University of Applied Sciences and Arts Northwestern Switzerland
School of Business

Next Generation
Enterprise Modelling
in the Age of Internet of Things

NEMO 2016 Summer School
Vienna, 18- 29 July 2016

Modeling Knowledge Work: Case Management and Decision-aware Business Processes

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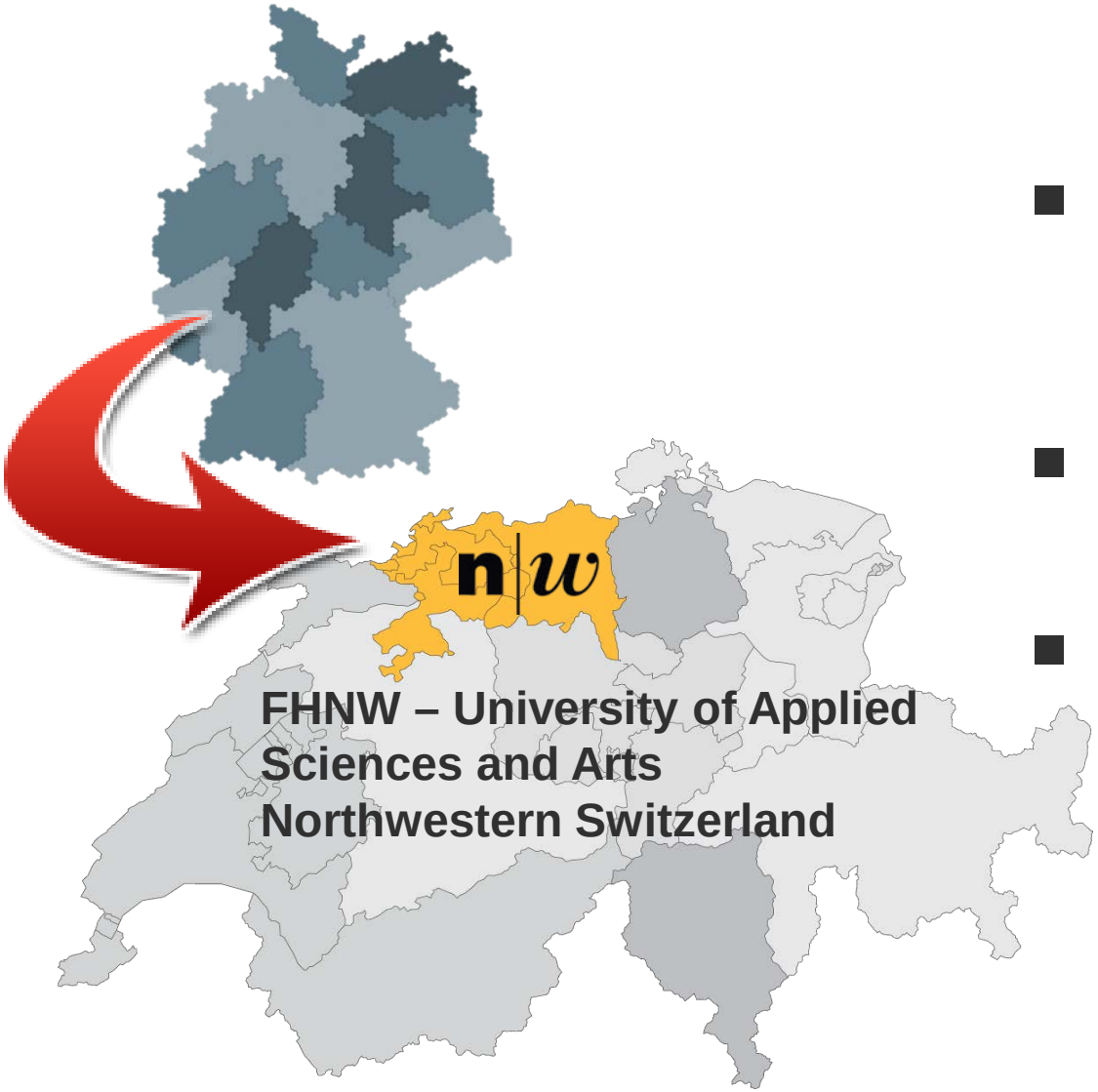
Well-known things from Switzerland

The Ultimate Swiss Armee Knife

About Me



- Head of Master of Science in Business Information Systems
- Research Associate at University of Pretoria
- Topics:
  - Enterpise Modelling
  - Business Processes and Knowledge Work
  - Alignment of Business and IT

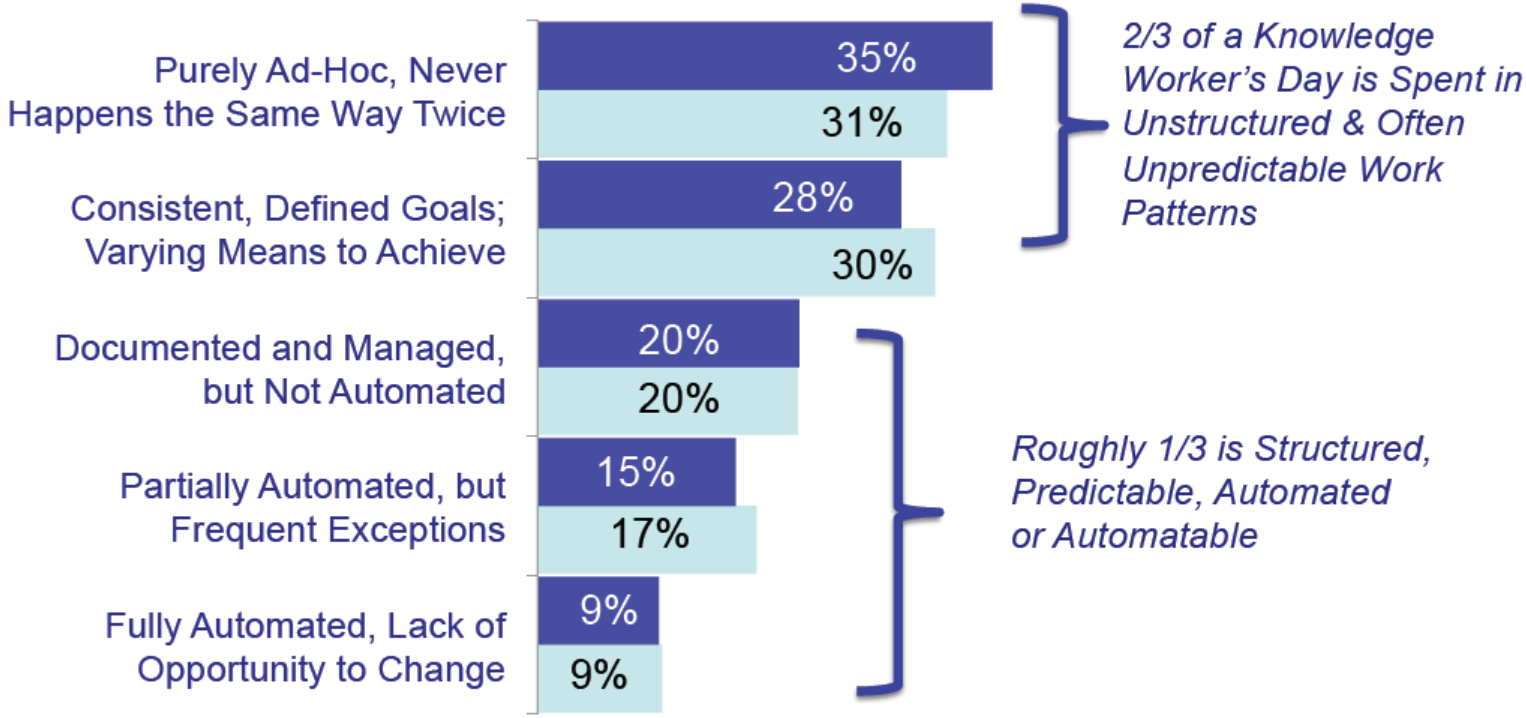
- For the latest material see:

http://knut.hinkelmann.ch/lectures/nemo2016/

Work Patterns of Knowledge Workers

Percent of the Day Spent in Different Modes

Most of a knowledge worker's day is spent working toward an identified outcome, yet the means for achieving this cannot be predetermined

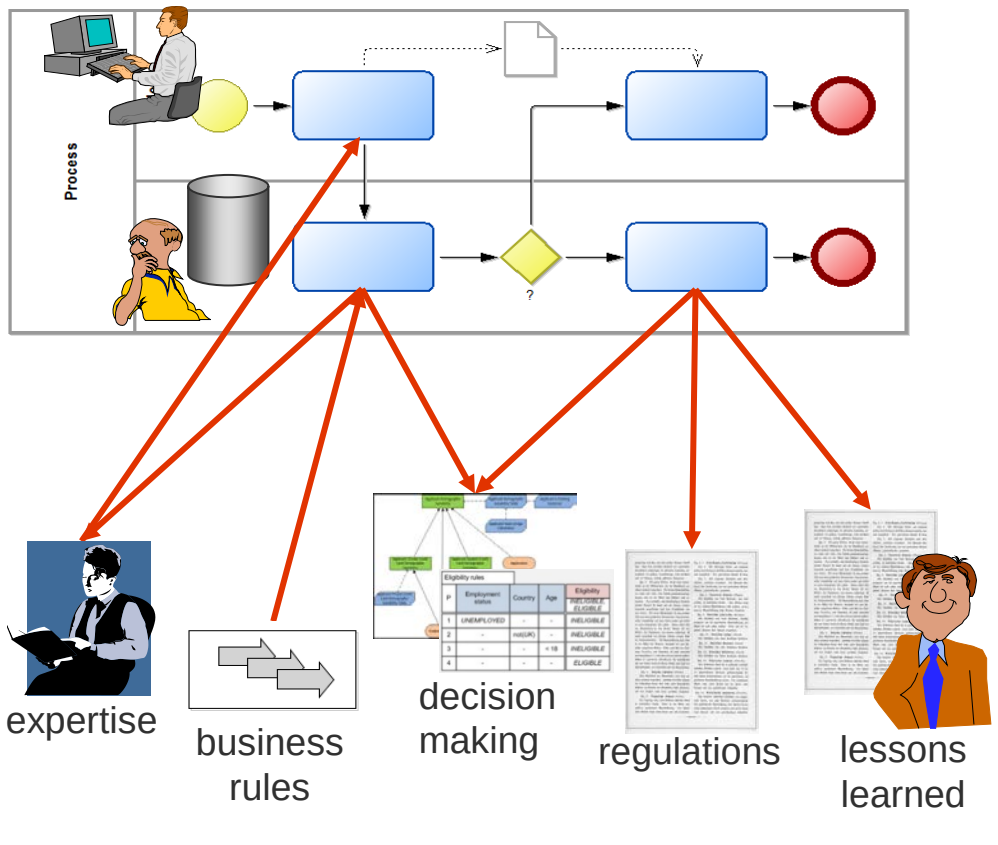


Source: 2011 - 2013 Case Management Survey

Process Logic and Business Logic

Process Logic

Business Logic



knowledge *about* processes:

- process flow
- roles
- resources

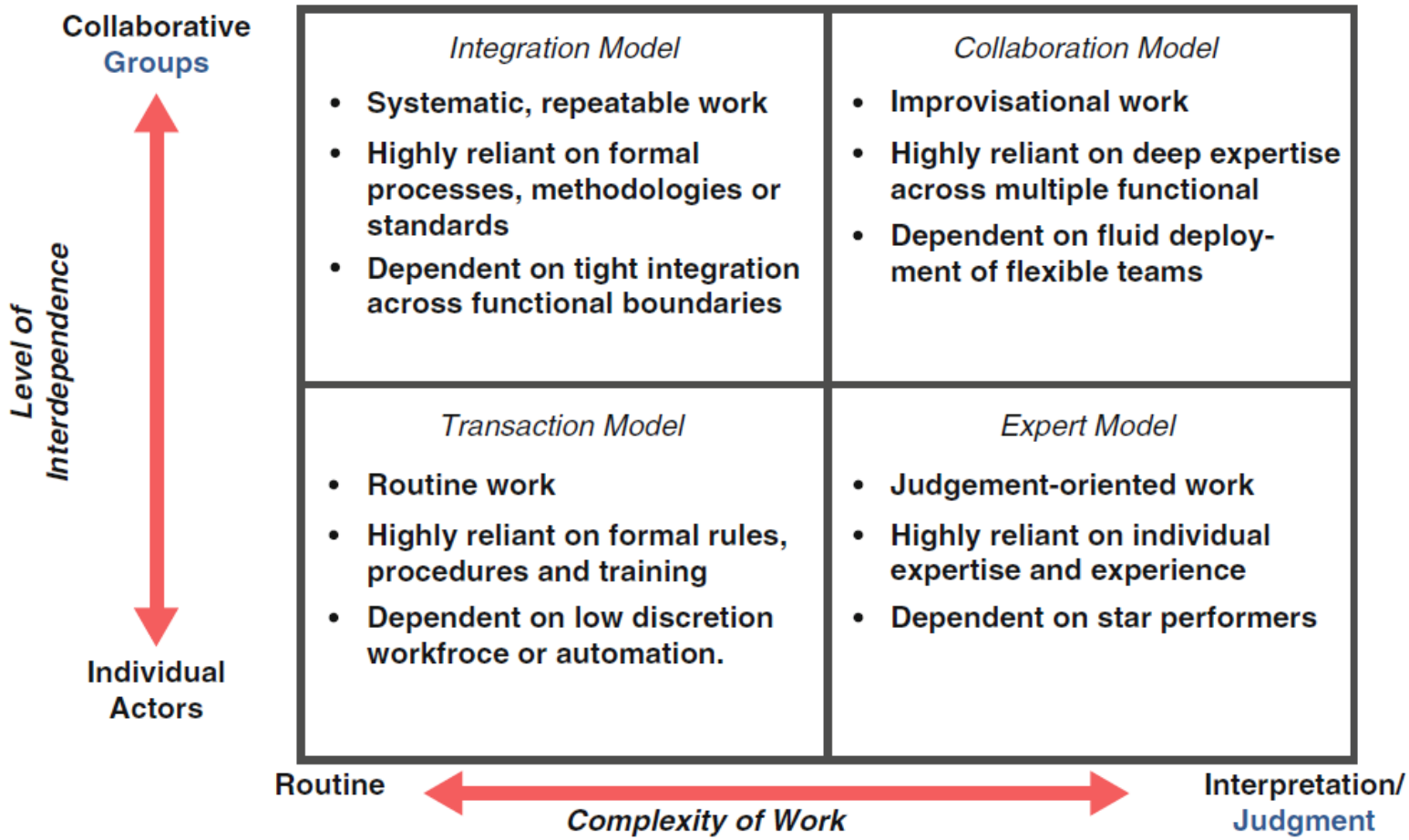
→ **process logic**

knowledge *in* processes:

- supports practice
- skills, experiences
- know how

→ **business logic**

Types of Knoweldge Work

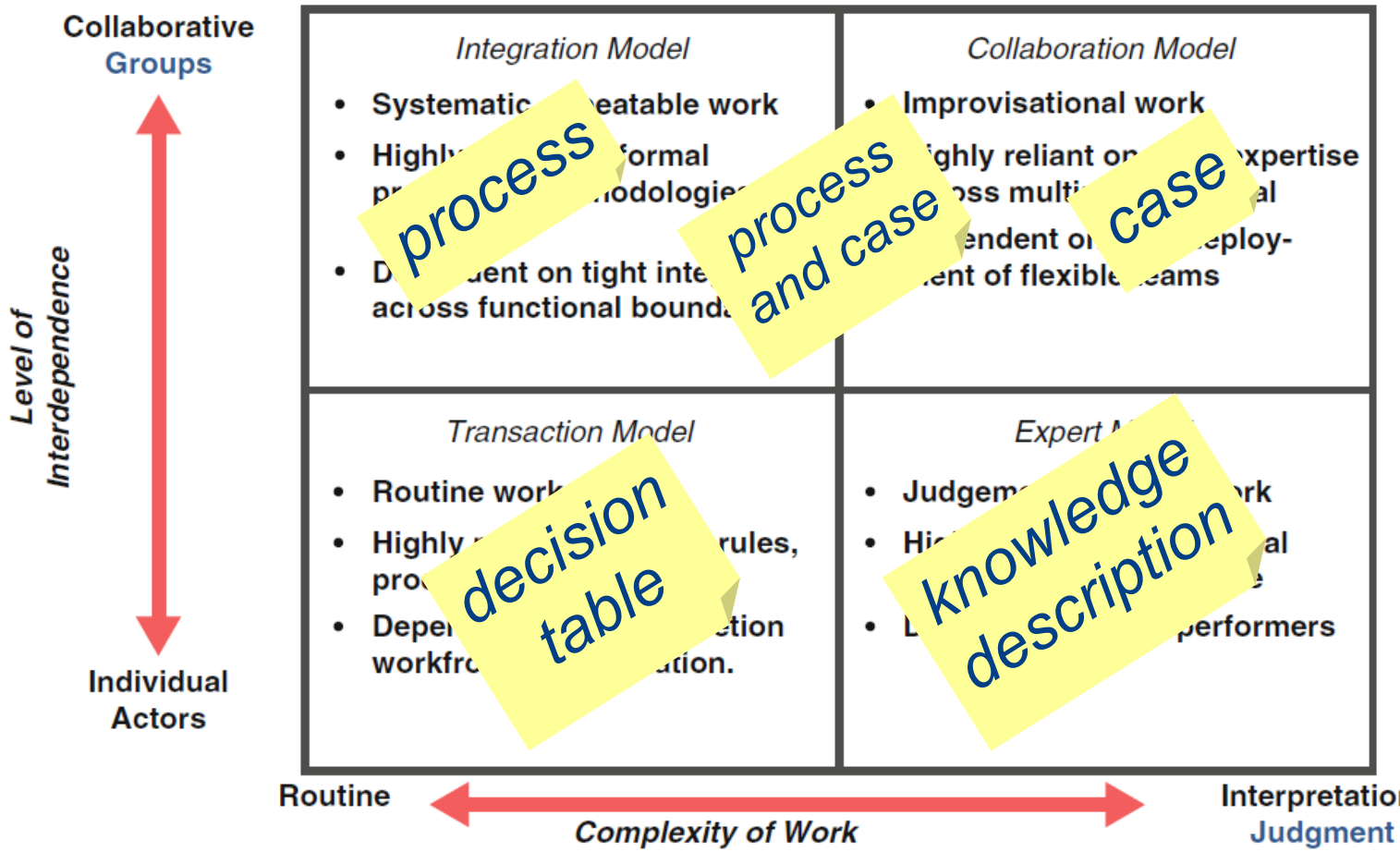


process logic

business logic

(Davenport 2010)

Types of Knoweldge Work

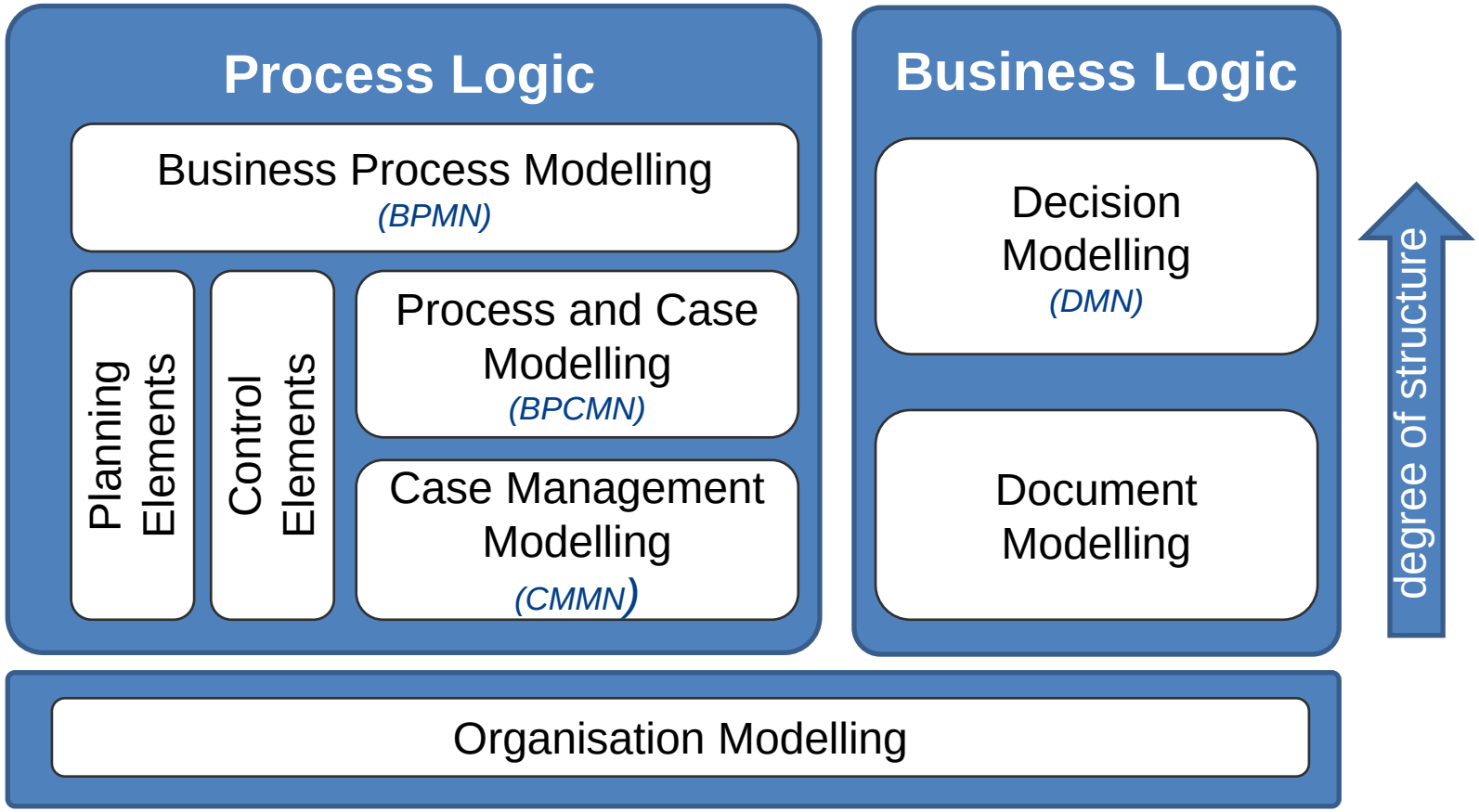


process logic

business logic

(Davenport 2010)

Model types of the Knowledge Work Designer



Modeling Business Processes

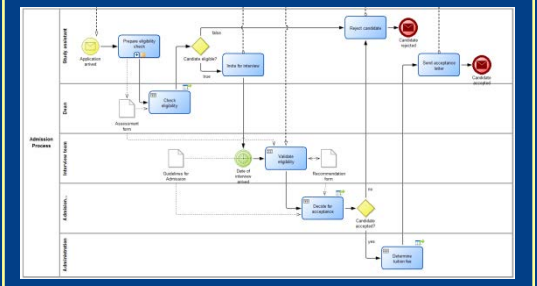
Classification of Processes

structured process	case	ad hoc process
• structured process flow • activites known in advance • many repetitive elements • no degree of freedom for people wrt process flow	• process flow can partly be structured • activites partly known in advance • some repetitive elements • some degree of freedom for people wrt process flow	• process flow cannot be structured – new tasks on the fly • activites partly known in advance • few repetitive elements • very high degree of freedom for people wrt process flow
← can be modelled →		← cannot be modelled →

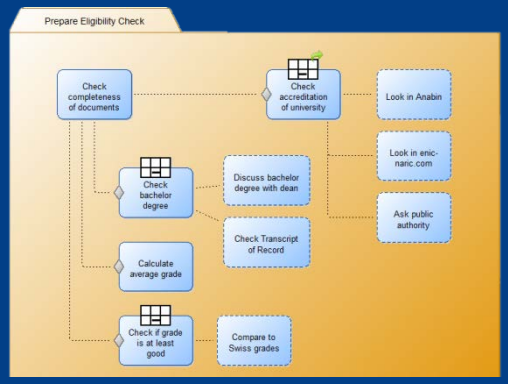
partly translated from (Gadatsch 2005, S. 44)

Structure of Processes

structured process



case



ad hoc process

- process flow cannot be structured – new tasks on the fly
- activites partly known in advance
- few repetitive elements
- very high degree of freedom for people wrt process flow

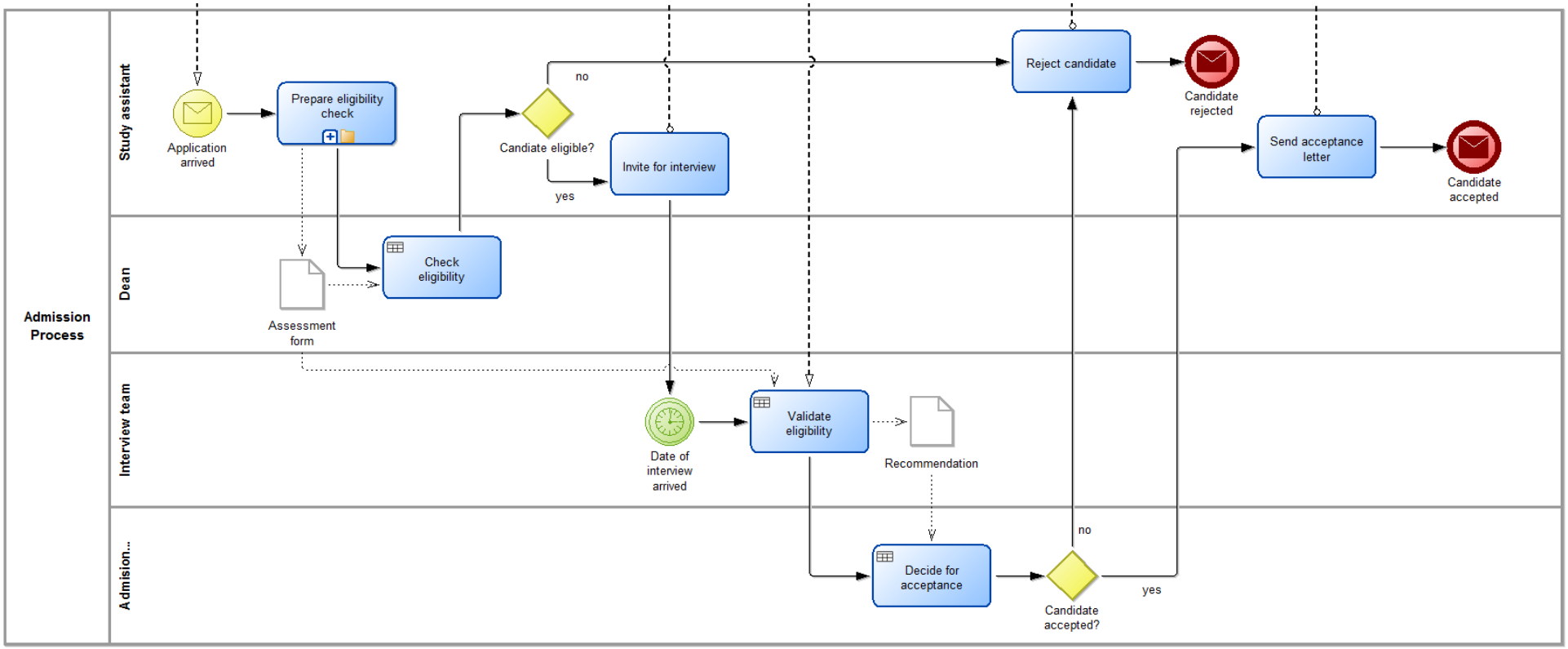
can be modelled

cannot be modelled

partly translated from (Gadatsch 2005, S. 44)

Business Process Model and Notation BPMN

Example: Admission for Master Study at FHNW



Case Management

Case Management

Case management is the management of ***long-lived collaborative processes*** that require ***coordination of knowledge, content, correspondence, and resources*** to achieve an objective or goal. The ***path of execution cannot be predefine***d. ***Human judgment*** is required in determining how to proceed, and the state of a case can be affected by ***external events***.

- Synonyms for Case Management are
  - Adaptive Case Management (ACM)
  - Dynamic Case Management (DCM)

(McCauley 2010)

Case Management Processes

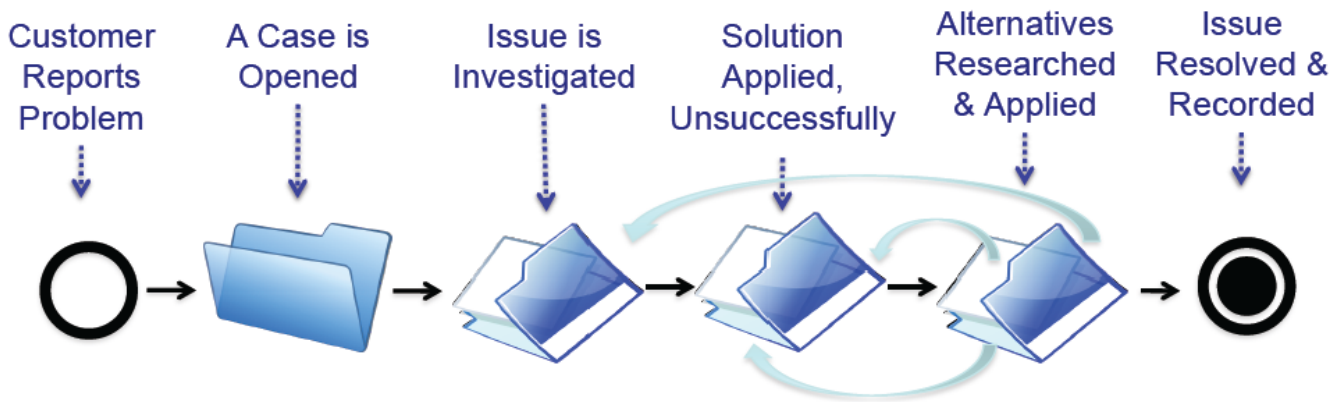
Case management processes: common in many industry segments, where activities and documents required depend on the circumstances of each case

- Benefits Administration
  - Examples: welfare assistance, student financial aid, grants programs, disability benefits
- Underwriting
  - Examples: commercial lending, life and disability insurance.
- Dispute Resolution
  - Example: customer demands a refund
- Project Management

(Silver 2011, p. 88f)

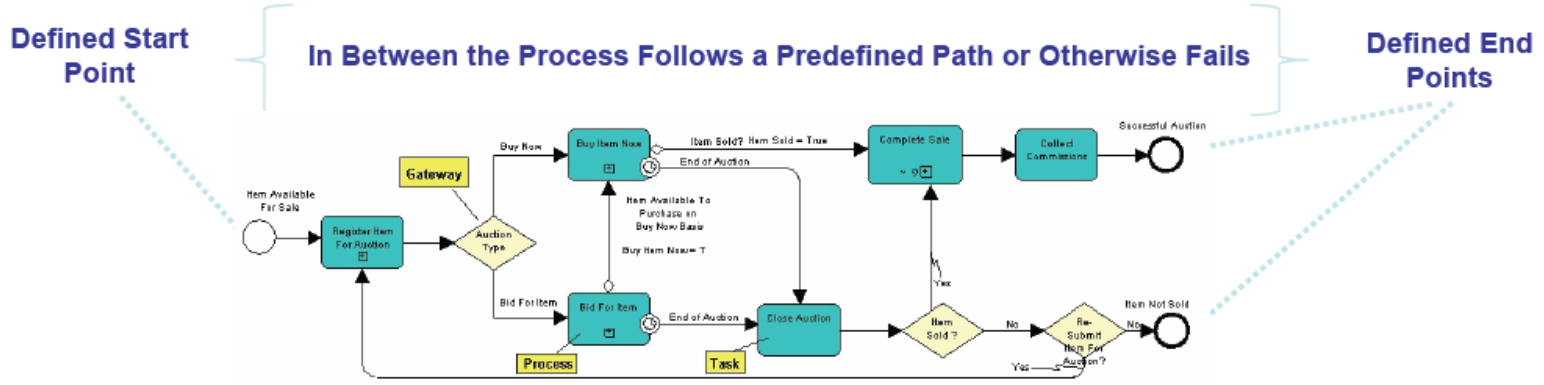
Content is Central for Case Management

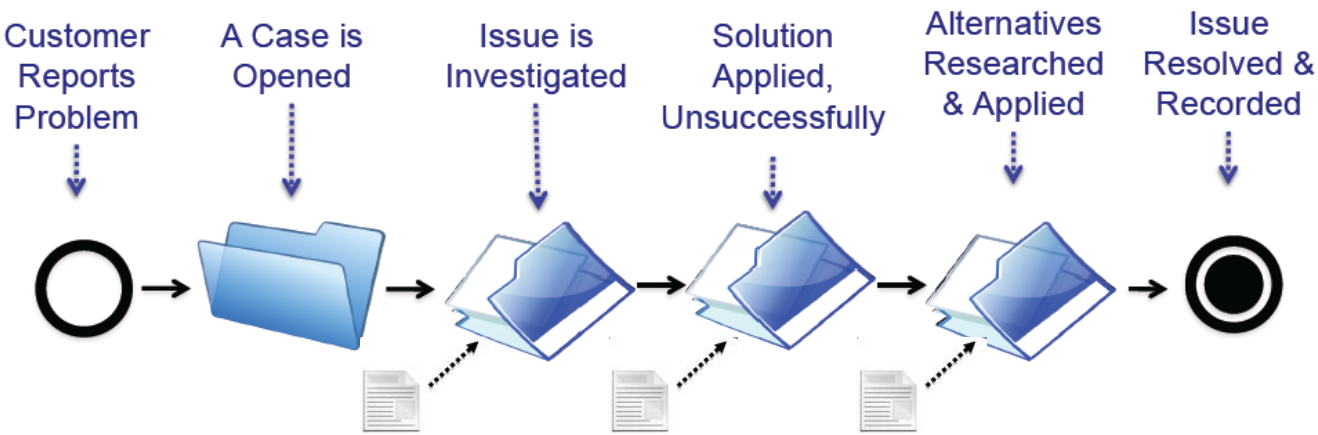
- Activities create information and add it to the case.
- Ability is required to jump forward, jump backward, re-do or otherwise perform work in a sequence that cannot be determined in advance
- The state of the Case is determined by the content within the case, not in which task the case is at any time



Source: Nathaniel Palmer

How Case Management (bottom) Differs From Structured Workflows (top)





Rather than a path determined by a predefined workflow, the case flow evolves based on content added to the case folder

Source: Nathaniel Palmer

Case File

- The Case File is a virtual folder ultimately providing the permanent record of a case
- The case folder provides overall coordination of the case as a whole.
- It is not possible to specify in advance all of the documents required.

Source: Nathaniel Palmer

Differences from Conventional BPM

- Case Information Managed as Documents
  - case-related information is received and managed in the form of business documents rather than structured data
- Case Activities Added at Runtime
  - Some tasks and processes may be defined in advance, but ad hoc tasks—whether selected from a pre- defined menu or defined from scratch—are a critical distinguishing element
- Case Advancement through Events
  - External events include messages whose contents are added to the case folder, Internal events include assignments and business rule to create and assign tasks.
- Case Context through Shared Case Folder
  - All case information, which is required for human judgment about advancement or resolution of the case, is typically available in the form of a shared case folder.

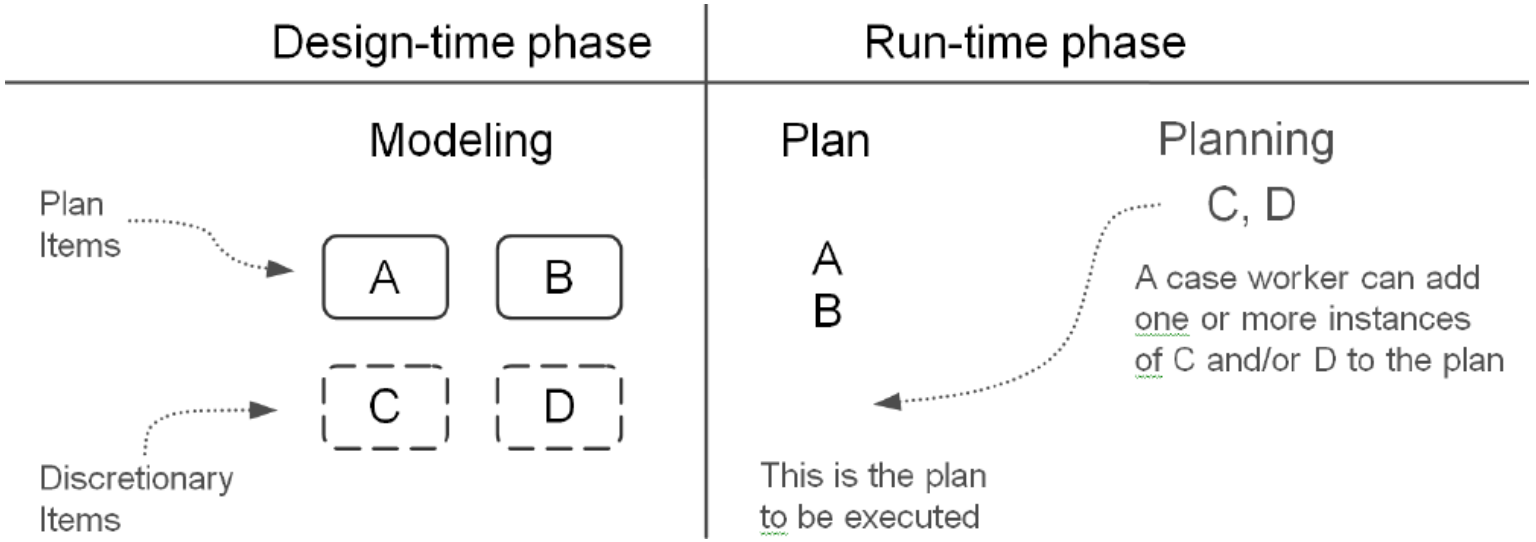
CMMN - Case Management Model and Notation

CMMN - Case Management Model and Notation

- OMG defined a Modeling Standard for Case Modeling
  - Case Management Model and Notation (CMMN)
- Version 1.0 is from May 2014
  - http://www.omg.org/spec/CMMN/1.0/PDF/
- Version 1.1 beta published in March 2016
  - http://www.omg.org/spec/CMMN/1.1/Beta/
- CMMN is specialized notation to model cases. It is independent from BPMN

Design Time vs Run Time = Modeling vs Planning

- A Case has two distinct phases: design-time and run-time
  - ***Design-time:* Business analysts** define
    - Tasks of pre-defined segments
    - "discretionary" Tasks that are additionally available to the Case worker
  - ***Run-time:* Case workers** execute the plan
    - performing Tasks based on control flow criteria,
    - adding discretionary Tasks if needed.



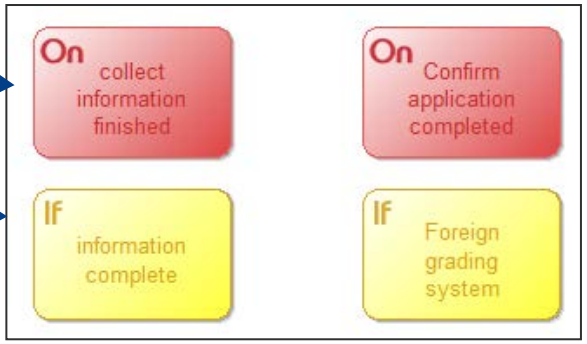
(CMMN 1.0, p. 5f)

Characteristics of Case Management Modeling

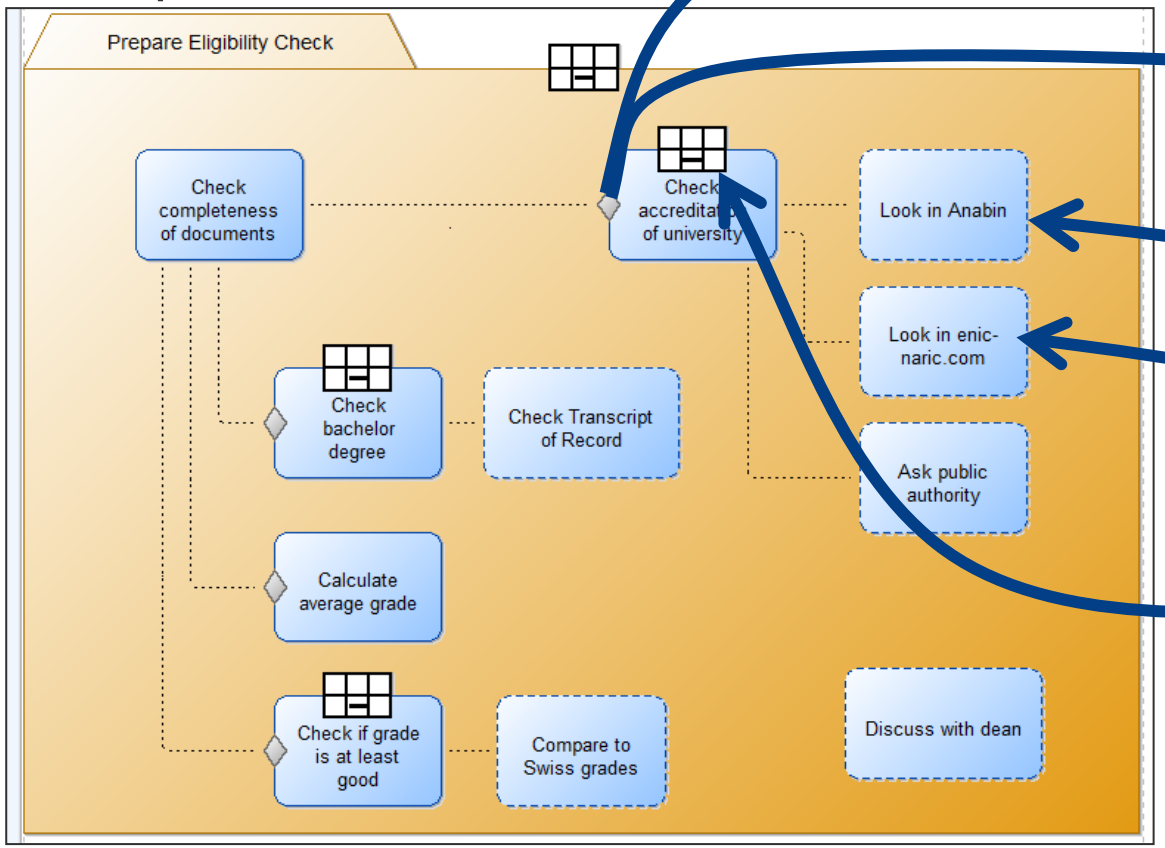
- No model of sequence flow
  - Execution of a task depends on events and conditions
    - **Sentries**
- Planning at run-time
  - Humans can decide about execution of tasks
    - **Discretionary tasks**
    - **Planning table**

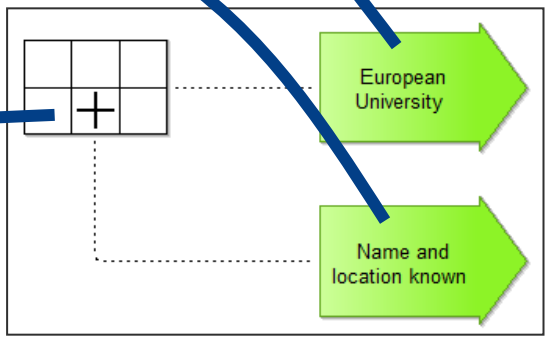
CMMN Case Plan Modelling in the Knowledge Work Designer

control elements:
determine task execution



case plan model

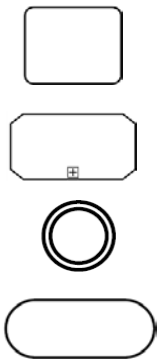




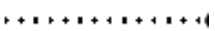
planning elements
support human planner

Case Plan Models

- There are four types of Plan Items:



  - ***Tasks / Discretionary Tasks***
  - ***Plan Fragments / Stages***
  - ***Event Listeners***
  - ***Milestones***

- There is one connector 
- There are two types of "control flow" elements:

  - ***Sentries***
  - ***Planning Tables***

(CMMN 1.0, p. 17)

Discretionary Tasks

- Discretionary Tasks are available to the Case worker, to be applied to his/her discretion
- It is up to the Case worker
  - ♦ whether he/she want to execute a discretionary task
  - ♦ when to execute a discretionary task
  - ♦ how often he/she wants to execute a discretionary task
- A discretionary Task is depicted with dashed lines

(CMMN 1.0, p48f)

Example:
Check Eligibility of MSc Candidates

Process: Check Eligibility of MSc Candidates

- A new application triggers the process.
- First: Study assistant confirms that the application has arrived.
- The study assistant determines whether the bachelor degree is ok. The study assistant may check the transcript of record if he/she is unsure.
- It is also checked whether the university is accredited. If the university is unknown to the study assistant can look in the Anabin database or enic-naric.net or ask public authorities.
- It is checked whether the average grade is at least “good”.
- The average grade is calculated, if it is not mentioned.
- The study assistant has to register the student.
- The study assistant can discuss with the dean at any time.
- The dean decides, whether the candidate is eligible.
- Candidates are informed by the study assistant.

- What is the basis process?
  - Which tasks are executed in every case?
  - Which tasks are executed only for specific cases?

Exercise: Check Eligibility of MSc Candidates

- A **new application** triggers the process.
- First: Study assistant **confirms that the application** has arrived.
- **The study assistant determines whether the bachelor degree** is ok. The study assistant may check the transcript of record if he/she is unsure.
- It is also **checked whether the university is accredited**. If the university is unknown to the study assistant can look in the Anabin database or enic-naric.net or ask public authorities.
- It is **checked whether the average grade is at least "good".**
- The **average grade is calculated**, if it is not mentioned.
- The study assistant has to **register the student**.
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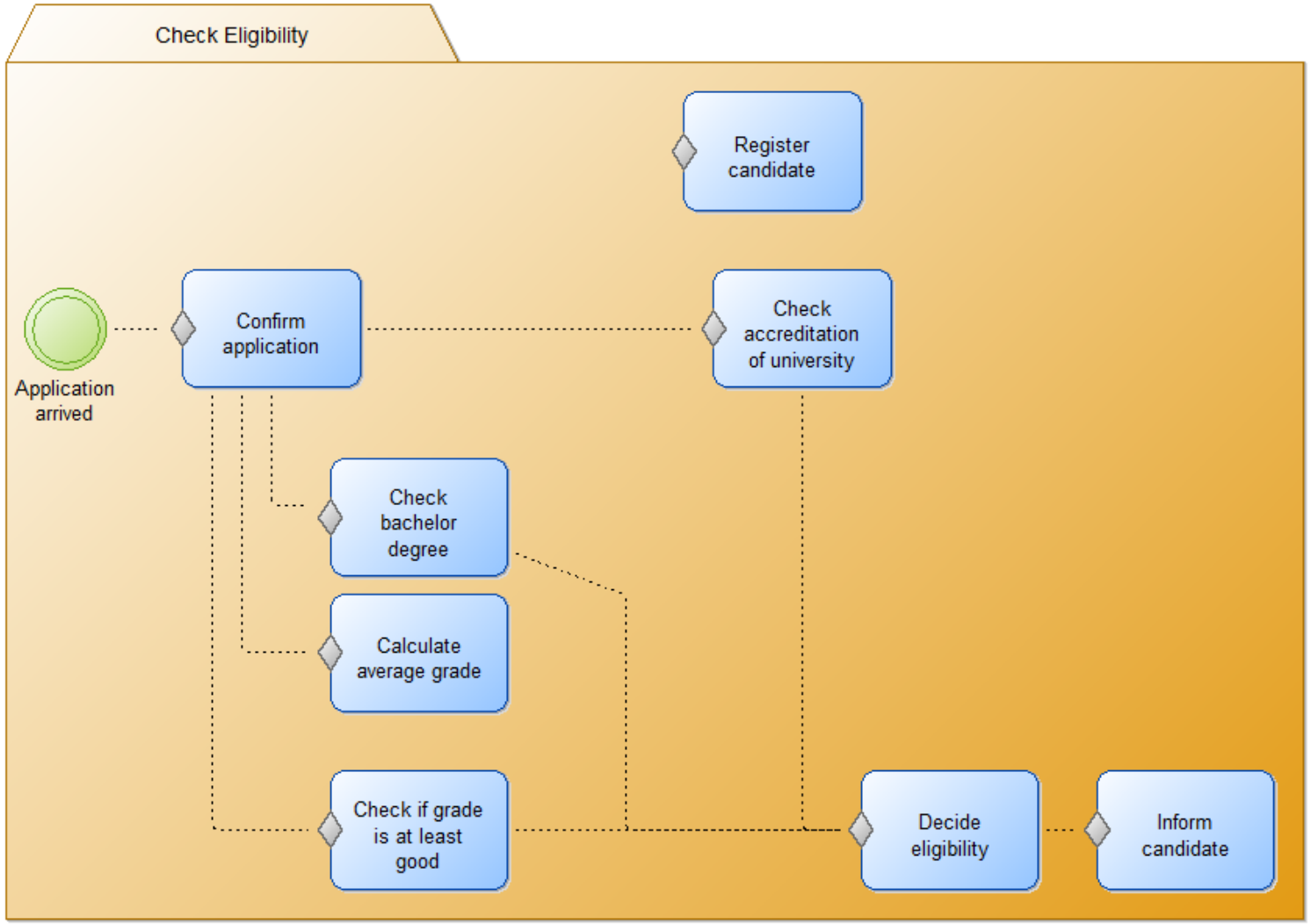
- The **dean decides**, whether the candidate is eligible.
- **Candidates are informed** by the study assistant.

Basic Process in CMMN



- Which tasks depend on the experience, preference or judgment of the worker?
  - These are the discretionary tasks

Exercise: Check Eligibility of MSc Candidates

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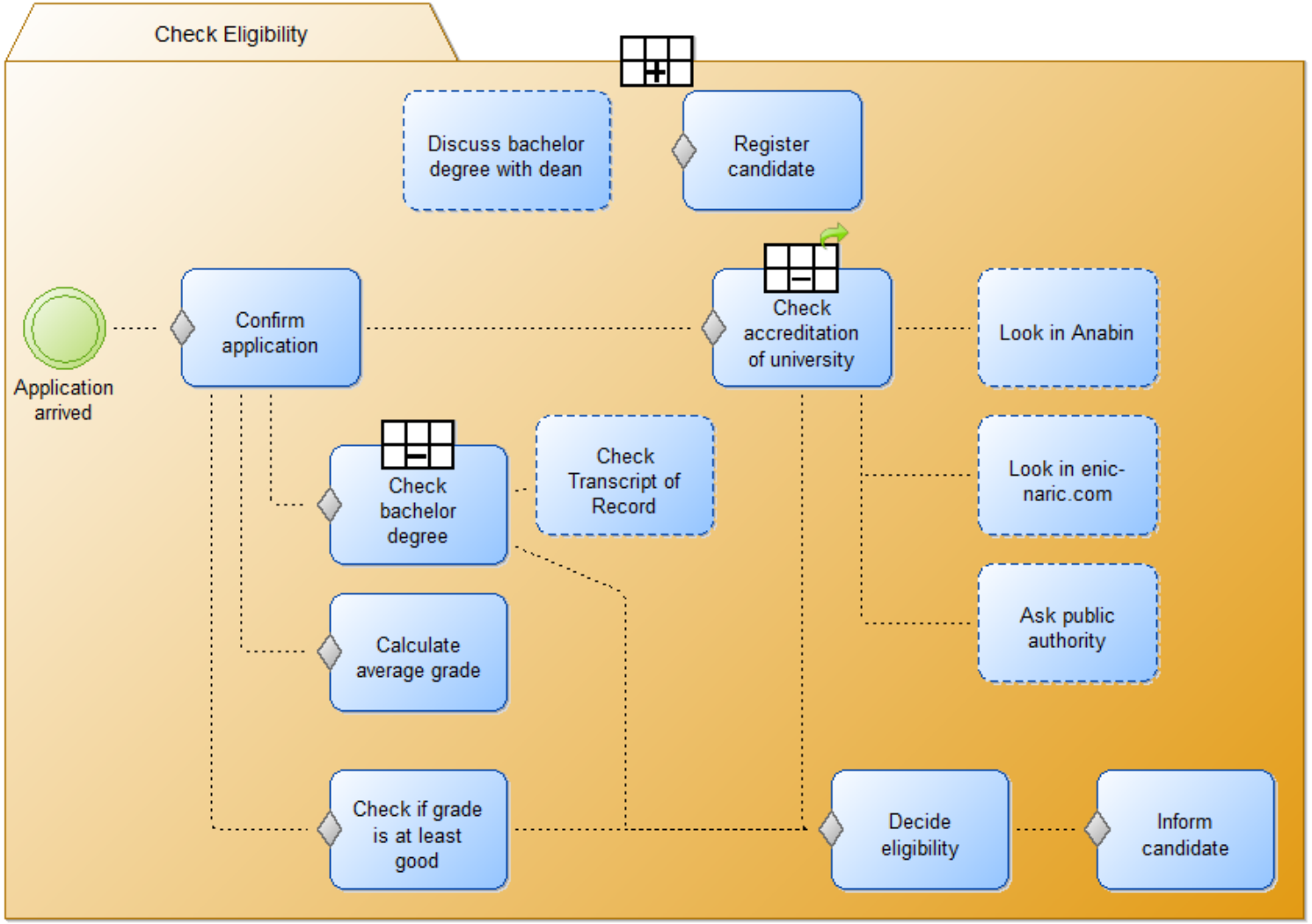
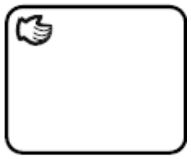
Process as CMMN Model



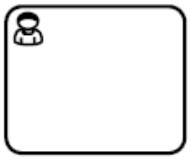
Details about CMMN Elements

Tasks

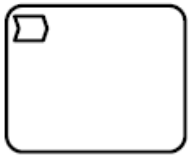
- Three types of tasks
  - **Human Task** - a Task that is performed by a Case worker, they can be
    - Blocking: Task is waiting until the work associated with the Task is completed
    - Non-Blocking: the Task is not waiting for the work to complete and completes immediately, upon instantiation.
  - **Process Task** - can be used in the Case to call a Business Process
  - **Case Tasks** - can be used to call another Case



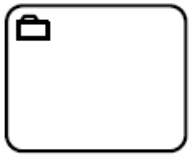
Non-Blocking Human Task



Blocking Human Task



Process Task

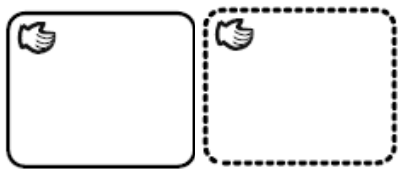


CaseTask

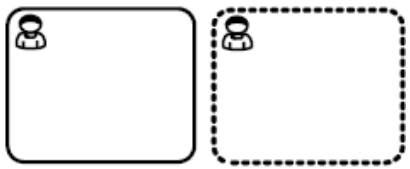
(CMMN 1.0, 48ff)

Discretionary Tasks

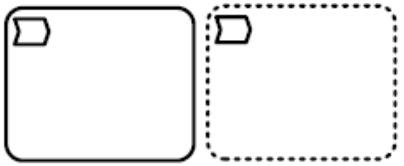
- Discretionary Tasks are available to the Case worker, to be applied to his/her discretion
- A discretionary Task is depicted by a rectangle shape with dashed lines and rounded corners
- Any task type can be discretionary



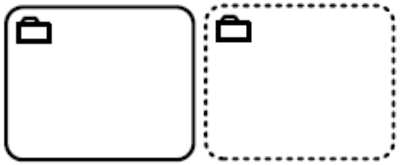
Non-Blocking Human Task



Blocking Human Task



Process Task



CaseTask

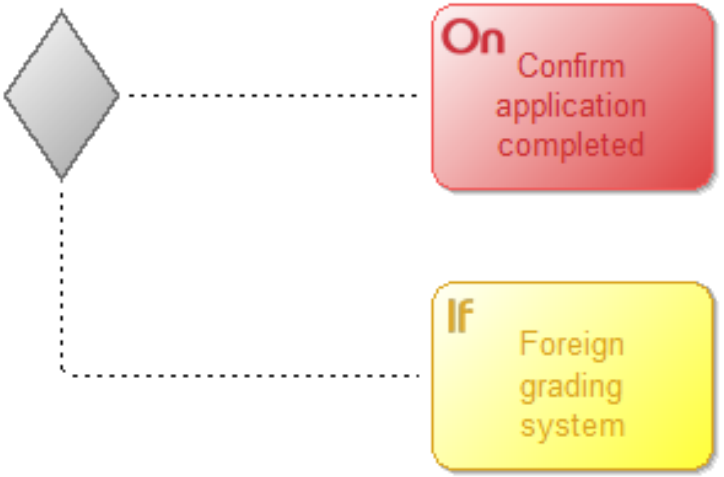
(CMMN 1.0, p48f)

Sentry

- Sentries define the criteria according to which the Plan Items are enabled (or entered) and terminated (or exited)
- A Sentry is a combination of an event and/or a condition.
  - On-Part specifies the event that serves as trigger.
  - If-Part specifies a condition that evaluates over the Case File.

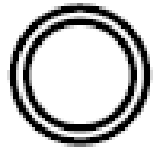
```
on <event>
if <condition>
```

- Both On-Part and If-Part are optional
- An Sentry and the task correspond to an ECA (Event-Condition-Action) rule.



(CMMN 1.0, p. 23f)

Events



CMMN distinguishes three kinds of events:

- Anything that can happen to information in the CaseFile
  - a case file time created, deleted, modified, ….
- Anything that can happen to Tasks, Stages and Milestones.
  - as tasks is started, cancelled, finished, …
- Event Listeners to model events that do not happen to plan items.
  - Event Listeners are specialized to

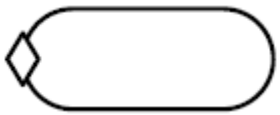
- Timer Event Listener

- User Event Listener

(CMMN 1.0, p. 18f, 52f)

Milestones

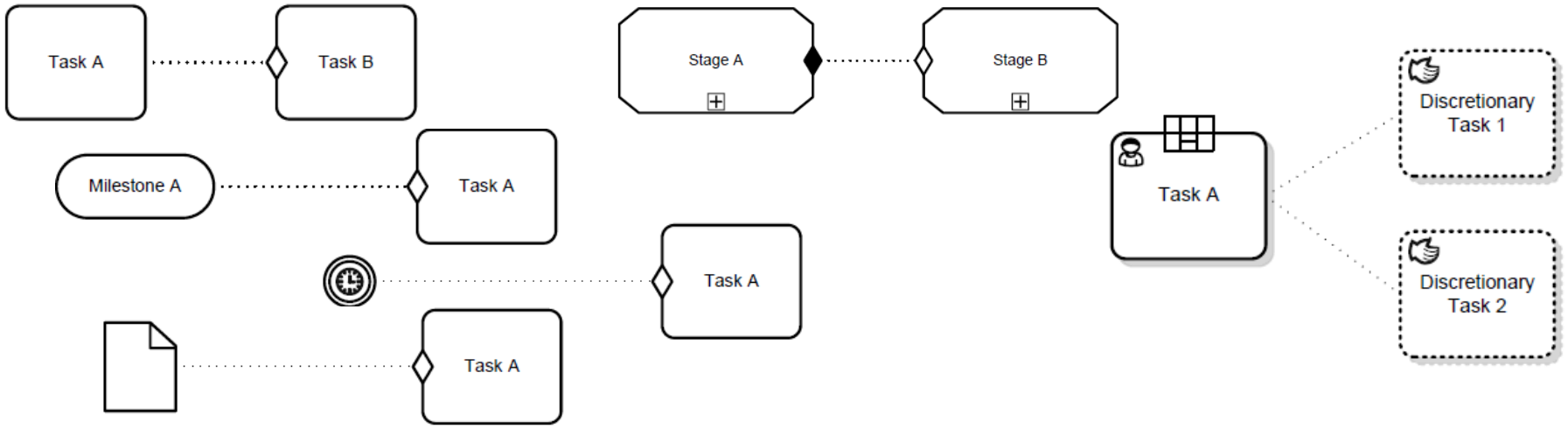
- A Milestone is a Plan Item Definition that represents an achievable target, defined to enable evaluation of progress of the Case.
- Completion of set of tasks or the availability of key deliverables (information in the CaseFile) typically lead to achieving a Milestone.
- A Milestone may have zero or more entry criteria, which define, when a milestone is reached



(CMMN 1.0, p. 21, 52)

Connectors

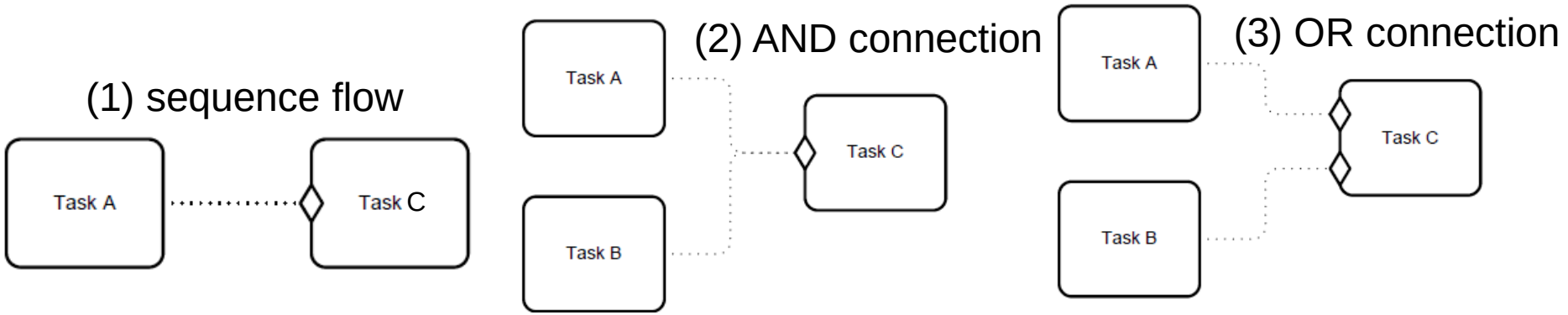
- Connectors can be used to visualize dependencies between Plan Items, in particular
  - The dependency of the On-Part of a Sentry
  - between a Human Task and Discretionary Items



(CMMN 1.0, p. 53ff)

Connector Usage: Control Flow

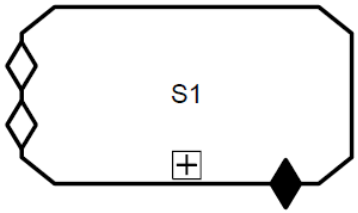
- Connectors that represent Sentry On-Parts can be used to visualize dependencies between Plan Items.
- The following pictures illustrates situations where Task C can be activated only
  (1) if Task A is complete
  (2) if Task A and Task B are complete
  (3) if Task A or Task B are complete



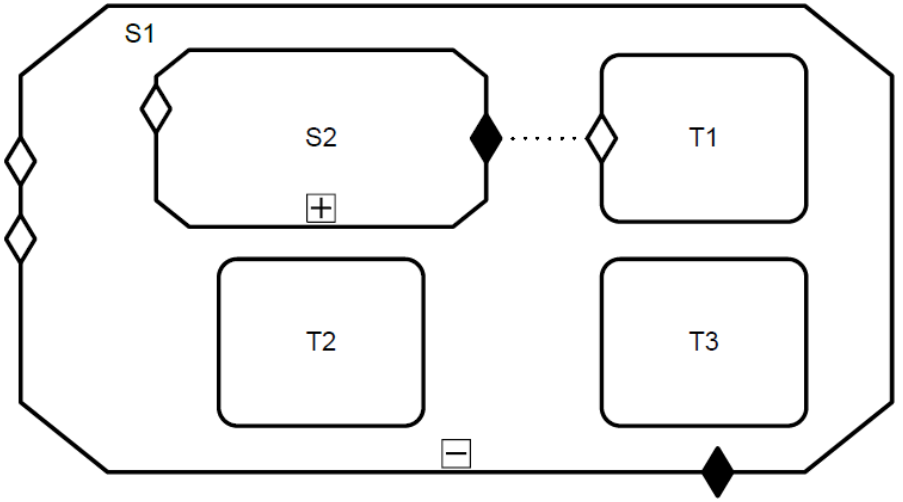
(CMMN 1.0, p. 54)

Plan Fragments and Stages

- A Plan Fragment is a container of Plan Items and the Sentries
- Stages are Plan Fragments that can be tracked.
- Stages maybe considered “episodes” of a Case.
- A Stage has a marker in the form of a “+” or "-" sign to designate expanded or collapsed stages.



collapsed stage with two entry and one exit criterion



Expanded versions of the Stage with one sub Stage and three Tasks

(CMMN 1.0, p. 46f)

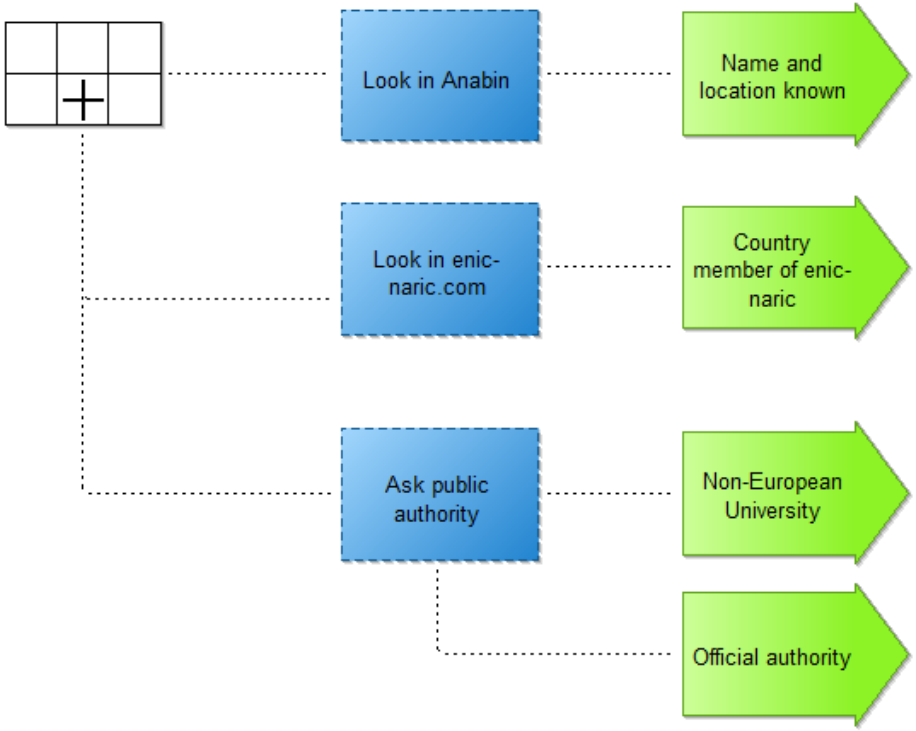
Planning at Run Time: Applicability Rules

- PlanningTables can be assigned to a Stage or a HumanTask.
- Case workers are said to “plan” (at run-time), when they select Discretionary Tasks
- A Planning Table can have can have applicability rules for Discretionary Tasks.
- Applicability Rules are used to specify, whether a Discretionary Task is “applicable” (“eligible”, “available”) for planning, based on conditions that are evaluated over information in the Case File.
- At run-time only Discretionary Items, for which the ApplicabilityRule evaluates to “true”, must be shown to the Case Worker

(CMMN 1.0, p. 29, 56)

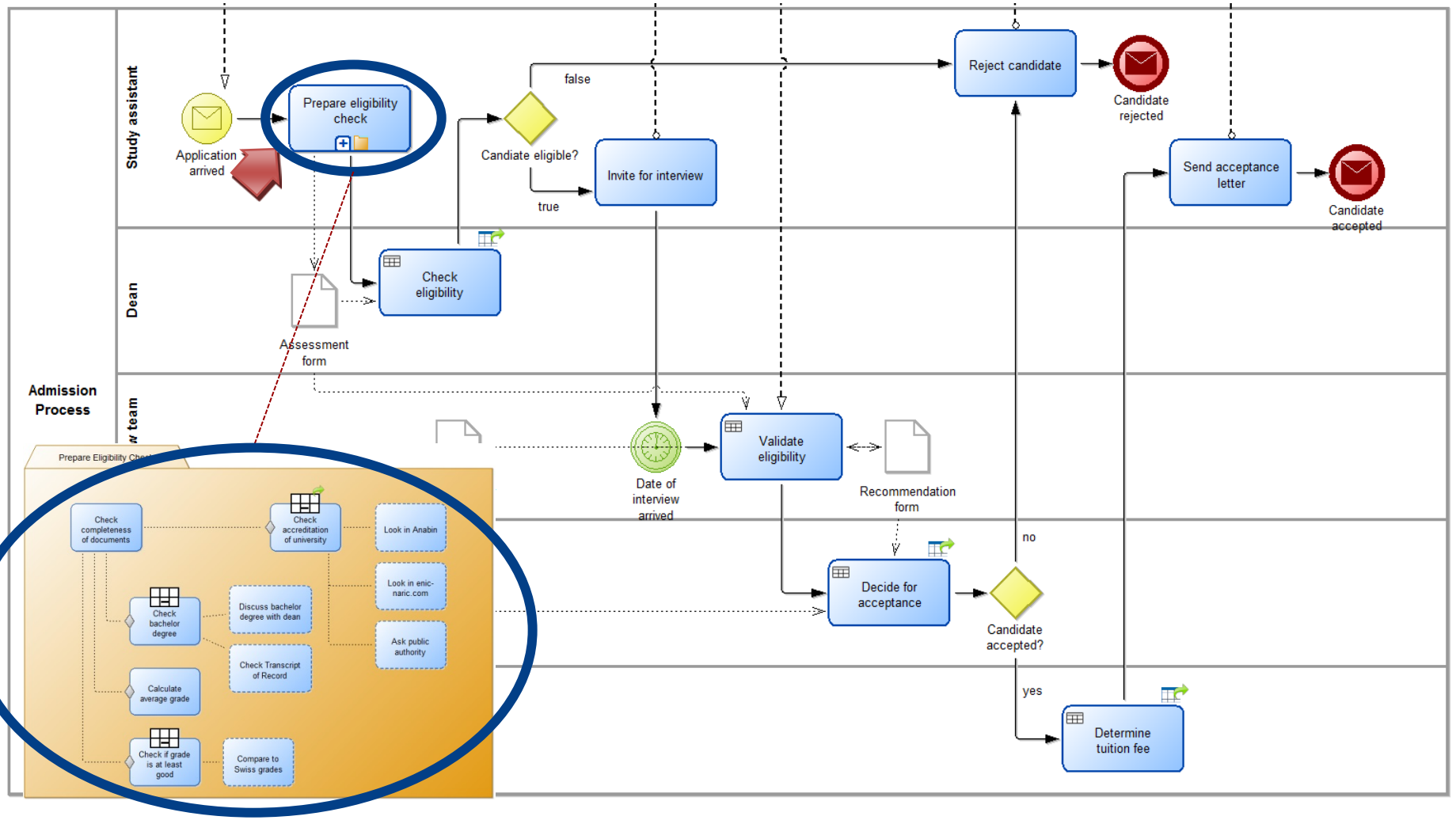
Planning Table and Applicability Rules

- Relation of Planning Table, Discretionary Item and Applicability Rules in the Knowledge Model Designer

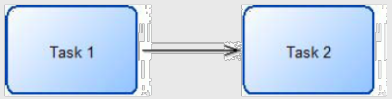
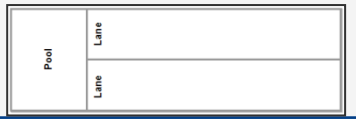


BPMN and CMMN

CMMN for Subprocesses in BPMN



Comparing Elements of BPMN and CMMN

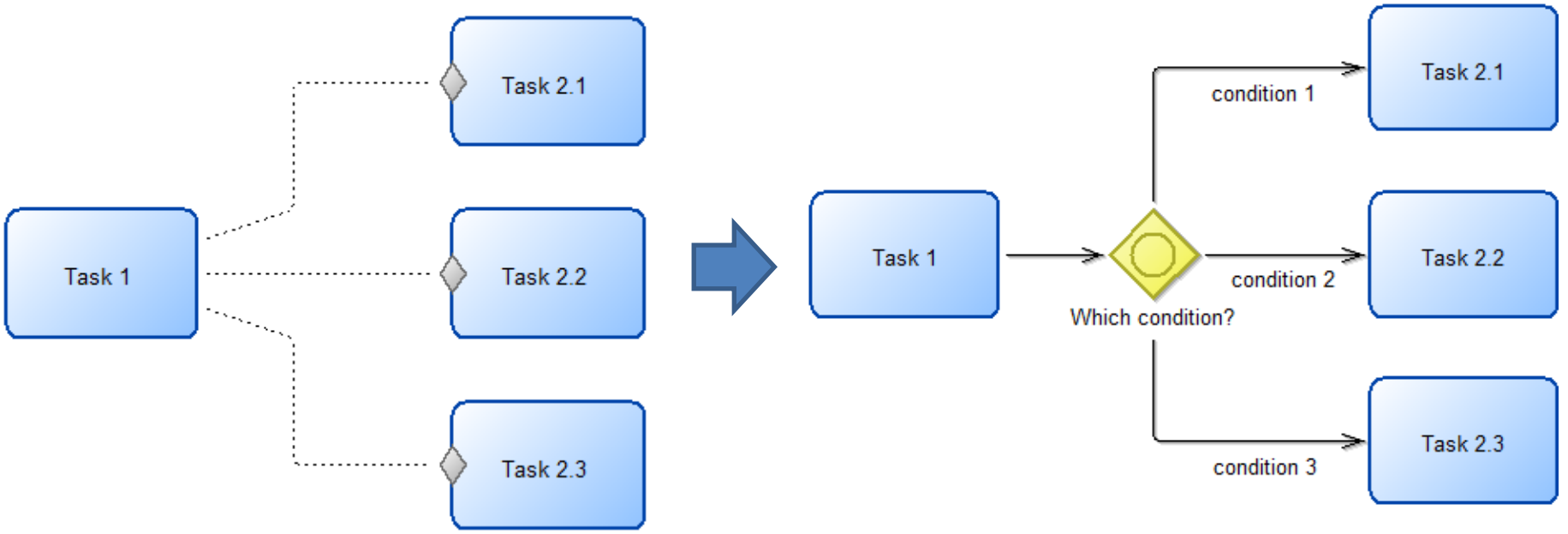
	BPMN	CMMN
Tasks	Tasks	Tasks
Process hierarchy	Subprocesses, Call Activities	Process Tasks, Case Tasks
Events	Events: start – intermediate – end catching – throwing	Event Listeners, implicit Events, Milestones
Control Flow	Gateways/Events	Sentries
	Sequence Flow 	Sentry with empty condition 
Planning	--	Discretionary Tasks
Responsibilities	Lanes	Role attribute
Process Container	Pool 	Folder 

Rules in BPMN and CMMN

BPMN	CMMN
Business rules (tasks)	---
Events/gateways	Sentries
---	Applicability rules (planning tables)

Implicit Control Flow in CMMN

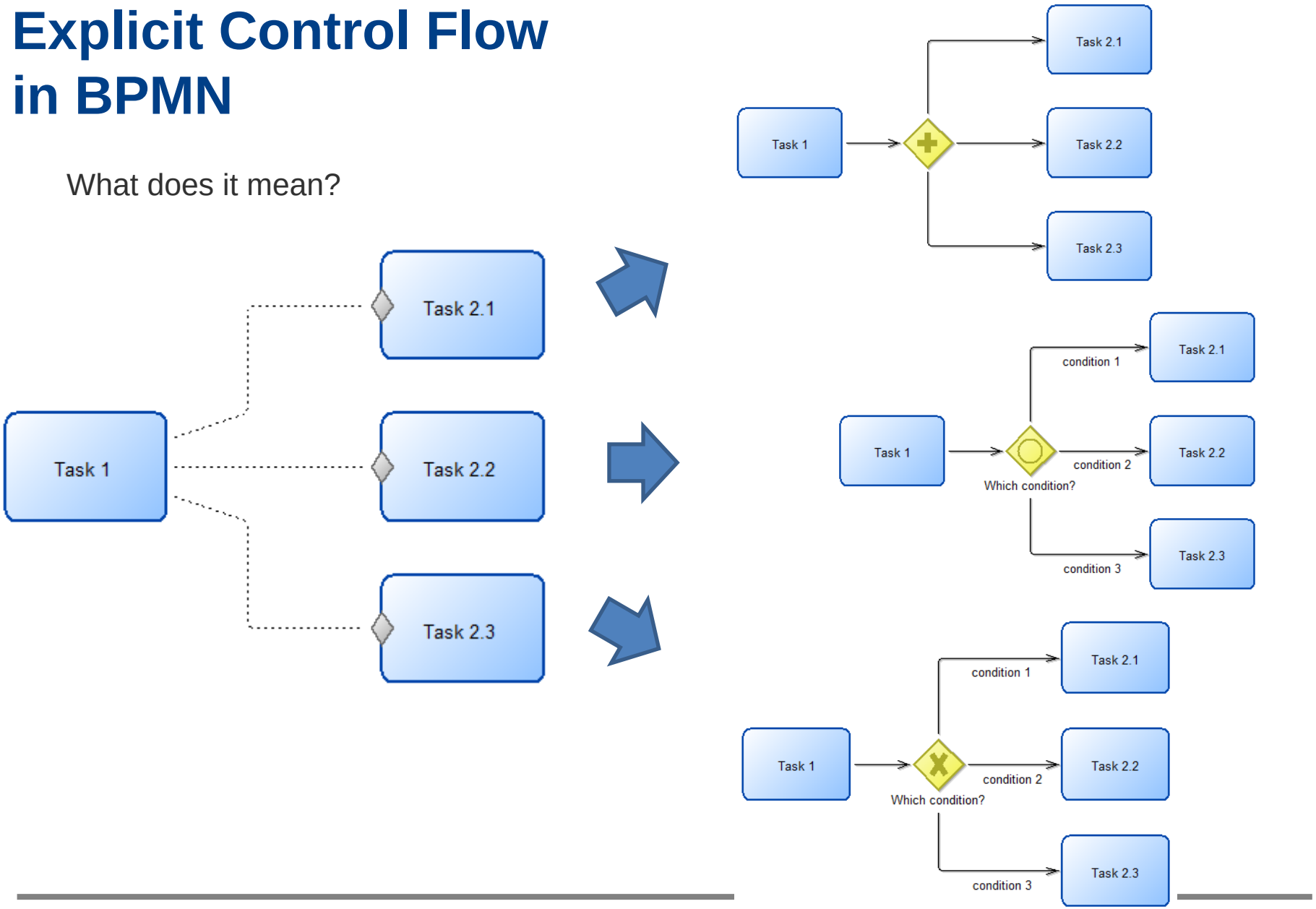
What does it mean?



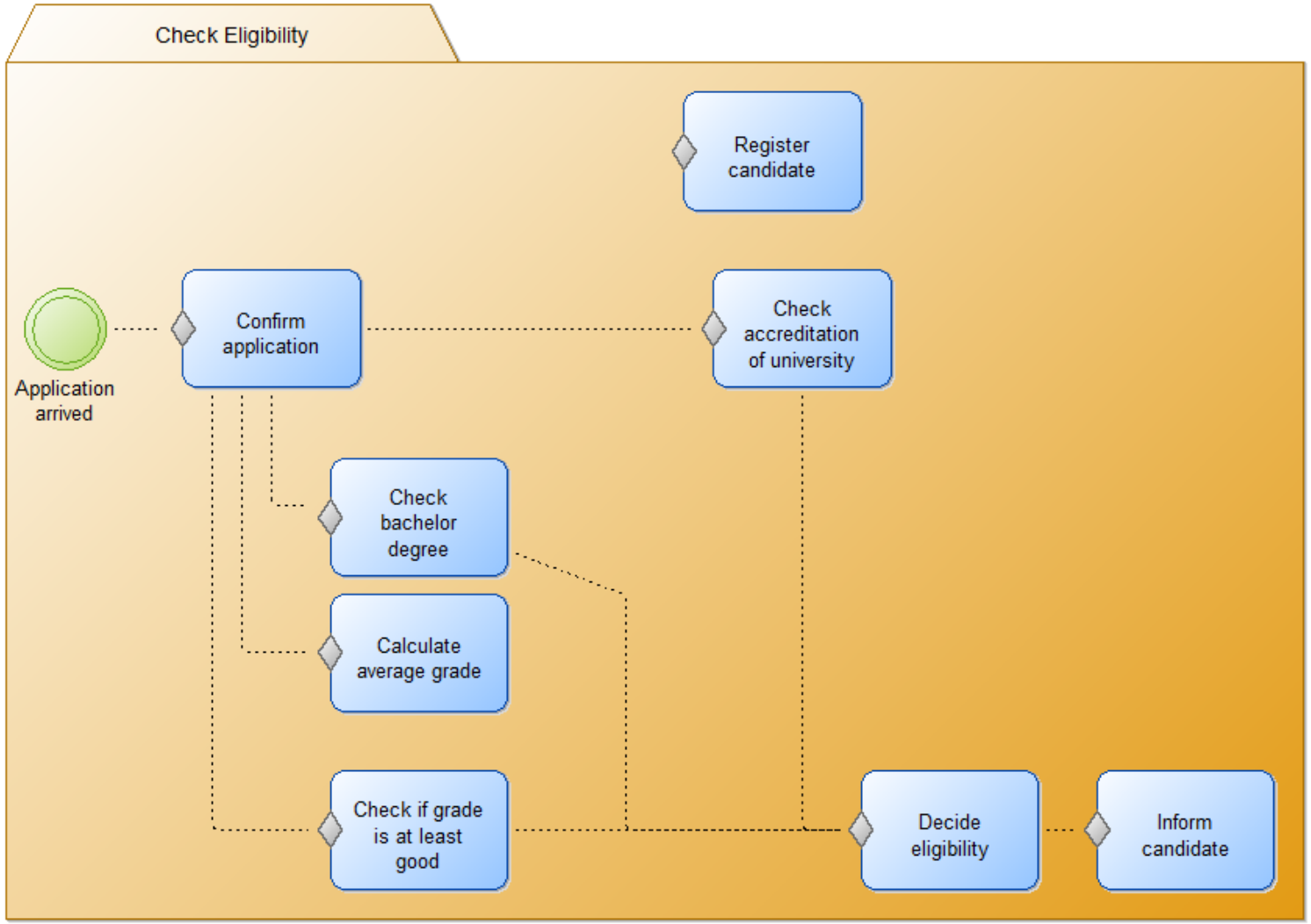
Visible conditions are better for understanding

Explicit Control Flow in BPMN

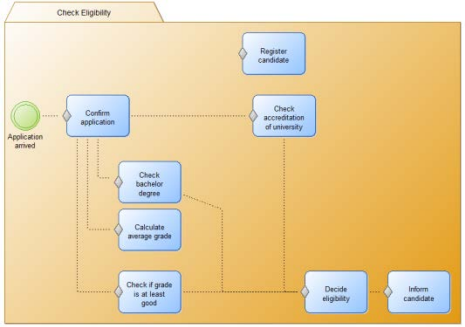
What does it mean?

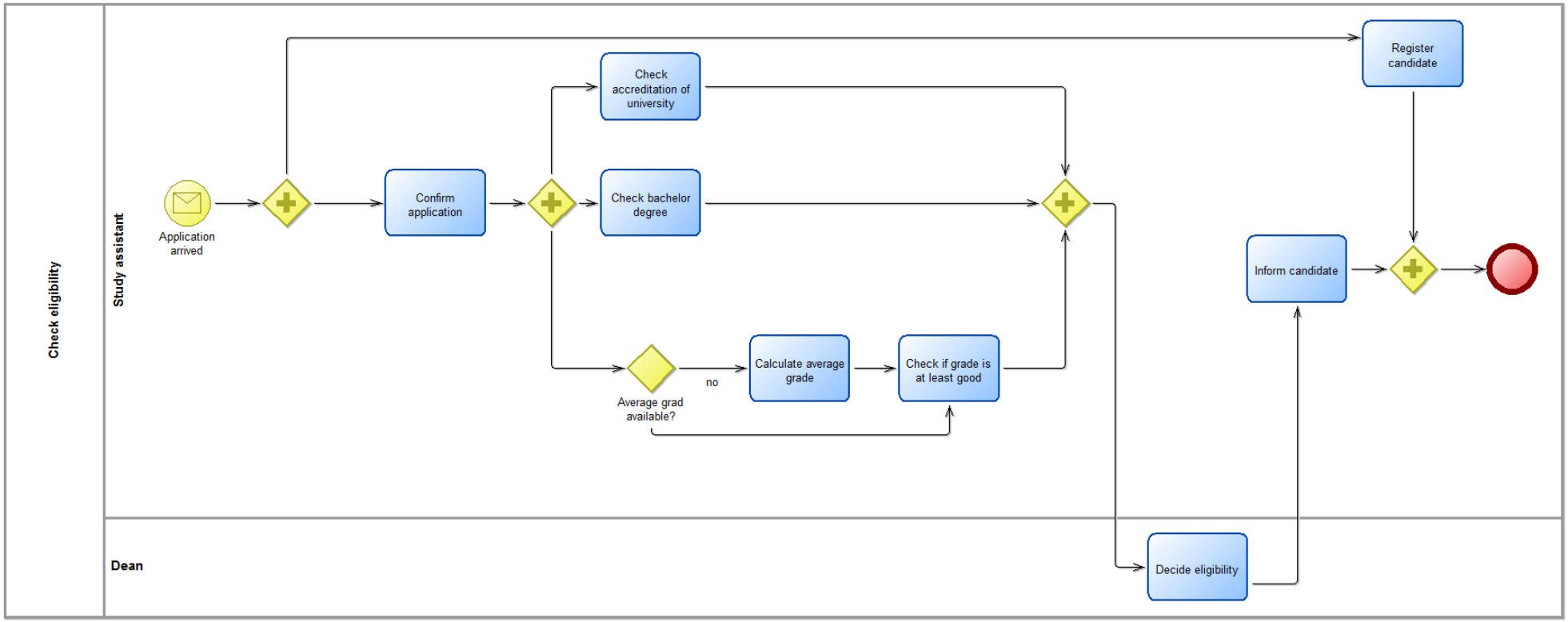


Basic Process in CMMN

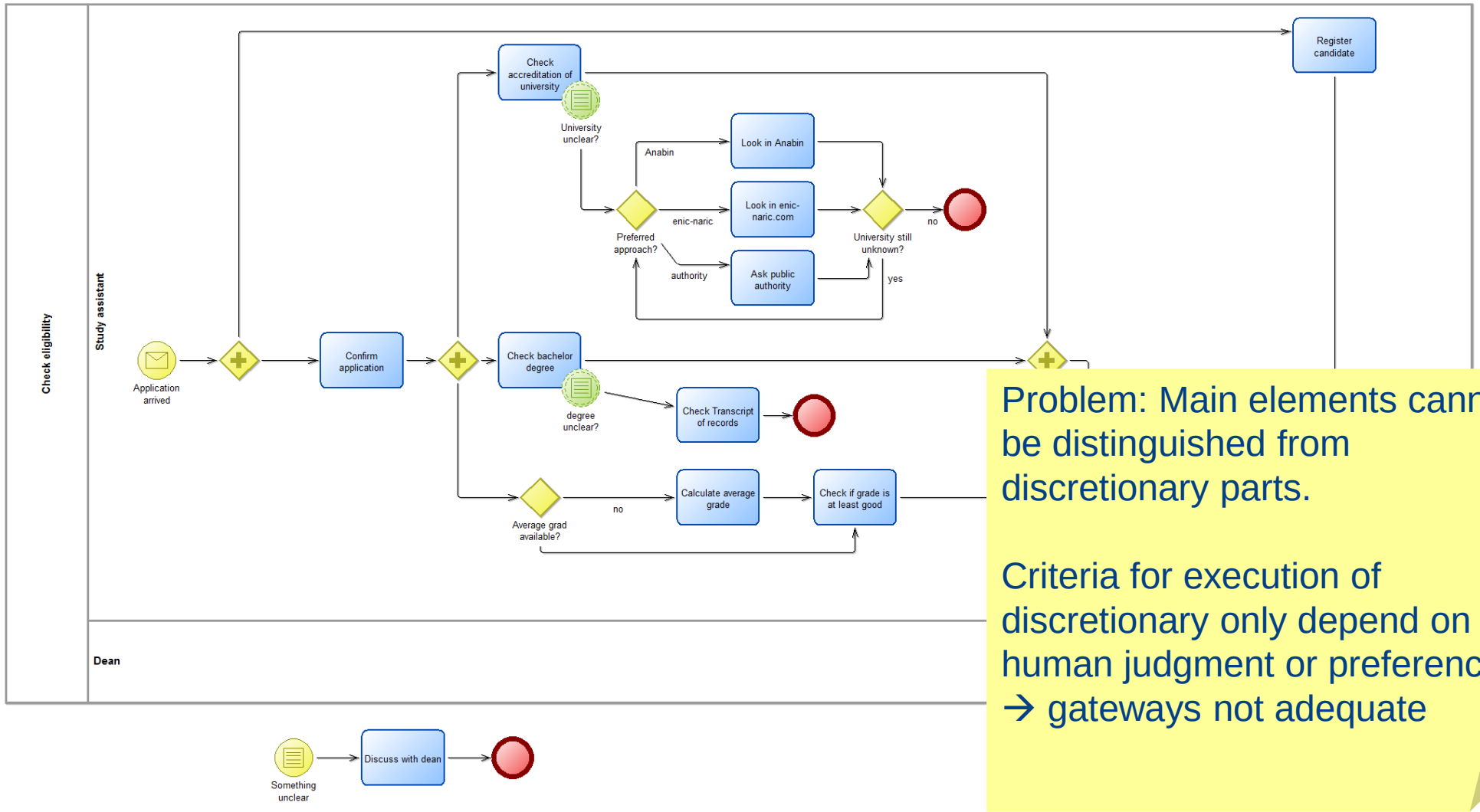


Basic Process in BPMN





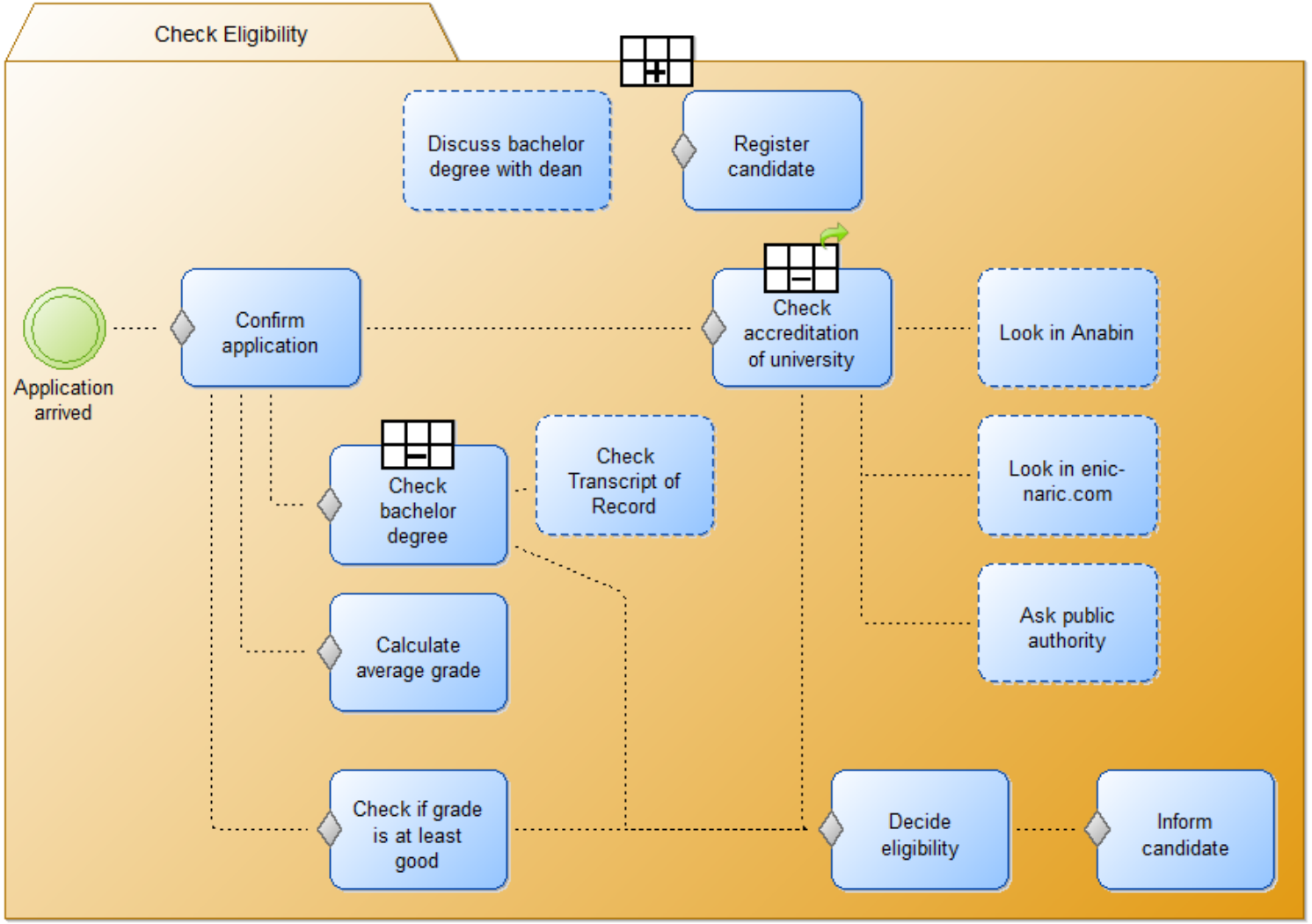
Process as BPMN including Discretionary Items



Problem: Main elements cannot be distinguished from discretionary parts.

Criteria for execution of discretionary only depend on human judgment or preference.
→ gateways not adequate

Discretionary Tasks in CMMN Model

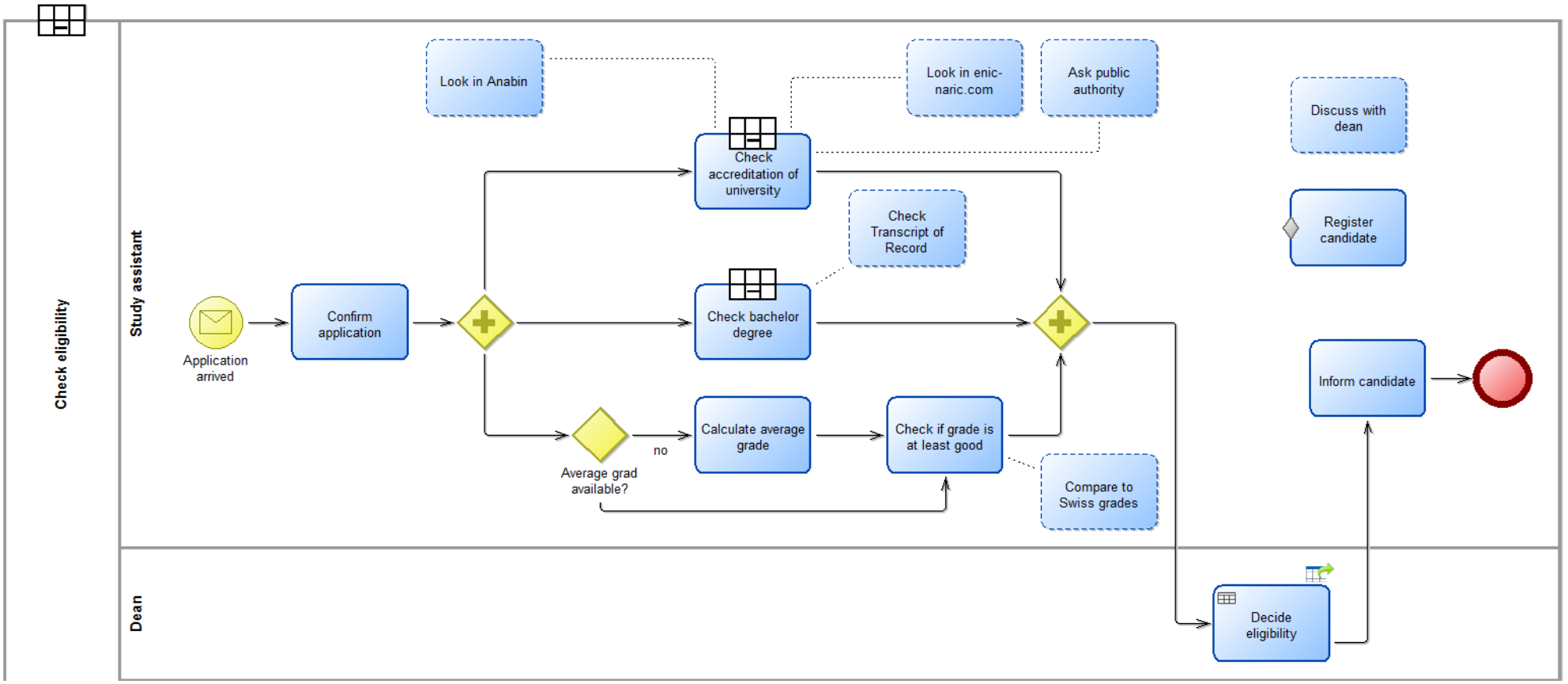


BPCMN: A combined Process and Case Modeling Language

A combination of
control flow elements of BPMN
and discretionary tasks
and planning elements of CMMN

a suitable language
to deal with any kind of process.

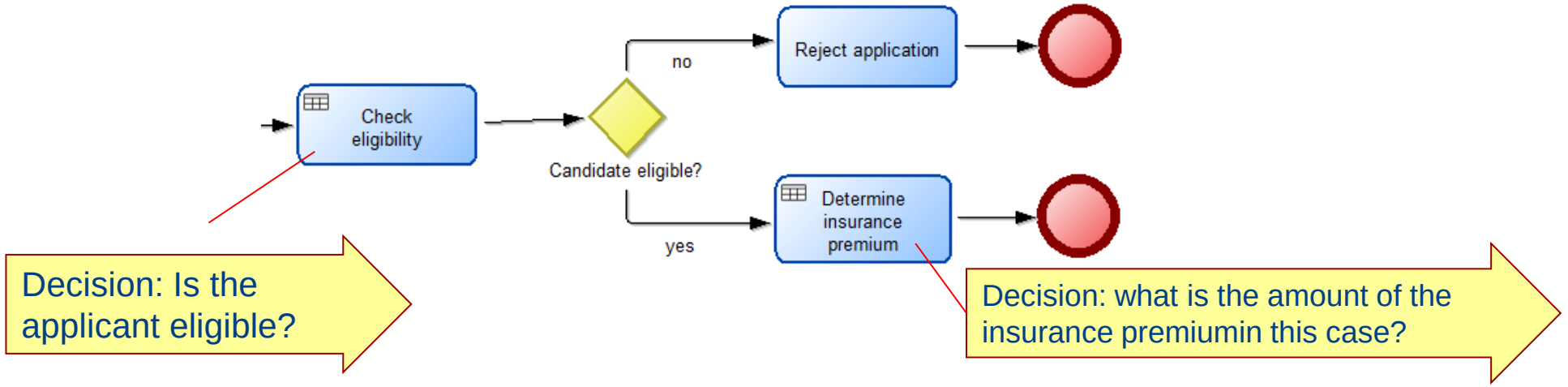
BPCMN – Combining BPMN and CMMN



Decision-aware Business Processes

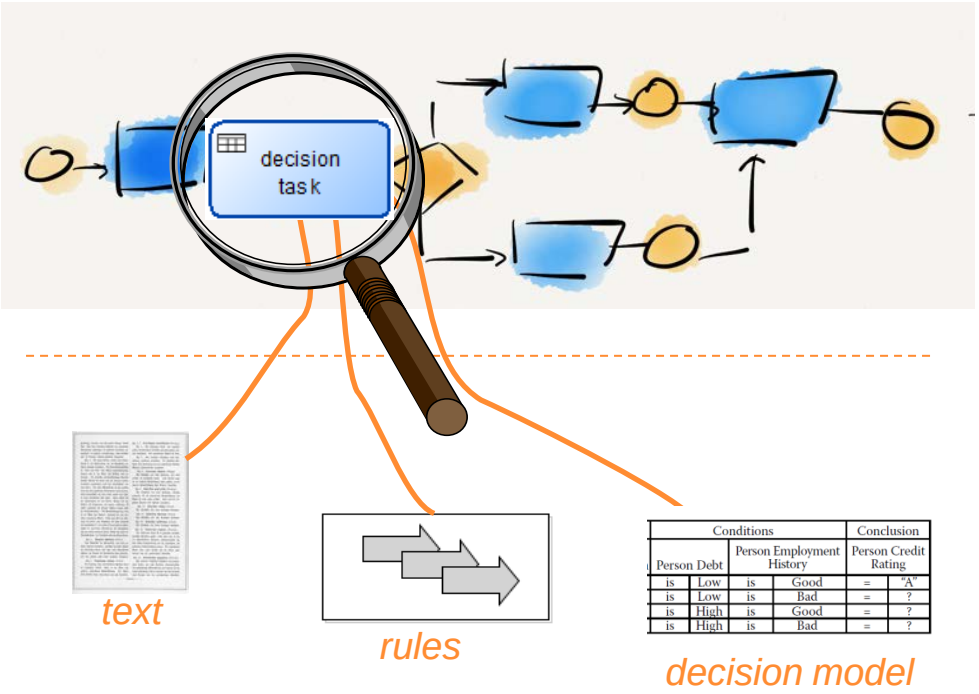
Decision Tasks in Business Processes

- A **decision task** is a task in which some decision is made
- The business logic that is used for decision making is called *decision logic*
- Two kinds of decision tasks:
  - Decision tasks deriving values for data
  - Decision tasks providing data for gateways
    - At the gateway only the result of the decision should be tested (for the selection of the path) not the criteria for the decision



Decision-Aware Process Models: Managing Process Logic and Decision Logic Separately

Process Logic

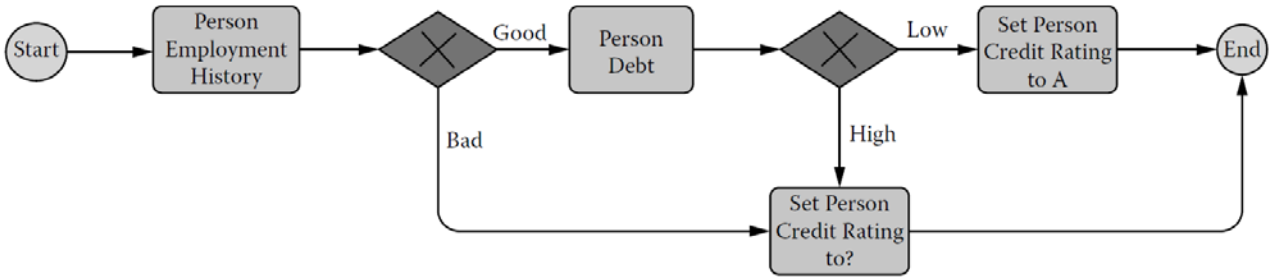


Business Logic / Decision Logic

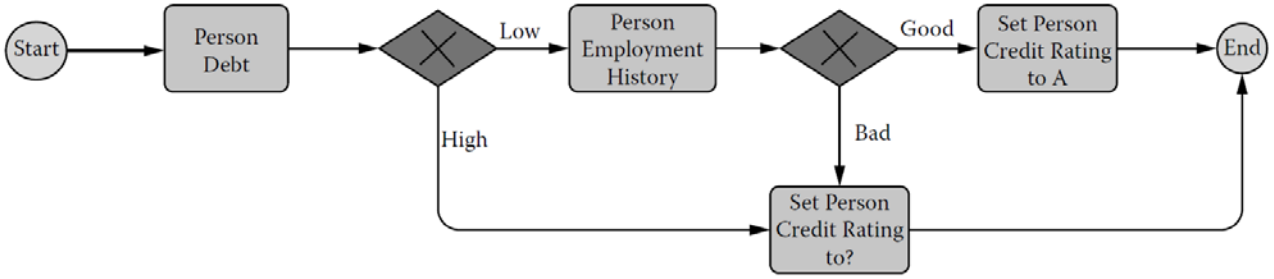
- The process model contains the process logic → **procedural**
- Decision logic is externalized from decision tasks and represented in a different kind of model → **declarative**
- Separating business decisions from business process tasks
  - simplifies the business process model
  - allows to manage business logic in a declarative form

Example: Declarative vs. Procedural Solutions

Option 1

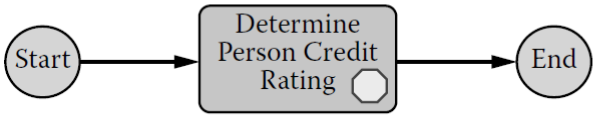


Option 2



Procedural

Option 3



Process Model

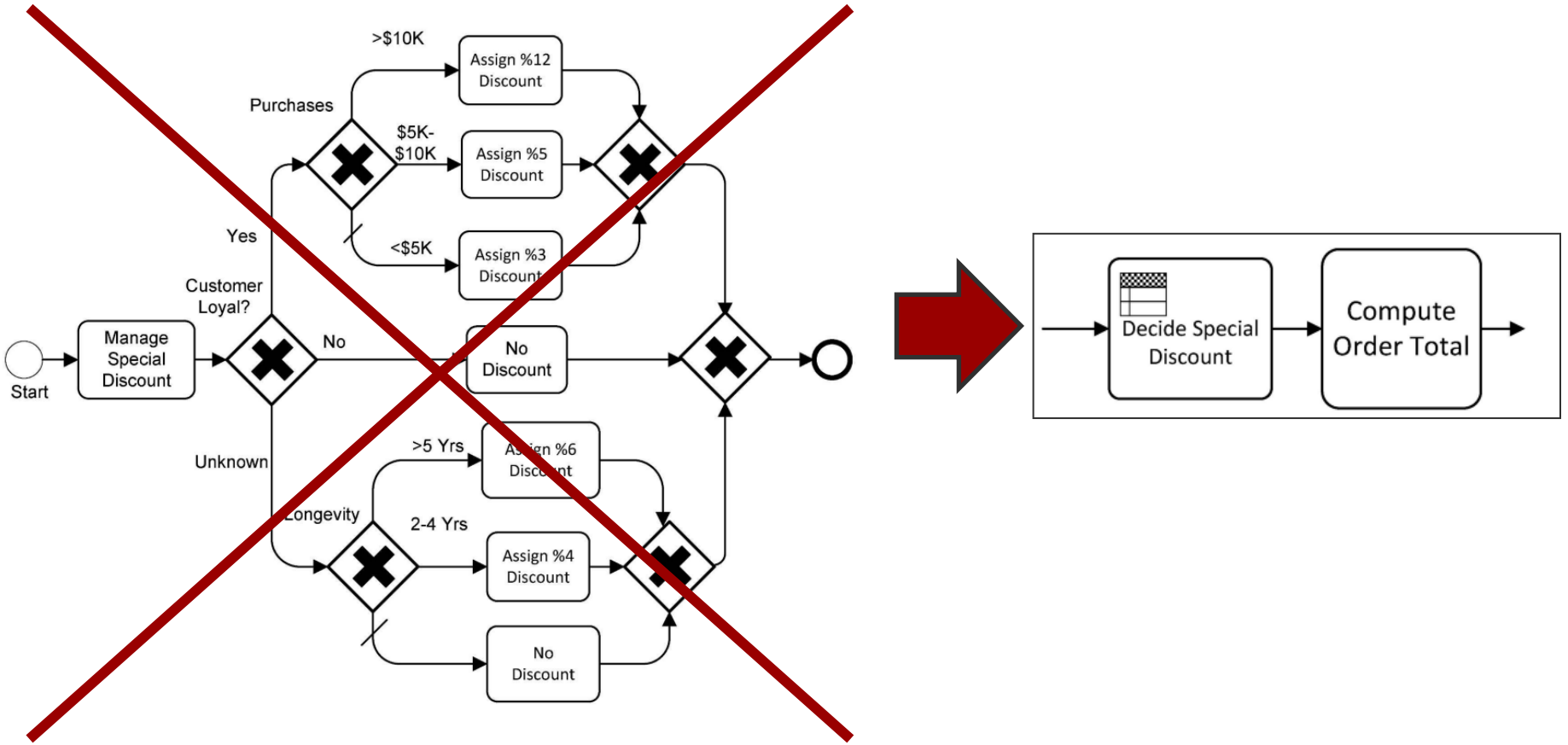
	Conditions				Conclusion	
Rule Pattern	Person Debt		Person Employment History		Person Credit Rating	
1	is	Low	is	Good	=	"A"
1	is	Low	is	Bad	=	?
1	is	High	is	Good	=	?
1	is	High	is	Bad	=	?

Decision Table

Declarative

(von Halle & Goldberg 2010, p. 69)

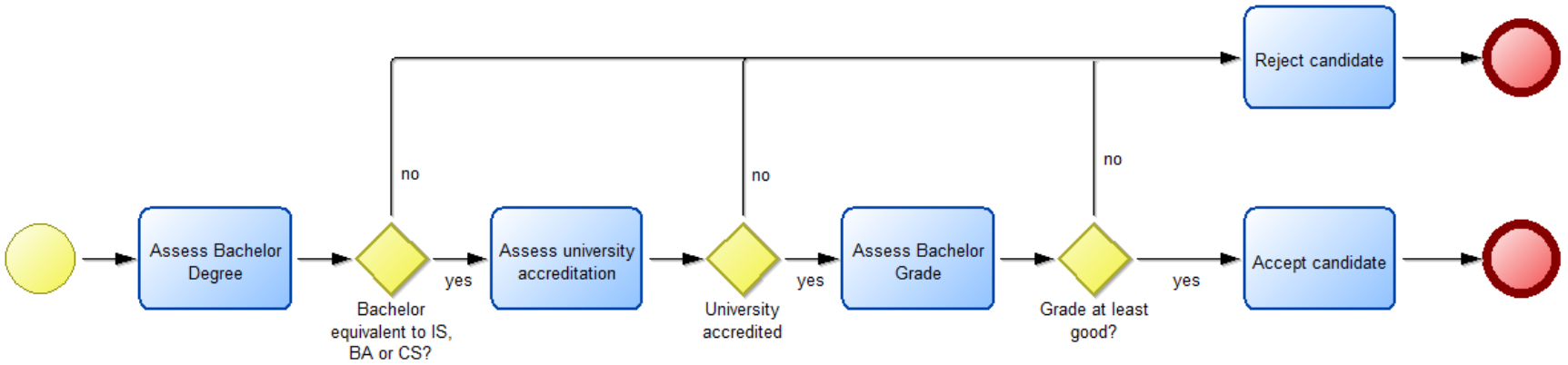
Collapsing Gateways into a Decision Task



Example:
Decision-aware Process

Exercise: Decisions in Processes (1)

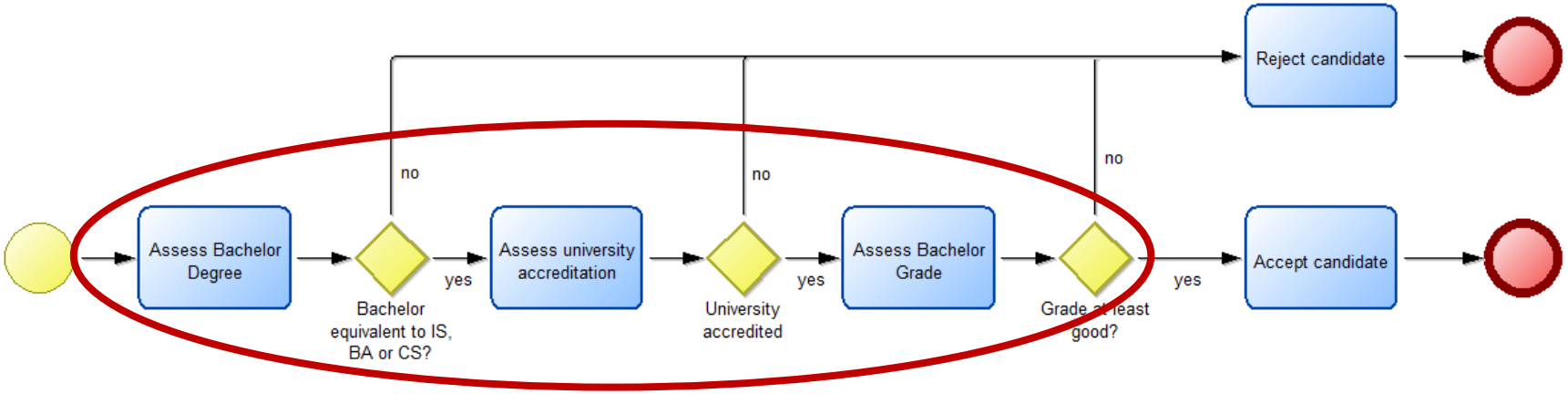
Process Logic vs Business Logic



- How many decisions are made in this process?
- Which business logic can you identify?
- What would you improve?

Exercise: Decisions in Processes (2)

Process Logic vs Business Logic

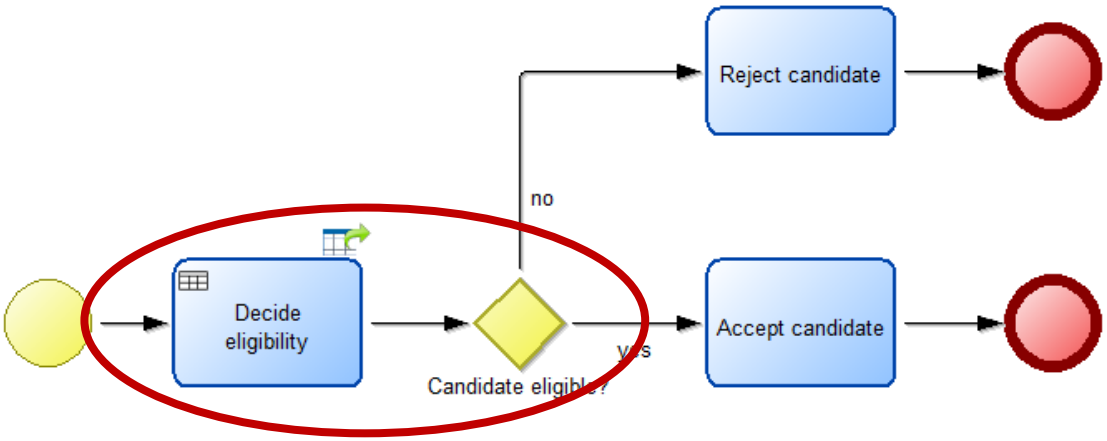


- This process only contains **one** decision:
  - Accept or reject application
- The decision is distributed over three acitivites which are executed sequentially
  - The order of the checks, however is not compulsory. There is an unnecessary sequentialisation.
- The criteria for the decision are written on the gateways. This is business logic and not process logic. It should be hidden.
  - Change in the criteria should not affect the process model.

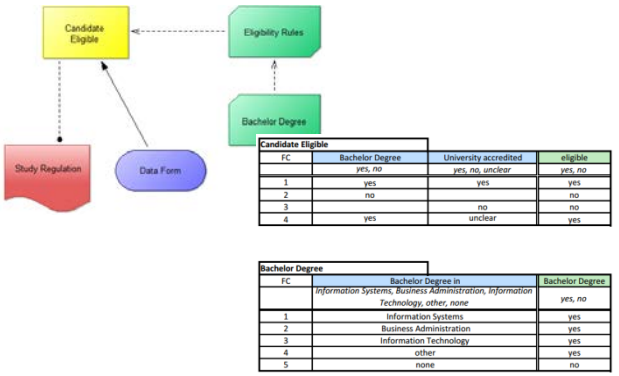
Exercise: Decisions in Processes (3)

Process Logic vs Business Logic

Process logic:



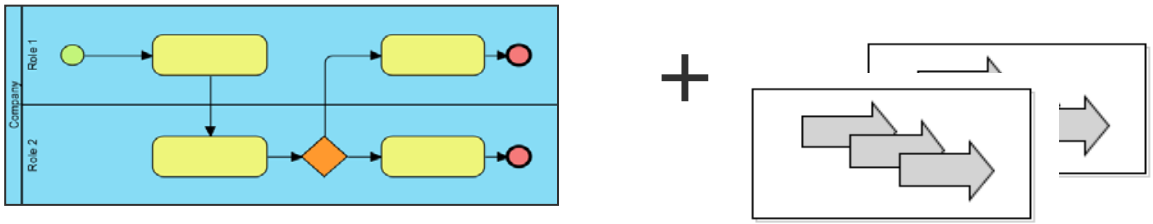
Busness logic:



- This model is more appropriate
  - Process is simplified
  - Decision logic is modeled separately
  - Change of business (decision) logic does not affect process model

Advantages of separating Business Logic from Business Process Model

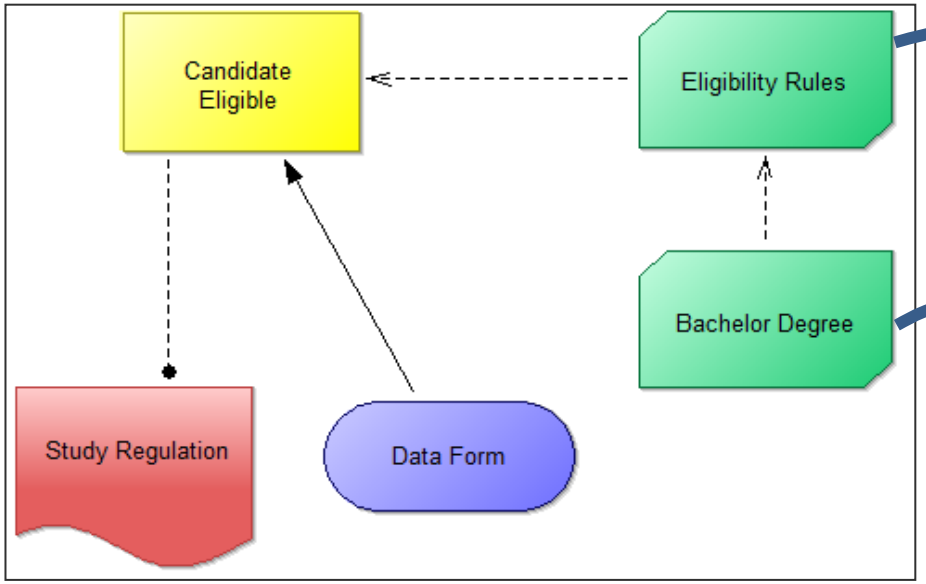
- Allows a much simpler business process model
  - If a business process is too complicated, a reason might be that business rules are embedded in the flow
- Makes changes to business process and business logic easier
  - Permits changes in the Decision Model without changing the business process model and vice versa
- Makes governance of business processes and business logic easier to manage
- Decision Model can be reused in several processes
  - the whole decision model
  - individual decision tables and rules



Modelling Decision Logic

Decision Model and Notation

Decision Requirements Diagram



Decision Tables

Candidate Eligible

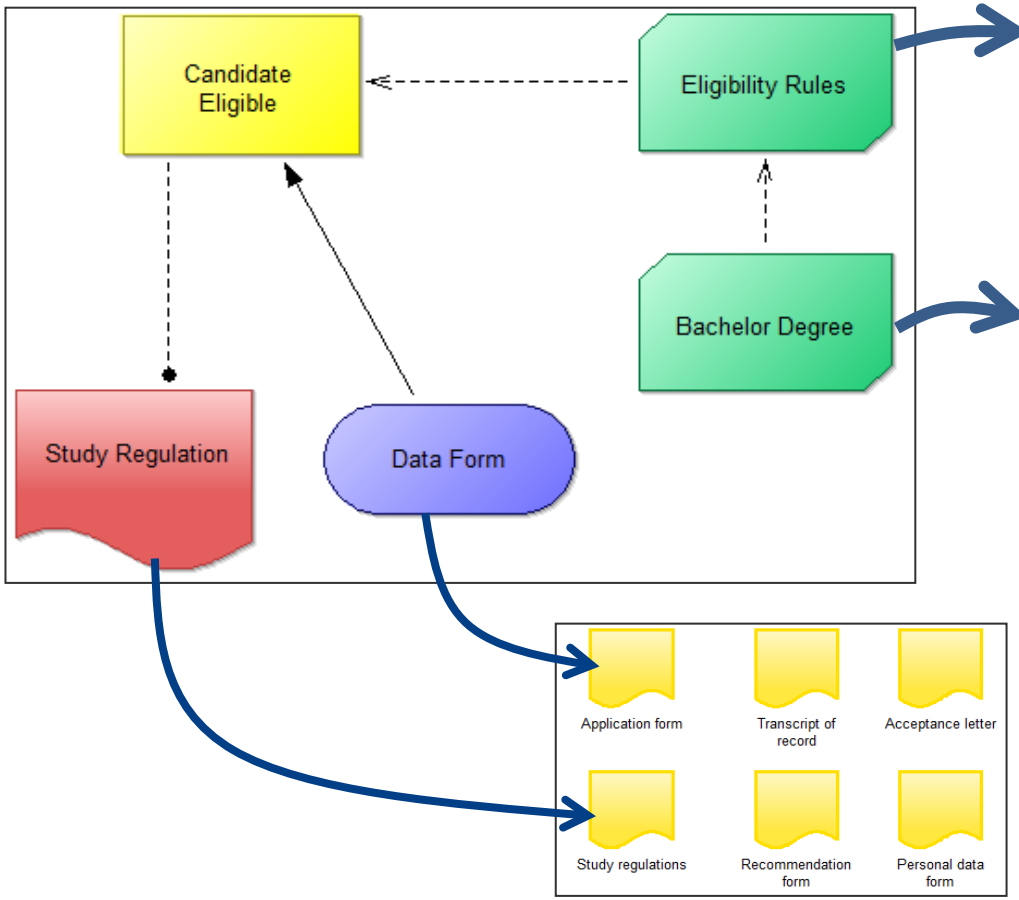
FC	Bachelor Degree	University accredited	eligible
	yes, no	*yes, no, unclear*	*yes, no*
1	yes	yes	yes
2	no		no
3		no	no
4	yes	unclear	yes

Bachelor Degree

FC	Bachelor Degree in	Bachelor Degree
	Information Systems, Business Administration, Information Technology, other, none	*yes, no*
1	Information Systems	yes
2	Business Administration	yes
3	Information Technology	yes
4	other	yes
5	none	no

Decision Model and Notation

Decision Requirements Diagram



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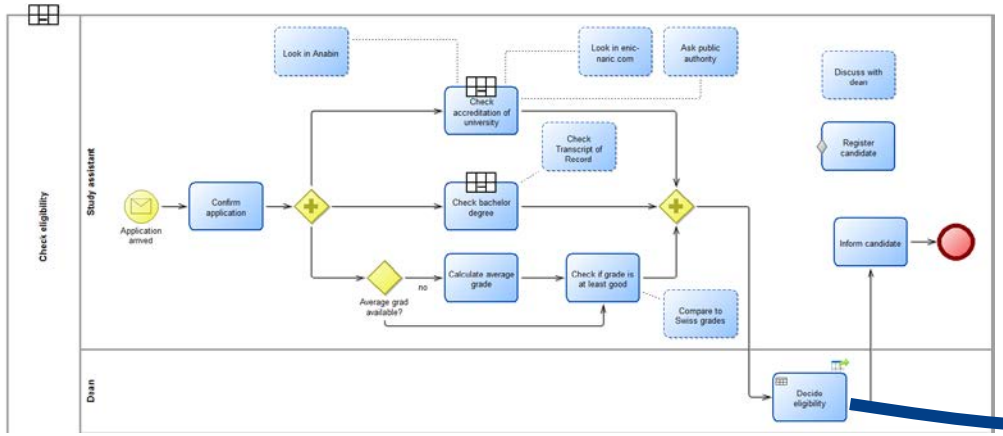
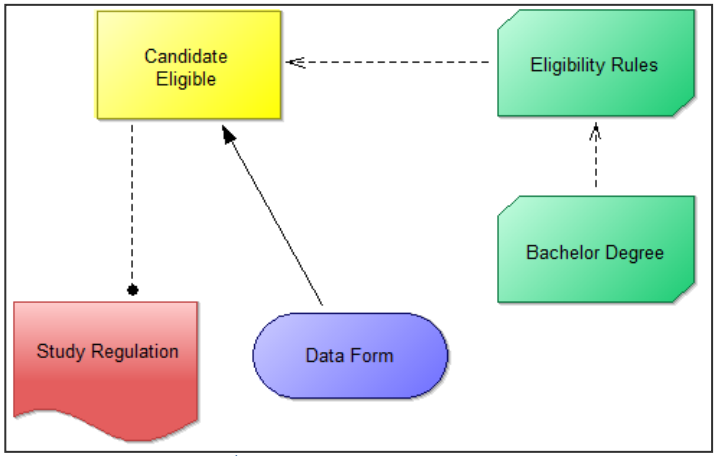
Documents in Case File

References to Decision Models

- Decision models can be referenced from
  - Process models
  - Case plan models
  - BPCMN models

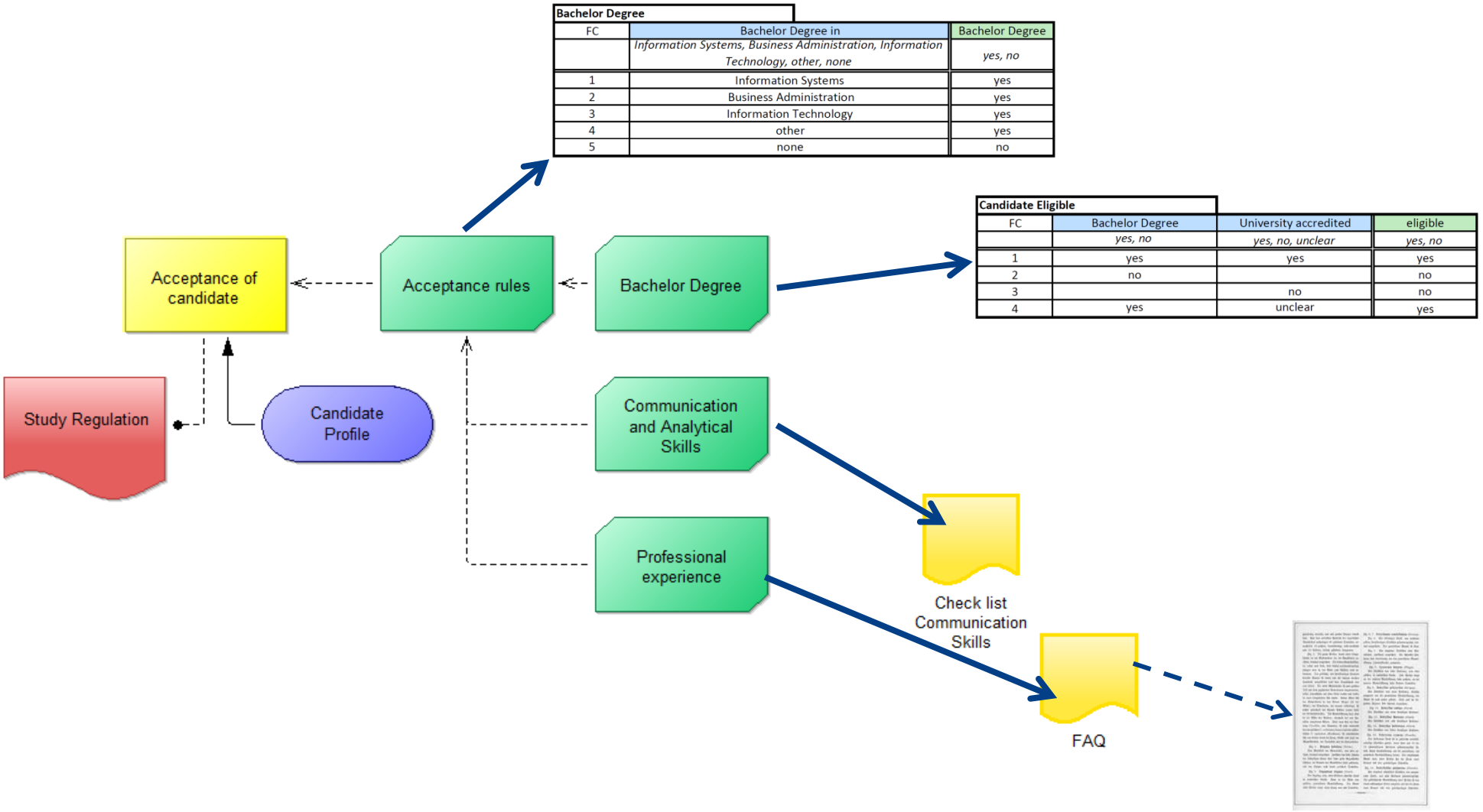




Decisions requiring Human Judgment

- Some decision require human judgment
  - Example: Communication and analytical skills
- Can be supported by …
  - Checklists
  - Best practices
  - Lessons learned
- Modelled as **documents**

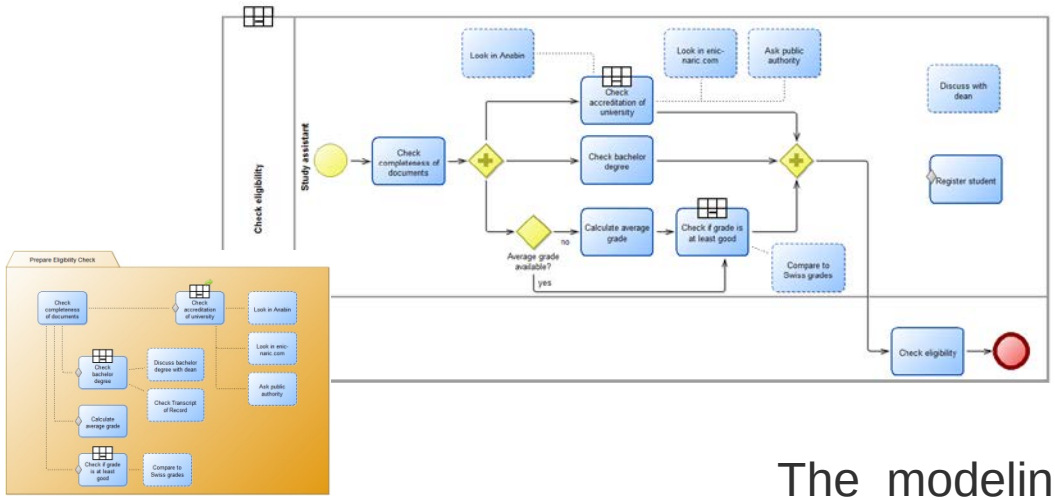
Decisions requiring Human Judgment

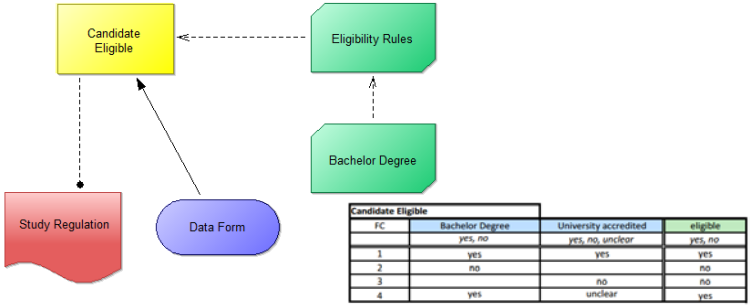


Conclusion

- Modeling of Knoweldge Work includes
  - ♦ process logic and business Logic
  - ♦ on different degrees of structure

in an integrated environment





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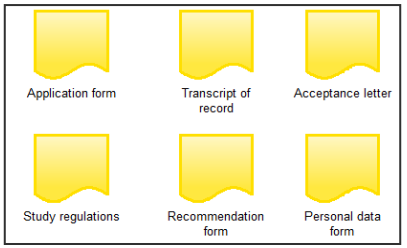

The modeling language was developed in adoxx.org

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