STF 476: TDL Phase 2

Status Report

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Document History

- 2014-10-10: Document submitted for MTS #62
  - long form for SG #3 / Technical Session
  - short form for MTS #62
- 2014-03-19: Document submitted for SG #2

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From the Terms of Reference…

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TDL Phase 2: Goal and Objectives

- Goal
  - Supporting ETSI and industrial users in using TDL
- Objectives
  - Extended TDL meta-model for supporting test automation
  - Standardised concrete syntaxes
    - Graphical syntax for end-users
    - Textual exchange syntax for tool interoperability
  - Analysis on the needs for a concrete syntax to support ETSI use cases

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TDL Phase 2: Deliverables

Del.	Work Item Code / Standard Number	Working Title / Scope
D1	RES/ES 203 119-1 V1.2.1	Test Description Language; Meta-Model and Semantics Scope: common concepts, meta-model, semantics
D2	DES/ ES 203 119-2 V1.1.1	Test Description Language; Graphical Syntax Scope: TDL graphical concrete syntax for end users
D3	DES/ ES 203 119-3 V1.1.1	Test Description Language; Exchange Format Scope: TDL exchange format for tool interoperability

Optionally: ES Part 4 on TDL textual concrete syntax (no WI created yet)

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TDL Phase 2: Organisation of Work

- Start: 02/2014
  - Task 0: Project management
  - Task 1: Extension of TDL meta-model (02-12/2014)
  - Task 2: Graphical concrete syntax (02-12/2014)
  - Task 3: Exchange syntax (06-12/2014)
  - Task 4a: Analysis on ETSI concrete syntax (02-05/2014)
- Potential STF extension: 06/2014 (decision at MTS#62)
  - Task 4b: ETSI concrete syntax (06-12/2014)
- End: 12/2014
  - WI: updated meta-model description + semantics
  - WI: concrete syntax + meta-model mapping
  - WI: exchange syntax + meta-model mapping

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TDL Phase 2: Milestones

- M0: 02/2014
  - Start of work of Tasks 0, 1, 2, 4
- M1: 05/2014 <- Discussion at MTS#62 (05/2014)
  - (T1) Early draft: updated meta-model, (T2) Early draft: graphical syntax,
  - (T4) Decision paper on textual syntax
  - (T3) Start of Task 3
- M2: 09/2014 <- Discussion at MTS#63 (10/2014)
  - (T1) Stable draft: updated meta-model, (T2) Stable draft: graphical syntax, (T3) Early draft: exchange syntax
- M3: 12/2014 <- Approval at MTS#64 (02/2015)
  - (T1) Final draft: updated meta-model, (T2) Final draft: graphical syntax, (T3) Final draft: exchange syntax

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Task 1: Extended TDL Meta-Model

- Targeted for M1
  - specification of sub-test configurations
  - types and data refinement (initial proposal)
- Open for M2 and M3
  - types and data (finalised)
  - time
  - behaviour
  - editorial clarifications and refinements

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Task 2: Graphical Concrete Syntax

- Different specification approaches studied
- OMG Diagram Definition (DD) selected “in principle”
- Means for user-accessible specification under study
- Decision on description and mapping structure pending

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Task 4: TDL Textual Syntax Analysis

- Understanding ETSI’s requirements for a textual syntax
  - review and discussion of notes and input collected during STF 454
  - discussion of CTI proposal based on ITS and GeoNetworking examples
  - initial focus on provided examples, (TPLan-like) format pushed within ETSI

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Task 0: Session Planning

- 6 sessions in total
- 2 sessions per milestone
    - 1 preparatory / debriefing
    - 1 finalising
- Homework and remote coordinated work in between

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Task 0: Milestone Resources

- ~15 days/expert per milestone
  - assuming roughly equal resource allocation per expert
  - 2x4 days sessions, ~7 days homework
- Milestone 1: ~60 days planned, 44.5 used so far (4 experts)
- Milestone 2: ~75 days (5 experts)
- Milestone 3: ~75 days (5 experts)

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Session 1 Summary

- Goal: Prepare and define roadmaps for Milestone 1
  - created initial pool of tasks
  - selected targets for Milestone 1
  - performed first analysis tasks
  - proposed conceptual solutions for analysed targets
- Targeted for Session 2
  - implementation and validation of analysed targets, progress on remaining targets

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Session 2 Summary (1/2)

- Goal: Implement targets for Milestone 1
  - Task 1: Meta-model
    - implemented sub-configurations
    - conceptualised data and action refinements (WIP)
  - Task 2: Graphical syntax
    - laid out document foundations and structure
    - drafted graphical symbols proposals for selected elements

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Session 2 Summary (2/2)

- Goal: Implement targets for Milestone 1
  - Task 4: Concrete syntax for ETSI
    - outlined different mapping and formalisation options
    - prepared examples for syntax
    - discussed preliminary results with CTI
    - clarified role of proposed syntax
    - finalised analysis report

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Task 2: Graphical Concrete Syntax

- Targeted for M1:
  - initial syntax proposals for majority of meta-model elements
  - initial draft structure proposal
    - identification of elements that can or shall not be graphically represented
- Open for M2 and M3
  - refinement and completion of graphical syntax elements, draft contents
  - study and application of graphical syntax on real-world examples

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Task 2: Graphical Concrete Syntax

- Table of contents and general structure based on Part 1
- Notational conventions
  - *text* - nonterminal element, type indicated by the italic *text*, substituted
  - **I** - represents a choice, in **bold**
  - ***[ ]*** - optional concrete syntax element, in ***bold and italic***
  - [ ] - terminal symbol, mandatory concrete syntax element, non-bold, non-italic

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Task 2: Graphical Concrete Syntax

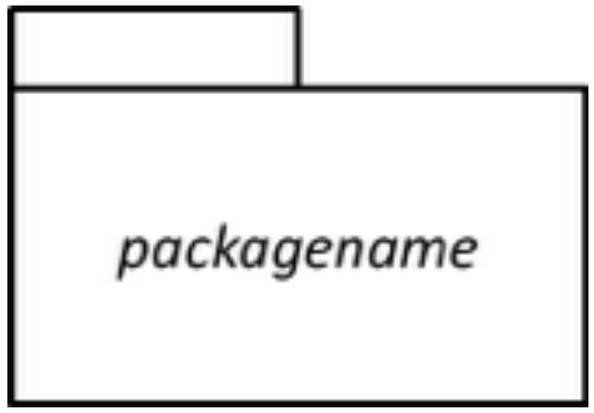
- Structure
  - Meta-Model Reference
  - Concrete Graphical Notation
  - Formal Description
  - Constraints
  - Comments
  - Example

5.1.3 Package

Meta-Model Reference

The definition of ‘Package’ can be found in chapter 5.3.3 in [1].

Concrete Graphical Notation



Formal Description

<to be added later>

Constraints

Comments

The *packagename* refers to the name of the ‘Package’.

Example

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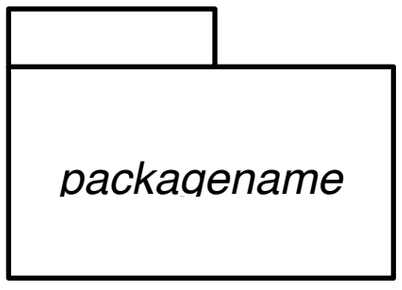
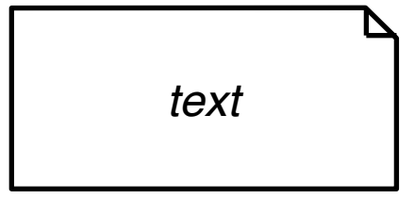
Task 2: Graphical Syntax Elements

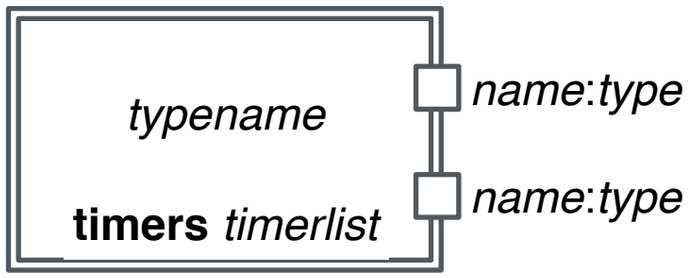


Package

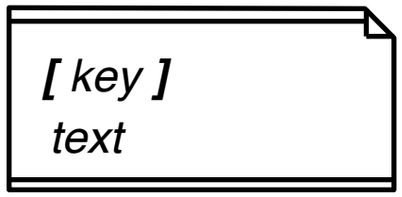
Gate Type



Comment



Component Type



Annotation

SUT|**TESTER**

Component Role

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- Understanding ETSI's requirements for a textual syntax
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  - focus initial analysis on provided examples, TPLan-like format pushed within ETSI
  - target a full syntax rather than an output format

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Task 4: Use Cases

- Documentation and communication
  - used in high-level discussions at meetings (often 80-100 participants)
  - reduce level of unnecessary technical detail as much as possible
  - primary constituent of documents
  - central role in ETSI processes

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Task 4: Use Cases

- Basis for implementation
  - high-level designs on which executable test specifications are based
  - previously done based on test purpose description (1-2 sentence description of objectives), or on requirements directly
  - current format is considered an improvement over these earlier approaches, has high acceptance among test engineers
  - additional technical details may be beneficial
  - consistency and lack of ambiguity are essential

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Task 4: Examples

TP Id	TP/CAM/INA/DOP/BV/02
Test objective	Checks that CAM message includes DoorOpen information 30s after closed
Reference	TS 102 637-2 [1], clauses 7.1 and 7.2
PICS Selection	PICS_PUBTRANSVEH
Initial conditions	

with {
the IUT being in the "initial state" and
the IUT having sent a valid CAM message
containing DoorOpen TaggedValue
}	

Expected behaviour	

ensure that {
when {
the door is closed
}
then {
the IUT sends CAM messages
containing DoorOpen TaggedValue during the 30s following the door closing event
}
}	

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Task 4: TDL Textual Syntax Analysis

- Graphical syntax concerns
  - level of completeness inherent in TDL, test configurations, behaviour, etc.
  - corresponding tooling is necessary and needs to be available
    - all stakeholders need to be familiar and fluent in the syntax
- May have negative impact on acceptance among users that have established process and practices in place, especially in early stages of deployment

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Task 4: Proposed Approach

- Determine level of formalisation
- Capture relevant concepts and relationships in a domain-specific meta-model
  - partially derived from TPLan
  - additional explicit structural patterns
- Define standardised mappings to textual and tabular elements
- Define standardised mappings to and from TDL

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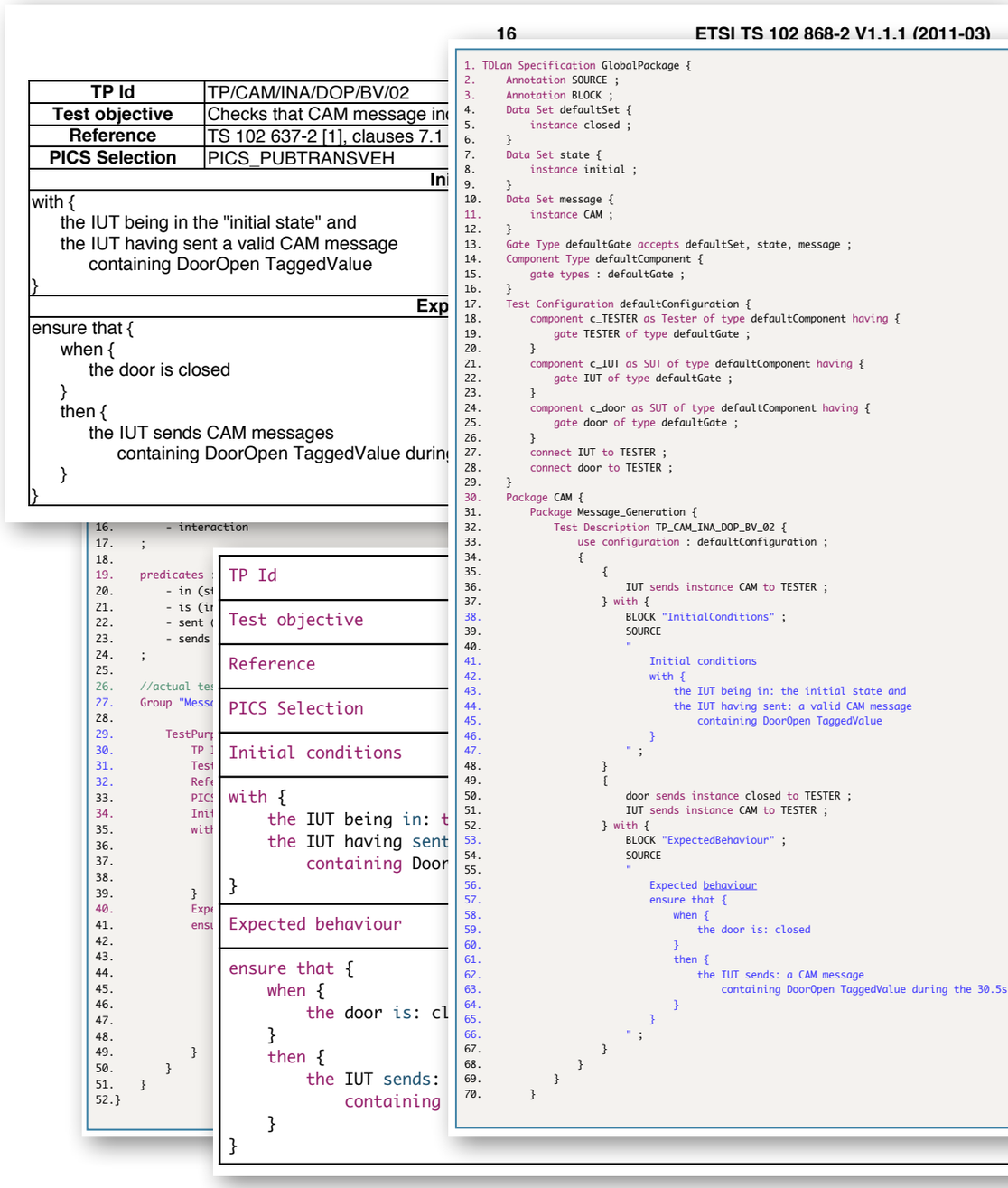
Task 4: Proposed Approach

- Indirect mapping
  - mapping at a high level of abstraction
  - flexible tailoring to a specific purpose
    - fewer compromises
    - no impact on the user
- Mixed level of formalisation
  - explicit relationships
  - freedom of expression



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Task 4: Strategic Outlook

- Early simplified access to TDL tailored for ETSI's processes
  - foster early adoption based on notation already in use
- Unified and suitable means for both
  - specifying concise and better structured test purposes, and
  - transitioning to more detailed and refined test descriptions
- Relying on the same underlying meta-model
- 3GPP involved at a later stage

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Task 4: Recommendations

Task 4: Use Cases

- Documentation and communication
  - used in high-level discussions at meetings (often 80-100 participants)
  - reduc
  - prima
  - centra

Task 4: Use Cases

- Basis for implementation
  - high-level designs on which executable test specificati
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    description of obj
  - current format is
    approaches, has
  - additional technic
  - consistency and

Task 4: Direct vs Indirect Mapping

+high-level
+better tailored
+complex manipulations possible
+flexibility
+low coupling

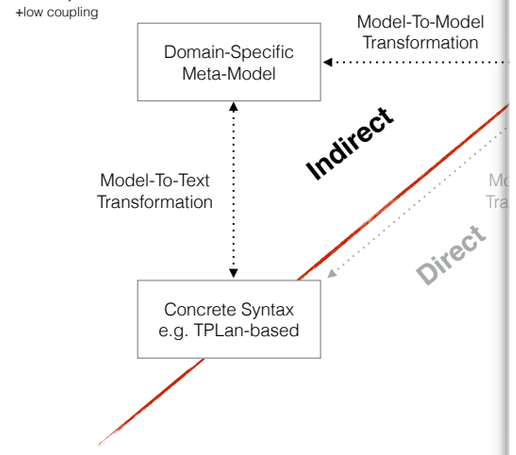

Figure 3: Differences between direct and indirect mapping approaches

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Task 4: Levels of Formalisation

Level of Formalisation	Advantages	Disadvantage
Highly structured	+ comprehensive tool support + consistency + translation and mapping + explicit relationships	- many definitions in advan - rigid structure - verbosity - convenience of use
Loosely structured	+ freedom of expression + few or no definitions in advance	- limited tooling - limited mapping and trans - ambiguities - inconsistencies - manual mark-up or definit advance - implicit relationships
Mixed	+ sufficient freedom of expression within well-defined patterns and conventions + explicit relationships + flexible translation and mapping + few or no definitions in advance	- some restrictions on how are structured - some syntactical sugar m necessary

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Task 4: Next Steps

Task	Description	Start	End	Days
1	Identification of relevant concepts and implementation into a domain-specific meta-model	07/2014	10/2014	7
2	Mapping of domain-specific meta-model elements to a concrete syntax notation	08/2014	10/2014	8
3	Definition of bi-directional mapping between the domain-specific meta-model the TDL meta-model	09/2014	12/2014	10
	Total resources:			**25**

Description	Days	Rate	Cost
Contracted experts (remunerated)	20	€ 600	€ 12.000
Contracted experts (voluntary, 20% from total)	5	€ 0	€ 0
CTI staff (voluntary)	10	€ 0	€ 0
Total manpower cost	**35**		**€ 12.000**
Total cost			**€ 12.000**

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Task 4: Next Steps

- Early Draft in September, 2014 (aligned with stable drafts for STF 476)
  - Stable domain-specific meta-model
  - Stable concrete syntax notation specification
  - Early mapping definitions
- Stable Draft in December, 2014 (aligned with final drafts for STF 476, submitted for approval at MTS #64)
  - Final domain-specific meta-model (normative)
  - Final concrete syntax notation specification (normative)
  - Final mapping definitions (normative)

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Task 1: Sub-configurations

- Understanding of sub-configurations
- 2 core aspects
  - configuration composition
  - relationship between test configurations and test descriptions
    - three different approaches to binding
    - binding upon declaration (“global constant”), allows for 1 : n
    - binding upon reference (“formal parameters”), allows for m : n
    - combination of both (global configurations bound upon reference)

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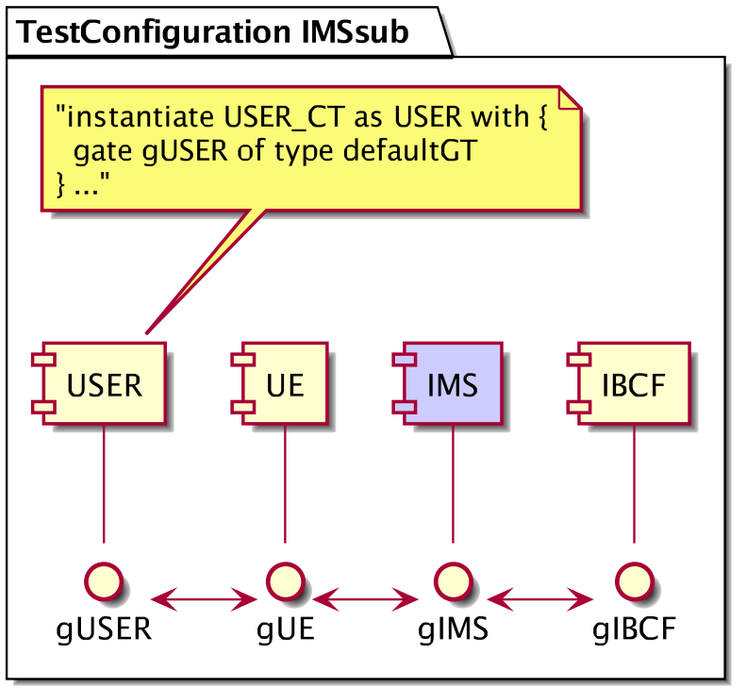
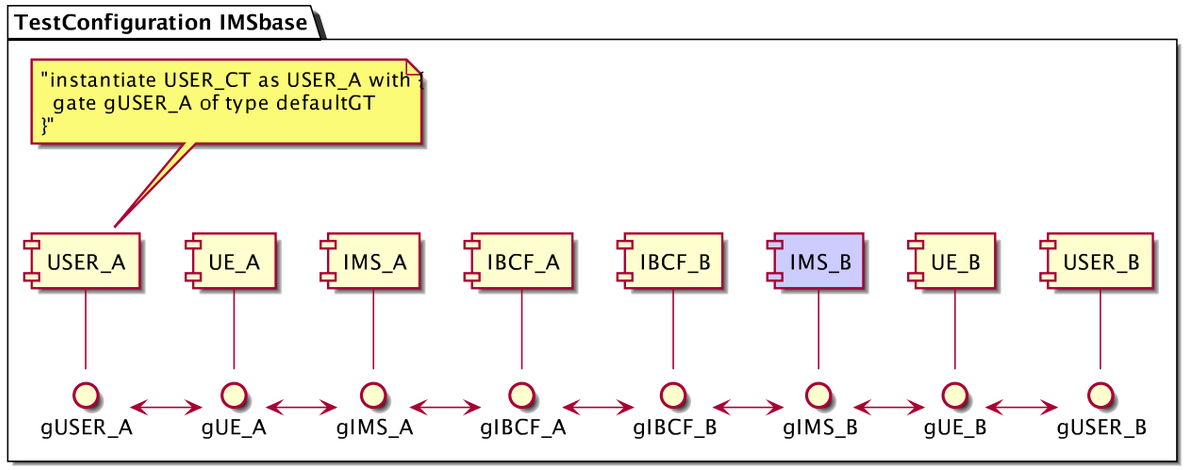
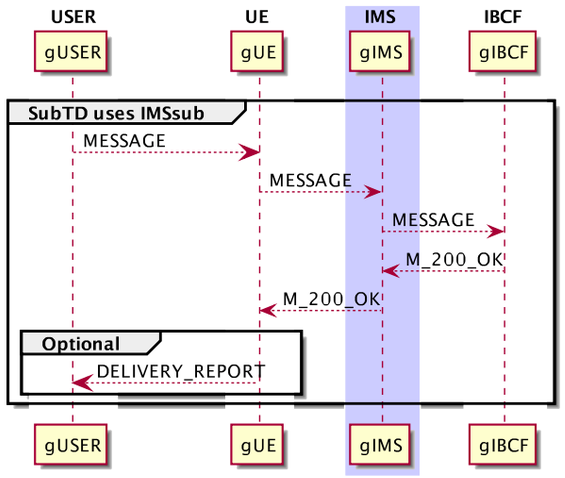
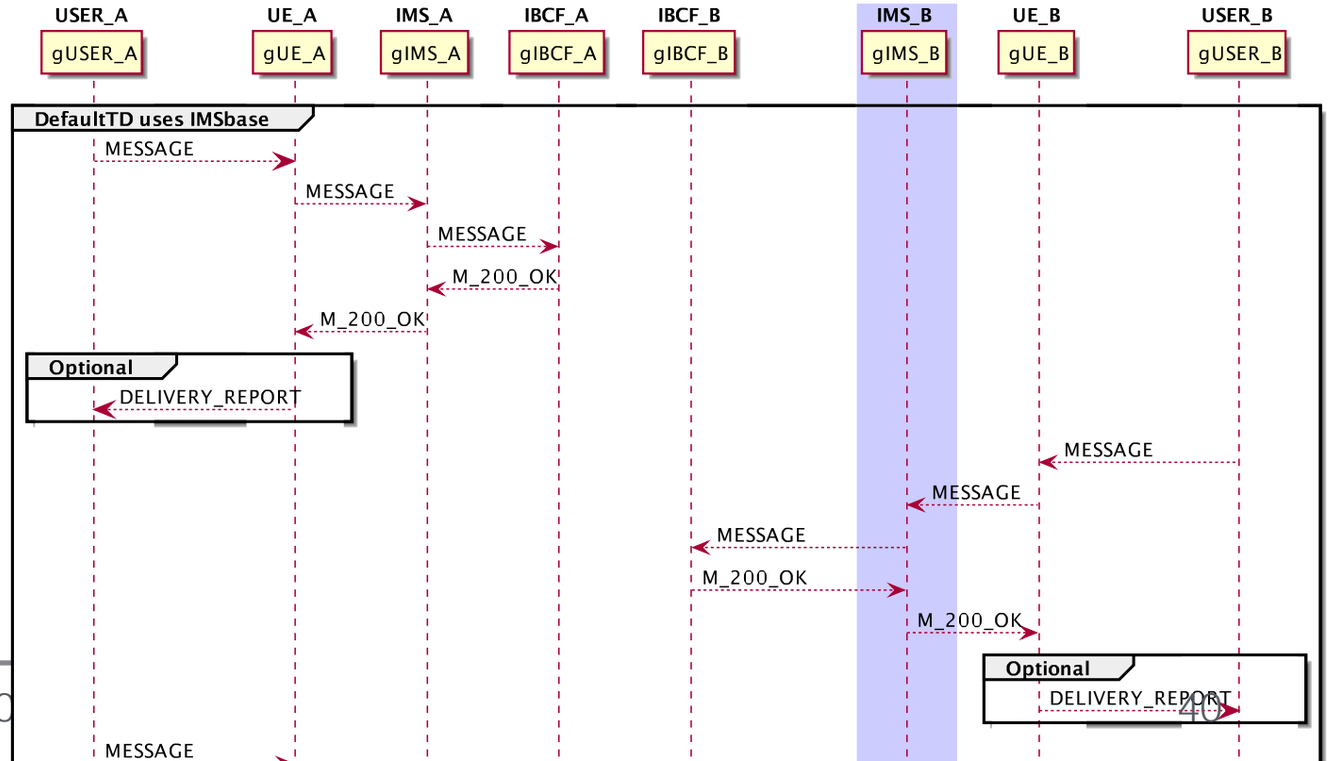
Task 1: Sub-configurations Example

- Extracted sub-configuration









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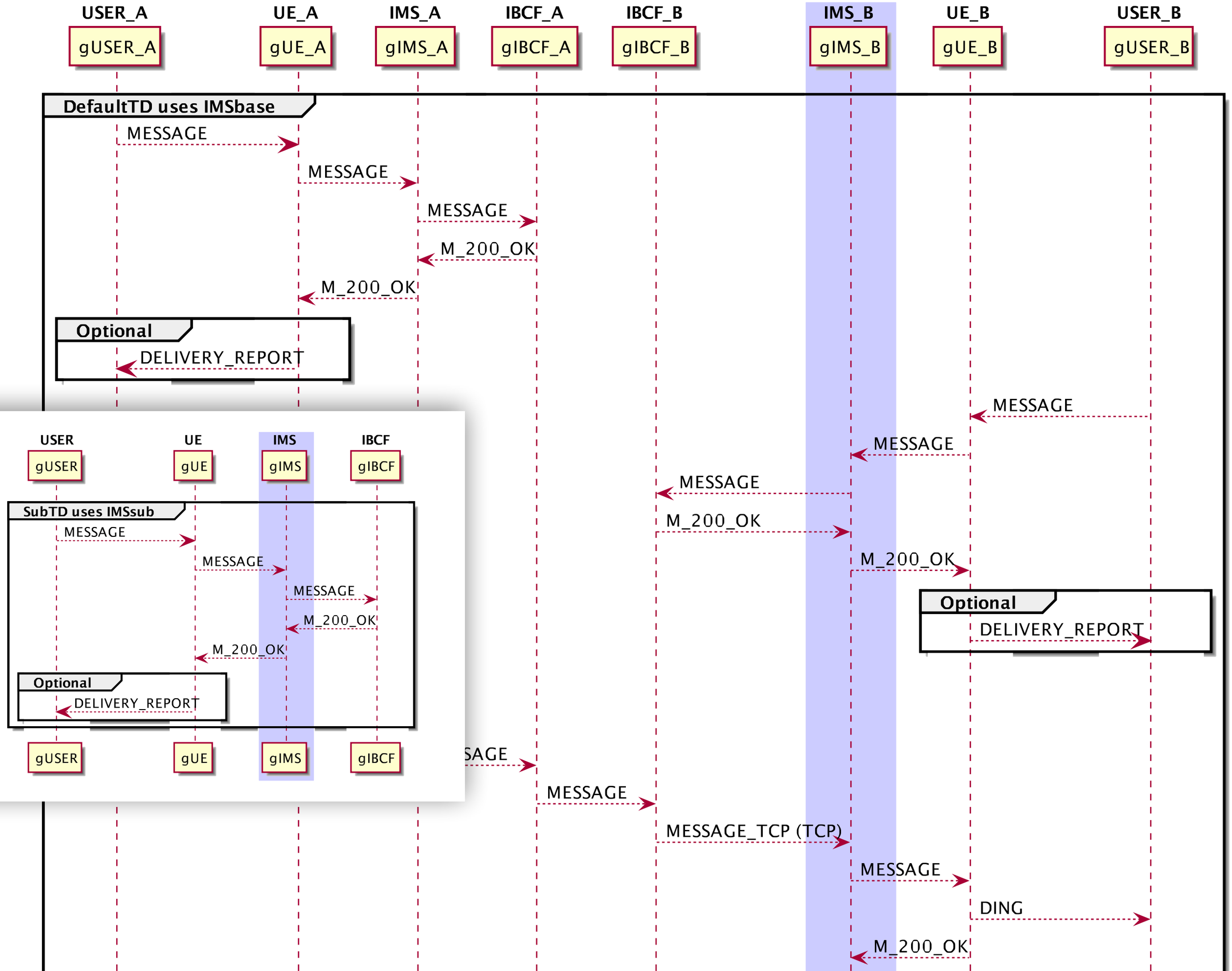
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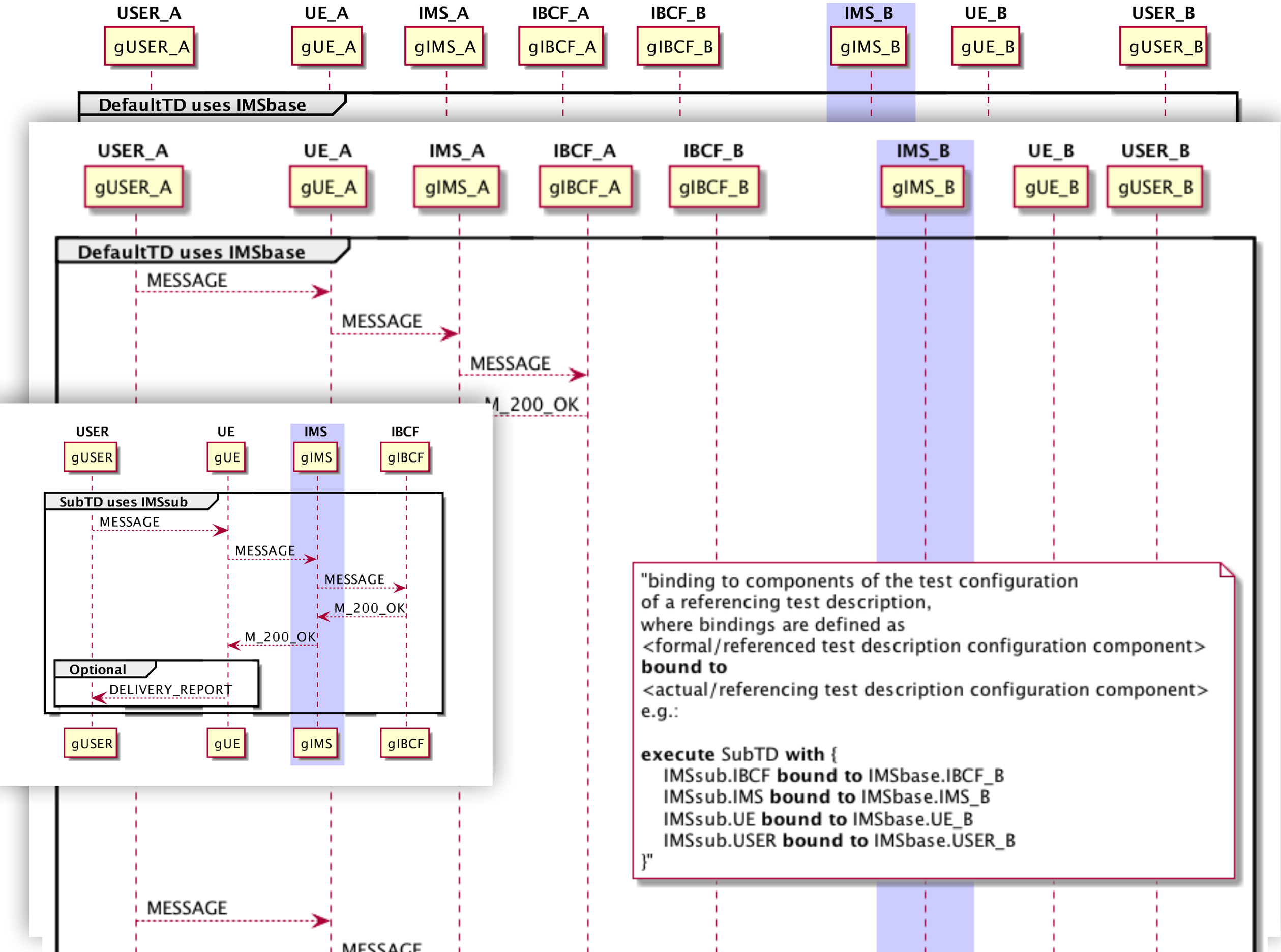
UE_A
IMS_A
IBCF_A
IBCF_B
IMS_B
UE_B
USER_B
gUSER_A
gUE_A
gIMS_A
gIBCF_A
gIBCF_B
gIMS_B
gUE_B
gUSER_B
DefaultTD uses IMSbase
MESSAGE
MESSAGE
MESSAGE
M_200_OK
M_200_OK
Optional
DELIVERY_REPORT
MESSAGE
MESSAGE
MESSAGE
M_200_OK
M_200_OK
Optional
DELIVERY_REPORT
SAGE
MESSAGE
MESSAGE_TCP (TCP)
MESSAGE
DING
M_200_OK
USER
UE
IMS
IBCF
gUSER
gUE
gIMS
gIBCF
SubTD uses IMSsub
MESSAGE
MESSAGE
MESSAGE
M_200_OK
M_200_OK
Optional
DELIVERY_REPORT
gUSER
gUE
gIMS
gIBCF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IMS_A
IBCF_A
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UE_B
USER_B
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gUE_A
gIMS_A
gIBCF_A
gIBCF_B
gIMS_B
gUE_B
gUSER_B
DefaultTD uses IMSbase
MESSAGE
MESSAGE
MESSAGE
M_200_OK
USER
UE
IMS
IBCF
gUSER
gUE
gIMS
gIBCF
SubTD uses IMSsub
MESSAGE
MESSAGE
MESSAGE
M_200_OK
M_200_OK
Optional
DELIVERY_REPORT
"binding to components of the test configuration
of a referencing test description,
where bindings are defined as
<formal/referenced test description configuration component>
bound to
<actual/referencing test description configuration component>
e.g.:
execute SubTD with {
IMSsub.IBCF bound to IMSbase.IBCF_B
IMSsub.IMS bound to IMSbase.IMS_B
IMSsub.UE bound to IMSbase.UE_B
IMSsub.USER bound to IMSbase.USER_B
}"
MESSAGE
MESSAGE

Any Other Business?

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Backup Slides

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Task 0: Resource Allocations

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STF 476: Resource Allocation and Contracts for 2014

Initial contracts (15 Feb - 30 Sep) to be extended in May (MTS#62) (management/editing not accounted for)

		Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
	Project management / Editing		3	3			6	6	0
	Task 1: Extended TDL meta-model	15	15		15		45	60	15
	Task 2: TDL graphical syntax	15	15	15	15		60	84	24
	Task 4: Analysis TDL textual syntax			10			10	10	0
	Task 3: TDL exchange format						0	48	48
	Total	**30**	**30**	**25**	**30**	**0**	**115**	**208**	**93**

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STF 476: Resource Allocation and Contracts for 2014

Initial contracts (15 Feb - 30 Sep) to be extended in May (MTS#62) (management/editing not accounted for)

		Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
	Project management / Editing		3	3			6	6	0
	Task 1: Extended TDL meta-model	15	15		15		45	60	15
	Task 2: TDL graphical syntax	15	15	15	15		60	84	24
	Task 4: Analysis TDL textual syntax			10			10	10	0
	Task 3: TDL exchange format						0	48	48
	Total	**30**	**30**	**25**	**30**	**0**	**115**	**208**	**93**

Complete contracts (15 Feb - 31 Jan) to be extended in May (MTS#62) (including management/editing allocations)

		Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
	Project management / Editing	1	1	4			6	6	0
	Task 1: Extended TDL meta-model	15	25	8	15	7	70	60	-10
	Task 2: TDL graphical syntax	28	18	15	23	10	94	84	-10
	Task 4: Analysis TDL textual syntax			10			10	10	0
	Task 3: TDL exchange format			10	5	13	28	48	20
	Total	**44**	**44**	**47**	**43**	**30**	**208**	**208**	**0**

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STF 476: Resource Allocation and Contracts for 2014

Initial contracts (15 Feb - 30 Sep) to be extended in May (MTS#62) (management/editing not accounted for)

		Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
	Project management / Editing		3	3			6	6	0
	Task 1: Extended TDL meta-model	15	15		15		45	60	15
	Task 2: TDL graphical syntax	15	15	15	15		60	84	24
	Task 4: Analysis TDL textual syntax			10			10	10	0
	Task 3: TDL exchange format						0	48	48
	Total	**30**	**30**	**25**	**30**	**0**	**115**	**208**	**93**

Complete contracts (15 Feb - 31 Jan) to be extended in May (MTS#62) (including management/editing allocations)

		Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
	Project management / Editing	1	1	4			6	6	0
	Task 1: Extended TDL meta-model	15	25	8	15	7	70	60	-10
	Task 2: TDL graphical syntax	28	18	15	23	10	94	84	-10
	Task 4: Analysis TDL textual syntax			10			10	10	0
	Task 3: TDL exchange format			10	5	13	28	48	20
	Total	**44**	**44**	**47**	**43**	**30**	**208**	**208**	**0**

Extended contracts (01 May - 31 Jan) to be extended in May (MTS#62) (including management/editing allocations)

		Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
	Project management / Editing	1	1	4	0	0	6	6	0
	Task 1: Extended TDL meta-model	0	10	8	0	7	25	60	35
	Task 2: TDL graphical syntax	13	3	0	8	10	34	84	50
	Task 4: Analysis TDL textual syntax	0	0	0	0	0	0	10	10
	Task 3: TDL exchange format	0	0	10	5	13	28	48	20
	Total	**14**	**14**	**22**	**13**	**30**	**93**	**208**	**115**

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STF 476: Preliminary Ressource Allocations During Preparatory Meeting

	Support		Edit coord	Leader			Days		
	Expert	Gusztav	Andreas	Philip	Martti	Marc-Florian	Alloc.	Required	Conting.
							0		0
M0	Start of work						0		0
T0	Project management			3			3	3	0
T0	Editing coordination	1	1	1			3	3	0
T1	Task 1: Extended TDL meta-model	20	20		20		60	60	0
T2	Task 2: TDL graphical syntax	25	25	15	15		80	84	4
T4	Task 4: Analysis TDL textual syntax			10			10	10	0
M1	Early draft for review						0		0
T3	Task 3: TDL exchange format			10	5	10	25	48	23
M2	Stable draft for review						0		0
M3	Final draft for TB approval						0		0
M4	Publication			0	0		0		0
Prog Rep	**Progress Report MTS#62**						0		0
Prog Rep	**Progress Report MTS#63**						0		0
Fin Rep	**Final Report MTS#64**						0		0
	Total	**45**	**48**	**38**	**40**	**10**	**181**	**208**	**27**

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STF 476: Rough Overall Resource Planning and Allocation for 2014

Description	Goals	4-day Sessions	5-day Sessions	Experts
First Session (Feb 2014)	Kick off, Post Phase 1, Prep M1	16	16	4
Homework and coordinated sessions				
Second Session (Apr 2014)	Finalise M1: Early Drafts	16	20	4
Finalisation homework if needed				
Third Session (Jun 2014)	Post M1, Prep M2, MFW available	20	25	5
Homework and coordinated sessions				
Fourth Session (Sep 2014)	Finalise M2: Stable Drafts	20	25	5
Finalisation homework if needed				
Fifth Session (Oct/Nov 2014)	Post M2, Prep M3	20	25	5
Homework and coordinated sessions				
Sixth Session (Dec 2014)	Finalise M3: Final Drafts	20	25	5
Finalisation homework if needed				
Milestone 1	April 2014	32	36	
Milestone 2	September 2014	40	50	
Milestone 3	December 2014	40	50	
Average resources per milestone		69,3	69,3	
Average contingency per milestone	For homework / session extension	32,0	24,0	
Contingency per milestone per expert	For homework / session extension	6,4	4,8	
Planned / used resources		**112**	**136**	
Total resources available		**208**	**208**	
Contingency		**96**	**72**	
Per homework session (all experts)		**16**	**12**	

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Task 0: Risks

- Internal / Operational risks
  - Task (inter-)dependencies hinder progress due to distributed work
  - Misunderstandings and communication barriers hinder progress
  - Misalignment of expectations towards the STF
- External risks
  - Lack of essential tool support considered a limiting factor
  - Lack of user base and technical challenges raise barrier to entry

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Task 0: Operational Risks

- Task (inter-)dependencies hinder progress due to distributed work
  - Severity: Medium, Likelihood: Low
  - Mitigation strategies
    - limit dependencies where possible
    - make dependencies explicit where these are inevitable in order to raise awareness
    - ensure communication and collaboration among experts working on inter-dependent tasks
    - reassign experts where applicable

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Task 0: Operational Risks

- Misunderstandings and communication barriers hinder progress
  - Severity: Medium, Likelihood: Medium
  - Mitigation strategies
    - recognise and differentiate between misunderstandings and technical disagreements
    - emphasis on facts, substantiated with examples
    - identify fundamental differences between alternative proposals and their impact
    - resolve persistent disagreements with the steering group

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Task 0: Operational Risks

- Misalignment of expectations towards the STF
  - Severity: Medium, Likelihood: Medium
  - Mitigation strategies
    - frequent reporting and technical discussions with the steering group
    - expectations perceived to be unrealistic communicated back to the steering group
    - concrete examples to support technical discussions and ensure aligned expectations

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Task 0: User Acceptance Risks

- Lack of essential tool support considered a limiting factor
  - Severity: High, Likelihood: Medium
  - Mitigation strategies
    - means to use and access the language need to be provided early on
    - early drafts need to be discussed and aligned with users' needs
    - simplified initial interface to TDL may be favourable (Task 4)
    - integration in existing processes and awareness among potential users (board report, collaboration with CTI)

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Task 0: Tool Vendor Adoption Risks

- Lack of user base and technical challenges raise barrier to entry
  - Severity: High, Likelihood: Medium
  - Mitigation strategies
    - awareness and collaboration with users seeks to create initial demand
    - early prototypical validation seeks to create a sound technical foundation and reduce inherent technical challenges
    - participating commercial and in-house tool vendors assure that their perspectives are considered in the design and execution of the standards

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Task 2: Diagram Definition Summary

- Kinds of graphical syntax information
  - User can control — Diagram Interchange (DI)
    - position of nodes, interconnections
    - interchangeable between tools
  - Defined by language standard — Diagram Graphics (DG)
    - shape, style of symbol
    - not interchangeable, shall be identical and is known a priori
- Common basic elements, types — Diagram Common (DC)

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Task 2: Diagram Definition Architecture

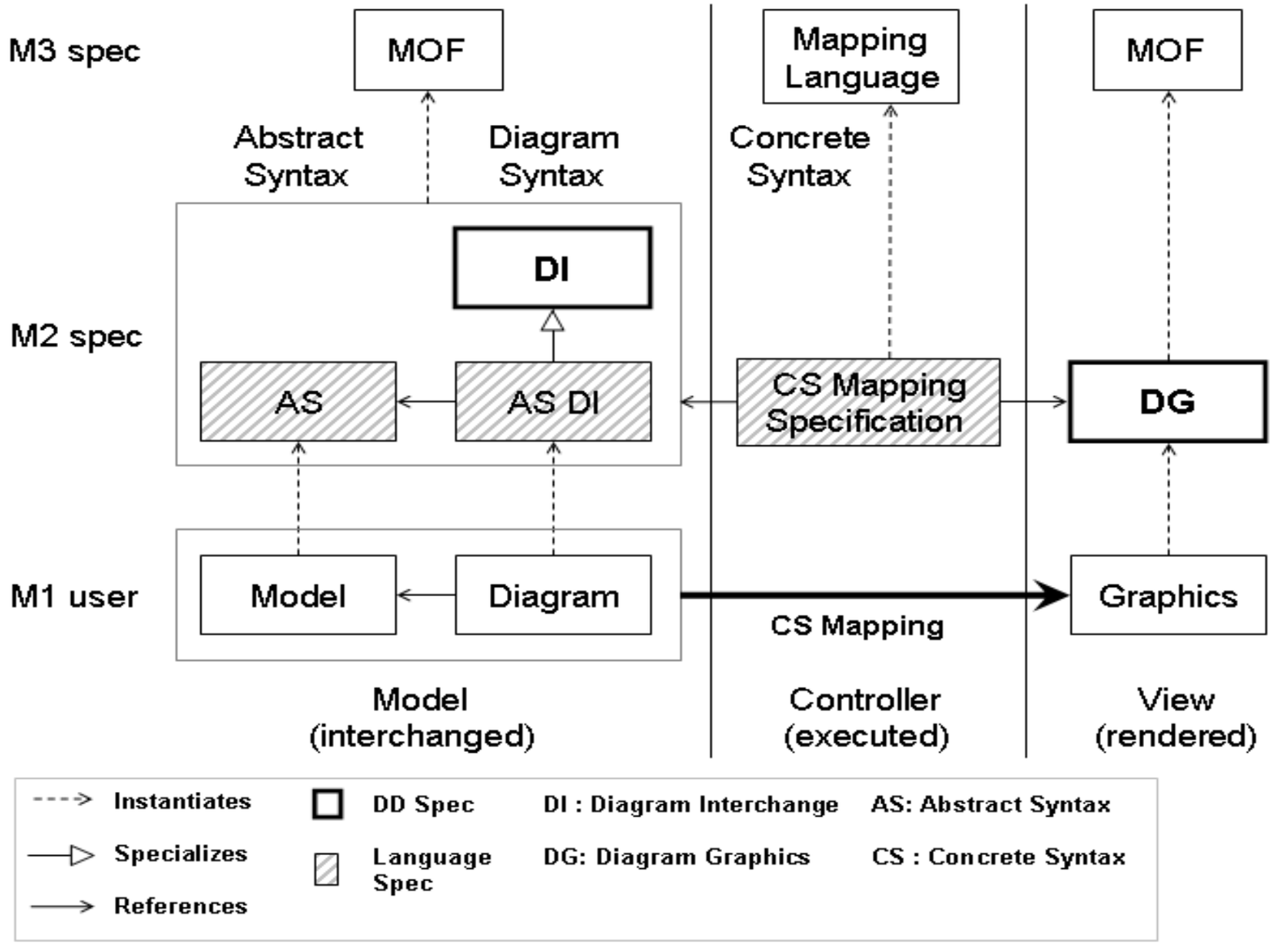

Figure 7.1 - Diagram Definition Architecture

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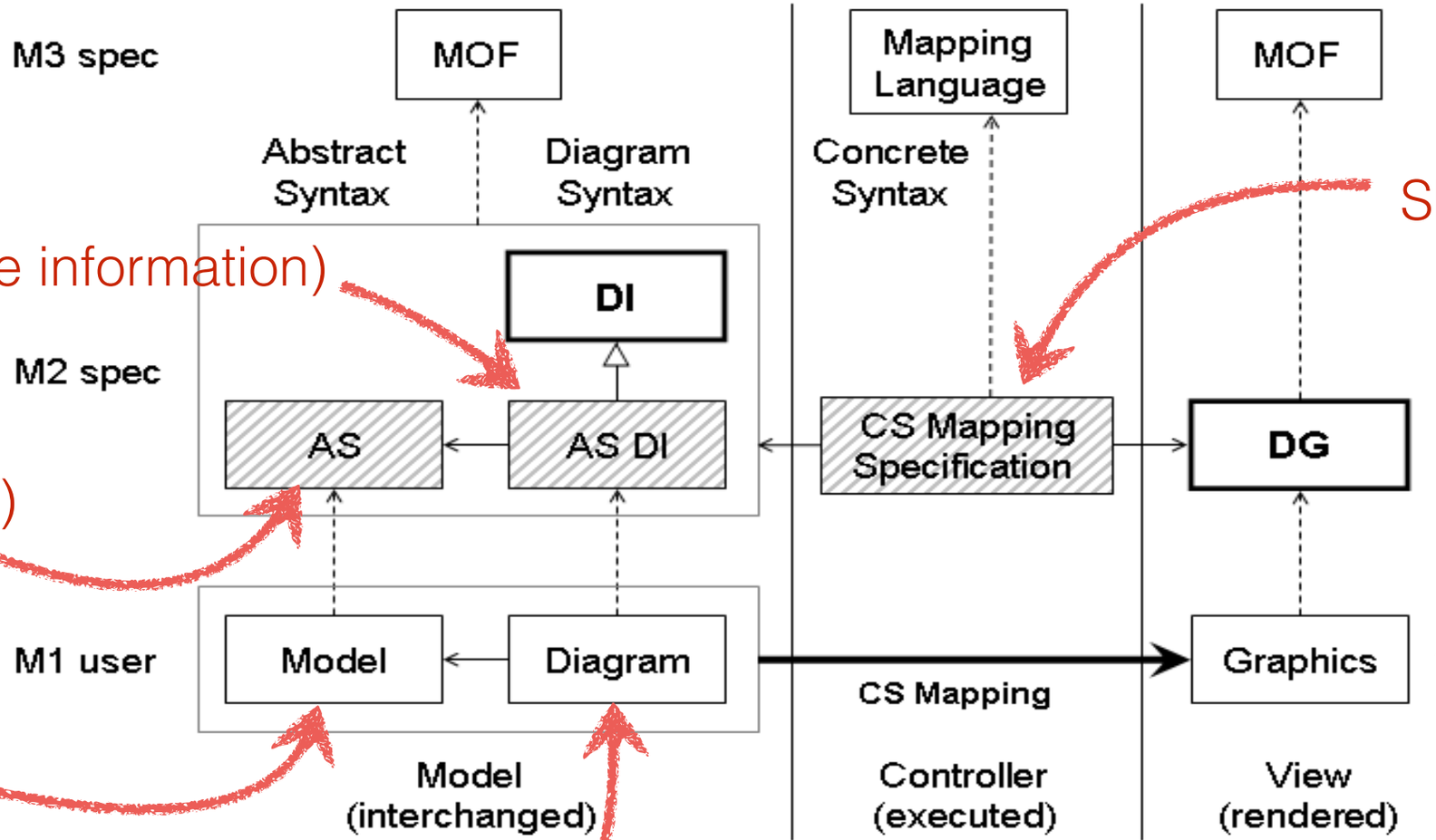
Task 2: Diagram Definition Architecture



Meta-model (interchangeable information)

Shape, style, etc. definitions

Meta-model (abstract syntax)

User Model

User Model layout

Graphical language elements

Figure 7.1 - Diagram Definition Architecture

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Task 2: Diagram Definition UML

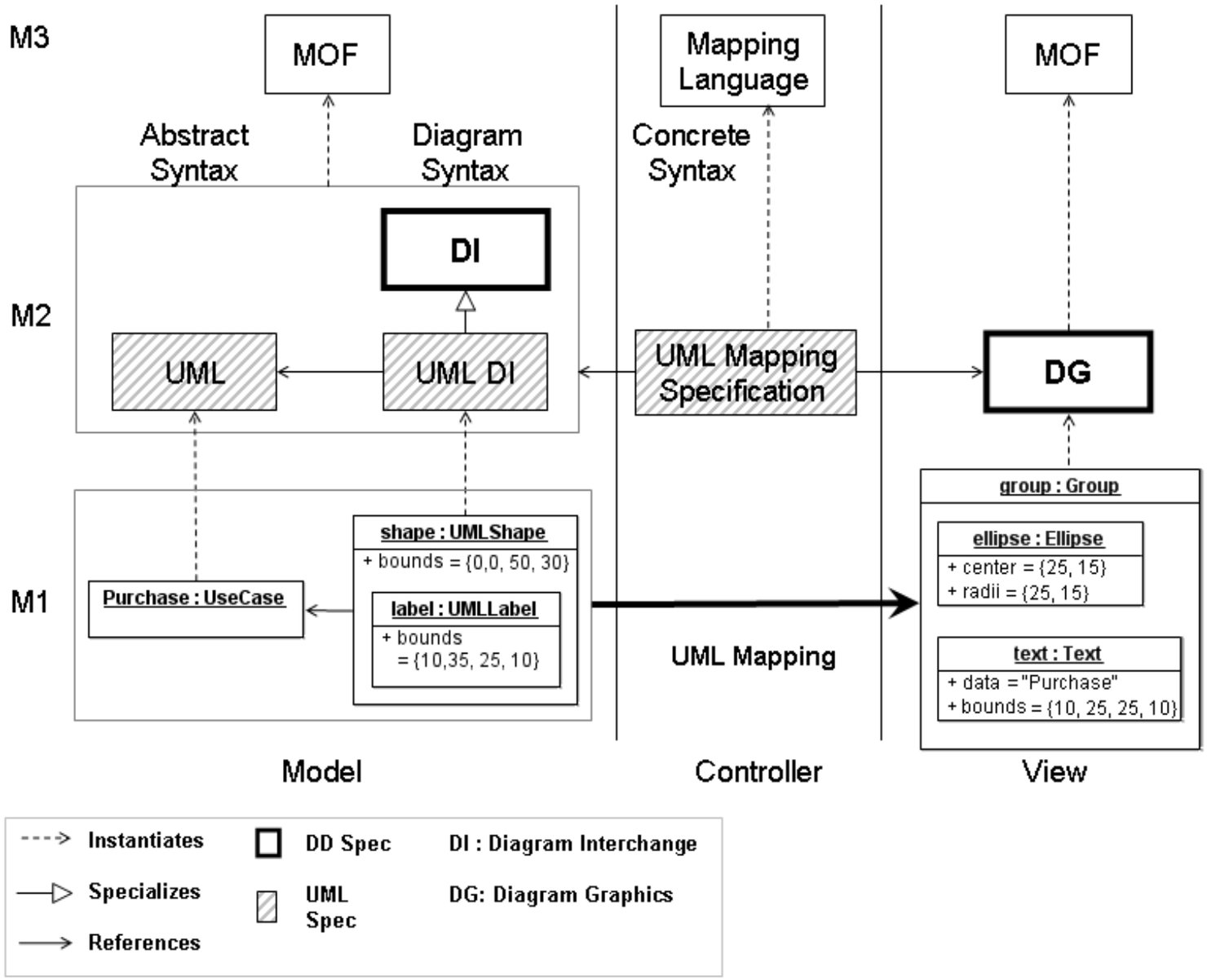

Figure 7.2 - Example of Diagram Definition Architecture For UML

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Task 2: Diagram Definition TDL

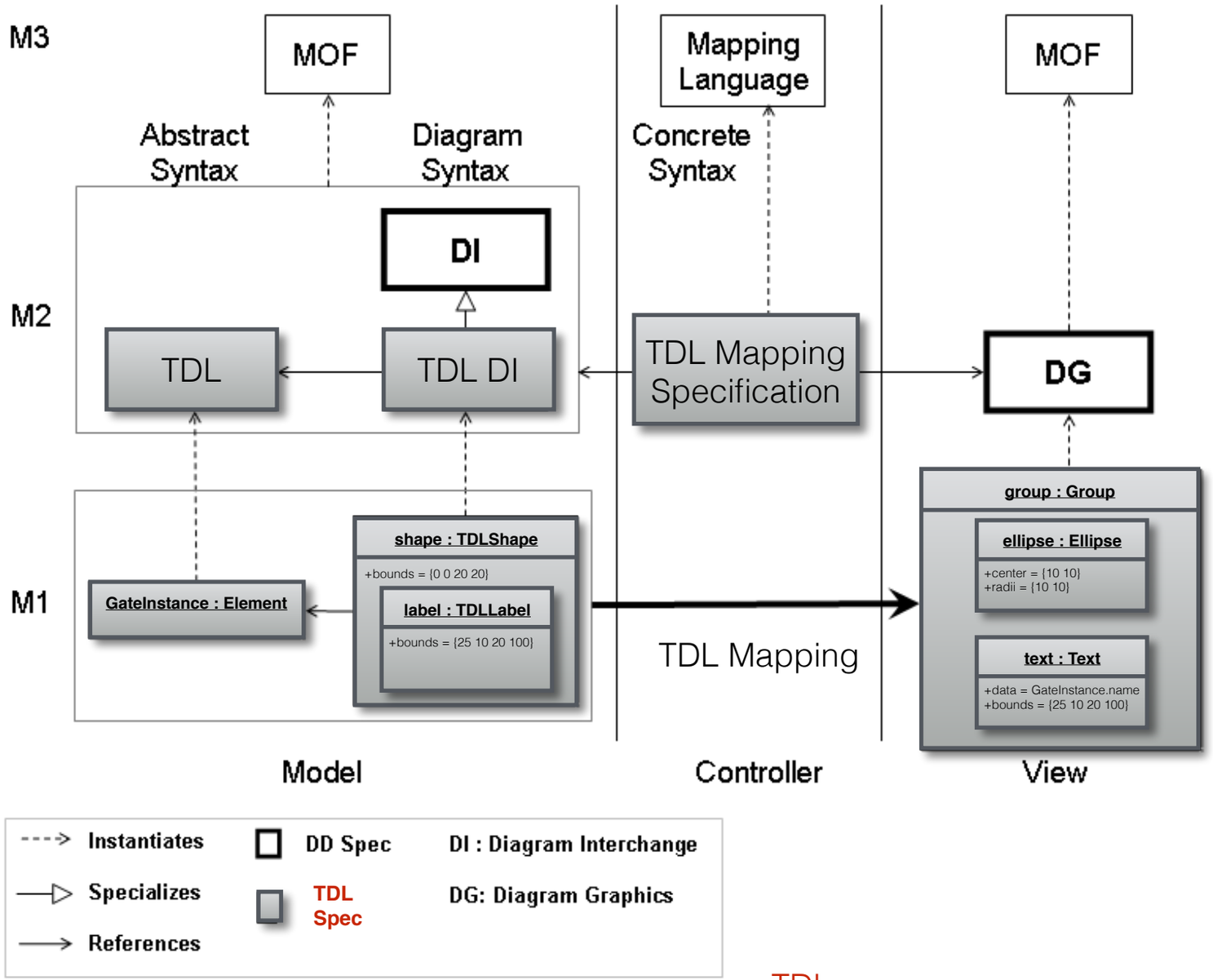

Figure 7.2 - Example of Diagram Definition Architecture For ~~UML~~ TDL

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Task 2: Diagram Definition TDL

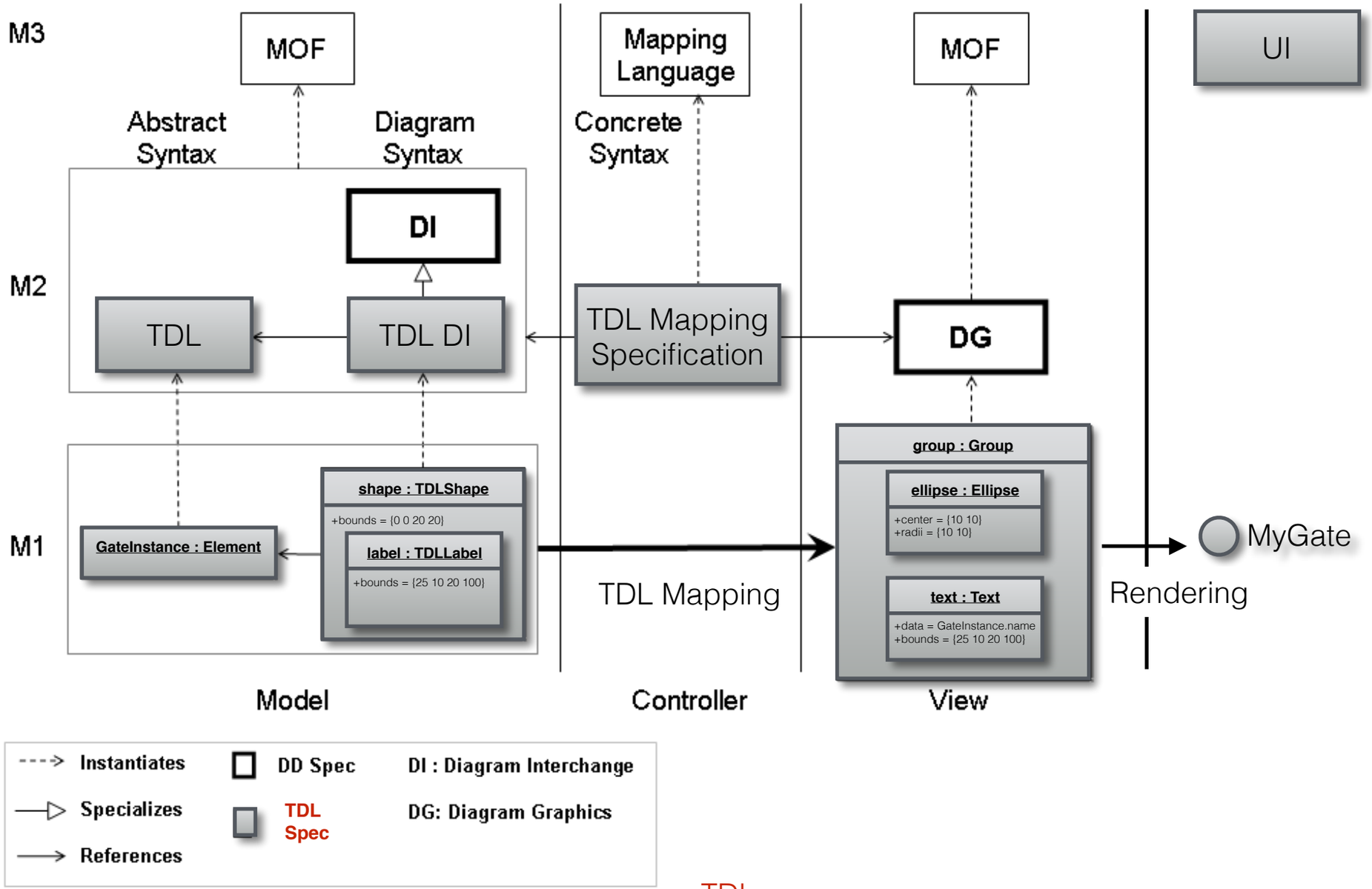

Figure 7.2 - Example of Diagram Definition Architecture For ~~UML~~ TDL

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Task 0: STF Process

- Define and set target goals for milestone
  - distributed among experts based on task responsibilities
  - approved by STF
- Execute and refine goals
  - analysis
  - implementation
  - validation

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Task 0: Execution

- Analysis
  - assigned expert understands goal and proposes a conceptual solution
  - STF approves conceptual solution
    - redo analysis and propose an improved conceptual solution in case of deficiencies
- Implementation
  - assigned expert implements the conceptual solution in the respective document

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Task 0: Execution

- Validation
  - STF reviews the implementation
  - prototypical realisation checks technical soundness where applicable
    - go back to implementation in case of minor deficiencies
    - go back to analysis in case of major deficiencies

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Task 1: Sub-Configurations

- Parameterisation-based approach (minor meta-model changes)
- Test Descriptions define their own local component instances
  - existing configurations and instances can be reused as copies
  - connections can be explicit (consistent) or implicit (convenient)
- Formal and actual component instances bound in references
  - binding concrete instances at reference time vs declaration time
  - m : n vs 1 : n relationships (configuration : test description)

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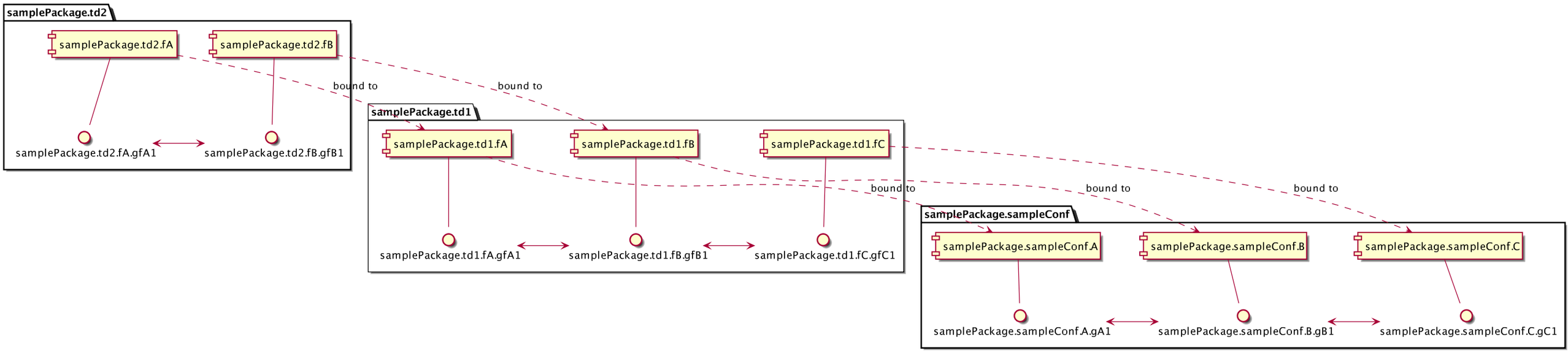

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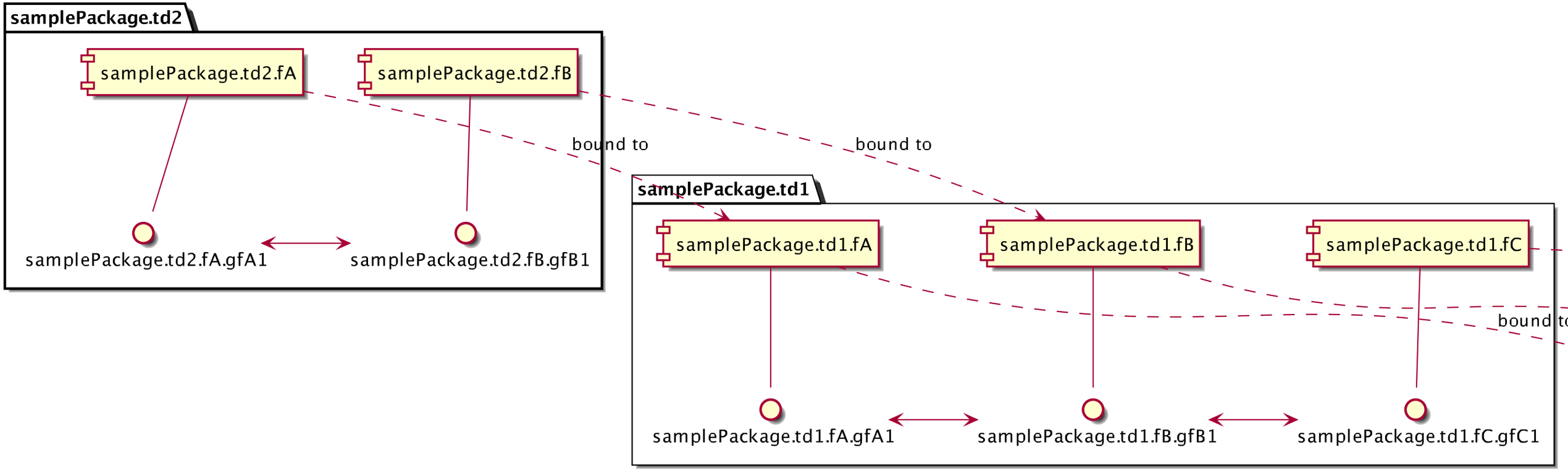

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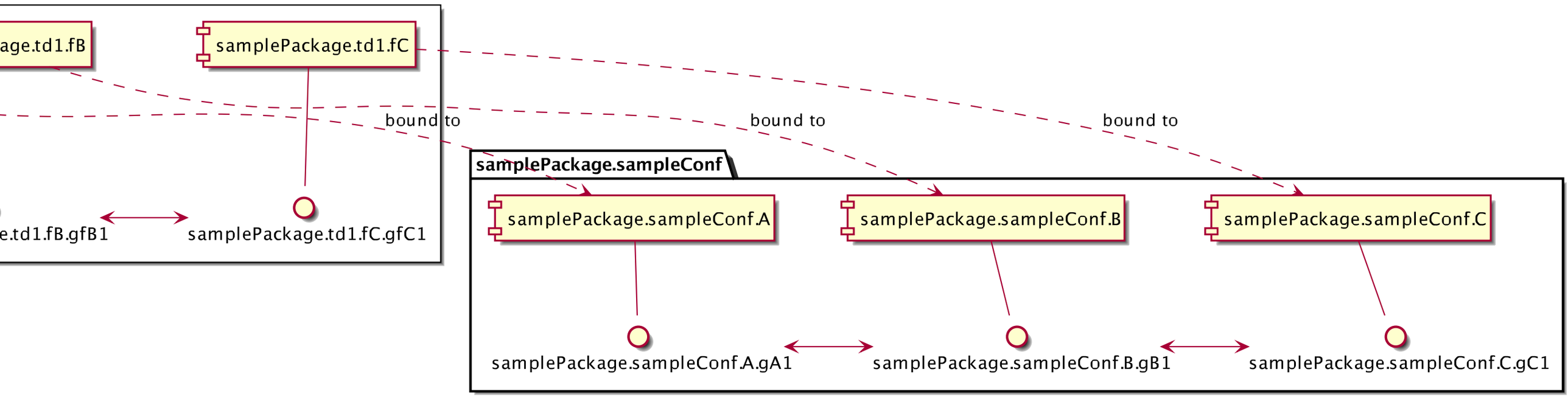

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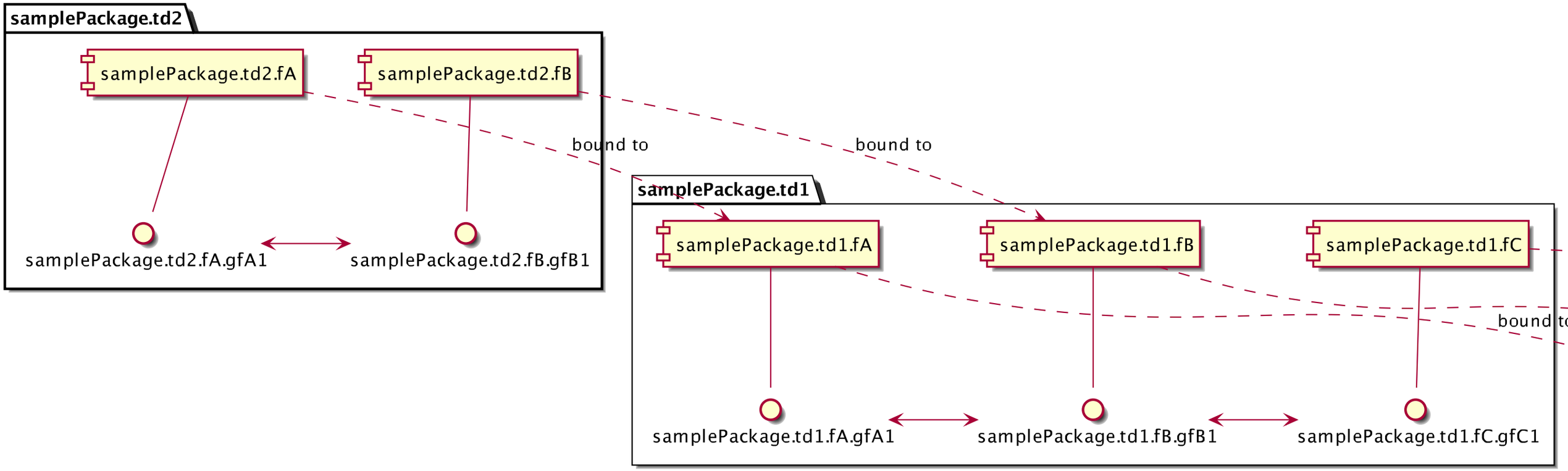

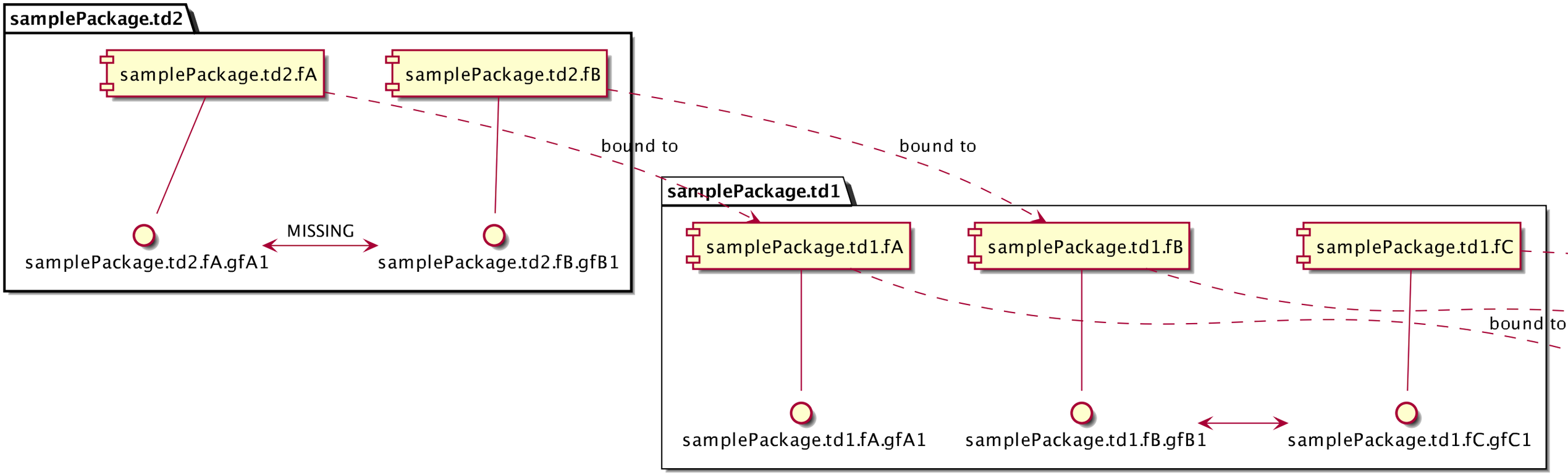

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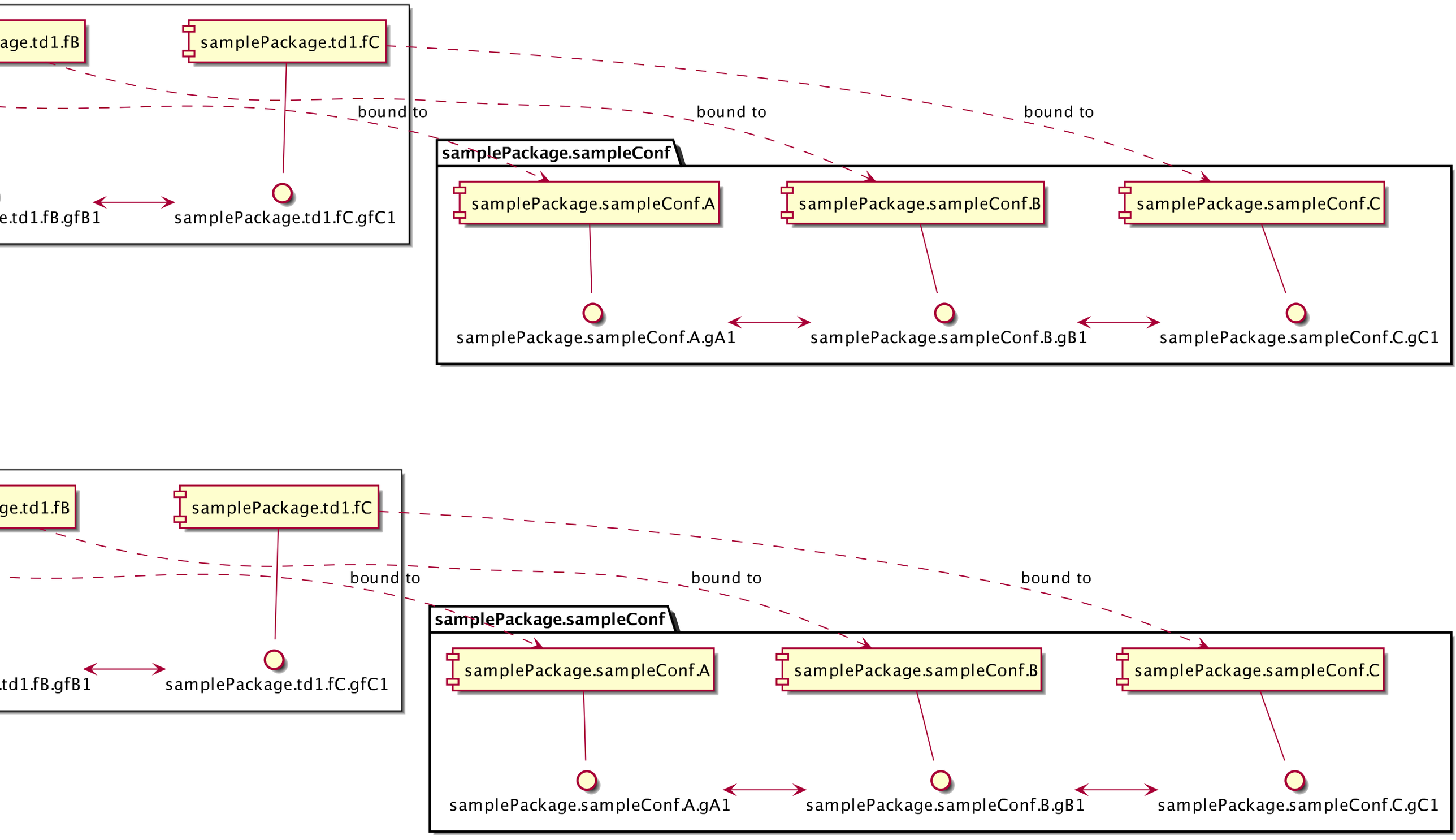

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Communication STF – SG

- Ensure overall direction of TDL design is OK
- Resolve deadlocks in STF internal discussions by providing guidance and advice
- Assist in developing a roadmap for TDL

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TDL Use Cases

U	Short Description	Example
A	TDL for documentation (incl. informal parts)	3GPP test specs
B	TDL for generation of tests that can be made executable (i.e. all parts are formal)	Automatic mapping of a TDL spec to partial TTCN-3 code
C	TDL for representation of generated tests (i.e. output from MBT tools)	Test cases generated from system models
D	TDL for representation of test logs	Test execution log of a TTCN-3 tool
E	TDL for test generation (i.e. input to MBT tools)	Test models as activity diagrams
F	TDL for performance testing	On-the-fly testing from a TDL spec
G	TDL for interoperability testing	Use case models, from which tests are derived

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TDL Feature Description Structure

- TDL feature name (title of sub-clause)
- Overview (covered in early draft)
  - Free description of the feature
- Abstract syntax
  - Representation of the feature and its elements in the meta-model
- Semantics
  - Preferably formal description of the semantics of the feature
- Constraints
  - Constraints on the feature that can be statically analysed
- Classifier description
  - Description of all elements contained in the meta-classes

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