Red Hat Powered Cloud RAN

Service Provider Tech Talk Series
Dec 8, 2022

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Red Hat

Agenda

- The Road to Cloud RAN
- So what is Red Hat Powered Cloud RAN?
- Designing with Red Hat OpenShift: The Horizontal Cloud Platform
- Summary

The Road to Cloud RAN

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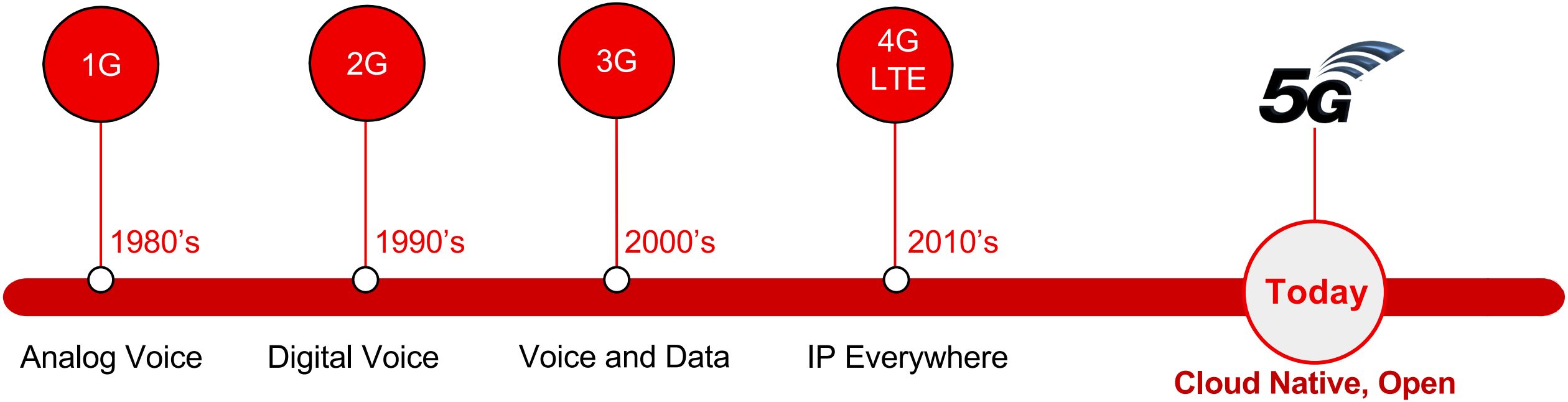
A Brief History of Mobile Evolution



What about the RAN evolution across generations?

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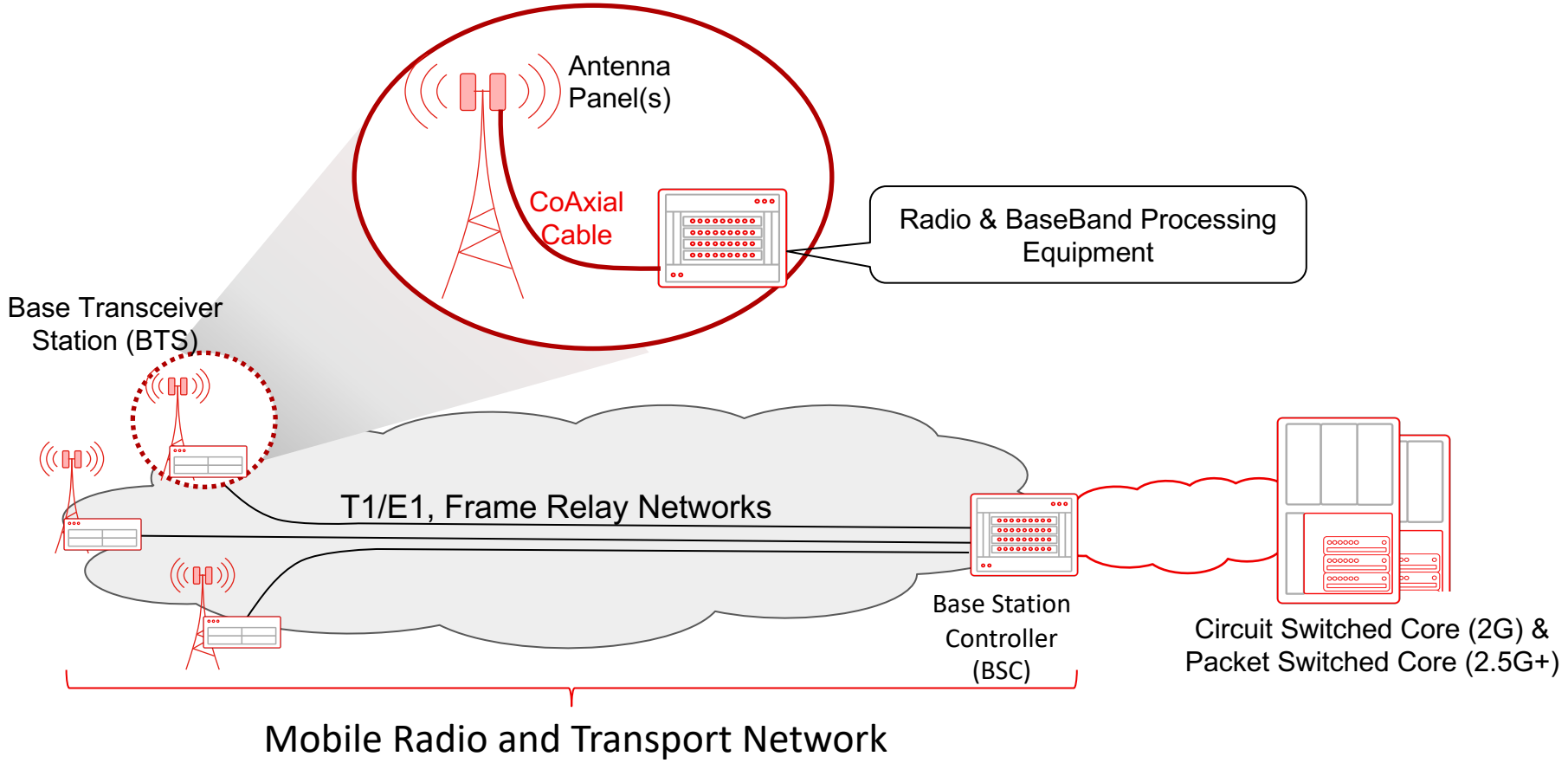
2G/2.5G RAN: Emergence of a real “Radio Access Network”

- 2G/2.5G introduced Basestation Sub-system (BSS)
- Hierarchical structure of BTS and its corresponding BSC



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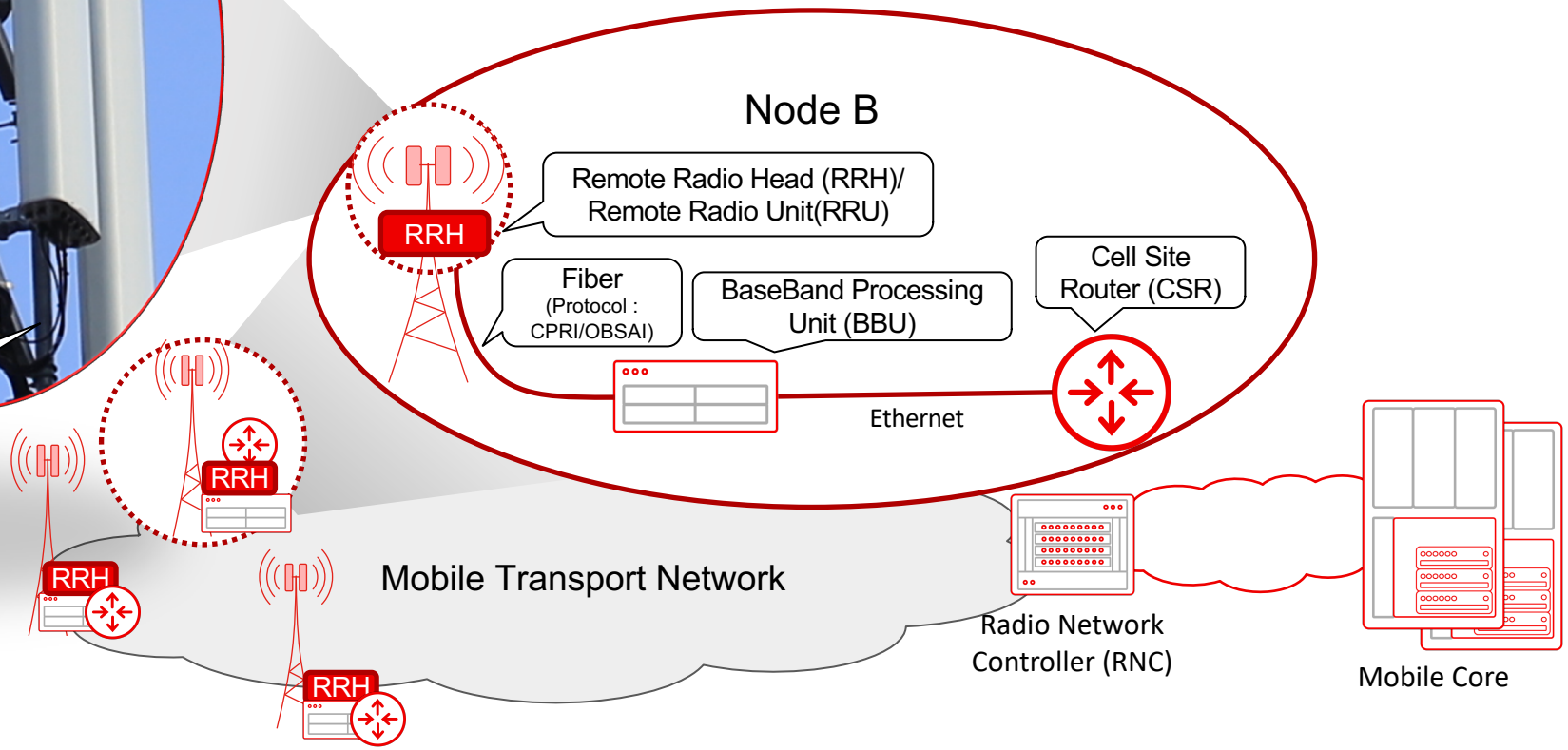
3G RAN: Things Getting Interesting

- Remote Radio Unit (RRU) moving closer to antenna
- BBU at the base of the tower
- Use of CPRI (and OBSAI)



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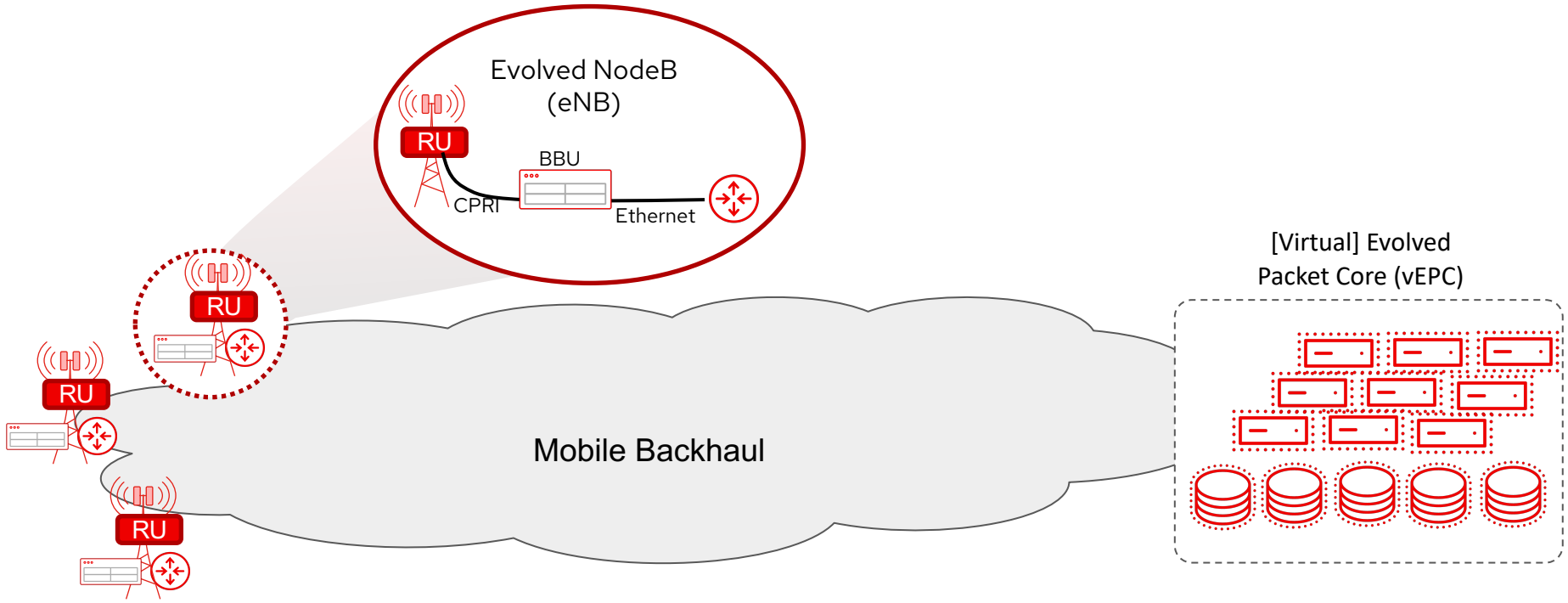
4G RAN: evolved NodeB

- Introduction of Distributed RAN (D-RAN)
  - Every cell site w/ eNB is a self-contained RAN entity – No more RNC
  - All baseband processing done on Cell Site



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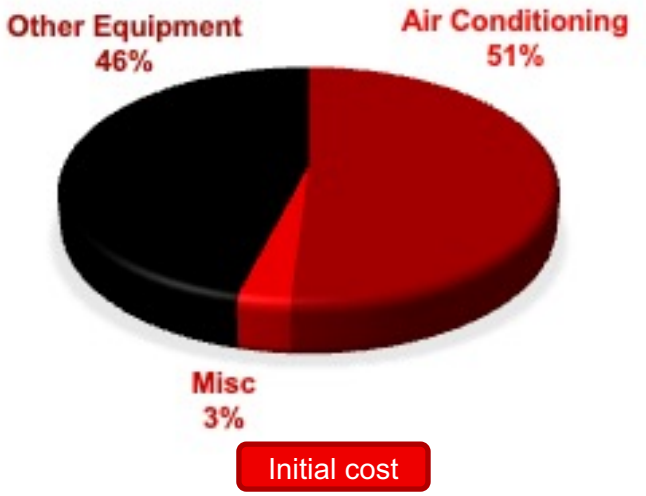
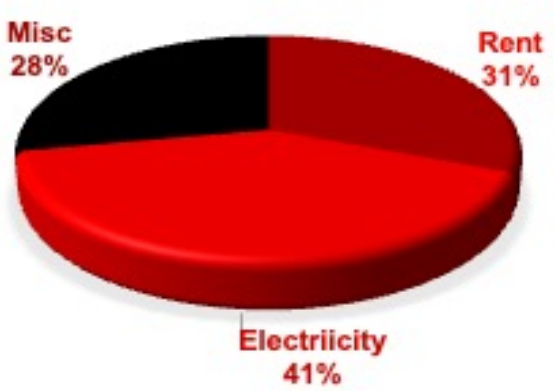
The D-RAN Challenges …

- Challenges with D-RAN deployment at scale made providers rethink
- Power:
  - Cell sites responsible for 70% of total power used in SP networks[1]
  - 50% of that power is used for cooling[1,2]
- Real Estate:
  - High rent & lack of feasible space in populated areas



Initial cost



Running cost

1. A Network Architect's Guide to 5G – ISBN-13: 978-0137376841, Chapter 5
2. https://cdn.rohde-schwarz.com/kr/downloads_31/seminar_materials/Session8-Demystifying_Massive_MIMO.pdf

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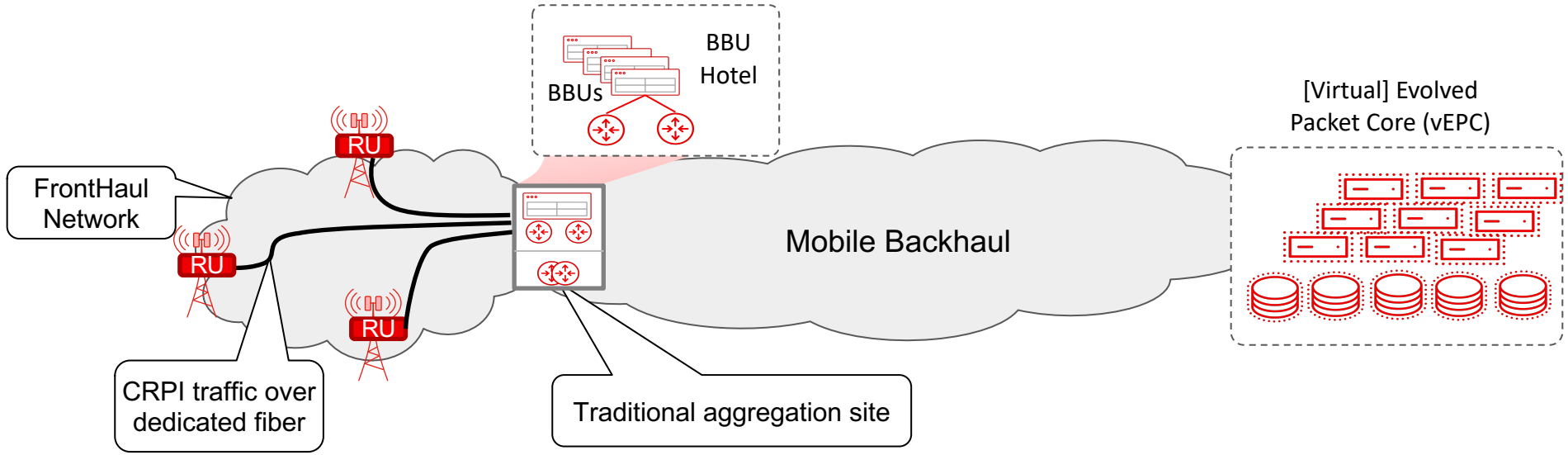
… a Shift toward Centralized RAN

- Centralized RAN architecture:
  - BBU to be moved away from Cell Site Only Antenna and RRU remains at Cell Sites – Leaner, more cost-effective site
  - Allows BBU pooling at a "BBU Hotel" or "C-RAN Hub" – in reality a small data center
  - Front Haul: The network between RU and BBU
  - Cost savings (real estate, power, management)
- Attractive! But practical challenges:
  - transporting unprocessed baseband data from RRU to the remote BBU-Hotel



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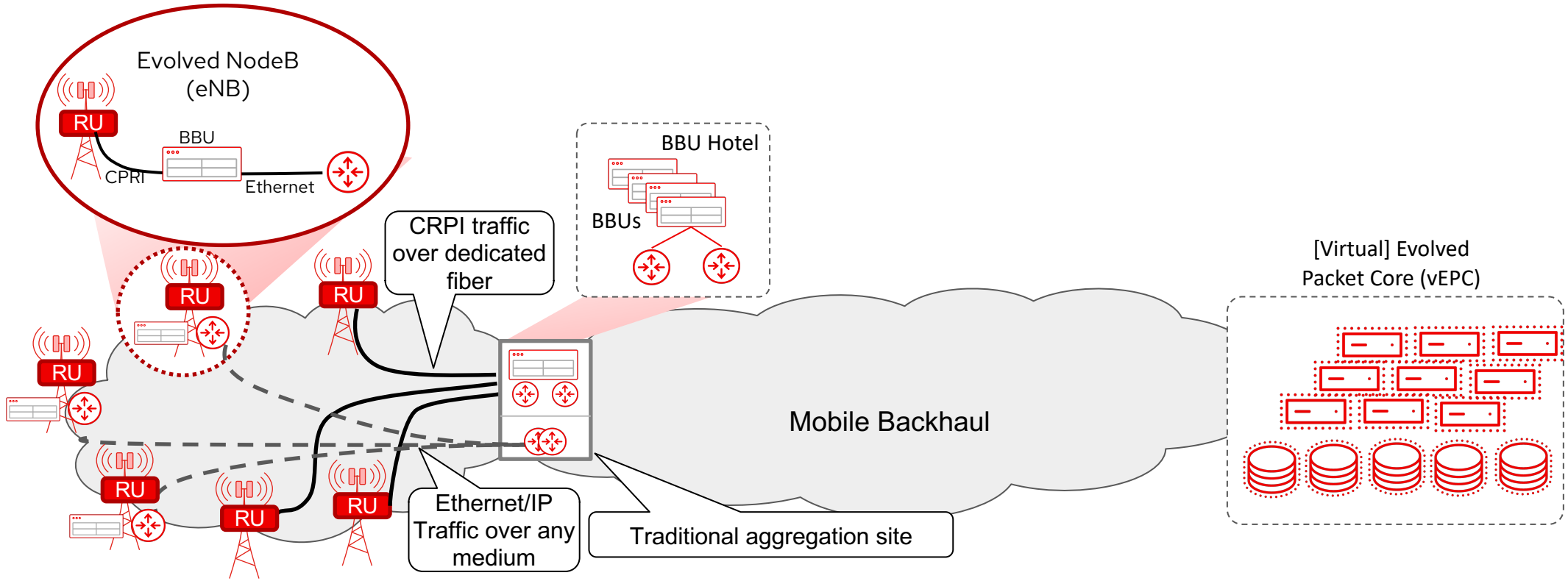
Distributed And Centralized RAN: They do Coexist

- Its not one or the other
- Shared Backhaul/Fronthaul Networks
- Over 90%+ Deployments today are D-RAN



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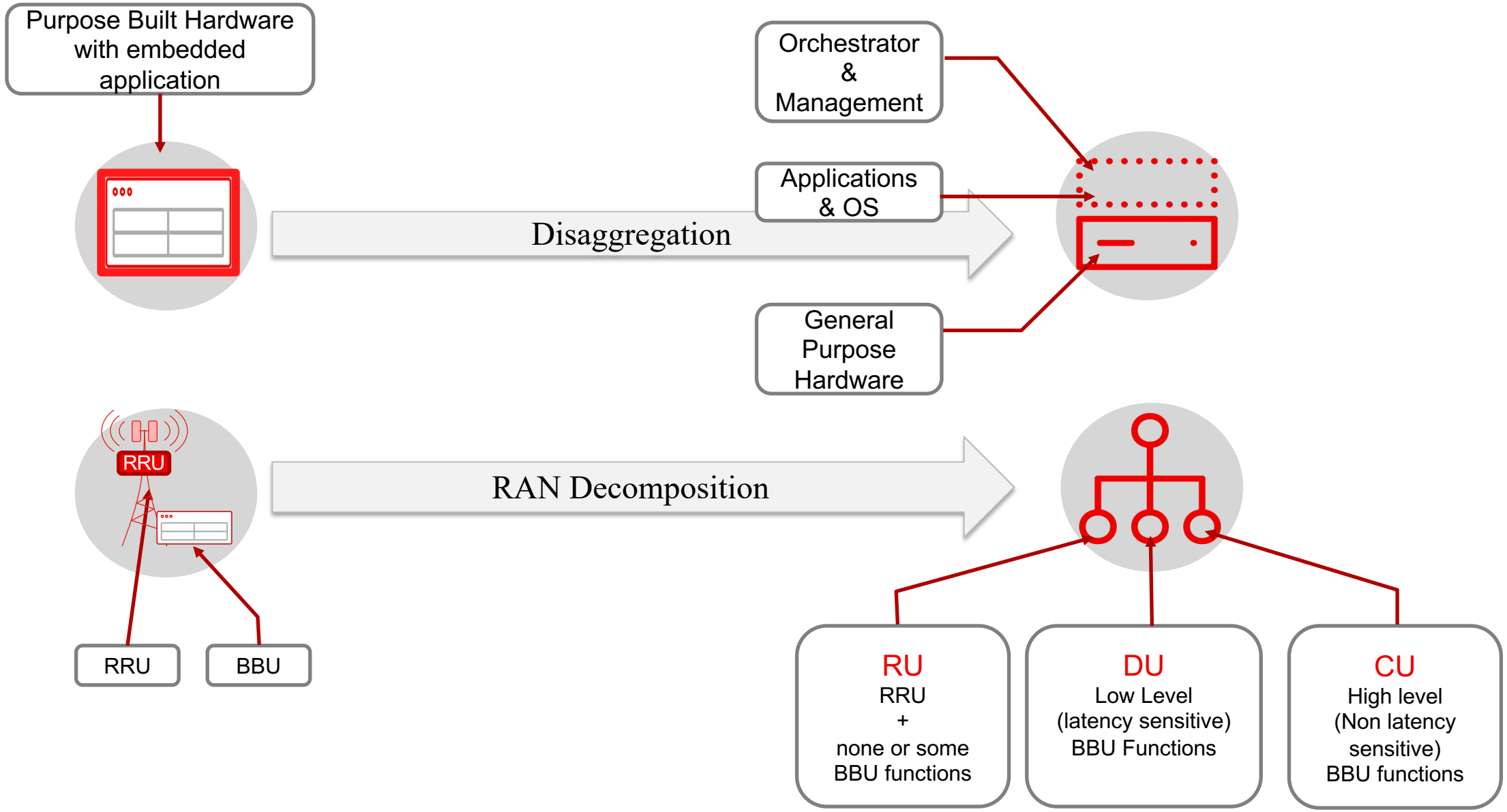
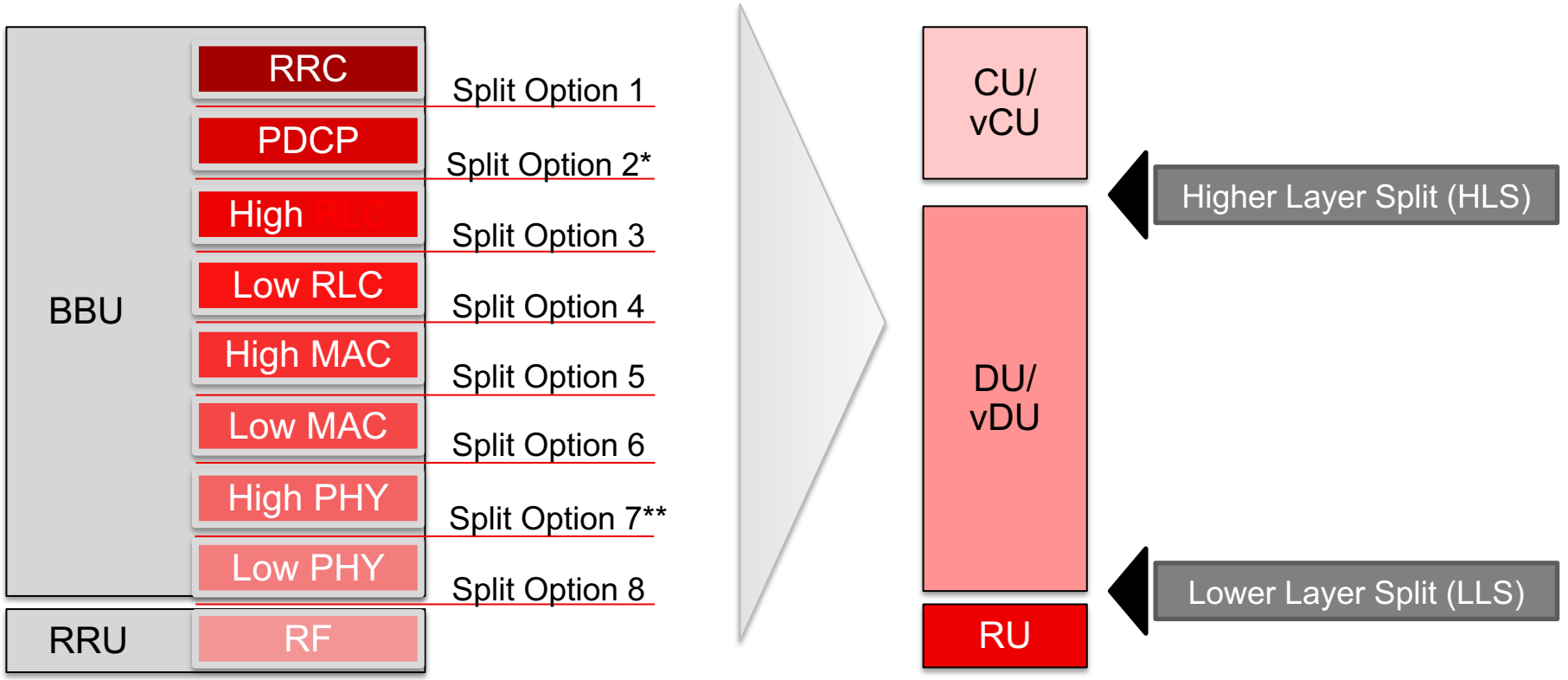
5G RAN: Decomposition along with Disaggregation



RAN Decomposition: Functional Splits



* Split Option 2, Standardized by 3GPP, is the Higher Layer Split (HLS) for function performed by CU and DU
** Lower Layer Split (LLS) option not explicitly defined by 3GPP, leaving room for other industry players like Small Cell Forum, O-RAN Alliance, eCPRI and others to refine LLS options.
** Currently O-RAN's Option 7-2x is industry's leading LLS option

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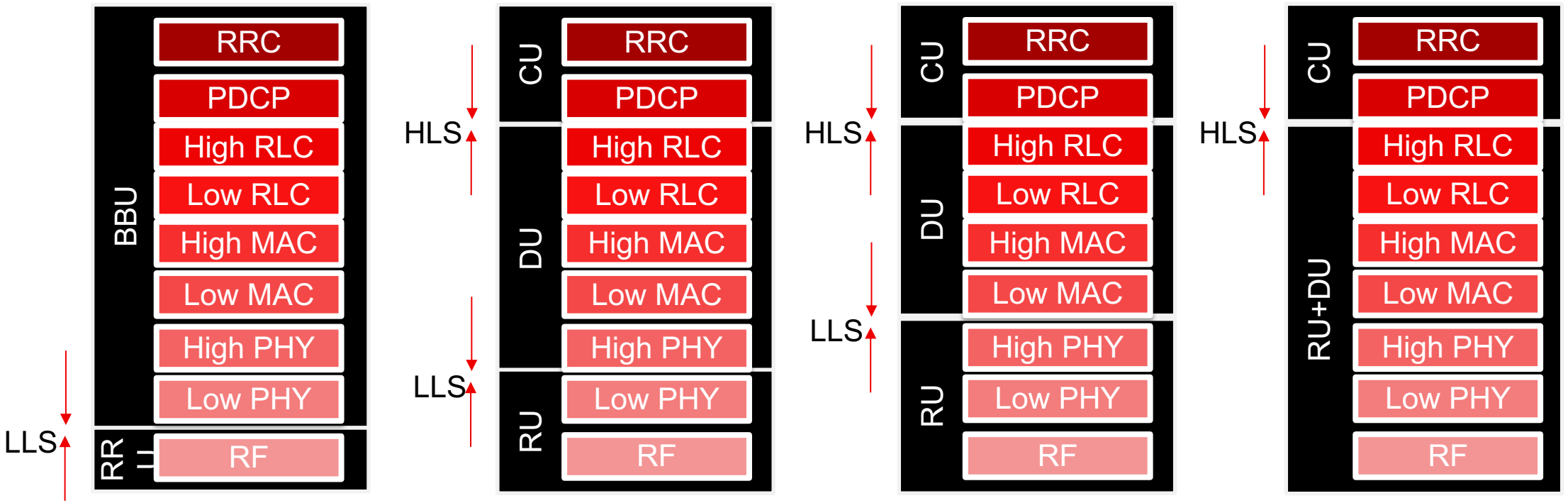
Various Split Options between CU, DU, and RU



No HLS
LLS: 8

HLS:2
LLS: 7

HLS:2
LLS: 6

HLS:2
No LLS

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Virtualized RAN vs Cloud RAN

Virtualized RAN (vRAN)

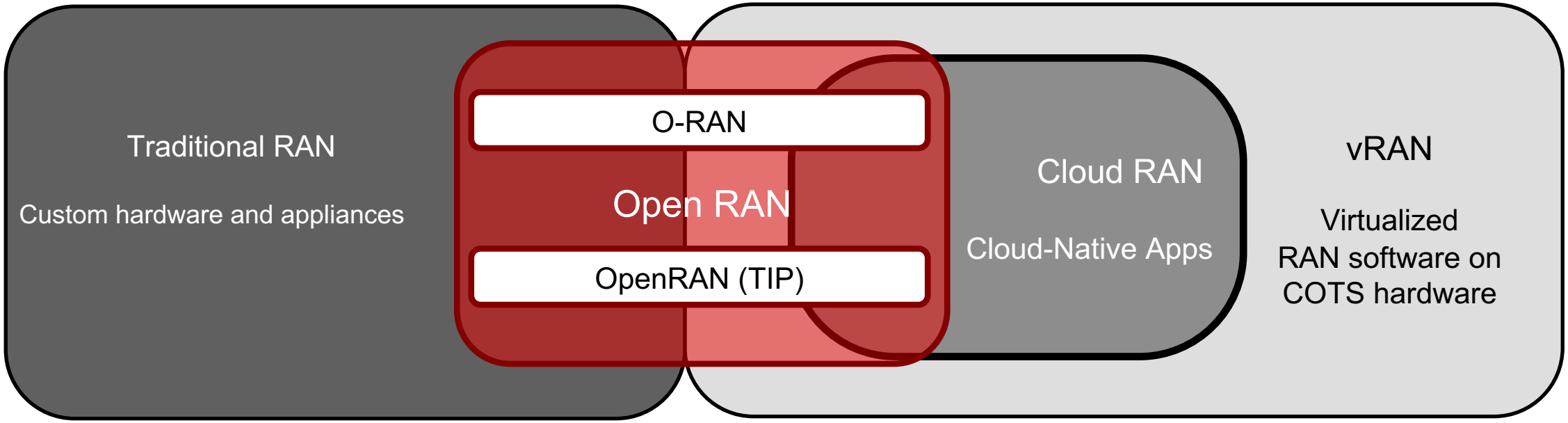
- Use of virtualization RAN components (vCU and vDU)
- Orthogonal to Distributed and Centralized RAN deployment models (See next 2 slides)

Cloud RAN

- Model where are the RAN components are designed to be cloud-native
- By definition, a subset of vRAN (See next slide)

What About Open RAN?

- Open RAN: Umbrella Term for the RAN ecosystem with open interfaces
- O-RAN Alliance : Consortium of operators and vendors, fostering Open RAN
- Telecom Infra Project(TIP) : defining reference architecture for Open RAN



TIP: Telecom Infra Project (http://telecominfraproject.com)
O-RAN: O-RAN Alliance (https://www.o-ran.org)

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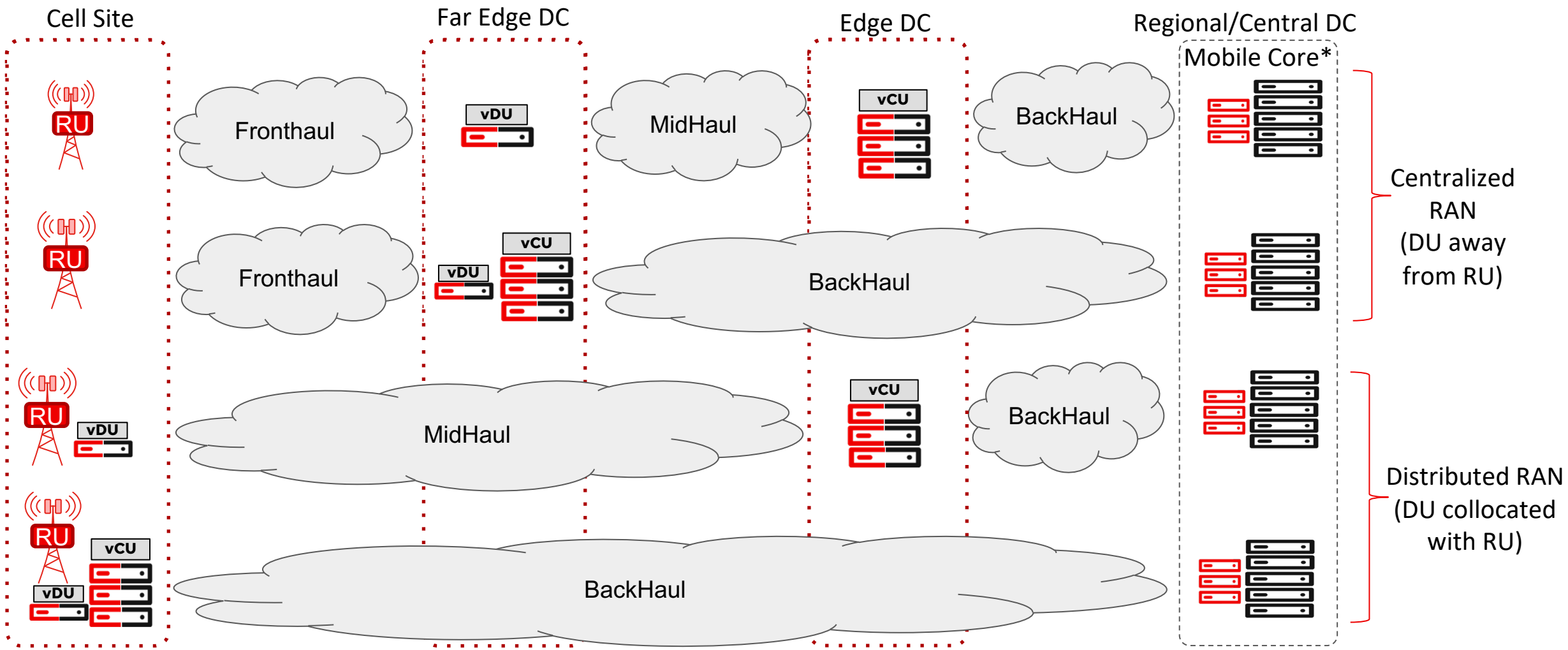
Virtual/Cloud RAN Placement Options



*Some Mobile Core components (such as UPF) can be moved closer to the subscriber and placed a the Edge DC collocated with the CU as part of Control Plane User Plane Separation (CUPS)

So What exactly is Red Hat Powered Cloud RAN?

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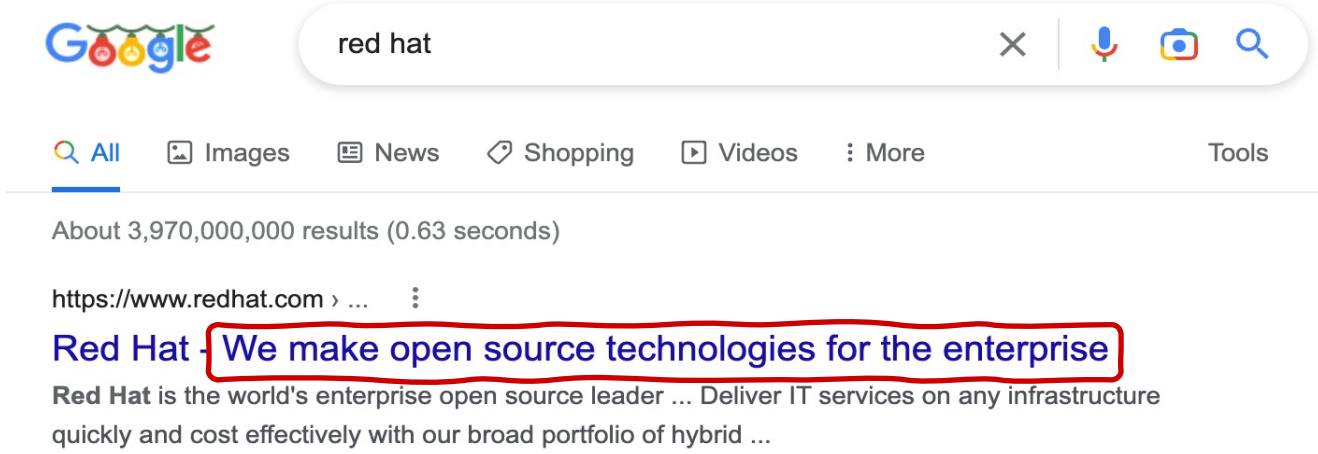
What does Red Hat have to do with Cloud RAN?

What does the Internet think we (Red Hat) do?

What do you immediately think of when someone mentions Red Hat?



So, really, what does Red Hat has to do with Cloud RAN?

We focus on the Cloud (platform) part of Cloud RAN !!!

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A Cloud Platform for Cloud RAN Era

Why do you need a Cloud Platform?

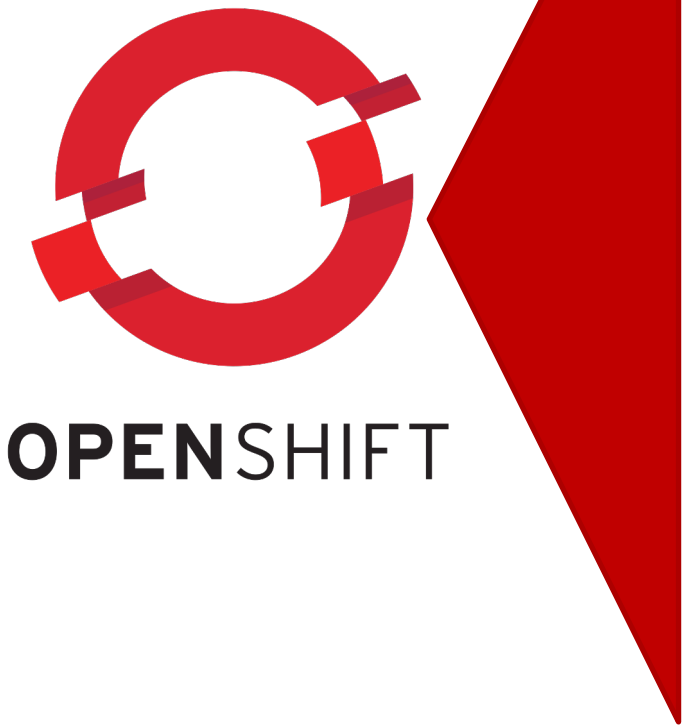
- Virtualization was the first wave, Cloud-Native applications are now!
- Containerized application are quickly becoming a norm, including in Cloud RAN
- Service Providers need a horizontal Cloud Platform beyond just hypervisors
- Extends from Access, Edge, Aggregation, Core, Data Centers – and of course, the Public Cloud
- Enables a software-based disaggregated protocol stack accelerating feature velocity

What should the Cloud Platform provide?

- Flexibility, Extensibility, Scalability, Consistency, Reliability
- Ready for Cloud-Native Application workloads
- Ability to adjust performance profiles required for applications
  - RT Kernel, Huge Pages, NUMA pinning, and more
- Ability to run on variety of underlying infrastructure
  - Baremetal, Virtual Machines, On-Prem, Public Cloud
- A robust partner ecosystem !!!

Application Workloads
(5GCore, RAN, IT, Mgmt , Etc)

Containers | Containers | Containers | Containers | Containers



Platform Services
CI/CD Pipelines, Service Mesh, Full Stack Logging

Application Services
Databases, Automation, Full Stack Logging

Developer Services
IDE Plugins, Code Ready Containers & Workplaces

Cluster Services
Monitoring, Registry, Networking CNI, Router, KubeVirt, Helm, Multus, Security capabilities etc.

Networking | Registry | Storage | Logs & Metrics | Security

Kubernetes

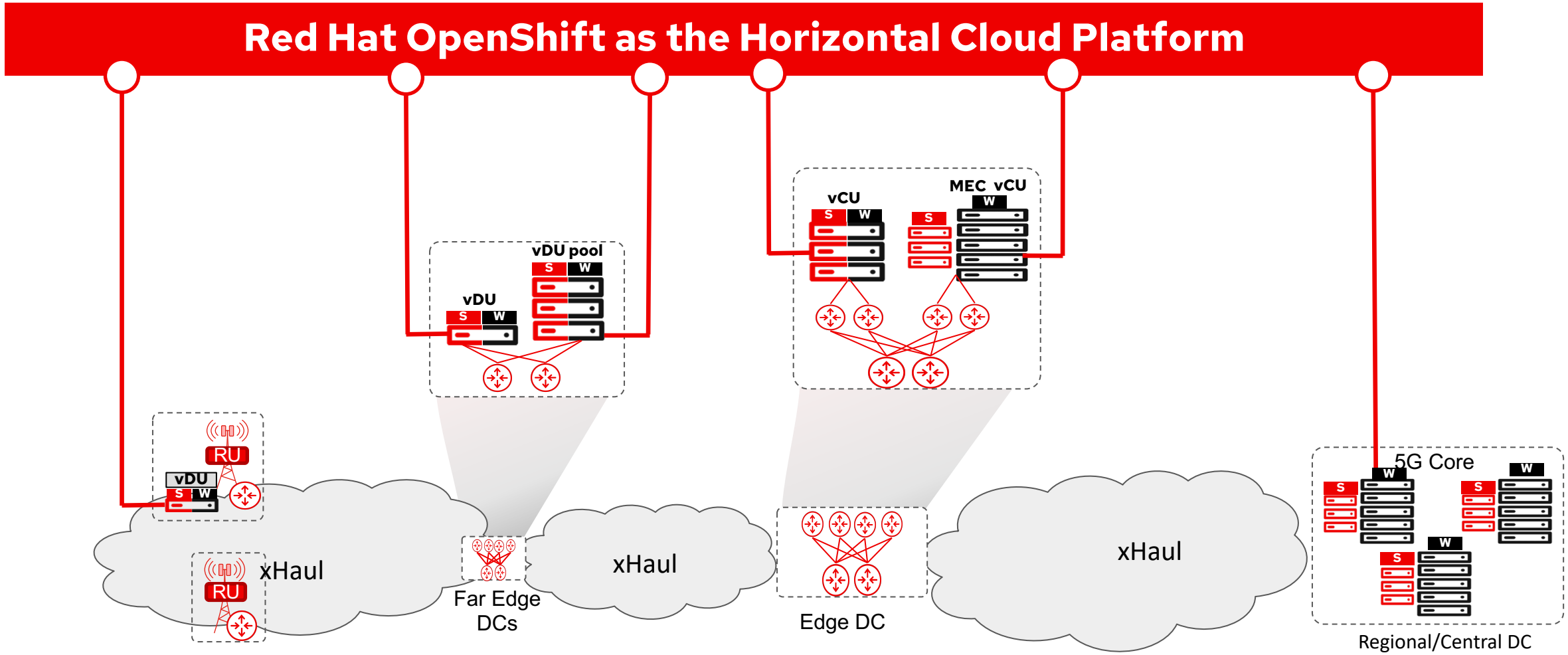
Container Runtime (CRI-O)

Red Hat CoreOS

Choice of Deployment Platforms

Physical Server | Virtual Machines | Private Cloud | Public Cloud | Hybrid Cloud

Red Hat OpenShift: The Horizontal Cloud Platform



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Designing with RedHat OpenShift: The Horizontal Cloud RAN Platform

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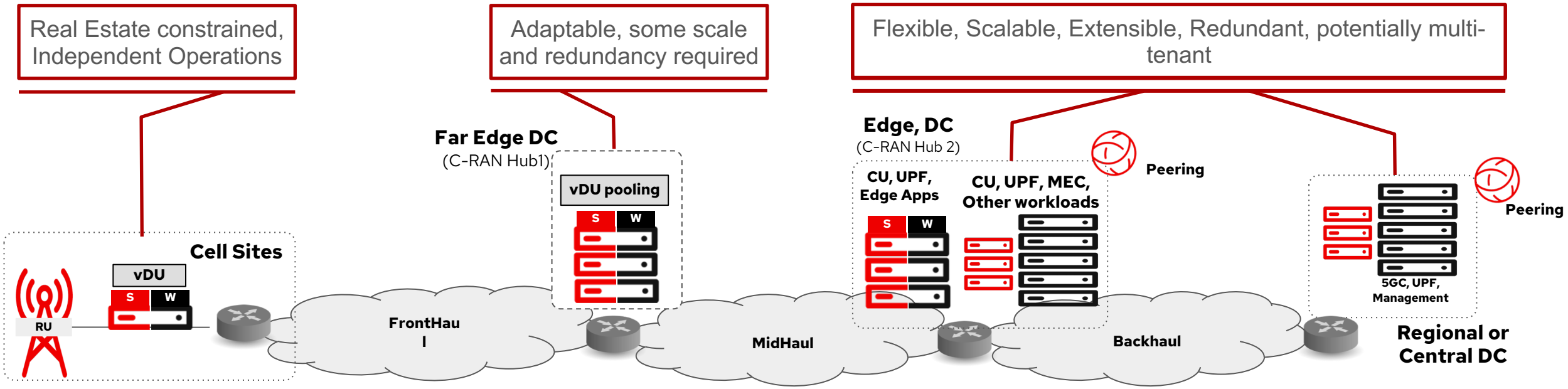
Varying Cloud Platform requirements across the Network



Unique requirements across the network,
Consistent user experience expected across the network

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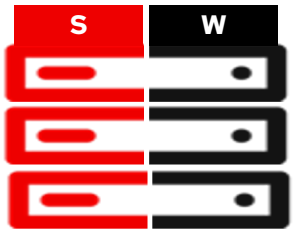
Red Hat OpenShift Form Factors to Match Domain Requirements

Single Node OpenShift (SNO)

Real Estate Optimized

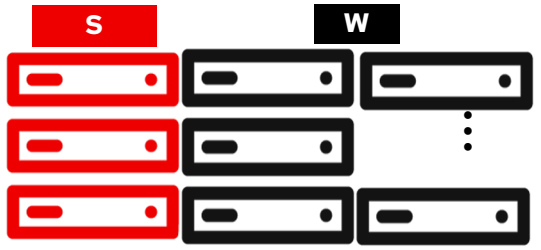
Large Scale Access Deployment



3-Node Compact Cluster

Redundancy and High Availability

Edge Optimized



Traditional Multi-Node Cluster

Scalable & extensible

Highly redundant

Ideal for: Cell Sites & Remote Locations

Ideal for: MEC, CUPS, Low Scale CU/DU pooling

Ideal for: CU pooling at scale, large application workloads

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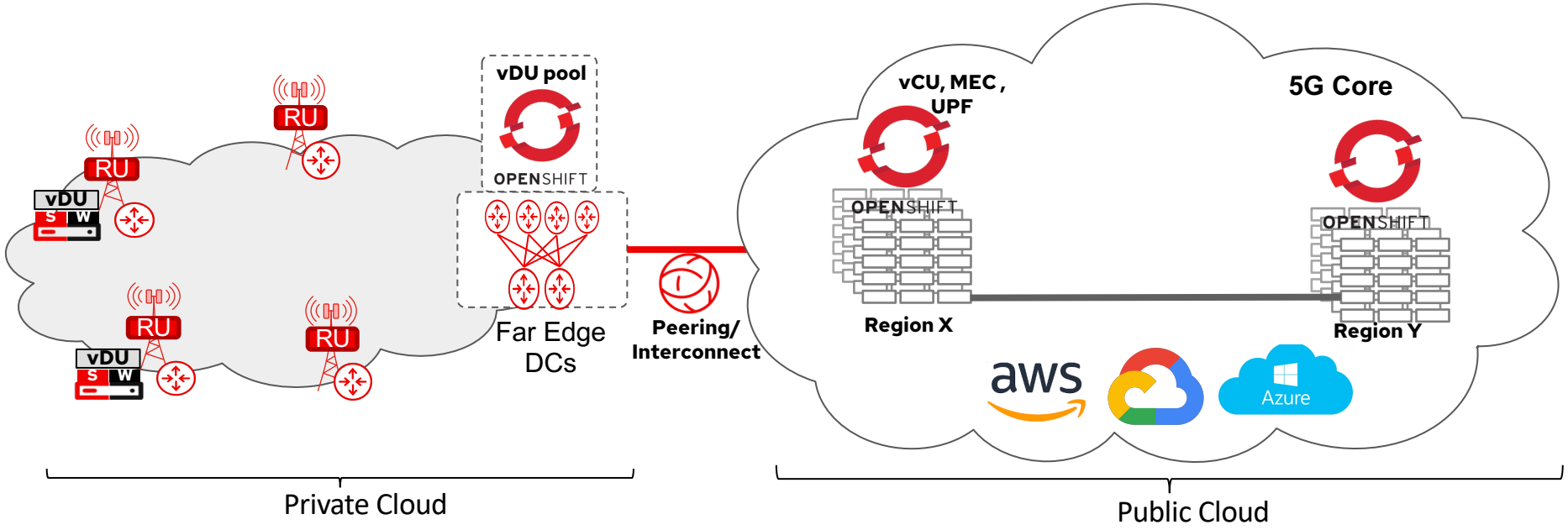
Can the RAN (and other 5G) Infrastructure move into Public Cloud?

- Yes, absolutely – as long as it makes sense
- RU-DU communication is latency sensitive, so moving DU to public cloud don't make sense right now
- CU is fair game for public cloud (so are other non-latency sensitive workloads)
- Red Hat OpenShift continues to provide a consistent cloud platform across private and public clouds



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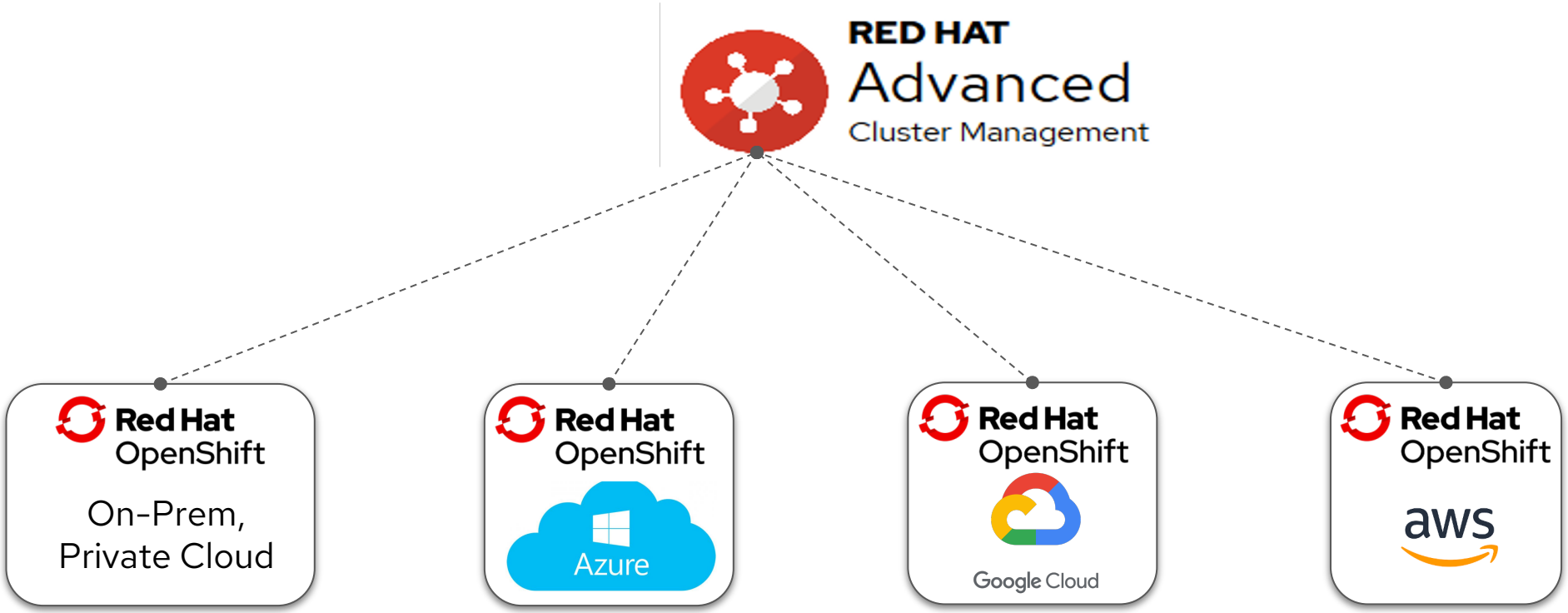
Managing a Cloud RAN Infrastructure on Any Cloud



Expand and run on any cloud - the right workload in the right place

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In Conclusion ...

RAN Evolution Across Mobile Generations

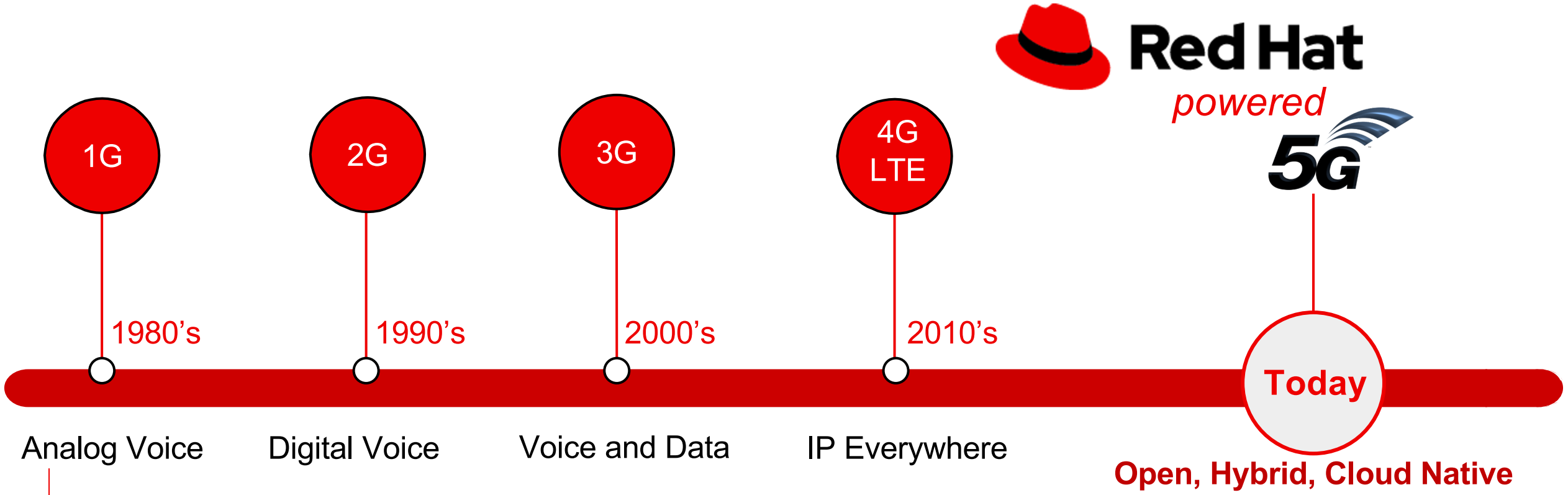
Cells & Base Stations

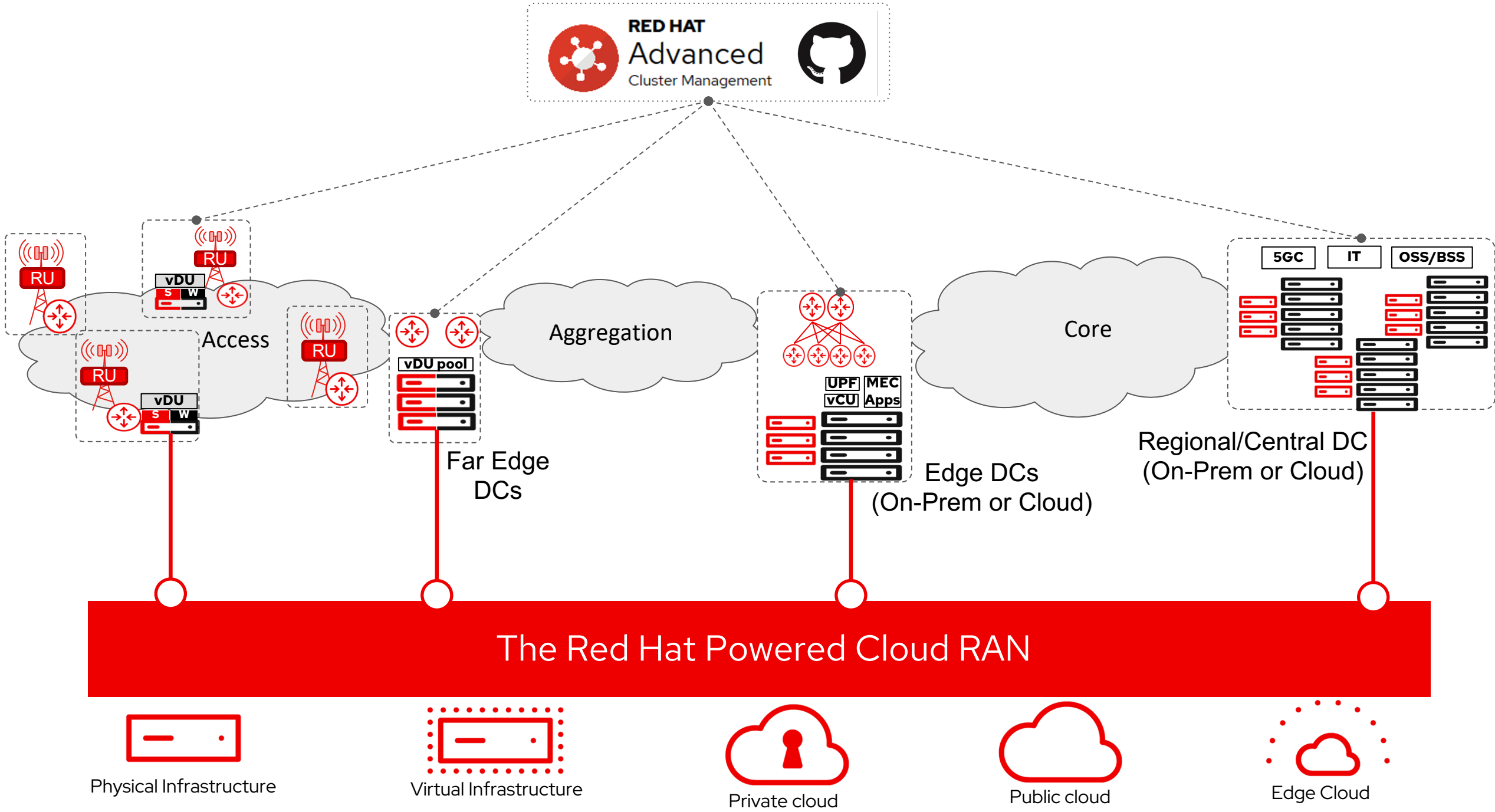
Base Station Subsystems (BSC+BTS)

NodeB + RNC, BBU-RRH Separation, CPRI/OBSAI

Evolved NodeB (eNB), Centralized RAN

5G NodeB (gNB) RAN Disaggregation & Decomposition




RED HAT
Advanced
Cluster Management
RU
vDU
S
W
Access
RU
vDU pool
Far Edge
DCs
Aggregation
UPF
MEC
vCU
Apps
Edge DCs
(On-Prem or Cloud)
Core
5GC
IT
OSS/BSS
Regional/Central DC
(On-Prem or Cloud)
The Red Hat Powered Cloud RAN
Physical Infrastructure
Virtual Infrastructure
Private cloud
Public cloud
Edge Cloud

Further Reading and Upcoming Tech Talks

The Road to Cloud RAN: From 1G to 5G
https://www.redhat.com/architect/mobile-architecture-cloud-ran

Red Hat Telco Architecture, Solution and Products
https://www.redhat.com/telco

Blog Series on Red Hat Powered Cloud RAN and other topics
https://cloudify.network/

Feb 9th: Designing Cloud RAN Cell Sites with Red Hat OpenShift
Mar 23rd: Deploying a Cloud RAN Network at Scale

Registration Opens January @ https://www.redhat.com/en/events/tech-talks

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