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Change Request #:	171
Assigned OGC Document #:	11-149
Name:	*JaeJun Yoo
Organization:	*ETRI
Email:	*jjryu@etri.re.kr
Document Name/Version:	*Requirements and Space-Event Modeling for Indoor Navigation / 0.1.0
OGC Project Document:	*10-191r1

If this is a revision of a previous submission and you have a Change Request Number, then check here: ☐

Enter the CR number here: 170

Enter the Revsion Number that you are revising here: 1

Title:	*Temporal Constraints for State and Transition UML class in the data model
Source:	*JaeJun Yoo (OGC member, 3DIM WG, etc)
Work item code:	
Category:	* C (Functional modification of feature)

Reason for change: ⓘ	* When modeling indoor spaces for some indoor services such as indoor-navigation, we need to consider some temporal constraints when can affect the indoor space model. For an example and more detailed comments, please refer the uploaded file at supporting document field below.
Summary of change: ⓘ	* please refer the uploaded file at supporting document field below
Consequences if not approved: ⓘ	
Clauses affected: ⓘ	* chapter 8 and chapter 10.
Additional Documents affected: ⓘ	
Supporting Documentation: ⓘ	
Comments: ⓘ	This change request is a revised version of previously submission. The focus is unchanged. some sentences and figures are fixed.
Status: ⓘ	Assigned ▲▼
Assigned To: ⓘ	3DIM DWG ▲▼
Disposition: ⓘ	Referred and Posted ▲▼

1. Reason for change

When we model indoor spaces for location-based services such as indoor-navigation, we need to consider some temporal constraints which can affect the indoor space routing.

For example, let's suppose room No. 413 is accessible only during the working hours from 9 AM to 6 PM as shown in *Fig. 1*. If each room and hallway are modeled as a state (*TP_Node* in the suggested data model) and the walkable path (including doors) between two of them is modeled as a transition (*TP_Edge* in the suggested data model), then the graph of the modeled space (dual graph) will look like the figure as shown in *Fig. 2* and *Fig. 3*. It means that the transition (*TP_Edge*) path to room 413 is valid only during 9 AM ~ 6 PM. This kind of temporal constraint can be applied to transitions, that is, joint edges, between the different *SpaceLayers*.
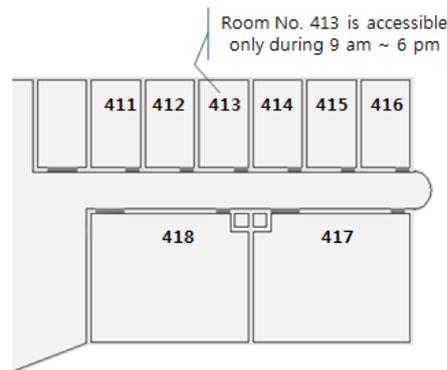
Fig. 1. Sample Indoor Space
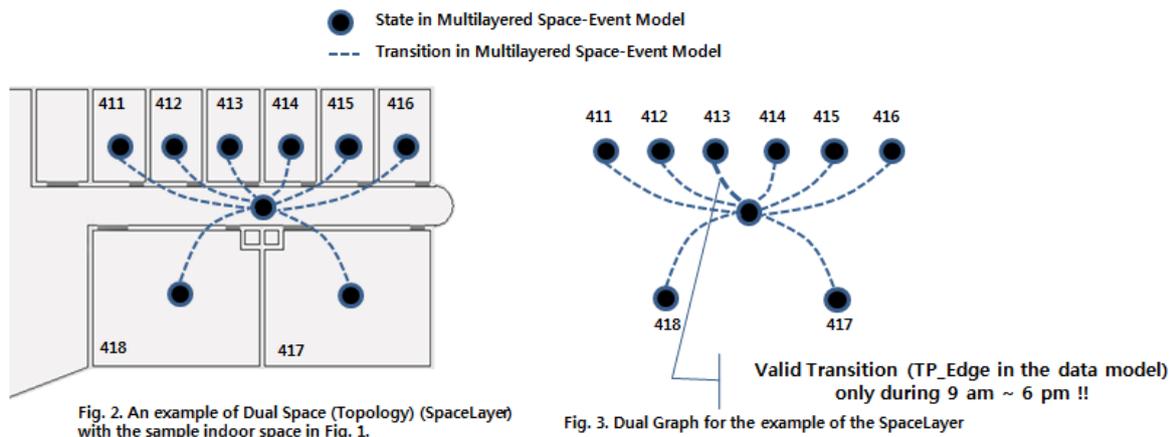
Fig. 2. An example of Dual Space (Topology) (SpaceLayer) with the sample indoor space in Fig. 1.

Fig. 3. Dual Graph for the example of the SpaceLayer

It is understood that the possible way of describing such temporal constraints in the suggested data model is 1) to model only the temporally constrained space as another *SpaceLayer*, that is, the temporally constrained *SpaceLayer* containing only the exclusive part from the whole space, and use *TypeOfRelation* in the data model to describe some relationship between the *SpaceLayers*, or 2) to duplicate the whole *SpaceLayer* according to temporal constraints. In this example, we get a whole *SpaceLayer* that is valid during the working hours from 9 AM to 6 PM, and another whole *SpaceLayer* that is valid during non-working hour from 6 PM to 9 AM, next day. However, the former still requires the additional consideration on how to describe temporal relationship between the *SpaceLayers*, and the latter brings out huge inefficiency caused by lots of duplication. Therefore, we need some modifications to existing indoor space model to resolve the problem.

2. Summary of change

When modeling real indoor spaces, we need to consider 'temporal constraints' such as allowed time to access a meeting room or a security room. Such temporal constraints are very common in indoor environment; therefore, it is proposed to include the temporal constraints into the data model of the multilayered space-event model (in Fig. 4 and also refer to Fig. 28 in the discussion paper).

That is, we need to add new methods describing temporal relationships of classes or instances of UML classes "*State*", "*Transition*", or "*InterSpaceConnection*" according to the some temporal constraints.

There can be several ways to describe some temporal constraints.

1. Add some <u>attributes</u> to "*State*", "*Transition*" or "*InterSpaceConnection*" UML classes in the data model, like shown in Fig. 4. (as a part of Fig. 28. in the discussion paper)

2. Add a new UML <u>class</u> to describe temporal constraints.

The first method is more simple to describe and can be intuitively understood although *SpaceLayer* can be complex if there are many temporal constraints in indoor space to be modeled. Moreover, to add a new class of temporal conditions to the model may have totally different concept from to add some attributes – "time" can be another focus point to model indoor space which can make the data model quite complicated.

Therefore, this change request proposes to add some attributes to describe temporal constraints of indoor space model to some classes, such as "*Transition*", "*State*", and "*InterSpaceConnection*", in the currently suggested UML data model. The type of attributes can be dateTime type in GML.
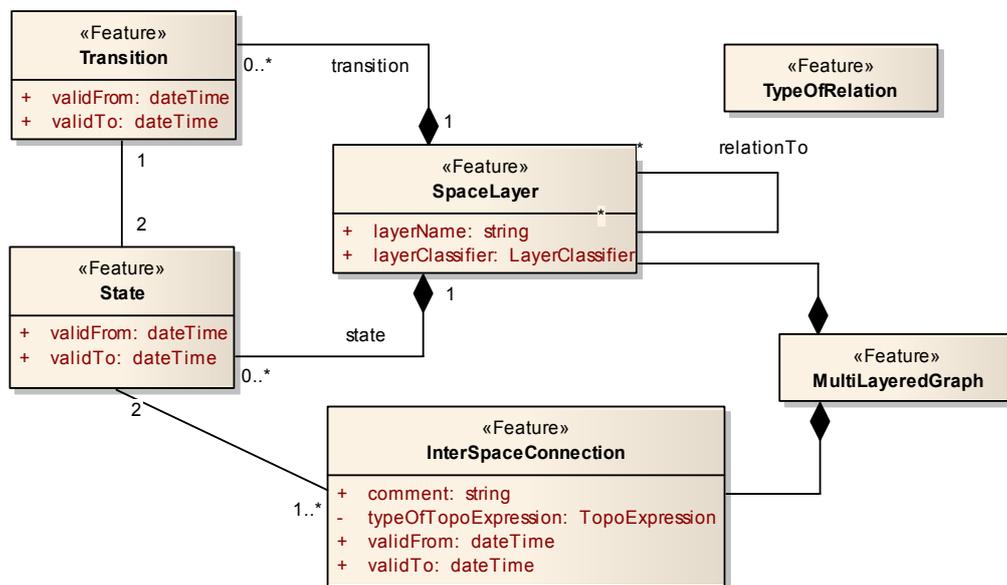

Fig. 4. Addition of attributes for temporal constraints in the UML data model

Definitely, there can be another way to temporal constraints, it will be worth to be discussed.