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Intent for Green Services
draft-contreras-nmrg-green-intent-01

Abstract

There is an increasing interest on incorporating sustainable dimension to the provision of commnunication services. This document describes an intent for allowing customers to express their desired intents in terms of the green service objectives they expect from the network provider.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on 18 September 2025.

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1. Introduction

Sustainability goals are moving the industry to the objective of providing services in a more efficient way from the perspective of energy consumption, which can be referred to as "green services". The actual provision of such green services has dependencies on the challenges identified for the management for green networking [I-D.irtf-nmrg-green-ps].

In this respect, it is of interest allowing customers to express their desired intents in terms of the green service objectives they expect from the network provider. Such objectives can be related not only to the energy consumption itself, but also to the source of the energy being consumed for providing the service. The former relates to the CO2 footprint associated to the service.

The provider could, or could not, honor the customer request expressed by the intent. It will be then necessary to enable a framework for negotiation, validation and enforcement of the objectives subject to the intent.

This document primarily focuses on the structure and attributes of an intent targeting green services. The discussion on how to assess the value of the intent attributes is out of scope of this document.

2. Intents Targeting Green Services

For customers it can be of interest to provide descriptive information about the expected energy and the CO2 intensity of the service. This information can be processed by the network provider for determining the way in which the service can be realized, as any other service constrained. For instance, according to some defined policies, a service could be provided using resources of a certain

geographical area.

It should be noted that the concept of service can include not only connectivity but also Service Functions hosted in different points of presence. All of them can be subject to different levels of energy consumption and different sources of energy generation.

2.1. Intent Structure

The following parameters are considered as possible attributes of the intent:

* _Energy consumption_. This attribute refers to the overall consumed energy, specifying a threshold value of consumption (e.g., less than such threshold).

* _Energy efficiency_. This attribute relates to the ratio of energy per a given unit related to the service (typically such unit refers to unit of traffic, e.g., bits per Joule), specifying a threshold value of efficiency (e.g., greater than such threshold).

* _Carbon emissions_. This attribute refers to the overall carbon intensity of the service (i.e., grams of CO2 per kWh), specifying a threshold value of emissions (e.g., less than such threshold).

* _Use of renewable energy_ (expressed as a rate). This attribute relates to ratio of renewable energy used for the service (e.g., greater than such threshold), as well as, potentially, the source of renewable energy.

These attributes do not necessarily be present at the same time in the green intent. Moreover, the final values of the intent attributes could be aligned with metrics defined in [I-D.cx-opsawg-green-metrics]. Finally, the customer can assess the commitment of the desired intents by the provider by means of APIs as the one defined in [I-D.petra-path-energy-api].

2.2. Relationship among intent attributes

The attributes mentioned above are interconnected at various levels. Exploring these relationships helps identify the implications of how one attribute influences others.

The use of renewable energy (URE) is directly linked to carbon emissions (CE), as a higher URE generally results in lower CE. However, the percentage of renewable energy is independent of both energy consumption (EC) and energy efficiency (EE), showing no direct correlation with these two factors.

Conversely, there is a clear relationship between EE and EC. A less energy-efficient network will require more energy. Consequently, for a fixed URE value, higher energy consumption leads to increased carbon emissions. Beyond this evident connection, analyzing the interplay between EE, EC, and CE enables a deeper understanding of a system's dynamics concerning these indicators. This is proposed as for further work.

For example, given a specific energy consumption (EC) value, the energy efficiency of a network can be improved by increasing its traffic load, thereby enhancing its performance. This aligns with current device and network element implementations, where energy consumption is primarily driven by idle power rather than traffic volume. As a result, traffic variations have minimal impact on energy usage.

Achieving a proportional relationship between energy consumption and traffic requires turning off (or entering into sleep mode) modular components, such as entire line cards. Additionally, for a fixed traffic volume, energy consumption can be reduced by adopting more energy-efficient equipment that consume less energy per unit of traffic. Consequently, lowering energy consumption also leads to a reduction in carbon emissions.

3. Green Intent Lifecycle

[RFC9315] defines an intent lifecycle composed of two phases, namely fulfillment and assurance.

Figure 2 captures the intent procedure for the fulfillment phase.

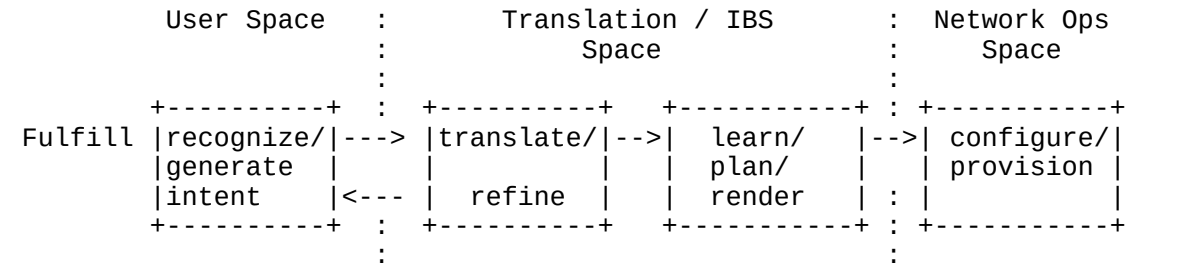

Figure 1: Fulfillment phase of the Green Intent

Similarly, Figure 3 sketches the intent procedure for the assurance phase.

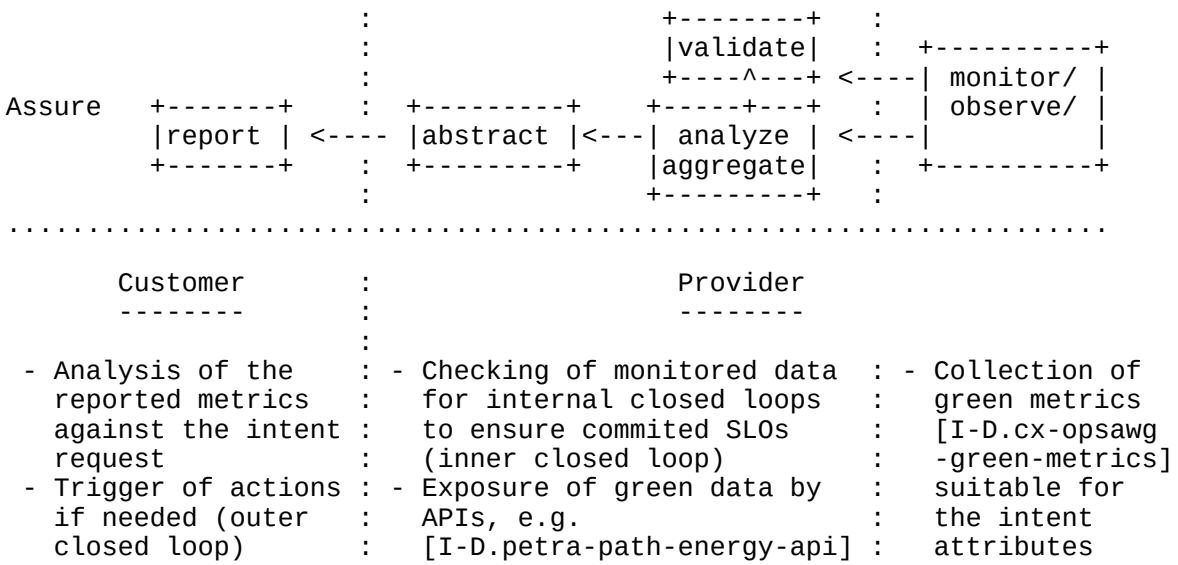

Figure 2: Assurance phase of the Green Intent

4. Implementation Status and Lessons Learned

This section will be used to track the status of the implementations of the model.

4.1. Implementation Status

Current implementation of the green intent can be accessed at: https://github.com/Telefonica/intent_engine/blob/develop/inputs/green_v2.yaml

4.2. Lessons learned

At this stage of definition of the intent for green services, the following lessons can be reported:

* There is yet an ongoing work on definition of metrics which requires to mature. Such metrics will conidtion the final format of the intents.

* A service is composed by multiple assets, each of them with their own way of characterizing energy and power related metrics. A typical service could be composed of connectivity services, service functions, control and processing capabilities, etc. Thus an abstract way of reporting the overall green attributes for a service is needed, since it can not be expected full knowledge of the particular aspects of a service by the customer using the intent.

As long as the work progress, additional lessons will be provided.

5. Security considerations

To be done.

6. Informative References

[I-D.cx-opsawg-green-metrics]
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[I-D.irtf-nmrg-green-ps]
Clemm, A., Pignataro, C., Westphal, C., Ciavaglia, L., Tantsura, J., and M. Odini, "Challenges and Opportunities

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[I-D.petra-path-energy-api] Rodriguez-Natal, A., Contreras, L. M., Muniz, A., Palmero, M., Munoz, F., and J. Lindblad, "Path Energy Traffic Ratio API (PETRA)", Work in Progress, Internet-Draft, draft-petra-path-energy-api-02, 8 July 2024, <https://datatracker.ietf.org/doc/html/draft-petra-path-energy-api-02>.

[RFC9315] Clemm, A., Ciavaglia, L., Granville, L. Z., and J. Tantsura, "Intent-Based Networking - Concepts and Definitions", RFC 9315, DOI 10.17487/RFC9315, October 2022, <https://www.rfc-editor.org/info/rfc9315>.

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