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Ericsson 5G Centralized Neighbor Relations rApp

Solution sheet

Available on Ericsson Intelligent Automation Platform

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The goal of automatic neighbor relation is to detect new neighbors based on measurements coming from user equipment (UE) and create neighbor relations (NRs) and all the relevant managed objects (MOs) between the source and the target cells.

These NRs can be used for use cases like handover, carrier aggregation, or E-UTRAN-NR Dual Connectivity (commonly known as ENDC) – a type of transmission where the UE receives information from both LTE and 5G at the same time.

Traditionally, automatic neighbor relation is a distributed self-optimizing network (DSON) feature running on the Radio Access Network (RAN) node, such as eNodeB or gNodeB. However in 5G, due to limitations in certain device chipsets in UE and some current limitations in RAN, the cell global identity (CGI) cannot be retrieved for high-band (HB) 5G cells.

Thus, an alternative, centralized self-optimizing network (CSON) method needs to be used in order to provide the source node with information about the target cell.

The Ericsson 5G Centralized Neighbor Relations rApp complements the DSON feature from the RAN to automatically discover and set up neighbor relations on the 5G high-band NR when UE moves from a serving cell to another cell (the target cell). To uniquely identify target cells, the UE first reports its CGI. Based on this information, it then decodes on System Information Block (SIB) 1. The SIB1 is broadcast in each cell and provides the same information to all UEs in idle mode.

At present, high-band NR cells don't broadcast SIB1, and certain device chipsets are not able to decode NR CGI, even if SIB1 was in place. This results in a lack of mapping of the physical cell identifier (PCI) → CGI in the node and, as the reported cell can't be identified, the DSON automatic neighbor relation is unable to add the new neighbor relation.

A solution is needed that will provide the possibility to map PCI → CGI for HB NR cells. The new Ericsson 5G Centralized Neighbor Relations rApp fills this gap.

rApps benefit strongly from Ericsson Intelligent Automation Platform capabilities

Beyond adherence to R1 for inter-rApp communication and access to external interfaces, the platform facilitates all the tasks around design, development, testing and life cycle management for rApp developers. The most relevant capabilities in these regards are the following:

- **AI/ML APIs** for model training, execution and life cycle management
- **analytics data collection** capabilities for raw data in a file- or stream-based format, with fault and performance management (FM/PM) provided out of the box
- **analytics processing** capabilities to provide insights on network behavior and performance
- **data management and movement**
- **controller framework** uses the open standard R1 interface to abstract details of the underlying system, allowing developers to focus on the use case
- **inventory and topology** offers near real-time source of truth
- **policy design and execution** for policy handling using multiple engines
- **service orchestration** covers the TOSCA-based orchestration engine for declarative orchestration
- **workflow execution** realization for activities supports the design and creation of new use cases
- **design and onboarding environment**

Our solution

Ericsson 5G Centralized Neighbor Relations rApp performs a distance-based geographical query, finding all neighboring 5G cells for an LTE cell.

Ericsson 5G Centralized Neighbor Relations rApp facilitates the creation of the ExternalGUtranCell, which provides the PCI → DGI mapping. The rApp then automatically creates the neighbor relations. In particular, the following scenarios are accommodated in the solution:

- LTE cell → HB NR cell
- HB NR cell → LTE cell
- HB NR cell → any NR cell

The first implementation of CSON ANR for 5G NR only concerns LTE → HB NR relations. HB NR cell relations to other NR bands will be covered in a later stage.

Ericsson 5G Centralized Neighbor Relations rApp is an application consisting of one microservice, supporting LTE to 5G FR2 cell relationship creation. The rApp provides the information needed by the LTE nodes for DSON automatic neighbor relation on the node to work with 5G HB cells.

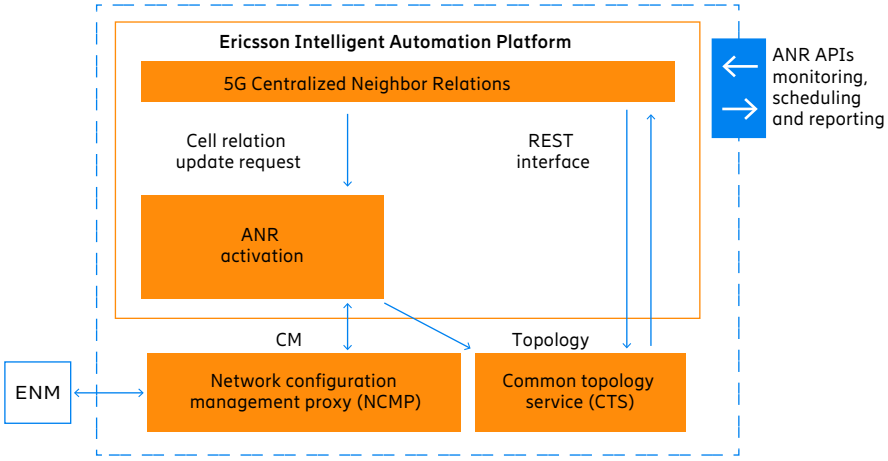
The microservice included in Ericsson 5G Centralized Neighbor Relations rApp for 5G HB performs the following tasks:

- Consume the cell's geographical and topological data, evaluating which cells are neighboring each other and configuring this neighbor information on the cell's gNodeB
- expose a simplified view of cell relationships that coordinates any configuration management (CM) requests towards the Ericsson Network Manager (ENM) and makes the necessary changes on the node, with corresponding updates to the SMO inventory and topology component

There are four types of API endpoints published in 5G automatic neighbor relation applications:

- **monitoring API** – gives the current state of the application and the last 1,000 events during processes
- **scheduler API** – is the most important type, as it is where the application process is started
- **health API** – is mainly for a Kubernetes environment, or for a user to easily check whether an application is up and running
- **neighbor relation candidate (NRC) API** – runs the algorithm to identify the NRCs and returns it to the end user without updating the network

Figure 1: Ericsson 5G Centralized Neighbor Relations rApp architecture



Key benefits

Hybrid SON solution

- Ericsson 5G Centralized Neighbor Relations rApp complements DSON 5G automatic neighbor relation functionality in the RAN to provide a complete solution for neighbor relationships for all frequency bands.

Increased efficiency

- Ericsson 5G Centralized Neighbor Relations rApp is a fully automated solution that works autonomously in a closed loop.
- Reduces opex by removing the need for manual configuration of neighbor lists for intra-frequency, inter-frequency handover.

Increased performance

- The rApp increases 5G resource usage, which leads to a significantly better user experience with fuller neighbor lists, and reduces the session drop rate by assuring that the best neighbors can always be used in handover.

Insights and visibility

- These are gained by means of standardized APIs that provide access to the insights and the execution details of the automatic neighbor relation application, including scheduling, recommendations and monitoring.

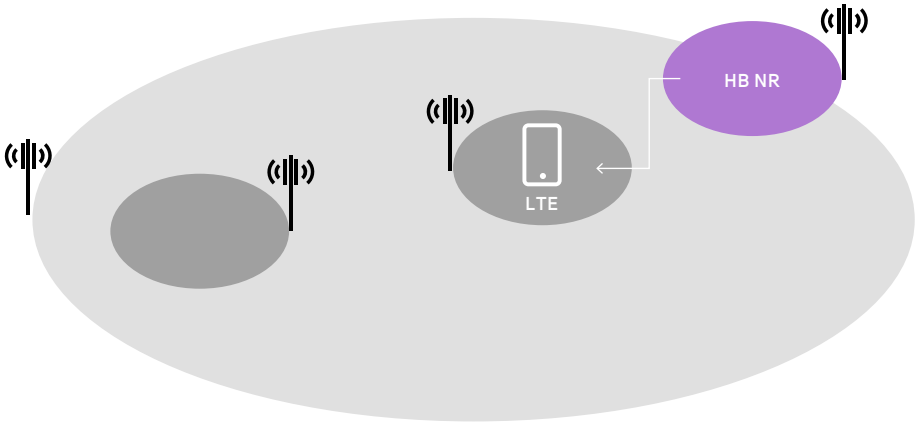
The solution enables the user to efficiently search for 4G to 5G cell neighbor candidates in the network.

In areas where the DSON solution has technical limitations, the Ericsson 5G Centralized Neighbor Relations rApp complements the DSON automatic neighbor relation functionality for NR, with this combination of functions forming a hybrid SON that covers all the neighbor relation combinations for low-, mid- and high-band 5G.

This combination of DSON and CSON solutions offers a more complete coverage of the situations that exist on real networks, achieving a higher degree of automation.

The CSON solution can work on open loop - where the recommended neighbor relations are created by a separate entity – or on closed loop, to obtain the full automation and performance gains.

Figure 2: Illustration of the Ericsson 5G Centralized Neighbor Relations rApp scope



Glossary

A1: Interface between non-RT RIC and near-RT RIC to enable policy-driven guidance of near-RT RIC applications/ functions and support AI/ML workflow.

E2: Interface connecting the near-RT RIC and one or more O-CU-CPs, one or more O-CU-UPs, and one or more O-DUs.

Near-RT RIC (near-real-time RAN Intelligent Controller): A logical function that enables near-real-time control and optimization of RAN elements and resources via fine-grained (for example, UE basis, cell basis) data collection and actions over E2 interface.

Non-RT RIC (non-real-time RAN Intelligent Controller): A logical function that enables non-real-time control and optimization of RAN elements and resources, AI/ML workflow including model training and updates, and policy-based guidance of applications/features in near-RT RIC.

O1: Interface between orchestration and management entities (orchestration/NMS) and managed elements for operation and management, by which FCAPS (fault, configuration, accounting, performance and security) management, software management, file management and other similar functions shall be achieved.

O2: Interface towards the O-Cloud to support orchestration of O-Cloud infrastructure management and deployment of the network functions on the O-Cloud.

O-Cloud: O-RAN Cloud computing platform comprising a collection of physical infrastructure nodes that meet requirements to host the relevant functions (such as near-RT RIC, O-CU-CP, O-CU-UP and O-DU, and so on), the supporting software components (such as operating system, virtual machine monitor, container runtime, and so on) and the appropriate management and orchestration functions.

O-CU-CP (central unit – control plane): A logical node hosting the RRC and the control-plane part of the PDCP protocol.

O-CU-UP (central unit – user-plane): A logical node hosting the user-plane part of the PDCP protocol and the SDAP protocol.

O-DU (distributed unit): A logical node hosting RLC/MAC/High-PHY layers based on a lower layer functional split.

R1: Interface comprised of a collection of services that facilitate the interactions between rApps and the non-RT RIC framework.

rApp: An application designed to run on the non-RT RIC. Such a modular application leverages the functionality exposed by the non-RT RIC to provide added value services relative to intelligent RAN optimization and operation. rApps communicate with the platform via the R1 interface.

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