IEEE P802.1AEdk YANG Instance Document

IEEE 802.1 Meeting

dk-fedyk-dot1ae-instance-discussion-0719-v01

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Version 1
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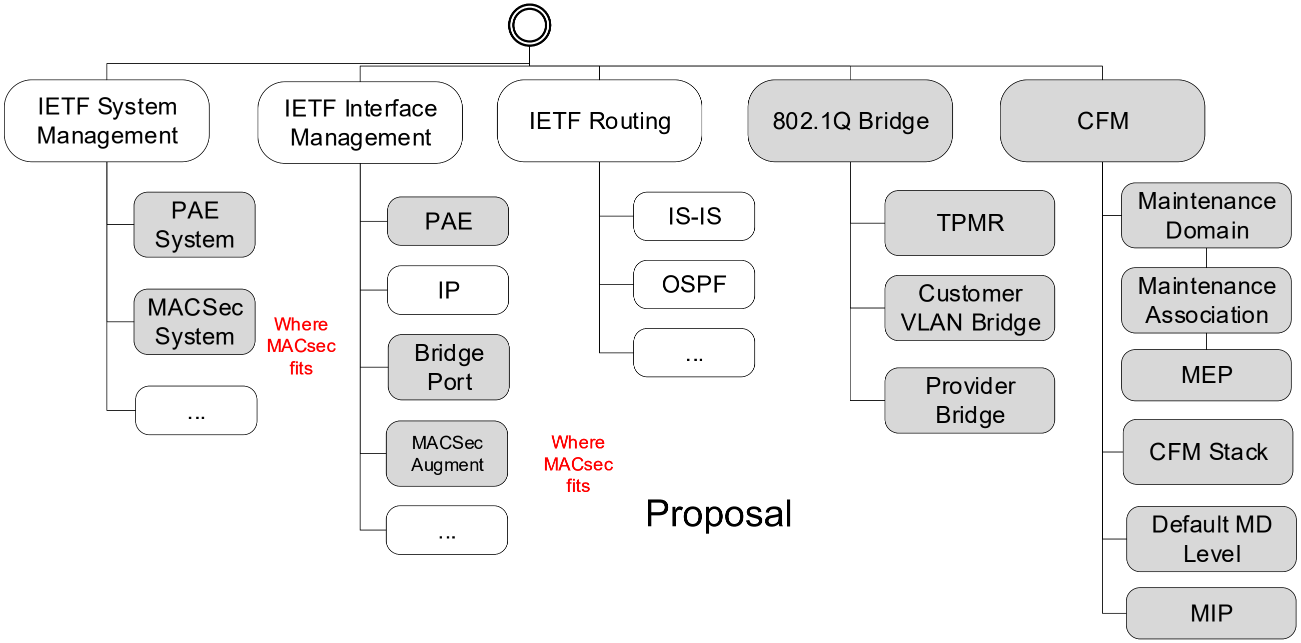
Note

- This updates some errors and corrections from discussion at the July Plenary

Introduction

- 802.1AEdk is a proposed project to update 802.1AE-2018 with Yang and privacy options for MACsec
- 802.1AEdk is not yet approved.
- Part of the work that needs to be done for 802.1AEdk is a YANG model for the existing 802.1AE
- This slide deck is a discussion of how a YANG model for 802.1AE could fit with 802.1X
- For reference
  - dk-fedyk-ieee802-dot1ae-yang-0719-v00
  - dk-fedyk-ieee802-dot1ae-types-yang-0719-v00
  - dk-fedyk-ieee802-dot1ae-tree-0719-v00

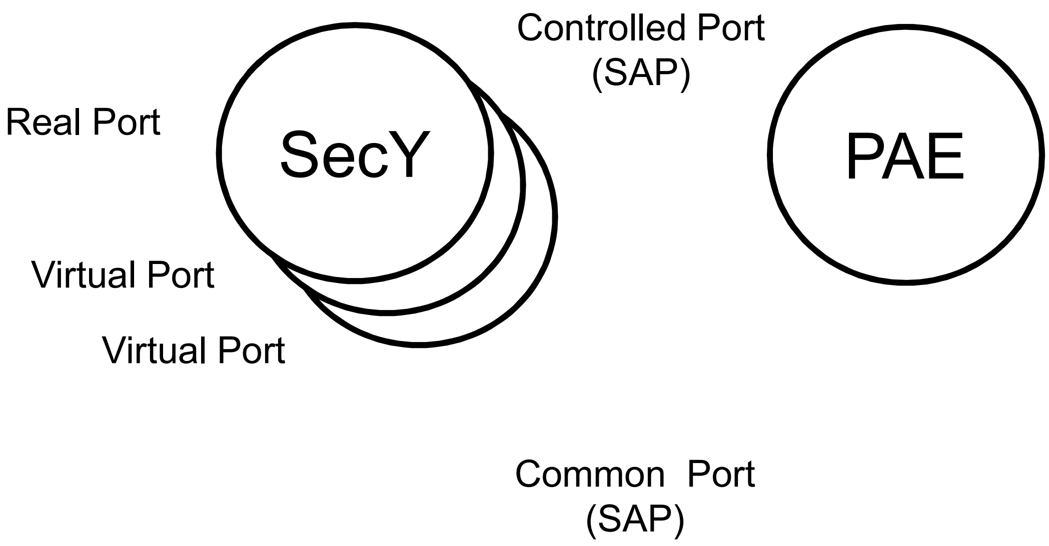
802.1 YANG Structure and Relationships



MAC SEC Information Model 802.1AE

- End stations (11.2)
- MAC Bridges (11.3)
- VLAN-aware Bridges (11.4)
- Systems that incorporate Link Aggregation (11.5)
- Systems that incorporate Link Layer Discovery Protocol (LLDP, 11.6)
- Provider Bridges and VLAN-aware Bridges attached to Provider Bridged Networks (11.7)
- LANs that provide independently secured access for multiple end stations (11.8).

Relationship to 802.1X



Controlled Port
(SAP)

Real Port

SecY

PAE

Virtual Port

Virtual Port

Common Port
(SAP)

Confirmed that Internal or logical interfaces may be required for the SAPs

IETF Interface Stats

```
module: ietf-interfaces
  +--rw interfaces
  |  +--rw interface* [name]
  |     +--rw name                        string
  |     +--rw description?                string
  |     +--rw type                        identityref
  |     +--rw enabled?                    boolean
  |     +--rw link-up-down-trap-enable?   enumeration {if-mib}?
  |     +--ro admin-status                enumeration {if-mib}?
  |     +--ro oper-status                 enumeration
  |     +--ro last-change?                yang:date-and-time
  |     +--ro if-index                    int32 {if-mib}?
  |     +--ro phys-address?               yang:phys-address
  |     +--ro higher-layer-if*            interface-ref
  |     +--ro lower-layer-if*             interface-ref
  |     +--ro speed?                      yang:gauge64
  |
```

```
|     +--ro statistics
|        +--ro discontinuity-time    yang:date-and-time
|        +--ro in-octets?            yang:counter64
|        +--ro in-unicast-pkts?      yang:counter64
|        +--ro in-broadcast-pkts?    yang:counter64
|        +--ro in-multicast-pkts?    yang:counter64
|        +--ro in-discards?          yang:counter32
|        +--ro in-errors?            yang:counter32
|        +--ro in-unknown-protos?    yang:counter32
|        +--ro out-octets?           yang:counter64
|        +--ro out-unicast-pkts?     yang:counter64
|        +--ro out-broadcast-pkts?   yang:counter64
|        +--ro out-multicast-pkts?   yang:counter64
|        +--ro out-discards?         yang:counter32
|        +--ro out-errors?           yang:counter32
```

The Base Model for interfaces or ports

The point is the counters are part of a real interface. A virtual interface may not have a complete set of counters on its own. An Internal interface could be complete. Removed deprecated counters.

802.1X Yang Augment of Interfaces (Snipits)

```
 augment /if:interfaces/if:interface:
    +--rw pae
       +--rw pae-system?                 -> /sys:system/dot1x:pae-system/name
       +--rw vp-enable?                  boolean
       +--rw port-capabilities
       |  +--rw supp?                  boolean
       |  +--rw auth?                  boolean
       |  +--rw mka?                   boolean
       |  +--rw macsec?                boolean
       |  +--rw announcements?         boolean
       |  +--rw listener?              boolean
       |  +--rw virtual-ports?         boolean
       |  +--rw in-service-upgrades?   boolean
       +--ro port-name?                  if:interface-ref
       +--ro port-number?                dot1x-types:pae-if-index
       +--ro controlled-port-name?       if:interface-ref
       +--ro controlled-port-number?     dot1x-types:pae-if-index
       +--ro uncontrolled-port-name?     if:interface-ref
       +--ro uncontrolled-port-number?   dot1x-types:pae-if-index
       +--ro common-port-name?           if:interface-ref
       +--ro common-port-number?         dot1x-types:pae-if-index
       +--rw port-type?                  enumeration
       +--ro virtual-port
       |  +--ro max?            uint32
       |  +--ro current?        yang:gauge32
       |  +--ro start?          boolean
       |  +--ro peer-address?   ieee:mac-address
       +--rw supplicant
       |  +--rw held-period?     uint16
       |  +--rw retry-max?       uint32
       |  +--ro enabled?         boolean
       |  +--ro authenticate?    boolean
       |  +--ro authenticated?   boolean
       |  +--ro failed?          boolean
+--ro terminate-cause?   enumeration
```

PAE augments Interfaces and has references to controlled uncontrolled and common ports.

Port is either real or virtual implying the whole interface is real or virtual.

802.1X Yang Augment of Interfaces (Snipits)

```
+--rw supplicant
+--rw authenticator
+--rw kay
+--rw logon-nid
+--rw announcer
+--rw listener
```

```
+--ro eapol-statistics
       |  +--ro invalid-eapol-frame-rx?       yang:counter32
       |  +--ro eap-length-error-frames-rx?   yang:counter32
       |  +--ro eapol-announcements-rx?       yang:counter32
       |  +--ro eapol-announce-reqs-rx?       yang:counter32
       |  +--ro eapol-port-unavailable?       yang:counter32
       |  +--ro eapol-start-frames-rx?        yang:counter32
       |  +--ro eapol-eap-frames-rx?          yang:counter32
       |  +--ro eapol-logoff-frames-rx?       yang:counter32
       |  +--ro eapol-mk-no-cfn?              yang:counter32
       |  +--ro eapol-mk-invalid-frames-rx?   yang:counter32
       |  +--ro last-eapol-frame-source?      ieee:mac-address
       |  +--ro last-eapol-frame-version?     uint8
       |  +--ro eapol-supp-eap-frames-tx?     yang:counter32
       |  +--ro eapol-logoff-frames-tx?       yang:counter32
       |  +--ro eapol-announcements-tx?       yang:counter32
       |  +--ro eapol-announce-reqs-tx?       yang:counter32
       |  +--ro eapol-start-frames-tx?        yang:counter32
       |  +--ro eapol-auth-eap-frames-tx?     yang:counter32
       |  +--ro eapol-mka-frames-tx?          yang:counter32
       +--rw logon-process
          +--rw logon?                boolean
          +--ro connect?              enumeration
          +--ro port-valid?           boolean
          +--ro session-statistics* [session-id]
             +--ro session-id         dot1x-types:pae-session-id
             +--ro user-name?         dot1x-types:pae-session-user-name
             +--ro octets-rx?         yang:counter64
             +--ro octets-tx?         yang:counter64
             +--ro frames-rx?         yang:counter64
             +--ro frames-tx?         yang:counter64
             +--ro time?              uint32
```

MACsec Yang Augment of Interfaces Stats Under SECY by controlled port

```
module: ieee802-dot1ae
  augment /if:interfaces/if:interface:
    +--rw secy
       +--rw secy* [controlled-port-number]
          |  +--rw controlled-port-number    dot1x-types:pae-if-index
          |  +--rw verification
          |  |  +--ro max-receive-channels?   uint8
          |  |  +--ro max-receive-keys?       uint8
          |  |  +--rw validate-frames?        enumeration
          |  |  +--rw replay-protect?         boolean
          |  |  +--rw replay-window?          uint32
          |  |  +--ro in-pkts-untagged?       yang:counter64
          |  |  +--ro in-pkts-no-tag?         yang:counter64
          |  |  +--ro in-pkts-bad-tag?        yang:counter64
          |  |  +--ro in-pkts-no-sa?          yang:counter64
          |  |  +--ro in-pkts-no-sa-error?    yang:counter64
          |  |  +--ro in-pkts-overrun?        yang:counter64
          |  |  +--ro in-octets-validated?    yang:counter64
          |  |  +--ro in-octets-decrypted?    yang:counter64
          |  |  +--ro receive-sc* [sci]
          |  |     +--ro sci                  dot1aetypes:sec-sci-type
          |  |     +--ro created-time?        yang:date-and-time
          |  |     +--ro started-time?        yang:date-and-time
          |  |     +--ro stopped-time?        yang:date-and-time
          |  |     +--ro receiving?           boolean
          |  |     +--ro in-pkts-ok?          yang:counter64
          |  |     +--ro in-pkts-unchecked?   yang:counter64
          |  |     +--ro in-pkts-delayed?     yang:counter64
          |  |     +--ro in-pkts-late?        yang:counter64
          |  |     +--ro in-pkts-invalid?     yang:counter64
          |  |     +--ro in-pkts-not-valid?   yang:counter64
          |  |     +--ro receive-sa* [rxa]
          |  |        +--ro in-use?           boolean
          |  |        +--ro ssci?             uint32
          |  |        +--ro next-pn?          dot1aetypes:sec-pn-type
          |  |        +--ro created-time?     yang:date-and-time
          |  |        +--ro started-time?     yang:date-and-time
          |  |        +--ro stopped-time?     yang:date-and-time
          |  |        +--ro rxa               dot1aetypes:sec-an-type
          |  |        +--ro lowest-pn?        dot1aetypes:sec-pn-type
          |  |        +--ro enable-receive?   boolean
          |  |        +--ro updt-next-pn?     dot1aetypes:sec-pn-type
          |  |        +--ro updt-lowest-pn?   dot1aetypes:sec-pn-type
          |  |        +--ro key-identifier?   dot1aetypes:sec-key-identifier-type
```

```
|  +--rw generation
      |  |  +--ro sci-base?                string
      |  |  +--rw max-transmit-channels?   uint16
      |  |  +--rw max-transmit-keys?       uint16
      |  |  +--rw protect-frames?          boolean
      |  |  +--rw always-include-sci?      boolean
      |  |  +--rw use-es?                  boolean
      |  |  +--rw use-scb?                 boolean
      |  |  +--ro including-sci?           boolean
      |  |  +--ro out-pkts-untagged?       yang:counter64
      |  |  +--ro out-pkts-too-long?       yang:counter64
      |  |  +--ro out-octets-protected?    yang:counter64
      |  |  +--ro out-octets-encrypted?    yang:counter64
      |  |  +--rw user-priority-0-7
      |  |  |  +--rw traffic-class?   uint8
I     |  |  |  +--rw traffic-class?   uint8
      |  |  +--rw user-pcp-ap* [user-pcp]
      |  |  |  +--rw user-pcp           uint8
      |  |  |  +--rw access-priority?   uint8
      |  |  +--ro transmit-sc* [sci]
      |  |     +--ro sci                   dot1aetypes:sec-sci-type
      |  |     +--ro created-time?         yang:date-and-time
      |  |     +--ro started-time?         yang:date-and-time
      |  |     +--ro stopped-time?         yang:date-and-time
      |  |     +--ro transmitting?         boolean
      |  |     +--ro encoding-sa?          dot1aetypes:sec-an-type
      |  |     +--ro out-pkts-protected?   yang:counter64
      |  |     +--ro out-pkts-encrypted?   yang:counter64
      |  |     +--ro transmit-sa* [txa]
      |  |        +--ro in-use?            boolean
      |  |        +--ro ssci?              uint32
      |  |        +--ro next-pn?           dot1aetypes:sec-pn-type
      |  |        +--ro created-time?      yang:date-and-time
      |  |        +--ro started-time?      yang:date-and-time
      |  |        +--ro stopped-time?      yang:date-and-time
      |  |        +--ro txa                dot1aetypes:sec-an-type
      |  |        +--ro confidentiality?   boolean
      |  |        +--ro key-identifier?    dot1aetypes:sec-key-identifier-type
```

As shown there are multiple SecYs per interface but could be 1 per real or virtual interface too.

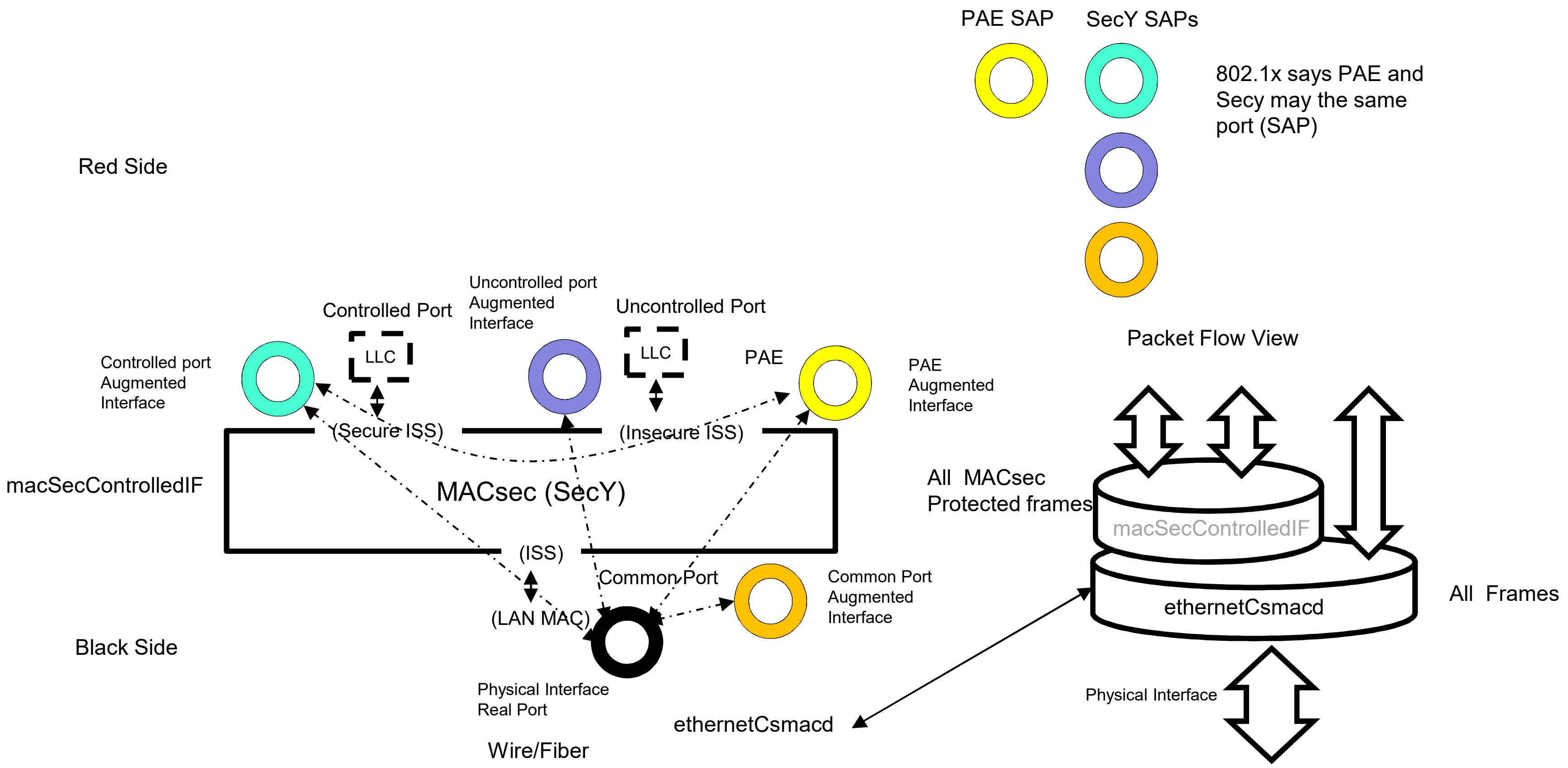
See dk-fedyk-ieee802-dot1ae-tree-0719-v00

MACsec Yang Augment of Interfaces Stats Under SECY by controlled port

```
|  +--rw current-cipher-suite
       |  |  +--rw cipher-suite-identifier?   dot1aetypes:sec-eui64-type
       |  |  +--rw data-key* [keys]
       |  |     +--rw keys              uint32
       |  |     +--ro key-identifier?   dot1aetypes:sec-key-identifier-type
       |  |     +--ro transmits?        boolean
       |  |     +--ro receives?         boolean
       |  +--rw controlled-interface
       |  |  +--ro provided-interface?         dot1x-types:pae-if-index
       |  |  +--ro mac-enabled?                boolean
       |  |  +--ro mac-operational?            boolean
       |  |  +--ro oper-point-to-point-mac?    boolean
       |  |  +--rw admin-point-to-point-mac?   enumeration
       |  |  +--ro controlled-port-enabled?    boolean
       |  +--rw uncontrolled-interface
       |  |  +--ro provided-interface?         dot1x-types:pae-if-index
       |  |  +--ro mac-enabled?                boolean
       |  |  +--ro mac-operational?            boolean
       |  |  +--ro oper-point-to-point-mac?    boolean
       |  |  +--rw admin-point-to-point-mac?   enumeration
       |  +--rw common-port
       |  |  +--ro common-port?   dot1x-types:pae-if-index
       |  +--rw cipher-suite-control* [implemented-cipher-suite]
       |     +--rw implemented-cipher-suite    dot1aetypes:sec-eui64-type
       |     +--rw enable-use?                 boolean
       |     +--rw require-confidentiality?    boolean
       +--rw cipher-suites* [cipher-suite]
          +--rw cipher-suite                  dot1aetypes:sec-eui64-type
          +--ro name?                         string
          +--ro integrity-protection?         boolean
          +--ro confidentiality-protection?   boolean
          +--ro offset-confidentiality?       boolean
          +--ro changes-data-length?          boolean
          +--ro icv-length?                   uint16
```

See   dk-fedyk-ieee802-dot1ae-tree-0719-v00

(Not so) Simple End Station Interface
All the little Pieces for PAE and SECY



PAE SAP

SecY SAPs

802.1x says PAE and Secy may the same port (SAP)

Red Side

Controlled port Augmented Interface

Controlled Port

LLC

Uncontrolled port Augmented Interface

Uncontrolled Port

LLC

PAE

PAE Augmented Interface

(Secure ISS)

(Insecure ISS)

macSecControlledIF

MACsec (SecY)

(ISS)

Common Port

Common Port Augmented Interface

(LAN MAC)

Black Side

Physical Interface Real Port

Wire/Fiber

ethernetCsmacd

Packet Flow View

All MACsec Protected frames

macSecControlledIF

ethernetCsmacd

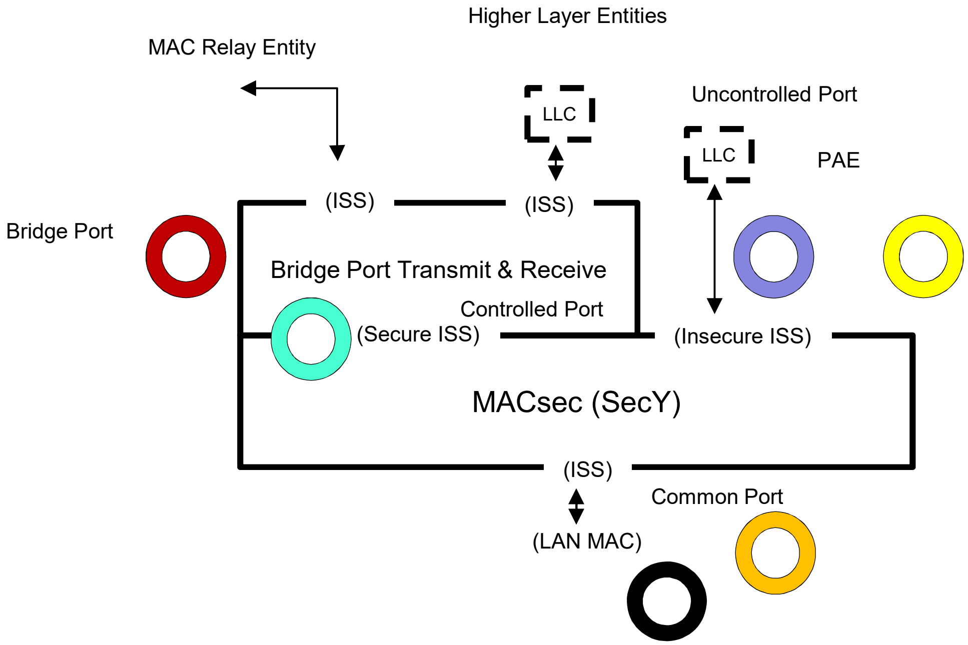
All Frames

Physical Interface

Notes

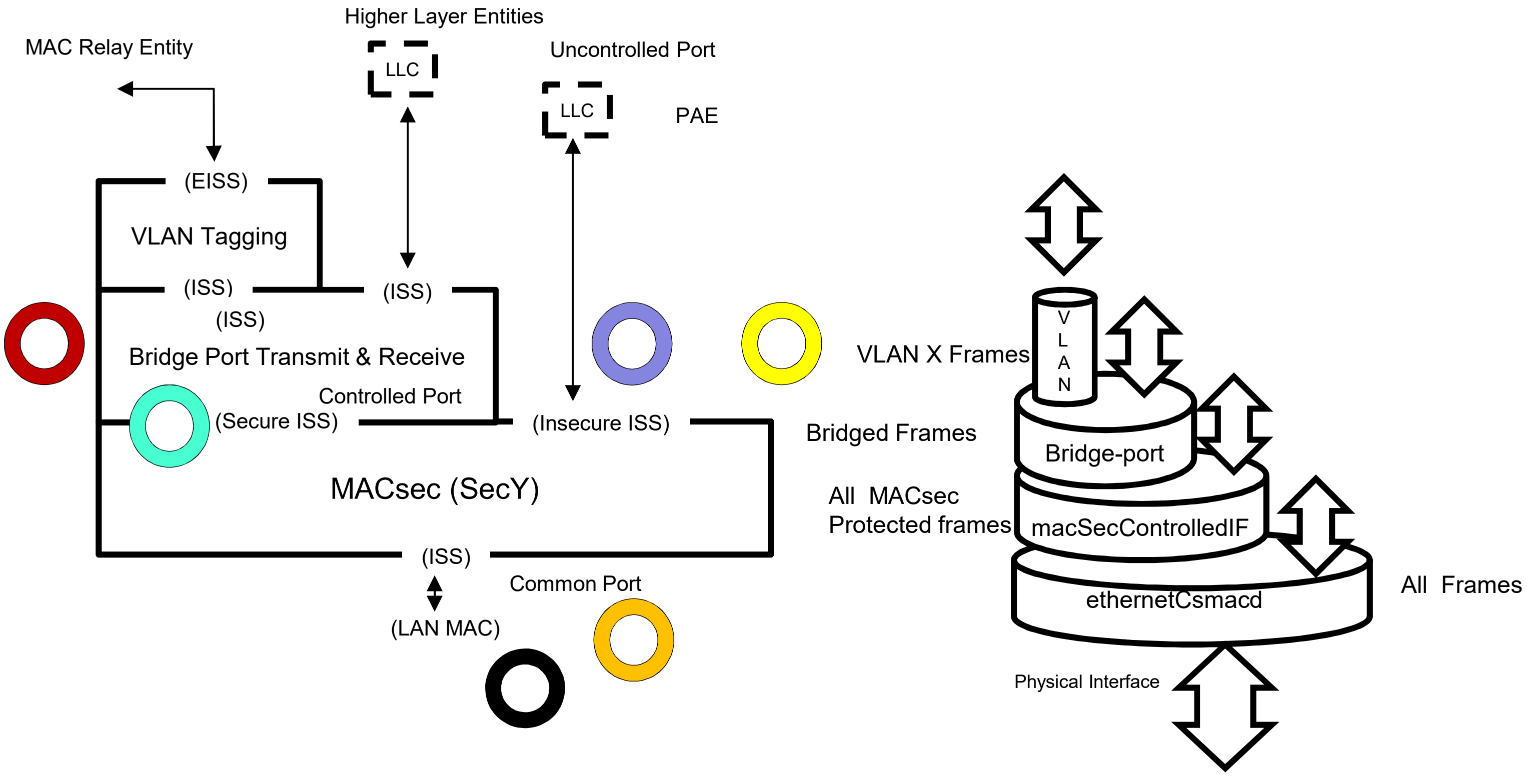
- Base Interfaces - ietf-interfaces are augmented by Ports (SAPs) PAE is a SAP, Controlled Interface is a SAP etc.
- (Division between interfaces and SAPs is blurry)
- Multiple SAPs are off the same Base Interface
- PAE and SecY share the same Base Interface but have different attributes.

VLAN-unaware MAC Bridge Port with MACsec



Basically relationships do not change as we add Bridges VLANs etc.

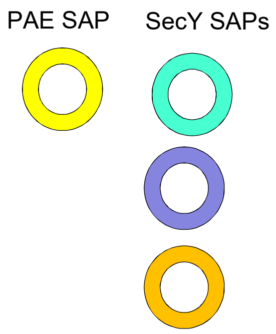
VLAN-unaware MAC Bridge Port with MACsec



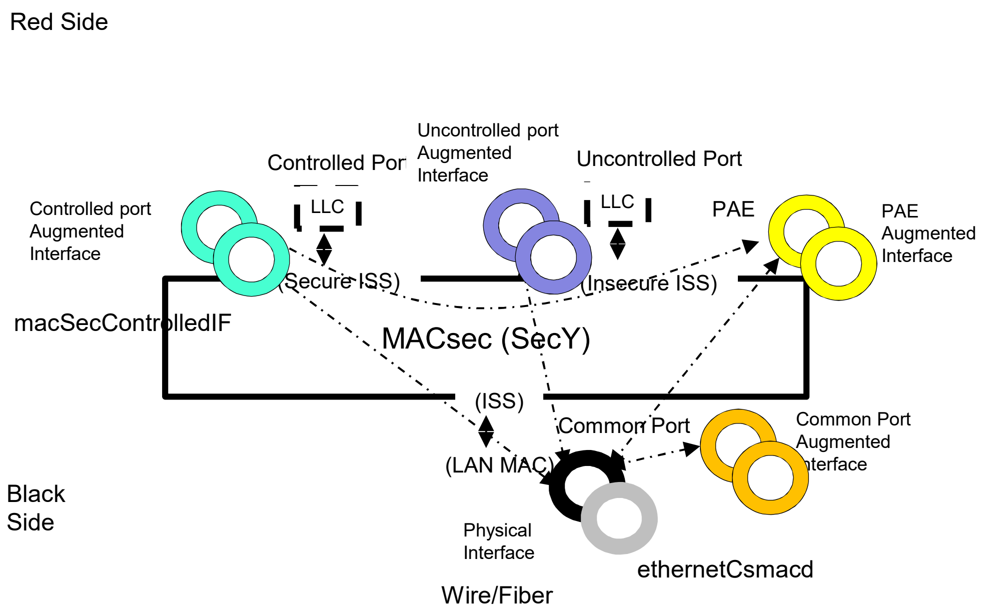
Virtual Ports

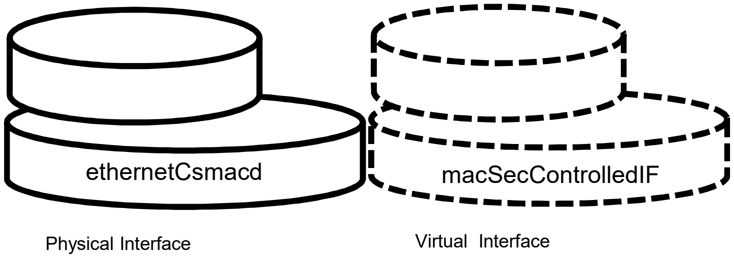
- One PAE supports a number of Virtual ports, but
  - As far as I can tell a Virtual port is a complete new virtual interface?
  - A PAE under an Interface is either a real port or a virtual port.
- How is a Single PAE with 1 real port and say 1 virtual port configured? (Two Interfaces with same PAE identifier?)
- A SecY per Virtual port.

Virtual Ports by Creating Virtual Interfaces



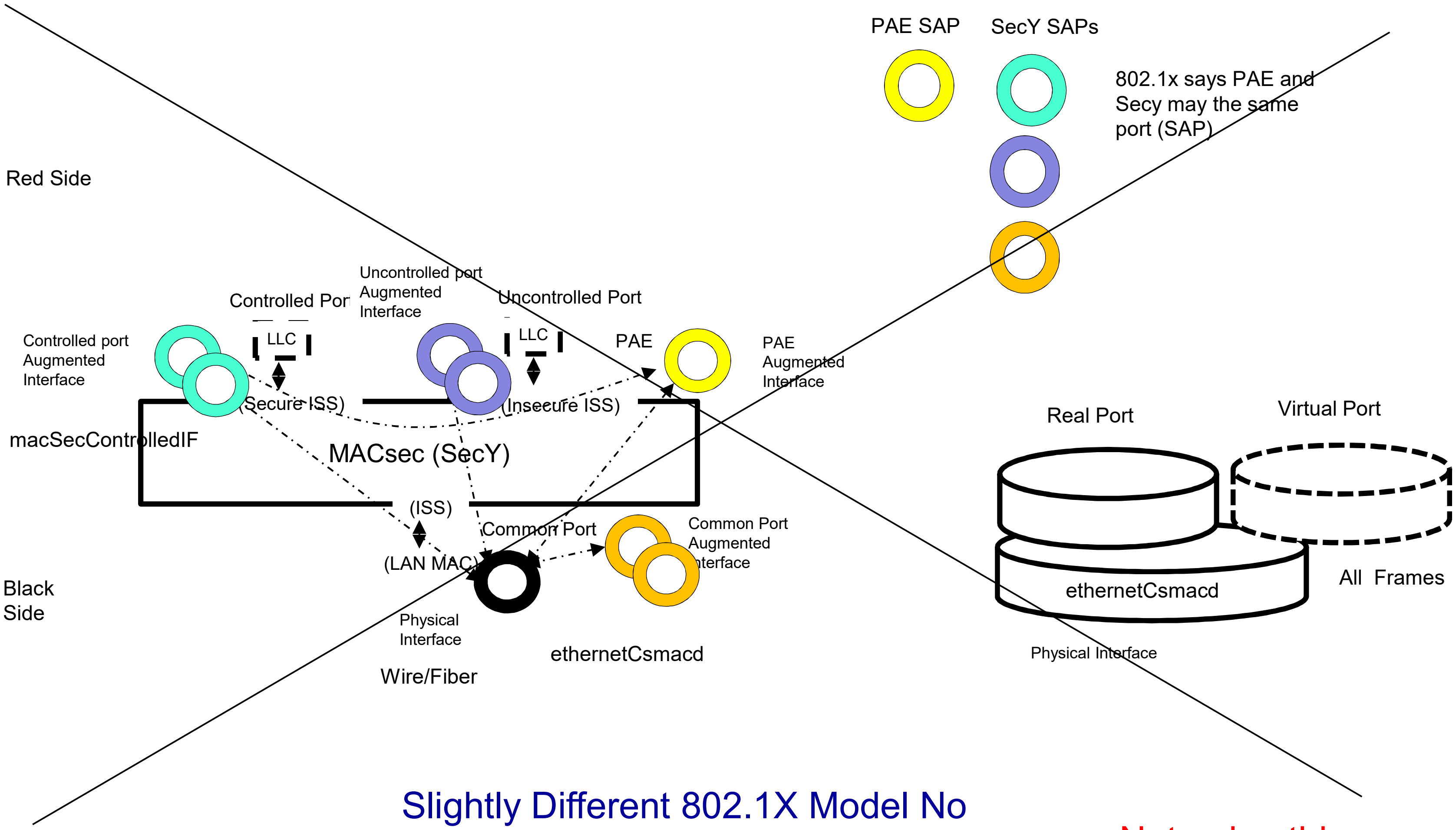
802.1x says PAE and Secy may the same port (SAP)





Seems to fit with current 802.1X Model

Virtual Ports by Multiple SecY



Slightly Different 802.1X Model No
Virtual Interface One PAE instance

Not going this way

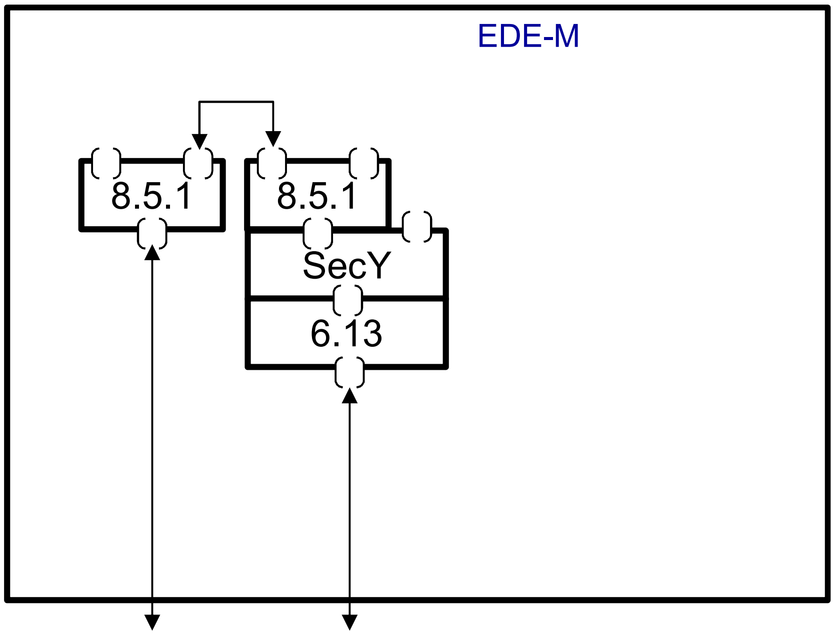
Questions

- Which way to go? Virtual Interfaces Yes
- It seems that 802.1X leans towards the Virtual Port is based on a Virtual Interface model but there is no mention of Virtual Interfaces just Virtual Ports. The PAE specifies the virtual or real interface characteristics.
- Is a macSecControlledIF a virtual Interface? Yes but Need an inventory of model to determine the usefulness of this.
- It is not clear how or when the Virtual Interfaces are created.
- Currently Management but could be object creation based,
- Choosing the Virtual Interface Model.
- See dk-fedyk-ieee802-dot1ae-yang-0719-v00 – Instance Key will become a reference.

Ethernet Encryption Device (EDE)

- EDEs are part of 802.1AE
- The YANG model applies to EDEs as well.
- The following is for discussion of what is needed to configure EDEs.

Ethernet Encryption Device
EDE-M



EDE-M needs no VLAN Config

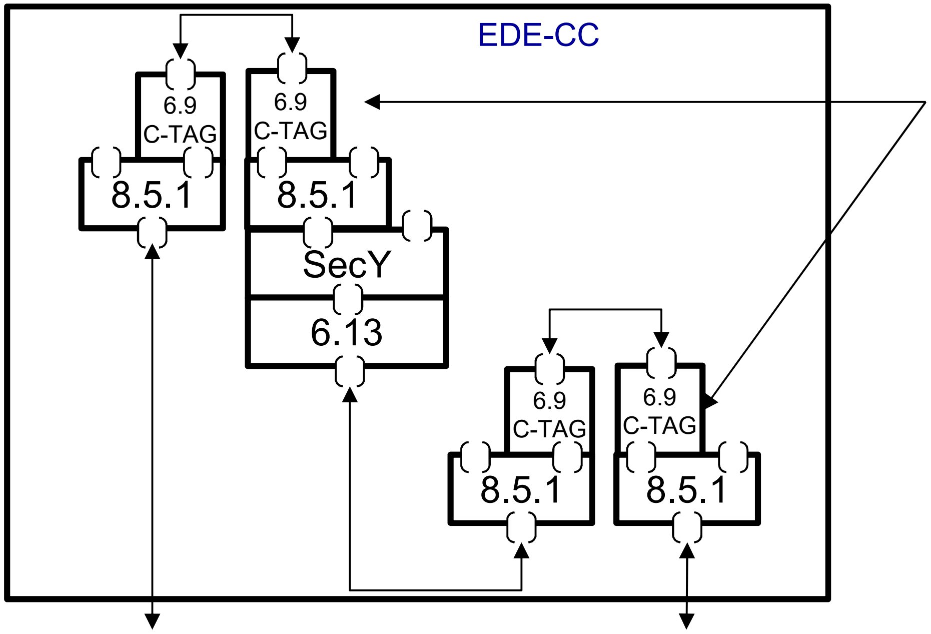
May use PVID

Current SecY Model is sufficient.

Data	S-Tag	SA	DA

Data	S-Tag	SecTag	DA	SA

Ethernet Encryption Device EDE-CC



EDE –CC uses C-Tag Config from Upper Bridge

Current SecY Model is sufficient.

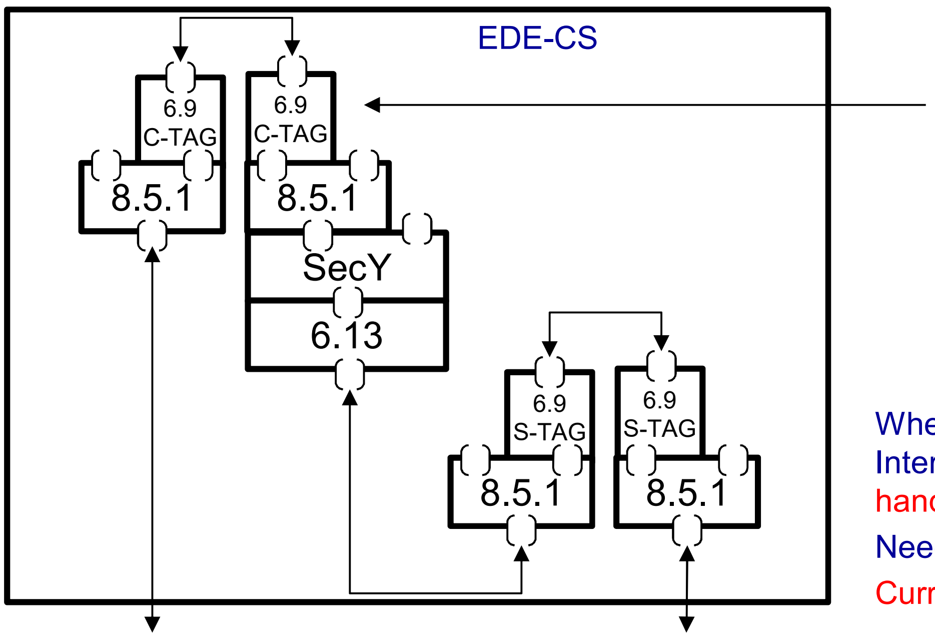
Inner and Outer C-Tag ~~are identical~~

Not always

Data	C-Tag	SA	DA

Data	C-Tag	SecTag	C-Tag	DA	SA

Ethernet Encryption Device
EDE-CS



C-Tag Config

Where is S-TAG Management Interface defined? PB model handles this.

Needs to be a Port Map?

Current SecY Model is sufficient.

S-TAG configured in
PB model

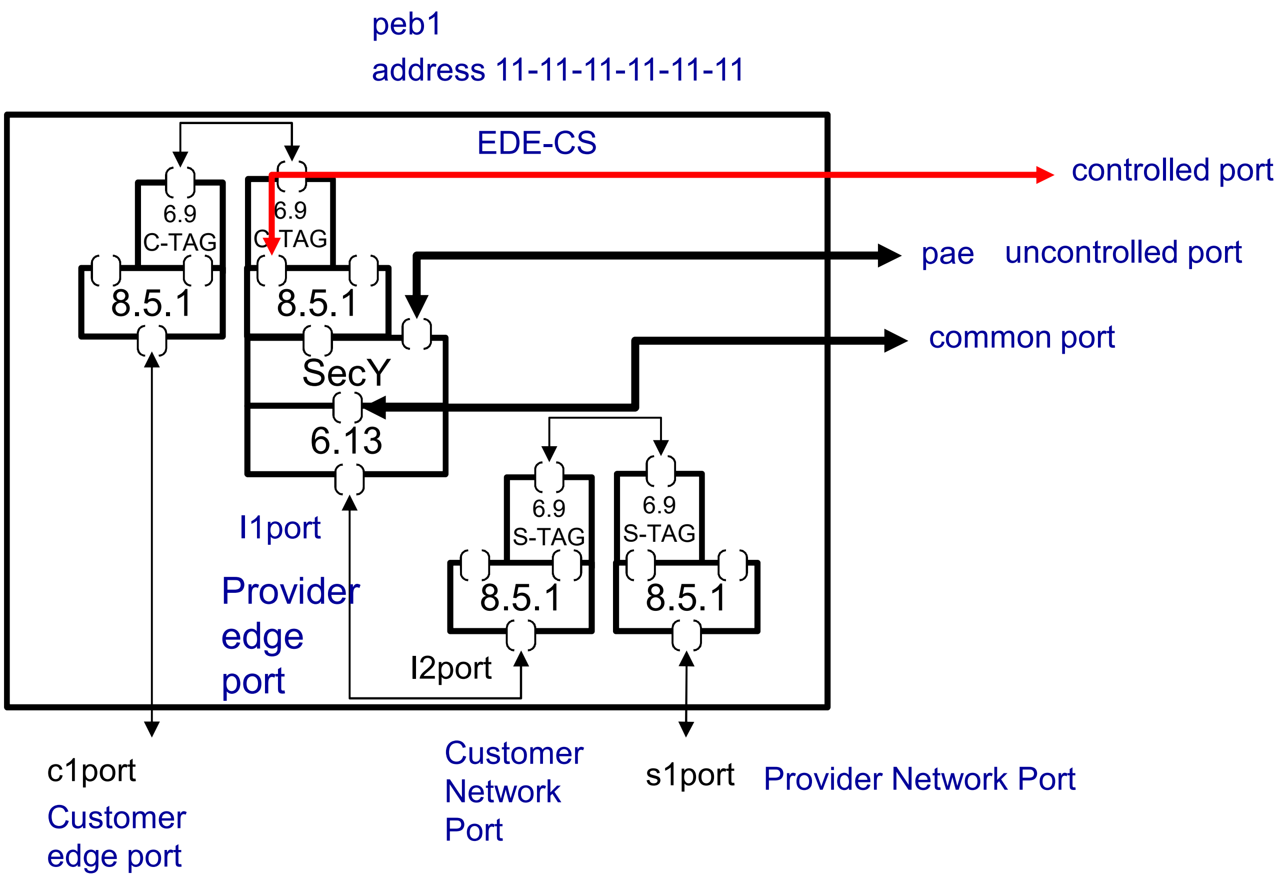
Data	C-Tag	SA	DA

Data	C-Tag	SecTag	S-Tag	DA	SA

EDEs and YANG Summary

- EDE-M
  - VLAN Unaware same YANG
- EDE-CC
  - C-VLAN comes from Bridge and outer C-VID can be independently controlled.
- EDE-CS
  - C-VLAN comes From Bridge and outer S-VID comes from the PB model.

Some Preliminary Config



YANG CLI

```
rpc-reply {
  data {
    bridges {
      bridge peb1 {
        name peb1
        address 11-11-11-11-11-11
        bridge-type dot1q:provider-edge-bridge
        component c1 {
          name c1
          type dot1q:c-vlan-component
        }
        component s1 {
          name s1
          type dot1q:s-vlan-component
        }
      }
    }
    interfaces {
      interface I1port {
        name I1port
        type ianaift:bridge
        secy {
          secy 1 {
            controlled-port-number 1
            controlled-interface {
            }
            uncontrolled-interface {
            }
            common-port {
            }
          }
        }
        pae {
          pae-system 1
          port-type virtual-port
        }
      bridge-port {
          component-name c1
          port-type dot1q:customer-network-port
        }
      }
      interface I2port {
        name I2port
        type ianaift:bridge
        bridge-port {
          component-name s1
          port-type dot1q:customer-network-port
        }
      }
      interface c1port {
        name c1port
        type ianaift:bridge
        bridge-port {
          component-name c1
          port-type dot1q:customer-edge-port
        }
      }
      interface s1port {
        name s1port
        type ianaift:bridge
        bridge-port {
          component-name s1
          port-type dot1q:provider-network-port
          svid 200
        }
      }
    }
    nacm {
    }
    system {
      pae-system {
        name pae1
      }
    }
  }
}
```

Summary:

- Resolved questions related to the virtual interface model.
- An inventory of MACsec for other conditions such as the applications listed on slide 5 will solidify the config
  - Action to configure LAG as the important one