An Integrated Approach to Process-Driven Business Process Performance Monitoring and Analysis for Real-Time Enterprises

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Need for Process Oriented Data Collection

- Diverse information from various sources of enterprise IT systems should be collected.
- Business performance data should be collected according to the events that can be generated by process execution.
- Data also be organized based on the viewpoint of process.

Research Objectives

- The development of an accelerator module, called xPIA, which facilitates the automated gathering of performance data of business processes by effectively integrating with BPMS.

- Supporting to find a statistical model that describes cause and effect relationships between the process quality and the factors which affect the quality.

Problem Definition

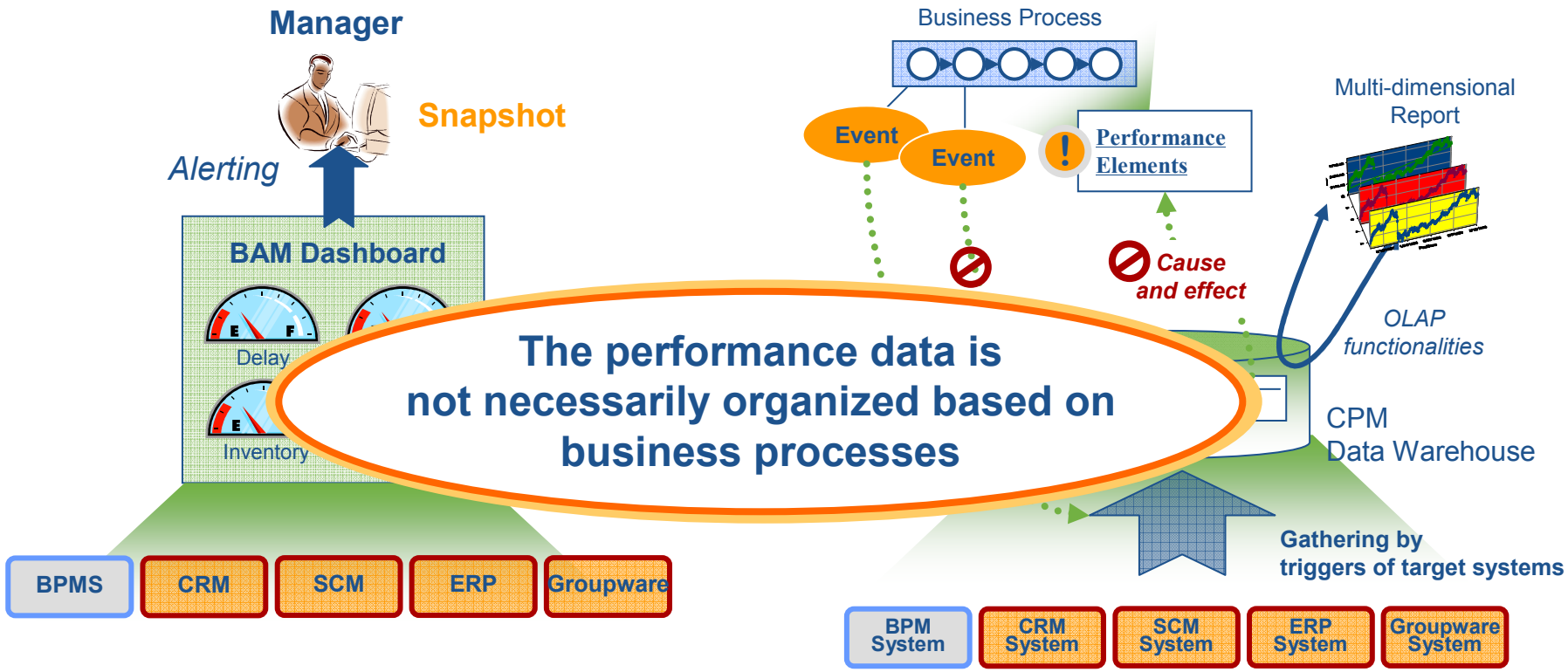
- Three Systems Supporting Continuous Process Improvement
  - Business Process Management System (BPMS)
  - Business Activity Monitoring (BAM) System
  - Corporate Performance Management (CPM) System

Process Data

- Only from BPMS.
- Independent of business processes.
- Not necessarily from viewpoint of process.

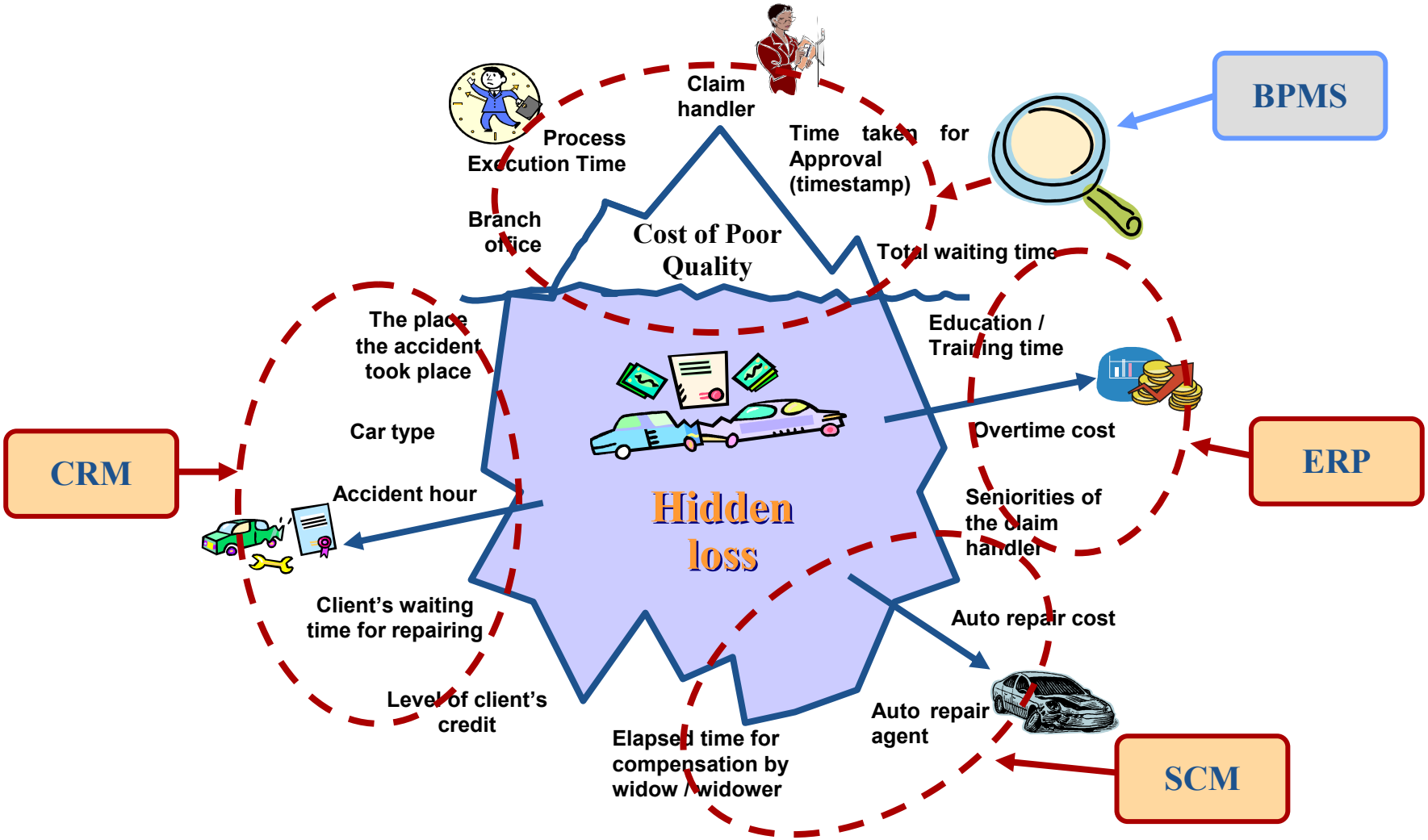
Limitations of Existing Approaches

- Business Activity Monitoring (BAM)
  - Calculation and presentation of KPIs independently from viewpoint of process.
  - E.g. Oracle Business Activity Monitoring.
- Corporate Performance Management (CPM)
  - Analyzing business processes through various OLAP capabilities without having relations with process events and performance elements.
  - E.g. ARIS PPM, FileNet Process Analyzer.



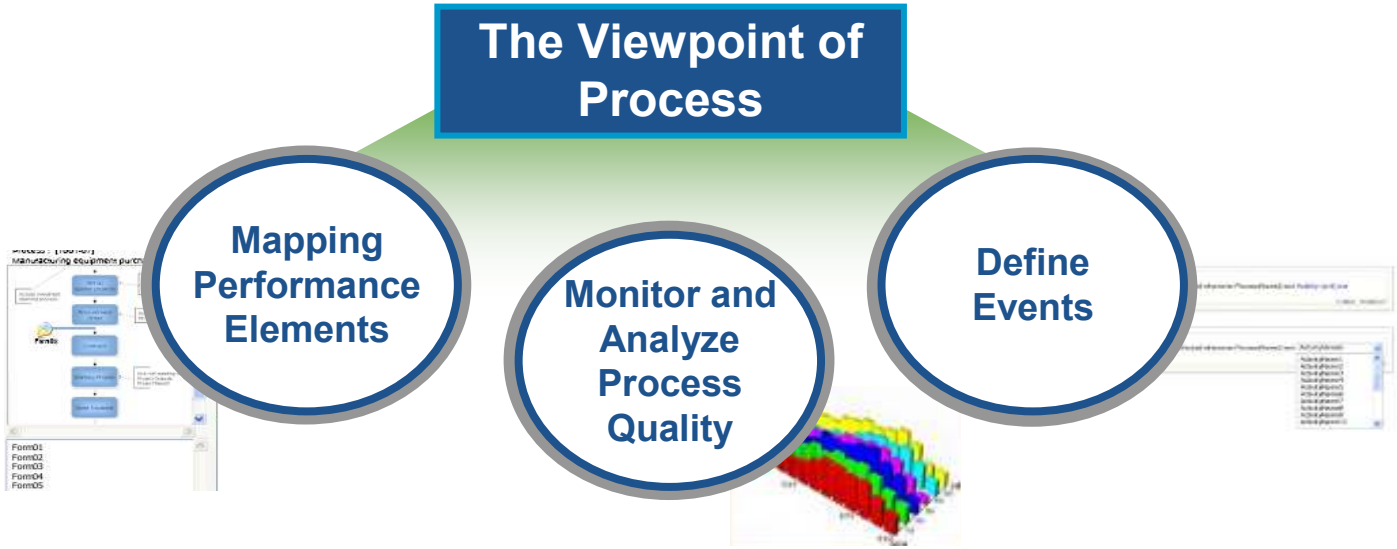
The performance data is not necessarily organized based on business processes

Limitations of Existing Approaches

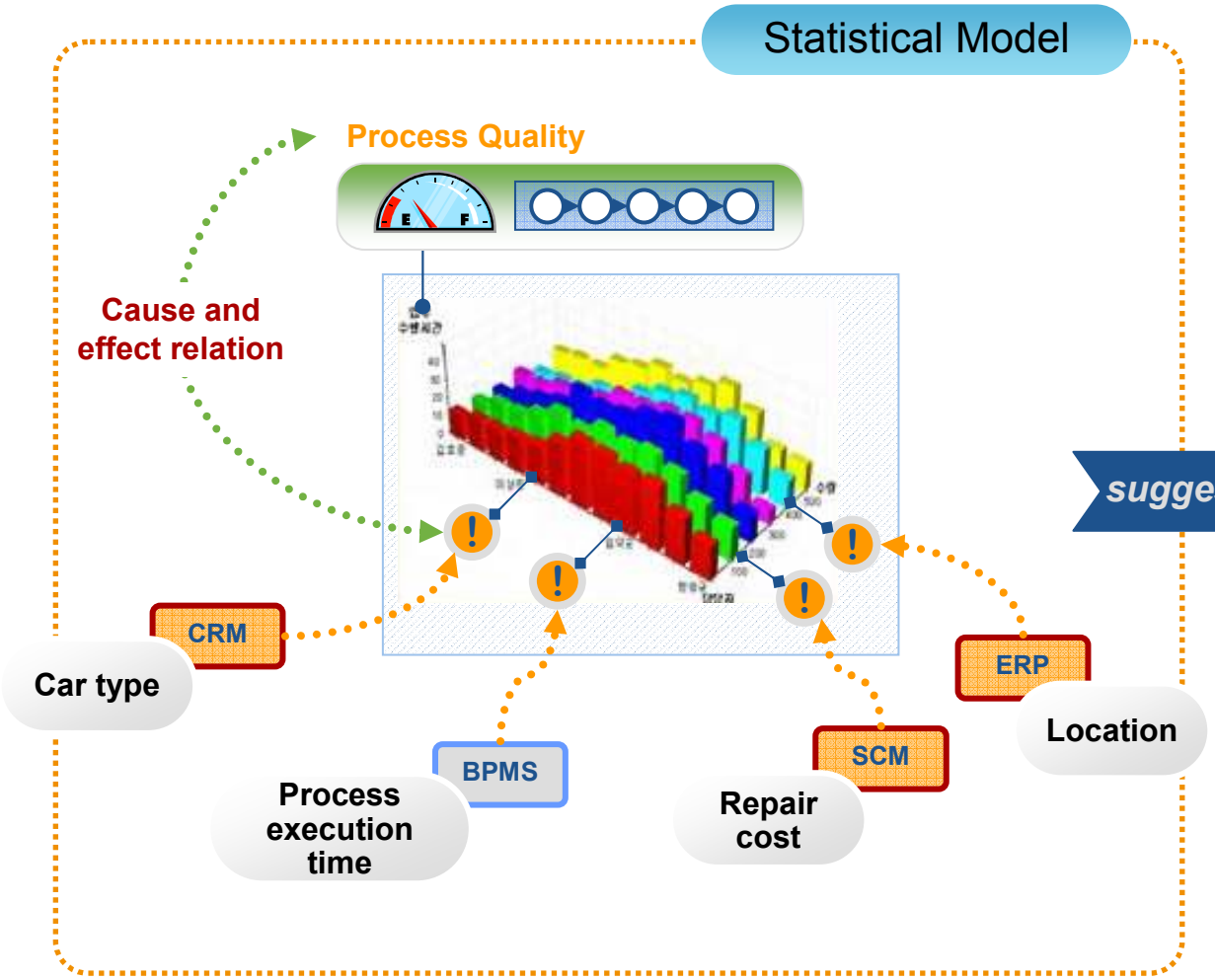


Proposed Method

- Process-driven approach
  - Target performance elements are selected, managed, and analyzed based on process-oriented views.
  - The process performance data is collected based on the rules that are defined in terms of the events which are generated during business process execution.



Process Quality Analysis



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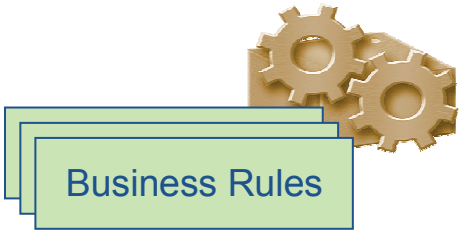
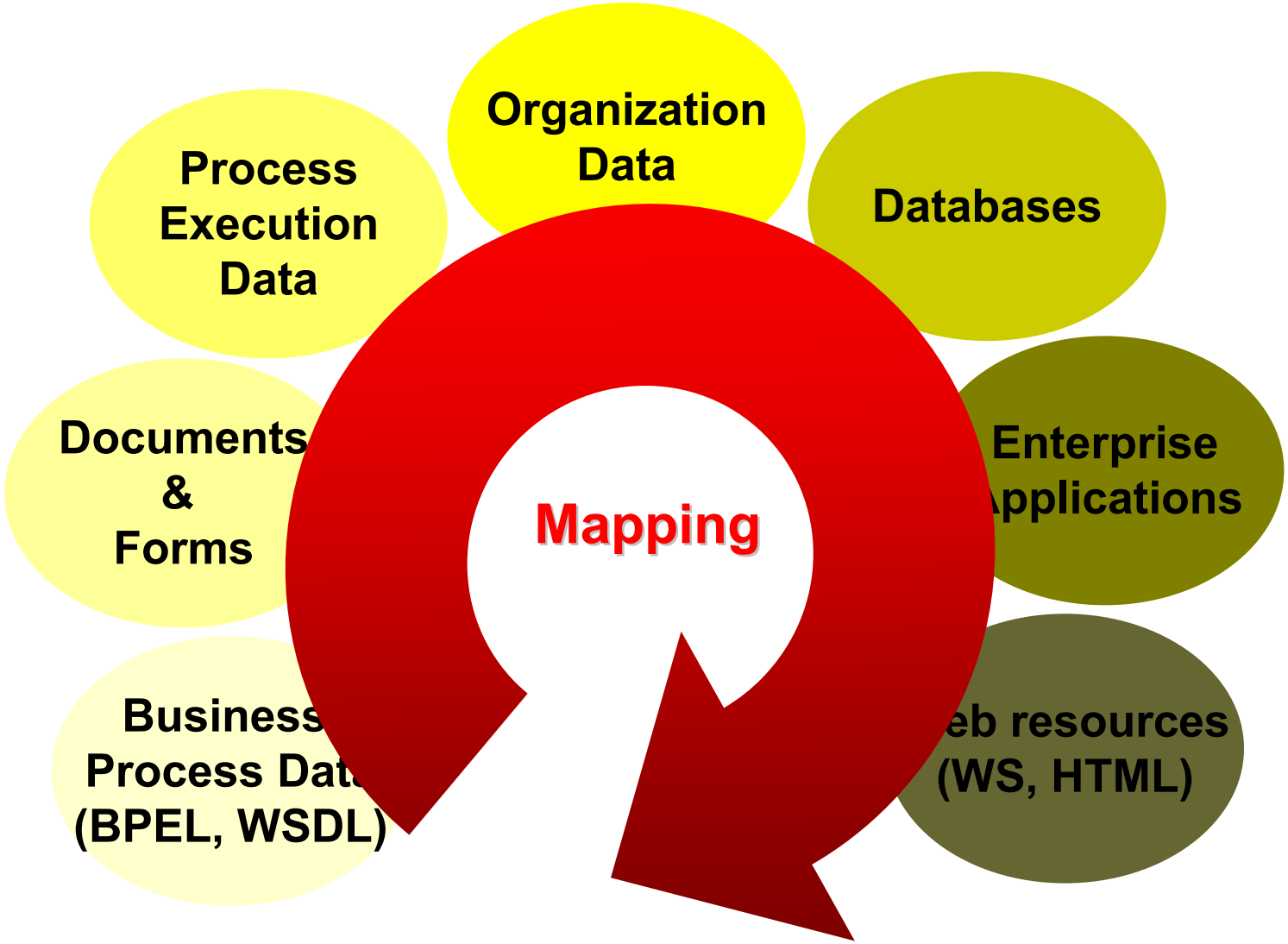


"**John** is the best person for handling the **BMW accident** that took place in the **Harvard University**"

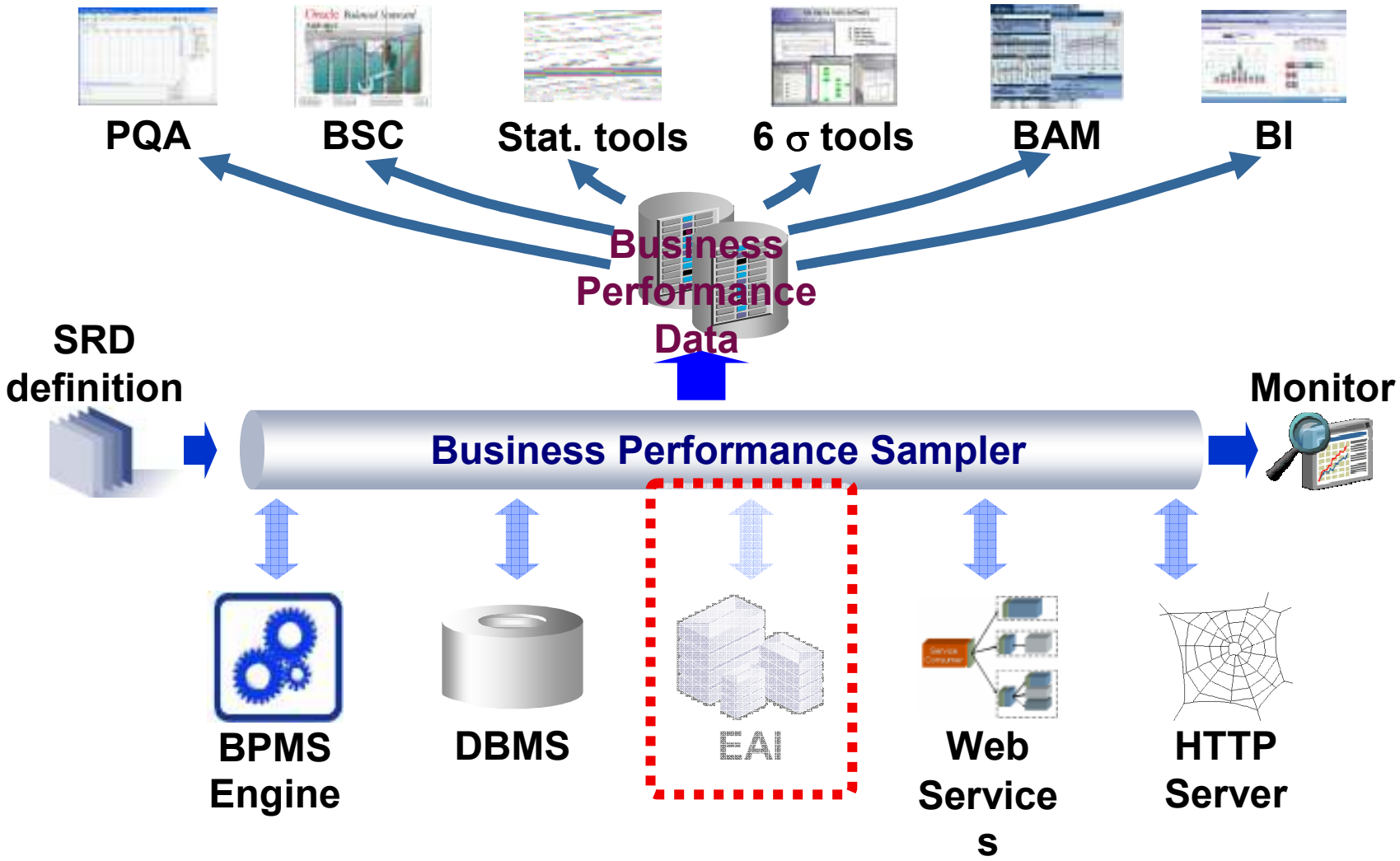
Target Systems of xPIA



System Components

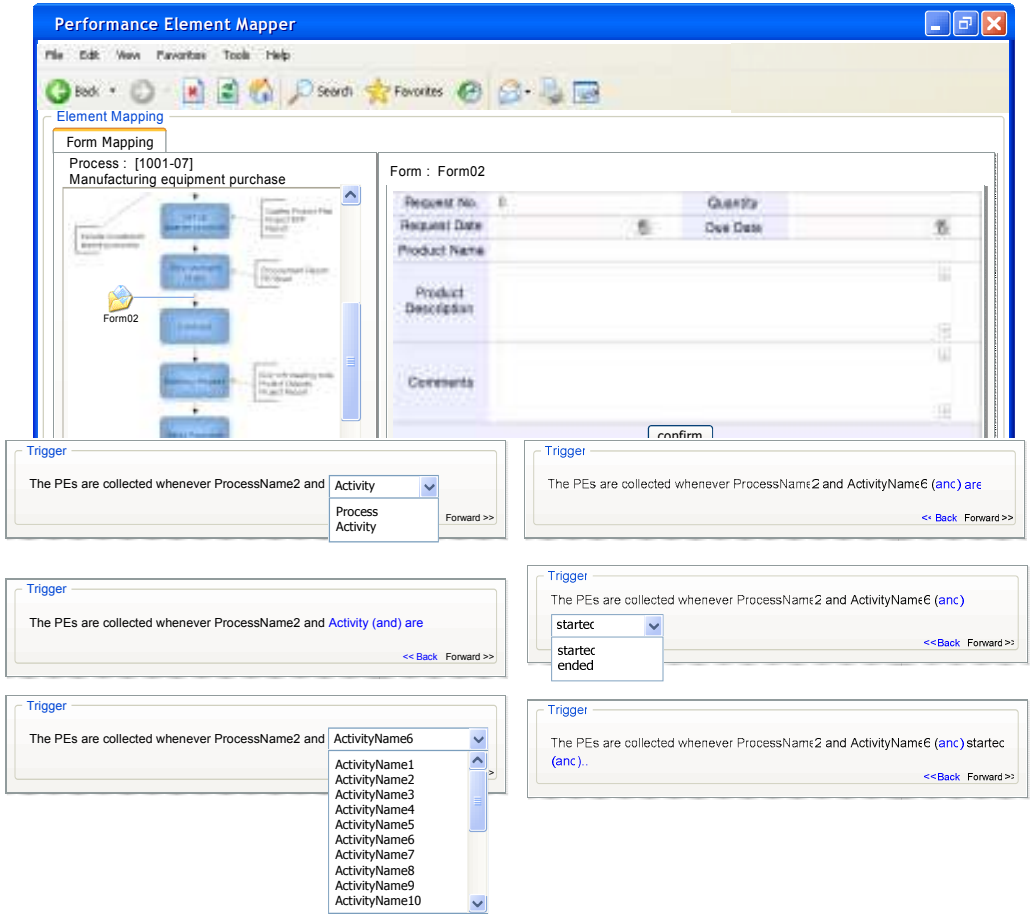
- Performance Element Mapper (PEM)
  - Define the performance element which should be collected and the event structure.
  - Output of PEM: Sampling Rule Definition (SRD) file.
- Business Performance Sampler (BPS)
  - Collect the values of performance elements from various sources of enterprise information systems (including BPMS).
  - Operate based on the rules that are defined in the SRD file.
- xPIA Monitor
  - Manage the status and configuration of BPS module.
- Business Performance Database
  - Storage for recording the performance data which is collected by BPS.
- Process Quality Analyzer (PQA)
  - Currently supports factor analysis and performance prediction.

Run-time Architecture of xPIA



Performance Element Mapper (PEM)

- Map performance elements with e-forms of activities and various enterprise information systems.
- Define association between performance element and event structure.
- Dialogue based user interface which is widely used in rule definition.



Performance Element Mapper (PEM)

Coverage of Performance Element Mapper (PEM)

- Data collecting from various enterprise IT systems
  - Provide capability to collect data in a process-oriented manner.
  - Current target systems: various enterprise applications such as databases, enterprise application integration, and web resources.

- Structure of Sampling Rule Definition (SRD) file
  - Output of PEM (Performance Element Mapper) module.
  - Specifies the performance data which is to be extracted and the data collection rule in the form of an XML document.
    - Set of performance element data to be collected.
    - Access information such as URL of a target system, protocol, login data, and XQuery (or SQL) expressions.
    - Type and structure of data and the event structure.

Example of Sampling Rule Definition (SRD)

- Elements of the Event Structure
  - Scope that defines the life time of the data collection.
  - Trigger that indicates when the data is collected.
  - Condition that needs to be satisfied for the data collection to processed.

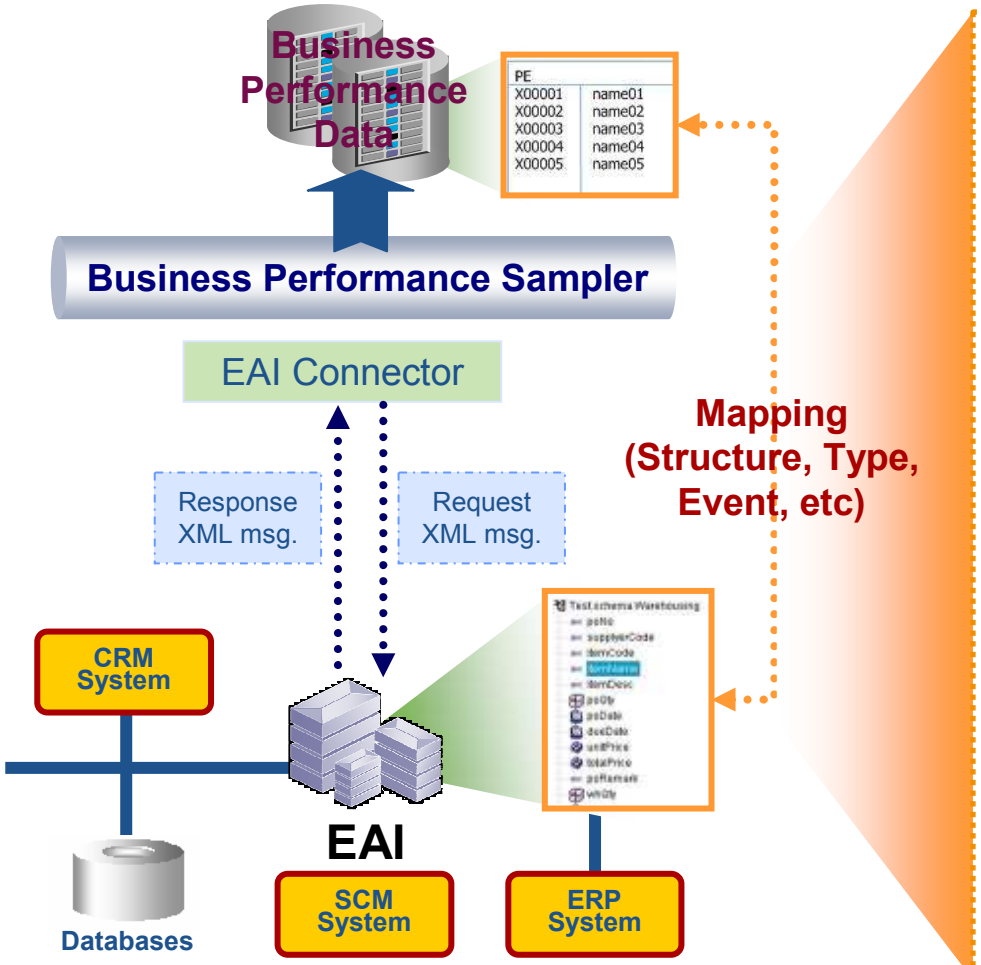
XML Schema of SRD

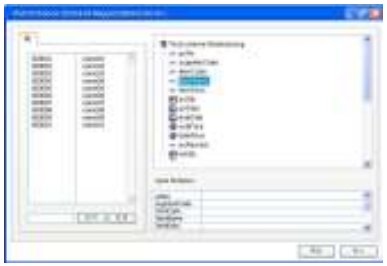
```
<?xml version="1.0" encoding="UTF-8"?>
<schema targetNamespace="http://mrd“
  elementFormDefault="qualified"
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:mrd="http://mrd">
   <complexType name="tExtensibleElements">
      <sequence>
         <element name="description" minOccurs="0">
            <complexType mixed="true">
               <sequence minOccurs="0"
                           maxOccurs="unbounded">
                  <any processContents="lax"/>
               </sequence>
            </complexType>
         </element>
         <any namespace="##other" processContents="lax"
                  minOccurs="0" maxOccurs="unbounded"/>
      </sequence>
. . .
```

A sample SRD file

```
<?xml version="1.0" encoding="UTF-8"?>
<Process creator=“snu" creatorid=“di10" mrdid="10“
   address="URL" id=“dilab" pass=“dilab" dbname="mrd">
    <X type="form" name="Cost" prcid="proc1" taskno="task1“
       vartype="varchar(10)" >
       <location>XPATH</location>
       <interval startdate="Datetime" enddate="Datetime“
        startinstanceid="" endinstanceid="“
        trigger="U:snu1_login"/>
       <condition>
          <instanceini>Root.SaleDef.Marry</instanceini>
          <activitywork>Root.SaleDef.Marry</activitywork>
          <formdata>XPATH=1</formdata>
          <typecond>int</typecond>
          <sizecond>&gt;100</sizecond>
       </condition>
    </X>
    . . .
```

Example of Collecting Performance Data from EAI System





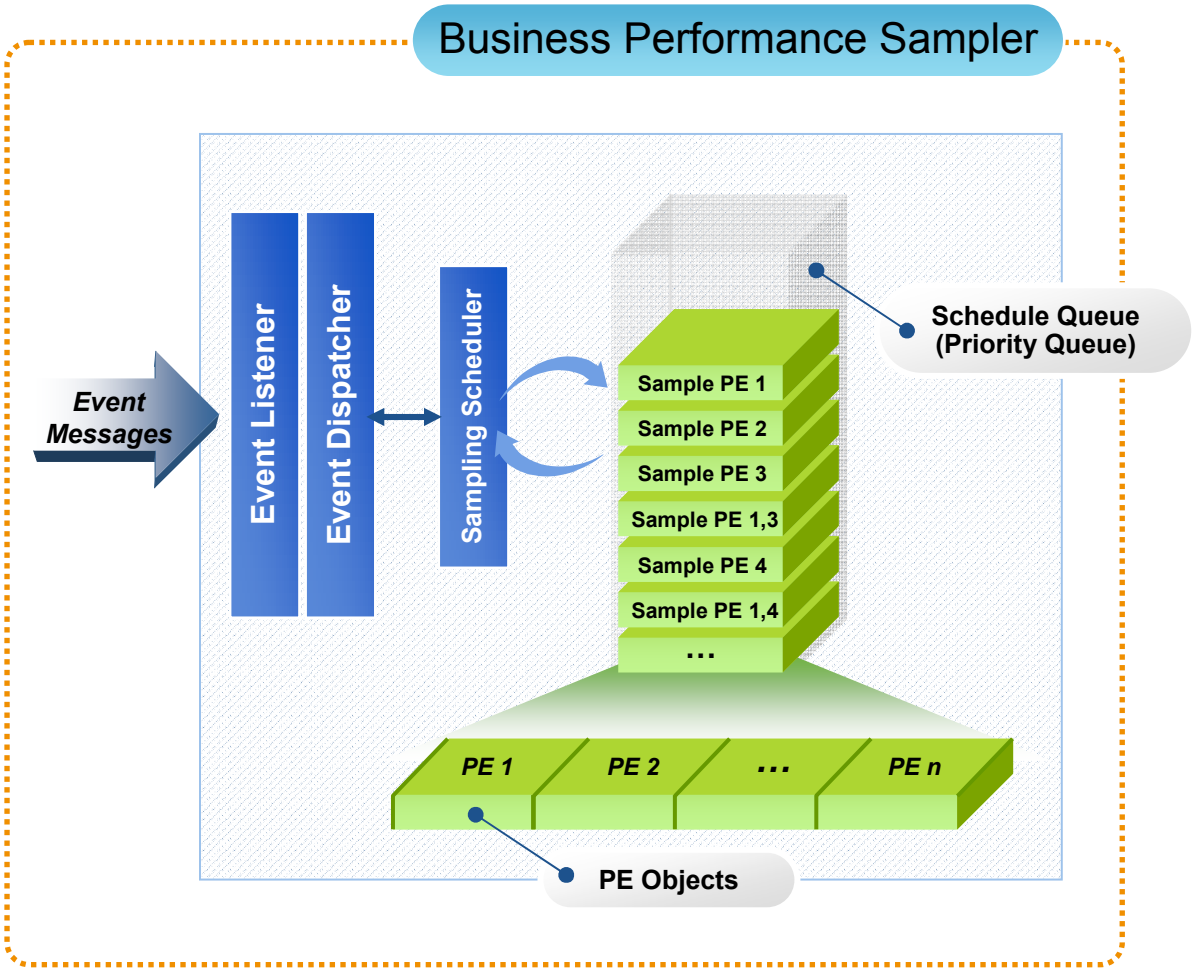
Map performance element with EAI data schema

Define data manipulation rules of specific element using various functions.

Specify event that contains period of time, conditions, scope, trigger type, etc.

Business Performance Sampler (BPS)

- Organize the data set based on the rules that are defined in the SRD files.
- Manage job schedule by using priority queue.
- Store organized data into the process performance database.



Representation of Business Performance Database

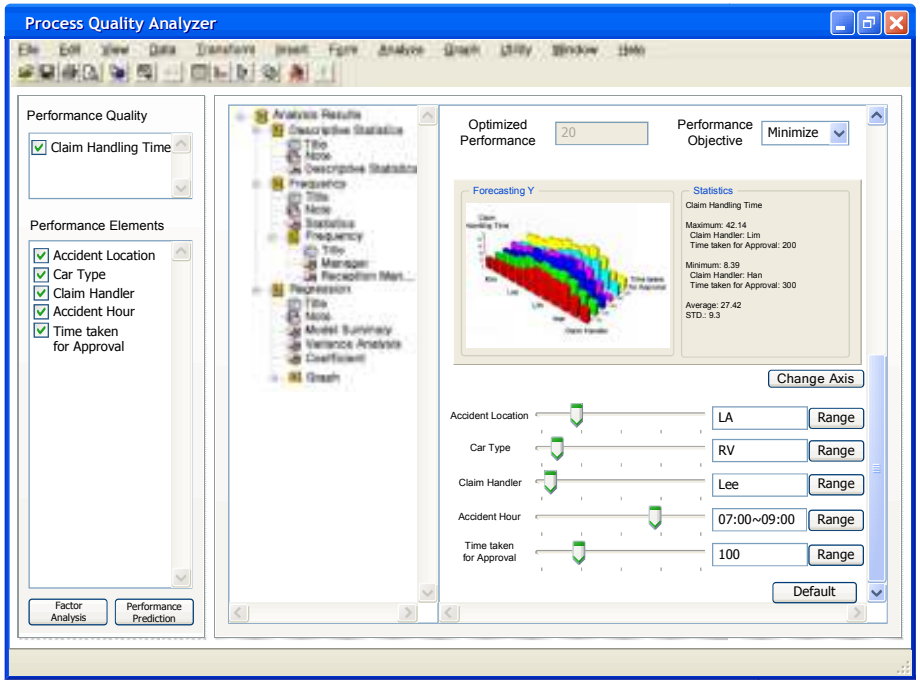
- Some performance elements may have different frequency requirements for data collections.
  - Data schema (X_1, X2, …, X_n, Δ) where $\Delta = d_1, d_2 \ldots d_n$
  - If the value of X_i is specified, d_i,(i = 1, … , n,) has a value of 1. Otherwise it has a value of 0.
  - If X_j has the collecting bit d_j, which the value of 0, are replaced by their most recent values.

- Example
  - Factor analysis with X_1, X_2, and X_3 with different sampling frequencies.
  - Independent variable X_1 and X_2 : Dependent variable X_3 .
  - (a', undef, c, 101), (a'', b, c, 100), and (a'', b, c', 111)

Process Quality Analyzer (PQA)

- Currently support
  - Factor analysis: Derive performance elements using a simple least squares regression model
  - Performance prediction: Used for cause and effect analysis and process optimization.

- Users examine effect of a factor by varying its value.



Process Quality Analyzer (PQA)

Conclusion

- Realization of continuous process improvement (CPI) requires
  - Diverse information from various enterprise IT systems. (including BPMS).
  - Data to be collected from process views.

- Proposed framework provides a distinct advantage
  - Organize and collect performance data from process views.
  - Help users find a useful statistical model to analyze process quality.

- Expect to increase the user acceptance of BPMS by using proposed framework as a vital tool for realizing the vision of continuous process improvement.


Thank You !