Why CAADence in architecture?

"The cadence is perhaps one of the most unusual elements of classical music, an indispensable addition to an orchestra-accompanied concerto that, though ubiquitous, can take a wide variety of forms. By personally selected or invented musical phrases, interspersed with previously played themes – in short, a free ground for virtuosic improvisation.”
CAADence in architecture
Back to command
Edited by Mihály Szoboszlai
Editor

Mihály Szoboszlai
Faculty of Architecture
Budapest University of Technology and Economics

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CAADence in Architecture. Back to command
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Proceedings of the International Conference on Computer Aided Architectural Design

16-17 June 2016
Budapest, Hungary
Faculty of Architecture
Budapest University of Technology and Economics

Edited by
Mihály Szoboszlai
The aim of these workshops and conference is to help transfer and spread newly appearing design technologies, educational methods and digital modelling supported by information technology in architecture. By organizing a workshop with a conference, we would like to close the distance between practice and theory. Architects who keep up with the new design demanded by the building industry will remain at the forefront of the design process in our IT-based world. Being familiar with the tools available for simulations and early phase models will enable architects to lead the process. We can get “back to command”.

Our slogan “Back to Command” contains another message. In the expanding world of IT applications, one must be able to change preliminary models readily by using different parameters and scripts. These approaches bring back the feeling of command-oriented systems, although with much greater effectiveness.

Why CAADence in architecture?
“The cadence is perhaps one of the most unusual elements of classical music, an indispensable addition to an orchestra-accompanied concerto that, though ubiquitous, can take a wide variety of forms. By definition, a cadence is a solo that precedes a closing formula, in which the soloist plays a series of personally selected or invented musical phrases, interspersed with previously played themes – in short, a free ground for virtuosic improvisation.”

Nowadays sophisticated CAAD (Computer Aided Architectural Design) applications might operate in the hand of architects like instruments in the hand of musicians. We have used the word association cadence/caadence as a sort of word play to make this event even more memorable.

Mihály Szoboszlai
Chair of the Organizing Committee
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Members of our local organizing team have supported this event with their special contribution – namely, their hard work in preparing and managing this conference.

Mihály Szoboszlai
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REINHARD KÖNIG

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Integration of Facility Management System and Building Information Modeling

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Abstract: Based on the investigation of administration of apartment building in Japan, a database for facility management, including the information of inspection schedule and maintenance frequency, are proposed in XML. The building information, including the IfcSystem data is created by ArchiCAD MEP Modeler. According to the IFC2x3 TC1, the IfcDistributionElement has an inverse attribute for boundaries defined by IfcRelSpaceBoundary. But the boundary information is undefined in most cases. By analyzing the geometric representation of IfcSpace and IfcFlowMovingDevice, the relationship between IfcFlowMovingDevice (for fun) and IfcSpace is added. By using IFCsvr ActiveX Component, a facility management tool iFM is developed. The equipment information is integrated into the building information in a tree-view. Furthermore, the facility management information of equipment devices can be listed quickly by the link of IFC data and the XML FM database, which is helpful for doing equipment maintenance plan and building administration.

Keywords: Facility Management, IFC, Database, Equipment Device, Apartment Building

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INTRODUCTION
The life cycle of buildings in Japan is about 40 to 50 years, while the equipment service life span is only about 15 years. Therefore, an equipment in a building needs to be replaced 2 to 3 times during the whole building life cycle, which means there are a lot of maintenance and repair during the facility management period. In houses, the residents have little knowledge about MEP inspection and maintenance. In this article, a database for facility management, including the information of inspection schedule and maintenance frequency, are proposed in XML, based on the investigation of administration of apartment building in Japan. And a facility management tool iFM is proposed, integrated with the IFC data and the proposed database. iFM tool can not only view the details of the building information in a tree-view, but also create the management information of equipment devices, which will be helpful for doing equipment maintenance plan and building administration.

LITERATURE SURVEY
In Japan, Tokyo Building Maintenance Association (TBMA) is a professional association in charge of the development of building maintenance technology and the promotion of the knowledge con-
Urban Renaissance (UR) Agency is an independent administrative institute not only managing the land development and urban development but also providing about 750,000 rental apartment with 2 million residents in the whole country. It has its own facility management manuals for its rental housing. The other administration agencies like Hokkaido Building Guidance Center (HBGC) also publish guides for facility management in houses.

According to the books and manuals published by TBMA, UR and HBGC [1, 2, 3], the items and contents of facility management, especially on MEP inspection are studied. In most documents, inspection items, method, inspection cycle, maintenance cycle, and expected service life are detailed.

PERSONAL INTERVIEW SURVEY

As to the status quo of the administration in residential houses, a personal interview survey was conducted in a 10-story mansion in Tagajo, Miyagi. The mansion administrator carries out his daily patrol of the common parts, such as staircases, elevator halls, roof top and lobbies, as well as the inspection of services and facilities, such as water pumpers, ventilation fans and fire extinguishers. He also writes the report for the patrol and surveillance. Examples of the job sheet are shown in Table 1. The administrator observes the defects in buildings, records the symptoms or phenomena, and also do some simple maintenance works, such as light alternation, and filter cleaning. As to the serious defects, such as pump failure, elevator noise, he will call the relevant service contractor to do the repairing. Finally, the maintenance result, together with repair cost, will be recorded according to the report from the contractor.

The administrator does his patrol from the outside to the inside, from the lower story to the higher, and from one room to another. Therefore, the information of system/facility name and location becomes important.
DATABASE FOR FACILITY MANAGEMENT

According to the results from literature survey and personal interview, the items of the FM database are extracted as shown in Figure 1. The database is in XML format, with the primary key of System/Facility Name, by which the other information about FM will be found.

IFC DATA FOR MEP SYSTEMS

The building information, including the IFC data for MEP systems is created by ArchiCAD and its MEP Modeler [4]. Using the IFC Manager, the IFC System is created for MEP systems. For example, a fan, ducts and a ventilation vent can be grouped into a ventilation system.

In the design phase of one project, MEP systems are often separated by the space information. The connection between MEP systems and spaces is not so clearly defined. But during the facility management period, the space information is important. For example, the building administrators inspect the rooms one by one, and they also record the inspection results together with the room name. Therefore, MEP systems, especially the equipment which can be found in the rooms, need space boundary information.

According to IFC2x3 TC1 [5], an MEP element, such as a fan, can be expressed as an IfcDistributionElement Entity having an inverse attribute for boundaries (ProvidesBoundaries) defined by IfcRelSpaceBoundary, shown in Figure 2 [6]. Although the boundary information is undefined in most cases, by analyzing the geometric representation of the IfcSpace entity standing for a room and the IfcFlowMovingDevice entity standing for a fan, the boundary relationship between IfcFlowMovingDevice and IfcSpace can be added. If the lowest horizontal level of a fan (IfcFlowMovingDevice) is contained in a room (IfcSpace), then a boundary relationship can be defined between this fan and the room. Therefore, the fan can be linked with the room, and the boundary relationship attribute is added in the iFM tool proposed in this article.

![Figure 2: Inheritance graph of IfcDistributionElement](image)
IFC DATA FOR A MODEL APARTMENT BUILDING

Case study is carried out in a two-story apartment building with the floor area of 76.8m², shown in Figure 3. Only the equipment in the toilet is studied. The ventilation system shown in Figure 4 consists of a fan (IfcFlowMovingDevice), a duct (IfcFlowSegment) and an outside vent (IfcBuildingElementProxy).

By the IFC manager, a new system (IfcSystem) can be created. The three entities of the ventilation system (fan, vent and duct), as well as the toilet (space) will be grouped by dragging and pulling them into the newly created IfcSystem. And the result can be confirmed in Figure 5.

Figure 3: A two-storey apartment building

Figure 4: Ventilation system in Toilet

Figure 5: MEP data confirmed by IFCExplorer
PROPOSITION OF IFM

Using the IFCsvr ActiveX Component released by SECOM CO., LTD., iFM is developed for facility management in houses and its interface is shown in Figure 6.
Choosing the File tab control and clicking the Open button, an ifc file will be opened and the building information can be shown in the right window.
Choosing the FM tab control and clicking the Treeview button, the facility management information can be shown in the right window (Figure 7).

CONCLUSION

Facility management contributes a large part of the life cycle cost in one building. According to the investigation of administration of apartment building in Japan, a database for facility management, are proposed in XML, including the information of inspection schedule and maintenance frequency. In this article MEP systems are drawn by ArchiCAD and its MEP modeler. Using the IFC Manager, an IfcSystem entity is created, which combines the different elements of one MEP system into a group. A facility management tool iFM is developed, which can integrate the IFC data with the XML facility management database. The equipment information, as well as the building information, is organized in a tree-view with the key item of space (room). Moreover, the facility management information of equipment devices can be listed in a tree-view by the link of IFC data and the XML FM database, which will be helpful for doing equipment maintenance plan and building administration.
Although IFC manager can combine the different elements into an IfcSystem group, it takes time to pick up the elements, and an easier grouping method is expected.
While the facility management information is gathered easily by iFM, the interface should be improved for the long-term preventive maintenance plan. In order to update and expand the facility management database, the personal interview survey of administration of apartment building will be continued and the needs for BIM application will also be investigated. With the popularity
of mobile devices, such as Surface, and iPad, the camera capture function is also expected, which will help the building administrators record their inspection results on site.

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The aim of these workshops and conference is to help transfer and spread newly appearing design technologies, educational methods and digital modelling supported by information technology in architecture. By organizing a workshop with a conference, we would like to close the distance between practice and theory.

Architects who keep up with the new designs demanded by the building industry will remain at the forefront of the design process in our information-technology based world. Being familiar with the tools available for simulations and early phase models will enable architects to lead the process. We can get “back to command”.

The other message of our slogan is <Back to command>.

In the expanding world of IT applications there is a need for the ready change of preliminary models by using parameters and scripts. These approaches retrieve the feeling of command-oriented systems, although, with much greater effectiveness.

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