Panel on Systems

Theme

Systems Integration: Bumps and Hopes
Panelists

Moderator
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Panelists
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Ivan Krejci, College of Polytechnics Jihlava, Czech Republic
Fabien Mieyeville, Ampere Laboratory, UMR CNRS 5005, France
Mihaela Iridon, Candea LLC, USA
Multiturn Absolute Angular Position Sensor

Ivan Krejčí
College of Polytechnics Jihlava
What is the absolute position sensor?

- The sensor must remember its last position when the equipment is switched off.

- If the position is changed when the equipment is switched off (manual handling), the sensor must show the new position after the equipment is switched on.

- The sensor must contain a memory element. The memory can be the mechanical one (the gear box) or the semiconductor one (reserve battery needed).
Where are these sensors required?

• In actuating mechanisms for the fluids control

• These actuators control the valve position. Some of these valves need many turns of the driving shaft:
The possible solutions

- The mechanical memory – the gear box requires one turn absolute angular position sensor on each axis of the transmission gearing. Single-turn sensors take advantage of the optical or magnetic (Hall-effect) principles. The actual position can be calculated from all sensors data.
  Advantage: it does not require any back-up battery.
  Disadvantages: complicate construction, complicate position calculation, gear box errors, price.
  The magnet for the single-turn sensor:

- The electrical solution uses a semiconductor memory. The system takes advantage of one magnetic single-turn absolute sensor and one magnetic field controlled two-bit encoder. The encoder is created by a pair of reed contacts that make an angle 45°. If the magnet turns, switches the reed contacts.
  Number of switchings is stored in the built-in microprocessor memory. Number of switchings and the single-turn sensor data determine the sensor position.
  Advantage: simple construction, the only mechanical element – the magnet keeper, low price.
  Disadvantage: Back-up battery and low power electronic required.
Reed contact encoder

P1 – Basic contact  P2 – Direction contact
The sensor realization

The electrical solution was selected.
The parameters achieved:
Main components: MCU MSP430F1122, single turn 12b sensor AS5045, reed contacts MK-17-B2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of turns</td>
<td>16 k</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.07 °</td>
</tr>
<tr>
<td>Back-up battery voltage</td>
<td>3 V</td>
</tr>
<tr>
<td>Power consumption in sleeping mode</td>
<td>&lt;1 µA</td>
</tr>
<tr>
<td>Battery life (supposed) in the back-up mode</td>
<td>&gt; 5 years</td>
</tr>
<tr>
<td>Interface:</td>
<td>SPI or UART use of RS485 levels</td>
</tr>
</tbody>
</table>
Building Better Integration APIs

MIHAELA IRIDON
IAN SCHLARMAN
CÂNDEA LLC (TEXAS, USA)
Discussion Points

✓ Exposing Data and Behavior
  ◦ General Goals for effective & efficient integration

✓ Consumption-Friendly APIs
  ◦ Qualities that make APIs/SDKs easy to understand, consume, test

✓ REST APIs Modeling
  ◦ Semantics and Structure Consideration

✓ Brief Comparative Study (REST APIs)
  ◦ Merriam Webster vs Oxford English Dictionary APIs
  ◦ Structure of Resource Models; Documentation: generated vs. curated
API Architecture:
Design Drivers & Goals

✓ API: Abstraction over some Domain, exposing
  ◦ Data
  ◦ Behavior

✓ Target Consumption
  ◦ Open/public
  ◦ Internal

✓ Access mechanism/channel
  ◦ REST: Web/HTTP(S)
  ◦ SOAP: Sockets, HTTP, ...
  ◦ Messaging

✓ Goals (Developer Experience)
  ◦ Reusability
  ◦ Consistency
  ◦ Stability
  ◦ Smooth evolution (versioning)
  ◦ Testability, discoverability
  ◦ Understanding of the underlying Domain
    (documentation, unambiguous semantics)
  ◦ Ease of troubleshooting (error messages)
    ◦ Visibility (logging)
Web APIs & SDKs
Resource Models: Structural Considerations

✓ Composition hierarchies
  ◦ FLAT vs HIERARCHICAL

✓ Validations (POST & PUT)
  ◦ Custom Frameworks; Rule-based validation rules: how to externalize validation rules (configurability)
  ◦ Meaningful error messages: validate all input vs. stop at first invalid field

✓ Access to similar data (REST)
  ◦ Custom routes & inheritance

✓ Redundancy for the sake of clarity/model semantics
  ◦ E.g., the use of enumerations in REST models:
    ▪ Use integer values (devoid of semantics), or string values (clarity/self-documenting data), or both?

✓ Inheritance in API Controllers
  ◦ Custom routes?
  ◦ Disambiguation?

✓ Inheritance in Resource Models
  ◦ Custom deserialization?
  ◦ Disambiguation?
Hierarchical versus Flat Models

**Flat**: better suited for REST

**Hierarchical**: better suited for SDKs, direct access libraries; Domain models.

**EXAMPLE**:

\[
3 \leq \text{Response} \leq 5
\]

\[
\text{Input-Type} == 'DEF'
\]

\[
\text{Output-Selector} \neq 24
\]

\[
\text{Response} < 3 \quad \text{AND} \quad \left( \text{Response} = 3 \quad \text{OR} \quad \text{Response} = 4 \quad \text{OR} \quad \text{Response} = 5 \right) \quad \text{OR} \quad \left( \text{Response} < 3 \quad \text{AND} \quad \text{Input-Type} == 'DEF' \right) \quad \text{AND} \quad \left( \text{Output-Selector} \neq 24 \right)
\]
REST: Resource Models

MERRIAM WEBSTER API V. OXFORD DICTIONARIES API
Merriam-Webster Dictionary API
Definition section of a Headword Resource

- Deep Hierarchies
- Emphasis on Information Density
  - Abbreviated Property Names
  - Partial Models
- Complex Custom Deserialization
  - Loosely-Typed Models
  - ["type", object] pattern
  - Object graph traversal to restore semantics

Binding Substitute 1
The act or process of integrating: such as..

Sense a
incorporation as equals into society...

Sense b
coordination of mental processes...

= Sense 1a
Sense 1b

SYSTEMS INTEGRATION: BUMPS AND HOPES (PANEL DISCUSSIONS) - NETWARE 2019, NICE, FRANCE
Oxford Dictionaries API

Senses custom route on a Word Resource

- Strongly-Typed
  - Proxy Models can be easily generated
  - No custom deserialization

- Flattened Hierarchy
  - Incorporates content from parent (Word) Resource
  - Standalone at the expense of verbosity
  - Object Graph hierarchy can be restored without additional content

- Descriptive Naming

- Resource Segregation
  - Words/{word_id}/Senses
  - Preserves relational semantics
Web APIs and SDKs
## Endpoint/Resource Documentation

### Generated versus Curated

<table>
<thead>
<tr>
<th>GENERATED</th>
<th>CURATED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumption</strong></td>
<td><strong>Consumption</strong></td>
</tr>
<tr>
<td>✓ Produces Standardized Artifacts</td>
<td>✓ Better Conveys Semantics</td>
</tr>
<tr>
<td>✓ Simplifies Content Duplication (not Code Duplication)</td>
<td>✓ Allows Adding Examples to Highlight “Special” Cases</td>
</tr>
<tr>
<td>✓ Removes “Human Error”</td>
<td>✓ Is Prone to Error</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td><strong>Implementation</strong></td>
</tr>
<tr>
<td>✓ Is Self-Updating (via code introspection)</td>
<td>✓ Requires Manual Updates</td>
</tr>
<tr>
<td>✓ Adds Time for Setup/Customization</td>
<td>✓ Enables Contract-First Implementation</td>
</tr>
<tr>
<td>✓ Introduces Metadata Clutter</td>
<td></td>
</tr>
<tr>
<td>✓ Adds a Dependency on an External Framework</td>
<td></td>
</tr>
</tbody>
</table>
 Swagger API Documentation

## Implementation Notes

The **/words/** endpoint returns a list of words documented in the OED, optionally filtered by a range of parameters. Each result typically corresponds to a dictionary entry in the OED, but may also correspond to a sub-entry within a main dictionary entry. These may be multi-word entries as well as single words. With no parameters, the **/words/** endpoint returns every word documented in the OED. To retrieve a specific word, use the **lemma** parameter, e.g.

```
https://developer.oxforddictionaries.com/our-data
```

### Example Value

```json
{
  "ad": "string",
  "forms": "string",
  "parts_of_speech": {
    "string"},
  "date_range": {
    "start": "0",
    "end": "1",
    "inclusive": true,
    "range_type": "string"},
  "definition": "string",
  "etymology": {
    "original_form": "string",
    "etymology_form": "string",
    "etymology_type": "string"},
  "example_value": {
    "id": "string",
    "lemma": "string",
    "parts_of_speech": {
      "string"}
  }
}
```

### Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
<th>Parameter Type</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>lemma</td>
<td></td>
<td>Dictionary lemma (case-, space-, and diacritic-insensitive)</td>
<td>query</td>
<td>string</td>
</tr>
<tr>
<td>part_of_speech</td>
<td></td>
<td>Restrict results to words with this part of speech (using Penn Treebank notation, e.g. <code>NN</code>, <code>JJ</code>, <code>VB</code>)</td>
<td>query</td>
<td>string</td>
</tr>
<tr>
<td>start_year</td>
<td></td>
<td>Restrict results to words first recorded in this year. Use a 4-digit year, e.g. 1719, a hyphen-separated range, e.g. 1500-1650, 1720-1850, or an open range, e.g. 1500-1985.</td>
<td>query</td>
<td>string</td>
</tr>
</tbody>
</table>
2.10.10 PARENTHESIZED SENSE SEQUENCE: PSEQ

The parenthesized sense sequence groups together senses whose sense numbers form a sequence of parenthesized numbers.

Hierarchical Context
Occurs as an element in an sseq array.

Display Guidance
If you are generating sense numbers for sense elements in a pseq sequence, put parentheses around the number. For example, the second sense in a sequence should have "(2)" as its sense number.

If you are instead using the sn to display the sense number, it will already contain the parentheses.

Data Model
array consisting of one or more sense elements and an optional bs element.

Example
In this example from "tab", the pseq contains a sequence of three elements: bs (binding substitute), sense, and sense. The sense numbers generated at each sense should be in parentheses.

```json
{
  "pseq": {
    "bs": {
      "sense": {
        "sm": "a",
        "en": "["text","bs"] short projecting device; such as"
      }
    },
    "sense": {
      "sm": "(1)",
      "en": "["text","sn" a small flap or loop by which something may be grasped or pulled]"
    },
    "sense": {
      "sm": "(2)",
      "en": "["text","sn" a projection from a card used as an aid in filing"]"
    }
  }
}
```