Colorless Metro

Routing and Switching Architecture

What problems are we trying to solve

Both the iLEC and Metro 2.0 networks are cost optimized for 1G Services

We need to invest to scale the Metro for 10G and 100G Services – we can't afford to strategically invest in both

Cell Site backhaul (VZ, AT&T, T-Mob ~ 18K ports) will require upgrade from 1G to 10G within 2+yrs

- ✓ 2700 wire centers in iLEC metro support cell cite backhaul
- ✓ T-Mobile has ~4800 tower in ~1600 Wire center
- ✓ 100G metro require to support 10G Tower
- ✓ 4% of the Current iLEC Wire center are 100G
- ✓ 70% of VZ, AT&T, T-Mobile towers are same Serving Wire Centers

Analysis of supporting T-Mobile cell site backhaul upgrade

- ✓ iLEC - $500M+
- ✓ Colorless $150M < $200M

Minimize development and reliance on iLEC OSS systems

Eliminate duplicity of network and hardware (NIDs) , truck rolls and streamline Access

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Colorless Metro - Strategy

Grow Metro 3.0 as strategic colorless Metro and develop support for "**all growth**" services

- iLEC Metro will continue to support existing services and speeds - consumer available port capacity
- Grow new and higher speed 10G/100G service on Metro 3.0

Interconnect the Metro with BGP-LU / Option-C NNI – allows service interoperability with a common **"Route Target"**

Deploy 100G Ethernet Collector Node (ECN) in each iLEC wire center

- Use existing (Orange) systems and process to deploy ECN into the Wire center
- Use Inter office Fiber to build 400G and 100G ECNs into the iLEC Wire center
- Use the iLEC lateral fiber to deploy 10G NID over single fiber to the customer/Cell site towers
  - A port/UNI on a NID can be iLEC (green) or National (Red/Blue/Orange/Green) – ***colorless***

Two touch service provisioning

- Node A - ILEC MER/MGR - use existing iLEC provision systems
- Node B - Metro Edge (3.0) – use go forward provisioning and automation
- Automates performance testing Y.1731 , Service turn-up Y.1564

Add new Metro 3.0/iLEC Node inventoried in iLEC systems (barebones/black box)

- Develop a sync-Engine to reconcile inventory between National ARM (ASPI) and iLEC ARM
- Real time Reconciliation of port inventory and Customer Facing Service (CFS)

New/Existing iLEC services can be design to new Metro 3.0 – fully interoperable to iLEC

- Support wireless backhaul , Wholesale Ethernet, MOE services

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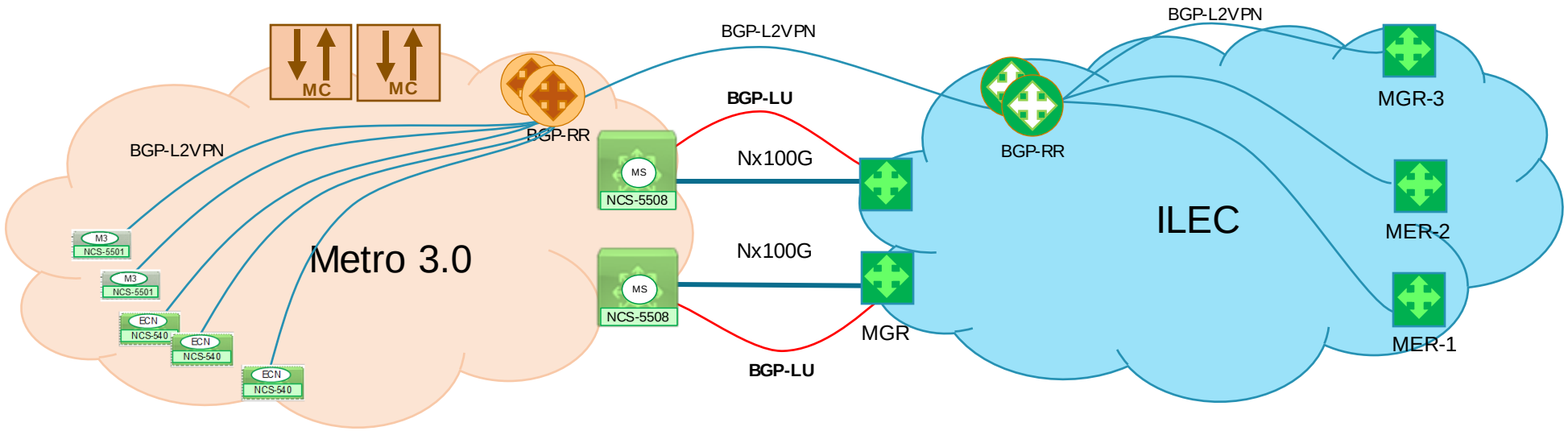
BGP-LU for colorless

- BGP-LU provides reachability between iLEC and Metro 3.0 by advertising PE loopbacks
- BGP-LU in turn advertises the loopbacks and label bindings to remote MEs/MERs/MGR between the iLEC and metro Nodes
- BGP-Address Family (SAFI) L2VPN – advertises VPLS Route targets
- BGP-LU NNIs would replace FIN-E NNIs in Metro Markets – existing Services would be migrated



Device	loopback	BGP-Label Unicast
ME3-1	1.1.1.1	1999345
ME3-2	1.1.1.2	1999347
ME3-3	1.1.1.3	1999386

BGP-LU

BGP-LU

Device	Loopback	BGP-Label Unicast
MER-1	10.2.2.1	2001342
MER-2	10.2.2.2	2002343
MGR-1	10.2.2.3	2003344

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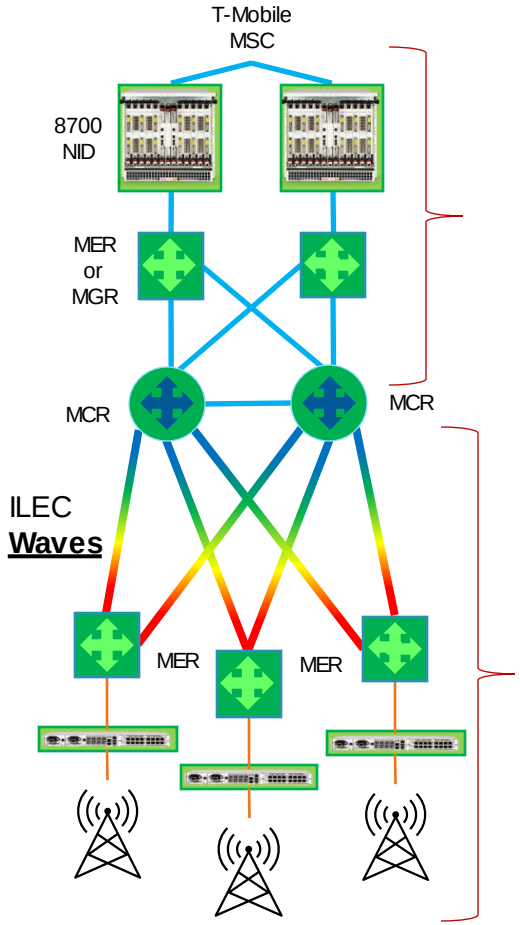
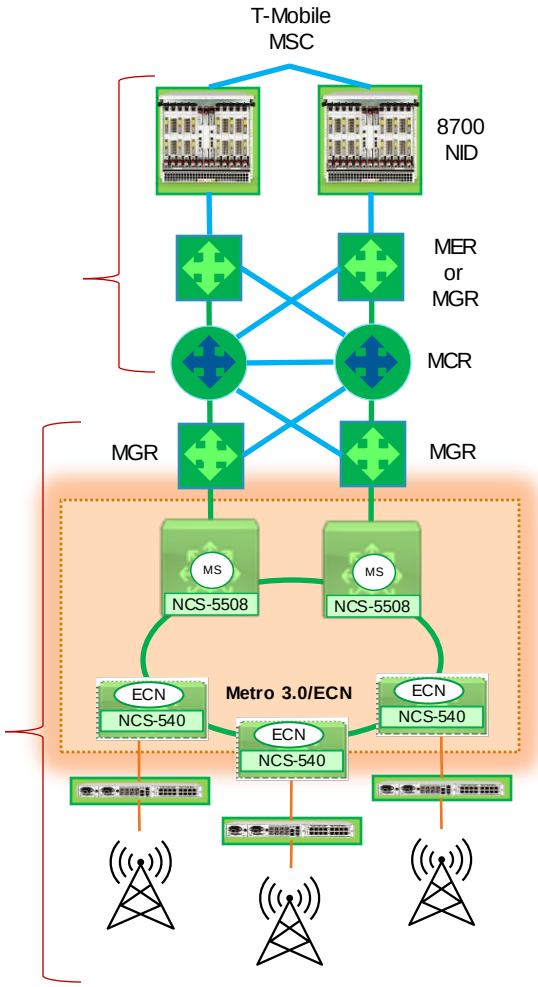
Cell Site backhaul and colorless – priority #1

- Target is to support this design in 1H2021
- Upgrade iLEC MTSO handoff to 100G
- Build option-C 100G NNI between metro 3.0 and iLEC
- Build 100G Metro 3.0 network to Wire center on Inter office Fiber
- Deploy ECN to the Wire center
- Overbuild 10G NID to tower on iLEC F1/F2 Fiber
- Build VPLS service from MTSO(s) to ECN/NID
- Migrate from 1G to 10G
- Complete T-mobile upgrade by End of 2023



100G upgrades already complete/near complete from previous T-Mobile requirement

ILEC
vs
Metro 3.0
(colorless)



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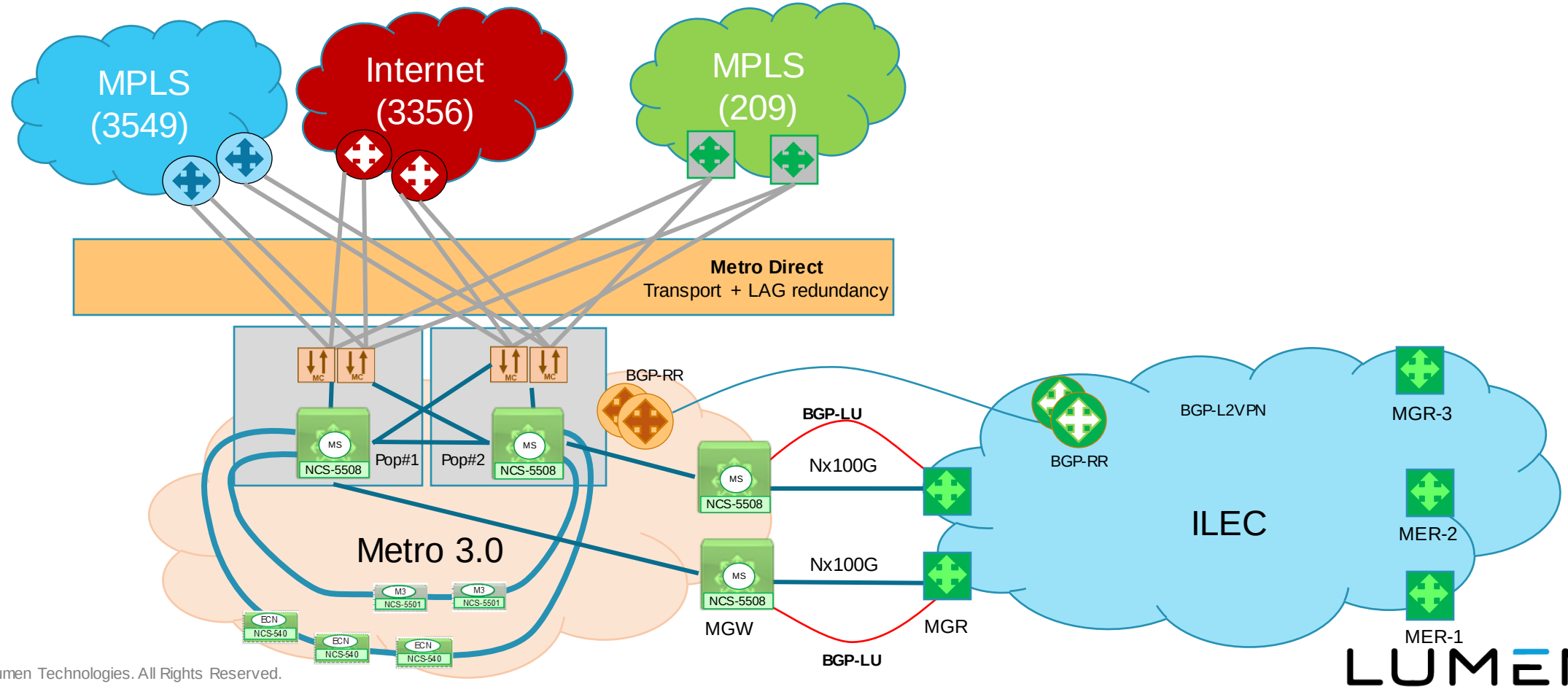
Metro Direct + Metro Pop diversity - Priority#2

- Metro Direct – LAG and Transport Diversity – simple and scalable
- Pop Diversity – Support Service Redundancy / PE redundancy
- Metro Ring Diversity – Metro 3.0 will allow Ring to span between Pop/GWs



Colorless Metro – Roadmap

HLD for Colorless Metro – published last Month

T-Mobile 10G Tower upgrade Business Case – based on Colorless

IT developing an OSS and BSS LOE and present to Leadership team

10G NID RFP in progress lower the cost of NID from ~ $1500 to $500 – Target for completion 2H21
- ✓ Indoor and Outdoor Variants
- ✓ 10G and 100G Variants
- ✓ Dual Vendor NID strategy
- ✓ Programmability Direct to device API

Metro hardware RFP - Target for completion 2H21
- ✓ 100G and 400G Metro Core and Distribution
- ✓ Spine Leaf/Ring design for scale
- ✓ Segment Routing with VPLS - EVPN in future
- ✓ Lower the $/G < $10, iLEC is currently ~ $60
- ✓ Programmability Direct to device API

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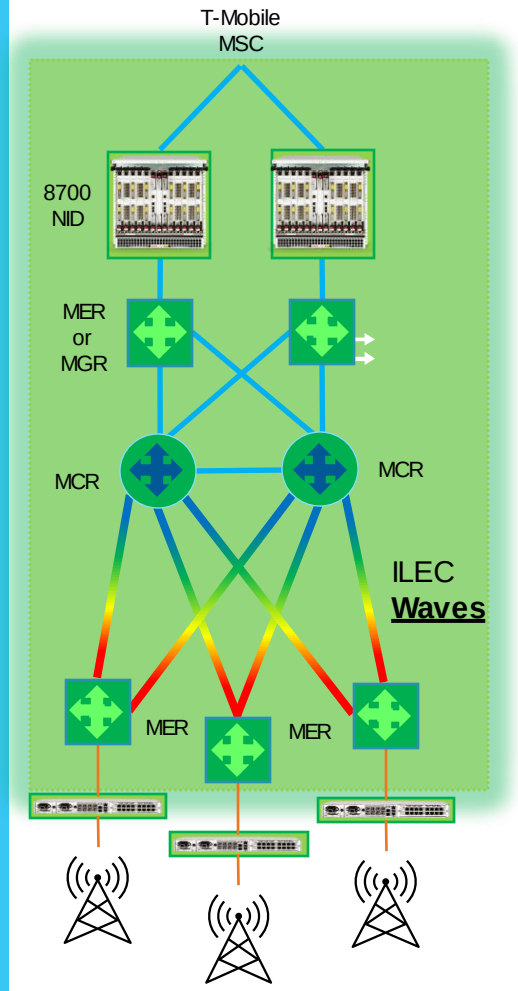
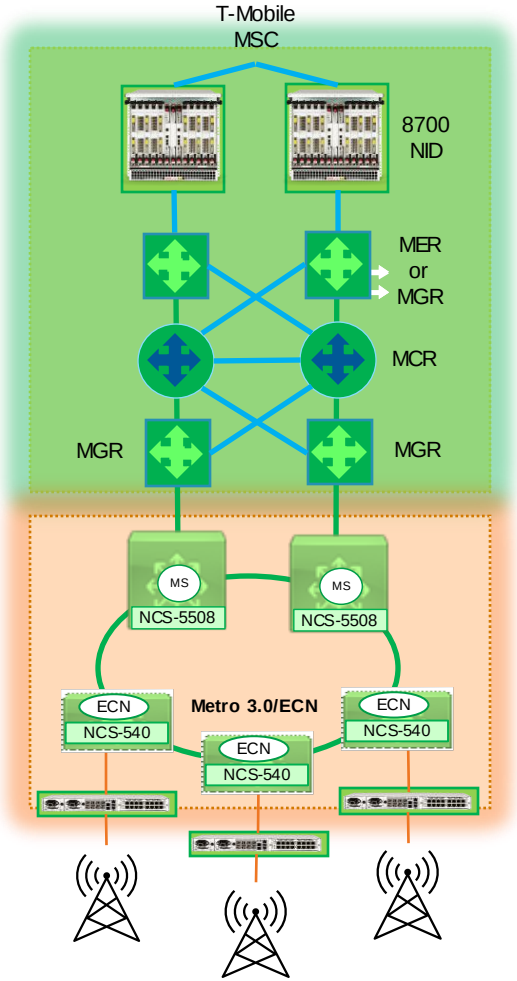
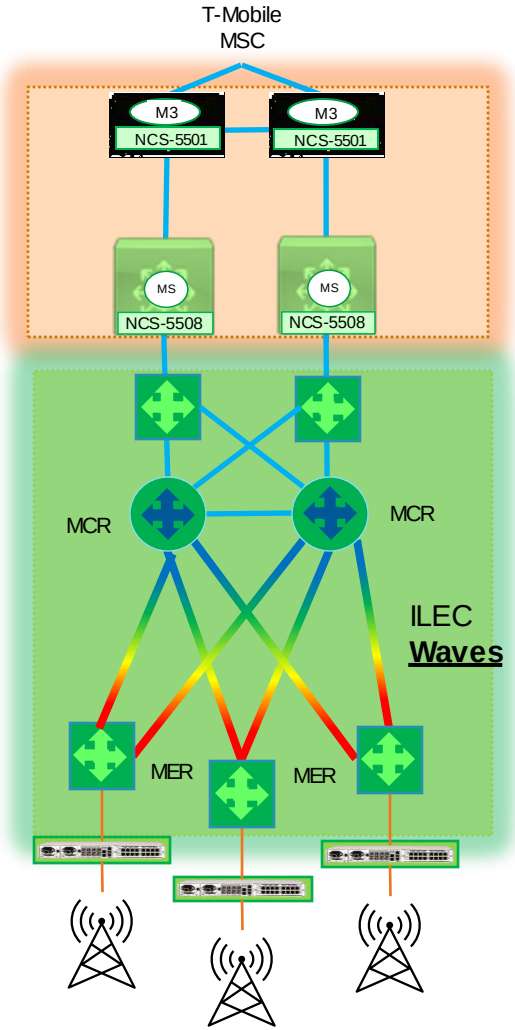
Cell Site MTSO on Colorless – priority #2



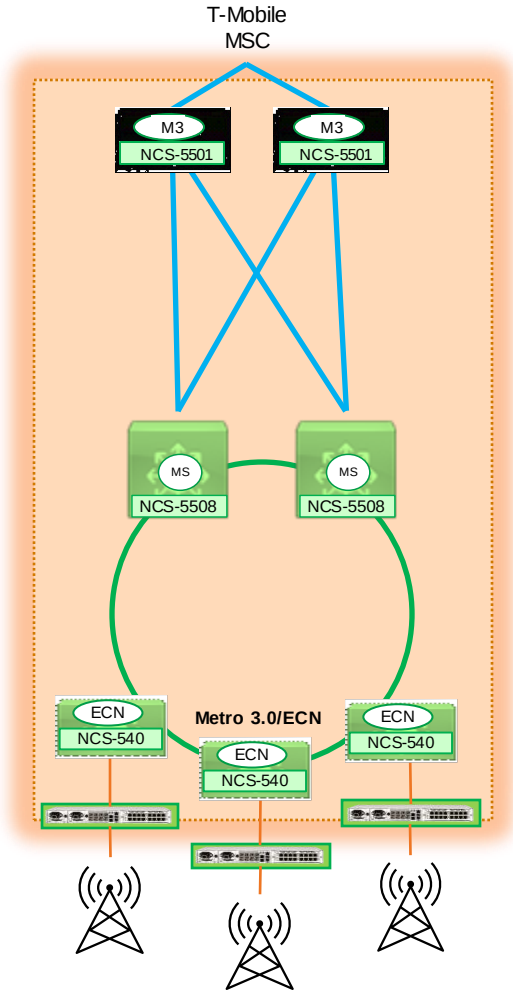
ILEC MTSO
iLEC Metro with 3 G EVC/10G UNI



ILEC MTSO
Metro 3.0 with 10G EVC/10G UNI



Metro 3.0 MTSO
iLEC Metro with 3 G EVC/10G UNI



Metro 3.0 MTSO
Metro 3.0 with 10G EVC/10G UNI

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Colorless Metro Development Roadmap