ISG ZSM PoC#9: Intent-driven Energy Saving

1 PoC Project Details

1.1 PoC Project

PoC Number:	#9
PoC Project Name:	Intent-driven Energy Saving
PoC Project Host:	Huawei
Short Description:	This PoC Project will describe the use of an intent-driven approach for radio network Energy Saving in the radio network domain. The PoC aims to demonstrate: 1) How an intent-driven approach used by a NOP (as MnS consumer/intent owner) to express the RAN energy saving expectation (including energy efficiency targets and user experience targets) to a NEP (as MnS producer/intent handler/intent management entity). 2) How the NOP monitors the RAN energy saving effects, by obtaining a detailed intent report (e.g. regarding energy consumption) from NEP. (Note: NOP - Network Operator; NEP - Network Equipment Provider) The implementation of the solution of this PoC complies with the 3GPP standards and ZSM standards. The design architecture of the use case follows ZSM 002 (ZSM framework), and uses the intent-driven management service (including intent management operations and intent information model) defined in 3GPP TS 28.312.

1.2 PoC Team Members

	Organisation name	ISG ZSM participant (yes/no)	Contact (Email)	PoC Point of Contact (*)	Role (**)	PoC Components
1	Huawei	Yes	shuxinye@huawei.com; liyexing@huawei.com; yuan.xie@huawei.com; xuruiyue@huawei.com;	X	Network Supplier	- Use case definitions -Storyline/ Implementation of the baseline architecture -Design of the Functional Block -Implementation of the specific algorithms -Provide hardware and software
2	China Telecom	Yes	wangd5@chinatelecom.cn; liz779@chinatelecom.cn		Network Operator	- Use case definitions -Business model definition
3	Deutsche Telekom	Yes	klotzm@telekom.de		Network Operator	-Use case definitions
4	Xidian University	No	guideyang2050@163.com		University	-Algorithms Model

All the PoC Team members listed above declare that the information in this proposal is conformant to their plans at this date and commit to inform ETSI timely in case of changes in the PoC Team, scope or timeline.

1.3 PoC Project Scope

1.3.1 PoC Topics

PoC Topics identified in this clause need to be taken for the PoC Topic List identified by ISG ZSM and publicly available in the ZSM WIKI. PoC Teams addressing these topics commit to submit the expected contributions in a timely manner.

PoC Topic Description	PoC Topic Description	Related WI	Expected Contribution	Target Date
Topic 3 (Intent-driven Closed-loop automation)	Intent-driven approach for radio network Energy Saving	ZSM-016	Reference Architecture for this PoC. RAN energy saving intent model, processing procedure.	Aug 2024

1.3.2 Other topics in scope

List here any additional topic for which the PoC plans to provide input/feedback to the ISG ZSM.

PoC Topic Description	Related WI	Expected Contribution	Target Date

1.4 PoC Project Milestones

PoC Milestone	Milestone description	Target Date	Additional Info
P.S	PoC Proposal submission	Nov 2023	Official PoC proposal submission
P.D1	PoC Demo 1	Mar 2024	Demonstrate standardized intent-driven interface. Please note that the software and setup used in Demo 1 will also be used in Demo 2. In other words, Demo 2 will be built upon Demo1.
P.PU	Contribution on lessons learned from Demo 1	April 2024	Collect feedback about Demo 1 and lessons learned about the PoC, and make improvements.
P.D2	PoC Demo 2	May 2024	Demonstrate intent handling, and RAN energy saving action execution, with intent report returned for energy saving effect evaluation and monitor.
P.R2	PoC Report completed	Jun 2024	Report final draft
P.R3	PoC Report feedback cleared	July 2024	PoC-Project-End Feedback
P.E	PoC Project End	Aug 2024	

NOTE: Milestones need to be entered in chronological order.

1.5 PoC Demonstration Plan

This PoC was first presented in ZSM#25, collecting suggestions. We are planning to present 2 Demos, on ZSM #26 meeting in March 2024, and ZSM #27 meeting in May 2024, respectively. The target development completion data for the PoC is May 2024. We will look for further opportunities to do presentations at meetings related to the topic of Network Autonomous, e.g., Layer 123 World Congress 2024, network X 2024 etc.

Huawei, as a network supplier, will provide computing hardware, network equipment and corresponding software for the PoC. The hardware will be set up in Huawei's lab in Xi'an, China. The PoC demo will be presented in the form of video clips.

2 PoC Technical Details

2.1 PoC Overview

2.1.1 Use case description

This PoC Project will demonstrate the use of intent between NOP (as intent owner) and NEP (as intent handler) in the RAN energy saving scenario, using the intent management operations and intent information model as defined in 3GPP TS 28.312 [3].

According to clause 3.1 of GS ZSM-016 [2], intent owner and intent handler maps to MnS consumer and MnS producer defined in 3GPP TS 28.312 [3] respectively:

- intent owner: logical entity that originates intents and is responsible for managing intents lifecycle. An intent owner is an intent-driven MnS consumer for a specific intent.
- intent handler: logical entity that receives intents and handles them in the domain that is responsible for that intent's fulfilment. An intent handler is an intent-driven MnS producer for a specific intent.

In this PoC, we use an Intent Platform GUI (as shown in figure 1) to convey the Network Operator's intent. The Intent Platform GUI is part of NOP, through which user can input the intent IOC (intent expectation, intent contexts, etc.), so here we mainly focus on demonstrating the interactions between NOP and NEP.

RAN energy saving benefits to lower OPEX for mobile operators, through the reduction of power consumption in the mobile networks. RAN energy saving is achieved by executing energy saving actions with suitable parameter configurations, such as energy saving state switch, start time and end time, the energy saving thresholds. One typical scenario of energy saving is to reduce (or switch-off) radio resources when the traffic demand is low, and re-activate them on a need basis. However, the energy saving actions may deteriorate the service experience (e.g. throughput, coverage), and it is not straightforward to evaluate the influence on service experience of energy saving actions, since the real network is complex with diverse services

of different requirements and the traffic distribution is always changing. Therefore, an intent driven approach may be used to determine the optimal energy saving solution to satisfy the NOP's intent expectation for energy saving and service experience.

2.1.2 PoC scope

This PoC demonstrates how to automatically promote energy saving with an intent-driven approach.

The detailed use case is as follows:

1. When receiving an intent related to RAN energy saving from NOP, NEP translates the intent and derives the energy saving actions to satisfy the intent. Typically, examples of these actions include "switch on some energy saving algorithms in the cell", "configure the cell overlaid relations" etc.
2. During intent fulfilment, detailed intent report will be sent to NOP to notify the fulfilment status continuously. In this use case, not only the intent fulfilment result will be presented, but more information about energy consumption or energy efficiency will be provided. The energy consumption metrics uses the RanEnergyConsumptionTarget as defined in 3GPP TR 28.312. All this information may be presented to NOP in a visualization view based on the required precision, such as the energy consumption of areas or radio access sites.

2.2 PoC Architecture

This PoC will use the intent-driven management service (including intent management operations and intent information model) defined in 3GPP TS 28.312 [3], which might be the instantiation of the management services defined in GS ZSM-016 [2] clause 8.1. Figure 1 illustrates an example of intent driving energy saving approach. Within E2E network and service domain, NOP can create energy saving intent by utilizing the intent management service, which is sent through the standard intent-driven interface. After intent execution, NEP may provide NOP with an intent report with detailed information of relevant performance metrics, such as energy saving effect distribution, domain energy consumption distribution, etc.

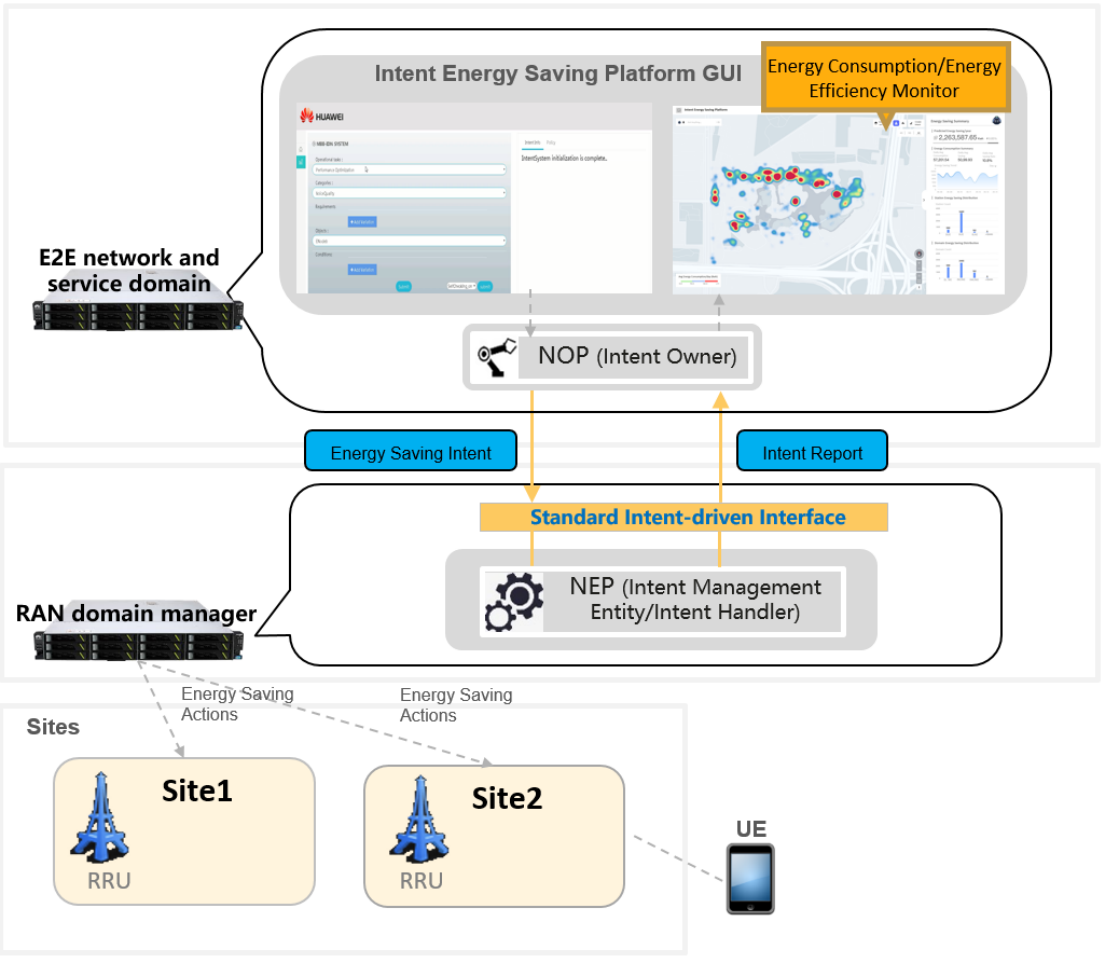

Figure 1 Use case of this PoC

The following figure depicts the PoC architecture mapping to the ZSM framework (ZSM 002 [1].

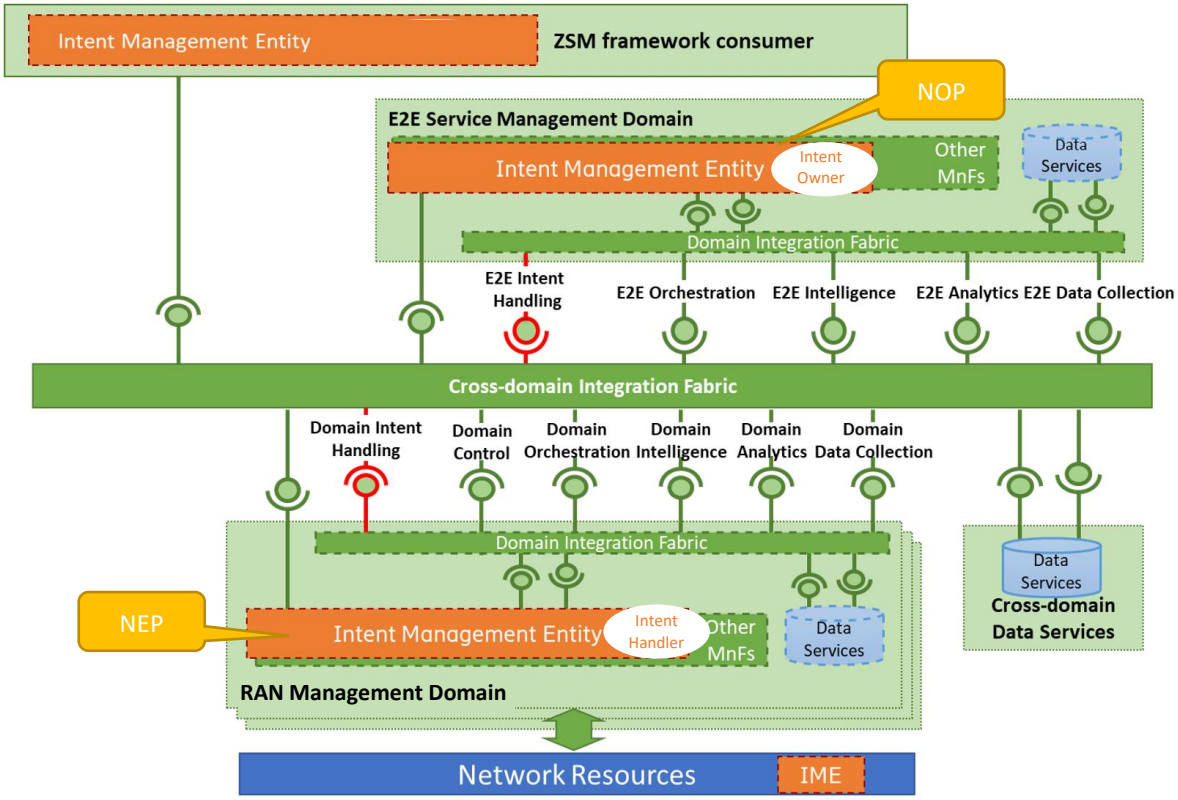

Figure 2 Architecture of Intent Based RAN Energy Saving

In order to achieve use case described in Figure 1, the architecture mainly consists of the following:

1. The E2E network and service domain may send energy saving intent through the standard intent-driven interface to the RAN domain manager. The E2E network and service domain is equivalent to NOP in Figure 2. The standard intent-driven interface in Figure 1 corresponds to Domain Intent Handling Interface in ZSM architecture, and the NEP in Figure 1 corresponds to intent handler/intent management entity in Figure 2.
2. NEP may request to execute the desired actions on RAN nodes. The RAN domain in this use case corresponds to the Network Resources in ZSM architecture (Figure 2).

2.3 Additional information

The references used throughout this document are listed below.

[1] ETSI GS ZSM 002: “Zero-touch network and Service Management (ZSM); Reference Architecture”.
[2] ETSI GS ZSM 016: “Zero-touch network and Service Management (ZSM); Intent-driven Closed Loops”.
[3] 3GPP TS 28.312: “Technical Specification Group Services and System Aspects; Management and orchestration; Intent driven management services for mobile networks”.