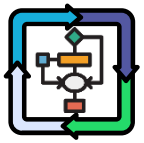

DD823 **Business Process Management**
Fall 2020 Semester

4 XML Process Definition Language

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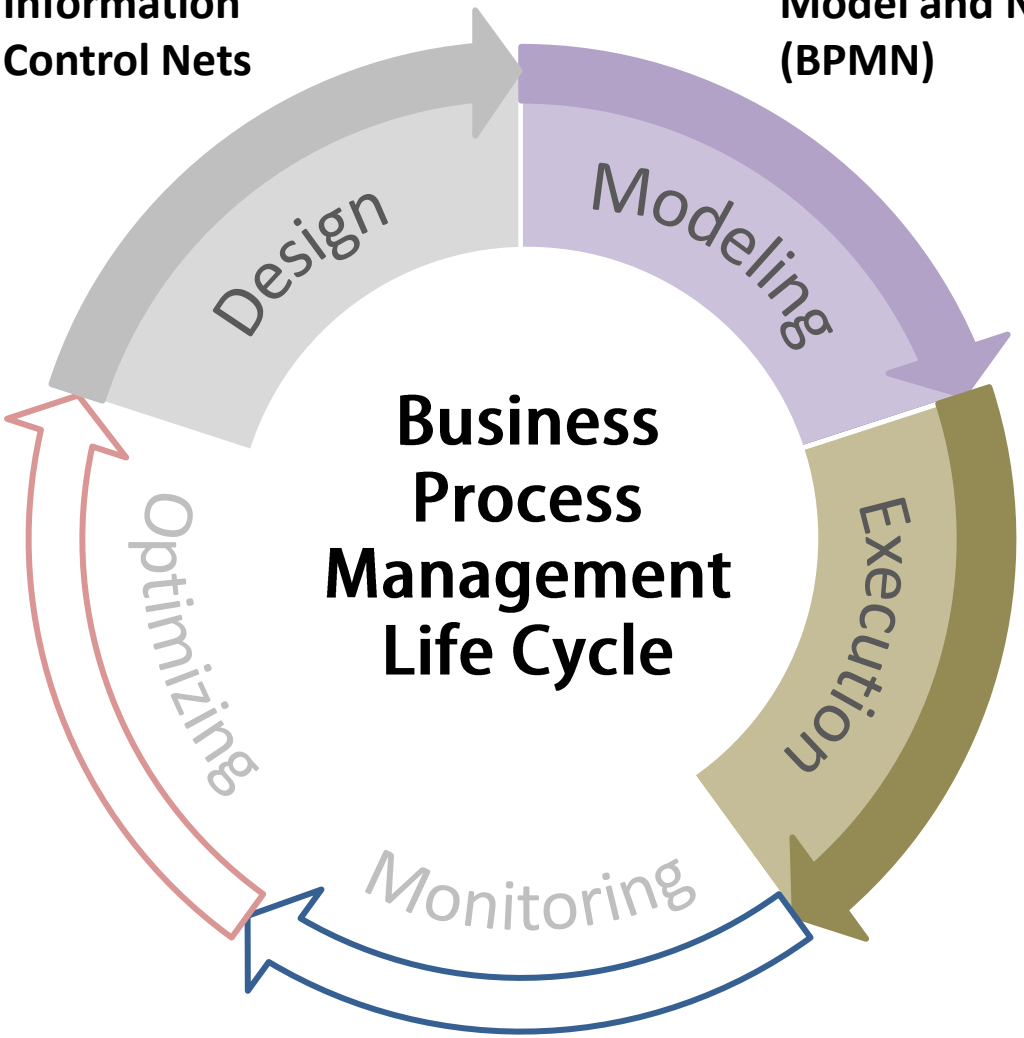
Outline of This Chapter

- Petri Net
- Information Control Nets

- Business Process Model and Notation (BPMN)

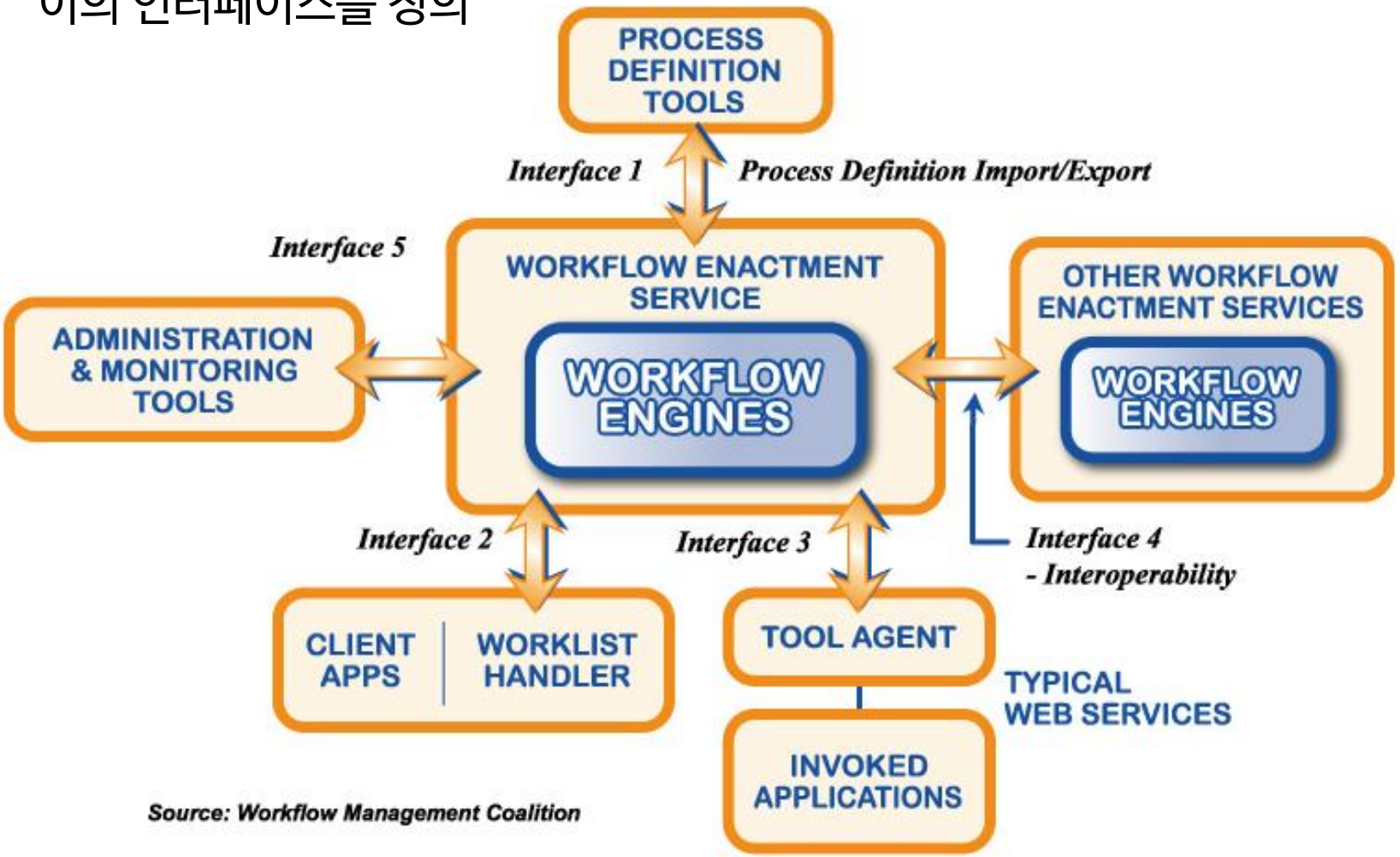


- XML Process Definition Language (XPDL)

4.1 XPDL 표준 개요

The Workflow Reference Model

- **워크플로우 참조모델:** 워크플로우 관리 시스템의 주요 컴포넌트들과 이들 사이의 인터페이스를 정의



The Workflow Reference Model - Interfaces

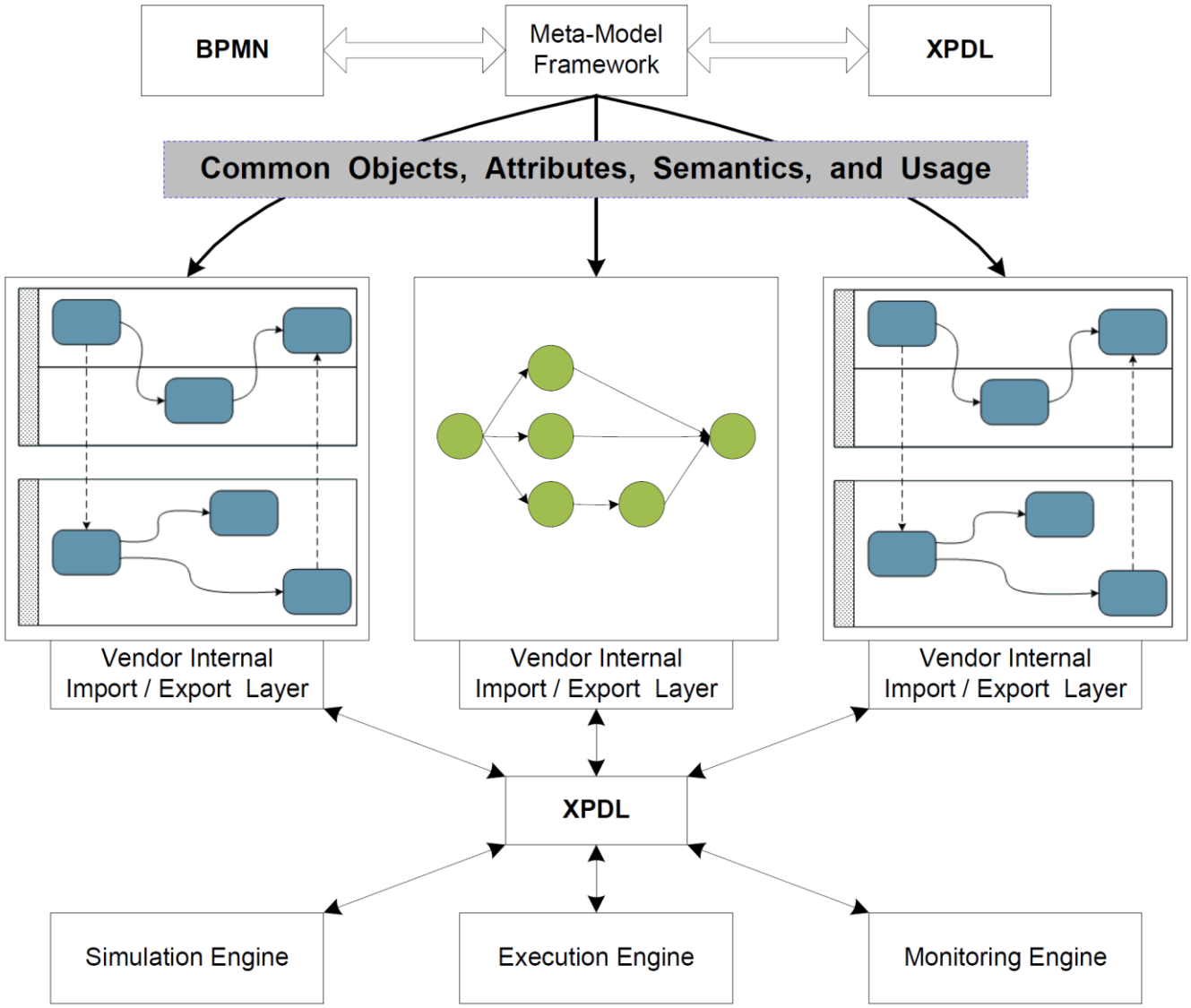
표준 인터페이스: 워크플로우 엔진을 중심으로 다른 컴포넌트와의 통신 규격을 정의

- 인터페이스 1: **프로세스 정의**(Process Definition Tools)
  - 프로세스 정의를 생성하는 모델링 시스템들과 워크플로우 엔진과의 인터페이스
- 인터페이스 2: **클라이언트 애플리케이션**(Client Applications)
  - 수행자가 사용하는 클라이언트 애플리케이션과 워크플로우 엔진과의 인터페이스
- 인터페이스 3: **호출 애플리케이션**(Invoked Applications)
  - 워크플로우 엔진이 애플리케이션들을 호출하기 위한 API들을 제공하는 인터페이스
- 인터페이스 4: **상호운용성**(Interoperability with Heterogenous Workflow Enactment Services)
  - 이기종 워크플로우 실행 서비스 사이의 상호운용성(interoperability)을 제공하기 위한 인터페이스
- 인터페이스 5: **시스템 관리 및 모니터링**(System Administration and Monitoring)
  - 프로세스의 관리 및 모니터링 기능을 제공하기 위한 인터페이스

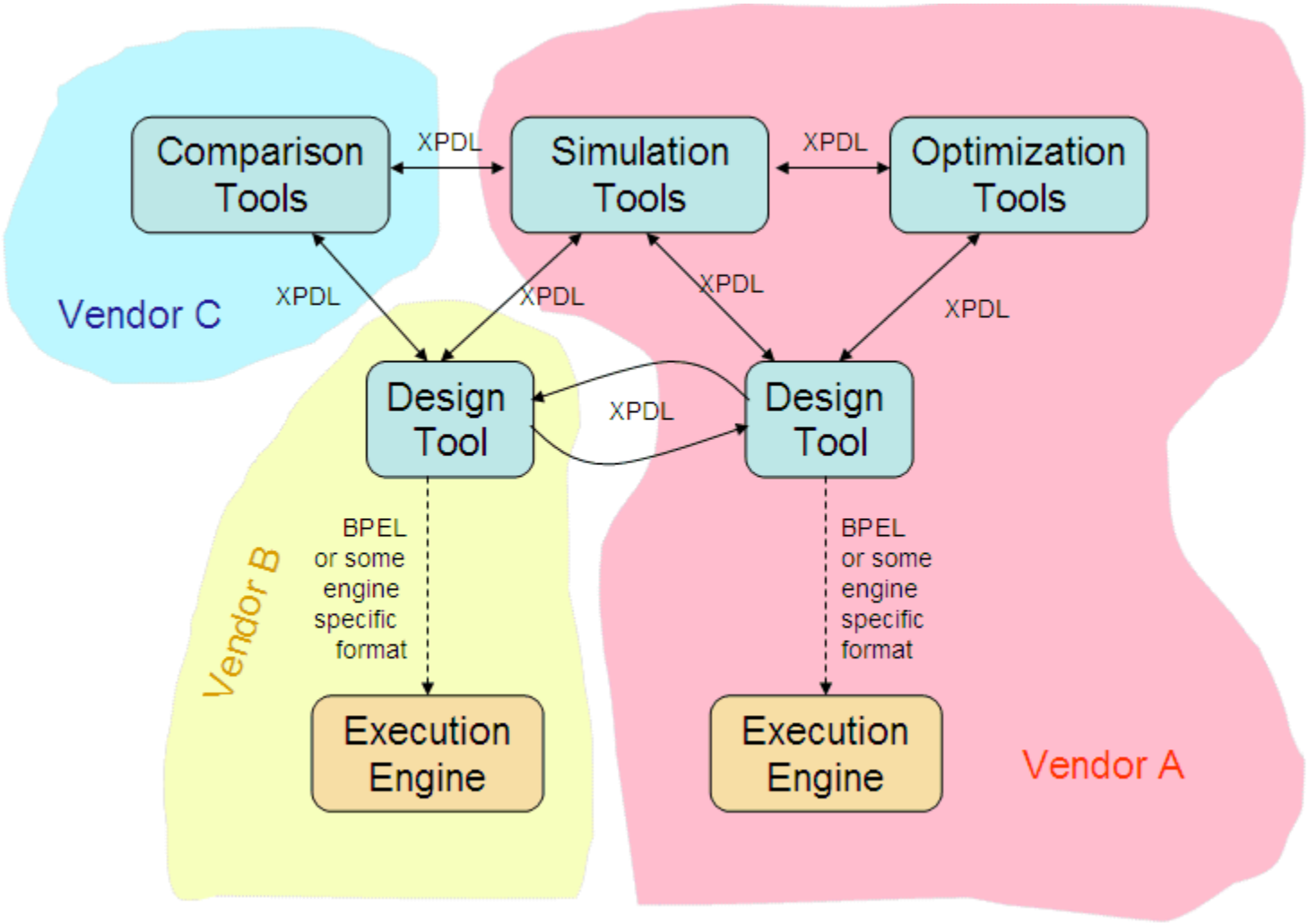
The XPDL Standard

- **XPDL**(XML Process Definition Language) **표준**
  - 프로세스 정의의 상호교환을 목적으로 WfMC(Workflow Management Coalition)에서 제정한 표준
    IBM, Hewlett-Packard, Fujitsu 등
- **표준화 이력**
  - 1998년: WPDL(Workflow Process Definition Language) 발표
    - 워크플로우 참조모델의 인터페이스 1을 구현하기 위한 표준으로서 제안됨
  - 2002년: XPDL 1.0 발표
    - WPDL 표준을 XML 기반으로 재수정 및 배포한 버전
  - 2012년: XPDL 2.2 발표
    - BPMN 2.0 버전과의 호환성 제공

XPDL Goal: **Process Definition Interchange**



ex) **Process Definition Interchange**



social-biz.org, The BPMN-XPDL-BPEL value chain (link)

Different Objectives, Slightly Different Terms

- **BPMN과 XPDL의 표준화 목적**
  - BPMN: 비즈니스 프로세스의 시각적 표기법을 제공
  - XPDL: 프로세스 정의의 상호교환

BPMN 개체 유형	XPDL 개체 유형
Activity, Gateway, Event	Activity
Sequence Flow	Transition
Pool, Lane	Pool, Lane

4.2 XPDL 메타모델

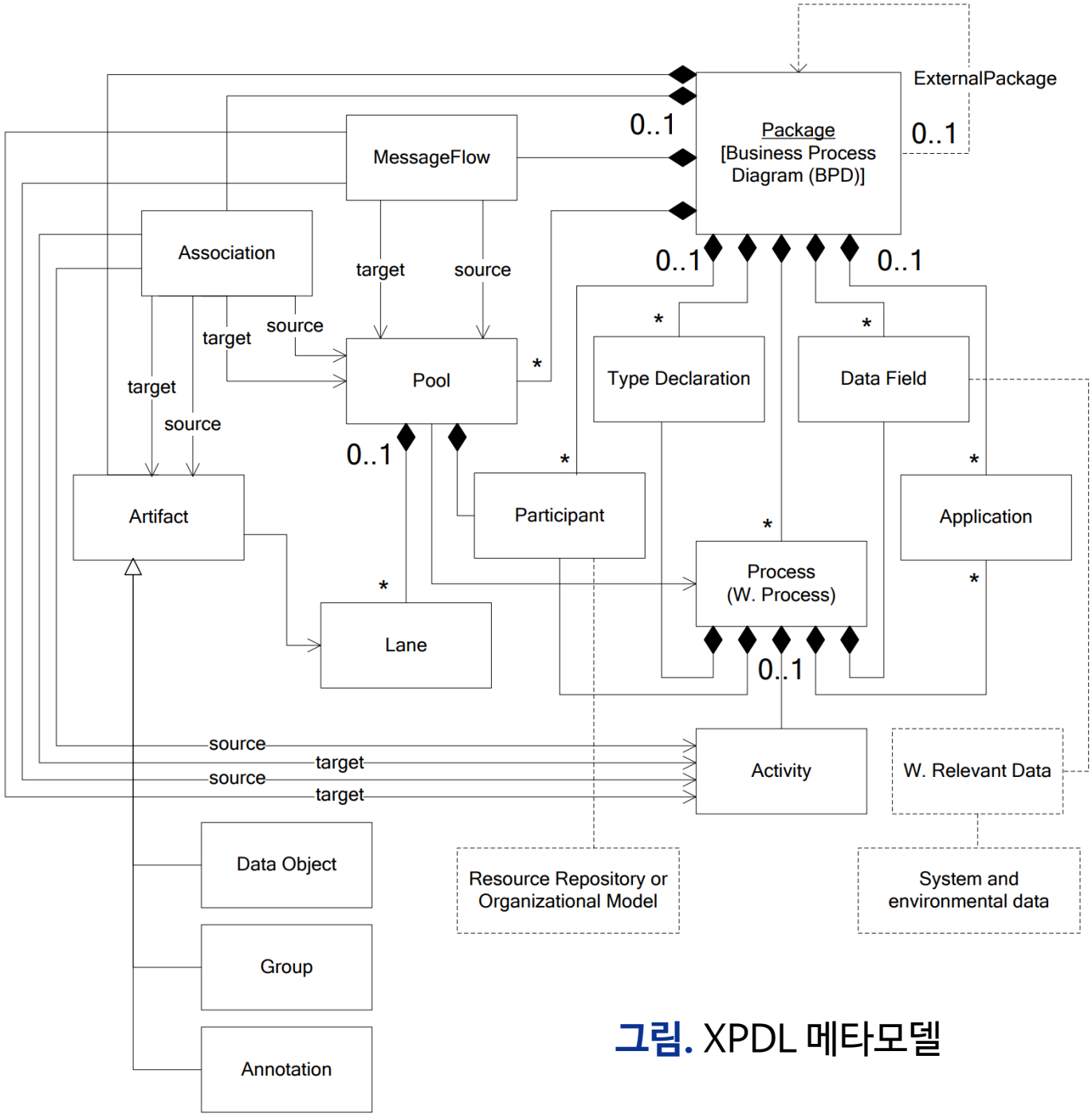

ExternalPackage
0..1
Package
[Business Process
Diagram (BPD)]
0..1
MessageFlow
Association
target
source
0..1
0..1
source
target
target
source
Pool
*
Type Declaration
Data Field
*
*
0..1
*
*
Artifact
Participant
Application
*
*
Process
(W. Process)
*
Lane
0..1
source
target
source
target
Activity
W. Relevant Data
Data Object
Resource Repository or
Organizational Model
System and
environmental data
Group
Annotation

그림. XPDL 메타모델

Primary Entity Types

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주요 개체 유형들

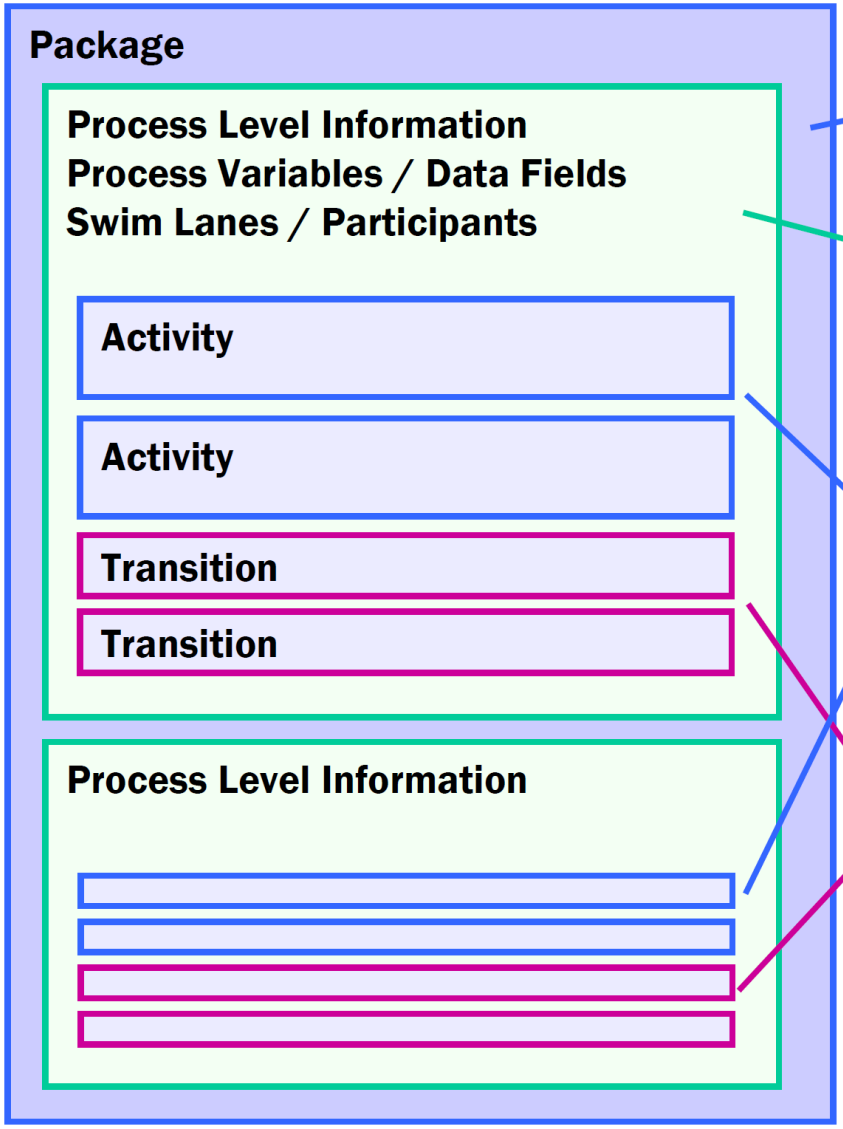
- **패키지**(Package)**:** XPDL의 **최상위 개체** 유형(루트 노드)
  - BPMN 프로세스 다이어그램과 대응되며, 다수의 프로세스들을 포함
- **타입선언**(Type Declaration)**: 데이터 유형**을 정의
- **데이터 필드**(Data Field)**: 데이터 아이템**을 정의
- **나머지 유형:** BPMN 표준에서 제공하는 개체 유형과 동일

Type Declaration & Data Field

```
<TypeDeclarations>
    <TypeDeclaration Id=”POType” Name=”PurchaseOrder”>
        <SchemaType>
            <schema xmlns="http://www.w3.org/2000/10/XMLSchema">
                <element name="PO">
                    <complexType>
                        <sequence>
                            <element name="CustomerName" type="string"/>
                            <element name="Address" type="string"/>
                            <element name="OrderNumber" type="string"/>
                        </sequence>
                    </complexType>
                </element>
            </schema>
        </SchemaType>
    </TypeDeclaration>
</TypeDeclarations>
```

```
<DataFields>
    <DataField Id=”newPO”>
        <DataType>
            <DeclaredType Id=”POType”/>
        </DataType>
    </DataField>
    <DataField Id=”checkedPO”>
        <DataType>
            <DeclaredType Id=”POType”/>
        </DataType>
    </DataField>
</DataFields>
```

XPDL Basic Structure



패키지 내의 모든 프로세스들이 공통적으로 참조하는 정보

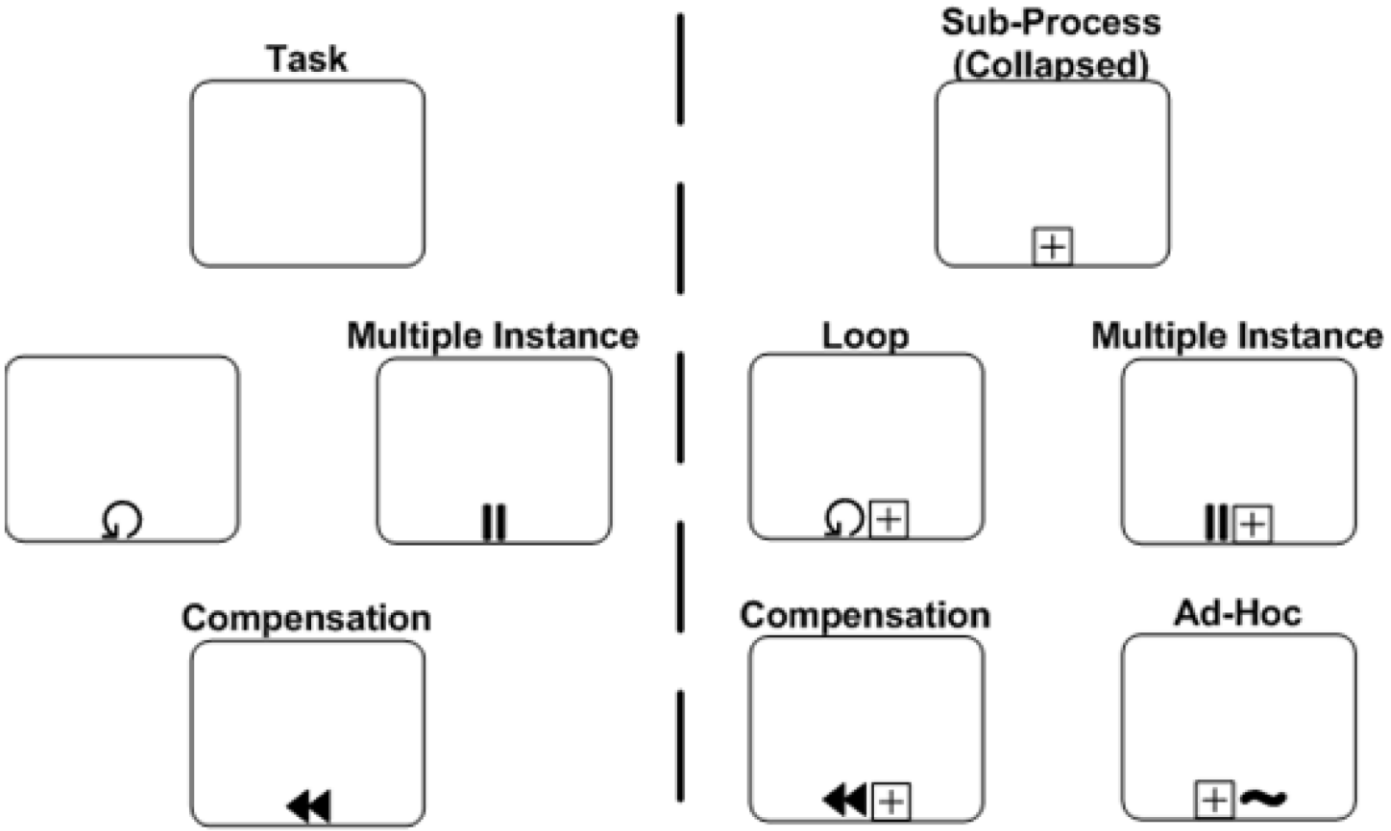
단일 프로세스와 관련된 정보
예: 스윔레인, 아티팩트, 데이터 필드, 참여자 등

XPDL의 "**액티비티**"는 BPMN의 모든 **흐름객체 유형**들을 나타냄
예: 액티비티, 게이트웨이, 이벤트

XPDL의 "**트랜지션**"은 BPMN의 모든 **연결객체 유형**들을 나타냄
예: 순차흐름, 메시지흐름, 연관관계

BPMN Activity == XPDL Generic Activity

– BPMN의 액티비티는 XPDL의 제네릭 액티비티를 나타냄

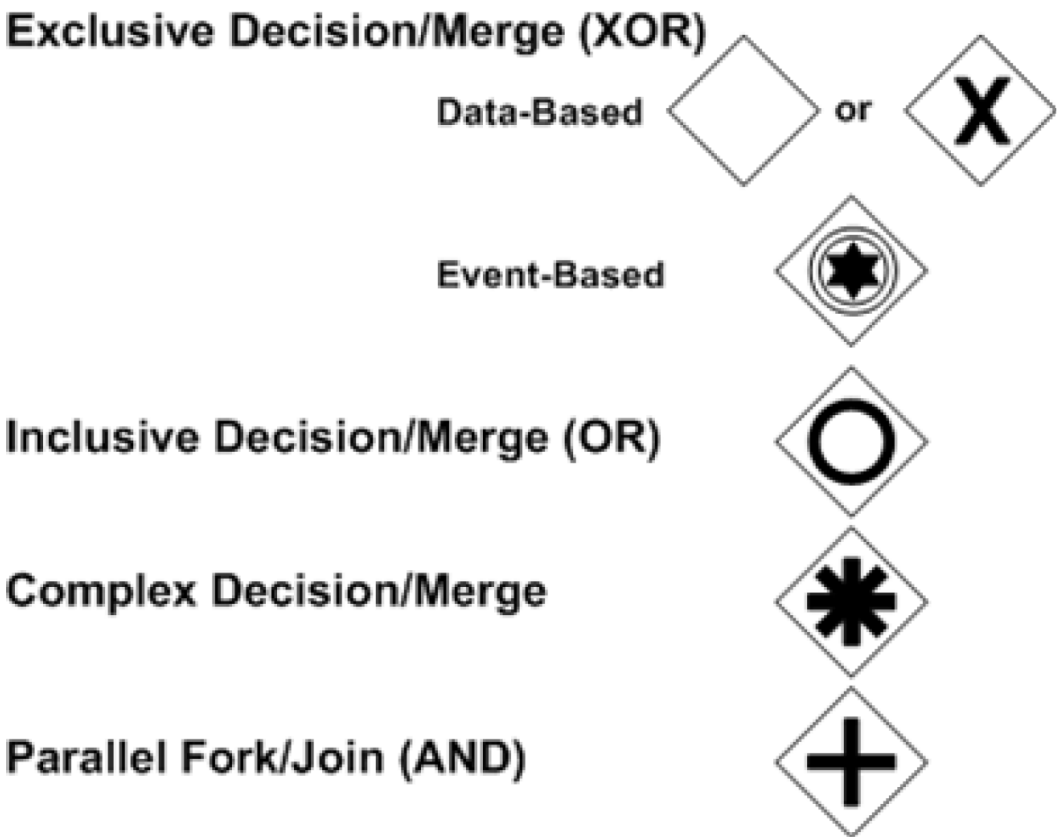


BPMN Event == XPDL Event Activity

- BPMN의 이벤트는 XPDL의 이벤트 액티비티를 나타냄

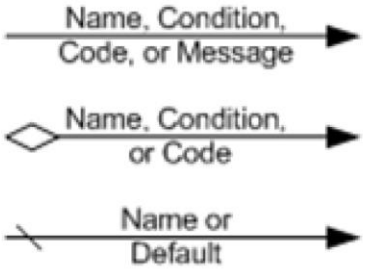
BPMN Gateway == XPDL Route Activity

- BPMN의 게이트웨이는 XPDL의 루트 액티비티를 나타냄



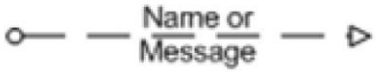
BPMN Connection == XPDL Transition

Sequence Flow

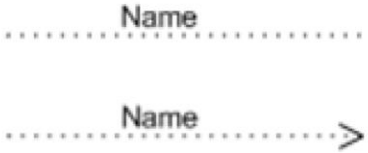


- BPMN의 연결객체는 XPDL의 트랜지션을 나타냄

Message Flow

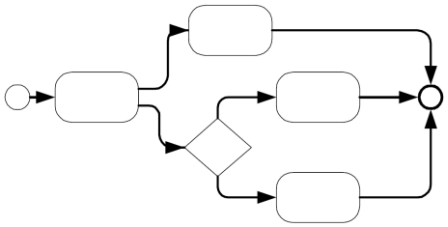


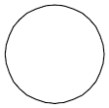
Association



Mappings From BPMN to XPDL

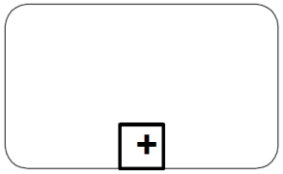
개체 유형	BPMN 표기	XPDL 표현

Process or **Pool**		`<WorkflowProcess>`
		`...`
		`</WorkflowProcess>`

Start Event		`<Activity>`
		`  <Event>`
		`  <StartEvent Trigger="..."/>`
		`  </Event>`
		`</Activity>`

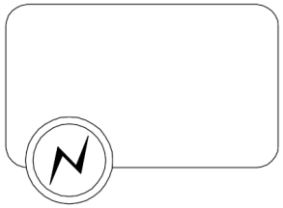
Sequence Flow		`<Transition/>`

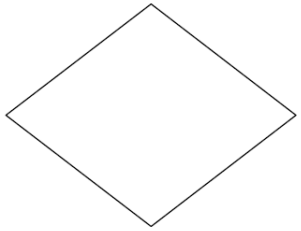
Task		`<Activity>`
		`  <Implementation>`
		`  <Task>...</Task>`
		`  </Implementation>`
		`  <Performers>...</Performers>`
		`</Activities>`

Sub-Process		`<Activity>`
		`  <Implementation>`
		`  <SubFlow>...<SubFlow/>`
		`  </Implementation>`
		`</Activity>`

Mappings From BPMN to XPDL

개체 유형	BPMN 표기	XPDL 표현

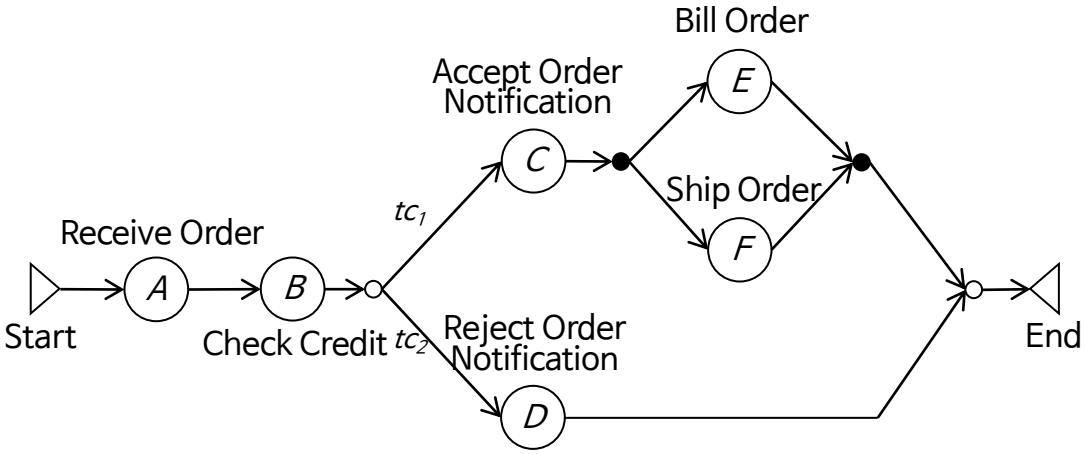
Intermediate Event (attached to activity boundary)		`<Activity Id="100" ...>`
		`  <Event>`
		`  <IntermediateEvent Trigger="Error" ... />`
		`</Activity>`
		`...`
		`<Transition Id="..." From="100" To="...">`
		`</Transition>`

Gateway (split)		`<Activity>`
		`  <Route GatewayType="..." ... />`
		`  <TransitionRestrictions>`
		`  <TransitionRestriction>`
		`  <Split Type="...">`
		`  <TransitionRefs>`
		`  ...`
		`  </TransitionRefs>`
		`  </Split>`
		`  </TransitionRestriction>`
		`  </TransitionRestrictions>`
		`</Activities>`
		`...`
		`<Transition>`
		`...`
		`</Transition>`

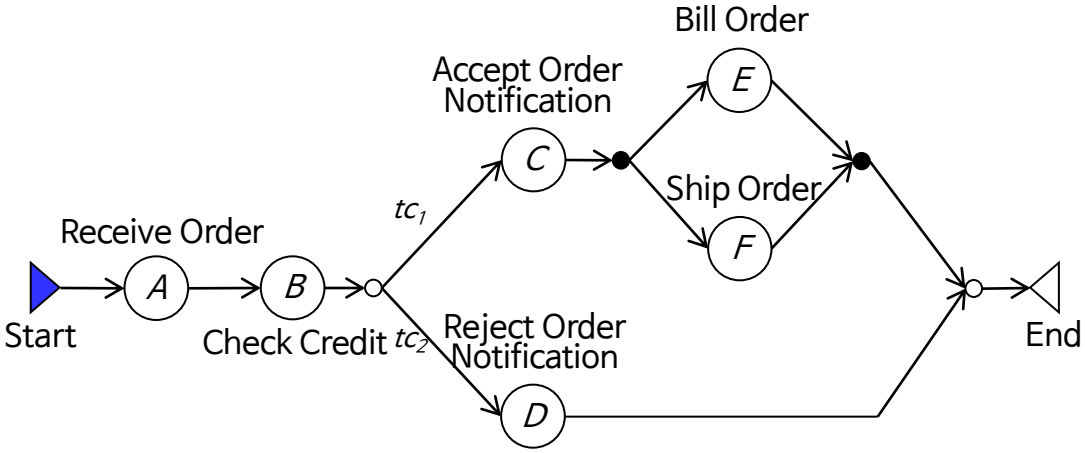
4.3 XPDL 프로세스 예제

ex) **Simple Order Process**

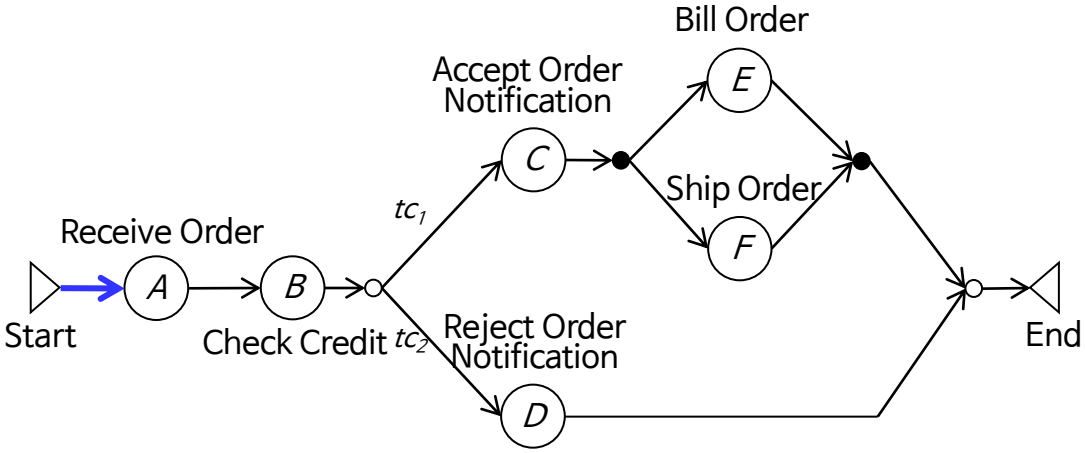
- 프로세스 예제: **간단한 주문 프로세스**(ICN ⇨ XPDL)



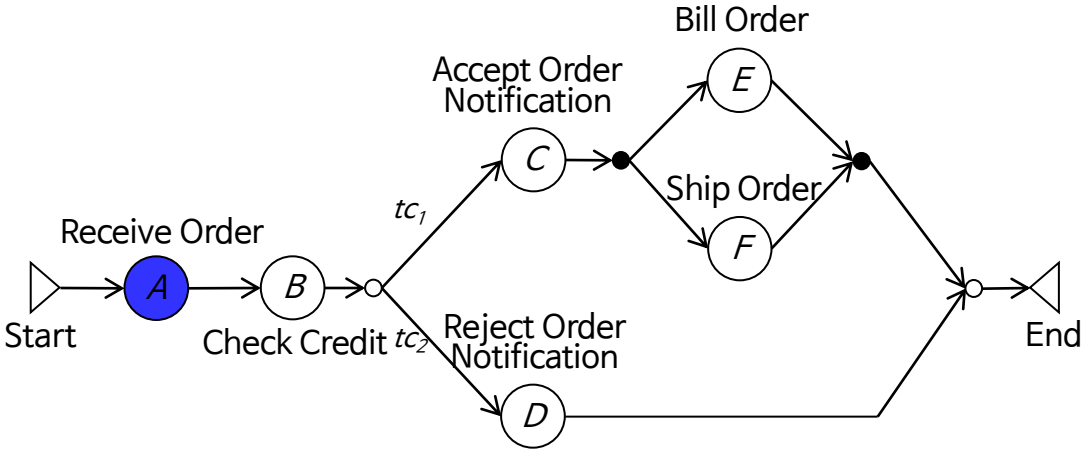

```
〈?xml version="1.0" encoding="UTF-8"?〉
〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg "〉
  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      …
      …
      …
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```



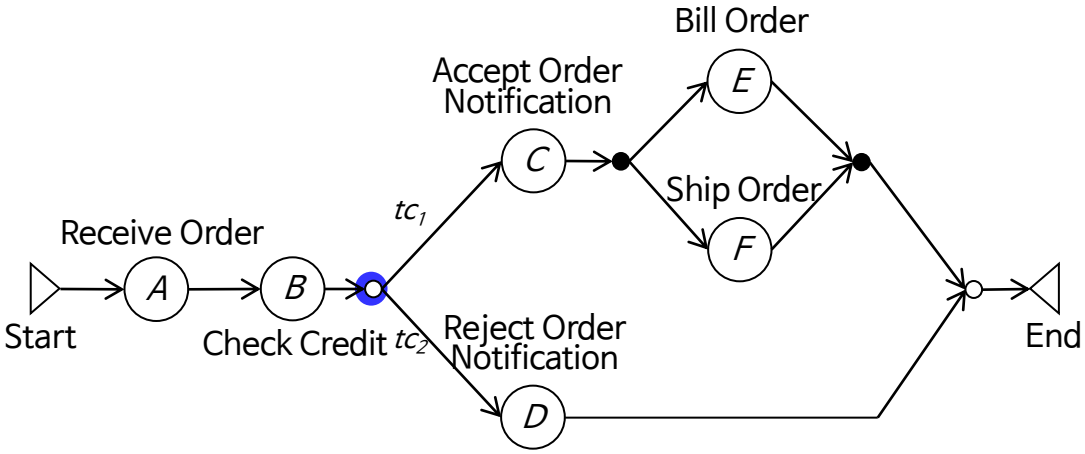

```
<?xml version="1.0" encoding="UTF-8"?>
<Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg ">
  <WorkflowProcesses>
    <WorkflowProcess Id="Process-1191836303703" Name="sampleProcess">
      ...
      <Activitys>
        <Activity Id="start" Name="Start">
          <Event>
            <StartEvent Trigger="None"/>
          </Event>
          <NodeGraphicsInfos>
            <NodeGraphicsInfo FillColor="light blue" LaneId="1" ToolId="Interstage"
                IsVisible="true" Page="1">
              <Coordinates XCoordinate="81.0" YCoordinate="80.0"/>
            </NodeGraphicsInfo>
          </NodeGraphicsInfos>
        </Activity>
      <Activitys>
      ...
    </WorkflowProcess>
  </WorkflowProcesses>
</Package>
```




```
〈?xml version="1.0" encoding="UTF-8"?〉
〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg "〉
  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      ...
      〈Transitions〉
        〈Transition Id="Transition1191836491265" From="Activity1191836318687"
                                          To="Activity1191836331343" Name="Start_To_Receive Order"〉
          〈ConnectorGraphicsInfos〉
            〈ConnectorGraphicsInfo FillColor="light blue" ToolId="Interstage"
            IsVisible="true" Page="1"〉
              〈Coordinates XCoordinate="258.0" YCoordinate="365.0"/〉
              〈Coordinates XCoordinate="426.0" YCoordinate="365.0"/〉
            〈/ConnectorGraphicsInfo〉
          〈/ConnectorGraphicsInfos〉
        〈/Transition〉
      〈/Tramsitions〉
      ...
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```




```
〈?xml version="1.0" encoding="UTF-8"?〉
〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg "〉
  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      ...
      〈Activitys〉
        〈Activity Id="Activity1191836331343" Name="Receive Order"〉
          〈NodeGraphicsInfos〉
            〈NodeGraphicsInfo FillColor="light blue" LaneId="1" ToolId="Interstage"
                IsVisible="true" Page="1"〉
              〈Coordinates XCoordinate="81.0" YCoordinate="80.0"/〉
            〈/NodeGraphicsInfo〉
          〈/NodeGraphicsInfos〉
        〈Activity〉
      〈Activitys〉
      ...
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```




```
〈?xml version="1.0" encoding="UTF-8"?〉
〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg "〉
  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      〈Activitys〉
        〈Activity Id="Activity1191836368000" Name="OR_SPLIT"〉
          〈Route GatewayType="XOR"/〉
          〈TransitionRestrictions〉
            〈TransitionRestriction〉
              〈Split Type="XOR"〉
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                〈/TransitionRefs〉
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          〈/TransitionRestrictions〉
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          〈/NodeGraphicsInfos〉
        〈/Activity〉
      〈/Activitys〉
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```

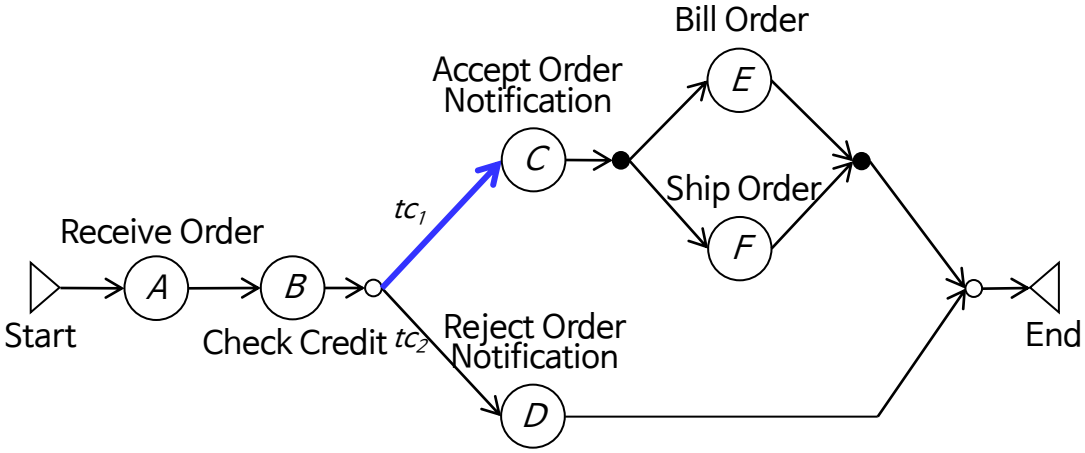


```
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〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg "〉
  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      ...
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        〈Transition Id="Transition1191836494593" From="Activity1191836368000"
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          〈/ConnectorGraphicsInfos〉
        〈/Transition〉
      〈/Tramsitions〉
      ...
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  〈/WorkflowProcesses〉
〈/Package〉
```

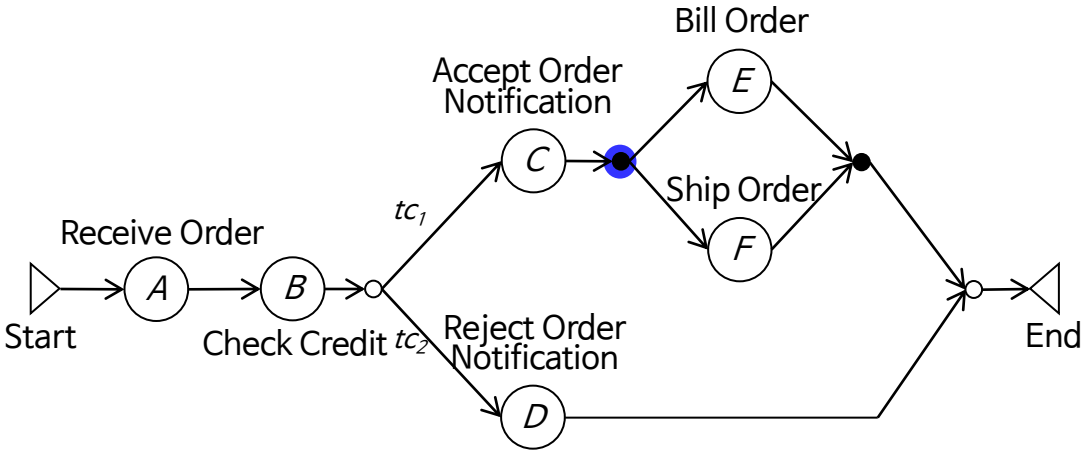


```
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〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
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  〈/WorkflowProcesses〉
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```

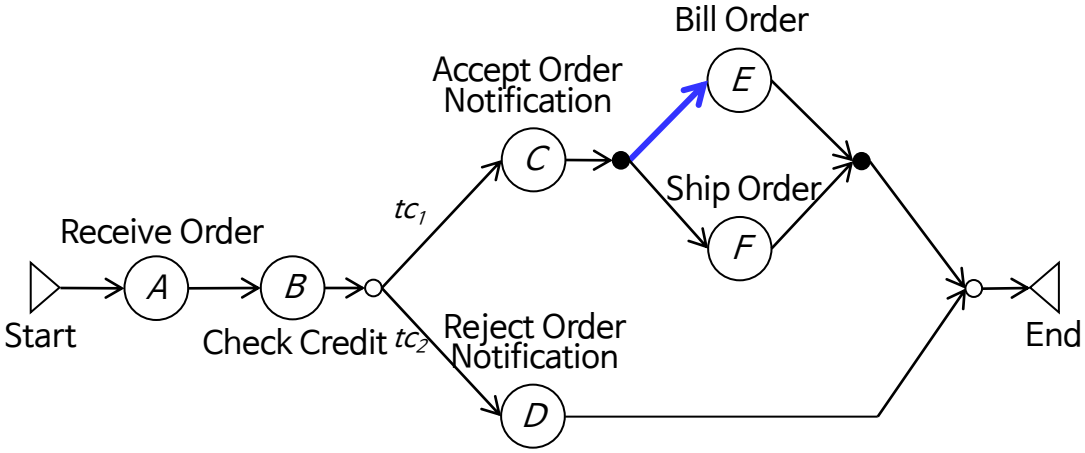


```
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〈Package xmlns="http://www.wfmc.org/2004/XPDL2.0alpha"
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  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      ...
      〈Transitions〉
        〈Transition Id="Transition1191836496437" From="Activity1191836403562"
                To="Activity1191836407937" Name="AND_SPLIT_To_Bill Order"〉
          〈ConnectorGraphicsInfos〉
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          〈/ConnectorGraphicsInfos〉                                    〈/Transition〉
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      ...
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```

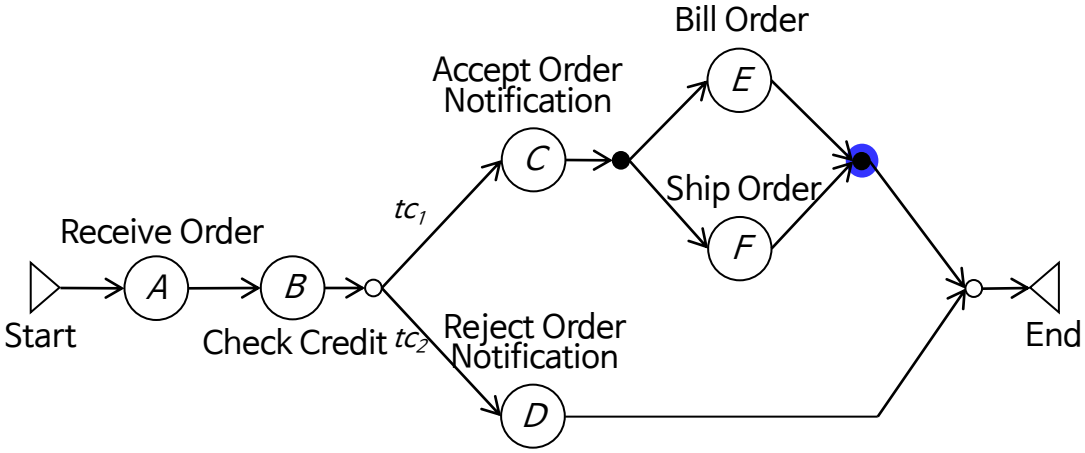


```
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            〈TransitionRestriction〉
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            〈/TransitionRestriction〉
          〈/TransitionRestrictions〉
        〈NodeGraphicsInfos〉
          〈NodeGraphicsInfo FillColor="light blue" LaneId="1" ToolId="Interstage" IsVisible="true" Page="1"〉
            〈Coordinates XCoordinate="81.0" YCoordinate="80.0"/〉
          〈/NodeGraphicsInfo〉
        〈/NodeGraphicsInfos〉
        〈/Activity〉
      〈Activitys〉
      ...
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```

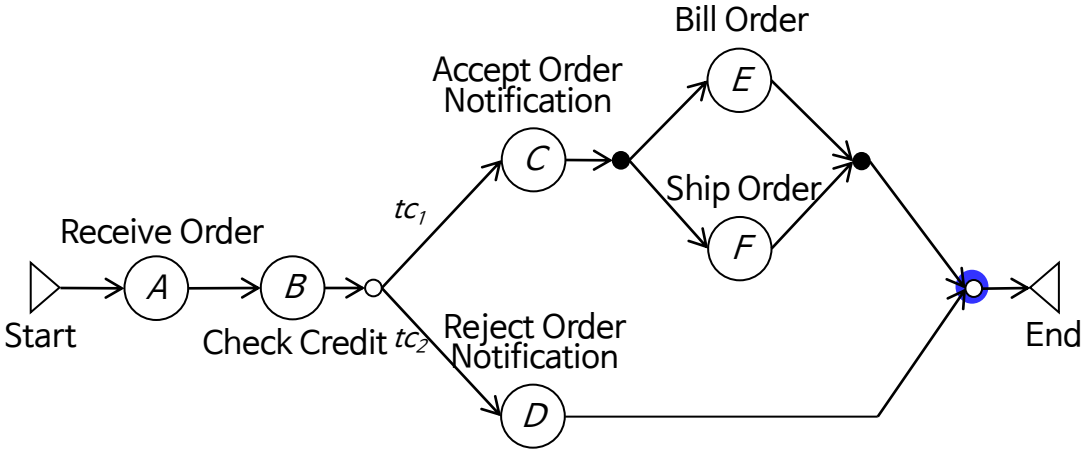


```
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  xsi:schemaLocation="http://www.wfmc.org/2004/XPDL2.0alpha file:/D:/workspace/XPDL_v2/TC-
1025_bpmnxpdl_24.xsd" Id="samplePkg " Name="samplePkg "〉
  〈WorkflowProcesses〉
    〈WorkflowProcess Id="Process-1191836303703" Name="sampleProcess"〉
      ...
      〈Activitys〉
        〈Activity Id="Activity1191836462765" Name="OR_JOIN"〉
          〈Route GatewayType="XOR" /〉
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          〈/NodeGraphicsInfo〉
        〈/NodeGraphicsInfos〉
        〈/Activity〉
      〈Activitys〉
      ...
    〈/WorkflowProcess〉
  〈/WorkflowProcesses〉
〈/Package〉
```
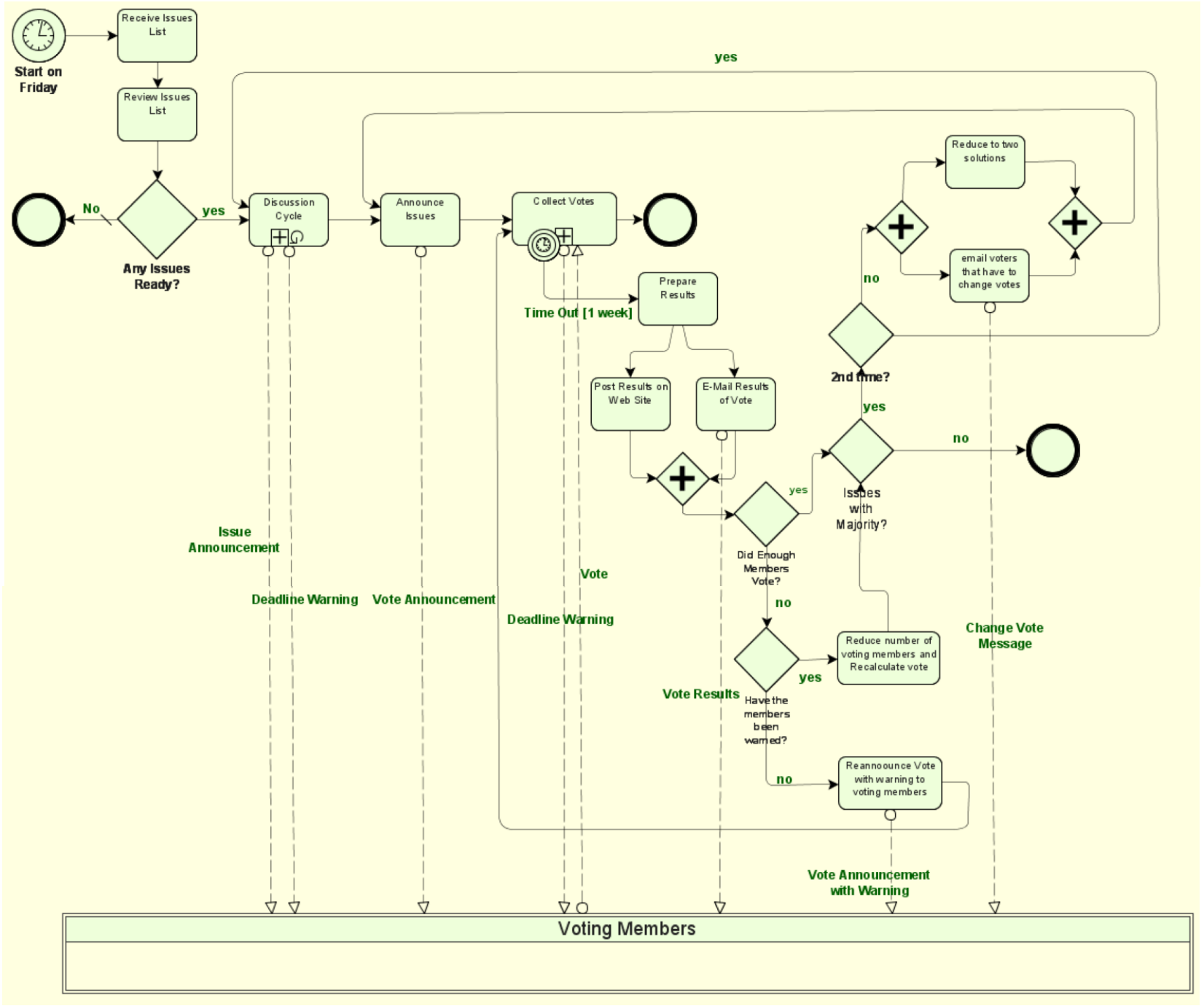
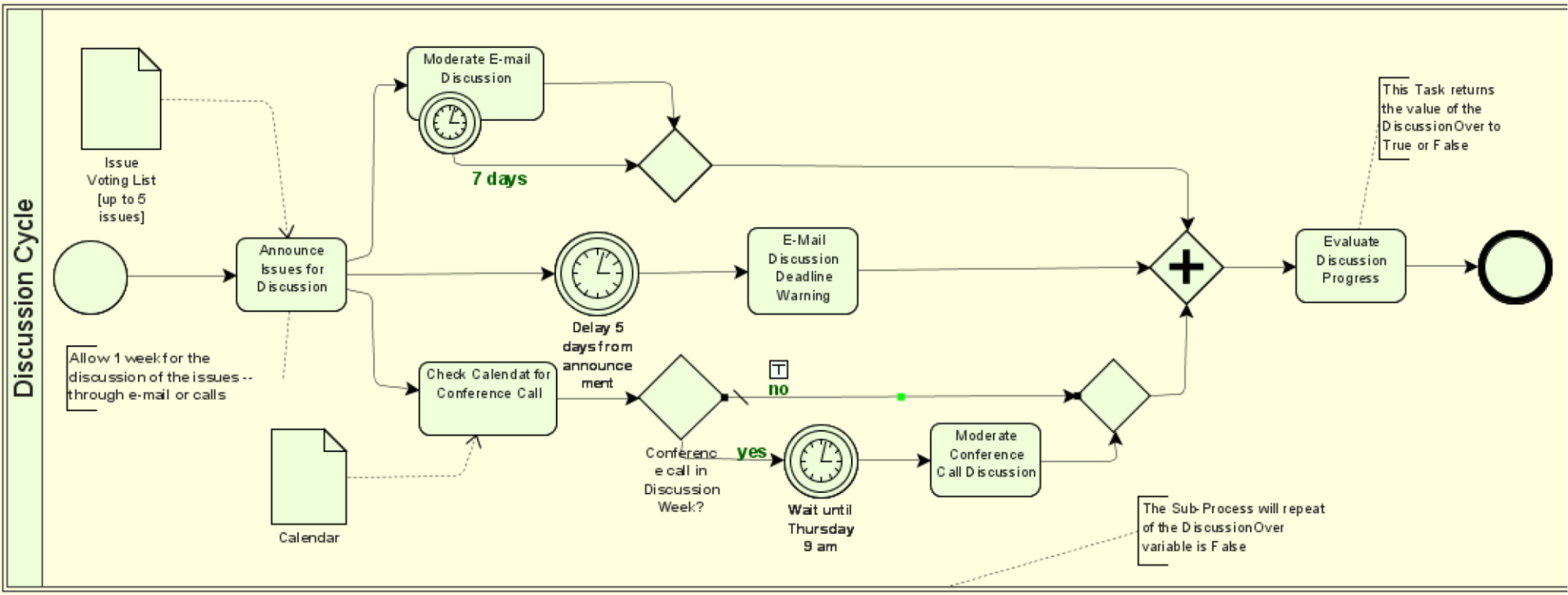

ex) **E-Mail Voting Process**

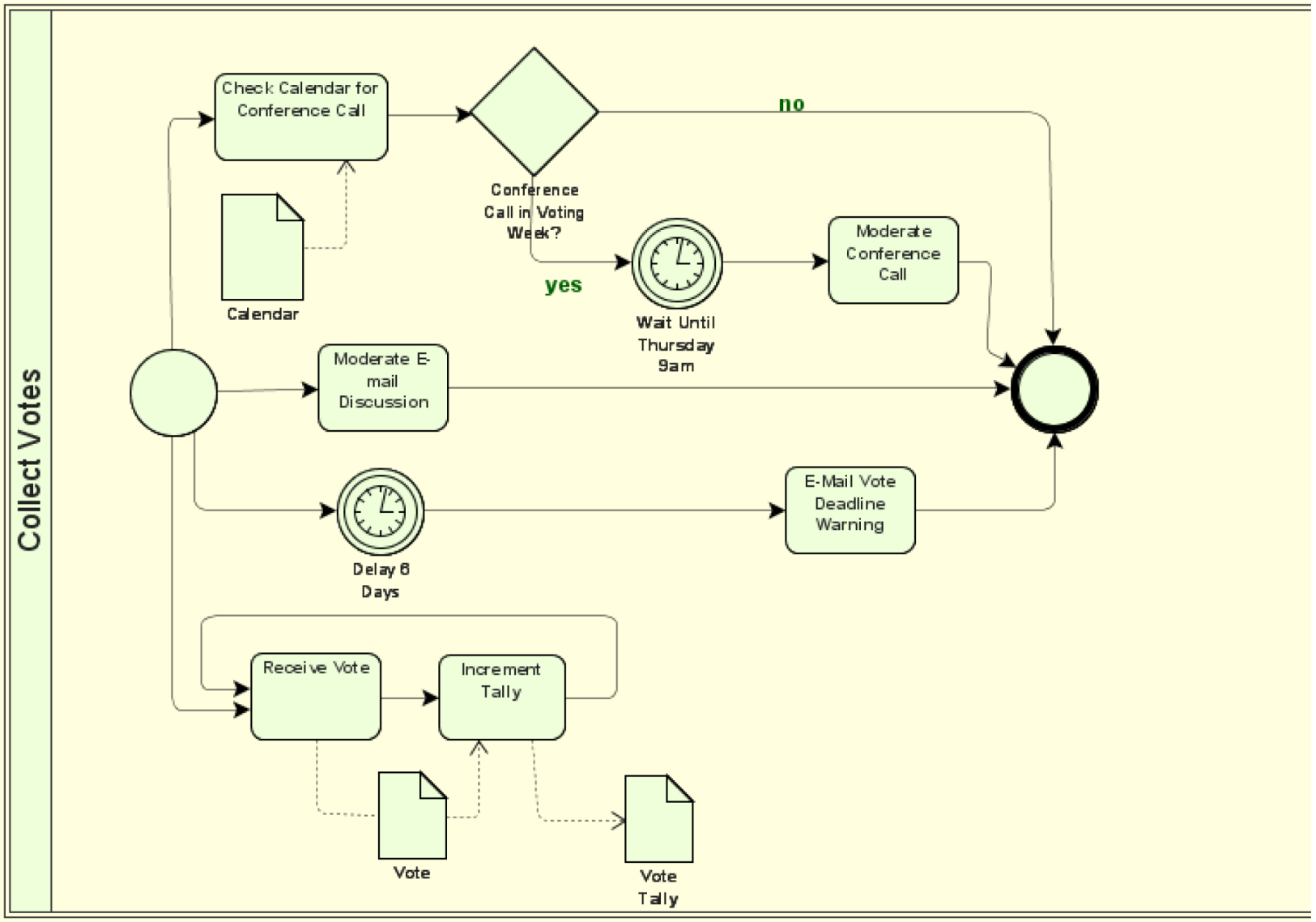
- 프로세스 예제: **이메일 투표 프로세스**(BPMN ⇨ XPDL)
  - 출처: XPDL 표준문서(LMS에 업로드)
  - 메인 프로세스: **EMailVotingProcess**
  - 서브 프로세스: **Discussion Cycle, Collect Votes**
  - 외부 참여자(external participants): **Voting Members**


Start on Friday
Receive Issues List
Review Issues List
Any Issues Ready?
No
yes
Discussion Cycle
Announce Issues
Collect Votes
Time Out [1 week]
Prepare Results
Post Results on Web Site
E-Mail Results of Vote
Did Enough Members Vote?
yes
no
Issues with Majority?
yes
no
2nd time?
no
Reduce to two solutions
email voters that have to change votes
Have the members been warned?
yes
no
Reduce number of voting members and Recalculate vote
Reannoounce Vote with warning to voting members
Issue Announcement
Deadline Warning
Vote Announcement
Vote
Deadline Warning
Vote Results
Change Vote Message
Vote Announcement with Warning
Voting Members

E-Mail Voting Process—**Discussion Cycle Subprocess**



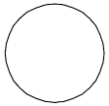
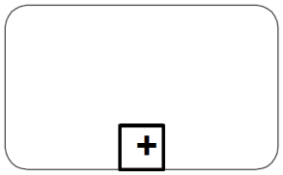
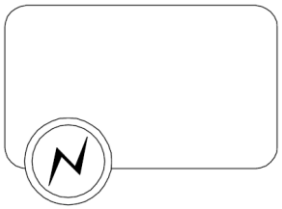
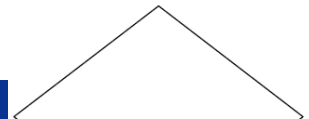
E-Mail Voting Process—**Collect Votes Subprocess**



References

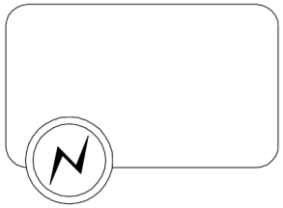
- social-biz.org, **The BPMN-XPDL-BPEL value chain** (link)
- Swenson, K., et al., **XPDL 2.0 and BPMN 1.0 Tutorial**, Docplayer (link)
- WfMC, **Process Definition Interface—XML Process Definition Language**, Version 2.1a, WFMC-TC-1025, 2008
- White, S.A., **XPDL and BPMN**, OMG (link)
- xpdl.org, **What is XML Process Definition Language (XPDL)** (link)

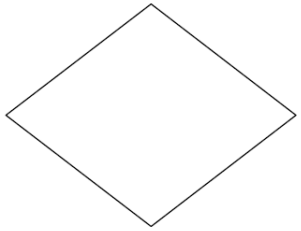
Questions?

Start Event		<Activity> <Event> <StartEvent Trigger="..."/> </Event> </Activity>
Sequence Flow		<Transition/>
Task		<Activity> <Implementation> <Task>...</Task> </Implementation> <Performers>...</Performers> </Activities>
Sub-Process		<Activity> <Implementation> <SubFlow>...<SubFlow/> </Implementation> </Activity>
Intermediate Event (attached to activity boundary)		<Activity Id="100" ...> <Event> <IntermediateEvent Trigger="Error" ... /> </Activity> ... <Transition Id="..." From="100" To="..."> </Transition>
		<Activity> <Route GatewayType="..." ... /> <TransitionRestrictions> <TransitionRestriction> <Split Type="..."> <TransitionRefs>

Mappings From BPMN to XPDL

개체 유형	BPMN 표기	XPDL 표현

Intermediate Event (attached to activity boundary)		`<Activity Id="100" ...>`
		`  <Event>`
		`  <IntermediateEvent Trigger="Error" ... />`
		`</Activity>`
		`...`
		`<Transition Id="..." From="100" To="...">`
		`</Transition>`

Gateway (split)		`<Activity>`
		`  <Route GatewayType="..." ... />`
		`  <TransitionRestrictions>`
		`  <TransitionRestriction>`
		`  <Split Type="...">`
		`  <TransitionRefs>`
		`  ...`
		`  </TransitionRefs>`
		`  </Split>`
		`  </TransitionRestriction>`
		`  </TransitionRestrictions>`
		`</Activities>`
		`...`
		`<Transition>`
		`...`
		`</Transition>`