

MINI-LINK™ R4

TECHNICAL PRODUCT
PRESENTATION,
ANSI



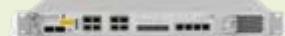
ERICSSON'S MINI-LINK PRODUCTS

MINI-LINK LH

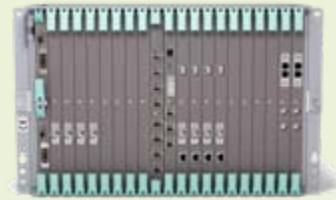
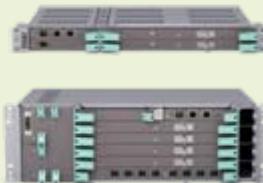


MINI-LINK CN

MINI-LINK CN 1010



MINI-LINK TN



**Common
Antenna**

**Common
Radio**



MINI-LINK

Ericsson's market leading Microwave Transport Solution

Ericsson delivers everything from single hops to turnkey networks



AGENDA

- › Functional descriptions
 - [The High Performance Radio Link](#)
 - [Ethernet Traffic Handling](#)
 - [Network Sync](#)
- › Technical Overview
- › MINI-LINK Common Outdoor units
- › MINI-LINK CN - Technical details
 - [MINI-LINK CN 1010](#)
- › MINI-LINK TN – Technical details
 - IDU's and Plug-in units
- › MINI-LINK LH – Technical details
- › MINI-LINK Accessories
- › MINI-LINK Standard packages
- › MINI-LINK Installation Alternatives
- › Management
- › Summary



MINI-LINK FUNCTIONAL DESCRIPTION

- › THE HIGH PERFORMANCE RADIO LINK
- › ETHERNET TRAFFIC HANDLING
- › NETWORK SYNC

MINI-LINK

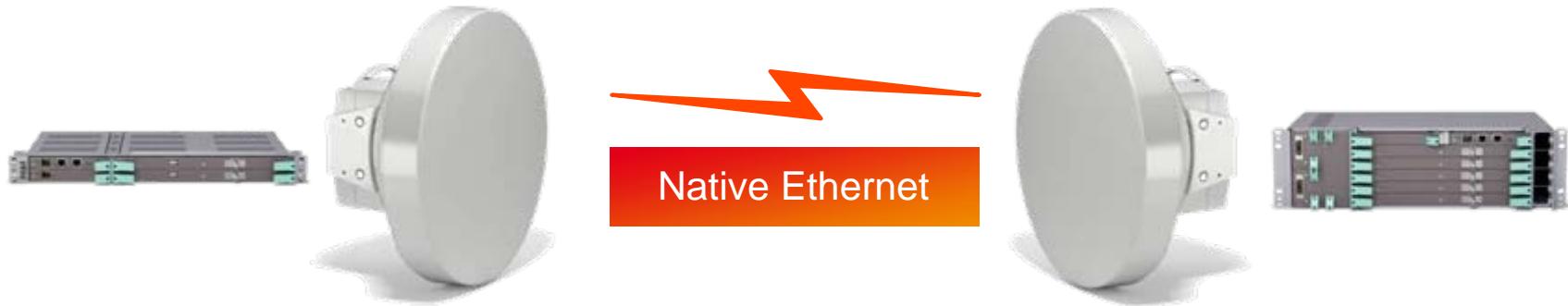
THE HIGH PERFORMANCE RADIO LINK

- › ETHERNET & TDM
- › HIGHER MODULATION – HIGHER CAPACITIES
- › ADAPTIVE MODULATION
- › XPIC & SPECTRAL EFFICIENCY

NATIVE ETHERNET

MMU2 DA & MMU2 H

TN



LH

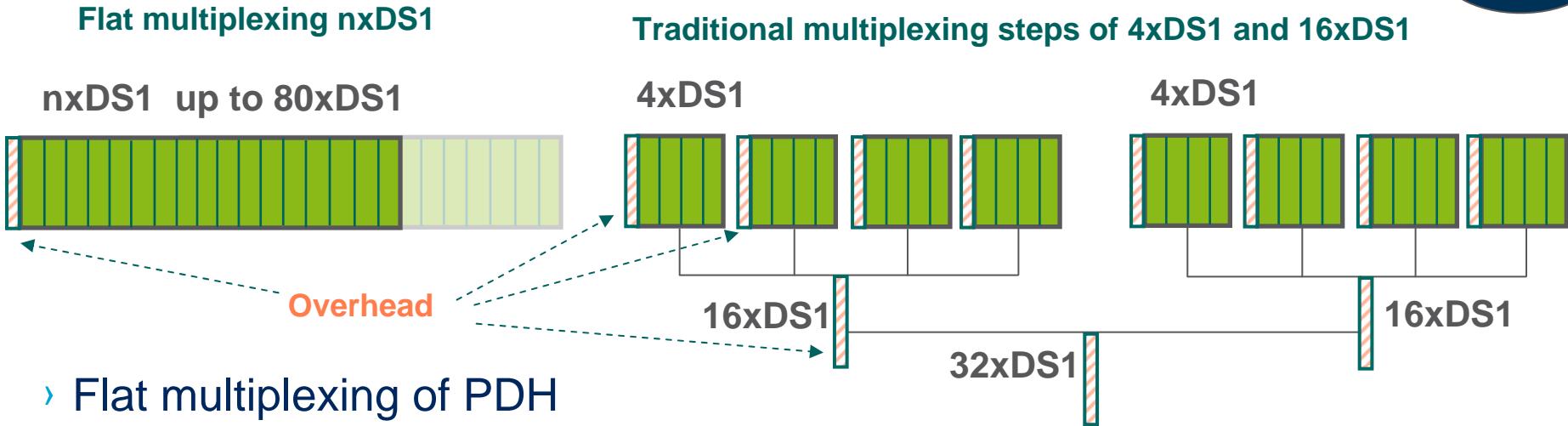
- › Native Ethernet
 - Only 0.5% overhead, no additional TDM overhead
 - Native throughout the node, switch, modem and radio
- › High Ethernet throughput with efficient use of spectrum

PERFECT FOR ALL-IP NETWORKS

OPTIMIZED NATIVE PDH

MMU2 DA & MMU2 H

TN



› Flat multiplexing of PDH

- No limitation to steps of 4xDS1 or 16xDS1
- Optimized usage of bandwidth
- Minimized overhead

› Example:

- 16 QAM and 20 MHz provides 32xDS1 with traditional multiplexing
- Move to flat multiplexing and increase capacity to 42xDS1 keeping the same modulation and bandwidth
- Only 1 dB impact on System Gain

HYBRID RADIO LINK

MMU2 DA & MMU2 H

- › Optimized for maximum

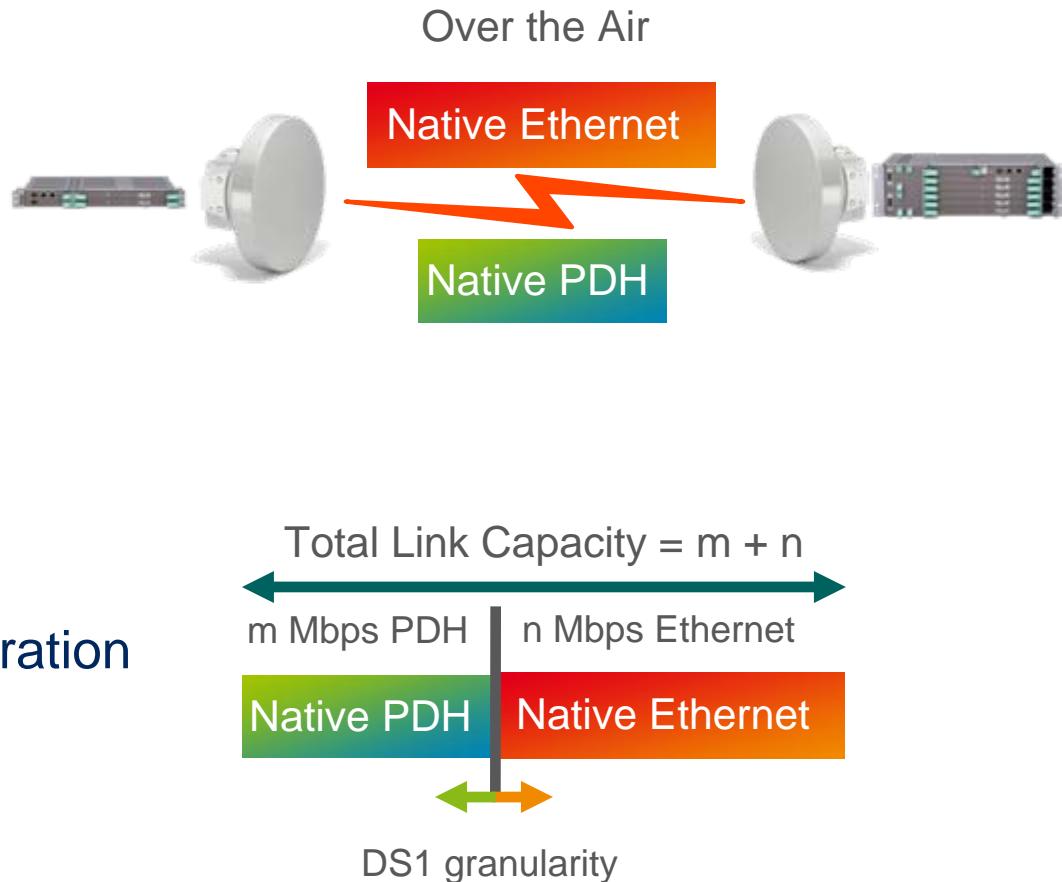
- Native Ethernet throughput
- Native PDH throughput

- › Configurable combination of Native PDH and Native Ethernet

- › Perfect for all-IP networks

- › Perfect for TDM to packet migration

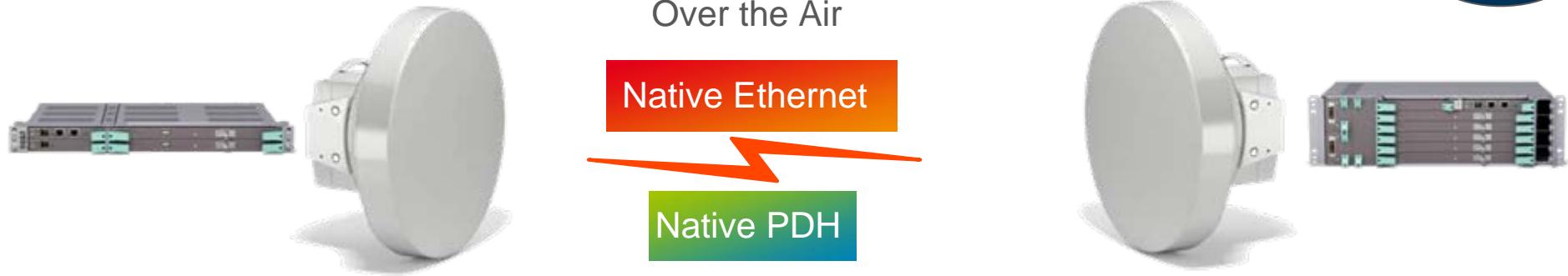
TN



HYBRID RADIO LINK

MMU2 DA & MMU2 H

TN



- › Native Ethernet and Native PDH
 - Simultaneously over the air
 - Maximized Ethernet throughput
 - Maximized PDH throughput
 - No extra delay or delay variation
- › Fully supporting Carrier Grade Networks

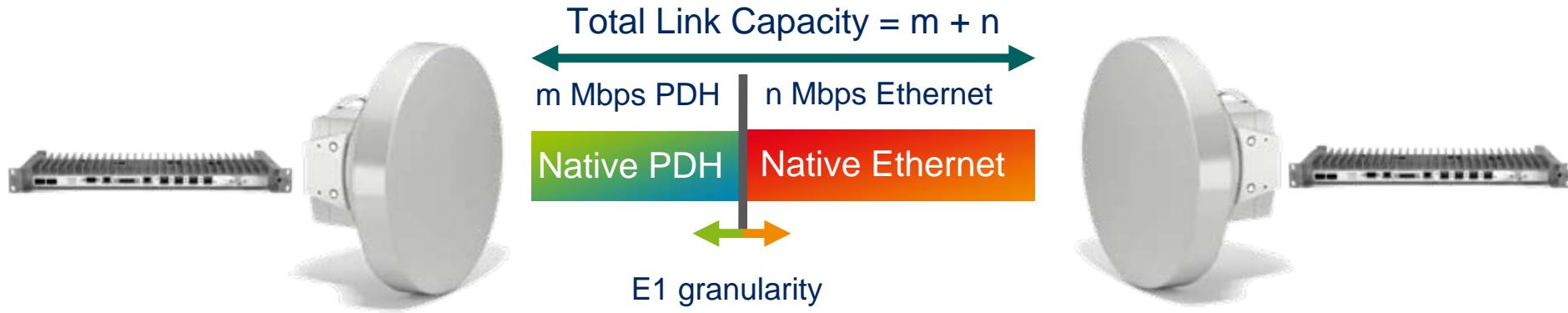
PERFECT FOR ALL-IP NETWORKS

PERFECT FOR YOUR NETWORK EVOLUTION

HYBRID RADIO LINK

MMU2 DA & MMU2 H

TN

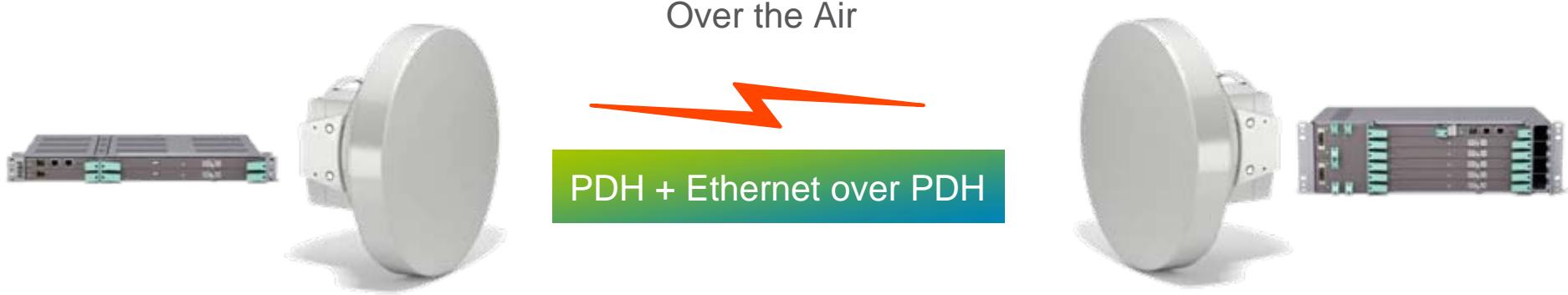


- › Cost effective TDM to packet migration
 - Start with all DS1's or a mix with Ethernet
 - Start with aggregation sites and new end nodes
 - Add more Ethernet as data traffic increases
 - Complete the migration by moving to all Ethernet

PERFECT FOR YOUR NETWORK EVOLUTION

ETHERNET OVER PDH

TN



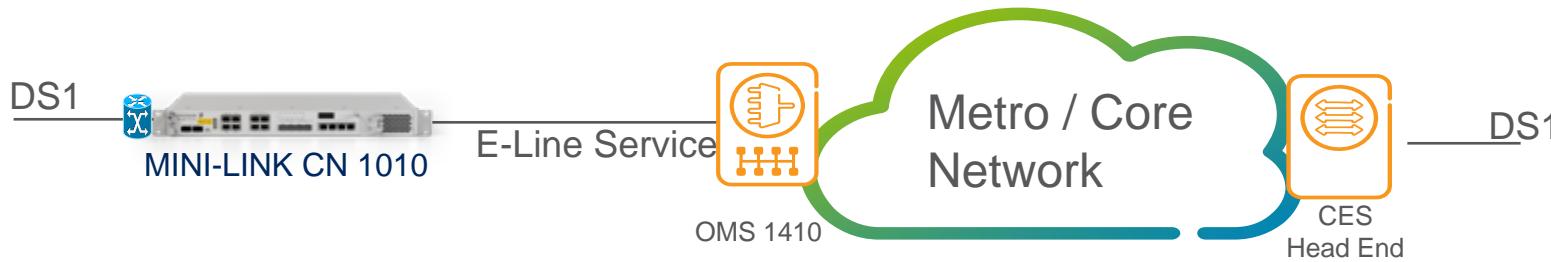
- › Ethernet over PDH can be used with
 - Any existing MINI-LINK TN PDH modem
 - Any PDH connection
- › Capacity up to 71 Mbps
- › Cost effective for Ethernet introduction at end nodes in an existing PDH network

MINI-LINK - EVOLVING YOUR NETWORK TO ALL-IP

CIRCUIT EMULATION OF TDM MINI-LINK CN 1010

- ›Flexible TDM Circuit emulation options
 - Circuit emulation of unstructured E1/DS1s, SAToP (RFC 4553) and MEF 8
 - Circuit Emulation of structured E1/DS1s, CESoPSN (RFC 5086) and MEF 8
 - Circuit Emulation over IP, Ethernet, or MPLS
- Part of Ericsson Mobile Backhaul Solution
- Standard compliant to provide general interoperability

CN 1010



CIRCUIT EMULATION PROTOCOLS

MINI-LINK CN 1010 TO 3PP CES INTEROPERABILITY

- Multiple protocols supported to cater for different Head End requirements and different transport technologies

CES over Ethernet (MEF8)

TDM Payload
RTP(O)
CES CW
ECID
VLAN(O)
S-VLAN(O)
MAC

CES over MPLS

TDM Payload
RTP(O)
CES CW
PW Label
VLAN(O)
S-VLAN(O)
MAC

CES over IP

TDM Payload
CES CW
RTP(O)
UDP
IP
VLAN(O)
S-VLAN(O)
MAC

CN 1010

Configurable Parameters:

- ECID Range 0..1048575 (2^{20} -1)
- Static Configuration
- C-VLAN p-bits is configurable
- S-VLAN p-bits is derived from C-VLAN p-bits through internal UNI

Configurable Parameters:

- PW Label Range 0..1048575 (2^{20} -1)
- Static Configuration
- MPLS tunnel is not supported
- PW EXP is configurable
- C-VLAN p-bits is copied from EXP
- S-VLAN p-bits is derived from C-VLAN p-bits through internal UNI

Configurable Parameters:

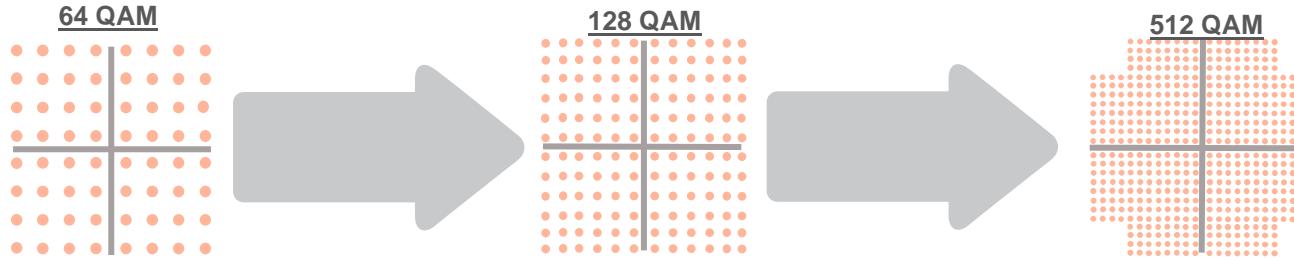
- UDP Port Range 0~0xFFFF
- Static Configuration
- TOS/DSCP is configurable
- C-VLAN p-bits is map from TOS/DSCP
- S-VLAN p-bits is derived from C-VLAN p-bits through internal UNI
- All PWs share the same source IP and source MAC address.

(O) = optional

HIGHER MODULATION - HIGHER CAPACITIES

512 QAM NOW AVAILABLE

- › Increase the Capacity in a frequency channel by increasing the modulation
- › 512 QAM @ 50 MHz gives up to **420*** Mbps per radio



TN

LH

Ericsson – the technology leader in microwave

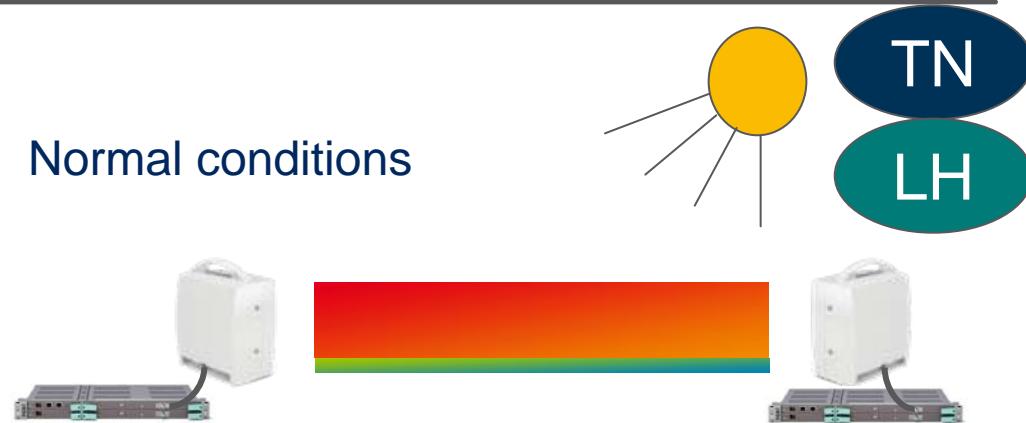
*maximum line interface capacity

HITLESS ADAPTIVE MODULATION

Weather Aware Availability

- › Benefit from full available bandwidth under normal conditions
- › Secure priority traffic by stepping down the modulation under unfavorable conditions

Normal conditions



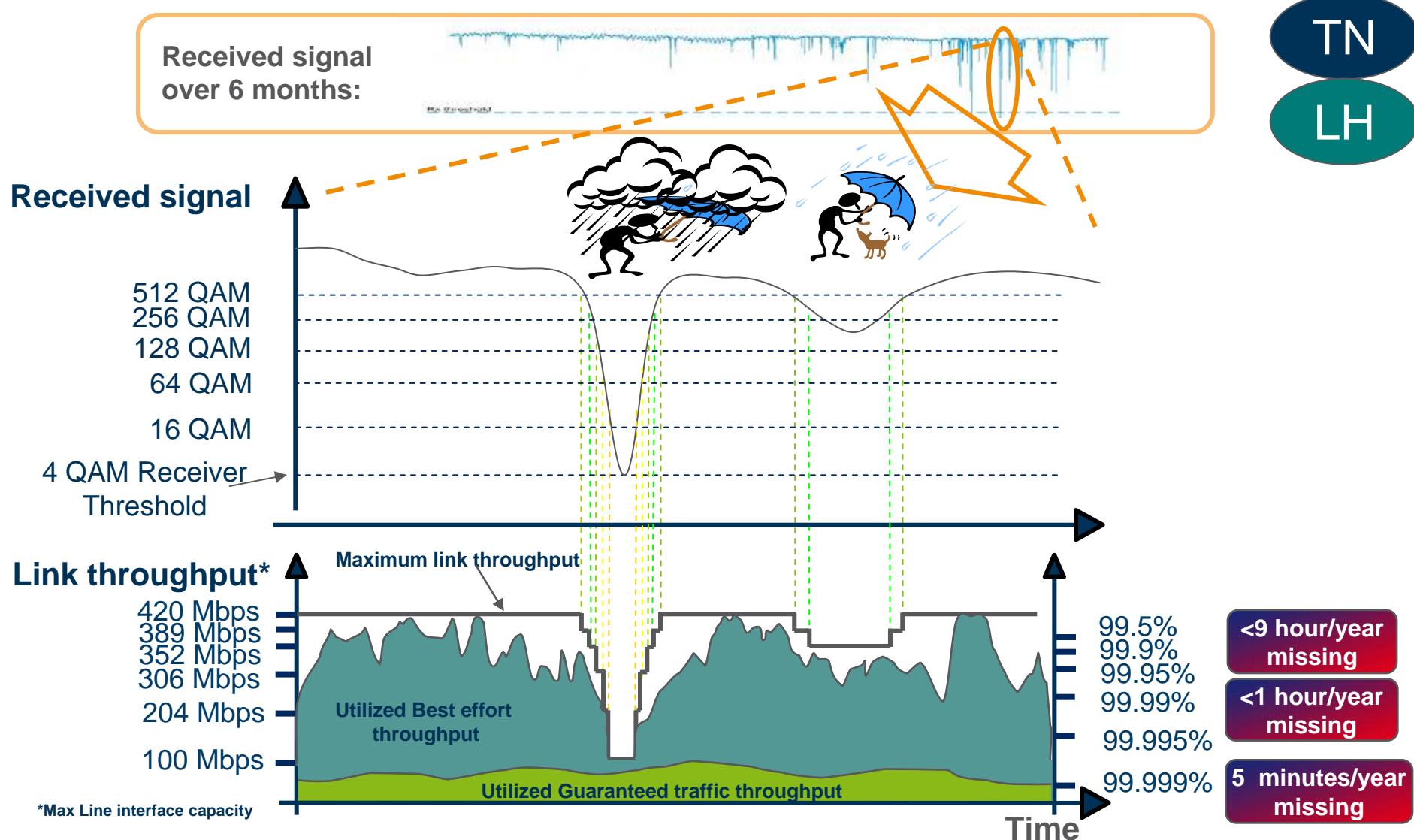
Unfavorable conditions



COST EFFICIENT HANDLING OF BEST EFFORT TRAFFIC

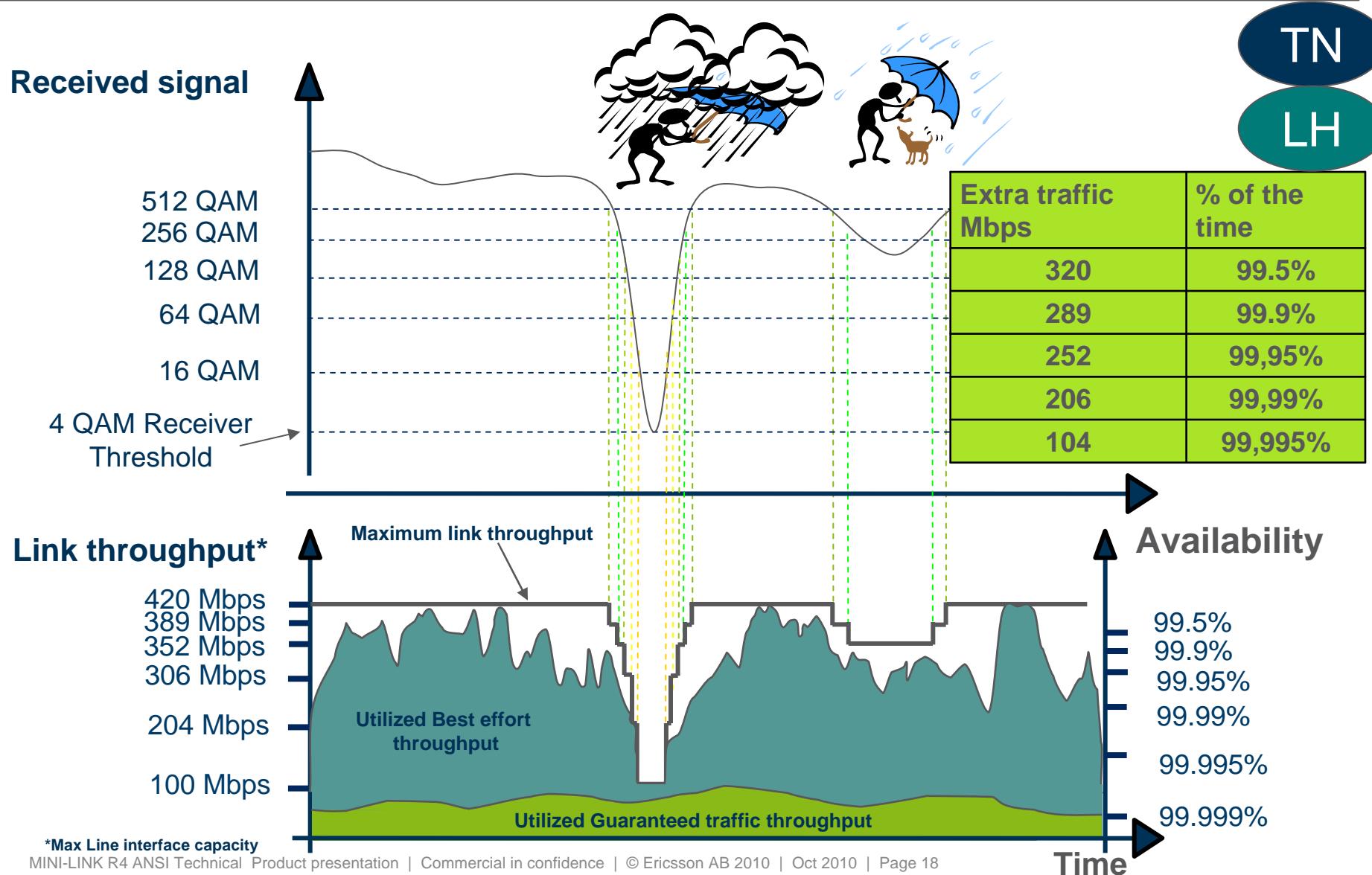
HITLESS ADAPTIVE MODULATION

WEATHER AWARE AVAILABILITY BASED ON QOS



NETWORK EXAMPLE ON 50 MHZ CHANNEL

320 MBPS EXTRA REVENUE GENERATING CAPACITY@ 99,5%



CARRIER GRADE ADAPTIVE MODULATION

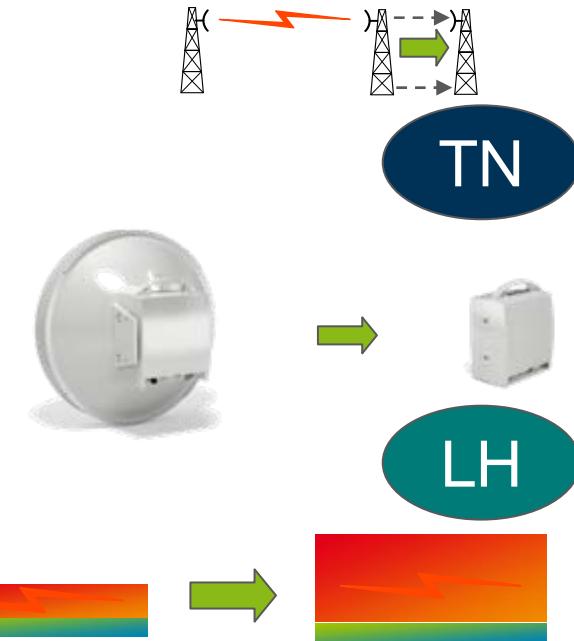
- › Error Free: Modulation change without bit errors
- › Constant Delay: Crucial for network sync
- › Handles not only Rain fading both also complex Selective/Multipath fading

DESIGNED FOR CARRIER GRADE NETWORKS

NETWORK APPLICATIONS

› New network roll-out

- Minimize investment cost with a **longer hop length** with lower availability for Best effort traffic
- Minimize site lease cost with a **smaller antenna** with lower availability for Best effort traffic
- Prepare for **future capacity growth** of Best effort traffic with lower availability



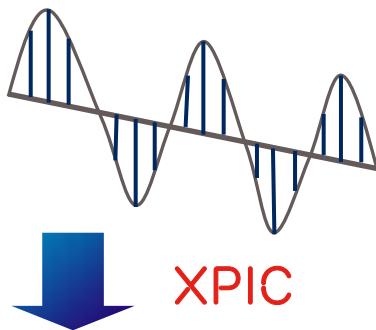
› Network evolution - TDM to packet migration

- Limit the investment cost by adding Best effort traffic while **keeping the installed antenna** and the availability on priority traffic

VALUABLE OPTIONS WHEN MUCH BEST EFFORT TRAFFIC

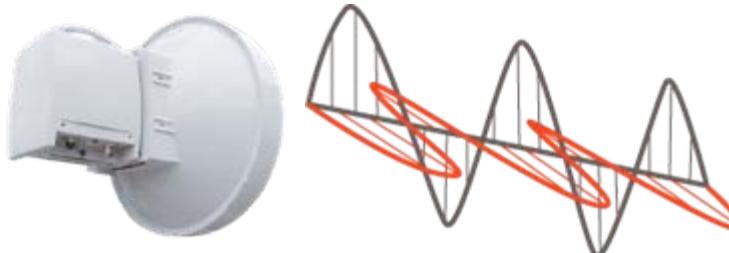
EFFICIENT SPECTRUM USAGE WITH XPIC

MMU2 H, MMU2 F 155



TN
e.g. 97 Mbps

in 16 QAM & 30 MHz



now 194 Mbps

in 16 QAM & 30 MHz

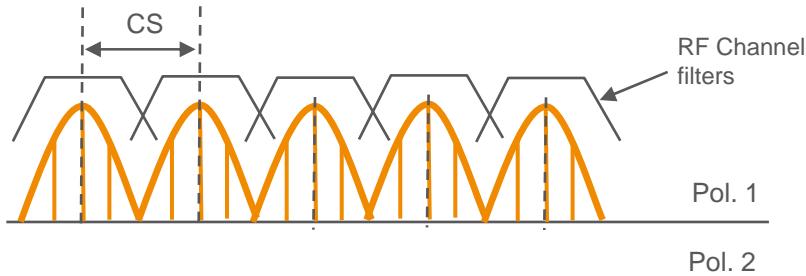
- › Double your capacity in a channel with XPIC, save spectrum and antenna cost

- Available for Ethernet and PDH for 10, 20, 30, 40 and 50 MHz (MMU2 H)
- Available for SONET for 28 MHz (MMU2 F)

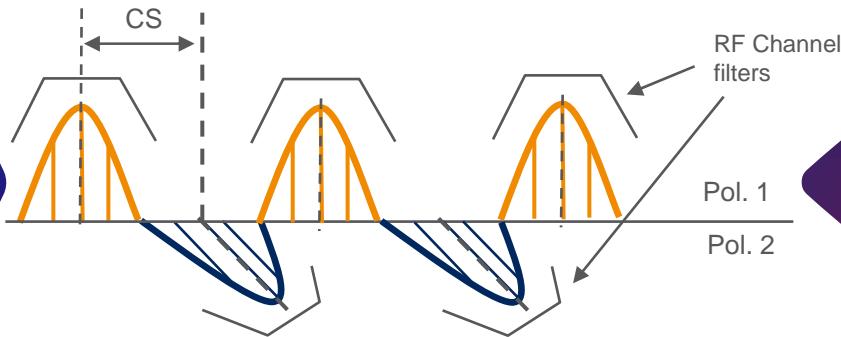
LH

FULL FREEDOM IN CHANNEL ARRANGEMENT HIGHEST TRANSMISSION CAPACITY

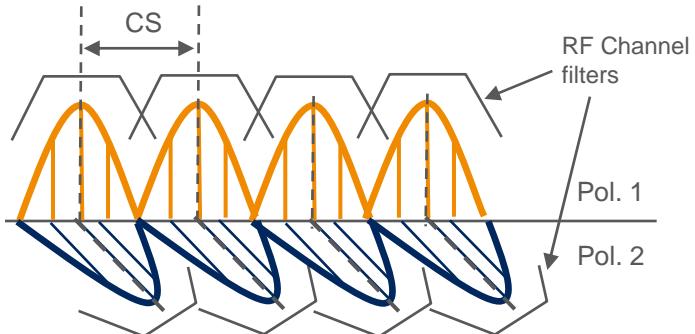
ACCP
Adjacent Channel
Co-polarization



ACAP
Adjacent Channel
Alternate Polarized



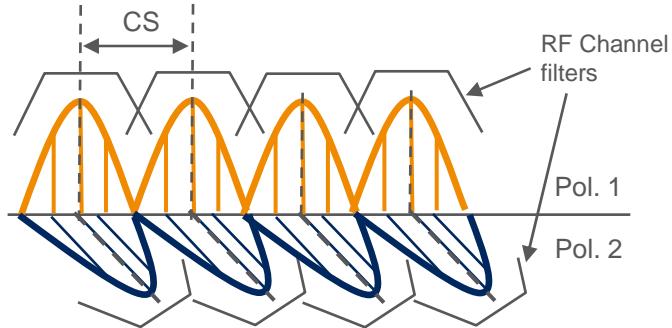
CCDP - with XPIC
Co-Channel
Dual Polarized



Each
immediate
channel
neighbor can
be used –
no limitation !

LH

HIGH ETHERNET TRAFFIC CAPACITY MAX CONFIGURATIONS



CCDP - with XPIC
Co-Channel
Dual Polarized

LH

Capacity at 30 MHz
and 128 QAM

$12 \times 204 \text{ Mbps} = 2.4 \text{ Gbps}^*$

Capacity at 50 MHz
and 512 QAM

$8 \times 420 \text{ Mbps} = 3.4 \text{ Gbps}^*$

*line interface capacity

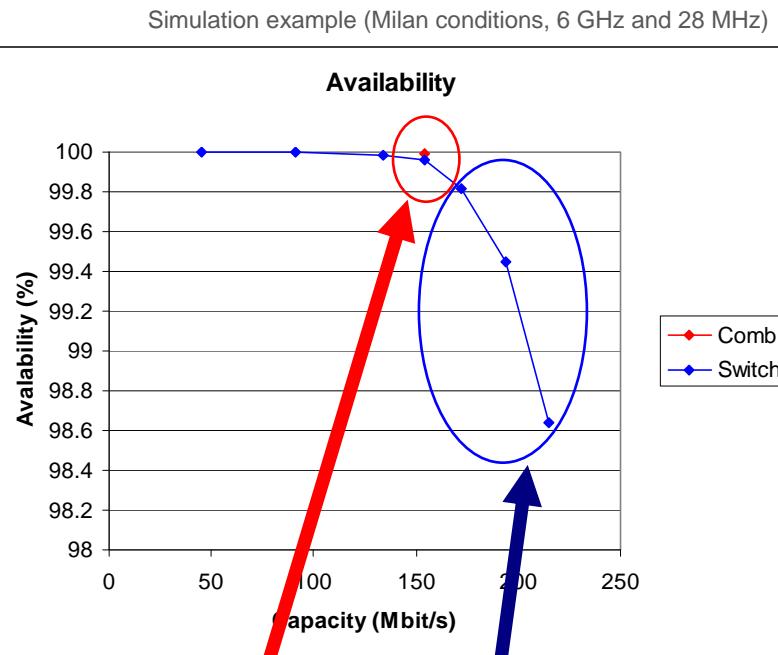
AVAILABILITY - MINI-LINK LH ETHERNET TRUNK VS. SDH/SONET TRUNK

› Ethernet Trunk

- With Adaptive Modulation and diversity switching

› SDH/SONET Trunk

- With diversity combiner and fixed modulation (128 QAM)



- Availability at 128 QAM is somewhat higher for SDH/SONET Trunk
- Ethernet Trunk has higher modulation than 128 QAM most of the time
 - › Enabling higher capacity throughput

LH

Ethernet Trunk has 30% higher average bit rate

CARRIER GRADE RADIO LINK

TN

- › Combine XPIC, Adaptive Modulation and Radio Link Bonding
 - Use your spectrum efficiently
 - Secure highest possible traffic capacity
 - Maximize traffic throughput in available frequency channels

LH

4.4

MINI-LINK ETHERNET TRAFFIC HANDLING

- › ETHERNET SWITCHING
- › ETHERNET QOS
- › MEF & EANTC
- › ETHERNET OAM

MINI-LINK ETHERNET SWITCHING

- › Q BRIDGE
- › PROVIDER BRIDGE
- › L1 RADIO LINK BONDING
- › GRACEFUL DEGRADATION
- › PROTECTED 2+0
- › LAG
- › JUMBO FRAMES

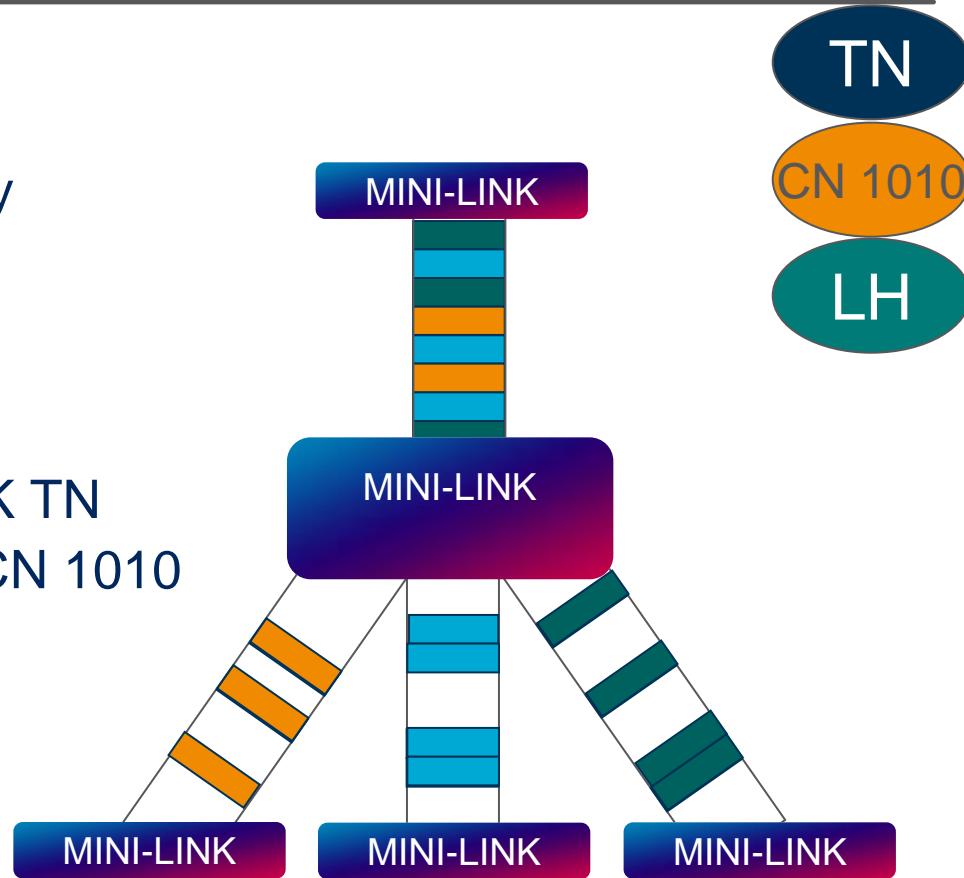
INTEGRATED ETHERNET SWITCH

Q BRIDGE

- › VLAN functionality, Q-bridge
 - Non blocking switching capacity

- › Aggregate Ethernet traffic
 - According to priority
 - 8 levels of priority for MINI-LINK TN
 - 8 priority levels for MINI-LINK CN 1010

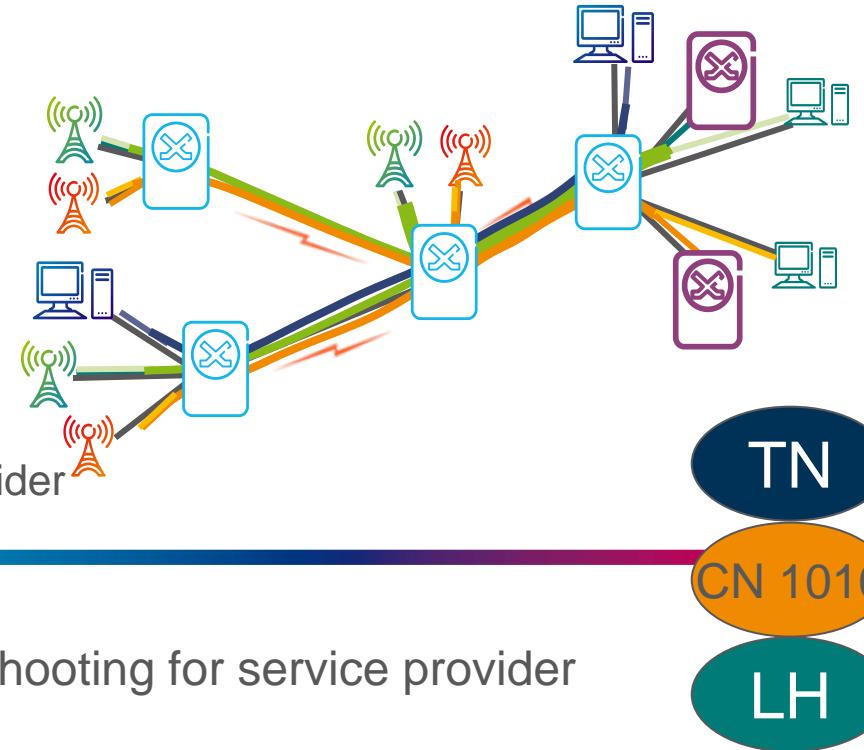
- › Substantial capacity savings
 - Let the initial revenue pay for future northbound upgrades



INTEGRATED PROVIDER BRIDGE

Provider bridge

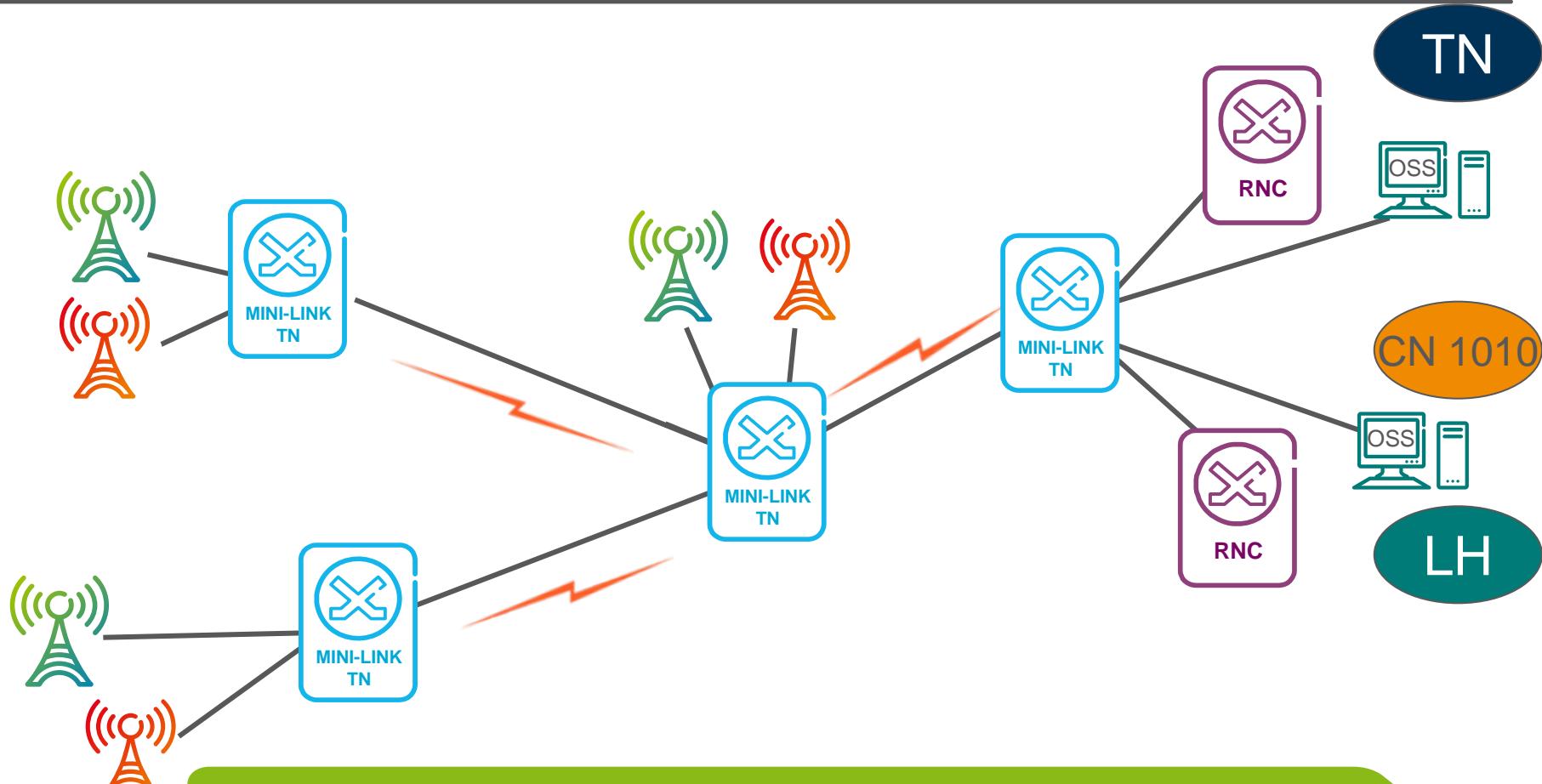
- › IEEE 802.1ad-2005
- › A Service provider configures one Service VLAN for a customer
 - Customers can run their own C-VLANs inside the VLAN provided by a service provider



- › Reduced OPEX for configuration/ troubleshooting for service provider (fewer VLANs)
- › Freedom for customer to use whatever priority and own VLAN id's he chooses – transparency
- › Secure way to separate customer traffic
 - Supports shared mobile backhaul networks as well as converged networks

PROVIDER BRIDGE

NETWORK EXAMPLE - 1 - WITHOUT PROVIDER BRIDGE

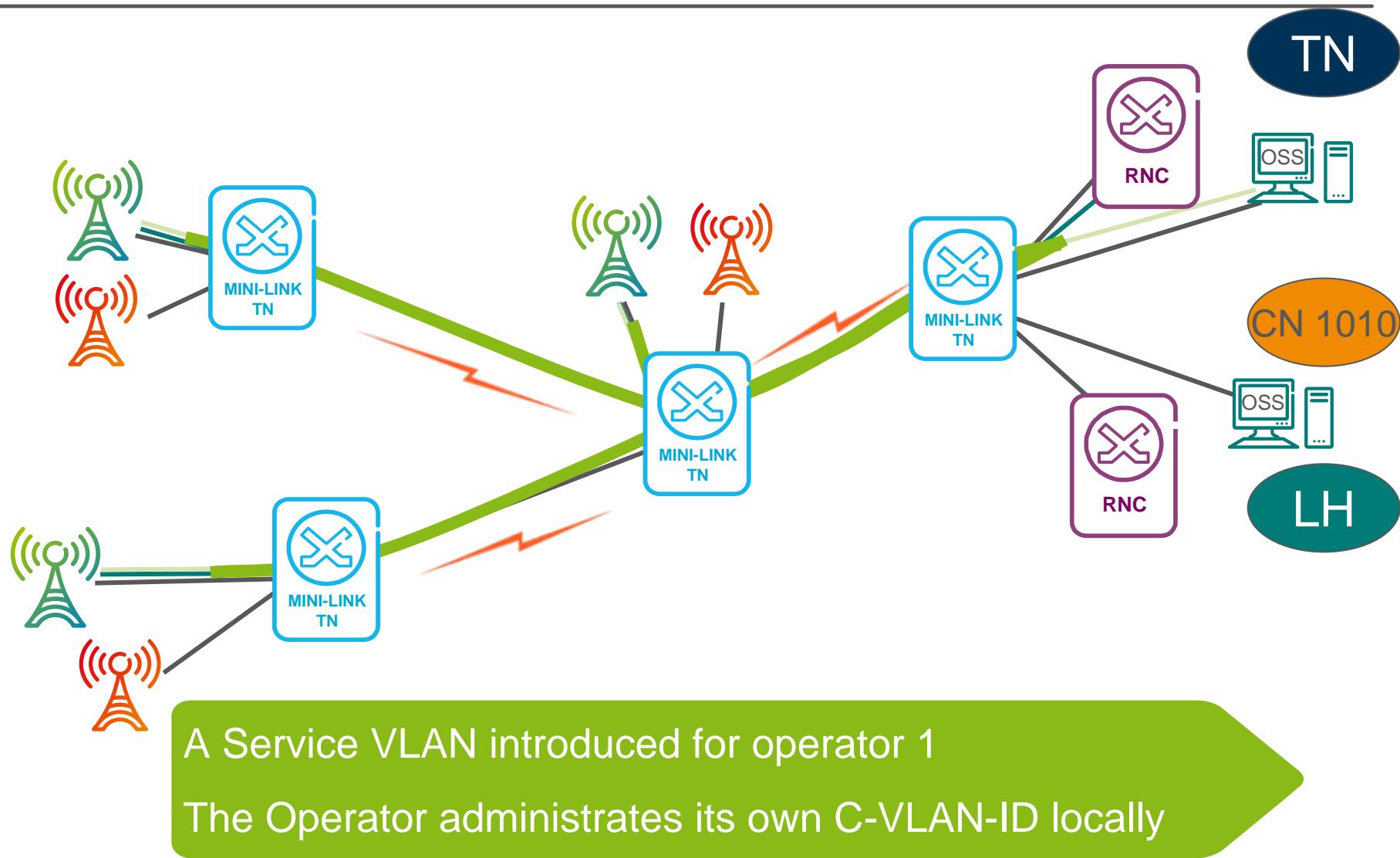


Two operators share sites and transport network

Their Customer VLAN-ID schemes need to be coordinated

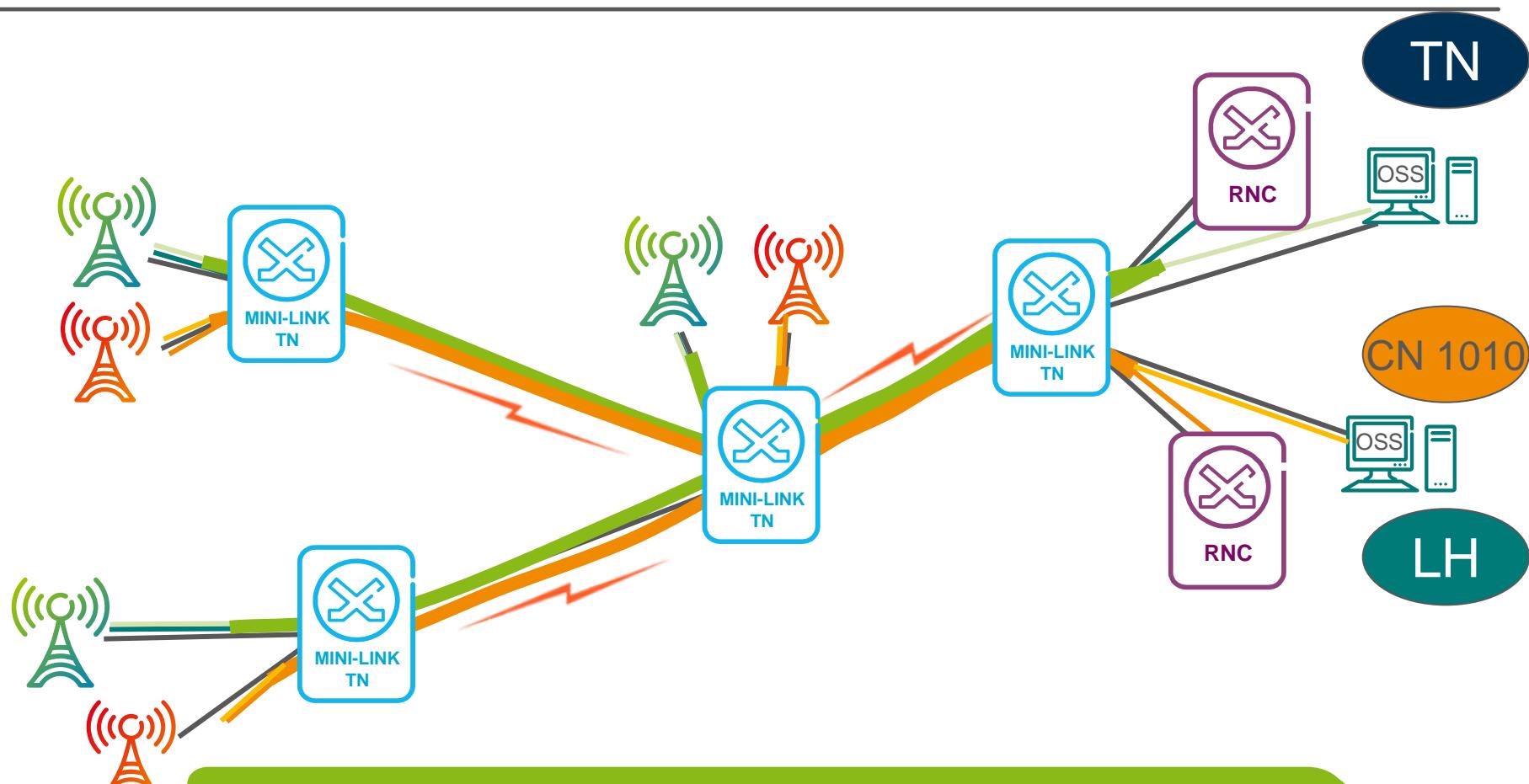
PROVIDER BRIDGE

NETWORK EXAMPLE – 2 – USING PROVIDER BRIDGE



PROVIDER BRIDGE

NETWORK EXAMPLE 2 – CONTINUED

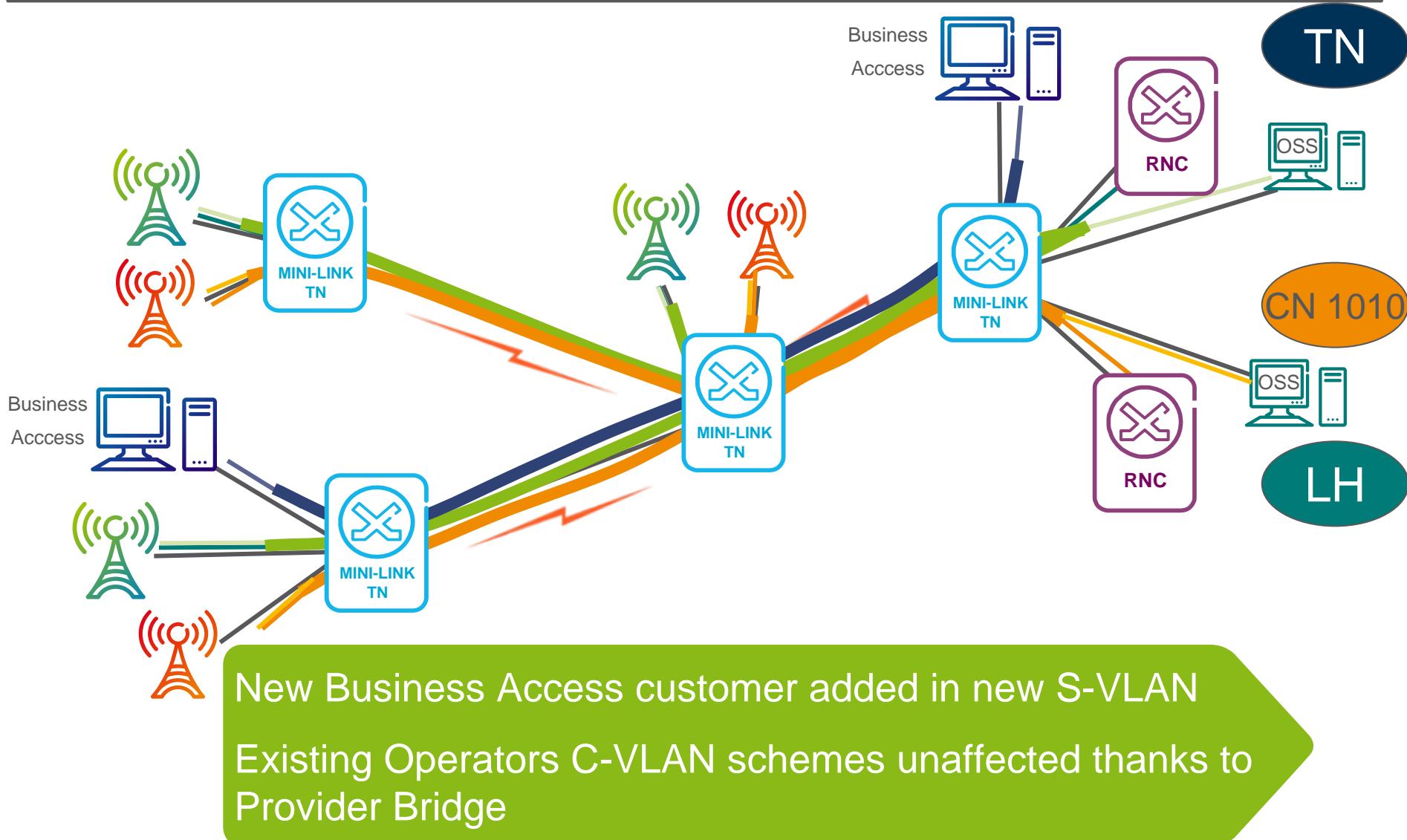


A Second S-VLAN introduced for operator 2

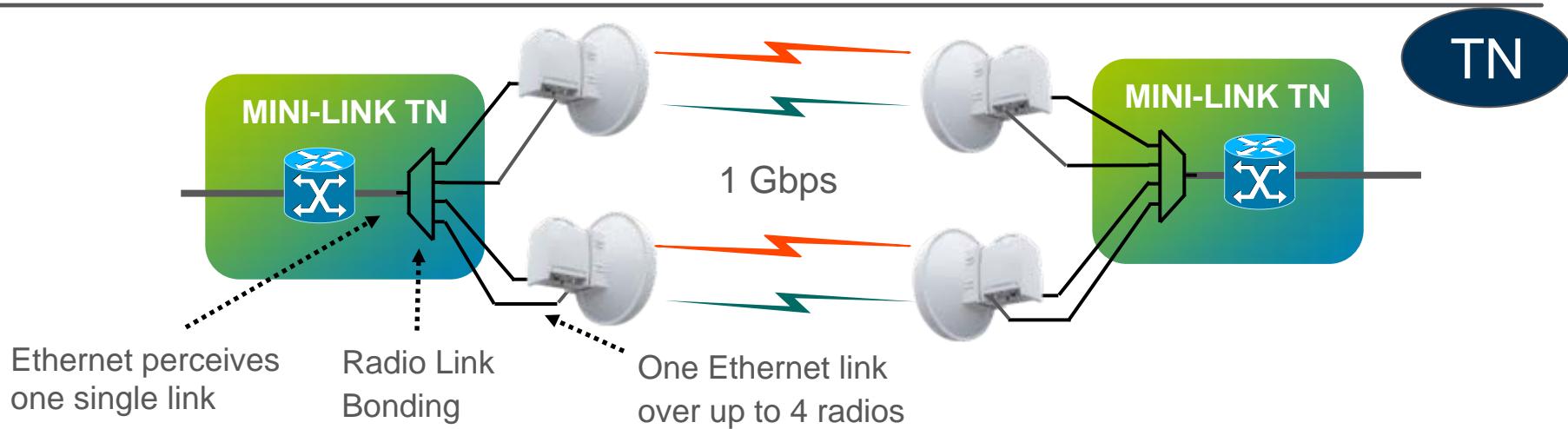
Both operators administrate their own C-VLAN-ID locally

PROVIDER BRIDGE

NETWORK EXAMPLE – 2 - CONTINUED



L1 RADIO LINK BONDING



- › Unique Radio Link Bonding
 - Perceived by Ethernet as one single GE link, over up to 4 radios
- › Advantages of L1 bonding, as compared to traditional L2 (& L3) LAG:
 - Always full throughput, full load balancing and full aggregation gain
 - Supports use of adaptive modulation
- › Up to 1 Gbps Ethernet traffic over the link
- › Graceful degradation at loss of one radio
 - Capacity just decreases, without traffic interruption

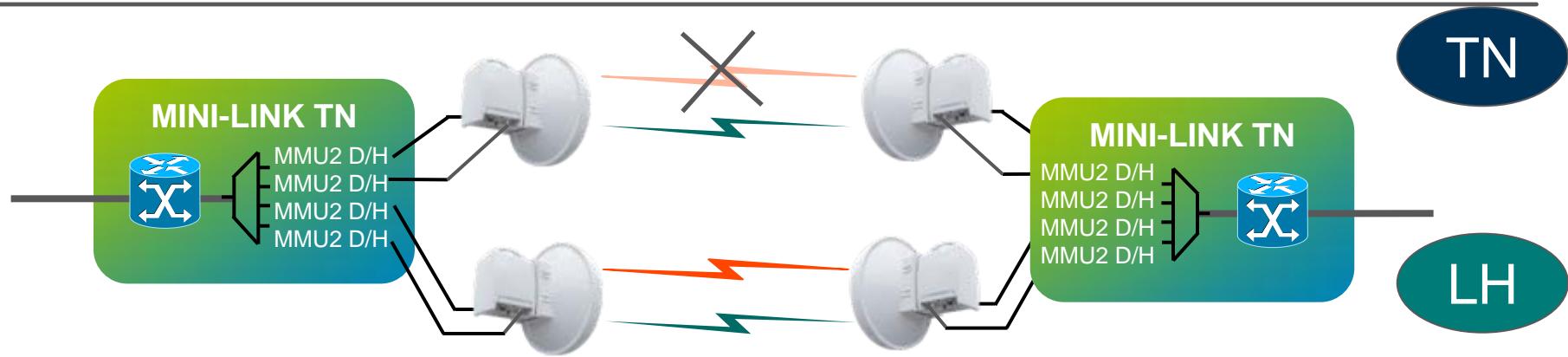
L1 RADIO LINK BONDING



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LH

GRACEFUL DEGRADATION

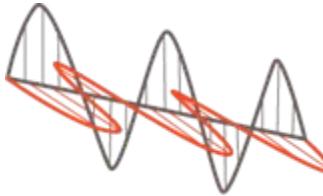


- › Ethernet traffic is sent over multiple radios
- › If one Ethernet stream is lost the Ethernet traffic continues
 - Priority traffic redirected to work stream
 - No traffic interruption
 - Capacity decreases

BOOSTING CAPACITY ON EXISTING LINKS PROTECTED 2+0



Ethernet and PDH



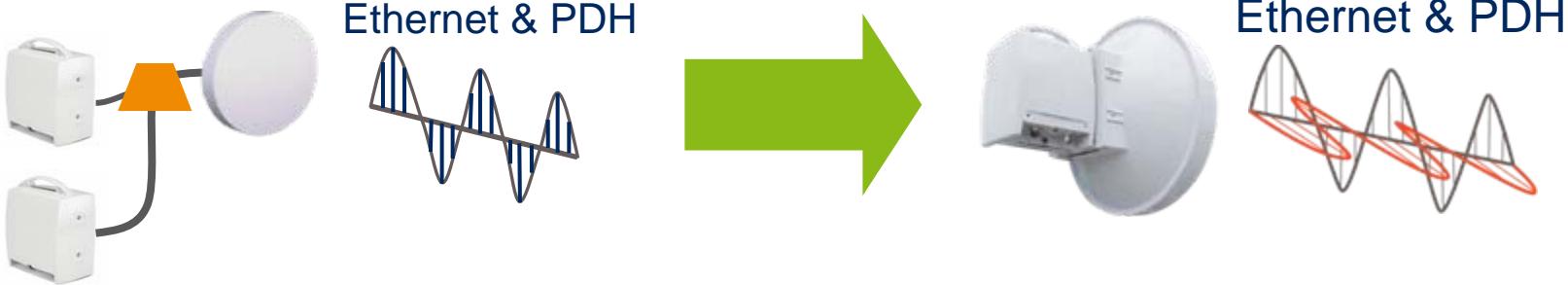
TN

- › Change redundant 1+1 into 2+0 using CCDP/XPIC
 - End-to-end hybrid support for hitless protection of priority traffic
 - › On both TDM and Ethernet Traffic
 - Unchanged spectrum and bandwidth
- › Get up to 3 times additional capacity out of your existing hop
 - Activating redundant equipment
 - Higher order modulation due to increased system gain

ETHERNET MAKES MICROWAVE MORE EFFICIENT

BOOSTING CAPACITY ON EXISTING LINKS

PROTECTED 2+0

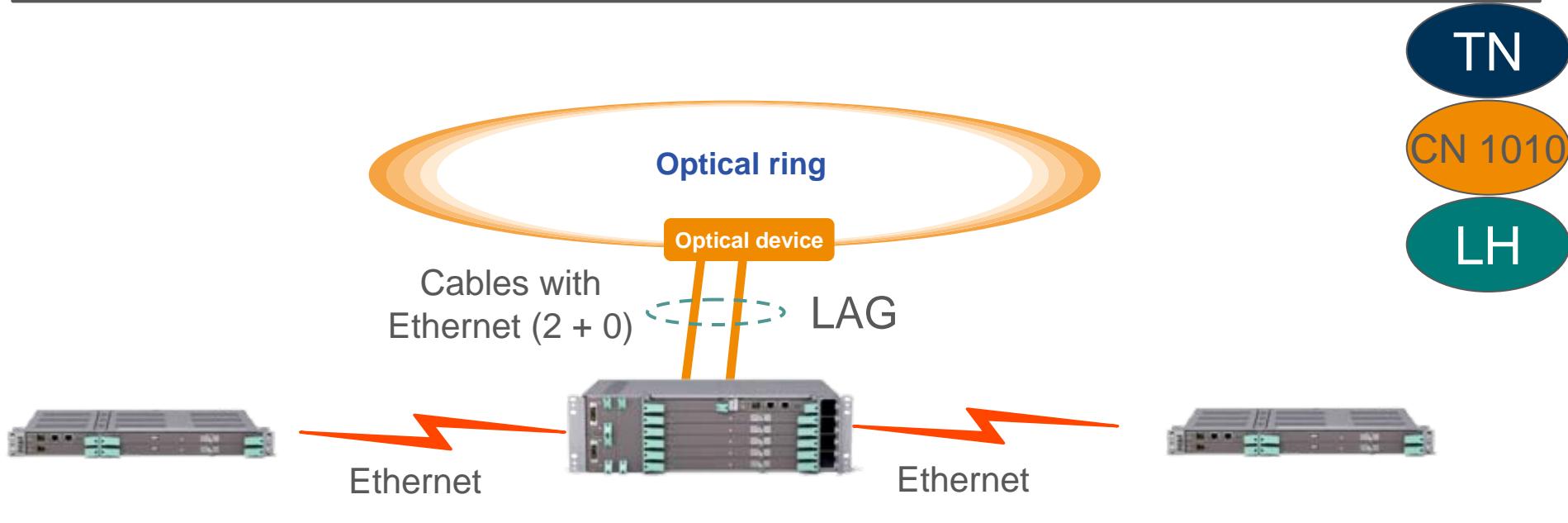


TN

- › Add up to 100% best effort traffic
 - By utilizing redundant equipment
- › Add up to 100% priority + 100% best effort traffic
 - Upgrade to an Integrated Dual Polarized Antenna
 - This Improves system gain by of up to 7-10 dB
 - Step up modulation and get higher capacity with retained availability

GET UP TO 3 TIMES ADDITIONAL CAPACITY

ETHERNET LINE PROTECTION



› Link Aggregation Group - LAG

- LAG allows multiple Ethernet interfaces in to MINI-LINK to be joined in a group
- Graceful degradation

JUMBO FRAMES

- › Jumbo Frames
 - 9 Kbyte frame
 - Optimization of Database traffic – Jumbo Frames minimizes overhead for certain traffic type by supporting Ethernet packets with size up to 9 Kbytes.



MINI-LINK ETHERNET QOS

- › COS CLASSIFICATION
- › TAGGING
- › STRICT PRIORITY QUEUING
- › WEIGHTED FAIR QUEUING, WFQ
- › POLICING
- › COLOR AWARENESS
- › AGING
- › WEIGHTED RANDOM EARLY DETECTION (WRED)
- › SHAPING
- › ORDER OF EXECUTION

ETHERNET QUALITY OF SERVICE

- › Strict Priority Queuing
 - Tail dropping
- › CoS Classification
 - Ethernet, IP and MPLS
- › Tagging
- › Weighted Fair Queuing, WFQ
- › Policing
- › Extra Queue dropping:
 - Color dropping
 - Aging
 - Weighted Random Early Detection (WRED)
- › Shaping



-available in
MINI-LINK TN,
MINI-LINK CN 1010 &
MINI-LINK LH

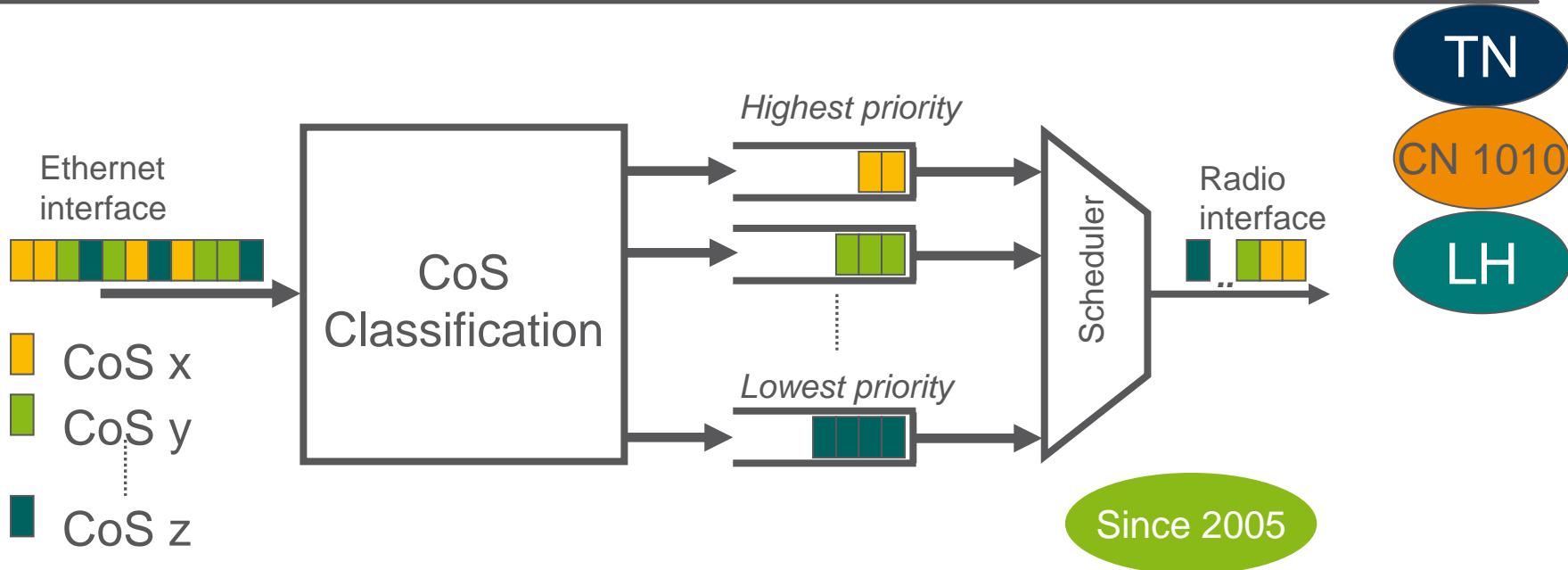


-available in
MINI-LINK CN 1010



PRIORITY QUEUING

ETHERNET QUALITY OF SERVICE, AVAILABLE SINCE 2005



- › 8 different priority queues available
 - Utilizing 3 bit value of PCP, easy and future proof
 - Important for HSPA and LTE backhaul and networks shared by several operators
 - Flexible mapping to queues



COS CLASSIFICATION AND TAGGING

ETHERNET QUALITY OF SERVICE

› The CoS Classification

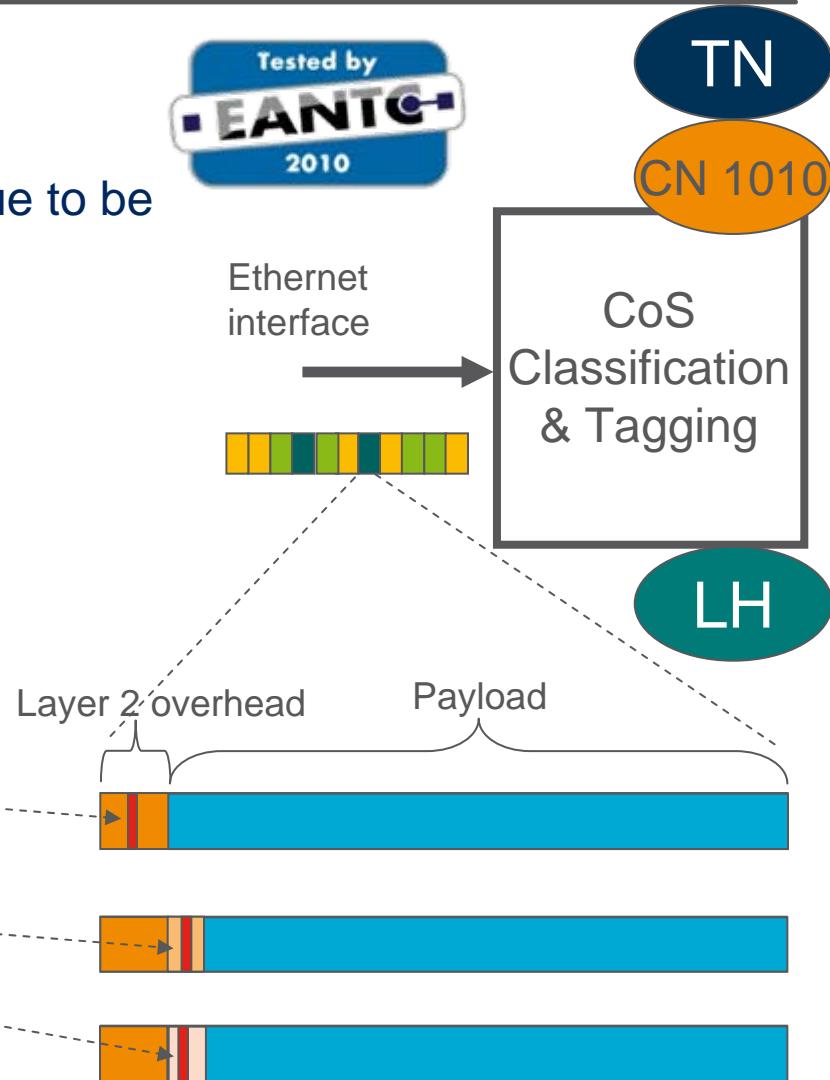
- Defines at the incoming port (UNI) the value to be used for priority through out the network

› Tagging of frame

- Stores the value as the PCP value in the Q-tag

› The CoS Classification can be based upon

- PCP value in Q tag
- Default value based on port
- DSCP value in IP header
- Exp value in MPLS header



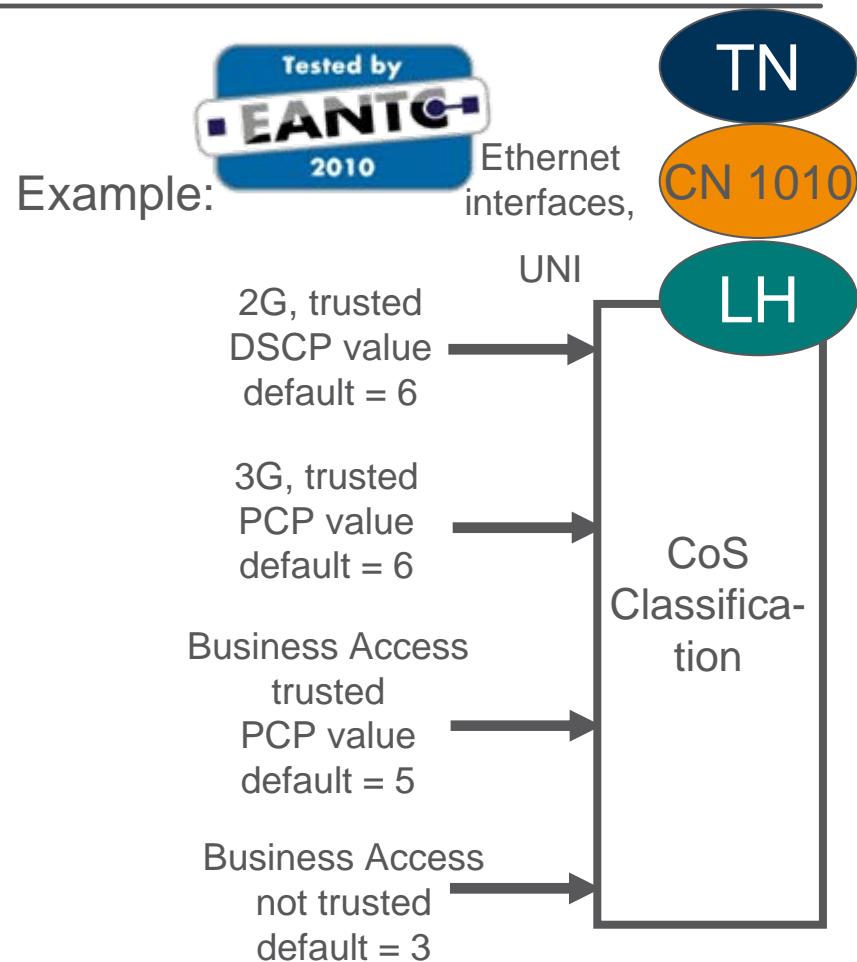
COS CLASSIFICATION AND TAGGING

ETHERNET QUALITY OF SERVICE

- › If a port (UNI) can be “Trusted”
 - Define which of priority values to use as input
 - Store the available value as PCP value
 - A trusted value can be translated through a table to a different value
 - If no available value use default value for port

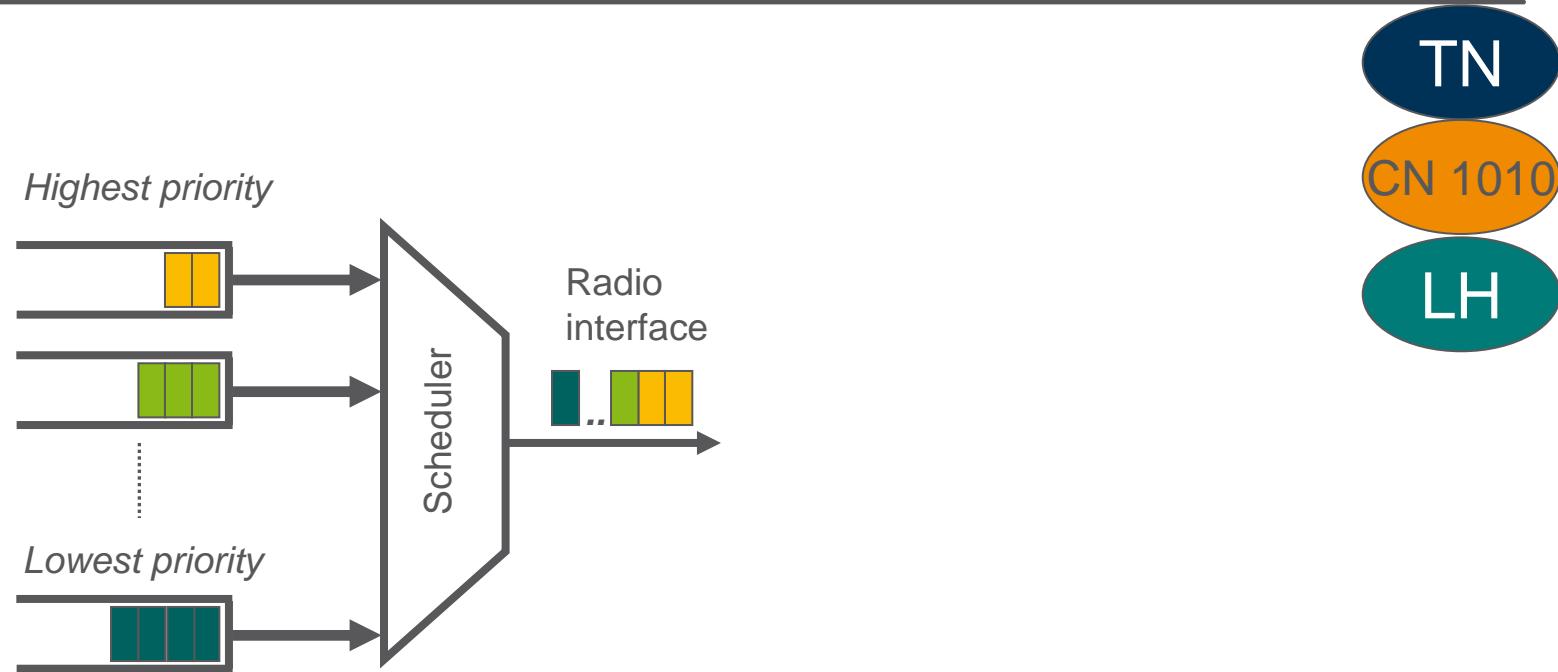
- › If a port (UNI) can not be “Trusted”
 - use default value for port

- › Normally the PCP value in the Q-tag is trusted and used
 - The other values are available for the exception when PCP is not available or trusted



STRICT PRIORITY QUEUING

PRIORITY GUARANTEE

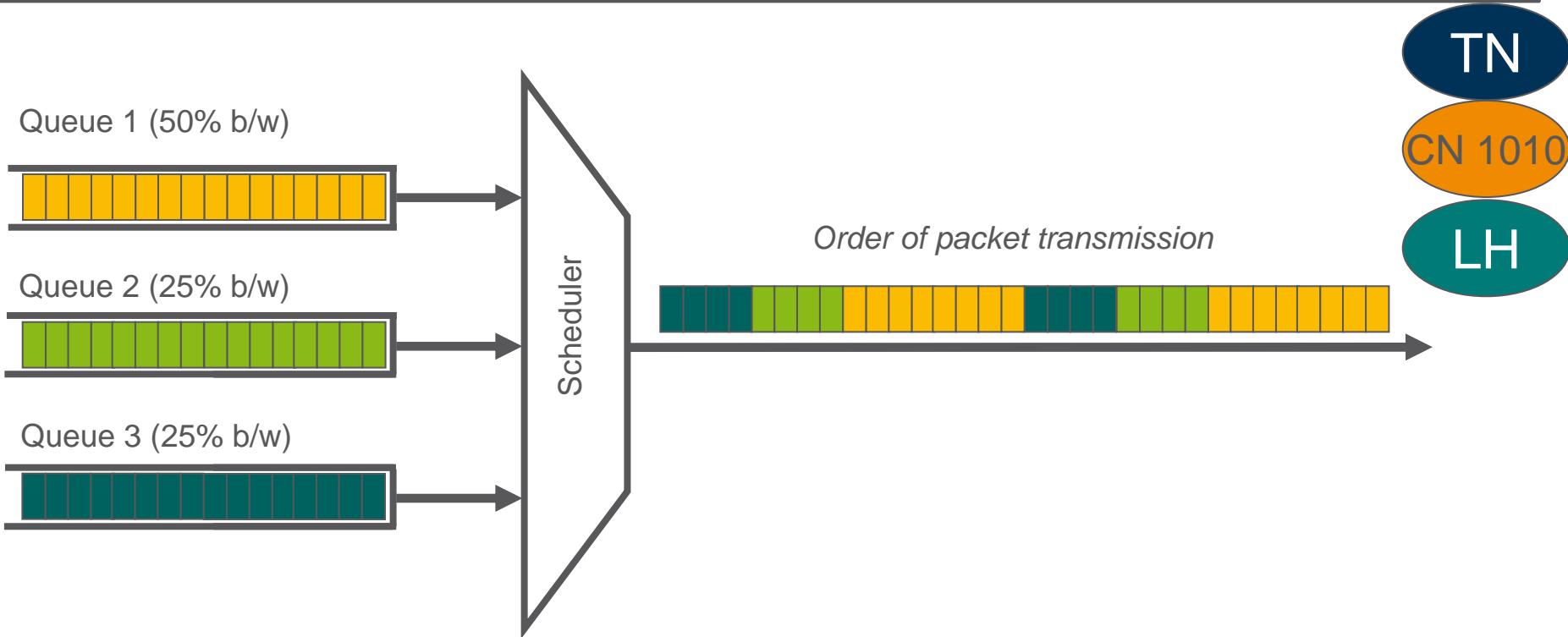


- › Always schedules highest priority queue first until empty
- › Then moves to next queue with lower priority
- › Ensures highest priority for critical traffic



WEIGHTED FAIR QUEUING, WFQ

QUEUE FAIRNESS

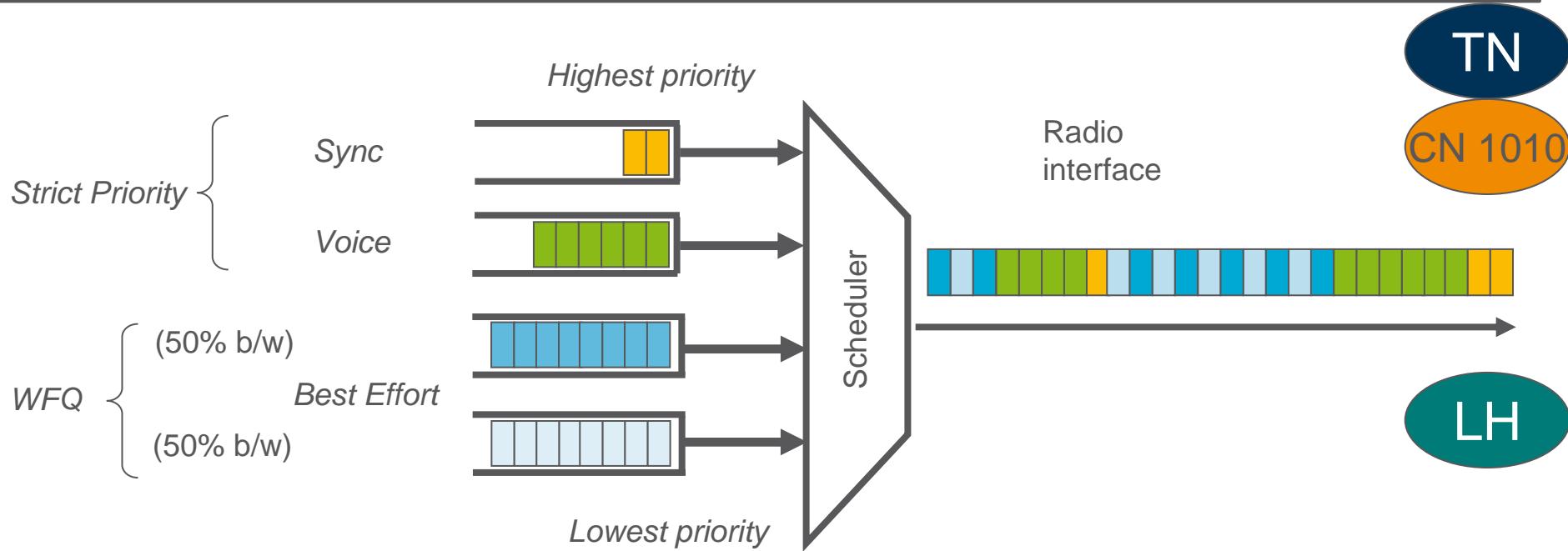


- › WFQ provides a share of bandwidth for each queue
 - Weight can be configured
 - Enables a faire share of the bandwidth
- › WFQ prevents queue starvation



COMBINING WFQ AND STRICT PRIORITY

GUARANTEED PRIORITY AND FAIRNESS

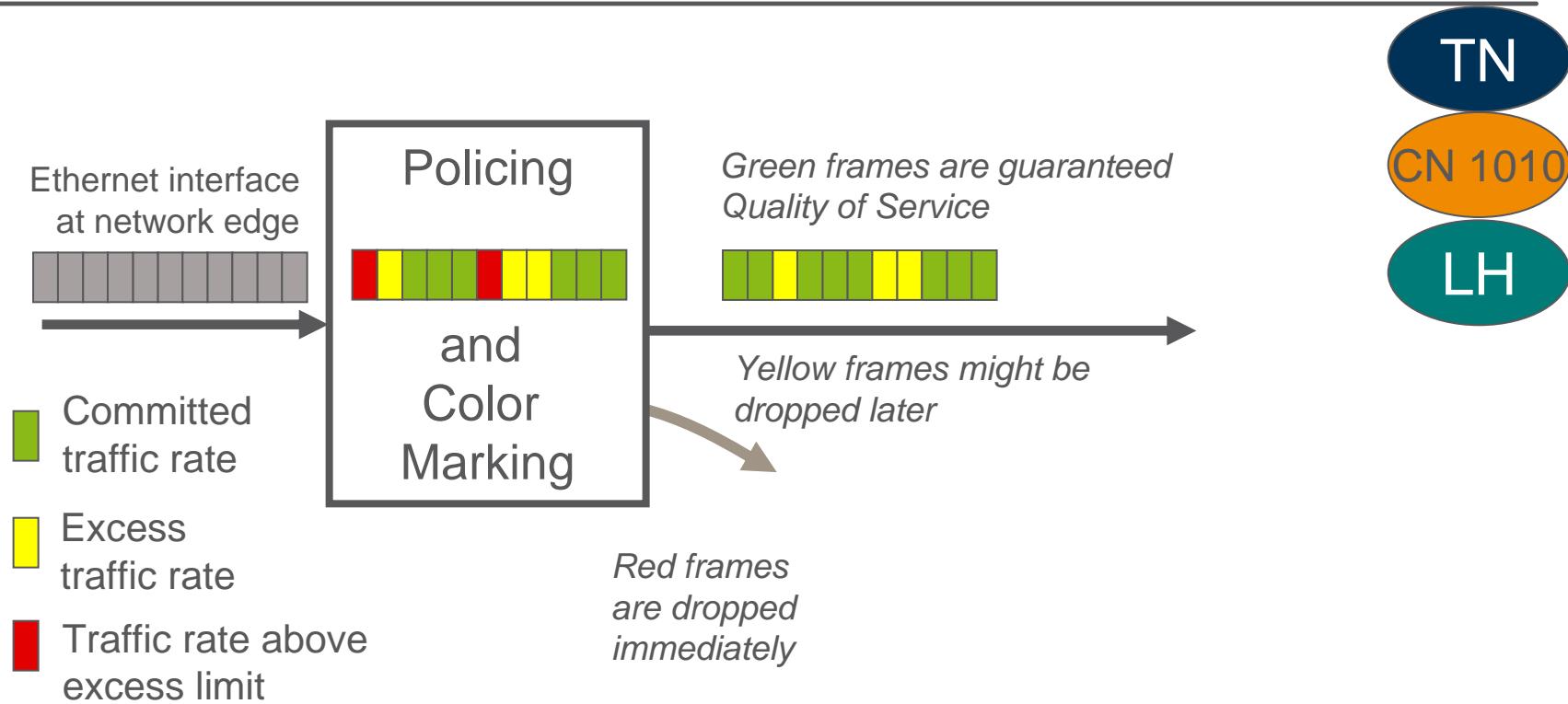


- › Combining WFQ and Strict priority can give both guaranteed priority and fairness
 - A site with both 3G and LTE gives fairness between LTE Best effort and 3G Best effort traffic
 - A site with 2 IP RAN operators gives fairness between their best effort traffic



POLICING

OVERLOAD PREVENTION

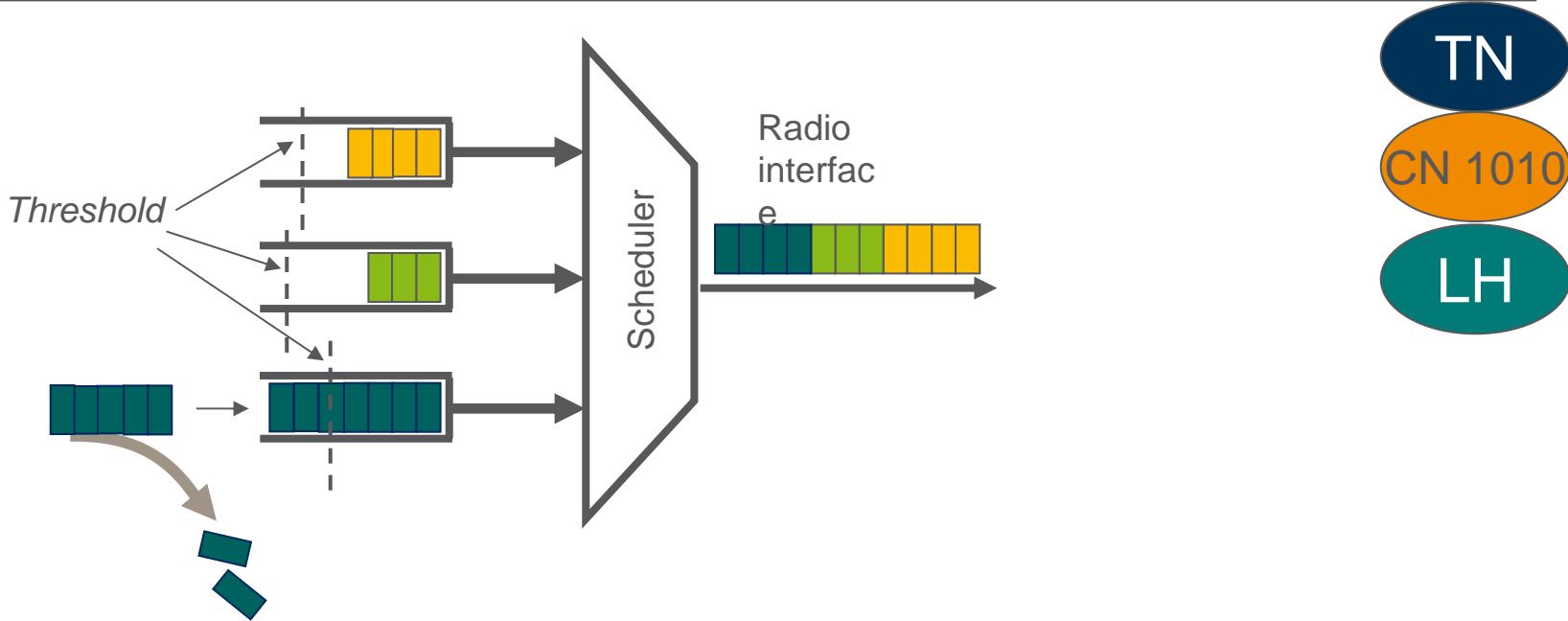


- › Control the traffic in your network at entrance to the network
- › Prevent network overload caused by improper user behavior



WEIGHTED RANDOM EARLY DETECTION

MAXIMIZED THROUGHPUT WITH TCP OSCILLATION PREVENTION

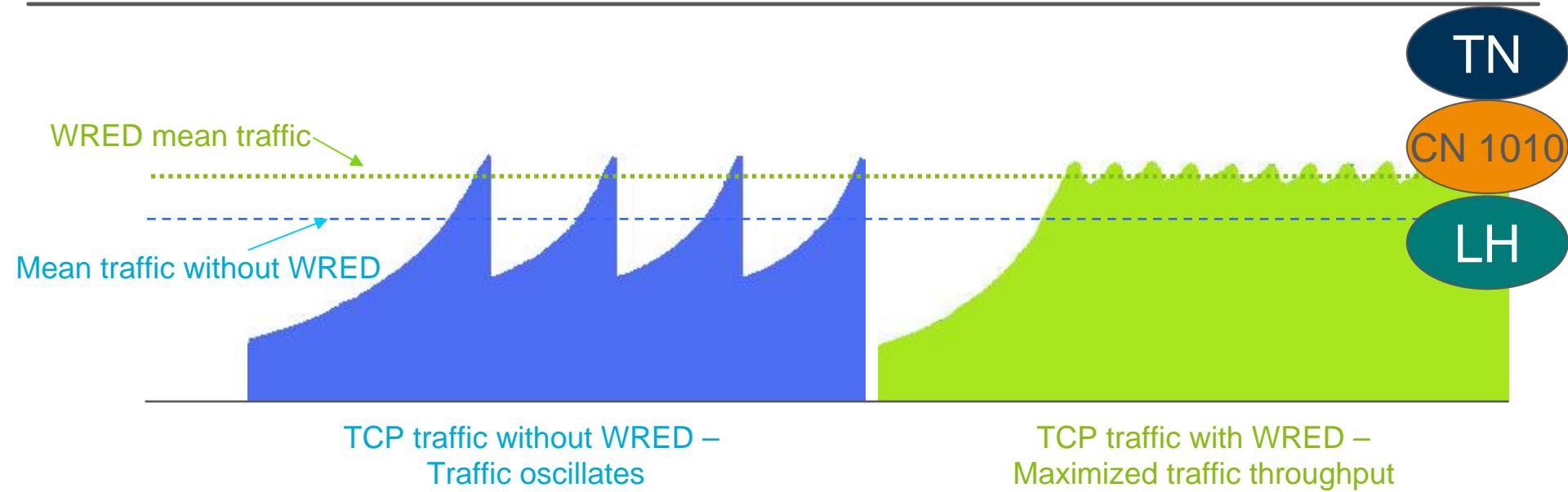


WRED, Weighted Random Early Detection

- › Monitors the load and triggers dropping of frames in a controlled manner when a predefined threshold is met (e.g. 80% of allocated buffer)
- › WRED works on each queue independently and starts dropping packets when the queue reaches the threshold.
- › Different thresholds possible for different queue buffers
- › In color-aware mode different threshold levels can be set for different packet colors

WEIGHTED RANDOM EARLY DETECTION

MAXIMIZED THROUGHPUT WITH TCP OSCILLATION PREVENTION



WRED, Weighted Random Early Detection

- › Prevents TCP traffic to oscillate
- › Handles congestion situations with minimal impact on the different traffic flows
- › Maximizes traffic throughput

QUEUE DROPPING

ETHERNET QUALITY OF SERVICE

- › Tail dropping
 - When a queue is full,
new incoming packets are dropped

- › Aging
 - Drop packets that have been stored
in the queue buffer for too long
 - They are too old for being delivered
with a purpose.

-available in MINI-LINK TN
MINI-LINK CN 1010 &
MINI-LINK LH



QUEUE DROPPING COLOR AWARENESS

› Color Dropping

- Frames are dropped based on color marking

 Committed traffic rate
 Excess traffic rate



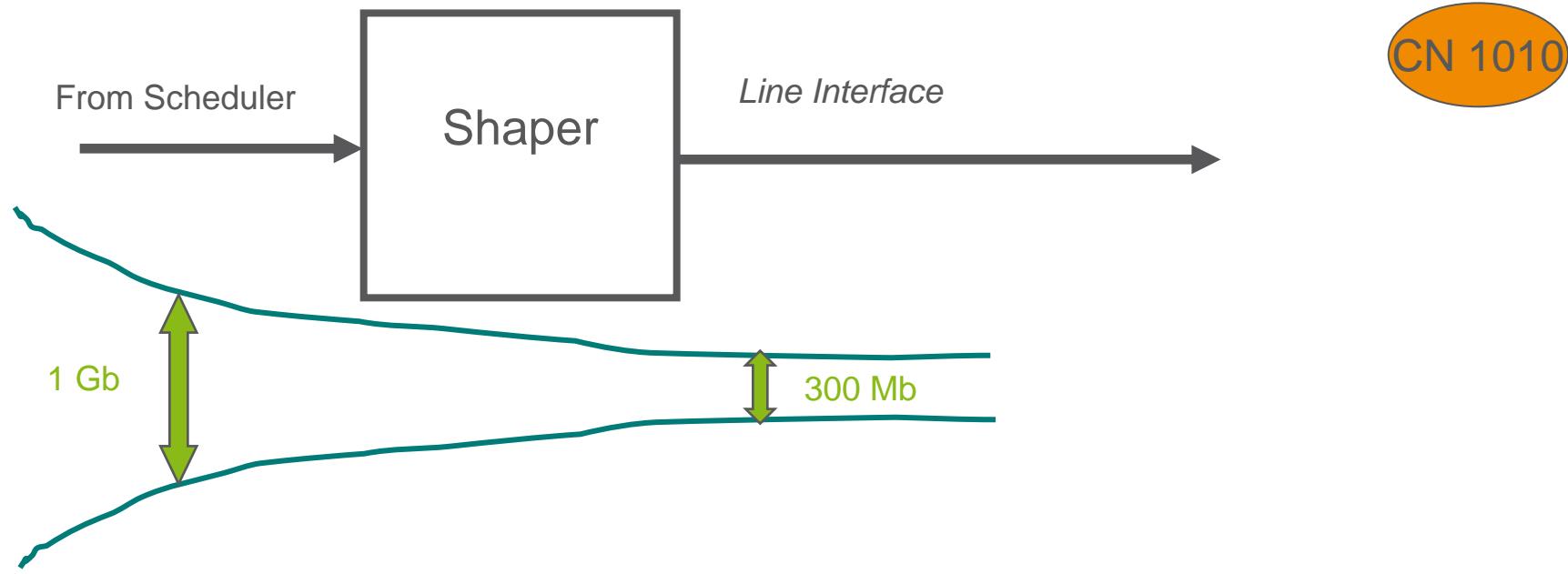
› Color awareness in WRED

- In color-aware mode different threshold levels can be set in the WRED function for different color marking
- I.e yellow frames starts to drop at 70% of allocated buffer, green frames at 80%



SHAPER

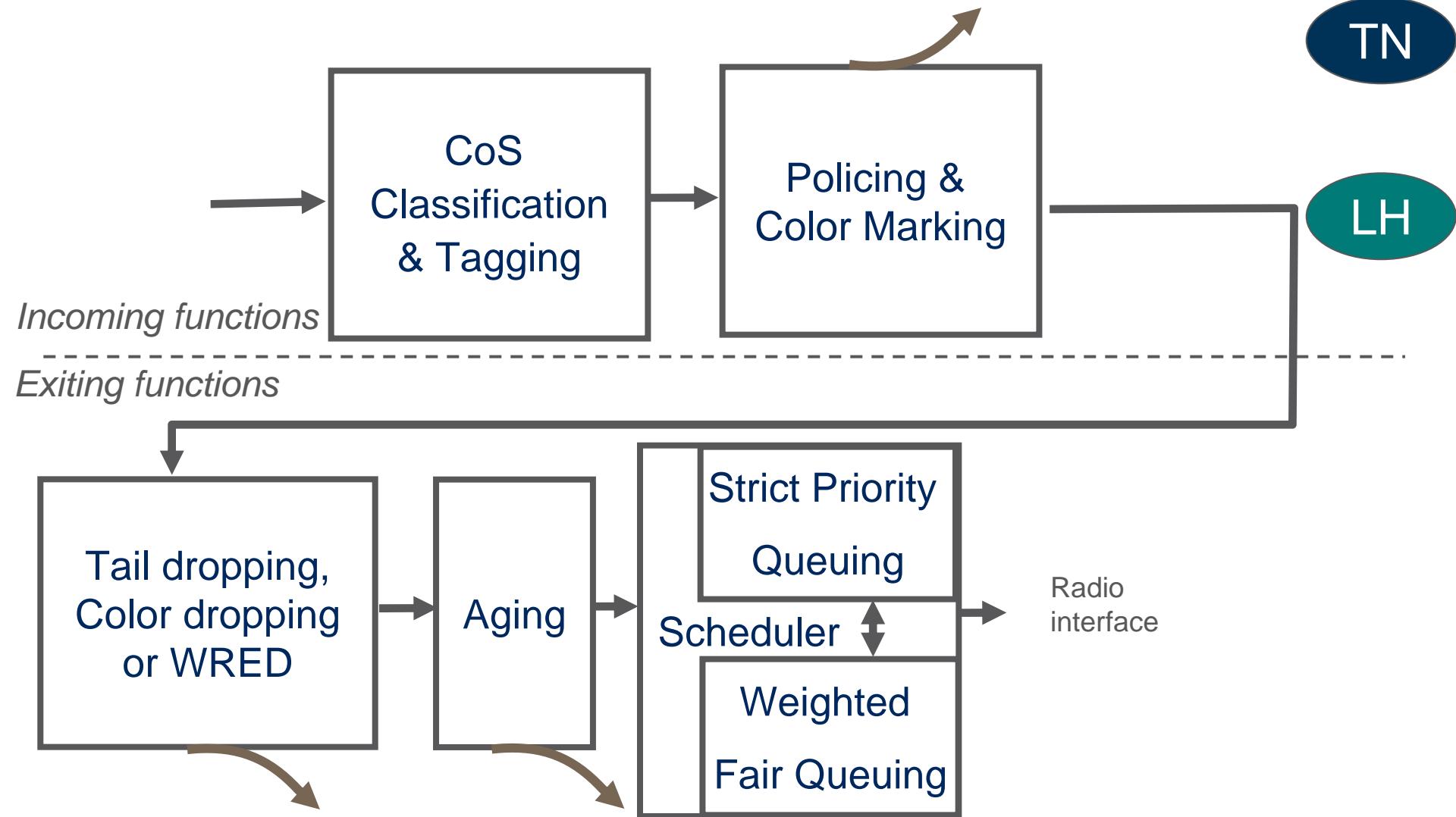
NETWORK OVERLOAD PREVENTION



- › Adapts traffic bandwidth sent into a network to desired capacity, the shaping is achieved by delaying packets.
- › Prevent traffic congestion in for example a leased line without QoS support

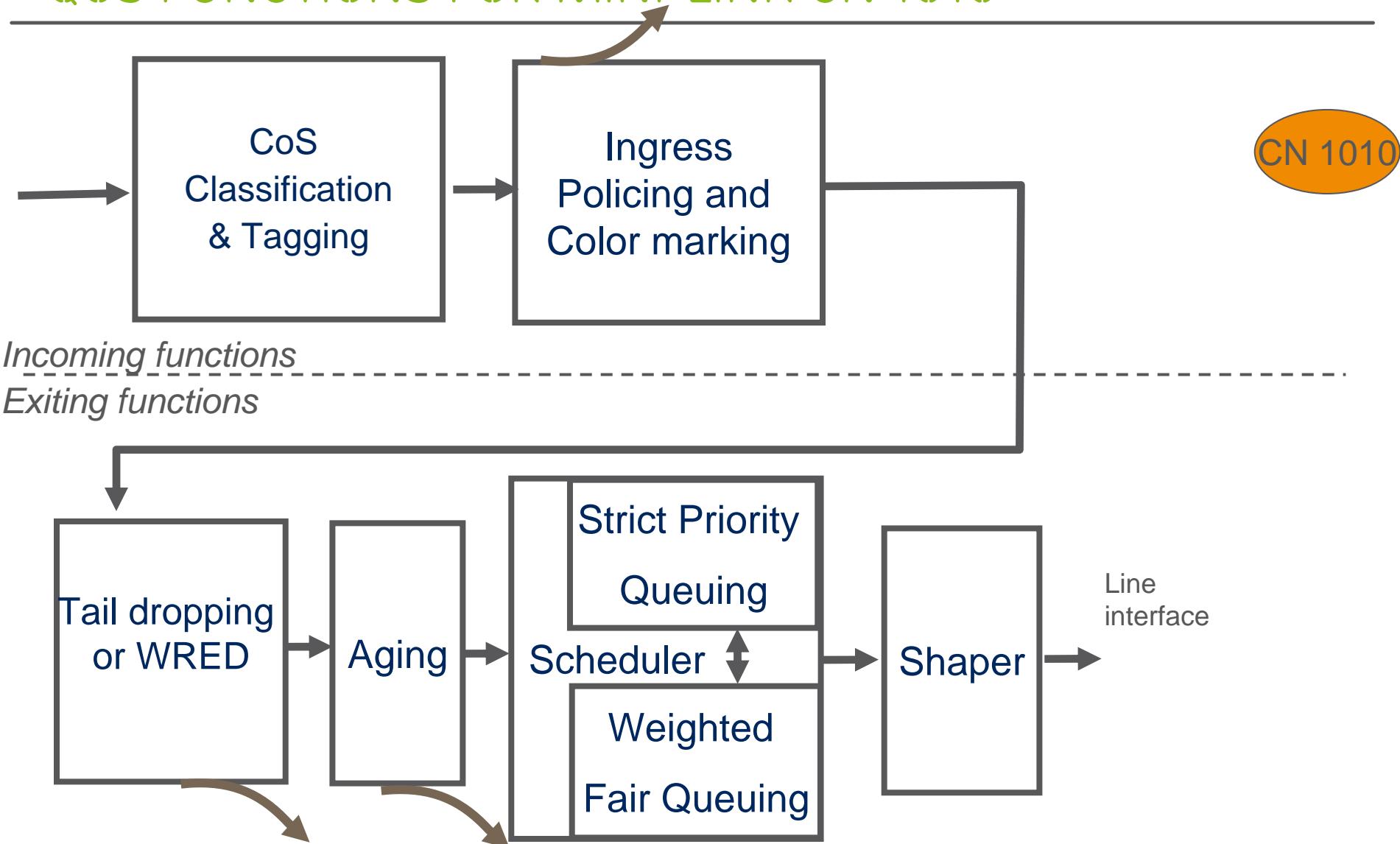
ORDER OF EXECUTION

QOS FUNCTIONS FOR MINI-LINK TN & MINI-LINK LH



ORDER OF EXECUTION

QOS FUNCTIONS FOR MINI-LINK CN 1010



ETHERNET PROTECTION & SECURITY

- › RSTP - Rapid Spanning Tree Protocol
 - Activates redundant link in case of link failure and protects the network from infinite loops.
 - Switch time < 50 ms/node
- › MSTP- Multiple Spanning Tree Protocol
 - Multiple RSTP's available for multiple VLAN's
- › Head of Line blocking prevention, HOLB
 - avoid congested ports blocking traffic to non congested ports
- › Storm protection
 - Filters in the switch prevents broadcast and multicast storms
- › White lists
 - Support for MAC/VLAN based white list for access control
- › LAG, Link Aggregation
- › Ethernet Ring Protection (ITU-T G.8032)
 - Switch time < 50 ms/network path
- › Graceful degradation

-available in
MINI-LINK TN,
MINI-LINK CN 1010 &
MINI-LINK LH

-available in
MINI-LINK CN 1010

-available in
MINI-LINK TN &
MINI-LINK LH



MINI-LINK MEF & EANTC

- › MEF SERVICES
- › EANTC

ETHERNET SERVICES – MEF CERTIFIED

› E-LINE

- MINI-LINK TN
- MINI-LINK CN 1010
- MINI-LINK LH



› E-LAN

- MINI-LINK TN
- MINI-LINK CN 1010
- MINI-LINK LH

› E-TREE

- MINI-LINK TN static E-TREE via Egress port blocking



EANTC'S CARRIER ETHERNET INTEROPERABILITY TESTS

- › Ericsson participation in EANTC's Carrier Ethernet interoperability test, Berlin Aug 2010, successfully shows:
 - Ericsson microwave products are recognized as best in class for latency and packet loss measurements during high congestion scenarios.



MINI-LINK ETHERNET OAM



ETHERNET OAM

- › Ethernet Link OAM -
Improved fault management on Ethernet links,
with monitoring, fault notification and loopback test
 - support for IEEE 802.3 ah

- › Ethernet Service OAM -
Support for improved fault and performance
management on Ethernet Services
 - FM according to IEEE 802.1 ag
 - PM according to

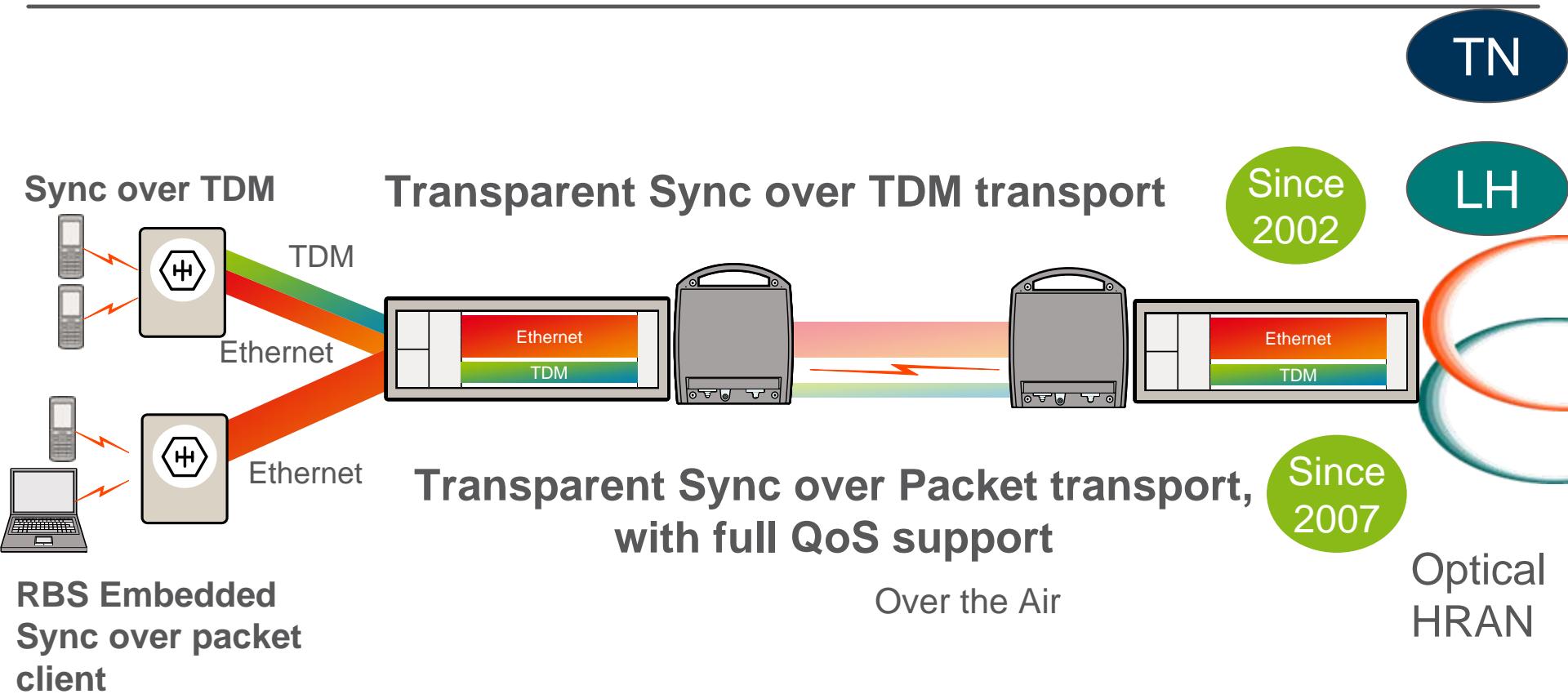


MINI-LINK NETWORK SYNC



TRANSPARENT SYNC TRANSPORT

SUPPORTED BY MINI-LINK TODAY



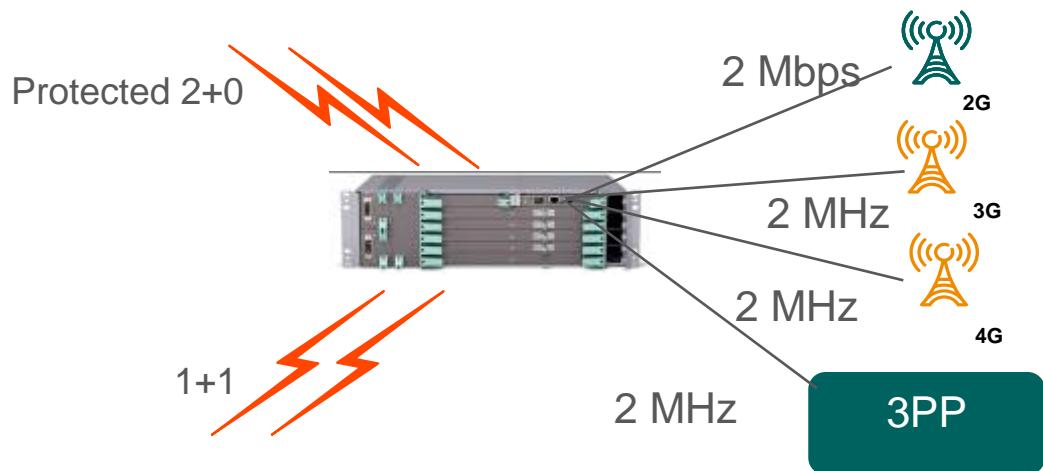
- › Transparent sync transport available today for both TDM and packet networks

MULTIPLE SYNC OUTPUT AVAILABLE

- › MHz Sync output over multiple DS1's
 - NPU3 & NPU3 B: 4 possible 2 MHz outputs
 - NPU1 BA & NPU1 C: 8 possible 2 MHz outputs
 - Can be combined with standard DS1 traffic with 2 Mbps sync

TN

LH



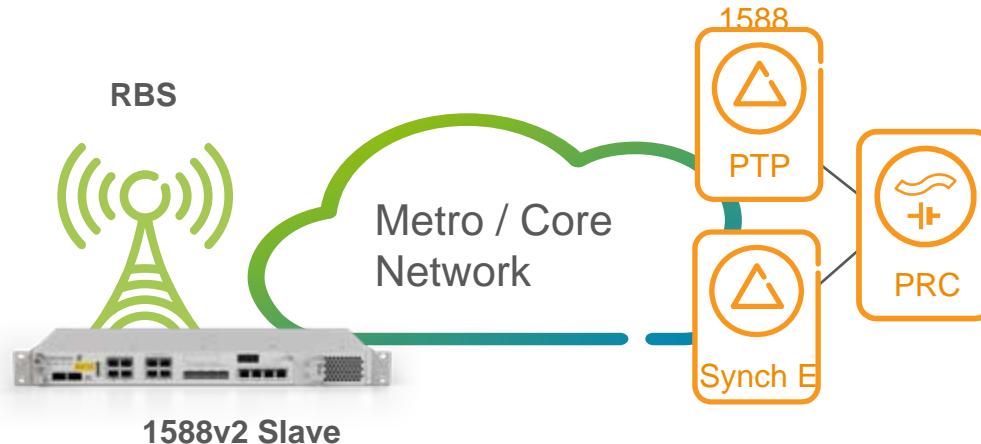
SEPARATE 2 MHZ SYNC AVAILABLE FOR
SEVERAL DIFFERENT RBS'S AND 3PP

MINI-LINK CN 1010 SYNCHRONIZATION SOLUTIONS

›Flexible Synchronization solutions:

- IEEE 1588v2 client
- Synchronous Ethernet (SyncE)
- 2 MHz clock in & out (RJ-45)
- 1 pps clock (GPS), Time Of Day - TOD (RJ-45)

CN 1010



MINI-LINK

TECHNICAL OVERVIEW



TECHNICAL OVERVIEW

MINI-LINK TN

A modular solution for evolving networks



Common Outdoor units
Radio and antenna



All-outdoor
solutions



MINI-LINK CN

Compact solutions for
microwave and fiber transport



MINI-LINK LH
The Ethernet Trunk Radio



HIGH PERFORMANCE RADIO LINK

MINI-LINK TN

TN

- › Ethernet:
 - Up to 1 Gbps per Ethernet connection
 - Using L1 Radio Link bonding
 - Up to 840 Mbps*
 - Over one antenna and one frequency channel using XPIC
 - Up to 420 Mbps*
 - Over one antenna and one frequency channel
- › PDH:
 - Up to 80 DS1
 - Over one antenna and one frequency channel
- › SONET:
 - Up to 2 OC-3
 - Over one antenna and one frequency channel using XPIC

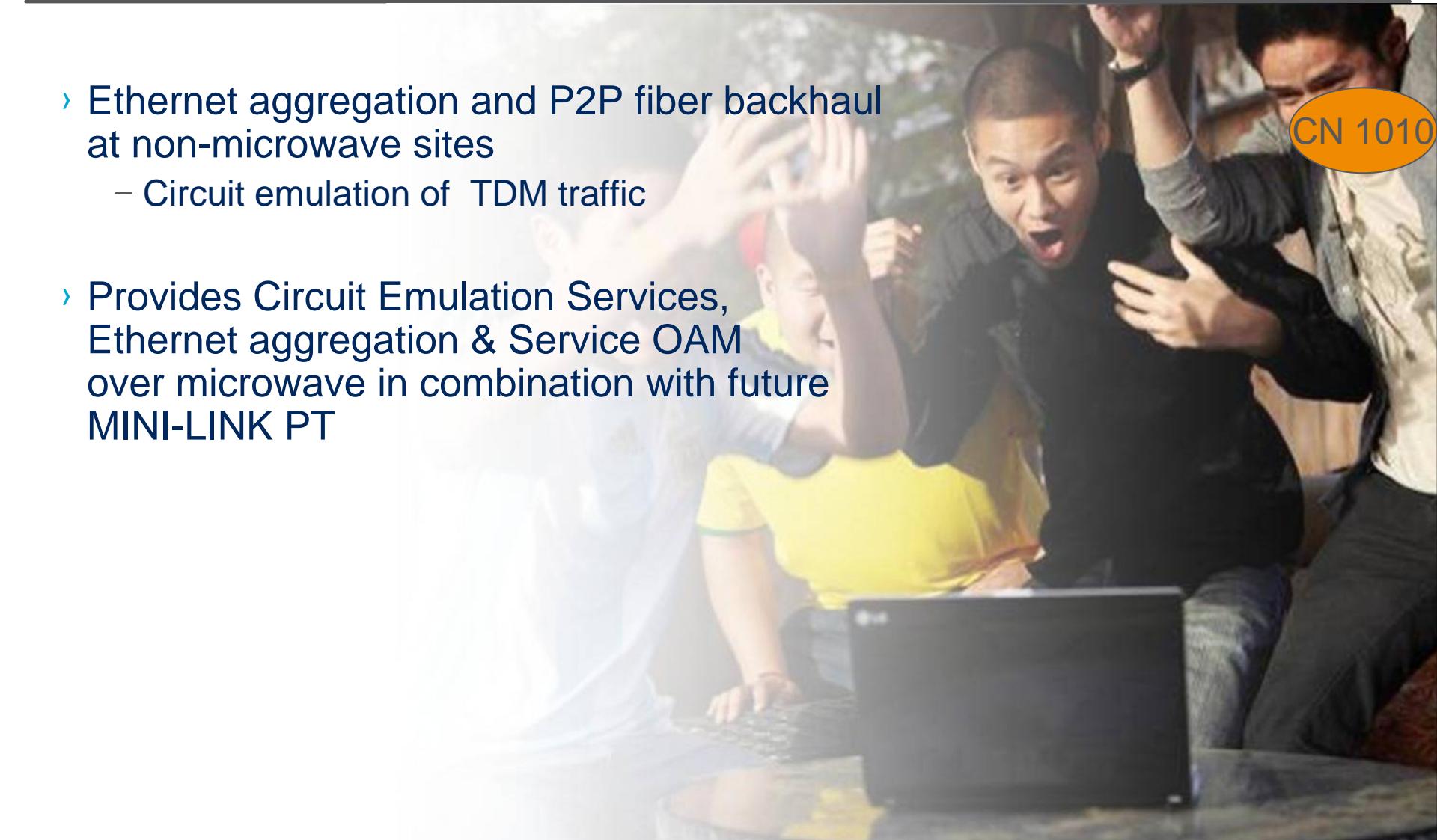


* the stated Ethernet capacity figure is based on maximum line interface capacity

MOBILE BACKHAUL GATEWAY

MINI-LINK CN 1010

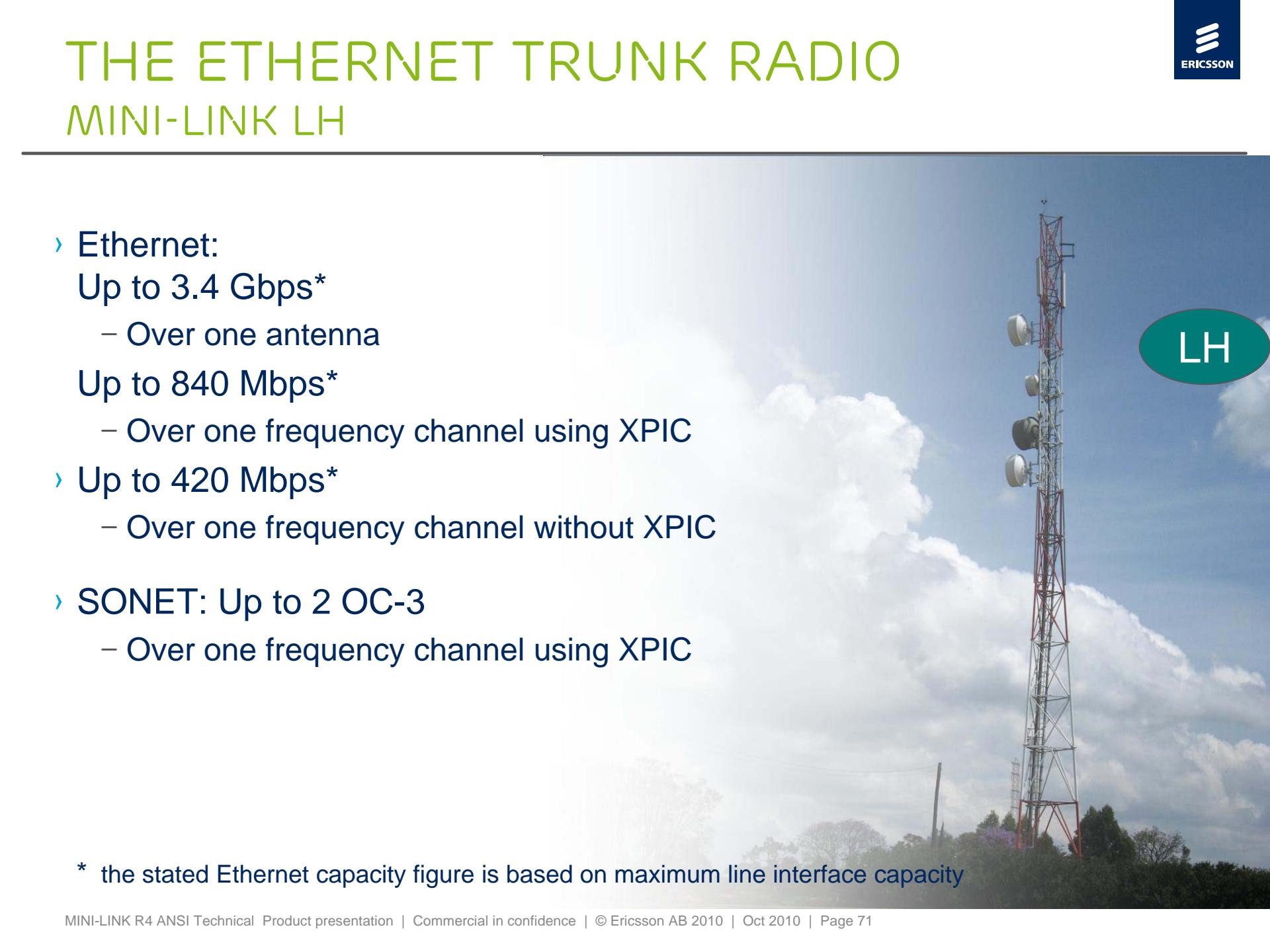
- › Ethernet aggregation and P2P fiber backhaul at non-microwave sites
 - Circuit emulation of TDM traffic
- › Provides Circuit Emulation Services, Ethernet aggregation & Service OAM over microwave in combination with future MINI-LINK PT

An orange oval containing the text "CN 1010" is overlaid on the right side of the image, which depicts a group of people cheering around a laptop.

THE ETHERNET TRUNK RADIO

MINI-LINK LH

- › Ethernet:
 - Up to 3.4 Gbps*
 - Over one antenna
 - Up to 840 Mbps*
 - Over one frequency channel using XPIC
- › Up to 420 Mbps*
 - Over one frequency channel without XPIC
- › SONET: Up to 2 OC-3
 - Over one frequency channel using XPIC

LH

* the stated Ethernet capacity figure is based on maximum line interface capacity

ADVANCED INTEGRATED TRAFFIC HANDLING

MINI-LINK TN



TN

- › PDH
 - Traffic cross connect on DS-1 level
- › Ethernet:
 - Integrated Ethernet L2 switch:
 - › VLAN switching (Q bridge)
 - › Provider bridge
 - L1 Radio link bonding
- › QoS with Priority Queuing
 - 8 priority levels
 - QoS for Ethernet, IP and MPLS
 - Carrier Grade QoS, with Policing, SP, WFQ & WRED



ADVANCED INTEGRATED TRAFFIC HANDLING

MINI-LINK CN 1010



- › Ethernet
 - Integrated Ethernet L2 switch:
 - › VLAN switching (Q bridge)
 - › Provider bridge
- › QoS with Priority Queuing
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ADVANCED INTEGRATED TRAFFIC HANDLING

MINI-LINK LH



- › Ethernet:
 - Integrated Ethernet L2 switch:
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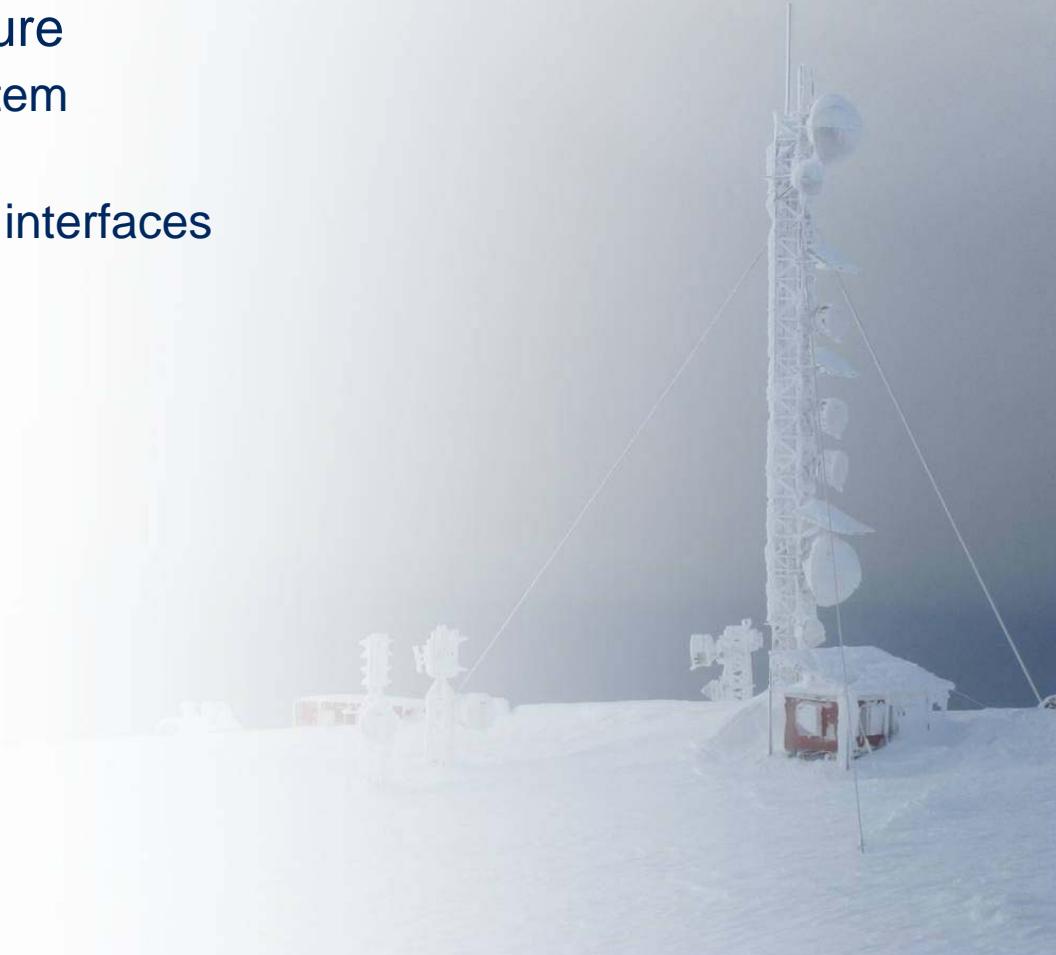
LH

EXTENSIVE PROTECTION FOR CARRIER CLASS EQUIPMENT

TN

MINI-LINK TN

- › Highly reliable system architecture
 - Separate traffic and control system
 - Hot swap
 - Minimized need for cabling and interfaces
- › Equipment and line protection
 - Redundant plug-in boards
 - Redundant power
 - Redundant buses
 - Microwave 1+1 protection
 - SONET protection:
 - › APS/MSP 1+1
 - › ELP
 - › EEP
 - Graceful degradation
 - LAG



EXTENSIVE PROTECTION FOR CARRIER CLASS EQUIPMENT

TN

MINI-LINK TN

- › Microwave propagation protection
 - Hitless Hot/Working standby (1+1 protection)
- › Network protection
 - SNCP
 - RSTP
 - MSTP



EXTENSIVE PROTECTION FOR CARRIER CLASS EQUIPMENT

MINI-LINK CN 1010

› Equipment protection

- Redundant power
- LAG

› Network protection

- RSTP, MSTP
- Ethernet Ring Protection (ITU-T G.8032)

EXTENSIVE PROTECTION FOR CARRIER CLASS EQUIPMENT

MINI-LINK LH

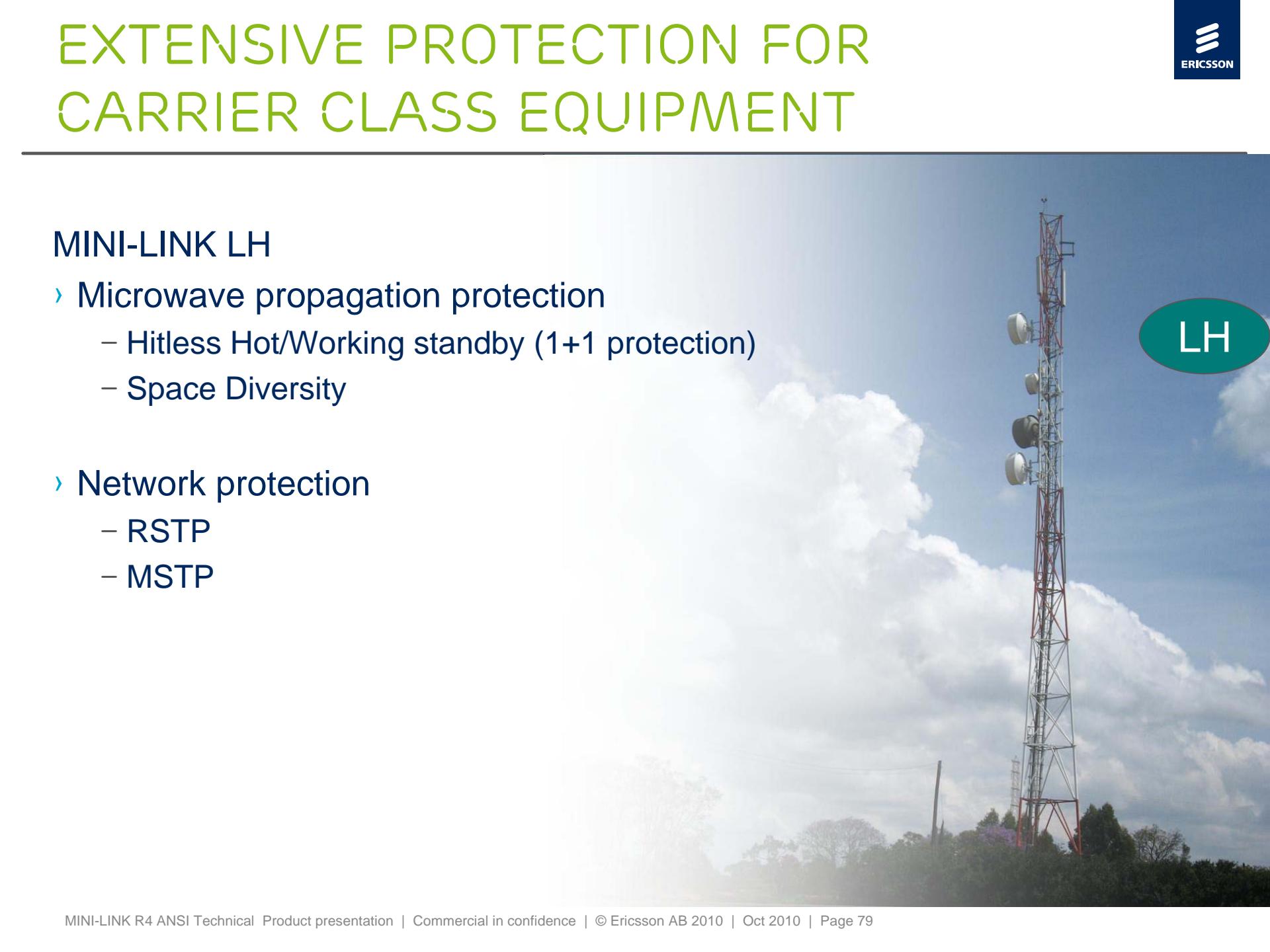
- › Highly reliable system architecture
 - Separate traffic and control system
 - Hot swap
 - Minimized need for cabling and interfaces
- › Equipment and line protection
 - Redundant plug-in boards
 - Redundant power
 - Redundant buses
 - Microwave 1+1 protection
 - SONET protection:
 - › ELP
 - › EEP
 - Graceful degradation
 - LAG



EXTENSIVE PROTECTION FOR CARRIER CLASS EQUIPMENT

MINI-LINK LH

- › Microwave propagation protection
 - Hitless Hot/Working standby (1+1 protection)
 - Space Diversity
- › Network protection
 - RSTP
 - MSTP

A tall, multi-tiered metal lattice telecommunications tower stands prominently against a bright blue sky filled with scattered white clouds. Several large, white, dish-shaped antennas are mounted at various heights along the tower's structure. In the bottom right corner of the slide, there is a teal-colored oval containing the letters "LH".
LH

MINI-LINK

COMMON OUTDOOR UNITS



MULTI AGILE RADIO

RAU X / RAU Xu

TN

- › RAU X
 - Modulation agile, C-QPSK and 4-512 QAM
 - Capacity agile
 - Transport technology agile
 - Fix and Adaptive modulation agile
- › RAU Xu
 - C-QPSK/4 QAM only
 - Soft Key enables modulation upgrade to a full-fledged RAU X
- › Compact radio case
 - Easy to handle
 - Compact outdoor installation for protected hops
- › Available frequencies
 - 6L, 6U, 7, 8, 10, 11, 13, 15, 18, 23, 24, 28, 38 GHz



HIGH POWER RADIO

RAU X HP

TN

- › Enhanced performance on TX powers
 - Best in Class TX Powers for split mount
 - All modulation schemes
 - Increased hop length
 - Smaller antenna with savings on site costs
 - Increased capacity due to higher modulation with retained availability
- › Part of the RAU X family
 - Multi agile radio
 - Compact radio case
 - Compact outdoor installation for protected hops
- › Available frequencies
 - 6L, 6U, 7, 8, 13, 15, 18 and 23 GHz

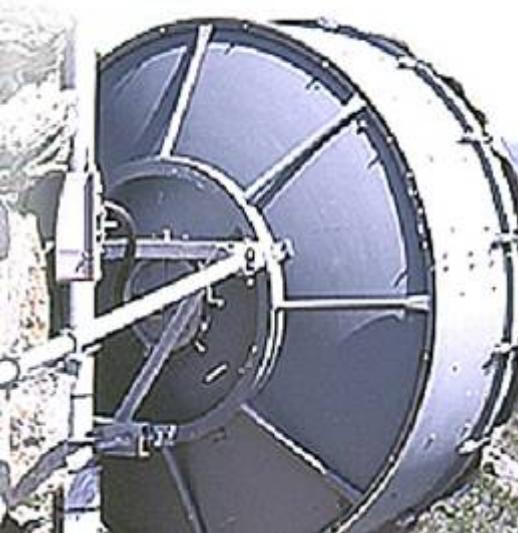


A BROAD ANTENNA PROGRAM



Separately installed antennas
8 ft – 12 ft

Integrated installation
9 in – 6 ft single polarized
1 ft – 6 ft dual polarized



INTEGRATED DUAL POLARIZED ANTENNAS 1, 2, 3, 4 AND 6 FT

TN

- › Integrated installation
 - Reduced installation time/costs
 - Easier to get building permit and public acceptance
- › No flexible waveguides losses
 - Reduce necessary output power
 - Use smaller antenna or longer hops.
- › Reduced footprint by up to 70%
 - Reduced tower rental costs
- › More robust installation
 - Reduced maintenance costs
- › Same planning data for single and dual polarized antennas.
- › Perfect in combination with XPIC



UPGRADE YOUR INSTALLED ANTENNA FROM SINGLE TO DUAL POLARIZATION

- › Upgrade your existing hop to XPIC - doubling the capacity
- › Keep your installed antenna - upgrading it to a dual polarized antenna, with an upgrade kit
 - Keep the upgrade cost down

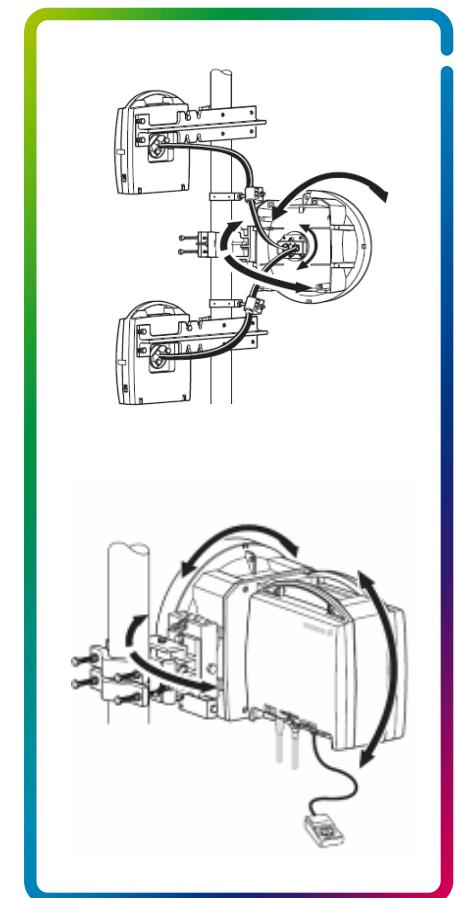
- › The following Ericsson designed antennas can be upgraded

- ANT1

- › 1 ft 15, 18, 23, 24, 38 GHz
 - › 2 ft 15, 18, 23, 24, 38 GHz
 - › Replace the feed and you have a dual polarized antenna that can be installed separately with RAU1 and RAU2.

- ANT2

- › 1 ft 15, 18, 23, 24, 28, 38 GHz
 - › 2 ft 7/8, 13, 15, 18, 23, 24, 28, 38 GHz
 - › Replace the feed and you have a dual polarized antenna that can be installed separately with RAU1 and RAU2.
 - › With an additional integration kit you also get an integrated installation with RAU2.



AVAILABLE ANTENNAS

MINI-LINK TN



TN

Frequency GHz			6	7/8	10/11	13	15	18	23	24/26	28	38
9 in	Integrated	Single										
1 ft	Integrated	Single										
		Dual										
2 ft	Integrated	Single										
		Dual										
3 ft	Integrated	Single										
		Dual										
4 ft	Integrated	Single										
		Dual										
6 ft	Integrated	Single										
		Dual										
8 ft	Separate	Single										
		Dual										
10 ft	Separate	Single										
		Dual										
12 ft	Separate	Single										
		Dual										

AVAILABLE ANTENNAS

MINI-LINK LH



LH

Frequency GHz		5 (4,7)	6L/6U	7/8	10/11	13
2 ft	Single					
	Dual					
3 ft	Single					
	Dual					
4 ft	Single					
	Dual					
6 ft	Single					
	Dual					
8 ft	Single					
	Dual					
10 ft	Single					
	Dual					
12 ft	Single					
	Dual					
15 ft	Single					
	Dual					



MINI-LINK CN 1010

TECHNICAL DETAILS

MINI-LINK CN 1010 MOBILE BACKHAUL GATEWAY

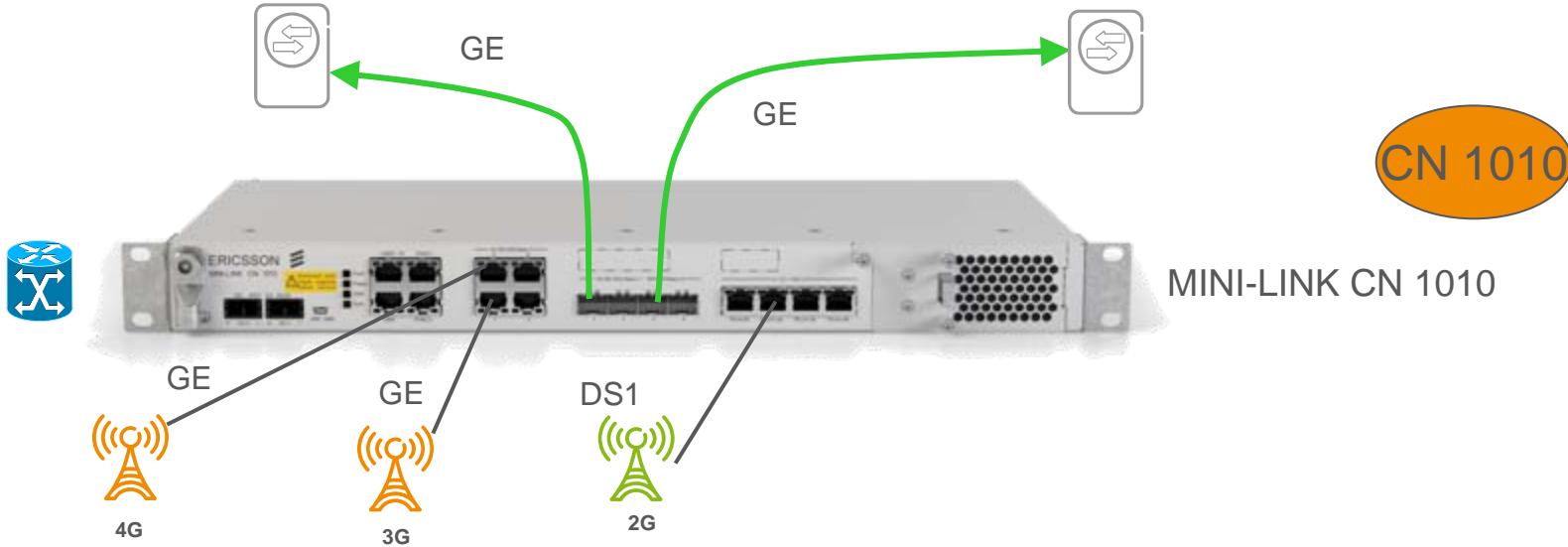


- › Cost efficient Compact Ethernet Mobile Backhaul Gateway
- › Ethernet aggregation and P2P fiber backhaul at non-microwave sites
 - Circuit emulation of TDM traffic
- › Provides Circuit Emulation Services, Ethernet aggregation and Service OAM over microwave in combination with
 - › MINI-LINK PT
- › Easy to install and configure



COMPLETE SOLUTION FOR ALL-IP NETWORKS

MINI-LINK CN 1010

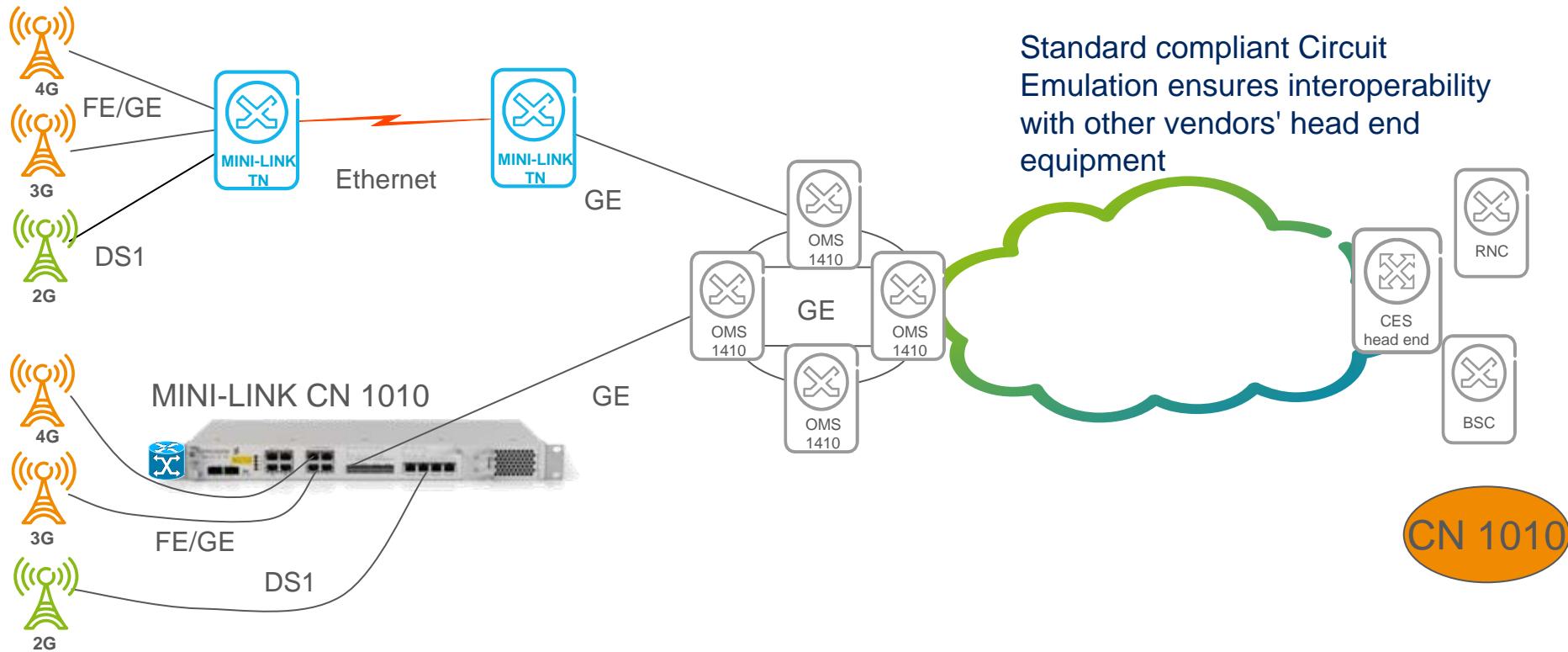


- › Aggregating traffic from multiple generation RBS' into an optical packet network
- › Gbit Ethernet capacities
 - 4 10/100/1000BASE-T (RJ45)
 - 4 SFP ports
- › 8xDS1 via Circuit emulation
- › Ethernet ring protection (ITU-T G.8032)



MINI-LINK CN 1010 IN THE NETWORK

MOBILE BACKHAUL GATEWAY



- › Part of Ericsson's Mobile Backhaul solution
 - E2e transport of Packet RAN
 - Common management with MINI-LINK TN and OMS 1410

MINI-LINK CN 1010 IN THE NETWORK

INDOOR UNIT FOR MINI-LINK PT

- › MINI-LINK CN 1010 is the compact indoor unit for the MINI-LINK PT outdoor product, with E-band as well as common carrier frequency bands
-
- › The combination offers
 - 1 Gbps microwave capacity
 - Multiple Ethernet ports
 - Local access to DCN without disturbing traffic
 - TDM support via Circuit Emulation Services



MINI-LINK CN 1010

GE



MINI-LINK CN 1010

TECHNICAL SPECIFICATIONS



CN 1010

› Interfaces:

- Ethernet 4 x 10/100/1000BASE-T + 4 x GE (SFP)
- TDM 8x DS1, 100 Ohm (2 x DS1 per RJ-45)
- Sync Synchronous Ethernet
2 MHz in/out, (RJ-45)
1pps, TOD (RJ-45)
- DCN 10/100/1000BASE-T (RJ-45)
- User I/O 4 input + 2 output
- USB port for local management

› Power

- - 48 VDC
- Redundant power intake

MINI-LINK CN 1010

ETHERNET FUNCTIONALITY



CN 1010

- › Ethernet switching & aggregation
 - D and Q bridge (IEEE 802.1 D & Q)
 - Provider bridge functionality (IEEE 801.2ad-2005)
- › Carrier Grade QoS
 - Ethernet, IP and MPLS aware QoS
 - Policing, SP, WFQ, WRED
 - 8 priority queues
- › LAG, Link Aggregation Group (Multiple Ethernet i/f)
- › 9k Jumbo frames
- › RSTP/MSTP
- › Ethernet Ring Protection (G.8032)
- › Synchronous Ethernet
- › Ethernet OAM
 - Link OAM (IEEE 803.2ah)
 - Service OAM
 - › FM (IEEE 802.1 ag)
 - › PM (ITU-T Y.1731)

MINI-LINK CN 1010

CIRCUIT EMULATION



CN 1010

›Flexible TDM Circuit emulation options

- Circuit emulation of unstructured DS1s, SAToP (RFC 4553) and MEF 8
- Circuit Emulation of structured DS1s, CESoPSN (RFC 5086) and MEF 8
- Circuit Emulation over IP, Ethernet, or MPLS

- Part of Ericsson Mobile Backhaul Solution
- Standard compliant to provide general interoperability



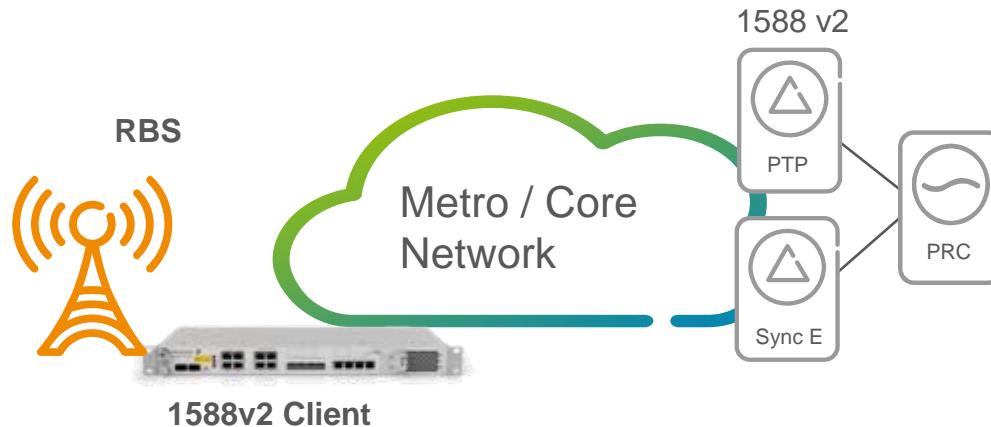
MINI-LINK CN 1010 SYNCHRONIZATION SOLUTIONS



›Flexible Synchronization solutions:

- IEEE 1588v2 client
- Synchronous Ethernet (SyncE)
- 2 MHz clock in & out (RJ-45)
- 1 pps clock (GPS), Time Of Day - TOD (RJ-45)

CN 1010





MINI-LINK TN

TECHNICAL DETAILS
IDU'S AND PLUG-IN UNITS



NODE ARCHITECTURE

TN

- › PDH bus, with traffic cross connect capabilities
- › Separate High speed buses for SONET and Ethernet.
- › Separate control bus
- › Separate power capable of redundancy
- › Separated PDH, SONET and Ethernet traffic



AMM 2P B END AND REPEATER NODE



TN

- › 2 slots for modem units, 2+0 or 1+1
- › 1 half slot for additional plug-in unit
- › 1 half slot for Node Processor Unit
- › Unused modem slots can be used for other plug-in units
- › Mix Ethernet, PDH and SONET
- › Power supply protected, -48V/+24V
- › Magazine height: 1 U (w. fan)

AMM 6P C AND AMM 6P D MEDIUM SIZED AGGREGATION NODE

TN

AMM 6p - General

- › 1 half slot for Node Processor Unit
- › Unused modem slots can be used for other plug-in units
- › Mix Ethernet, PDH and SONET
- › Power supply protected, -48V/+24V
- › Magazine height: 3 U (w. fan)



AMM 6p C



AMM 6p D

AMM 6P C AND AMM 6P D MEDIUM SIZED AGGREGATION NODE

TN

AMM 6p C - Modem slot optimized

- › 5 slots for modem units, 5+0 or 2x(1+1)+1
- › 1 half slot for additional plug-in unit



AMM 6p C

AMM 6p D - Small slot optimized

- › 4 slots for modem units, 4+0 or 2x(1+1)
- › 3 half slot for additional plug-in units



AMM 6p D

AMM 20P B

LARGE AGGREGATION NODE

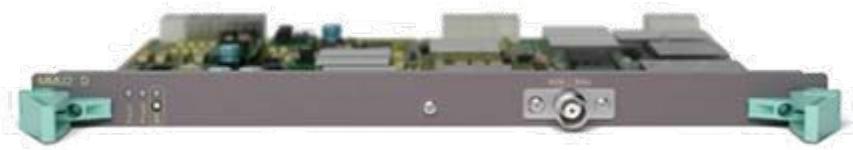
TN

- › 1 slot for Node Processor Unit
- › 19 slots for modem units, $19 \times (1+0)$ or $9 \times (1+1) + 1 \times (1+0)$
- › Unused modem slots can be used for other plug-in units
- › Mix Ethernet, PDH and SONET
- › Power supply, protected :
 - -48 V
 - +24 V by external PSU
- › Magazine height:
 - 7 U magazine only
 - 10 U with fan and air inlet



MINI-LINK TN PLUG-IN UNITS

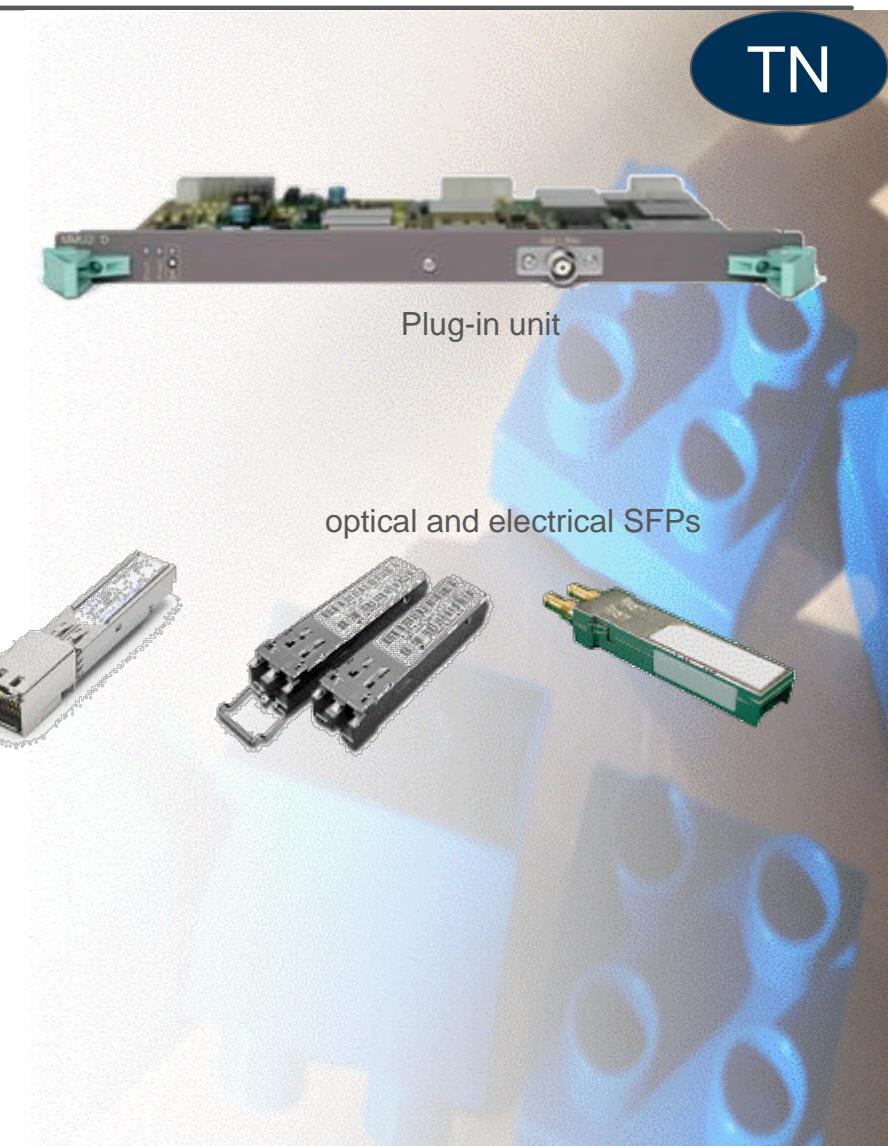
TN



- Node Processor Unit (NPU)
- Modem Unit (MMU)
- Line Terminal Unit (LTU)
- Ethernet Termination Unit (ETU)
- Power Unit (PFU)
- Fan Unit (FAU)

SCALABLE ARCHITECTURE

- › Plug-in units
 - User-selectable
 - Hot swap
 - Redundant
- › SFP modules
 - User-selectable
 - Optical or electrical
- › Capacity and modulation agility
- › Optional features via Soft Keys
 - Invest-as-you-grow



NPU

NODE PROCESSOR UNIT

- › Mandatory plug-in card
- › Centralized node processor:
 - OSPF router for DCN network
 - SNMP Master Agent
 - Configuration data stored in RMM
 - USB port for LCT connection
 - DCN Connection
- › Available NPU's
 - NPU1 BA
 - NPU1 C
 - NPU3
 - NPU3 B

TN

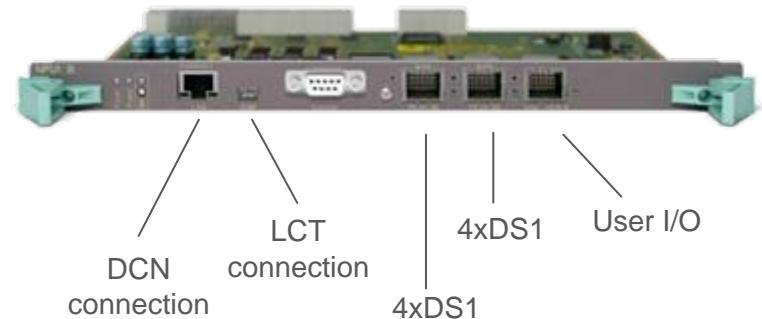


NPU1 BA

NODE PROCESSOR

TN

- › Full size plug-in board. Fits in
 - AMM 20p B, AMM 20p, AMM 6p and AMM 6p B
- › 8xDS1 for local add/drop
 - 1xDS1 can be used as wayside channel for SONET modem
- › User I/O
 - 3 input
 - 3 output
- › 10/100BASE-T for DCN traffic

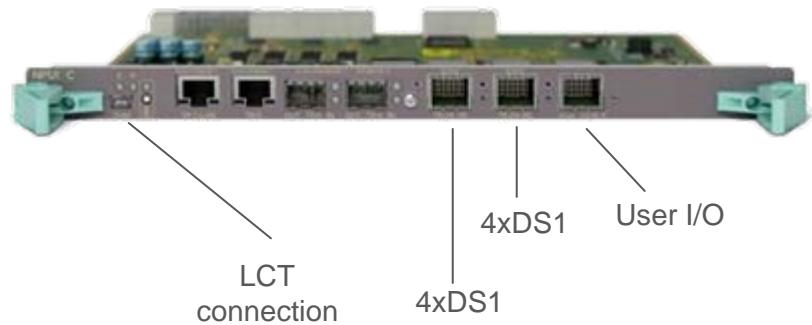


NPU1 C

NODE PROCESSOR WITH ETHERNET SWITCHING

TN

- › Full size plug-in board. Fits in
 - AMM 20p B, AMM 20p, AMM 6p and AMM 6p B
- › 8xDS1 for local add/drop
 - 1xDS1 can be used as wayside channel for SONET modem
- › User I/O
 - 3 input
 - 3 output

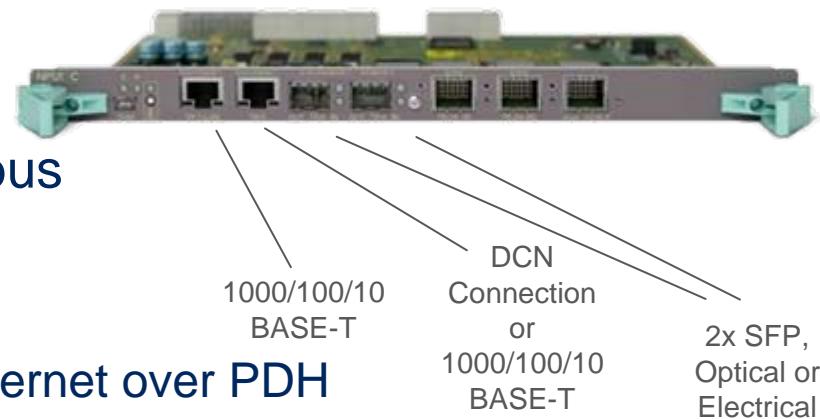


NPU1 C

NODE PROCESSOR WITH ETHERNET SWITCHING

TN

- › 2 x 1000BASE-T, Gbit Ethernet ports
 - One dedicated for Ethernet traffic
 - One dedicated for DCN traffic but configurable to Ethernet traffic
- › 2 x SFP, Gbit Ethernet port
 - Electrical SFP's as well as Optical multimode, singlemode and CWDM SFP's available
- › Support for Ethernet over high speed bus
 - To access e.g.
 - › MMU2 DA for Native Ethernet
 - › ETU2 B for more interfaces and Ethernet over PDH



NPU1 C



NODE PROCESSOR WITH ETHERNET SWITCHING

TN

› Ethernet Functions

- Integrated non blocking Ethernet switch
Q-bridge and Provider bridge
 - › 4 GE switch port to front plane
 - › 20 GE switch ports to back plane
 - › 24 Gbps full-duplex switch capacity
 - › 48 Gbps half-duplex switch capacity
- QoS with Strict priority Queuing, 8 priority queues
- CoS classification for Ethernet, IP and MPLS
- Tagging
- Enhanced QoS
 - › Weighted Fair Queuing
 - › Policing and Color dropping
 - › WRED
- Gbit Ethernet link with L1 Radio Link Bonding



NPU1 C



ERICSSON

NODE PROCESSOR WITH ETHERNET SWITCHING

TN

› Ethernet Functions

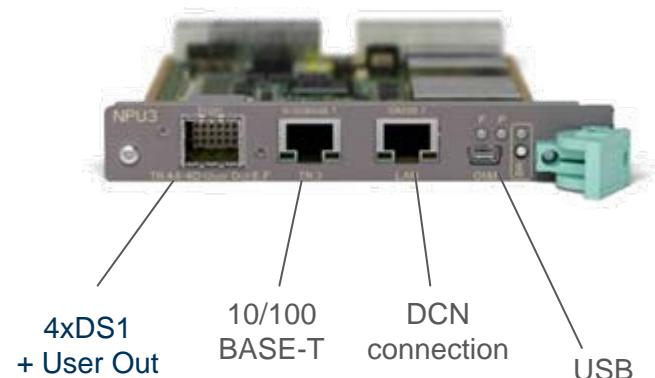
- Jumbo frames
- Ethernet link O&M
- RSTP
- MSTP
- LAG
- Head of line blocking prevention (HOLB)
- White list
- Storm protection

NPU3

NODE PROCESSOR UNIT

TN

- › Half-slot plug-in board. Fits in
 - AMM 2p B, AMM 6p C and AMM 6p D
- › 10/100BASE-T for 24 Mbps Ethernet traffic
 - Enabling Ethernet traffic without adding new HW
- › 4xDS1 for local add/drop
 - 1xDS1 can be used as wayside channel for SONET modem
- › User I/O
 - 2 output
- › 10/100BASE-T for DCN traffic



NPU3

NODE PROCESSOR UNIT



TN

› Ethernet Functions

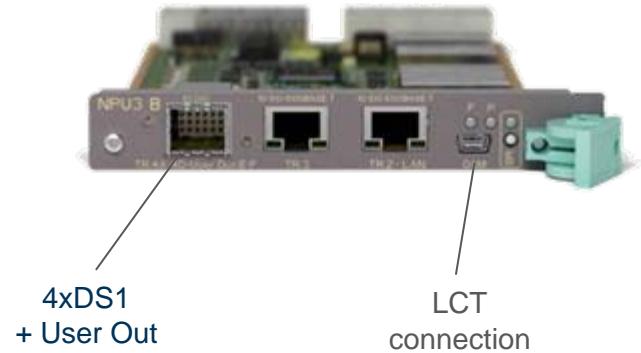
- QoS with Strict priority Queuing, 8 priority queues
- CoS classification for Ethernet, IP and MPLS

NPU3 B

NODE PROCESSOR WITH ETHERNET SWITCHING

TN

- › Half-slot plug-in board. Fits in
 - AMM 2p B, AMM 6p C and AMM 6p D
- › 4xDS1 for local add/drop
 - 1xDS1 can be used as wayside channel for SONET modem
- › User I/O
 - 2 output

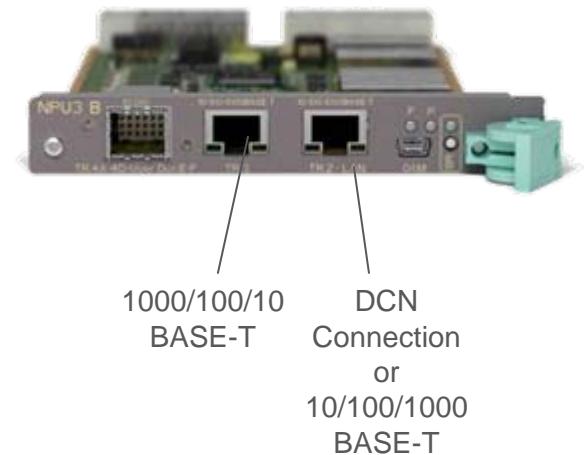


NPU3 B

NODE PROCESSOR WITH ETHERNET SWITCHING

TN

- › 2 x 1000BASE-T, Gbit Ethernet ports
 - One dedicated for Ethernet traffic
 - One dedicated for DCN traffic but configurable to Ethernet traffic
- › Support for Ethernet over high speed bus
 - To access e.g.
 - › MMU2 DA for Native Ethernet
 - › ETU3 and ETU2 B for more interfaces and Ethernet over PDH



NPU3 B

NODE PROCESSOR WITH ETHERNET SWITCHING



TN

› Ethernet Functions

- Integrated non blocking Ethernet switch
 - Q-bridge and Provider bridge
 - › 4 GE switch port to front plane
 - › 20 GE switch ports to back plane
 - › 24 Gbps full-duplex switch capacity
 - › 48 Gbps half-duplex switch capacity
 - QoS with Strict priority Queuing, 8 priority queues
 - CoS classification for Ethernet, IP and MPLS
 - Tagging
 - Enhanced QoS
 - › Weighted Fair Queuing
 - › Policing and Color dropping
 - › WRED
 - Gbit Ethernet link with L1 Radio Link Bonding



NPU3 B

NODE PROCESSOR WITH ETHERNET SWITCHING



TN

› Ethernet Functions

- Jumbo frames
- Ethernet link O&M
- RSTP
- MSTP
- LAG, Link Aggregation Group
- Head of line blocking prevention (HOLB)
- White list
- Storm protection

NPU COMPARISON

TN

	NPU1 B	NPU1 C	NPU3	NPU3 B
Ethernet interfaces	-	Up to 2 x 10/100/1000BASE-T for Ethernet traffic Up to 2 GE interface via SFP, Optical or Electrical	10/100BASE-T for 30 Mbps Ethernet traffic	Up to 2 x 10/100/1000BASE-T for Ethernet traffic
Switch capacity	-	4 GE switch ports to front plane 20 GE switch ports to back plane 24 Gbps switch capacity, full-duplex 48 Gbps switch capacity, half-duplex	-	2 GE switch ports to front plane 7 GE switch ports to back plane 9 Gbps switch capacity, full-duplex 18 Gbps switch capacity, half-duplex
Ethernet over high speed bus	-	Supported	-	Supported

NPU COMPARISON

	NPU1 BA	NPU1 C	NPU3	NPU3 B	TN
Ethernet functionality	-	Q and Provider bridge QoS, Strict priority Queuing CoS classification Tagging Enhanced QoS Gbit Ethernet link Jumbo frames Ethernet link O&M RSTP MSTP LAG HOLB Graceful degradation White List Storm Protection	QoS, Strict priority Queuing CoS classification	Q and Provider bridge QoS, Strict priority Queuing CoS classification Tagging Enhanced QoS Gbit Ethernet link Jumbo frames Ethernet link O&M RSTP MSTP LAG HOLB Graceful degradation White List Storm Protection	

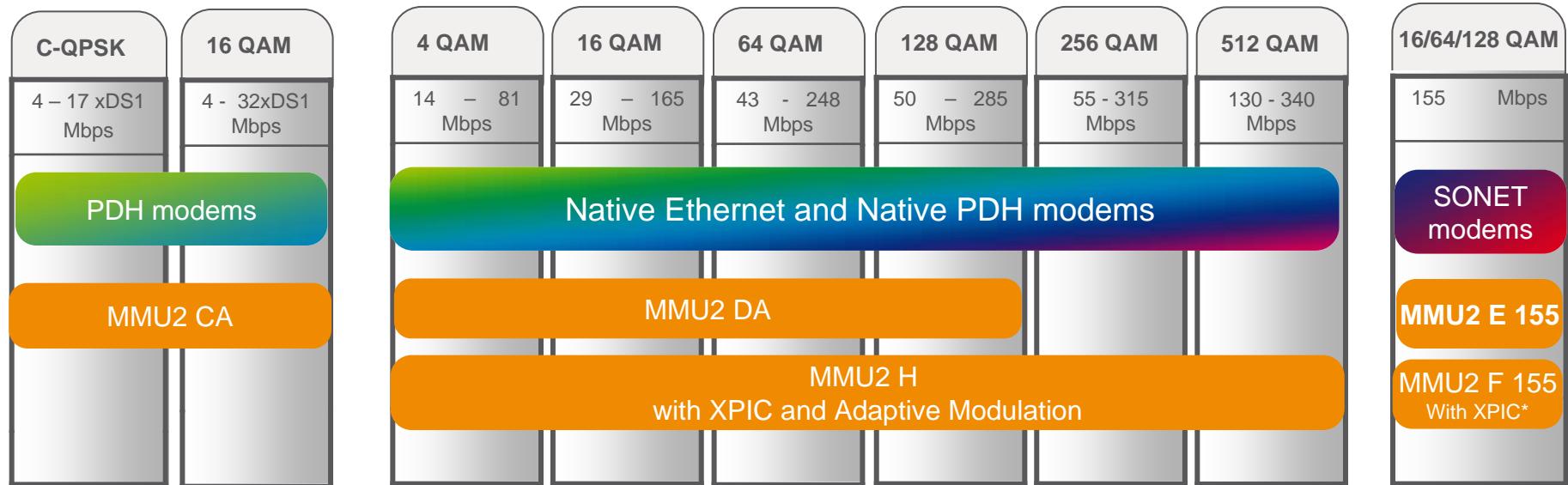
NPU COMPARISON

	NPU1 B	NPU1 C	NPU3	NPU3 B	TN
DS1 Interfaces	8XDS1, for local add-drop	8XDS1, for local add-drop	4XDS1, for local add-drop	4XDS1, for local add-drop	
User I/O	3 User Input and 3 User Output signals	3 User Input and 3 User Output signals	2 User Output for A and B alarms	2 User Output for A and B alarms	
DCN	10/100BASE-T for DCN traffic	10/100BASE-T for DCN traffic alt. 10/100/1000BASE-T for Ethernet traffic	10/100BASE-T for DCN traffic	10/100BASE-T for DCN traffic alt. 10/100/1000BASE-T for Ethernet traffic	
Fits in	AMM 20 p, AMM 20p B AMM 6p, AMM 6p B	AMM 20 p, AMM 20p B AMM 6p, AMM 6p B	AMM 2p B, AMM 6p C and AMM 6p D	AMM 2p B, AMM 6p C and AMM 6p D	

MODEMS



TN



- › Capacity and modulation agile modems optimized for Ethernet, PDH & SONET transport
- › MINI-LINK TN handles Ethernet over any of these modems

*XPIC for SONET available with 128 QAM

MMU2 CA PDH MODEMS



TN

- › Capacity agile modem
 - 4xDS-1 to 32xDS-1
 - 6 to 48 Mbps Ethernet
 - Invest-as-you-grow by use of Soft Keys
- › Modulation agile
 - C-QPSK and 16 QAM
- › Fits in all AMMs
- › Built-in 1+1 protection
- › Built-in traffic routing through backplane

MMU2 DA

ETHERNET AND SUPER PDH MODEM



TN

- › Hybrid Radio Link:
 - Native Ethernet : only 0.5% overhead
 - Native PDH Optimized with flat multiplexing
 - Mix Native Ethernet and Native PDH in steps of 1.54 Mbps
 - Optimized for high efficiency low overhead
- › Connect to Ethernet switch via backplane
- › Add/drop of 1xDS1 - 80xDS1 through backplane
- › Protected 2+0
- › Optimized for all IP and TDM to packet migration

MMU2 DA

TRAFFIC CAPACITIES – FIXED MODULATION



TN

Modulation	Bandwidth				
	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz
4 QAM	15	30	50	65	85
16 QAM	30	65	100	135	170
64 QAM	45	95	145	200	255
128 QAM	-	105	165	225	295



Available Physical modes

MIX NATIVE ETHERNET & NATIVE PDH IN STEPS OF 1.54 MBPS

Stated Capacity are air interface figures
295 Mbps air interface equals
300 - 365 Mbps line interface capacity

MMU2 DA

ETHERNET AND SUPER PDH MODEM

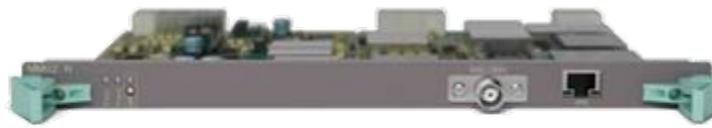


TN

- › Built-in support for fully redundant traffic routing
- › Built-in 1+1 protection
- › Fits in all AMMs

MMU2 H

ETHERNET AND SUPER PDH MODEM

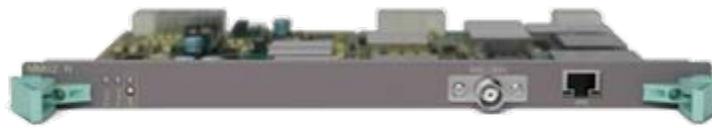


TN

- › Hybrid Radio Link:
 - Native Ethernet : only 0.5% overhead
 - Native PDH Optimized with flat multiplexing
 - Mix Native Ethernet and Native PDH in steps of 1.54 Mbps
- › XPIC support
- › Adaptive modulation
- › Protected 2+0
- › Modem optimized for all IP and TDM to packet migration

MMU2 H

ETHERNET AND SUPER PDH MODEM



TN

- › Built-in support for fully redundant traffic routing
- › Built-in 1+1 protection
- › Fits in all AMM's

MMU2 H



ERICSSON

TRAFFIC CAPACITIES – FIXED OR ADAPTIVE MODULATION

Modulation

Bandwidth

TN

Capacity Mbps	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz
4 QAM	14	31	47	64	81
16 QAM	29	64	97	131	165
64 QAM	43	93	143	194	248
128 QAM	50	107	165	225	285
256 QAM	55*	120	182	248	315
512 QAM	65*	130*	200	273	340

- Available Physical modes
- Physical modes planned for 4.4 via SW upgrade
- Physical modes planned for 4.4FP via SW upgrade

- Available Hitless adaptive modulation
- Hitless adaptive modulation planned for 4.4 via SW upgrade
- Hitless adaptive modulation planned for 4.4FP via SW upgrade

MIX NATIVE ETHERNET & NATIVE PDH
IN STEPS OF 1.54 MBPS

* Not available for 24, 28 and 38 GHz bands

MMU2 H



ERICSSON

TRAFFIC CAPACITIES – FIXED OR ADAPTIVE MODULATION

Modulation

Bandwidth

TN

Capacity Mbps	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz
4 QAM	14	31	47	64	81
16 QAM	29	64	97	131	165
64 QAM	43	93	143	194	248
128 QAM	50	107	165	225	285
256 QAM	55*	120	182	248	315
512 QAM	65*	130*	200	273	340

Physical modes planned to be available before and including release 4.4FP

Hitless adaptive modulation planned to be available before and including release 4.4 FP

MIX NATIVE ETHERNET & NATIVE PDH
IN STEPS OF 1.54 MBPS

Stated Capacity are air interface figures
340 Mbps air interface equals
342 - 420 Mbps line interface capacity

* Not available for 24, 28 and 38 GHz bands

MMU2 H



ERICSSON

TRAFFIC CAPACITIES – XPIC & ADAPTIVE MODULATION

Modulation

Bandwidth

TN

Capacity Mbps	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz
4 QAM	14	31	47	64	81
16 QAM	29	64	97	131	165
64 QAM	43	93	143	194	248
128 QAM	50	107	165	225	285
256 QAM	55*	120	182	248	315
512 QAM	65*	130*	200	273	340

Physical modes planned to support XPIC in 4.4 via SW upgrade

Physical modes planned to support XPIC in 4.4FP via SW upgrade

Physical modes planned for 4.4 via SW upgrade that can combine XPIC and AM

Physical modes planned for 4.4FP via SW upgrade that can combine XPIC and AM

Stated Capacity are air interface figures
340 Mbps air interface equals
342 - 420 Mbps line interface capacity

MIX ADAPTIVE MODULATION & XPIC
SECURE HIGHEST POSSIBLE TRAFFIC CAPACITY

* Not available for 24, 28 and 38 GHz bands

MMU2 H



ERICSSON

TRAFFIC CAPACITIES – XPIC & ADAPTIVE MODULATION

Modulation

Bandwidth

TN

Capacity Mbps	10 MHz	20 MHz	30 MHz	40 MHz	50 MHz
4 QAM	14	31	47	64	81
16 QAM	29	64	97	131	165
64 QAM	43	93	143	194	248
128 QAM	50	107	165	225	285
256 QAM	55*	120	182	248	315
512 QAM	65*	130*	200	273	340

Physical modes planned to be available with XPIC before and including release 4.4FP

Physical modes that can combine XPIC and AM planned before and including release 4.4 FP

Stated Capacity are air interface figures
340 Mbps air interface equals
342 - 420 Mbps line interface capacity

MIX ADAPTIVE MODULATION & XPIC
SECURE HIGHEST POSSIBLE TRAFFIC CAPACITY

* Not available for 24, 28 and 38 GHz bands

MMU2 DA & MMU2 H COMPARISON

	MMU2 DA	MMU2 H	TN
	Hybrid Radio Link	Hybrid Radio Link	
Bandwidth	10 – 50 MHz	10 – 50 MHz	
Modulation	4 – 128 QAM	4 – 512 QAM	
Additional functions	Protected 2+0	Protected 2+0 XPIC Hitless Adaptive Modulation	

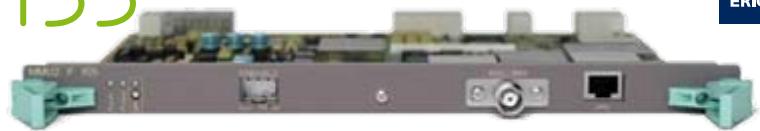
MMU2 E 155, MMU2 F 155 SONET MODEMS



TN

- › OC-3 capacity
 - MMU2 E 155 SONET Framing modem
 - MMU2 F 155 also support XPIC using 128 QAM
- › Modulation agile
 - 16, 64 and 128 QAM
- › Integrated line interface
 - OC-3 front feed through a SFP (Small Form-factor Pluggable) module, one per terminal
 - Wayside 1xDS-1 via backplane

MMU2 E 155, MMU2 F 155 SONET MODEMS



TN

- › Fits in all AMMs
- › SONET protection
 - Integrated switch for 1+1 protection
 - ELP supporting APS 1+1
 - EEP
- › Supporting ACAP, ACCP, CCDP

LTU3 12/1, LTU 16/1, LTU 32/1

PDH LINE TERMINATION UNIT


TN

- › Interfaces for 12xDS-1, 16xDS-1 and 32xDS-1
- › Using Sofix connectors, each with 4xDS-1

	LTU3 12/1	LTU 16/1	LTU 32/1
Interfaces	12xDS1, Balanced G.703	16xDS1, Balanced G.703	32xDS1, Balanced G.703
Size	Half slot	Full size	Full size
Fits in	AMM 2p AMM 2p B AMM 6p C AMM 6p D	all AMMs	all AMMs
Power	-48/+24 V	-48/+24 V	-48/+24 V

LTU 3/3

PDH LINE TERMINATION UNIT FOR DS-3



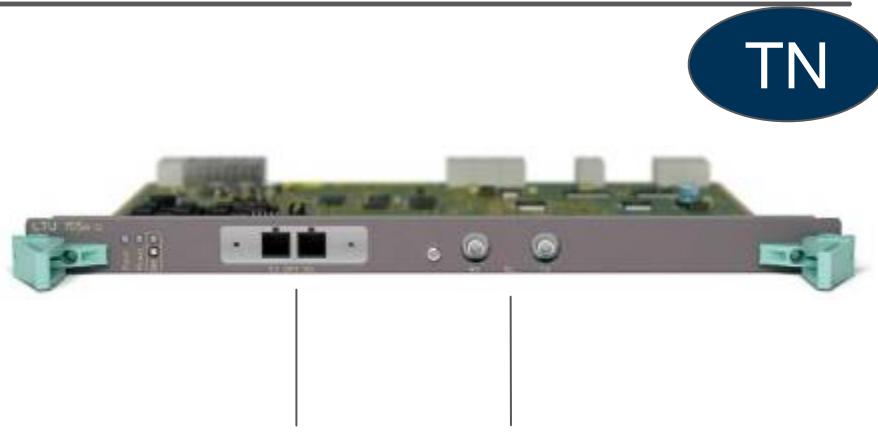
TN

- › Connection to metropolitan access networks
- › Termination of three DS-3 interfaces
 - Three M13 multiplexers, de-multiplexing DS-3 into 28 DS-1s to the backplane
- › Fits in all AMMs

LTU 155 ANSI

SONET LINE TERMINATION UNIT

- › Terminal multiplexer function
 - 84x VT1.5 terminated
- › Fits in all AMMs
- › APS 1+1 and hardware protection
- › Electrical or optical traffic interfaces
- › -48 V



TN

ETU2 B, ETU3



ETHERNET TERMINATION UNITS

TN

- › Capacity:
 - Up to 2 Gbps maximum throughput for ETU 3 and ETU2 B*
 - 140 Mbps maximum throughput for IM groups
 - Maximum 71 Mbps per IM group
 - Capacity agility, Invest-as-you-grow by use of Soft Keys
- › Ethernet interfaces
 - 2 x GE interface, through optical or electrical SFP
 - 2 x 10/100/1000BASE-T
- › Provides extra Ethernet interfaces to the Integrated Ethernet switch
 - Enhanced QoS from Ethernet switch
- › Provides Ethernet over PDH for Ethernet switch
 - Termination of Ethernet over IM groups
 - Maximum 6 IM groups
- › -48/+24 V

*depending on which slot and subrack ETU 2B is placed in



ETHERNET TERMINATION UNITS

TN

- › Capacity:
 - 140 Mbps maximum throughput for IM groups
 - Maximum 71 Mbps per IM group
 - Capacity agility, Invest-as-you-grow by use of Soft Keys
- › Ethernet interfaces
 - 1 x 10/100/1000BASE-T
 - 5 x 10/100BASE-T
- › Provides Ethernet over PDH for PDH modems
 - Termination of Ethernet over IM groups
 - Maximum 6 IM groups
 - Stand alone work mode - No interworking with Ethernet switch.
- › QoS with Strict Priority Queuing
- › -48/+24 V

ETU COMPARISON



	ETU2	ETU2 B	ETU3
Ethernet interfaces	1 x 10/100/1000BASE-T 5 x 10/100BASE-T	2 x GE interface, through optical or electrical SFP 2 x 10/100/1000BASE-T	2 x GE interface, through optical or electrical SFP 2 x 10/100/1000BASE-T
Total Ethernet Capacity	Up to 140 Mbps total throughput	Up to 2 Gbps total throughput depending on AMM slot capacity	Up to 2 Gbps total throughput
Ethernet over PDH Capacity	Up to 140 Mbps throughput for IM groups Up to 71 Mbps per IM group Up to 6 IM groups	Up to 140 Mbps throughput for IM groups Up to 71 Mbps per IM group Up to 6 IM groups	Up to 140 Mbps throughput for IM groups Up to 71 Mbps per IM group Up to 6 IM groups

ETU COMPARISON



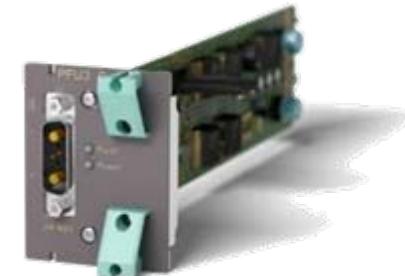
	ETU2	ETU2 B	ETU3	TN
Quality of Service	Strict Priority Queuing	Enhanced QoS via NPU3 B and NPU1 C	Enhanced QoS via NPU3 B and NPU1 C	
Interworking with Ethernet switch (NPU3 B or NPU1 C)	-	Required	Required	
Stand alone Ethernet	Supported	-	-	
Size	Full size	Full size	Half slot	
Fits in	All AMM's	All AMM's except AMM 2p	AMM 2p B, AMM 6p C and AMM 6p D	

PFU

POWER FILTER UNIT

TN

- › Power supply to AMM
- › PFU Versions:
 - PFU1 for AMM 20p (-48V*)
 - PFU3 B for AMM 6p C and AMM 6p D
(-48/+24V)
- › One PFU required, a second optional PFU for redundancy



* + 24V DC via external converter

FAU FAN UNIT

TN

- › FAU1 for AMM 20p B
 - Installed on top of AMM 20p B
 - Alarm interface towards PFU1
 - Three fans for redundancy
 - Two power interfaces for redundancy
- › FAU2 for AMM 6p C and AMM 6p D
 - Integrated in AMM
- › FAU4 for AMM 2p B
 - placed vertically inside AMM



MINI-LINK LH

TECHNICAL DETAILS



MINI-LINK LH

PROVIDING HIGH CAPACITIES OVER LONG HOPS

› Packet-optimized Radio link

- Gigabit Ethernet interfaces including SFP modules
- Integrated Layer 2 Switch with multiple Ethernet interfaces
- 4 - 512 QAM in 30 / 40 and 50* MHz
- Adaptive modulation
- Carrier Grade QoS

› TDM support

- Support for up to two OC-3 carriers
- Higher SONET capacity in combination with Marconi LH 2.5.4

› Short haul support

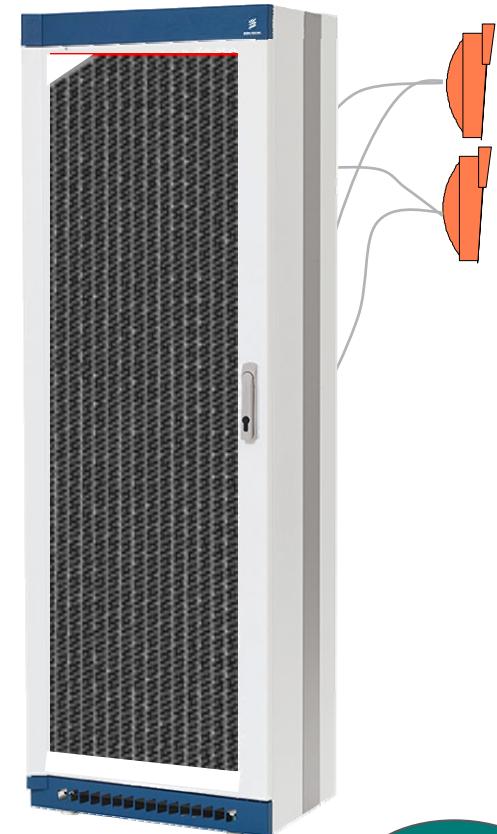
- MINI-LINK short-haul modems are supported



MINI-LINK LH

KEY FEATURES

- › New TRX
 - Adaptive Modulation 4 - 512 QAM
 - 30 / 40 / 50* MHz channel bandwidth
- › Available frequencies
 - 5*, 6L, 6U, 7, 8, 11*, 13*
- › Channel Branching kit from Marconi LH
- › Up to 12+0 in one rack w/o Space Diversity
- › Ethernet protection
- › OC-3 as “wayside channel” 2+0 or 1+1
- › Short haul split mount equipment support if space available



LH

* Available in later release

ACCESS MODULE MAGAZINES

MINI-LINK LH – HARDWARE SYNERGIES WITH MINI-LINK TN

- › AMM 20p B
 - Max 16 slots used for Ethernet modems
 - Unused slots can be used for Short Haul



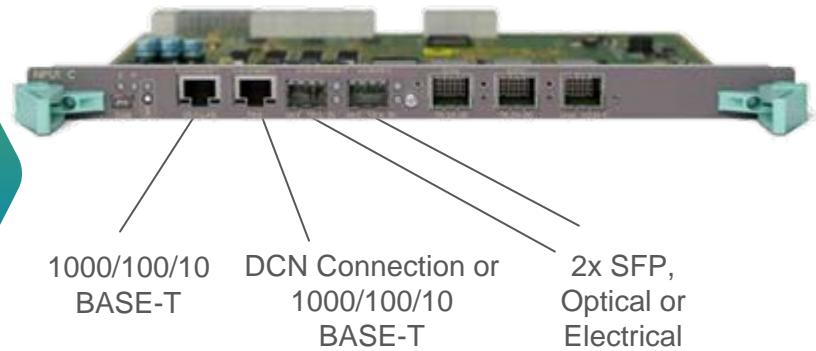
- › AMM 6p C (release 1.1)
 - Max 4 slots used for Ethernet modems
 - Unused slots can be used for Short Haul



PROCESSOR AND MODEMS

MINI-LINK LH – HARDWARE SYNERGIES WITH MINI-LINK TN

- › NPU1 C – Node Processor
 - 2 GE Ethernet ports
 - 2 additional GE SFP's
 - 48 Gbps integrated Ethernet switch
 - Carrier Grade Quality of Service



- › MMU2 H – Ethernet modem
 - Native Ethernet, up to 420 Mbps
 - XPIC-support
 - Adaptive Modulation
 - 4-512 QAM, 30 - 50 MHz



- › MMU2 F 155 – SDH/SONET modem
 - 1 x OC-3, 155 Mbps
 - XPIC-support
 - 16-128 QAM, 30 - 50 MHz



TRX & CHANNEL BRANCHING NETWORK

TRX

- › Frequencies:
 - First release 1.0: 6L / 6U / 7 / 8 GHz
 - Second release 1.1: 5 / 11 / 13 GHz
 - 4 GHz (TBD)
- › Output power: ~30 dBm @ 256 QAM



Well proven CBN – same as in Marconi LH

- › TX filter with circulator
- › RX filter with circulator
- › Harmonic filter
- › Branching circulator
- › Waveguide absorber
- › Isolator on TX-side



MINI-LINK

MINI-LINK ACCESSORIES



SFP'S

OPTICAL AND ELECTRICAL INTERFACES

Ethernet SFP's

- › Electrical SFP
 - 10/100/1000BASE-T
- › Optical GE SFP
 - 1000BASE-LX Singlemode 1310 nm
 - 1000BASE-ZX Singlemode 1550 nm
 - 1000BASE-X CWDM Singlemode 1471-1611 nm
 - 1000BASE-SX Multimode 850 nm



SONET SFP's

- › Electrical
 - OC-3 CX
- › Optical
 - OC-3 IR-1

ACCESSORIES

TECHNICAL SOLUTIONS FOR RELIABLE AND EASY INSTALLATION:

› Pre-fabricated cables

- Wide range of pre-fabricated cables
- Balanced Sofix cables with one open end, for easy way to connect to existing patch panels on site
- Sofix to 4xRJ45 for mounting on DDF-panel



MINI-LINK

MINI-LINK STANDARD PACKAGES

MINI-LINK TN STANDARD PACKAGES

PRE-ASSEMBLED INDOOR PACKAGES

- › Easy to order –
configuration already done, e.g.
 - PDH node with 16xDS1
 - SONET node with OC-3, Optical interface and 1+1
 - Ethernet node with 200 Mbps, GE and 4xDS1

- › Easy to install –
pre-assembled
 - Delivered as one package
 - Plug-in units mounted in sub-rack
 - Pre-tested
 - No loading of SW or HW licenses needed



MINI-LINK TN, PDH NODE EXAMPLE WITH 16XDS-1

TN

- › Sub-rack:
 - AMM 2p B
- › Plug-in unit
 - NPU3
 - MMU2 CA
 - LTU3 12/1
- › Pre-assembled and tested
 - No loading of SW licenses needed



MINI-LINK TN, SONET NODE EXAMPLE WITH OC-3, OPTICAL INTERFACE AND 1+1

TN

- › Sub-rack:
 - AMM 2p B
- › Plug-in unit
 - NPU3
 - FAU4
 - MMU2 E 155 x 2
 - SFP Optical x 2
- › Pre-assembled and tested
 - No loading of SW licenses needed



MINI-LINK TN, ETHERNET NODE EXAMPLE WITH 200 MBPS, GE, 4XDS-1

TN

- › Sub-rack:
 - AMM 2p B
- › Plug-in unit
 - NPU3 B
 - FAU4
 - MMU2 DA
- › Pre-assembled and tested
 - No loading of SW licenses needed



MINI-LINK

INSTALLATION ALTERNATIVES



INTEGRATED INSTALLATION

- › Integrated Radio and Antenna
 - >90% of installations worldwide
- › Higher system gain with no wave guide losses
 - Enables smaller antennas or longer hops
 - Enables higher capacity with higher modulation
- › High reliability
 - A high MTBF figure of 100 years for the radio unit
 - › Based on repair statistics
 - 2 million installations worldwide in all climates, from deserts to arctic climate
- › No maintenance needed on Radio



ALTERNATIVE INSTALLATION

- › Ground installation of radio unit
 - Inside on 19 inch rack
 - At bottom of tower
 - Wall-mounted on shelter
- › Pro's: Enables easy access to the radio unit
 - E.g. when no right to climb
- › Con's: Reduces system gain
 - Long wave guides resulting in lower system gain
 - Larger antenna or shorter hops needed
- › Mostly valid for lower frequencies
 - up to 11 GHz



MPH – MINI-LINK PROTECTIVE HOUSING ALL OUTDOOR SOLUTION

TN

- › All outdoor casing for
 - MINI-LINK TN, AMM 2p B
- › Cost efficient solution for:
 - End and Repeater Sites
 - Protected/unprotected hops
 - All capacities
- › Small footprint - easier to find sites
 - E.g. in metro areas
- › Speeds up new roll-outs
 - No need for site building
- › Outdoor Power Supply Unit (PSU)
- › Can be mounted on
 - a pole
 - a wall



TMR 9302

ALL-OUTDOOR SOLUTION

TN

- › All outdoor casing for MINI-LINK TN
 - AMM 2p B, AMM 6p C and AMM 6p D
- › High number of cable and radio interfaces
 - 12 cable interfaces
 - 5 radio interfaces
- › 200 W cooling capacity
- › Heater available
- › Power
 - -48 V, Support for redundant power
 - External AC/DC converter available
- › Can be mounted on
 - a pole
 - a wall



MINI-LINK

MANAGEMENT SYSTEMS



MANAGEMENT SYSTEMS

- › MINI-LINK Craft
 - Local Craft tool for MINI-LINK that enables set-up, configuration and alarm handling on site or via LAN
- › ServiceOn Element Manager
 - Minimize network downtime with fault, configuration, inventory and performance management
- › ServiceOn Network Manager
 - Management of a transport network infrastructure providing a clear network view and allowing total network control
- › ServiceOn Ethernet Service Activator
 - Providing operators the ability to support the end to end configuration and management of Ethernet services on packet enabled Ericsson transport products.
- › LDS, License Distribution Server
 - Effective management of licenses for HW/SW features



MINI-LINK CRAFT

LOCAL CRAFT TOOL FOR MINI-LINK

- › Set-up, configuration and alarm handling on site or via LAN
- › Cross connect set-up for PDH and Ethernet
- › Easy installation, including FTP server
- › Dynamically updated alarm & event list
- › Advanced hop-view layout



SERVICEON ELEMENT MANAGER

FULL CONTROL OVER ALL YOUR TRANSPORT NETWORK ELEMENTS

- › The single management solution for the support of the complete Microwave portfolio.
- › ServiceOn Microwave
 - Task focused GUI for speed and simplicity.
 - Integrates with the ServiceOn Network Management layer products for end to end service creation
 - Fast efficient management of element features – Controlling OPEX
 - Enhanced external interfaces for improved integration
 - Extendible management system grows to support network size and new functionality – Controlling CAPEX.
 - The cost effective single platform management system supporting the Ericsson Mobile Backhaul solution.

SERVICEON NETWORK MANAGER

MANAGEMENT OF TRANSPORT NETWORKS

- › The single management solution for support of the complete Microwave portfolio
- › Key Benefits
 - Task focused GUI for speed and simplicity
 - Integrates Microwave and selected Optical products under a single NM Layer
 - Supports for client traffic rates from 1.54 Mbps to 40 Gbps.
 - Fast efficient creation of traffic circuits – Controlling OPEX
 - External interfaces for process automation.
 - Extendible management system grows to support network size and new functionality – Controlling CAPEX.
 - Key to exploiting the world leading features of the Ericsson products.

SERVICEON ETHERNET SERVICE ACTIVATOR

MANAGEMENT OF ETHERNET SERVICES

- › Workflow oriented management application for Ethernet services.

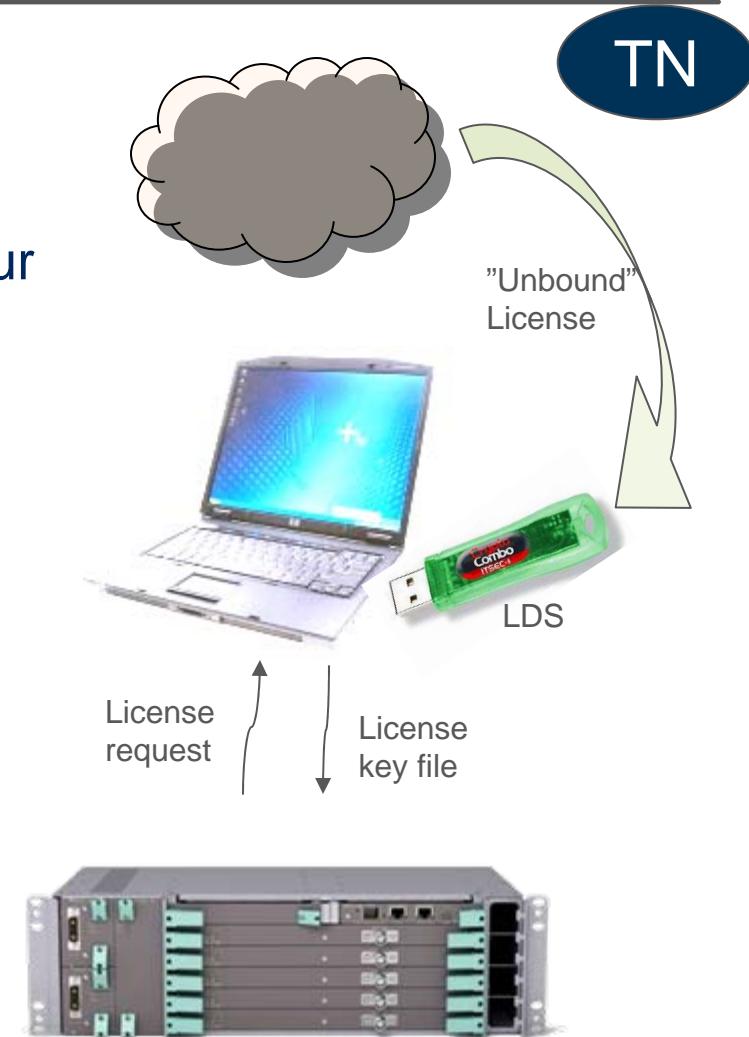
- › Key Benefits

- Task focused GUI for speed and simplicity.
- Supports Ethernet capable products from the Optical Transport and Microwave product sets.
- Integrates with the ServiceOn portfolio for end to end Ethernet service management.
- Fast efficient service management – Controlling OPEX
- Export of Service data via XML interface.
- The cost effective provisioning and administration solution for Ethernet service management.

LICENSE DISTRIBUTION SERVER, LDS

EFFICIENT HANDLING OF SW LICENSES

- › SW Licenses can be purchased in bulk
- › License keys are generated for a node in your own network. No Ericsson involvement
- › LDS can be used centrally, via DCN network, and locally
- › Unbound SW licenses can be delegated between LDS's



MINI-LINK

SUMMARY



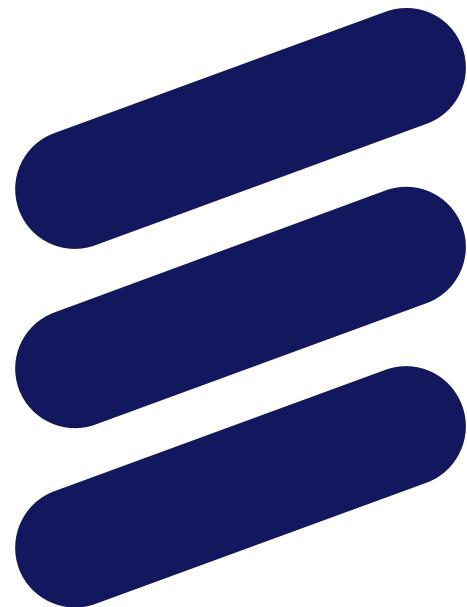
MINI-LINK IS LTE READY

PERFECT FOR ALL-IP NETWORKS

- › Support for high capacities
 - Up to 1 Gbps over the link
- › Optimized traffic handling
 - Built-in traffic aggregation and remote cross-connect
- › Optimized capacity use
 - Carrier Grade Hitless Adaptive Modulation
 - Protected 2+0
- › Native Ethernet with low delay and delay variation
 - High quality handover between cells
 - Aligned with LTE requirements, including X2 requirements
- › QoS for Ethernet, IP and MPLS
- › Full Support for mixed 2G, 3G and LTE Backhaul

MINI-LINK CONCLUSION

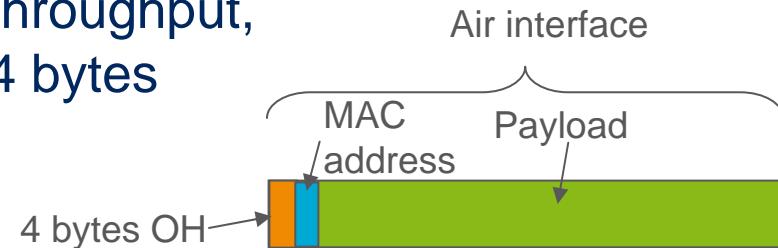
- › Flexible and speedy network rollout
- › Market leading on High Capacity Microwave
 - Gigabit capacities @ telecom grade availability
- › Handling your IP network evolution
 - Optimized products for any network scenario
 - Best in Class on delay variation proven at EANTC
- › Network cost saver
 - › Easy capacity upgrades
 - › Integrated Ethernet switch - Optimizing your capacity usage with traffic aggregation
 - › Re-using installed base
- › Ericsson - the market leader
 - More than 2 million MINI-LINK delivered



ERICSSON

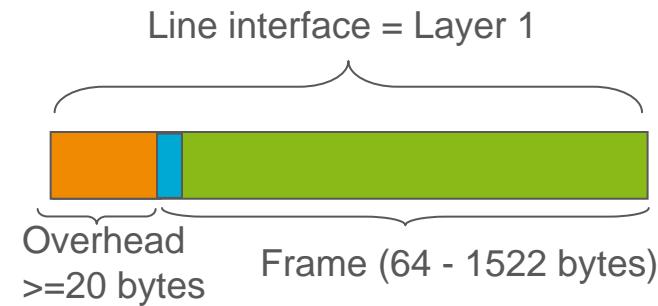
ETHERNET CAPACITY LINE INTERFACE AND AIR INTERFACE CAPACITY

- › Air interface capacity is basically the net throughput, i.e. layer 2 figures + a small overhead of 4 bytes



- › Line interface capacity is the layer 1 figure, i.e. layer 2 figures + minimum of 20 bytes overhead

- Normally used for the cable connected to the line interface
- Due to the larger overhead, the capacity figure is dependent on the frame size



Modulation and bandwidth	Air interface, Mbps	Line interface, Mbps (depending on frame size)
128 QAM, 30 MHz	165	167 - 204
256 QAM, 50 MHz	315	318 - 390