TSSG 5 criteria – Compatibility, Distinct Identity and Feasibility

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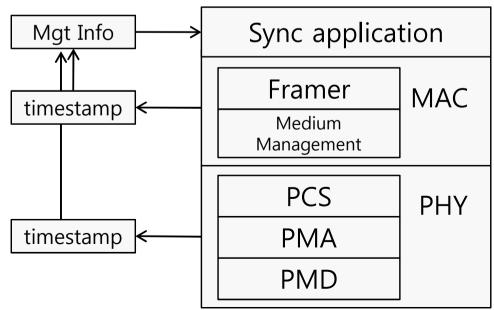[1] KAIST, [2] Hanyang Univ., and [3] ETRI, S. Korea

Requirements for TSSG

- Should support common timestamp method for various 802.3 MAC and PHY
  - Some MAC and PHYs use different architectures and methods for transmission.
  - E.g. FE, GE, 10GE, and 100GE

- Compatibility for current MAC and PHY
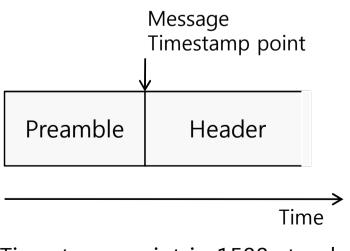 - Minimum addition to the current architecture

KAIST

Architecture consideration for timestamp

- ## MAC Timestamp
  - ### SFD detection in MAC/RS
    - SFD is created in every TX Frame
    - SFD is detected in every RX Frame

- ## PHY Timestamp
  - ### Start of Packet detection in PHY
    - SPD is detected in PCS sub-Layer of PHY
  - ### Lane alignment marker detection in 802.3ba MLD

<Architecture consideration for timestamp>

Architecture consideration for timestamp

- ## Timestamp using SFD
  - When any SFD is detected in MAC, do timestamp.
  - Use timestamp information based on following information. (Eth type, port number)
  - It meets message timestamp point in standard.
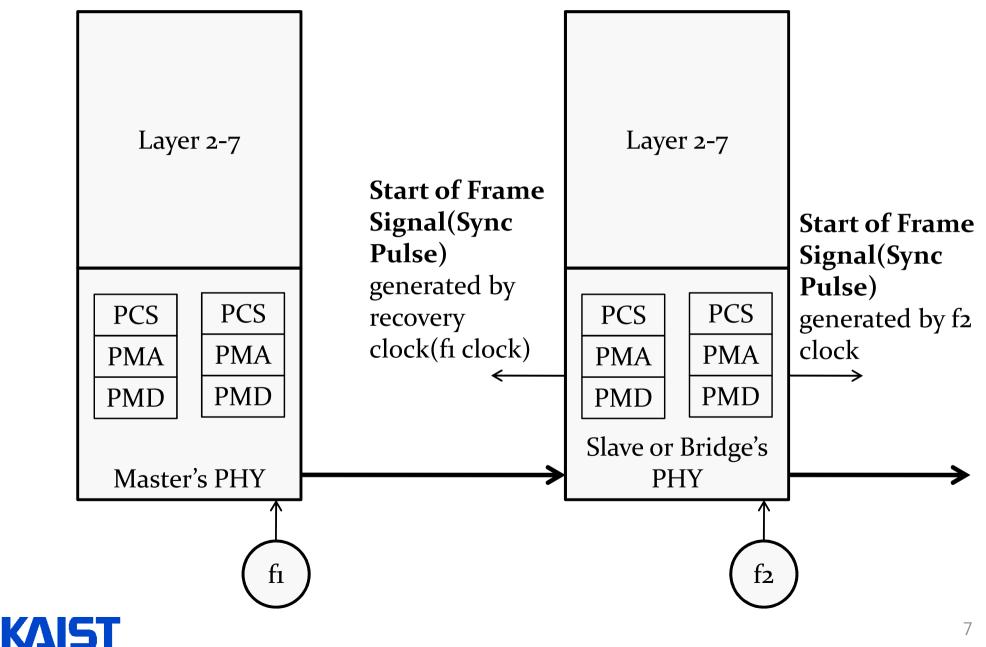 - Minimum modification in legacy architecture.

Message
Timestamp point

Preamble	Header

Time

\<Timestamp point in 1588 standard\>

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- ## Timestamp using SFD
  - ### Delay and jitter can be introduced by retransmission, channel-access, and management.
    - E.g.: Backoff, burst frame(1Gb/s)
  - ### For half duplex mode, they can be worse.
  - ### Rx Clock vs System Clock wonder and jitter
    - Eg.: GE : 1 GHz (Rx clock) vs 25 MHz (System clock)
    - Elastic buffer

Architecture consideration for timestamp

- Every frame start point should be detected in order for accurate timestamp as near the PMD as possible.
- Frame start can be detected in PHY.
  - E.g. Start of Packet Delimiter(SPD) in PCS layer of PHY
  - Similar concept to SFD.
  - More accurate timestamp can be supported.
  - Uncertainty of MAC can be eliminated.
  - In order to identify sync related packet, it may use
    - Special logic
    - Pre-determined pattern in message. (e.g. TLV field)

Start of Frame Signal(Sync Pulse) generated by recovery clock(f1 clock)

Start of Frame Signal(Sync Pulse) generated by f2 clock

Layer 2-7

Layer 2-7

PCS | PCS
PMA | PMA
PMD | PMD

Master's PHY

PCS | PCS
PMA | PMA
PMD | PMD

Slave or Bridge's PHY

f1

f2

- When frame start is detected, PHY generates a simple Sync Pulse(Start of Frame Signal) and transports it out for external generation of the timestamp.

- The external timestamp generation procedure and the corresponding time protocol operation comply with the typical time protocol or the layer transport procedures.

- The detail methods of detecting frame start, generating the time stamp, and time protocol procedure remain as future study.

Compatibility

- The standard should conform to 802.3 MAC/PHY interface.
  - The same timestamp method for various interface speeds(FE/GE/10GE/100GE) and modes are applied.

- The proposed standard will comply to 802.1
  - Management and Interworking.
  - The same timestamp method for wireless-Ethernet interworking is applied.

- The backward compatibility is applied to the legacy network synchronization protocol (PTP, NTP, etc.).

- If modification is needed, it should be minimum.

Distinct Identity

- The proposed standard supports accurate timestamp method in PHY/MAC layer.
- The proposed standard will meet the synchronization requirements for various application.
  - The precision timestamp is supported for
    - Transfer mode independent.
    - Hierarchy or layer independent.
    - Medium independent.
    - Compatibility with the various time protocols.

Feasibility

- The proposed project may not require any modification in IEEE 802.3 and 802.1 architecture.

- The timestamp operation can be implemented separately.

- Layer scalable implementation should be possible since multi-layer appropriate protocol can be used.

Summary

- ## Compatibility

  - The standard should conform to 802.3 MAC/PHY interface

- ## Distinct Identity

  - The standard supports an accurate timestamp method in PHY/MAC layer.

- ## Feasibility

  - The proposed project may not require any modification in IEEE 802.3 and 802.1 architecture.