Metadata for Improving Transparency in the Credentialing Marketplace

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Topics

• Making Sense of the Credentialing Marketplace
• Credential Engine Family of RDF Specifications
• Connecting Credentials to Other Entities
• 1st, 2nd and 3rd Party Assertions
• The Role of Competencies and Their Frameworks
• Questions and Answers
Making Sense…

apprenticeships
degrees
badges
licenses
microcredentials
certificates
diplomas
certifications
The problem...

- Growing number and type of labor market credentials
- Growing uncertainty about their meaning, content, quality, and value
The problem...

- Lack of a common language for describing and comparing credentials confuses employers, students, job seekers, educators, regulators, and certifiers.
- Misalignment of what industry says they need, what education produces and what the industrial credentialing organizations test.
The problem...

- Concept of “stacking” credentials to support career pathways is inefficient, does not prevent undue duplication of learning

- No mechanism for stacking credentials based on “competencies”
Credential Engine: Addressing the Problem

Credential Engine is a 501C3 non-profit organization dedicated to the mission of promoting transparency and credential literacy in the marketplace to reveal the world of credentials and inform the public.
Credential Engine: Addressing the Problem

• Developed a common language, Credential Transparency Description Language, for credentials based on the W3C specifications for semantic metadata

• Community-based, transparent approach with a large Technical Advisory Committee and over 100 credentialing organizations
Credential Engine: Addressing the Problem

• Reused existing, publicly available properties and classes

• Offered for re-use via a Creative Commons International License

• Modeled to take into account Schema.org, providing the means for some of the work to serve as an extension for schema.org credential description
### Transparency through Credential Engine Technology

<table>
<thead>
<tr>
<th>Credential Transparency Description Language (CTDL) and CTDL ASN-DL</th>
<th>Credential and Competency Framework Registry</th>
<th>Credential Finder search app</th>
</tr>
</thead>
<tbody>
<tr>
<td>provides a common language to describe key features of credentials, credentialing organizations, competency frameworks, and quality assurance (QA) bodies based on the principles of Linked Data.</td>
<td>continuously capture, connect, archive, and share metadata about credentials, credentialing organizations, QA bodies, and competency frameworks, supporting an open applications marketplace.</td>
<td>designed to demonstrate the power of the registry and foster a competitive apps marketplace.</td>
</tr>
</tbody>
</table>
Credential Engine Infrastructure

- **Credential Engine**
  - **Authentication**
  - **CTDL Editor**
  - **Workkit**

- **Registry**
  - **CTDL API**
  - **CTDL-ASN API**
  - **CTDL-SKOS API**

- **Third-Party Applications**
  - **Read/Write**

- **CASS Repository**
  - **CASS APIs**
  - **Read/Write**

- **External Systems**
  - **Users**
  - **Interact with**

- **Authentication**
  - **Concept Scheme Editor (SKOS)**
  - **Competency Editor (ASN)**
  - **Competency Search, View, Download**
  - **Embedded In**
Schema Management

Authentication
- Schema Management System
- Schema Serializations
- Schema Viewer
- Schema Mapping Guidance

Credential Engine

Provide JSON-LD for schema entities
Provide Validation Schema

Registry
- CTDL API
- CTDL-ASN API
- CTDL-SKOS API

Third-Party Applications

Read/Write

Interact with Users

CASS Repository
- CASS APIs
Credential Engine Family of RDF Specifications
<table>
<thead>
<tr>
<th>Credentials</th>
<th>Competency Frameworks</th>
<th>Concept Schemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credential Transparency Description Language (CTDL)</td>
<td>Credential Engine Profile of the Achievement Standards Network Description Language (CTDL-ASN)</td>
<td>Simple Knowledge Organization System (SKOS)</td>
</tr>
<tr>
<td><strong>50 Classes</strong>&lt;br&gt;<strong>236 Properties</strong></td>
<td><strong>3 Classes</strong>&lt;br&gt;<strong>49 Properties</strong></td>
<td><strong>18 Concept Schemes</strong>&lt;br&gt;<strong>128 Concepts</strong></td>
</tr>
</tbody>
</table>
Description Fundamentals

• Directed graphs through W3C’s Resource Description Framework (RDF)
• Built off schema.org’s types and properties
• Leverages schema.org’s lightweight semantics; e.g.
  • Uses
    • schema:domainIncludes
    • schema:rangeIncludes
  • Instead of
    • rdfs:domain
    • rdfs:range
• Properties and classes declared in Credential Engine namespaces
  • Identifies property and class equivalencies (e.g, to Schema.org, Dublin Core, etc.)
Credential defined...

“A qualification, achievement, personal or organizational quality, or aspect of an identity typically used to indicate suitability.”

*Educational and Occupational Credentials: diplomas, academic degrees, certifications, qualifications, badges, that a person can obtain through learning, education and/or training. Typically awarded on successful completion of an assessment of relevant capabilities*
## CTDL credential subclasses…

<table>
<thead>
<tr>
<th>Badge</th>
<th>Degree</th>
<th>Diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Badge</td>
<td>Associate Degree</td>
<td>General Education Development</td>
</tr>
<tr>
<td>Open Badge</td>
<td>Bachelor’s Degree</td>
<td>Secondary School Diploma</td>
</tr>
<tr>
<td>Certificate</td>
<td>Master’s Degree</td>
<td>Diploma</td>
</tr>
<tr>
<td>Apprenticeship</td>
<td>Doctoral Degree</td>
<td>License</td>
</tr>
<tr>
<td>Certificate</td>
<td>Professional</td>
<td>MicroCredential</td>
</tr>
<tr>
<td>Journeyman</td>
<td>Doctorate</td>
<td>Research</td>
</tr>
<tr>
<td>Certificate</td>
<td>Research</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>Master Certificate</td>
<td>Doctorate</td>
<td>Credential</td>
</tr>
<tr>
<td>Certification</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Model: The simple case…
Simple case example...

“Santa Rosa Junior College”

Offers

Type

CredentialOrganization

Accredited By

“American Dental Association, Commission on Dental Accreditation”

Name

Type

LearningOpportunityProfile

Requires

Certificate

Type

“Dental Assisting”

Name

Requires

“Applied Dental Science”

Name

Type

Certificate

Type

“Competency

Description

“Graduates of the dental assisting program will be able to make ethical decisions, and demonstrate problem-solving abilities through independent and critical thinking.”
Model: The not so simple case...

- Relationship between Credential and other entities may be qualified by:
  - different types of credential seekers (audience)
  - different regions of applicability (jurisdictions)
  - different timeframes
Example: Alternative entry conditions

http://purl.org/ctdl/terms/Certificate

“ce-67532d13-4411-491a-901e-0e21dac3bfab”

ctid

eentryCondition

targetCredential

alternativeCondition

rdf:type

“Transcripts”

submissionOf

alternativeCondition

targetAssessment

yearsOfExperience

http://purl.org/ctdl/terms/ConditionProfile

“2 Years in relevant field”

http://purl.org/ctdl/terms/BachelorDegree

http://purl.org/ctdl/terms/MasterDegree

“ce-e9a210a8-a77c-41af-b594-4543ef4c2b08”

crid

targetCredential

targetCredential

“ce-719cf6fe7-d380-4ebd-89ca-f6c143d8a3d5”

http://purl.org/ctdl/terms/Assessment

ctid
Example: Degree with various concentrations
Supporting Profile Classes

- **Credential**
- **Agent**
- **Assessment Profile**
- **Condition Profile**
- **Learning Opportunity Profile**

**Profiles**

- **Duration Profile**: Description of the temporal aspects of a resource
- **Employment Outcome Profile**: Description of employment outcomes and related statistical information
- **Jurisdiction Profile**: Description of geo-political and geographic aspects of a resource
- **Earnings Profile**: Description of earnings and related statistical information
- **Revocation Profile**: Describes the conditions and methods by which a credential can be removed from a holder
- **Process Profile**: Describes a process's type, nature, and related information
- **Verification Service Profile**: Describes the means by which someone can verify whether a credential has been attained
- **Cost Profile**: Describes the type and nature of direct costs one would incur if one were to pursue attaining a credential
- **Financial Assistance Profile**: Describes the types of financial assistance available to the seeker of a credential
Connecting Credentials to Other Entities

Relationships of identity & purpose
Required & recommended relationships
Relationships of Identity

Credential to Credential Alignment

Competency to Competency Alignment

Minor Alignment

Major Alignment

Exact Alignment

Broad Alignment

Narrow Alignment
Relationships of purpose[1]

**Advanced Standing For**
- `isAdvancedStandingFor`

**Preparation For**
- `advancedStandingFrom`
- `isPreparationFor`
- `preparationFrom`

**Latticed With**
- `latticedWith`

**Latticed With***

**Lateral Movement***
- `lateralCredential`

*In development*
Relationships of purpose

Stackable Credentials*

Component Credentials*

*In development
Required/recommended relationships

- requires
- isRequiredFor
- recommends
- isRecommendedFor
Required/recommended relationships
1st, 2nd and 3rd Party Assertions
First Party Statements (Assertions)

Agent “A” (1st Party)

owns

Credential “A”

advancedStandingFor

Credential “B”

Agent “B” (2nd Party)
First & Second Party Assertions

Agent “A” (1st Party)

owns

 Credential “A”

advancedStandingFor

Credential “B”

owns

Agent “B” (2nd Party)

advancedStandingFrom

advancedStandingFor
Third Party Assertion (Map)

Agent “A” (1st Party)

owns

Credential A’

advancedStandingFor

Credential “B”

owns

Agent “C” (3rd Party)

asserts
## Military Bridge Program Roadmap

**Branch: US Army**

**School Name:** Vincennes University  
**Degree Plan:** A.S. Career/Tech Degree in Pharmacy Technician  
**MOS/Rating:** 68Q Pharmacy Specialist

### Degree Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits Required</th>
<th>MILITARY CREDIT EARNED</th>
<th>Alternative Completion Options</th>
<th>ACE Exhibit Number / Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University Core Curriculum</strong></td>
<td></td>
<td>E4 E5 E6 E7 E8 E9</td>
<td>Testing Credit, SOC Course Transferability</td>
<td></td>
</tr>
<tr>
<td>ENGL 101: English Composition I</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATT 105: Business Mathematics</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMM 148: Interpersonal Communication</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 100: Elementary Chemistry</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 100L: Elementary Chemistry Lab</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>PSYC 142: General Psychology</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 101: Principles of Human &amp; A&amp;P I</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGL 108: Technical Writing</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PFWX 101: Lifetime Fitness/Wellness</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Major Program Requirements</strong></td>
<td></td>
<td>E4 E5 E6 E7 E8 E9</td>
<td>Testing Credit, SOC Course Transferability</td>
<td></td>
</tr>
<tr>
<td>ACCT 102: Basic College Accounting</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL 105: Principles of Human &amp; A&amp;P II</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMP 110: Intro to Computer Concepts</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>HRFM 110: Medical Terminology</td>
<td>3</td>
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<td></td>
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<tr>
<td>PHRM 102: Pharmacology I</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHRM 106: Pharmacology II</td>
<td>3</td>
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<tr>
<td>PHRM 110: Dispensing Lab I</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PHRM 111: Dispensing Lab II</td>
<td>3</td>
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<tr>
<td>PHRM 115: Pharmacy Law for Technicians</td>
<td>3</td>
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<tr>
<td>PHRM 120: Pharmacy Calculations</td>
<td>3</td>
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<td></td>
<td></td>
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<tr>
<td>PHRM 125: Practicum</td>
<td>2</td>
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<td></td>
<td></td>
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<tr>
<td>PHMW 200: Pharmacy Management</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Total Required for Degree Completion</strong></td>
<td></td>
<td>E4 E5 E6 E7 E8 E9</td>
<td>Testing Credit, SOC Course Transferability</td>
<td>60</td>
</tr>
</tbody>
</table>

### Notes

- Course Offering: Online, At designated sites, On campus
- University Residency Requirement: 6 semester hours with Vincennes University
- ACE Review last done: 8/27/2015
- Institutional Review Last Done: 8/27/2015

**This Roadmap is for planning purposes only. Students should not view this degree map as an official evaluation of credit.**

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**3rd Party Map Structure**

![Map Diagram](image)

- **Agent**
- **Map**
- **ownedBy**
- **creator**
- **hasMap**
- **inMap**
- **hasStatement**

**Statement (1-n)**
The Role of Competencies and Their Frameworks
Inter- and Intra-Registry Competency Mapping

Registry “A”

Competency Framework “A”

Registry “B”

Competency Framework “B”

Registry “C”

Competency Framework “C”

Registry “D”

Competency Framework “D”
Basic Competency Architecture

CTDL/ASN-DL is made up of two fundamental entities:

1. Standards Document—a competency framework as a whole, and

2. Statement—the individual assertions of knowledge, skill, and abilities of which a Standards Document is comprised. These two entities—documents and statements—are modeled in terms of an entity-relationship model (ER) and embodied as a directed graph using W3C's Resource Description Language (RDF).

The diagram below illustrates the use of the Standards Document and Statement entities using an example encoding of a competency in the Degree Qualification Profile (DPQ).
Basic Competency Architecture

Because every CTDL/ASN-DL resource and every ASN Statement resource is identified by URI, competency frameworks and their individual competencies can be mapped to each other regardless of where the Frameworks are located on the open Web.

The figure to the right, is an example that asserts an exact match relationship between a competency in a Brandman University competency framework and a competency in the Degree Qualification Profile (DQP).
Competency Framework References

Credential

- `ceterns:requires`
  - `@type`: `ceterns:CredentialAlignmentObject`
  - `ceterns:framework`: `{ @id: "http://example.com/competencies.pdf" }
  - `ceterns:targetNodeName`: "Competency 12-2"
  - `ceterns:targetNodeDescription`: "This is another competency's text.

- `@type`: `ceterns:CredentialAlignmentObject`
  - `ceterns:framework`: `{ @id: "http://example.com/competencies.pdf" }
  - `ceterns:targetNodeName`: "Additional Competency"
  - `ceterns:targetNodeDescription`: "This is the text of a standalone competency, recorded in the object itself, since no framework and no individual URI is available yet for this competency."

Competency Framework (CASS)

- `@id`: "http://example.com/competencies.pdf"
  - `ceterns:conceptKeyword`: "Competency Name"
  - `ceterns:statementNotation`: "CFW.1.A"
  - `ceterns:description": "This is the text of the competency"

- `@id`: "http://example.com/competencies.pdf"
  - `ceterns:conceptKeyword": "A Child Competency Name"
  - `ceterns:statementNotation": "CFW.1.A.1"
  - `ceterns:description": "This is the text of a child competency"

- `@id`: "http://example.com/competencies.pdf"
  - `ceterns:conceptKeyword": "Another Competency Name"
  - `ceterns:statementNotation": "CFW.1.B"
  - `ceterns:description": "This is the text of another competency"

- `@id`: "http://example.com/competencies.pdf"
  - `ceterns:conceptKeyword": "Another Child Competency Name"
  - `ceterns:statementNotation": "CFW.1.B.1"
  - `ceterns:description": "This is the text of another child competency"

- `@id`: "http://example.com/competencies.pdf"
  - `ceterns:conceptKeyword": "One More Child Competency Name"
  - `ceterns:statementNotation": "CFW.1.B.2"
  - `ceterns:description": "This is the text of one more child competency"

Competency Framework PDF

http://example.com/competencies.pdf

Competency 12-1: This is the text of this competency
Competency 12-2: This is another competency's text.
Competency 12-2-A: And so on
Credential Engine References

- Credential Engine Informational Site: http://credentialengine.org
- Credential Engine Technical Website: http://credreg.net/
- Technical Advisory Committee: http://credreg.net/tac
- Technical Approach: http://credreg.net/tac/technicalapproach
- Namespace Policy: http://credreg.net/page/namespacepolicy
- CTDL Guide: http://credreg.net/ctdl/handbook
- CTDL Terms: http://credreg.net/ctdl/terms
- CTDL Serializations: http://credreg.net/ctdl/schema
- CTDL Mapping Guide: http://credreg.net/ctdl/mapping
- CTDL Release History: http://credreg.net/ctdl/release
- CTDL ASN Guide: http://credreg.net/ctdlasn/handbook
- CTDL ASN Terms: http://credreg.net/ctdlasn/terms
- CTDL ASN Serializations: http://credreg.net/ctdlasn/schema
- CTDL ASN Mapping Guide: http://credreg.net/ctdlasn/mapping
- CTDL ASN Release History: http://credreg.net/ctdl/release
- Credential Engine Registry Introduction: http://credreg.net/registry
- Registry Assistant API Guide: http://credreg.net/registry/assistant
- Credential Registry Search Query Builder Tool: http://credreg.net/registry/search
- GitHub Repository: https://github.com/CredentialEngine
- Use Cases: http://credreg.net/tac/usecases
- Credential Finder Search App Prototype: http://credentialfinder.org
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