A Mobility Protocol Framework to Support Multiple Namespaces

Masahiro Ishiyama

Corporate R&D Center, Toshiba Corporation

Mitsunobu Kunishi

Keio University

Michimune Kohno

Sony Computer Science Laboratories, Inc

Fumio Teraoka

Keio University

Background

- Mobile access devices are increasingly popular
  - laptops, PDAs
- Demands for mobile protocols are emerging
  - Mobile IPv6
  - LIN6

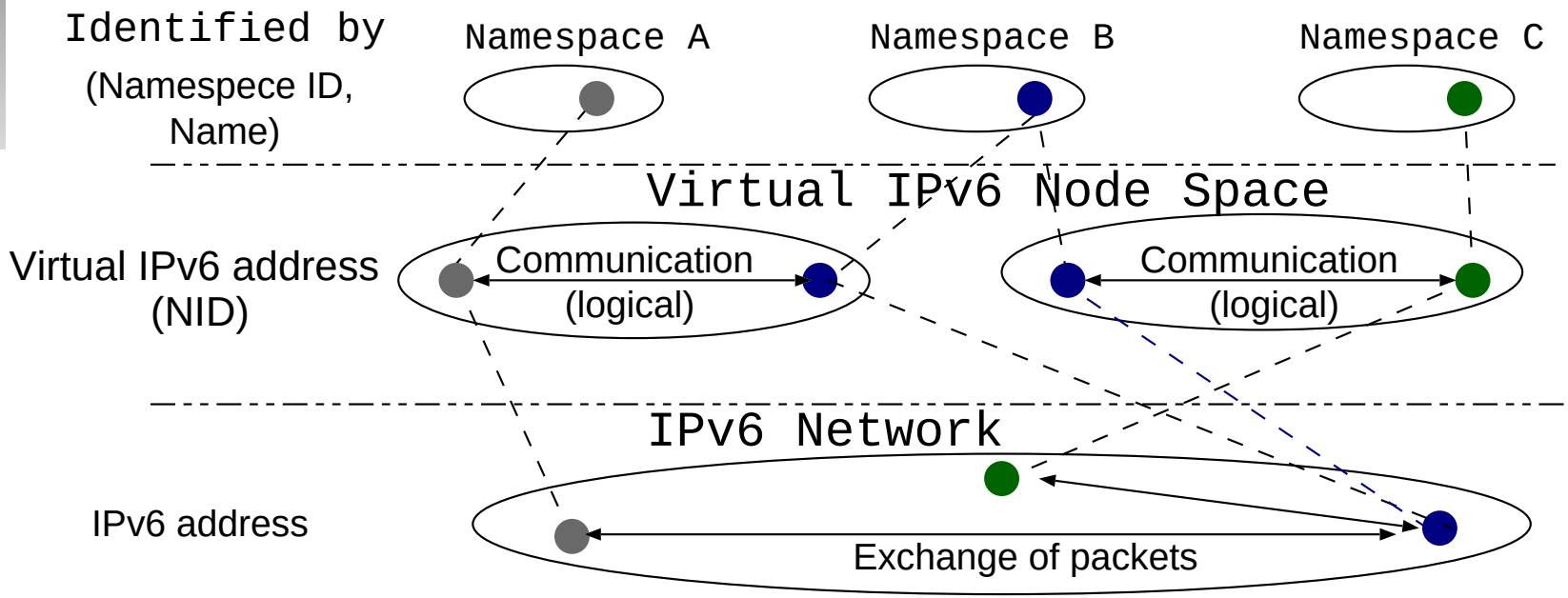
Issues of Mobility Protocols

- Mobility protocols need an identifier defined in the protocol
  - Mobile IP: Home Address, LIN6: LIN6 ID
- Cannot ignore the demand for defining an identifier of a node independent of the protocol
  - e.g. Auto-ID center
- Complexity in maintaining integrity of such identifiers
  - Namespaces are expected to become more diversified
- Hard to provide anonymity
  - Must disclosure its identifier, e.g. Home Address

Proposed Framework

- L3 Transparent Mobility
  - based on LINA
- Supports Multiple namespaces
  - L3 identifiers NOT needed
- Coexists with current IPv6 infrastructure
- No modification is needed for IPv6 applications
- Anonymity

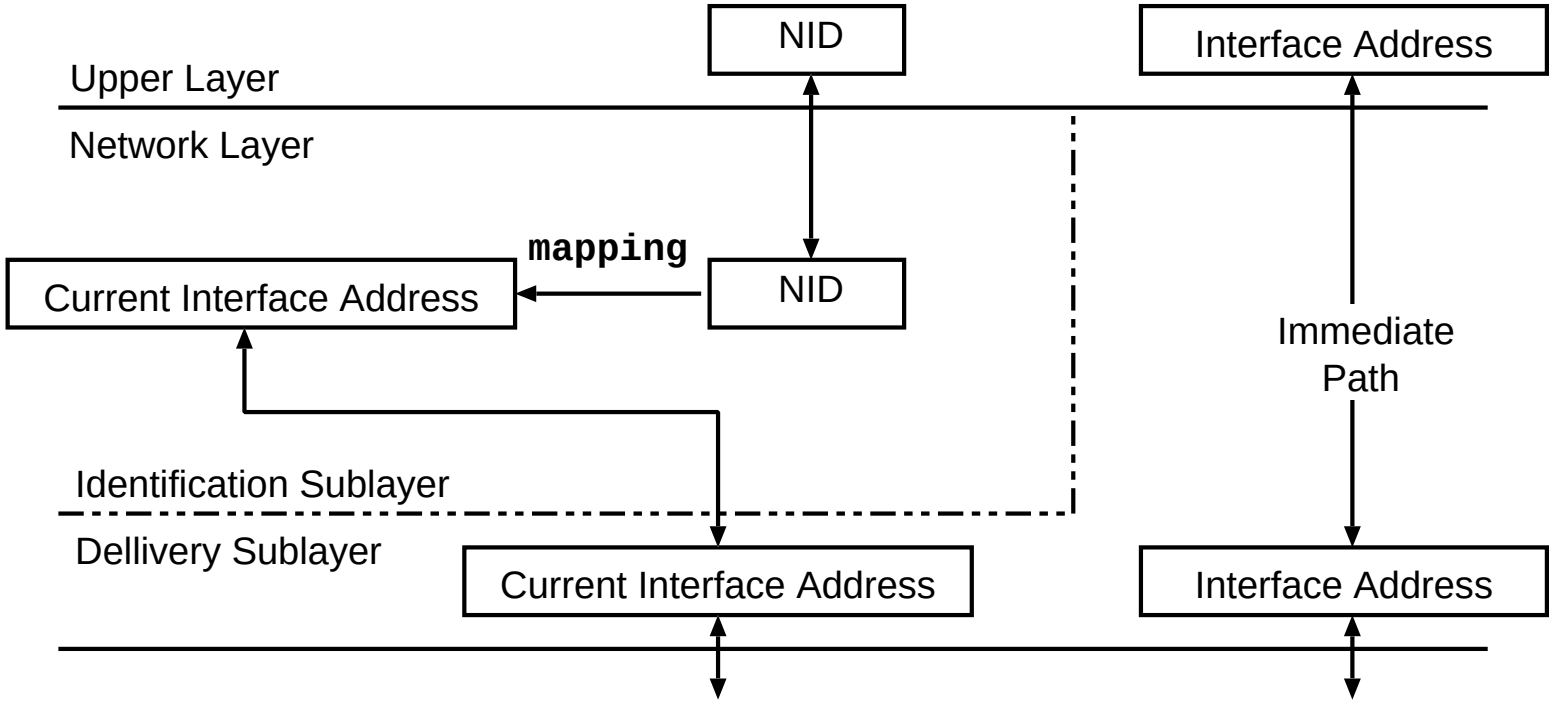
Concept (1/2)


Identified by
(Namespece ID, Name)
Namespace A
Namespace B
Namespace C
Virtual IPv6 Node Space
Virtual IPv6 address (NID)
Communication (logical)
Communication (logical)
IPv6 Network
IPv6 address
Exchange of packets

Concept (2/2)

- A node specifies a target node by "name"
- Binding a name with a dynamically determined ID (NID)
  - conforms to the format of the IPv6 address
- The association of NID with the current interface address (Maddr) is maintained in each node
  - used for packet delivery

Communication model: Overview



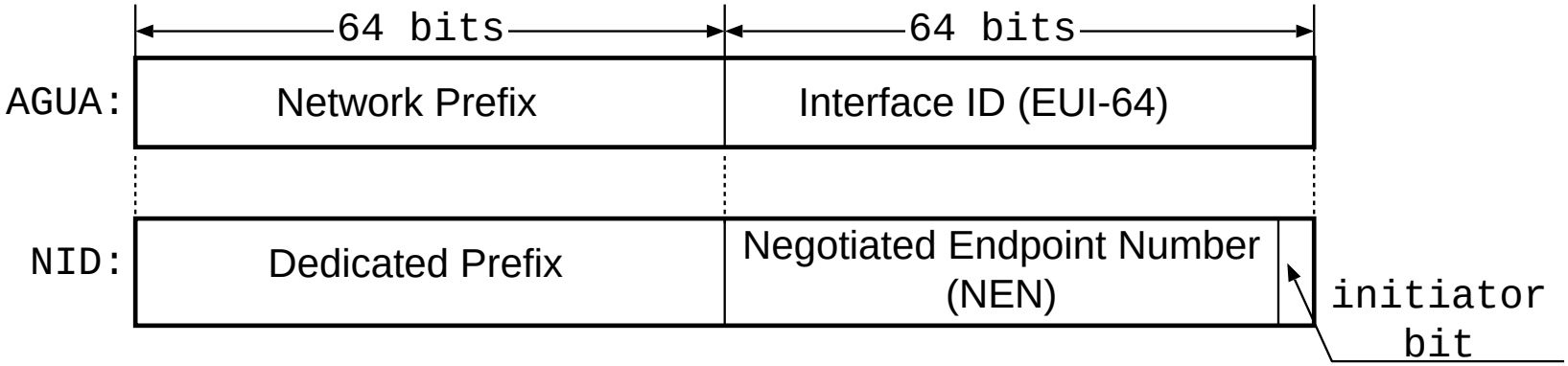
- Immediate path: identification layer is bypassed
  - no address conversion

Mapping Agent: Resolving interface address from node name

- Mapping: association of the node name with current interface address
- Mapping Agent:
  - Maintains mappings
  - Replies with a mapping when requested
- A node registers a new mapping with its MA
- Each namespace needs a mechanism to discover a MA
  - This mechanism is dependent on each namespace
  - Out of the scope of this paper

Negotiated endpoint ID (NID) (1/2)

- NID: a dynamically determined "temporary" IPv6 address
  - Each name in any namespace is mapped to NID
  - Used in upper layers
  - Not interface address

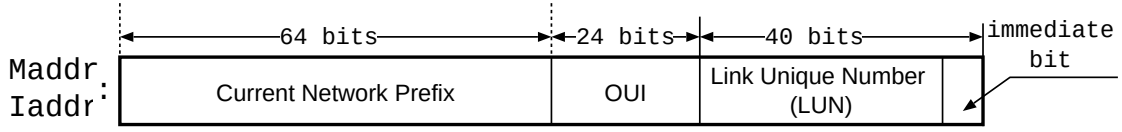


Negotiated endpoint ID (NID) (2/2)

- NEN: determines the endpoint of a communication
  - Unique in the communicating nodes
  - Determined by negotiation
- Dedicated Prefix: predefined well-known fixed value
  - Does not determine any physical point of the network

Mobility address: Maddr

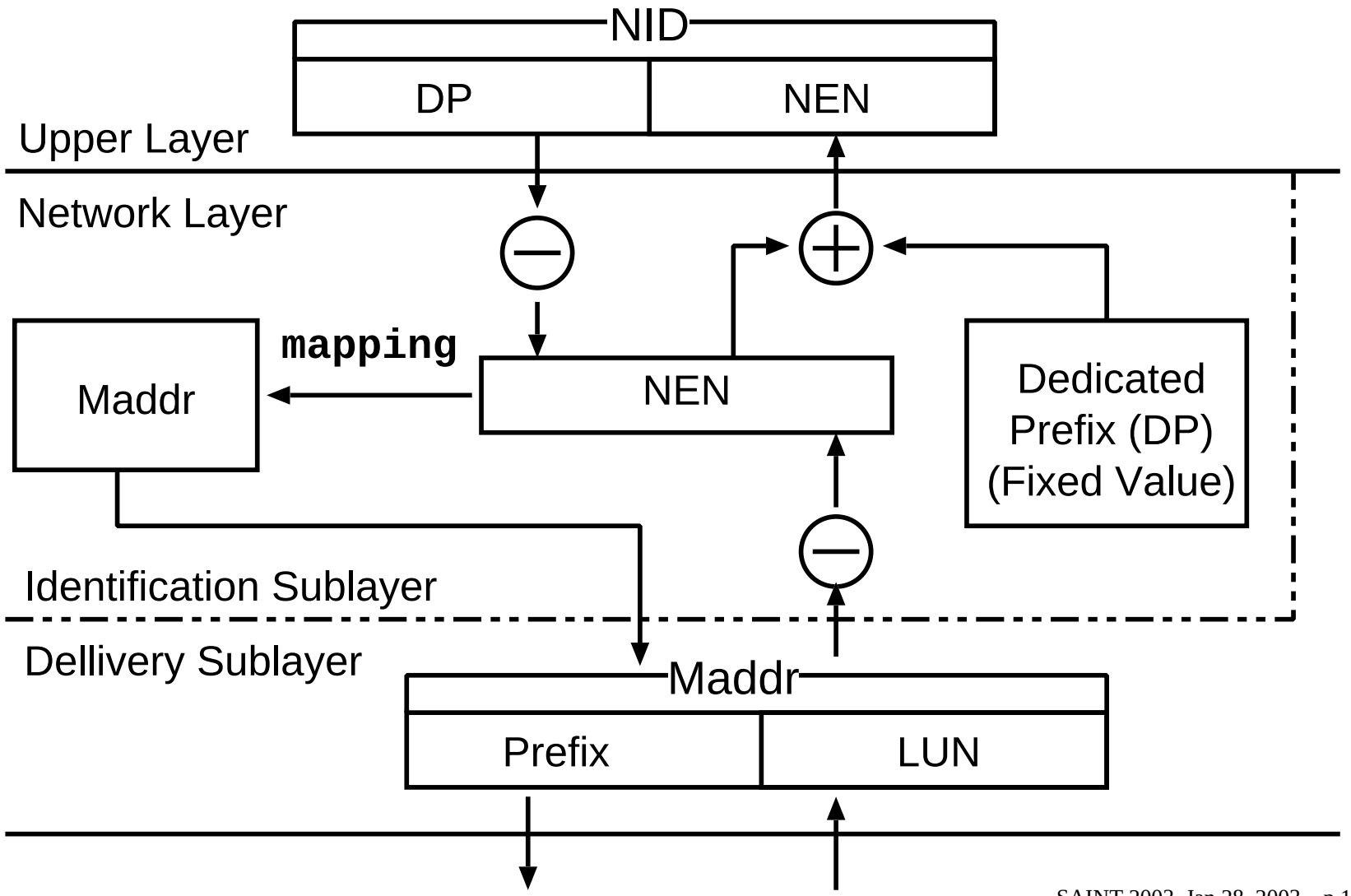
- Maddr: enables mutual conversion between NID and Locator
  - Conforms to the IPv6 address format



- LUN: Randomly chosen value by the node
  - Embedded in the interface address
  - Immediate bit: goes to immediate path
    - no address conversion
- Mapping Entry:
  - Table for mutual conversion

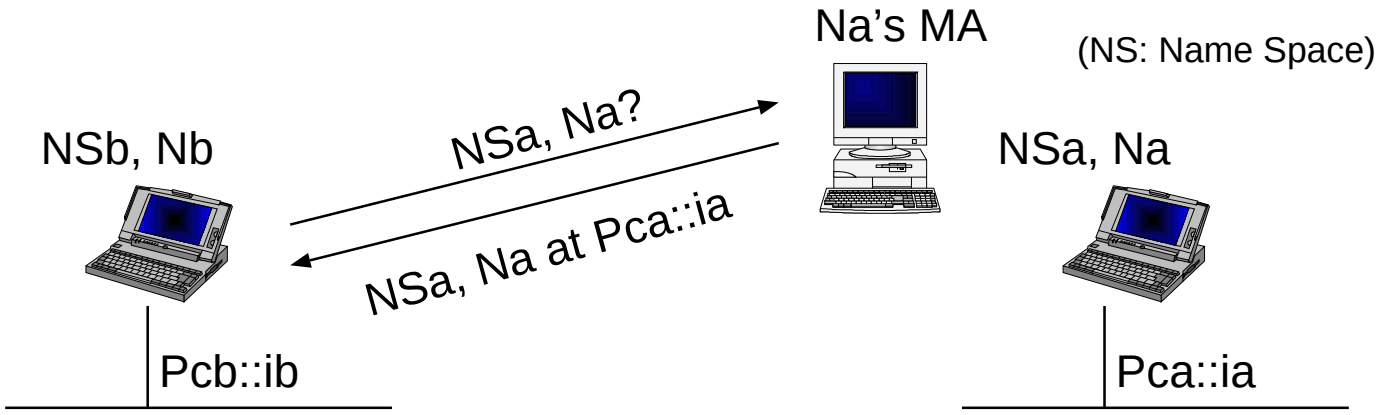
(Namespace-ID, Name, NEN, lLUN, tLUN, tMaddr, ...)

Communication model



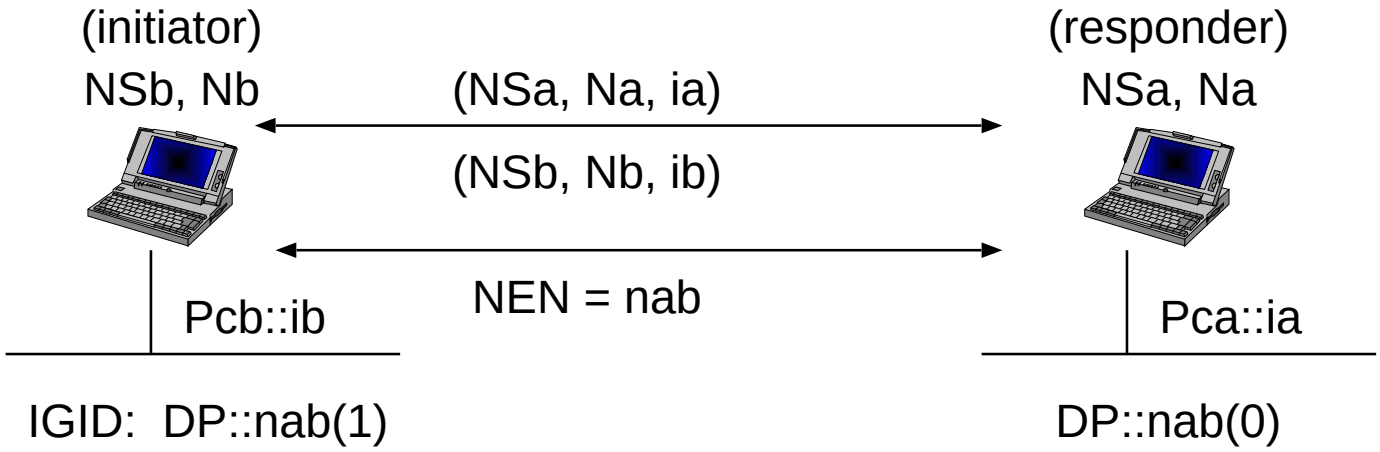
Communication Procedure (1/2)

- Determining LUN
  - Each node determines at least one LUN on bootstrap
- Assigns Maddr to its interface
- Resolving Target Maddr
  - queries for the mapping to one of Na's MAs.



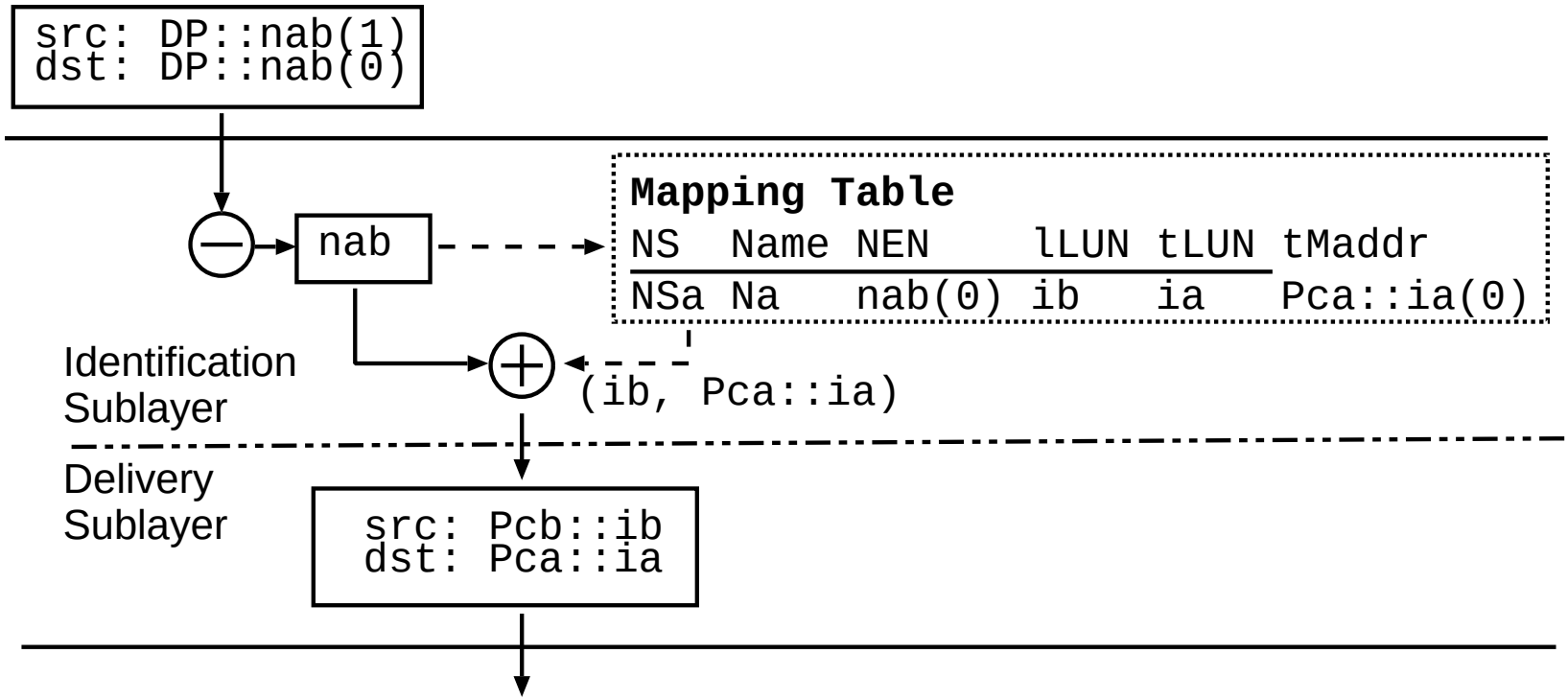
Communication Procedure (2/2)

- Determination of NEN: NEN negotiation
  - Notify each other of (Namespace-ID, name, LUN)
  - Negotiate unique NEN in the two nodes
  - Generate mapping entry:
    - (NSb, Nb, nab, ia, ib, Pcb::ib)



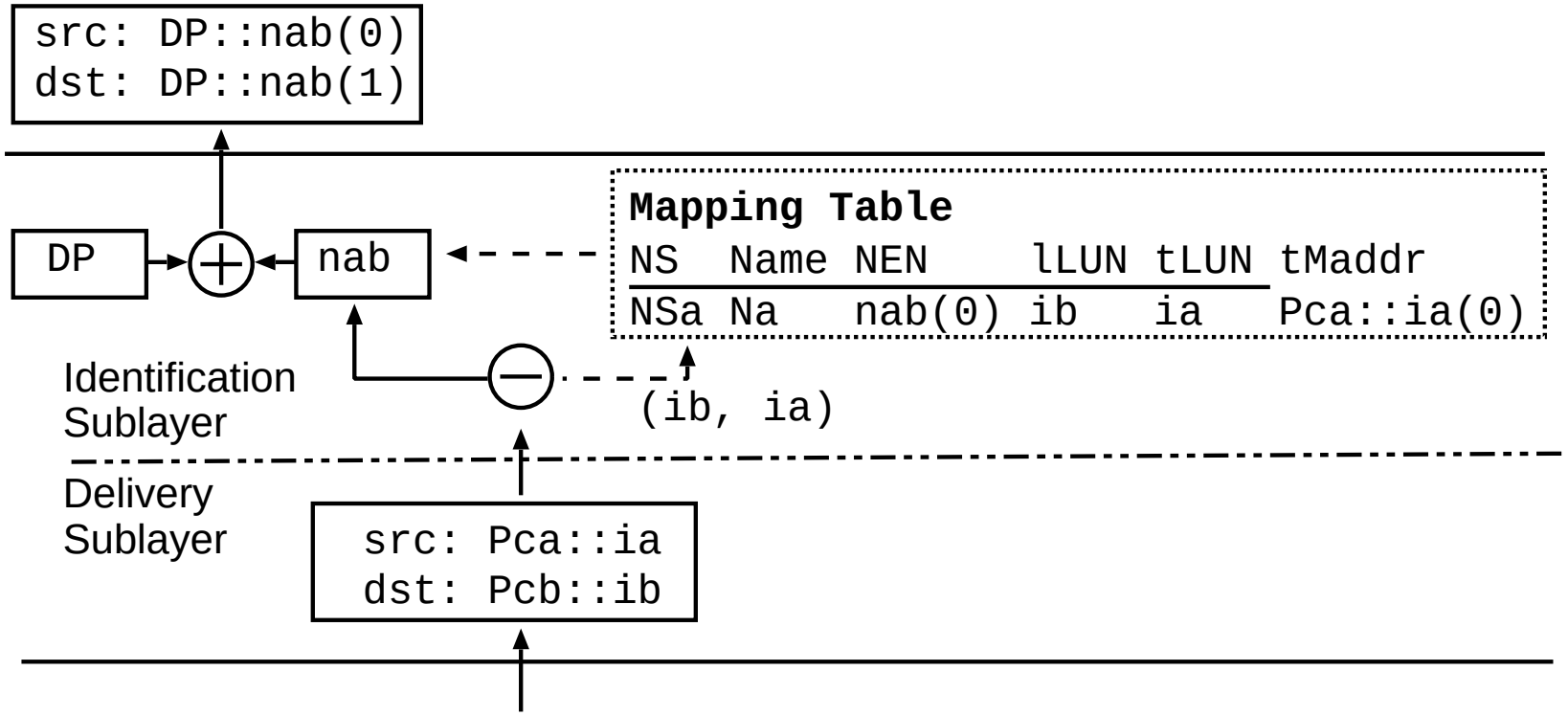
Sending a packet

- Obtains NEN from specified NID
- Search for mapping entry, get target Maddr



Receiving a packet

- Obtains (local LUN, target LUN) pair from addresses in the packet
- Search for Mapping entry, get NEN



Hand-off of a Node

- Assigns a new Maddr to the interface
- Notifies its MA of the new mapping
- May send the new mapping to correspondent nodes
  - Or wait untill the correspondent node refreshes the mapping

Anonymity (1/2)

- Supports the two types of anonymity:
- Eavesdropping
  - Addresses used in packets are based on LUN
    - Generated autonomously and are random numbers
    - Difficult to derive names of nodes from addresses of packets
  - Difficult to determine the name of a node by eavesdropping on communication packets

Anonymity (2/2)

- Hiding Caller-ID
  - "Name" is needed to find designated MAs and to query for a mapping
    - Initiator can declare a temporary name
      - random number, hash...
    - Declare address list of its designated MA on NEN negotiation
  - No need to disclose its real name to the correspondent node

Conclusion

- Proposed a new mobility protocol framework
  - Supports Multiple Namespaces
  - Allows to specify a correspondent node by a name
    - Defined in any namespace
  - Adapted to a new namespace with ease
  - Can support two types of anonymity
- Future work
  - Prototype implementation of this framework
  - Evaluation on real IPv6 networks