A Generic Packet Convergence Sublayer (GPCS) for Supporting Multiple Protocols over 802.16 Air Interface

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Purpose:

Slides to support and facilitate discussion of GPCS proposoal. Contributors ask 802.16g to review and approve GPCS.

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Generic Packet Convergence Sublayer (GPCS)

- What it is:
  - Another CS
  - A layering simplification to foster 802.16 conformance and allow a wide variety of upper layer protocol configurations
- What it isn't:
  - A replacement for already-defined packet CS layers
  - A solution to bridging and mobility convergence interoperability issues

Reference: 802.16 Protocol Layering

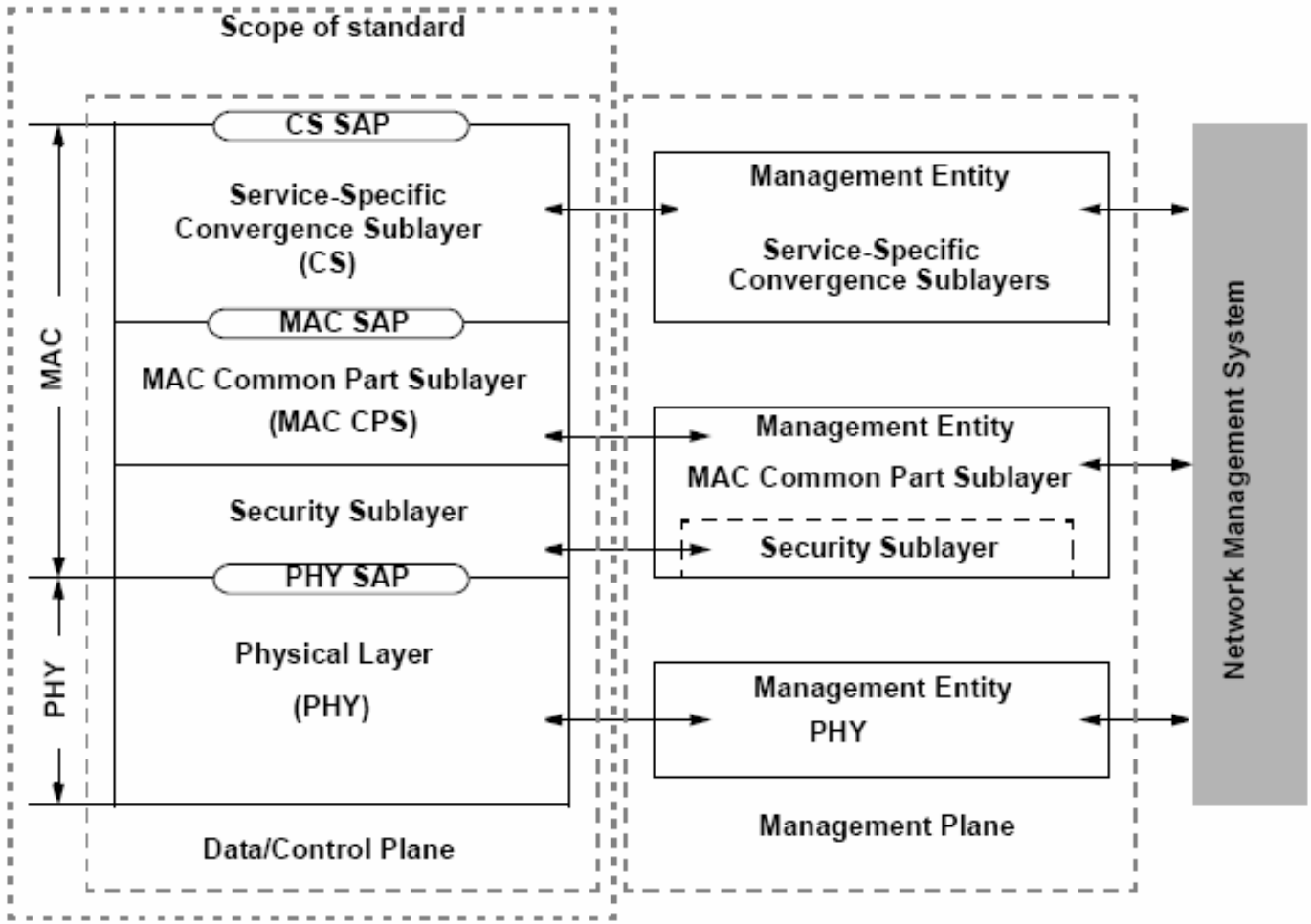


Figure 1—IEEE Std 802.16 protocol layering, showing SAPs

Problems with Current 802.16 Packet CS

- 802.16 needs to “know” the format and configuration of upper layer protocol stacks for classification to operate correctly
  - When new upper protocols are defined, or configured in different ways (address re-mapping, tunneling, header-compressed), 802.16 standard needs to be modified

Problems (continued)

- 802.16 neglected the MAC SAP in favor of CS
  - A proprietary 802.16 application that does not use an 802.16 CS cannot claim to be “compliant”
    - Example: video-streaming without Ethernet or IP
  - Excludes potentially many upper layer protocol stack configurations that “deserve” to be 802.16-compliant
  - Note: “No-CS” was removed from the standard

Problems (continued)

- One upper protocol type per connection
  - A CID is a valuable resource in some devices and subsystems (e.g., chips)
  - Multi-protocol over one CID should be (optionally) allowed
    - Example: IPv4 and IPv4-ROHC on same CID

Problems (continued)

- Poor extendibility
  - Hard process to add more CS types
- Repeated functions of upper layer protocols (ULPs)
  - ULP-address-based classification rules
  - Address assignment (especially for mobility)
  - Tunneled packets with multiple nested addresses
- Limited header compression schemes
  - Many varieties are possible, but 802.16 can’t help define them all

GPCS

- *Parameterized* classification instead of *header-parsing* classification
- Locally-assigned SAP parameters
  (not transmitted over the air)
  - LOGICAL_PORT_ID
  - COS_ID
- Fully specified SAP parameters exchanged between end points
  - MULTIPROTOCOL_ENABLE
    - Optionally activated in DSX messages
  - PROTOCOL_TYPE
    - Prepended to each SDU if MULTIPROTOCOL_ENABLE active
    - Sent in DSX messages if MULTIPROTOCOL_ENABLE not active

PROTOCOL_TYPE

- A number to uniquely identify all possible upper layer protocols
- Each PROTOCOL_TYPE number might need a specification to define protocol semantics (e.g., IP-over-GPCS)
- 802.16 receiver can de-multiplex to the proper protocol stack
- Proposal: Use IANA method to assign numbers
- Allocate a new IANA registry for GPCS protocol numbers
  - 8 bit number

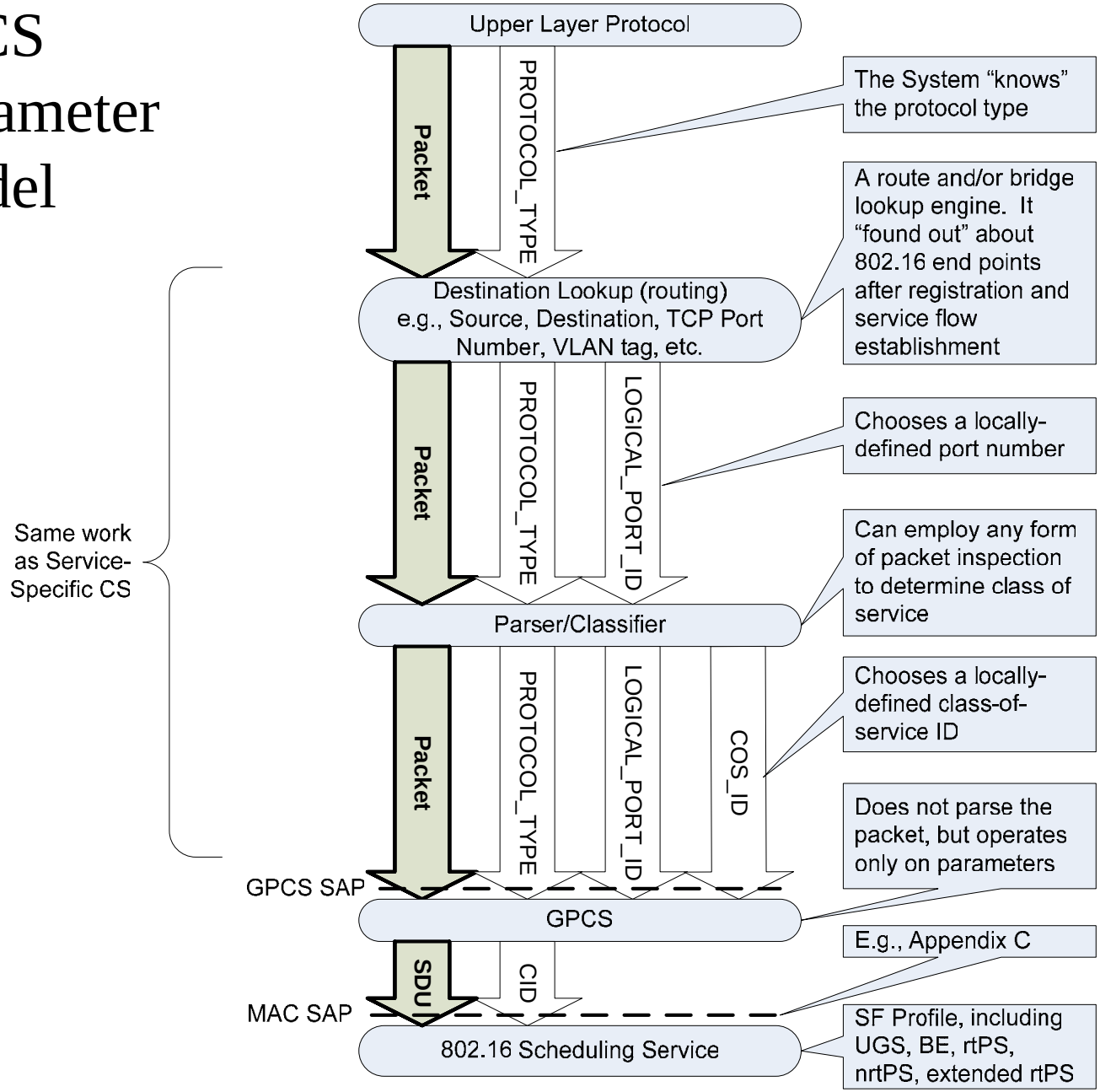
LOGICAL_PORT_ID

- A locally-assigned number
- Like a port number in a bridge device
- The output of routing and/or bridging path lookup
- Identifies a network element
- Scope: identifies a group of COS_IDs on a path to a network element
- For BS, could be a logical path to an MS or SS
- For SS, could be a BS selector
- Could be used to associate a VLAN ID with a group of CIDs
- Could be “null”

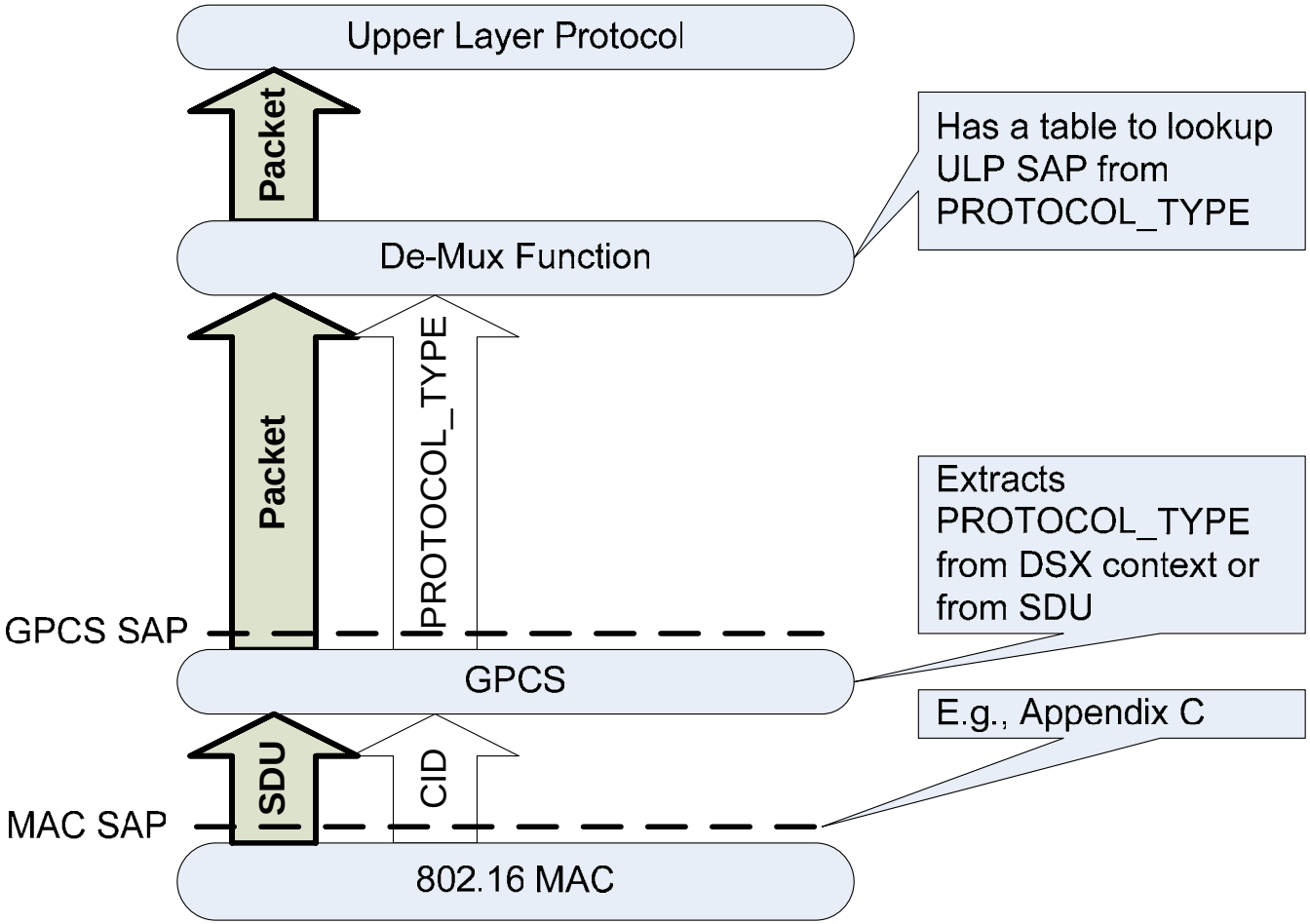
COS_ID

- A locally-assigned number
- Scope: the class of service within a logical port
- Like an 802.16 scheduling service type
- The output of a packet-parsing classification engine (could be an off-the-shelf component)
- The number of COS_IDs in a system could be much larger than the number of CIDs

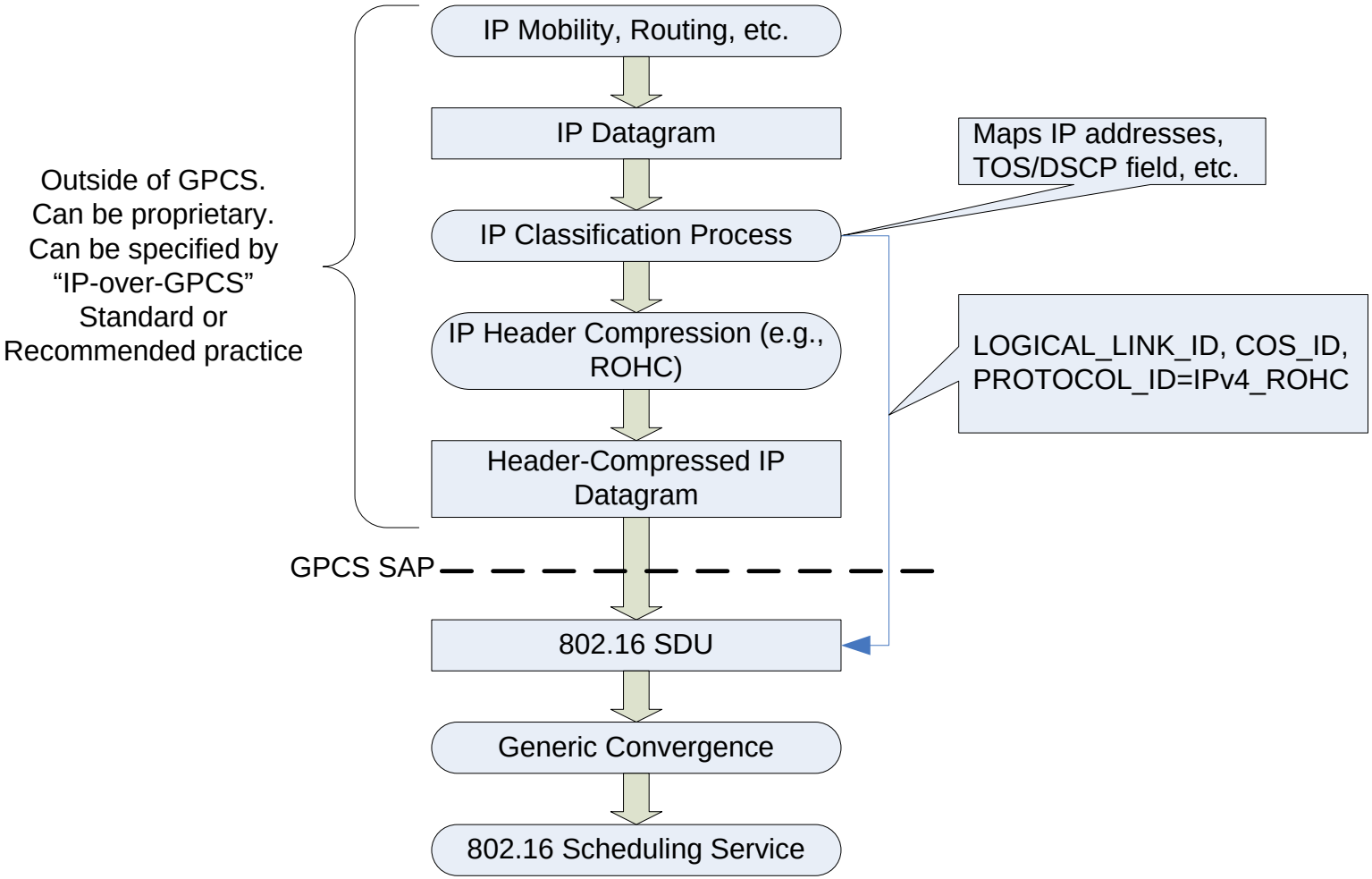
GPCS SAP Parameter Model



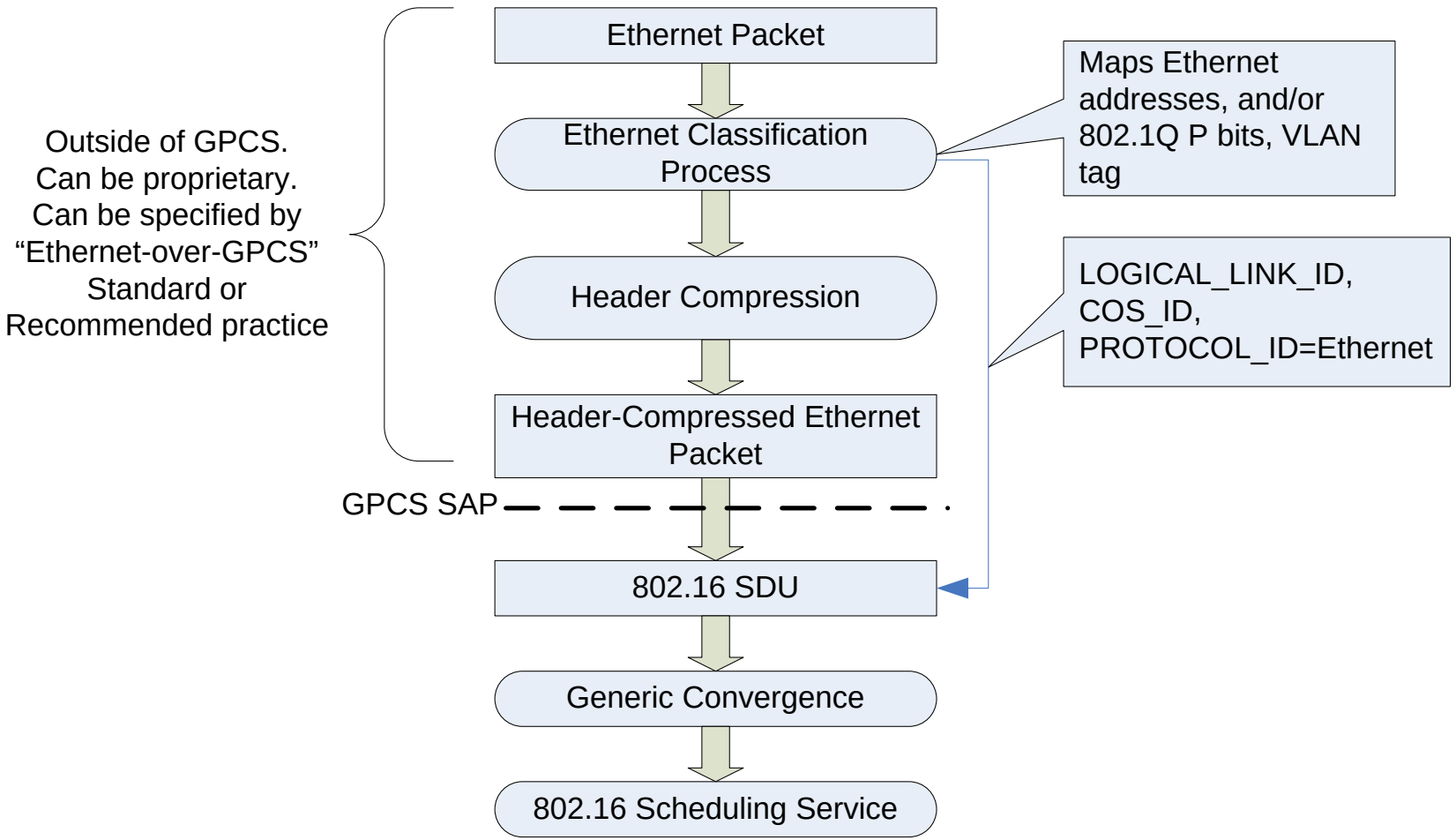
PROTOCOL_TYPE
Usage by Receiver



IP-ROHC Example

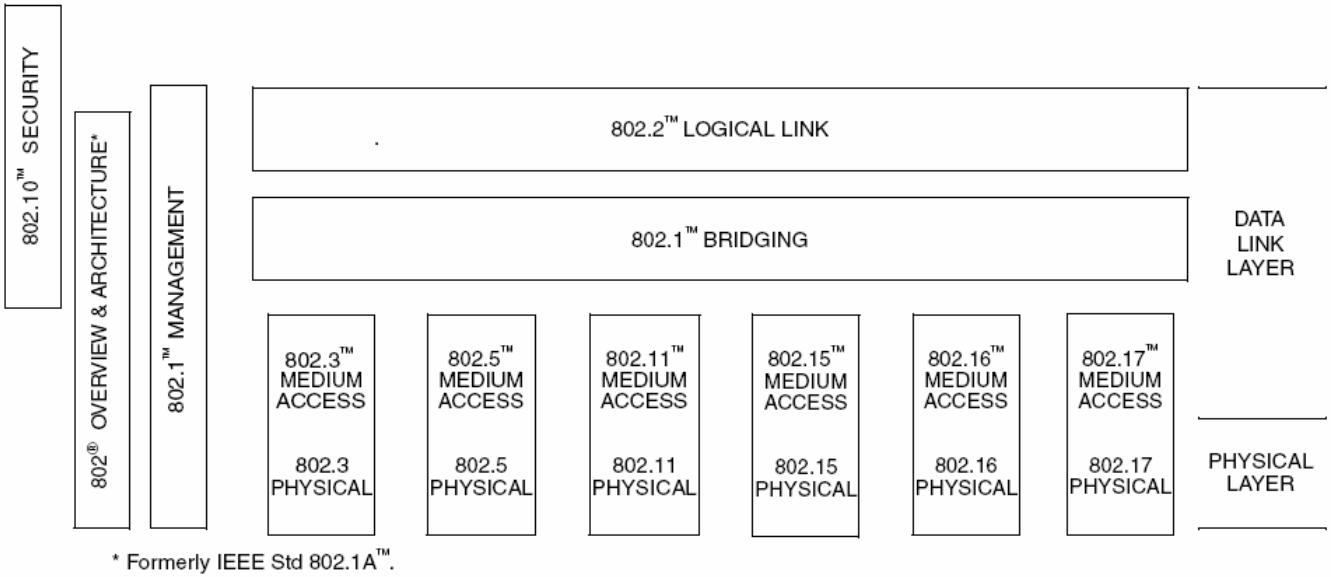


Ethernet Example



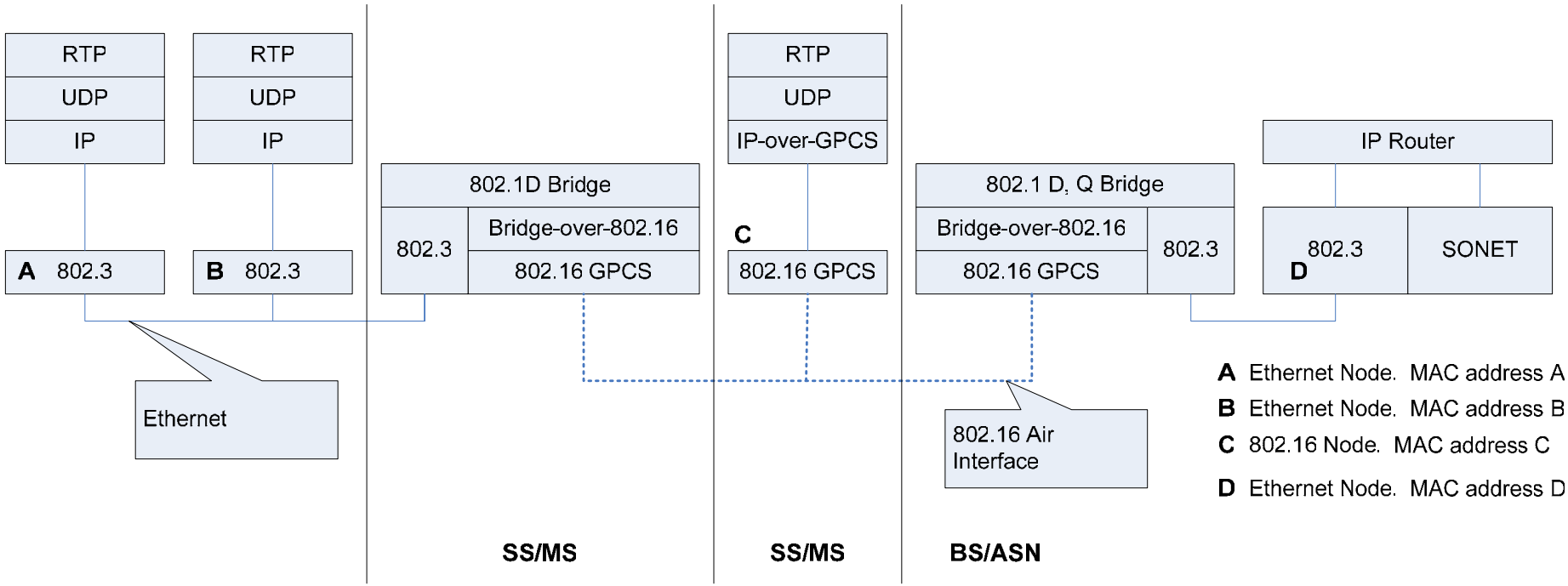
Bridging

- GPCS does not solve bridging issues, but simplifies layering



- Need to define
  - service flow establishment for bridge protocols
  - service flow discovery for data path connections
  - bridge port and VLAN mapping to LOGICAL_PORT
  - 802.16 multicast usage

Bridged LAN Example



- LOGICAL_PORT_ID
  - Bridge function can portion LOGICAL_PORT_IDs for LAN end-points A,B,C
  - Bridge-over-802.16 can be defined later

Summary of Changes to Standard

- Add GPCS to list of Packet CS's
- Define LOGICAL_PORT_ID and COS_ID as locally-assigned values
- Define GPCS to use MAC SAP: maps SAP parameters to CID
- Define MULTIPROTOCOL_ENABLE and PROTOCOL_TYPE for DSx
- Define use of PROTOCOL_TYPE as SDU prepend

Questions

- Why not use “No-CS” instead?
  - No-CS removed in corrigenda
  - MAC-SAP is not normative
  - GPCS provides an upper protocol binding to identify the header in an SDU payload
  - GPCS provides optional multi-protocol over one connection
  - GPCS provides an abstraction of .16 attributes (CID, SFID, etc.)