Representation of RAN Inventory in AAI

- Context
- Additions to AAI Schema
- Representation of Planned RAN Inventory
- Representing Planned Nodes
- AAI Cell object high level diagram
- AAI Cell Model specification
    - AAI model details
        - Cell
        - Neighbour
- AAI Cell object Relationships
- Deployed RAN Model

Context

For the radio access network (RAN) domain, additional objects are required in AAI to effectively maintain the inventory of a Service Management & Orchestration (SMO) system, so that this information can be used for various use cases such as cell site map, SON, etc.

Note: The proposed model in this document applies to all radio access technologies e.g. 2G, 3G, 4G, 5G, etc

Additions to AAI Schema

1. A new "cell" object (and its relationships) has to be added into AAI schema.
2. The existing "site-resource" object can be used to represent PLANNED RAN inventory.
    1. In the site-resource model, an additional relationship from site-resource to PNF should be added into the schema. This is useful to relate a deployed physical RAN node to a planned one e.g. Radio Unit
    2. A new relationship between site-resource objects is required, to show the dependancy or relationship between two site-resources e.g. which planned CU will control a planned DU
3. A new relationship between VNFs is required to indicate the connection between two virtualised RAN nodes e.g. which CU controls a DU

Representation of Planned RAN Inventory

In this model, RAN planning data is represented as AAI objects such as :

1. geo-region (Tracking Area or larger physical site such as Berlin, etc) ,
2. complex (Cell Site) and
3. site-resource (a planned RAN node e.g. 4G eNB, 5G eNB, etc)
4. a new "cell" object which can represent a cell of any radio technology e.g 5g, 4g, etc.

Representing Planned Nodes

A site-resource represents a **Planned** RAN node

A complex represents a cell-site.

A new "Supports" relationship between site-resource objects can be used to represent the interaction between the planned RAN nodes.

Some example queries are listed below:

As an example, we consider an eNB here, but as stated before, other RAN technologies can be modelled in a similar way.

How to find planned eNBs:

Query all site-resources of type "eNB"

How to find planned CU/DU in an eNB :

Follow the (new) Supports relationship from site-resource of type "eNB" to find the site-resources of type "cu" or "du"

How to find planned eNBs covering a cell-site :

Follow the Uses relationship from Complex to Site-resources of type "eNB"

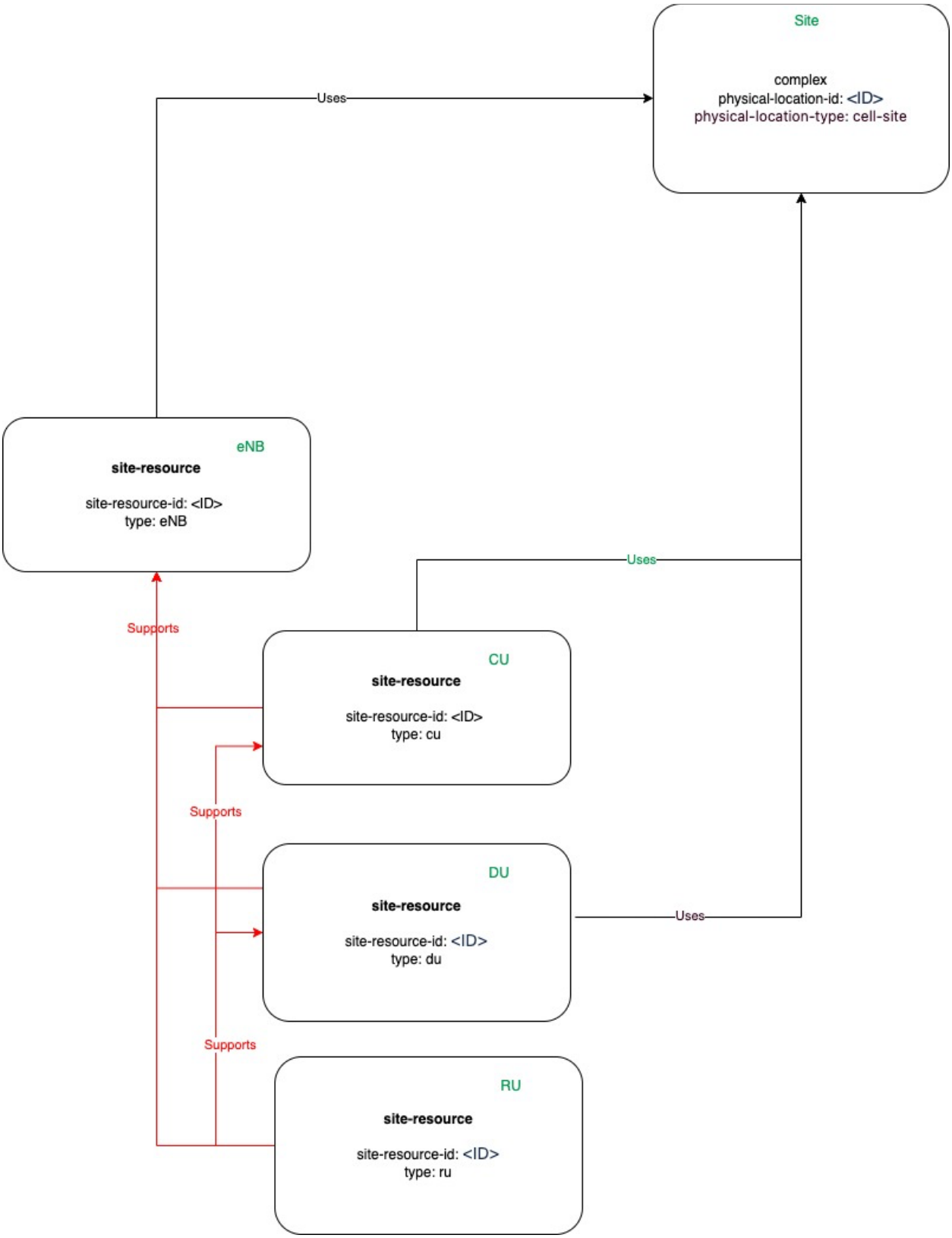
How to find planned DU covering a cell-site:

Follow the Uses relationship from Complex to Site-resources of type "du"

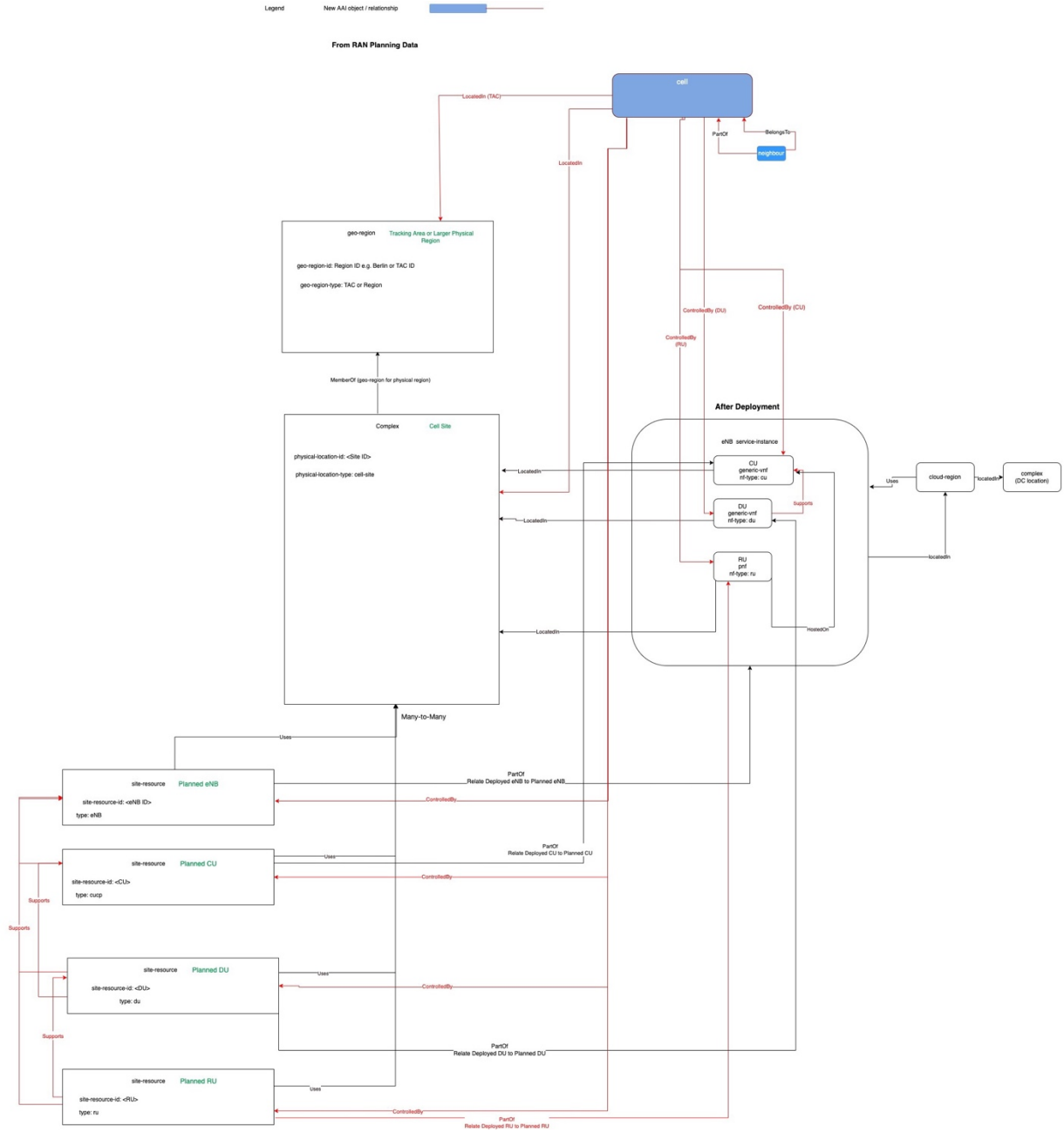
How to find planned mapping of DU to CU:

Follow the (new) Supports relationships from the site-resource of type "du" , to find the connected site-resources of type "cu"

Note: All new relationships in AAI are indicated in red in the following diagrams


Site
complex
physical-location-id: <ID>
physical-location-type: cell-site
Uses
eNB
site-resource
site-resource-id: <ID>
type: eNB
Uses
Supports
CU
site-resource
site-resource-id: <ID>
type: cu
Supports
DU
site-resource
site-resource-id: <ID>
type: du
Uses
Supports
RU
site-resource
site-resource-id: <ID>
type: ru

AAI Cell object high level diagram



AAI Cell Model specification

A single Cell object can represent a cell of any radio technology e.g 5G, 4G, etc. The relationships mainly indicate the geographical and tracking areas that this Cell is part of, and the planned and deployed radio resources controlling the cell.

AAI model details

Cell

Cell: *object*

DESCRIPTION
radio cell of the mobile network operator

PROPERTIES

cell-id: *string*
unique identifier of the cell (i.e. could be globally unique like NCGI or unique within operator domain like NCI)

cell-local-id: *string*
unique identifier of the cell within node (like eNodeb, gNodeb)

mno-id: *string*
operator specific cell identifier

node-id: *string*
cell's node id (like gNodeb id, eNodeb id)

cell-name: *string*
individual name of cell

radio-access-technology: *string*
cell radio access technology (i.e. GSM, UMTS, LTE, NR)

latitude: *float*
latitude of cell

longitude: *float*
longitude of cell

azimuth: *float*
direction of cell beam (range: 0-360)

height: *float*
cell height above ground

mechanical-tilt: *float*
mechanical tilt of cell

electrical-tilt: *float*
electrical tilt of cell

beamwidth: *float*
horizontal beamwidth of cell

cell-type: *string*
type of cell (i.e. macro, micro, indoor, outdoor, string)

coverage-area: *string*
type of coverage area (i.e. urban, suburban, rural, string)

frequency-band: *string*
cell operating frequency band

mnc: *string*
operator mobile network code

mcc: *string*
operator country code

selflink: *string*
CPS link to additional cell info (it may be a collection of links e.g. operator-specific cell attributes, 3gpp-config, vendor-config, NRCellDU, NRCellCU in CPS)

neighbours: Neighbour[]

Neighbour

Neighbour: *object*

DESCRIPTION
Cell neighbour relation

PROPERTIES

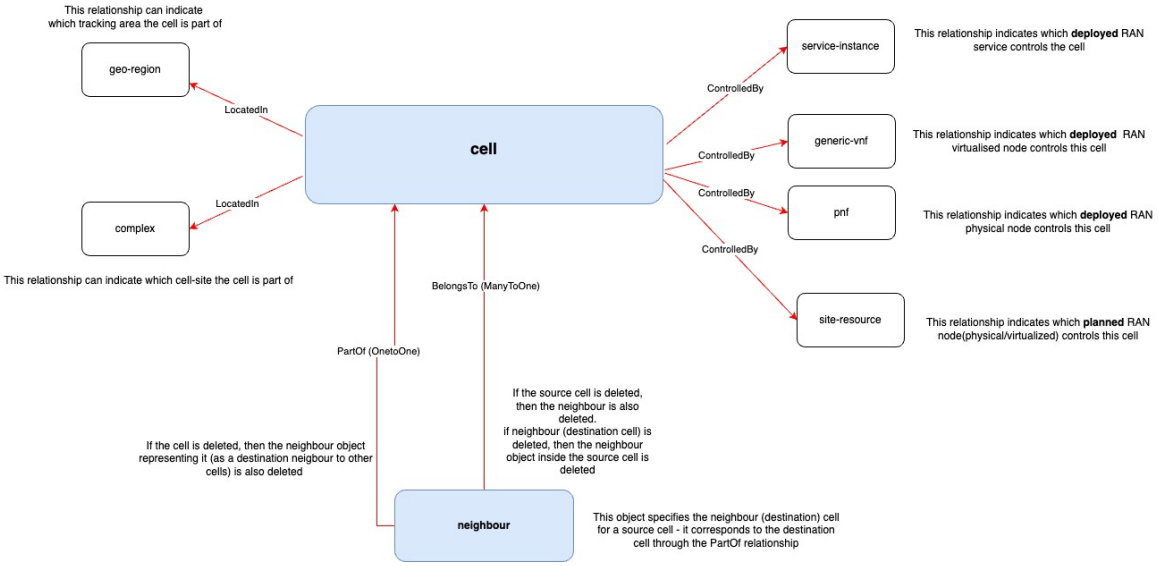
neighbour-id: *string*
unique identifier of neighbour relation (i.e. in following format cell.**cell-id-neighbour-cell-id**)

neighbour-cell-id: *string*
identifier of the neighbour cell

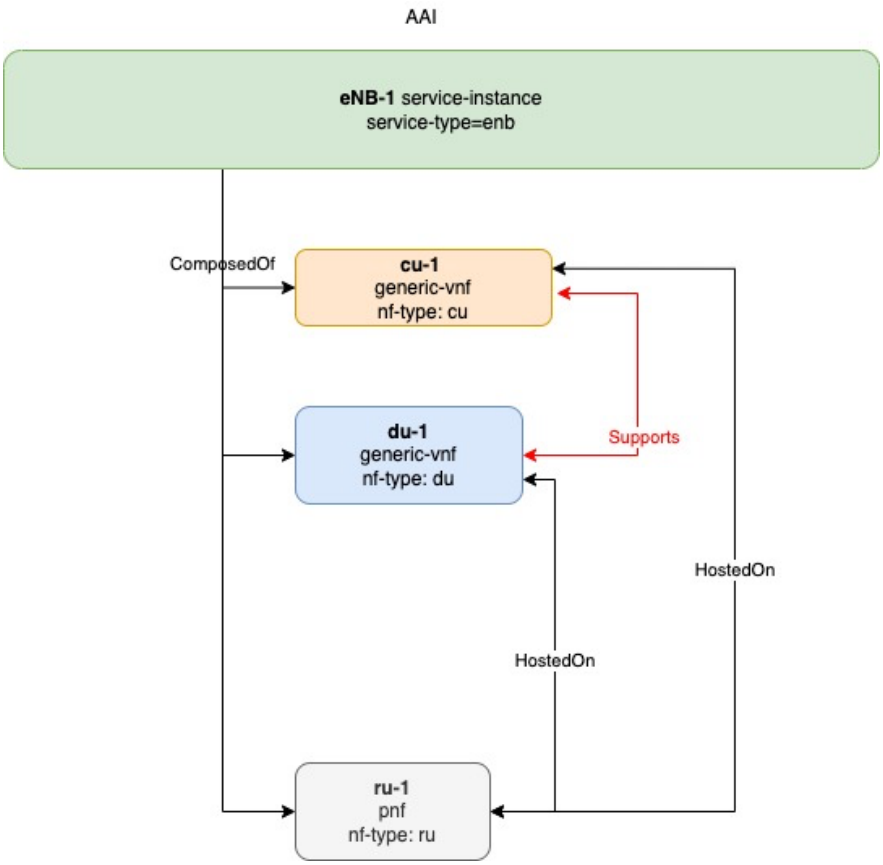
neighbour-cell-name: *string*
name of zthe neighbour cell

selflink: *string*
CPS link to additional neighbour info (i.e. 3gpp NRCellRelation)

AAI Cell object Relationships



Deployed RAN Model

We have taken as example of an eNB (4G) , but other RAN technologies can be modelled in a similar way.

When RAN nodes are deployed, there is often a dependency between nodes that should be represented in AAI. For this reason, a new relationship called "Supports" should be introduced between generic-vnf objects, as shown below in an example RAN eNB representation.