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FERATEL CONTENT ANNOTATION WITH SCHEMA.ORG

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1. Introduction

This document presents our solution on annotating Feratel contents with Schema.org. The main objective is to marking the content up with structured vocabularies provided by Schema.org in ways the Feratel customers can utilize and incorporate the annotated contents into their sites directly such that will be recognized by major search engines.

Our solution is currently tested under collaboration with Tourismusverband (TVb) Innsbruck. The solution is implemented as web-services available on the TVb server. The solution should be fully integrated with the new TVb's website which is expected to be release on March 2015.

This document is structured as follow, first we introduce our strategies to mapping the Feratel content (XML elements and attributes) to Schema.org (classes and properties) in Section 2. Then Section 3 describes how the mapping was implemented using XSL Transformation as well as introduces our web service-based system (so called Feratel Plugin) that performs the annotation. A few technical notes regarding the mapping and implementation are described in Section 4, and finally Section 5 concludes the document and describes potential future work.

2. Conceptual Mapping of Feratel Content to Schema.org

The conceptual mapping was constructed based on the Feratel Deskline 3.0 Standard Interface (DSI), version 1.0.58 [1] and Schema.org specifications¹. First, a short overview of Feratel Deskline 3.0 Standard Interface and Schema.org will be explained, followed by the actual mapping of Feratel XML types to Schema.org classes and properties and summarized this section with some open discussions related to the mapping.

2.1. Overview

This section briefly introduces the two specification we want to map, namely Feratel Deskline 3.0 Standard Interface and Schema.org.

2.1.1. Feratel Deskline 3.0 Standard Interface

Feratel Deskline 3.0 Standard Interface, or shortly Feratel DSI, is the service interface provided by Feratel media technologies AG². The Feratel DSI is provide as a Web Service offering content about Hotels, Apartments, Camping, Restaurants, Bars or Pubs, Cafes, Events, Sightseeing and many more [1]. The communication with the service is done using XML data, i.e. Feratel DSI receives and produces XML data according to an XML Schema defined by Feratel³.

2.1.2. Schema.org

In 2011 the main search engines, including Google, Yahoo!, Bing, and Yandex announced schema.org, a joint effort to create and support a common set of schemas for structured data markup on web pages (Google, 2011). Using schema.org, webmasters can markup their pages in ways recognized by major search providers. This brings several benefits, enabling search engines to properly interpret content and, therefore, increasing the likelihood that the web pages are included in the search results for a related query. In a nutshell, schema.org provides a rich vocabulary for talking about common things on the web that are of interest to search engines, such as people, places, reviews, recipes, offers and events. Schema.org is intended to help site owners and developers learn about structured data and improve how their sites appear in major search engines, as well as provide a one stop source for webmasters looking to add mark-up to their pages. It includes schemas for a large number of concepts and domains, such as creative works (e.g. movies, music, TV, shows), events, places, products, organizations, lodging businesses, reviews, etc. Therefore, schema.org intends to be the de-facto source of vocabulary terms at the description of content in the Web.

¹ <https://schema.org/>

² <http://www.feratel.at/>

³ <http://interface.deskline.net/DSI/XML>

2.2. Mapping

For notation, if does not mentioned explicitly, we use “element” to refer to an XML element from Feratel API and “class” to a class from Schema.org. The mapping of the Feratel XML elements to Schema.org classes is done according to the following steps:

1. For each top-element in Feratel XML:
 - a. Look for a suitable class to be used in the markup format for this element.
 - i. If class is found than assign the class in the corresponding Schema.org/Class cell of the element;
 - ii. If no class in found then assign ?? in the corresponding Schema.org/Class cell of the element;
2. For each sub-element of a top element in Feratel XML:
 - a. Look at the properties of the class assigned at step 1. for the top-element and check if their expected types are suitable classes to be used in the markup format for the sub-element.
 - i. If class is found than assign the class in the corresponding Schema.org/Class and the property in the corresponding Schema.org/Property cells of the sub-element;
 - ii. If no class is found look for a suitable class in the entire schema.org
 1. If class is found than assign the class in the corresponding Schema.org/Class cell of the element; add ?? in the corresponding Schema.org/Property cell of the sub-element;
 2. If no class is found then add ?? in the corresponding Schema.org/Class and Schema.org/Property cells of the sub-element;
3. For each attribute of an element (top or sub-element) in Feratel XML:
 - a. If the element has a related class in Schema.org assigned at step 1. or 2. then use the relevant property from the assigned class of the element;
 - b. If not then then assign ?? in the corresponding Schema.org/Class and Schema.org/Property cells of the attribute.

The mapping is representing a relation between the elements of Feratel XML and the classes of Schema.org including their properties.

2.2.1. Service Providers

Table 1 shows how the mapping of service providers information from Feratel XML to Schema.org can be done. A service provider in the Feratel model is an accommodation service provider. A service provided by a Hotel for example is seen as a set of physical rooms with the same properties (e.g. a Hotel can provide triple room with shower or bath, toilet and no smoking service which includes all rooms of this type). Table 2 shows how the mapping of service information from Feratel XML to Schema.org can be done. Based on a service there can be different products (e.g. product X: one regular triple room, product Y: special package for weekend, including one regular

triple room at a discount price). Products are the units that can be booked by customers. Table 3 shows how the mapping of product information from Feratel XML to Schema.org can be done.

Table 1 Feratel XML to Schema.org Mapping of Service Providers

| No | XML Element | Schema.org | |
|----|--|---|--------------------|
| | | Class | Property |
| 1 | ServiceProvider | LodgingBusiness | |
| 2 | ServiceProvider/Details/Name | | name |
| | ServiceProvider/Details/Type | ?? | ?? |
| | ServiceProvider/Details/Town | City | location |
| | ServiceProvider/Details/District | ?? | ?? |
| | ServiceProvider/Details/Rooms | ?? | ?? |
| | ServiceProvider/Details/Beds | ?? | ?? |
| | ServiceProvider/Details/Position | GeoCoordinates | geo |
| | @Latitude | | latitude |
| | @Longitude | | longitude |
| | ServiceProvider/Details/Stars | Rating | ?? |
| | ServiceProvider/Details/Categories | Hotel, Hostel, Motel, BedAndBreakfast | ?? |
| | ServiceProvider/Details/Classifications | ?? | ?? |
| | ServiceProvider/Details/MarketingGroups | ?? | ?? |
| | ServiceProvider/Details/HotelChain | ?? | ?? |
| | ServiceProvider/Details/CreditCards/CreditCard | | paymentAccepted |
| | ServiceProvider/Details/Bookable | ?? | ?? |
| | ServiceProvider/Details/BankAccounts/Bank | BankOrCreditUnion | ?? |
| | ServiceProvider/Details/CurrencyCode | | currenciesAccepted |
| 3 | ServiceProvider/Descriptions/Description | | description |
| 4 | ServiceProvider/Links/Link | | url |
| 5 | ServiceProvider/Facilities/Facility | ?? | ?? |
| 6 | ServiceProvider/Addresses/Address | PostalAddress | location |
| | ServiceProvider/Addresses/Address/Company | ?? | ?? |
| | ServiceProvider/Addresses/Address/FirstName | ?? | givenName |
| | ServiceProvider/Addresses/Address/LastName | ?? | familyName |
| | ServiceProvider/Addresses/Address/AddressLine1 | | streetAddress |
| | ServiceProvider/Addresses/Address/AddressLine2 | | streetAddress |
| | ServiceProvider/Addresses/Address/Country | | addressCountry |
| | ServiceProvider/Addresses/Address/ZipCode | | postalCode |
| | ServiceProvider/Addresses/Address/Town | | addressLocality |
| | ServiceProvider/Addresses/Address/Email | | email |
| | ServiceProvider/Addresses/Address/Fax | | faxNumber |
| | ServiceProvider/Addresses/Address/URL | | url |
| | ServiceProvider/Addresses/Address/Phone | | telephone |
| | ServiceProvider/Addresses/Address/Mobile | | telephone |
| 7 | ServiceProvider/RatingsAverage/RatingAverage | AgregateRating | agregateRating |
| | @Type | | ?? |
| | @Value | | ratingValue |
| | @Count | | ratingCount |

| | | | |
|----|--|-------------|--------------|
| | @Satisfaction | | ?? |
| | @Recommended | | ?? |
| | ServiceProvider/RatingsAverage/RatingAverage/Rating | Review | review |
| | @Points | | ?? |
| | @Satisfaction | | ?? |
| | @Recommended | | ?? |
| | @Nickname | | author |
| | ServiceProvider/RatingsAverage/RatingAverage/Rating/UserComment | UserComment | comment |
| | ServiceProvider/RatingsAverage/RatingAverage/Rating/ParrentComment | Comment | comment |
| | ServiceProvider/RatingsAverage/RatingAverage/Rating/Answer | ?? | ?? |
| 8 | ServiceProvider/HotSpots/HotSpot | ?? | ?? |
| 9 | ServiceProvider/MetaRatings | Rating | ?? |
| 10 | ServiceProvider/ClosedPeriods | Duration | openingHours |
| 11 | ServiceProvider/HandicapFacilities | ?? | ?? |
| 12 | ServiceProvider/HandicapClassifications | ?? | ?? |

Table 2 Feratel XML to Schema.org Mapping of Service

| No. | XML Element | Schema.org | |
|-----|--|------------|-------------|
| | | Class | Property |
| 1 | ServiceProvider/Services/Service | Service | |
| 2 | ServiceProvider/Services/Service/Details/Type | | serviceType |
| | ServiceProvider/Services/Service/Details/Name | | name |
| | ServiceProvider/Services/Service/Details/ServiceClassification | | ?? |
| 3 | ServiceProvider/ Services/Service/Rooms | ?? | ?? |
| 4 | ServiceProvider/ Services/Service/BedRooms | ?? | ?? |
| 5 | ServiceProvider/ Services/Service/Size | ?? | ?? |
| 6 | ServiceProvider/Services/Service/Links/Link | | url |
| 7 | ServiceProvider/Services/Service/Facilities/Facility | ?? | ?? |
| 8 | ServiceProvider/Services/Service/Descriptions/Description | | description |
| 9 | ServiceProvider/Services/Service/Availabilities/Availability | ?? | ?? |
| 10 | ServiceProvider/Services/Service/HandicapFacilities | ?? | ?? |
| 11 | ServiceProvider/Services/Service/HandicapClassifications | ?? | ?? |

Table 3 Feratel XML to Schema.org Mapping of Product

| No. | XML Element | Schema.org | |
|-----|---|------------|----------------|
| | | Class | Property |
| 1 | ServiceProvider/Services/Service/Products/Product | Offer | |
| 2 | ServiceProvider/Services/Service/Products/Product/Details/Name | | name |
| | ServiceProvider/Services/Service/Products/Product/Details/ProductType | | additionalType |

| | | | |
|----|--|--------------------|--------------------|
| | ServiceProvider/Services/Service/Products/Product/Details/AcomodationType | ?? | ?? |
| | ServiceProvider/Services/Service/Products/Product/Details/Occupancy/Beds | ?? | ?? |
| | ServiceProvider/Services/Service/Products/Product/Details/Occupancy/Adults | ?? | ?? |
| | ServiceProvider/Services/Service/Products/Product/Details/Occupancy/Children | ?? | ?? |
| | ServiceProvider/Services/Service/Products/Product/Details/Occupancy/MinFullPayer | ?? | ?? |
| 3 | ServiceProvider/Services/Service/Products/Product/HolidayThemes | ?? | ?? |
| 4 | ServiceProvider/Services/Service/Products/Product/Beds (Min, Max) | ?? | ?? |
| 5 | ServiceProvider/Services/Service/Products/Product/Adults (Min, Max, Standard) | ?? | ?? |
| 6 | ServiceProvider/Services/Service/Products/Product/Children (Min, Max) | ?? | ?? |
| 7 | ServiceProvider/Services/Service/Products/Product/PriceRanges | PriceSpecification | priceSpecification |
| 8 | ServiceProvider/Services/Service/Products/Product/CalculationRule | ?? | ?? |
| 9 | ServiceProvider/Services/Service/Products/Product/PriceNights | ?? | ?? |
| 10 | ServiceProvider/Services/Service/Products/Product/PriceInclVT | ?? | ?? |
| 11 | ServiceProvider/Services/Service/Products/Product/FromToPrice | PriceSpecification | priceSpecification |
| 12 | ServiceProvider/Services/Service/Products/Product/ValidDates | Quantitative Value | eligibleDuration |
| 13 | ServiceProvider/Services/Service/Products/Product/Descriptions/Description | | description |
| 14 | ServiceProvider/Services/Service/Products/Product/Availabilities/Availability | ?? | ?? |
| 15 | ServiceProvider/Services/Service/Products/Product/Gaps | ?? | ?? |

The XML schema defined by Feratel includes more detailed elements for a Product including Price Details, Arrival Departure Templates, Sales Rule Templates, Cancellation Payment Templates. The mapping of these sub elements will be provided in the next versions of this document.

Besides Service Provider, the Feratel model introduces the concept of Additional Service Provider concept, which is a provider of services that are not accommodation such as ski passes, entry to spa, guided hiking tours, etc. The data structure for Additional Service Provider is the same as the data structure for a Service provider with a few fields less. Main difference is that an Additional Service Provider can only provide Additional Services, while a ServiceProvider can provide both Service and Additional Service. As an Additional Service Provider does not provide accommodation, the elements related to accommodation i.e. Rooms, Beds, HotelChain are not available. The mapping in Table 1 applies to Additional Service Provider with the restrictions

mentioned before. Similarly, the mapping in Table 2 applies to Additional Service with the restrictions mentioned before.

Table 4 shows how the mapping of Additional Product information from Feratel XML to Schema.org can be done. Additional Products are ski passes, trips, etc.

Table 4 Feratel XML to Schema.org Mapping of Additional Product

| No. | XML Element | Schema.org | |
|-----|---|--------------------|--------------------|
| | | Class | Property |
| 1 | ServiceProvider/AdditionalServices/Products/Product | Offer | |
| 2 | ServiceProvider/AdditionalServices/Products/Product/Name | | name |
| 3 | ServiceProvider/AdditionalServices/Products/Product/Bookable | ?? | ?? |
| 4 | ServiceProvider/AdditionalServices/Products/Product/Prices/BasicPrice | PriceSpecification | priceSpecification |
| | @Currency | | priceCurrency |
| 5 | ServiceProvider/AdditionalServices/Products/Product/StartDay | DateTime | validFrom |
| 7 | ServiceProvider/AdditionalServices/Products/Product/StartTime | DateTime | validFrom |
| 8 | ServiceProvider/AdditionalServices/Products/Product/Duration | DateTime | validThrough |
| 9 | ServiceProvider/AdditionalServices//Products/Product/MinParticipants | ?? | ?? |

2.2.2. Shop Items

Shop Items include brochures, articles and guides. The following shows how the mapping of shop items information from Feratel XML to Schema.org can be done.

Table 5 Feratel XML to Schema.org Mapping of Shop Items

| No. | XML Element | Schema.org | |
|-----|-----------------------------------|--|-----------------|
| | | Class | Property |
| 1 | ShopItem | CreativeWork | |
| 2 | ShopItem/Details/Name | | name |
| 3 | ShopItem/Details/Type | Article (no class for Guide or Brochure) | |
| 4 | ShopItem/Details/Owner | Organiyation, Person | copyrightHolder |
| 5 | ShopItem/Details/HolidayThemes | ?? | ?? |
| 6 | ShopItem/Links/Link | | url |
| 7 | ShopItem/Descriptions/Description | | description |

2.2.3. Events

The following shows how the mapping of events information from Feratel XML to Schema.org can be done.

Table 6 Feratel XML to Schema.org Mapping of Events

| No. | XML Element | Schema.org | |
|--------------------------------|--------------------------------------|----------------|----------------|
| | | Class | Property |
| 5 | Event | Event | |
| | Event/Details/Names/Translation | | name |
| | Event/Details/Dates/Date | | |
| | @From | | startDate |
| | @To | | endDate |
| 2 | Event/Details/Position | GeoCoordinates | ?? |
| | @Latitude | | latitude |
| | @Longitude | | longitude |
| | Event/Descriptions/Description | | description |
| | Event/Links/Link | | url |
| 3 | Event/Addresses/Address | PostalAddress | location |
| | Event/Addresses/Address/Company | ?? | ?? |
| | Event/Addresses/Address/FirstName | ?? | givenName |
| | Event/Addresses/Address/LastName | ?? | familyName |
| | Event/Addresses/Address/AddressLine1 | | streetAddress |
| | Event/Addresses/Address/AddressLine2 | | streetAddress |
| | Event/Addresses/Address/Country | | addressCountry |
| | Event/Addresses/Address/ZipCode | | postalCode |
| | Event/Addresses/Address/Town | | addressRegion |
| | Event/Addresses/Address/Email | | email |
| | Event/Addresses/Address/Fax | | faxNumber |
| | Event/Addresses/Address/URL | | url |
| | Event/Addresses/Address/Phone | | telephone |
| Event/Addresses/Address/Mobile | | telephone | |

2.2.4. Infrastructure

In the Feratel model, infrastructure item are entities which have a fix type (e.g. Food & Beverages, Routes & Tours, Sport & Leisure, Wellness & Health) and various topics concerning this type (e.g. “Bar” for “Food & Beverages”). The following shows how the mapping of infrastructure information from Feratel XML to Schema.org can be done.

Table 7 Feratel XML to Schema.org Mapping of Infrastructure

| No. | XML Element | Schema.org | |
|-----|---------------------------------|--------------------------------|----------|
| | | Class | Property |
| 1 | InfrastructureItem | LocalBusiness | |
| 2 | InfrastructureItem/Name | | name |
| 3 | InfrastructureItem/Topics/Topic | BarOrPub, FoodEstablishment | |
| 4 | InfrastructureItem/Towns/Item | City | location |

| | | | |
|----|--|----------------|----------------|
| 5 | InfrastructureItem/Position | GeoCoordinates | geo |
| | @Latitude | | latitude |
| | @Longitude | | longitude |
| 6 | InfrastructureItem/HolidayThemes | ?? | ?? |
| 7 | InfrastructureItem/ConnectedEntries/ConnectedEntry | Service | ?? |
| 8 | InfrastructureItem/OpeningHours | Duration | openingHours |
| 9 | InfrastructureItem/Addresses/Address | PostalAddress | location |
| | InfrastructureItem/Addresses/Address/Company | ?? | ?? |
| | InfrastructureItem/Addresses/Address/FirstName | ?? | givenName |
| | InfrastructureItem/Addresses/Address/LastName | ?? | familyName |
| | InfrastructureItem/Addresses/Address/AddressLine1 | | streetAddress |
| | InfrastructureItem/Addresses/Address/AddressLine2 | | streetAddress |
| | InfrastructureItem/Addresses/Address/Country | | addressCountry |
| | InfrastructureItem/Addresses/Address/ZipCode | | postalCode |
| | InfrastructureItem/Addresses/Address/Town | | addressRegion |
| | InfrastructureItem/Addresses/Address/Email | | email |
| | InfrastructureItem/Addresses/Address/Fax | | faxNumber |
| | InfrastructureItem/Addresses/Address/URL | | url |
| | InfrastructureItem/Addresses/Address/Phone | | telephone |
| | InfrastructureItem/Addresses/Address/Mobile | | telephone |
| 10 | InfrastructureItem/Descriptions/Description | | description |
| 11 | InfrastructureItem/Links/Link | | url |
| 12 | InfrastructureItem/HotSpots/HotSpot | ?? | ?? |
| 13 | InfrastructureItem/CustomAttributes | ?? | ?? |
| 14 | InfrastructureItem/HandicapFacilities | ?? | ?? |
| 15 | InfrastructureItem/ HandicapClassifications | ?? | ?? |

2.2.5. Destination Packages

A bundle of different services and products is called destination package. The following shows how the mapping of destination packages information from Feratel XML to Schema.org can be done.

Table 8 Feratel XML to Schema.org Mapping of Destination Packages

| No. | XML Element | Schema.org | |
|-----|-------------------------------|----------------|-------------------|
| | | Class | Property |
| 1 | Package | Offer | |
| 2 | Package/Details/Name | | name |
| 3 | Package/Details/Priority | | |
| 4 | Package/Details/MeetingPoint | Place | availableAtOrFrom |
| 5 | Package/Details/HolidayThemes | ?? | ?? |
| 6 | Package/Details/Position | GeoCoordinates | geo |
| | @Latitude | | latitude |
| | @Longitude | | longitude |
| 7 | Package/Details/ValidDates | DateTime | validFrom |
| | | DateTime | validThrough |
| 8 | Package/Links/Link | | url |

| | | | |
|----|--|--------------------|--------------|
| 9 | Package/Descriptions/Description | | description |
| 10 | Package/Prices/Price | PriceSpecification | ?? |
| | @DateFrom | DateTime | validFrom |
| | @DateTo | DateTime | validThrough |
| | Package/Prices/Price/PriceValue | Number | price |
| 11 | Package/ContentDescriptions/ContentDescription | | description |
| | Package/Products/Product | Offer | addOn |

2.3. Discussion

There are many Service Provider, Service and Product XML elements in the Feratel schema that can't be mapped to Schema.org classes or properties. These include for example Rooms, Beds, Size, Stars, Facilities, HandicapFacilities, Availabilities, etc. Their transformations (marked with ?? red color) need to be considered and discussed. A possible solution would be to use other ontologies such as the Accomodation Ontology⁴ to annotate these elements.

⁴ <http://ontologies.sti-innsbruck.at/acco/ns.html>

3. Feratel Plugin Implementation

The Feratel Plugin was designed to consume an XML response output from Feratel API described in DSI [1], parsing the XML elements and properties then mapping each element/property to related class/property from Schema.org according to the specified mapping described in Section 2, and finally insert the selected class/property into the XML output according to a specific format by using an XSL Transformation [2].

3.1. Mapping Design

First we need to select a markup format to be used and then based on this format we can determine how the mapping between XML element to Schema.org class including their properties will be performed through an XSL Transformation. We also need to comply all Schema.org specification especially the *Domain* and *Range* specifications for each property.

Table 9 Specification for property `http://schema.org/startDate`

| |
|--|
| <code>http://schema.org/startDate</code> |
| Domains: |
| <code>http://schema.org/Event</code> |
| <code>http://schema.org/Role</code> |
| <code>http://schema.org/Season</code> |
| <code>http://schema.org/Series</code> |
| <code>http://schema.org/TVSeason</code> |
| <code>http://schema.org/TVSeries</code> |
| Ranges: |
| <code>http://schema.org/Date</code> |

As shown in Table 9, a value for property “startDate” is expected to be a type of Date and used for one of entities Event, Role, Season, Series, TVSeason, TVSeries only.

Table 10 Specification for property `http://schema.org/organizer`

| |
|---|
| <code>http://schema.org/organizer</code> |
| Domains: |
| <code>http://schema.org/Event</code> |
| Ranges: |
| <code>http://schema.org/Organization</code> |
| <code>http://schema.org/Person</code> |

As indicated in Table 10, a value for property “organizer” must be an Organization or a Person. Therefore, in our mapping implementation for Events (which is mapped to PostalAddress through a property “organizer”), an Organization entity has to be inserted between those classes to make sure the specification is conformed as shown at Figure 6.

3.1.1. Markup Format

There are various formats available to annotate an XML such as RDFa [3] and Microdata [4], where both formats are supported by Schema.org. After tested with the Apache Any23 [5] to extract triples out of the annotated XML from both formats, we found that Microdata is more convenient to interlinking a class to the other class.

3.1.2. XSLT with Microdata

Based on the obtained mapping described in Section 2, we construct the transformation by using the XSL transformation as follow:

1. Namespaces declaration

From the Feratel XML output (see an example at Appendix A), it has a specific namespace “*http://interface.deskline.net/DSI/XSD*”, therefore this namespace is required to be declared in the XSL namespaces.

```
<xsl:stylesheet version="1.0"
xmlns: idn="http://interface.deskline.net/DSI/XSD"
xmlns: schema="http://schema.org/"
xmlns: xsl="http://www.w3.org/1999/XSL/Transform">
```

2. Element to Class transformation

An XSL template can be used to transform the mapping between an element to a related class directly.

```
<xsl:template match=" idn:Result/idn:Events/idn:Event ">
  <Event itemscope="" itemtype="http://schema.org/Event">
    <xsl:apply-templates select="node()|@*" />
  </Event>
</xsl:template>

<xsl:template match=" idn:Result/idn:ServiceProviders/idn:ServiceProvider ">
  <ServiceProvider itemscope=""
itemtype="http://schema.org/LodgingBusiness">
    <xsl:apply-templates select="node()|@*" />
  </ServiceProvider>
</xsl:template>
```

3. Element's properties to relevant Class's properties

Properties transformation can be implemented directly as a new property of related element.

```
<xsl:template
match=" idn:Result/idn:Events/idn:Event/idn:Descriptions/idn:Description "
>
  <Description itemprop="description"><xsl:copy-of
select="node()|@*" /></Description>
</xsl:template>
```

```

<xsl:template
match="idn:Result/idn:CalendarDates/idn:Calendar/idn:Events/idn:Event/id
n:Name">
  <xsl:copy>
    <xsl:attribute name="itemprop">name</xsl:attribute>
    <xsl:apply-templates select="@* | node()"/>
  </xsl:copy>
</xsl:template>

```

4. Element's properties transformation without a relevant Class

A special transformation is required whenever a property has no relevant class. For example, property *FirstName* in XML is covered by the element *Address* where in Schema.org the relevant property *givenName* is covered by class *Person*. Therefore, a meta element to represent class *Person* needs to be inserted first. On the other side, the *organizer* property in Schema.org is connecting *Event* to *Person* or *Organization* only, therefore an *Organization* class needs to be inserted between *Event* and its *PostalAddress*.

```

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Details/idn:Dates/idn:Date">
  <Date>
    <xsl:copy-of select="node()|@*" />
    <meta itemprop="startDate" content="{@From}" />
    <meta itemprop="endDate" content="{@To}" />
  </Date>
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Addresses/idn:Address[@Type!=
'Venue']">
  <xsl:copy>
    <xsl:attribute name="itemscope" />
    <xsl:attribute name="itemprop">organizer</xsl:attribute>
    <xsl:attribute
name="itemtype">http://schema.org/Organization</xsl:attribute>
    <xsl:apply-templates select="@* | node()"/>
    <meta itemprop="name" content="{idn:Company}" />
    <schema:Person itemscope="" itemtype="http://schema.org/Person"
itemprop="employee">
      <meta itemprop="givenName" content="{idn:FirstName}" />
      <meta itemprop="familyName" content="{idn:LastName}" />
    </schema:Person>
    <schema:PostalAddress itemprop="address" itemscope=""
itemtype="http://schema.org/PostalAddress">
      <meta itemprop="contactType" content="{@Type}" />
      <meta itemprop="streetAddress" content="{idn:AddressLine1}" />
      <meta itemprop="streetAddress" content="{idn:AddressLine2}" />
      <meta itemprop="addressCountry" content="{idn:Country}" />
      <meta itemprop="postalCode" content="{idn:ZipCode}" />
      <meta itemprop="addressRegion" content="{idn:Town}" />
    </schema:PostalAddress>
    <meta itemprop="email" content="{idn:Email}" />
    <meta itemprop="faxNumber" content="{idn:Fax}" />
    <meta itemprop="url" content="{idn:URL}" />
    <meta itemprop="telephone" content="{idn:Phone}" />

```



```
<meta itemprop="telephone" content="{idn:Mobile}"/>
</xsl:copy>
</xsl:template>
```

3.2. Plugin Design

The Feratel plugin is a web service-based system to insert the Schema.org vocabulary into XML responses from Feratel API endpoints. The system comprises of two main components:

1. Dispatcher, is responsible to organize the communication flow between Client, Feratel API and Annotator.
2. Annotator, is responsible to annotate any XML input with Schema.org vocabulary according to the predefined mapping and produce an annotated XML output.

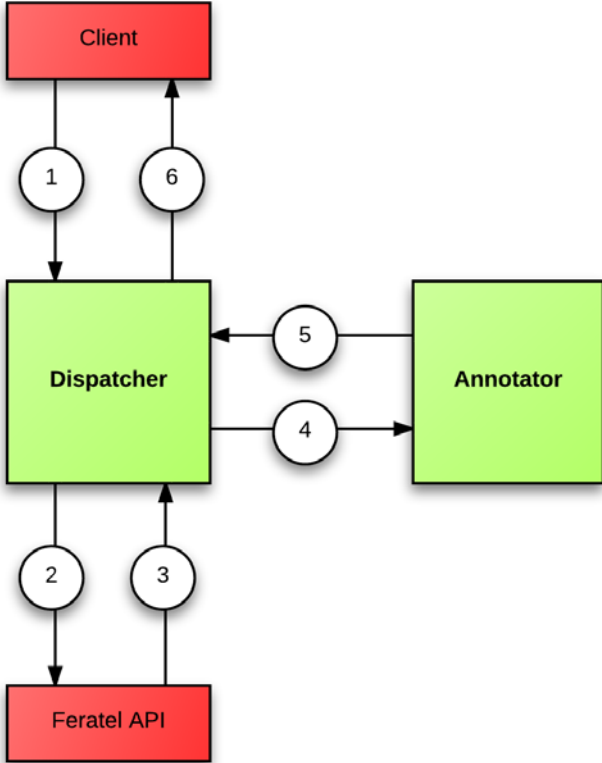


Figure 1 Diagram of Feratel Plugin Implementation

As shown at Figure 1, the Dispatcher will intercepts a request from Client (1) and then forwards it to the designed Feratel API endpoint (2), receives the response (3) and forwards it to the Annotator (4), receives the result from the Annotator (5) and forwards it back to the Client (6).

To use the plugin, a simple step is required at the client side, instead of pointing to the Feratel API directly; a client could use our endpoints to receive an annotated XML response of Feratel content.

3.2. Result

The Desktline 3.0 Standard Interface (DSI) [1] offers various functionalities such as get basic data for various content, searches for availabilities, booking, saving requests, etc. Two functionalities which are relevant to our work in content annotation:

1. **Basic Data.** Provides the detail data of Service Providers, Shop Items, Events, and Infrastructure items.
2. **Search.** Provides the brief data of Service Providers and their products, Destination Packages and their details.

Each functionality is offered through a specific API endpoint with a specific XML format for API requests and responses as well.

3.2.1. Service Providers

A service provider is an accommodation provider such as Hotel. Beside offers an accommodation service, a provider could also offers additional services such as ski-passes, spa-entries, guided hiking tours. Information about service providers and their offered services can be obtained from the Basic Data endpoint and Search endpoint (including for the additional services that are might be offered by a provider).

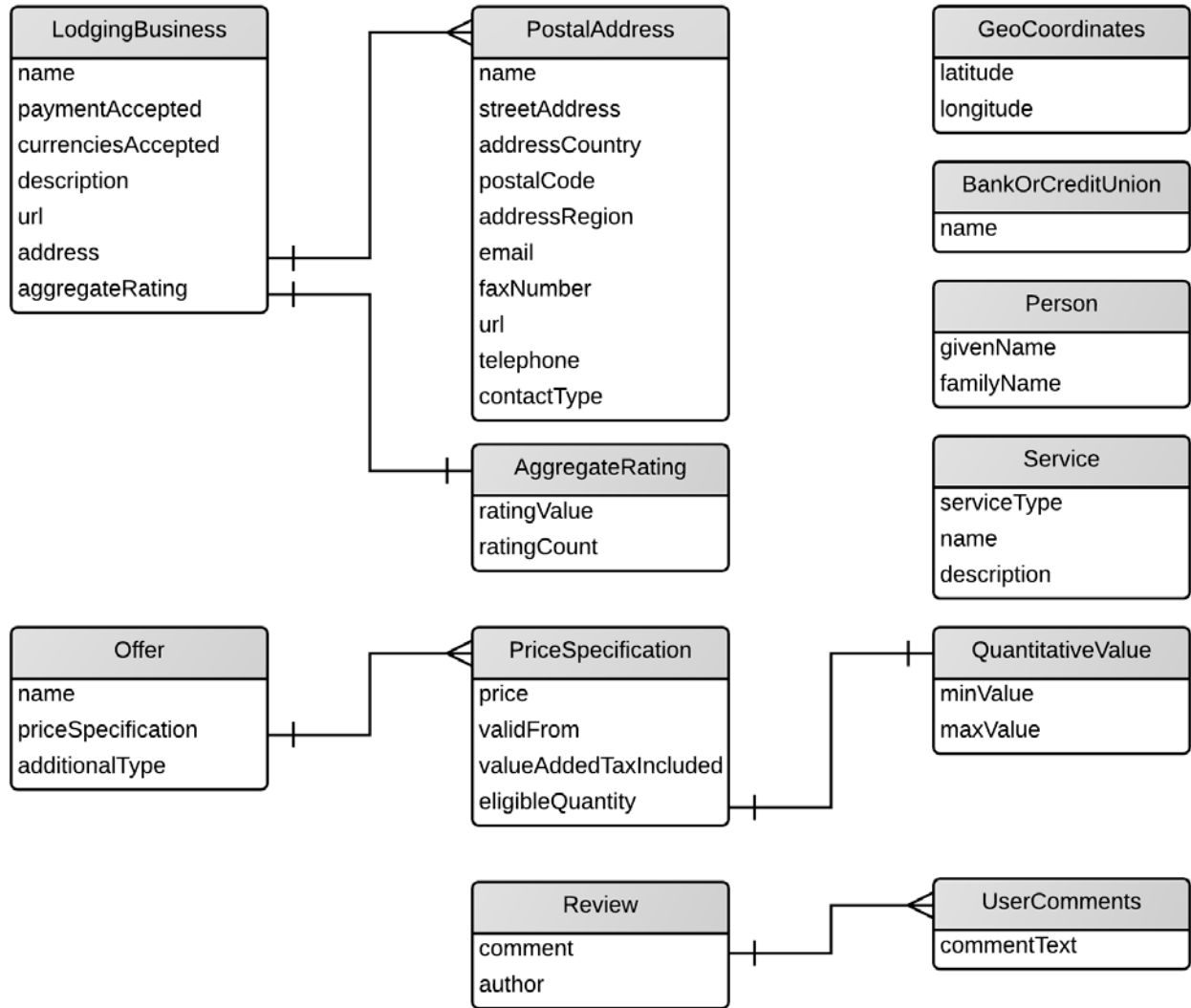


Figure 2 Entity Relationship for the Basic Data of Service Providers

As shown at Figure 2, there are about 12 entities can be extracted from a service provider basic data, where a LodgingBusiness has multiple PostalAddress entities (to represent Object, Landlord, Owner, KeyHolder). An Offer could has multiple PriceSpecification and a Review has multiple UserComments entities.

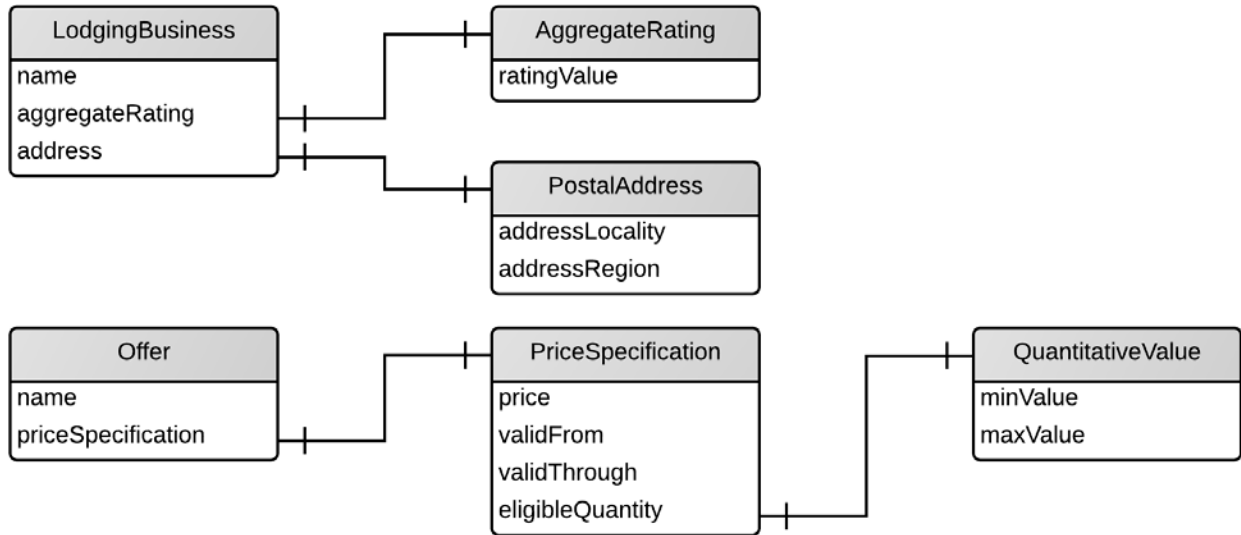


Figure 3 Entity Relationship for Search of Service Providers

Figure 3 shows the extracted entities from the service provider search data, while the extracted entities from additional services search data are shown at Figure 4.

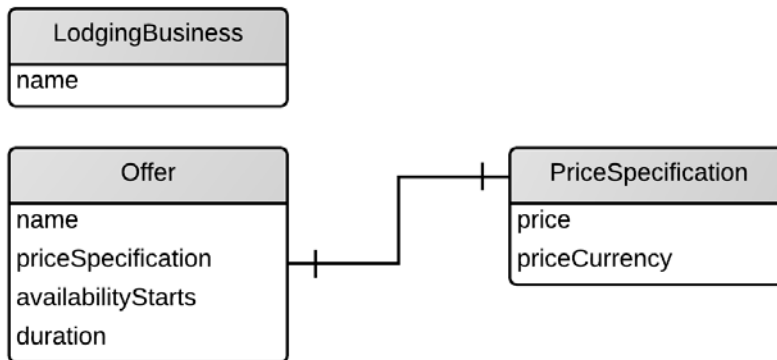


Figure 4 Entity Relationship of Search for Additional Services

3.2.2. Shop Items

The extracted entities from Shop Items (include brochures, articles and guides) basic data are shown at Figure 5.

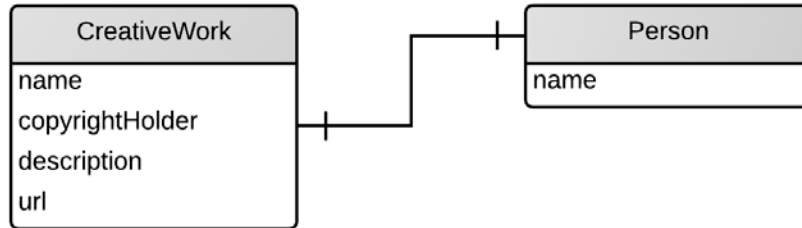


Figure 5 Entity Relationship for Basic Data of Shop Items

3.2.3. Event

Content about events can be obtained from the Basic Data endpoint and Search endpoint. Figure 6 shows the extracted entities from event basic data. From 4 different available addresses (Organizer, Booking, Info and Venue), the address for Venue is connected by “location” property while the other three are connected by “organizer” property.

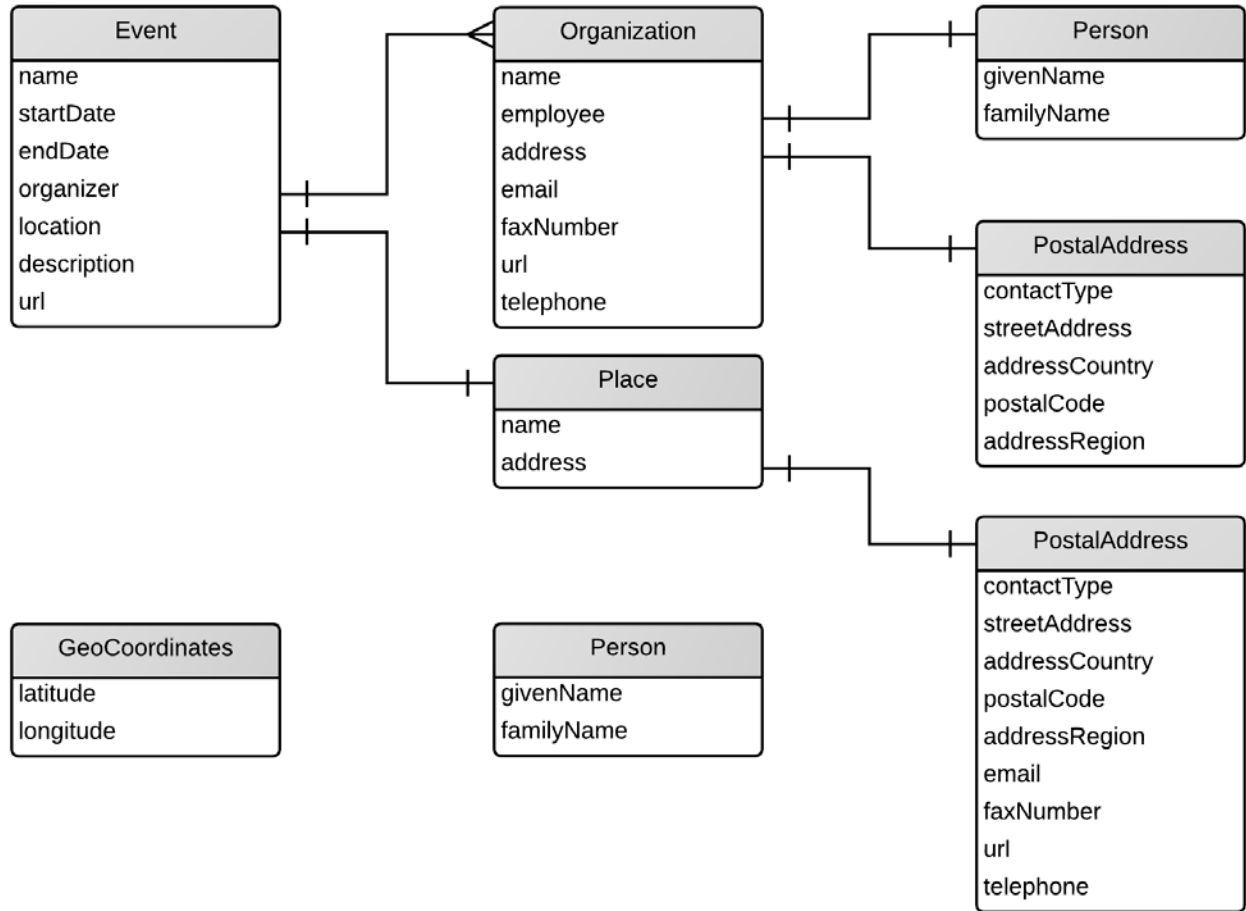


Figure 6 Entity Relationship for Basic Data of Event

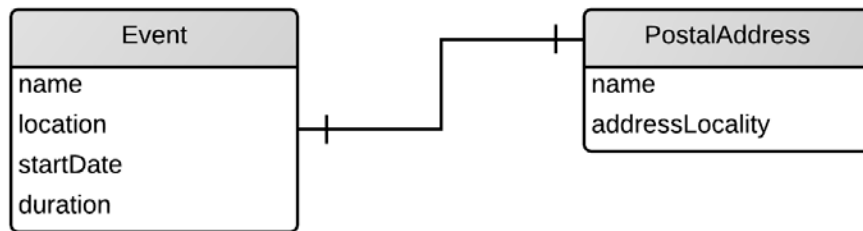


Figure 7 Entity Relationship for Search of Event

Only two entities were extracted from the event search data as shown at Figure 7.

3.2.4. Infrastructure

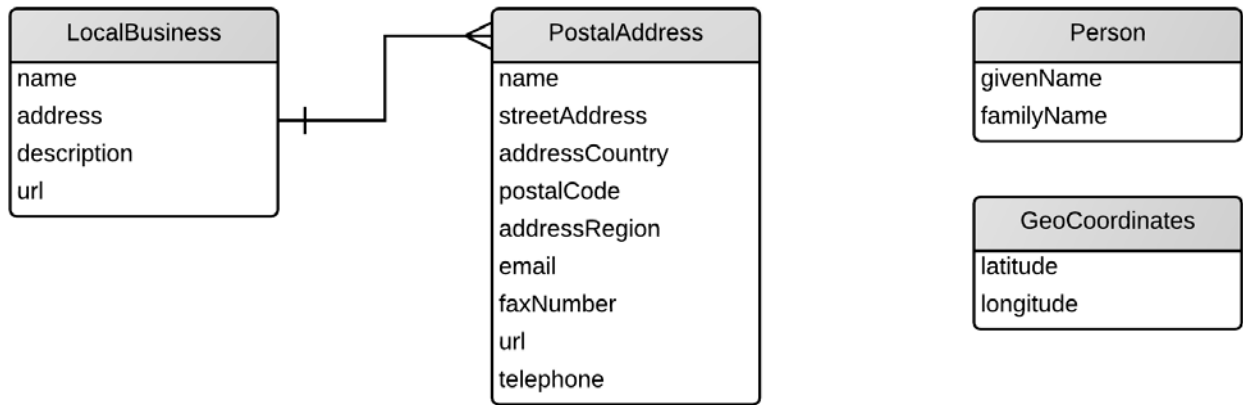


Figure 8 Entity Relationship for Basic Data of Infrastructure

As shown at Figure 8, there are four entities were extracted from the infrastructure basic data. Each LocalBusiness could has two PostalAddress (ExternalAddress and InternalAddress).

3.2.5. Destination Packages

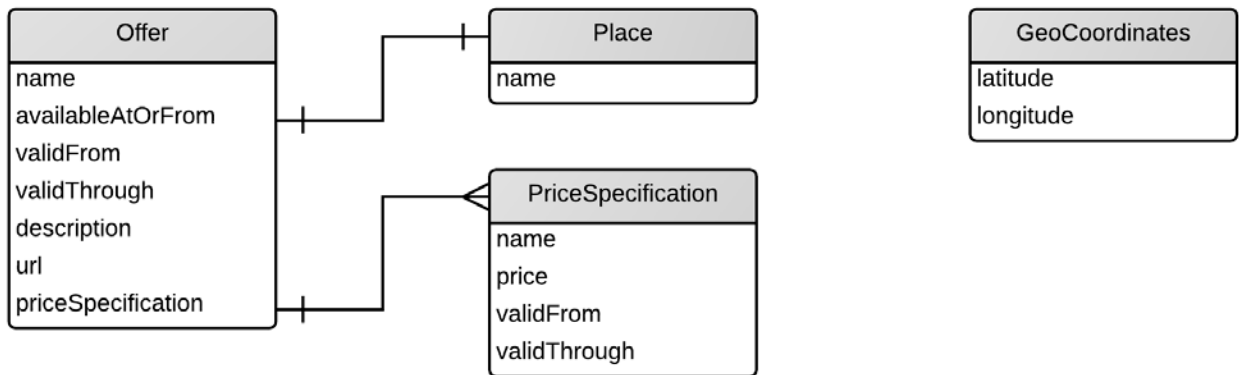


Figure 9 Entity Relationship for Basic Data of Destination Packages

As shown at Figure 9, from the destination packages basic data, about four entities were extracted, where an Offer could has multiple PriceSpecification.

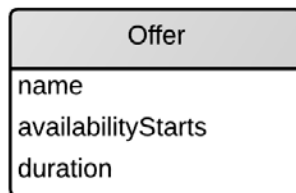


Figure 10 An Entity from Search of Destination Packages

Only one entity was extracted from the destination packages search data as shown at Figure 10.

3.3. Evaluation

For evaluation we use an Event response example as input (see Appendix A). The XSL Transformation for Event shown at Appendix B and the produced output shown at Appendix C. The produced annotated output then used as input to the Apache Any23 [5] in order to extract all recognized triples (result is shown at appendix D), the Yandex Structured Data Validator [6] (result is shown at appendix E) and Google Structured Data Testing Tool [7] (result is shown at appendix F). In general, we were able to extract the classes and properties shown at Table 11.

Table 11 The Extracted Classes and Properties for Evaluation

| No. | Class | Property |
|-----|---------------|----------------|
| 1 | Event | |
| | | name |
| | | startDate |
| | | endDate |
| | | organizer |
| | | location |
| | | description |
| | | url |
| 2 | Organization | |
| | | name |
| | | employee |
| | | address |
| | | email |
| | | faxNumber |
| | | url |
| | | telephone |
| 3 | Person | |
| | | givenName |
| | | familyName |
| 4 | PostalAddress | |
| | | contactType |
| | | streetAddress |
| | | addressCountry |
| | | postalCode |
| | | addressRegion |
| 5 | Place | |
| | | contactType |
| | | streetAddress |
| | | addressCountry |
| | | postalCode |
| | | addressRegion |
| | | email |
| | | faxNumber |
| | | url |

| | | |
|---|----------------|-----------|
| | | telephone |
| 6 | GeoCoordinates | |
| | | latitude |
| | | longitude |

4. Technical Notes

During the mapping and plugin implementation, we encountered a few drawbacks that are opened for possible improvements in the future. The drawbacks are mainly caused by the non-existence of possible mapping between XML elements of Feratel content to classes or properties of Schema.org.

4.1. Missing Relationships

While the mapping was trying to map as much as possible the Feratel content to Schema.org, a few adaptations were necessary to meet with Schema.org specifications.

As shown at Figure 2 - Figure 10, several entities were extracted successfully but have no connection to the other entities. One of the two possible following conditions can cause this situation:

1. There is no property in Schema.org that could be representing suitable relation between entities.
2. A suitable property is available in Schema.org but only available for relation between certain entities. For example, property “geo” is possible to link entity Place to entity GeoCoordinate or GeoShape only.

4.2. Missing Required Properties

Each entity in Schema.org must be accompanied by a few basic properties. If these properties are missing then an error will be raised during the extraction of structured data from content. We are detecting these errors by using Yandex Structured Data Validator [6] and Google Structured Data Testing Tool [7].

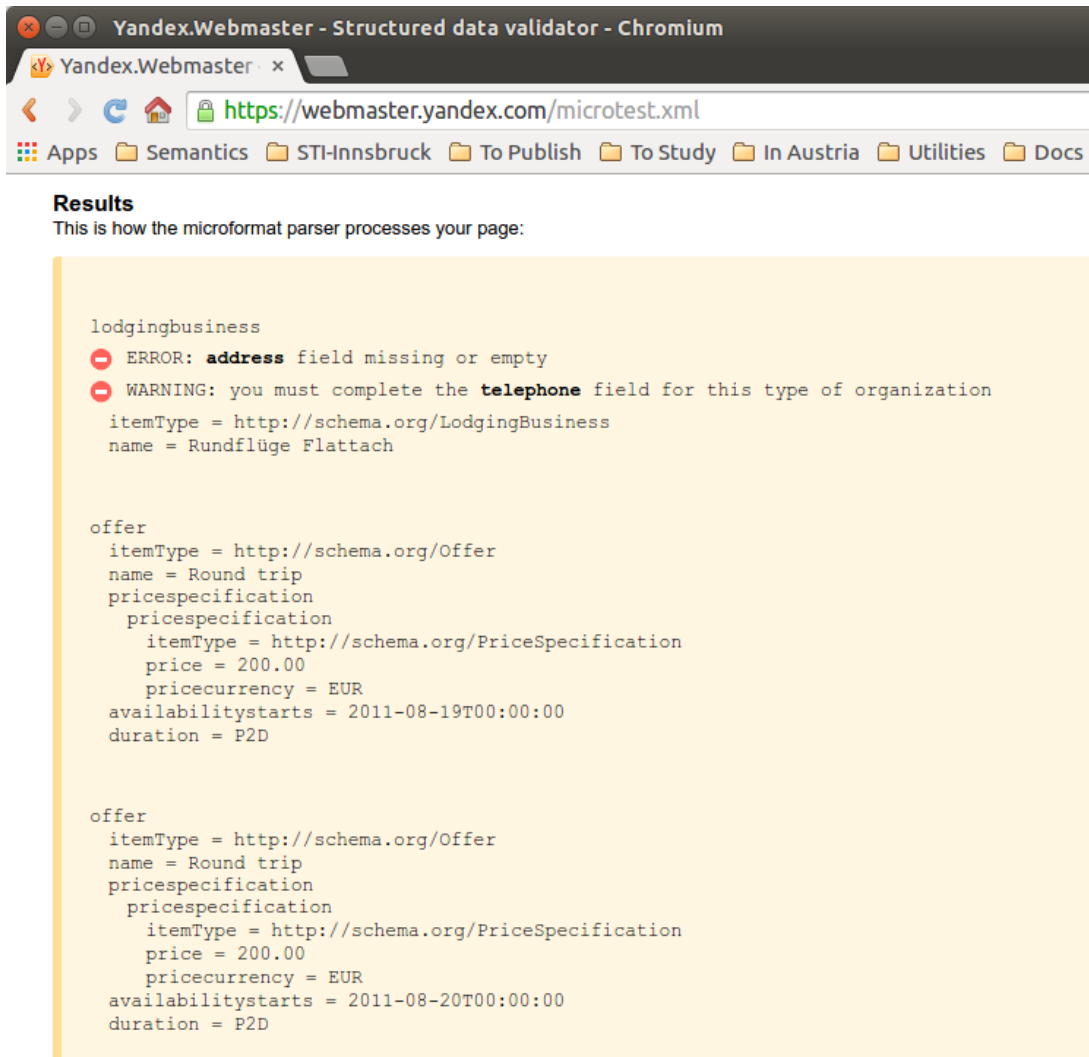


Figure 11 Structured Data Extraction with Yandex Validator

Figure 11 shows a structured data extraction using Yandex structured data validator from an annotated XML response of additional services search data of ServiceProviders. It shows that the “address” property is missing and a warning also rose for the missing of “telephone” property.

4.3. ID as Item Values

Several items in XML response from the Feratel API are provided in the format of IDs only as shown in the following response:

```

...
<Town>5c7e1d37-0060-4811-a996-a8b36094d01e</Town>
<District>65f056cd-4bc9-4272-ald6-3fadf7aac9d9</District>
...
<Stars Id="EBF4EE39-F7E0-45FE-A410-46D75C3B769C" />
<Categories>
  <Item Id="AB4F2086-F06D-4DAC-8B99-09EDA5577C67" />
</Categories>

```

```
<Classifications>
  <Item Id="50A3AF54-33DB-4612-8848-B9CF0A65C558" />
  <Item Id="89C1A7D7-0222-4DEE-AA35-D6A01496B0BC" />
</Classifications>
<MarketingGroups>
  <Item Id="9B3F881D-D73F-4772-AD7B-99DCAE16BB59" />
</MarketingGroups>
...
```

Technically, this problem can be solved by sending another request to the Feratel API to find the relevant values for those IDs or maintain a local database of those IDs-values mapping. But first, we have to decide if we want to alter the XML response structure by adding the external relevant values into the original XML response including to decide which external additional values are will be selected.

5. Conclusion

Through this document, we explained our strategies in annotating the Feratel content with Schema.org. By defining a mapping (which can be extended easily to incorporate a new mapping in the future) between XML elements of Feratel API responses to relevant classes and properties provided by Schema.org, we were able to construct an XSL Transformation to insert the relevant terms into an XML response to produce an annotated output.

Furthermore, a web service-based system was developed not only to do the annotation but also capable to accept requests from clients, to forward them to the appropriate API and to return the relevant annotated contents to clients. In this way, the Feratel customers could easily obtain an annotated content by changing their endpoint settings from Feratel API directly to our Feratel Plugin endpoints.

Our system is currently under testing to annotate the content provided by Feratel for Tourismusverband (TVb) Innsbruck website⁵. The fully working system is provided as a Web Application Archive (WAR) file⁶, installed locally on the TVb server. The system should be fully integrated with the new TVb's website which is expected to be release on March 2015.

⁵ <http://www.innsbruck.info/>

⁶ http://en.wikipedia.org/wiki/WAR_%28file_format%29

Appendix A. An XML Response of Event

The output from Feratel API of Event obtained from Deskline Documentation [1].

```
<?xml version="1.0"?>
<FeratelDsiRS xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" Status="0" Message="OK"
xmlns="http://interface.deskline.net/DSI/XSD">
<Result Index="1">
  <Events>
    <Event Id="eaff6469-2dc8-4369-9ac3-51f9baf9dddd" ChangeDate="2010-05-
21T16:41:00">
      <Details>
        <Names>
          <Translation Language="de">Beach-Party</Translation>
          <Translation Language="en">Beach-Party</Translation>
        </Names>
        <Location>
          <Translation Language="de">Grand Hotel Patricia</Translation>
          <Translation Language="en">Grand Hotel Patricia</Translation>
        </Location>
        <Active>true</Active>
        <Towns>
          <Item Id="090a18ae-5d50-421e-a65a-c5a2b8227ae5" />
          <Item Id="2f7c71f3-f375-434b-9a04-49f474df6b68" />
        </Towns>
        <Position Latitude="13.9056015014648" Longitude="46.6095920078523"
/>
        <IsTopEvent>false</IsTopEvent>
        <HolidayThemes>
          <Item Id="090a18ae-5d50-421e-a65a-c5a2b8227ae5" />
          <Item Id="2f7c71f3-f375-434b-9a04-49f474df6b68" />
        </HolidayThemes>
        <ConnectedEntries>
          <ConnectedEntry Type="EventInfrastructure" Id="2f050ae2-85f5-
4a99-8c92-075ff4b3f58b" />
          <ConnectedEntry Type="EventInfrastructure" Id="034927b4-062e-
499e-9bea-bb638814dae5" />
          <ConnectedEntry Type="EventServiceProvider" Id="e59a3a87-8b76-
423a-9a54-767ddc405d90" />
        </ConnectedEntries>
        <SerialEvents>
          <SerialEvent Id="3a8b8857-500c-4693-8afe-7ec4c258b234" />
        </SerialEvents>
        <Visibility>Local</Visibility>
        <Dates>
          <Date From="2010-07-30" To="2010-08-01" />
        </Dates>
        <StartTimes>
          <StartTime Time="00:23:00" Mon="false" Tue="false" Wed="false"
Thu="false" Fri="true" Sat="true" Sun="true" />
        </StartTimes>
        <Duration Type="None">0</Duration>
      </Details>
      <Addresses>
        <Address Type="Organizer" ChangeDate="2009-10-01T14:17:00">
```

```

<Company>Hotel Sonne, Abr. Res.</Company>
<FirstName />
<LastName>Huber</LastName>
<AddressLine1>Am Wald 1</AddressLine1>
<AddressLine2 />
<Country>DE</Country>
<ZipCode>88605</ZipCode>
<Town>Messkirch</Town>
<Email />
<Fax />
<URL />
<Phone />
<Mobile />
</Address>
<Address Type="Booking" ChangeDate="2009-10-01T14:17:00">
  <Company>Hotel Sonne, Abr. Res.</Company>
  <FirstName />
  <LastName>Huber</LastName>
  <AddressLine1>Am Wald 1</AddressLine1>
  <AddressLine2 />
  <Country>DE</Country>
  <ZipCode>88605</ZipCode>
  <Town>Messkirch</Town>
  <Email />
  <Fax />
  <URL />
  <Phone />
  <Mobile />
</Address>
<Address Type="Info" ChangeDate="2009-10-01T14:17:00">
  <Company>Hotel Sonne, Abr. Res.</Company>
  <FirstName />
  <LastName>Huber</LastName>
  <AddressLine1>Am Wald 1</AddressLine1>
  <AddressLine2 />
  <Country>DE</Country>
  <ZipCode>88605</ZipCode>
  <Town>Messkirch</Town>
  <Email />
  <Fax />
  <URL />
  <Phone />
  <Mobile />
</Address>
<Address Type="Venue" ChangeDate="2009-10-01T14:17:00">
  <Company>Hotel Sonne, Abr. Res.</Company>
  <FirstName />
  <LastName>Huber</LastName>
  <AddressLine1>Am Wald 1</AddressLine1>
  <AddressLine2 />
  <Country>DE</Country>
  <ZipCode>88605</ZipCode>
  <Town>Messkirch</Town>
  <Email />
  <Fax />
  <URL />
  <Phone />

```

```
<Mobile />
  </Address>
</Addresses>
<Descriptions>
  <Description Id="e57d510f-8a90-4689-a4d5-0b5eb95641a6"
Type="EventHeader" Language="de" Systems="L T I C" ShowFrom="101"
ShowTo="1231" ChangeDate="2010-05-03T16:15:00">Dieses Mega-Event findet
direkt am Faaker-See statt.</Description>
  </Descriptions>
  <Links>
    <Link Id="c857610e-2c5b-4317-bbbc-e5cb81654293" Name="fest"
URL="http://www.test.com" ChangeDate="2010-05-20T16:40:00" Type="0"
Order="1" />
  </Links>
  <Facilities ChangeDate="2009-10-01T14:17:00">
    <Facility Id="189c28da-b1e1-455b-8a02-1191931ab458" Value="1" />
    <Facility Id="9dbe2baf-9c86-4e95-9dc3-55b14730b23b" Value="1" />
  </Facilities>
</Event>
</Events>
</Result>
</FeratelDsiRS>
```


Appendix B. An XST Transformation for Event

```
<?xml version="1.0" encoding="UTF-8"?>

<xsl:stylesheet version="1.0"
xmlns:idn="http://interface.deskline.net/DSI/XSD"
xmlns:schema="http://schema.org/"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

<!-- === BASIC DATA -->

<xsl:template match="idn:Result/idn:Events/idn:Event">
  <Event itemscope="" itemtype="http://schema.org/Event">
    <xsl:apply-templates select="node()|@*" />
  </Event>
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Details/idn:Names/idn:Translation
">
  <Translation><xsl:copy-of select="node()|@*" /></Translation>
  <meta itemprop="name" content="{text()}@{@Language}" />
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Details/idn:Position">
  <xsl:copy>
    <xsl:attribute name="itemscope" />
    <xsl:attribute
name="itemtype">http://schema.org/GeoCoordinates</xsl:attribute>
    <xsl:apply-templates select="@* | node()" />
    <meta itemprop="latitude" content="{@Latitude}" />
    <meta itemprop="longitude" content="{@Longitude}" />
  </xsl:copy>
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Details/idn:Dates/idn:Date">
  <Date>
    <xsl:copy-of select="node()|@*" />
    <meta itemprop="startDate" content="{@From}" />
    <meta itemprop="endDate" content="{@To}" />
  </Date>
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Addresses/idn:Address[@Type='Venu
e']">
  <xsl:copy>
    <xsl:attribute name="itemscope" />
    <xsl:attribute name="itemprop">location</xsl:attribute>
    <xsl:attribute name="itemtype">http://schema.org/Place</xsl:attribute>
    <xsl:apply-templates select="@* | node()" />

    <meta itemprop="name" content="{idn:Company}" />
    <schema:Person itemscope="" itemtype="http://schema.org/Person">
```

```

        <meta itemp="givenName" content="{idn:FirstName}"/>
        <meta itemp="familyName" content="{idn:LastName}"/>
    </schema:Person>
    <schema:PostalAddress itemp="address" itemscope=""
itemtype="http://schema.org/PostalAddress">
        <meta itemp="contactType" content="{@Type}"/>
        <meta itemp="streetAddress" content="{idn:AddressLine1}"/>
        <meta itemp="streetAddress" content="{idn:AddressLine2}"/>
        <meta itemp="addressCountry" content="{idn:Country}"/>
        <meta itemp="postalCode" content="{idn:ZipCode}"/>
        <meta itemp="addressRegion" content="{idn:Town}"/>
        <meta itemp="email" content="{idn:Email}"/>
        <meta itemp="faxNumber" content="{idn:Fax}"/>
        <meta itemp="url" content="{idn:URL}"/>
        <meta itemp="telephone" content="{idn:Phone}"/>
        <meta itemp="telephone" content="{idn:Mobile}"/>
    </schema:PostalAddress>
</xsl:copy>
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Addresses/idn:Address[@Type!='Venue']">
    <xsl:copy>
        <xsl:attribute name="itemscope"/>
        <xsl:attribute name="itemprop">organizer</xsl:attribute>
        <xsl:attribute
name="itemtype">http://schema.org/Organization</xsl:attribute>
        <xsl:apply-templates select="@* | node()"/>

        <meta itemp="name" content="{idn:Company}"/>
        <schema:Person itemscope="" itemtype="http://schema.org/Person"
itemprop="employee">
            <meta itemp="givenName" content="{idn:FirstName}"/>
            <meta itemp="familyName" content="{idn:LastName}"/>
        </schema:Person>
        <schema:PostalAddress itemp="address" itemscope=""
itemtype="http://schema.org/PostalAddress">
            <meta itemp="contactType" content="{@Type}"/>
            <meta itemp="streetAddress" content="{idn:AddressLine1}"/>
            <meta itemp="streetAddress" content="{idn:AddressLine2}"/>
            <meta itemp="addressCountry" content="{idn:Country}"/>
            <meta itemp="postalCode" content="{idn:ZipCode}"/>
            <meta itemp="addressRegion" content="{idn:Town}"/>
        </schema:PostalAddress>
        <meta itemp="email" content="{idn:Email}"/>
        <meta itemp="faxNumber" content="{idn:Fax}"/>
        <meta itemp="url" content="{idn:URL}"/>
        <meta itemp="telephone" content="{idn:Phone}"/>
        <meta itemp="telephone" content="{idn:Mobile}"/>
    </xsl:copy>
</xsl:template>

<xsl:template
match="idn:Result/idn:Events/idn:Event/idn:Descriptions/idn:Description">
    <Description itemp="description"><xsl:copy-of
select="node()|@*"/></Description>

```

```

</xsl:template>

<xsl:template match="idn:Result/idn:Events/idn:Event/idn:Links/idn:Link">
  <Link>
    <xsl:copy-of select="node()|@*" />
    <meta itemprop="url" content="{@URL}" />
  </Link>
</xsl:template>

<!-- === SEARCH -->

<xsl:template
match="idn:Result/idn:CalendarDates/idn:Calendar/idn:Events/idn:Event">
  <xsl:copy>
    <xsl:attribute name="itemscope" />
    <xsl:attribute name="itemtype">http://schema.org/Event</xsl:attribute>
    <xsl:apply-templates select="@* | node()" />
    <xsl:choose>
      <xsl:when test="boolean(../@Date)">
        <meta itemprop="startDate" content="{../@Date}" />
      </xsl:when>
      <xsl:otherwise>
        <meta itemprop="startDate" content="{../../@Date}" />
      </xsl:otherwise>
    </xsl:choose>
    <xsl:choose>
      <xsl:when test="idn:Duration/@Units='Hours'">
        <meta itemprop="duration" content="PT{idn:Duration}H" />
      </xsl:when>
      <xsl:when test="idn:Duration/@Units='Minutes'">
        <meta itemprop="duration" content="PT{idn:Duration}M" />
      </xsl:when>
      <xsl:when test="idn:Duration/@Units='Days'">
        <meta itemprop="duration" content="P{idn:Duration}D" />
      </xsl:when>
      <xsl:otherwise>
        <meta itemprop="duration" content="P{idn:Duration}" />
      </xsl:otherwise>
    </xsl:choose>
  </xsl:copy>
</xsl:template>

<xsl:template
match="idn:Result/idn:CalendarDates/idn:Calendar/idn:Events/idn:Event/idn:Name">
  <xsl:copy>
    <xsl:attribute name="itemprop">name</xsl:attribute>
    <xsl:apply-templates select="@* | node()" />
  </xsl:copy>
</xsl:template>

<xsl:template
match="idn:Result/idn:CalendarDates/idn:Calendar/idn:Events/idn:Event/idn:Location">
  <xsl:copy>
    <xsl:attribute name="itemscope" />

```

```
<xsl:attribute
name="itemtype">http://schema.org/PostalAddress</xsl:attribute>
<xsl:attribute name="itemprop">location</xsl:attribute>
<xsl:apply-templates select="@* | node()"/>
<meta itemprop="name" content="{.}"/>
<meta itemprop="addressLocality" content="{../idn:Town}"/>
</xsl:copy>
</xsl:template>
</xsl:stylesheet>
```

Appendix C. Transformed XML of Event

```
<?xml version="1.0" encoding="UTF-8"?>
<FeratelDsiRS
  xmlns="http://interface.deskline.net/DSI/XSD"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema" Status="0" Message="OK">
  <Result
    xmlns:schema="http://schema.org/"
    xmlns:ids="http://interface.deskline.net/DSI/XSD" Index="1">
    <Events>
      <Event itemscope="" itemtype="http://schema.org/Event"
        Id="eaff6469-2dc8-4369-9ac3-51f9baf9dddd" ChangeDate="2010-05-21T16:41:00">
        <Details>
          <Names>
            <Translation Language="de">Beach-Party</Translation>
            <meta itemprop="name" content="Beach-Party@de"/>
            <Translation Language="en">Beach-Party</Translation>
            <meta itemprop="name" content="Beach-Party@en"/>
          </Names>
          <Location>
            <Translation Language="de">Grand Hotel
            Patricia</Translation>
            <Translation Language="en">Grand Hotel
            Patricia</Translation>
          </Location>
          <Active>true</Active>
          <Towns>
            <Item Id="090a18ae-5d50-421e-a65a-c5a2b8227ae5"/>
            <Item Id="2f7c71f3-f375-434b-9a04-49f474df6b68"/>
          </Towns>
          <Position itemscope=""
            itemtype="http://schema.org/GeoCoordinates" Latitude="13.9056015014648"
            Longitude="46.6095920078523">
            <meta itemprop="latitude"
            content="13.9056015014648"/>
            <meta itemprop="longitude"
            content="46.6095920078523"/>
          </Position>
          <IsTopEvent>false</IsTopEvent>
          <HolidayThemes>
            <Item Id="090a18ae-5d50-421e-a65a-c5a2b8227ae5"/>
            <Item Id="2f7c71f3-f375-434b-9a04-49f474df6b68"/>
          </HolidayThemes>
          <ConnectedEntries>
            <ConnectedEntry Type="EventInfrastructure"
            Id="2f050ae2-85f5-4a99-8c92-075ff4b3f58b"/>
            <ConnectedEntry Type="EventInfrastructure"
            Id="034927b4-062e-499e-9bea-bb638814dae5"/>
            <ConnectedEntry Type="EventServiceProvider"
            Id="e59a3a87-8b76-423a-9a54-767ddc405d90"/>
          </ConnectedEntries>
          <SerialEvents>
            <SerialEvent Id="3a8b8857-500c-4693-8afe-
            7ec4c258b234"/>
          </SerialEvents>
        </Event>
      </Events>
    </Result>
  </FeratelDsiRS>
```

```

<Visibility>Local</Visibility>
<Dates>
  <Date From="2010-07-30" To="2010-08-01">
    <meta itemprop="startDate" content="2010-07-
30"/>
    <meta itemprop="endDate" content="2010-08-01"/>
  </Date>
</Dates>
<StartTimes>
  <StartTime Time="00:23:00" Mon="false" Tue="false"
Wed="false" Thu="false" Fri="true" Sat="true" Sun="true"/>
</StartTimes>
<Duration Type="None">0</Duration>
</Details>
<Addresses>
  <Address itemscope="" itemprop="organizer"
itemtype="http://schema.org/Organization" Type="Organizer" ChangeDate="2009-
10-01T14:17:00">
    <Company>Hotel Sonne, Abr. Res. 1</Company>
    <FirstName/>
    <LastName>Huber</LastName>
    <AddressLine1>Am Wald 1</AddressLine1>
    <AddressLine2/>
    <Country>DE</Country>
    <ZipCode>88605</ZipCode>
    <Town>Messkirch</Town>
    <Email/>
    <Fax/>
    <URL/>
    <Phone/>
    <Mobile/>
    <meta itemprop="name" content="Hotel Sonne, Abr.
Res. 1"/>
    <schema:Person itemscope=""
itemtype="http://schema.org/Person" itemprop="employee">
      <meta itemprop="givenName" content=""/>
      <meta itemprop="familyName" content="Huber"/>
    </schema:Person>
    <schema:PostalAddress itemprop="address"
itemscope="" itemtype="http://schema.org/PostalAddress">
      <meta itemprop="contactType"
content="Organizer"/>
      <meta itemprop="streetAddress" content="Am Wald
1"/>
      <meta itemprop="streetAddress" content=""/>
      <meta itemprop="addressCountry" content="DE"/>
      <meta itemprop="postalCode" content="88605"/>
      <meta itemprop="addressRegion"
content="Messkirch"/>
    </schema:PostalAddress>
    <meta itemprop="email" content=""/>
    <meta itemprop="faxNumber" content=""/>
    <meta itemprop="url" content=""/>
    <meta itemprop="telephone" content=""/>
    <meta itemprop="telephone" content=""/>
  </Address>

```

```

        <Address itemscope="" itemprop="organizer"
itemtype="http://schema.org/Organization" Type="Booking" ChangeDate="2009-
10-01T14:17:00">
            <Company>Hotel Sonne, Abr. Res. 2</Company>
            <FirstName/>
            <LastName>Huber</LastName>
            <AddressLine1>Am Wald 1</AddressLine1>
            <AddressLine2/>
            <Country>DE</Country>
            <ZipCode>88605</ZipCode>
            <Town>Messkirch</Town>
            <Email/>
            <Fax/>
            <URL/>
            <Phone/>
            <Mobile/>
            <meta itemprop="name" content="Hotel Sonne, Abr.
Res. 2"/>
            <schema:Person itemscope=""
itemtype="http://schema.org/Person" itemprop="employee">
                <meta itemprop="givenName" content=""/>
                <meta itemprop="familyName" content="Huber"/>
            </schema:Person>
            <schema:PostalAddress itemprop="address"
itemscope="" itemtype="http://schema.org/PostalAddress">
                <meta itemprop="contactType" content="Booking"/>
                <meta itemprop="streetAddress" content="Am Wald
1"/>
                <meta itemprop="streetAddress" content=""/>
                <meta itemprop="addressCountry" content="DE"/>
                <meta itemprop="postalCode" content="88605"/>
                <meta itemprop="addressRegion"
content="Messkirch"/>
            </schema:PostalAddress>
            <meta itemprop="email" content=""/>
            <meta itemprop="faxNumber" content=""/>
            <meta itemprop="url" content=""/>
            <meta itemprop="telephone" content=""/>
            <meta itemprop="telephone" content=""/>
        </Address>
        <Address itemscope="" itemprop="organizer"
itemtype="http://schema.org/Organization" Type="Info" ChangeDate="2009-10-
01T14:17:00">
            <Company>Hotel Sonne, Abr. Res. 3</Company>
            <FirstName>First</FirstName>
            <LastName>Huber</LastName>
            <AddressLine1>Am Wald 1</AddressLine1>
            <AddressLine2/>
            <Country>DE</Country>
            <ZipCode>88605</ZipCode>
            <Town>Messkirch</Town>
            <Email/>
            <Fax/>
            <URL/>
            <Phone/>
            <Mobile/>

```

```

Res. 3"/>
    <meta itemprop="name" content="Hotel Sonne, Abr.
    <schema:Person itemscope=""
itemtype="http://schema.org/Person" itemprop="employee">
    <meta itemprop="givenName" content="First"/>
    <meta itemprop="familyName" content="Huber"/>
    </schema:Person>
    <schema:PostalAddress itemprop="address"
itemscope="" itemtype="http://schema.org/PostalAddress">
    <meta itemprop="contactType" content="Info"/>
    <meta itemprop="streetAddress" content="Am Wald
1"/>
    <meta itemprop="streetAddress" content=""/>
    <meta itemprop="addressCountry" content="DE"/>
    <meta itemprop="postalCode" content="88605"/>
    <meta itemprop="addressRegion"
content="Messkirch"/>
    </schema:PostalAddress>
    <meta itemprop="email" content=""/>
    <meta itemprop="faxNumber" content=""/>
    <meta itemprop="url" content=""/>
    <meta itemprop="telephone" content=""/>
    <meta itemprop="telephone" content=""/>
    </Address>
    <Address itemscope="" itemprop="location"
itemtype="http://schema.org/Place" Type="Venue" ChangeDate="2009-10-
01T14:17:00">
    <Company>Hotel Sonne, Abr. Res. 4</Company>
    <FirstName/>
    <LastName>Huber</LastName>
    <AddressLine1>Am Wald 1</AddressLine1>
    <AddressLine2/>
    <Country>DE</Country>
    <ZipCode>88605</ZipCode>
    <Town>Messkirch</Town>
    <Email/>
    <Fax/>
    <URL/>
    <Phone/>
    <Mobile/>
    <meta itemprop="name" content="Hotel Sonne, Abr.
Res. 4"/>
    <schema:Person itemscope=""
itemtype="http://schema.org/Person">
    <meta itemprop="givenName" content=""/>
    <meta itemprop="familyName" content="Huber"/>
    </schema:Person>
    <schema:PostalAddress itemprop="address"
itemscope="" itemtype="http://schema.org/PostalAddress">
    <meta itemprop="contactType" content="Venue"/>
    <meta itemprop="streetAddress" content="Am Wald
1"/>
    <meta itemprop="streetAddress" content=""/>
    <meta itemprop="addressCountry" content="DE"/>
    <meta itemprop="postalCode" content="88605"/>
    <meta itemprop="addressRegion"
content="Messkirch"/>

```



```

        <meta itemprop="email" content="" />
        <meta itemprop="faxNumber" content="" />
        <meta itemprop="url" content="" />
        <meta itemprop="telephone" content="" />
        <meta itemprop="telephone" content="" />
    </schema:PostalAddress>
</Address>
</Addresses>
<Descriptions>
    <Description itemprop="description" Id="e57d510f-8a90-
4689-a4d5-0b5eb95641a6" Type="EventHeader" Language="de" Systems="L T I C"
ShowFrom="101" ShowTo="1231" ChangeDate="2010-05-03T16:15:00">Dieses Mega-
Event findet direkt am Faaker-See statt.</Description>
</Descriptions>
<Links>
    <Link Id="c857610e-2c5b-4317-bbbc-e5cb81654293"
Name="fest" URL="http://www.test.com" ChangeDate="2010-05-20T16:40:00"
Type="0" Order="1">
        <meta itemprop="url" content="http://www.test.com" />
    </Link>
</Links>
<Facilities ChangeDate="2009-10-01T14:17:00">
    <Facility Id="189c28da-b1e1-455b-8a02-1191931ab458"
Value="1" />
    <Facility Id="9dbe2baf-9c86-4e95-9dc3-55b14730b23b"
Value="1" />
</Facilities>
</Event>
</Events>
</Result>
</FeratelDsiRS>

```

Appendix D. Result: Apache Any23

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix doac: <http://ramonantonio.net/doac/0.1/#> .

_:node7b7629b90e738e21cflac9fc7b2ec52 a <http://schema.org/Event> ;
    <http://schema.org/Event/startDate> "2010-07-30" .

_:node863d873b00ebelf8b9c87e5d2d632 a <http://schema.org/Place> .

_:nodebd15f94de5fbb31e2ed382f197a8dcf a <http://schema.org/PostalAddress> ;
    <http://schema.org/PostalAddress/streetAddress> "Am Wald 1" , "Null" ;
    <http://schema.org/PostalAddress/postalCode> "88605" ;
    <http://schema.org/PostalAddress/faxNumber> "Null" ;
    <http://schema.org/PostalAddress/email> "Null" ;
    <http://schema.org/PostalAddress/addressRegion> "Messkirch" ;
    <http://schema.org/PostalAddress/contactType> "Venue" ;
    <http://schema.org/PostalAddress/addressCountry> "DE" ;
    <http://schema.org/PostalAddress/telephone> "Null" , "Null" ;
    <http://schema.org/PostalAddress/url> "Null" .

_:node863d873b00ebelf8b9c87e5d2d632 <http://schema.org/Place/address>
_:nodebd15f94de5fbb31e2ed382f197a8dcf ;
    <http://schema.org/Place/name> "Hotel Sonne, Abr. Res. 4" .

_:node7b7629b90e738e21cflac9fc7b2ec52 <http://schema.org/Event/location>
_:node863d873b00ebelf8b9c87e5d2d632 ;
    <http://schema.org/Event/description> "Dieses Mega-Event findet direkt
am Faaker-See statt." ;
    <http://schema.org/Event/name> "Beach-Party@de" , "Beach-Party@en" .

_:nodeb796b08548264fa79cbb261984ce03f a <http://schema.org/Organization> ;
    <http://schema.org/Organization/faxNumber> "Null" .

_:noded0ab5fe3ea2ff79790feff936759ef a <http://schema.org/PostalAddress> ;
    <http://schema.org/PostalAddress/streetAddress> "Am Wald 1" , "Null" ;
    <http://schema.org/PostalAddress/postalCode> "88605" ;
    <http://schema.org/PostalAddress/addressRegion> "Messkirch" ;
    <http://schema.org/PostalAddress/contactType> "Organizer" ;
    <http://schema.org/PostalAddress/addressCountry> "DE" .

_:nodeb796b08548264fa79cbb261984ce03f
<http://schema.org/Organization/address>
_:noded0ab5fe3ea2ff79790feff936759ef ;
    <http://schema.org/Organization/email> "Null" ;
    <http://schema.org/Organization/name> "Hotel Sonne, Abr. Res. 1" .

_:node5cc712edf62a98b5dfb728b07d8e4e74 a <http://schema.org/Person> ;
    <http://schema.org/Person/familyName> "Huber" ;
    <http://schema.org/Person/givenName> "Null" .

_:nodeb796b08548264fa79cbb261984ce03f
<http://schema.org/Organization/employee>
_:node5cc712edf62a98b5dfb728b07d8e4e74 ;
    <http://schema.org/Organization/telephone> "Null" , "Null" ;
```

```

    <http://schema.org/Organization/url> "Null" .

_:node7b7629b90e738e21cflac9fc7b2ec52    <http://schema.org/Event/organizer>
_:nodeb796b08548264fa79cbb261984ce03f .

_:node93bfde642f855374e139ald7b5972b a <http://schema.org/Organization> ;
    <http://schema.org/Organization/faxNumber> "Null" .

_:node5cc66bbc50138a5c2fef60faeba59c41 a <http://schema.org/PostalAddress> ;
    <http://schema.org/PostalAddress/streetAddress> "Am Wald 1" , "Null" ;
    <http://schema.org/PostalAddress/postalCode> "88605" ;
    <http://schema.org/PostalAddress/addressRegion> "Messkirch" ;
    <http://schema.org/PostalAddress/contactType> "Booking" ;
    <http://schema.org/PostalAddress/addressCountry> "DE" .

_:node93bfde642f855374e139ald7b5972b
<http://schema.org/Organization/address>
_:node5cc66bbc50138a5c2fef60faeba59c41 ;
    <http://schema.org/Organization/email> "Null" ;
    <http://schema.org/Organization/name> "Hotel Sonne, Abr. Res. 2" .

_:node95be4c6cadcf89b1c31b6ce389fb122 a <http://schema.org/Person> ;
    <http://schema.org/Person/familyName> "Huber" ;
    <http://schema.org/Person/givenName> "Null" .

_:node93bfde642f855374e139ald7b5972b
<http://schema.org/Organization/employee>
_:node95be4c6cadcf89b1c31b6ce389fb122 ;
    <http://schema.org/Organization/telephone> "Null" , "Null" ;
    <http://schema.org/Organization/url> "Null" .

_:node7b7629b90e738e21cflac9fc7b2ec52    <http://schema.org/Event/organizer>
_:node93bfde642f855374e139ald7b5972b .

_:nodec3cbac5fca15c2b65abd9fc8d9d426 a <http://schema.org/Organization> ;
    <http://schema.org/Organization/faxNumber> "Null" .

_:nodedb535a68ac7b97188ba3cc06e7da9e a <http://schema.org/PostalAddress> ;
    <http://schema.org/PostalAddress/streetAddress> "Am Wald 1" , "Null" ;
    <http://schema.org/PostalAddress/postalCode> "88605" ;
    <http://schema.org/PostalAddress/addressRegion> "Messkirch" ;
    <http://schema.org/PostalAddress/contactType> "Info" ;
    <http://schema.org/PostalAddress/addressCountry> "DE" .

_:nodec3cbac5fca15c2b65abd9fc8d9d426
<http://schema.org/Organization/address>
_:nodedb535a68ac7b97188ba3cc06e7da9e ;
    <http://schema.org/Organization/email> "Null" ;
    <http://schema.org/Organization/name> "Hotel Sonne, Abr. Res. 3" .

_:nodebcfee296952f7d2d1f3b933e563b50d2 a <http://schema.org/Person> ;
    <http://schema.org/Person/familyName> "Huber" ;
    <http://schema.org/Person/givenName> "First" .

_:nodec3cbac5fca15c2b65abd9fc8d9d426
<http://schema.org/Organization/employee>
_:nodebcfee296952f7d2d1f3b933e563b50d2 ;

```

```
<http://schema.org/Organization/telephone> "Null" , "Null" ;
<http://schema.org/Organization/url> "Null" .

_:node7b7629b90e738e21cf1ac9fc7b2ec52 <http://schema.org/Event/organizer>
_:nodec3cbac5fca15c2b65abd9fc8d9d426 ;
  <http://schema.org/Event/endDate> "2010-08-01" ;
  <http://schema.org/Event/url> "http://www.test.com" .

<http://any23.org/tmp/> <http://www.w3.org/1999/xhtml/microdata#item>
_:node7b7629b90e738e21cf1ac9fc7b2ec52 .
```

Appendix E. Result: Yandex Structured Data Validator

```
event
  itemType = http://schema.org/Event
  name = Beach-Party@de
  name = Beach-Party@en
  startdate = 2010-07-30
  enddate = 2010-08-01
  organizer
    organization
      WARNING: the business directory does not currently support organizations
      from this country, this information cannot be used
      itemType = http://schema.org/Organization
      name = Hotel Sonne, Abr. Res. 1
      employee
        person
          itemType = http://schema.org/Person
          givenname =
          familyname = Huber
        address
          postaladdress
            itemType = http://schema.org/PostalAddress
            contacttype = Organizer
            streetaddress = Am Wald 1
            streetaddress =
            addresscountry = DE
            postalcode = 88605
            addressregion = Messkirch
          email =
          faxnumber =
          url =
          telephone =
          telephone =
      organizer
        organization
          WARNING: the business directory does not currently support organizations
          from this country, this information cannot be used
          itemType = http://schema.org/Organization
          name = Hotel Sonne, Abr. Res. 2
          employee
            person
              itemType = http://schema.org/Person
              givenname =
              familyname = Huber
            address
              postaladdress
                itemType = http://schema.org/PostalAddress
                contacttype = Booking
                streetaddress = Am Wald 1
                streetaddress =
                addresscountry = DE
                postalcode = 88605
                addressregion = Messkirch
              email =
              faxnumber =
              url =
```

```

        telephone =
        telephone =
    organizer
        organization
            WARNING: the business directory does not currently support organizations
            from this country, this information cannot be used
            itemType = http://schema.org/Organization
            name = Hotel Sonne, Abr. Res. 3
            employee
                person
                    itemType = http://schema.org/Person
                    givenname = First
                    familyname = Huber
            address
                postaladdress
                    itemType = http://schema.org/PostalAddress
                    contacttype = Info
                    streetaddress = Am Wald 1
                    streetaddress =
                    addresscountry = DE
                    postalcode = 88605
                    addressregion = Messkirch
                email =
                faxnumber =
                url =
                telephone =
                telephone =
    location
        place
            WARNING: the business directory does not currently support organizations
            from this country, this information cannot be used
            itemType = http://schema.org/Place
            name = Hotel Sonne, Abr. Res. 4
            address
                postaladdress
                    itemType = http://schema.org/PostalAddress
                    contacttype = Venue
                    streetaddress = Am Wald 1
                    streetaddress =
                    addresscountry = DE
                    postalcode = 88605
                    addressregion = Messkirch
                email =
                faxnumber =
                url =
                telephone =
                telephone =
            description = Dieses Mega-Event findet direkt am Faaker-See statt.
            url = http://www.test.com

geocoordinates
    itemType = http://schema.org/GeoCoordinates
    latitude = 13.9056015014648
    longitude = 46.6095920078523

person
    itemType = http://schema.org/Person

```

```
givenname =  
familyname = Huber
```

Appendix F. Result: Google Structured Data Testing Tool

| | |
|--|--|
| Item | |
| type: | http://schema.org/event |
| property: | |
| name: | Beach-Party@de |
| name: | Beach-Party@en |
| startdate: | 2010-07-30 |
| enddate: | 2010-08-01 |
| organizer: | Item 1 |
| organizer: | Item 2 |
| organizer: | Item 3 |
| location: | Item 4 |
| description: | Dieses Mega-Event findet direkt am Faaker-See statt. |
| url: | http://www.test.com |
| Error: Page contains property "organizer" which is not part of the schema. | |
| Error: Page contains property "organizer" which is not part of the schema. | |
| Error: Page contains property "organizer" which is not part of the schema. | |
| Error: Event urls are pointing to a different domain than the base url. | |
| Item | |
| type: | http://schema.org/geocoordinates |
| property: | |
| latitude: | 13.9056015014648 |
| longitude: | 46.6095920078523 |
| Item 1 | |
| type: | http://schema.org/organization |
| property: | |
| name: | Hotel Sonne, Abr. Res. 1 |
| employee: | Item 5 |
| address: | Item 6 |
| email: | |
| faxnumber: | |
| url: | |
| telephone: | |
| telephone: | |
| Item 5 | |
| type: | http://schema.org/person |
| property: | |
| givenname: | |
| familyname: | Huber |
| Item 6 | |
| type: | http://schema.org/postaladdress |
| property: | |
| contacttype: | Organizer |
| streetaddress: | Am Wald 1 |
| streetaddress: | |
| addresscountry: | DE |
| postalcode: | 88605 |
| addressregion: | Messkirch |
| Item 2 | |


```

type: http://schema.org/organization
property:
  name: Hotel Sonne, Abr. Res. 2
  employee: Item 7
  address: Item 8
  email:
  faxnumber:
  url:
  telephone:
  telephone:

Item 7
type: http://schema.org/person
property:
  givenname:
  familyname: Huber

Item 8
type: http://schema.org/postaladdress
property:
  contacttype: Booking
  streetaddress: Am Wald 1
  streetaddress:
  addresscountry: DE
  postalcode: 88605
  addressregion: Messkirch

Item 3
type: http://schema.org/organization
property:
  name: Hotel Sonne, Abr. Res. 3
  employee: Item 9
  address: Item 10
  email:
  faxnumber:
  url:
  telephone:
  telephone:

Item 9
type: http://schema.org/person
property:
  givenname: First
  familyname: Huber

Item 10
type: http://schema.org/postaladdress
property:
  contacttype: Info
  streetaddress: Am Wald 1
  streetaddress:
  addresscountry: DE
  postalcode: 88605
  addressregion: Messkirch

Item 4
type: http://schema.org/place

```

```
property:
  name:           Hotel Sonne, Abr. Res. 4
  address:        Item 11

Item
  type:           http://schema.org/person
  property:
    givenname:
    familyname:   Huber
Error: Missing required field "name (fn)".

Item 11
  type:           http://schema.org/postaladdress
  property:
    contacttype:  Venue
    streetaddress: Am Wald 1
    streetaddress:
    addresscountry: DE
    postalcode:   88605
    addressregion: Messkirch
    email:
    faxnumber:
    url:
    telephone:
    telephone:
```

References

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