Design and prototypical implementation of a language empowering business users to define Key Performance Indicators for Enterprise Architecture Management

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What is EA? What is EAM? What are KPIs?

- **EA**: Enterprise Architecture
  - *"Fundamental organization of a system [enterprise] embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution"*. [ISO Standard 42010]

- **EAM**: Enterprise Architecture Management
  - Maintaining the EA's flexibility, efficiency, and transparency by
  - developing, implementing and **controlling** the EA's components and relations

- **KPI**: Key Performance Indicator
  - Metric, which measures quality and performance aspects
  - Evaluation of goal achievement

Motivation

- EAM KPI Catalog
  - 52 well-documented KPIs
  - Supports enterprise architects
  - Requires a certain EA data model
- EAM tools
  - Methods for gathering the EA model's data
  - EA modeling techniques
  - Visualization guidelines

Lack of implementation and tool integration

No support for formal definition and automated computation of EAM KPIs

TxL

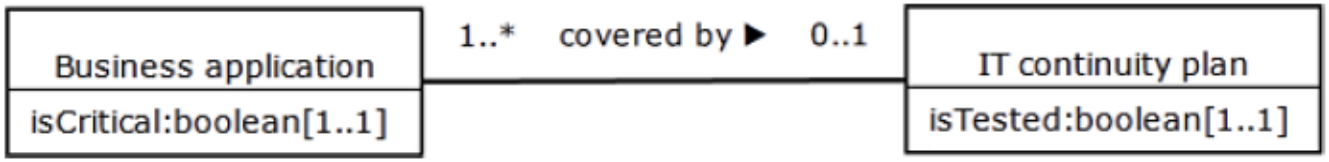
Tricia eXpression Language

Exemplary KPI of the catalog

- Application continuity plan availability

  “A measure of how completely IT continuity plans for business critical applications have been drawn & tested up for the IT's application portfolio”

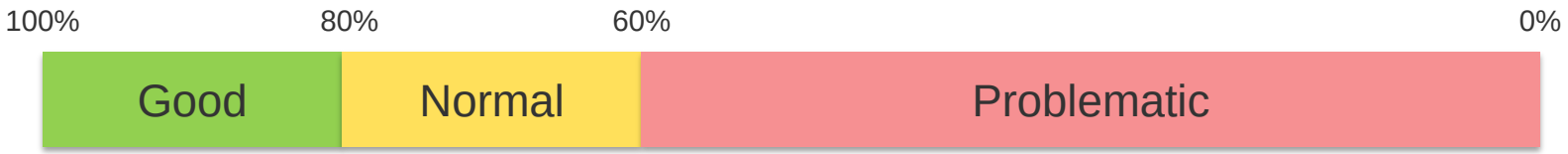
  – **Information model**:



  – **Calculation**:

  The number of critical applications where tested IT continuity plan available divided by the total number of critical applications

  – **Possible interpretation**:



Requirements & research questions

- Identified requirements for EAM KPI Catalog tool integration:
  - **RQ1**: EAM tool has to provide a flexible data model to adapt it to the catalog‘s needs
  - **RQ2**: The language has to provide a sufficient expressiveness to define all the catalog‘s KPIs
    - ➢ Language requirements were already examined in another research
  - **RQ3**: Business users must be able to define and visualize KPIs at runtime

- Emerging research questions:
  - Are these requirements met by existing EAM tools and wiki systems?
  - Which language properties are relevant for the design of a DSL to support the computation of the catalog‘s KPIs?
  - What is a possible implementaiton of such a DSL?

Existing EAM tools and wiki systems

- 9 examined EAM tools:

- 4 examined wiki systems:

Neither the examined **EAM tools**, nor the **wiki systems**, fulfil the three requirements RQ1, RQ2, and RQ3

➢ Design of TxL and prototypical implementation

Design of TxL

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- TxL is a domain-specific language (DSL)
  - Object-oriented | Sequence-oriented |Functional | Reflective | Strictly evaluated | Dynamically typed

- Data types in TxL
  - **Simple types**: Object | String | Number | Boolean | Date
  - **Constructor types**: Sequence | Map | Function | Entity
- Operators in TxL
  - **Arithmetic** operators: *add, sub, mul, div, …*
  - **Conditional** and **logical** operators: *equals, greaterThan, and, or, not, …*
  - **Query** operators: *select, where, selectMany, orderby, …*
  - **Aggregation** operators: *count, sum, max, min, first, …*

Formal definition of an exemplary KPI

- Reminder: The calculation of the KPI *Application continuity plan availability* is informally described as:

  The number of critical applications where tested IT continuity plan available divided by the total number of critical applications

- A formal definition by TxL could be:

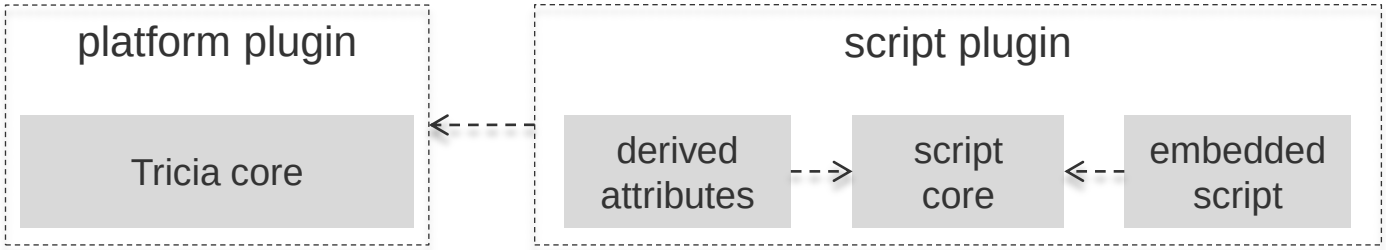
```
/* Determine all critical business applications */
let criticalApplications = find("business application","is critical","yes") in

/* Determine all critical business applications with tested IT continuity plan */
let criticalApplicationsWithCoveringContinuityPlan =
        criticalApplications
                .where(?(ca)(ca["covering continuity plan"].isNotNull()
                        ? ca["covering continuity plan"].first()["is tested"]
                        : false)) in

/* Calculate proportion of critical business applications */
criticalApplicationsWithCoveringContinuityPlan.count()
        .div(criticalApplications.count())
```

Prototypical implementation of TxL

- Integration in our research tool *Tricia*



- Three logical components:
  - **Script core**

    TxL Interpreter | TxL execution environment | Extensibility mechanism | User interface enhancements
  - **Embedded script**

    Embedding of single TxL expressions into rich text content
  - **Derived attributes**

    Definition of an attribute, whose value is dervied from other attribute values

Definition of a KPI as custom TxL function

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- Each KPI of the catalog can be defined as custom function:

Type	
Name	getApplicationContinuityPlanAvailabilityKPI
Parameters	*no parameters*
Description	A measure of how completely IT continuity plans for business critical applications have been drawn & tested up for the IT's application portfolio
Method Stub	

```
// Determine all critical business applications
let criticalApplications =
  find("business application","is critical","yes") in

// Determine all critical business applications
// with tested IT continuity plan
let criticalApplicationsWithCoveringContinuityPlan =
  criticalApplications
    .where(?(ca)(ca["covering continuity plan"].isNotNull()
                ? ca["covering continuity plan"].first()["is tested"]
                : false)) in

// Calculate proportion of critical business applications
criticalApplicationsWithCoveringContinuityPlan.count()
  .div(criticalApplications.count())
```

- Invocation of KPI function by name:

```
getApplicationContinuityPlanAvailabilityKPI()
```

HTML-based visualization of KPIs

- Based on the custom function and the capability to embed TxL expressions into rich text, business users are able to define suitable KPI visualizations based on HTML-markup:

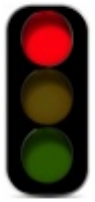
```
/* Evaluate KPI value by custom function */
let kpivalue = getApplicationContinuityPlanAvailabilityKPI() in

/* Interpretation: Good if >80%, normal if 60% - 80%, problematic if <60% */
kpivalue.greaterThanOrEqualTo(0.8)
        ? "<img src='trafficlight-green.jpg'/>"
        : kpivalue.greaterThanOrEqualTo(0.6)
                ? "<img src='trafficlight-yellow.jpg'/>"
                : "<img src='trafficlight-red.jpg'/>"
```

Application continuity plan availabiltity: 1

or

Application continuity plan availabiltity: 0.5



Conclusion & Outlook

- Conclusion
  - Existing EAM tools and wiki systems do not fulfil the identified requirements
  - Therefore, we designed TxL and implemented a prototype, which fulfils these requirements
  - All KPIs of the catalog were successfully implemented

- Outlook
  - Evaluation
  - Authorization concept
  - Time series
  - Visualizations

Thanks for your attention!

Questions?

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