



Evolution of Network-Based PTP Timing Services in Canada

Cory Beitel

WSTS 2023

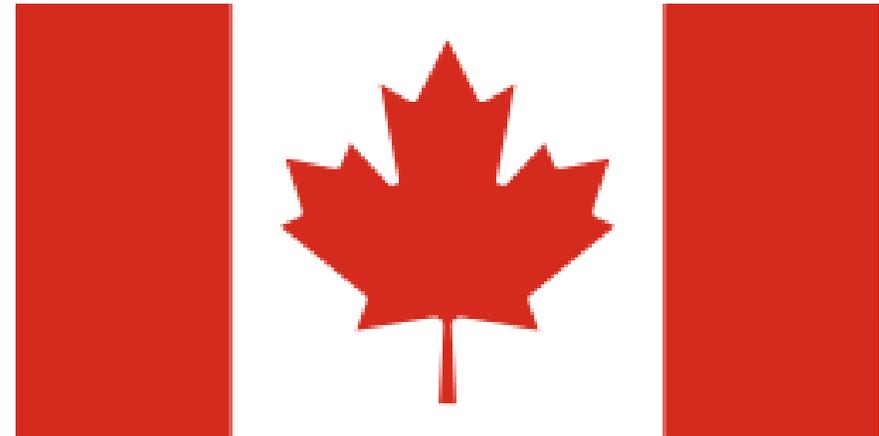


Agenda

- Landscape of Mobile Service Providers in Canada
- Challenges for Canadian Wireless Operators
- Evolution of Synchronization and Network Based Timing Services

Landscape of Mobile Service Providers in Canada

- Rogers Communications
 - BCE Inc. (Bell Mobility)
 - Telus
 - Shaw Communications
 - Videotron
 - Sasktel
-
- Fido, Virgin Mobile, Koodoo
 - Service providers own their own infrastructure...for the most part (Rogers, Bell/TELUS)
 - Population densification (or lack there of) a challenge for providing services
 - Implementing and maintaining a network is costly across such a large geographic area



Canadian Population Density



Challenges for Canadian Wireless Operators

- **Sparse Population**
 - Expensive to build and maintain telecommunications infrastructure in these areas
- **Geographical Barriers**
 - Forests, mountains, and lakes, can make it challenging to build and maintain telecom networks
- **Weather Conditions**
 - Difficult and expensive to maintain telecom infrastructure in certain parts of the country.
- **Remote Areas**
 - Lack of infrastructure and additional challenges of operating in these areas.

A Contrast in Population and Geography

- **Canada**

- Total Area: 9.985 million km²
- Population: 38,586,061
- 4 people per square km
- Mobile subscribers: 32 million

- **United States**

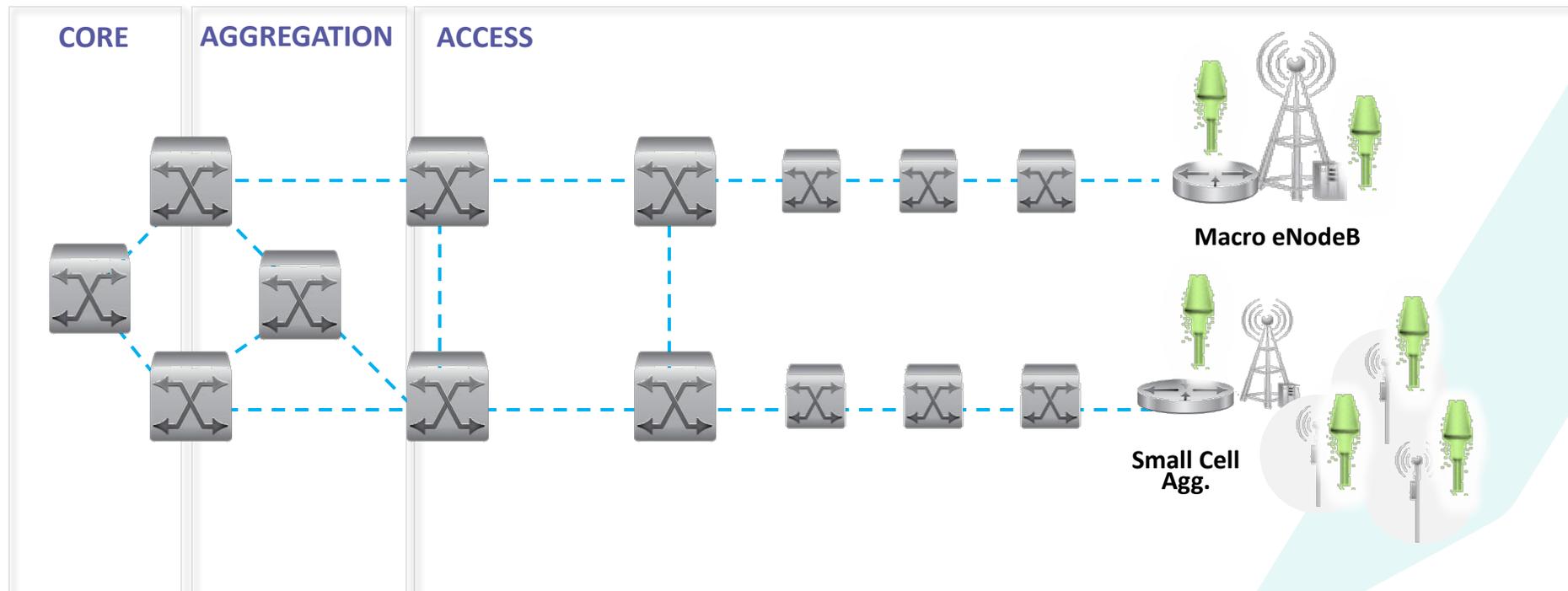
- Total Area: 9.834 million km²
- Population: 335,956,837
- 34 people per square km
- Mobile subscribers: 351.4 million

Land Border: 8,890-km border with the United States, the longest international border in the world

3G—Synchronization Evolution—GPS - T1/E1

- 3G

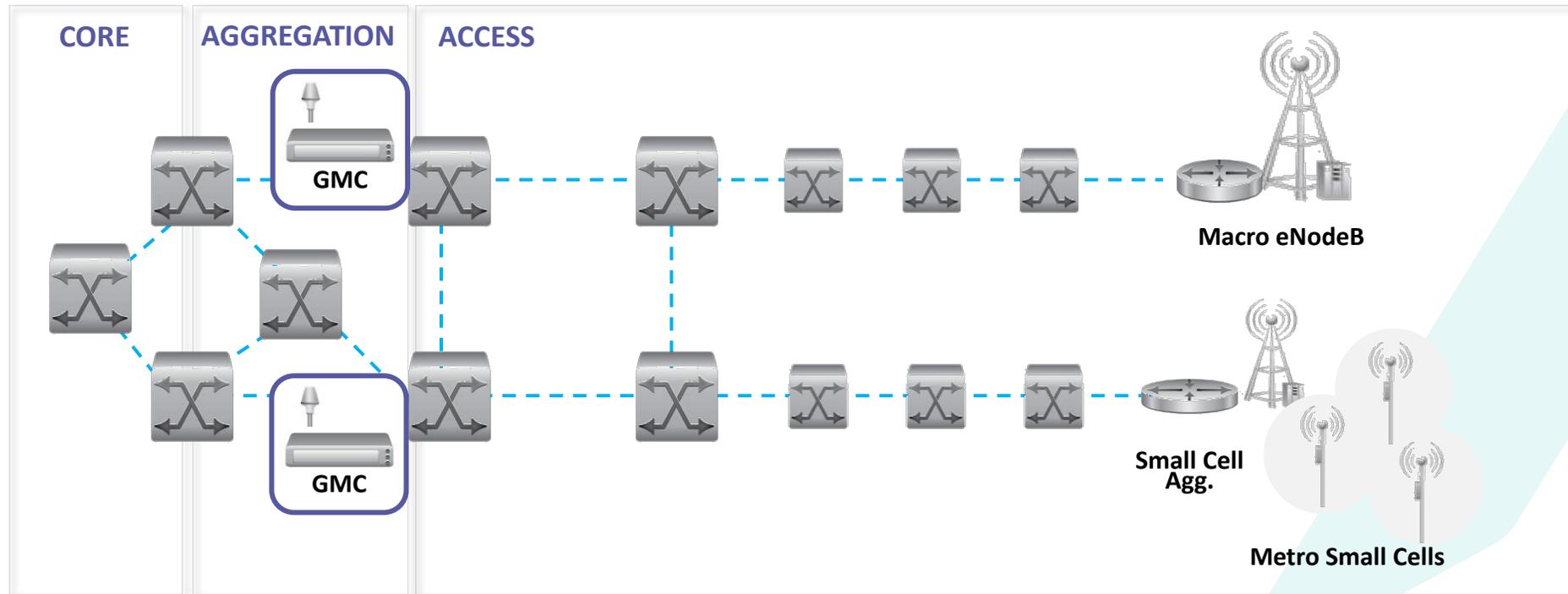
- GPS receivers
- T1/E1 for clock recovery
- Transition from TDM to ethernet



3G- 4G Synchronization Evolution – PTP – Frequency - G8265.1

- 4G

- GNSS antennas still in place, but with increased radio and small cell densification that number would need to increase
- PTP deployed for frequency synchronization (FDD) for mobile backhaul, small cells and circuit emulation as an alternative to GNSS.
- Timing could traverse through many hops with good performance

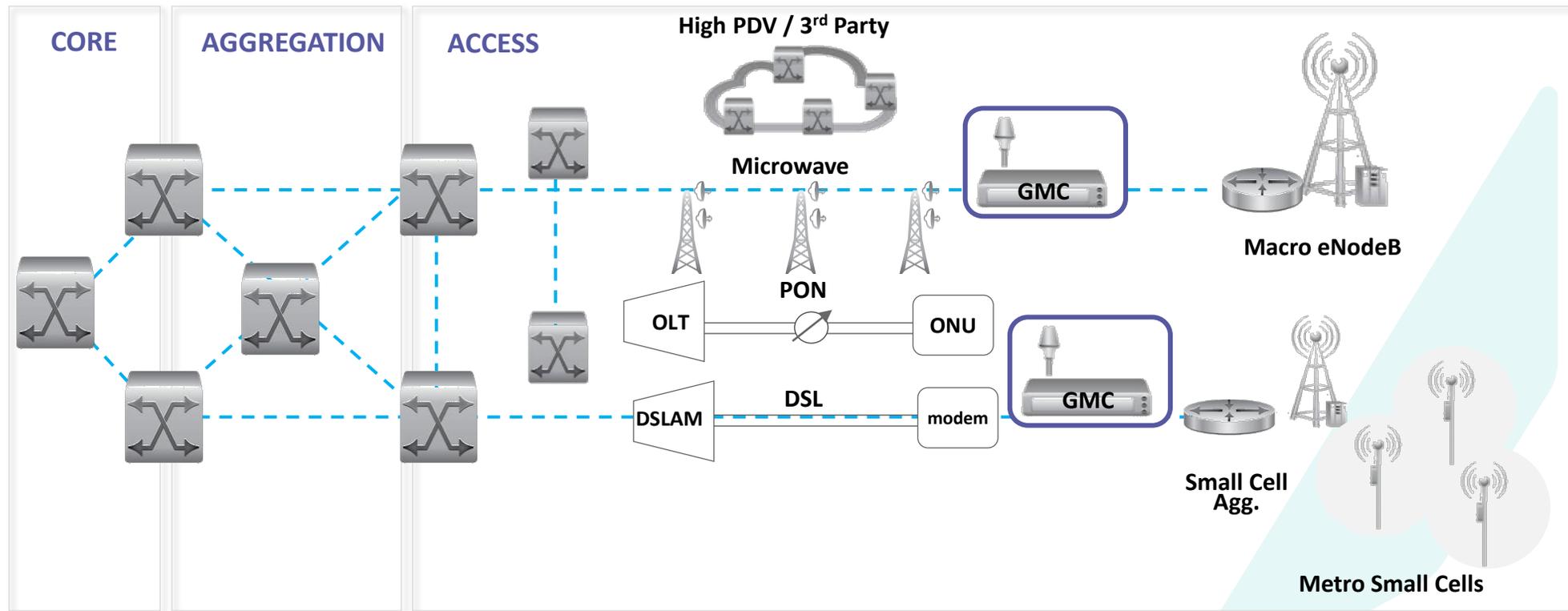


GMC – Grandmaster Clock
FDD – Frequency Division Duplexing

4G Synchronization Evolution – PTP – Frequency - G8265.1

- 4G

- High PDV a concern through 3rd party facilities and certain transport technologies
- Move GMC closer to the applications consuming timing

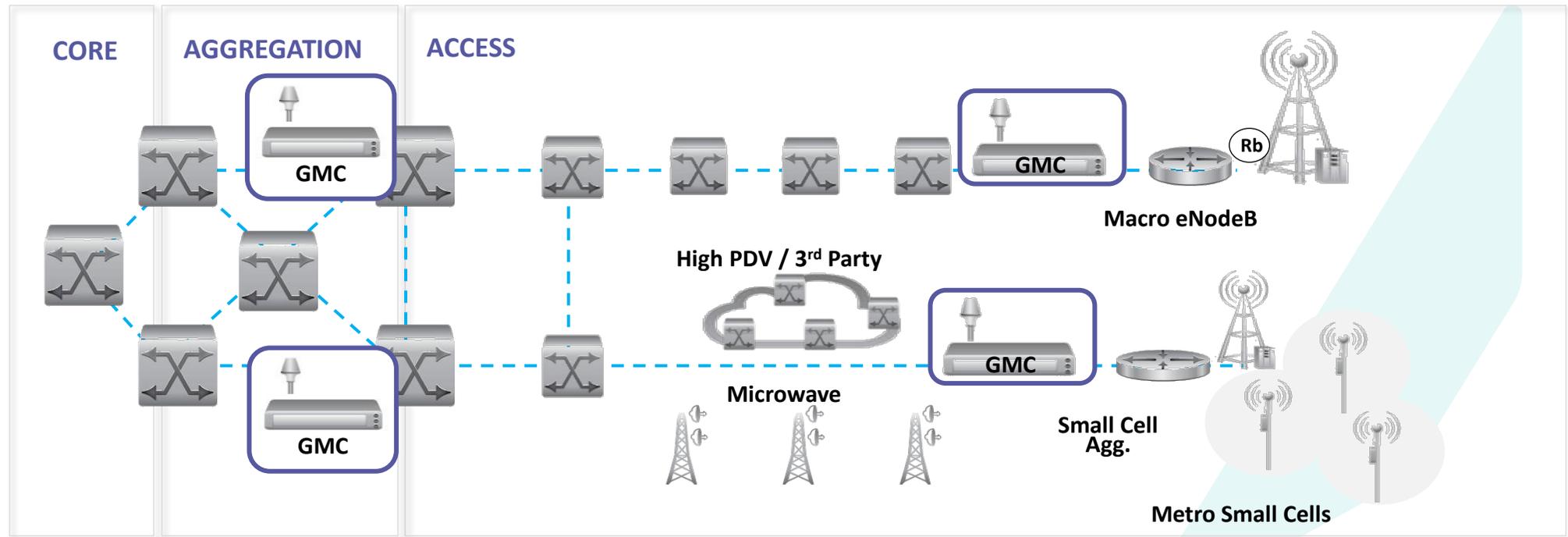


GMC – Grandmaster Clock
PDV – Packet Delay Variation

4G- 5G Synchronization Evolution – Phase I – Time/Phase - G8275.2

- 5G

- Network is brownfield, legacy equipment is PTP unaware for the most part
- Upgrading equipment to be PTP aware will take time, overhaul of network
- Re-purpose for TDD synchronization using G.8275.2 as a backup to GNSS
- APTS from upstream GM's to edge clocks

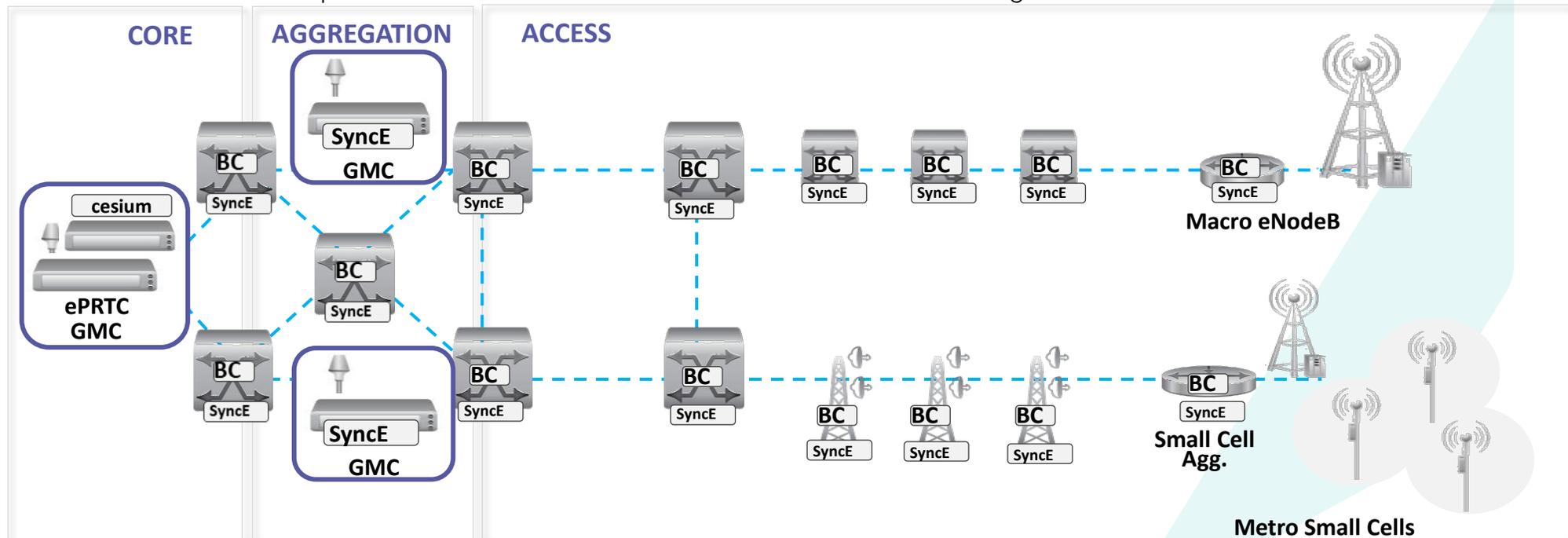


GMC – Grandmaster Clock
PDV – Packet Delay Variation
APTS – Assisted Partial Timing Support
TDD – Time Division Duplexing

5G Synchronization Evolution – Phase II – Time/Phase - G8275.1

- 5G

- Move away from APTS (G.8275.2) to Full On-path Support (G.8275.1) in dense urban areas for better performance, increased accuracy and less reliance on GNSS
- GNSS performance more difficult to achieve in dense downtown locations with tall buildings, urban canyon effect
- No immediate need to switch to G.8275.1 in rural areas due to much lower density of population
- Addition of ePRTC for superior holdover in the event of an extended GNSS outage



GMC – Grandmaster Clock
BC – Boundary Clock
SyncE – Synchronous Ethernet
APTS – Assisted Partial Timing Support
ePRTC – Enhanced Primary Reference Time Clock

Summary

- Canadian market has some unique challenges
 - Will continue to follow and rely on the standards
- Will likely continue using a hybrid of profiles:
 - G.8275.1 – Urban population density
 - G.8275.2 – Rural less populated areas
- Full 5G rollout will take time
 - Large amount of legacy equipment needs to be upgraded/replaced





Thank you.

COPYRIGHT © 2023 OPTM | ALL RIGHTS RESERVED

This document is furnished to the user solely for informational purposes and may not be reproduced, distributed, or used for any other reason without the prior written consent of Optm. This document does not grant any intellectual property rights to or other rights in the information disclosed in it. The information contained in this document is provided strictly "AS IS" and is subject to change at any time without notice or obligation by Optm. Neither Optm, nor any party through whom the user obtains this document guarantees that it is accurate or complete or makes any warranties regarding the material described in it.

All third-party product and company names are trademarks or registered trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them or Optm.