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Event Condition Action Approach to Process' Control Layer Modeling in Unified Process Metamodel

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HR EXCELLENCE IN RESEARCH

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Agenda

Introduction

Resources in UPM
- Static resources
- Flowing resources
- Resource flow

Control Layer

Event–Condition–Action

Conclusions

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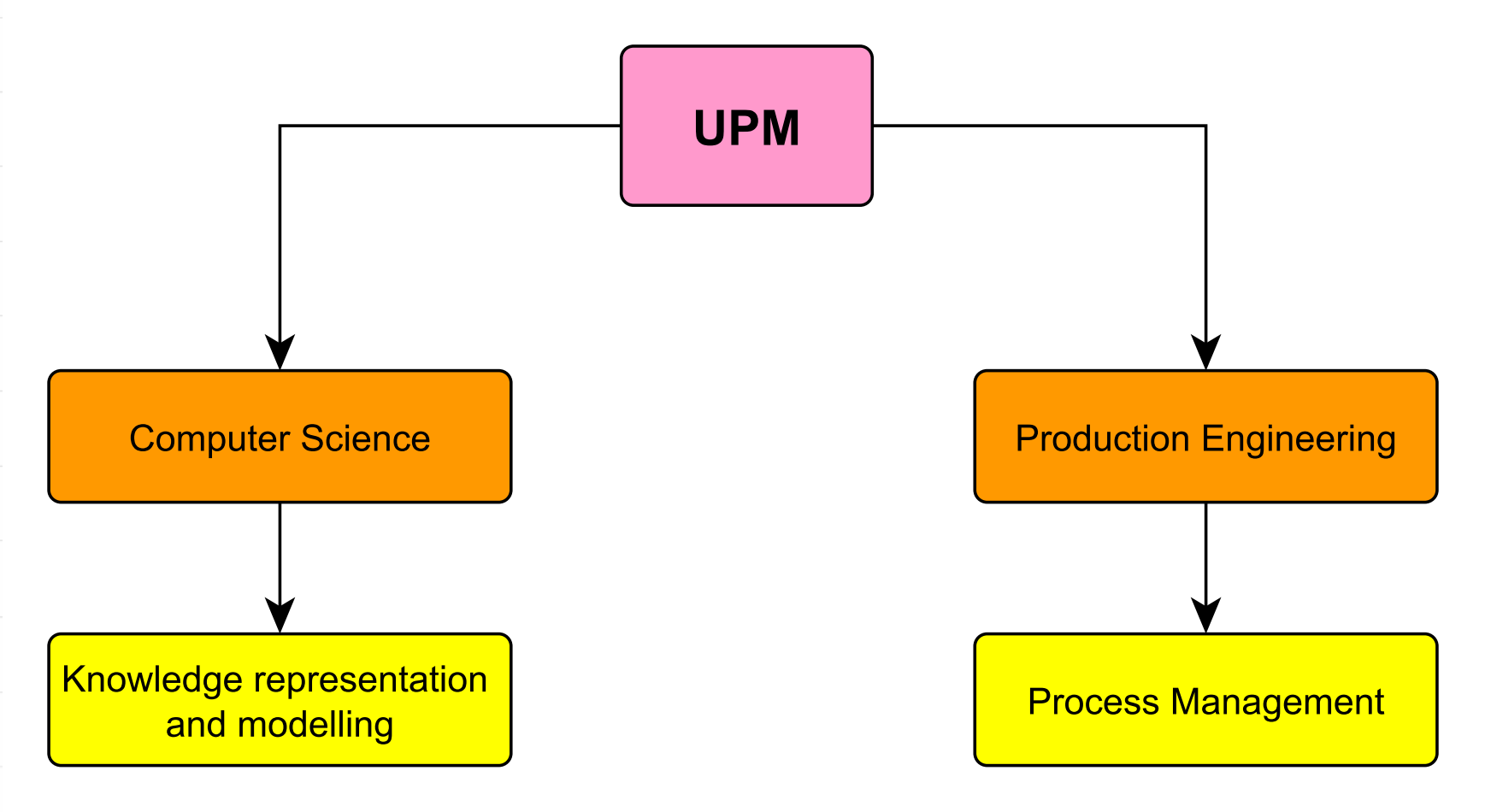
Introduction

Research field



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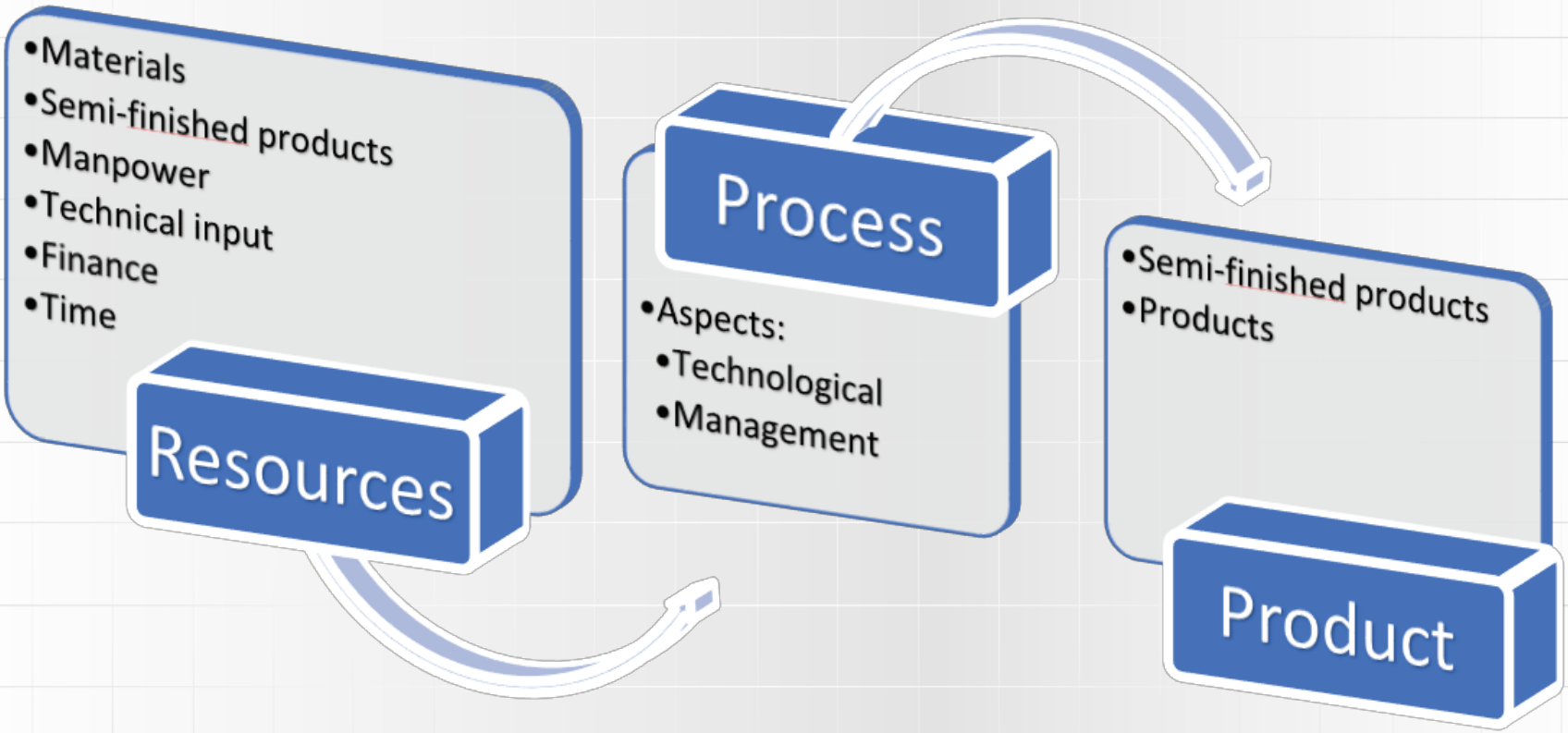
Introduction

What is a process?



Introduction

UPM – Unified Process Metamodel

The Unified Process Metamodel (UPM) consists of:

- theoretical base (full identification of categories and relationships among them),
- formal notation,
- modelling language,
- algorithms and processing methods.

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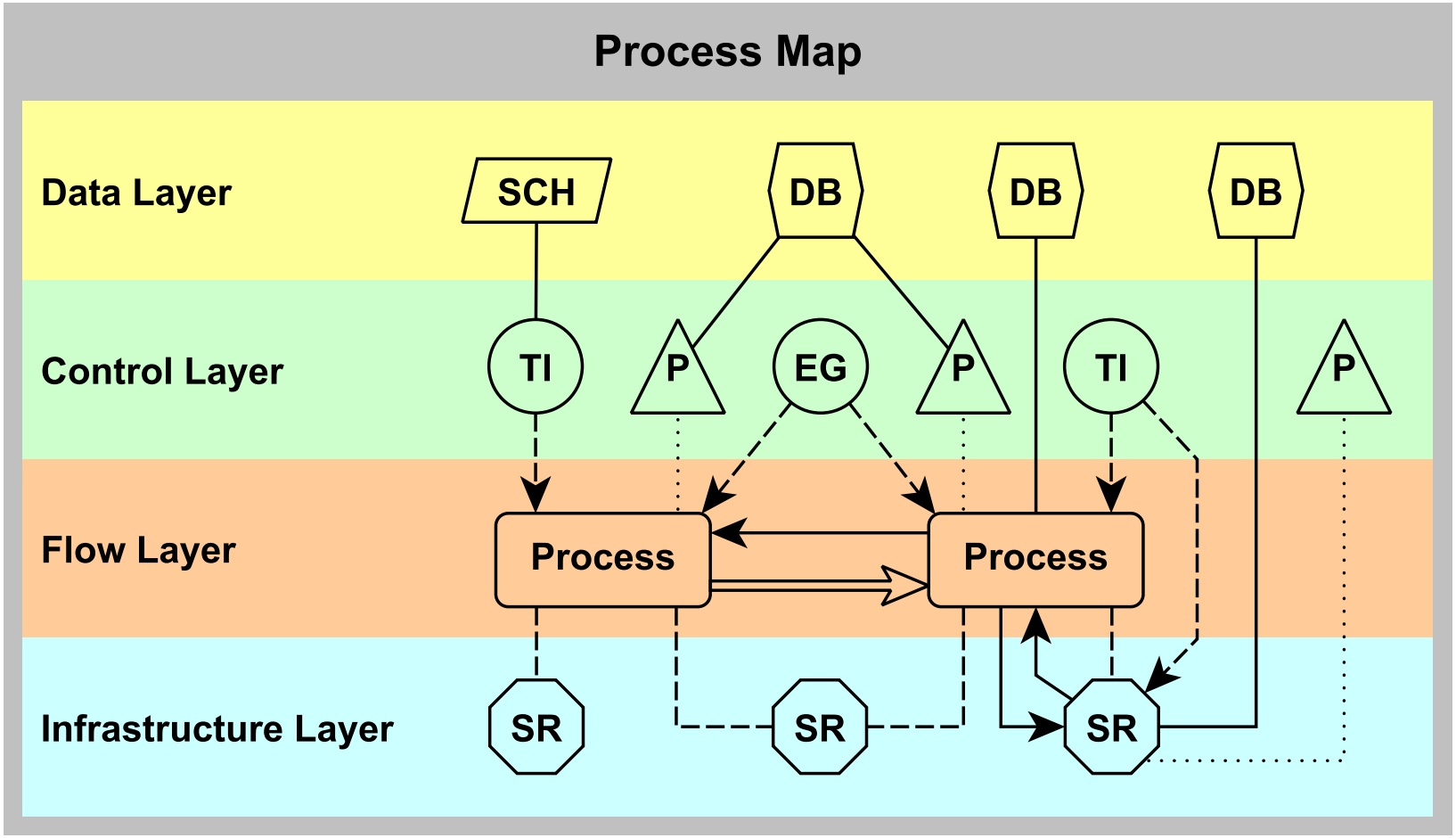
Introduction

UPM – Modelling Layers



Resources in UPM

UPM – Yet another approach to resources definition

There are two aspects of the resource management in *UPM*:

- *Static resources*
- *Flowing resources*

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Resources in UPM

Static resources

UPM – Static Resource

- The Static Resource is the sole component of the infrastructure layer that is responsible for making resources available.
- The Static Resource is not subject to processing, flows or other operations.
- It is the base for the components of the *resource source* and the *resource target* so that they could generate or absorb flowing resources.

$$\sigma(SR) = (id : ID, conn : \langle C \rangle) \tag{1}$$

where:

SR – type defining the static resource,

id – component identifier,

$conn$ – list of connectors of a given component.

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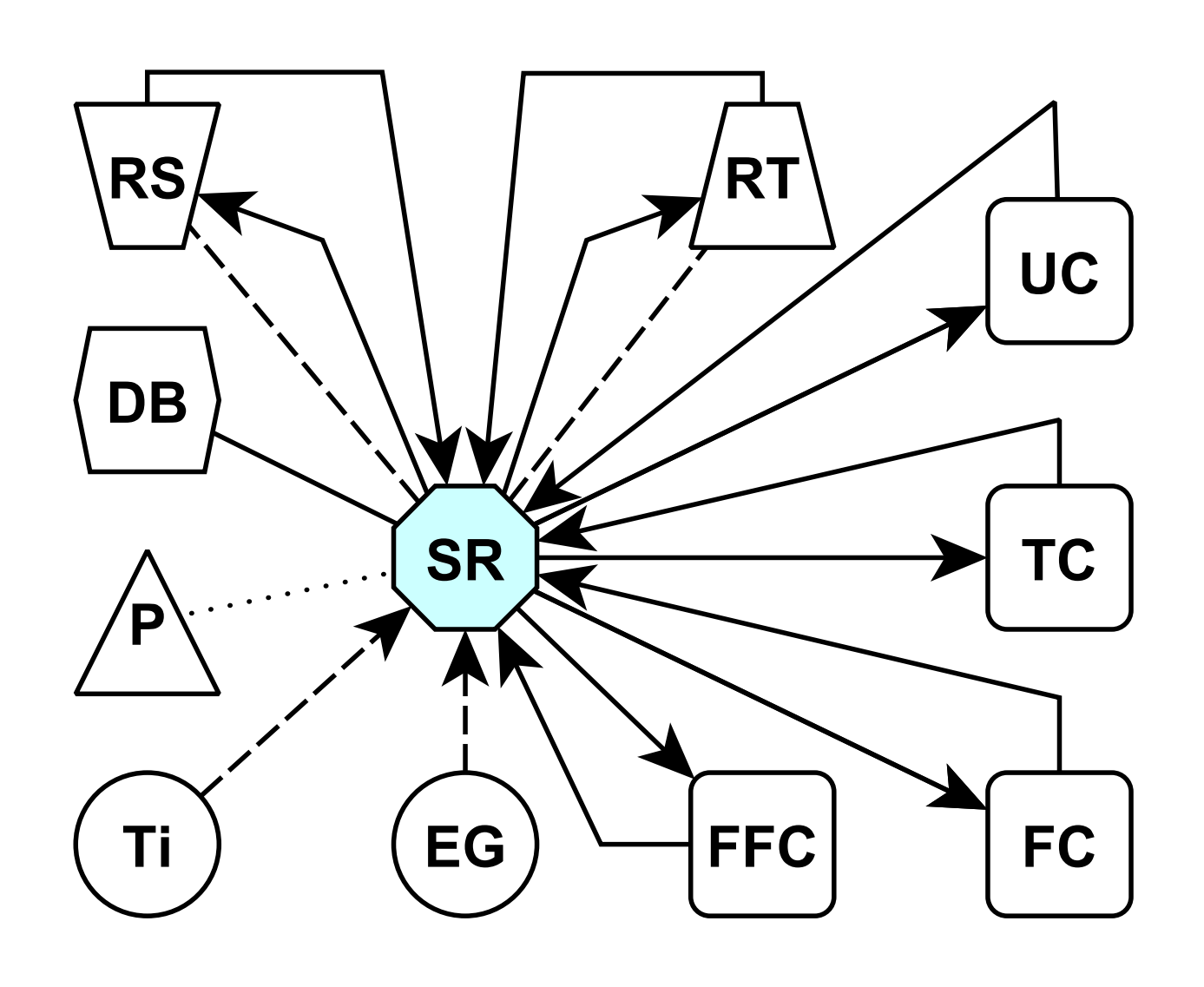
Resources in UPM

Static resources

UPM – Static Resource



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Resources in UPM

Flowing resources

UPM – Flowing Resource

The *Flowing Resource (FR)* introduced by the UPM should be understood as material or immaterial being having discrete or continuous nature and which is an input or output element of the process

FR is generated in *Resource Source* that utilize *Static Resource*. FR is absorbed by dedicated *Resource Target*connected with *Static Resource*.

$$\sigma(FR) = (id : ID, unit : ID, pack : double, storage : bool) \quad (2)$$

where:

- *FR* – *flowing resource* type,
- *id* – *flowing resource* identifier,
- *unit* – basic measurement unit of the *flowing resource*,
- *pack* – the smallest amount ("pack") of the resource which can be used,
- *storage* – Boolean value determining whether a given *flowing resource* has the ability to store it

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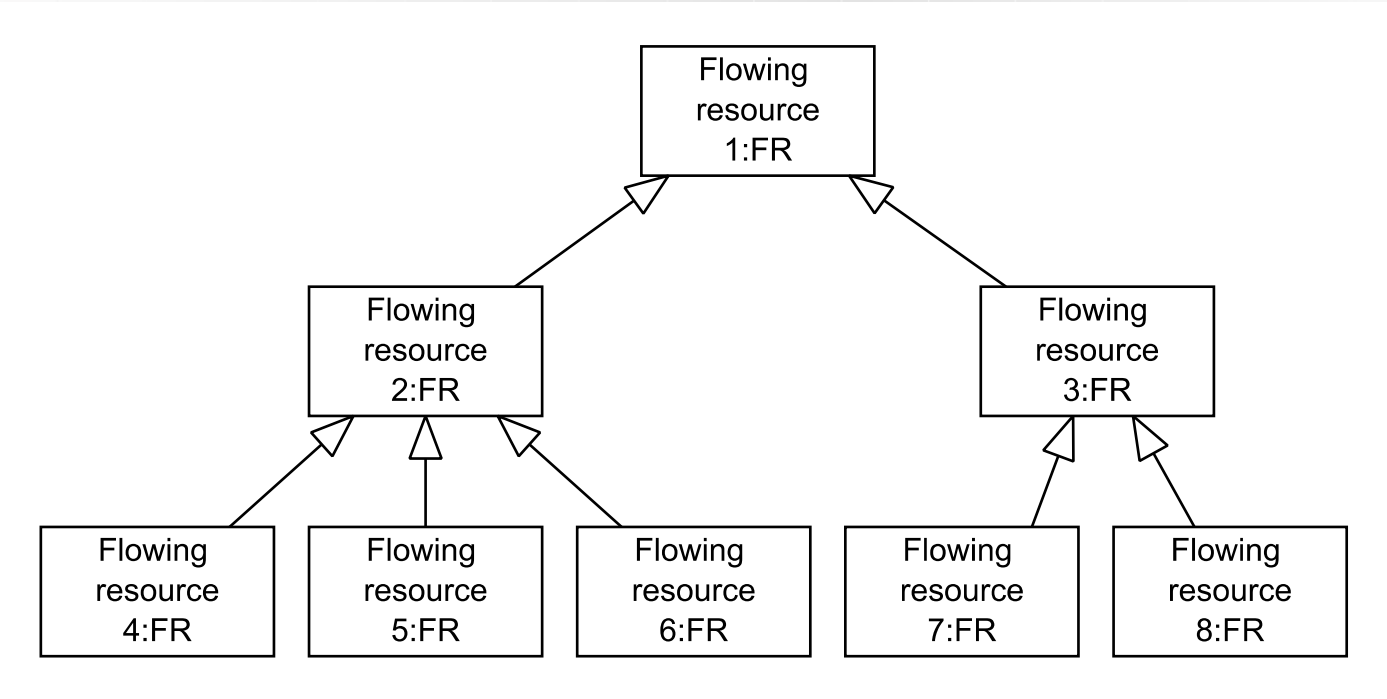
Resources in UPM

Flowing resources

UPM – Flowing Resource exemplary taxonomy



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Resource flow control possibilities:

- neutral - no change introduced,
- suction nature for inputs (In) – suction pump (SP),
- forcing nature for outputs (Out) – force pump (FP).

We measure it by the means of resource flow force:

$$rfr = \frac{fr}{t} \tag{3}$$

where:

rfr – *resource flow rate*,

fr – *flowing resource amount*,

t – *time*.

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Resources in UPM

Resource flow

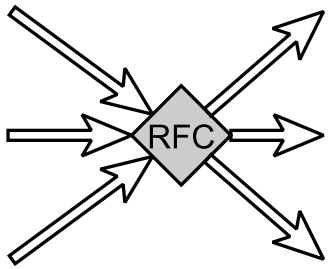
Resource Flow Control module

The Resource Flow Control module, as a type, is formally defined as:

$$\sigma(RFC) = \left\langle \begin{array}{l} id : ID, \\ in : \langle PORT \rangle, \\ out : \langle PORT \rangle, \\ sep : \langle double \rangle \end{array} \right\rangle; \tag{4}$$

where:

- id – module identifier,
- in – list of input ports,
- out – list of output ports,
- sep – list of resource flow separation coefficient.



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Resources in UPM

Resource flow

Types of Resource Flow Control

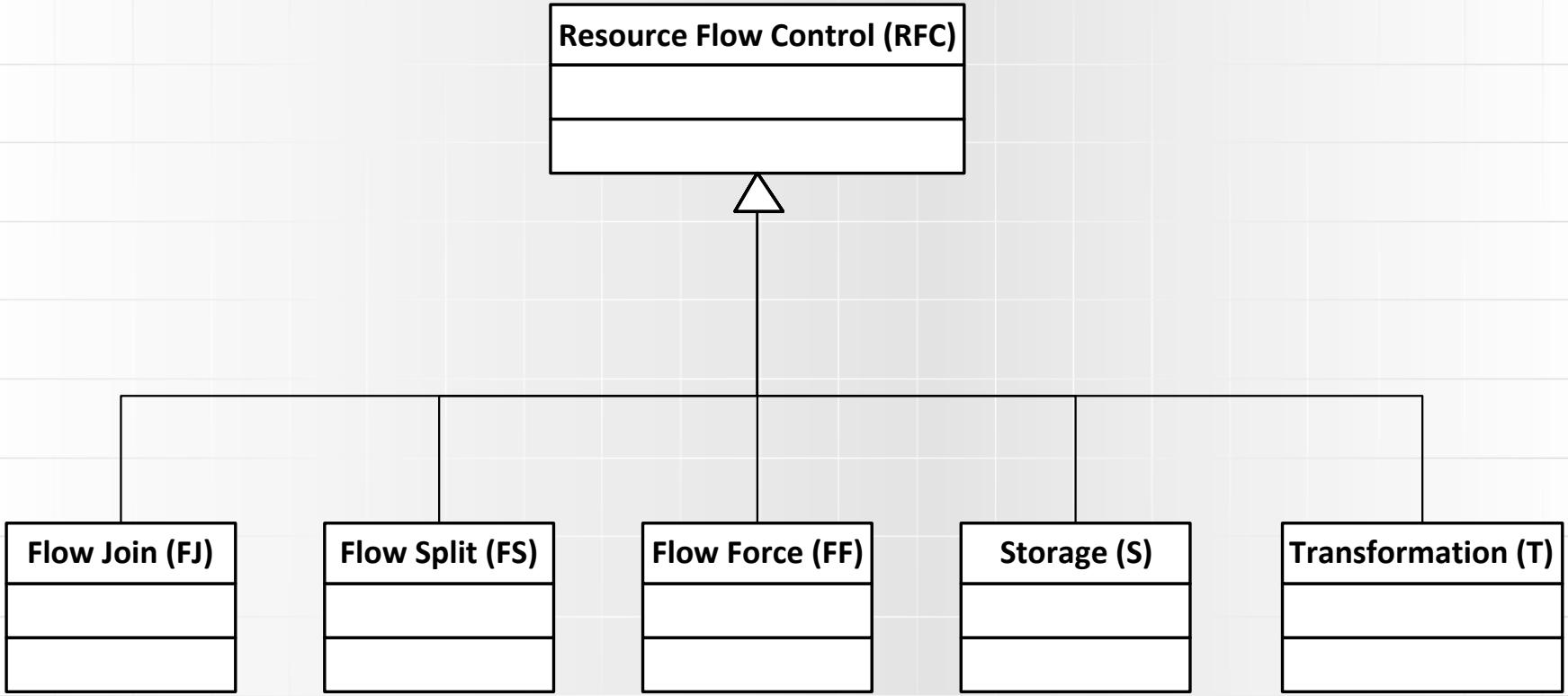

Figure: Taxonomy of Resource Flow Control Component

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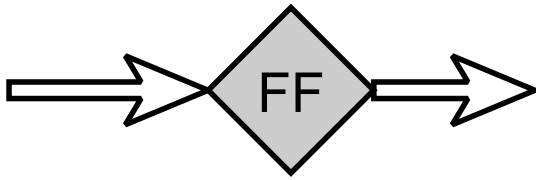
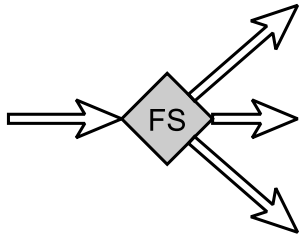
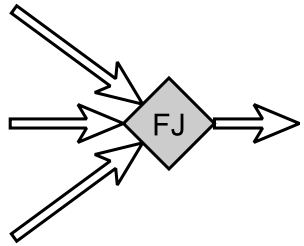
Resources in UPM

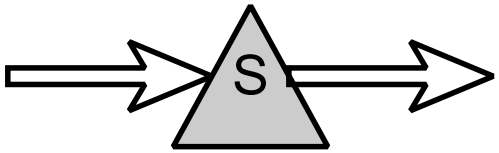
Resource flow

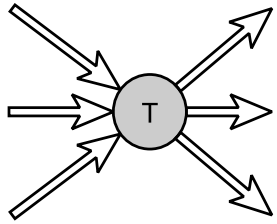
Types of Resource Flow Control

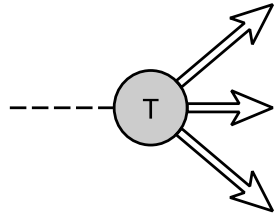












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Formally *control layer* as a type is defined as:

$$\sigma(CL) = (ti : \langle TI \rangle, eg : \langle EG \rangle, p : \langle P \rangle) \tag{5}$$

where:

CL – type defining *control layer*,

TI – type defining *timer* component,

EG – type defining *event generator* component,

P – type defining *procedure* component,

ti – list of *timer* components,

eg – list *event generator* components,

p – list *procedures* components.

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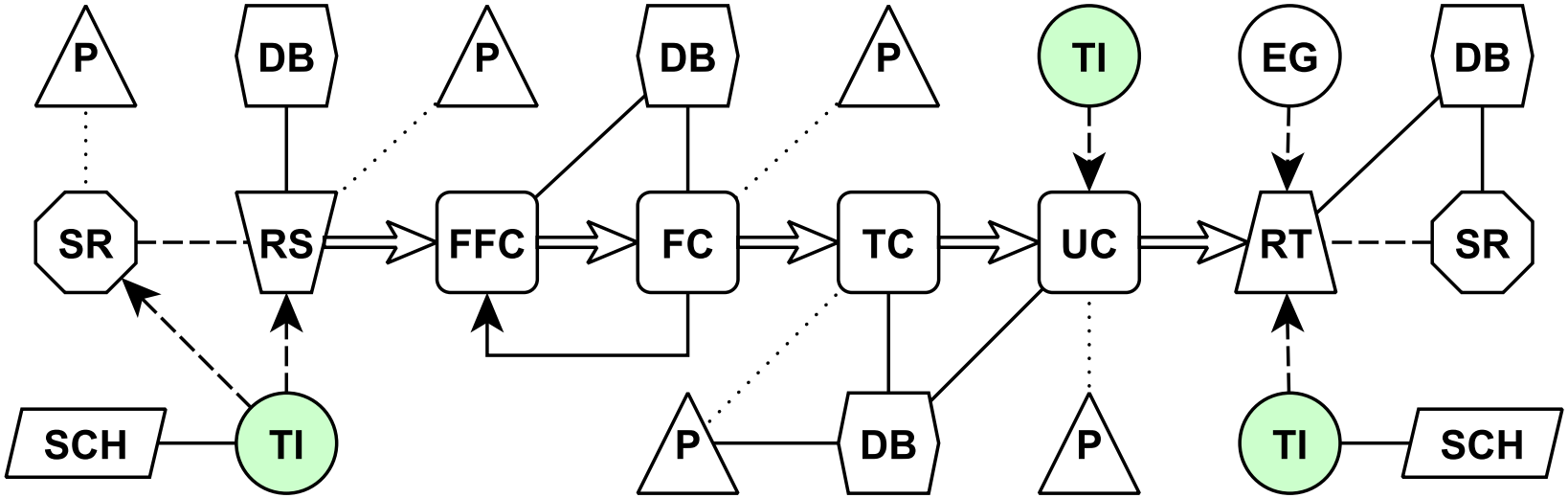
Control Layer

Timer



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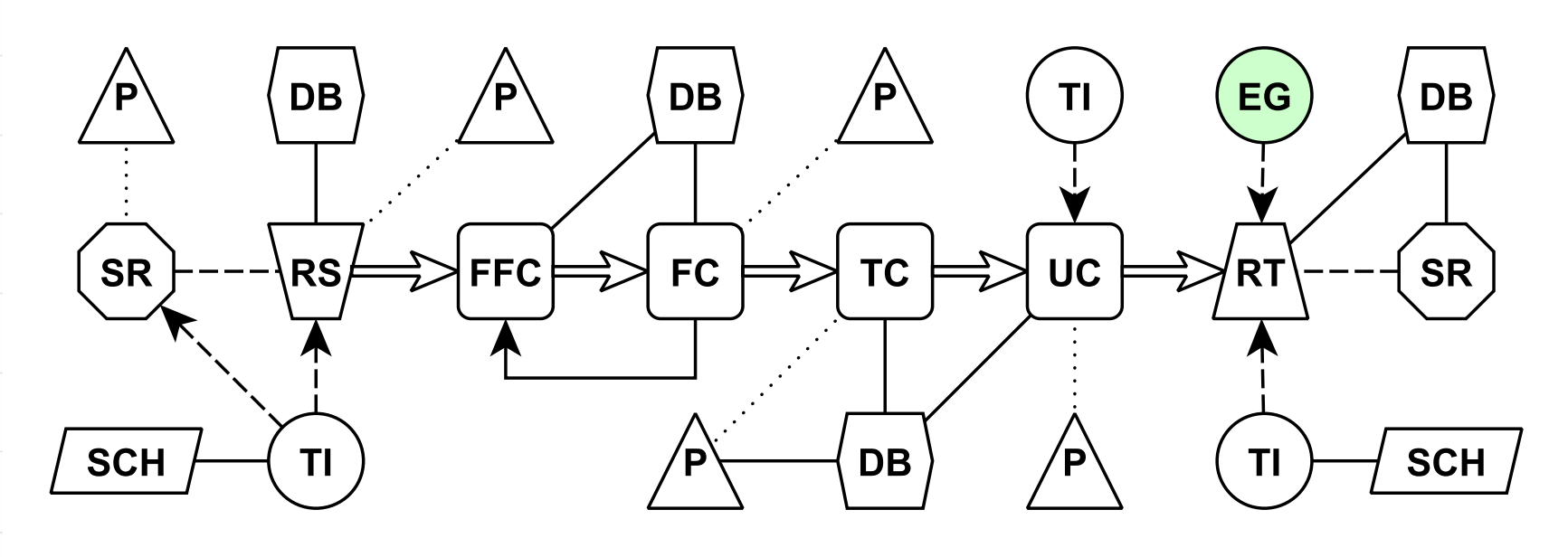
Control Layer

Event generator



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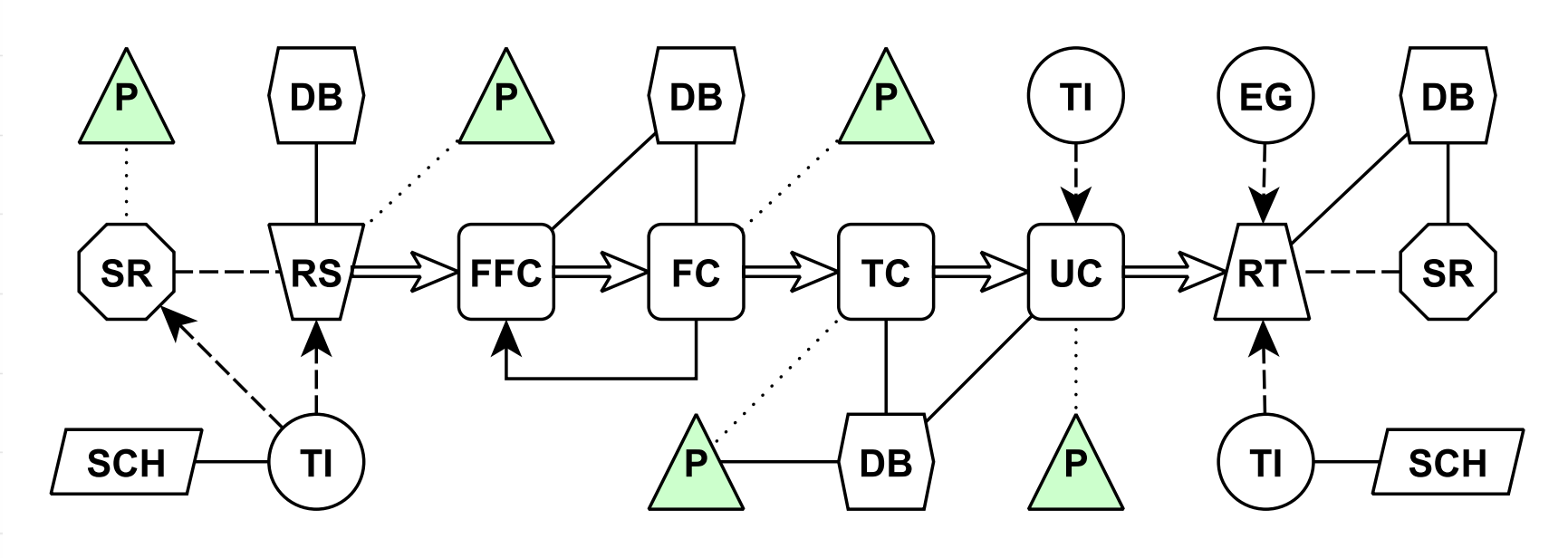
Control Layer

Procedures



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Event–Condition–Action

Concept of ECA

Event Condition Action (ECA) concept is based on the assumption that:

- *Event* (EV) is a signal initializing the *condition* fulfillment verification,
- *Condition* (CN) is a logic element, that if checked to be *true* triggers the *action*,
- *Action* (AC) is a manifestation of *script* that is assigned to the *event*.

Event–Condition–Action

Triggers of ECA

The sequence based on *message* sending mechanism is defined as follows:

$$\textit{Message}\ (\mathrm{M}) \mapsto \textit{Event}\ (\mathrm{EV}) \mapsto \textit{Condition}\ (\mathrm{CN}) \mapsto \textit{Action}\ (\mathrm{AC}),$$

in case of *events* generated by components

$$\textit{Timer}\ (\mathrm{TI}) \mapsto \textit{Event}\ (\mathrm{EV}) \mapsto \textit{Condition}\ (\mathrm{CN}) \mapsto \textit{Action}\ (\mathrm{AC}),$$

or

$$\textit{Event Generator}\ (\mathrm{EG}) \mapsto \textit{Event}\ (\mathrm{EV}) \mapsto \textit{Condition}\ (\mathrm{CN}) \mapsto \textit{Action}\ (\mathrm{AC}).$$

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Conclusions

Conclusions and future work

1. The new approach towards process definition has been proposed
2. The notion of resource in the process has been unambiguously defined
3. Even–Condition–Action schema has been applied to control layer default operation

Future work:

1. Implementation of design tool for process definition
2. Implementation of simulation environment

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Thank you for your attention

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