

# A MDA-based Development Process for Collaborative Business Processes



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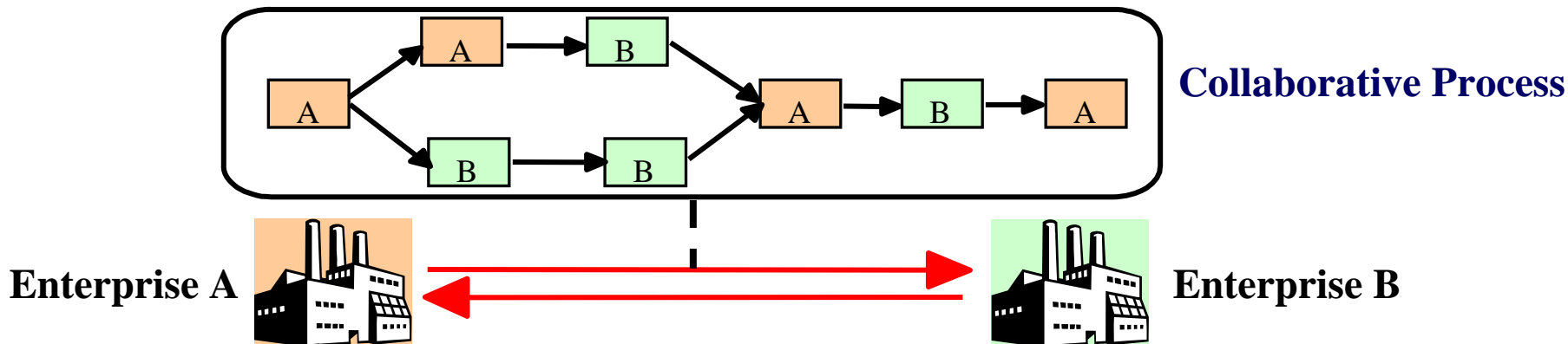
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## Collaborative Business Process

- It expands across several enterprises (partners)
- Defines the information exchange and the coordination of the activities among the partners
- Achieves a common business goal agreed by the partners
- Is defined and executed jointly among the partners
- Describes the global view of the collaboration





# Introduction: B2B Collaboration

**Business Level  
(Problem Domain)**

Collaborative Model (Business Model)

How to guarantee  
consistence  
between both  
levels?

Collaborative Business Processes

Development of  
B2B solutions is  
complex and costly

**Technological Level  
(Solution Domain)**

B2B Protocols

How to guarantee  
consistence  
between both  
specifications?

Specifications of Collaborative  
Business Processes

B2B Standard  
(e.g.: ebXML, BPEL, WS-CDL)

Partners' Interfaces of the  
B2B Information System



# Motivation

## MDA is a key enabler to support:

- The design of technology-independent collaborative processes
- Automatic generation of B2B specifications from conceptual collaborative process models

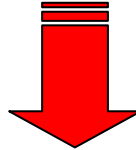
### Benefits:

- Increase of the abstraction level
- Reduction of development time and cost
- Guarantee of consistence on the generated technological solutions:
  - Consistence with the processes defined in the business level
  - Consistence among the specifications of processes and their corresponding partners' interfaces specifications.
- Reuse of collaborative process models
  - Independence of the collaborative process models from the B2B standards



# Contribution

- MDA does not provides the concrete guidelines, artifacts and techniques required for a particular application domain



## Contribution:

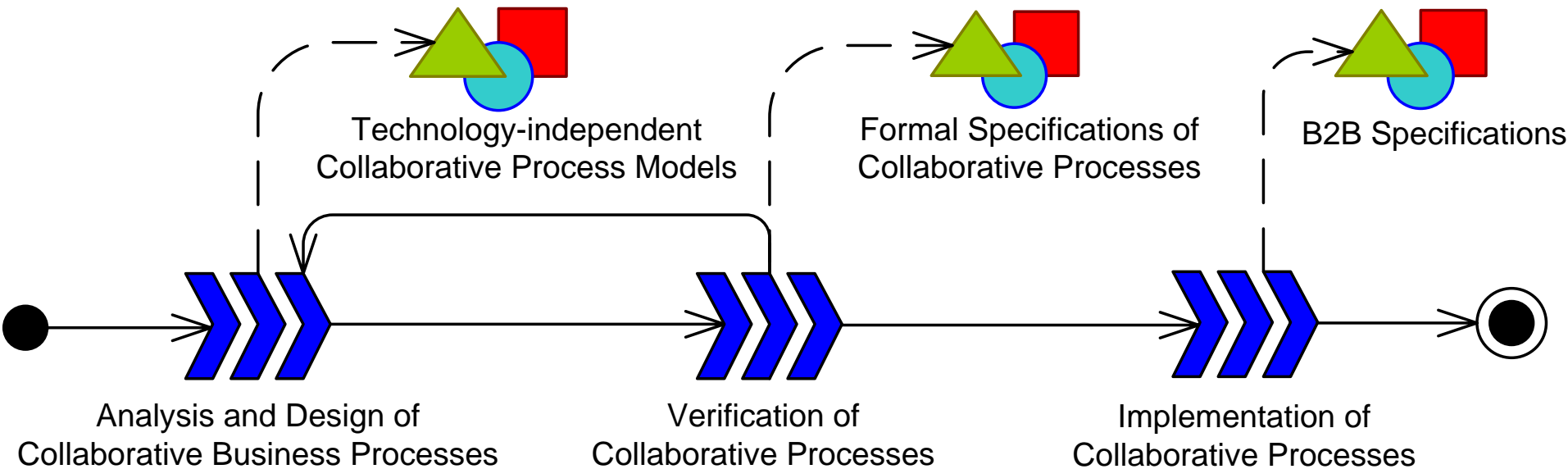
A MDA-based development process for the domain of *Collaborative Business Processes*:

- The *phases* to be carried out
- The *artifacts* to be built
- The *techniques* required to build the artifacts
- The *pattern of transformations* to be applied

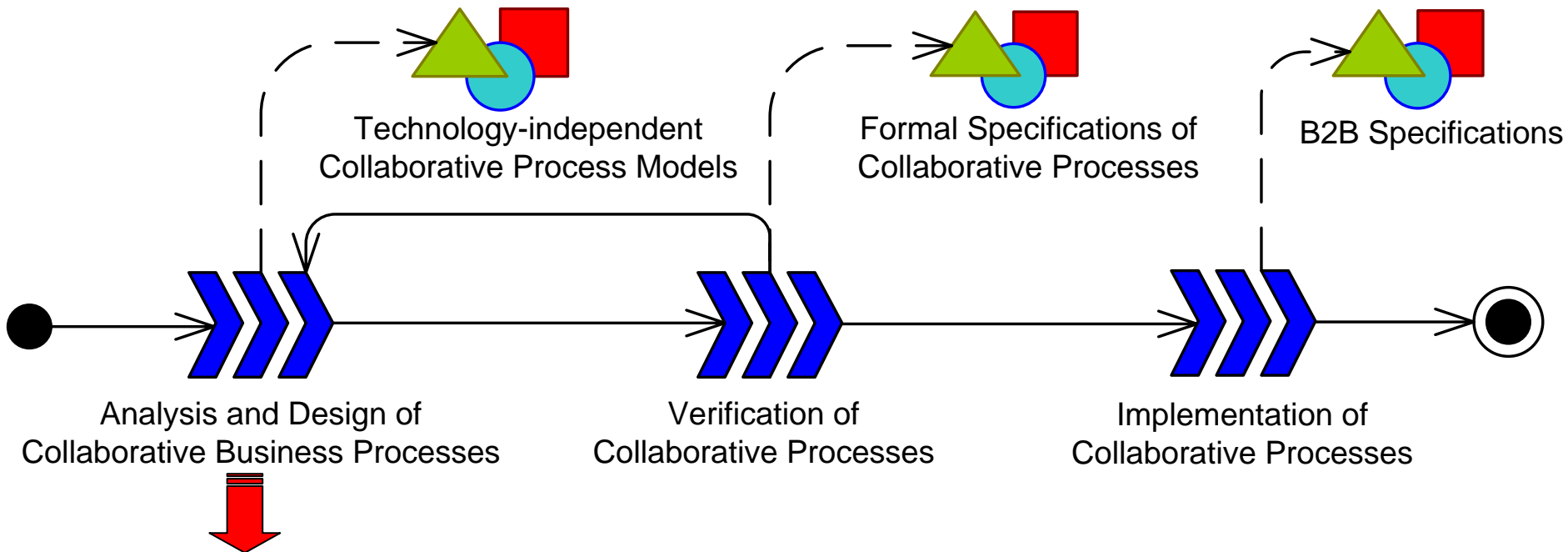


# The MDA-based Development Process

## Phases



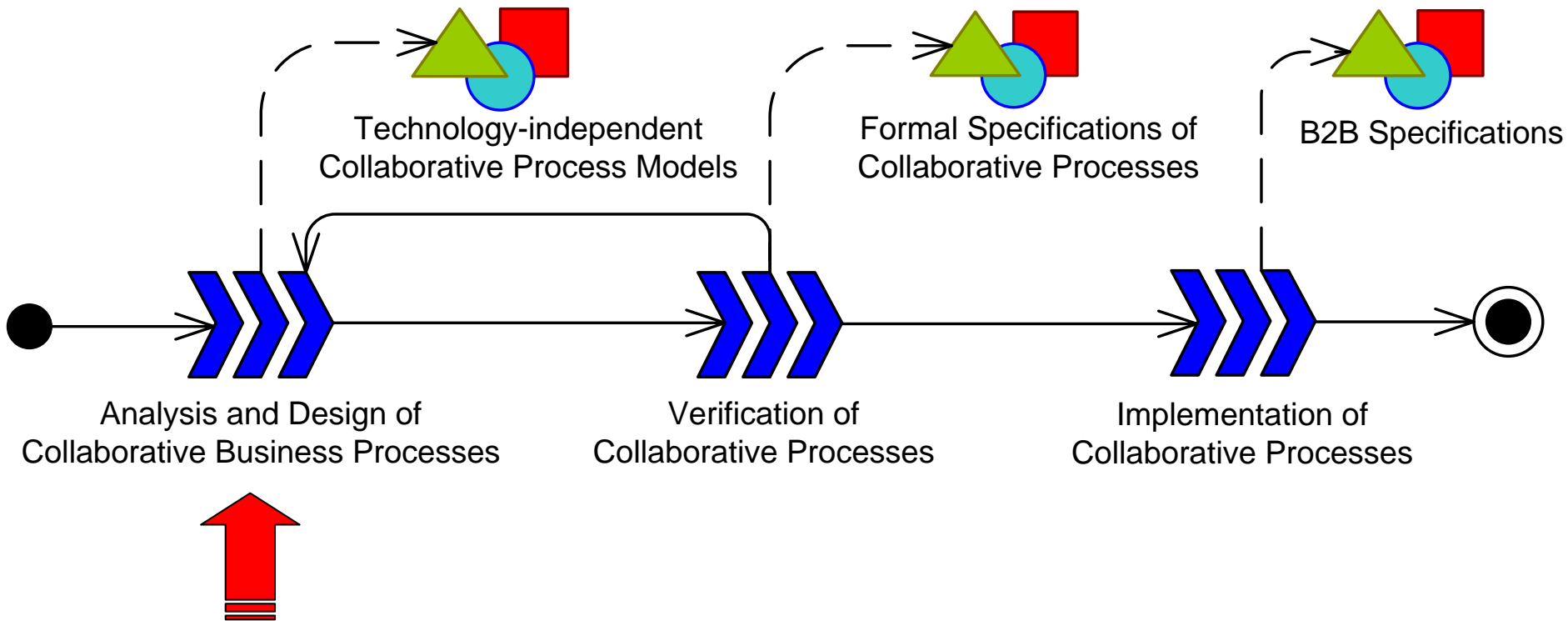
# Phase 1: Analysis and Design of Collaborative Business Processes



- **Purpose:** Modeling of collaborative processes from a business perspective of a B2B collaboration (independent of the technology)
- **Analysis:** identification of the business requirements and the collaborative processes of the B2B collaboration
- **Design:** definition of the behavior of the collaborative processes and the business interfaces of the partners



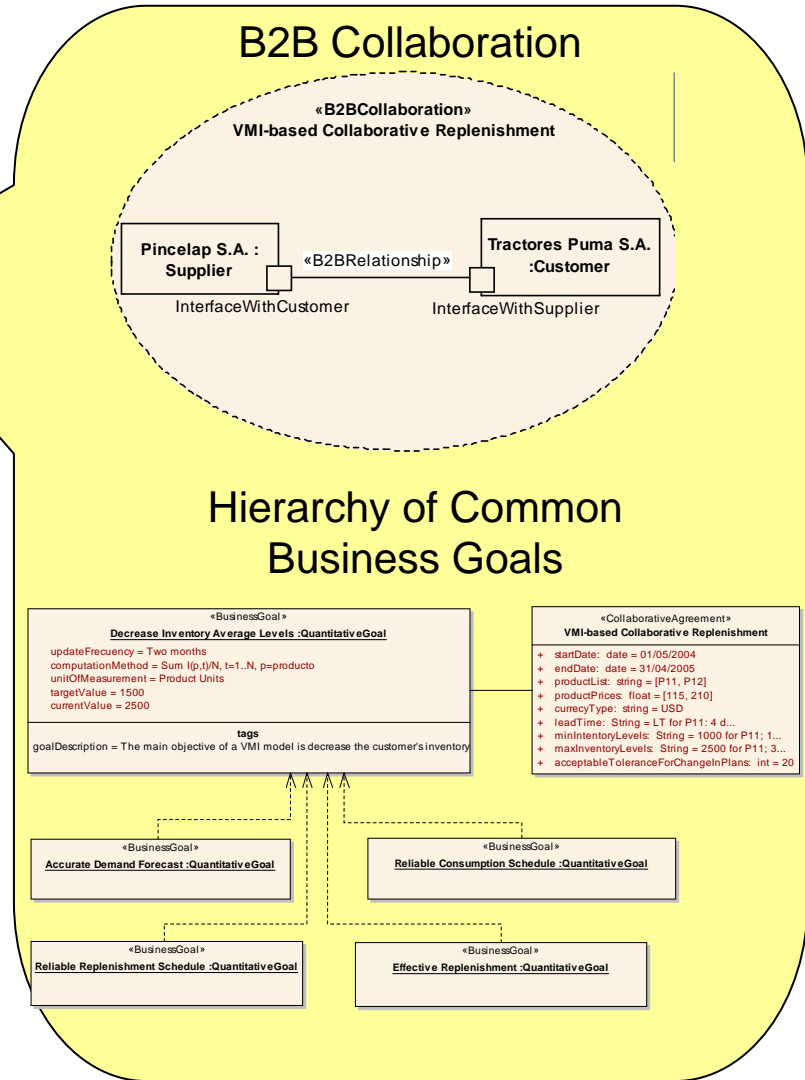
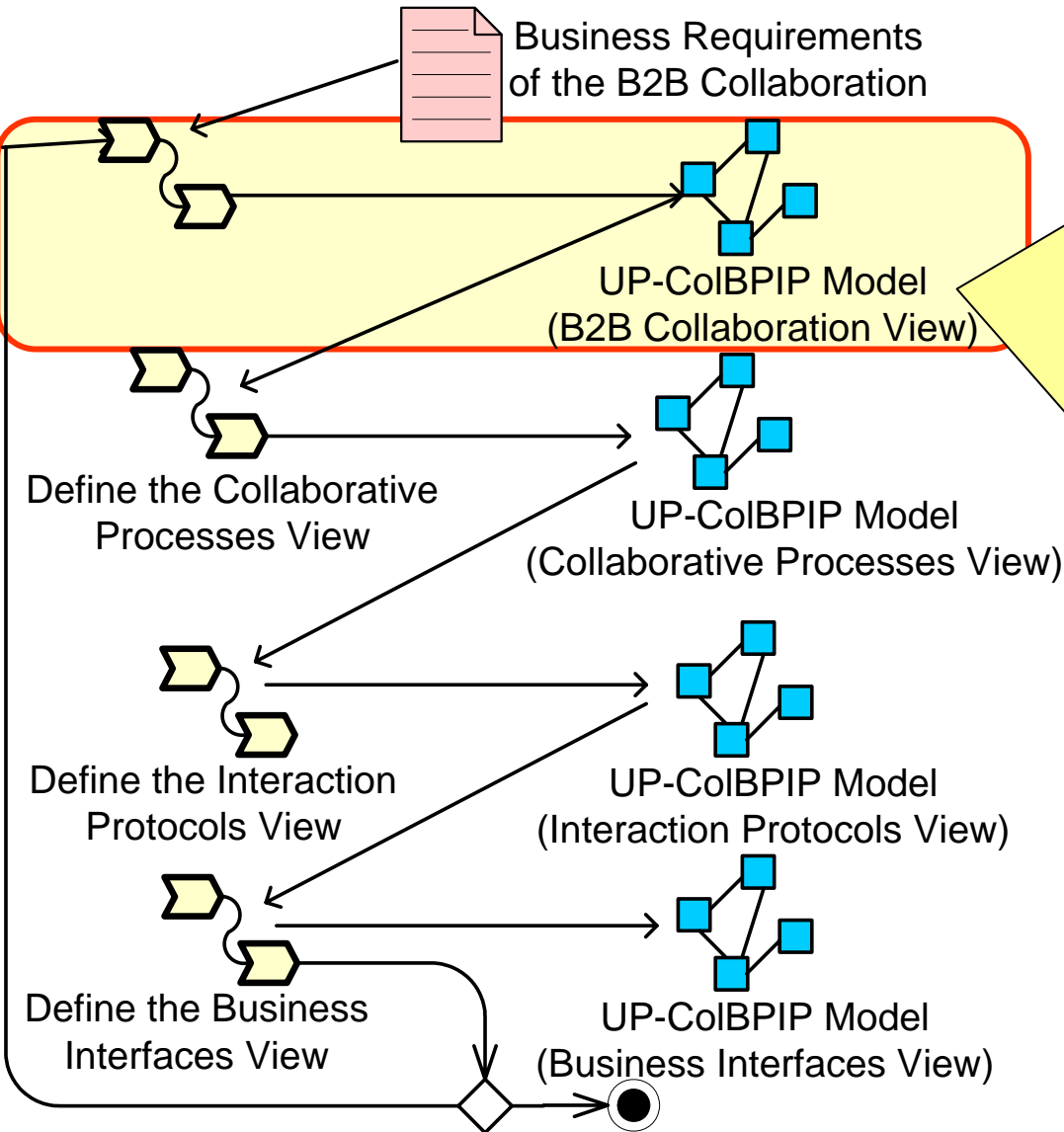
# Phase 1: Analysis and Design of Collaborative Business Processes



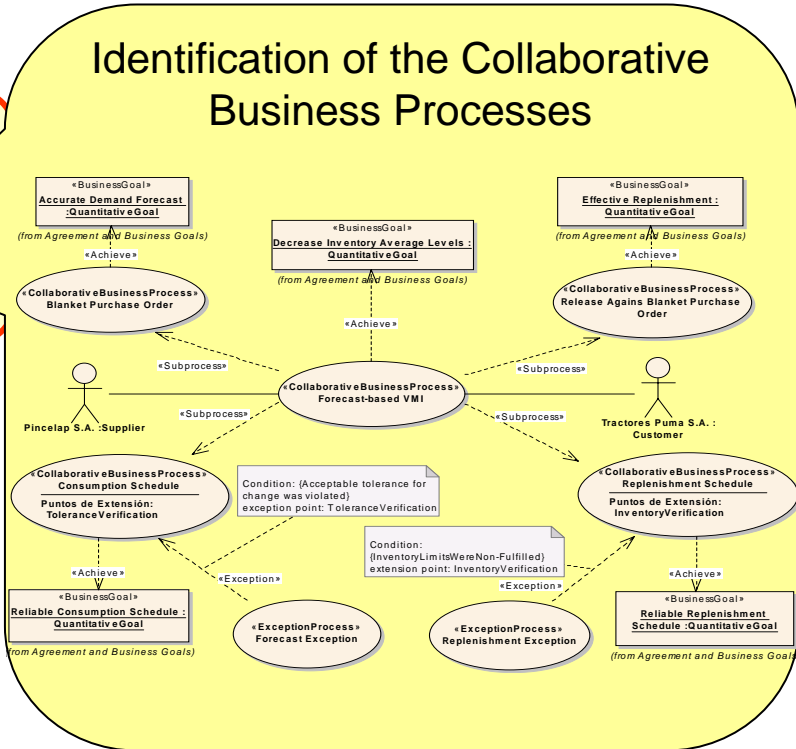
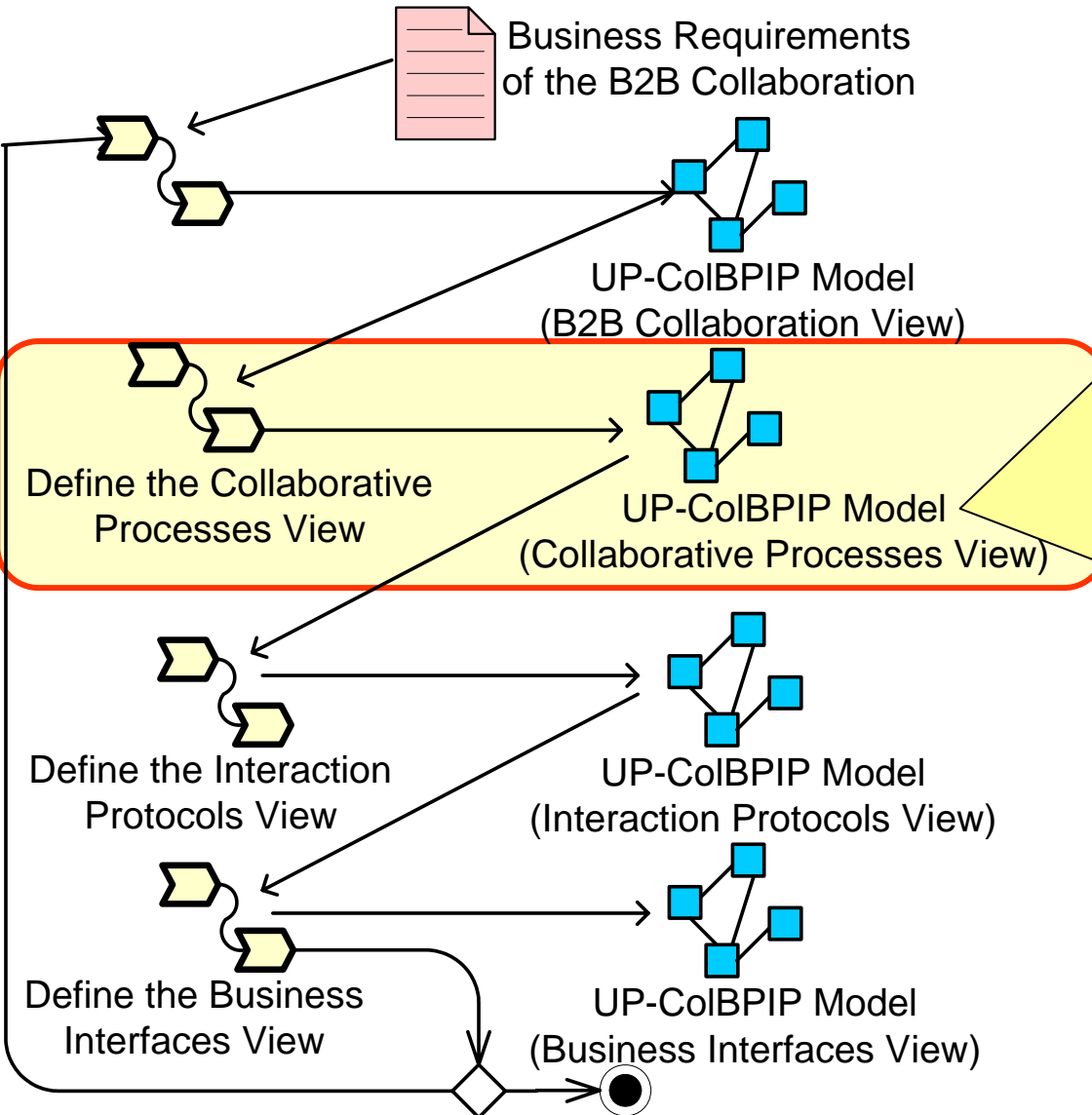
**UP-CoIBPIP:** UML Profile for Collaborative Business Processes based on Interaction Protocols



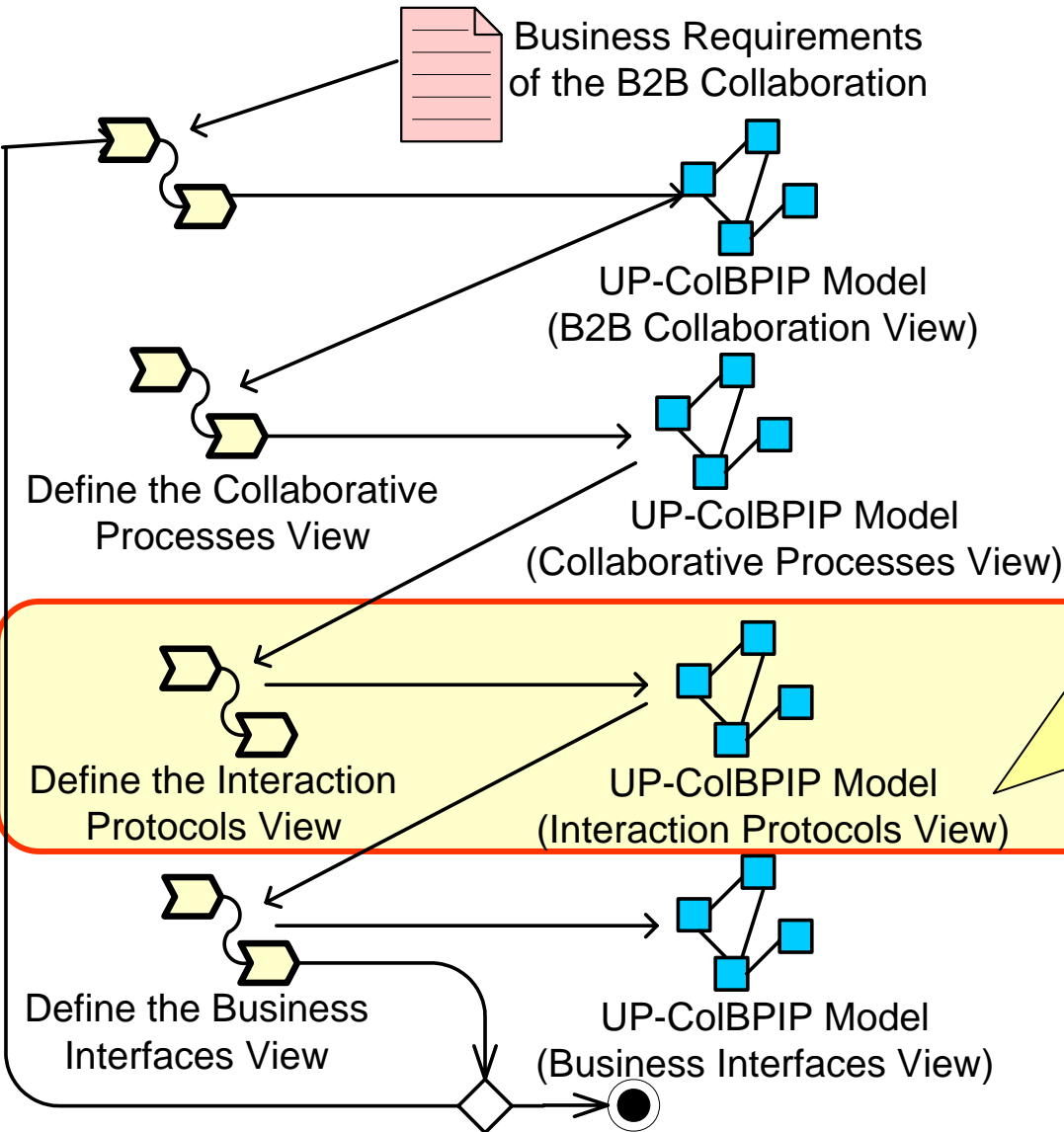
# Phase 1: UP-CoIBPIP Modeling Language



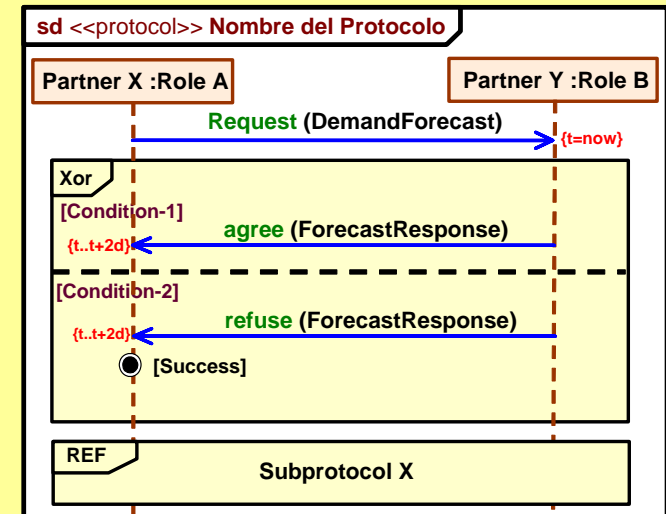
# UP-CoIBPIP Modeling Language



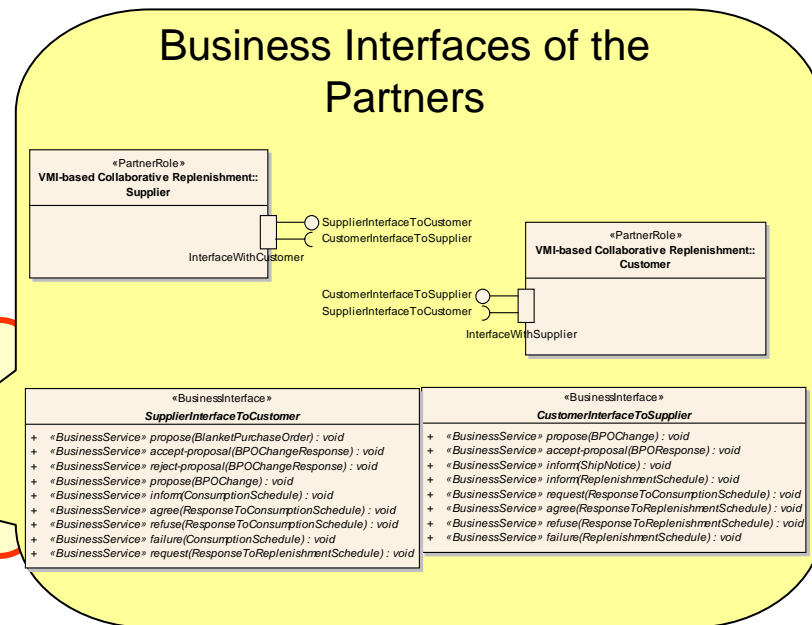
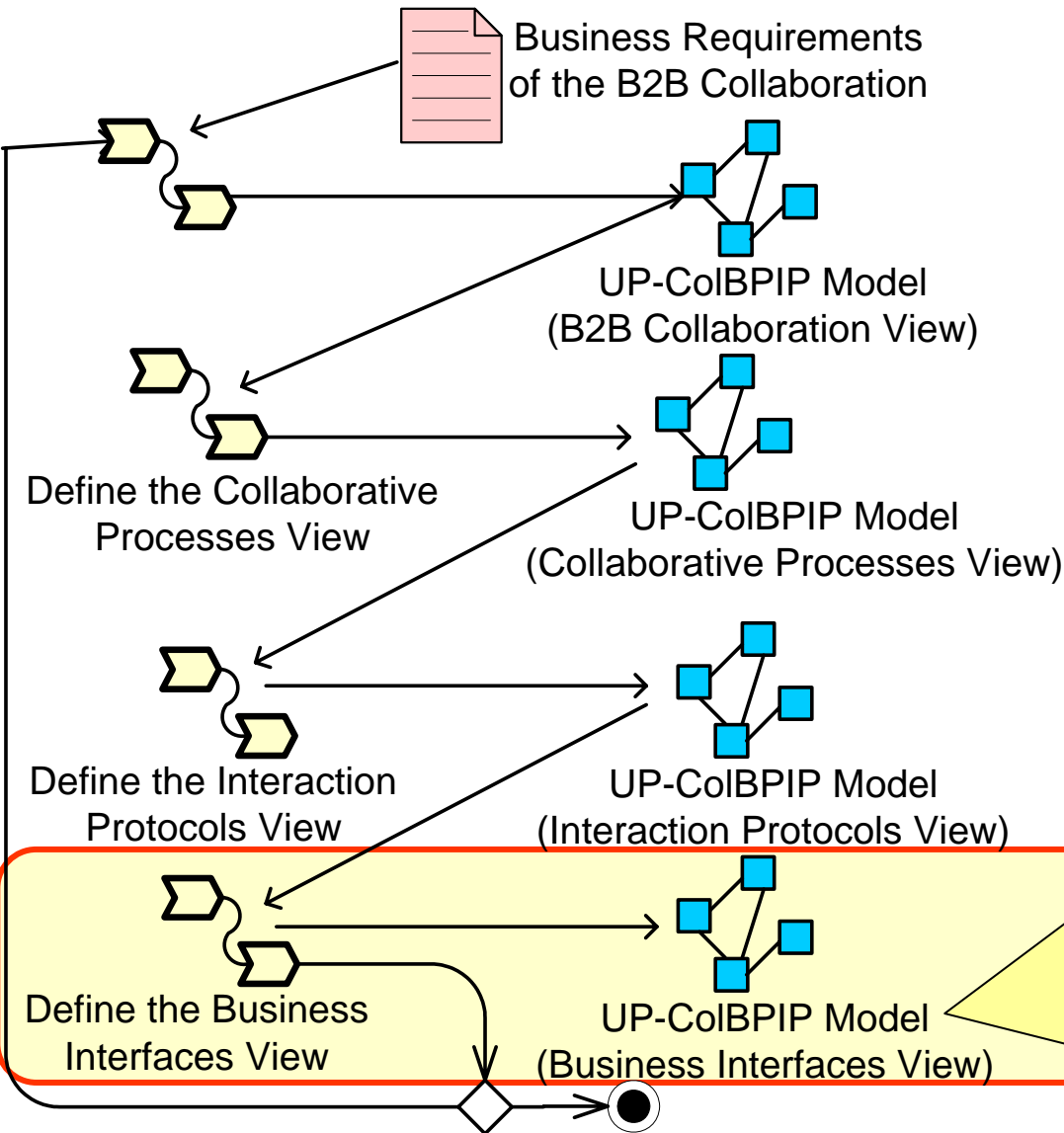
# UP-CoIBPIP Modeling Language



Interaction Protocols that realize the Collaborative Processes

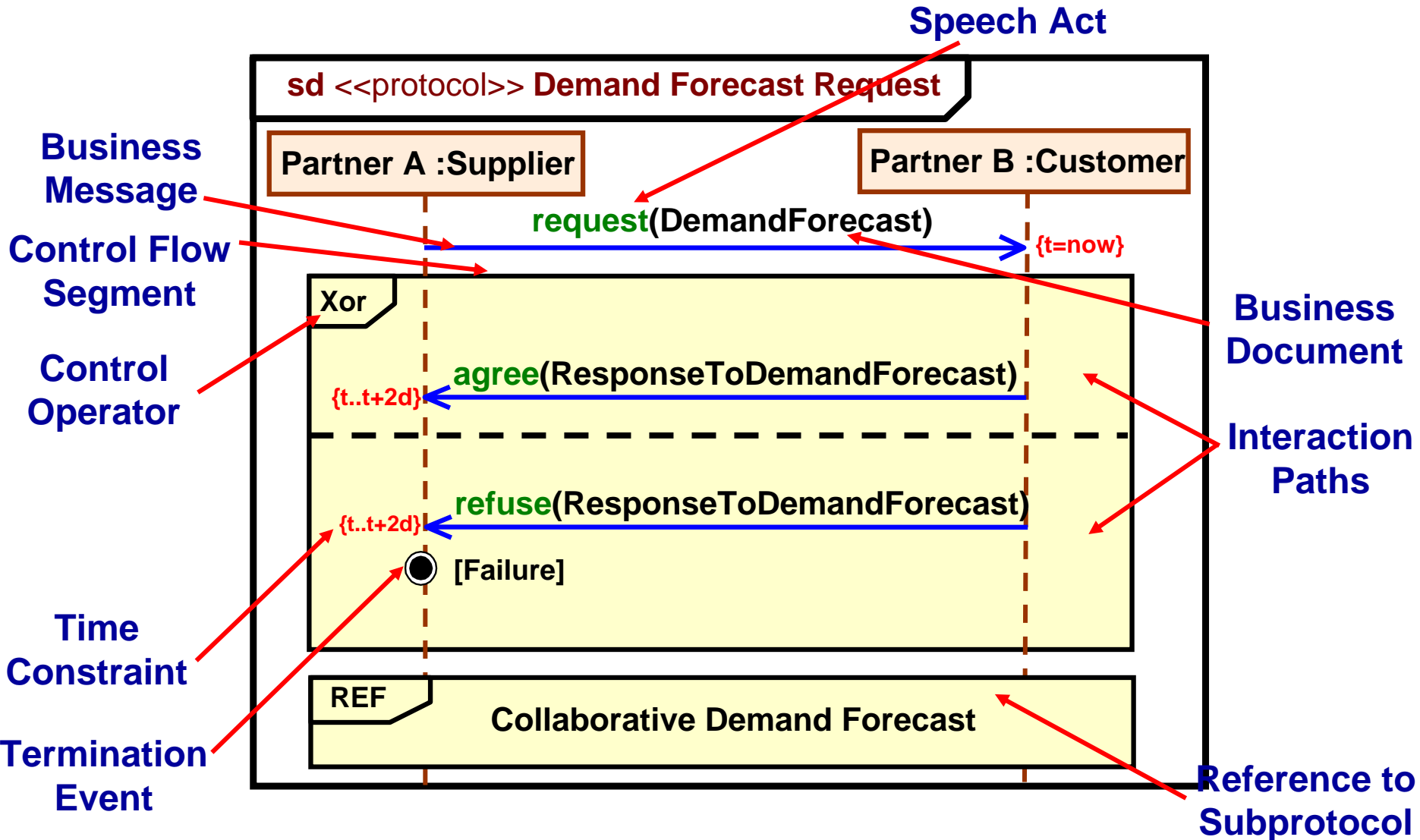


# UP-CoIBPIP Modeling Language





# UP-CoIBPIP: Interaction Protocols View



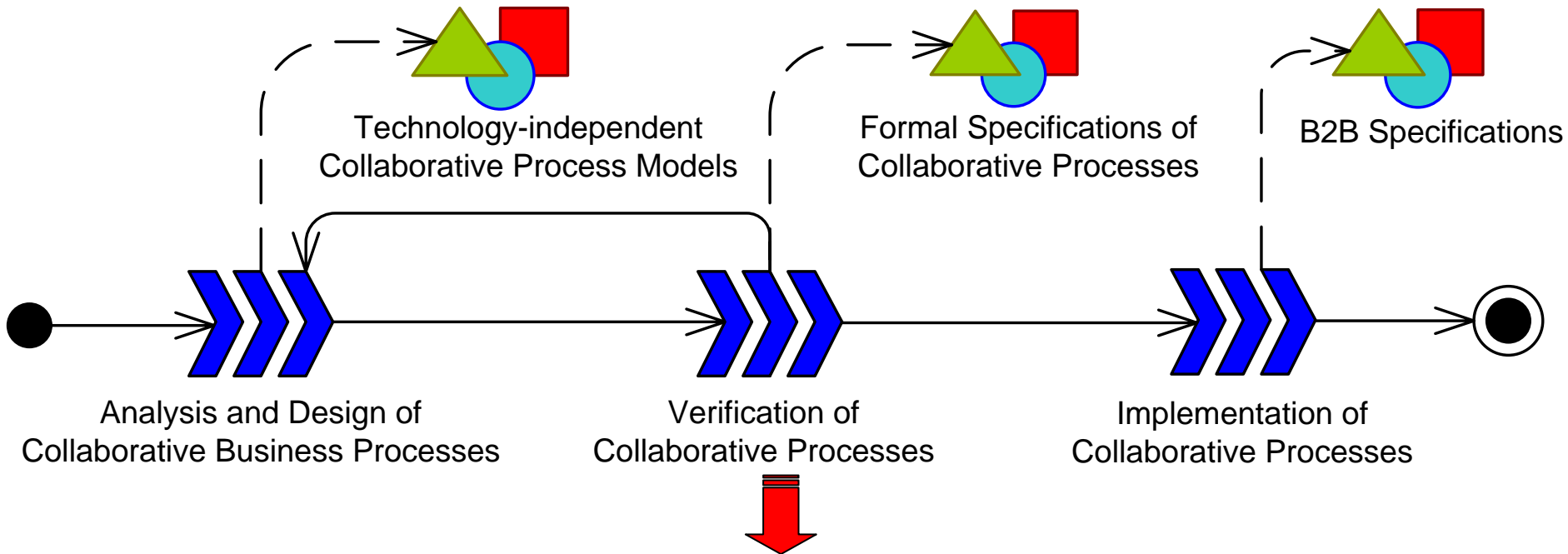


## Contributions:

- Supporting a methodological guide for the A&D of collaborative processes
- Modeling of Interaction Protocols supports the requirements of B2B Collaborations:
  - Representation of the global view of the interactions among the partners
  - Enterprise Autonomy
  - Decentralization and Peer-to-Peer Interactions
  - Representation of the Communicative Aspects of the B2B interactions
  - Representation of Negotiations



# Phase 2: Verification of Collaborative Processes

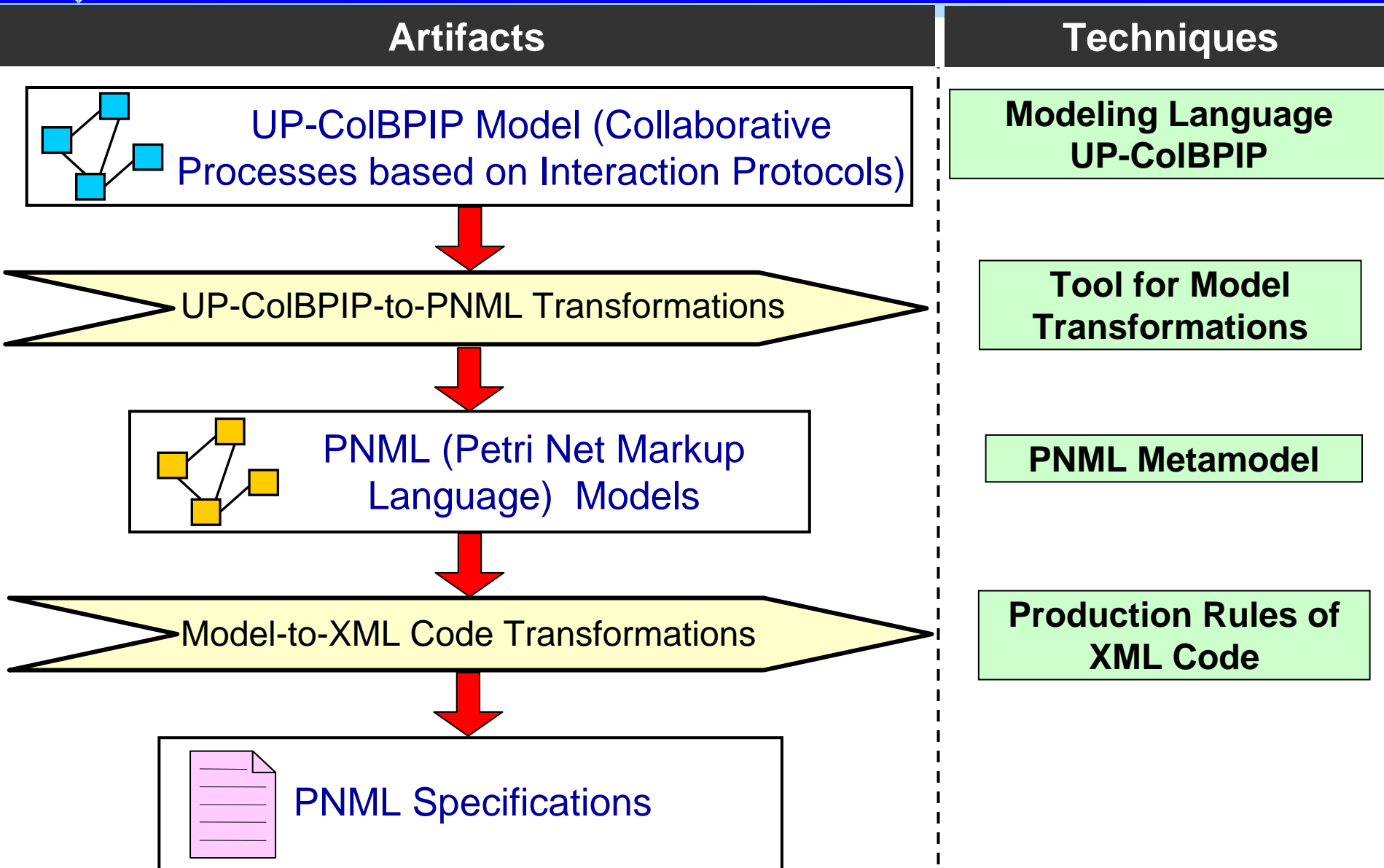


## Purpose:

- Verification of processes in an *early stage of the development*
- Verification of collaborative process models, instead of B2B specifications
- Automatic generation of formal specifications of Interaction Protocols
- We are using the Petri Net formalism to verify desirables properties (e.g.: absence of deadlocks, livelocks) of Interaction Protocols



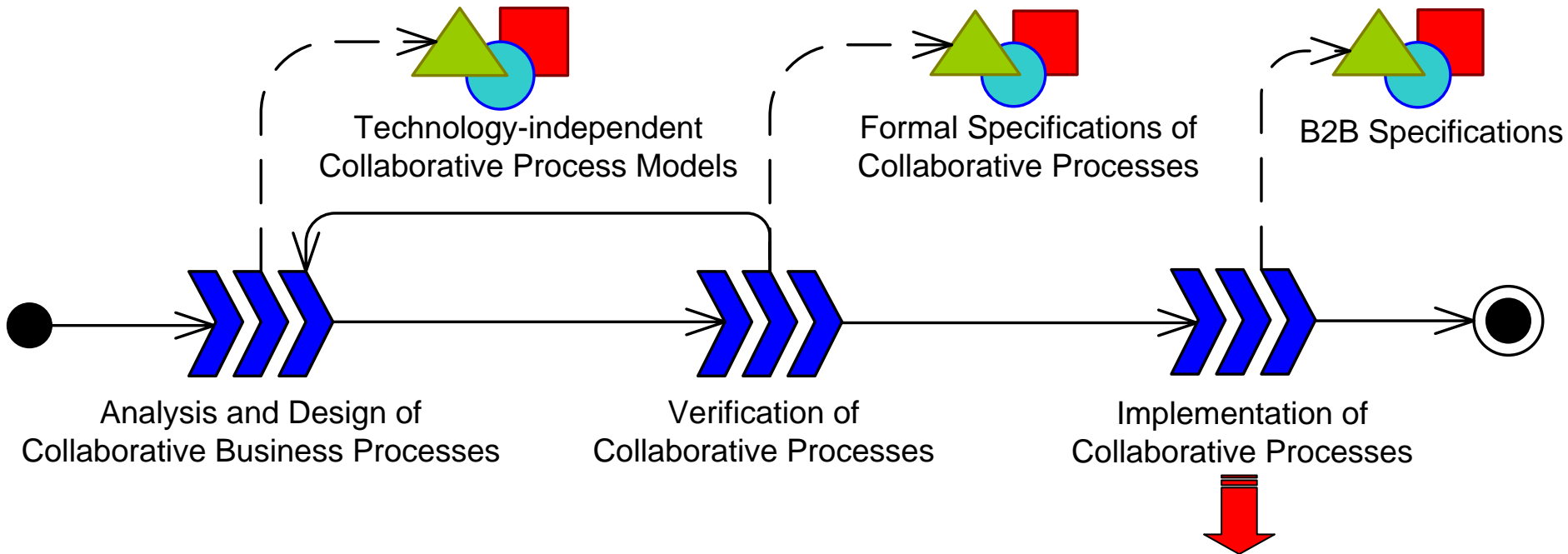
# Phase 2: Verification of Collaborative Processes





## Phase 3:

# Implementation of Collaborative Processes

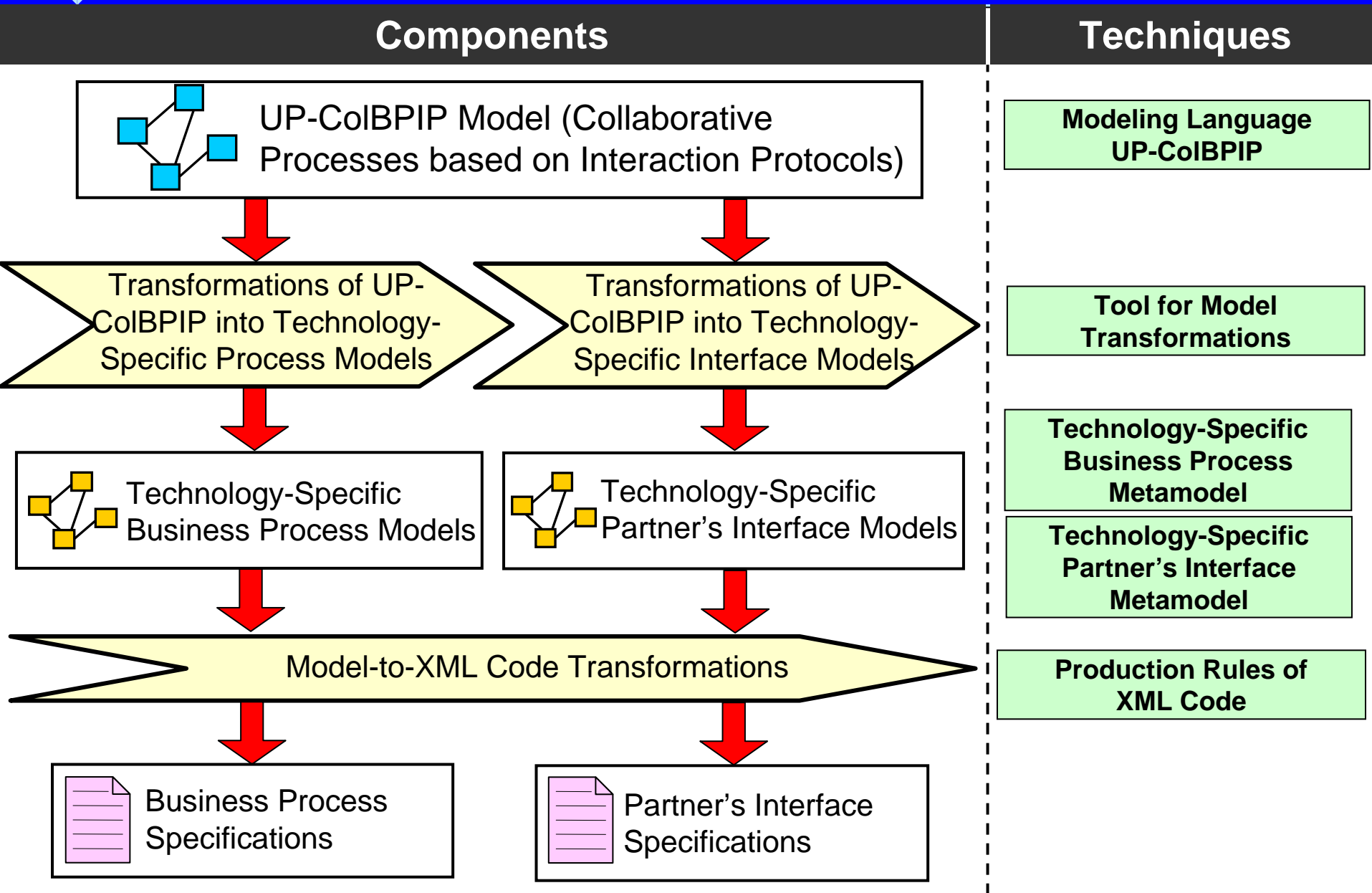


- **Purpose:** Generation of the specifications of the processes and the partners' interfaces
- Selecting a B2B standard



# Phase 3:

# Implementation of Collaborative Processes



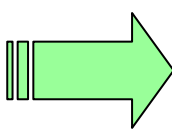


## Phase 3:

# Implementation of Collaborative Processes

## Transformations defined:

- Generation of Technological Solutions using a B2B standard based on *Business Transactions*
  - ➔ **UP-CoIBPIP to ebXML**
- Generation of Technological Solutions using B2B standards based on *Web Services Composition*
  - ➔ **UP-CoIBPIP to BPEL**
  - ➔ **UP-CoIBPIP to WS-CDL**



UP-CoIBPIP provides the suitable concepts to generate process specifications in these technology-specific languages

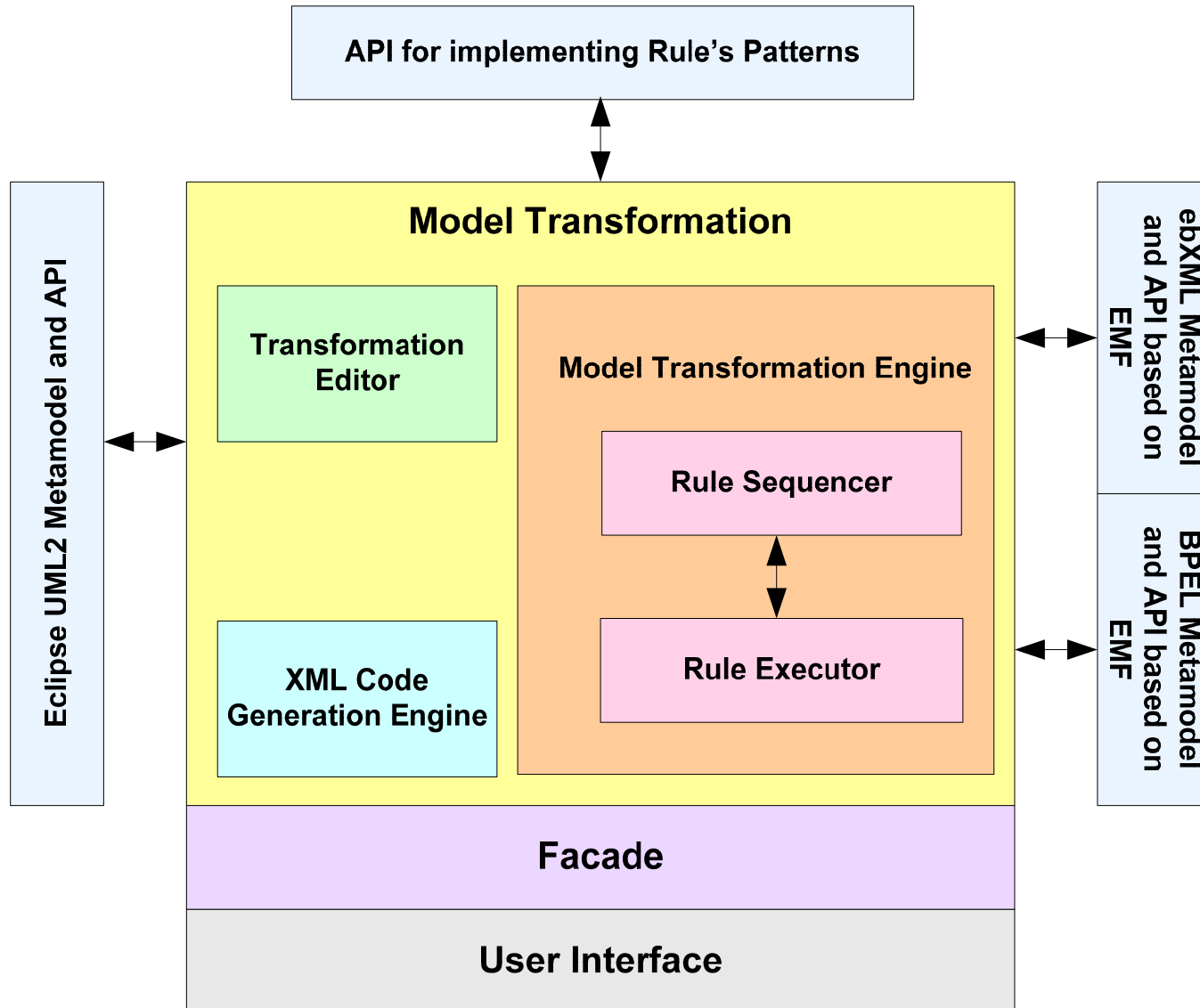


# Tool for Model Transformations

- Supports transformations required in the 2nd and 3rd phases
- Built specifically for the domain of collaborative processes:
  - Importation of XMI files, generation of XML code, use and manipulation of different target metamodels, support to define recursive and composed transformation rules
- Supports the definition and execution of model transformations
- Implements the Production Rules of XML Code



# Architecture of the Tool for Model Transformations





# Conclusions

Definition of a MDA-based development process for collaborative business processes:

- The ***phases*** to be carried out
- The ***artifacts*** to be built and generated
- The ***techniques*** to be used for building the artifacts
- The ***pattern of transformations*** to be applied



# Conclusions

Definition of a MDA-based development process for collaborative business processes:

- The ***phases*** to be carried out
  - ***Analysis and Design*** of collaborative processes have to be done in an independent way of the technology
  - ***Verification*** of processes should be done on process models in an early stage of the development
  
- The ***artifacts*** to be built and generated
  - The main artifacts are the technology-independent collaborative process models
  - Formal specifications of collaborative process models
  - Technology-specific models of processes and interfaces



# Conclusions

Definition of a MDA-based development process for collaborative business processes:

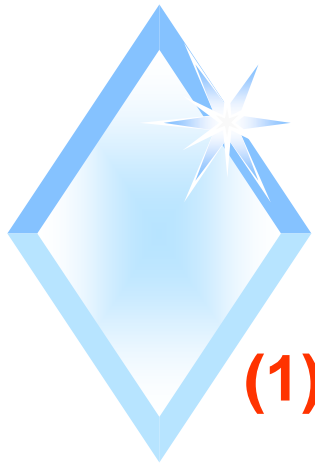
- The ***techniques*** to be used for building the artifacts
  - UP-ColBPIP modeling language
    - ➔ Supports a methodological guide for the analysis and design of collaborative processes
    - ➔ Modeling of interaction protocols fulfills the requirements of B2B collaborations
  - A tool for the model transformations and the generation of XML code
- The ***pattern of transformations*** to be applied
  - The principles of MDA were applied in each phase of development



# Future Work

- Extension of the Tool for model transformations
  - Problem: patterns of transformation rules are defined in an imperative way. Correctness of the defined transformations cannot also be guaranteed.
  - Solution: integrate a graph transformation tool (AGG)
- Building of a Software Environment that supports the above MDA-based development process
- Define the phases required to derive internal processes of the partners from collaborative processes

# A MDA-based Development Process for Collaborative Business Processes



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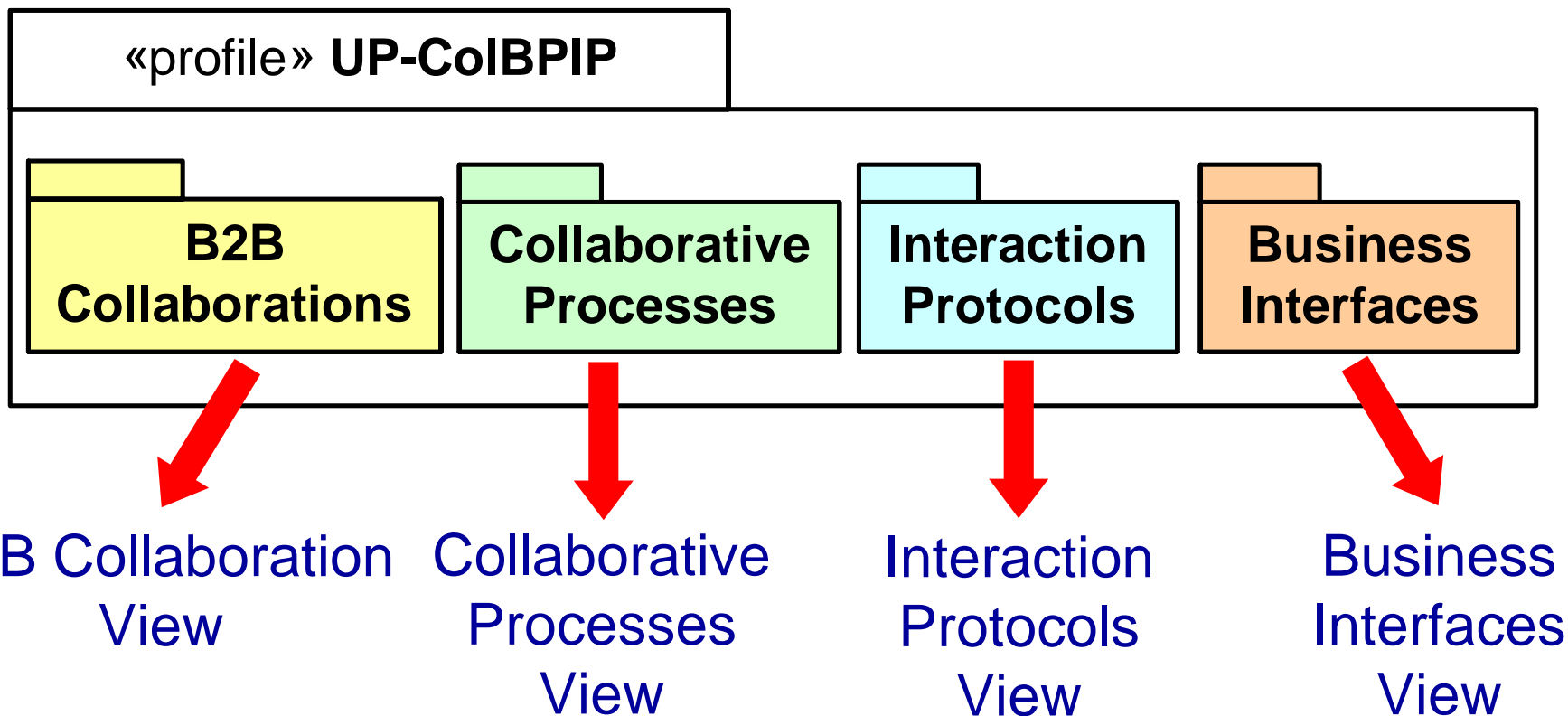


# Overview

- Introduction
- Motivation
- Contribution and Proposal
- Conclusions and Future Work

# UP-CoIBPIP Modeling Language

**UP-CoIBPIP:** UML Profile for Collaborative Business Processes based on Interaction Protocols





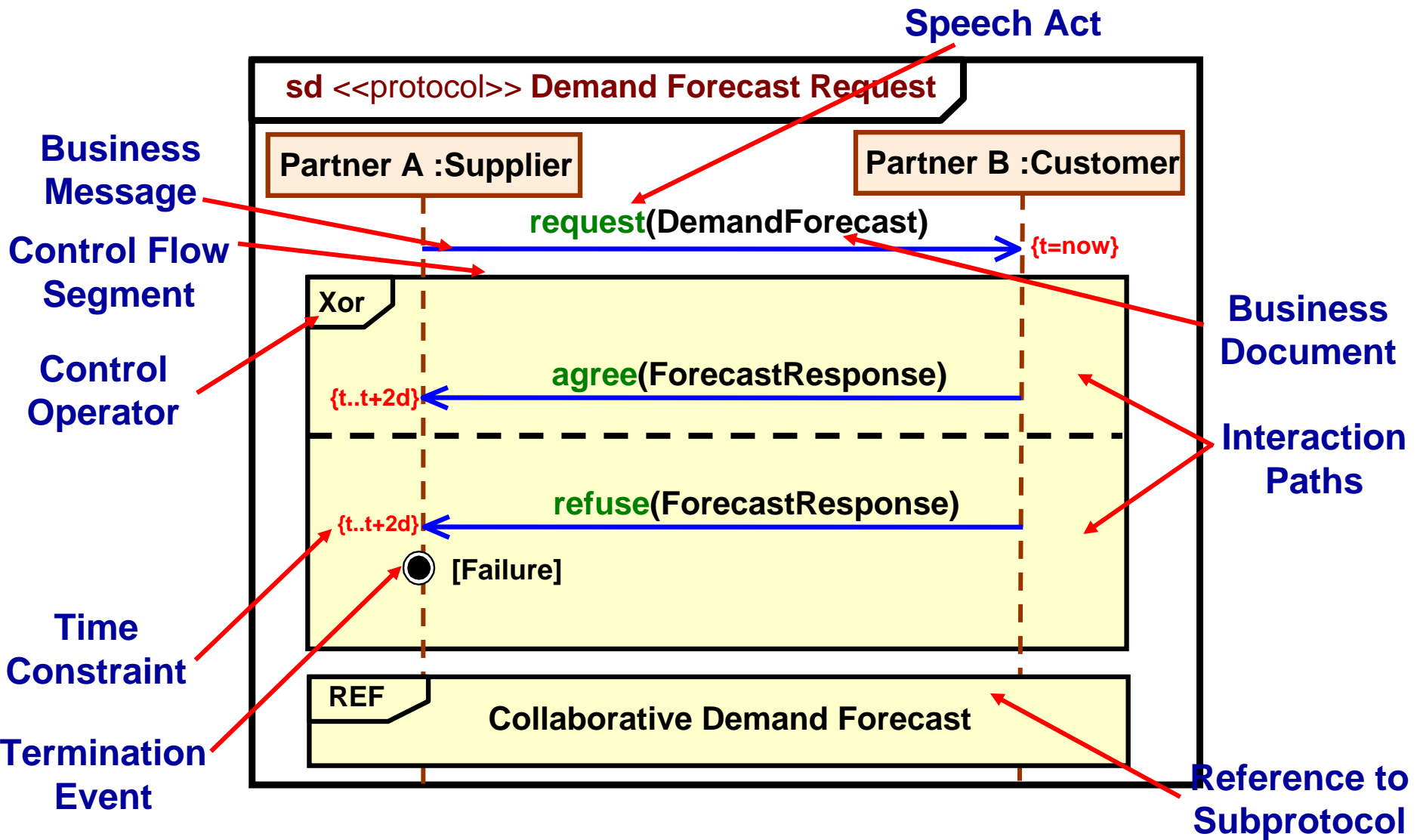
# UP-CoIBPIP Modeling Language

**Interaction Protocol:** Describes a high-level communication pattern through a choreography of business messages between enterprises performing different roles

- An oriented-communication design approach (Business Messages are based on Speech Acts)
- Speech Acts allow to represent intentions that a partner has in an interaction:
  - Eg: *request*(DemandForecast) and *propose*(DemandForecast)
- **Objective:** to support the requirements of B2B Collaborations
  - Representation of the global view of the interactions among the partners
  - Enterprise Autonomy
  - Decentralization and Peer-to-Peer Interactions
  - Representation of Negotiations
  - Representation of the Communicative Aspects of the B2B interactions

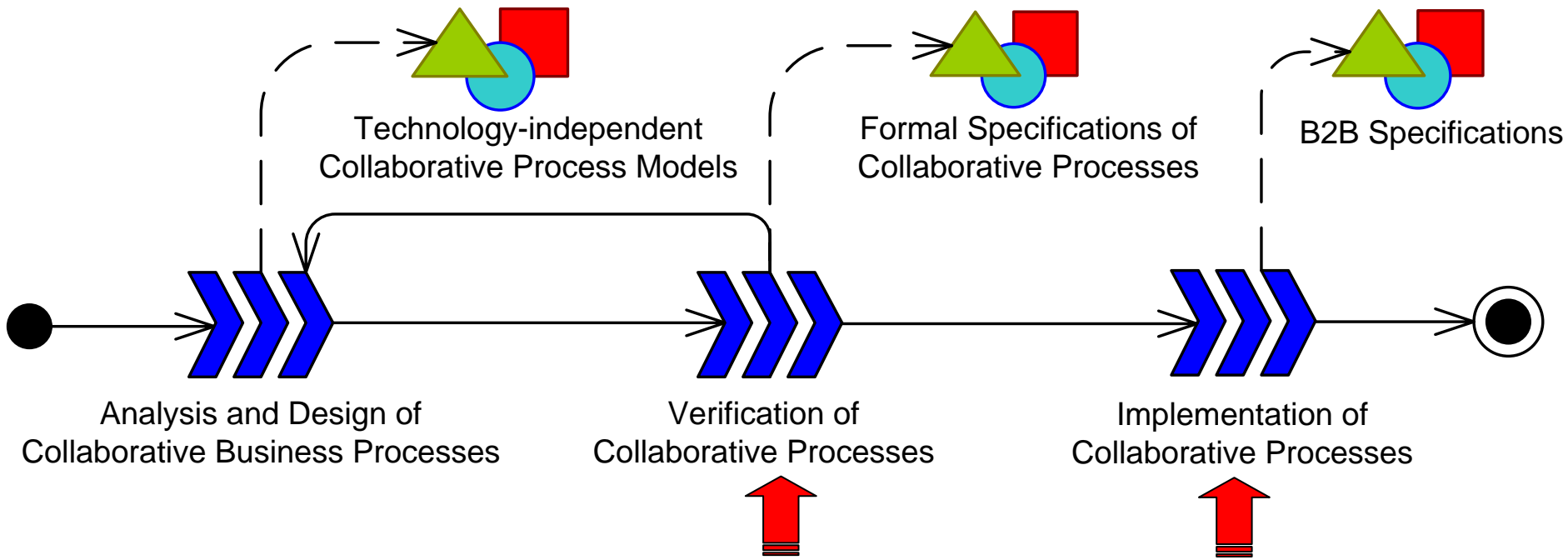


# UP-CoIBPIP: Interaction Protocols View





# The MDA-based Development Process: Phases



**Application of Model Transformations**



# Generic Pattern of Transformations

## Components (Type of Artifacts)

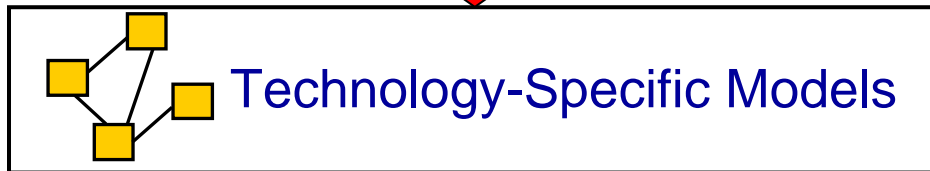
## Type of Techniques



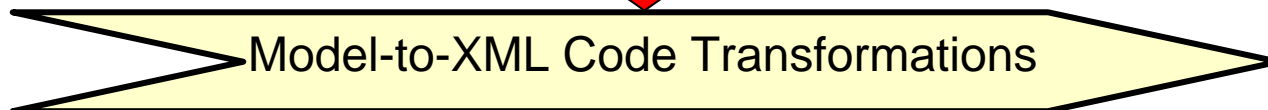
Technology-Independent Modeling Language



Tool for Model Transformations



Technology-Specific Metamodels



Production Rules of XML Code





# Transformation Process

