

Meeting of the IEEE Task Force on Process Mining

Monday September 3rd 2012, 16:30-18.00

Room Grande 1 of Sokos Hotel Viru, Viru väljak 4, Tallinn, Estonia.

<http://www.win.tue.nl/ieeetfpm/>

Agenda

- 16.30 Introduction of participants and IEEE Task Force on Process Mining
- 16.40 Overview of activities 2011-2012
- 16.50 Standardization process of XES
- 17.15 Restructuring the Task Force
- 17.30 Development of new activities for 2012-2013
- 17.50 Closing

TF on Process Mining

Chair: Wil van der Aalst (The Netherlands)

Members:

Aalst, Wil van der
Baier, Thomas
Blickle, Tobias
Brand, Peter van den
Brandtjen, Ronald
Burattin, Andrea
Carmona, Josep
Castellanos, Malu
Claes, Jan
Cook, Jonathan
Costantini, Nicola
Curbera, Francisco
Dongen, Boudewijn van
Dumas, Marlon
Ferreira, Diogo
Geffen, Frank van
Goel, Sukriti
Günther, Christian
Guzzo, Antonella
Harmon, Paul

Hofstede, Arthur ter
Hoogland, John
Ingvaldsen, Jon Espen
Jung, Jae-Yoon
Kato, Koki
Kuhn, Rudolf
Kumar, Akhil
Malerba, Donato
Manuel, Alberto
McCreesh, Martin
Mello, Paola
Mendling, Jan
Motahari Nezhad, Hamid Reza
Muehlen, Michael zur
Munoz-Gama, Jorge
Passova, Sofia
Rozinat, Anne
Seguel Pérez, Hugo
Seguel Pérez, Ricardo
Sepúlveda, Marcos

Sinur, Jim
Soffer, Pnina
Song, Minseok
Sperduti, Alessandro
Stoel, Casper
Swenson, Keith
Talamo, Maurizio
Turner, Chris
Vanderhaeghen, Dominik
Vanthienen, Jan
Varvaessos, George
Verbeek, Eric
Verdonk, Marc
Vigo, Roberto
Wang, Jianmin
Weber, Barbara
Webster, Charles
Weffers, Harold
Weijters, Ton
Wynn, Moe

See <http://www.win.tue.nl/ieeetfpm/> for full list and affiliations.

Composition of TF

- **Software vendors** (Pallas Athena, IDS Scheer/Software AG, Futura Process Intelligence, HP, IBM, Infosys, Fluxicon, Businesscape, Iontas, Fujitsu, Business Process Mining, etc.)
- **Consultancy** (Some of the above and ProcessGold, Business Process Trends, Gartner, Deloitte, Rabobank, etc.)
- **Universities** (TU/e, University of Padua, University of Catalunya, New Mexico State University, Technical University of Lisbon, University of Calabria, Penn State University, University of Bari, Humboldt-Universität, Queensland University of Technology, Vienna University of Economics and Business, Stevens Institute of Technology, University of Haifa, Seoul National University of Technology, Cranfield University, K.U.Leuven, Tsinghua University, Innsbruck University, etc.)

Goals

- The goal of this Task Force is to promote the research, development, education and understanding of process mining.
- More concretely, the goal is to:
 - make end-users, developers, consultants, and researchers aware of the state-of-the-art in process mining,
 - promote the use of process mining techniques and tools and stimulating new applications,
 - play a role in standardization efforts for logging event data,
 - the organization of tutorials, special sessions, workshops, panels,
 - the organization of Conferences/Workshop with IEEE CIS Technical Co-Sponsorship, and
 - publications in the form of special issues in journals, books, articles (e.g., in the IEEE Computational Intelligence Magazine).
- Note that process mining includes (automated) process discovery (extracting process models from an event log), conformance checking (monitoring deviations by comparing model and log), social network/organizational mining, automated construction of simulation models, case prediction, and history-based recommendations.



Overview of activities 2011-2012

Activities 2011-2012



A manifesto is a "public declaration of principles and intentions" by a group of people. This manifesto is written by members and supporters of the IEEE Task Force on Process Mining. The goal of this task force is to promote the research, development, education, implementation, evolution, and understanding of process mining.

Process mining is a relatively young research discipline that sits between computational intelligence and data mining on the one hand, and process modeling and analysis on the other hand. The idea of process mining is to discover, monitor and improve real processes (i.e., not simulated processes) by extracting knowledge from event logs readily available in today's (information) systems. Process mining includes (automated) process discovery (i.e., extracting process models from an event log), conformance checking (i.e., monitoring deviations by comparing model and log), social network/organizational mining, automated construction of executable models,

model extension, model repair, case prediction, and history-based recommendations.

Contents:

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Process mining techniques are able to extract knowledge from event logs commonly available in today's information systems. These techniques provide new means to discover, monitor, and improve processes in a variety of application domains. There are two main drivers for the growing interest in process mining. On the one hand, more and more events are being recorded, thus providing detailed information about the history of processes. On the other hand, there is a need to improve and support business processes in competitive and rapidly changing environments. This manifesto is created by the IEEE Task Force on Process Mining and aims to promote the topic of process mining. Moreover, by defining a set of guiding principles and listing important challenges, this manifesto hopes to serve as a guide for software developers, scientists, consultants, business managers, and end-users. The goal is to increase the visibility of process mining as a new tool to improve the (design, control, and support of operational business processes.



Activities 2011-2012

- Promotion of Process Mining and the Task Force based on the manifesto: IEEE Computer, Communications of the ACM, Informatica, Informatik Spektrum, Information Systems, Mondo Digitale, Communication of China Computer Federation, Institute for Internal Auditors, Computing Now, Computable, BPTrends, Automatiseringsgids, KDD, etc. etc.
- Various publications and presentations of group members (list is endless).
- Promotional videos, e.g.,:
http://www.youtube.com/watch?v=DaK_o8e1WKw,
<http://www.youtube.com/watch?v=BMoEuzqFOPo>,
http://www.youtube.com/watch?v=D_8Xr8UWkis,
<http://www.youtube.com/watch?v=oqI3RHCmHcl>,
<http://fluxicon.com/camp/2012/anne>
- Special Session on Process Mining at 2012 IEEE World Congress On Computational Intelligence (June 10-15, Brisbane, Australia), Moe Wynn, Jan Vanthienen, Zbigniew Michalewicz, Adam Ghandar.

Activities 2011-2012

- 8th International Workshop on Business Process Intelligence 2012 (Boudewijn van Dongen, Diogo R. Ferreira, Barbara Weber).
- Second International Business Process Intelligence Challenge (BPIC'12) (Boudewijn van Dongen, Diogo R. Ferreira, Barbara Weber).
- Process Mining Camp (<http://fluxicon.com/camp/2012/>), Fluxicon, Anne Rozinat, Christian W. Günther, June 4th 2012.
- ...

XXES

Extensible Event Stream

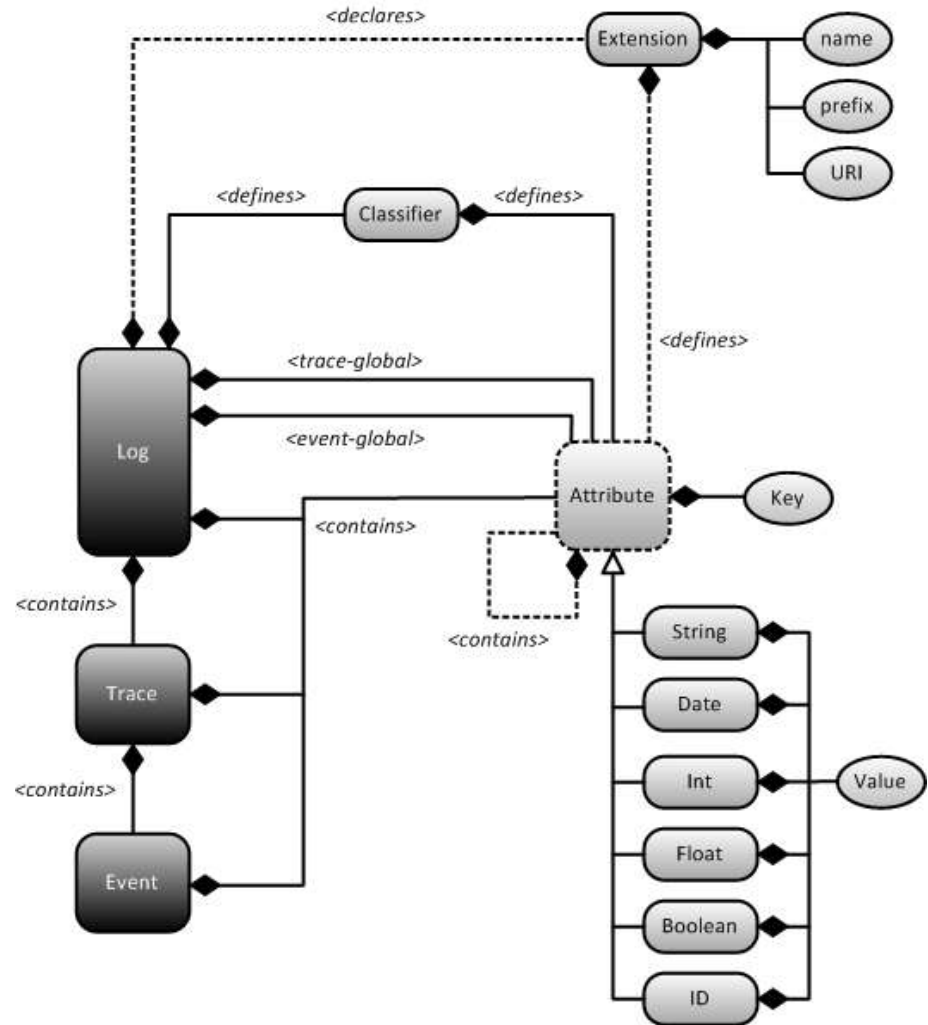
Overview XES

XES

Extensible Event Stream



event logs, audit trails,
databases, message
logs, etc.



www.xes-standard.org

XES (compatible with MXML)

Event log consists of:

- traces (process instances)
 - events
- Standard extensions:
 - concept (for naming)
 - lifecycle (for transactional properties)
 - org (for the organizational perspective)
 - time (for timestamps)
 - semantic (for ontology references)
- Possible extensions/extensions under development:
 - costs (QUT)
 - security
 - ...

```
<log xes.version="1.0" xes.features="nested-attributes" openxes.version="1.0RC7">
  <extension name="Concept" prefix="concept" uri="http://code.deckfour.org/xes/concept.xesext"/>
  <extension name="Semantic" prefix="semantic" uri="http://code.deckfour.org/xes/semantic.xesext"/>
  <extension name="Time" prefix="time" uri="http://code.deckfour.org/xes/time.xesext"/>
  <extension name="Organizational" prefix="org" uri="http://code.deckfour.org/xes/org.xesext"/>
  <extension name="Lifecycle" prefix="lifecycle" uri="http://code.deckfour.org/xes/lifecycle.xesext"/>
- <global scope="trace">
  <string key="conceptname" value="__INVALID__"/>
</global>
- <global scope="event">
  <string key="conceptname" value="__INVALID__"/>
  <string key="lifecycle:transition" value="complete"/>
</global>
<classifier name="MXML Legacy Classifier" keys="conceptname lifecycle:transition"/>
<classifier name="Event Name" keys="conceptname"/>
<classifier name="Resource Name" keys="orgresource"/>
<string key="source" value="http://code.deckfour.org/xes/trace_d_more_data.zip"/>
<string key="conceptname" value="invite reviewers"/>
<string key="lifecycle:mode" value="standard"/>
<string key="description" value="Simulated process"/>
- <trace>
  <string key="conceptname" value="1"/>
  <string key="description" value="Simulated process instance"/>
- <event>
  <string key="orgresource" value="Mike"/>
  <date key="time:timestamp" value="2006-01-01T00:00:00.000+01:00"/>
  <string key="conceptname" value="invite reviewers"/>
  <string key="lifecycle:transition" value="start"/>
</event>
- <event>
  <string key="orgresource" value="Mike"/>
  <date key="time:timestamp" value="2006-01-06T00:00:00.000+01:00"/>
  <string key="conceptname" value="invite reviewers"/>
  <string key="lifecycle:transition" value="complete"/>
</event>
- <event>
```

extensions loaded

every trace has a name

every event has a name and a transition

start of trace (i.e. process instance)

classifier = name + transition

name of trace

resource

timestamp

name of event (activity name)

transition

```
<event>
  <string key="org.resource" value="Anne"/>
  <date key="time.timestamp" value="2009-06-23T01:00:00.000+02:00"/>
  <string key="conceptname" value="accept"/>
  <string key="lifecycle.transition" value="start"/>
</event>
```

end of trace (i.e. process instance)

```
<event>
  <string key="org.resource" value="Anne"/>
  <date key="time.timestamp" value="2009-06-28T01:00:00.000+02:00"/>
  <string key="conceptname" value="accept"/>
  <string key="lifecycle.transition" value="complete"/>
</event>
```

start of trace

```
<trace>
  <string key="conceptname" value="68"/>
  <string key="description" value="Simulated process instance"/>
</trace>
```

name of trace

```
<event>
  <string key="org.resource" value="Mike"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.000+02:00"/>
  <string key="conceptname" value="invite reviewers"/>
  <string key="lifecycle.transition" value="start"/>
</event>
```

resource

timestamp

name of event (activity name)

```
<event>
  <string key="org.resource" value="Mike"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.000+02:00"/>
  <string key="conceptname" value="invite reviewers"/>
  <string key="lifecycle.transition" value="complete"/>
</event>
```

data associated to event

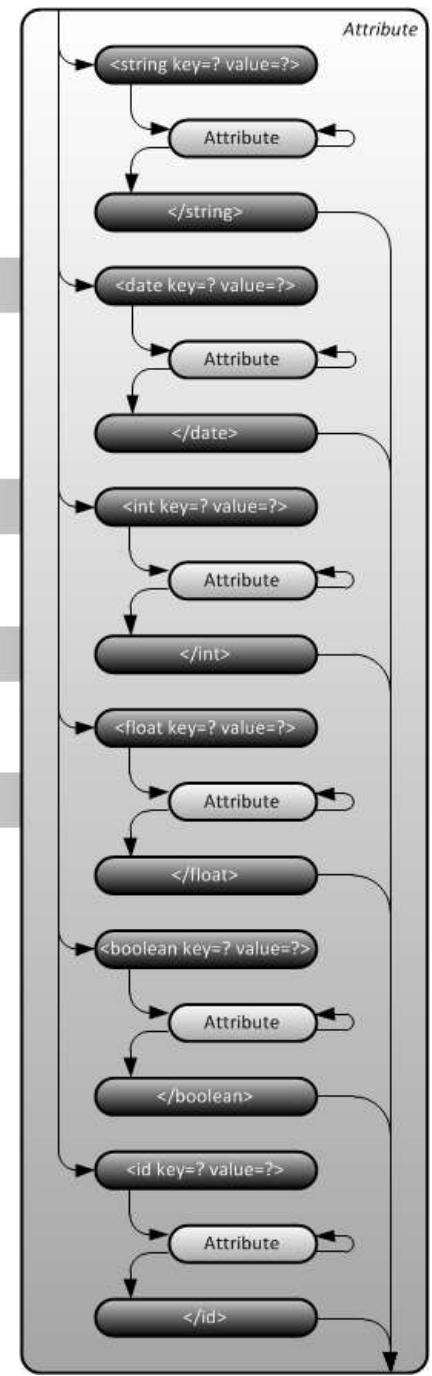
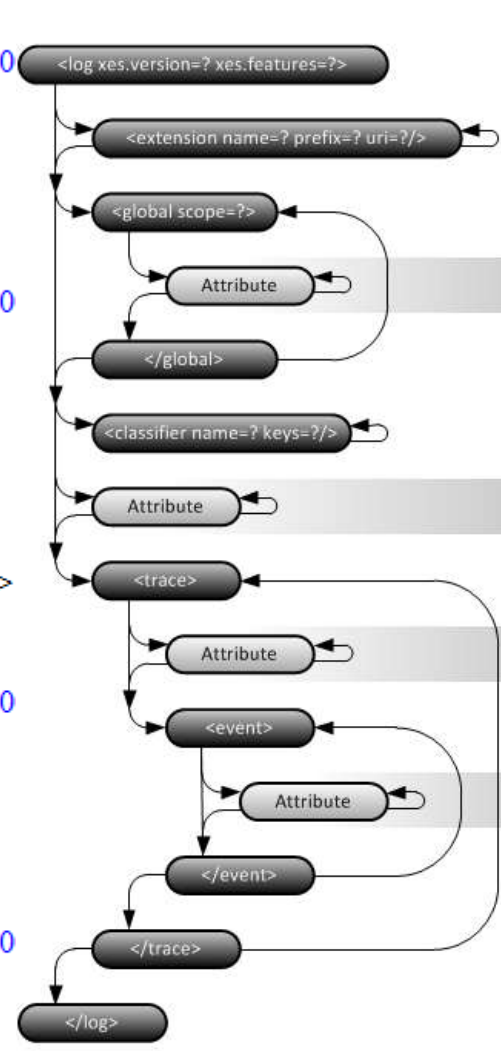
```
<event>
  <string key="org.resource" value="Pam"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.000+02:00"/>
  <string key="lifecycle.transition" value="complete"/>
  <string key="Result by Reviewer A" value="reject"/>
  <string key="conceptname" value="get review 1"/>
</event>
```



```

<event>
  <string key="org.resource" value="Anne"/>
  <date key="time.timestamp" value="2009-06-23T01:00:00.0"/>
  <string key="conceptname" value="accept"/>
  <string key="lifecycle.transition" value="start"/>
</event>
- <event>
  <string key="org.resource" value="Anne"/>
  <date key="time.timestamp" value="2009-06-28T01:00:00.0"/>
  <string key="conceptname" value="accept"/>
  <string key="lifecycle.transition" value="complete"/>
</event>
</trace>
- <trace>
  <string key="conceptname" value="68"/>
  <string key="description" value="Simulated process instance"/>
- <event>
  <string key="org.resource" value="Mike"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.0"/>
  <string key="conceptname" value="invite reviewers"/>
  <string key="lifecycle.transition" value="start"/>
</event>
- <event>
  <string key="org.resource" value="Mike"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.0"/>
  <string key="conceptname" value="invite reviewers"/>
  <string key="lifecycle.transition" value="complete"/>
</event>
- <event>
  <string key="org.resource" value="Pam"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.0"/>
  <string key="lifecycle.transition" value="complete"/>
  <string key="Result by Reviewer A" value="reject"/>
  <string key="conceptname" value="get review 1"/>
</event>
- <event>
  <string key="org.resource" value="INVALID"/>
  <date key="time.timestamp" value="2006-10-14T01:00:00.0"/>
  <string key="conceptname" value="INVALID"/>
  <string key="lifecycle.transition" value="INVALID"/>
</event>

```



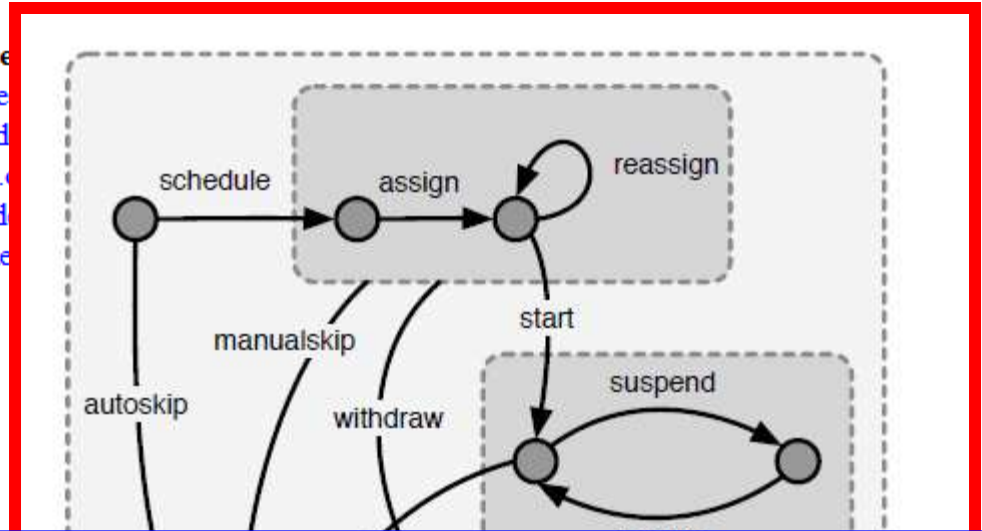
Example: Lifecycle extension

```
<log xes.version="1.0" xes.features="nested-attributes" openxes.ver
  <extension name="Concept" prefix="concept" uri="http://code.de
  <extension name="Semantic" prefix="semantic" uri="http://code.d
  <extension name="Time" prefix="time" uri="http://code.deckfour.
  <extension name="Organizational" prefix="org" uri="http://code.d
  <extension name="Lifecycle" prefix="lifecycle" uri="http://code.de
```

```
<global scope="trace">
  <string key="conceptname" value="__INVALID__"/>
</global>
<global scope="event">
  <string key="conceptname" value="__INVALID__"/>
  <string key="lifecycle.transition" value="complete"/>
</global>
```

```
<classifier name="MXML Legacy Classifier"
<classifier name="Event Name" keys="conce
<classifier name="Resource" keys="orgreso
<string key="source" value="CPN Tools sim
<string key="conceptname" value="versioning
<string key="lifecycle.model" value="standard
<string key="description" value="Simulated p
```

```
<trace>
  <string key="conceptname" value="1"/>
  <string key="description" value="Simulated
  <event>
    <string key="orgresource" value="Mike
    <date key="time.timestamp" value="200
    <string key="conceptname" value="ini
    <string key="lifecycle.transition" value="
  </event>
</event>
```



```
<?xml version="1.0" encoding="UTF-8" ?>
<xesextension name="Lifecycle" prefix="lifecycle" uri="http://code.fluxicon.
</log>
<string key="model">
  <alias mapping="EN" name="Lifecycle Model" />
  <alias mapping="DE" name="Lebenszyklus-Modell" />
  <alias mapping="FR" name="Modèle du Cycle Vital" />
  <alias mapping="ES" name="Modelo de Ciclo de Vida" />
  <alias mapping="PT" name="Modelo do Ciclo de Vida" />
</string>
</log>
<event>
  <string key="transition">
    <alias mapping="EN" name="Lifecycle Transition" />
    <alias mapping="DE" name="Lebenszyklus-Transition" />
    <alias mapping="FR" name="Transition en Cycle Vital" />
    <alias mapping="ES" name="Transición en Ciclo de Vida" />
    <alias mapping="PT" name="Transição do Ciclo de Vida" />
  </string>
</event>
```

Tool support

- **OpenXES library** (<http://www.openxes.org/>): reference implementation of the XES standard in Java
- **ProM 6** (<http://www.promtools.org/prom6/>): loads and analyzes XES files.
- **XESame** (<http://www.promtools.org/prom6/>): conversion from non-event log data sources.
- **Nitro** (<http://www.fluxicon.com/nitro/>): easy conversion from CSV/XLS-like formats.
- **Disco** (<http://www.fluxicon.com/disco/>): beautiful visual maps from your process data.

Work done

- Consolidated standard
- Consolidated ID attribute
- Consolidated documentation
 - Standard definition
 - OpenXES Developer guide
- www.xes-standard.org
- www.openxes.org

More information

www.xes-standard.org

www.openxes.org

Standardization process of XES: Becoming an "official" IEEE Standard

Motivation

- Exposure
- XML (<http://standards.ieee.org/>)
- Common Format for Event Data Exchange
 - A common format for data files used for the interchange of various types of event data collected from electrical power systems or power system models is defined. Extensibility, extension mechanisms, and compatibility of future versions of the format are discussed. An XML schema is defined. A sample file is given.

Timeline

- Sep 2012: Form Working Group
- Nov 2012: Proposal
 - Short PowerPoint presentation, focus on problem to solve, not too detailed or too technical
- Jan 2013: Project Authorization Request
 - Small, structured, and highly detailed document that essentially states the reason why the project exists and what it intends to do
 - Permission to move forward
- Apr 2013: Proposal
 - Current XES standard

Working Group Proposal

- Chair: Wil van der Aalst
- Vice-chair: Christian Günther
- Technical Editor: Eric Verbeek
- Industrial liaison: Keith Swenson
- Moe Wynn
- Lijie Wenn
- Michael zur Muehlen

XES tips, tricks, and workarounds

Meta attributes

- Workaround for aggregated values
- Dummy attributes
- Extension keys:
 - Trace/Event: aggregated value
 - Meta: value
 - The aggregated value aggregates all the descending values

Example

```
<event key="x:sumval" value="37">  
  <attribute key="id1" value="">  
    <attribute key="x:val" value="13"/>  
  </attribute>  
  <attribute key="id2" value="">  
    <attribute key="x:val" value="3"/>  
  </attribute>  
  <attribute key="id3" value="">  
    <attribute key="x:val" value="21"/>  
  </attribute>  
</event>
```

XES extensions

Motivation

- Provide semantics
- Commonly understood attributes
- Specific application domains
- Supporting special features

Process

- Submit proposal extension
 - To Extension Coordinator of Working Group
- Request for comments
 - To Task Force
 - One month
- Decision
 - Working Group
 - Accept, reject, or resubmit
- Publication
 - Xes-standard.org

Cost Extension

- Example extension
- Driven by Moe Wynn (QUT)
- Analysis, evaluation, treatment, and overall management of cost as it relates to business processes
- Capture process-related costs in event logs

Definition

- Cost
 - Trace/Event
 - Total (Float)
 - Total cost incurred for trace or event
 - Currency (String)
 - Any valid currency format
 - Meta
 - Amount (Float)
 - Cost amount for cost driver
 - Driver (String)
 - Id for cost driver
 - Type (Key)
 - Cost type (e.g., Fixed, Overhead, Materials)

Example

```
<trace>
  <float key="cost:total" value="20.00">
    <string key="xyz123" value="">
      <float key="cost:amount" value="20.00"/>
      <string key="cost:driver" value="xyz123"/>
      <string key="cost:type" value="Fixed Overhead"/>
    </string>
  </float>
  <string key="cost:currency" value="AUD"/>
  <event>
    <float key="cost:total" value="123.50">
      <string key="d2f4ee27" value="">
        <float key="cost:amount" value="21.40"/>
        <string key="cost:driver" value="d2f4ee27"/>
        <string key="cost:type" value="Labour"/>
      </string>
      <string key="abc124" value="">
        <float key="cost:amount" value="102.10"/>
        <string key="cost:driver" value="abc124"/>
        <string key="cost:type" value="Variable Overhead"/>
      </string>
    </float>
    <string key="cost:currency" value="AUD"/>
  </event>
</trace>
```

Restructuring the Task Force

Restructuring the Task Force

- What members are we missing? (Please provide suggestions, preferably more people from industry, academics should be interested to promote the topic also outside academic world).
- How to activate members more?
- Proposal: listing based on organizations rather than individuals (with one contact person per organization and possibly several additional members).

Development of new activities for 2012-2013

Planned activities 2012-2013

- IEEE Standardization of XES
- Dagstuhl Seminar "Unleashing Operational Process Mining" in 2013 (Rafael Accorsi, Malu Castellanos, Ernesto Damiani, Wil van der Aalst)
<http://www.dagstuhl.de/en/program/calendar/semhnp/?semnr=13481>
- 2nd Belgian Process Mining Research Day, Gent, Sept. 2012, <http://processmining.ugent.be/pmday.php>
- Process Mining Programming Workshop, September 28, 2012 Hasselt University, Belgium (Benoît Depaire)
- Special Session Proposal on Process Mining at the 2013 IEEE Symposium Series on Computational Intelligence, (IEEE SSCI 2013), 15-19 April 2013, Singapore. (Andrea Burattin, Fabrizio Maggi)

Planned activities 2012-2013

- Special issue on Business Process Intelligence/Process Mining of ACM Transactions on Management Information Systems
- Creation of regional chapters (suggestion Rafael Accorsi)
- Novel track at the ACM Symposium on Applied Computing? (Rafael)
- Summer school on process mining? (Rafael Accorsi)
- Special issue on in the journal "Business & Information Systems Engineering"? (Rafael)
- Process Mining Winter Camp (Jan Claes)
- BPI 2013 (exploit Chinese interest in topic)?
- Business Process Intelligence Challenge 2013 ?

Closing

