



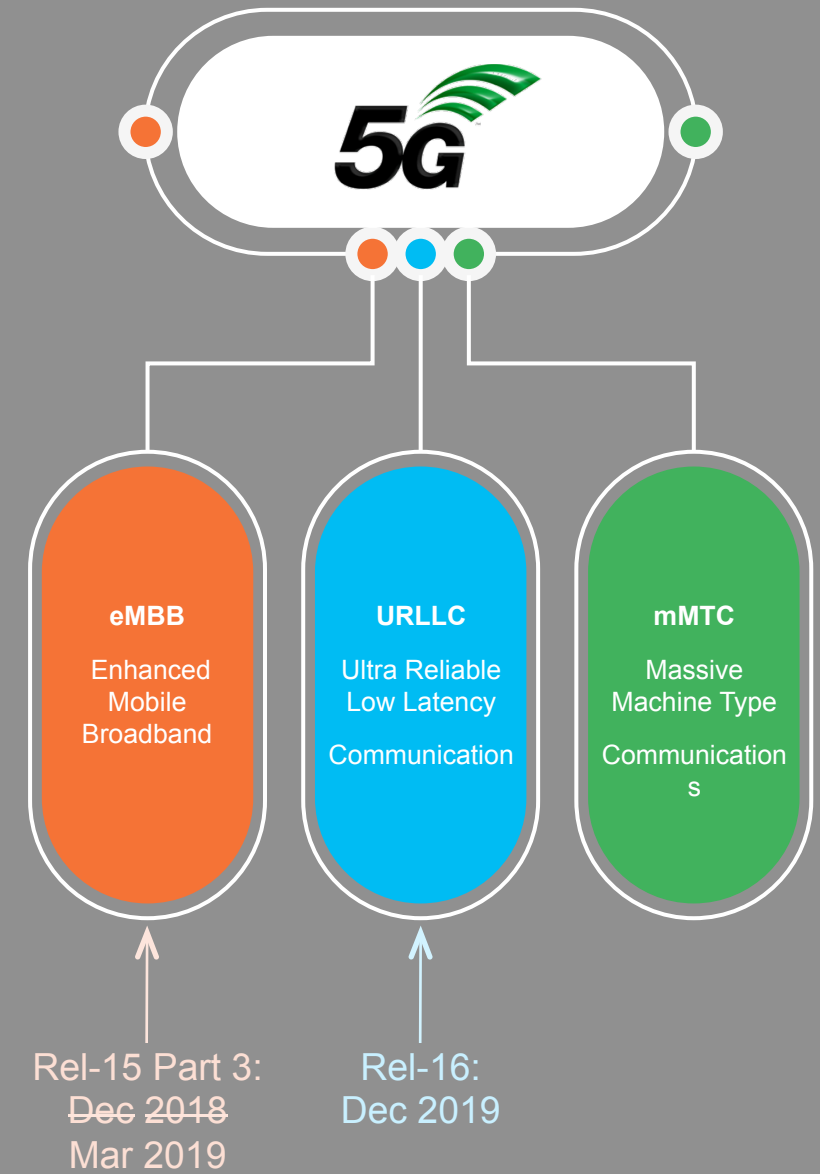
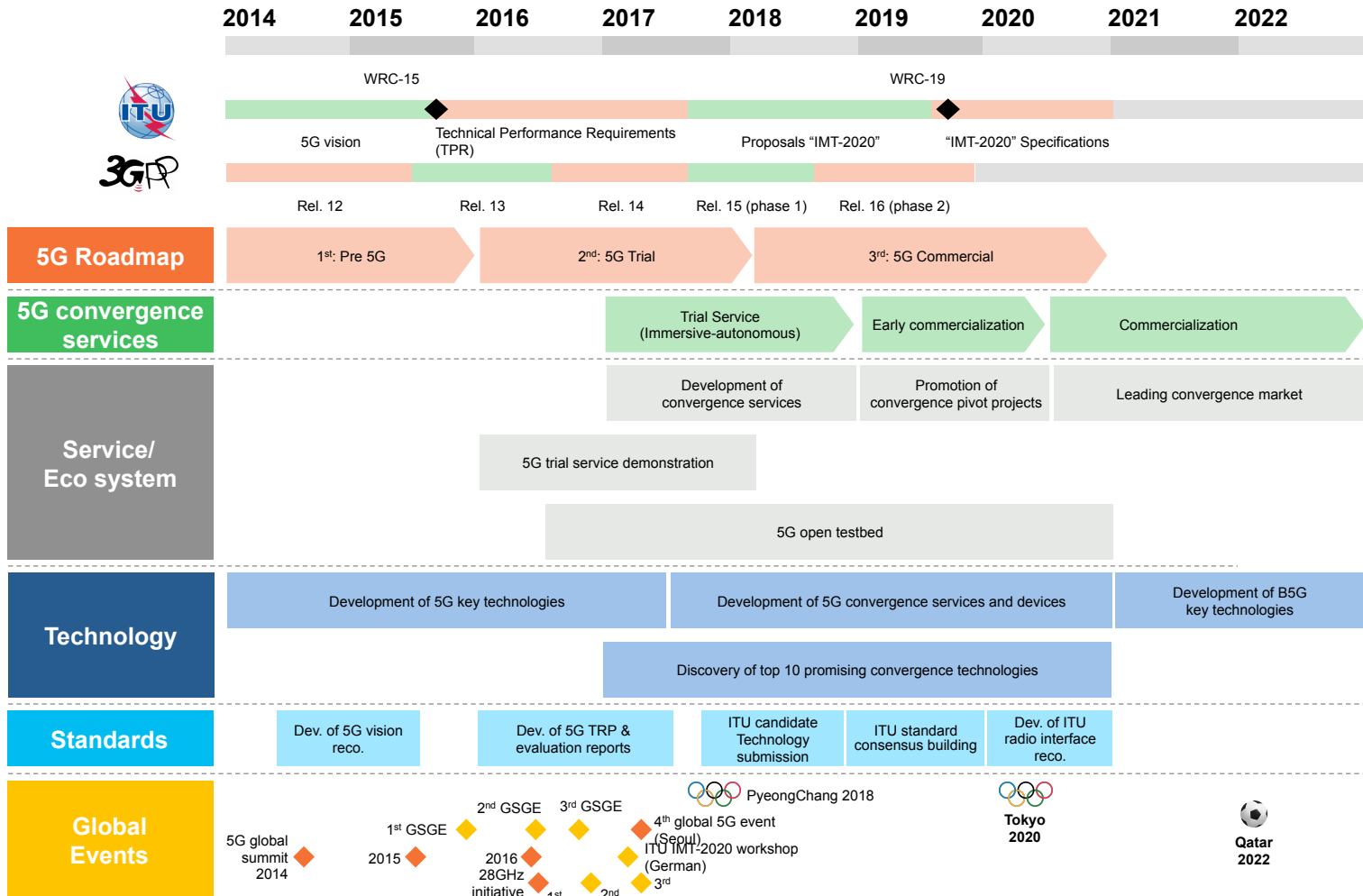
Infrastructure
Innovation

Parallel
WIRELESS

5G OpenRAN in the UK

5G Vision and 3GPP Plans

PW 5G native OpenRAN architecture is software upgradable to any release



March 2018: 5G RuralFirst: Parallel Wireless 5G Deployment

- **5G UK initiative funded by the UK government and led by Cisco**
- [Cisco Press Release](#)
- **Key Points:**
 - A consortium of over 29 partners
 - Focus on providing connectivity to consumers, enterprises, businesses and to enable innovative use cases
 - PW Unified architecture across all Gs allows 4G network investment to be extended for 5G
 - Sw upgradability to 5G
 - Disaggregation of hw and sw
- [Customer Testimonial](#)



5G RuralFirst

Testbed Innovation, R&D, and Research Partnerships



CISCO
Microsoft
zeetta NETWORKS
DATAVITA
Where your data comes to life
UNIVERSITY OF SURREY

5G Cloud Infrastructure

BBC
R&D
University of Strathclyde
SHEFA

Broadcast Mode

CloudNet IT-Solutions Ltd
ORKNEY ISLANDS COUNCIL
BROADWAY PARTNERS
SCOTTISH FUTURES TRUST

Community & Infrastructure

CENSIS stream
UNIVERSITY OF STRATHCLYDE
POWER NETWORKS DEMONSTRATION CENTRE

Industrial IoT

BT
HERIOT WATT UNIVERSITY
pureLiFi
Lime microsystems
UNIVERSITY OF EDINBURGH
Parallel WIRELESS

5G Access Technology

Fairspectrum
NOMINET
Teli'nt
University of Strathclyde
FØROYATELE

Shared Spectrum

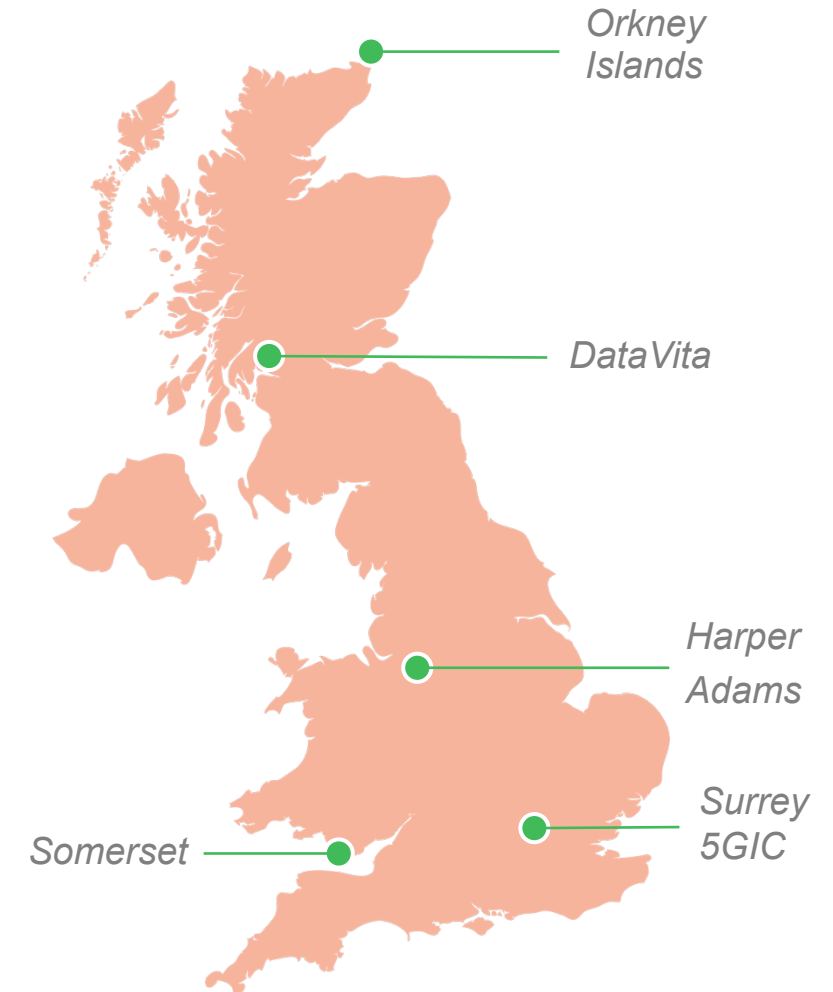
AGRIEPICENTRE
Engineering • Precision • Innovation
Precision Decisions Ltd
Origin ENTERPRISES PLC
Kingshay
soilessentials
precision farming solutions
Harper Adams University
afimilk
MILKALYSER
hyperceptions

Rural Agri-Tech

What is 5G RuralFirst ?

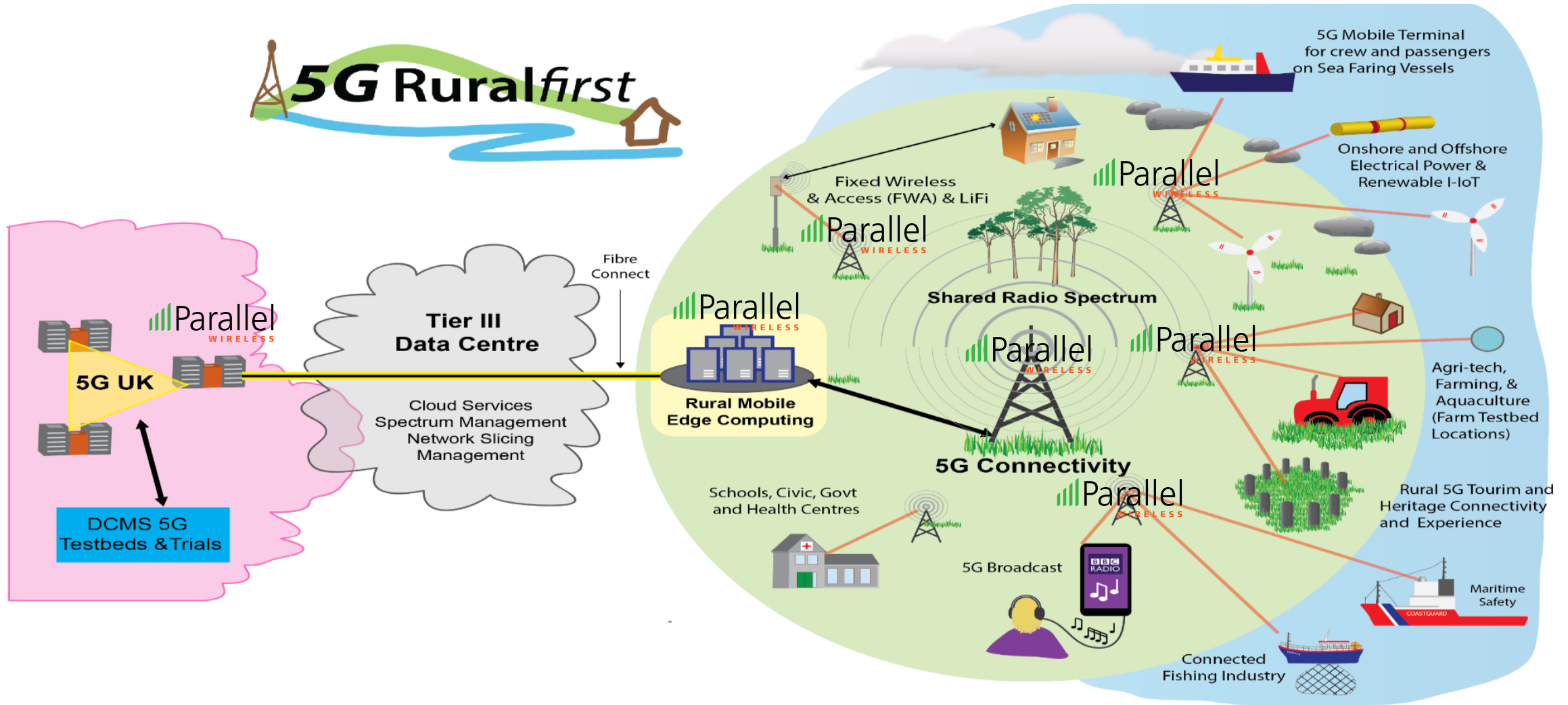
Review differing rural 5G challenges and inform economics for **business models**: communities, agriculture, broadcast, local industry.

- Demonstrated **spectrum sharing** and deployment of **disaggregated 5G** lower cost OpenRAN radios & RAN by Parallel Wireless (Orkney).
 - **Radio broadcast** over Parallel Wireless enabled 5G (Orkney)
 - Renewable Energy/**IoT**/Security (Orkney)
 - Salmon farming/Safety/IoT – monitoring (Orkney)
 - **Agri-tech**: Autonomous farm vehicles, Crop/Soil Condition Mapping, Augmented Reality Veterinary Information (Shropshire & Somerset)
 - Test & Connect locations to the **Cisco 5G Cloud** at DataVita data centre via 5G Network Slices (Glasgow).
 - **Business model** investigations



System Architecture

5G RuralFirst: Rural Coverage and Dynamic and Shared Spectrum Access



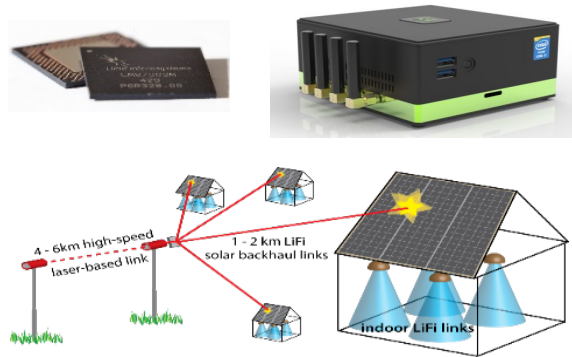
Parallel Wireless Technology...



Mix of Radio Technologies (incl. pre-5G)

All orchestrated by PW OpenRAN Controller

- pre-5G
- 4G
- 5G NR
- SDR
- LiFi
- LoRa
- CBRS



Dynamic Spectrum Access

Licensed Spectrum

Exclusive use
Over 40 bands globally for LTE

Shared Spectrum

New shared spectrum paradigms
e.g. 2.3GHz Europe (LSA),
3.5GHz USA (CBRS),
Spectrum Sharing Framework (UK)

License-Exempt Spectrum

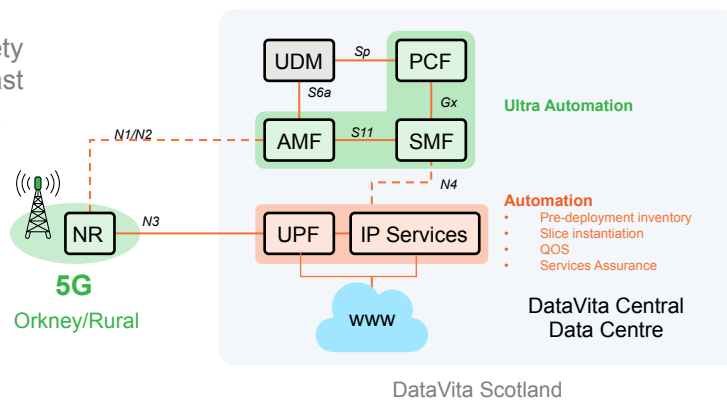
Shared use
e.g. TVWS,
2.4GHz/5GHz/60GHz global



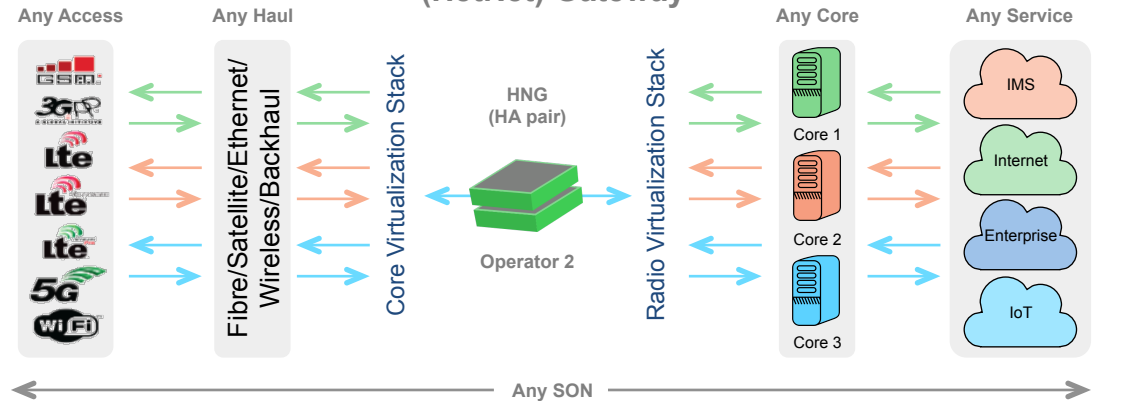
Network Slicing

Slices:

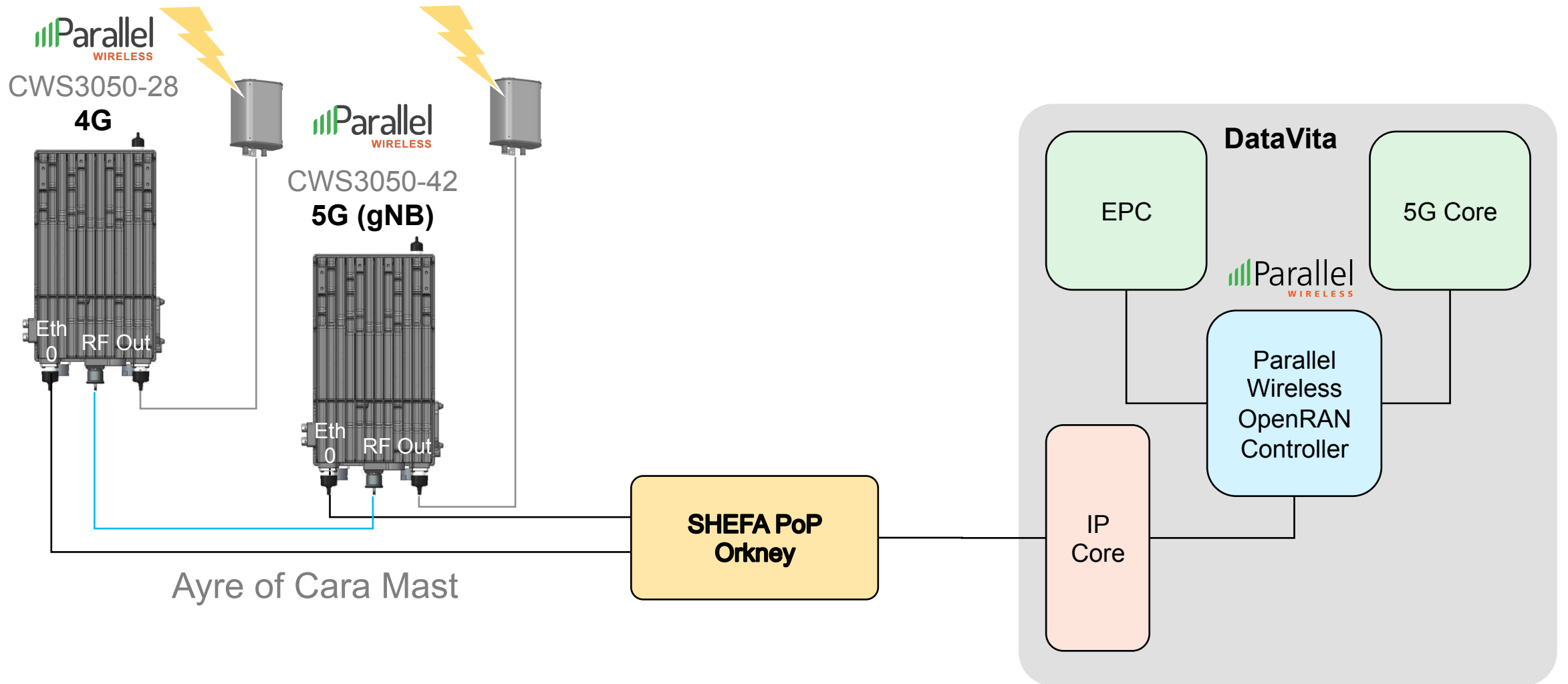
- Consumer mobile data
- Connected health
- Connected fishing
- Marina safety
- 5G broadcast
- Home FWA
- Seaport



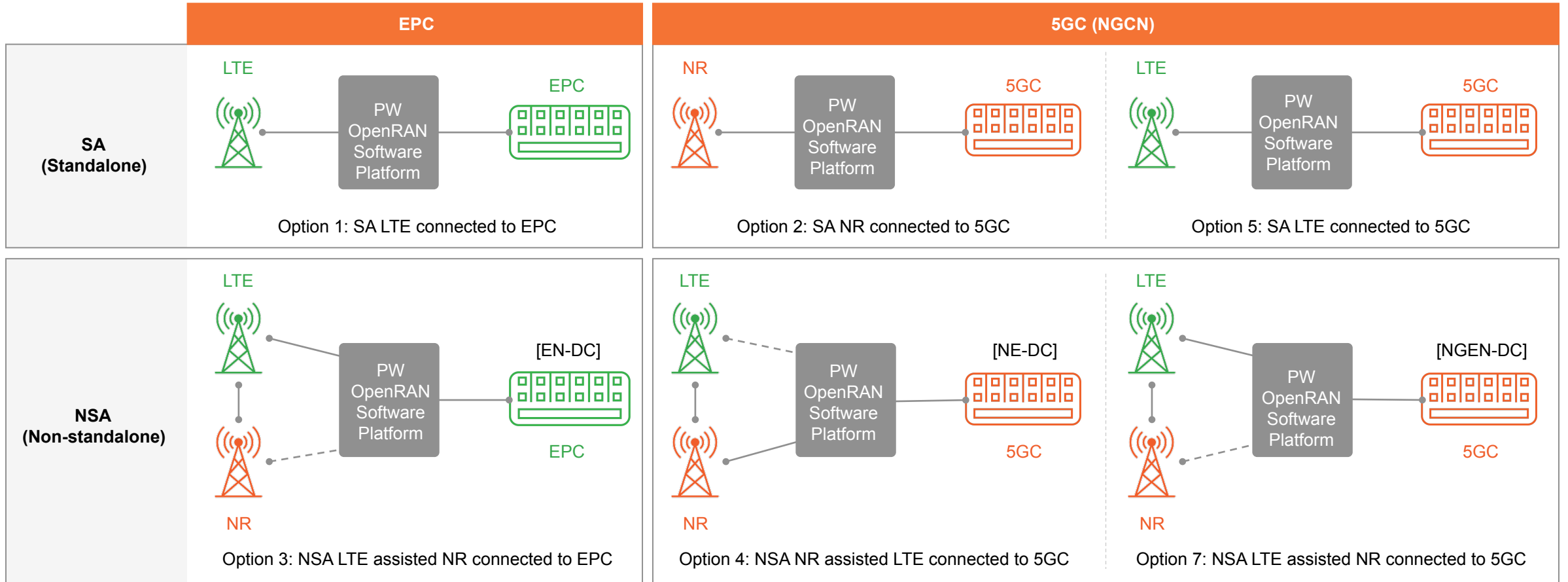
Heterogeneous Network (HetNet) Gateway



Ayre of Cara – Option 3x



Easy and Flexible Migration Strategy with 5G Native Architecture



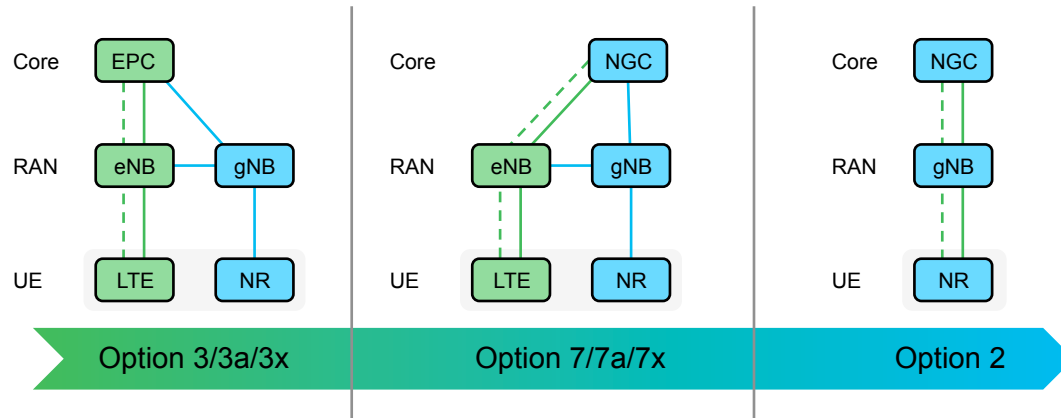
MIGRATION STRATEGY With 5G native architecture MNOs can select ANY migration option based on their timelines and budget

HNG support for 5G Architecture

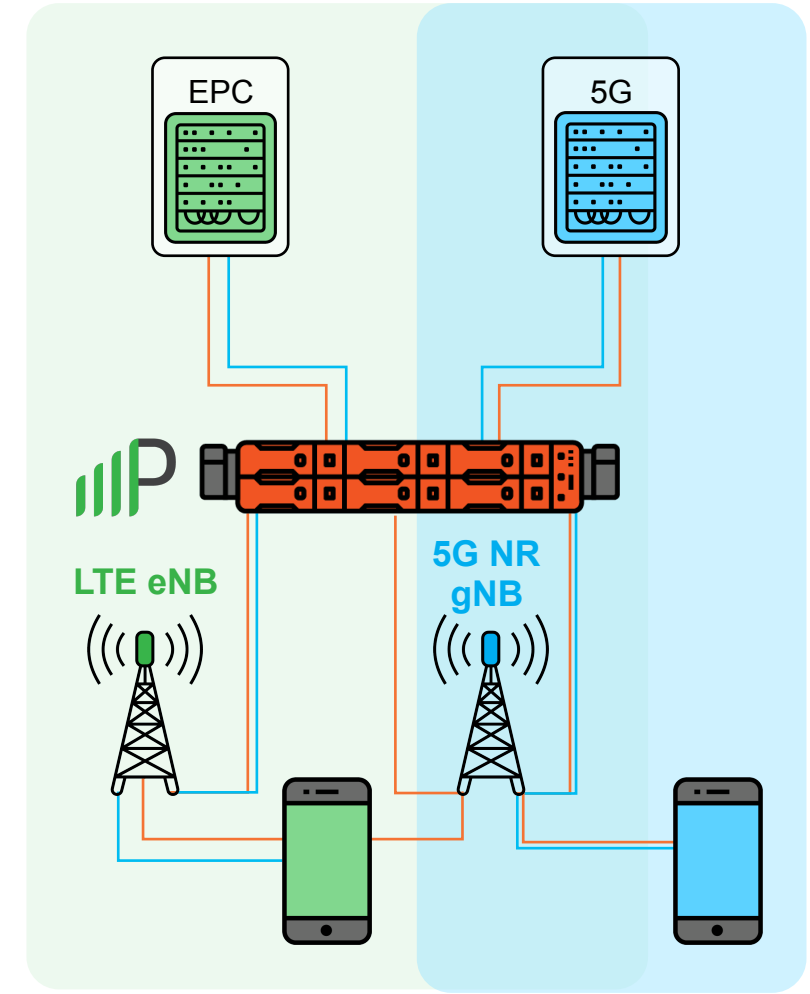
NSA today, SA tomorrow

- 3GPP Standards 5G - NSA and SA:
 - NSA deployment standards finalized in Dec'2017
 - SA deployment standards finalized in Jun'2018
 - All other architecture options remain within 5G New Radio (NR) Work Item Description (WID)
- Parallel Wireless HetNet Gateway (HNG):
 - Flexible to support all 5G architecture options
 - Allows interworking with EPC & 5G CN
 - Fully virtualized, scalable & decomposed architecture

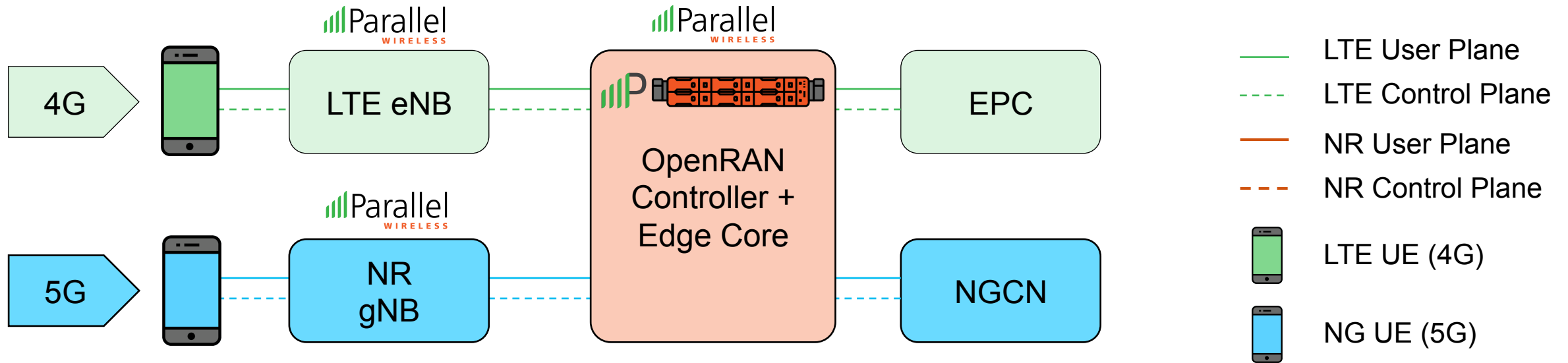
5G Migration Options



Non-Standalone (NSA) Option 3/3a/3x Standalone (SA) Option 2



HNG simplifies 4G & 5G integration



- HNG simplifies evolution and integration of 4G and 5G networks, for all scenarios
- HNG provides advanced RAN functions, simplifying 4G LTE (eNB) & 5G NR (gNB) deployments
- HNG supports all 3GPP standard interfaces and procedures for 4G & 5G
- HNG can support Core functionality for EPC (4G Core) & NGCN (5G Core)
- HNG will seamlessly work with all deployment options for 5G

Showing our Innovation to Phillip Hammond, Chancellor of the Exchequer, UK Government



Survey to Connect the Cows



Frank Nevens @frank_nevens · Sep 11
@5GRuralFirst @agri_epi @Parallel_tw day out to Somerset for site survey. A view back of the milking shed at Beard Hill Farm and showing the coverage area for 'cow tracking'.... @EEESTrathclyde

5 8



5G Rural First Newsletter

Connectivity in Progress

5GRuralFirst
@5GRuralFirst Follow

A few more 📸 from @CloudNet4's visit to Orkney. Action shots on the ferry to and from Stronsay. Thanks @GregWhitton! 🌈 🚢
#5GRuralFirst



12:09 PM - 31 Oct 2018

2 Retweets 5 Likes



4. Parallel Wireless's 700MHz radios for the enhanced mobile broadband use cases arrived in Orkney this week and Cloudnet's Greg was on the case to get them set up. Cloudnet is vital in helping us connect Orkney's difficult to reach areas. Watch this space!

Connected Cows (IoT) 🐮



Summary

- Parallel Wireless All-Gs (2G, 3G, 4G & 5G) solution, helping connectivity of legacy and future technologies.
- Small footprint and cost-effective OpenRAN solution allows operators to deploy the solution in rural areas that would typically be overlooked.
- Support for any transport allows it to be connected it even in the remotest of communities where satellite backhaul is the only option.
- 5G-native architecture enables:
 - eMBB connectivity to help connect unconnected communities.
 - IoT to enable innovative use cases within rural communities.



www.parallelwireless.com