ipinfusion™
Accelerating Network Disaggregation

Transforming 5G Networks with Disaggregated Cell Site Gateways (DCSG)

December 8, 2021

Agenda

1 Corporate Overview

2 Network Disaggregation

3 5G & DCSG

4 IP Infusion DCSG Solution

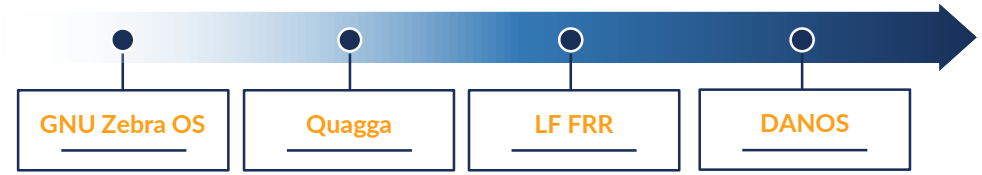
5 Why IP Infusion ?

IP Infusion Corporate Overview

20 Years of Innovative Network Software Solutions

- Carrier-Grade Open Networking
- Unparalleled Control Plane
- 1,000s of customers
- 10,000s of deployments

Open Source Innovation



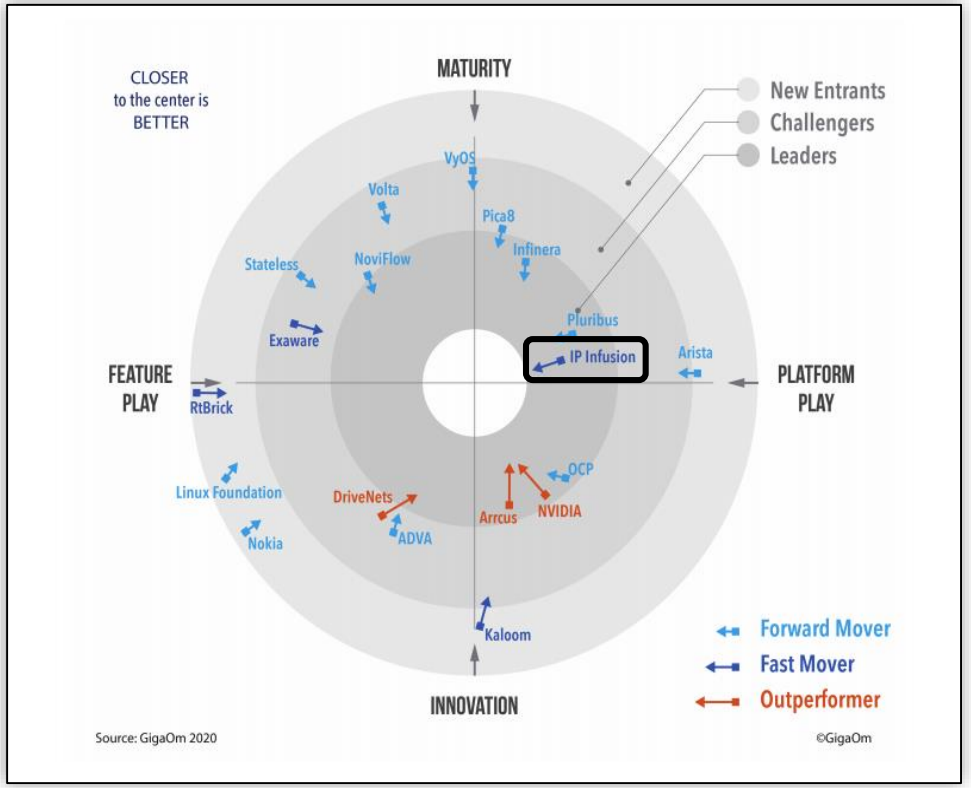
Product and Technology Leadership

White Box Solutions

Carrier Grade OcNOS

Control Plane

IP Infusion Recognized as Leader by Industry Analysts



"With over 20 years' experience providing NOS solutions, IP Infusion's rich pedigree guarantees you won't get fired for choosing this company."

Chris Grundemann, Analyst, ***GigaOm***

IP Infusion is the leading CSP NOS vendor, with strong hardware abstraction capabilities and open-source credentials
Gorkem Yigit, ***Analysys Mason***

20 Years of Enabling Network Equipment Manufacturers

ADARA
affirmed
Aaltice labs
Extreme
casa systems
WIND
AN INTEL COMPANY
CERAGON
COWEAVER
DRS TECHNOLOGIES
a LEONARDO company
FUJITSU
GALAXYWIND
NEC
Hansol
한솔넥스지
HFR, Inc.
for Mobile Internet
华辰泰尔
HUACHENTEL
Huahuan
HUAWEI
DASAN Networks
infinera
ciena
MAIPU
MAKE IT INTELLIGENT
MERCURY
Corporation
엔아이투스(주)
N·ITUS
CETC
汉柏opzoon
Padtec
SMC
siae microelettronica
ubiQuoss
waystream
FOUNDRY
NETWORKS
PIOLINK
qamcom
Sagemcom
Selex ES
A Finmeccanica Company
f5
BROCADE

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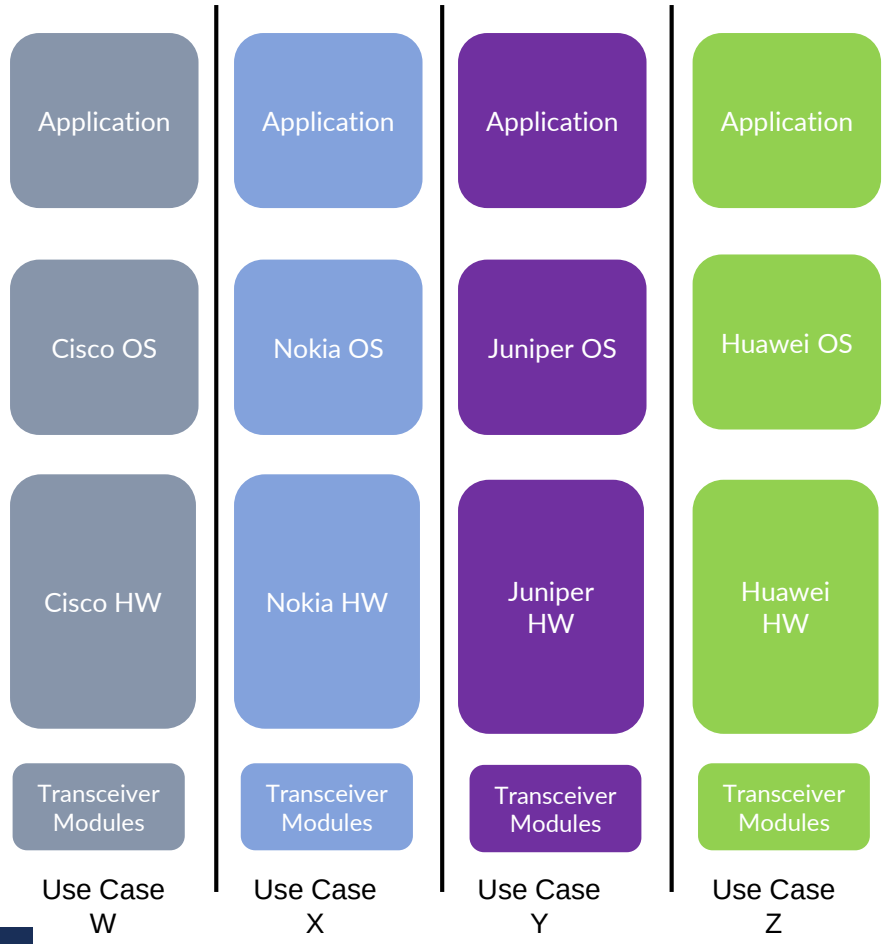
Enabling End-to-End Solutions for Service Providers

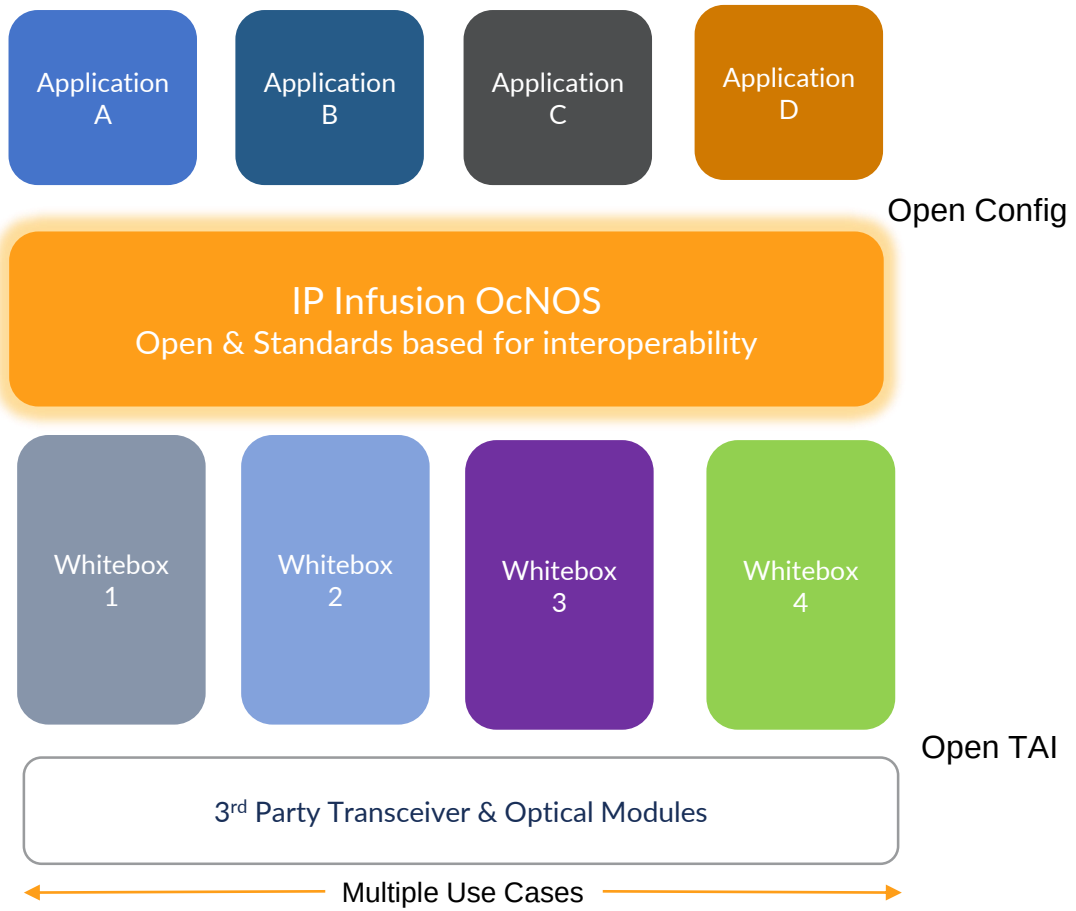
ip infusion

IP Infusion Enables Operators To Break Vendor Lock-in

Traditional networking forces a mix of HW + NOS for multiple use cases
Stove-pipe solutions and an Operational nightmare



IP Infusion enables best-of-breed HW across multiple use cases with standardized NOS
Operational simplicity with HW flexibility



Disaggregation Delivers Benefits Over Traditional Model

Traditional Way

Slow innovation and longer TTR
- New platforms/features take 18-24 months

Lack of interoperability
- Proprietary solutions lack of interop across vendors

Lack of choice
- Operators do not have flexibility in selecting best-of-breed or latest technologies

Higher TCO and operational complexity
- Trapped to higher CapEx and growing OpEx

Shackled by vendor lock-in
- Control is in the hands of the vendor, not network operators

IP Infusion Way

Fast paced innovation and shorter TTR
- Open networking solutions accelerate innovation & quicker TTR

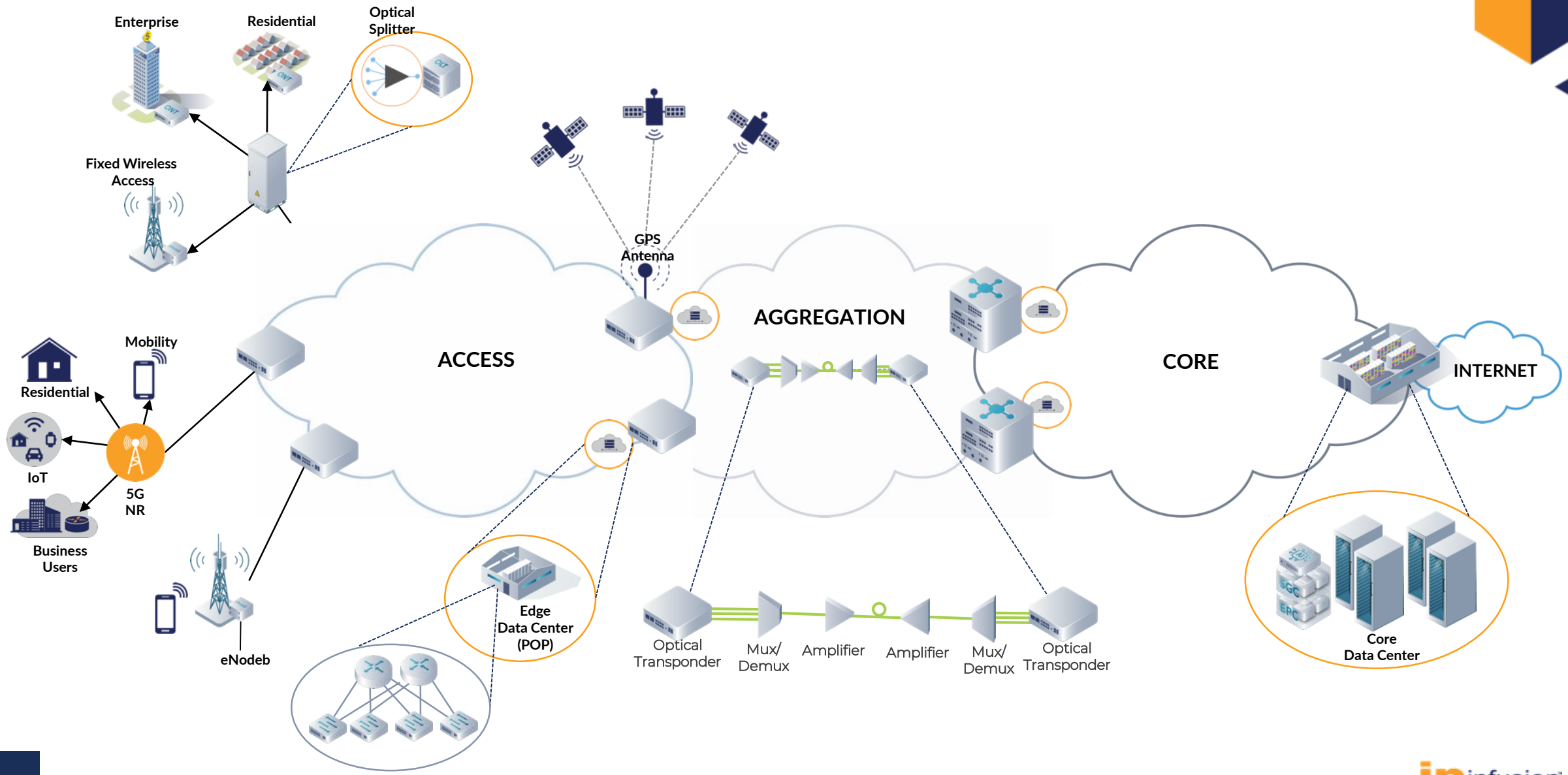
Interoperable across vendors
- Open, standards-based solutions ensures interop across vendors

Enabling choice and supply chain agility
- Operators can quickly adopt latest hardware from different white-box vendors

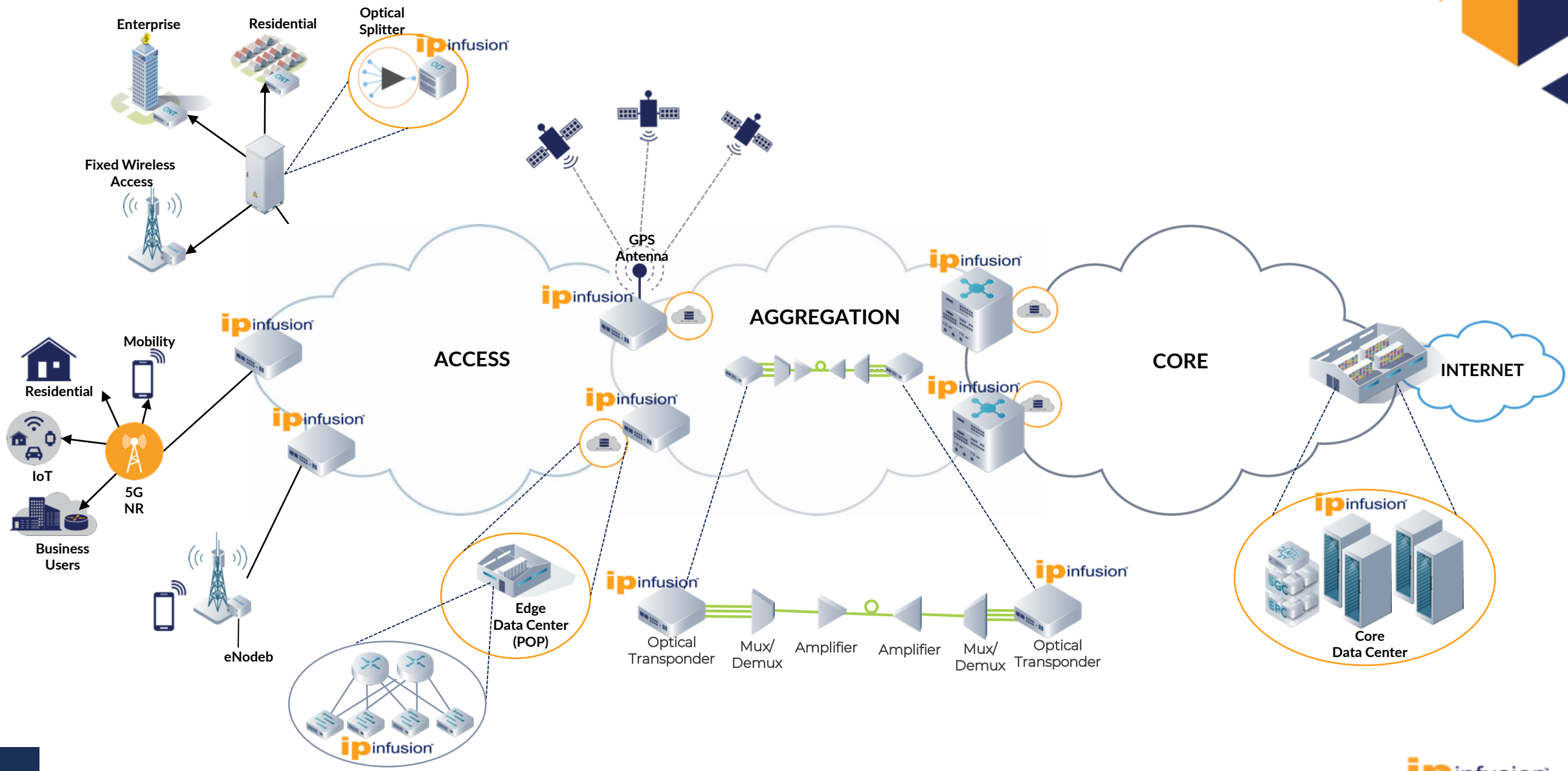
Lower TCO and operational complexity
- Significant TCO saving annually over traditional model

Free from vendor lock-in
- Handing strategic control back to network operators

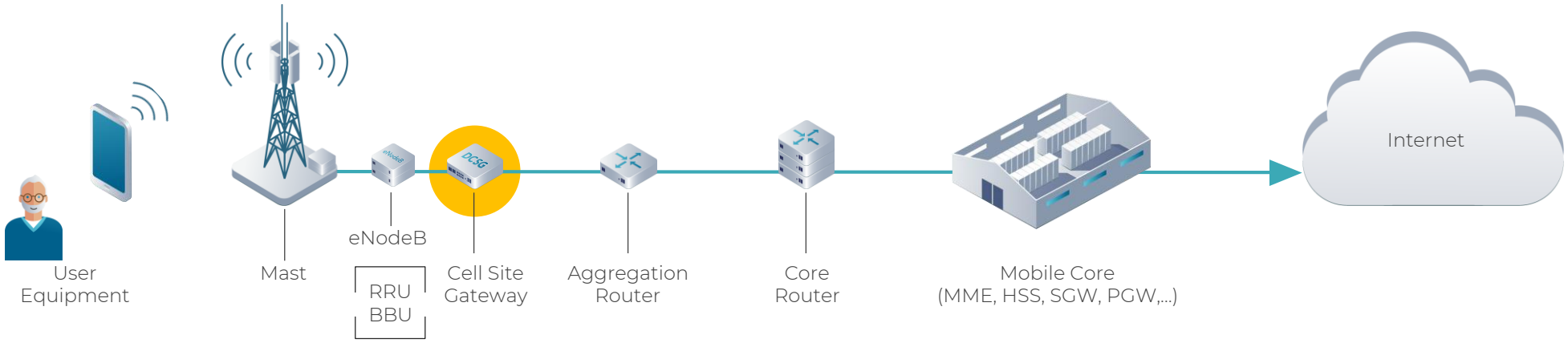
End-to-End Service Provider Network: Traditional Solutions



End-to-End Service Provider Network With IP Infusion



5G Drives New Challenges & Requirements



5G brings new challenges & xHaul requirements

MORE CELLS
Increase number of CSRs, compelling greater need to reduce costs

HIGHER SPEEDS
Transport disaggregation requires range of interfaces spanning orders of magnitude of bandwidth

LOWER LATENCIES
Disaggregation necessitates low-cost timing and synchronization

ORAN
Open RAN requires flexible and diverse xHaul transport, and legacy services for migration

Disaggregated Cell Site Gateway At A Glance

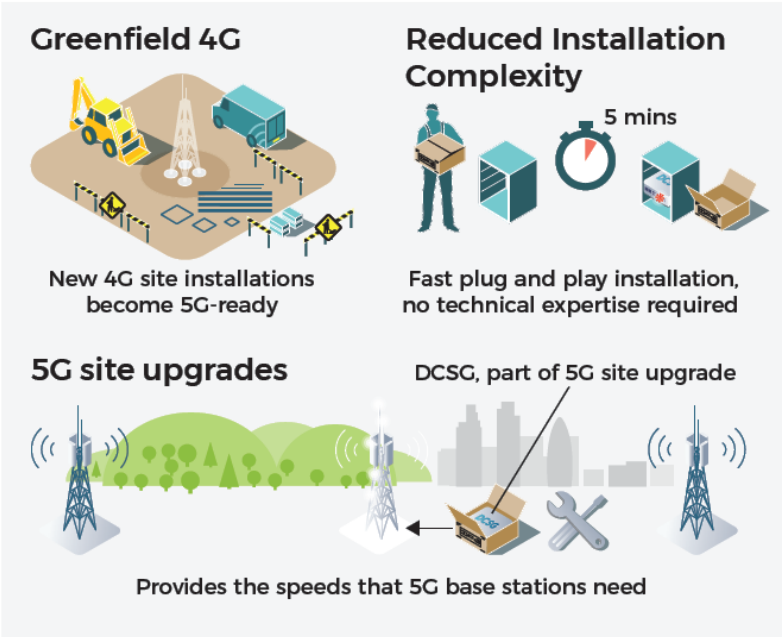
The Cell Site router is a critical component of any xHaul deployment

Backhaul

Midhaul

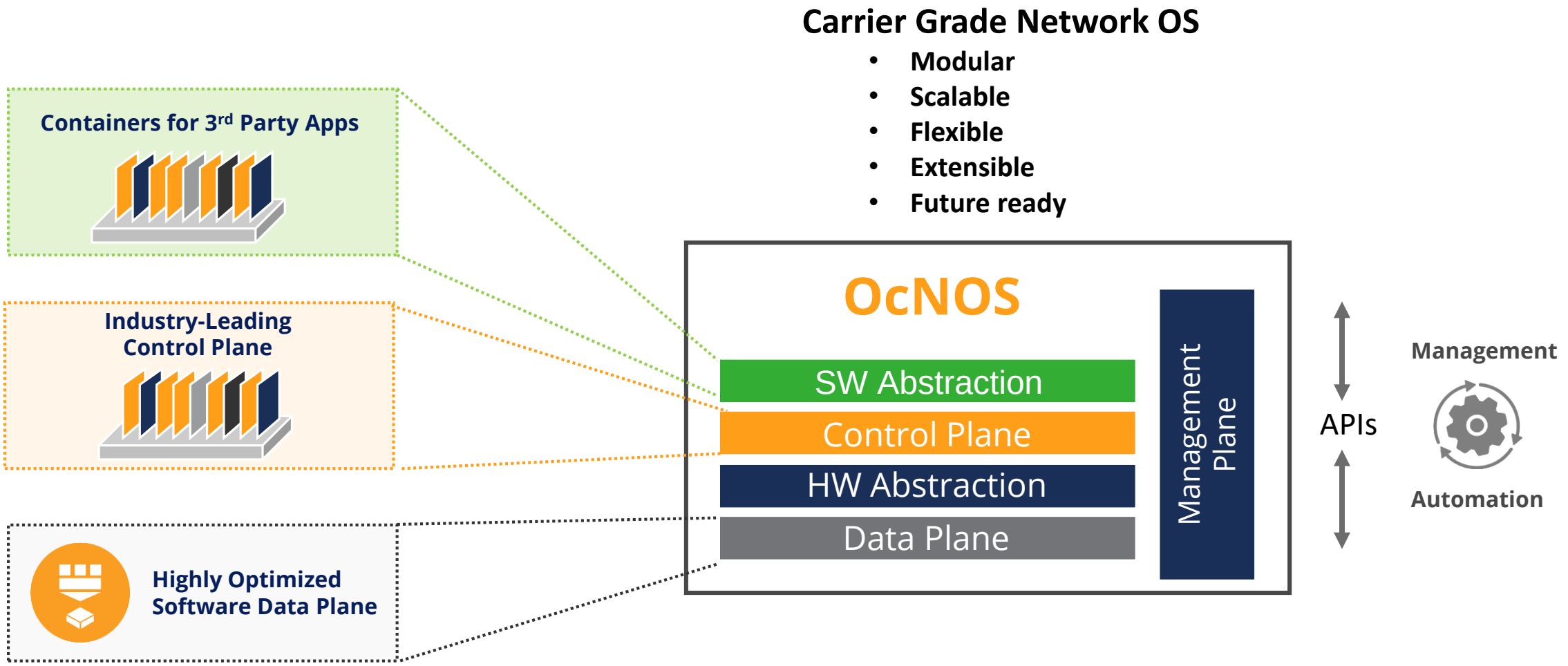
Fronthaul

DCSG – A family of white-box aggregation routers based on an open and disaggregated architecture for existing 2G/3G/4G and 5G mobile infrastructures.



- Modularize the SW functions to enable different use cases and deployment scenarios
- Build HW SKUs for each deployment scenario with common APIs and SW capabilities
- Enabling disaggregated solutions for any deployment type and architecture

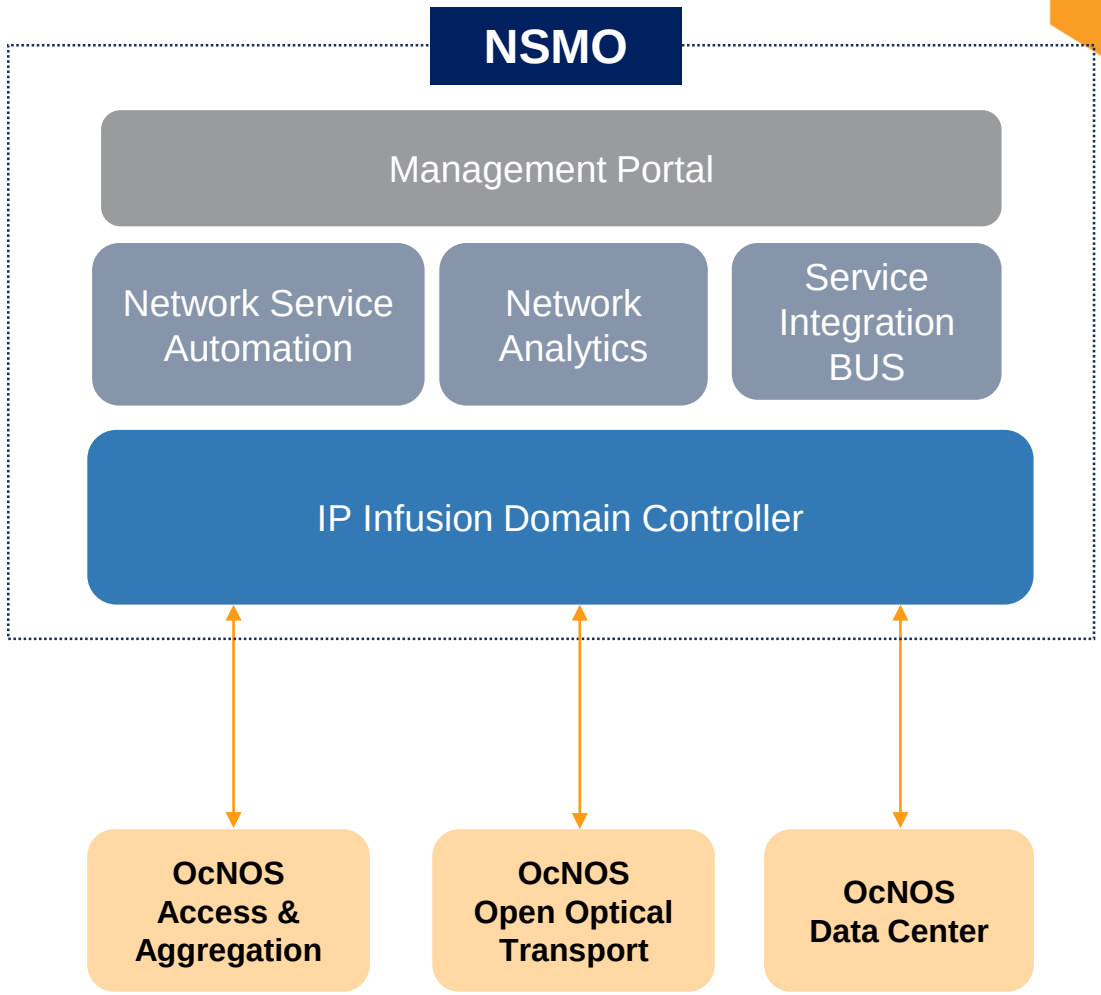
IP Infusion Software Platform: OcNOS



Network Service Mediation & Orchestration Platform

NSMO Functions

- Network Service Automation (OAM)
- Network Telemetry
- Event Correlation (FCAPS)
- Integration for 3rd party EMS/NMS
- Integration for 3rd Party Domain Controllers
- SDN Based, Cloud Enabled



OcNOS Software Platform: Key Differentiators

INNOVATION

- One Software Platform for diverse use cases:
  - Access, Aggregation, Transport, DCN
- Open programmability & automation approach
- Extensive OAM functionality
- Best-of-breed Grandmaster clock solution on COTS silicon
- Microwave radio awareness for Softhaul
- Customization for meeting unique one-off requirements

NETWORK SIMPLIFICATION

- Simplified network operations via CLI/NETCONF/OPENCONFIG/SNMP
- Broad ecosystem of technology and integration partners
- Packaged solutions for faster deployment and TTR
- ITU/IEEE/IETF/TIP/MEF Standards Compliance

DE-RISKING DISAGGREGATION

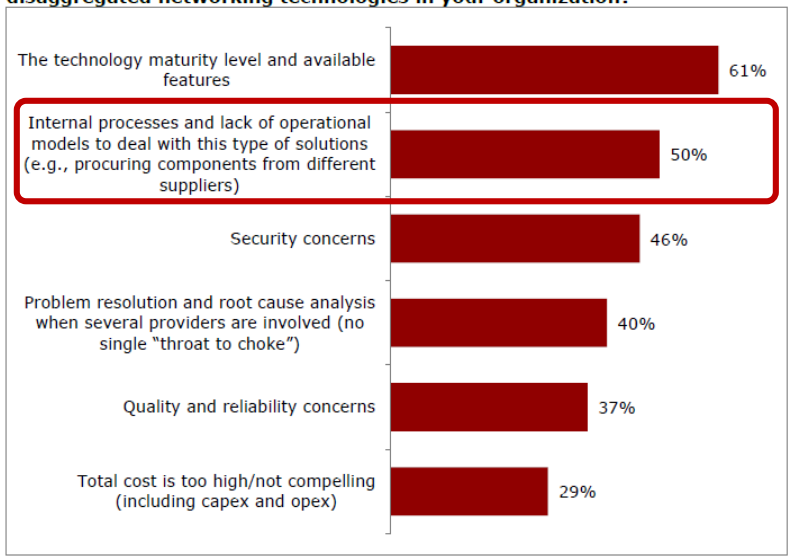
- Investment protection through Service Interworking
- Seamless migration from legacy to next gen networks
- Fully validated, hardened and carrier grade solutions
- Single point of contact support model for Hardware and Software

IP Infusion Turnkey Solutions

Simple Procurement Process with OEM Quality Support for Disaggregated Solutions

Problem

Figure 9: What are the biggest challenges to adopting/deploying open disaggregated networking technologies in your organization?



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Source: Heavy Reading

Operational Complexity And Full Support For Open Solutions Are Key Challenges For Network Operators

Solution

Customer

- One supplier
- One point of contact for support & RMA

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PURCHASE ORDER

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Testing

Integration

24x7 Support

ipinfusion + Edge-corE NETWORKS

IP Infusion *PRO*

ipinfusion + ufiSpace

IP Infusion *FAST*

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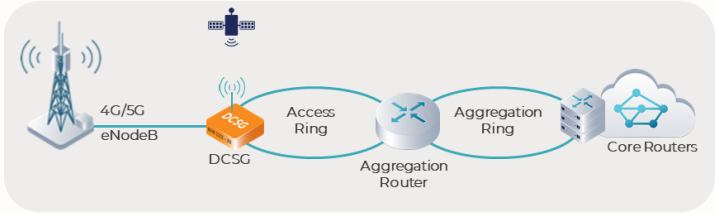
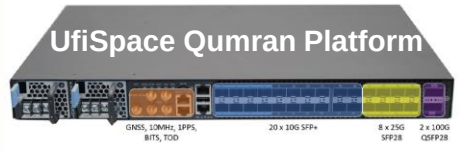
Cell Site Router Deployments

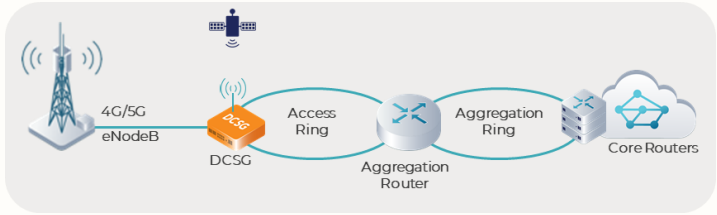
- Asia Pacific Telecom (APT) launched 5G services based on IP Infusion's Disaggregated Cell Site Gateway (DCSG) solution
- Delivered increased bandwidth with a compact, feature rich, and cost efficient solution
- Helped APT achieved a fast, reliable 5G network for consumers and business users
- Located in Taipei, Taiwan





亞太電信 Gt

Deployed

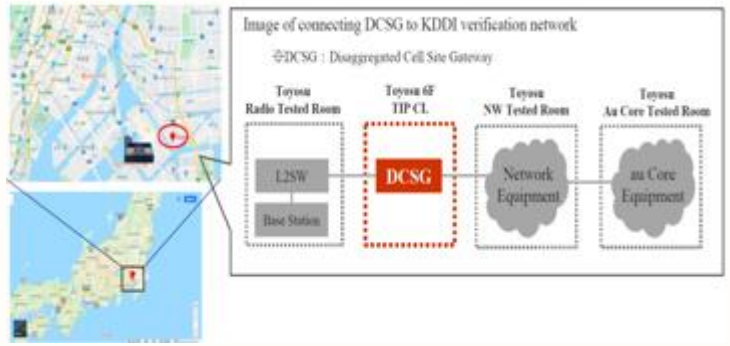


SKY

Deployed

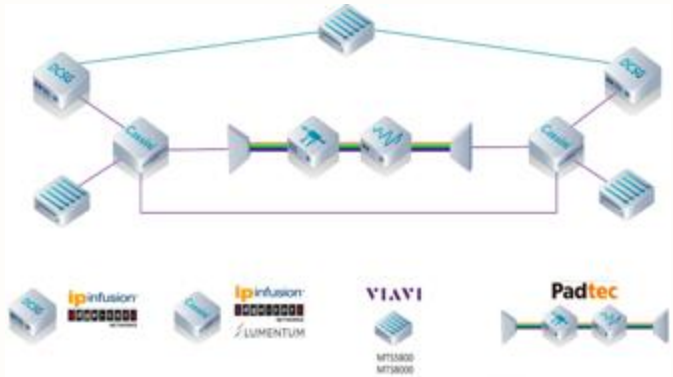
- IP Infusion's DCSG solution validated and deployed in Sky Networks, Telco in Brazil
- Key differentiators evaluated – Cost, Performance and Agility
- Single solution able to address multiple Provider Edge, and Backhaul use-cases
- Metro ring for fixed and mobile wireless, 11 sites, 45 node network

- IP Infusion's DCSG tested and validated at KDDI
- Lab Trial by KDDI as per TIP specifications for DCSG Solution
- End-to-End Integration testing carried out
- Located in Tokyo, Japan



Tomorrow, Together
KDDI

TIP Lab Tested



cpqd

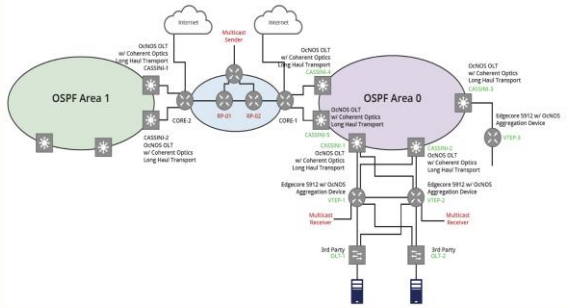
TIP Lab Tested

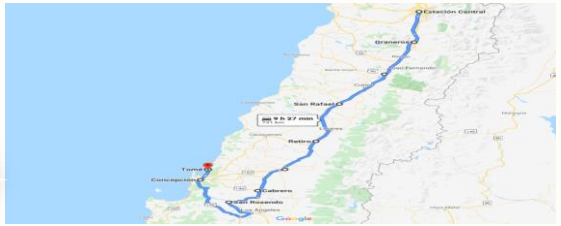
- IP Infusion's DCSG & Cassini Solutions (Optical) validated in CPqD Lab
- Achieved optical coherent 100/200 Gbps transmission over 2000 km without regeneration
- Located in Sao Paulo, Brazil

IP Infusion Commercial Deployments

Enabled high capacity optical packet transport network in Chile

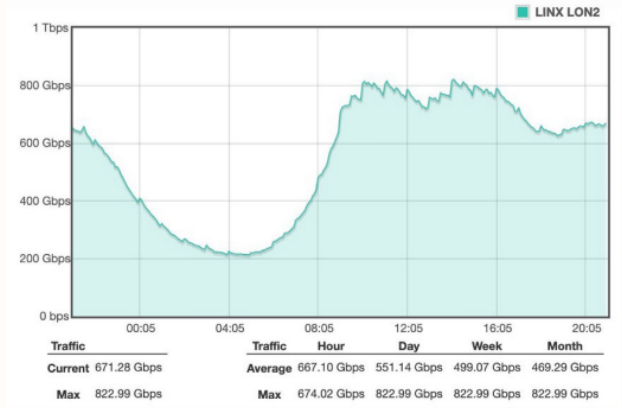
- Delivered triple-play services, agility in service creation & scalability
- Expanding countrywide backbone capacity across 80km to 120km over 200 Gbps optical links
- All cities deployed with leaf dual-homed to the spines for redundancy





mundo
UNA EMPRESA DE MUNDO PACÍFICO

Deployed



The World's First Disaggregated IXP

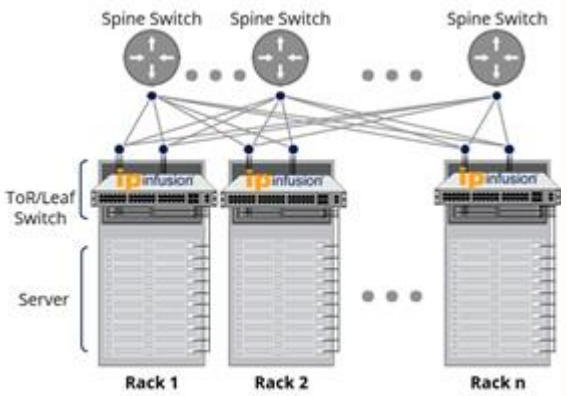
- Connecting more than 820 networks in over 75 countries
- Best-of-breed platform, EVPN over VxLAN, leaf-spine topology
- Reduces total cost of ownership
- Exceeding 800Gb peak traffic & SLA of 99.9999%

linx

Deployed

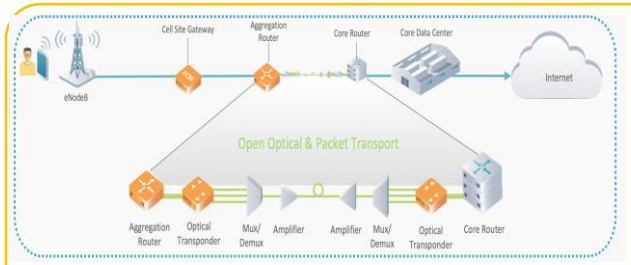
Innovating Data Center with Disaggregated Solutions

- Modernizing and expanding datacenter capacity with open disaggregated spine-leaf architecture
- Reducing TCO with best-of-breed white box solution
- Automation using NETCONF and ZTP with controller



SAKURA internet

Deployed



First Commercial Deployment of DCSG & Cassini in Africa

- 200 km network connectivity between Ouagadougou & Dakola
- First 200 Gbps link extending ISP capacity in Burkina Faso
- Land-locked country, with limited access to transit network connections

VIRTUAL
TECHNOLOGIES AND SOLUTIONS

Deployed

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Supported DCSG Platforms

S. No.	Vendor	Platform	Broadcom Chipset	Port Configuration
1	Edgecore	AS5915-18X	Qumran-UX	6 x 10GE, 8 x 1GE, 4 x 1GE RJ45
2	Edgecore	AS7316-26XB	Qumran-AX	2 x 100GE, 8 x 25GE, 16 x 10GE
3	UfiSpace	S9500-30XS	Qumran-AX	2 x 100GE, 8 x 25GE, 20 x 10GE
4	UfiSpace	S9500-22XST	Qumran-AX	2 x 100GE, 8 x 25GE, 8 x 10GE, 4 x 1GE RJ45
5	UfiSpace	S9501-18SMT	Qumran-UX	6 x 10GE, 8 x 1GE, 4 x 1GE RJ45
6	UfiSpace	S9501-28SMT	Qumran-UX	8 x 10GE, 16 x 1GE, 4 x 1GE RJ45

Edge-corE® NETWORKS

AS5915-18X

AS7316-26XB

ufiSpace

S9500-30XS

S9500-22XST

S9501-18/28SMT

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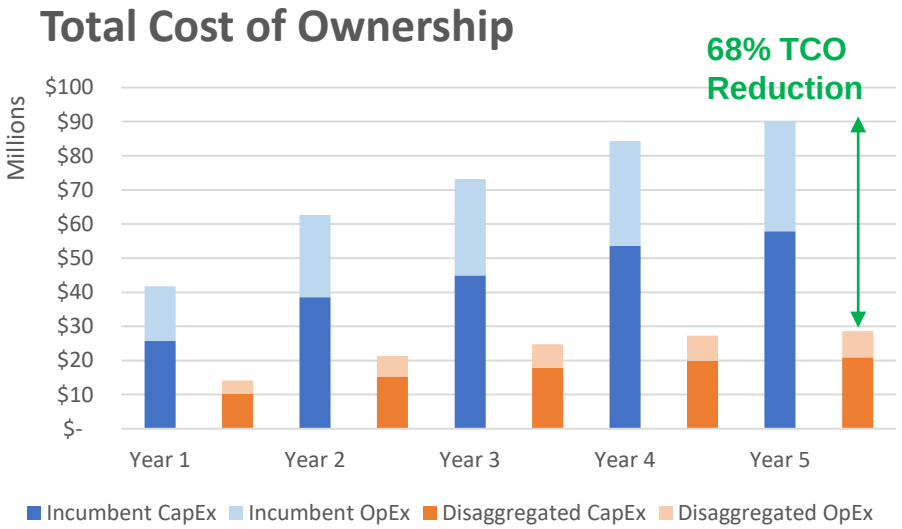
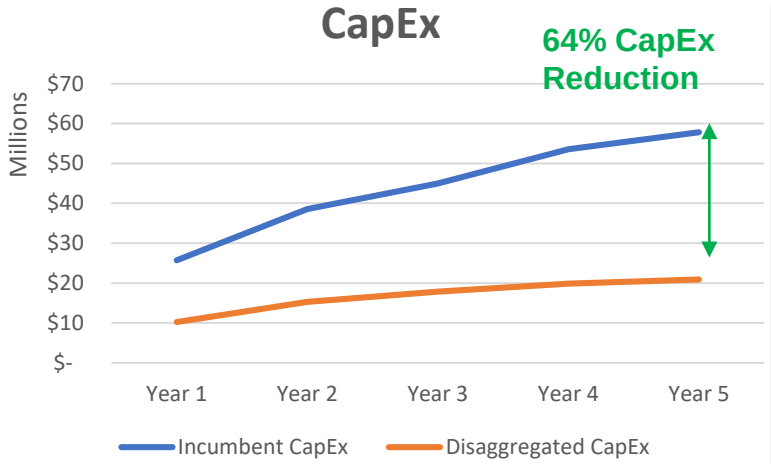
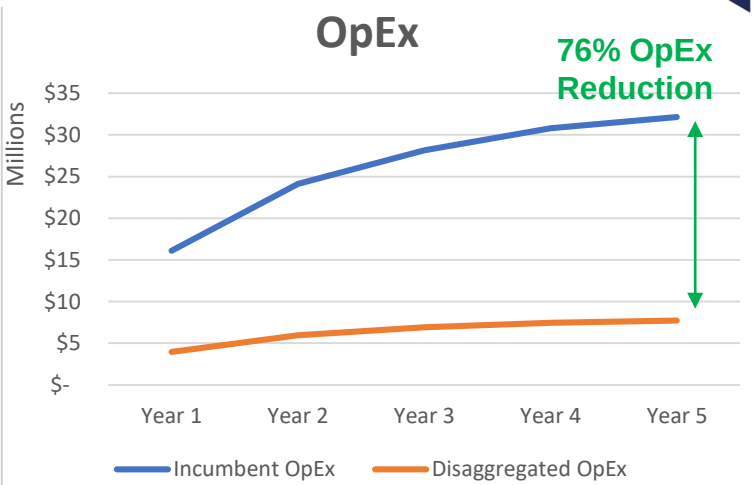
Delivering Lower TCO Compared to Traditional Networking



- Up to 68% TCO saving annually over traditional networking model
- Lower TCO ~ $61M over 5 years

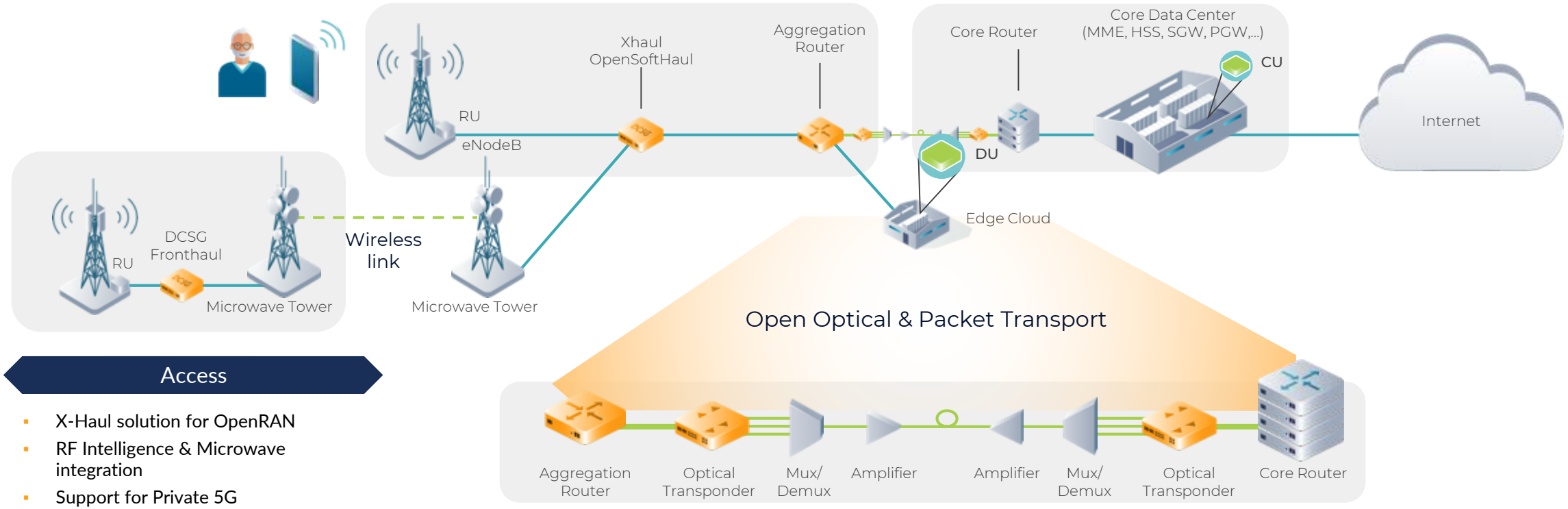


- Up to 64% CapEx saving over traditional networking model
- Lower CapEx ~ $37M over 5 years



- Up to 76% OpEx saving over traditional networking model
- Lower OpEx ~ $24M over 5 years

IP Infusion Delivers End-to-End Disaggregated Network Solutions



Access

- X-Haul solution for OpenRAN
- RF Intelligence & Microwave integration
- Support for Private 5G
- WAN Overlay, Traffic engineering
- Carrier Ethernet, XGSPON/NGPON2
- Programmability and advanced telemetry for automation and insights

Aggregation

- Capacity:
  60 Gbps - 2.4 Tbps
- Interworking with existing networks
- Tunable optics for long range

Optical Transport

- Cassini: Long range, minimal delay
- Phoenix, Galileo
- 100/400/800 Gbps +
- DCO/ACO and ZR pluggable optics

Core & DC

- Edge-computing: Massive data exchanged at datacenter
- DCI, Next Gen DC/HPC
- 25/51/102Tbps Scale Carrier Packet Switching

Services and Capacity, at lower cost per bit without complexity, seamless interworking with legacy network without any service disruption

IP Infusion Solution Recap

Open Compute Network Operating System (OcNOS)

Open Standards-based Software Platform
(IETF/ITU/IEEE/OIF/MEF/TIP Compliant)

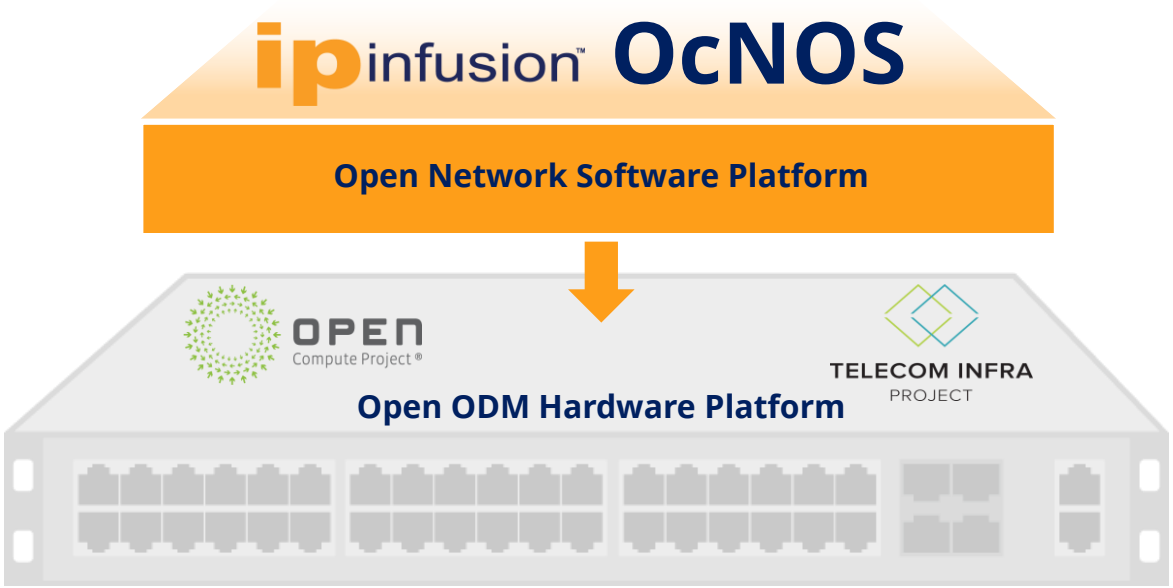
End-to-end use cases (Access/PE/CSR/OTN/DC)

Proven Industry-leading Control Plane

Lower TCO (choice of ODM hardware)

Advanced Network Services

Future Ready (ODM/COTS Silicon/Optics/3rd Party Application integration)



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Accelerating Network Disaggregation

Shaji Nathan

Chief Product Officer

shaji.nathan@ipinfusion.com

For more product info:

https://www.ipinfusion.com/products/ocnos/?1#osp

Contact us:

ipisales@ipinfusion.com