

NORME ISO 18629 PSL Process Specification Language

Pr. A.F. CUTTING-DECELLE, Université d'Evry, IUT – Département OGP, F

Dr. L. POUCHARD, ORNL (Oak Ridge National Labs), Oak Ridge, USA

G. TESFAGABER, Loughborough University, UK

Interopérabilité des informations de processus



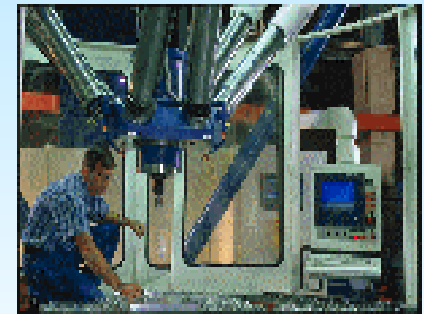
Process Modeler



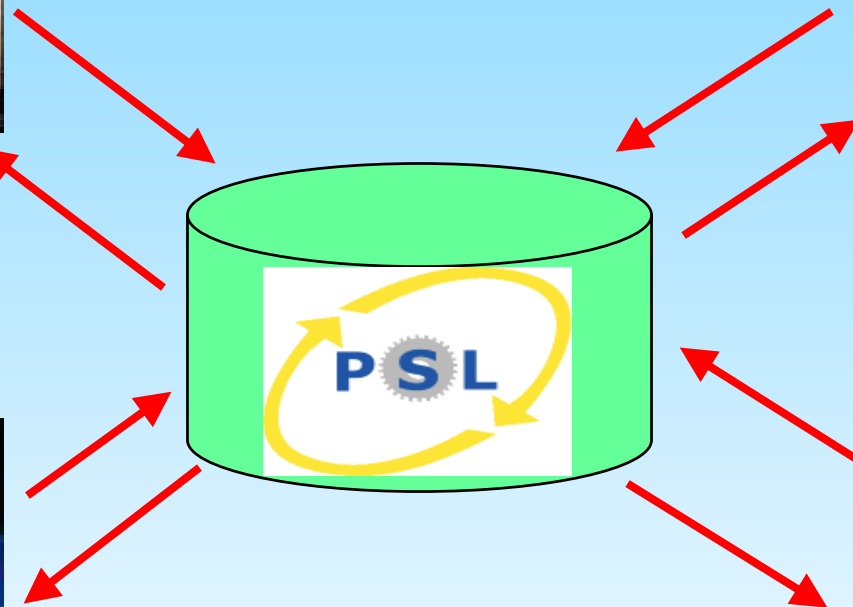
Design Modeler



Simulateur

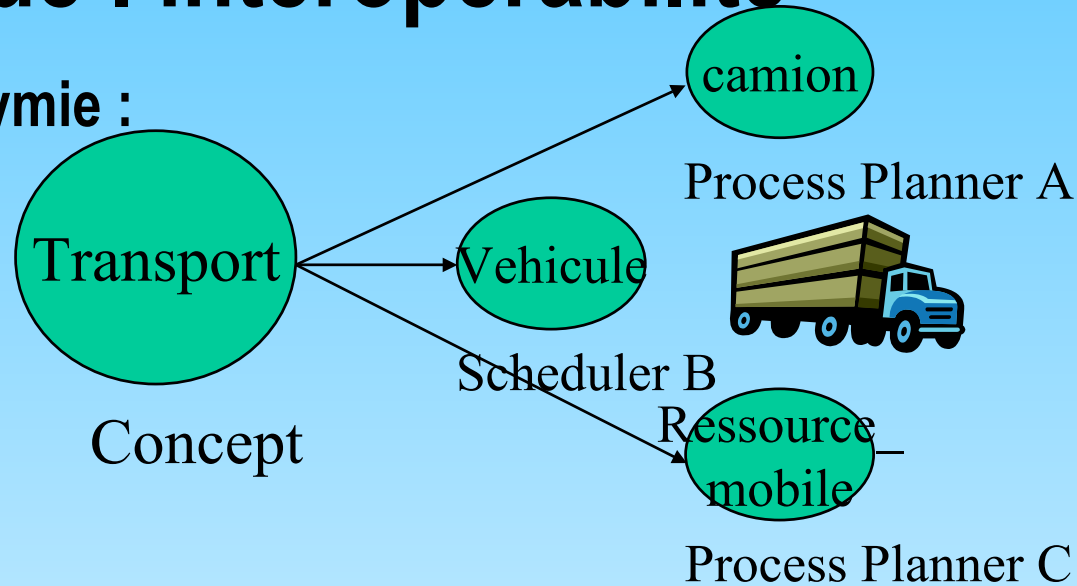


ordonnancement

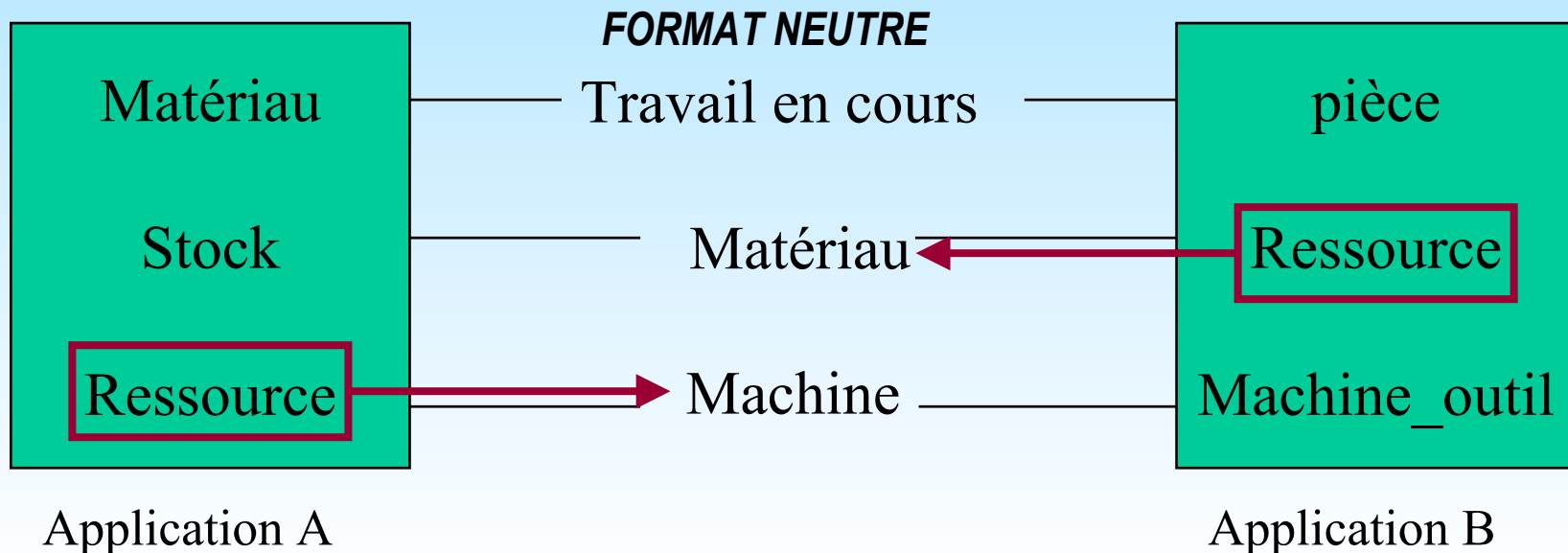


Challenges de l'interopérabilité

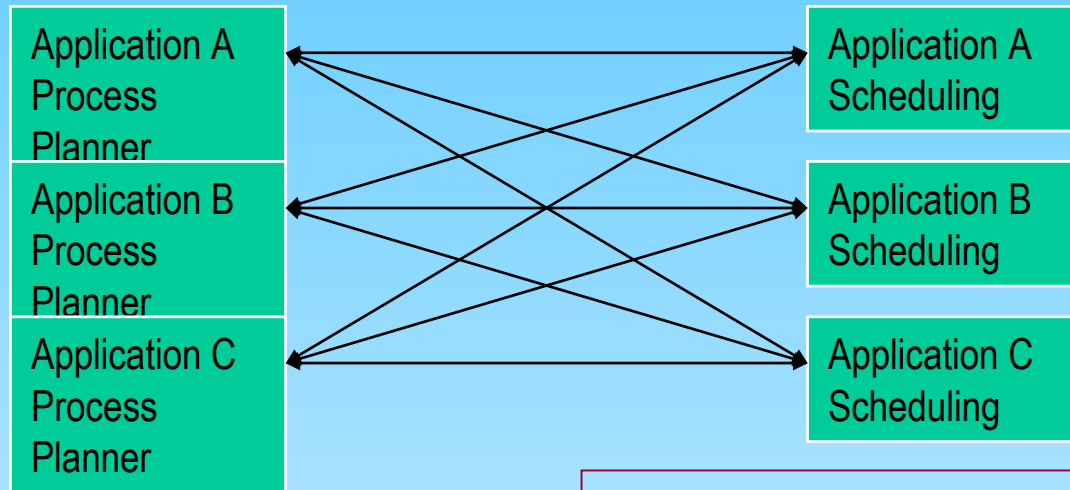
Challenge sémantique 1: synonymie :



Challenge sémantique 2: ambiguïté :

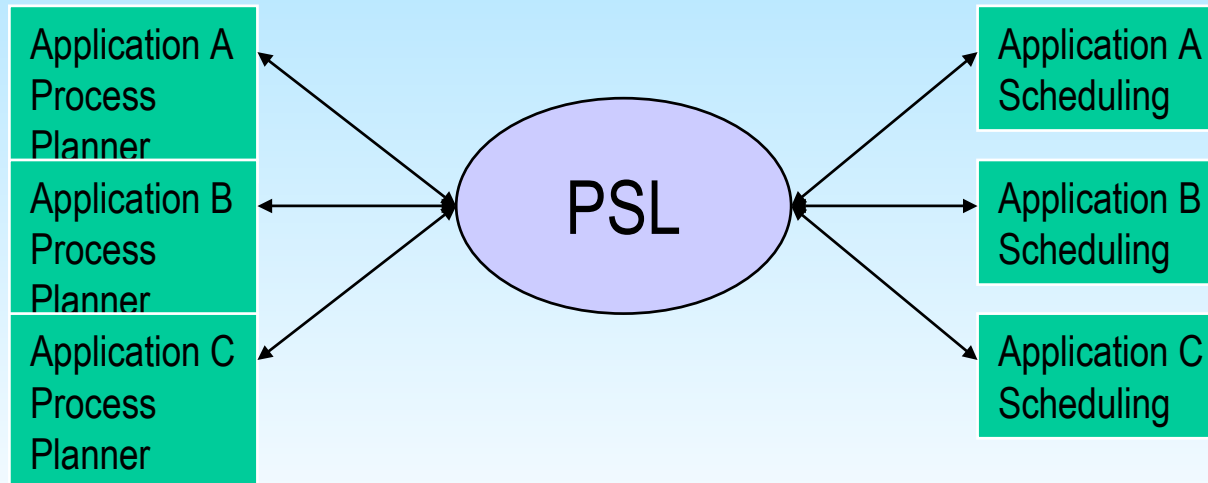


Scenario 1 : traduction point à point



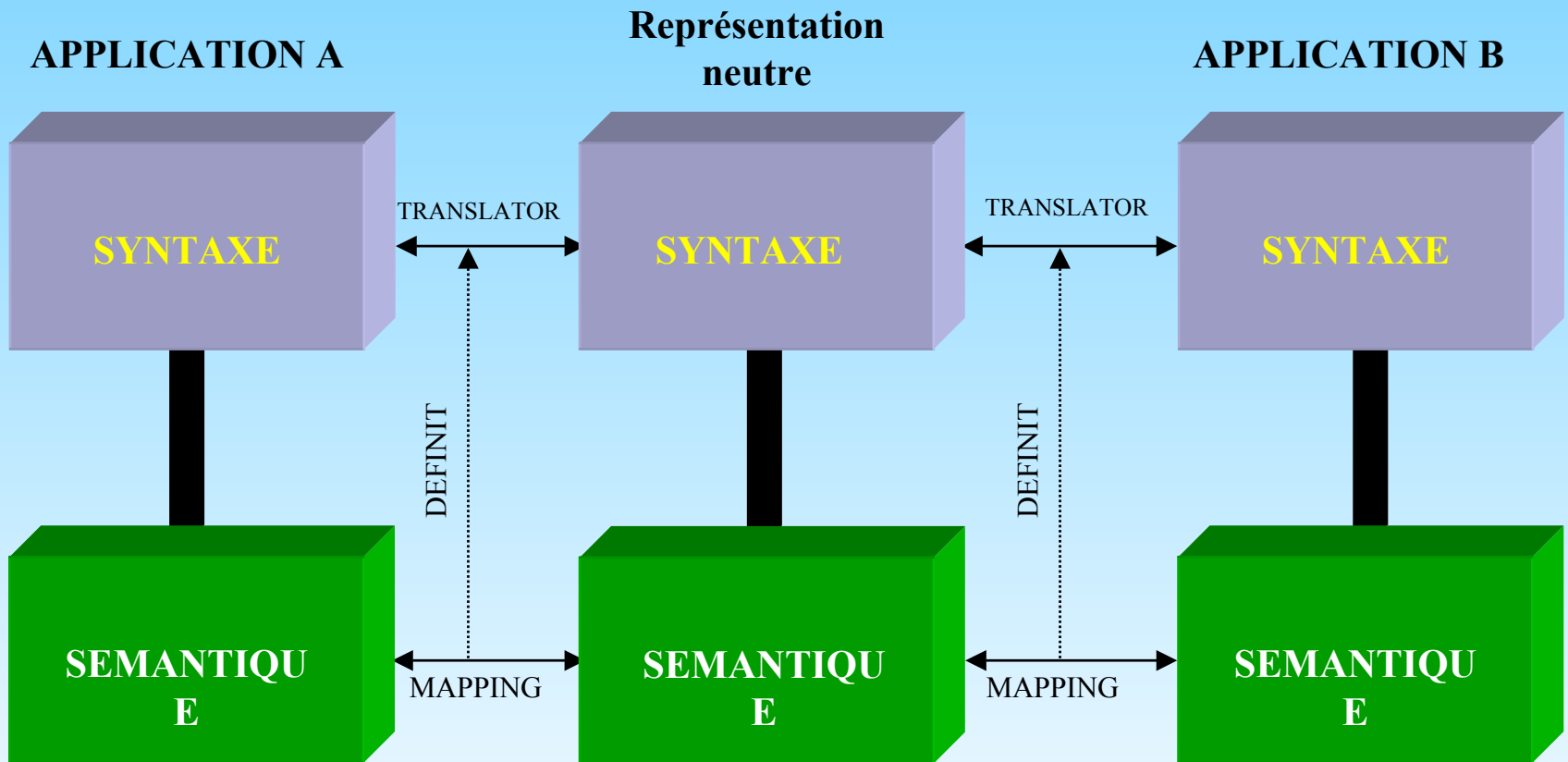
n planners, m schedulers \implies n*m traductions

Scenario 2 : traduction avec PSL



n planners, m schedulers \implies n + m traductions

Scenarrio d'échange

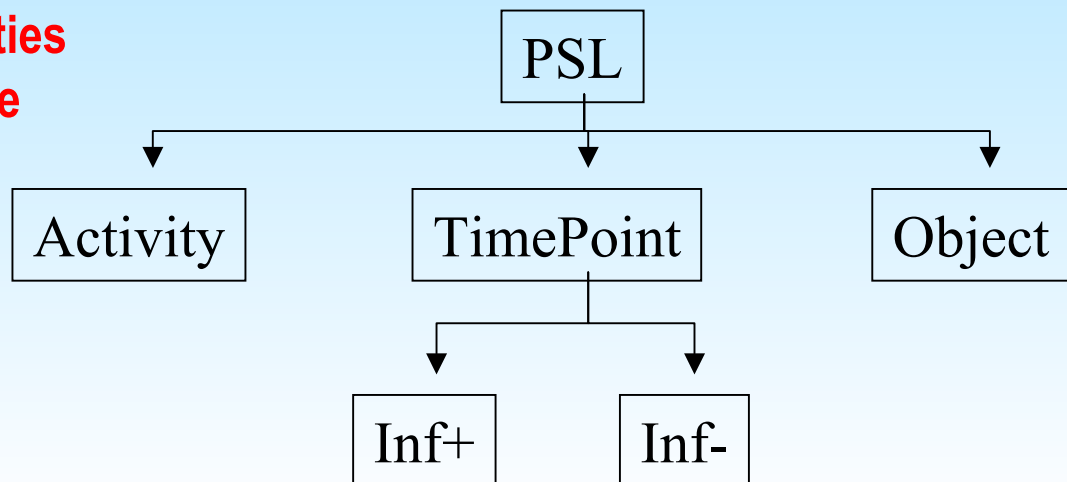


Qu'est-ce que PSL?

- Ce que PSL est actuellement :
 - un programme de développement de sept ans, au NIST (US), d'une représentation neutre des informations relatives aux processus de fabrication
 - un modèle de donnée modulaire, extensible (ontologie) intégrant les concepts inhérents aux processus de fabrication
- Ce que PSL va être :
 - un langage permettant l'**interopérabilité** de l'information relative aux processus industriels

Qu'est-ce qu'un processus ?

A process is one or more **activities** that occurs over a period of **time** in which **objects** participate



BUTS de PSL

- **Process specification language** : spécifie un processus ou un flux de processus, avec les paramètres correspondants

---- ce n'est pas un langage de modélisation ----

- **Cible** : processus discrets de fabrication : gammes, ordonnancement, simulation, ...
- **Actuellement** : normalisation en cours au niveau international : ISO TC 184 SC4-SC5
JWG8 ISO 18629 : norme PSL
composé de : une ontologie et des représentations : EXPRESS, XML, ...

En tant que langage :

- **Lexique** : symboles logiques (connecteurs booléens et quantificateurs), symboles non logiques (constantes, symboles de fonctions, predicats (unaires et binaires))
- **Grammaire** : basée sur la grammaire de KIF et la logique du premier ordre, spécification BNF rigoureuse, permettant une définition récursive de la classe d'expressions grammaticalement correctes du langage

Qu'est-ce qu'une ontologie ?

- Termes de base et relations contenant le vocabulaire d'un domaine donné
 - Un ensemble de définitions de ces termes
 - Des règles de combinaison de ces termes et des relations
-

A quoi servent les ontologies ?

- Fournir les définitions et les axiomes contraignant l'utilisation des termes, sous une forme lisible par les machines et compréhensibles par l'homme
 - Permettre la création de systèmes de classification hiérarchique, avec généralisation, héritage, agrégation, avec relations de structure plus variées que dans les taxinomies et les vocabulaires organisés
-

Quand faut-il utiliser une ontologie ?

- Pour les hommes : pour fournir un cadre de référence commun et un certain consensus sur des entités dans un domaine donné
- Pour les machines : pour améliorer : les schémas de données, l'interopérabilité des systèmes basée sur une approche sémantique, les systèmes à base d'agents

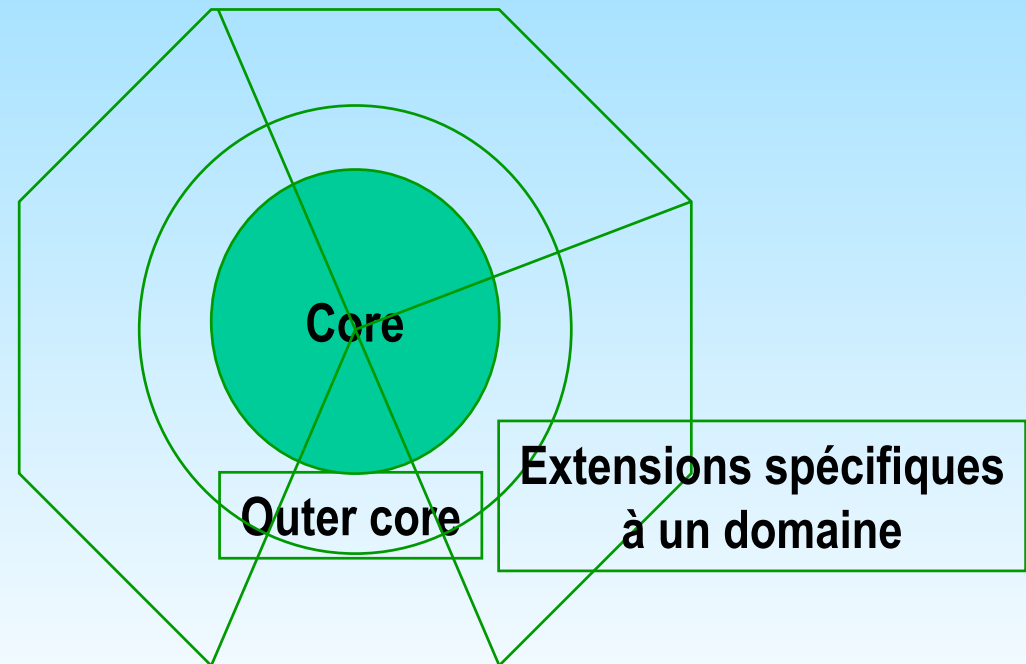
**SPECIFICITE DE PSL : ontologies applicables aux NOMS et VERBES
==> ORIGINALITE DE L'APPROCHE PSL**

- **Exemple :** *La durée d'une activité est la différence entre son point de départ et son point d'arrivée, pour toutes les occurrences de l'activité*

```
(defrelation duration (?a ?d) :=  
(forall (?t1 ?t2)  
  (=> (and (= ?t1 (Beginof ?a))  
            (= ?t2 (Endof ?a))  
            (= ?d (time_minus ?t2 ?t1))))))
```

Structure de PSL

- **Objectif** : définir d'une manière rigoureuse les concepts nécessaires pour spécifier les processus de fabrication afin de permettre l'échange d'information de process entre eux
- **Structure** : deux couches principales :
 - core
 - extensions



PSL core

- Ensemble de concepts communs à **TOUTES** les applications de fabrication
- Langage formel, mathématique, basé sur la logique du premier ordre, avec une sémantique précise et un ensemble d'axiomes pour exprimer cette sémantique
- **classes** :
 - **OBJECT** : abstract or concrete « thing », participating in :
 - **ACTIVITY**
 - **ACTIVITY_OCCURRENCE** : limited, temporally extended piece of the world, determined by its begin and end :
 - **TIMEPOINT**
- **fonctions** : beginof, endof
- **relations** : is_occurring_at, occurrence_of, participates_in, before (and beforeEq), between (and betweenEq), exists_at

Quelques axiomes de PSL-Core

Axiome 10. **Objects, activities, activity occurrences, and timepoints are all distinct kinds of things.**

```
(forall (?x)
  (and   (=>      (activity ?x)
              (not (or (activity_occurrence ?x) (object ?x) (timepoint ?x))))
    (=>      (activity_occurrence ?x)
              (not (or (object ?x) (timepoint ?x))))
    (=>      (object ?x)
              (not (timepoint ?x))))
```

Axiome 11. **The occurrence relation only holds between activities and activity occurrences.**

```
(forall (?a ?occ)
  (=>      (occurrence_of ?occ ?a)
            (and      (activity ?a)
                      (activity_occurrence ?occ))))
```

Extensions de PSL

- **Objectifs :**
fournir les ressources permettant d'exprimer des concepts qui ne figurent pas dans PSL-Core
- **Contenu :**
nouvelles constantes / prédicats, avec axiomes et définitions correspondants
- **Aujourd'hui :**
 - environ 330 concepts
 - dans 46 extensions

LISTE des extensions actuelles

Part 10 Series: Core Theories

Part 11 : PSL-Core

Part 12 : Outer Core

Part 13 : Duration and Ordering Theories

Part 14 : Resource Theories

Part 15 : Actor and Agent Theories

Part 40 Series: Definitional Extensions of PSL

Part 41 : Activity Extensions

Part 42 : Temporal and State Extensions

Part 43 : Activity Ordering and Duration Extensions

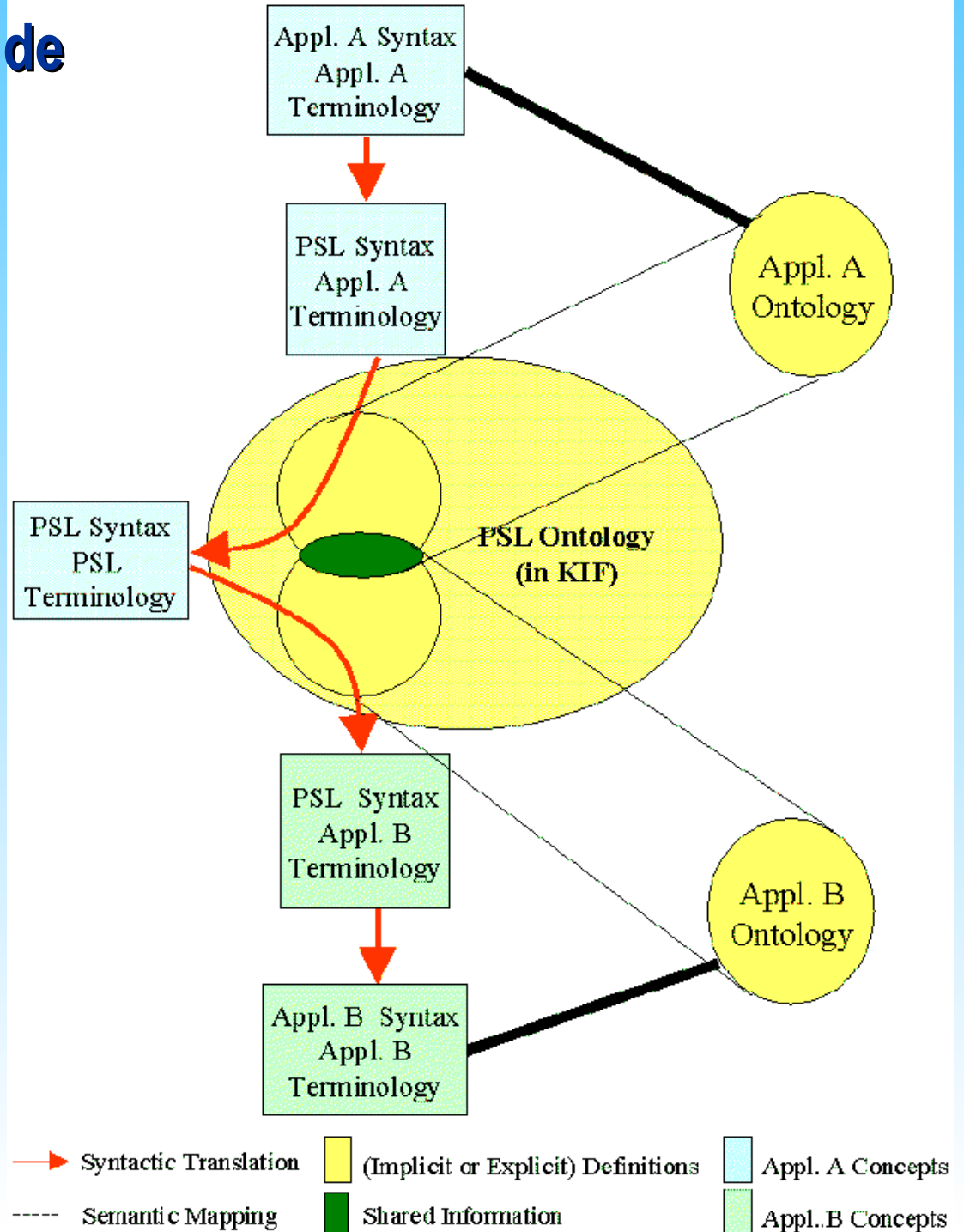
Part 44 : Resource Roles

Part 45 : Resource Sets

Part 46 : Processor Activity Extensions

Echange d'informations de Process avec PSL

- L'ontology de chaque application est exprimée en utilisant des concepts de PSL
- On peut faire un mapping direct (inconditionnel)
- SOIT le terme de l'application est plus restrictif => contraintes
- SOIT PSL est étendu pour prendre en compte le nouveau concept



NORME ISO 18629 PSL : Process Specification Language

- **Part 1 : Process specification language** : overview and basic principles
- **Part 11 : Process specification language** : PSL core
- **Part 12 : Process specification language** : Outer core
- **Part 13 : Process specification language** : Duration and ordering theories
- **Part 41 : Process specification language** : Definitional extension : activity extension
- **Part 42 : Process specification language** : Definitional extension :
Temporal and state extension
- **Part 43 : Process specification language** : Definitional extension :
Activity ordering and duration extension

Quel est le public de PSL ?

- **Utilisateurs finaux** : ingénieurs confrontés à des échanges d'informations de processus entre des logiciels internes à leur entreprise, et avec leurs partenaires
- **Première étape** : incorporation de « traducteurs » PSL dans les applications logicielles professionnelles

NORME ISO 18629 PSL :

EXEMPLE D'APPLICATION AU SECTEUR DU BATIMENT

(Thèse en cours, G. Tesfagaber, Univ. of Loughborough, UK)

Objectif : interopérabilité entre 3 applications logicielles utilisées par les bureaux d'études de conception et ingénierie Bâtiment :

- **CAO :** AutoCAD v13
- **Planification :** MS Project 98
- **Estimation :** CCS Estimating

- * **informations relatives aux processus techniques**
- * **niveau de sémantique élevé : échanges de connaissances entre les modèles**
- * **élaboration d'un modèle générique de processus (IDEF3)**

EXEMPLE D'APPLICATION AU SECTEUR DU BATIMENT

Scenario :

- * projet : **Bâtiment de bureaux**
- * échange d'informations relatives à la mise en place d'une : **porte extérieure**
- * étude à faire : conception, estimation du projet, planification

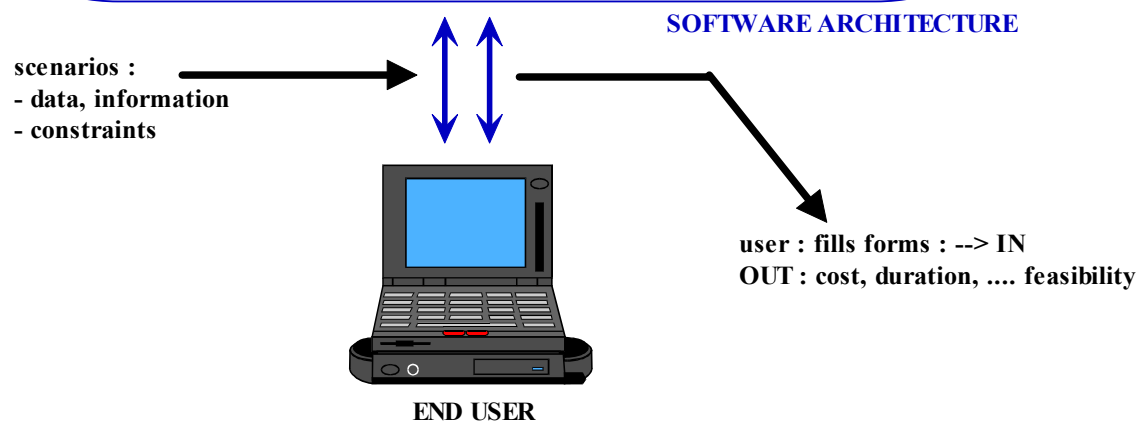
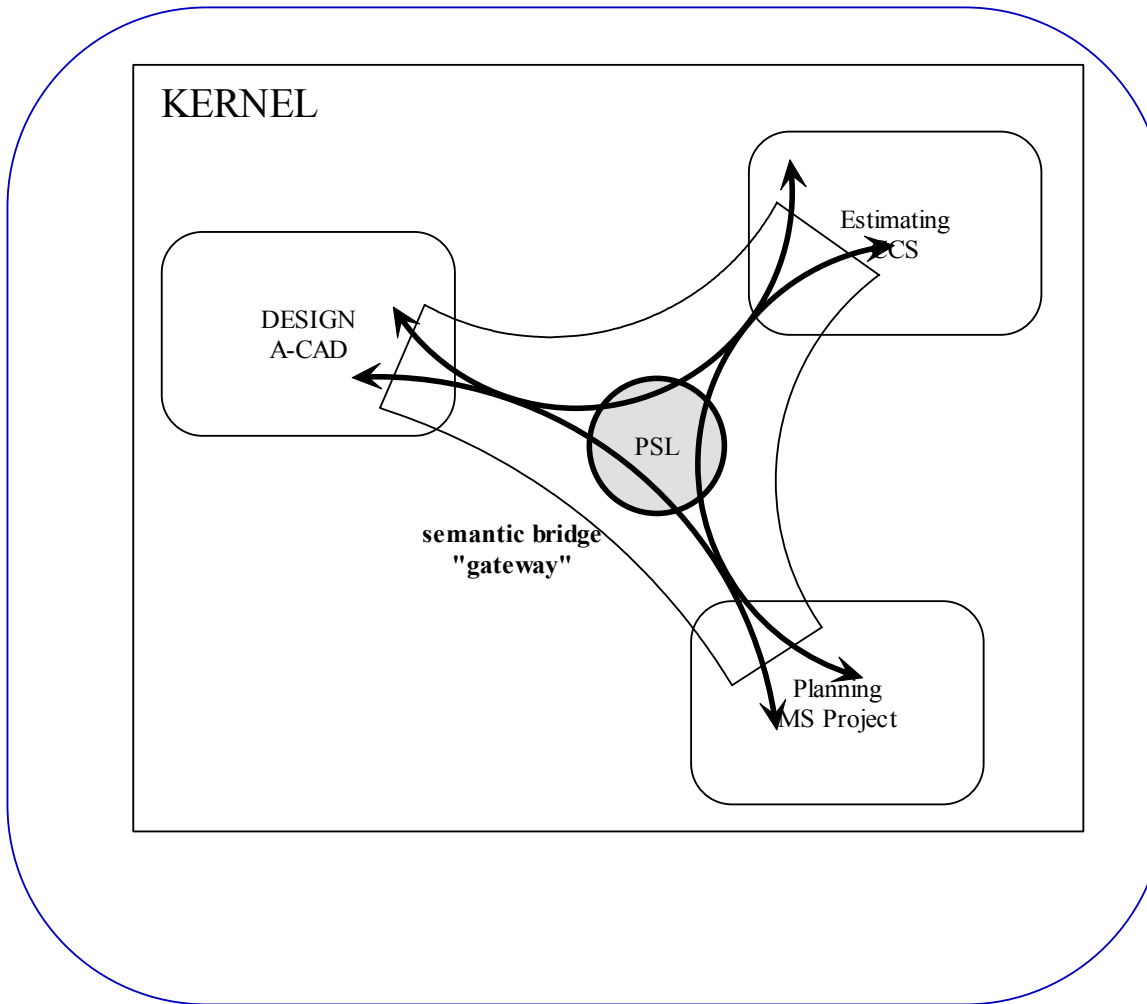
***** scenario voisin : simulation d'un changement de fournisseur**

SCENARIO DETAILLE :

**Mise en place d'une porte métallique (porte de protection anti-ouragan)
sur menuiserie métallique adéquate à installer :**

Ensemble des processus à prendre en compte en termes de :

- conception architecturale**
- estimation du coût**
- planification**



DESCRIPTION DU PRODUIT « PORTE » (extraits)

Metal Building Opening Construction

Overall Opening Dimension

97" w x 102 1/2" h

Height of Horizontal Girt above the floor

7'-5" (above normal installation height)

Adjustable Attachment clip

1 5/8" x 8" x 0.100"

Horizontal Top Girt

5 5/8" x 8" d x 0.023" t x 95- 15/16"

Horizontal Intermediate Girt

5 5/8" x 8" d x 0.023" t x 27 1/2"

Method of Construction:

A wood frame measuring 97" wide x 102 1/2" high was constructed using double 2 x 12 Douglas Fire Wood. An 8" girth with 3" flange was installed 89" above the base floor (which is above normal installation height of Girt).

The Top Girt Attachment:

The top Girt was attached with wood frame using a girt attachment clip.

DETAILS DE CONSTRUCTION DE LA PORTE (extraits)

PRODUCT Single Metal Door Installed in Metal Building Opening

DESCRIPTION OF UNIT

Model Designation	AMSCOKD, 20 Gage Textured
Overall door size	41" x86 1/8" h
Configuration	X
No. and size of vents	(1) 35 3/4" x 83 3/8" (active)

Door Frame Material & Construction

Strut: A sliding 1 3/4"x8" galvanized steel strut with 2 1/2"x3 7/8x wide welded steel clip on top. The assembly was slid upward to attach to horizontal girt using two 5/6" X 3/4" nut and bolt on interior and exterior face of jamb.

Jamb and Head: 16 Gage Kerfed frame profile, double rabbet with a foam filled Gasket, measuring 3"X81/8" (overall dimension). The depth of the door stop was 2 1/8" in front and 1 15/16" in rear; the height of door stop was 5/8".

DESCRIPTION DE « MENUISERIE METALLIQUE » (extrait)

Metal Building Opening Construction

Overall Opening Dimension	97" w x 102 1/2" h
Height of Horizontal Girt above the floor	7'-5" (above normal installation height)
Adjustable Attachment clip	1 5/8 "x 8" x 0.100"
Horizontal Top Girt	5 5/8" x 8" d x0.023" t x 95- 15/16 "
Horizontal Intermediate Girt	5 5/8" x 8" d x0.023" t x 27 1/2 "

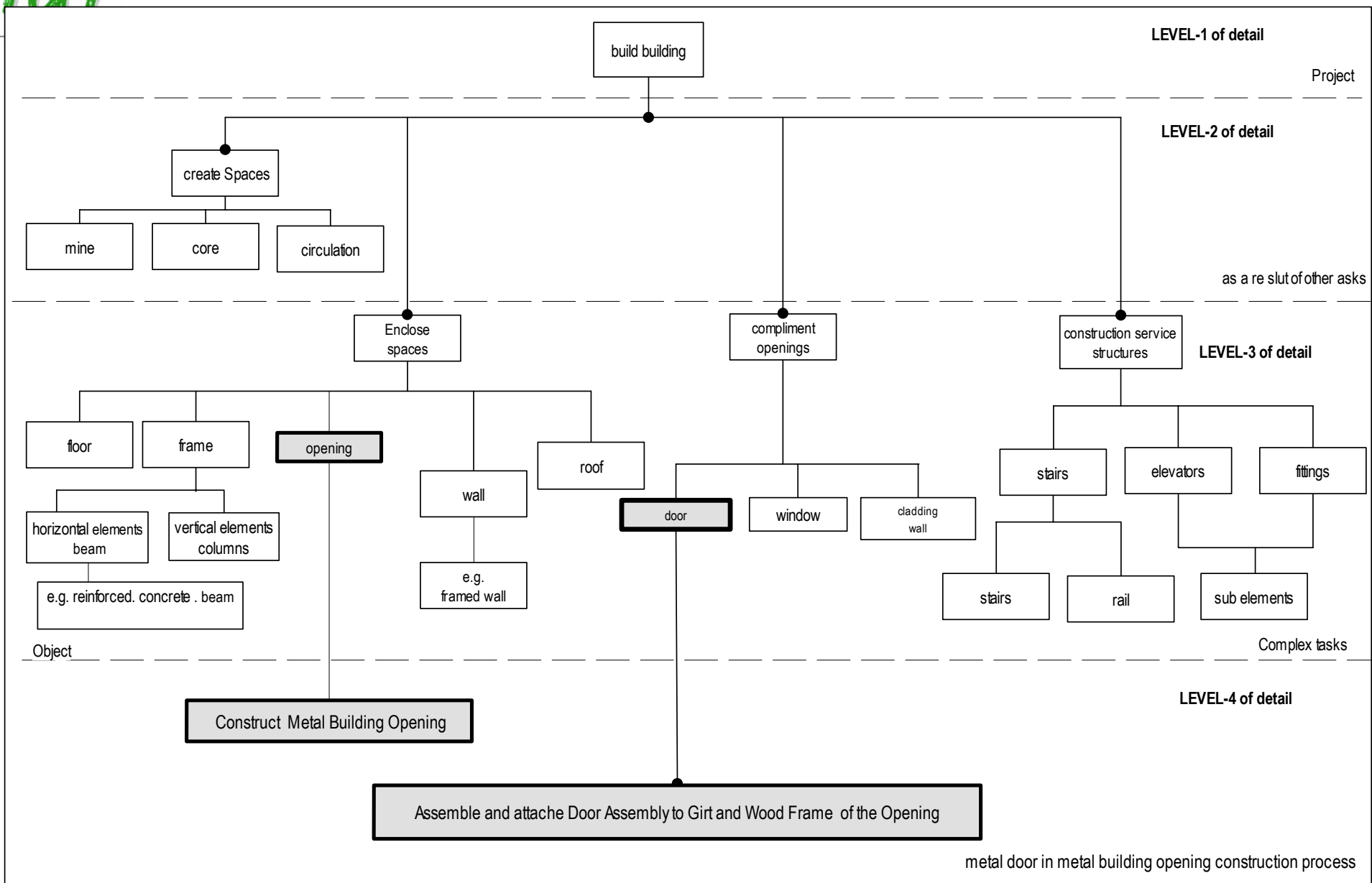
Method of Construction:

A wood frame measuring 97" wide x 102 1/2 " high was constructed using double 2 x 12 Douglas Fire Wood. An 8" girth with 3" flange was installed 89" above the base floor (which is above normal installation height of Grit).

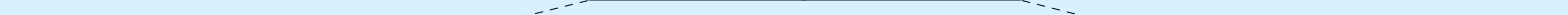
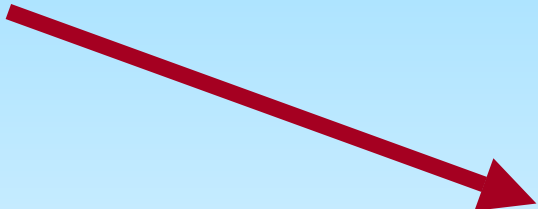
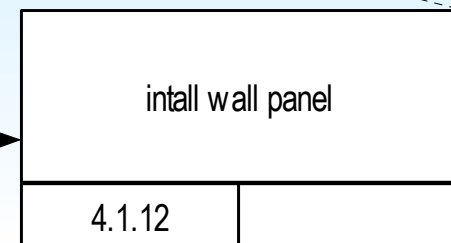
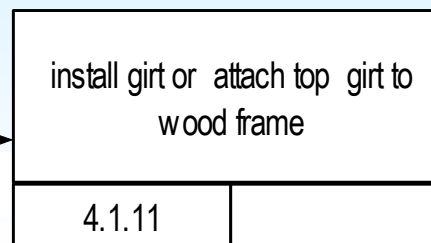
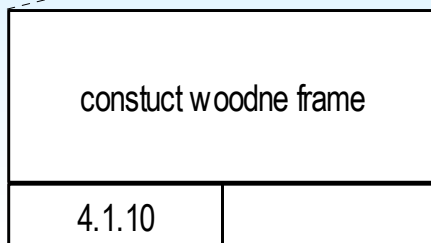
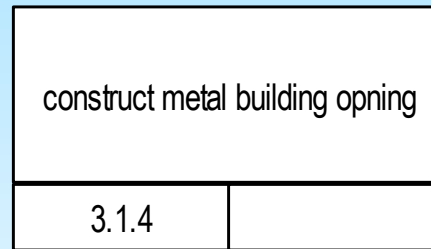
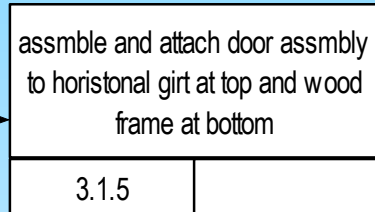
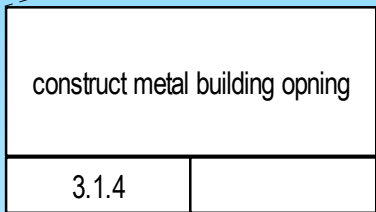
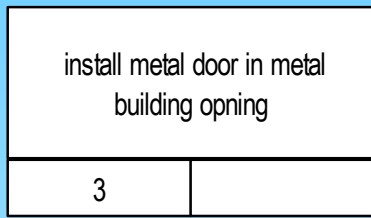
The Top Girt Attachment:

The top Girt was attached with wood frame using a girt attachment clip.

LA PORTE DANS LA HIERARCHIE DE CONSTRUCTION DU BATIMENT



SCHEMAS IDEF3 : installation porte métallique (extraits)



Informations nécessaires à AUTOCAD (extrait)

Microsoft Excel - Design data file final VERISON

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U % , +.00 -.00

D47 =

	A	B	C	D	E	F	G	
1	DWG_OBJECT					NUMBER	QTY	
2		TYPE	OVERALL DIMENSION	MATERIAL OF CONSTRUCTION	CONSTRUCTION			COMP 1
3	meta_door	AMSCO KD	41" *96 1/8" h			D-112	15	door fra
4								
5								
6								
7	door frame,			doorjamb, four 1/4" x 1" machine screws; four 5/8" x 1 5/8" wood lags sliding 1 1/2" x 8" h galvanized steel strut; two 5/8" x 1/2" nut and bolt two 5/16" x 1/2" hex head nut and bolt screws three, 7 Gage, 10" x 1 1/2" hinge reinforcement	jamb mounted to girt & wood frame with machine screw and wood lag strut attached to horizontal girt and doorjamb jamb attached to frame head extension with nut and bolt screws hinge reinforcement welded to doorjamb			
8				12 Gage galvanized steel angle measuring 1 1/2" x 2" x 7 1/2" x 0.039" thick, 1 1/2" leg	steel angle welded to doorjamb			
9				4.86" x 1.75" x 0.073" thick steel strike plate	4.86" x 1.75" x 0.073" thick steel strike plate installed to doorjamb.			
10				three point spot-welded 16 gage x 1 1/2" x 6" strike plate reinforcement	16 gage x 1 1/2" x 6" strike plate reinforcement installed in plate			
11								
12	door leaf		35 3/4" w x 83 1/8" h x 1 3/4" d	35 1/2" wide x 83 1/8" high x 1 3/4" deep 20 Gage galvanized steel door leaf	door leaf hinged on frame			
13				16 Gage flush top and bottom channel	top and bottom channel welded to both faces sheets of door leaf			
14				(3) 3" x 1 1/2" x 7 Gage hinge reinforcement	hinge reinforcement installed at centre of the leaf			
15				16 Gage steel lock reinforcement plate	steel lock reinforcement plate welded to door face sheet.			
16								
17	hardware & components			(1) Yale 5307 Lever Lock	lock fixed on door leaf			
18				4 1/2" steel Hinges with non-removable pin template	hinge installed on door leaf			
19				AMSCO extruded aluminum & vinyl weatherstrip	weatherstrip applied to door			
20								
21	door opening	metal	37" w *102.1/2"			Opening -112		37" *102
22								
23	37" *102 1/2" wood frame			2"12 Douglas Fir Wood	37" *102 1/2" wood-frame construction as design			
24								
25	8" with 3" flange steel girt			girt, clip, six #12*1 1/4" Self Drilling Screws, 0.563" steel washers four #12*1 1/4" Wood Lag Screws	clip attached to girt with self-drilling screws clip attached to wooden frame with wood Lag Screws			
26								
27	metal wall panel			metal wall panel; twenty two #12*1 1/4" Self drilling Screws nine #12*1 1/4" Self drilling Screws	wall panel attached to vertical members wall panel attached to door frame			
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								
54								

Sheet1 Sheet2 Sheet3

Ready NUM

Start chapters 7to9 VER... REFENRCES - Micr... Project Implement... Microsoft Excel... Document2

16:30

Informations nécessaires à CCS (extrait)

1.08c1 - Loughborough University - metal in metal building opening

Bill Of Quantities

PAGE	ITEM	OP CODE	DESCRIPTION	UNIT	BILLED QUANTITY	NETT RATE	NETT AMOUNT
1	A	9M8371	metal building opening	no	15	0.00	0.00
1	B	9M8372	41" x 86 1/82" h metal door	no	15	0.00	0.00

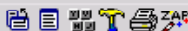
9M8371 Macro

ITEM	OP CODE	DESCRIPTION	UNIT	QUANTITY	NETT RATE	NETT AMOUNT
A	8t8373	97" x 102 1/2" woodframe	no	15	0.00	0.00
B	7s8374	8" with 3" flange steel girt	no	15	0.00	0.00
C	6M8375	38" x 108 1/2" metal wall panel	no	15	0.00	0.00

9M8372 Macro

ITEM	OP CODE	DESCRIPTION	UNIT	QUANTITY	NETT RATE	NETT AMOUNT
A	5d8376	doorframe	no	15	0.00	0.00
B	4e8377	steel door leaf	no	15	0.00	0.00
C	3f8378	hardware and coponents	no	15	0.00	0.00

1 Help 2 Variables 3 Zoom 4 Formula 5 Go to macro 6 Copy macro 7 More keys 8 Pricing qty 9 Display rate 10 Worksheet 11 Next macro



Right-click to select tool buttons



Candy: Master: prototype Door project



SitePlan: No Current Program

Informations nécessaires à MS Project (extrait)



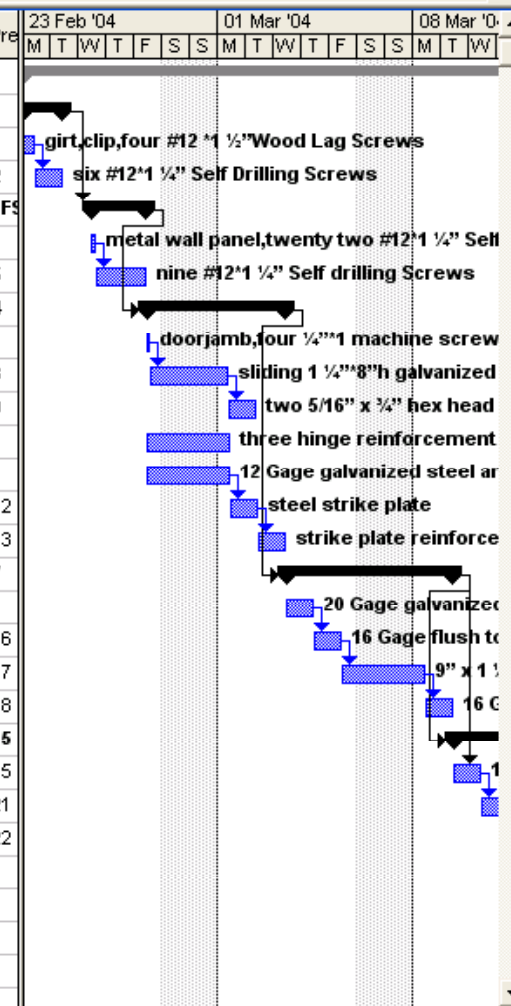
Microsoft Project - metal door in metal building opening

File Edit View Insert Format Tools Project Window Help



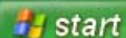
Arial 10 B I U All Tasks

	WBS	ID	Task Name	Duration	Start	Finish	Pre	23 Feb '04	01 Mar '04	08 Mar '04															
								M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	
0	0	0	metal door in metal building opening	#####	#####	#####																			
1	1	1	attach girt to wood frame with girt attachment	1.33 days	Mon 23/02/04	Tue 24/02/04																			
2	1.1	2	attach clip to girt with self-drilling screws	0.33 days	Mon 23/02/04	Mon 23/02/04																			
3	1.2	3	attach clip to wooden frame with wood Lag Screws	1 day	Mon 23/02/04	Tue 24/02/04	2																		
4	2	4	attach metal panel to vertical members & door	2 days	Wed 25/02/04	Fri 27/02/04	1F5																		
5	2.1	5	attach wall panel to vertical members	0.5 days	Wed 25/02/04	Wed 25/02/04																			
6	2.2	6	attach wall panel to door frame	1.5 days	Wed 25/02/04	Fri 27/02/04	5																		
7	3	7	construct doorframe as design	3 days	Fri 27/02/04	Wed 03/03/04	4																		
8	3.1	8	mount jamb to girt & wood frame	0.33 days	Fri 27/02/04	Fri 27/02/04																			
9	3.2	9	attach strut to horizontal girt and doorjamb	0.5 days	Fri 27/02/04	Mon 01/03/04	8																		
10	3.3	10	attach jamb to frame head extension	1 day	Mon 01/03/04	Tue 02/03/04	9																		
11	3.4	11	weld hinge reinforcement to doorjamb	1 day	Fri 27/02/04	Mon 01/03/04																			
12	3.5	12	weld steel angle to doorjamb	1 day	Fri 27/02/04	Mon 01/03/04																			
13	3.6	13	install steel strike plate to doorjamb	1 day	Mon 01/03/04	Tue 02/03/04	12																		
14	3.7	14	install strike plate reinforcement	1 day	Tue 02/03/04	Wed 03/03/04	13																		
15	4	15	construct door leaf as design	4 days	Wed 03/03/04	Tue 09/03/04	7																		
16	4.1	16	hang door leaf on frame	1 day	Wed 03/03/04	Thu 04/03/04																			
17	4.2	17	Weld top and bottom channel to door leaf	1 day	Thu 04/03/04	Fri 05/03/04	16																		
18	4.3	18	Install hinge reinforcement at centre of the leaf	1 day	Fri 05/03/04	Mon 08/03/04	17																		
19	4.4	19	Weld steel lock reinforcement plate to door face	1 day	Mon 08/03/04	Tue 09/03/04	18																		
20	5	20	fix hardware & components on door	3 days	Tue 09/03/04	Fri 12/03/04	15																		
21	5.1	21	fix lock on door leaf	1 day	Tue 09/03/04	Wed 10/03/04	15																		
22	5.2	22	install hinge on door leaf	1 day	Wed 10/03/04	Thu 11/03/04	21																		
23	5.3	23	install weatherstrip	1 day	Thu 11/03/04	Fri 12/03/04	22																		



Ready

EXT CAPS NUM SCRL OVR

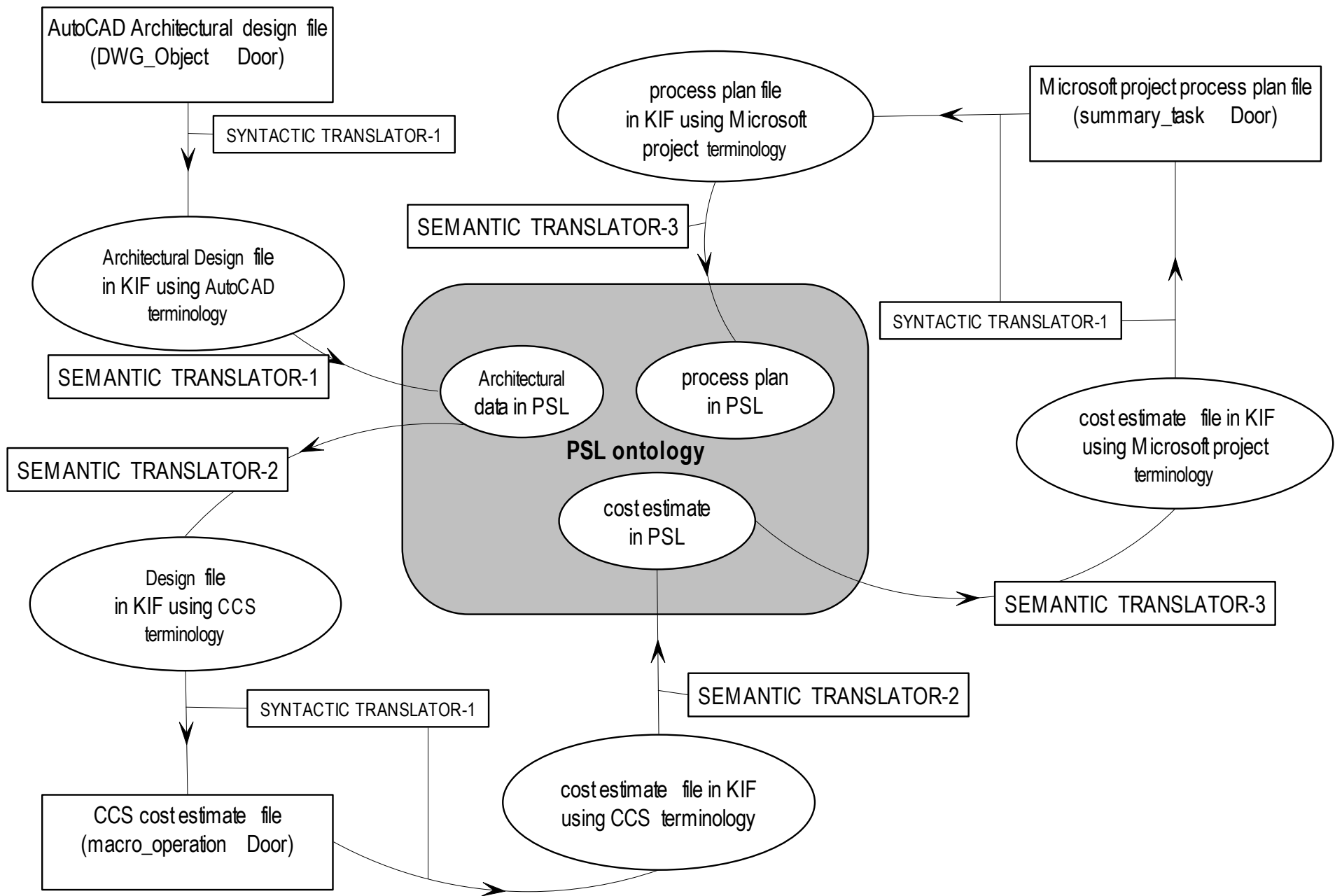


now.doc - Microsoft ...

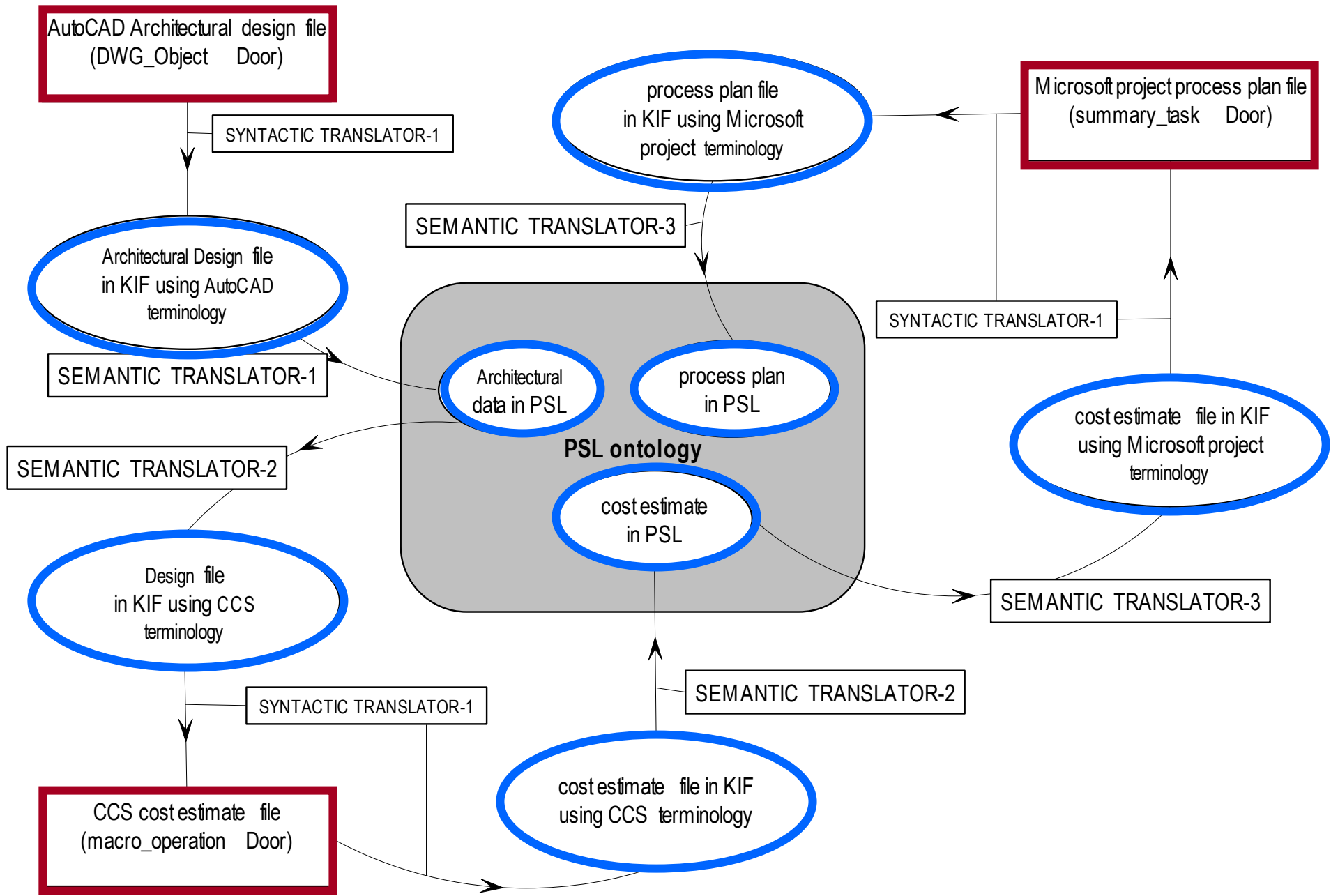
Microsoft Project - m...

Microsoft Project

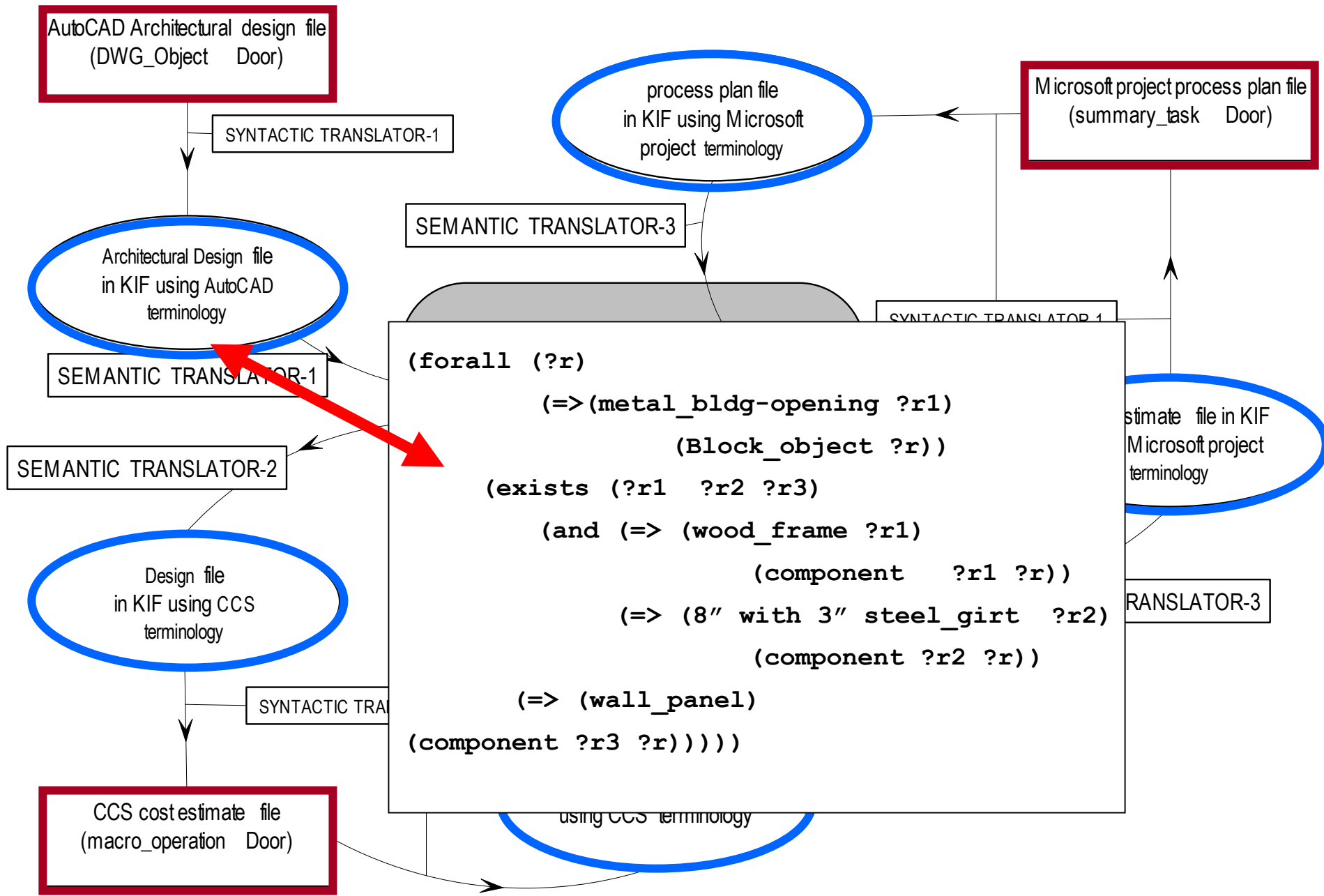
12:23



Processus de traduction entre les applications utilisant PSL



Processus de traduction entre les applications utilisant PSL



Processus de traduction entre les applications utilisant PSL

AutoCAD Architectural design file
(DWG_Object Door)

SYNTACTIC TRANSLATOR-1

Architectural Design file
in KIF using AutoCAD
terminology

SEMANTIC TRANSLATOR-1

SEMANTIC TRANSLATOR-2

Design file
in KIF using CCS
terminology

SYNTACTIC TRANSLATOR-1

CCS cost estimate file
(macro_operation Door)

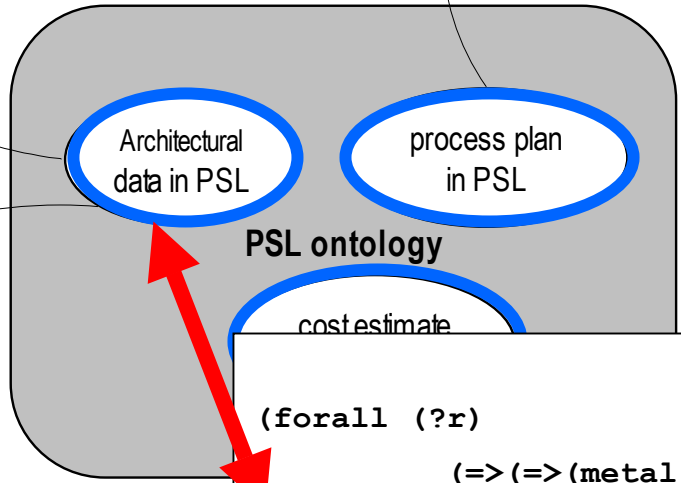
process plan file
in KIF using Microsoft
project terminology

Microsoft project process plan file
(summary_task Door)

SEMANTIC TRANSLATOR-3

SYNTACTIC TRANSLATOR-1

cost estimate file in KIF
using Microsoft project
terminology



```
(forall (?r)
  (=>(=>(metal_bldg-opening ?r)
    (product ?r))
  (exists (?r1 ?r2 ?r3)
    (and (=> (wood_frame ?r1)
      (resource_created ?r1 ?r))
      (=> (8" with 3" steel_girt ?r2)
        (resource_created ?r2 ?r))
      (=> (wall_panel)
        (resource_created ?r3 ?r))))))
```

Processus de traduction

AutoCAD Architectural design file
(DWG_Object Door)

SYNTACTIC TRANSLATOR-1

Architectural Design file
in KIF using AutoCAD
terminology

SEMANTIC TRANSLATOR-1

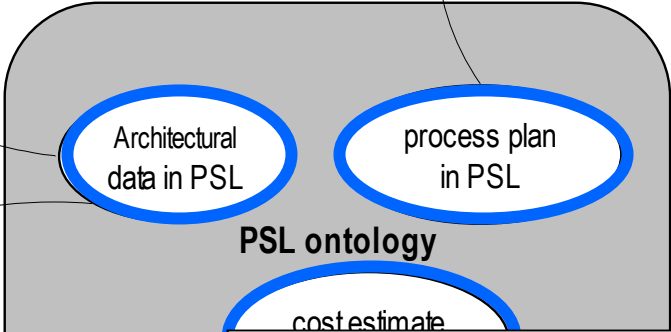
process plan file
in KIF using Microsoft
project terminology

Microsoft project process plan file
(summary_task Door)

SYNTACTIC TRANSLATOR-1

cost estimate file in KIF
using Microsoft project
terminology

SEMANTIC TRANSLATOR-3



SEMANTIC TRANSLATOR-2

Design file
in KIF using CCS
terminology

SYNTACTIC TRANSLATOR-1

CCS cost estimate file
(macro_operation Door)

```
(forall (?r)
  (=>(=>(metal_bldg-opening ?r)
    (bill_of_quantity_macro_op ?r))
  (exists (?r1 ?r2 ?r3)
    (and (=> (97"*102 ½" wood_frame ?r1)
      (macro_op ?r1 ?r))
      (=> (8" with 3" steel_girt ?r2)
        (macro_op ?r2 ?r))
      (=> (wall_panel)
        (macro_op ?r3 ?r))))))
```

Processus de traduction

AutoCAD Architectural design file
(DWG_Object Door)

SYNTACTIC TRANSLATOR-1

Architectural Design file
in KIF using AutoCAD
terminology

SEMANTIC TRANSLATOR-1

SEMANTIC TRANSLATOR-3

process plan file
in KIF using Microsoft
project terminology

Microsoft project process plan file
(summary_task Door)

SYNTACTIC TRANSLATOR-1

cost estimate file in KIF
using Microsoft project
terminology

Architectural
data in PSL

process plan
in PSL

PSL ontology

cost estimate

[macro Metal Building Opening]

(Item Number)

(Op Code)

(Macro Op Code Description 97"*102 1/2" wood frame)

(Macro Op Code Description steel girt)

(Macro Op Code Description metal panel)

(Op Code Unit)

(Billed Quantity)

(Nett Rate)

(Nett Amount)

[97"*102 1/2" wood frame]

(Item Number)

(Op Code)

(Op Code Description construct wood frame)

(Op Code Unit)

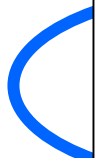
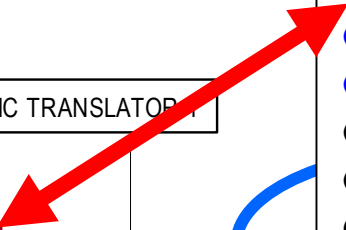
SEMANTIC TRANSLATOR-2

Design file
in KIF using CCS
terminology

SYNTACTIC TRANSLATOR-1

CCS cost estimate file
(macro_operation Door)

Processus de traduction



```

(forall (?r)
  (=>(=>(metal_bldg-opening ?r)
    (bill_of_quantity_macro_op ?r))
  (exists (?r1 ?r2 ?r3)
    (and (=> (97"*102 ½" wood_frame ?r1)
      (macro_op ?r1 ?r))
      (=> (8" with 3" steel_girt ?r2)
        (macro_op ?r2 ?r))
      (=> (wall_panel)
        (macro_op ?r3 ?r))))))

```

SEMANTIC TRANSLATOR-2

Design file
in KIF using CCS
terminology

SYNTACTIC TRANSLATOR-1

CCS cost estimate file
(macro_operation Door)

an file
Microsoft
terminology

s plan
SL

cost estimate
in PSL

SYNTACTIC TRANSLATOR-1

Microsoft project process plan file
(summary_task Door)

cost estimate file in KIF
using Microsoft project
terminology

SEMANTIC TRANSLATOR-3

SEMANTIC TRANSLATOR-2

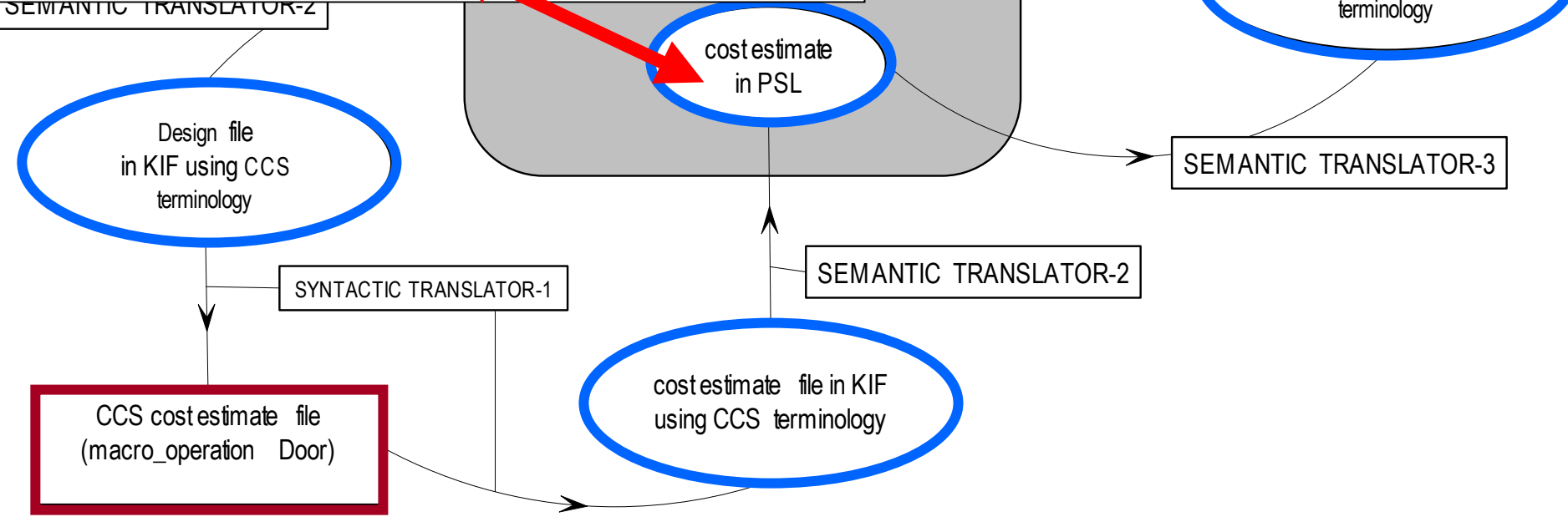
cost estimate file in KIF
using CCS terminology

Processus de traduction entre les applications utilisant PSL

```

(forall (?r)
  (=>(=>(metal_bldg-opening ?r)
    (product ?r))
    (exists (?r1 ?r2 ?r3)
      (and (=> (97"*102 ½" wood_frame ?r1)
        (resouce_created ?r1 ?r))
        (=> (8" with 3" steel_girt ?r2)
          (resouce_created ?r2 ?r))
        (=> (wall_panel)
          (resouce_created ?r3 ?r))))))

```



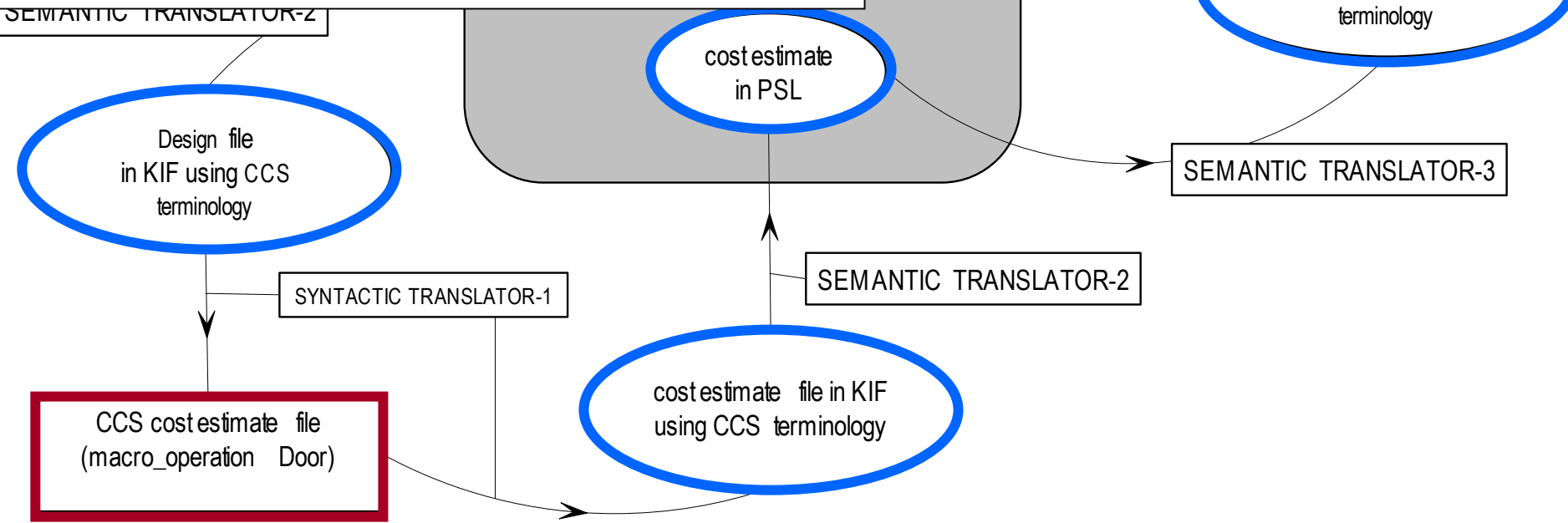
Processus de traduction entre les applications utilisant PSL

```

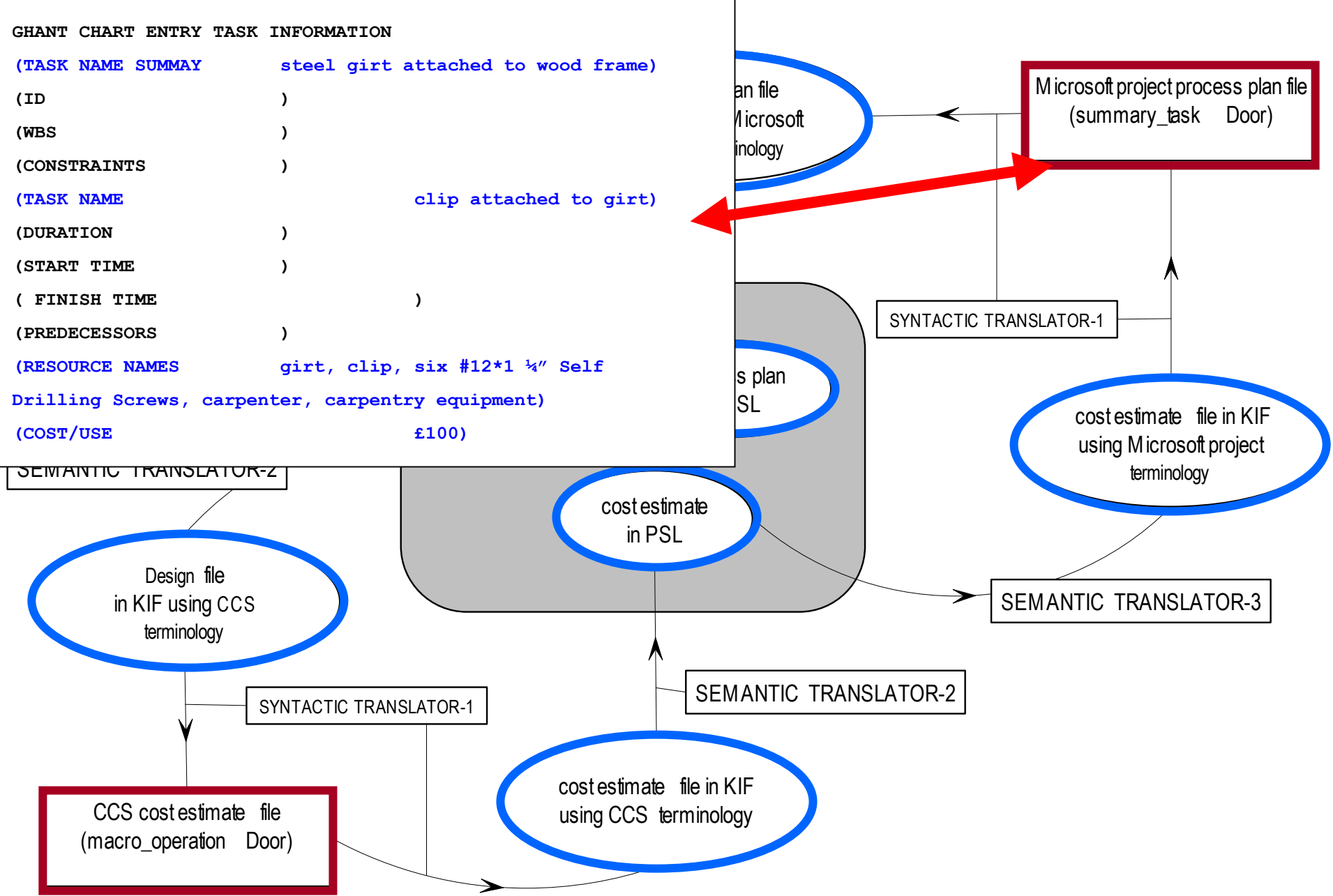
(forall (?r)
  (=> (41" x86 1/8" h metal door in a metal building opening ?r)
    (project ?r)))

(<=> (<=> (=> (wood-frame_constructed_as_design ?a)
  (task ?a)
  (creates ?a ?r))
  (exists (?r1 ?r2 ?r3)
    (=> (and (=> (2*12 Douglas Fire Wood ?r1)
      (resource ?r1 ?a)
      (=> (carpenter ?r2)
        (resource ?r2 ?a)
        (=> (carpentry_equipment ?r3)
          (resource ?r3 ?a))

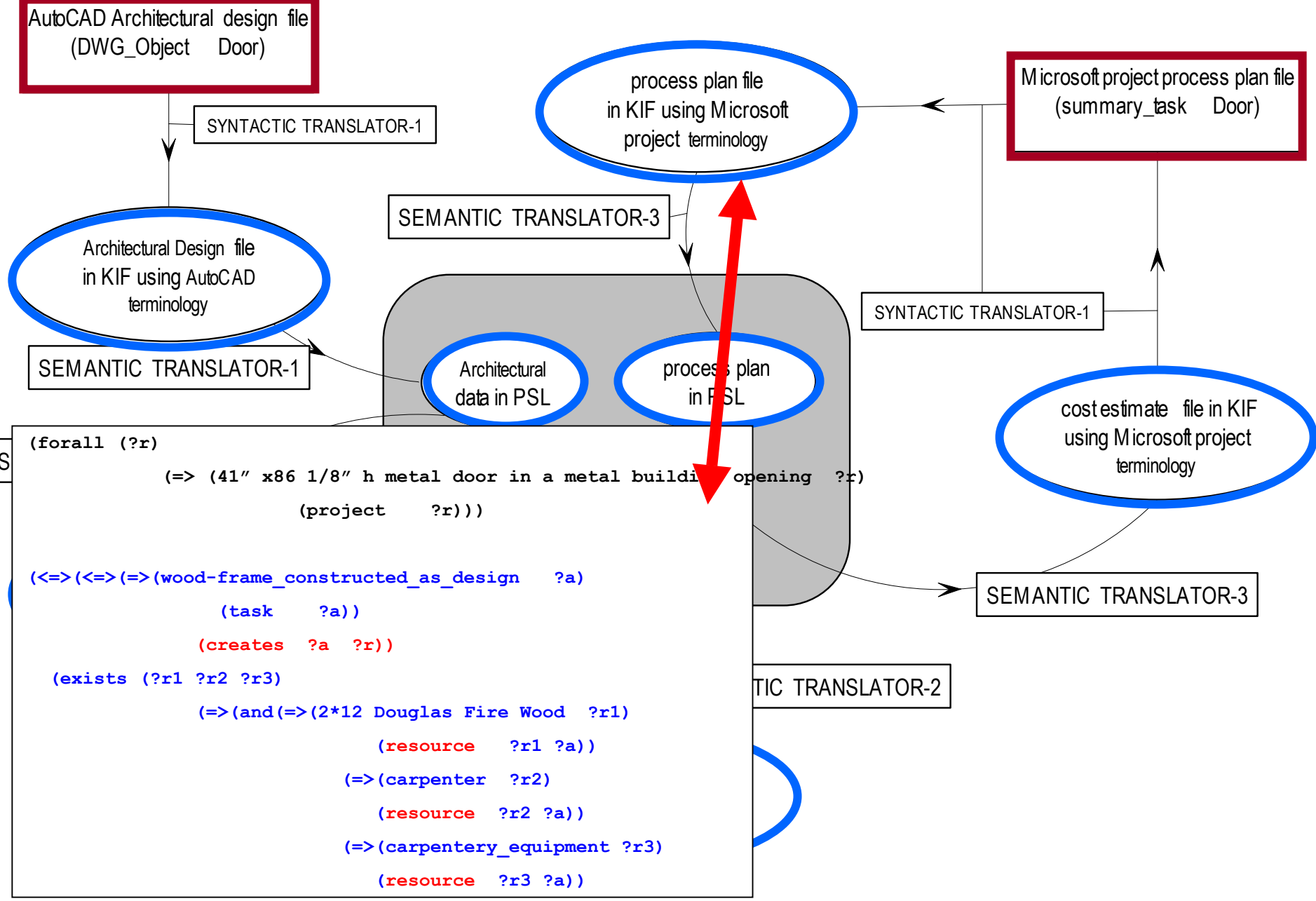
```



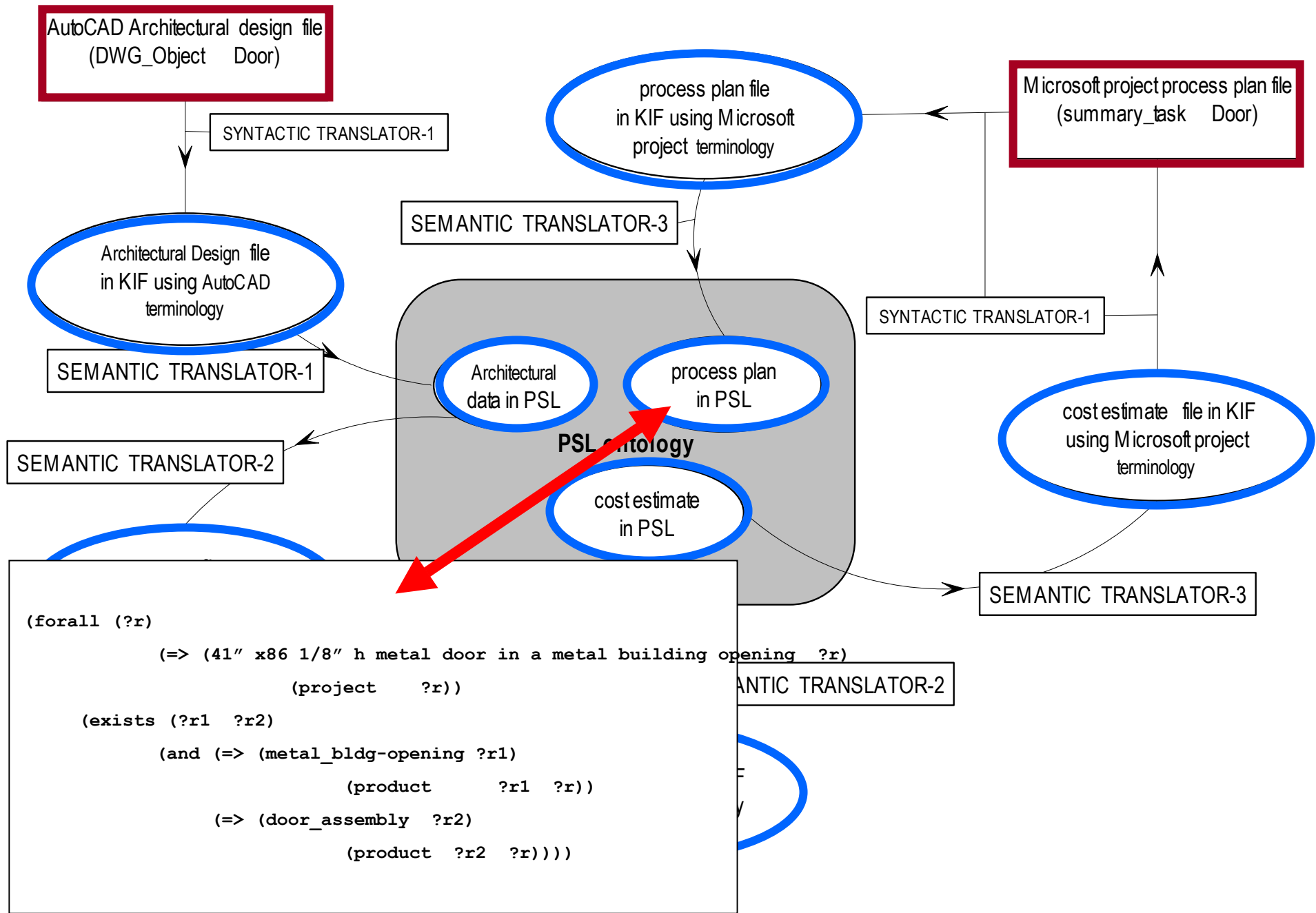
Processus de traduction entre les applications utilisant PSL



Processus de traduction entre les applications utilisant PSL



Processus de traduction entre les applications utilisant PSL



Processus de traduction entre les applications utilisant PSL

REMARQUES

- Actuellement : traducteurs écrits à la main
- Scenario proposé : unidirectionnel
- Les traducteurs seront automatisés au fur et à mesure du développement de la norme, avec une aide au choix des concepts du langage les mieux adaptés
- Etude proposée ici : **faisabilité de l'utilisation de PSL en construction** jusqu'à présent le langage a été testé sur des scénarii de "manufacturing"

QUESTIONS ?