1 Description of the Use Case

1.1 Name of Use Case: Circuit Segment Optimization

Use Case Identification		
ID	*Domain(s)/ Zone(s)*	*Name of Use Case*
		Circuit Segment Optimization

1.2 Version Management

Version Management				
Version No.	*Date*	*Name of Author(s)*	*Changes*	*Approval Status*
20161107a	20161107	SGIP OpenFMB Priority Action Plan	20161107 UML	
20181231a	20181231	UCA OpenFMB Users Group	20181011a UML	
1.0.0	20190430	UCA OpenFMB Users Group	Section 5 Information Exchanged separated into supplemental document	

1.3 Scope and Objectives of Use Case

Scope and Objectives of Use Case	
Scope	Optimization of a circuit segment
Objective(s)	Harmonize local device coordination with centralized system controls through schedule optimization for a service provider defined period of time.
Related business case(s)	DER Circuit Segment Management

1.4 Narrative of Use Case

Narrative of Use Case
Short description
The business objective of this DER Circuit Segment Optimization use case is to harmonize local device coordination with centralized system controls through schedule optimization for a service provider defined period of time based upon information such as weather, markets, and dispatch / load forecasts. Considering component status and capabilities over appropriate timeframes, circuit segment optimization schedules maintain proper voltage, frequency, and power factor for safe, reliable operation either while connected to the larger grid or as an islanded microgrid for those circuit segments with appropriate capabilities. Circuit segment schedules may also consider objectives such as: • Import or export schedules • Economic dispatch • Solar smoothing to reduce circuit segment volatility • Volt-VAr for power factor optimization • Peak demand management by shaving / shifting
Complete description
The business objective of this DER Circuit Segment Optimization use case is to harmonize local device coordination with centralized system controls. Figure 1 represents a circuit segment of an example utility provider's Open Field Message Bus (OpenFMB) reference implementation starting at a substation with storage, load, protection and voltage regulation devices, renewable generation (PV), and a microgrid along it. Within this OpenFMB reference implementation, a microgrid has the ability to independently seamlessly island without interruption. The circuit breaker at the head of the segment and the microgrid Point of Common Coupling (PCC) motor operated switch, which isolates the microgrid from the other circuit segment, delineate two separate but coordinated, self-optimized layers. Each layer has a distributed coordination service providing ongoing voltage, frequency, and power factor support. Each layer also has a distributed virtual optimizer preparing schedules for a service provider defined period of time. For the circuit segments shown in Figure 1, there is PCC Optimizer for the microgrid and a POI Optimizer for its parent circuit segment. Optimizers can be physically hosted along the appropriate circuit segment, at a local facility such as a building or campus, at a central site, or at a third party or aggregator.

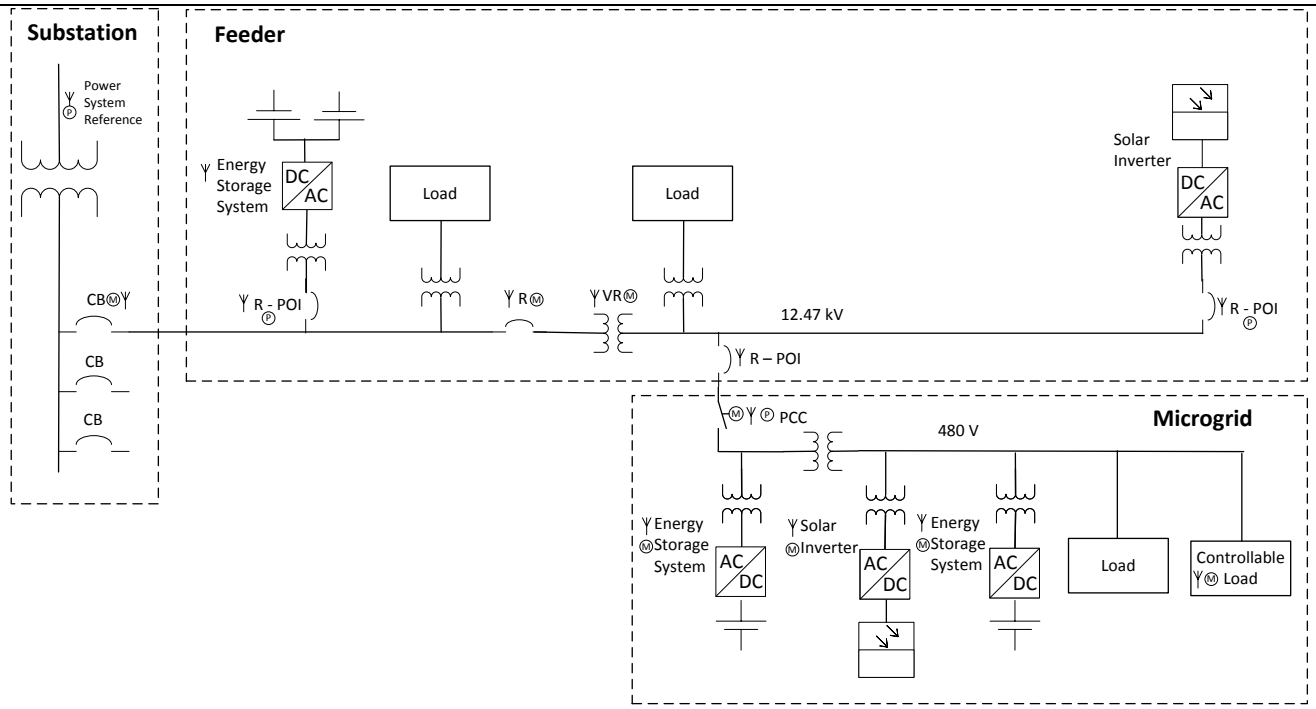

Figure 1: Circuit Segment Optimization Use Case Single Line Diagram

Considering component status and capabilities over appropriate timeframes, circuit segment optimization schedules maintain proper voltage, frequency, and power factor for safe, reliable operation. Circuit segments may either be connected to the larger grid or an islanded microgrid for those circuit segments with appropriate capabilities. Circuit segment schedules may also consider objectives such as:

- Import or export schedules
- Economic dispatch
- Solar smoothing to reduce circuit segment volatility
- Volt-VAr for power factor optimization
- Peak demand management by shaving / shifting

Circuit segment optimization schedules utilize appropriate weather and markets information as well as dispatch / load forecasts incorporating actual circuit segment conditions from that circuit segment's coordination service. Depending upon local conditions and objectives, multiple algorithms may satisfy local needs. This use case is agnostic to such differing algorithms and only addresses interactions between the use case actors. For a specific circuit segment layer, such as shown in Figure 1, the general event-driven iterative optimization flow of information is:

1. Whenever significant circuit segment changes occur but not longer than a service provider defined time interval, circuit segment Coordination Service publishes planned optimizer schedule reflecting current status of that circuit segment
2. Circuit segment Optimizer subscribes to planned optimizer schedule, weather and markets information as well as dispatch / load forecasts
3. Circuit Segment Optimizer develops hours to days ahead duration requested optimizer schedule
4. If there are schedule changes, circuit segment Optimizer publishes requested optimizer schedule
5. Circuit segment Coordination Services subscribes to requested optimizer schedule

1.5 General Remarks

General Remarks
Not Applicable

2 Diagrams of Use Case

Diagram(s) of Use Case

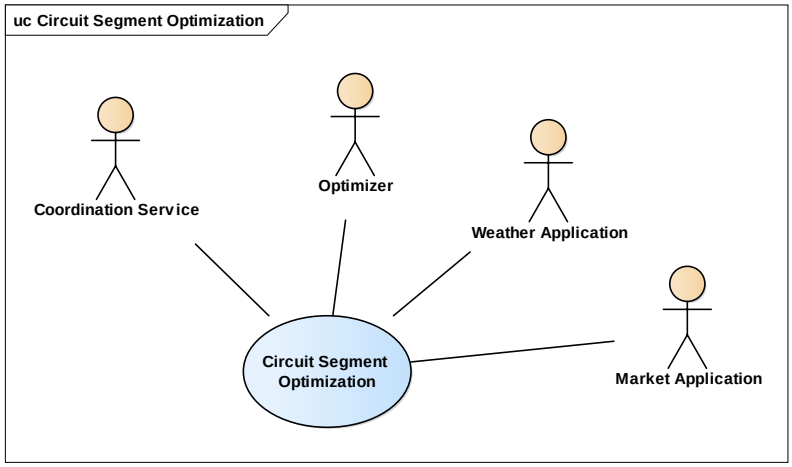

Figure 2: Circuit Segment Optimization Use Case

3 Technical Details

3.1 Actors

Actors			
Grouping (e.g. domains, zones)		*Group Description*	
Actor Name see Actor List	*Actor Type* see Actor List	*Actor Description* see Actor List	*Further info*
Services			
Optimizer	Service	Publishes requested schedule for a circuit segment for a service provider defined period of time with time intervals ranging from minutes to several hours.	
Coordination Service	Service	A system service that coordinates actions of devices on a portion of the grid.	
Other Services	Service	Publish information such as weather or market data.	

3.2 Triggering Event, Preconditions, Assumptions

Use Case Conditions			
Actor/System/Information/Contract	*Triggering Event*	*Pre-conditions*	*Assumption*
Optimizer	Optimizer publishes requested optimizer schedule	Optimizer operating	
Coordination Service	Coordination Service publishes planned optimizer schedule	Coordination Service operating	
Other Services	Other Services publish information	Other Services operating	

3.3 References

References						
No.	*References Type*	*Reference*	*Status*	*Impact on Use Case*	*Originator / Organisation*	*Link*
1	IEC	62559-2		Utilized use-case narrative template	Omnetric, Jim Waight	

3.4 Further Information to the Use Case for Classification / Mapping

Classification Information
Relation to Other Use Cases
This use case has bidirectional flow of information with the DER Circuit Segment Management use case
Level of Depth
Mid level
Prioritization
High
Generic, Regional or National Relation
Will be applied in a generic test at Duke test bed.
Viewpoint
Technical
Further Keywords for Classification

4 Step by Step Analysis of Use Case

4.1 Steps – Scenario Name

Scenario Conditions					
No.	**Scenario Name**	**Primary Actor**	**Triggering Event**	**Pre-Condition**	**Post-Condition**
1	Circuit Segment Optimization	Optimizer	Coordination Service publishes planned optimizer schedule Other Services publish information	Optimizer, Coordination Service, and Other Services operating	Coordination Service devices executing schedule

4.2 Steps – Scenarios

4.2.1 Steps – Circuit Segment Optimization

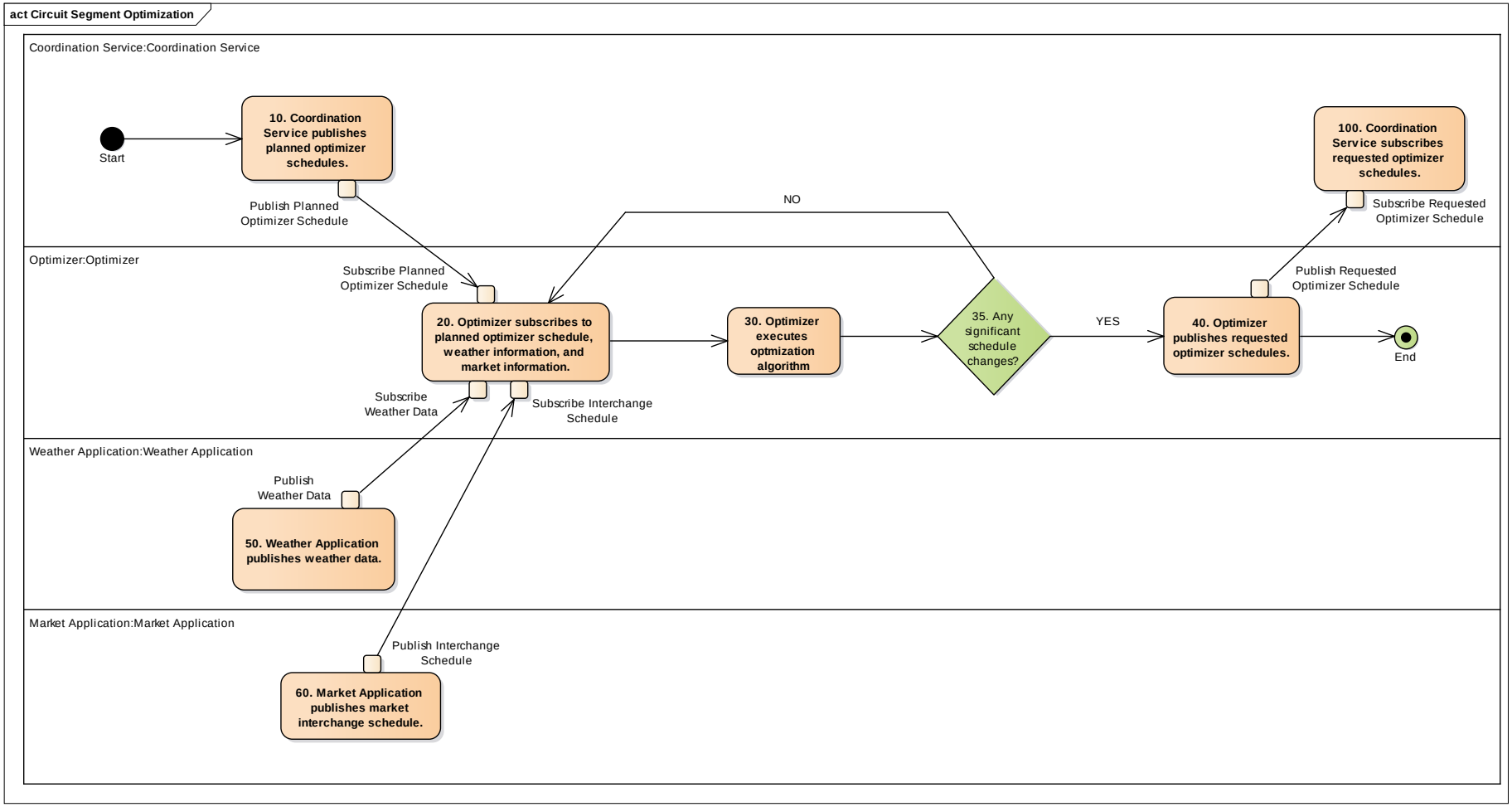

Figure 3: Circuit Segment Optimization Activity Diagram

5 Information Exchanged

See OpenFMB Information Exchanged supplementary document.

6 Requirements (optional)

Requirements (optional)	
Categories for Requirements	**Category Description**
NA	
Requirement ID	**Requirement Description**
NA	

7 Common Terms and Definitions

Common Terms and Definitions	
Term	**Definition**
NA	

8 Custom Information (optional)

Custom Information (optional)		
Key	*Value*	*Refers to Section*
NA		