ENDL
TEXAS

Date: 1 March 2008
To: T10 Technical Committee
From: Ralph O. Weber
Subject: SPC-4 UML Conventions and CbCS UML Updates

Introduction

07-430r2 (UML model for CbCS) added the first UML diagram to SPC-4 but did not specify the contents of the Conventions subclause for UML.

Attempting to draft a UML conventions subclause based on SAM-4 produced the following substantive changes:

- The requirement that association relationship lines have multiplicity notation was reduced to requiring the notation only when there is no aggregation relationship line connecting the same two classes.
- Text clarifying the fact that aggregations are a special type of association was added.
- The constraints box was shaded to give it a distinguishing characteristic other than {} in the text.

All of these changes seen significant enough to warrant a formal review of the new conventions subclause prior to incorporation.

Also, the CbCS UML lacks the required multiplicity notations, and they are proposed here.

Revision History

r0 Initial revision
r1 Revised figure 11 (CbCS overview class diagram) as requested by Sivan Tal and George Penokie. Since change bars do not effectively identify changes in figures, no change bars were added in r1

Except for figure 11, all changes in this proposal represent new SPC-4 text. In figure 11, additions are shown in blue text, there are no deletions proposed. Comments are shown in green text.

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Proposed additions to SPC-4

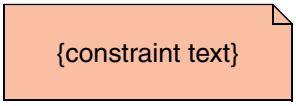
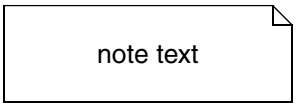
3.6.u Notation for UML figures

3.6.u.1 Introduction

This standard contains class diagram figures that use notation that is based on UML (see 2.6).

Some class diagrams contains constraints or notes that use the notion shown in table x1.

Table x1 — Class diagram constraints and notes notation

Notation	Description
	The presence of the curly brackets defines constraint that is a normative requirement. An example of a constraint is shown in figure x1.
	The absence of curly brackets defines a note that is informative. An example of a note is shown in figure x3.

The notation used to denote multiplicity in class diagrams is shown in table x2.

Table x2 — Class diagram multiplicity notation

Notation	Description
not specified	The number of instances of an attribute is not specified.
1	One instance of the class or attribute exists.
0..*	Zero or more instances of the class or attribute exist.
1..*	One or more instances of the class or attribute exist.
0..1	Zero or one instance of the class or attribute exists.
n..m	n to m instances of the class or attribute exist (e.g., 2..8).
x,n..m	Multiple disjoint instances of the class or attribute exist (e.g., 2, 8..15).

Class diagrams show:

a) Two or more classes (see 3.6.u.2); and
b) One or more of the following relationships between them:
   A) Association (see 3.6.u.3);
   B) Aggregation (see 3.6.u.4);
   C) Generalization (see 3.6.u.5); and
   D) Dependency (see 3.6.u.6).

3.6.u.2 Class notation

The notation used for classes is shown in table x3.

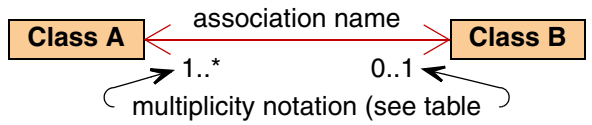
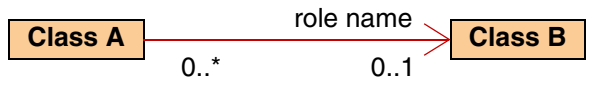
Table x3 — Class diagram notation for classes

Notation	Description
Class Name **Class Name** **Class Name**	A class with no attributes or operations
Class Name Attribute01[1] Attribute02[1] **Class Name** Attribute01[1] Attribute02[1]	A class with attributes and no operations
Class Name Operation01() Operation02()	A class with operations and no attributes
Class Name Attribute01[1] Attribute02[1] Operation01() Operation02()	A class with attributes and operations
Class Name Attribute01[1..*] Attribute02[1] Operation01() Operation02()	A class with attributes that have a specified multiplicity (see table x2 in 3.6.u.1) and operations

3.6.u.3 Class association relationships notation

The notation used to denote association (i.e., “knows about”) relationships between classes is shown in table x4. Unless the two classes in an association relationship also have an aggregation relationship (see 3.6.u.4), association relationships have multiplicity notation (see table x2 in 3.6.u.1) at each end of the relationship line.

Table x4 — Class diagram notation for associations

Notation	Description
	Class A knows about Class B (i.e., read as “Class A association name Class B”) and Class B knows about Class A (i.e., read as “Class B association name Class A”)
	Class B knows about Class A (i.e., read as “Class B knows about Class A”) but Class A does not know about Class B
	Class A knows about Class B (i.e., read as “Class A uses the role name attribute of Class B”) but Class B does not know about Class A
Note: The use of role names and association names are optional.	

Several example association relationships between classes are shown in figure x1.

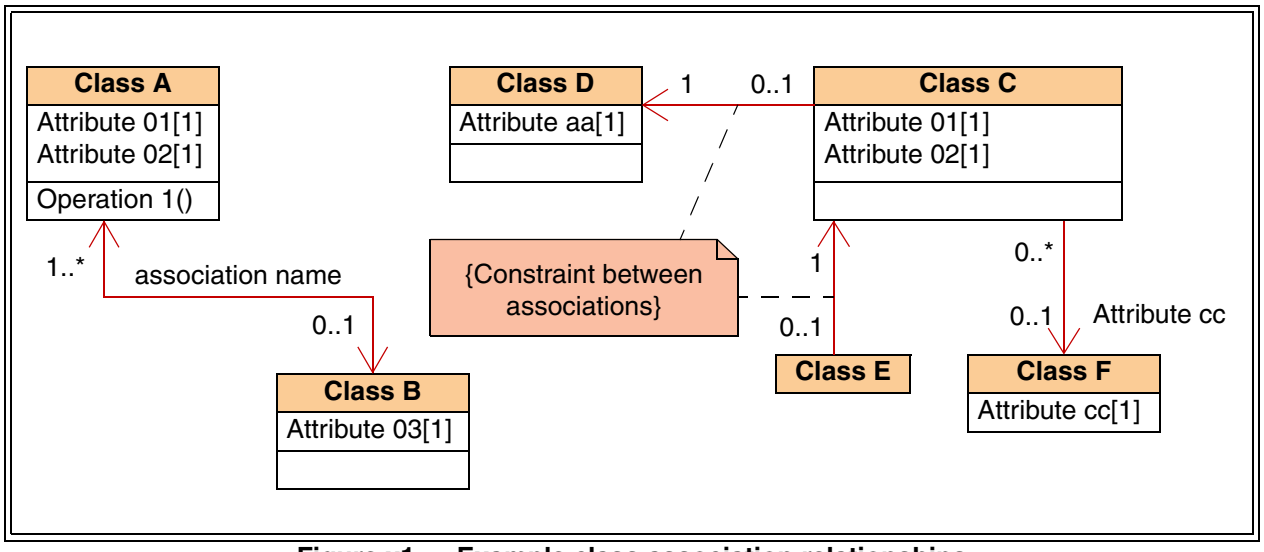
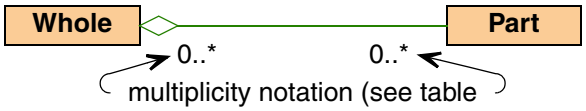


Figure x1 — Example class association relationships

3.6.u.4 Class aggregation relationships notation

The aggregation relationship is a specific type of association. The notation used to denote aggregation (i.e., “is a part of” or “contains”) relationships between classes is shown in table x5. Aggregation relationships always include multiplicity notation (see table x2 in 3.6.u.1) at each end of the relationship line.

Table x5 — Class diagram notation for aggregations

Notation	Description
	The Part class is part of the Whole class and may continue to exist even if the Whole class is removed (i.e., read as “the Whole contains the Part.”)
	The Part class is part of the Whole class, shall only belong to one Whole class, and shall not continue to exist if the Whole class is removed (i.e., read as “the Whole contains the Part.”)

Several example aggregation relationships between classes are shown in figure x2.

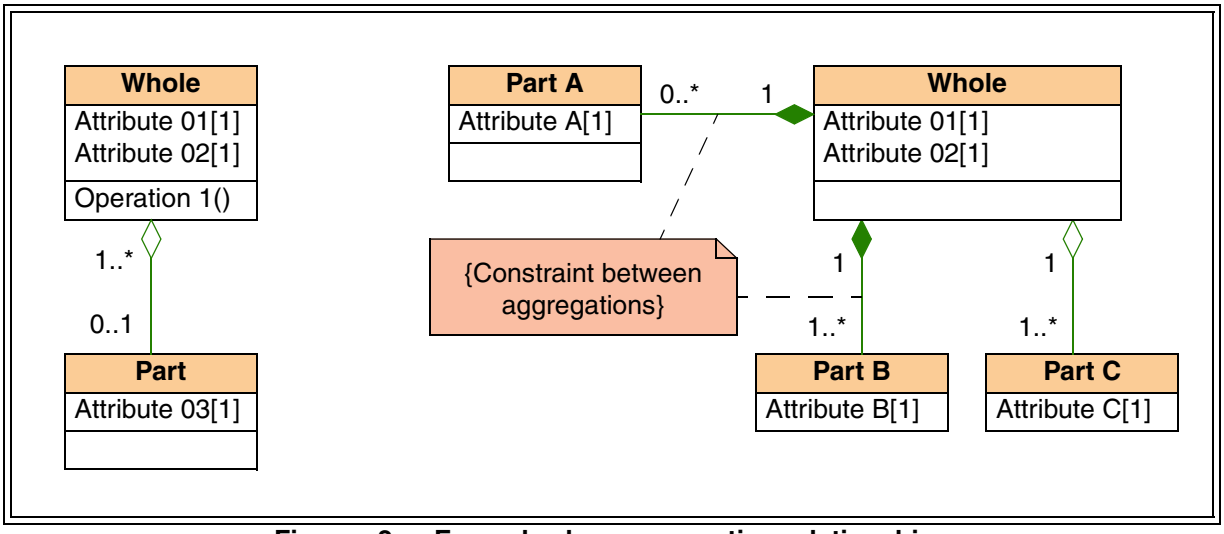


Figure x2 — Example class aggregation relationships

3.6.u.5 Class generalization relationships notation

The notation used to denote generalization (i.e., “is a kind of”) relationships between classes is shown in table x6.

Table x6 — Class diagram notation for generalizations

Notation	Description
	Subclass is a kind of superclass. A subclass shares all the attributes and operations of the superclass (i.e., the subclass inherits from the superclass).

Several example generalization relationships between classes are shown in figure x3.

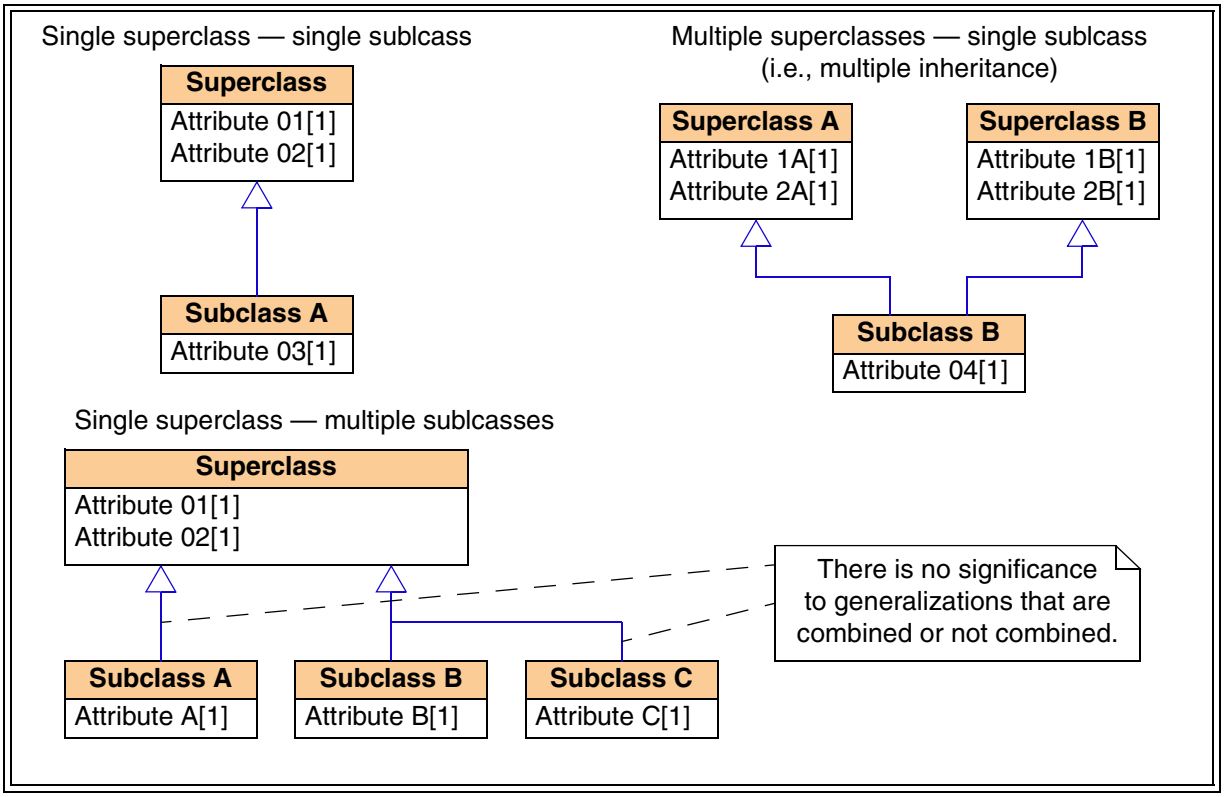


Figure x3 — Example class generalization relationships

3.6.u.6 Class dependency relationships notation

The notation used to denote dependency (i.e., “depends on”) relationships between classes is shown in table x7.

Table x7 — Class diagram notation for dependencies

Notation	Description
	Class A depends on class B. A change in class B may cause a change in class A.

An example dependency relationship between classes is shown in figure x4.

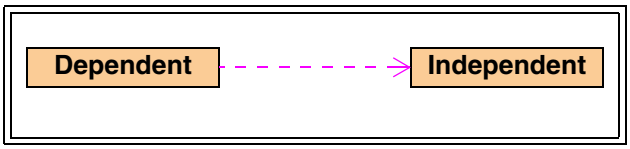


Figure x4 — Example class dependency relationships

Figure 11 shows the flow of transactions between the components of a CbCS capable SCSI domain.

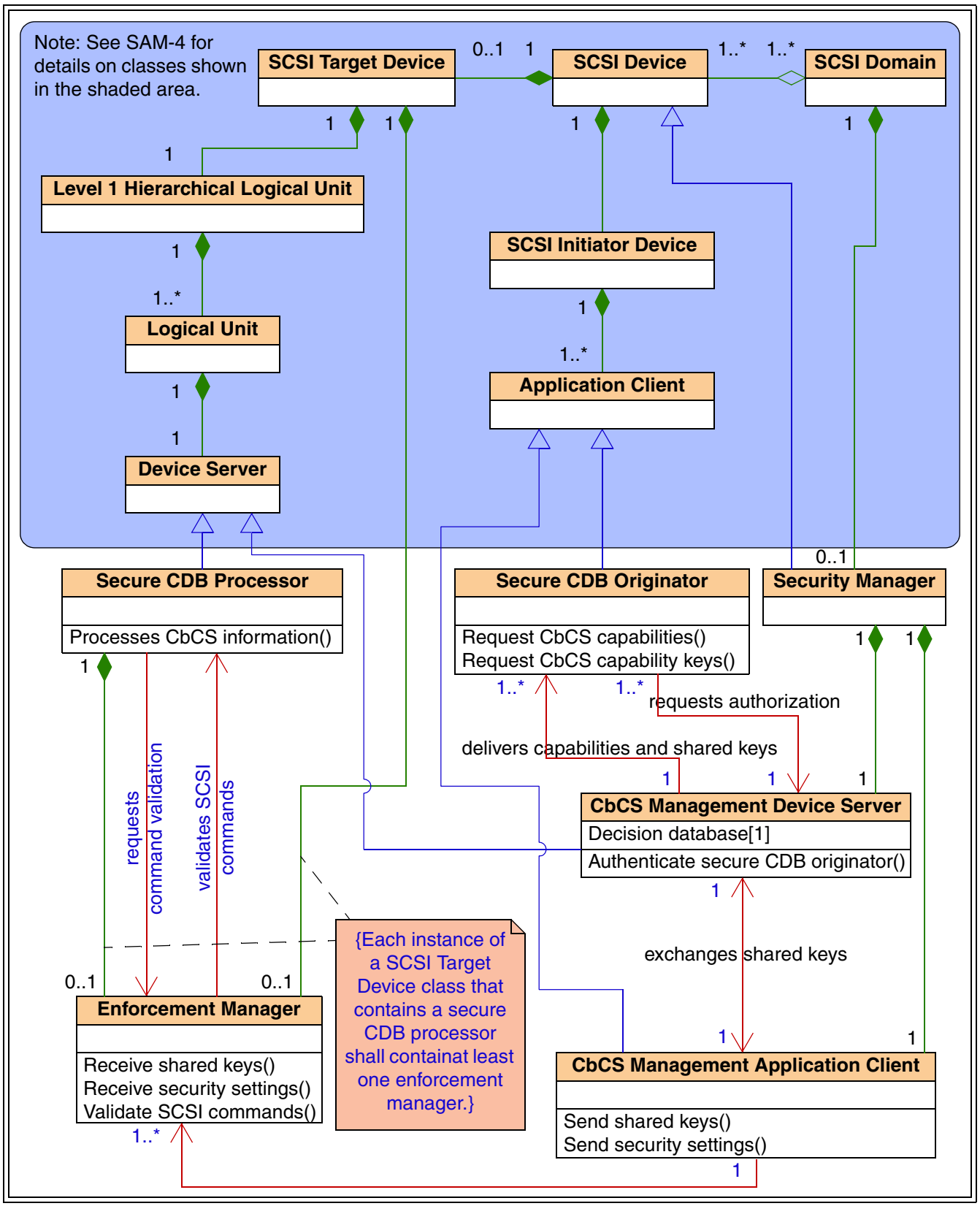


Figure 11 — CbCS overview class diagram