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Impregnable network defense for a porous world

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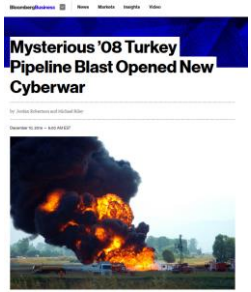
Porous defense leads to fatal and costly incidents



[Turkey pipeline blast report 2014]

[Arizona fiber trunk vandal 2015]

[Ukraine grid down 2015]

[Bangladesh Central Bank cyber bank heist 2016]

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Threats to industrial networks accident, error or malice

Deliberate threats

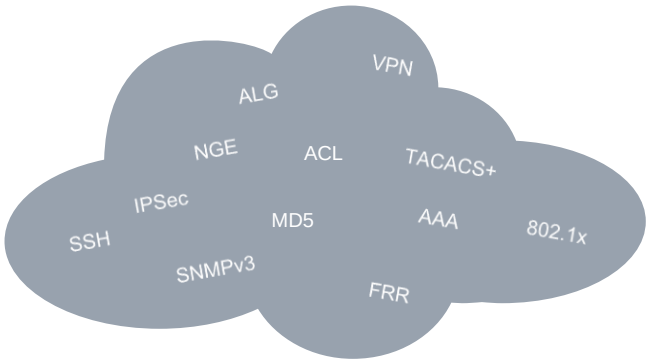
- Disgruntled employees
- Identify theft
- Sabotage
- Espionage
- Vandalism
- Terrorism
- Malware
- Theft
- Denial-of-service

Inadvertent threats

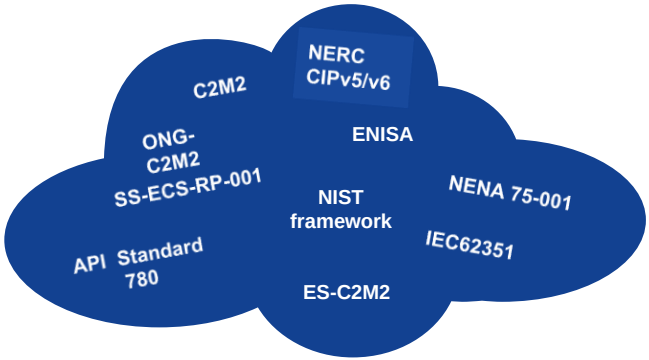
- Safety failures
- Equipment failures
- Carelessness
- Misconfiguration
- Fire
- Natural disasters

The security numeric and alphabet soup

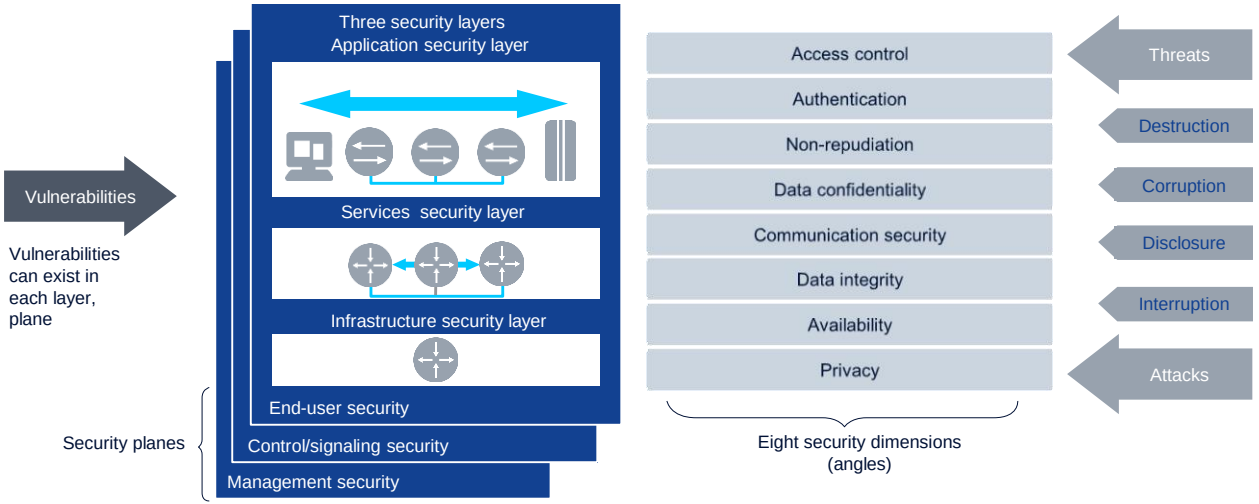
Security toolbox



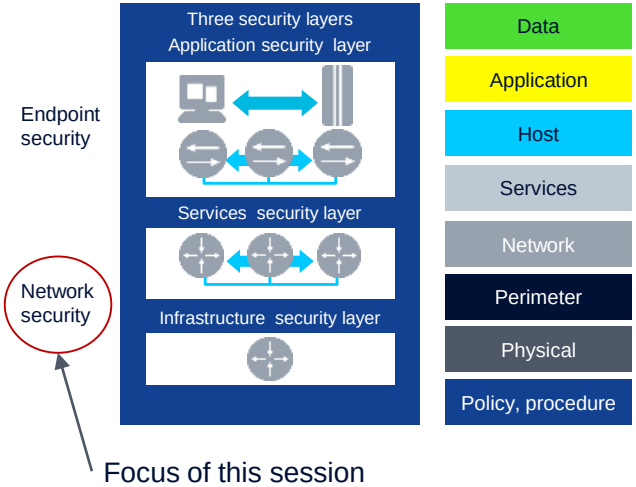
Industry security frameworks/guidelines



ITU-T X.805 communications (network) security framework



An X.805-based In-depth network defence

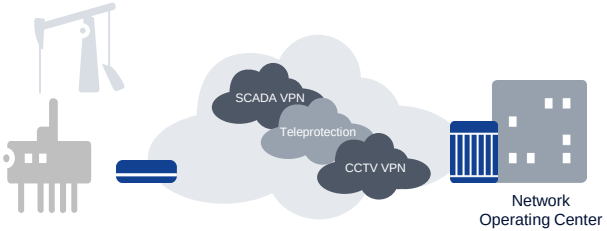


Network defense mechanism highlights

X.805 layer	Defense highlights
Services layer	• Service encryption protects application traffic • Firewall/NAT shields endpoints • Access control list inspects traffic
Infrastructure layer	• Control plane (IP/MPLS/L2) security • Management security • Layer 1 encryption to protect all network data • Network availability, reliability and resilience to withstand network attack and sabotage • Secure node authentication protects against network equipment assault

Inherent strong security of IP/MPLS

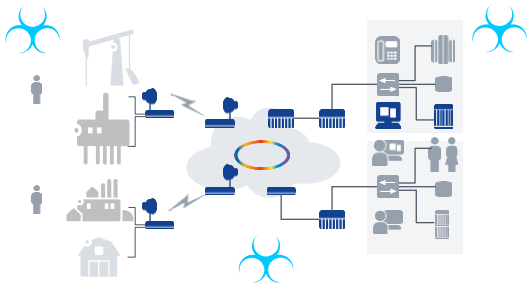
LSP-based transport renders security at par with frame relay/ATM VC



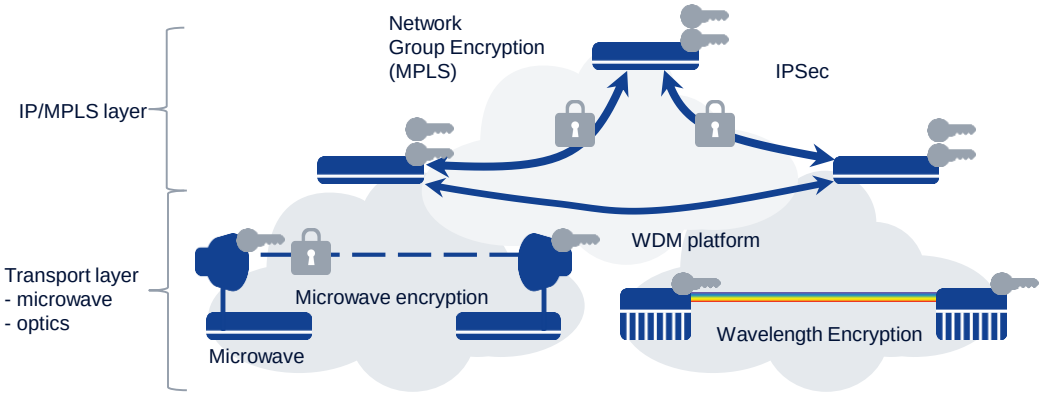
MPLS-based VPNs segregate control and data plane of each application zone

But attacks are becoming rampant and sophisticated

Stakes are higher than ever



Encrypt critical communications with a best-fit approach



A multi-layer encryption framework

Critical network service encryption requirements

Universal encryption

- Encrypting multi-service (TDM, layer 2 and IP) at MPLS layer
- Service aware, optimizing hardware performance
- Full MPLS advantages (FRR, QoS, OAM, scalability)

Meshed persistent connectivity

- Scale up for large meshed networks
- Persistent connectivity
- Ready the network for future distributed application/IoT intelligence

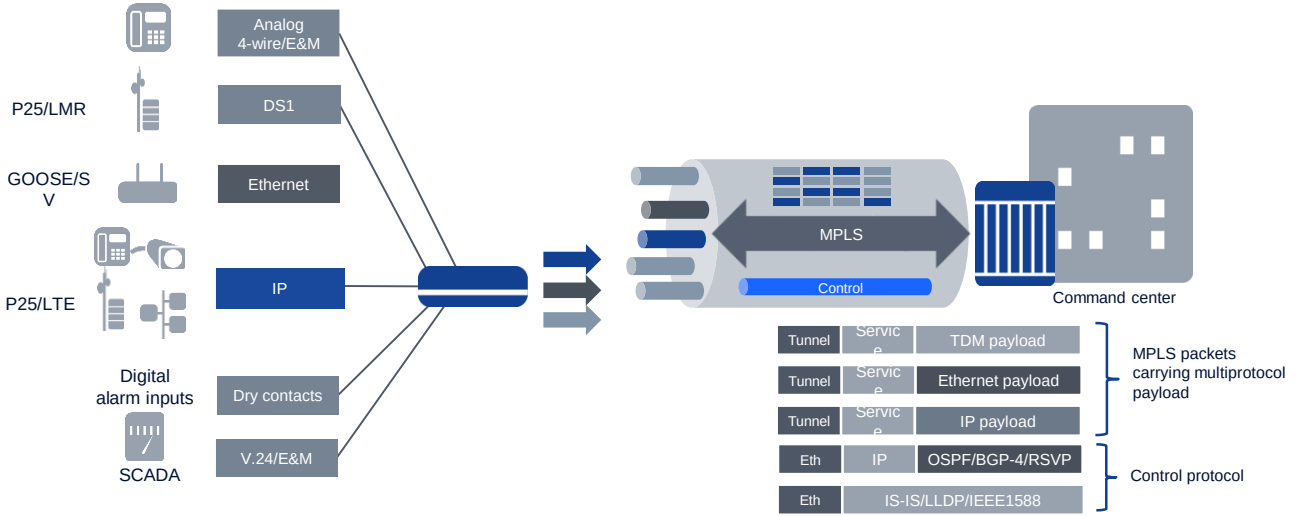
Robust key management

- Elegant service-based hierarchical group key management
- Secure key distribution and hitless re-keying
- No extensive IPsec compute tax

High network efficiency

- Optimal use of hardware resources
- Low packet overhead
- Transparent to core network

Understand traffic in the network - service traffic and control traffic

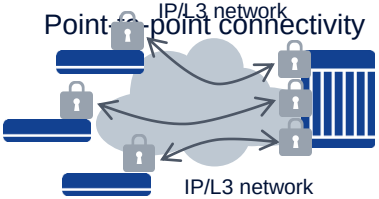


But how to secure multiprotocol traffic?

Universal encryption approach with service encryption

Traditional IPSec

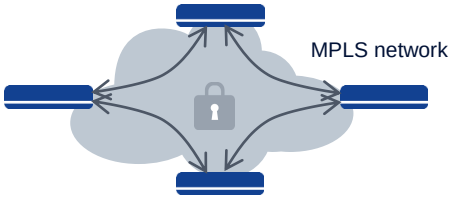
Point-to-point connectivity



- Tunnel based approach designed primarily for IP/L3 services
- PE-PE configuration considerations needed
- Multiple keys managed by IKEv2
- Some added overhead (GRE, IPSec headers and IKE control plane)

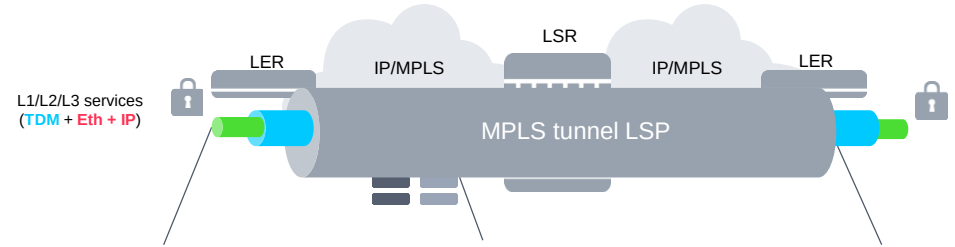
Service Encryption

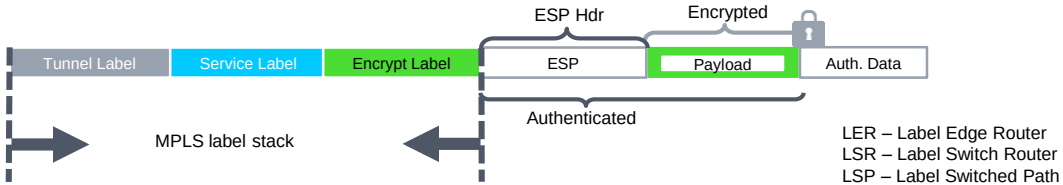
Persistent meshed connectivity



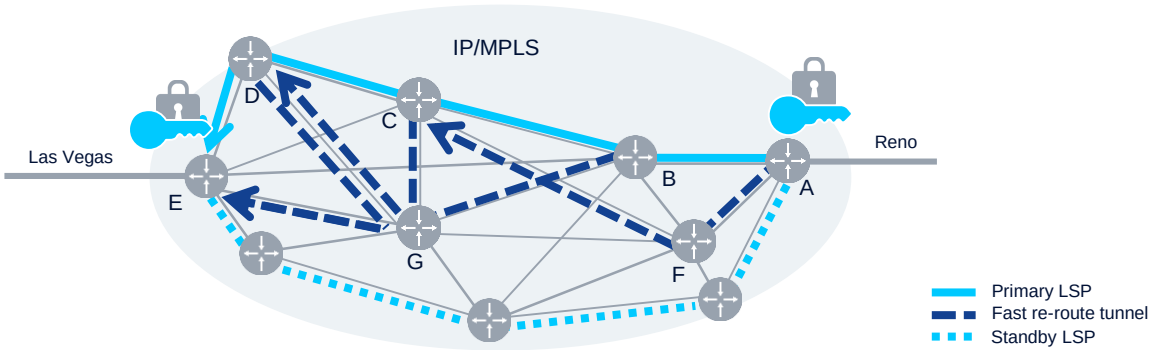
- MPLS-based/service aware group encryption
- Supports all service types over MPLS:
  - P2P and multi-point TDM, Ethernet and IP VPNs
- Leverage seamless MPLS and high availability
- Lower overhead and less complex

Service encryption added to MPLS seamlessly





Service encryption with MPLS resiliency



Standard LSP failover

- Failure signaled at Ingress LSR
- Calculate and signal new LSP
- Reroute traffic to new LSP

Standby LSP

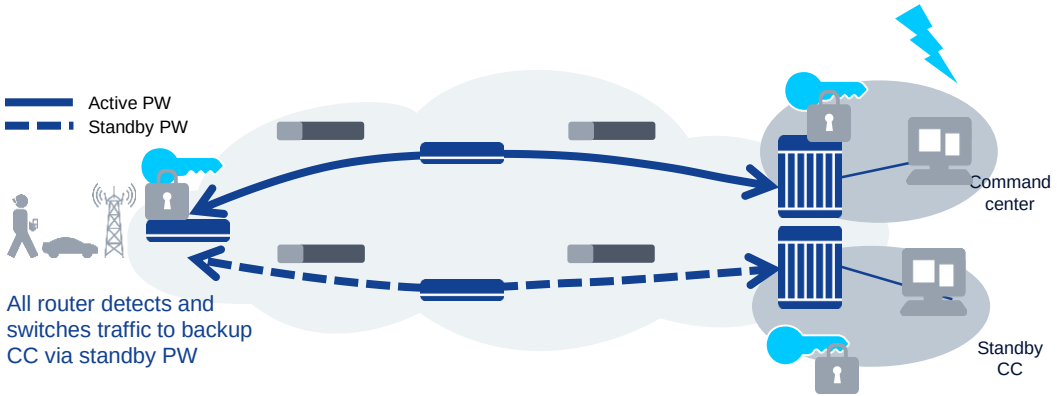
- Pre-established LSP
- Sub-second switchover

Fast Re-Route (FRR)

- Signaled during LSP setup as topology requires
- Each LSR computes a detour path
- Supports failover in < 50 ms after detection

Same key regardless of which protecting LSPs are in use

Service encryption with geo-redundancy



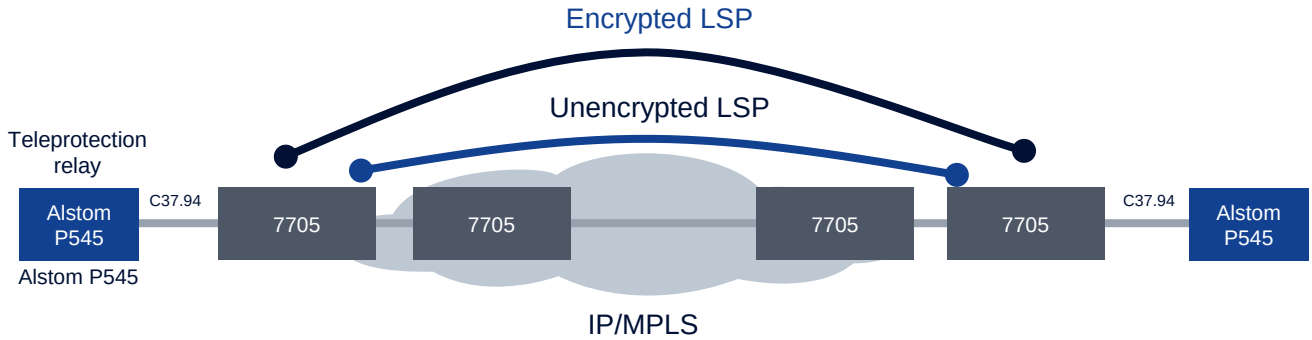
All traffic is lost due to site disaster

A pair of geo-redundant command centers

- Pseudowire redundancy protects end-to-end connections
  - Protection against end-point failure at control center (router, control center building etc.)
  - All remote routers switches automatically without manual intervention
  - Multi-Chassis Synch (MCS) maintains flow/group/link state information across routers

Control center site protection against disaster with same key

Independent service encryption delay measurement



A. E2E delay without encryption = 1.68 ms
B. E2E delay with service encryption = 1.70 ms

Incurred end-to-end delay is only 20 US

Mitigating management security risk

Role-based user profiles

Based on each user's role in network operations, only

- grant visibility of the relevant network span (span of control), and
- empower germane network command capability (scope of command)

User action non-repudiation

- Through logging, each user's every action is recorded
- Archive for future analysis and audit

Workflow checkpoint

- When creating, deleting and modifying services, insert checkpoints to verify validity

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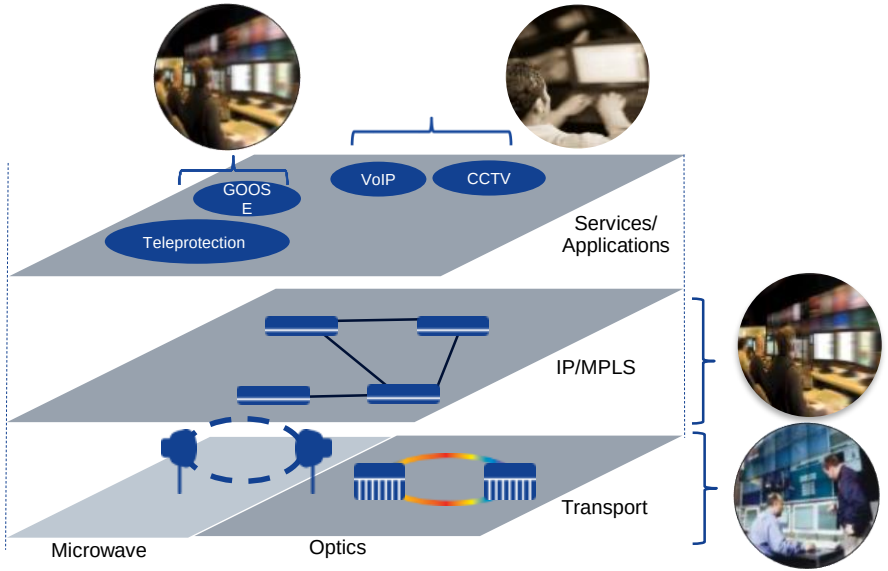
Role-based user profiles – minimize security exposure

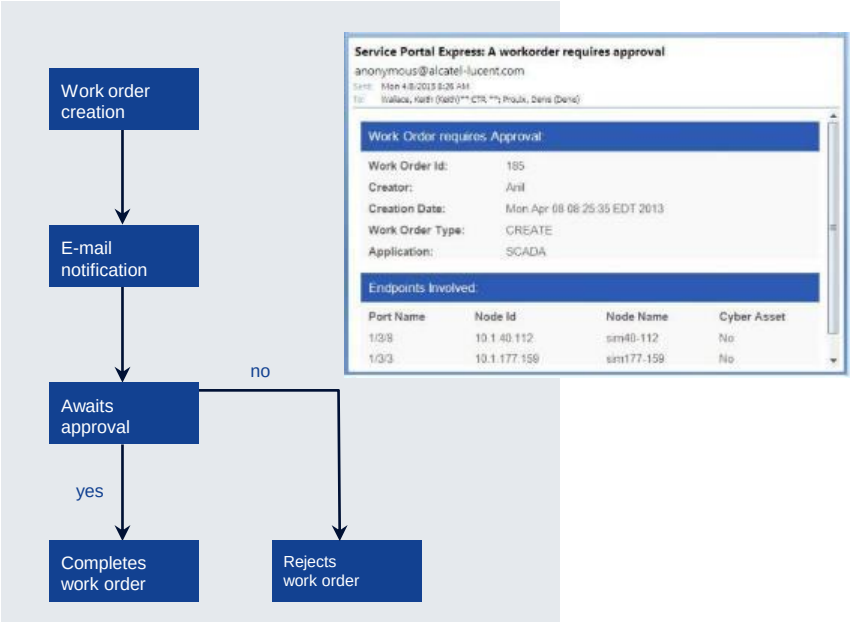


Span of control/scope of command

- Give staff only necessary control according to their jobs
- Reduce risk of operation error

Workflow checkpoint

- Email notification to supervisor for approval
- Work Order States:
- Pending Approval,
- Approved,
- Rejected,
- Withdrawn,
- Completed,
- Failed



Deploy network security with no performance compromise

Centralized policy creation and update

Security processing in forwarding hardware

MPLS QoS and performance preserved

Negligible latency incurred

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Nokia network security resources

Whitepapers

- Impregnable defense for mission-critical networks (download here)
- Encryption for mission-critical networks (download here)
- Network Group Encryption (download here)
- 7705 SAR security overview for mission-critical industries (download here)

Article

- Mission possible with Network Group Encryption (NGE)

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