Geolocation Proposal

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August 6, 2020 Version 3

STANDARDS WORK
GeoLocation Addition to ETSI NFV SOL001

ONAP IM Proposal for Geolocation Information

Geolocation PNF in ETSI NFV IFA014 v2.5.1

Attribute	Qualifier	Cardinality	Content	Description
pnfdId	M	1	Identifier	Identifier of this Pnfd information element. It uniquely identifies the PNFD.
functionDescription	M	1	String	Describes the PNF function
provider	M	1	String	Identifies the provider of the PNFD. (NOTE: The provider of the PNFD might be different from the provider of the PNF.)
version	M	1	Version	Identifies the version of the PNFD.
pnfdInvariantId	M	1	Identifier	Identifies a PNFD in a version independent manner. This attribute is invariant across versions of PNFD.
name	M	1	String	Provides the human readable name of the PNFD.
pnfExtCp	M	1..N	PnfExtCpd	Specifies the characteristics of one or more connection points where to connect the PNF to a VL. See clause 6.6.4.
security	M	0..1	SecurityParameters	Provides a signature to prevent tampering.
geographicalLocationInfo	**M**	**0..1**	**Not specified**	**It provides information about the geographical location (e.g. geographic coordinates or address of the building, etc.) of the PNF. The cardinality 0 is used when the location is unknown.**

PNF Geolocation missing in ETSI SOL 001

Name	Required	Type	Constraints	Description
country_code	yes	string		Shall be a two-letter ISO 3166 country code in capital letters.
civic_address_element	no	list of tosca.datatypes.nfv.CivicAddressElement		Elements composing the civic address where the PNF is deployed.
Geolocation element	**no**	**tosca.datatypes.nfv.GeographicCoordinates**		**Geographic coordinates (e.g. Altitude, Longitude, Latitude) where the PNF is deployed.**

tosca.datatypes.nfv.CivicAddressElement: an element of a civic location as specified in IETF

tosca.datatypes.nfv.LocationInfo: geographical information on the location where a PNF is deployed

ETSI NFV IFA to ETSI NFV SOL 001

ETSI NFV IFA014 v2.5.1

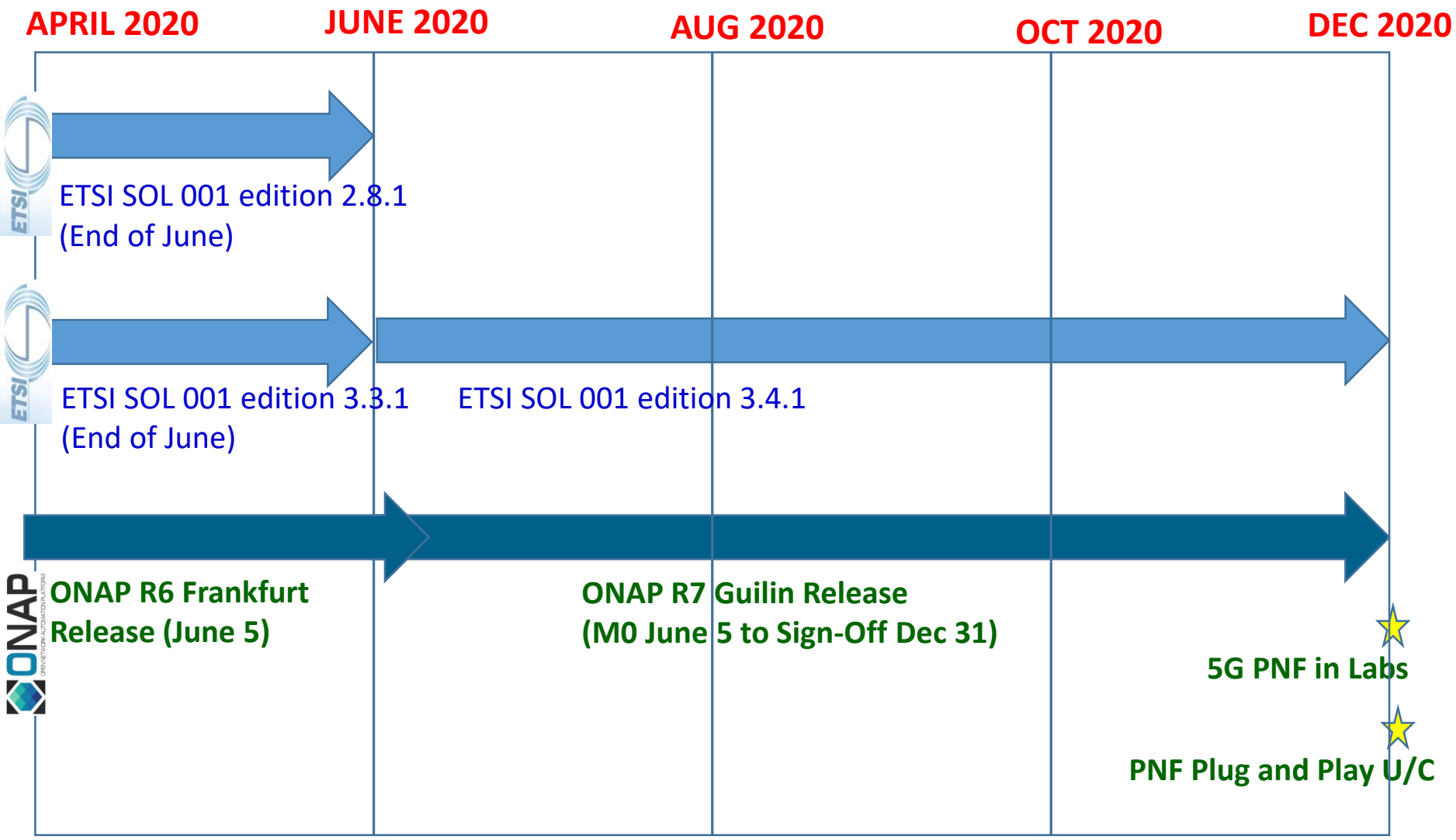
Attribute	Qualifier	Cardinality	Content	Description
geographicalLocationInfo	M	0..1	Not specified	It provides information about the geographical location (e.g. geographic coordinates or address of the building, etc.) of the PNF. The cardinality 0 is used when the location is unknown.

ETSI NFV SOL001 v2.8.1 (June 2020)

Name	Required	Type	Description
civic_address_element	no	list of tosca.datatypes.nfv.CivicAddressElement	Elements composing the civic address where the PNF is deployed.
Geolocation element	no	list of tosca.datatypes.nfv.GeolocationElement	RFC6225 specification for Geolocation information (e.g. Altitude, Longitude, Latitude)

https://tools.ietf.org/html/rfc4776

Standards & ONAP Timelines



ETSI Standard Proposal

ETSI GS NFV-SOL 001 V2.7.3 (2020-05)

**Network Functions Virtualisation (NFV) Release 2;
Protocols and Data Models;
NFV descriptors based on TOSCA specification**

Disclaimer

The present document has been produced and approved by the Network Functions Virtualisation (NFV) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG.
It does not necessarily represent the views of the entire ETSI membership.

8.2.5.2 Properties

The properties of the LocationInfo data type shall comply with the provisions set out in table 8.2.5.2-1.

Table 8.2.5.2-1: Properties

8.2.5.3 Definition

The syntax of the LocationInfo data type shall comply with the following definition:

Name	Required	Type	Constraints	Description
country_code	yes	string		Shall be a two-letter ISO 3166 [10] country code in capital letters.
civic_address_element	no	list of tosca.datatypes.nfv.CivicAddressElement		Elements composing the civic address where the PNF is deployed.
geographic_coordinates	no	tosca.datatypes.nfv.GeographicCoordinates		Geographic coordinates (e.g. Altitude, Longitude, Latitude) where the PNF is deployed.

```
tosca.datatypes.nfv.LocationInfo:
  derived_from: tosca.datatypes.Root
  description: Represents geographical information on the location where a PNF is deployed.
  properties:
    country_code:
      type: string # two-letter ISO 3166 country code
      description: Country code
      required: true
    civic_address_element:
      type: list
      entry_schema
       type: tosca.datatypes.nfv.CivicAddressElement
       description: Elements composing the civic address where the PNF is deployed.
      required: false
    geographic_coordinates:
      type: tosca.datatypes.nfv.GeographicCoordinates
      description: Geographic coordinates (e.g. Altitude, Longitude, Latitude) where the PNF is
deployed.
      required: false
```

ETSI Standard Proposal

8.2.7 tosca.datatypes.nfv.GeographicCoordinates

8.2.7.1 Description

The GeographicCoordinates data type represents a geographic coordinate location as specified in IETF RFC 6225 [21]. Table 8.2.7.1-1 specifies the declared names for this data type. These names shall be used as specified in TOSCA-Simple-Profile-YAML-v1.2 [3].

Table 8.2.7.1-1: Type name, shorthand, and URI

Shorthand Name	GeographicCoordinates
Type Qualified Name	toscanfv: GeographicCoordinates
Type URI	tosca.datatypes.nfv.GeographicCoordinates

8.2.7.2 Properties

The properties of the GeographicCoordinates data type shall comply with the provisions set out in table 8.2.7.2-1.

Table 8.2.7.2-1: Properties

Name	Required	Type	Constraints	Description
latitude_uncertainty	no	string		Describe the content of latitude_uncertainty. The value of latitude_uncertainty shall comply with LatUnc in section 2.3 of IETF RFC 6225 [21].
latitude	yes	string		Describe the content of latitude. The value of latitude shall comply with Latitude in section 2.3 of IETF RFC 6225 [21].
longitude_ uncertainty	no	string		Describe the content of longitude_uncertainty. The value of longitude_uncertainty shall comply with LongUnc in section 2.3 of IETF RFC 6225 [21].
longitude	yes	string		Describe the content type of longitude. The value of longitude shall comply with Longitude in section 2.3 of IETF RFC 6225 [21].
altitude_type	yes	string		Describe the content type of altitude_type. The value of altitude_type shall comply with AType in section 2.4 of IETF RFC 6225 [21].
altitude_uncertainty	no	string		Describe the content of altitude_uncertainty. The value of altitude_uncertainty shall comply with AltUnc in section 2.4 of IETF RFC 6225 [21].
altitude	yes	string		Describe the content of altitude. The value of altitude shall comply with Altitude in section 2.4 of IETF RFC 6225 [21].

8.2.7.3 Definition

The syntax of the GeographicCoordinates data type shall comply with the following definition:

```
  tosca.datatypes.nfv.GeographicCoordinates:
    derived_from: tosca.datatypes.Root
    description: Represents an element of a geographic coordinate location as
specified in IETF RFC 6225 [21].
    properties:
      latitude_uncertainty:
        type: string # RFC 6225
        description: LatUnc as per RFC 6225
        required: false
      latitude:
        type: string # RFC 6225
        description: Latitude value as per RFC 6225
        required: true
      longitude_uncertainty:
        type: string # RFC 6225
        description: LongUnc as per RFC 6225
        required: false
      longitude:
        type: string # RFC 6225
        description: Longitude value as per RFC 6225
        required: true
      altitude_type:
        type: string # RFC 6225
        description: AType value as per RFC 6225
        required: true
      altitude_uncertainty:
        type: string # RFC 6225
        description: AltUnc as per RFC 6225
        required: false
      altitude:
        type: string # RFC 6225
        description: Altitude value as per RFC 6225
        required: true
```

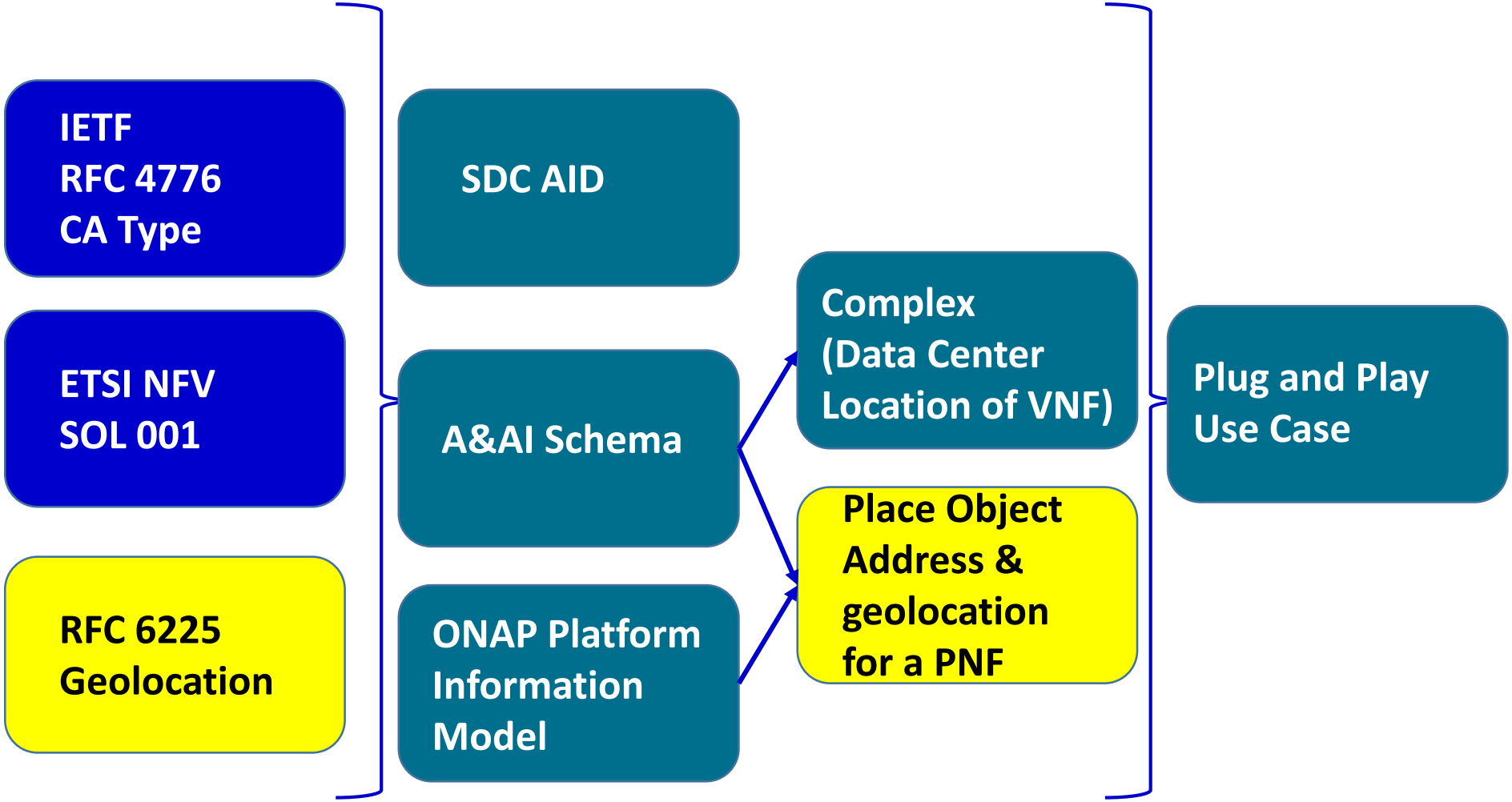
8.2.7.4 Examples

None.

MODELING WORK
GeoLocation Modeling Work

ONAP Information Modeling - Geolocation Information

Standards → Info Model → Data Model → Use Cases



RFC 6225 Geolocation (DHCP options / coordinate LCI)

Description	Examples
Latitude Uncertainty - When the Ver field = 1, this field represents latitude uncertainty. Uncertainty = 2 ^ (21 - x). x = 21 - ceil(log2(uncertainty))	
Latitude – Latitude in binary geodetic form. A 34-bit fixed-point value consisting of 9 bits of integer and 25 bits of fraction.	
Longitude Uncertainty - When the Ver field = 1, this field represents longitude uncertainty. Uncertainty = 2 ^ (21 - x). x = 21 - ceil(log2(uncertainty))	
Longitude – Longitude in binary geodetic form. A 34-bit fixed-point value consisting of 9 bits of integer and 25 bits of fraction.	
Altitude Uncertainty - When the Ver field = 1, this field represents altitude uncertainty.	
Altitude – A 30-bit value defined by the Altitude Type field	
Altitude Type – (1) Altitude in Meters, (2) Altitude in Floors.	1 (indicates Altitude in Meters)
Altitude Resolution - value encodes the number of high-order altitude bits that should be considered valid	
Map Datum - The Map Datum used for the coordinates given in this option: WGS84, NAD83 + NAVD88, NAD83 + MLLW.	2 (Indicates NAD83+ NAVD88)

RFC6225 supersedes RFC 3825

IETF RFC 4776 definition of CAtype

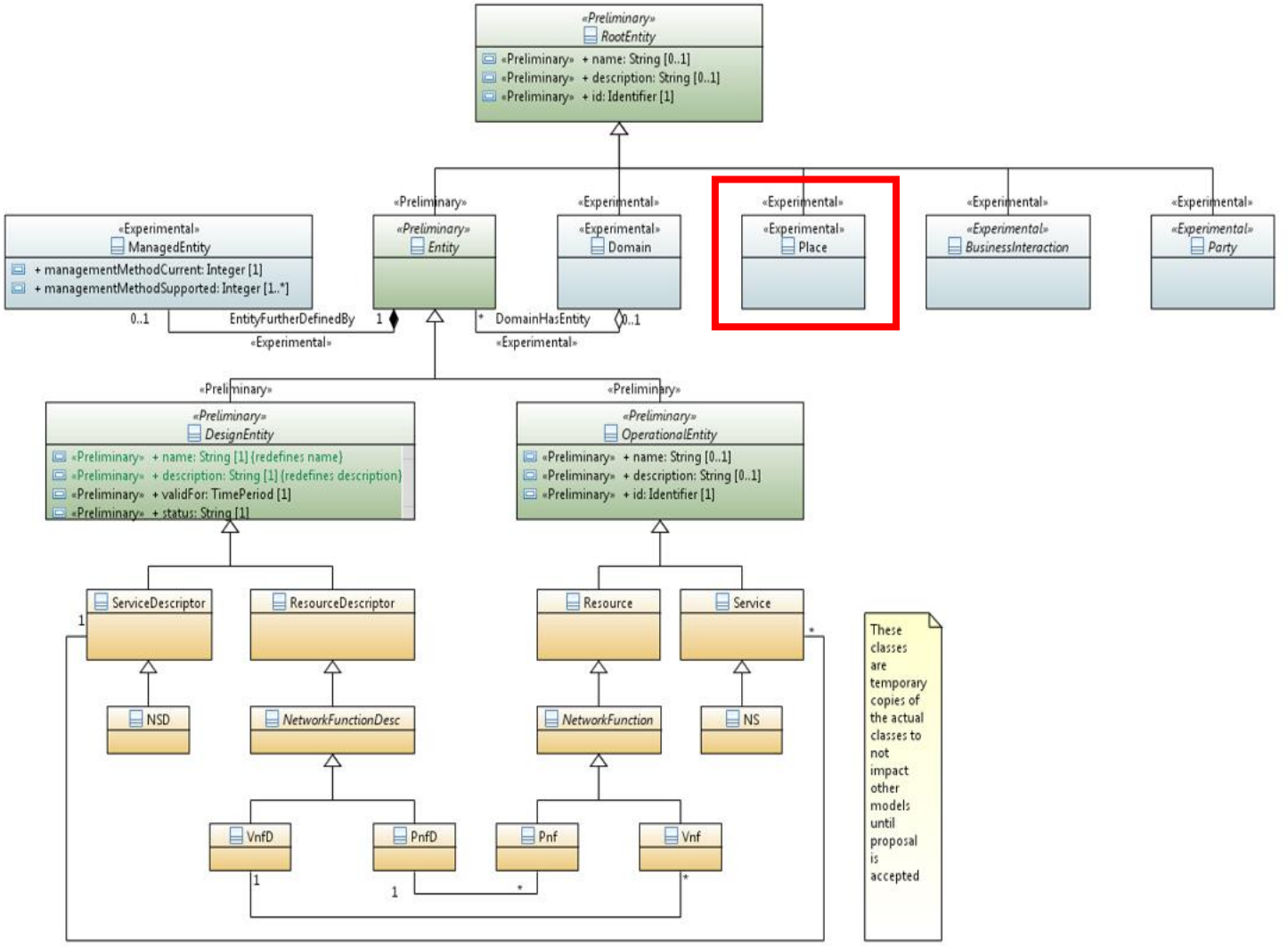
- This document specifies a Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) option containing the civic location of the client or the DHCP server.
  - Civic information is useful since it often provides additional, human-usable information, particularly within buildings.
  - RFC 3825/RFC 6225 Geolocation specification Lat/Long/Alt

CAtype	label/ NENA/PIDF	description	examples
1	A1	national subdivisions (state, canton, region, province, prefecture)	
2	A2	county, parish, gun (JP), district (IN)	
3	A3	city, township, shi (JP)	
4	A4	city division, borough, city district, ward, chou (JP)	
5	A5	neighborhood, block	
6	A6	group of streets below the neighborhood level	
16	PRD	leading street direction	N
17	POD	trailing street suffix	SW
18	STS	street suffix or type	Ave, Platz
19	HNO	house number	123
20	HNS	house number suffix	A, 1/2
21	LMK	landmark or vanity address	Columbia University
22	LOC	additional location information	South Wing
23	NAM	name (residence and office occupant)	Joe's Barbershop
24	ZIP/PC	postal/zip code	10027-1234
25		building (structure)	Low Library

CAtype	label/ NENA/PIDF	description	examples
26		unit (apartment, suite)	Apt 42
27	FLR	floor	4
28		room	450F
29		type of place	office
30	PCN	postal community name	Leonia
31		post office box (P.O. Box)	12345
32		additional code	13203000003
33	SEAT	seat (desk, cubicle, workstation)	WS 181
34		primary road name	Broadway
35		road section	14
36		branch road name	Lane 7
37		sub-branch road name	Alley 8
38		street name pre-modifier	Old
39		street name post-modifier	Service
0		language	
128		script	Latn
255		reserved	

- "NENA" correspond to items from the National Emergency Number Association, "NENA Recommended Formats and Protocols For ALI Data Exchange, ALI Response and GIS Mapping", NENA NENA-02-010, January 2002.
- "PIDF" indicates the element name from Peterson, J., "A Presence-based GEOPRIV Location Object Format", RFC 4119, December 2005.

“Place” object in modeling



Location / Place
NF has “planning view” / planning from system

Planning location
Reporting of location
Matching processing
Reconciliation

What’s in MIB
AAI has info from somewhere
Populated through VID??

Street add in PNFD (ETSI
Planning info / placeholder

“Place” object in modeling

```
PUT /aai/v11/cloud-infrastructure/complexes/complex/clli2 HTTP/1.1
Host: <AAI_VM1_IP>:8443
X-TransactionId: 9999
X-FromAppId: jimmy-postman
Real-Time: true
Authorization: Basic QUFJOkFBSQ==
Content-Type: application/json
Accept: application/json
Cache-Control: no-cache
Postman-Token: 734b5a2e-2a89-1cd3-596d-d69904bcda0a
```


```
{
   "physical-location-id": "clli2",
   "data-center-code": "example-data-center-code-val-6667",
   "complex-name": "clli2",
   "identity-url": "example-identity-url-val-28399",
   "physical-location-type": "example-physical-location-type-val-28399",
   "street1": "example-street1-700MountainAvenue",
   "street2": "example-street2-GlenSideRoad",
   "city": "example-city-MurrayHill",
   "state": "example-state-NewJersey",
   "postal-code": "example-postal-code-07974",
   "country": "example-country-UnitedStates",
   "region": "example-region-val-28399",
   "latitude": "111.1",
   "longitude": "234.2,
   "elevation": "example-elevation-538feet",
   "lata": "example-lata-val-28399"
}
```


https://wiki.onap.org/pages/viewpage.action?pageId=25431491

“Place” object in Platform Information Model

ATTRIBUTE	DESCRIPTION	EXAMPLE	TYPE	NOTES
physical-location-id	Unique identifier for physical location, e.g., CLLI (Location ID)	clli Code	String	
data-center-code	Data center code which can be an alternate way to identify a complex	example-data-center-code-val-6667	String	(Data Center centric - may need adaptation for PNF)
complex-name	Gamma complex name for LCP instance.	clli2	String	(ibid)
identity-url	URL of the keystone identity service	example-identity-url-val-28399	String	(ibid)
resource-version	Used for optimistic concurrency. Must be empty on create, valid on update and delete.		String	
physical-location-type	Type, e.g., central office, data center.	example-physical-location-type-val-28399	String	
street address	A string describing the street address of the place.	example-street1-val-28399	Map	Tag Value Array (Name/Value) = (1) "Street value #1=String" ; (2)"Street value #2=String"
city	The name of the metropolitan area, city, township, borough, district, or ward. The Map has with further specific city sub-divisions such as: division, borough, district, ward, chou, neighborhood, block, street group	example-city-val-28399	Map	Map of City (City, Township, Parish) City Division (Borough, District, Ward, Chou) Neighborhood (Block, Street groups)
state	The name of the state, province	example-state-val-28399	String	
postal-code	The string for the postal code or zip code	example-postal-code-val-28399	String	
country	The name of the country	example-country-val-28399	String	
region	The name of the region	example-region-val-28399	String	
additional qualifiers	These are additional descriptive qualifiers (general string) that may be concatenated information representing the structure qualifiers. This is a map, a tag value array of pre-defined qualifier fields including: unit, floor, room, desk	Tag Value Array	Map	
latitude	Latitude in binary geodetic form. A 34-bit fixed-point value consisting of 9 bits of integer and 25 bits of fraction. From RFC6225 (Optional)	example-latitude-val-28399	String	
longitude	Longitude in binary geodetic form. A 34-bit fixed-point value consisting of 9 bits of integer and 25 bits of fraction. From RFC6225 (Optional)	example-longitude-val-28399	String	
elevation	A 30-bit value defined by the Altitude Type field. From RFC6225 (Optional)	example-elevation-val-28399	String	
location-name	the location name (CANDIDATE)		String	
lata	Local Access Transport Area (1920s) (CANDIDATE)	example-lata-val-28399	String	
ctag-pools	CE VLAN IDs		Array	#/definitions/ctag-pool
relationship-list			Object	#/definitions/relationship
Latitude Uncertainty	(Candidates from RFC6225)	When the Ver field = 1, this field represents latitude uncertainty. Uncertainty = 2 ^ (21 - x). x = 21 - ceil(log2(uncertainty))	String	
Longitude Uncertainty	(Candidates from RFC6225)	When the Ver field = 1, this field represents longitude uncertainty. Uncertainty = 2 ^ (21 - x). x = 21 - ceil(log2(uncertainty))	String	
Altitude Uncertainty	(Candidates from RFC6225)	When the Ver field = 1, this field represents altitude uncertainty.	String	
Altitude Type	(Candidates from RFC6225)	(1) Altitude in Meters, (2) Altitude in Floors.	String	
Altitute Resolution	(Candidates from RFC6225)	value encodes the number of high-order altitude bits that should be considered valid	String	
Map Datum	(Candidates from RFC6225)	The Map Datum used for the coordinates given in this option: WGS84, NAD83 + NAVD88, NAD83 + MLLW.	String	
Geographic Geometry	TMForum GB922	Modeling sub-team has considered and discussed inclusion of (surfaces, multi-points, and shapes) and concluded that for now, there are immediate use cases that would need this.	Object	

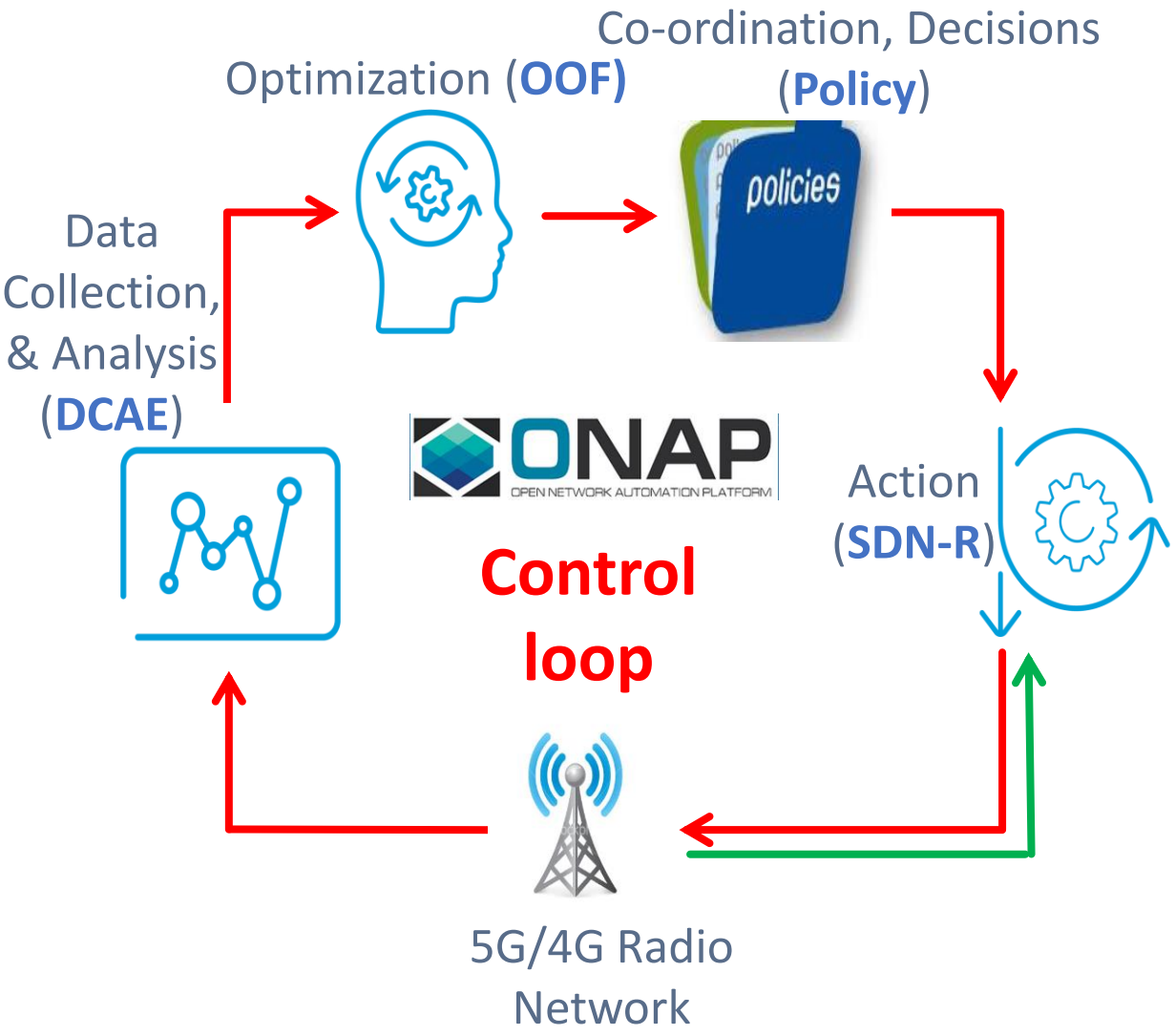
ETSI SOL001 PNFD LocationInfo vs. AAI Complex (3/3)

ETSI SOL001 PNFD LocationInfo	AAI Complex	description	Handling
-	physical-location-id	Unique identifier for physical location, e.g., CLLI	Generate witin ONAP
-	data-center-code	Data center code which can be an alternate way to identify a complex	?
-	complex-name	Gamma complex name for LCP instance.	?
-	identity-url	URL of the keystone identity service	?
-	resource-version	Used for optimistic concurrency. Must be empty on create, valid on update and delete.	Generate witin ONAP
-	latitude		Geospatial coordinates not included in ETSI PNFD, needs to be added? (See RFC3825)
-	longitude		Geospatial coordinates not included in ETSI PNFD, needs to be added? (See RFC3825)
-	elevation		Geospatial coordinates not included in ETSI PNFD, needs to be added? (See RFC3825)
-	lata	Local access and transport area	Specific to USA (Canadian equivalent is Local interconnection region, LIR. Unclear what equivalents exist in other countries/areas.)

Use Cases & Applications

ONAP Information Modeling - Geolocation Information

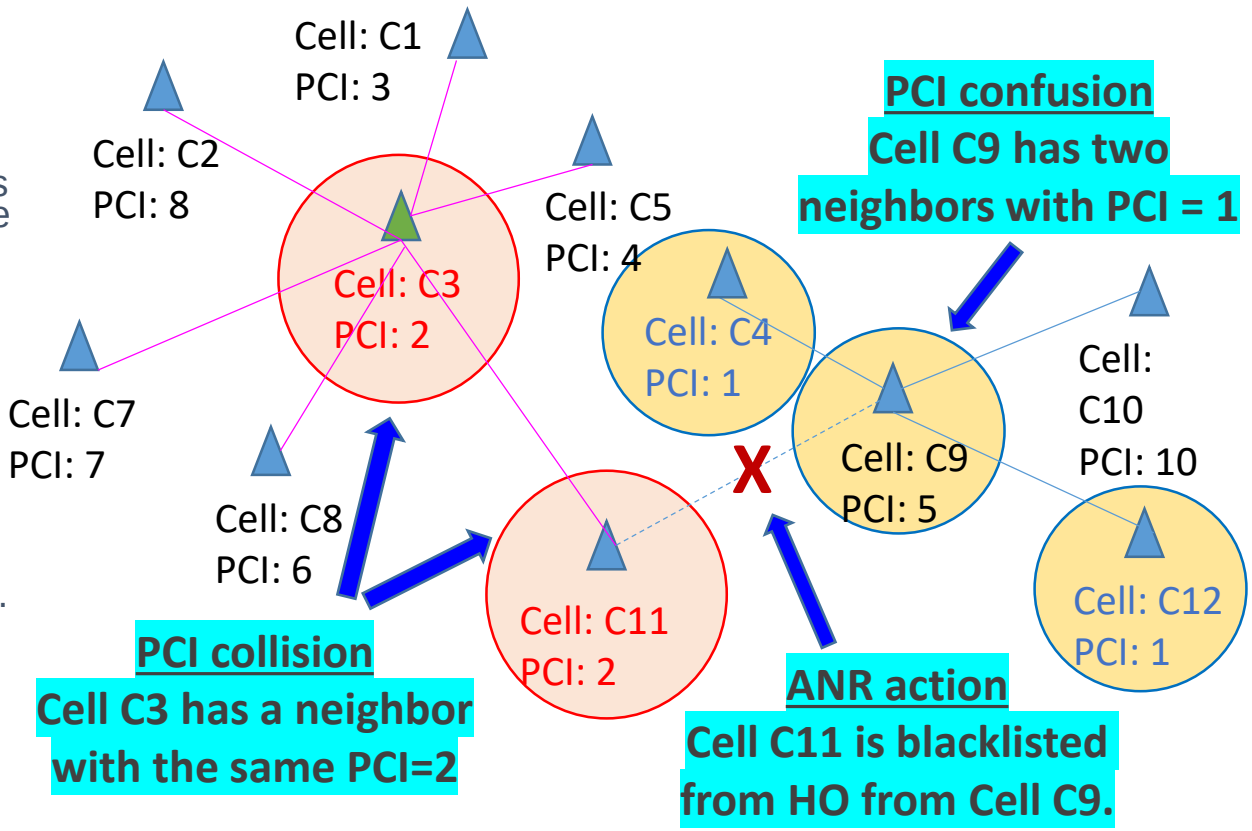
Self Optimizing Networks (SON)



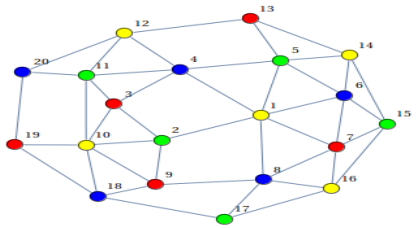
- SON ⇔ Control Loop (CL)
- ONAP: Open-source platform, with basic open-source code
- Companies can use framework to add proprietary SON solutions
- OOF-PCI Casablanca –
  - First ONAP SON PCI use case
  - PoC Demo in Dec 2018
- OOF-PCI Dublin
  - Added SON function: ANR
  - More SON data flows: FM, PM
  - More ONAP code integration

OOF SON PCI Use Case

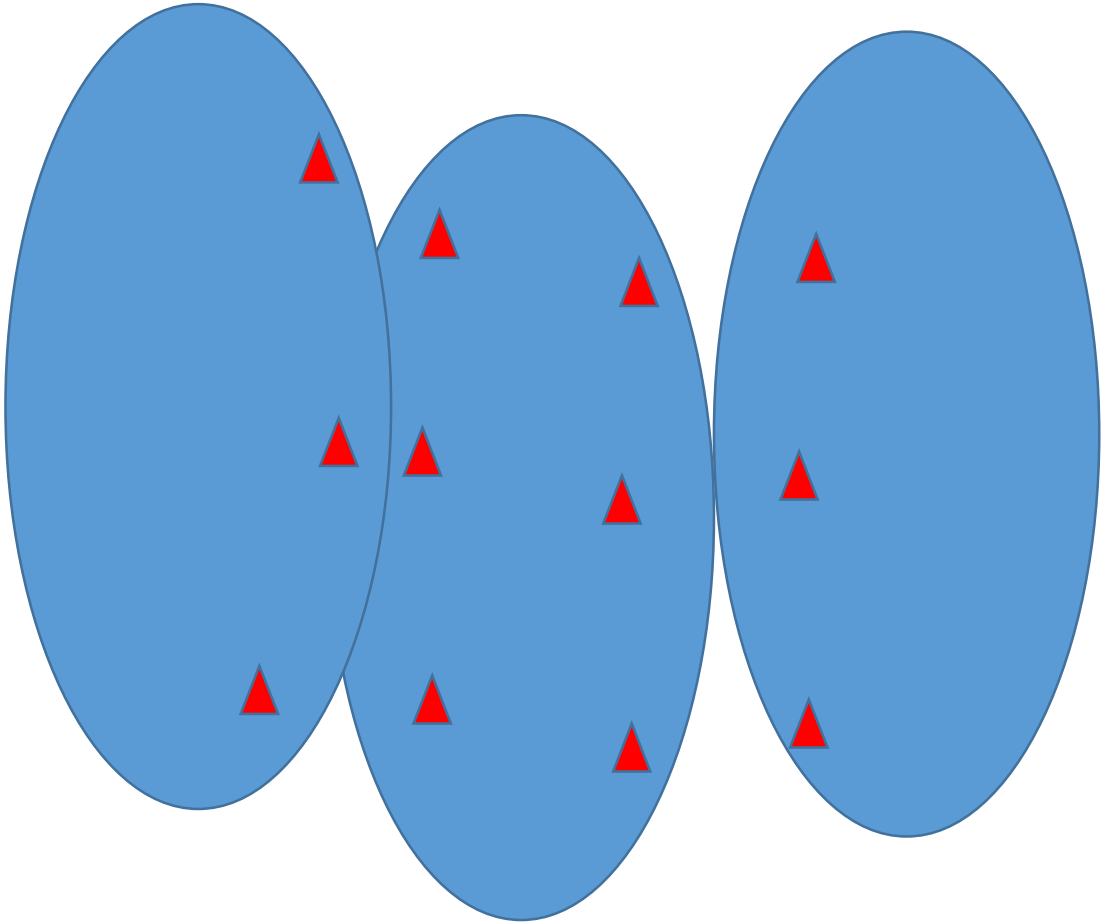
- Physical cell ID (PCI) is a locally unique integer ID in 4G/5G
  - Used for handoff and physical layer design
  - PCI ranges: (LTE: 0-503, 5G: 0-1007)
- PCI optimization: Assign PCI values to avoid **PCI collision** and minimize **PCI confusion**
- Automated Neighbor Relations (ANR) builds & maintains neighbor relation tables in eNodeB and gNodeB
  - Distributed ANR in eNodeB, gNodeB
  - Centralized ANR optimizes neighbor tables based on global information
- PCI needs to be re-optimized if neighbor relationship changes, (e.g. during distributed ANR function in RAN)
- Centralized ONAP ANR optimization is best done jointly with PCI - blacklisting neighbors from HO based on HO metrics over a period of time



Graph Coloring Problem



Electrical & Mech Tilt w/ Topology Mapping



Traffic Management & Recovery