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MACsec - Securing data in motion without performance penalty

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[Security]

MACsec - Securing data in motion without performance penalty

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Agenda

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- MACsec market and technology overview
- Why MACsec is now mission-critical?
- The state of the industry and the key use cases for hyperscalers
- The challenges of realizing the promises of MACsec
- Testing must evolve to ensure proper validation
- Introduce Keysight/Juniper Joint 100/400GE MACsec demo

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Encryption Market Overview

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Cloud/Data Center

- Data Center Interconnect
  - 100G, 400G
- Direct connect service for enterprise
  - 10G, 100G

5G/Open RAN

- Secure Open RAN network
- RU, DU, Transport device
- Speed - 10G, 25G, 100G

Industrial/Automotive

- Automotive
- Access Point and Modem
- Speed - 10G, 5/2.5G, 1G

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MACsec Technology Overview

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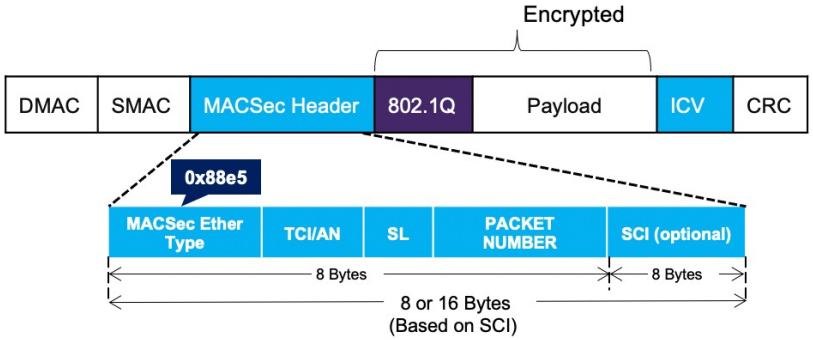
- Secure LAN/WAN and encrypt data for L2 and above
- Services: Integrity, Confidentiality, Replay Protection
- Key features:
  - GCM-AES-128/256 and GCM-AES-XPN-128/256 Cipher
  - Clear 802.1Q tag
  - Confidentiality Offset 0/30/50
- Key provision modes
  - Pre-shared Keys (PSK) - Static CAK mode
  - Master Session Key (802.1X/EAP) – Dynamic CAK mode
  - Static SAK mode
- MACsec Key Agreement (MKA) protocol for



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Why MACsec is now mission-critical?

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- Cloud and data center drives higher Ethernet link speed with increased bandwidth demand
- Bandwidth application requirements outpacing IP encryption capabilities

- MACsec secure data in motion without performance penalty
  - Suitable for both LAN and WAN
  - Line rate encryption throughput for high-speed Ethernet
  - Secure Layer 2 and above, transparent to higher layer applications
  - Strong encryption protection and lower overhead

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Encryption at Different Layer

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- Enterprise IT infrastructure and mission-critical apps moving to Cloud
- Cloud Services MUST provide very high security
- Every part of a network is vulnerable and requires protection
- Encryption at different layers provides comprehensive protection

Application Layer Encryption	IPSec L3 Encryption	MACsec L2 Encryption	L1 Encryption
• End-to-end encryption • Operationally complex • High latency and overhead • bandwidth inefficient	• IETF standards-based • Support IP only • High latency and overhead • bandwidth inefficient	• IETF standards-based • High efficiency and low latency • Requested by hyperscalers	• 100% throughput • High efficiency • Protocol agnostic

Best fit for securing network infrastructure

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MACsec Technology Evolution

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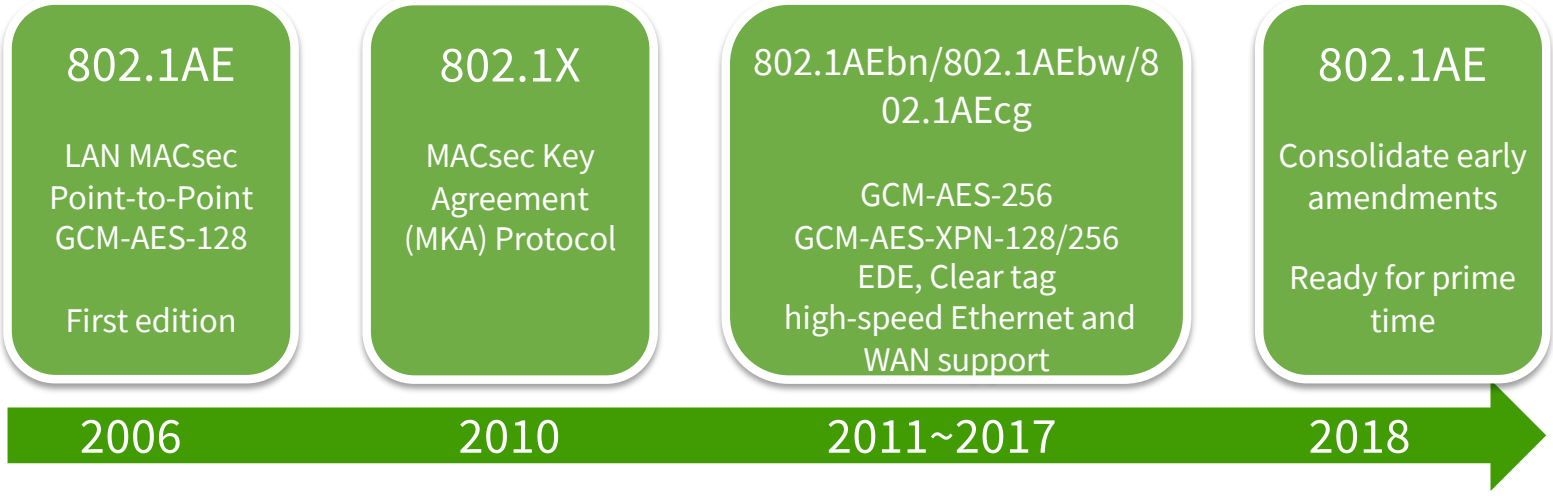
- Standards:
  - IEEE 802.1AE-2018 - Media Access Control (MAC) Security
  - IEEE 802.1X-2020. Port-Based Network Access Control



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The State of the Industry

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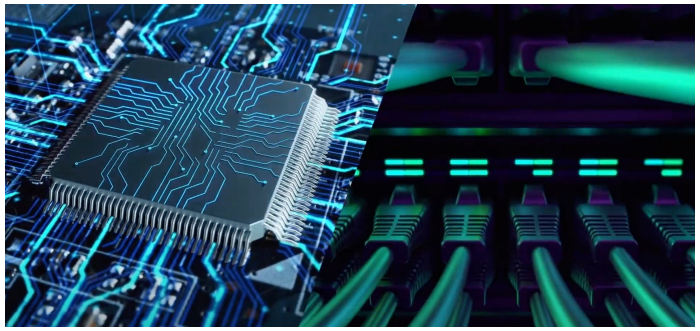
- MACSEC is now built into the silicon (PHY + FABRIC)
- MACsec is now shipped with next-generation routers and switches
- OCP whitebox switch with MACsec support is emerging
- Linux add MACsec support back in 2016
- SONiC SAI WG created API extension to cover MACsec and external Phys



SONiC

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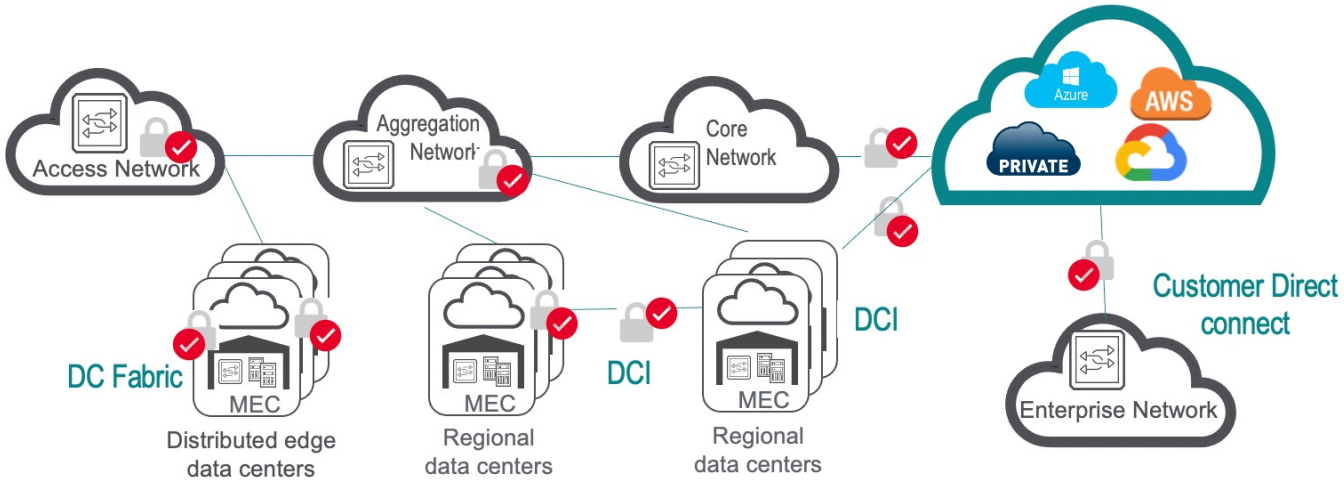
Key Use Cases for Hyperscalers



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Data Center Interconnect

- Secure any link outside of physical control
- No performance penalty
- Protect against outage and incident

Direct Customer Connect

- Provided by all major hyperscalers
- Extends customer on-premises network into Cloud
- From 10 Gbps to 100 Gbps circuit sizes
- Enterprise-grade SLA

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Challenges of Realizing the Promises of MACsec

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- Achieve line rate throughput at high-Ethernet speed
- Support smaller to Jumbo frame size without loss and impact on throughput
- Minimize the latency impact with encryption
- Multiplex services over a physical link
- Ensure service continuity during key rotation
- Optimize control and data plane interaction
- Guarantee robustness under various network conditions

Early MACsec Testing Uncovers Critical Issues

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- Broken MACsec Key Agreement (MKA) Control Plane
  - MKA failure with XPN cipher, such as session failure, wrong SSCI, etc.
  - MKPDU failure with Clear Text VLAN
  - Stops sending MKPDU under stress (100G line rate traffic with frames < 128 bytes
- Data Plane Forwarding issue
  - Padding 64 bytes frame to 96 bytes causing packet drop
  - Failure under traffic with different frame sizes, eg. IMIX traffic, cause loss and CRC error
  - Failure understand stress, like mismatch SCI, sending to a port in different CA – Serious security concern
- Issue during key rotation
  - Wrong key server ID cause delayed switchover to the new key and a short period of loss
  - Wrongly sending unencrypted traffic during rekey
  - Failure of detecting PN exhaustion by Key server due to wrong LLPN and cause loss

Testing Must Evolve to Ensure Proper Validation

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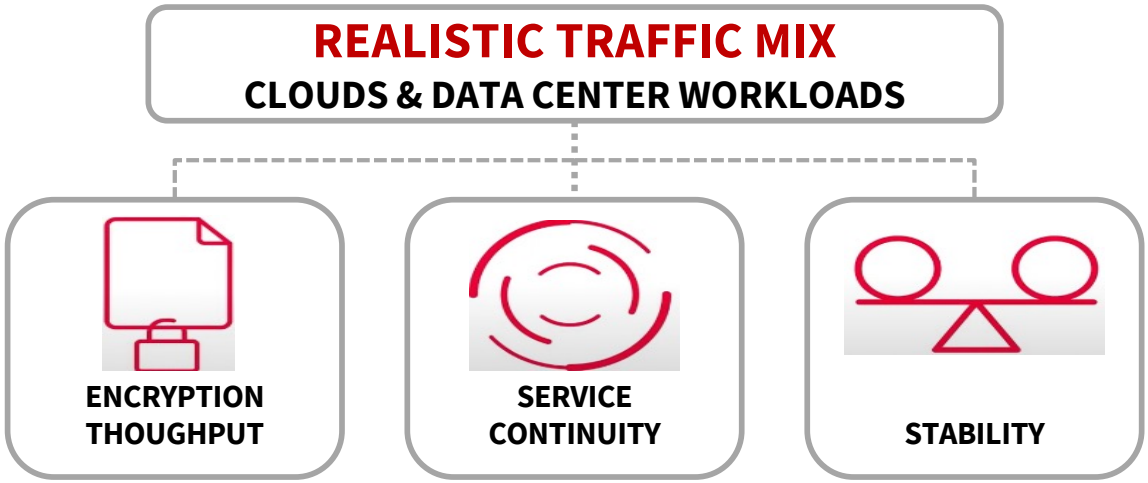
- No effective test tool in the market for high-speed Ethernet
- Most vendors and end customers test B2B between vendor devices
- Back-to-back test fall short and compromise quality
- Testing must evolve to deploy MACsec with confidence



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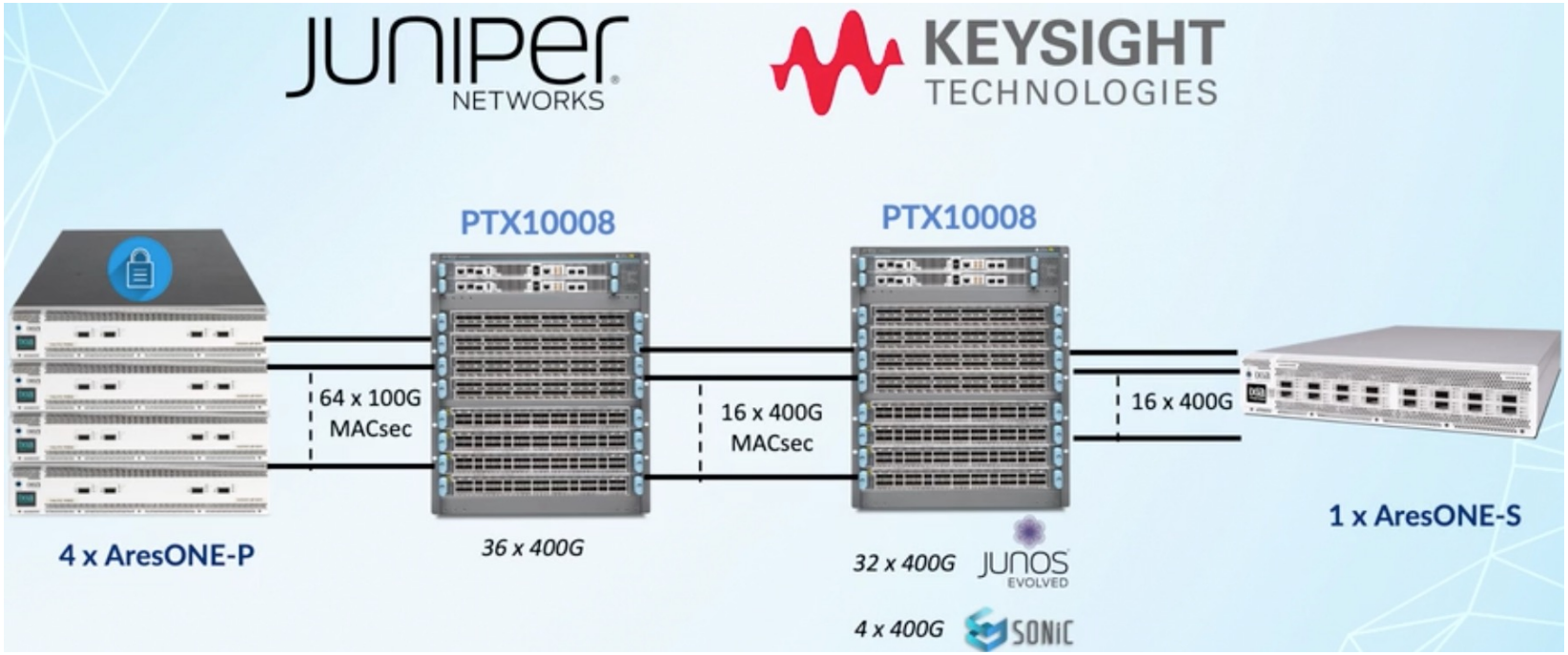
Demo MACsec Readiness for 100/400GE



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Keysight booth # C33

Also visit OCP virtual expo

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Call to Action

- Enhance test methodology for effective validation
- Contribute MACsec test cases to community to improve quality
- MACsec support with more whitebox switch and open-source NOS – get ready for large sale deployment
- Expand SONiC MACsec SAI Extensions to improve MACsec feature coverage

SONiC MACsec HLD (high level design): https://github.com/Azure/SONiC/tree/master/doc/macsec

Keysight IxNetwork MACsec datasheet: https://www.keysight.com/us/en/assets/3120-1442/data-sheets/IxNetwork-MACsec-Test-Solution.pdf

Keysight MACsec Blackbook: https://www.keysight.com/us/en/assets/3121-1137/application-notes/Keysight-MACsec-Test-Suite.pdf#?success=true

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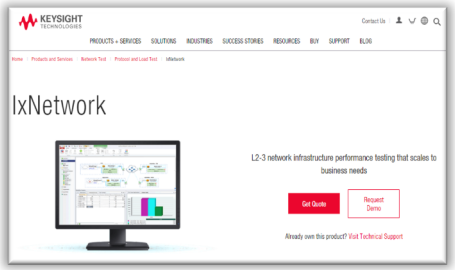
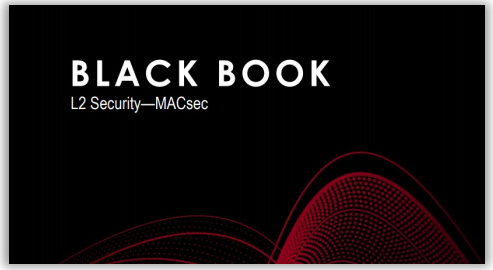
Available Resources

[IxNetwork MACsec Intro Video]



[IxNetwork Product page]

[MACsec Data Sheet]



[MACsec Black Book]

[MACsec Blogs]

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Thank you!

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