NC”) and control computers (hereafter referred to as “computers”).

Note ⁽¹⁾ Programmable logic controller is abbreviated to “PLC” according to IEC 61131-1 which has been revised in 2003, regardless of the abbreviation “PC” of JIS B 3500.

Figure 1 shows the positioning of the FL-net in the OSI/CIM model.



Remarks : EMV: Electro-magnetic valve, FA SCOM: Small computer for FA

Figure 1 Positioning of FL-net in OSI/CIM model

1 Scope This Standard specifies protocol specifications of the controller-level networks which realize communication networks between PLC, RC or NC and FA controllers or computers [hereafter referred to as “FL-net (OPCN-2)⁽²⁾”].

This Standard provides the network specifications such as service and protocol. Conformity to the FL-net (OPCN-2) can be realized by implementing this Standard into systems and units. Verification of conformity and interconnectivity is outside the scope of this Standard.

Note ⁽²⁾ Abbreviation of FA Link network (Open Programmable Controller Network level 2)

2. Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of coming into effect apply only to the most recent edition (including amendments).

JIS B 3500 *Glossary of terms used in programmable controller*

JIS X 0001 *Glossary of terms used in information processing—Fundamental terms*

Remarks : ISO/IEC 2382-1:1993 *Data processing—Vocabulary—Part 1: Fundamental terms* is identical with the said standard.

JIS X 0005 *Glossary of terms used in information processing (Representation of data)*

Remarks : ISO 2382-5:2000 *Information technology—Vocabulary—Part 5: Representation of data* is equivalent to the said standard.

JIS X 0009 *Glossary of terms used in information processing (Data Communication)*

Remarks : ISO/IEC 2382-9:1995 *Information technology—Vocabulary—Part 9: Data communication* is identical with the said standard.

JIS X 5003 *Open Systems Interconnection—Basic reference model*

Remarks : ISO 7498:1984 *Information Processing Systems—Open Systems Interconnection—Basic Reference Model* is equivalent to the said standard.

JIS X 5252 *Local and metropolitan area networks—Specific requirements—Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

Remarks : ISO/IEC 8802-3:1996 *Information technology—Telecommunications and information exchange between systems—Local and metropolitan area networks—Specific requirements—Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications* is equivalent to the said standard.

3 Definitions For the purposes of this Standard, the definitions given in JIS B 3500, JIS X 0001, JIS X 0005, JIS X 0009 and JIS X 5003 and the following definitions apply.

3.1 Terms defined in JIS X 5003 This Standard uses the following terms defined in JIS X 5003.

- a) **<N>-layer**
- b) **application layer**
- c) **presentation layer**
- d) **session layer**
- e) **transport layer**
- f) **network layer**
- g) **data link layer**
- h) **physical layer**
- i) **<N>-service**
- j) **<N>-service-access-point**
- k) **<N>-service-data-unit**
- l) **<N>-protocol**
- m) **<N>-protocol-data-unit**
- n) **<N>-interface-control-information**
- o) **<N>-protocol-control-information**
- p) **<N>-connection**
- q) **packet segmenting/reassembling**

3.2 Terms defined in JIS X 0001 This Standard uses the following terms defined in JIS X 0001.

- a) **hardware**
- b) **software**

3.3 Terms defined in JIS X 0005 This Standard uses the following terms defined in JIS X 0005.

- a) **MSB (most significant bit)**
- b) **LSB (least significant bit)**

3.4 Terms defined in JIS X 0009 This Standard uses the following terms defined in JIS X 0009.

- a) **interface**
- b) **data transmission**
- c) **data communication**

- d) **transmission line**
- e) **data circuit transparency**
- f) **protocol**
- g) **data signaling rate**
- h) **phase**
- i) **polling**
- j) **selecting**
- k) **packet**
- l) **time out**

3.5 Terms defined in JIS B 3500 This Standard uses the following terms defined in JIS B 3500.

- a) **execution**
- b) **internal failure**
- c) **module**
- d) **unit**
- e) **peripheral**

3.6 Terms defined in this Standard This Standard uses the following terms defined specifically.

- a) **FA link protocol** protocol defined to realize the FL-net. The FA link protocol layer lies between a transport layer and an application layer. The protocols of token management, cyclic transmission and message transmission are defined so that each node transmits data equally to each other
- b) **FA link** entity to execute the FA link protocol
- c) **FA link header** header information part of the frame defined in the FA link protocol
- d) **token** temporary right to use the network transmission medium. A token is transferred consecutively from one node to another node
- e) **valid linking state** state where a token is consecutively circulated among nodes
- f) **network startup state** node status where the node requests to participate in the network in the invalid linking state
- g) **in-ring startup state** node status where the node requests to participate in the network in the valid linking state
- h) **cyclic transmission** transmission method where a node transmits data stored in an allocated common memory area to all the nodes in a broadcast communication mode whenever the node acquires a token. Refer to 8.3.2 for details

- i) **message transmission** non-cyclic transmission method for transmitting an event between nodes. Refer to 8.3.3 for details
- j) **cyclic frame** frame used for cyclic transmission
- k) **token frame** frame for transmitting and receiving a token between nodes
- l) **message frame** frame used for message transmission
- m) **trigger frame** frame used when a node notifies its “participation request frame transmission waiting timer start” in a network startup state
- n) **participation request frame** frame used when a node notifies an existence of itself to participate in the network
- o) **ACK (message acknowledgment)** information used to acknowledge message frame transmission
- p) **version of sequence number** number used to judge if a received message is the same as the previously received one. The “version of sequence” number is generated when a node participates in the FL-net (OPCN-2), and holds its value until the node leaves the network
- q) **sequence number** number used to judge if a received message is the same as the previously received one. The sequence number value is initialized at the network startup time, and is incremented when each message transmission is completed
- r) **TCD: transaction code** code for identifying each frame defined in the network. For the transaction code, some numbers are reserved by the FA link protocol and others can be defined optionally by users. Refer to 7.2 for details
- s) **node** data station used in the network
- t) **node number** number for identifying each node connected to the network. Number 1 to 254 can be assigned. For the FA link protocol, the node number is used as information on destination address and source address in the FA link header
- u) **common memory** virtual memory for cyclic transmission defined in the network. It has two areas, “area 1” and “area 2”, with respective memory sizes of 512 words and 8 192 words. Refer to 6.1 for details
- v) **word** unit for indicating quantity of data. A one (1) word means two (2) bytes
- w) **virtual address space** accessible memory space in message transmission
- x) **token mode** mode that indicates whether the network can process independent token frames
- y) **major version** the integer part of the FA link protocol version represented with a 4-bit number. If it is zero (0), it is regarded as one (1)
Example 1 Ver.1.00 The major version is 0 or 1
Example 2 Ver.2.00 The major version is 2
- z) **minor version** the decimal part of the FA link protocol version represented with a 4-bit number

Example 1 Ver.2.01 The minor number is 1

Example 2 Ver.2.10 The minor number is 10

- aa) **double word** unit to indicate quantity of data. A one (1) double word means 4 bytes
- ab) **final cyclic frame** cyclic frame transmitted immediately before the token frame
- ac) **server function** functions for receiving a request message and transmitting a response message in message transmission
- ad) **client function** functions for transmitting a request message and receiving a response message in message transmission
- ae) **protocol type** information for distinguishing protocols from each other

3.7 Notation used in this Standard

- a) Numbers not especially specified are decimalized. To denote a hexadecimal number, "16#" precedes the number

Example 1 Decimal number — 12 0 4 782

Example 2 Hexadecimal number 16#FF 16#00 16#12AE

- b) In this Standard, "#" precedes a node number

Example : Node number 1 Node #1

- c) "Ver.*.*" is used to denote a version of the protocol specifications in this Standard. "*" is a decimal number 0 to 15. An integer part denotes its major version, and a decimal part denotes its minor version

The minor version consists of two figures

4 Abbreviations This Standard uses the abbreviations listed in table 1.

Table 1 Abbreviation list

Abbreviation	Terms in English
3CWT	three-circulation waiting time
AWT	message acknowledgment waiting time
BCT	broadcast transmission
BSIZE	current block size
CBN	current fragment block number
C_AD1	common memory area 1 data top address
C_AD2	common memory area 2 data top address
C_SZ1	common memory area 1 data size
C_SZ2	common memory area 2 data size
DA	destination address
DNA	node address of destination side
H_TYPE	header type
LKS	FA link status
MAJ_VER	FA link protocol version (major version)

Table 1 (concluded)

Abbreviation	Terms in English
MFT	allowable minimum frame interval time
MIN_VER	FA link protocol version (minor version)
MODE	FA link protocol version (major version, minor version), token mode
MSN	manufacturer model name of node information
M_ADD	message offset-address in virtual address space
M_CTL	message control
M_RLT	message result
M_SZ	message data size in virtual address space
NDN	node name of node information
PAT	participation request frame acceptance time
PDU	protocol data unit
PPT	peer to peer transmission
PRI	message priority
PWT	participation request frame transmission waiting time
P_TYPE	protocol type
RCT	allowable refresh cycle time
RMT	refresh cycle measurement time
RPA	response data by ACK
SA	source address
SDU	service data unit
SEQ	sequence number
SNA	node address of source side
TBN	total fragment block number
TCD	transaction code
TDT	joining token detection time
TFL	total frame octet length of header and data
TM	token mode
TW	token watchdog time
TrWT	trigger frame transmission waiting time
ULS	upper layer status
VDN	vendor code of node information
VER	program version
V_SEQ	version of sequence number

5 Basic specifications

5.1 Relation between OSI basic reference model and FL-net (OPCN-2) Figure 2 shows the relation between the OSI reference model and the protocol specifications of the FL-net (OPCN-2). In this Standard, no Presentation and Session layers are used because of the properties of the applied control systems. Furthermore, the Transport, Network and Data link layers are defined as “FA link lower layer”. In the FA link lower layer, the other functions are not specified except the broadcast function.

JIS X 5252 is used as the physical layer in this Standard.

This Standard defines the “FA link layer” as the upper layer of the lower layers. The FA link has not only a network management function, but also a cyclic transmission function for periodically collecting and distributing each node data, and a message transmission function for notifying event information. There is an “Upper application” above the FA link layer. In this Standard, “Upper layer” means the upper application.

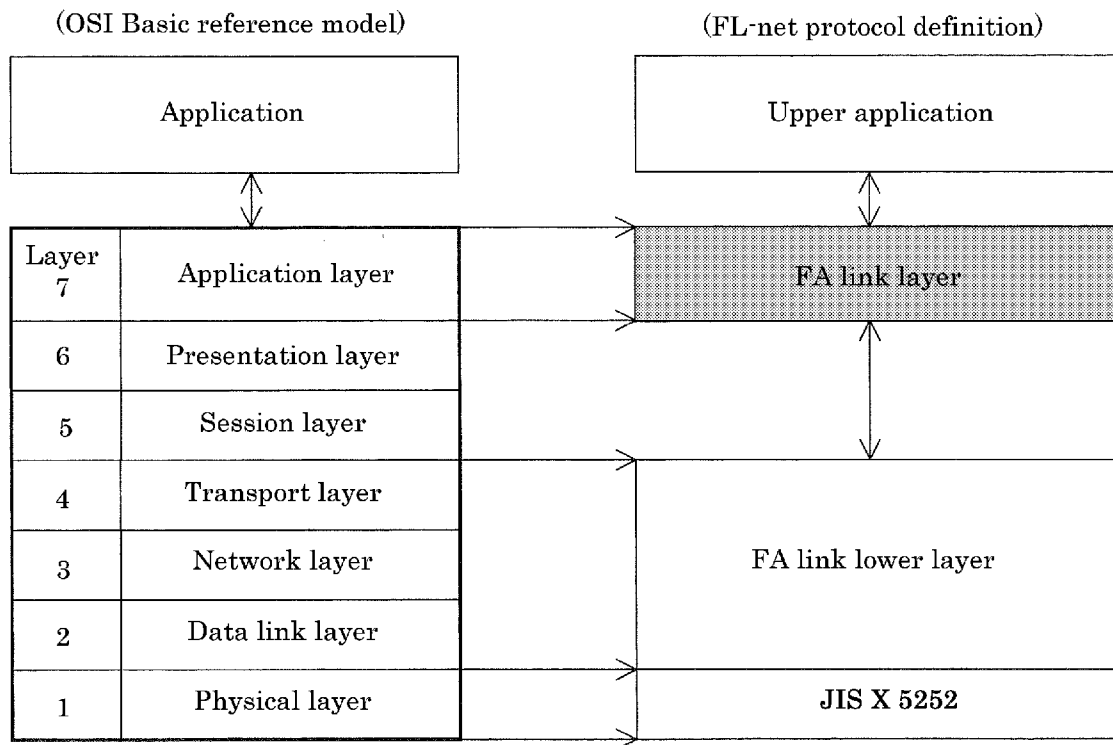


Figure 2 Relation between OSI reference model and protocol specifications of the FL-net (OPCN-2)

5.2 Number of connectable nodes Maximum of 254 nodes shall be connected to the network.

6 Services This clause defines the services the FL-net (OPCN-2) provides and those it requires. The specified services are as follows:

a) **Services to upper layer**

- 1) **Read from and Write to the common memory data**
- 2) **Messages**
 - Byte Block Read service
 - Byte Block Write service
 - Word Block Read service
 - Word Block Write service

- Network Parameter Read service
- Network Parameter Write service
- Stop command service
- Start command service
- Profile Read service
- Transparent mode message service
- Log Data Read service
- Log Data Clear service
- Message echo back service
- Vendor specific message service

3) Network management

- Configuration parameter setting
- Own node management information parameter read
- Participating node management information parameter read
- Network management information parameter read
- Message sequence number management table read
- Node status read

b) Services to lower layer

- Transmission SAP
- Cyclic transmission SAP
- Message transmission SAP
- Participation request reception SAP

6.1 Common memory

6.1.1 General The common memory provides nodes with a service that can be regarded as a global memory shared among them in cyclic transmission. Implementation of the service is optional.

Two area types (area 1 and area 2) shall be assigned to the common memory. Data size of the area 1 is 512 words, and 8 192 words for area 2. The communication unit of each node shall provide a fixed size of 8 192 bits + 8 192 words = 8 704 words as the common memory. A node that does not implement the service does not need to provide the common memory.

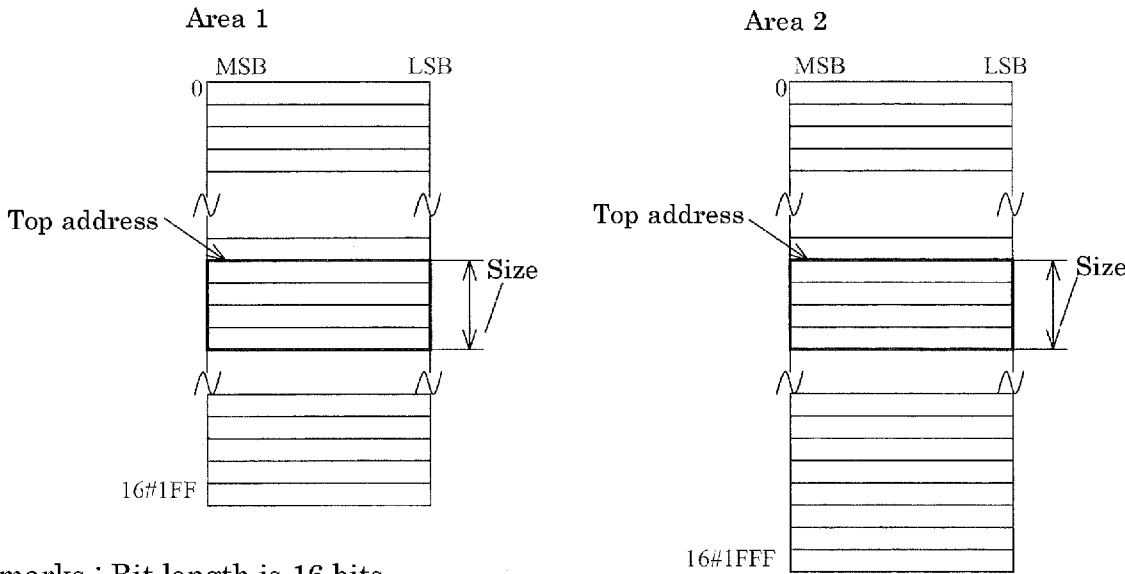
For the common memory, a node's sending area in either area 1 and area 2 can be set at any size up to the maximum.

6.1.2 Allocation of common memory A node may assign its data areas at both area 1

and area 2 of the common memory. The data areas shall not overlap those of the other nodes.

For the common memory of each node, area 1 can be set at any word size in zero (0) to 512 words, and also area 2 in zero (0) to 8 192 words. The area assignment for each node shall be set with its top address and size.

Figure 3 shows an example of the common memory allocation.



Remarks : Bit length is 16 bits.

Figure 3 Example of common memory allocation

6.1.3 Data sharing function Each node broadcasts its sending area data assigned to the common memory in a fixed cycle so that all the nodes in the system can share the same data. Each node on the network has a specific sending area in the common memory that shall not overlap others.

In the common memory operation, an area assigned to one node shall be the sending area for the node, and the receiving area for other nodes (refer to figure 4). A node may use all the common memory area as a receiving area (Example: Node #01 in figure 5).

A node implementing no common memory discards all the receiving data. (Example: Node #01 in figure 6)

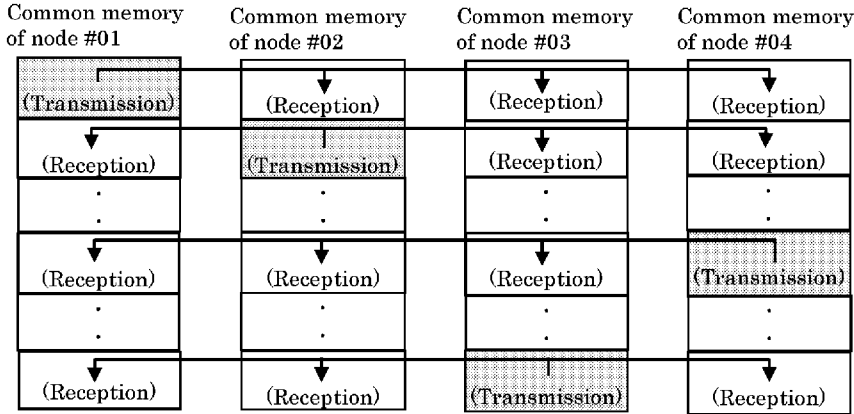


Figure 4 Example of data share function

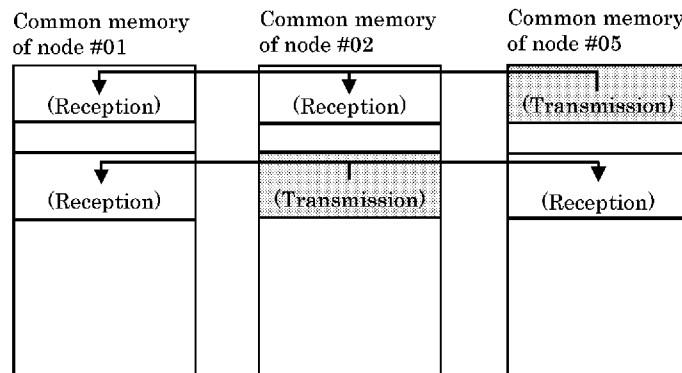


Figure 5 Example of node for reception only

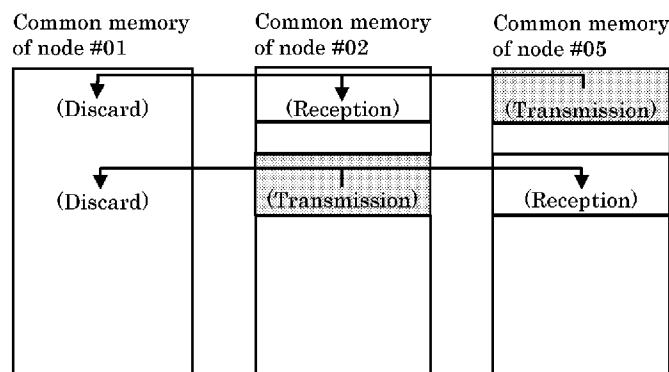


Figure 6 Example of node with no common memory

6.1.4 Data transmission

- a) **Write-request to common memory** The upper layer issues a “write-request” to a corresponding area of common memory so as to set the data in the common memory. Parameters for the write-request are as follows:
 - Top address of the common memory
 - Data size
 - Data
- b) **Transmission request** The upper layer requests the FA link layer to transmit data in a transmission area of the common memory.

The FA link layer that receives the transmission request transfers the node data allocated in the common memory to a transmission buffer to prepare the transmission. When the node acquires a token, it transmits the data in the buffer. The data are divided into multiple frames and then transmitted if the transmission area size of the node exceeds the transmission size of one frame, that is, 1 024 bytes. Whenever each node acquires a token, it transmits all the transmission data in the common memory. Figure 7 shows an example of a flow of the common memory data.

6.1.5 Data reception

- a) **Read-request to the common memory** The upper layer issues a “read-request” to a corresponding area of the common memory so as to read data in the common memory. Parameters for the read-request are as follows:
- Top address of the common memory
 - Data size
- b) **Reception request** The upper layer requests the FA link layer to transmit reception data to the corresponding area in the common memory.

When each node receives a cyclic frame, it transfers the data to the corresponding area in the common memory. In this event, when the reception node finishes receiving all the cyclic data from one node, it updates the corresponding area in synchronization with the upper layer. That is, if the cyclic data are divided into multiple frames and transmitted, the data transfer to the common memory area is executed when all the frames from one node are finished receiving. If all the frames are not received successfully, all the data from the node are discarded. An example of a flow of the common memory data is shown in figure 7.

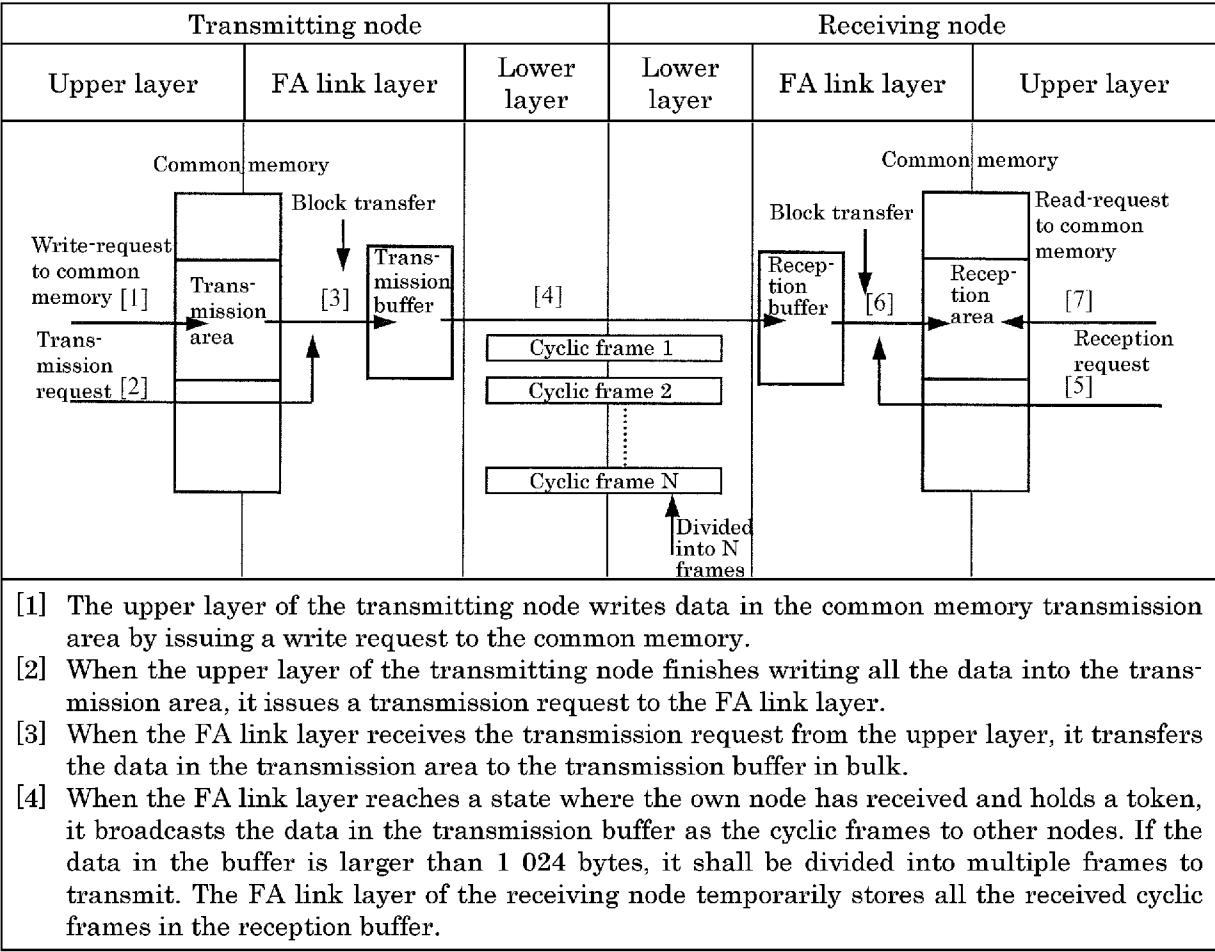


Figure 7 Example of flow of common memory data

- [5] The upper layer of the receiving node issues a reception request to the FA link layer.
- [6] Responding to the reception request from the upper layer, the FA link layer in the receiving node transfers the data in the reception buffer to the corresponding reception area in bulk.
- [7] The upper layer of the receiving node reads data from the reception area of the common memory by a read-request to the common memory.

Figure 7 (concluded)

6.2 Message transmission

6.2.1 General Message transmission is a function that supports non-cyclic data exchange between nodes. A maximum data size is 1 024 bytes for a transmission.

Both peer-to-peer transmission to a specific destination node and broadcasting transmission to all nodes are provided. For the peer-to-peer message transmission, an acknowledgment function is provided to confirm successful delivery of data to the peer node, and a response message is specified. This assures reliability of the message data transmission.

6.2.2 Service type This Standard specifies services a) to n) for the message transmission. The peer-to-peer transmission and the broadcast transmission are specified for transparent message service, log data clear service and vendor-specific service. Only the peer to peer transmission is specified for services other than the above three. Request and response are specified for services other than the transparent message service. Each message type is identified by the following transaction codes. Each message is provided with both a transaction code for request and a one for response. User may define transaction codes for request/response of the transparent message if necessary.

Services defined in this Standard are as follows:

- a) Byte block read service
- b) Byte block write service
- c) Word block read service
- d) Word block write service
- e) Network parameter read service
- f) Network parameter write service
- g) Stop command service
- h) Start command service
- i) Profile read service
- j) Transparent message service
- k) Log data read service
- l) Log data clear service
- m) Message echo back service

n) Vendor-specific message service

6.2.3 Byte block read service

a) **Function** By this service the source node reads the byte block data of the destination node. The service uses the area defined in the virtual address space.

Figure 8 shows the virtual address space for the byte block. The virtual address space is of 32 bits, and its content is defined for each node.

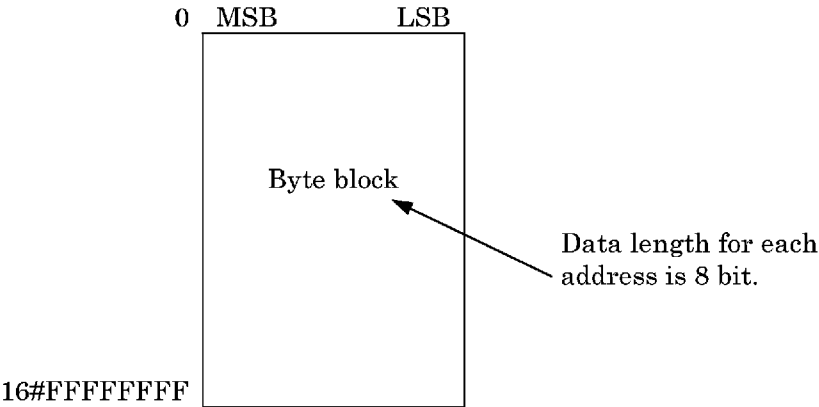


Figure 8 Virtual address space for byte block

b) **Protocol** Figure 9 shows the sequence of the byte block read service.

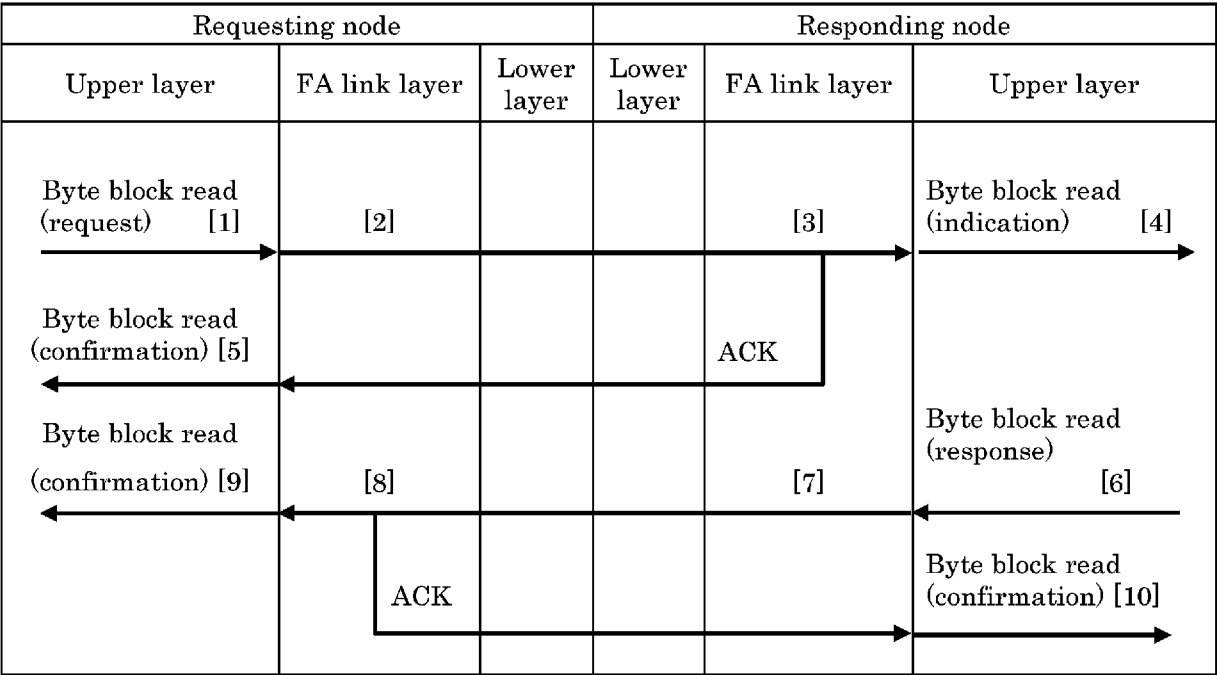


Figure 9 Sequence of byte block read service

- [1] The upper layer of the requesting node sets the following parameters, and requests the byte block read to the FA link layer.
 - Node address of requested side: DNA
 - Offset address of requesting byte block (Address in virtual address space): M_ADD
 - Size of requesting byte block (Data size in virtual address space): M_SZ
- [2] The FA link layer of the requesting node receives the PDU (request) from the upper layer as an SDU, and requests transmission to the lower layer.
- [3] The responding node requests to transmit an ACK in response to the PDU (indication) received from the lower layer, and sends the PDU (indication) to the upper layer.

If the response processing by the responding node finishes before the token acquisition by the responding node, the processing described in [6], [7] and [8] may precede the ACK transmission in response to the request.
- [4] The upper layer of the responding node receives the PDU (indication) as an SDU, and begins processing of the request.
- [5] Based on the ACK received from the lower layer, the upper layer of the requesting node confirms that the responding node has received the request.
- [6] When the processing finishes, the upper layer of the responding node responds the byte block read request to the FA link layer setting the following parameters.
 - Node address of requesting side: DNA
 - Offset address of responding byte block (Address in virtual address space): M_ADD
 - Size of responding byte block (Data size in virtual address space): M_SZ
 - Response message result: M_RLT
 - Response data (Byte block data read): data
- [7] The FA link layer of the responding node receives the PDU (response) from the upper layer as an SDU, and requests transmission to the lower layer.
- [8] The FA link layer of the requesting node requests to transmit an ACK in response to the PDU (response) received from the lower layer and sends the PDU (confirmation) to the upper layer. The ACK does not have response data.
- [9] The upper layer of the requesting node receives the PDU (confirmation) as an SDU, that is, receives the data in response to the byte block read request.
- [10] Based on the ACK received from the lower layer, the upper layer of the responding node confirms that the requesting node has received the response data.

Figure 9 (concluded)

6.2.4 Byte block write service

- a) **Function** This service writes the byte block data to the destination node for the source node. It uses the area defined in the virtual address space. Refer to 6.2.3 on the virtual address space.
- b) **Protocol** Figure 10 shows the sequence of the byte block write service.

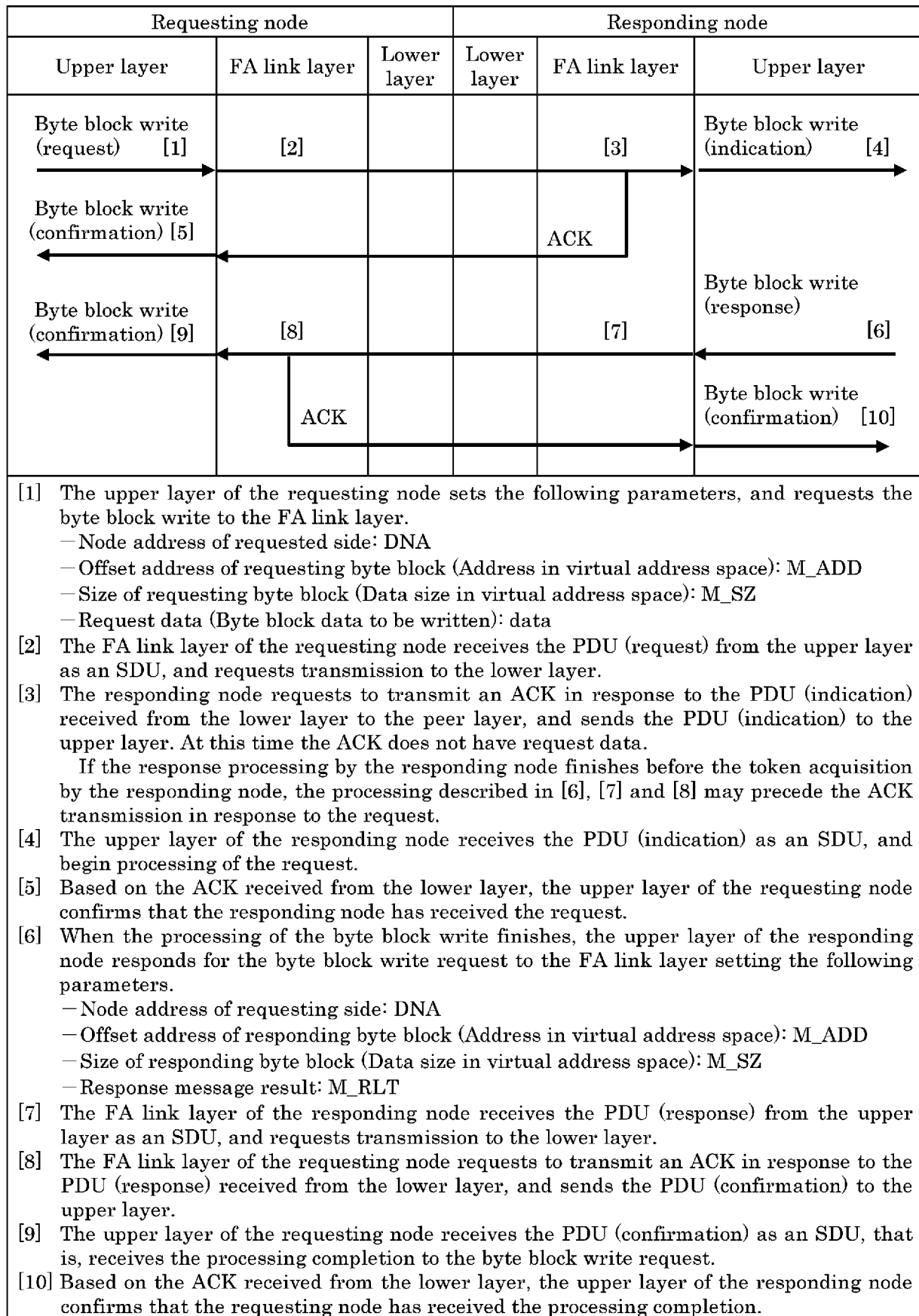


Figure 10 Sequence of byte block write service

6.2.5 Word block read service

- a) **Function** This service reads the word block data of the destination node for the source node. It uses the area defined in the virtual address space. Figure 11 shows the virtual address space for word blocks. The virtual address space is of 32 bits, and its internal content is defined for each node.

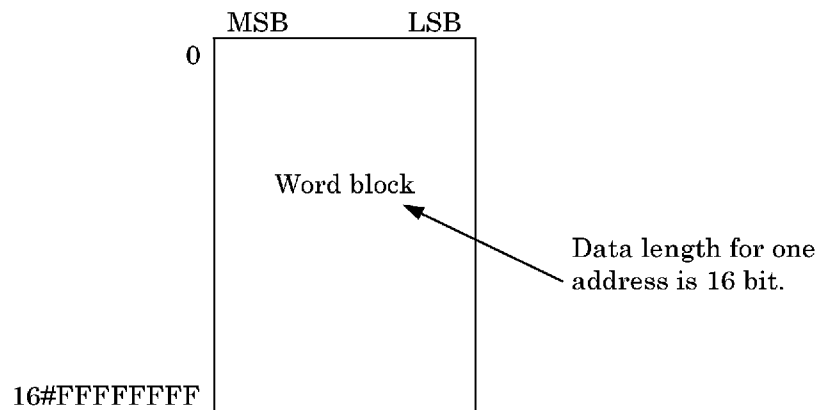


Figure 11 Virtual address space for word block

- b) **Protocol** Figure 12 shows the sequence of the word block read service.

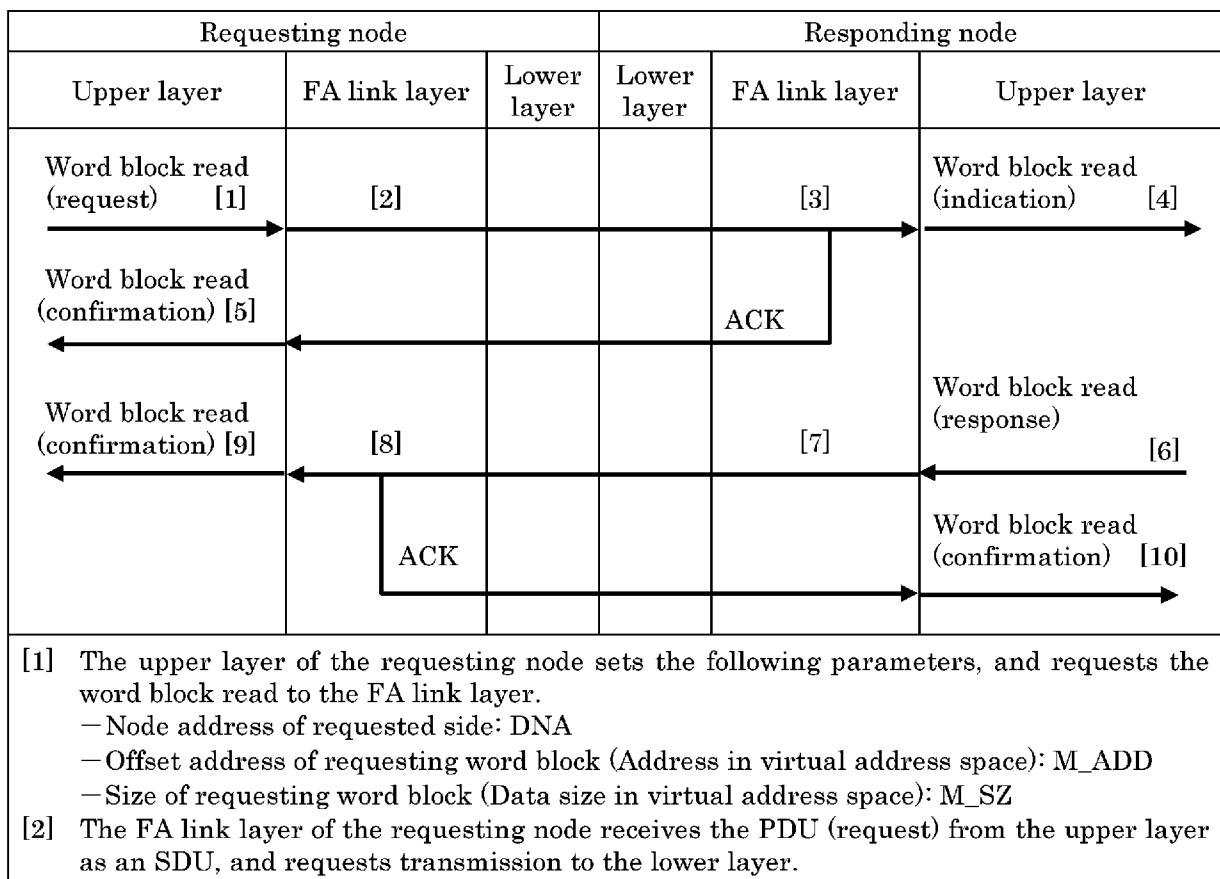


Figure 12 Sequence of word block read service

- [3] The responding node requests to transmit an ACK in response to the PDU (indication) received from the lower layer to the peer layer, and sends the PDU (indication) to the upper layer.
- If the response processing by the responding node finishes before the token acquisition by the responding node, the processing described in [6], [7] and [8] may precede the ACK transmission in response to the request.
- [4] The upper layer of the responding node receives the PDU (indication) as an SDU, and begins processing of the request.
- [5] Based on the ACK received from the lower layer, the upper layer of the requesting node confirms that the responding node has received the request.
- [6] When the processing of the word block read has been completed, the upper layer of the responding node responds to the word block read request in the FA link layer setting the following parameters.
- Node address of requesting side: DNA
 - Offset address of responding word block (Address in virtual address space): M_ADD
 - Size of responding word block (Data size in virtual address space): M_SZ
 - Response message result: M_RLT
 - Response data (Word block data read): data
- [7] The FA link layer of the responding node receives the PDU (response) from the upper layer as an SDU, and requests transmission to the lower layer.
- [8] The requesting node requests to transmit an ACK in response to the PDU (response) received from the lower layer to the peer layer, and sends the PDU (confirmation) to the upper layer. The ACK does not have response data.
- [9] The upper layer of the requesting node receives the PDU (confirmation) as an SDU, that is, receives the data in response to the word block read request.
- [10] Based on the ACK received from the lower layer, the upper layer of the responding node confirms that the requesting node has received the response data.

Figure 12 (concluded)

6.2.6 Word block write service

- a) **Function** This service writes the word block data to the destination node for the source node. It uses the area defined in the virtual address space. Refer to 6.2.5 on the virtual address space.
- b) **Protocol** Figure 13 shows the sequence of the word block write service.

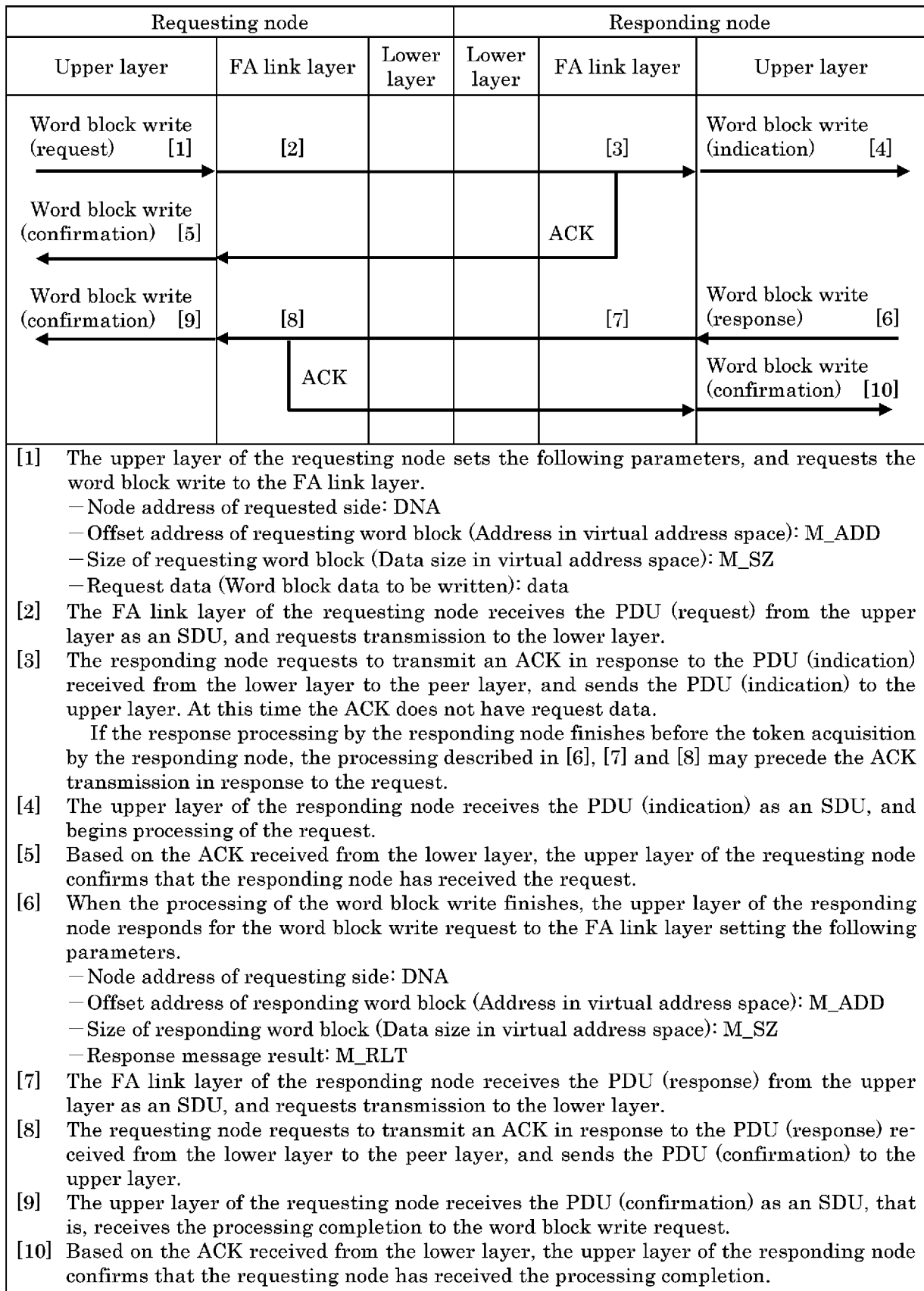


Figure 13 Sequence of word block write service

6.2.7 Network parameter read service

- a) **Function** This service reads the network parameters of the destination node for the source node.
- b) **Protocol** Figure 14 shows the sequence of the network parameter read service.

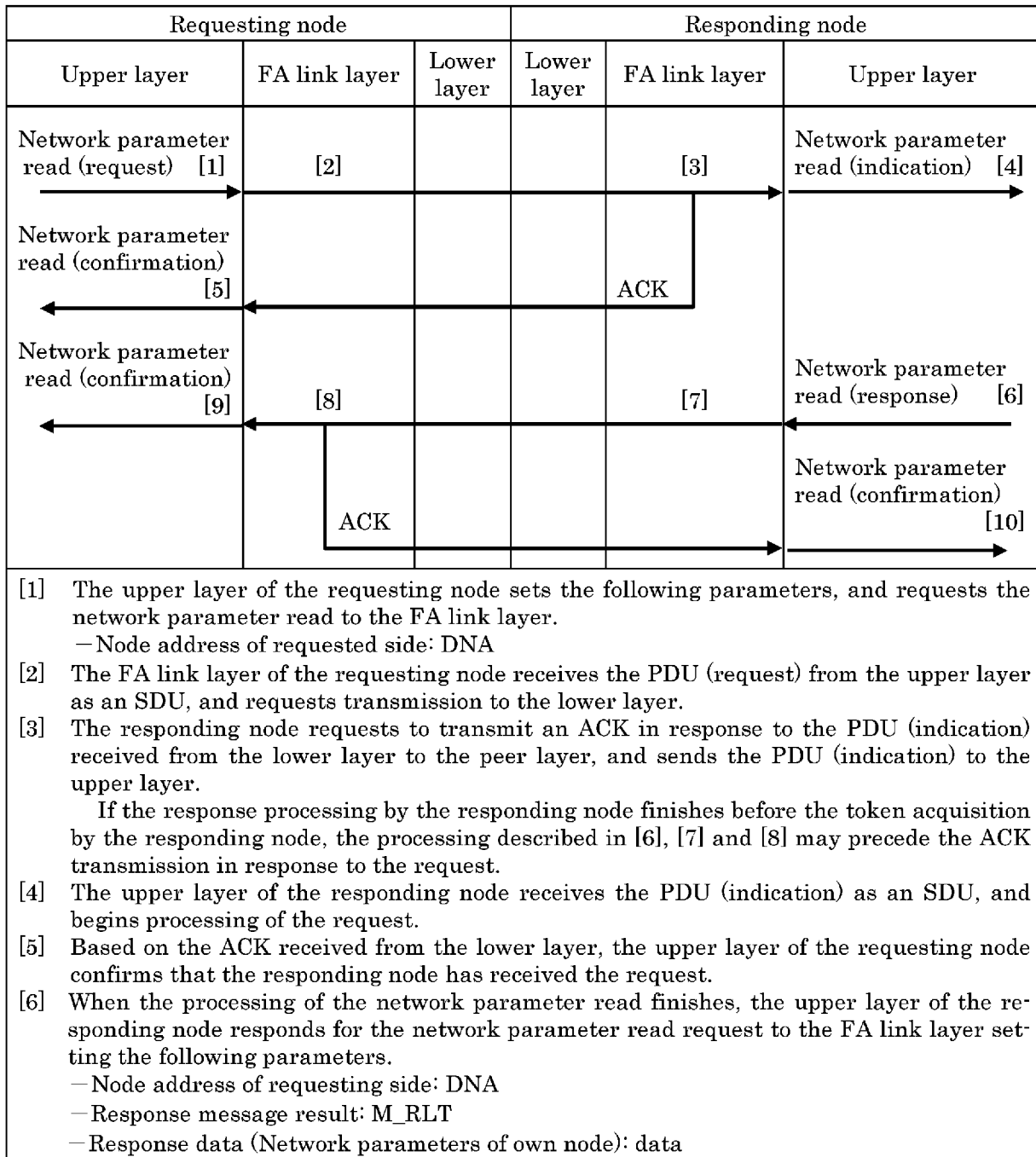


Figure 14 Sequence of network parameter read service

- Node name (Equipment name): The user shall assign.
 - Vendor name: The vendor shall assign.
 - Manufacturer model name: The manufacturer shall assign
 - Top address of area 1
 - Size of area 1
 - Top address of area 2
 - Size of area 2
 - Token watchdog time
 - Allowable minimum frame interval time
 - FA link status
 - Protocol type
 - Upper layer status
 - Allowable refresh cycle time (Set value)
 - Measured refresh cycle time (Current value)
 - Measured refresh cycle time (Maximum value)
 - Measured refresh cycle time (Minimum value)
- [7] The FA link layer of the responding node receives the PDU (response) from the upper layer as an SDU, and requests transmission to the lower layer.
- [8] The requesting node requests to transmit an ACK in response to the PDU (response) received from the lower layer to the peer layer, and sends the PDU (confirmation) to the upper layer. The ACK does not have response data.
- [9] The upper layer of the requesting node receives the PDU (confirmation) as an SDU, that is, receives the data in response to the network parameter read request.
- [10] Based on the ACK received from the lower layer, the upper layer of the responding node confirms that the requesting node has received the response data.

Figure 14 (concluded)

6.2.8 Network parameter write service

- a) **Function** This service writes the network parameters to the destination node for the source node.
- b) **Protocol** Figure 15 shows the sequence of the network parameter write service.

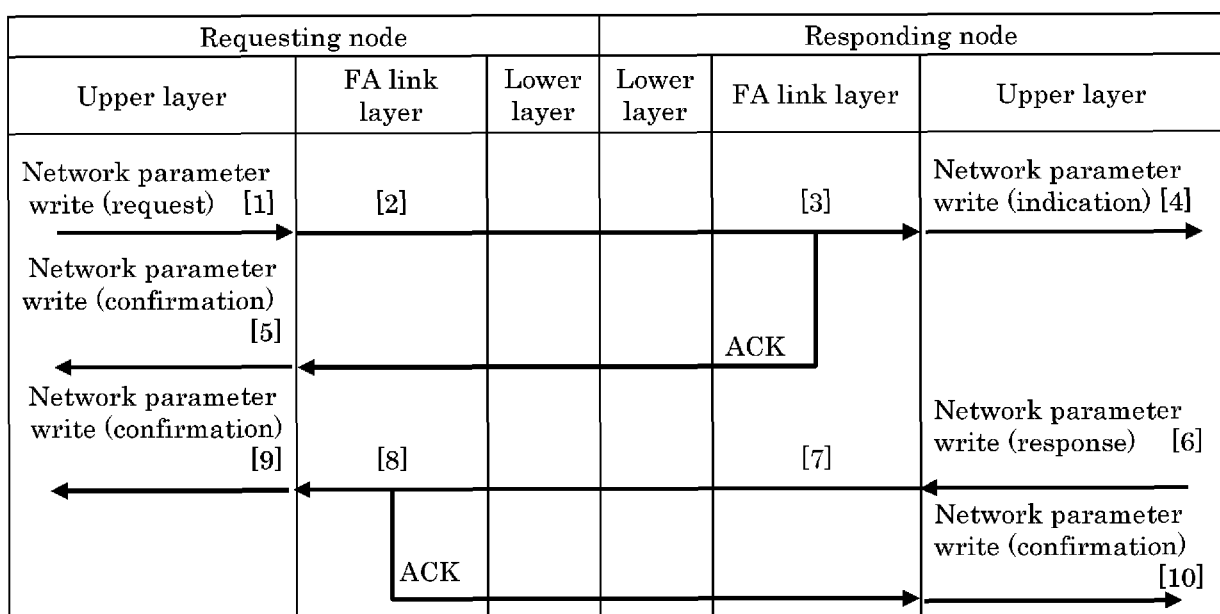


Figure 15 Sequence of network parameter write service

- [1] The upper layer of the requesting node sets the following parameters, and requests the network parameter write to the FA link layer.
 - Node address of requested side: DNA
 - Request data (Network parameters to be written): data
 - Setting parameter flag
 - 16#01: In case only the top addresses and sizes of the area 1 and 2 are to be written
 - 16#02: In case only the node name (equipment name) is to be written
 - 16#03: In case the top addresses, sizes of the area 1 and 2 and the node name (equipment name) are to be written
 - Top address of area 1
 - Size of area 1
 - Top address of area 2
 - Size of area 2
 - Node name (Equipment name): The user shall assign.
- [2] The FA link layer of the requesting node receives the PDU (request) from the upper layer as an SDU, and requests transmission to the lower layer.
- [3] The responding node requests to transmit an ACK in response to the PDU (indication) received from the lower layer to the peer layer, and sends the PDU (indication) to the upper layer. At this time the ACK does not have request data.
If the response processing by the responding node finishes before the token acquisition by the responding node, the processing described in [6], [7] and [8] may precede the ACK transmission in response to the request.
- [4] The upper layer of the responding node receives the PDU (indication) as an SDU, and begins processing of the request.
- [5] Based on the ACK received from the lower layer, the upper layer of the requesting node confirms that the responding node has received the request.
- [6] When the processing of the network parameter write finishes, the upper layer of the responding node responds for the network parameter write request to the FA link layer setting the following parameters.
 - Node address of requesting side: DNA
 - Response message result: M_RLT
- [7] The FA link layer of the responding node receives the PDU (response) from the upper layer as an SDU, and requests transmission to the lower layer.
- [8] The requesting node requests to transmit the ACK in response to the PDU (response) received from the lower layer to the peer layer, and sends the PDU (confirmation) to the upper layer.
- [9] The upper layer of the requesting node receives the PDU (confirmation) as an SDU, that is, receives the processing completion to the network parameter write request.
- [10] Based on the ACK received from the lower layer, the upper layer of the responding node confirms that the requesting node has received the processing completion.

Figure 15 (concluded)

6.2.9 Stop command service

- a) **Function** This service requests the stop command to the destination node for the source node.
- b) **Protocol** Figure 16 shows the sequence of the stop command service.

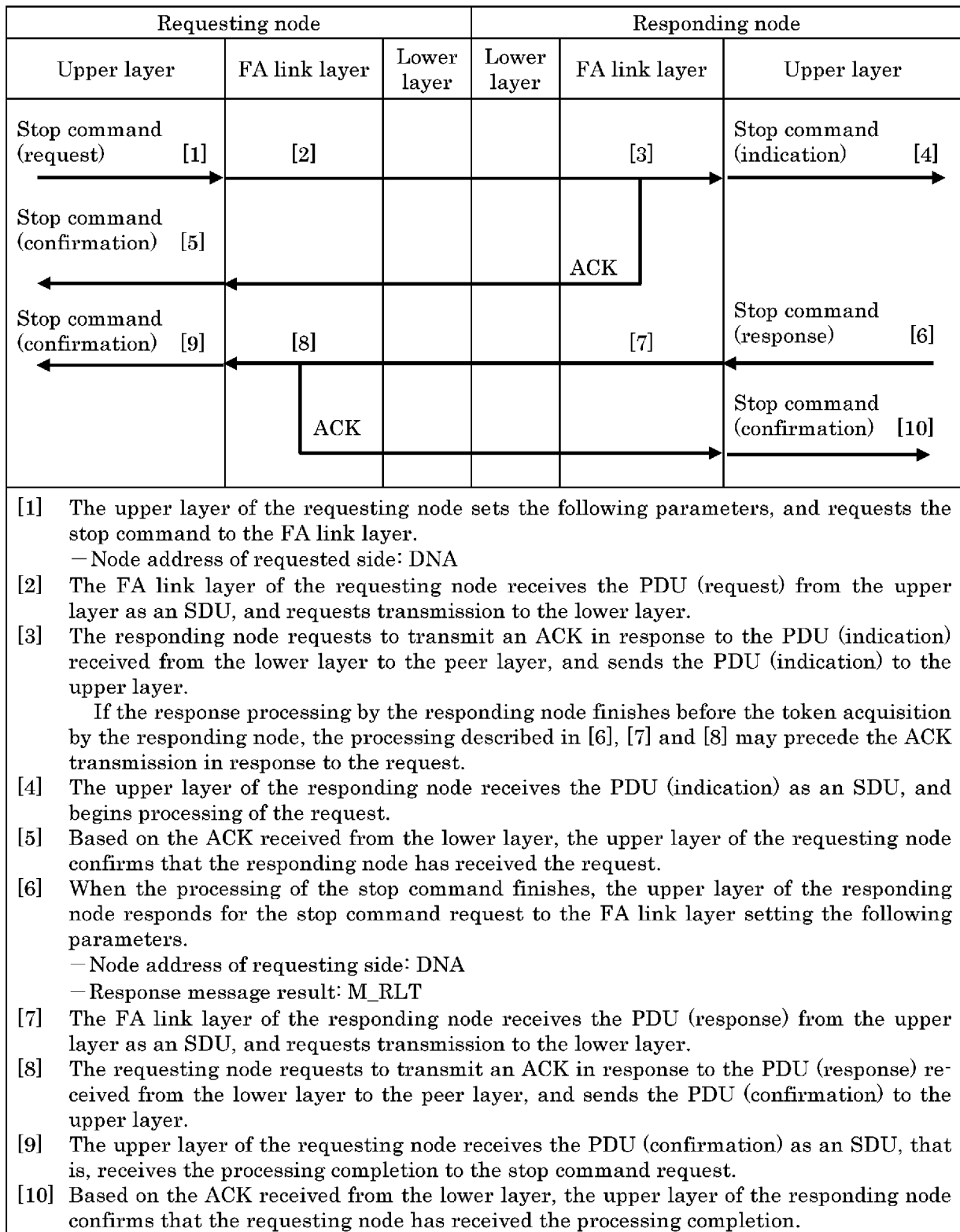


Figure 16 Sequence of stop command service

6.2.10 Start command service

- a) **Function** This service requests the start command to the destination node for the source node.
- b) **Protocol** Figure 17 shows the sequence of the start command service.

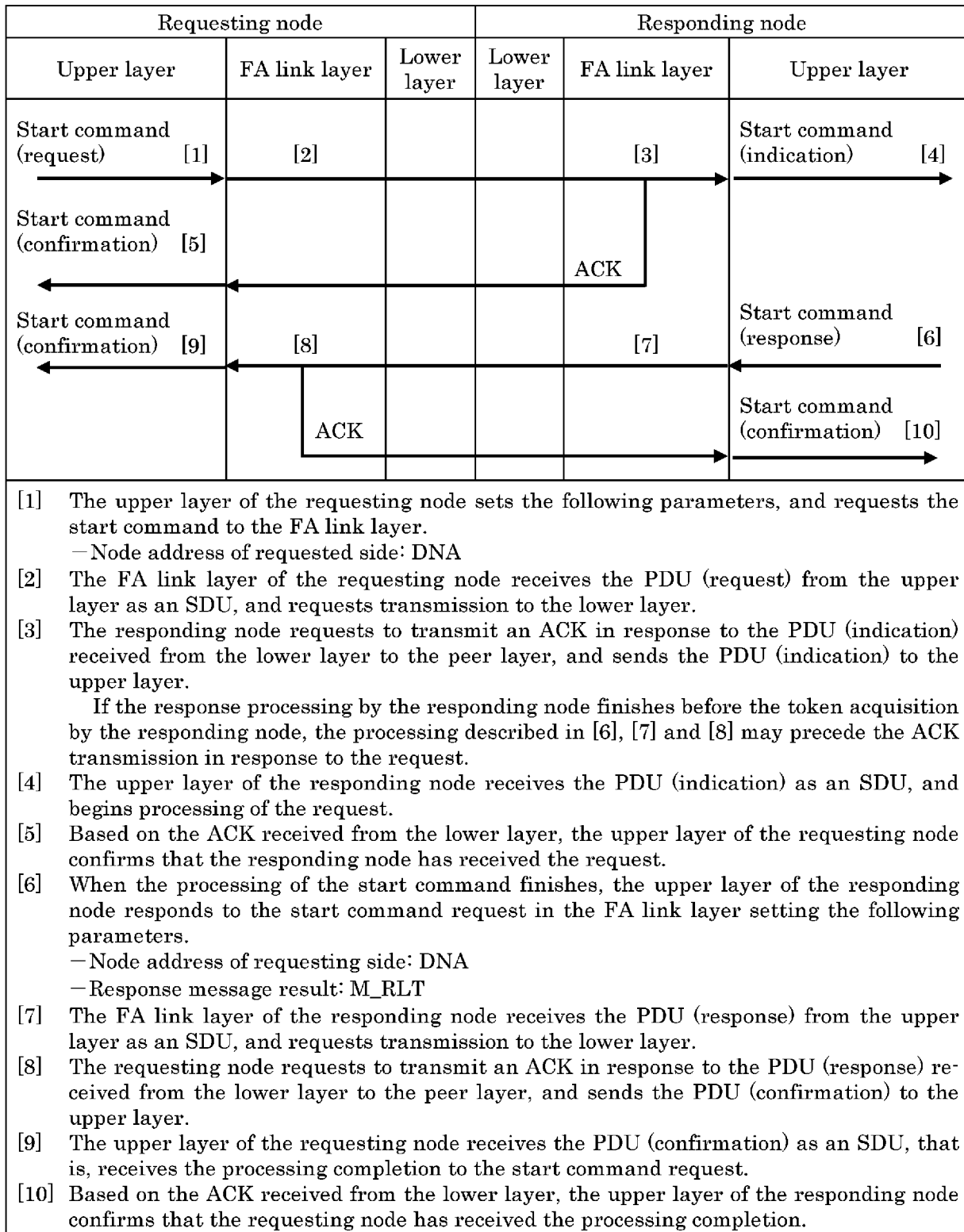


Figure 17 Sequence of start command service

6.2.11 Profile read service

- a) **Function** This service reads the profile of the destination node for the source node.
- b) **Protocol** Figure 18 shows the sequence of the profile read service.

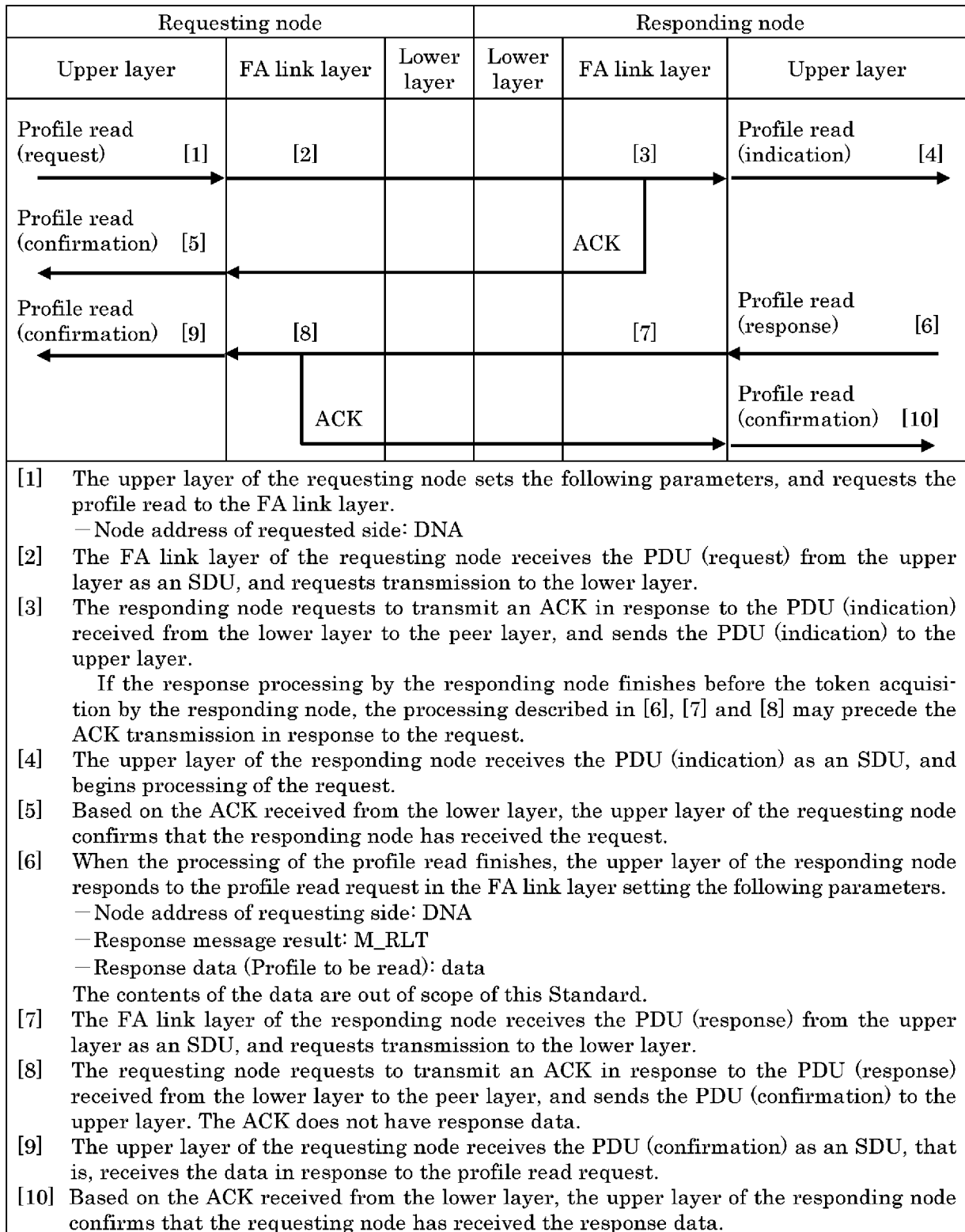
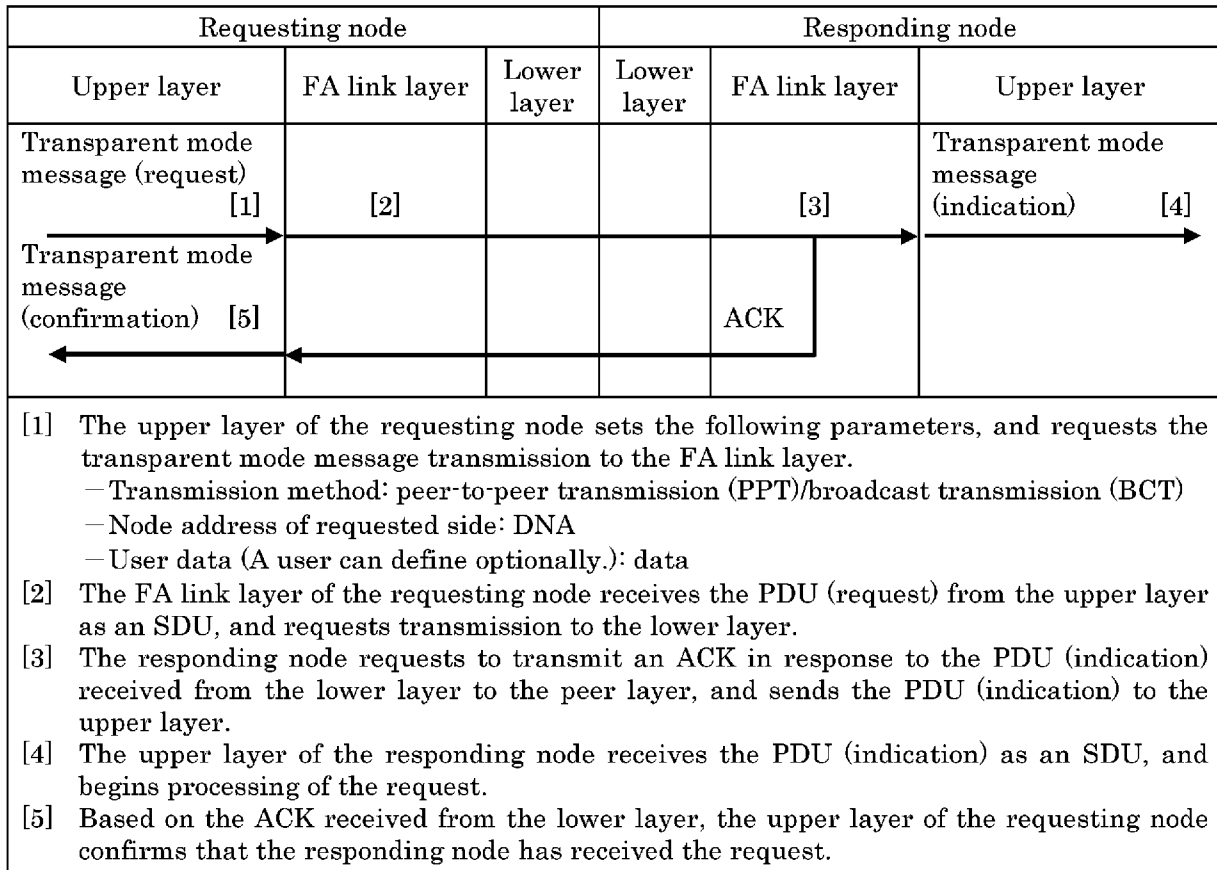


Figure 18 Sequence of profile read service

6.2.12 Transparent mode message service

- a) **Function** This service transmits user-defined service from the source node to the destination node. In this service, any response is not defined. User-defined transparent mode message should be used to respond to the transmission request.
- b) **Protocol** Figure 19 shows the sequence of the transparent mode message service.



Remarks : In case broadcast transmission method is used, processing of the ACK ([3]) and the confirmation to the transparent mode message ([5]) are not executed.

Figure 19 Sequence of transparent mode message service

6.2.13 Log data read service

- a) **Function** This service reads the log data of the destination node for the source node.
- b) **Protocol** Figure 20 shows the sequence of the log data read service.

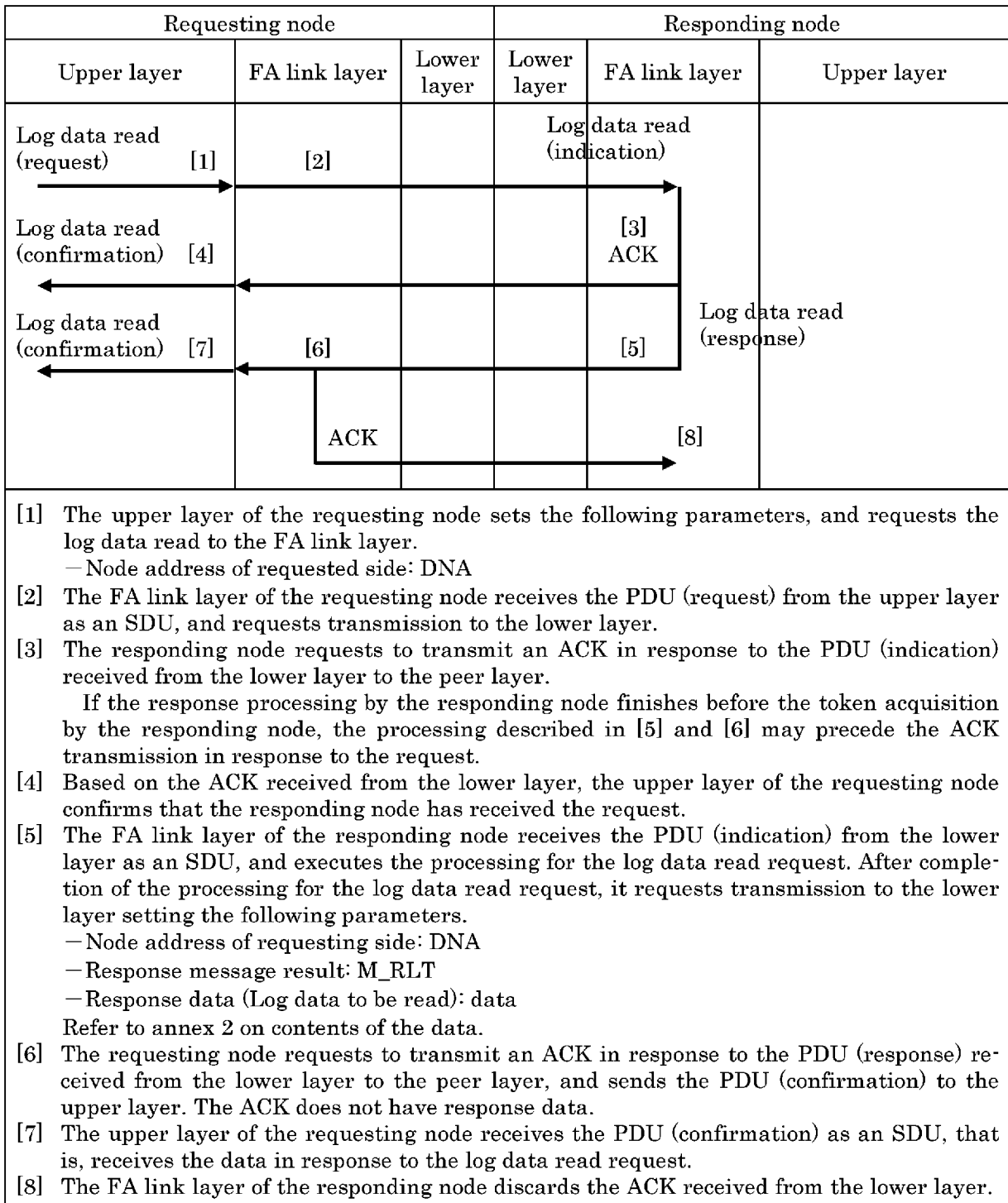
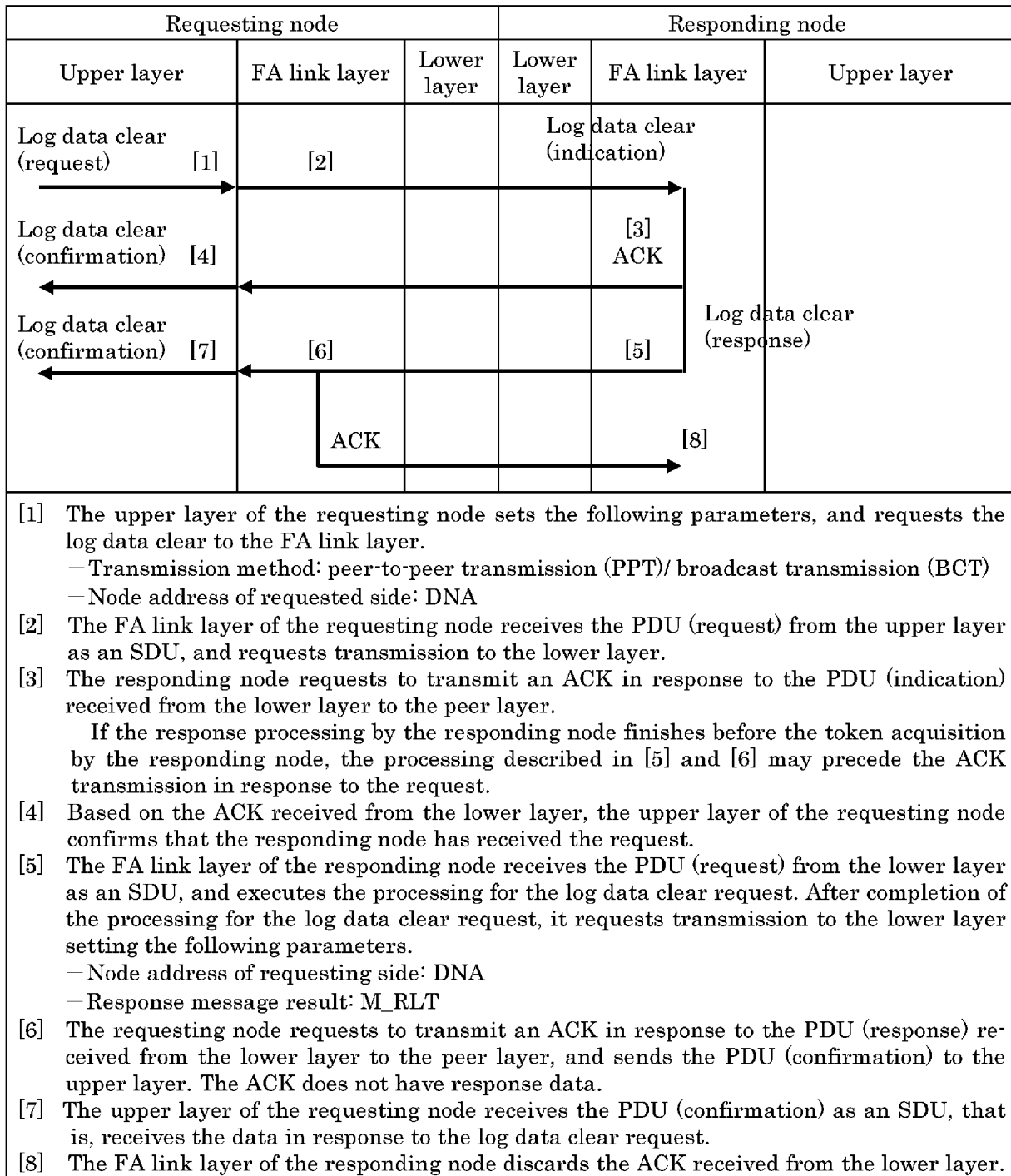


Figure 20 Sequence of log data read service

6.2.14 Log data clear service

- a) **Function** This service clears the log data of the destination node for the source node.
- b) **Protocol** Figure 21 shows the sequence of the log data clear service.



Remarks : In case broadcast transmission method is used, processing of the ACK ([3] and [4]), the response ([5] and [6]) and items thereafter are not executed.

Figure 21 Sequence of log data clear service