



Common  
Education  
Data  
Standards

# DATA MODEL GUIDE

Version 12 Spring 2024

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## Introduction

The Common Education Data Standards (CEDS) includes a broad scope of data elements spanning much of the P-20W spectrum (pre-kindergarten through workforce education) and provides a context for understanding the standards' interrelationships and practical utility. CEDS focuses on data elements and modeling across the Early Learning, K12, Postsecondary, Career and Technical Education (CTE), Adult Education, and Workforce sectors, and it has data domains for Assessments, Competency Frameworks, Credentials, Learning Resources, and Authentication and Authorization.

The latest version of the standards and related resources can be found on the CEDS website at <http://ceds.ed.gov>.

The CEDS standards are composed of several pieces of information that provide a context for and describe the data items within CEDS. These are as follows:

- Domain
- Entity
- Data Element
- Option Set
- Related Uses (these are defined as Connections in the online CEDS Connect tool)
- Alternative names and other notes

The CEDS website offers four ways to view and interact with CEDS:

1. By Element—Via the [CEDS elements page](#), users can access a searchable catalog of the CEDS vocabulary.
2. By Relationship—Through the [CEDS Data Models](#), users can explore the relationships that exist among entities and elements.
3. By Comparison—The [CEDS Align Tool](#) allows users to load their organization's data dictionary and compare it, in detail, to CEDS and the data dictionaries of other users.
4. By Use – The [CEDS Connect Tool](#) allows users to define a use of education data derived from CEDS elements. It can define a policy or research question, report, or metric that might be calculated using the elements defined in the CEDS standards.

## What's New in Version 12

In February 2024, the Common Education Data Standards (CEDS) Version 12 was released on the CEDS website, <https://ceds.ed.gov>.

The Version 12 standards include new data definitions and updated data models to support additional use cases across early learning, K12, postsecondary, and workforce domains.

This major version of CEDS includes:

- 101 new elements including:
  - 4 elements pertaining to board members
  - 3 salary schedule elements
  - 3 attendance elements
  - 25 military elements
  - 12 job elements
  - 2 elements supporting EDFacts reporting
  - 8 elements to support the collection of accessible formats
- 92 updated elements including:
  - 595 context updates in the CEDS Domain Entity Schema to support new use cases involving 168 elements (new and updated)
  - 685 option changes involving 84 elements (new and updated) include:
    - 14 end dated options
    - 19 changed options
    - 652 new options

## Data Model Changes

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Both the Domain Entity Schema (DES) and Integrated Data Store (IDS) have been modified to reflect new elements and the application of existing elements to new use cases.

### DES Changes

Changes to the DES included the addition of new elements into the DES context(s) and the addition of existing elements to new DES contexts. For example, elements originally scoped for one domain such as K12 are updated to recognize use in early learning or postsecondary contexts.

### Integrated Data Store (IDS) Changes

The **Integrated Data Store (IDS)** was updated to support physical implementations of the CEDS data model. The IDS supports use as a logical model and physical implementations for the integration of data from multiple sources and across learning domains (for example, K12 and postsecondary). Some state education agencies (SEAs) and those using Generate, a system that supports federal EDFacts and state reporting, have implemented physical instances of the IDS.

The IDS SQL scripts included in each release of CEDS include scripts to populate reference tables with metadata about the standard option sets defined for CEDS elements.

The IDS SQL scripts are available on the CEDS Open Source Community GitHub site at <https://github.com/CEDStandards/CEDS-IDS/tree/master/src>.

Scripts for the Version 12 IDS include:

- **CEDS-IDS.sql**  
This [script](#) creates the tables, constraints, and relationships defined in Version 12.0.0.0 of the CEDS IDS. The script was generated from a model database hosted on a Microsoft SQL Server 2019 platform.
- **Populate-CEDS-Element-Tables.sql**  
This [script](#) populates the CEDS element and mapping tables in an IDS Version 12.0.0.0 model database.
- **Populate-CEDS-Ref-Tables.sql**  
This script populates the CEDS reference tables in an IDS Version 12.0.0.0 model database.
- **V11.0.0.0-to-V12.0.0.0.sql**  
This [script](#) updates an IDS version 11.0.0.0 model database to version 12.0.0.0.  
This script contains potentially breaking changes. Queries are included to preserve data.  
However, programming logic should be adjusted where necessary for these changes.

**NOTE:** Search for "WARNING!!!!" through the update and populate scripts to see potentially breaking changes and make necessary adjustments before executing.

Questions on the scripts can be sent to [ceds@ed.gov](mailto:ceds@ed.gov). More information on the data model is available at the CEDS website, <https://ceds.ed.gov/> and the CEDS Open Source Community (OSC) site, <https://github.com/CEDStandards/CEDS-IDS>.

### **Breaking Changes**

As a major release, the IDS update includes breaking changes from the previous (11.0.0.0) release. These breaking changes may impact the migration of data from physical instances using previous versions of the data schema. Please see the notes in the database scripts for details.

## About This Document

This document describes how to use the CEDS Data Models published on the CEDS website (<https://ceds.ed.gov>) and Open Source Community (<https://github.com/CEDStandards>). The CEDS Domain Entity Schema includes a hierarchical schema of domains and entities—as a nontechnical reference showing CEDS elements in context—and a fully normalized logical, or physical, model, the Integrated Data Store. This document also includes examples showing CEDS elements in the context of other types of data models, such as the star schema typically used in dimensional data warehouse design.

### The Domain Entity Schema (DES)

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The Domain Entity Schema (DES) provides a user-friendly structured framework for understanding CEDS elements and organizing them by domain and entity. The **domains** include the following:

- Early Learning (EL)
- Elementary and Secondary Education (K12)
- Postsecondary Education (abbreviated as PS)
- Career and Technical Education (CTE)
- Adult Education (AE)
- Workforce (WF)
- Assessments
- Credentials
- Competencies
- Learning Resources
- Facilities
- Implementation Variables
- Authentication and Authorization

**Entities** are commonly thought of as persons, places, events, objects, or concepts about which data can be collected. An entity provides the context for a data element. Some examples of entities include Early Learning Child, K12 Student, K12 Staff, Postsecondary Student, and Postsecondary Institution. There are over 70 entities in the DES.

The [CEDS website](#) presents the DES structure as a hierarchy of folders. This makes it easy to navigate to an entity and expand it to show its elements.

## The Integrated Data Store (IDS)

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CEDS supports the standardization of educational organizations and their relationships with other organizations, with people, and with time. The Integrated Data Store (IDS) is a model for operational implementations aligned to the CEDS standards. It is based on the CEDS Conceptual Model, a canonical organization of entities based on a foundation of Person, Organization, Resource, and Relationship.

The P-20W focus of CEDS means that it supports a transition from siloed, domain-specific, or location-specific datasets, to data that are compatible across domains and geographic boundaries. It also is designed to support longitudinal data that change over time and the versioning of data to support the most accurate representation of the truth.

In addition to supporting the existing federal and state reporting requirements, as well as supporting the analysis and comparison of aggregate statistics, the standards also support moving data along with a learner from an early learning program, to K12, postsecondary, and workforce learning programs.

The IDS supports the multiple roles and relationships in learning processes: the inputs, process steps (work), and outputs of learning.

The IDS is a Third Normal Form<sup>1</sup> structure organized around the key concepts of organization, person, resource, and relationship (see the CEDS Conceptual Model Guide). The IDS was developed to support physical implementations that integrate P-20W data, supporting data that represent the relationships that people have with formal and informal education organizations over time.

The IDS starts with a flexible directory of organizations that may have multiple parent-child relationships with one another. People exist independently, and roles exist within the context of their relationship to a specific organization, for a specific date range.



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<sup>1</sup> See [http://en.wikipedia.org/wiki/Third\\_normal\\_form](http://en.wikipedia.org/wiki/Third_normal_form).

Each person shares common attributes, or data points, that allow the model to represent a person at all levels of education. Each person has one or more “roles.” Roles are a time-aware association between a person and an “organization.”

At the intersection of organizations, persons, and learning resources are key learning processes. CEDS includes definitions of process data elements, such as assignments, activity, and achievements. Also defined in CEDS are the data elements and relationships covering formative, summative, and benchmark assessment processes. The IDS model also supports key relationships, such as the relationships between competencies (and/or learner goals) and learning resources, assignments, and assessment items.

## Naming Conventions and Key Terms

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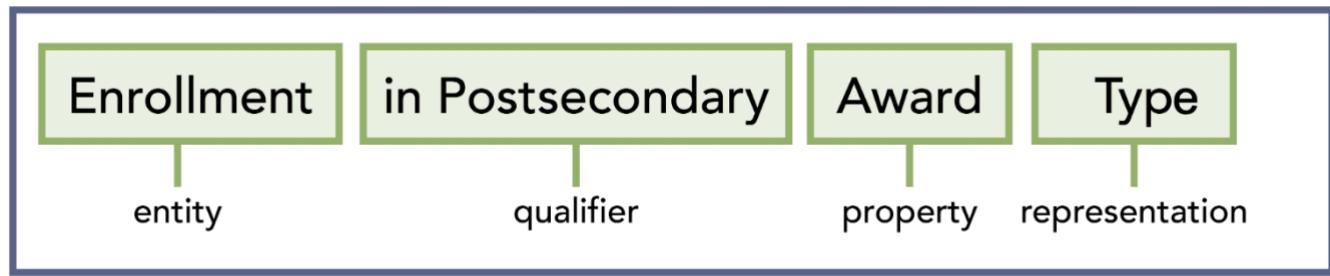
For consistency, the CEDS initiative has adopted a set of naming conventions for data entities and elements.

The standard name of a data element in CEDS is defined for human readability and understandability, and to avoid possible confusion when using an element in a different context or across domains.

CEDS elements also include a “Technical Name” in a more machine-readable format, which may support alignment with external technical standards. CEDS also supports an “Alternate Name,” which is used for discoverability when searching. Unless otherwise set based on an external standard, CEDS technical names are the full CEDS element name with spaces and special characters removed and with initial caps on each word (Pascal case). For example, the CEDS element “Country Code” has the technical name “CountryCode.” Additional technical conventions used in the IDS are documented elsewhere in this guide.

Based on the [ISO 11-179 guidelines](#), element names have **name parts** that consist of discrete terms.

The name parts may be entity terms, property terms, representation terms (optional), or qualifier terms (optional). Consider the following illustration.



### **Entity Terms**

Entity terms provide the context for an element. For example, in the following data element names, the terms Person, Accountability Report, Dental Insurance Coverage, and Advanced Placement are entity terms.

- Person Middle Name
- Accountability Report Title
- Dental Insurance Coverage Type
- Advanced Placement Credits Awarded

### **Property Terms**

A property is an attribute common to all members of an entity. For example, all persons have a date of birth. In the following data element names, the terms Name, Title, and Credits Awarded are property terms.

- Person Middle Name
- Accountability Report Title
- Dental Insurance Coverage Type
- Advanced Placement Credits Awarded

Note that in this list, three of the element names have an Entity-Property structure. One of the element names (“Dental Insurance Coverage Type”) has an Entity-Property-Representation structure.

### **Representation Terms (Optional)**

Representation terms describe the form of representation, or the kind of information for which the data element is defined. For example, this document defines the following representation terms and their uses: “Indicator,” “Status,” “Identifier,” “Descriptor,” “Description,” and “Type.”

In “Dental Insurance Coverage Type,” Type is a representation term. Element names use the “Type” suffix when the element has an option set, a controlled vocabulary of values used to classify or categorize the entity.

### Qualifier Terms (Optional)

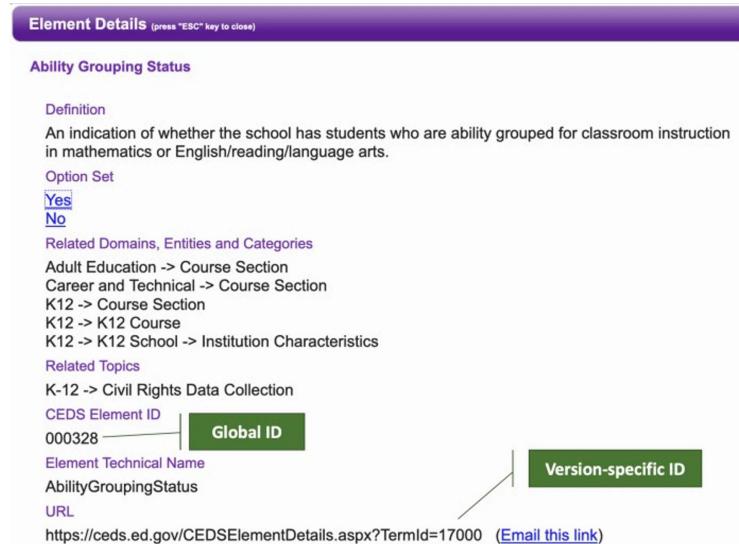
Entity terms define a context for an element. If the context applies only to one domain, the entity terms may include a qualifier to make it clear that the element is for a specific domain. For example, in the element name “Postsecondary Enrollment Type,” it is clear that this enrollment type element is defined for use in the postsecondary domain only—its option set may not be compatible with K12 uses. Qualifier terms may appear before or after an entity term, as appropriate to convey meaning.

## Element Identifiers

Each CEDS element has a **Global ID** (see the image below). On the website, this is labeled as the “CEDS Element ID.” The Global ID persists across different versions of CEDS. In other words, the Global ID will always remain the same, even if other attributes of the element (Name, Definition, Format, Option Set, etc.) change. Every element has a globally unique Uniform Resource Locator (URL) using the format

<https://ceds.ed.gov/element/<Global ID>>.

For example, the element displayed in the image has a Global ID (CEDS Element ID) of 000328, so the URL is: <https://ceds.ed.gov/element/000328>.



If the element has an option set, each option also has a unique URL composed of the element URL followed by “/” and the option code. For example:

<https://ceds.ed.gov/element/000328/#Yes>.

Each element also has a **version-specific URL**. For example, the version of the element “Ability Grouping Status” shown above has a TermId of 17000 and the version-specific URL <https://ceds.ed.gov/CEDSElementDetails.aspx?TermId=17000>. If the element is updated in a future version, it will keep the same Global ID (000328) but will be issued a new TermId.

Version history is maintained on the CEDS website's [Elements](#) page. You may use the element's **CEDS Element ID** (aka the Global ID) with the version-specific identifier to examine when and how an element has changed over time. For example, you can find when an option in an element's option set was added.

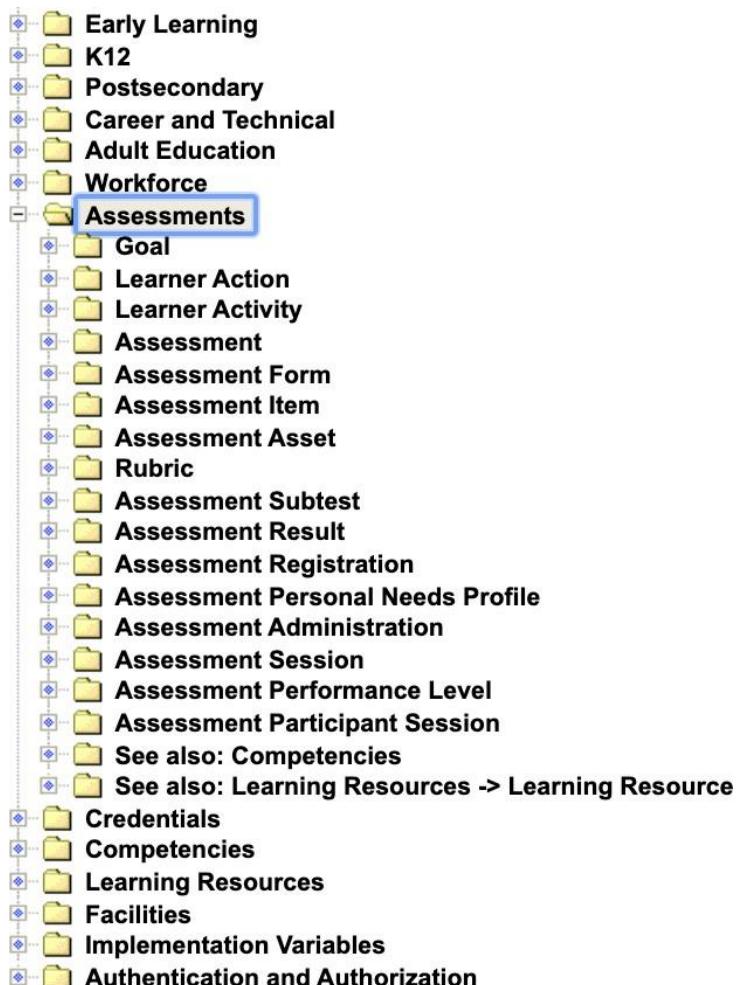
# CEDS Domain Entity Schema

## Domain Entity Schema (DES) Structure

The Domain Entity Schema (DES), as illustrated to the right, provides a user-friendly structure that allows people to easily identify elements within their domain of interest, sorted by entity and category.

Some facts about the DES:

- The DES is a hierarchy of domains, entities, attribute categories, and attributes.
- It is used primarily as an index to search, map, and organize elements.
- CEDS elements may exist in more than one place in the DES.
- It contains strong constraints specific to the sub-type.
- The DES contains mostly unit-level elements with only a few derived/aggregated attributes. (CEDS Connect is available for defining derived, or aggregated, metrics based on unit-level elements.)
- The DES provides a framework for a “flatter” and “de-normalized” view of data element definitions, in the context of an organization, process, or person-role (for example, a K12 Student).



The DES changes with each version of CEDS. Nodes are added and removed based on input from the development community and to accommodate expanded uses for new and existing elements. The DES context(s) for each element are specific to the version and are included on the “Element Details” page. This is illustrated in the image on the next page.

In the DES on the CEDS site, a user can enter the “Element Details” page for a particular element and see a unique URL. This unique URL identifies the data element at a specific DES location, for the specific

version of CEDS. For example, in the Element Details page indicated by the URL <https://ceds.ed.gov/CEDSElementDetails.aspx?TermxTopicId=19808>, the number after “TermxTopicId=” uniquely identifies the element at this specific location within the DES.

Note that the “TermTopicId=” used in this URL is different from the “TermId=” used in the URL on the Element Details page accessed from the elements page. The TermTopicId is for a specific location in the DES. The TermId references the version-specific element definition apart from the DES context.

Also note that in the downloadable template for the Align tool, the column “CEDS Element Data Model ID” on the “CEDS\_Element\_Listing” tab corresponds to the number after “TermxTopicId=” within the context-specific URL.

The screenshot shows the 'Element Details' page for the 'Telephone Number' element. The page has a purple header bar with the title 'Element Details (press "ESC" key to close)'. On the left, there's a sidebar with navigation links like 'Home', 'Domains', 'Search', and 'Note: This element was last updated on January 1, 2018'. The main content area is titled 'Telephone Number' and contains sections for 'Definition' (describing it as the telephone number including the area code and extension if applicable), 'Format' (alphanumeric - 24 characters maximum), and 'Option Set' (None). Below these, under 'Related Domains, Entities and Categories', there is a long list of relationships, many of which have a green 'New' button next to them. Some examples include: Adult Education -> AE Staff -> Contact -> Telephone; Adult Education -> AE Student -> Contact -> Telephone; Career and Technical -> CTE Staff -> Contact -> Telephone; Career and Technical -> CTE Student -> Contact -> Telephone; Early Learning -> EL Child -> Contact -> Telephone; Early Learning -> EL Organization -> Contact -> Telephone; Early Learning -> EL Staff -> Contact -> Telephone; Early Learning -> EL Staff -> Professional Development -> Instructor; Early Learning -> EL Staff -> Professional Development Activity -> Session - Location; Early Learning -> Parent/Guardian -> Contact -> Telephone; K12 -> K12 School -> Telephone; K12 -> K12 Staff -> Contact -> Telephone; K12 -> K12 Staff -> Professional Development Activity -> Session - Location; K12 -> K12 Student -> Contact -> Telephone; K12 -> LEA -> Telephone; K12 -> Organization -> Contact -> Telephone [New]; K12 -> Parent/Guardian -> Contact -> Telephone; K12 -> SEA -> Contact -> Telephone; Postsecondary -> Parent/Guardian -> Contact -> Telephone; Postsecondary -> PS Student -> Contact -> Telephone; Workforce -> Workforce Program Participant -> Contact -> Telephone [New].

DES contexts for the element “Telephone Number”

## Domains

Domains provide a common perspective for collaborators with different backgrounds and interests to approach the CEDS model. Domains describe the various entities and their attributes, roles, and relationships, plus the constraints that govern the integrity of the model elements comprising a particular problem domain. The following table displays the CEDS domains.

Domain		Definition
<b>Early Learning</b>	EL	Early Learning (EL) is the CEDS domain on the stage in human development from birth through the early school years (often defined as birth to age 8), during which significant social, emotional, cognitive, language, psychological, and physical development occurs.
<b>Elementary and Secondary</b>	K12	Elementary and Secondary (K12) is the CEDS domain on the formal instructional program whose curriculum is designed primarily for students who have entered kindergarten through those who have exited high school.
<b>Postsecondary</b>	PS	Postsecondary (PS) is the CEDS domain on the formal instructional program whose curriculum is designed primarily for students who are beyond the compulsory age for high school. This includes programs whose purpose is academic, vocational, and continuing professional education, and excludes avocational and adult basic education programs. (See also the Integrated Postsecondary Education Data System [IPEDS]).
<b>Career and Technical Education</b>	CTE	Career and Technical Education (CTE) is the CEDS domain on career and technical education programs, as defined by Perkins IV, and information about the students served by these programs.
<b>Adult Education</b>	AE	Adult Education (AE) is the CEDS domain on programs that help adults get the basic skills they need to be productive workers, family members, and citizens. It includes information about the adults served by these programs.
<b>Workforce</b>	WF	Workforce (WF) is the CEDS domain that includes people's participation in workforce and employment development programs, as well as employment and earnings data that are matched between education and workforce data sources.
<b>Assessments</b>		Assessments is the CEDS domain that includes entities and elements to support the design, administration, and scoring or evaluating the results of assessments used to measure one or more persons' mastery of one or more learning objectives.

<b>Credentials</b>	The CEDS domain that includes entities and elements that define attributes of a qualification, achievement, personal or organizational quality, or aspect of an identity typically used to indicate suitability.
<b>Competencies</b>	The CEDS domain that includes entities and elements that define learner competencies established in learning standards documents or competency frameworks that may exist within the structure of a taxonomy or competency-based pathways.
<b>Learning Resources</b>	Information about materials that support teaching and learning.
<b>Facilities</b>	The CEDS domain that includes entities and elements related to a building or buildings located on a single site.
<b>Implementation Variables</b>	Information used for implementing data systems and processes, such as variables to track the date that a report was produced.
<b>Authentication and Authorization</b>	Information used by an application or service that authenticates the identity of a person or authorizes a person's access to information or services.

## Entities

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Entities are persons, places, events, objects, or concepts about which data can be collected. An entity provides the context for a data element. The tables on the following pages display examples of CEDS entities at the top level of each domain in the DES. *Please use the following URL to see the most up-to-date version of these examples:*

[https://github.com/CEDStandards/CEDS-Elements/blob/master/doc/CEDS\\_DES\\_Domain\\_and\\_Entity\\_Definitions.md](https://github.com/CEDStandards/CEDS-Elements/blob/master/doc/CEDS_DES_Domain_and_Entity_Definitions.md)

***IMPORTANT: Complete and authoritative definitions for all CEDS Entities represented as Tables in the IDS are documented in the CEDS Open Source Community. Please see separate documentation for the definitions of entities (tables) in the IDS repository at the following URL:***

<https://github.com/CEDStandards/CEDS-IDS/blob/master/doc/IDS-Reference.xlsx>

## **Early Learning (EL)**

Early Learning (EL) is the CEDS domain on the stage in human development from birth through the early school years (often defined as birth to age 8), during which significant social, emotional, cognitive, language, psychological, and physical development occurs.

Entity	Description
<b>Early Learning Program</b>	An entity with information about a system of services, opportunities, or projects, designed to meet academic or non-academic needs. (A Program entity may be related to an organization as the service provider and to people as program staff, participants, and recipients of program services. CEDS broadly defines Program for information about program types such as work-study programs or athletic programs that are not specifically defined. CEDS also has more specific program entities such as PS Institution Program and CTE Program.)
<b>EL Child</b>	A person for whom instruction, services, and/or care are provided in an early childhood program under the jurisdiction of a school, education agency, or other institution or program.
<b>EL Class/Group</b>	A cohort of children receiving services together, or in some cases individually, usually for a predetermined amount of time, with at least one assigned primary teacher.
<b>EL Family</b>	All persons (i) living in the same household who are (a) supported by the income of the parent(s) or guardian(s) of the child enrolling or participating in the program, or (b) related to the child by blood, marriage, or adoption; or (ii) related to the child enrolling or participating in the program as parents or siblings by blood, marriage, or adoption.
<b>EL Organization</b>	An institution that provides early learning services. This can be a grantee with delegates at various locations, possibly in one or more buildings; it has an assigned administrator(s).
<b>EL Staff</b>	A person who performs specified activities for a public or private education institution, agency, or household that provides instructional and/or support services to students or staff at the early childhood level.
<b>Parent/Guardian</b>	A person having parental or legal guardianship responsibility for a learner.

## **Elementary and Secondary (K12)**

Elementary and Secondary (K12) is the CEDS domain on the formal instruction program whose curriculum is designed primarily for students who have entered kindergarten through those who have exited high school.

Entity	Description
<b>K12 School</b>	An institution that provides educational services, has one or more grade groups (PreK through 12), has one or more teachers, is located in one or more buildings, and has an assigned administrator(s).
<b>Local Education Agency (LEA)</b>	Local educational agency, or LEA, means a public board of education or other public authority legally constituted within a state for either administrative control or direction of, or to perform a service function for, public elementary schools or secondary schools in a city, county, township, school district, or other political subdivision of a state, or for a combination of school districts or counties as are recognized in a state as an administrative agency for its public elementary schools or secondary schools.
<b>State Education Agency (SEA)</b>	The SEA is the state-level entity primarily responsible for the supervision of the state's public elementary and secondary schools.
<b>K12 Student</b>	A person for whom instruction, services, and/or care are provided in an elementary or secondary educational program under the jurisdiction of a school, education agency, or other institution or program.
<b>Parent/Guardian</b>	A person having parental or legal guardianship responsibility for a learner.
<b>K12 Staff</b>	An individual who performs specified activities for any public or private education institution, agency, or household that provides instructional and/or support services to students or staff at the early childhood level through high school completion.
<b>K12 Course</b>	The organization of subject matter and related learning experiences provided for the instruction of students on a regular or systematic basis, usually for a predetermined period of time (e.g., a semester or a two-week workshop) to an individual or group of students (e.g., a class).
<b>Course Section</b>	A setting in which organized instruction of course content is provided to one or more students for a given period of time. (A K12 Course may be offered to more than one Course Section. Instruction may be delivered in person by one or more instructors or via a different medium. Sections that share space should be considered as separate Course Sections if they function as separate units for more than 50 percent of the time.)

<b>Organization</b>	An organization, institution, agency, or business referenced to by schools, social services, or other education agencies.
<b>Program</b>	A system of services, opportunities, or projects designed to meet academic or non-academic needs. (A Program entity may be related to an organization as the service provider, and to people as program staff, participants, or recipients of program services. CEDS broadly defines Program for information about program types, such as work-study programs or athletic programs, that are not specifically defined. CEDS also has more specific program entities, including PS Institution Program and CTE Program.)
<b>Incident</b>	An infraction ranging from a minor problem behavior that disrupts the orderly functioning of a school or classroom (such as tardiness) to a criminal act that results in the involvement of a law enforcement official (such as robbery). A single event (e.g., a fight) is one incident regardless of how many perpetrators or victims are involved.
<b>Calendar</b>	A set of dates associated with an organization.

### **Postsecondary (PS)**

Postsecondary (PS) is the CEDS domain on the formal instructional program whose curriculum is designed primarily for students who are beyond the compulsory age for high school. This includes programs whose purpose is academic, vocational, and continuing professional education, and excludes avocational and adult basic education programs. (See also the Integrated Postsecondary Education Data System [IPEDS]).

Entity	Description
<b>PS Institution</b>	An organization that provides educational programs for individuals who have completed or otherwise left educational programs in secondary school(s).
<b>PS Student</b>	An individual who is a prospect, applicant, admitted student, enrolled student, or alum of a postsecondary institution.
<b>PS Section</b>	A postsecondary instructional course in a particular field of study that typically involves a prescribed number of instruction periods or meetings for enrolled students.

<b>PS Staff</b>	A person who performs specified activities for any public or private education institution, agency, or household that provides instructional and/or support services to students or staff at the postsecondary level.
<b>PS Applicant</b>	An individual who is an applicant of a postsecondary institution.
<b>Parent/Guardian</b>	A person having parental or legal guardianship responsibility for a learner.
<b>Learning Resource</b>	The CEDS entity that includes information about materials that support teaching and learning.
<b>Organization</b>	An organization, institution, agency or business referenced to by schools, social services, or other education agencies.

### Career and Technical Education (CTE)

Career and Technical Education (CTE) is the CEDS domain on career and technical education programs, as defined by Perkins IV, and information about the students served by these programs.

Entity	Description
<b>CTE Student</b>	A person for whom instruction, services, and/or care are provided in a Career and Technical Education program and who has met the state-defined threshold of Career and Technical Education participation, as defined in the state's approved Perkins IV State Plan.
<b>CTE Staff</b>	An individual who performs specified activities for any public or private education institution, agency, or household that provides instructional and/or support services to students or staff in a Career and Technical Education program.
<b>Program</b>	A system of services, opportunities, or projects designed to meet academic or non-academic needs. (A Program entity may be related to an organization as the service provider and to people as program staff, participants, and recipients of program services. CEDS broadly defines Program for information about program types, such as work-study programs and athletic programs, that are not specifically defined. CEDS also has more specific program entities such as the CTE Program.)
<b>Course</b>	The organization of subject matter and related learning experiences provided for the instruction of students on a regular or systematic basis,

<p>usually for a predetermined period of time (e.g., a semester or a two-week workshop) to an individual or group of students (e.g., a class).</p>
<p><b>Course Section</b> A setting in which organized instruction of the course content is provided to one or more students for a given period of time. (A Course may be offered to more than one Course Section. Instruction may be delivered in person by one or more instructors or via a different medium. Sections that share space should be considered as separate Course Sections if they function as separate units for more than 50 percent of the time.)</p>

### **Adult Education (AE)**

Adult Education (AE) is the CEDS domain on programs that help adults get the basic skills they need to be productive workers, family members, and citizens. It includes information about the adults served by these programs.

Entity	Description
<b>AE Student</b>	A person for whom instruction and/or services are provided in an Adult Education program.
<b>AE Staff</b>	A person who is employed by an Adult Education program.
<b>AE Provider</b>	A program that helps adults get the basic skills they need to be productive workers, family members, and citizens.
<b>Program</b>	A system of services, opportunities, or projects, designed to meet academic or non-academic needs. (A Program entity may be related to an organization as the service provider and to people as program staff, participants, or recipients of program services. CEDS broadly defines Program for information about program types, such as work-study programs and athletic programs, that are not specifically defined. CEDS also has more specific program entities such as the CTE Program.)
<b>Course Section</b>	A setting in which the organized instruction of course content is provided to one or more students for a given period of time. (A Course may be offered to more than one Course Section. Instruction may be delivered in person by one or more instructors or via a different medium. Sections that share space should be considered as separate Course Sections if they function as separate units for more than 50 percent of the time.)

## Workforce (WF)

Workforce (WF) is the CEDS domain that includes people's participation in workforce and employment development programs, as well as employment and earnings data that are matched between education and workforce data sources.

Entity	Description
<b>Workforce Program Participant</b>	A person for whom instruction and/or services are provided in a workforce and/or an employment development program.
<b>Quarterly Employment Record</b>	Person-level employment and earnings information from quarterly employment and earnings-related data from sources such as State UI Wage Records, the Wage Record Interchange System, or the Federal Employment Data Exchange System (FEDES).

## Assessments

Assessments is the CEDS domain that includes entities and elements to support the design, administration, and scoring or evaluating the results of assessments used to measure one or more persons' mastery of one or more learning objectives.

Entity	Description
<b>Assessment</b>	An instrument used to evaluate a person with at least one form, section, and Assessment Item. (A summative assessment typically addresses a particular level, subject, and date range. A person's individual responses during the summative assessment administration are evaluated, and then the results are scored using one or more Assessment Subtest Scoring Rules.)
<b>Assessment Form</b>	An instance of an assessment that can equate scores with another instance of that same assessment.
<b>Assessment Session</b>	An entity with information related to an instance of delivering an assessment during a specific period of time.
<b>Assessment Item</b>	A specific prompt that defines a question or protocol for a measurable activity that triggers a response from a person used to determine whether the person has mastered a learning objective.

<b>Assessment Asset</b>	An entity that represents content used to compose an Assessment Item, is referenced by an item but not part of the item content itself, or is content that is included as part of a section within an assessment form. Assets can be static content such as artwork or dynamic assets such as calculators or other tools.
<b>Assessment Subtest</b>	An entity that defines information for scoring an Assessment Form based on a set of Assessment Item responses with explicit rules to produce an Assessment Subtest Result, which may be for the entire Assessment Form or one aspect of evaluation based on a subset of Assessment Items.
<b>Assessment Result</b>	An entity that includes information about a person's results from an assessment, which may be for the entire assessment or one aspect of evaluation. The entity includes the score value and information about the score, such as a diagnostic statement. Note that information for interpreting an assessment result is available in the related Assessment Subtest information. This includes the minimum, maximum, and optimal values for the measurement. The Subtest may in turn be associated with one or more content standards using the Learning Standard Item Association entity.
<b>Assessment Registration</b>	An entity with information related to a specific person registered for an Assessment Administration, assigned a specific Assessment Form for participation in one or more Assessment Sessions.
<b>Assessment Administration</b>	Information related to an assessment event or administration period. It includes information related to the time period of administration and the place(s) of administration.
<b>Assessment Personal Needs Profile</b>	An entity that includes information about the personal needs and preferences for assessment participants, based on the IMS Global (R) Accessible Portable Item Protocol.
<b>Assessment Participant Session</b>	An entity that includes information about a specific person's participation in an Assessment Session.
<b>Goal</b>	An entity that includes information about a goal set for a person or organization.

<b>Assessment Performance Level</b>	<p>An entity that includes information about the performance levels that may be assigned to an Assessment Result and specifications for selecting the performance level based on a score. Four styles are supported:</p> <ol style="list-style-type: none"> <li>1. Specification of performance level by lower and upper cut score</li> <li>2. Specification of performance level by lower cut score only</li> <li>3. Specification of performance level without any mapping to scores</li> <li>4. Specification of performance level by mapping to other scores</li> </ol> <p>Performance levels are repeatable. A list of all the possible performance levels for an Assessment Result are derived from the relationship between Assessment Subtest and Assessment Performance Level. The performance levels that have been met for a specific Assessment Result are derived from the relationship between Assessment Result and Assessment Performance Level.</p>
<b>Learner Action</b>	An entity with information about learning experiences, including actions taken by or on behalf of a learner.

## Credentials

The CEDS domain that includes entities and elements that define attributes of a qualification, achievement, personal or organizational quality, or aspect of an identity typically used to indicate suitability.

Entity	Description
<b>Credential Definition</b>	A resource that defines a competency or qualification, achievement, personal or organizational quality, experience, attribute, or aspect of an identity typically used to indicate suitability (See: Credential Engine's ceterms:Credential).
<b>Credential Offered</b>	Information about a credential offered by a credentialing organization or other credential agent.
<b>Credential Award</b>	Event data that include an assertion by an agent/issuer that documents a person or organization's qualification, achievement, personal or

	organizational quality, experience, attribute, or aspect of an identity as of a certain date or date range.
<b>Credential Agent</b>	Organization that plays one or more key roles in the lifecycle of a credential.

## Competencies

The CEDS domain that includes entities and elements that define learner competencies established in learning standards documents or competency frameworks that may exist within the structure of a taxonomy or competency-based pathways.

Entity	Description
<b>Competency Framework</b>	A resource that includes metadata about a logically related set of Competency Definitions.
<b>Competency Definition</b>	A resource that includes a statement that describes a capability or behavior that a person may learn or be able to do within a given situation and environment, and may include definitions of the potential levels of mastery and metadata related to that statement.
<b>Competency Assertion</b>	An assertion by an agent/issuer that documents a person or organization's qualification, achievement, personal or organizational quality, experience, attribute, or aspect of an identity as of a certain date or date range.
<b>Competency Association</b>	Competency Association: The relation of competency definitions to other competency definitions to support competency maps or to relate competency definitions to other objects such as learning resources.
<b>Competency Set</b>	An entity that supports the definition of a set of competency definitions.

## Learning Resources

Information about materials that support teaching and learning.

Entity	Description
<b>Learning Resource</b>	The content, materials, or informational resources that support learning.
<b>Peer Rating</b>	A person's rating of a Learning Resource.
<b>Peer Rating System</b>	A system by which a person can rate a Learning Resource.

## Facilities

The CEDS domain that includes entities and elements related to a building or buildings located on a single site.

Entity	Description
<b>Campus</b>	The buildings or buildings located on a site that are under the control of a single entity.
<b>Facility</b>	The building or buildings located on a single site.

## Implementation Variables

Information used for implementing data systems and processes, such as variables to track the date that a report was produced.

Entity	Description
<b>Report</b>	An entity with information about a report, such as the date the report was generated or the date the report was submitted to an authority.

## **Authentication and Authorization**

Information used by an application or service that authenticates the identity of a person or authorizes a person's access to information or services.

Entity	Description
<b>Authentication</b>	An application or service that can authenticate the identity of a person. The CEDS entity that includes information about an authentication provider, the login identifier used to authenticate a person's identity, and other information related to authentication of a person's identity.
<b>Authorization</b>	Information about a data system or application that an authenticated person may access.

## CEDS Integrated Data Store (IDS)

The CEDS Integrated Data Store (IDS) offers a logical and physical data model and Entity Relationship Diagrams (ERDs) providing visual representations of how the tables, or entities, within a data model pertain to each other. IDS diagrams are provided in the appendix of this Data Model Guide.

The IDS is available as SQL scripts for import into data modeling tools or to create a physical database instance. Scripts are included to populate reference tables with applicable controlled vocabulary (CEDS option sets) and tables with metadata mapping CEDS element definitions to columns defined in the IDS. Also, a spreadsheet file is included along with this document. The file “Table and Column Listing” is available via the IDS page (<https://ceds.ed.gov/dataModelIDS.aspx>) and on the CEDS Open Source Community in GitHub (<https://github.com/CEDStandards/CEDS-IDS>).

The nomenclature used to describe the IDS includes terms used for a physical model. This facilitates the comprehension of the contents because technical people tend to be familiar with physical terms (such as table and field or column) as opposed to the terms entity and element used for CEDS definitions.

Additionally, since the terms entity and element are used within the DES, using the physical terms when discussing the IDS differentiates the context.

### IDS Core Structure Logic

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The IDS database model is normalized to Third Normal Form and designed for integration of P-20W data.

*The IDS is not designed to address the needs of all possible physical implementations. For example, a database supporting data from only one domain (Early Learning, K12, or Postsecondary) could use a less normalized model, and a denormalized dimensional data model may be more appropriate for reporting and analytics.*

Because CEDS elements are defined at the unit level, the IDS is designed for unit-level data. Aggregate metrics that might be derived from CEDS elements generally are not included in the IDS. Instead, these metrics can be defined using CEDS Connect and modeled in a reporting data store. Some examples of reporting data store structures are included later in this guide.

This model includes longitudinal aspects, such as for tracking enrollment status over time. It also addresses production aspects of log and change management with the introduction of Record End Date Time and Record Start Date Time properties in all tables as of version 8. In a physical implementation, an alternative approach using a sub-model supporting the audit of edits to all attributes may be used.

Comparability of education data has some exciting possibilities for educators, administrators, and vendors. The IDS is designed for data at rest. It serves to provide a level of interoperability such that

- standardized terminology succeeds in promoting more effective communication and in streamlining knowledge transfer;
- mapping takes less effort;
- the development of reports, imports, exports, dashboards, and/or modules can be shared more easily across organizations;
- there is centralized or baselined design documentation; and
- resources can be shared.

Traceability largely addresses the internal aspects of a P-20W system. It ensures that the data surrounding a person's education can be stored persistently and can be retrieved accurately.

To provide a data model that promotes comparability and traceability across P-20W boundaries, the data abstraction process must reconcile myriad sources, interpretations, and definitions for each data structure. The IDS's highly normalized data model promotes these requirements.

The resulting model is flexible, and it supports diversified needs across P-20W education agencies while providing a consistent approach that supports comparability. Consequently, a layer of abstraction exists based on several key concepts:

- Time—A duration that constrains the relevance of data.
- Person—A human being, alive or deceased, as recognized by each jurisdiction's legal definitions.
- Organization—An organized group of one or more people with a particular purpose.
- Resource—Anything could be a resource, depending on its context defined in metadata.
- Relationship—People, Organizations, and Resources all can have standard association types within and across concepts.



Types of Relationships:

- Role—People have roles in Organizations for specific periods of time.
- Event—People and Organizations have events with each other and with Resources on or over specific periods of time.



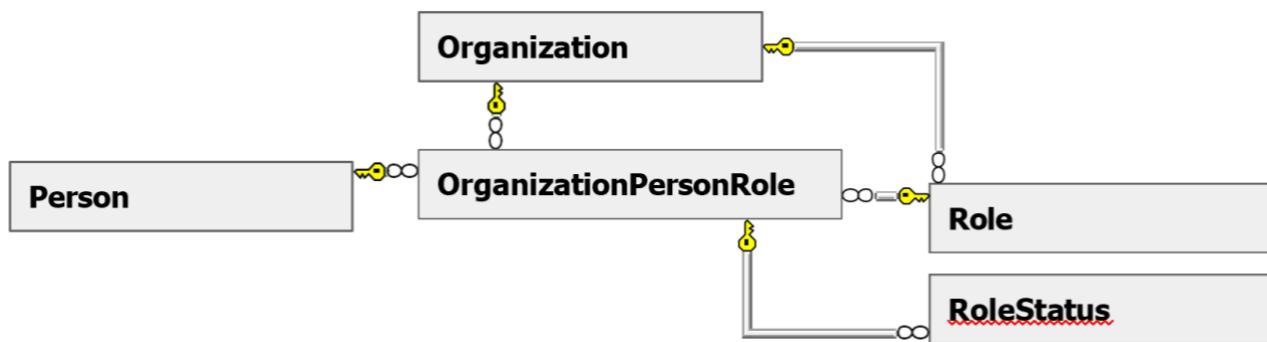
Learning Processes involve the inputs, process steps, and outputs related to the work of People and education Organizations.

Note that people in the IDS only have roles in relationship to a specific organization and a designated date range. Persistent information about a person is modeled separate from the person's role and relationship to an organization.

## IDS Entity Relationship Model

### A High-Level Logical Model

Here is an example of a high-level logical model in the IDS.



### Normalization and the IDS Model

Normalization is a data-structuring process that results in the following:

- The elimination of redundancies—Normalization prevents update anomalies and reduces the amount of stored data.
- An ensured accuracy of data—Normalization prevents insert anomalies and guarantees the quality of the data.
- The understanding of data—Discrete objects clearly identify a purpose.
- Scalability—Normalization better accommodates growth.
- Extensibility—Normalization facilitates the modification of the model.

A system is considered to be well normalized if it meets the Third Normal Form. C.J. Date said that database design is common-sense formalized. Applying normalization is similar to factoring algebraic equations: simply reduce factors to like terms. Identifying whether an attribute exists always or sometimes determines its “optionality” or “nullability.”

The attribute's type of relationship determines the “cardinality” of the data modeling. In data modeling terms, a 1-1 cardinality means that one row in table A relates to one row in table B. For example, a person has only one birthplace (1-1). A 1-many cardinality means that one row in table A relates to many rows in table B, for example, a person may speak one or more languages.

**NOTE: Cardinality was removed from some table relationships in version 8.0.0 of the IDS at the request of some collaborators to support a versioning methodology. For example, the Person to PersonBirthplace is now modeled as if a Person may have more than one birthplace but is intended to support if the birthplace information was entered and later corrected. See note below.**

As a result of normalization, some CEDS elements are not represented as distinct fields in the IDS. However, every CEDS element is supported. For example, the CEDS elements Organization Name (000204), Name of Institution (000191), Program Name (000626), and Responsible Organization Name (000631) all normalize to OrganizationDetail: Name in the IDS.

#### *Normal Forms*

Each form must comply with lower-level forms. The main premises of the first three normal forms are as follows:

- First Normal Form (1NF)—Records are uniquely identifiable and contain no repeating fields.
- Second Normal Form (2NF)—All attributes are directly dependent on the primary key.
- Third Normal Form (3NF)—Non-key fields do not have dependencies on other non-key fields.

#### *Reference Data*

When a known set of values (**controlled vocabulary**) exists, as defined in the **option set** of a CEDS element, the model uses a reference table. In the data model, reference tables have the prefix “Ref.”

CEDS provides scripts to populate reference tables with option sets from the CEDS element definitions. CEDS Option Sets and IDS reference tables include the following:

- **Code**—A machine-readable value that uniquely identifies the option. Codes contain a numeric or alphanumeric string with no spaces. In some cases, “spacer” characters are used, including the hyphen (-), slash (/), period (.), and underscore (\_). All options contain at least one code value.
- **Description**—A human-readable label or short description of the option up to 100 characters with spaces.
- **Definition**—A longer human-readable text defining the option.

#### *Surrogate Keys*

Surrogate keys are used instead of natural keys to simplify joins. Joins are simplified in that there is always one field to join to one table. Composite keys, which require one or more fields and data knowledge to join tables, were not used for this data model. Additionally, surrogate keys allow the logical primary key to be changed without implementing logic to handle the change. This was considered necessary to support the wide range of datasets, since some potential uses of this model allow for primary keys to change over time.

Surrogate keys support super-type/sub-type data and education data being closely tied to organization identifiers and person identifiers.

#### *The Use of Super-types/Sub-types*

To provide a database flexible enough to fit multiple business models, configurable hierarchies and reference data are critical. In line with the CEDS Conceptual Model superclasses (Organization, Person, Resource, Relationship) the IDS uses a super-type/sub-type construct. Super-types/sub-types may be used when an idea has common and different elements. For example, a parent and an Early Learning child both can be categorized as people and can share certain people elements, such as the birth date and home address. However, only the parent will have a job, and only the child will have a lunch program. Some attributes are not about the Person but about the Role that they serve in relationship to an Organization.

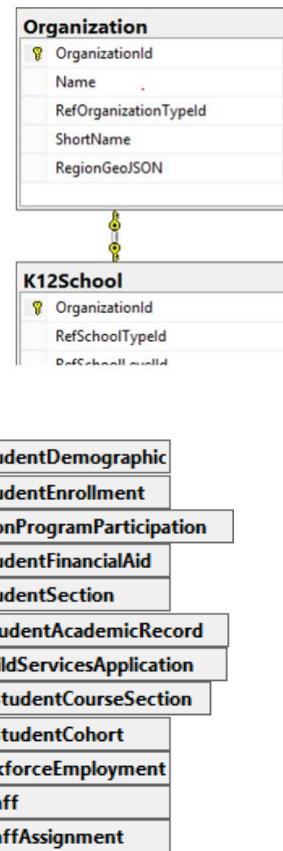
### **Important Change as of Version 8.0.0:**

In the version 8.0.0 IDS, some cardinality constraints were loosened and super-type and sub-type tables using a shared primary key changed. Organization and the tables that are types of organization (ELOrganization, K12School, PSInstitution, Course, CourseSection, etc.) no longer share a primary key, and the OrganizationPersonRole table and sub-types such as K12Student and PSStudent no longer share a primary key. The constraint was loosened to allow organization sub-types tables their own primary key. This was done in response to database administrator requests as an approach to versioning data.

If using version 8 or later releases, **implementers will need to maintain the integrity of the superclass and subclass in code rather than assuming the database layer will handle it**. For example, an implementation using an Object to Relational Mapping (ORM) layer in software could enforce the 1-1 relationship there.

Alternately, implementers could force "table inheritance" by

- changing the key relationship between the OrganizationId primary key column in the Organization table to the OrganizationId in the subclass tables (ELOrganization, K12School, PSInstitution, Course, CourseSection, etc.); or
- changing the key relationship between the OrganizationPersonRoleId primary key column in the Organization table to the OrganizationId in the subclass tables (ELOrganization, K12School, PSInstitution, Course, CourseSection, etc.).



Using a shared key enforces the superclass/subclass relationship in the database layer.

## Common Model

Each of the three super-types (Person, Organization, and Role) contains information that applies to all types. For example, each person, regardless of role, has demographic information, and all types of organizations may have calendar information.

## Understanding the IDS Entity Relationship Diagrams

### IDS Table and Field Syntax

#### Tables

Tables are represented as a rectangle. The surrogate key is indicated by a key  symbol. This is shown in the image to the right.

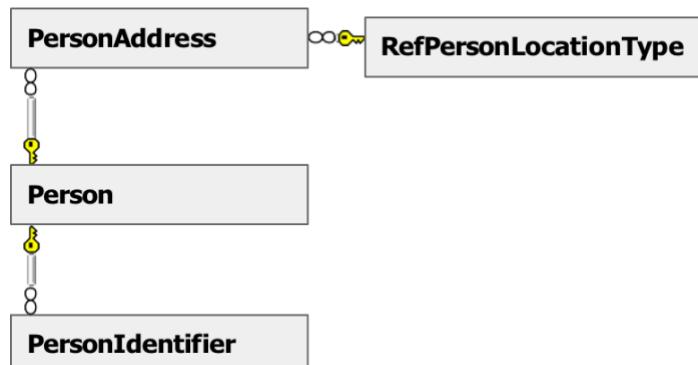
The function of the surrogate key is to uniquely identify one record from all other records within the same table. The CEDS model uses a design standard of “surrogate keys.”

TableName
 SurrogateKey
FieldName

Surrogate keys do not replace primary keys; however, they simplify using them. Surrogate keys serve as system-generated unique identifiers that are unrelated to the actual data within a table and are typically used as primary keys for database management efficiency. While they uniquely identify each record, they coexist with natural keys that may represent real-world meaning, like an organization’s ID number. In practice, this means that surrogate keys facilitate database operations without affecting the use of natural keys for business logic and data relationships.

#### Relationships

The heart of the Entity Relationship Diagram (ERD) is an illustration of how data relates to itself. By effectively using lines and boxes, we can gather understanding from a simple diagram:



This diagram tells us that a Person may have an Address and an Identifier. The infinity  symbol tells us that there may be more than one Address and Identifier for a Person. We also know by the “Ref”

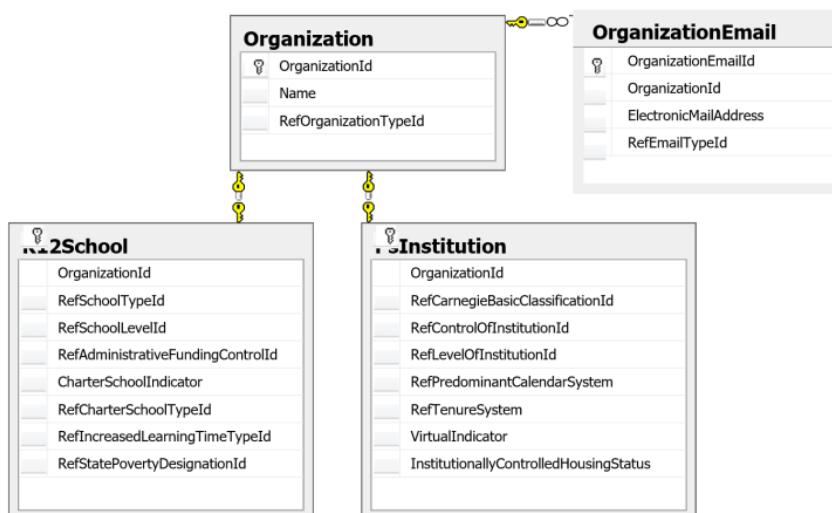
table that the PersonLocationType field in the PersonAddress table uses a CEDS-controlled vocabulary. “Ref” tables represent the option set defined for CEDS elements.

The IDS model leaves it up to the implementation to define additional business rules. For example, a system may apply a business rule to limit the number of PersonIdentifiers that may be associated with a Person, or to ensure that a PersonIdentifier for a given Person Identification System must be unique. A best practice for multitier applications is to enforce such rules at all tiers of the application.

Since the CEDS Data Model uses surrogate keys, the presence of identifying relationships is reduced to super-type and sub-type relationships.

The symbols on the ends of the lines indicate the cardinality of the relationship. The key-to-infinity  symbol represents a one-to-many relationship, and the key-to-key  symbol represents a one-to-one relationship, such as a sub-type relationship. For example, in the image shown below from a previous version of CEDS, K12 School was modeled as a sub-type of Organization with a common key, so the relationship in the diagram has a key on both ends.

Super-type/sub-type relationships indicate that a record of a super-type may have a corresponding sub-type record, but a sub-type record cannot exist without the parent super-type. The power of the super-type/sub-type construct is that it allows one object to have different sets of properties. By extension, this mechanism allows multiple tables to be referenced by one common object. For example, a K12 school and a postsecondary institution are two kinds of organizations. Common attributes include a name and zero or more email addresses, but they each have some domain-specific attributes, as well. Notice in the diagram below that both K12School and PsInstitution used the surrogate key (OrganizationId) of the parent table (Organization).



## Finding CEDS Elements in the IDS Model

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All CEDS elements are supported in the IDS model except elements in the “Implementation Variables” domain defined only for use in a reporting data store (for example, “Report Date”). Sometimes there is a one-to-one correspondence between the CEDS element and a table column in the IDS model. For example, the CEDS element Financial Account Name corresponds to the “Name” column in the IDS table “Financial Account.”

In other cases, as a result of normalization, CEDS elements may not represent distinct fields in the IDS. Consider the following element.

### **Child Developmental Screening Status**

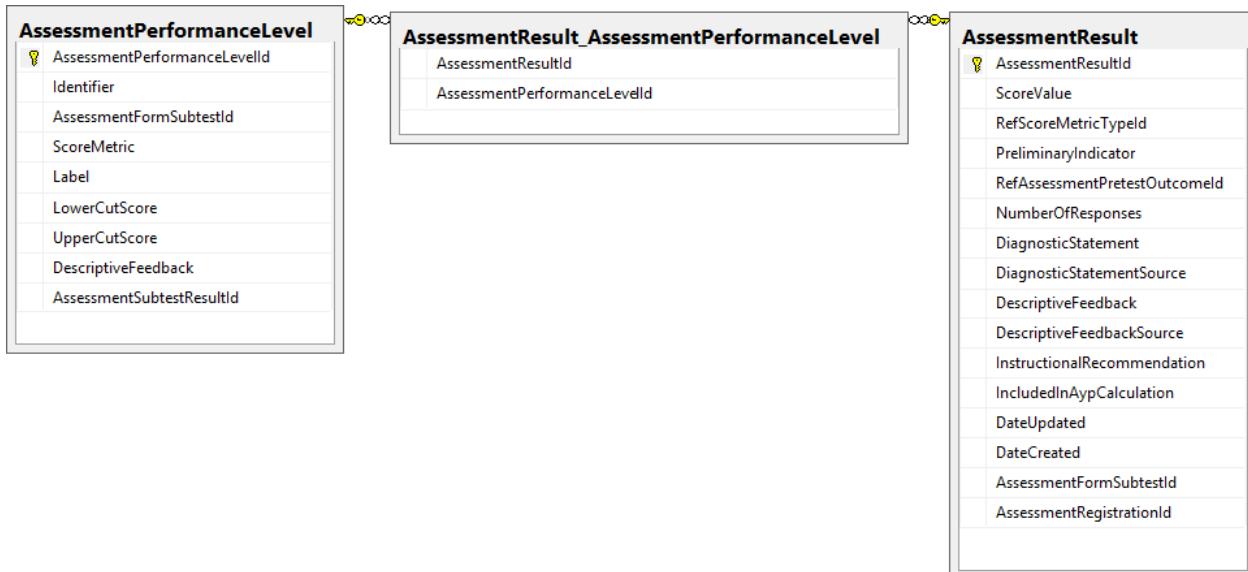
#### Definition

The result of a brief standardized screening tool aiding in the identification of children at risk of a developmental delay/disorder.

#### Option Set

Further evaluation needed	FurtherEvaluationNeeded
No further evaluation needed	NoFurtherEvaluationNeeded
No Screening Performed	NoScreeningPerformed
Appropriate Assessment Tool Unavailable	AssessmentToolUnavailable
Personnel Unavailable	PersonnelUnavailable

The element represents a specific kind of Assessment Result. The IDS already has a well-developed model supporting assessment results that may be used, as shown in the diagram below. Each of the values in the option set may be stored as an “Assessment Performance Level” using an “Assessment Performance Level Identifier” and “Assessment Performance Level Label.” Then, the result of an early learning screening, “Early Learning Child Developmental Screening Status,” may be recorded as an Assessment Result and linked to the appropriate Assessment Performance Level.



### *Normalization of CEDS PersonStatus Elements*

PersonStatus elements from the CEDS data dictionary have been “normalized out” of the IDS model. These are attributes of a person with a value of “Yes” or “No” that may change over time. For example, CEDS defines elements for a student’s homelessness, migrant, and limited English proficiency status. Instead of separate fields, the IDS model handles PersonStatus as a row in the table “PersonStatus.” The related table RefPersonStatusType contains the possible types of status (for example, homeless, migrant, limited English proficient) that correspond to the individual elements in the CEDS data dictionary.

PersonStatus	
PersonStatusId	
PersonId	
RefPersonStatusTypeld	
StatusValue	
StatusStartDate	
StatusEndDate	

## CEDS Use within P-20W Enterprise and Web-Scaled Architectures

A typical architecture that crosses P-20W education boundaries is made up of any number of source systems, an operational data store, and a data warehouse for analytics and reporting. Data that move from an authoritative source transactional system to other integrated systems and operational data store(s) most often must be transformed for compatibility with the receiving system. The CEDS IDS reference model is normalized to represent an example structure for a P-20W operational data store.

This section provides examples of CEDS data elements as they may exist in a de-normalized P-20W longitudinal databases.

**NOTE: An open-source data warehouse model is now available in the Open Source Community. This is not documentation of those specific structures, only examples to demonstrate the differences between normalized operational models and de-normalized data models used for reporting.**

Please visit the CEDS-Data-Warehouse GitHub repository here:

<https://github.com/CEDStandards/CEDS-Data-Warehouse>.

CEDS standardizes data element definitions and option sets to make the data more compatible and to serve as a common vocabulary. CEDS does not define standards for the movement of data (transport protocols and APIs), but organizations that do set standards for data movement have embraced CEDS as a common vocabulary.

Despite the existence of the CEDS common vocabulary, it is recognized that different data models are used to support different uses. The following example data warehouse star schemas demonstrate the application of the CEDS standards into a data warehouse domain of the P-20W enterprise architecture.

### **Case Study #1: The Teacher-Student Data Link—Data to Analyze Student Growth and Teacher Preparation**

For this example, we look at data that link students to teachers and data that link teachers to their educator preparation programs. Several factors make this example a good fit. It reaches across domains (K12, PS, and Assessments) and involves data from multiple source systems. It also involves some interesting transformations of data between the schemas of source systems—the CEDS IDS as a reference P-20W normalized operational data model, and an example de-normalized star schema.

Further, it involves the high-profile data domains of enrollment and assessment results.

This example uses student growth rather than achievement, recognizing that there are multiple methods for measuring student growth. In this example, we recognize that there is a step of calculating growth from assessment data, but we will not get into the details of any specific method. The target data model is designed to receive those metrics using one or more methods.

It also is worth noting that student growth based on assessment data is just one of multiple measures when using the teacher-student data link to answer questions about the effectiveness of educator preparation programs. Other measures of teacher effectiveness—such as classroom observations and student surveys—and other measures of program effectiveness are needed.

We start with an example source system that links teachers to students as course-section enrollment records. The following illustration shows how the teachers and students might be linked through a Course Section in a student information system. Note that this is a fictitious view of data as they might be structured in a student information system; it is not part of the CEDS DES or IDS models.



A “Student Class Membership” record captures a student’s enrollment in a class (Course Section) with details such as Start Date and End Date. Similarly, a “Staff Class Assignment” record captures a teacher’s association with the class, including Start and End dates, the teacher’s Role, and a Teacher of Record Indicator.

Note that this example does not cover all the issues that need to be addressed when implementing the use of teacher-student data links. Key success factors—such as teacher-of-record policies, data governance policies, source system readiness, roster verification, and scheduling processes—must be considered. For more information, refer to the National Forum on Education Statistics’ *Forum Guide to the Teacher-Student Data Link: A Technical Implementation Resource*, available at [http://nces.ed.gov/forum/pub\\_2013802.asp](http://nces.ed.gov/forum/pub_2013802.asp).

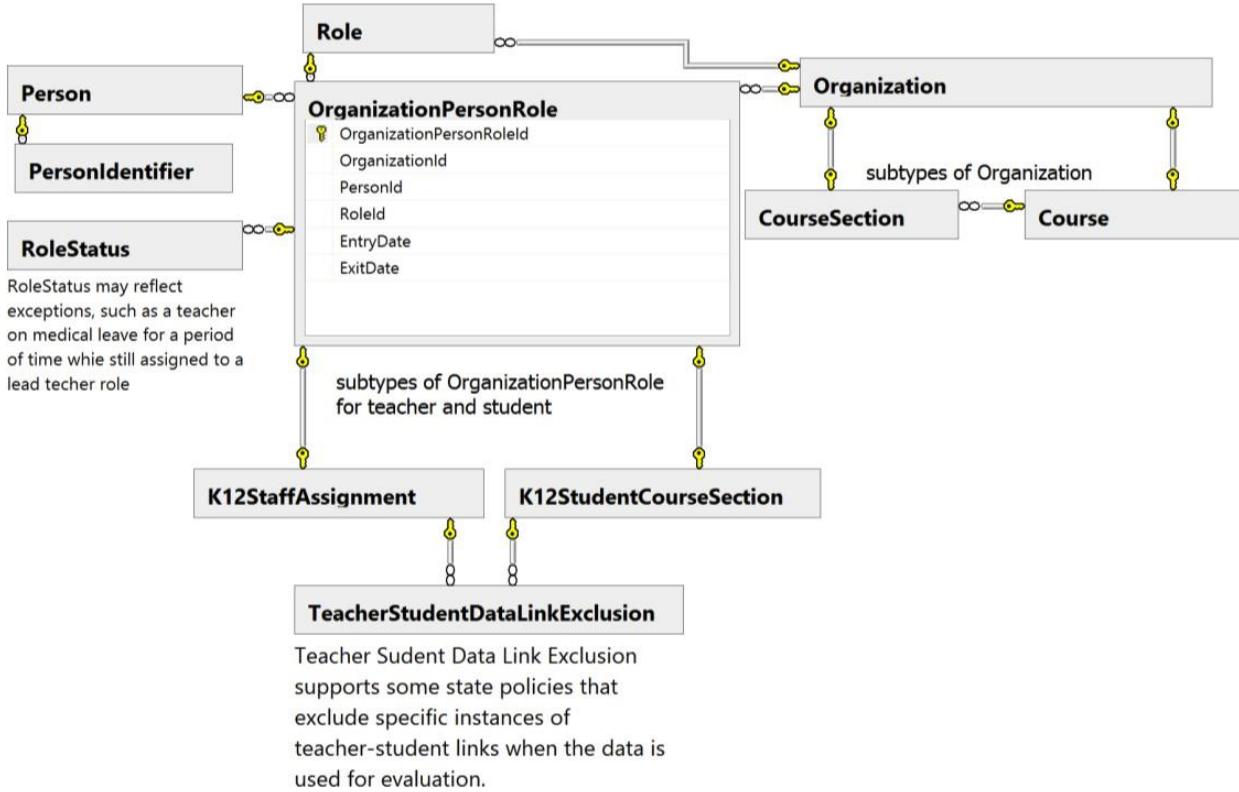
### From Source System to Operational Data Store

A P-20W implementation must transform the data from the source system into a data schema such as the CEDS IDS. Both systems may use elements defined by the CEDS standards, but the structure of the data is different.

A key difference is that the source system defines “student” and “employee” as separate entities, whereas the IDS model takes a P-20W approach so that a “person” may have the role of a PS Student while enrolled in a teacher preparation or professional development program. The same “person” takes on the role of a teacher when assigned to a K12 Course Section. The IDS model also normalizes K12CourseSection as a subclass of Organization.

### **NOTE: The diagrams used in case study show an older version of the CEDS IDS.**

The following illustration shows how the CEDS IDS is organized by person-organization-role. It shows the section of the data model pertaining to the teacher-student data link.



In this model, each person associated with the course section is represented as a record in OrganizationPersonRole. If the person is a teacher, teacher's aide, or paraprofessional, the model uses K12StaffAssignment to capture the information required for that type of association. If the person is a student, the model uses K12StudentCourseSection to capture the information required for the student's association with the course section. (In Postsecondary, there is a PSStudentSection table that serves the same purpose as K12StudentCourseSection to extend the properties of OrganizationPersonRole used for students enrolling in a postsecondary course section. A dual enrollment class may be represented by records in OrganizationPersonRole + K12StudentCourseSection + PSStudentSection all linked to the same OrganizationPersonRole record.)

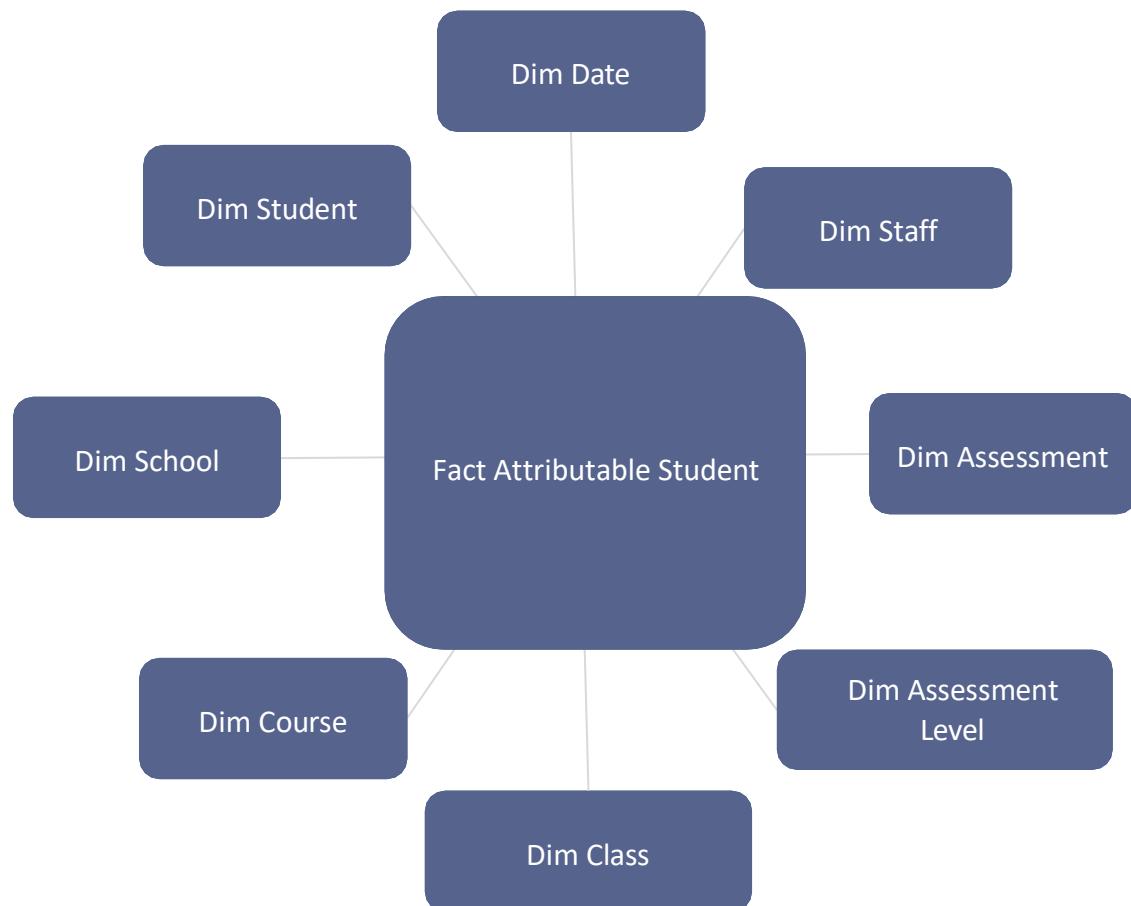
The OrganizationPersonRole table includes the ExitDate and EntryDate fields that apply to the student enrollment or staff assignment to the course section. This allows for the capture of the specific “dosage” information often required for teacher-student data link analysis. For example, a teacher who goes on medical leave, is replaced temporarily, and then returns later in the year may have two records in OrganizationPersonRole for the course section, one with EntryDate=2019-09-01 and ExitDate=2019-10-15, and another with EntryDate=2020-02-03 and ExitDate=2020-06-17. (RoleStatus also may be used to capture changes in the person's association with the course section over time.)

To transform the data from the K12 source system to the P-20W integration data store, these actions must be taken:

1. Personal information about the student and staff (teacher) must be transformed into the Person tables of the IDS.
2. Information about the course section and corresponding course must be transformed into Organization, CourseSection, and Course.
3. Information about course section enrollment for the student and teacher's assignments must be transformed into the model that uses the common OrganizationPersonRole.

### **Moving to the Data Warehouse**

A best practice for the reporting structure is a “star schema” data structure, with Fact tables representing numeric measures (for example, student growth) and with conformed Dimension tables containing attributes by which the fact data are filtered, sorted, and labeled (for example, school name, teacher identifier, and course-section identifier). The following diagram shows an example of a “star schema” data model that might be used in a dimensional data warehouse.

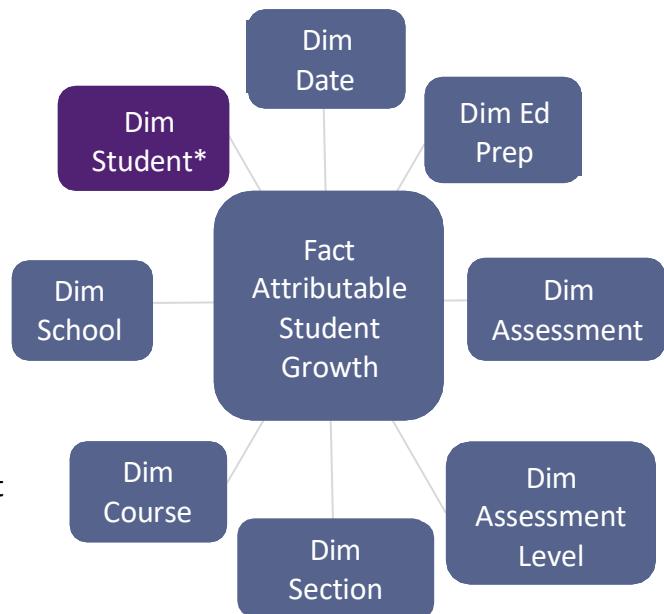


Like the transformation from the K12 student information system to the P-20W integration data store, a transformation from the normalized data store to the de-normalized star schema in the data warehouse is needed due to the differences in structure. Moreover, like the previous transformation, both schemas may use CEDS standard element definitions.

This example star schema, like the source system, is organized by a person's role (student, staff) in the context of a course section (for example, the student enrolled in a course and the staff member assigned to a section of a course). (The figure assumes that one growth or value-add methodology is used, but adding a "Dim Growth Model" table could allow for growth to be calculated in multiple ways and compared, as long as the system is configured and/or users are trained to avoid invalid comparisons.)

Note that the star schema is an effective model for analytics within a relational database management system due to its usability, scalability, and performance. The performance is gained due to the reduced number of join operations that the relational database management systems must execute, and because the Dimension tables are kept "shallow" but "wide," while the Fact tables are "deep" but "narrow." Fact tables may contain millions or billions of rows (deep), but they contain only numeric measures and keys (narrow). Dimension tables contain fewer rows (shallow), but they have a rich set of descriptive labels (wide). Non-relational database technologies accomplish performance gains for analytics using other methods.

In the above example, we can attribute student growth to a teacher, to a course section taught by one or more teachers, to a course, or to a school. What if instead we want to look for trends in student growth based on the educator preparation program from which a teacher received training? The primary teacher prep program could be an attribute of the Staff dimension, but another approach is the use of postsecondary data. This is possible because CEDS crosses P-20W data domains.



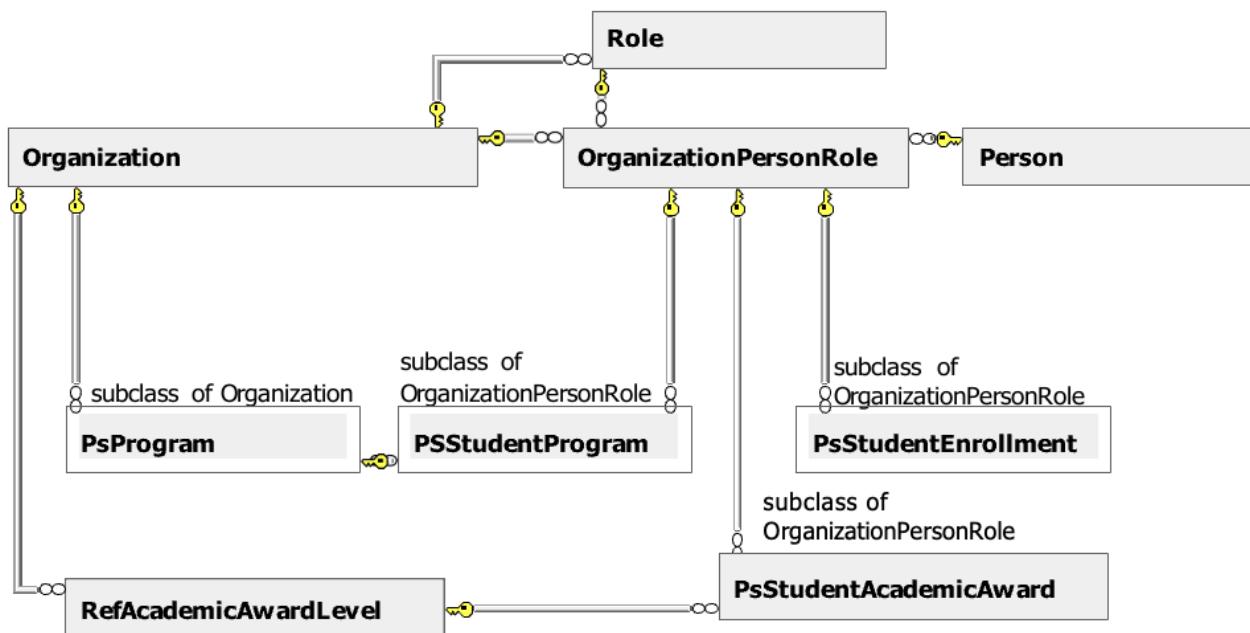
\* A best practice for data warehouse design is to use the most atomic level of data available. In this case, the grain is a record in the Fact table for every student growth metric that can be associated with a course section. The end user of the system may not have the option of seeing student-level results, but

the student-level detail needs to be in the Fact table to support the flexibility of rolling up the data along the other dimensions

Since a teacher may have multiple degrees from multiple institutions, all being a part of his or her teacher preparation experience, we could redesign the star schema with a Dim Educator Prep Program.

Note that this would get more complicated if we wanted to optimize the analysis of questions that involve the timing or level of participation, versus the completion of the program, for each educator at each prep program. For this example, however, we will limit the design to merely the educator prep program(s) completed by the teachers assigned to a particular course section.

To finish the example, we will show how CEDS elements that relate to postsecondary teacher preparation programs might be transformed from the CEDS IDS to the Dim Ed Prep Program table. The following illustration shows the CEDS IDS tables that might be needed to populate the Dim Ed Prep Program table.



The table below shows some of the information that might be needed to populate Dim Ed Prep Program and the source elements, as defined in the CEDS IDS.

Source Table	Source Column	Destination Column
<b>Organization (PsInstitution)</b>	Name	Institution Name
<b>OrganizationIdentifier (PsInstitution)</b>	Identifier (selected by RefOrganizationIdentificationSystemId)	IPEDS Identifier
<b>Organization (PsProgram)</b>	Name	Program Name
<b>PsProgram</b>	RefCIPCodeId (using Ref table to look up the code)	CIP Code
<b>PsStudentAcademicAward</b>	RefAcademicAwardLevelId	Academic Award Level
Source Table	Source Column	Destination Column
<b>Organization (PsInstitution)</b>	Name	InstitutionName
<b>OrganizationIdentifier (PsInstitution)</b>	Identifier (selected by RefOrganizationIdentificationSystemId)	IPEDSIdentifier
<b>Organization (PsProgram)</b>	Name	ProgramName
<b>PsProgram</b>	RefCIPCodeId (using Ref table to lookup the code)	CIPCode
<b>PsStudentAcademicAward</b>	RefAcademicAwardLevelId	AcademicAwardLevel

For this transformation, we first need the data that link the Person assigned as Teacher of Record for a Course Section to his or her educator prep program, and then we can get the data we need about the organizational attributes of the program and institution. The transformation rules may include filters

such as only populating the table when the Postsecondary Program is for specific CIPCodes (Classification of Instructional Program Code).

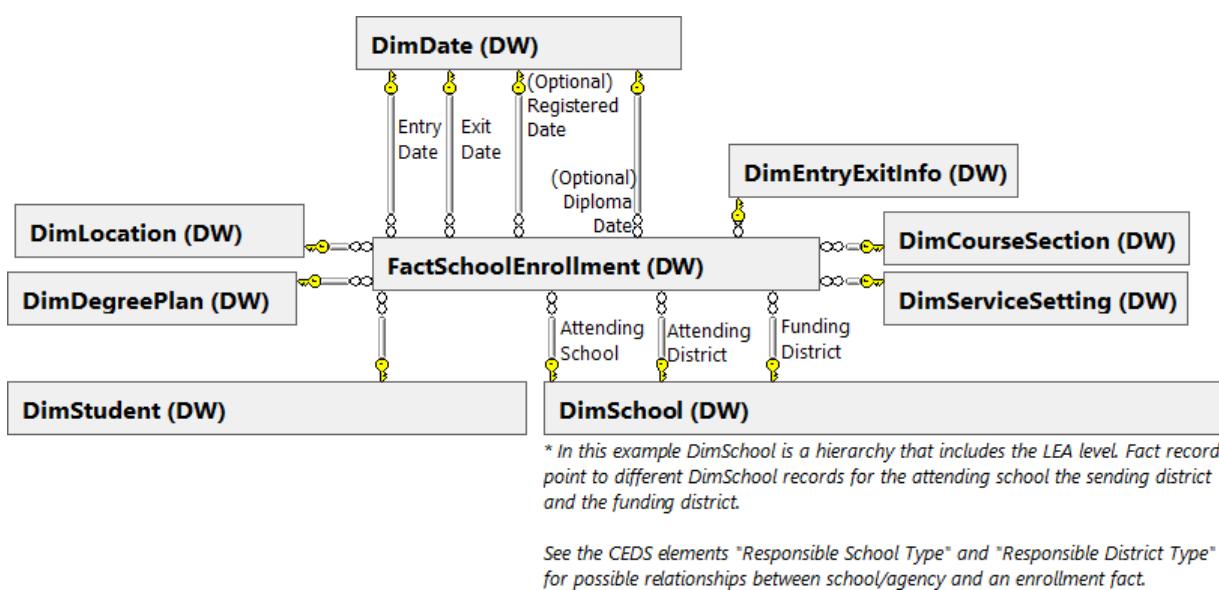
### Case Study #2: Data Warehouse Star Schema for Student Enrollment

In this example, we look at a star schema for ad hoc queries about student enrollments in a school or school district. The goals of the design are the flexibility and usability of the data for ad hoc queries, as well as optimized performance. Optimized performance refers to the database engine's ability to return results quickly, even if there are millions of enrollment facts.

The star schema accomplishes performance in part by simplifying the structure, requiring fewer table joins for each query, and making the Fact tables "narrow." Fact records are "narrow" in that they are limited to non-string measurement values (for example, numeric values that can be summed for aggregation of counts), and surrogate keys to the Dimension tables. The Dimension tables are "wide," containing the string values from which the user can choose for filtering and sorting.

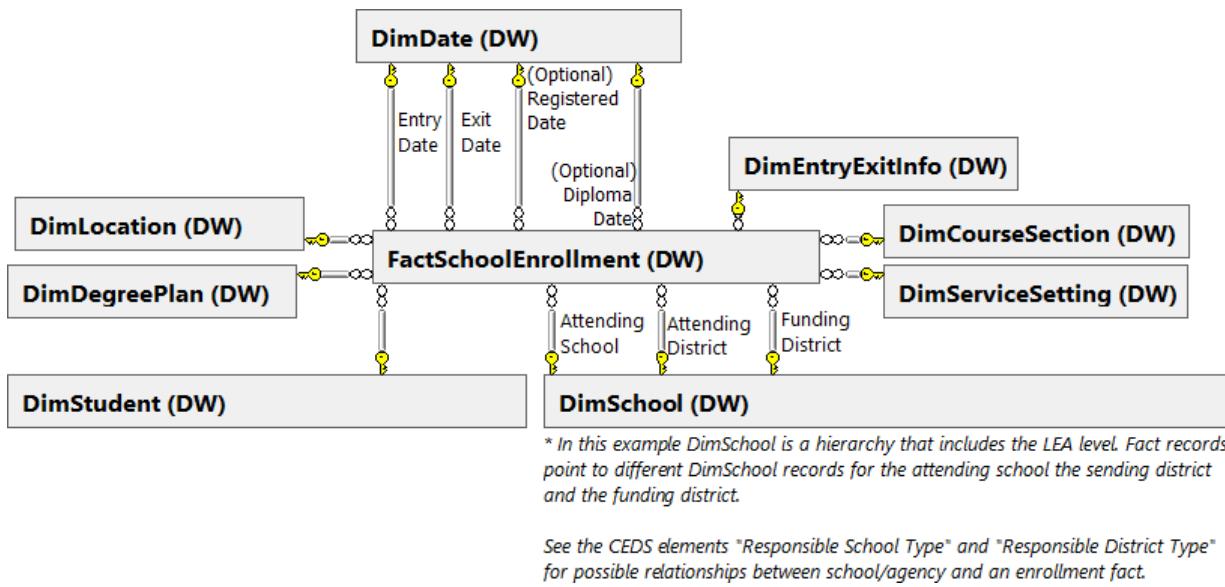
By designing the Fact table to store data at a granular level, the model maximizes flexibility for ad hoc queries; that is, the model is not designed for a limited number of predefined queries but can sort and select aggregations of the granular measurements based on the selection of any number of attributes from the related Dimension tables.

In the model shown below, the FactSchoolEnrollment table may contain a row for each student enrollment record in a state. This could be down to the Course Section enrollment level or to the School/Program level. Result sets perform aggregation operations on the facts, such as counting the number of students enrolled at any point in time within a school with certain characteristics.



DimSchool represents a hierarchy of local education agencies and schools, and/or the coordinating or governing board and institutions of higher education. The model allows for the selection of any organizational characteristic within DimSchool to be used to filter or sort a result set.

Here is another view of the Dimension tables (on the left), and an expanded view of the Fact table surrogate key columns (on the right).



This Fact table is “narrow,” containing columns of integer values as metrics (for example, “Number of ...” or “Percentage of ...”) or as surrogate keys to a row in a Dimension table. The metrics in the Fact table may correspond to CEDS Connections, whereas the attributes within the Dimension tables may be defined based on CEDS element definitions. For example, the table DimCourseSection may contain columns aligned to the following CEDS Course Section elements:

- Course Section Identifier
- Classroom Identifier
- Session Begin Date
- Session End Date
- Session Designator
- Session Type
- Class Beginning Time
- Class Ending Time
- Class Meeting Days
- Class Period
- Timetable Day Identifier
- Course Section Time Required for Completion
- Instruction Language
- Course Section Single Sex Class Status
- Receiving Location of Instruction
- Course Section Instructional Delivery Mode

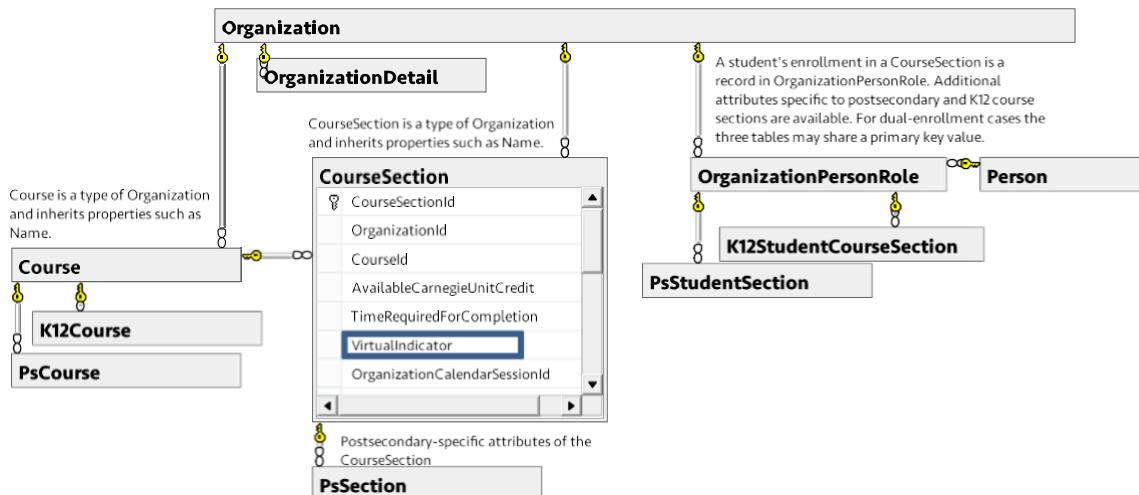
- Virtual Indicator
- Course Aligned with Standards
- Additional Credit Type
- Advanced Placement Course Code
- Blended Learning Model Type
- Career Cluster
- Course Applicable Education Level
- Course Certification Description
- Course Description
- Course Funding Program
- Course Identifier
- Course Interaction Mode
- Family and Consumer Sciences Course Indicator
- National Collegiate Athletic Association Eligibility
- Tuition Funded

The star schema data warehouse is just one kind of enterprise/web-scale architecture for reporting. There are emerging web-scale architectures, including those using “NoSQL” databases, that also may be aligned with CEDS at the element level.

### Case Study #3: Reporting Changes in Virtual Learning Over Time

In this example, we examine how a star schema similar to the one introduced in the previous use case may be used to report on changes in virtual learning over time. In this case study, we will examine the relevant source data integrated into the IDS and what it looks like in the data warehouse star schema.

The source data is integrated into the IDS in the following tables:

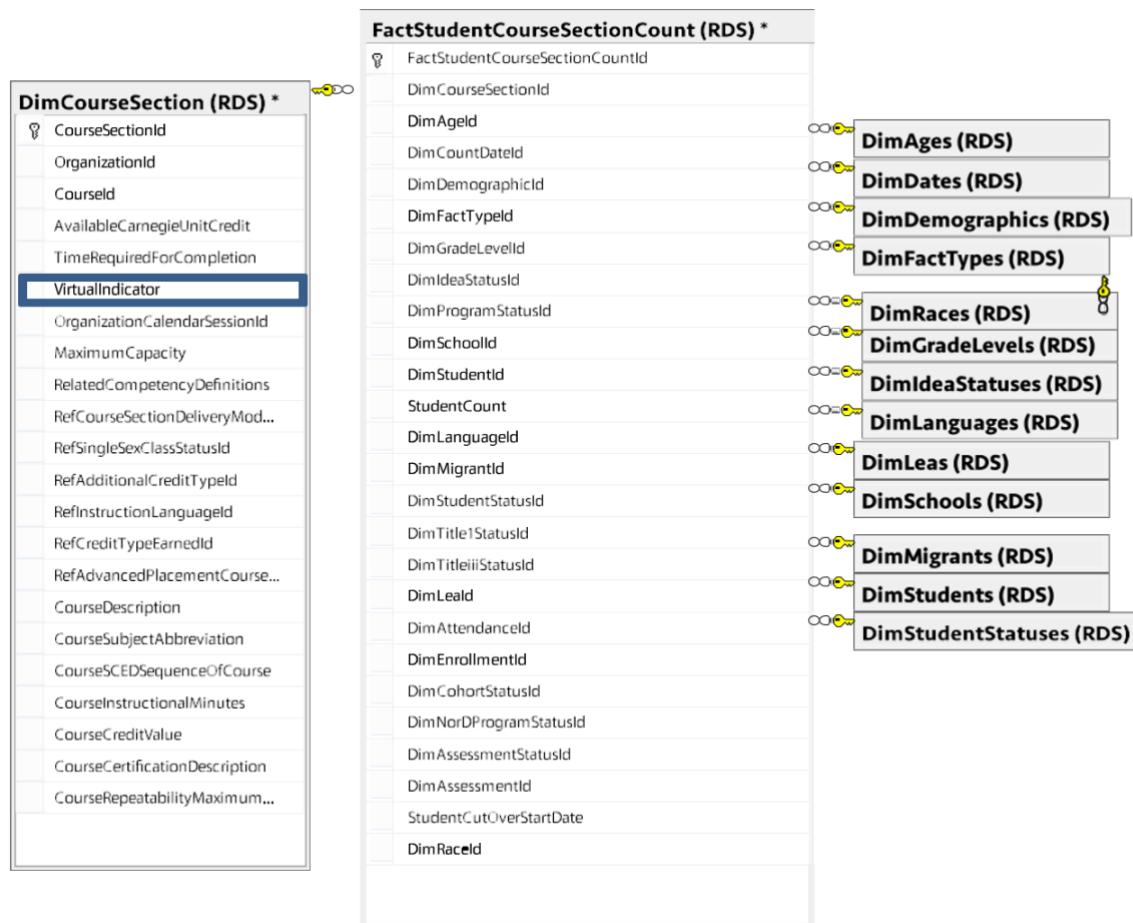


For reporting, the Course and Course Section data from seven tables may be transformed into a single DimCourseSection table in the data warehouse star schema.

Data from the OrganizationPersonRole table and related tables give us information about which students were enrolled in which course sections during which periods of time. This information is transformed into a fact for each student course section enrollment and dimensional data covering the characteristics of each enrollment.

The transformed data in the star schema shown below allows for efficient reporting even with very large datasets. For example, if we wanted to **know the percentage of courses taken remotely by K12 students in California over the past decade**, over 400 million course enrollment facts might be involved in generating that report.

Using the following data warehouse model, the facts in FactStudentCourseSectionCount could be counted for each session or school year where DimCourseSection:VirtualIndicator=TRUE and divided by the total count of course section enrollments (not filtering on VirtualIndicator).



For more information about data used to support and report on virtual learning, see the *Forum Guide to Elementary/Secondary Virtual Education Data*, available at  
<https://files.eric.ed.gov/fulltext/ED565838.pdf>.

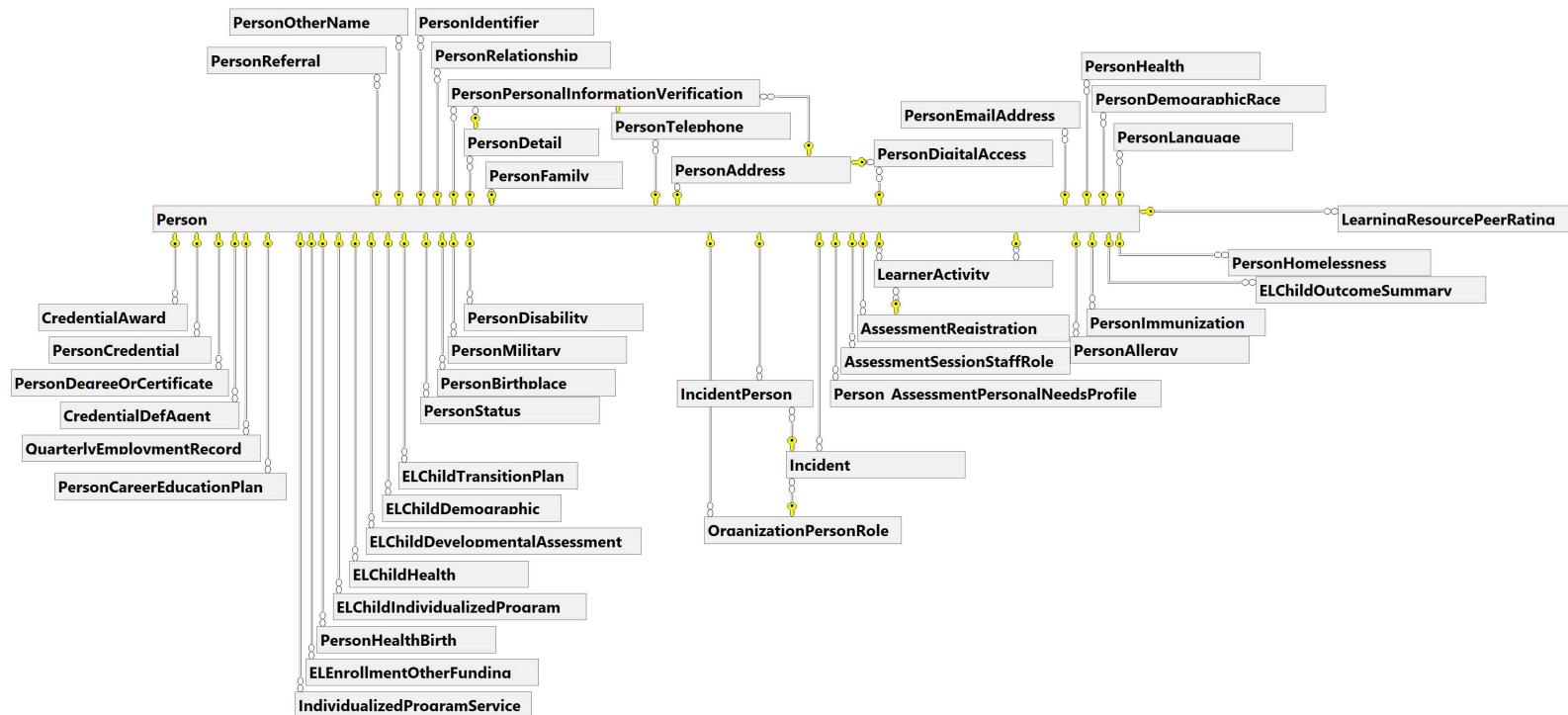
## Appendix A: IDS Entity Relationship Diagrams

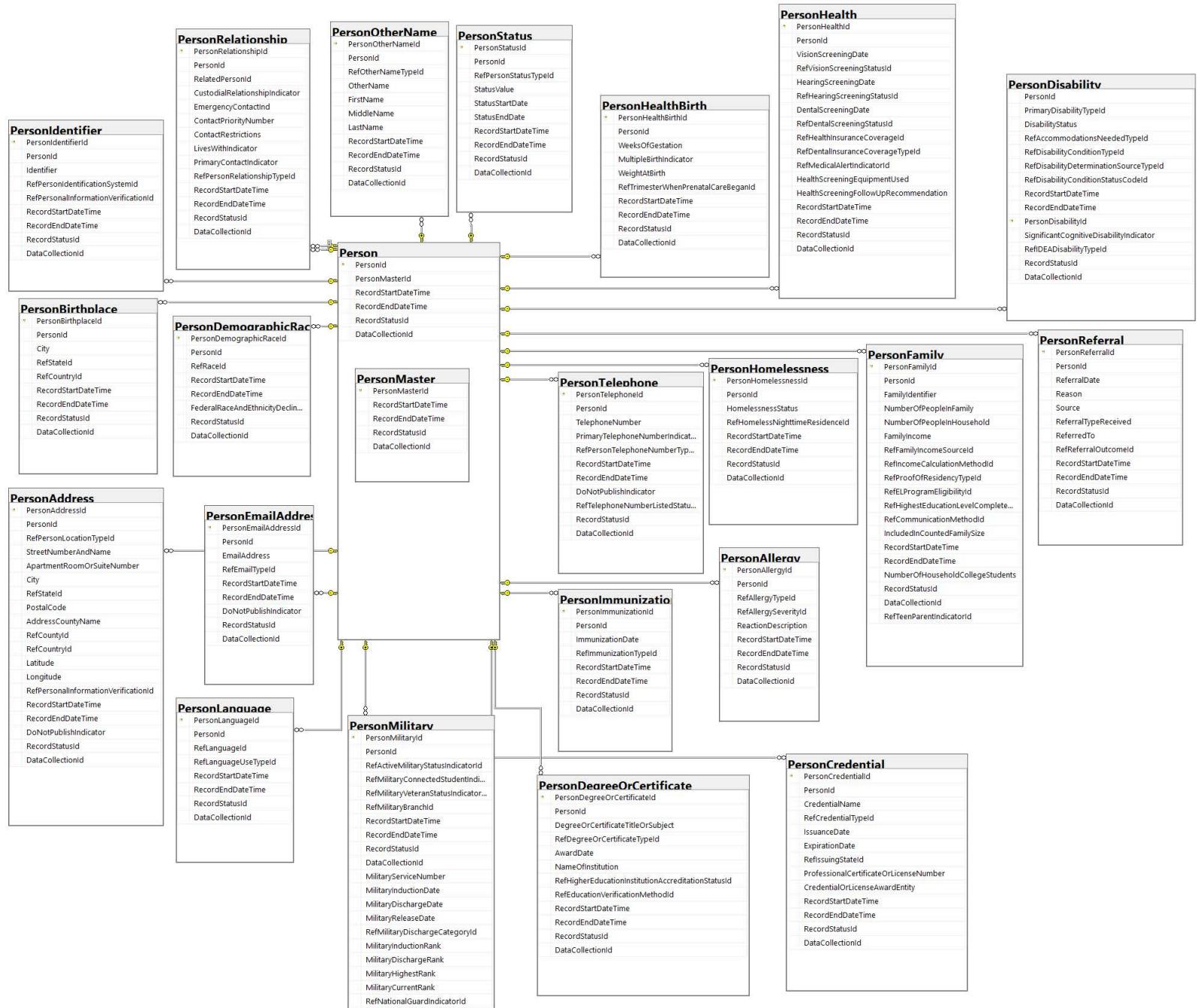
The following entity relationships diagrams (ERDs) provide visual representations of the CEDS Integrated Data Store (IDS) organized by the high-level common concepts of people, organizations, and roles/relationships between people and organizations, and by the Domains including Early Learning, K12, Postsecondary, Assessments, Competencies, and Credentials.

This document and the source files for creating instances of these database structures can be found on the CEDS Open Source Community GitHub: <https://github.com/CEDStandards/CEDS-IDS/>.

## Common: Person

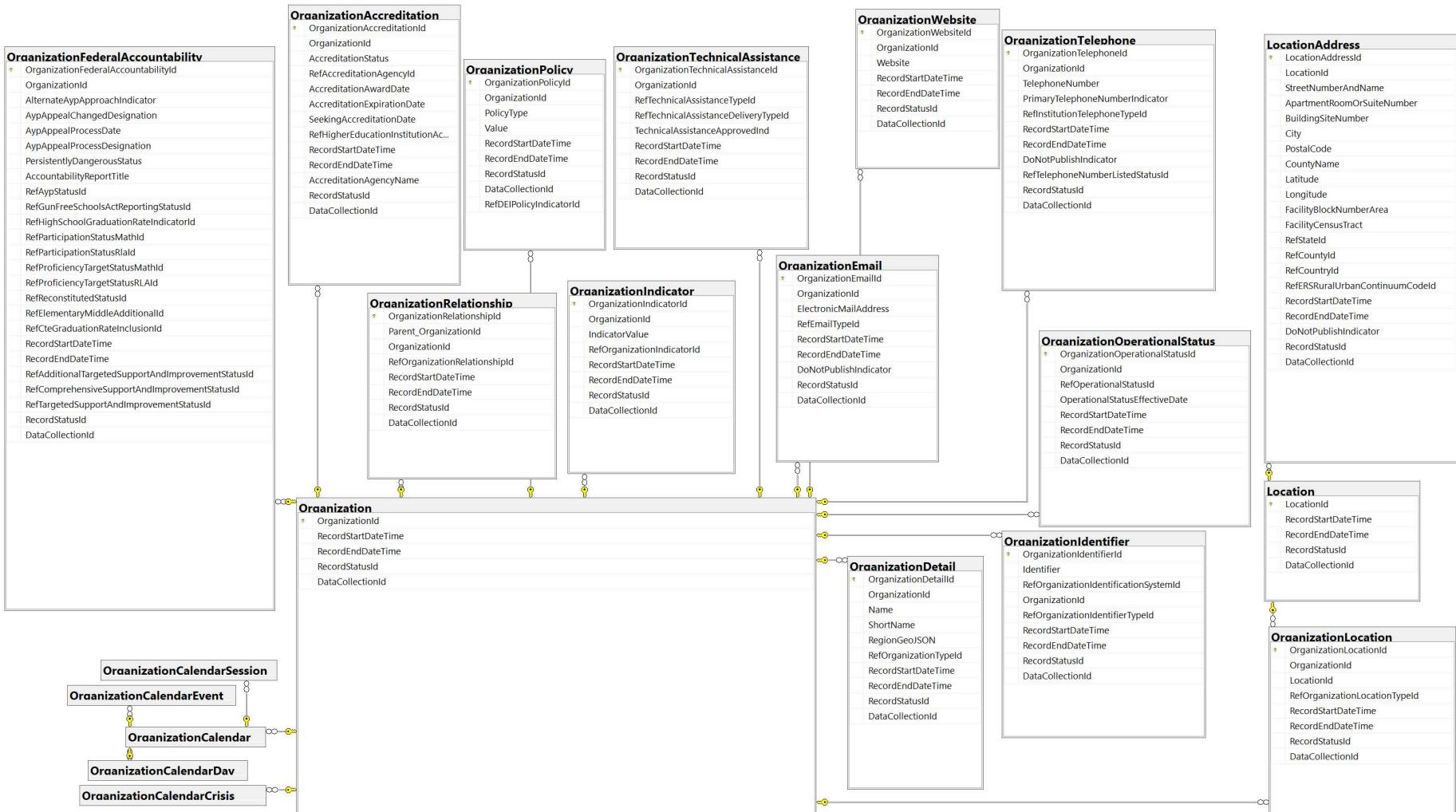
The first diagram shows all the tables related to the Person table in the IDS. The second diagram expands the Person table and some of the related tables to show some key properties/elements. Elements modeled here represent multiple use cases for locally used unit-level data. This model normalizes Person data apart from the person's connection to a Role with an Organization (for example, EL Child, K12 Student, PS Student, PS Staff, Parent, etc.). The applicable personal attributes will vary with age and participation; for example, information shown in the PersonHealthBirth table is used only to support early learning programs, and MilitaryVeteranStudentIndicator will apply only to adults. This is an exhaustive model and does not imply that these data should exist in any particular system. The PersonRelationship table supports information about Person-to-Person relationships, such as parent-to-child relationships. The PersonMaster table supports connecting multiple Person records (personas) when more than one version of information about a Person needs to be retained to satisfy different use requirements.





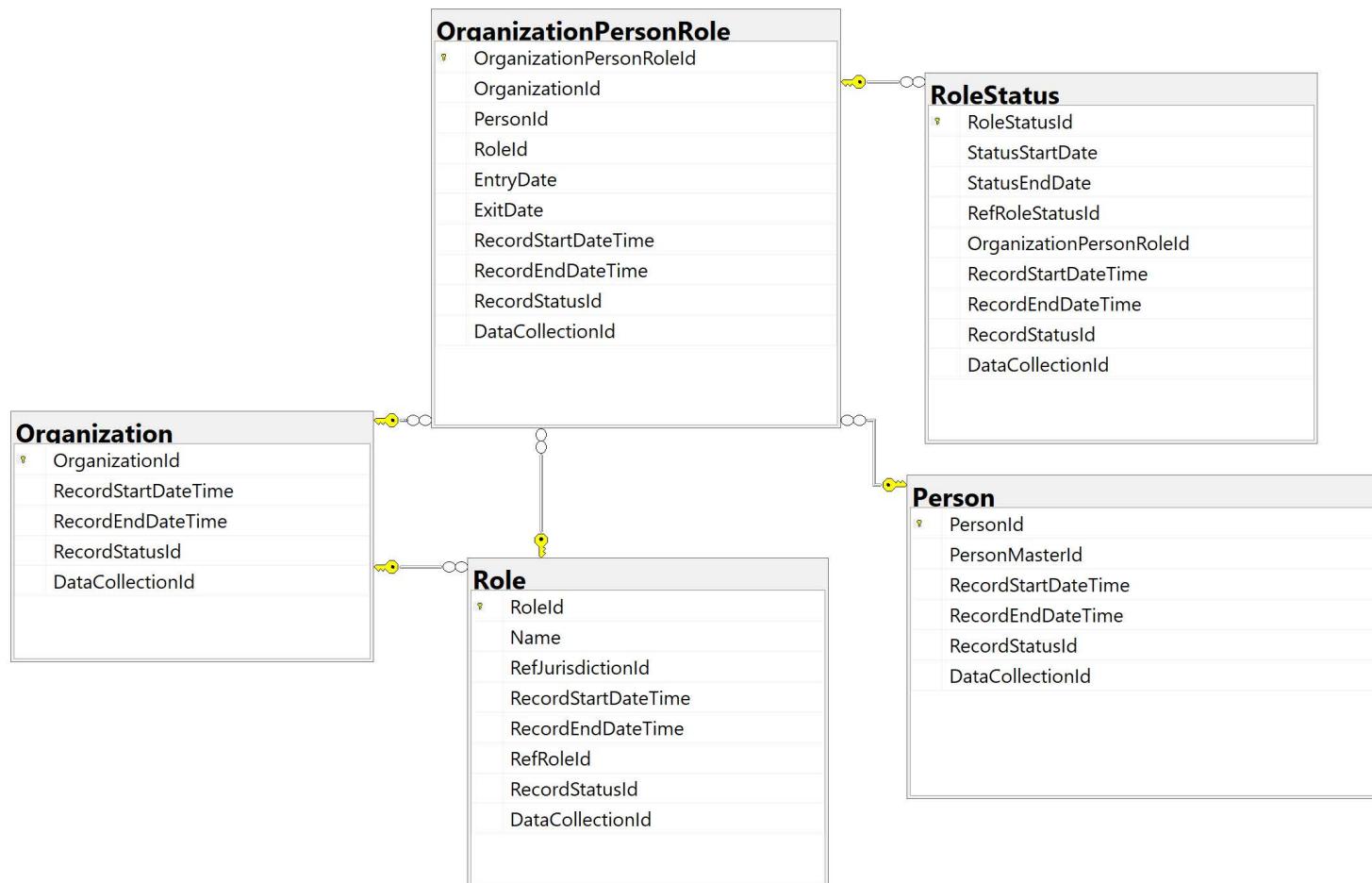
## Common: Organization

A recent change to the Organization model was to separate the OrganizationDetail (properties common to all types of organizations) because a separate table allows for tracking of longitudinal changes to the details (such as name) while preserving the OrganizationId over time.



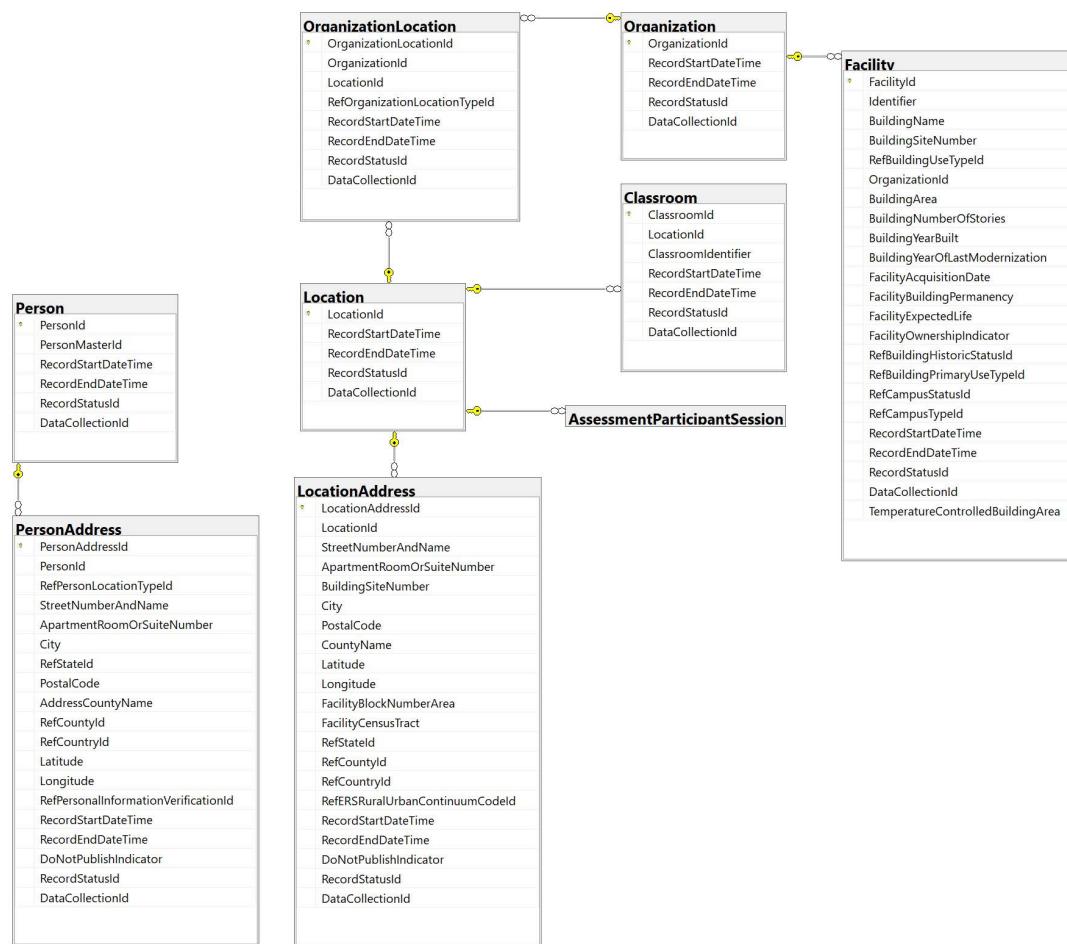
## Common: Role

The Role represents a Person's role within an Organization. Example roles include a child enrolled in an early learning program; a student enrolled in a school or course section; staff employment and assignment; and a person participating in a workforce program. RoleStatus supports cases such as when a student "applied" for enrollment in a Course Section, Program, or School/Institution, was "accepted," and then was "enrolled."

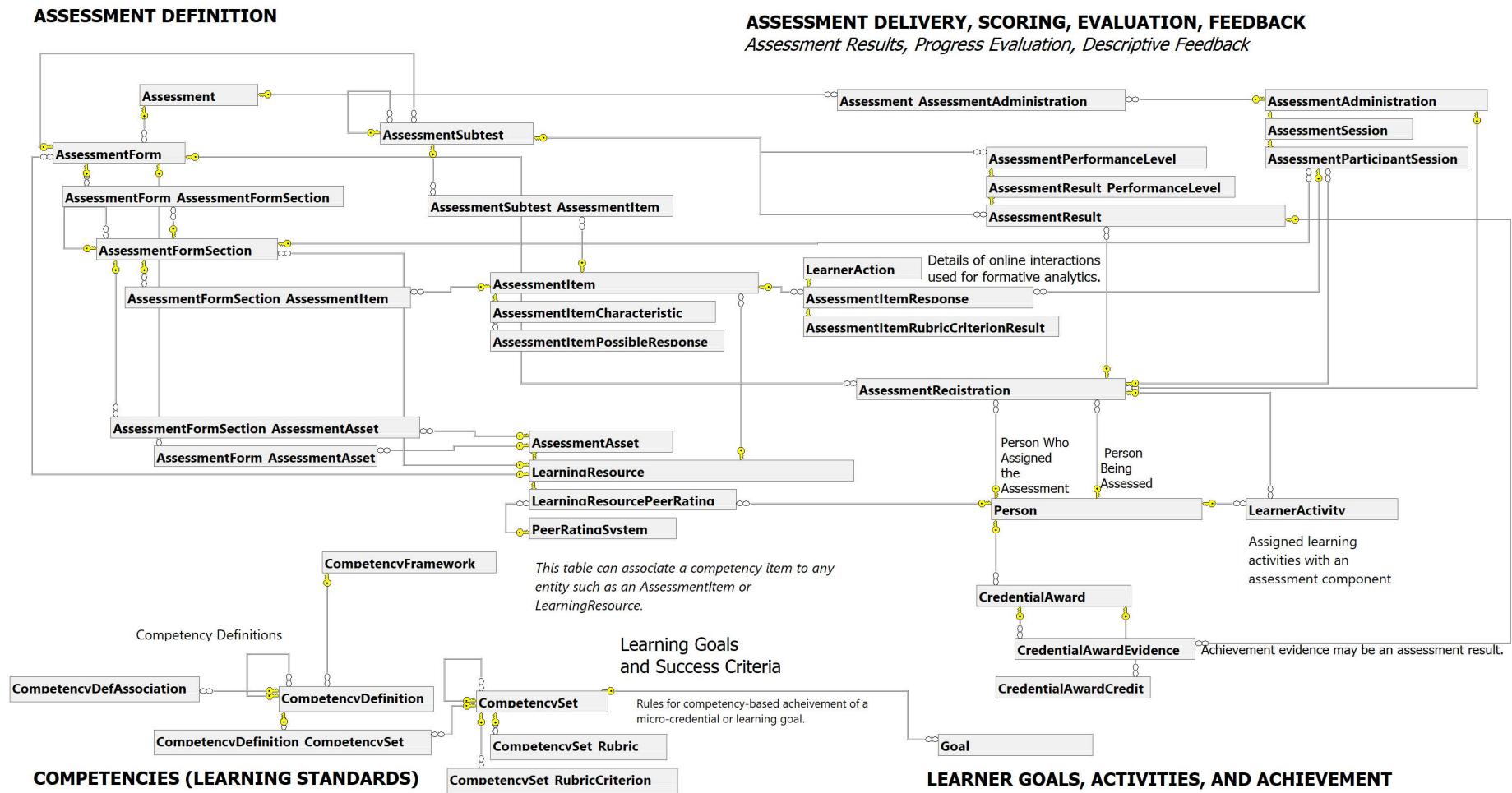


## Common: Location

A Facility is considered a type of Organization within the IDS, and every Facility has an associated Organization ID. Accordingly, the Facility table is connected to the Location table via the Organization table. Any entity categorized under Organization Type [element 001156] (<https://ceds.ed.gov/element/001156>) in the Data Model Guide is treated as an organization in the IDS and will have a unique Organization ID that links it to other tables, including Location.

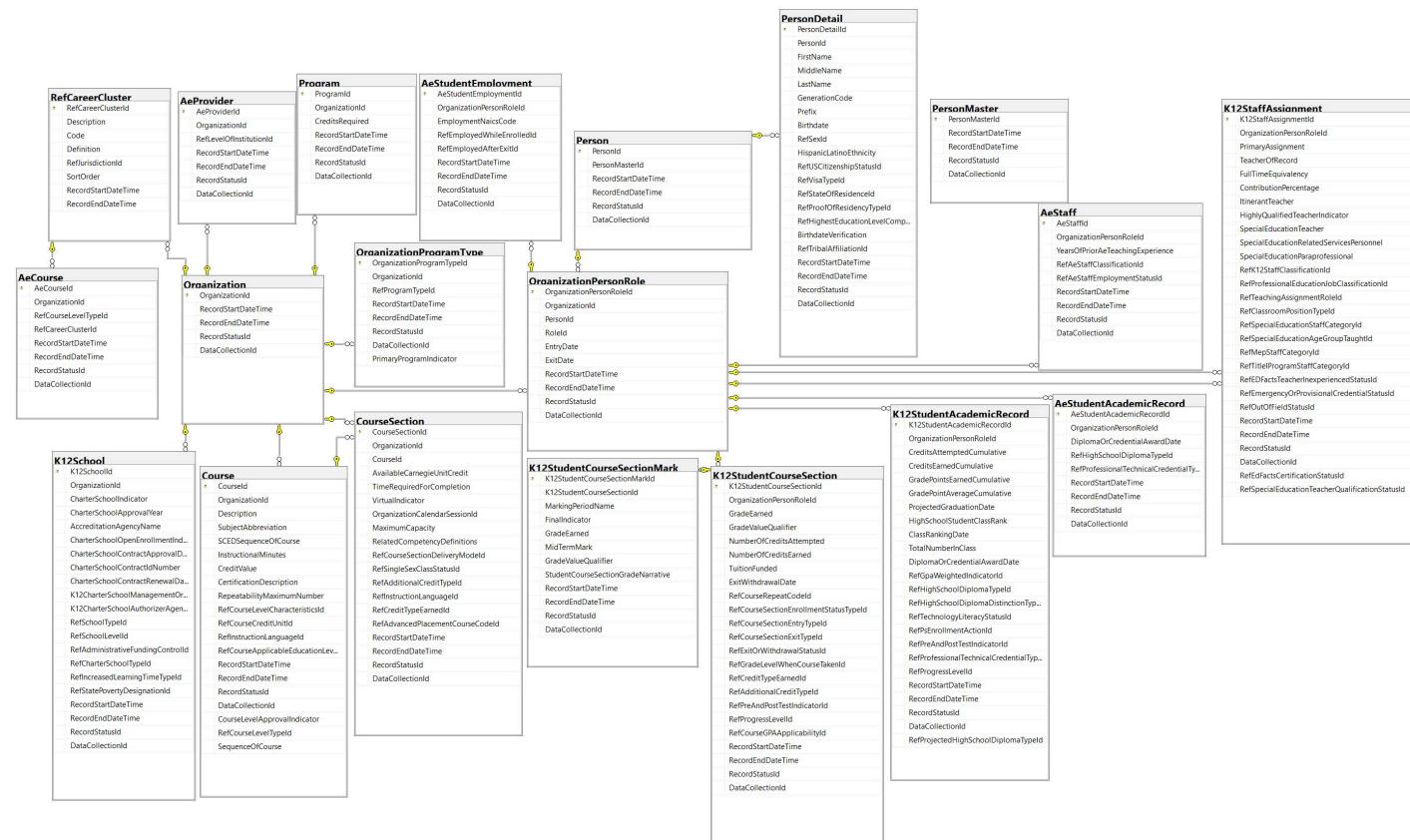


## Common: Formative Assessment and Adaptive Learning Model

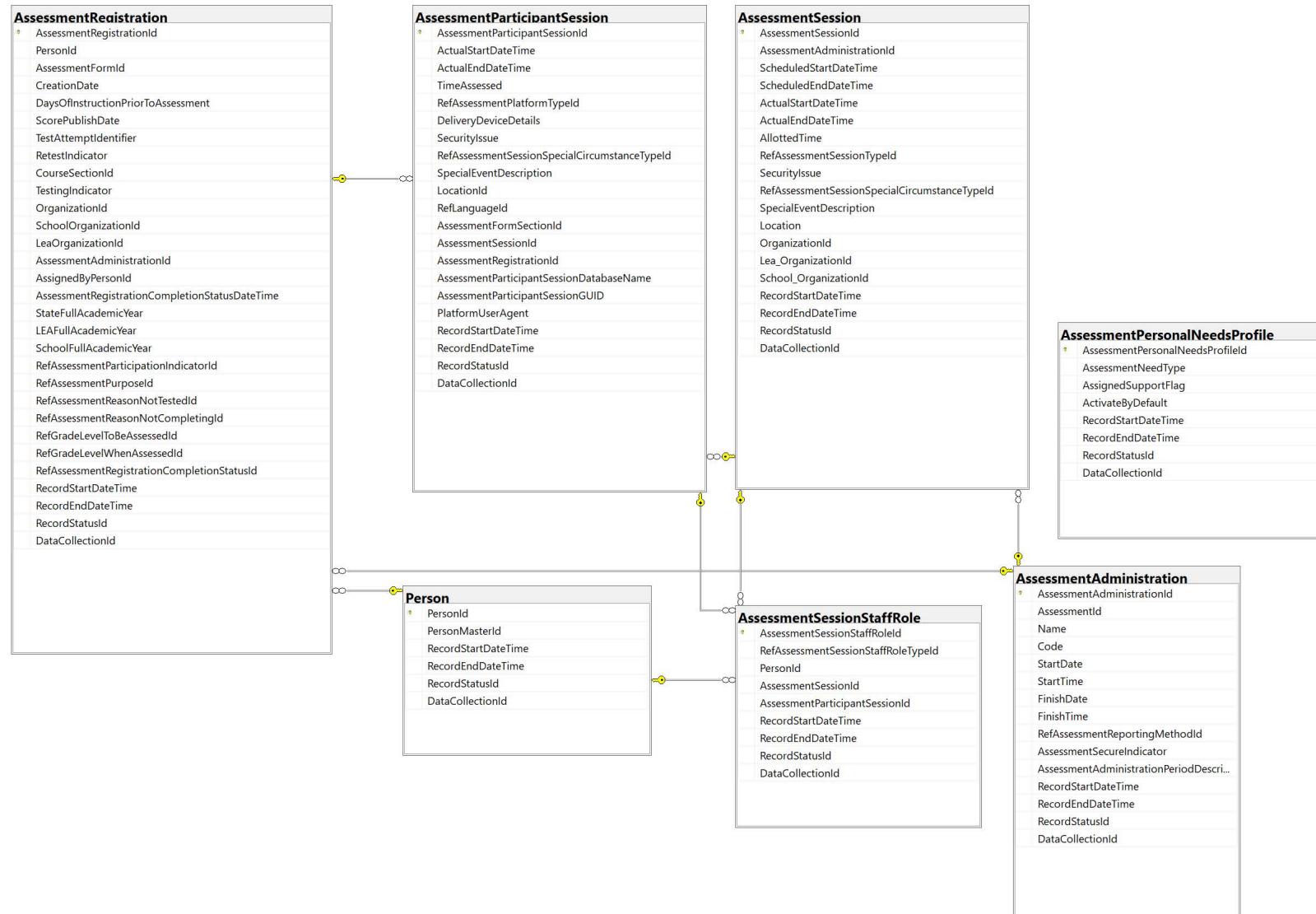


## Adult Education

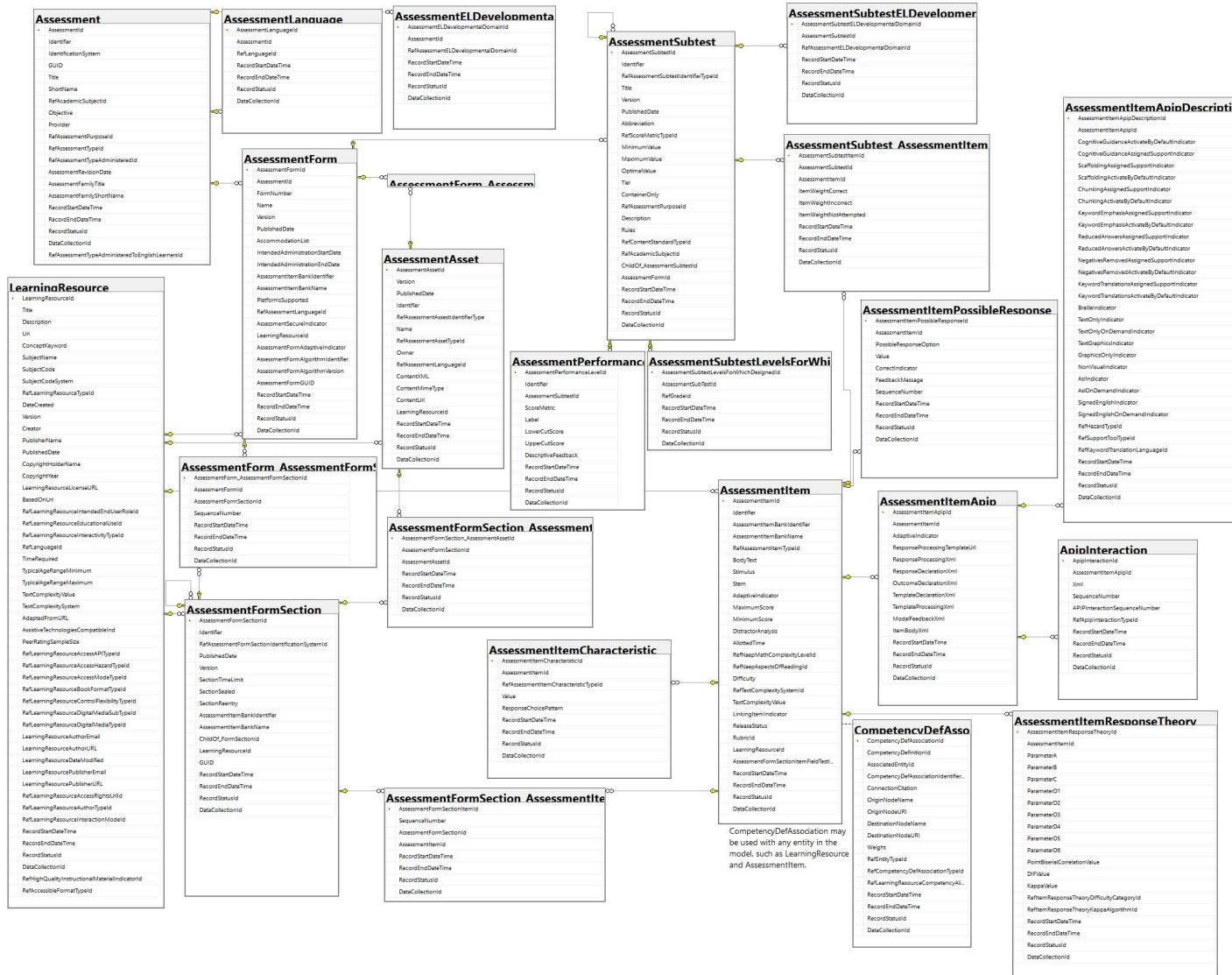
OrganizationPersonRole defines the relationship between the adult (Person) and the various adult-education-related programs, courses, or activities offered by Organizations. Depending on the context, subclasses of OrganizationPersonRole also may apply. For example, when the organization providing the AE course or program is a K12 LEA, the attributes in K12StaffAssignment may apply for the Person assigned to teach a course, and K12StudentCourseSection may apply for the student. In this model AeProvider, Program, AeCourse, K12School, Course, and Course Section are all subclasses of Organization meaning, for example, a Course inherits properties like Name from Organization and may have a relationship with OrganizationPersonRole.



## Assessment Delivery



## Assessment Design

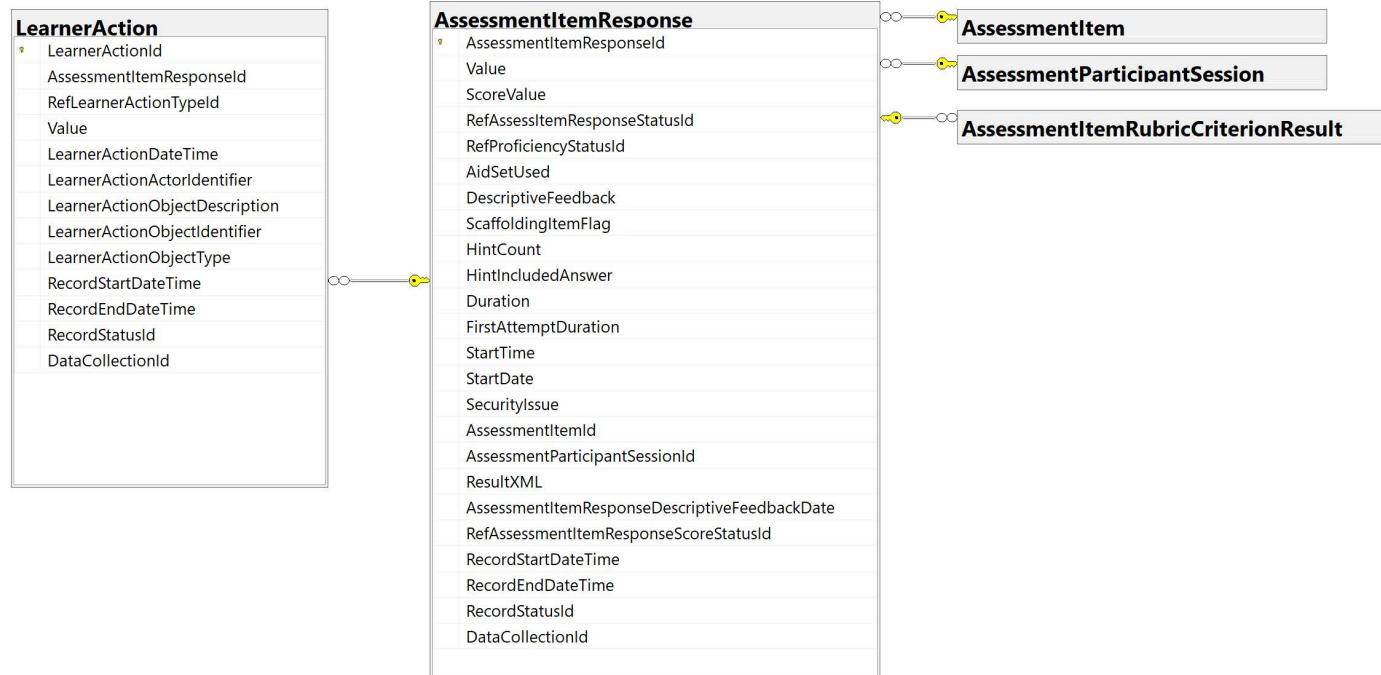


## Assessment Item Response and Learner Action

LearnerAction is designed to handle clickstream data for online assessments and other experiences such as is used by intelligent tutoring systems. The model is compatible with the structure of data found in Experience API (xAPI) specification. AssessmentItemResponse includes information about a learner response and subsequent information about feedback and scoring of the response. Some properties like DescriptiveFeedback are for support of a formative assessment process. Some properties are used within intelligent tutoring systems such as HintCount and ScaffoldingItemFlag.

LearnerAction is designed to handle clickstream data for online assessments and other experiences such as is used by intelligent tutoring systems. The model is compatible with the structure of data found in Experience API (xAPI) specification.

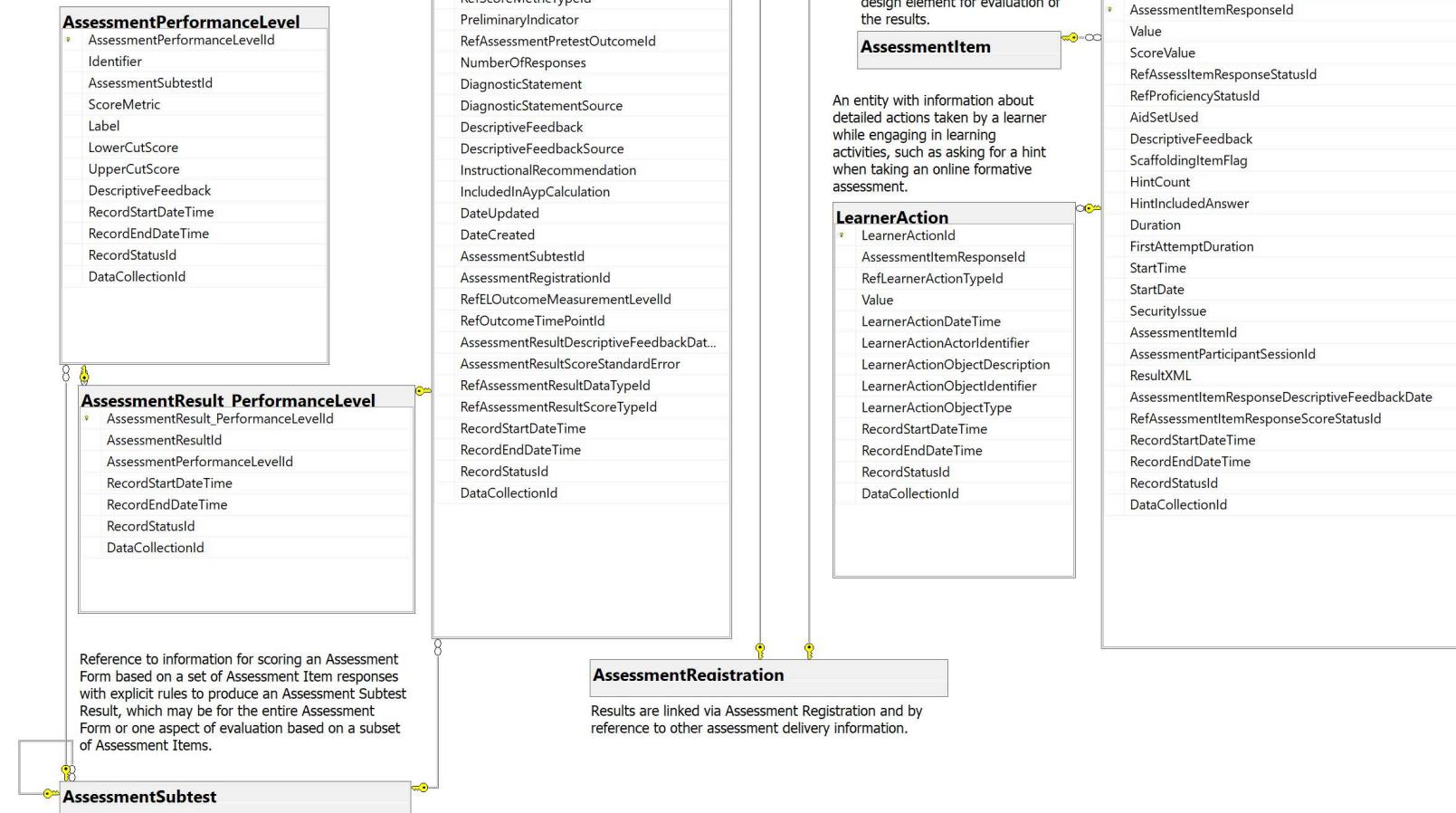
AssessmentItemResponse includes information about a learner response and subsequent information about feedback and scoring of the response. Some properties like DescriptiveFeedback are for support of a formative assessment process. Some properties are used within intelligent tutoring systems such as HintCount and ScaffoldingItemFlag.



## Assessment Results

Reference to information about the performance levels that may be assigned to an Assessment Subtest Result and specifications for selecting the performance level based on a score. Four styles are supported:

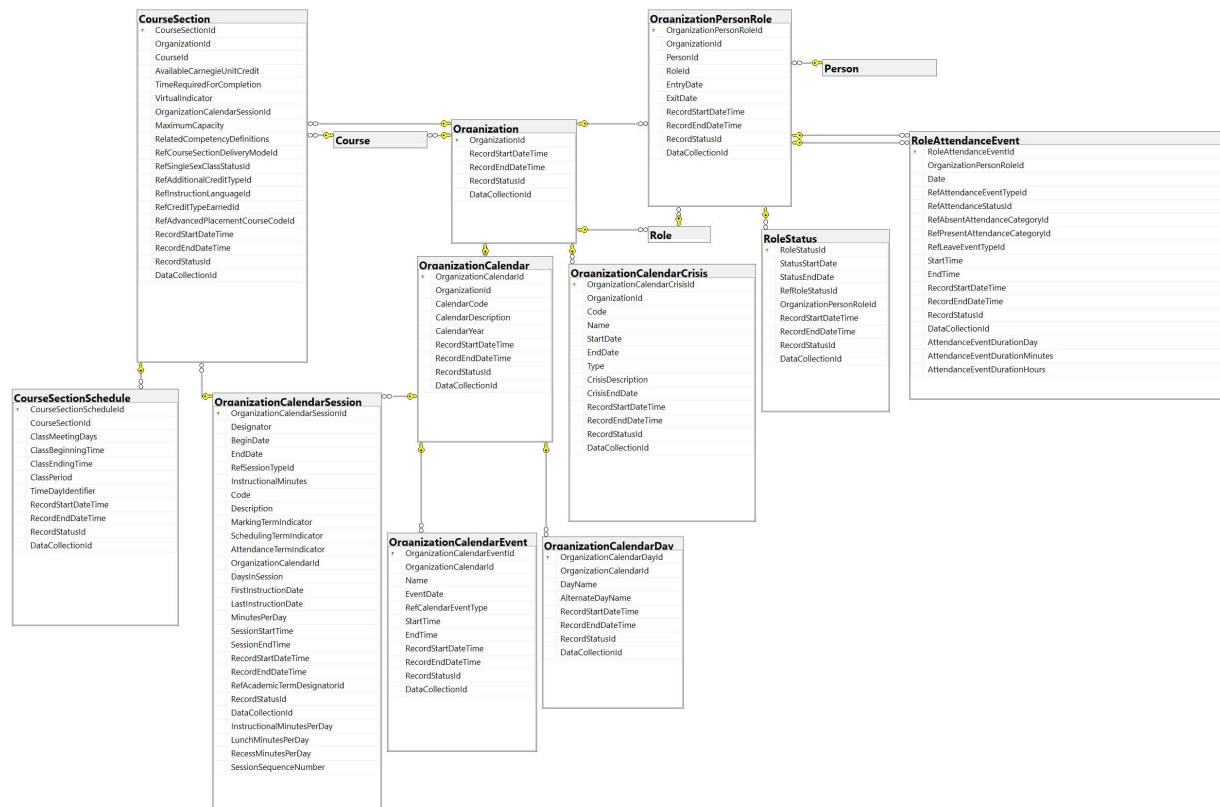
- 1) specification of performance level by lower and upper cut score,
- 2) specification of performance level by lower cut score only,
- 3) specification of performance level without any mapping to scores, and
- 4) Specification of performance level by mapping to other scores.



## Attendance (Course Section)

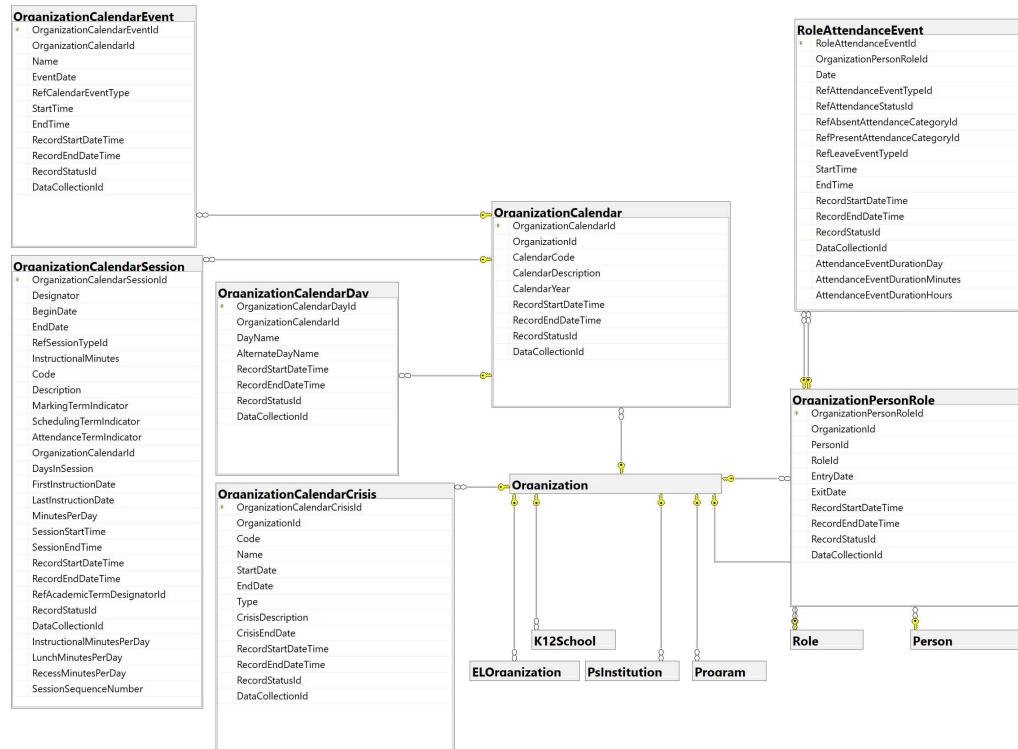
OrganizationPersonRole in this context may have a record for each period of time that each student is enrolled in a CourseSection and a separate record for each period of time an instructor is assigned to the CourseSection. CourseSectionSchedule contains the times and days that a class is scheduled to meet weekly. OrganizationCalendarSession provides the beginning and end date of the term.

OrganizationCalendarEvent provides the scheduled exceptions (holidays) and unscheduled exceptions (closings) to the general schedule. This data may be combined to determine the total time (and specific times) that the class meets. RoleAttendanceEvent captures student and teacher attendance on a specific date and may include start and end times. CourseSection includes a VirtualIndicator and CourseSectionDeliveryMode.

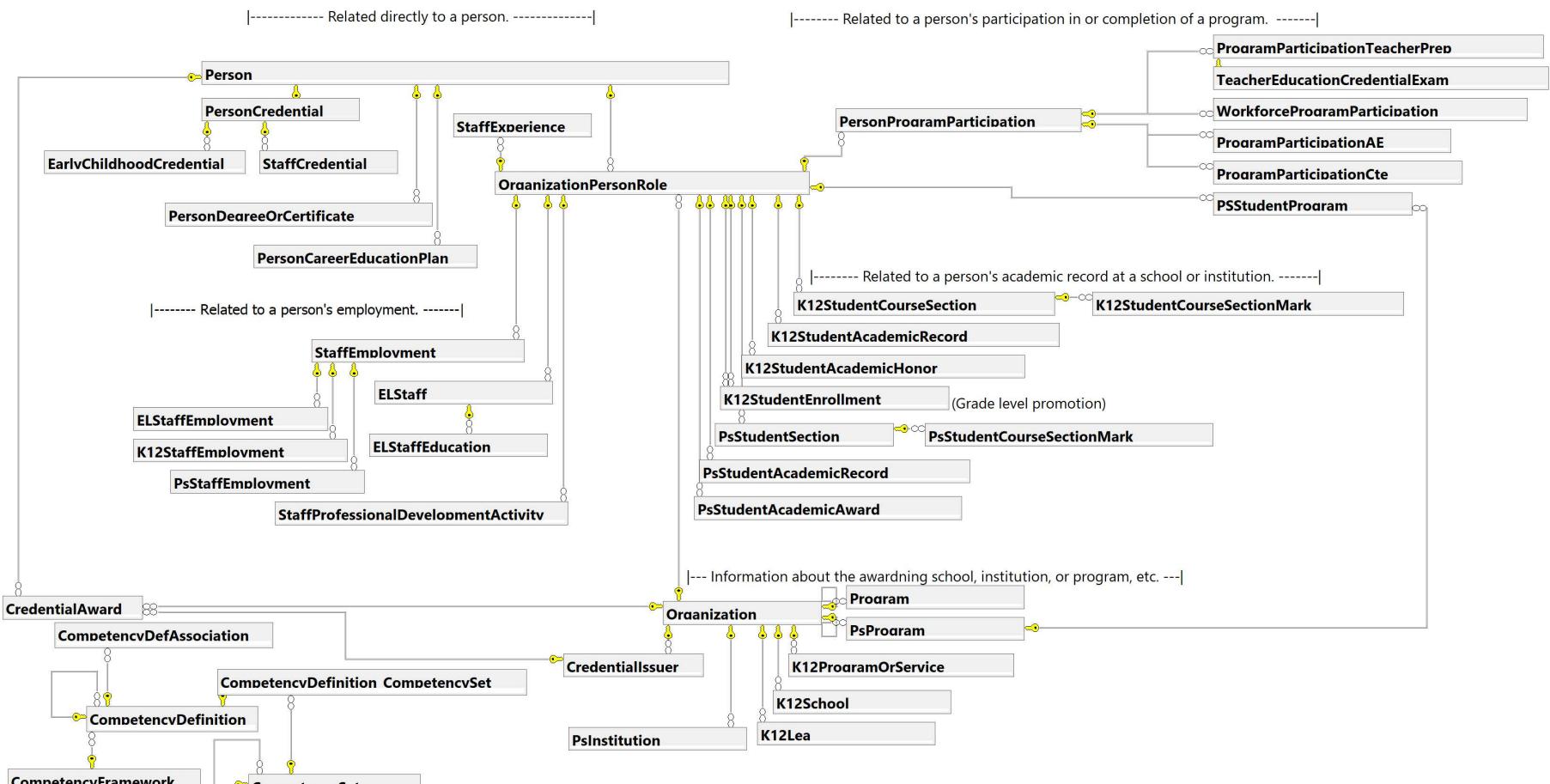


## Attendance (Daily)

OrganizationCalendarSession defines a period of time such as a semester or term. It specifies the beginning and end dates. It may be flagged as an "attendance term." It may include a value for DaysInSession, or the specific days applicable for attendance may be derived using OrganizationCalendarEvent. OrganizationCalendarEvent handles scheduled or unscheduled events such as holidays or closings on a specified date. OrganizationCalendarDay is for naming days within the regular schedule. OrganizationPersonRole here would be the student enrollment or staff employment/assignment record to which the daily attendance information applies. RoleAttendanceEvent captures information about student or staff attendance on a given date. Use it with data in OrganizationCalendar information to calculate attendance rate.



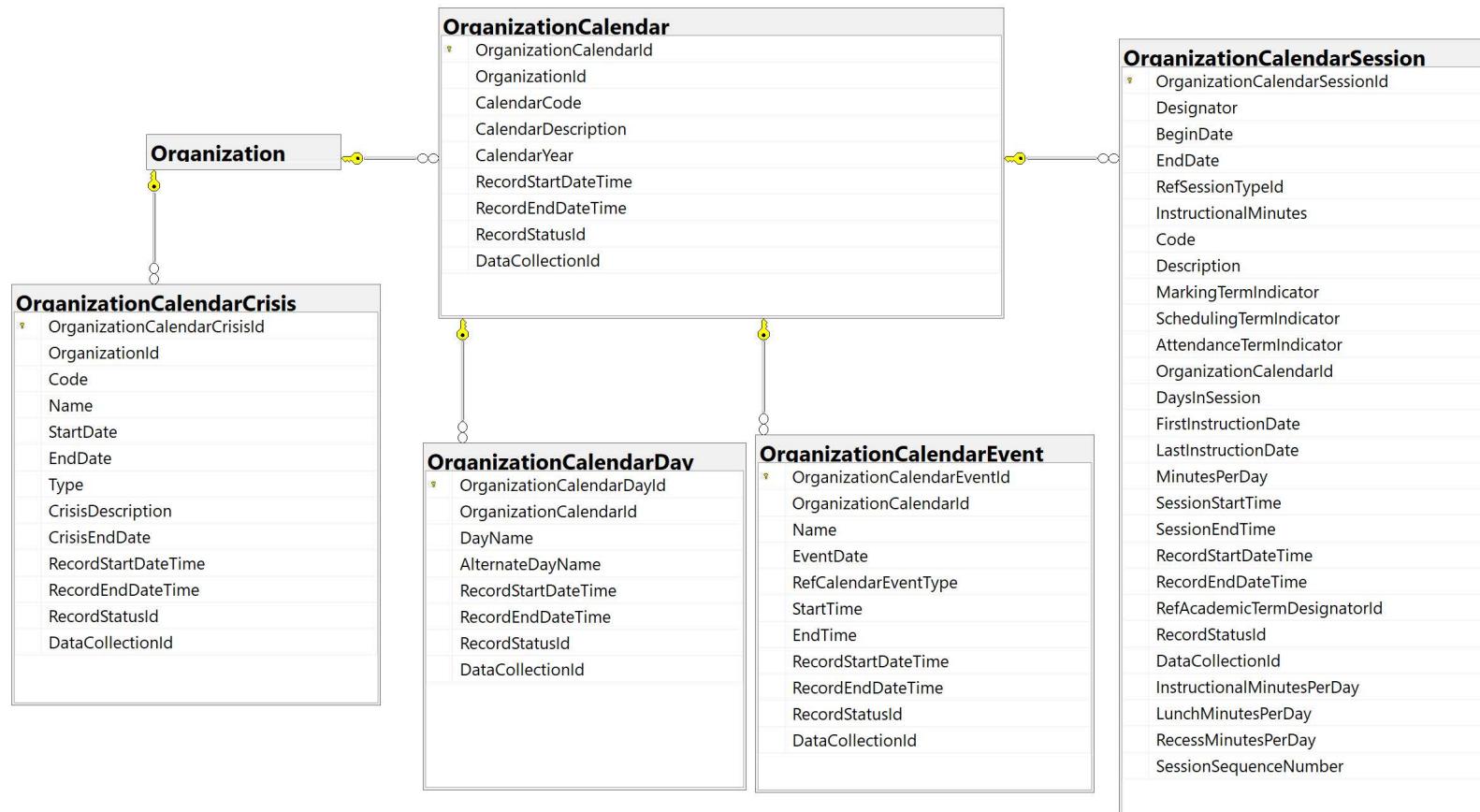
## Awards Honors Credentials Earned



(See also "Credentials")

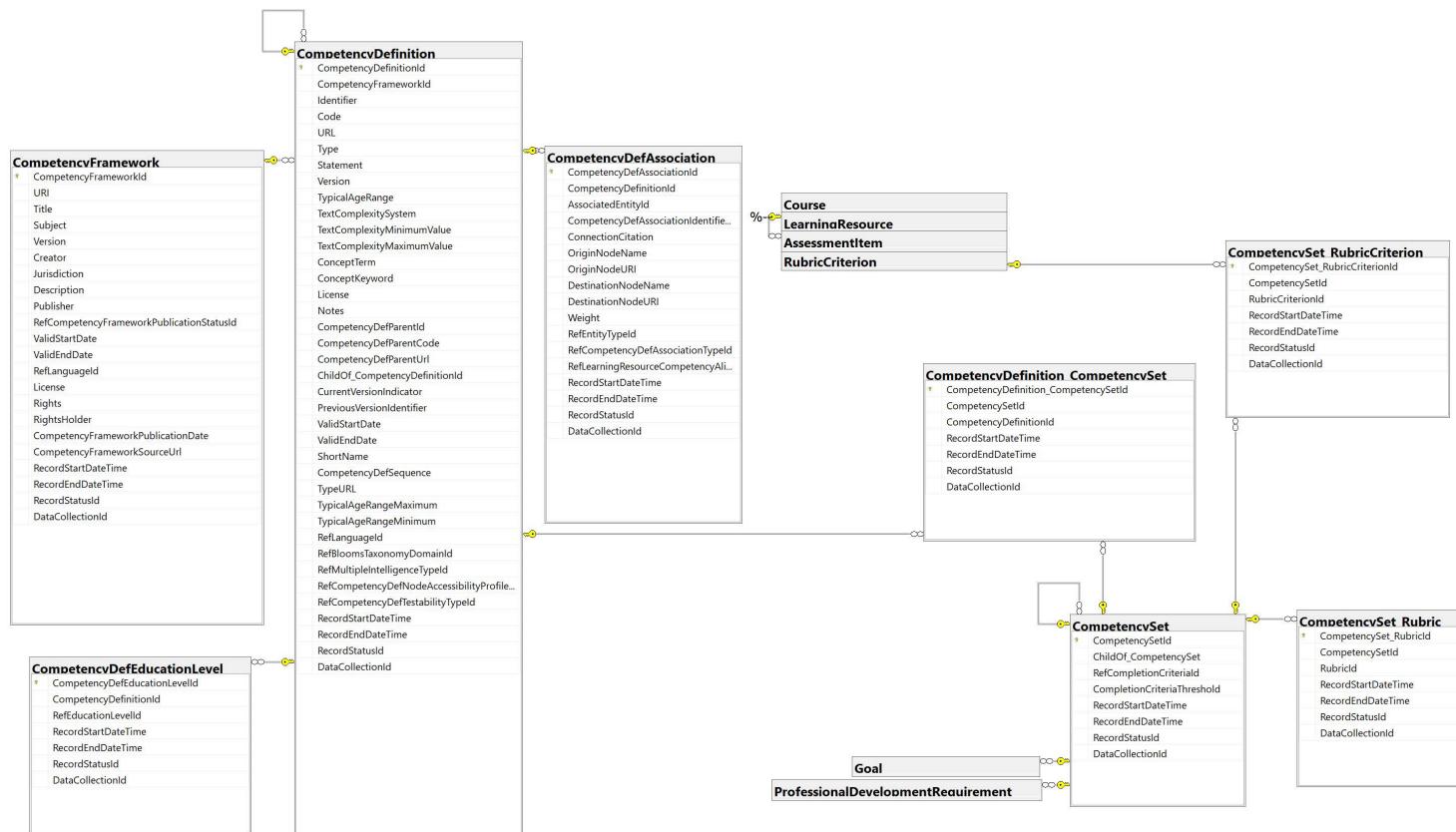
## Calendar (Organization Calendar)

OrganizationCalendar represents a calendar owned by an Organization. The details of the calendar are defined by OrganizationCalendarSession (a period of time such as a semester or attendance term), OrganizationCalendarEvent (a scheduled or unscheduled day within the calendar, such as a holiday), OrganizationCalendarDay (for naming days within the regular schedule), and OrganizationCalendarCrisis (to support unscheduled exceptions to a calendar that may span multiple days, such as a natural disaster that closes a school or displaces students).



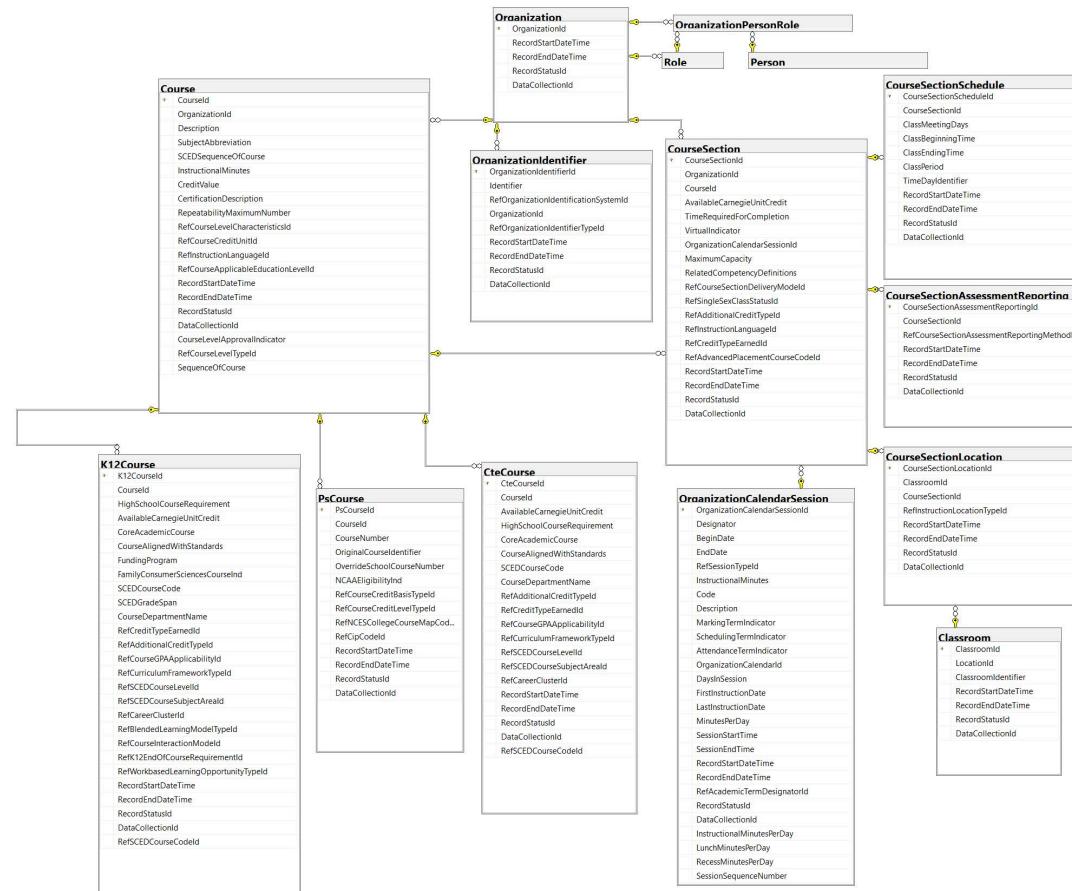
## Competency Definition and Competency Framework

Competency Definition is a resource that states a capability or behavior that an actor may learn or be able to do within a given context with references to potential levels of competence, a mastery threshold, and other contextualizing metadata. Actors may include persons, teams, and organizations. CompetencyFramework is a resource that identifies a collection of logically related Competency Definitions, Competency Associations, and contextualizing metadata. CompetencyDefAssociation is a resource association used to relate one CompetencyDefinition to another CompetencyDefinition or to any other resource within or without a CompetencyFramework including resources about a course, learning resource, assessment item, rubric criterion, and job/role.



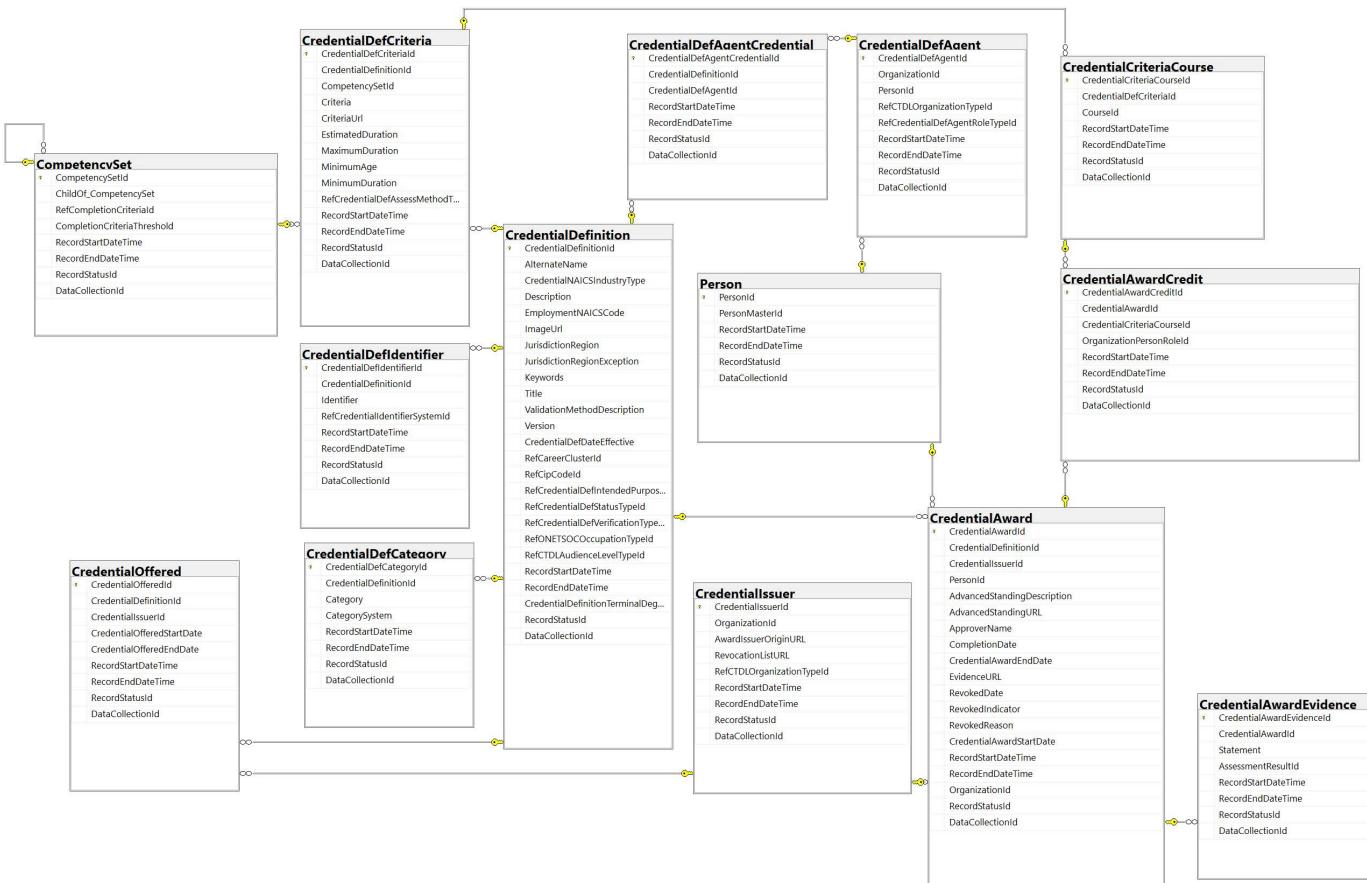
## Course Section

CourseSection represents an instance of a Course offered/delivered in a specific timeframe and/or place or through specific media or mode of study or to a specific section of students. (In the CEDS IDS, CourseSection is a subclass of Organization that can be linked to persons and roles using OrganizationPersonRole. Subclasses include K12 Course, PsCourse, CteCourse, AeCourse). Both Course and CourseSection are subclasses of Organization and inherit their properties from OrganizationDetails, for example, Name. Students and staff are associated with a CourseSection using OrganizationPersonRole.



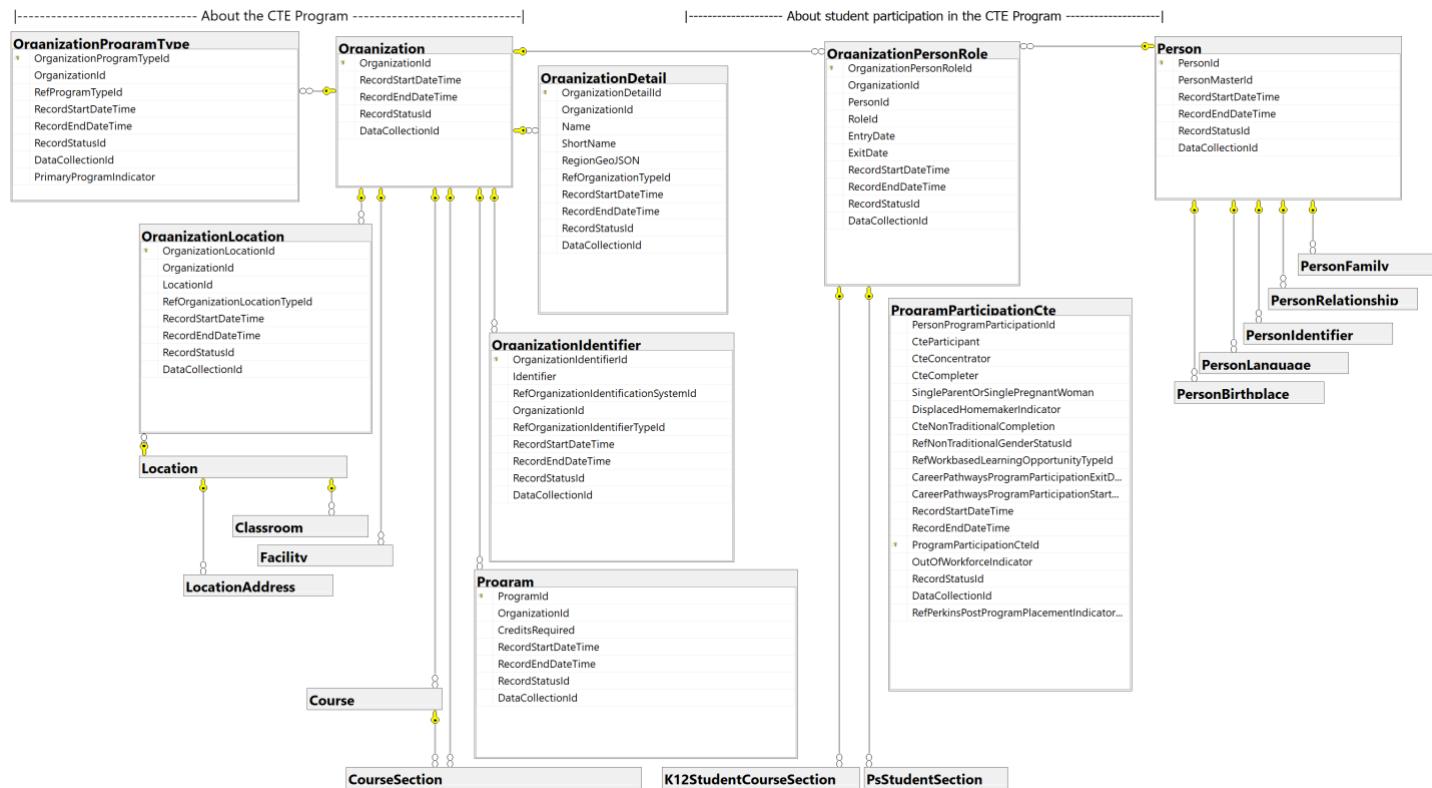
## Credential

CredentialAward is the information about the award/assertion of a credential or achievement. It is dependent on CredentialDefinition. CredentialAwardEvidence includes a statement or reference describing the evidence that the learner met the criteria for attainment of the achievement and may be related to an AssessmentResult. Credential AwardCredit may be used to record a specific course instance (CourseSection) that a Person completed to qualify for a CredentialAward using OrganizationPersonRoleId and/or it could use CredentialCriteriaCourseId to reference the course completed.



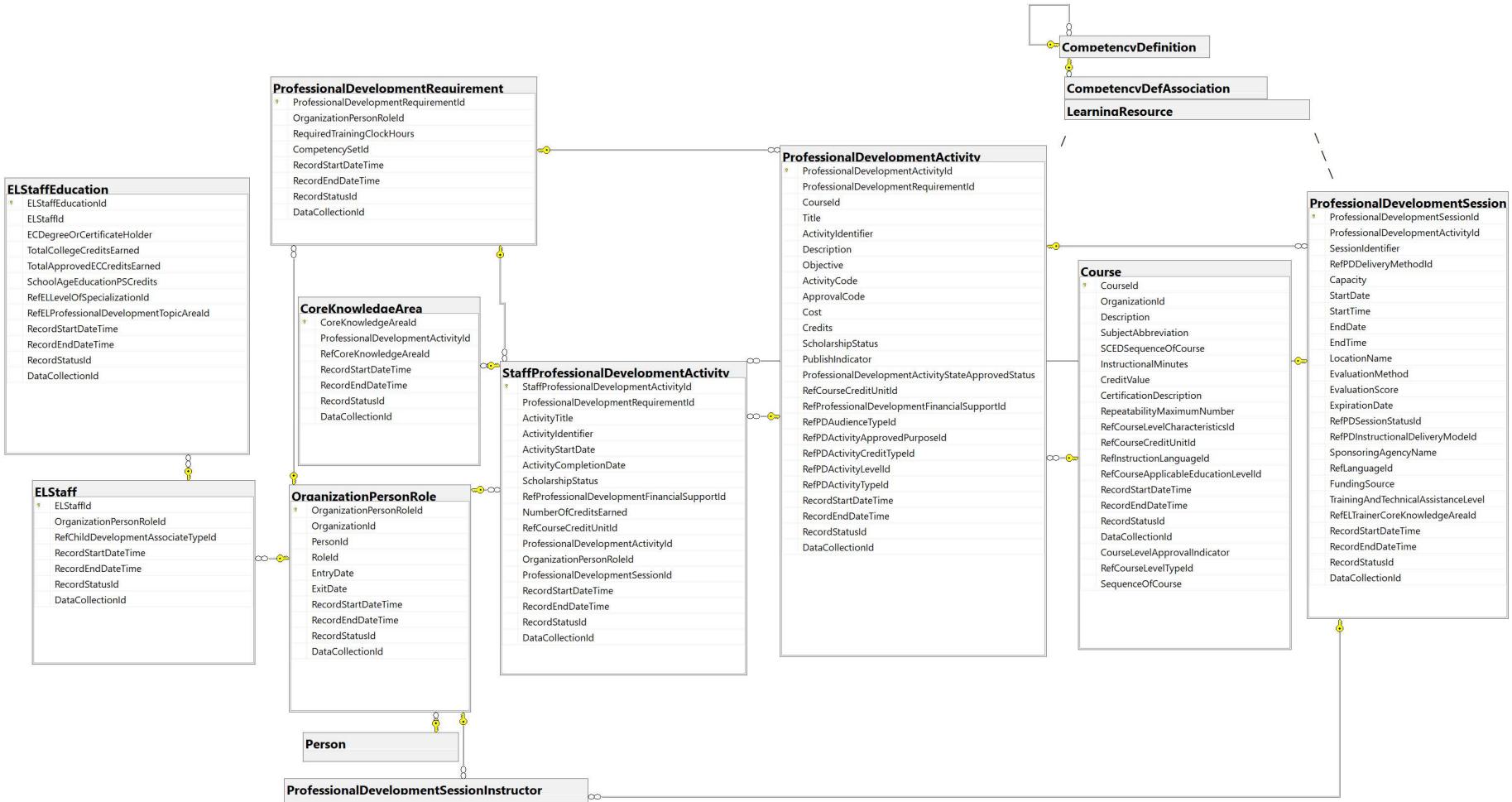
## Career and Technical Education (CTE)

**NOTE:** Organizations that offer CTE have OrganizationProgramType record with a RefProgramType value of “04906” for Career and Technical Education. **NOTE:** CTE-specific elements having to do with a student's participation in the program are handled in ProgramParticipationCte. General information about the program as an organization is normalized to Organization. A person's enrollment in a CTE Course is modeled using OrganizationPersonRole. CTE spans domains, so depending on the context the enrollment may also use domain-specific tables, for example, K12 StudentCourseSection or PsStudentSection. ProgramParticipationCTE is a sub-type of OrganizationPersonRole with attributes unique to a person participating in a CTE program.



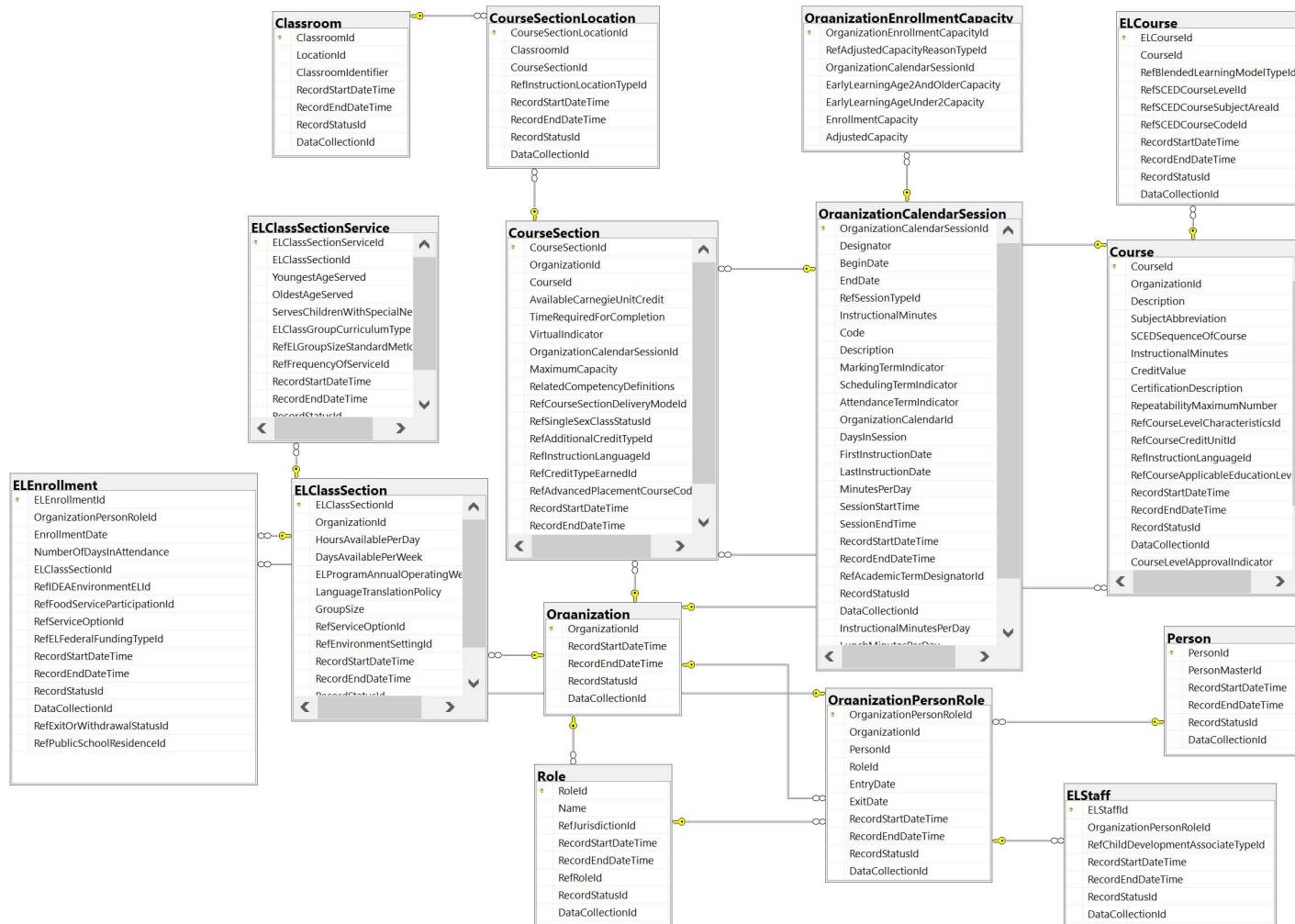
## Early Learning: Child Enrollment

Separate OrganizationPersonRole records are used with subtables for 1) the child's enrollment in the program (ELEnrollment) and 2) the child's assignment to a class/group (ELClassSection).

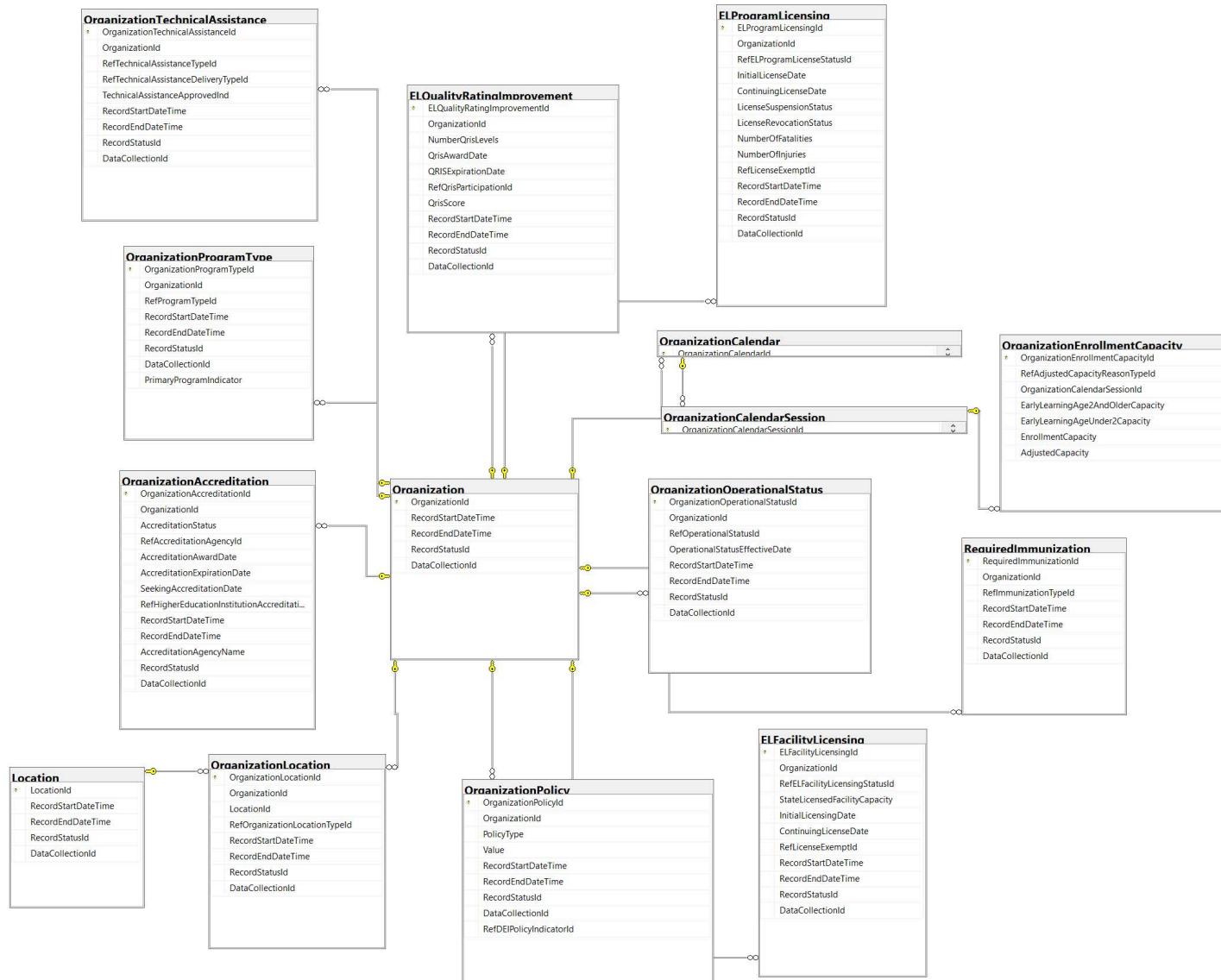


## Early Learning: Class Group

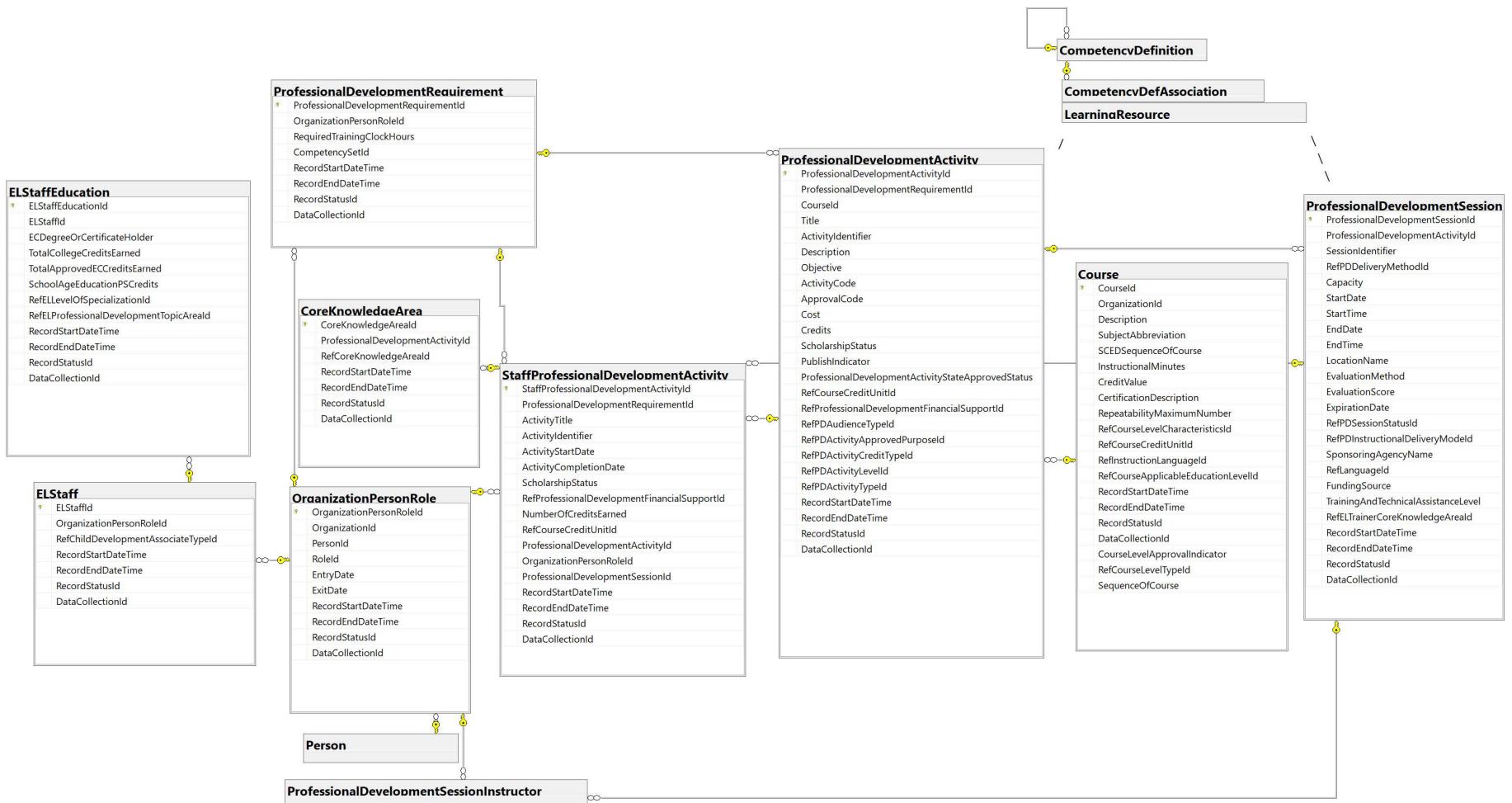
OrganizationPersonRole handles participation information; that is, each record represents a child enrollment or staff assignment to the class/group. It includes start and end dates for each person.



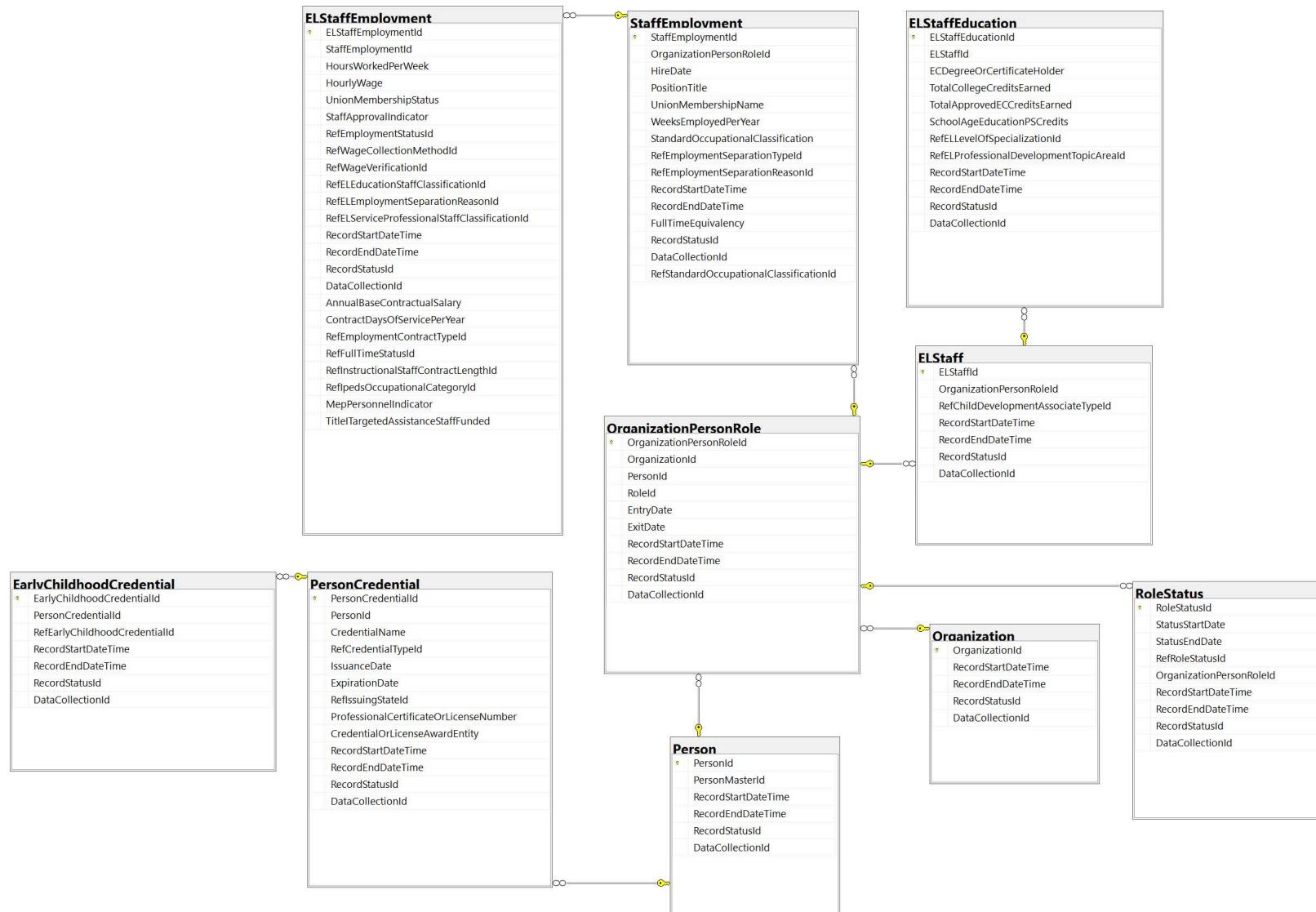
## Early Learning: Organization



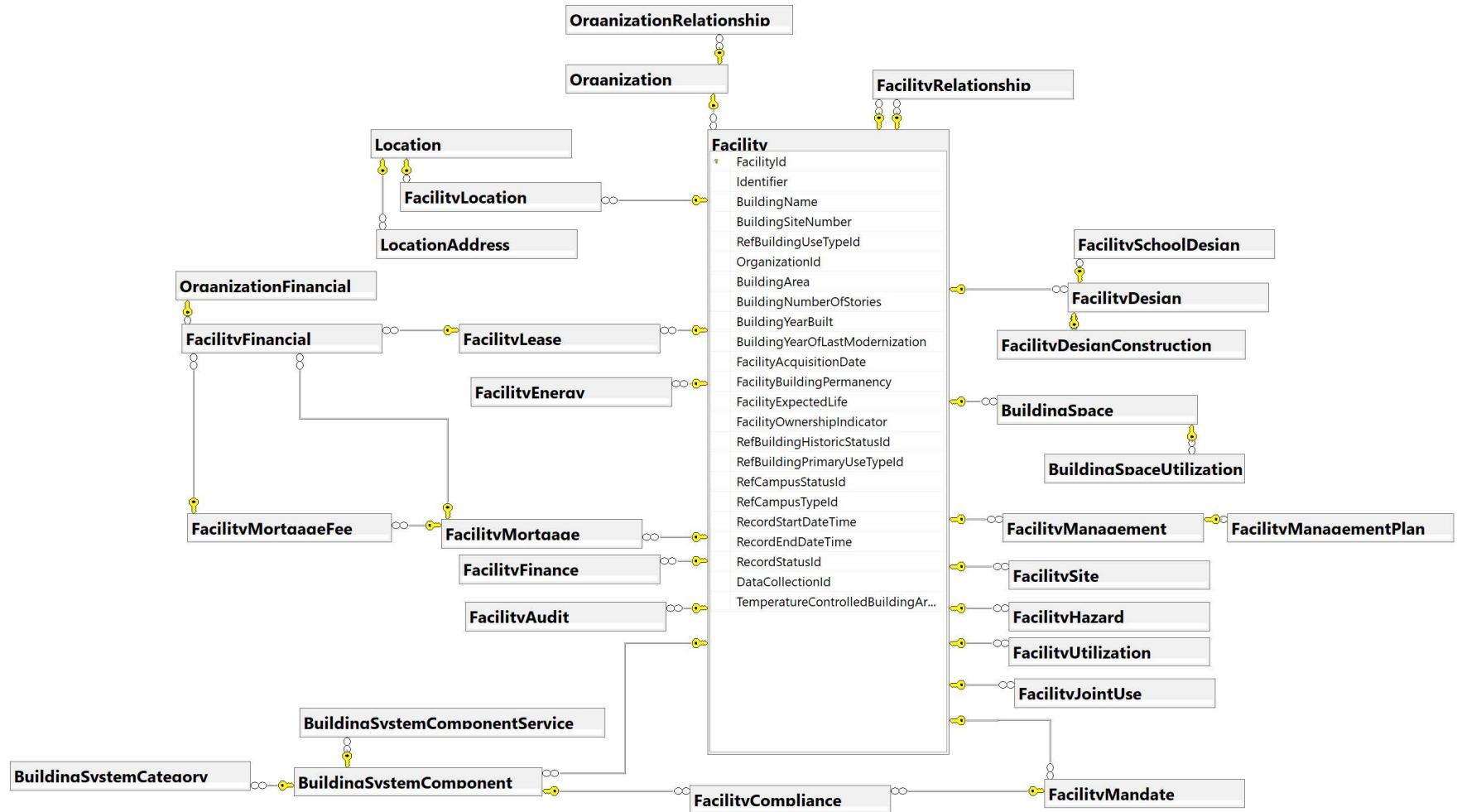
## Early Learning: Professional Development



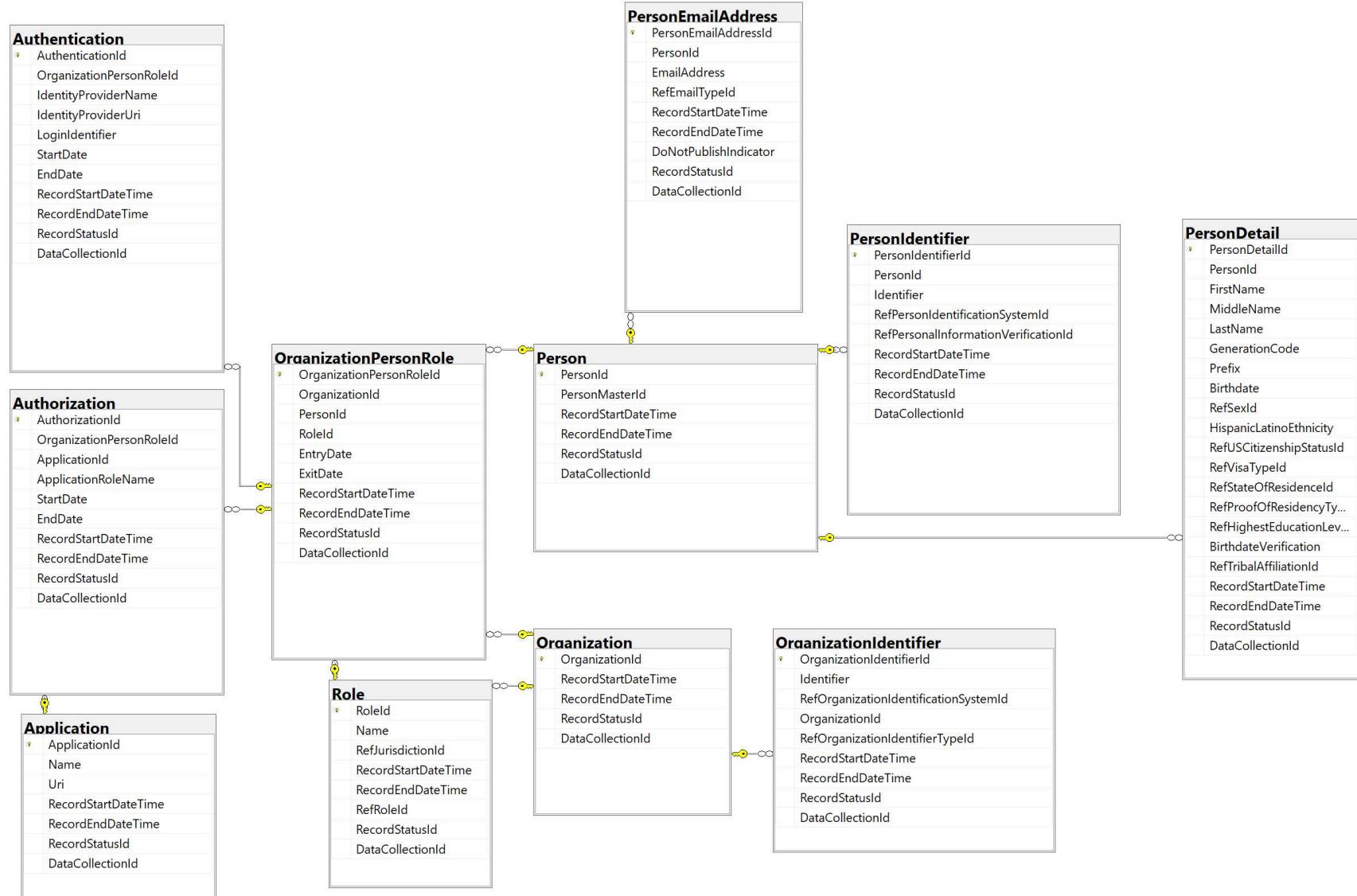
## Early Learning: Staff



## Facilities

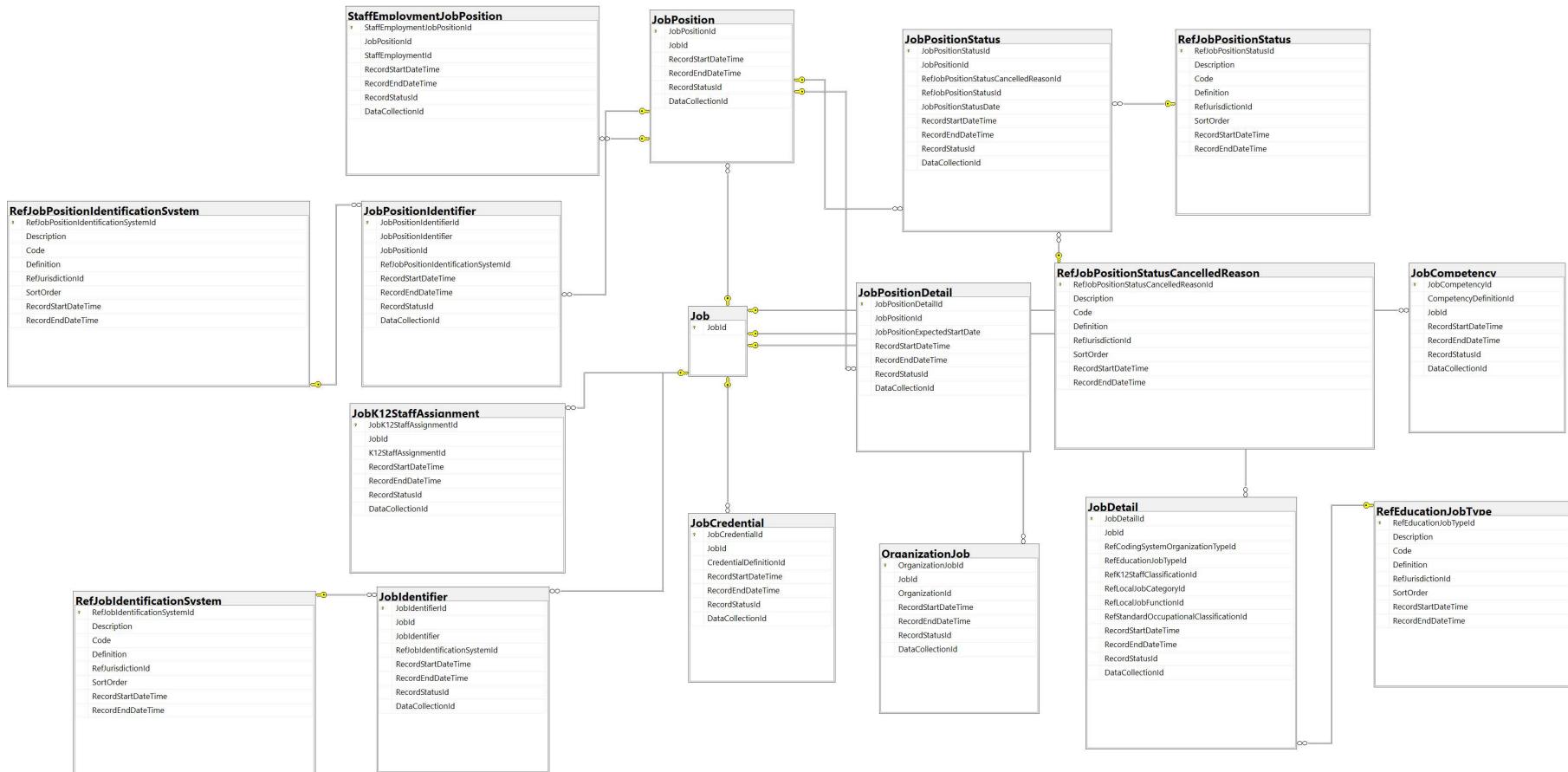


## Identity Authentication and Authorization

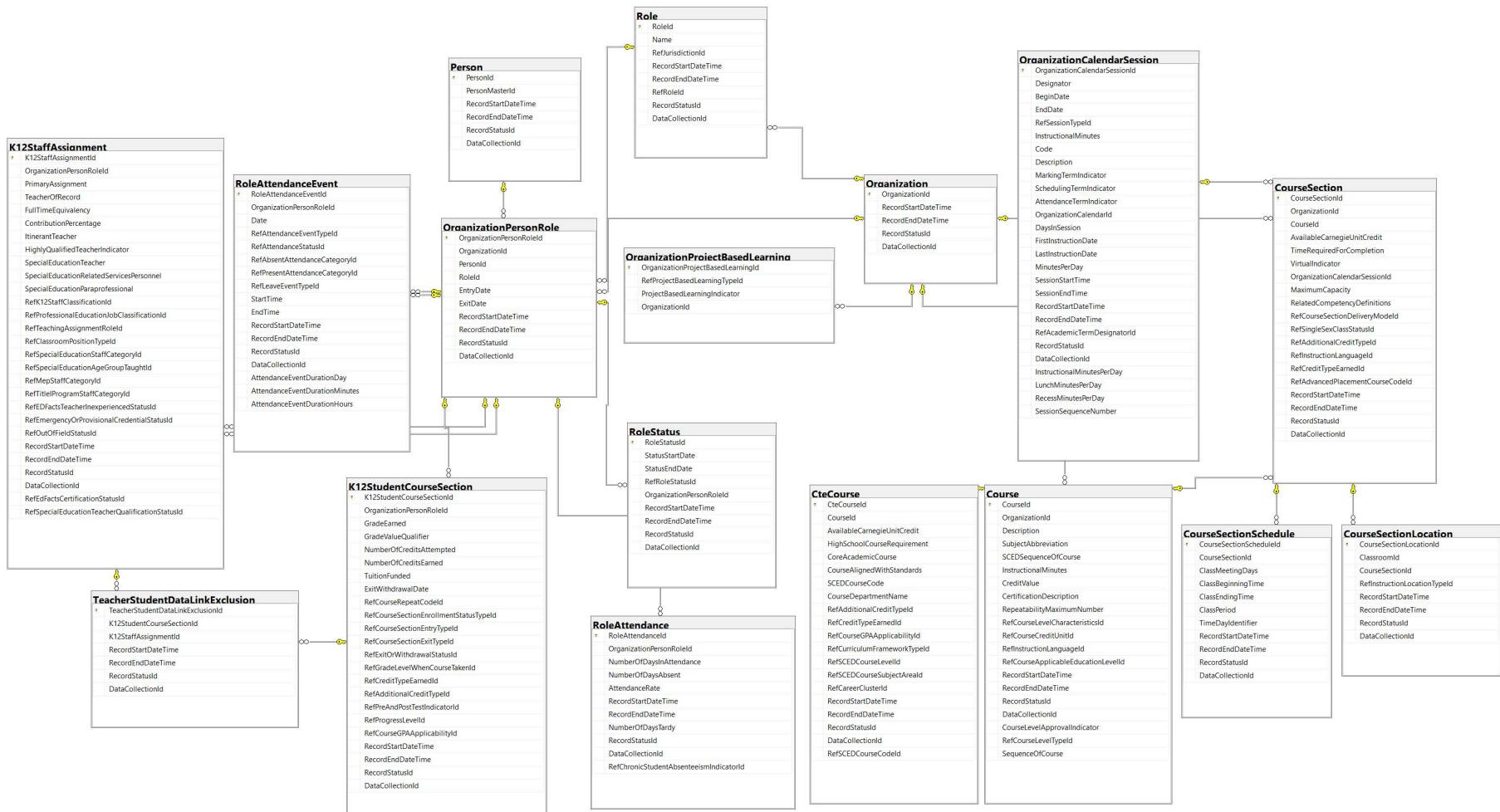


## Job: Organization and Position

CEDS Job management framework focuses on the employment aspect, offering a structured approach to help streamline job management and define and align job positions with organizational goals and job functions. This model illustrates the relationships between OrganizationJob, JobPosition, JobDetail, JobIdentifier, and JobCompetency. It defines roles, job requirements, competencies and credentials.

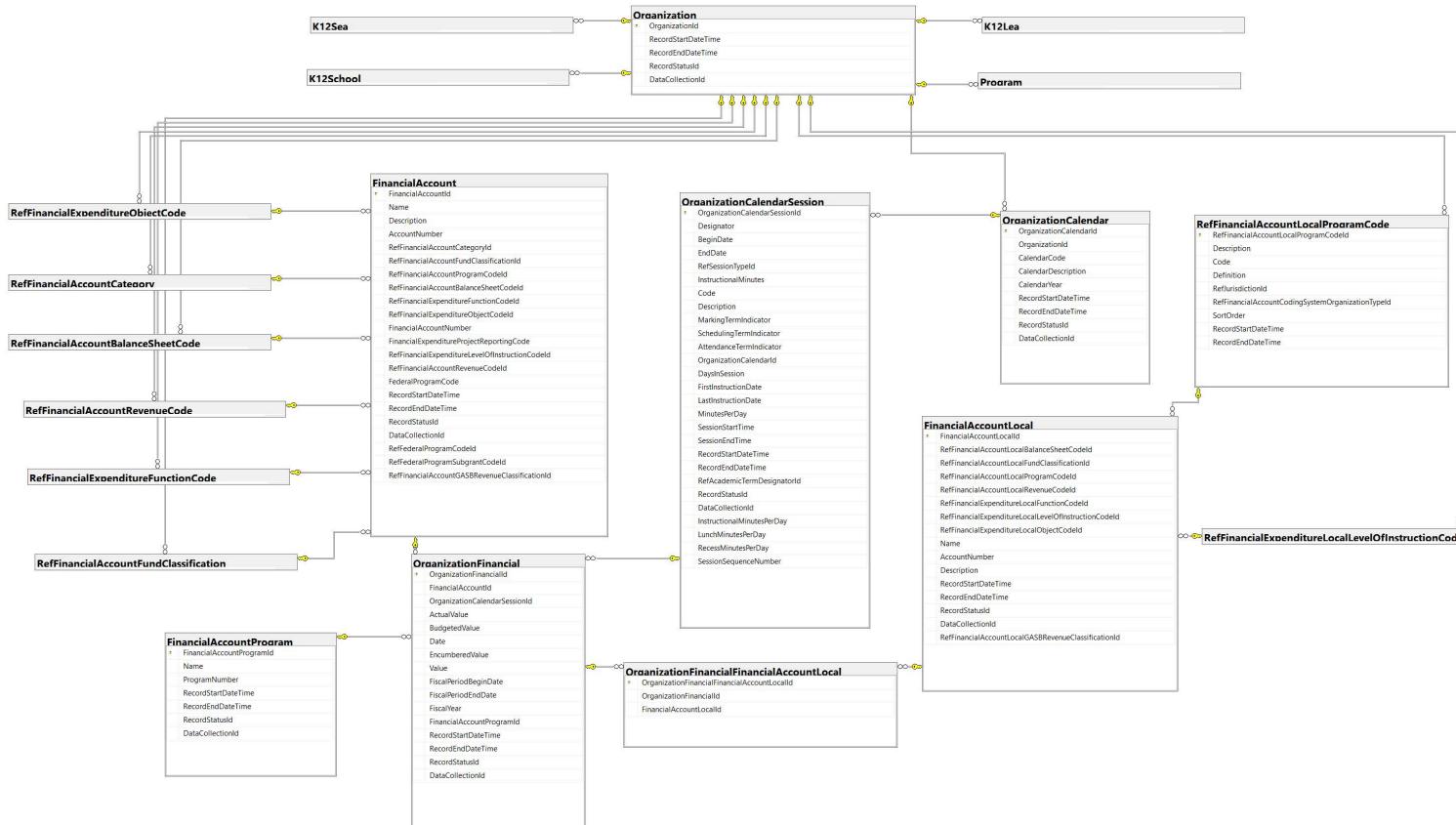


## K12: Course Section



## K12: Financial

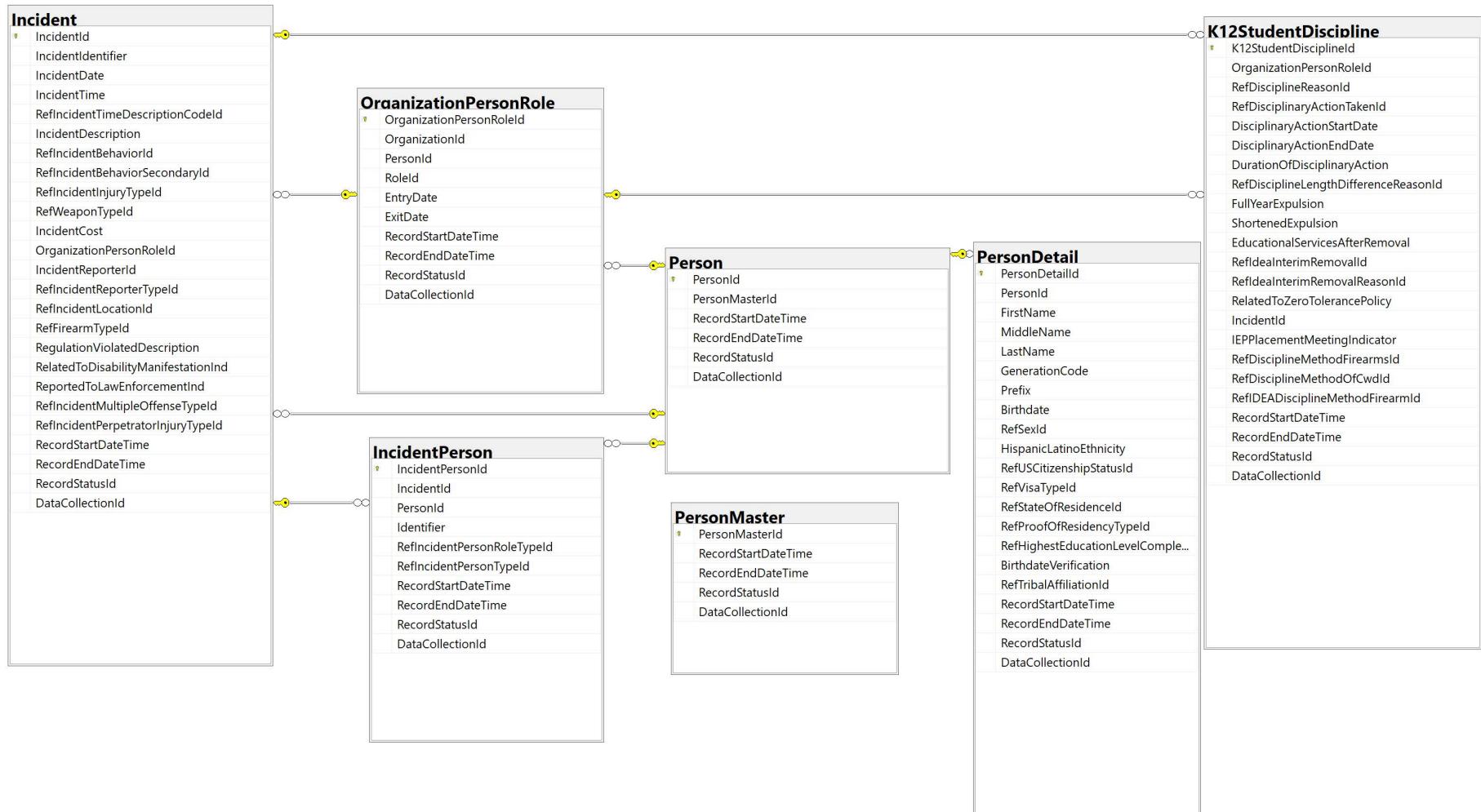
CEDS Financial elements support financial reporting use cases. In this model, each record in the table "OrganizationFinancial" represents values for the period—for example, ActualValue, BudgetedValue, and EncumberedValue—or a single "Value" for an account balance or transaction.



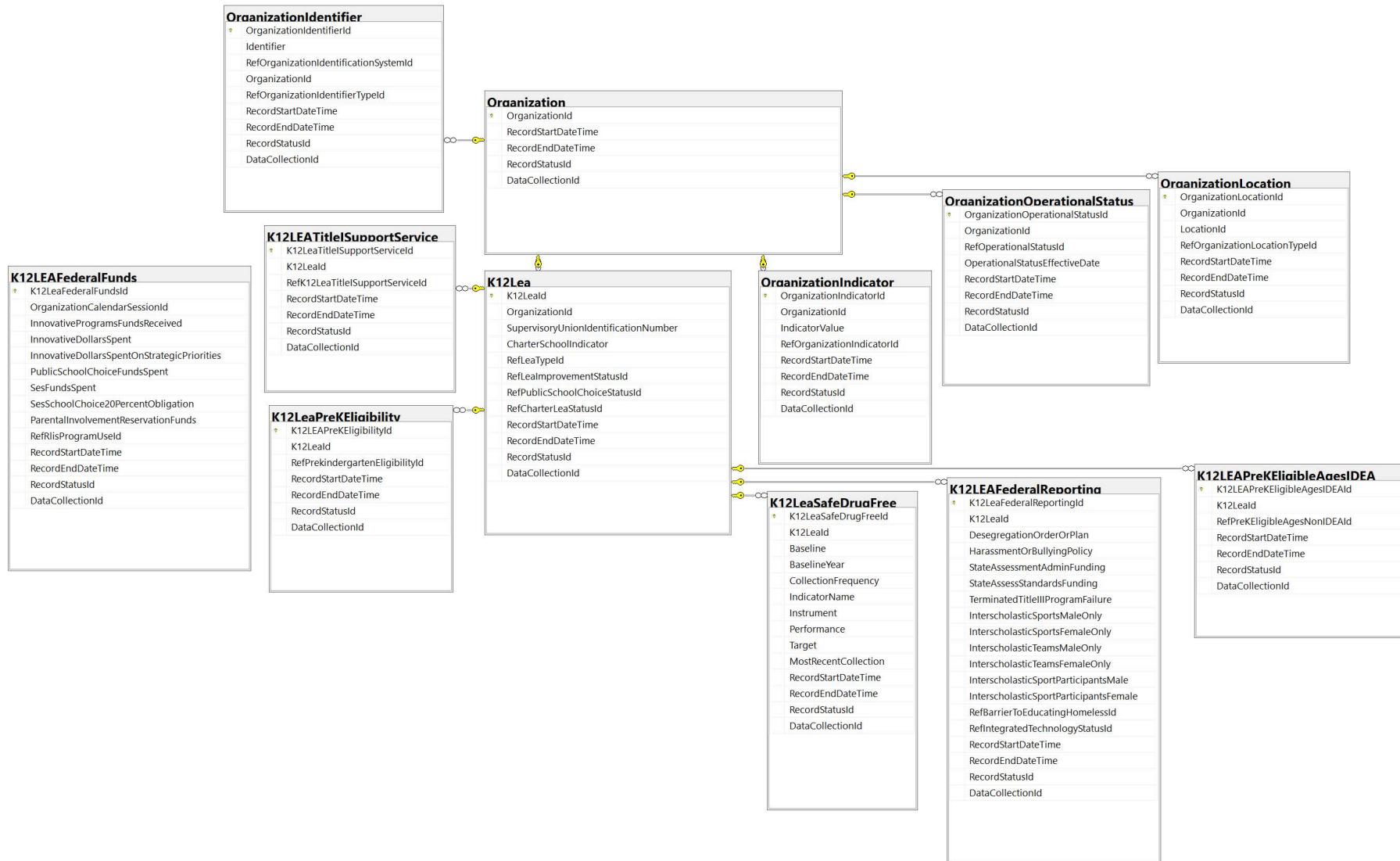
See the NCES Handbook Financial Accounting for Local and State School Systems: 2014 Edition ([http://nces.ed.gov/pubs2015/fin\\_acct/chapter6\\_3.asp](http://nces.ed.gov/pubs2015/fin_acct/chapter6_3.asp)).

## K12: Incident and Discipline

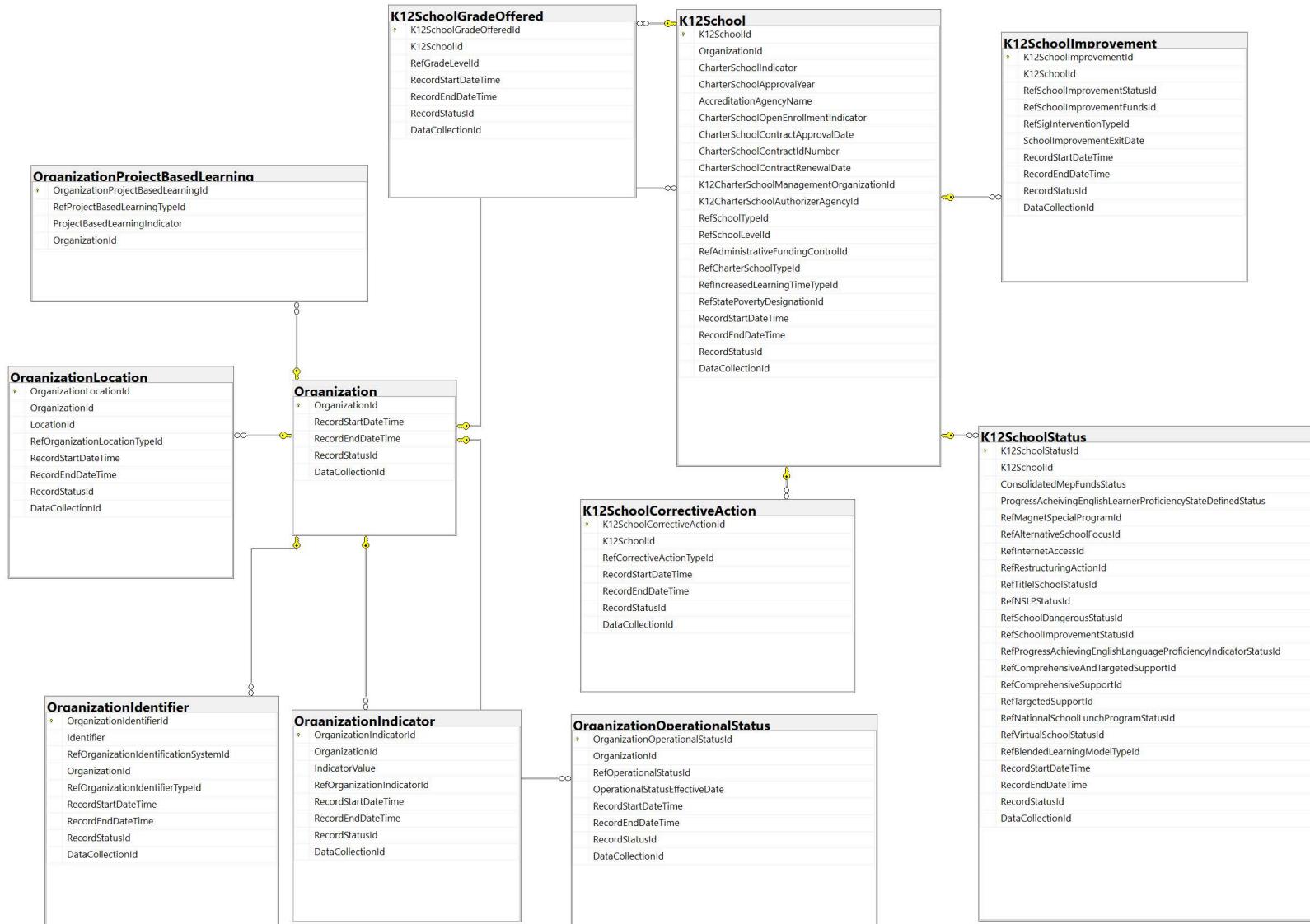
OrganizationPersonRole is used to relate the incident or discipline event to an applicable student enrollment record or staff employment record.



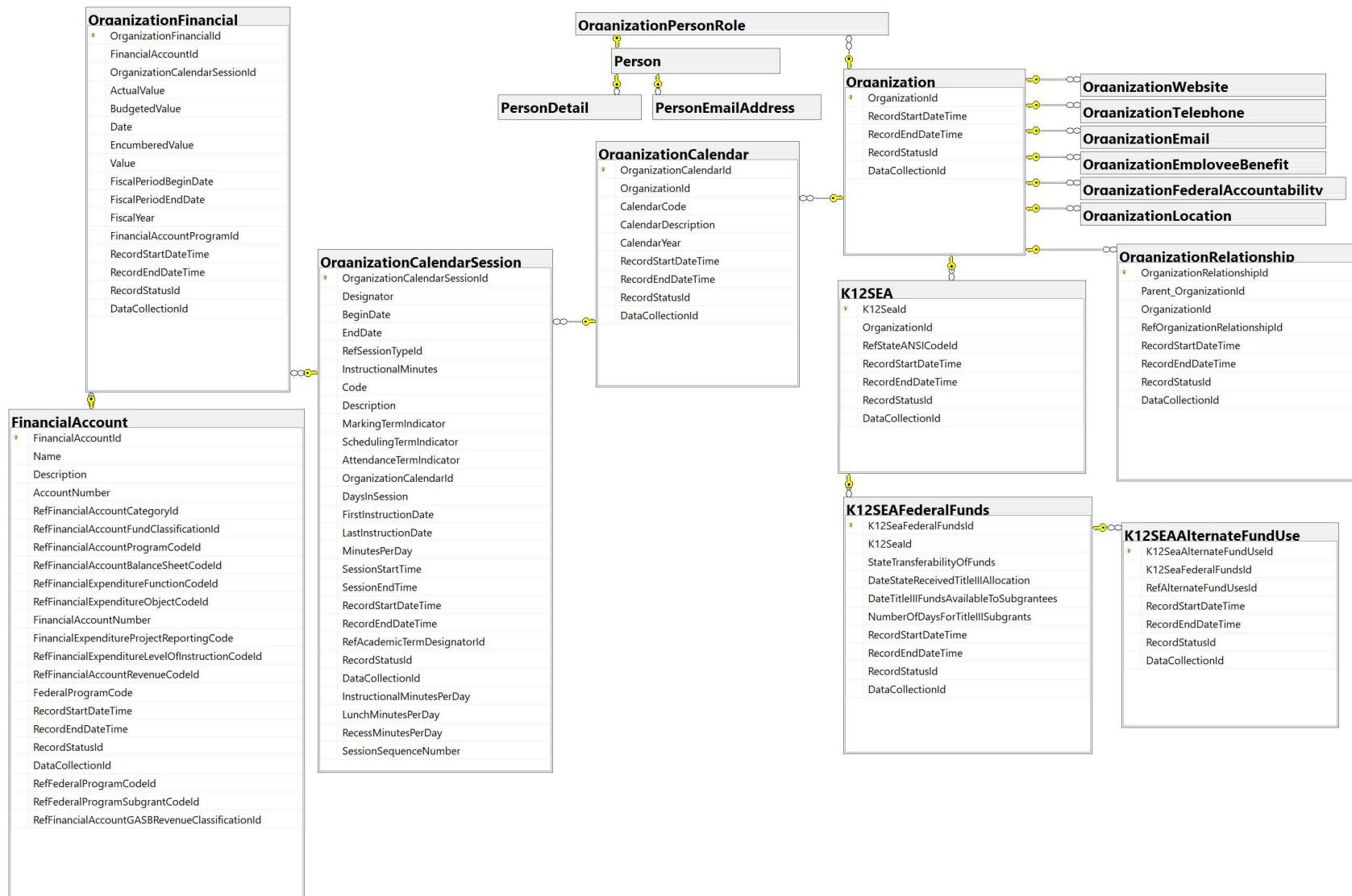
## K12: LEA



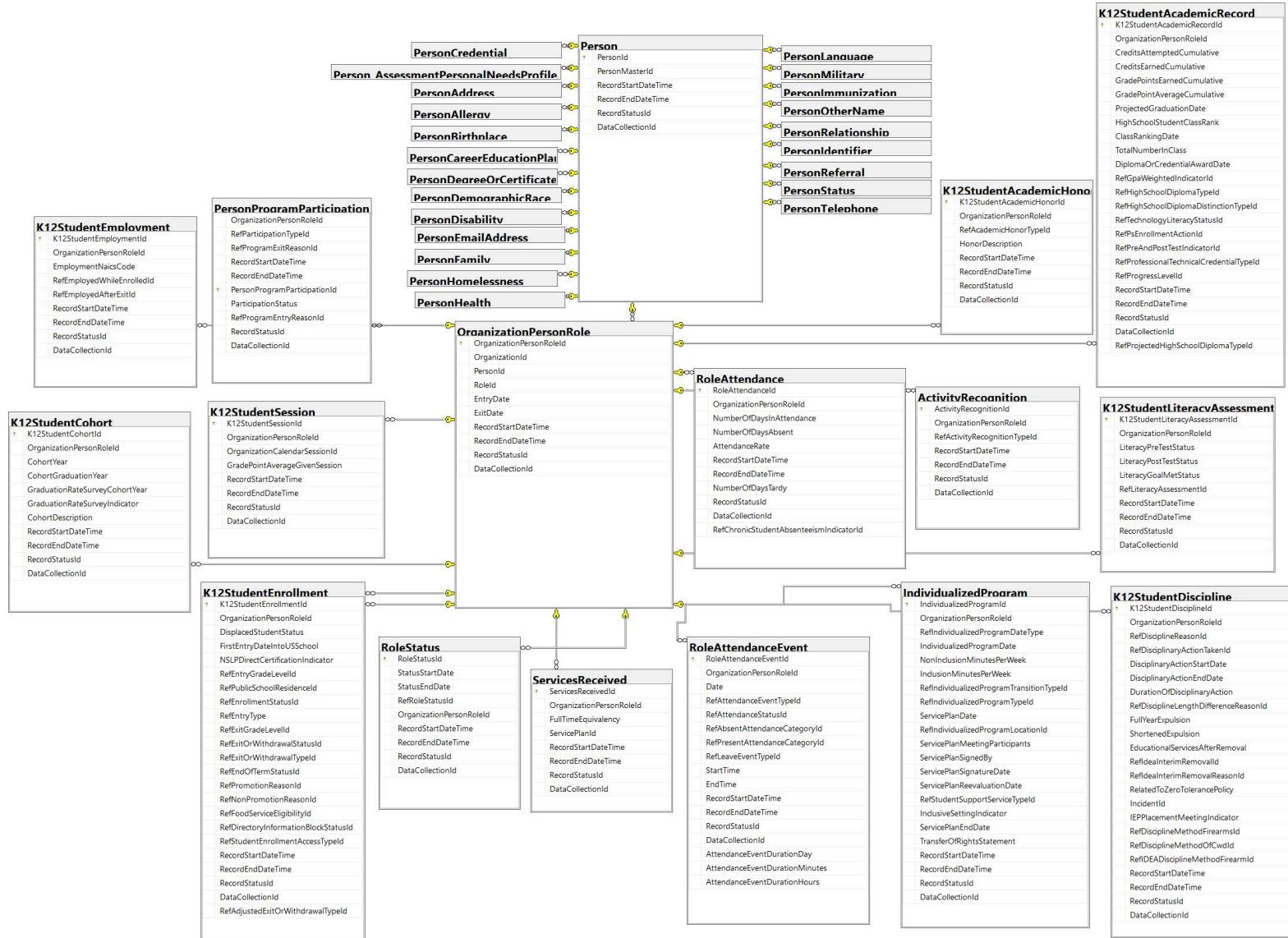
## K12: School



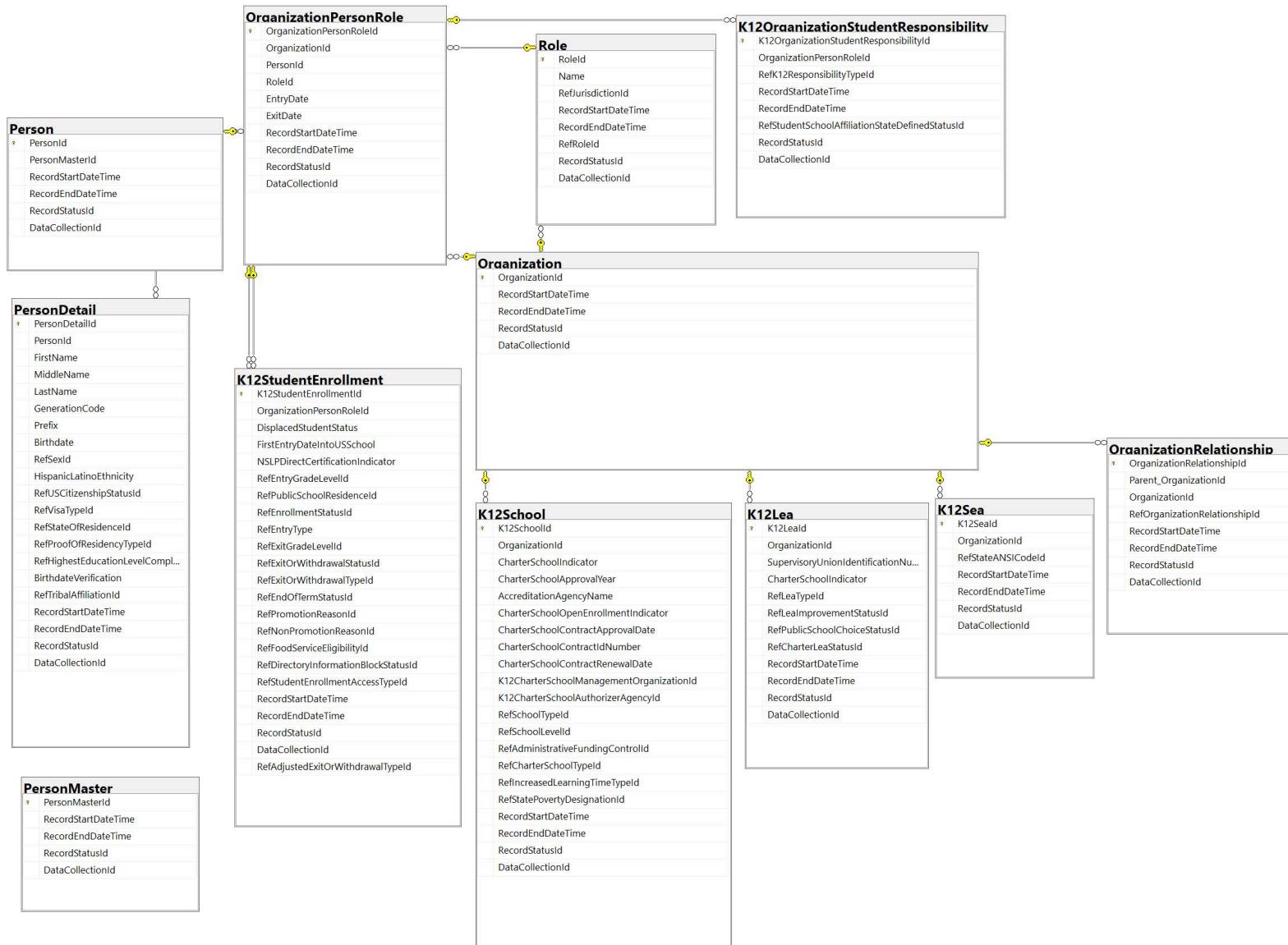
## K12: SEA



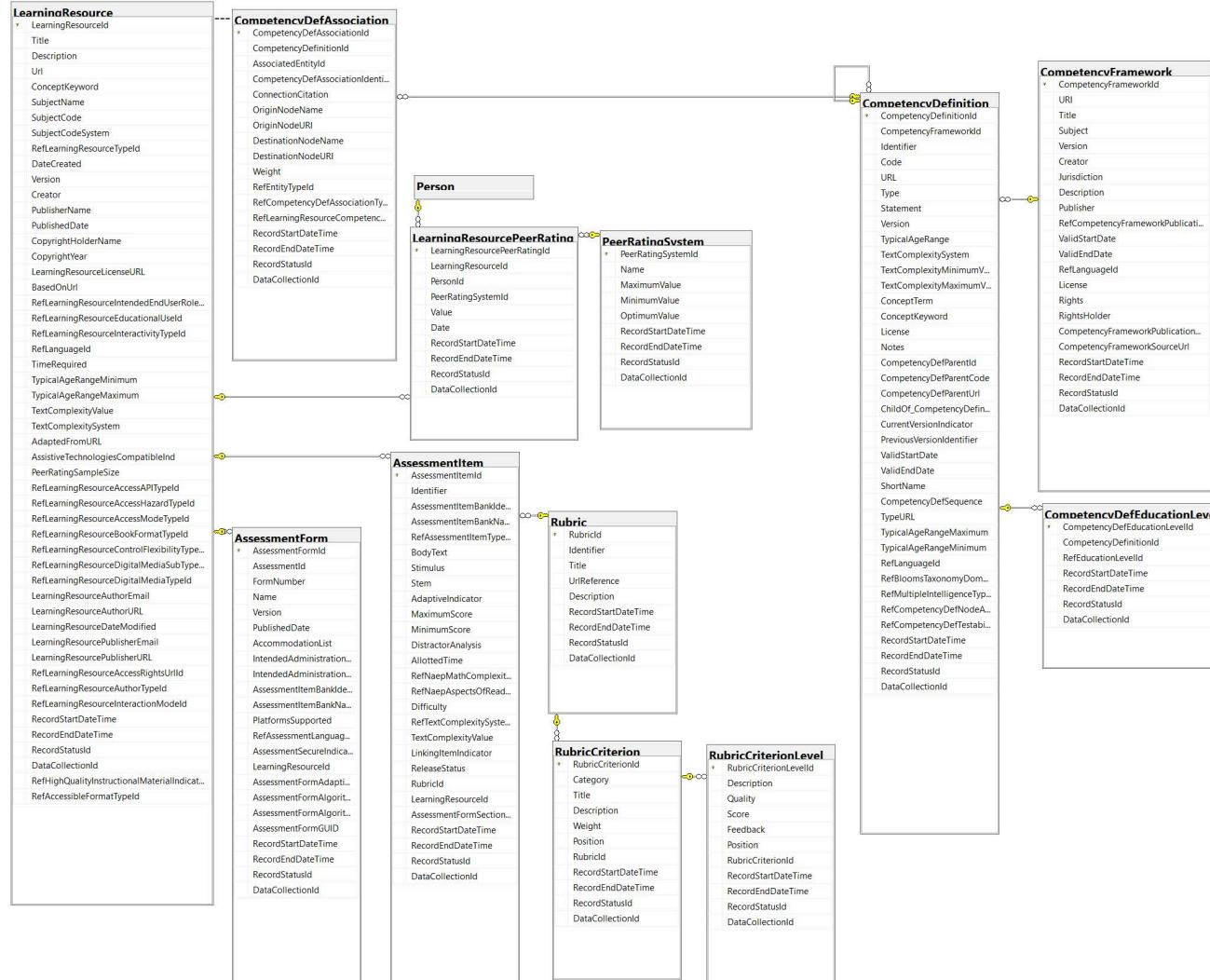
## K12: Student



## K12: Student Enrollment

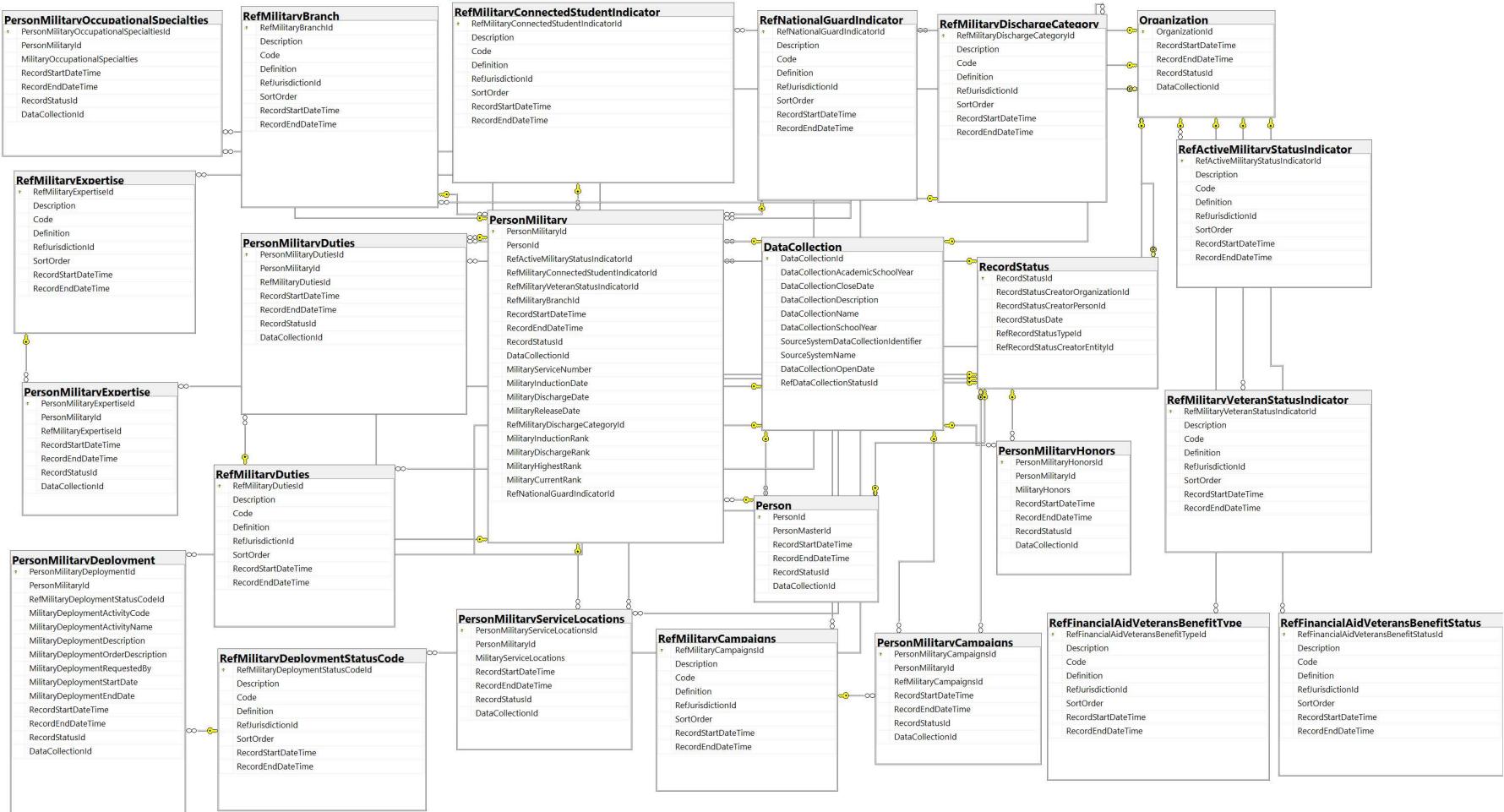


## Learning Resources



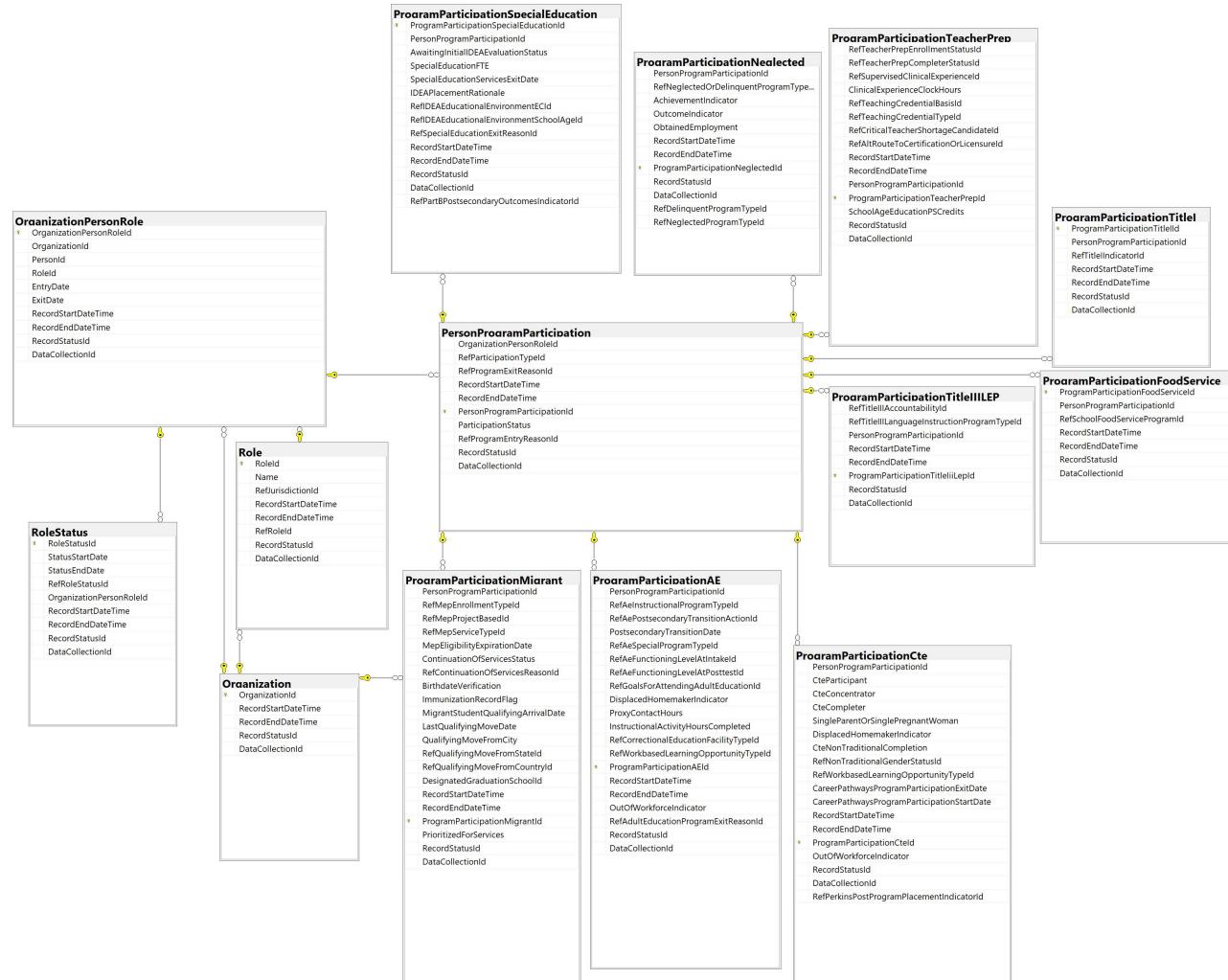
## Military

The Military personnel data model integrates key components such as PersonMilitary, PersonMilitaryOccupationalSpecialties, PersonMilitaryDuties, and PersonMilitaryDeployment to provide a comprehensive framework for tracking military service records, including career trajectories, specialties, and deployments.



## Person Program Participation

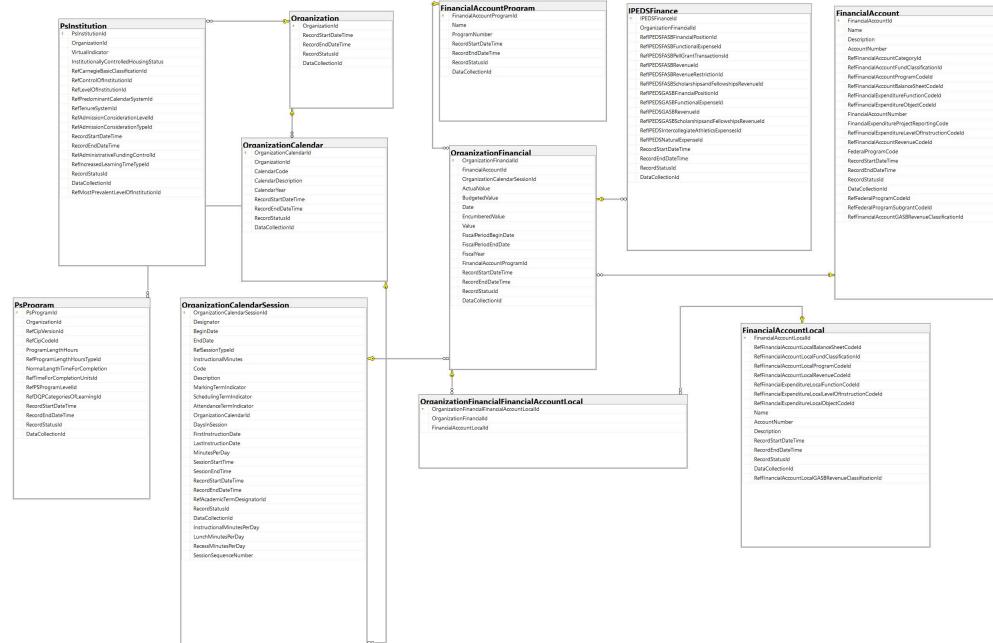
The most basic information about a person's participation in a program (entry and exit dates) is handled using the common OrganizationPersonRole table. "Program" is data.



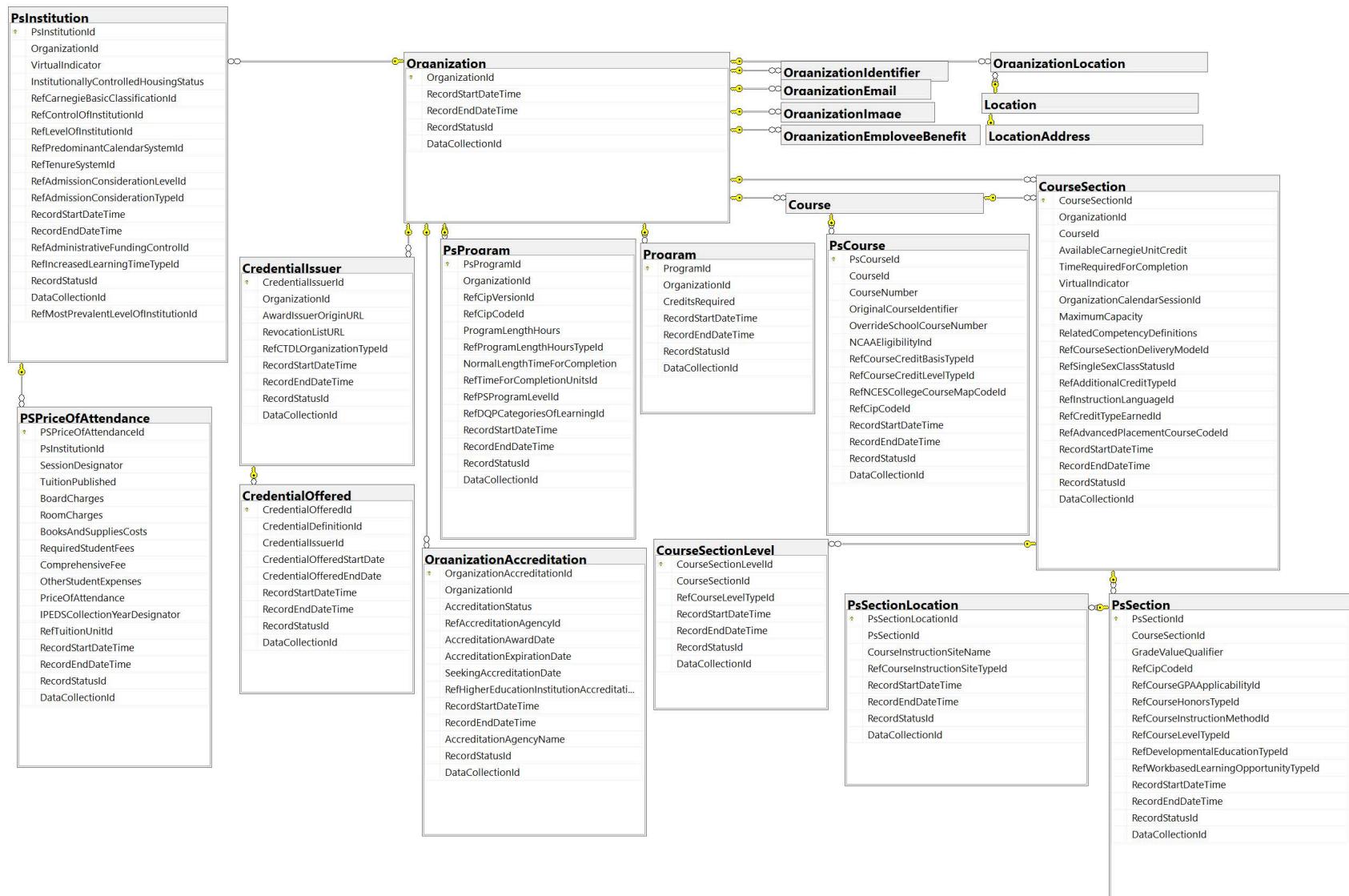
## Postsecondary: Finance – IPEDS Reporting

CEDS Financial elements support financial reporting use cases. In this model, each record in the table "OrganizationFinancial" represents values for the period—for example, ActualValue, BudgetedValue, and EncumberedValue—or a single "Value" for an account balance or transaction.

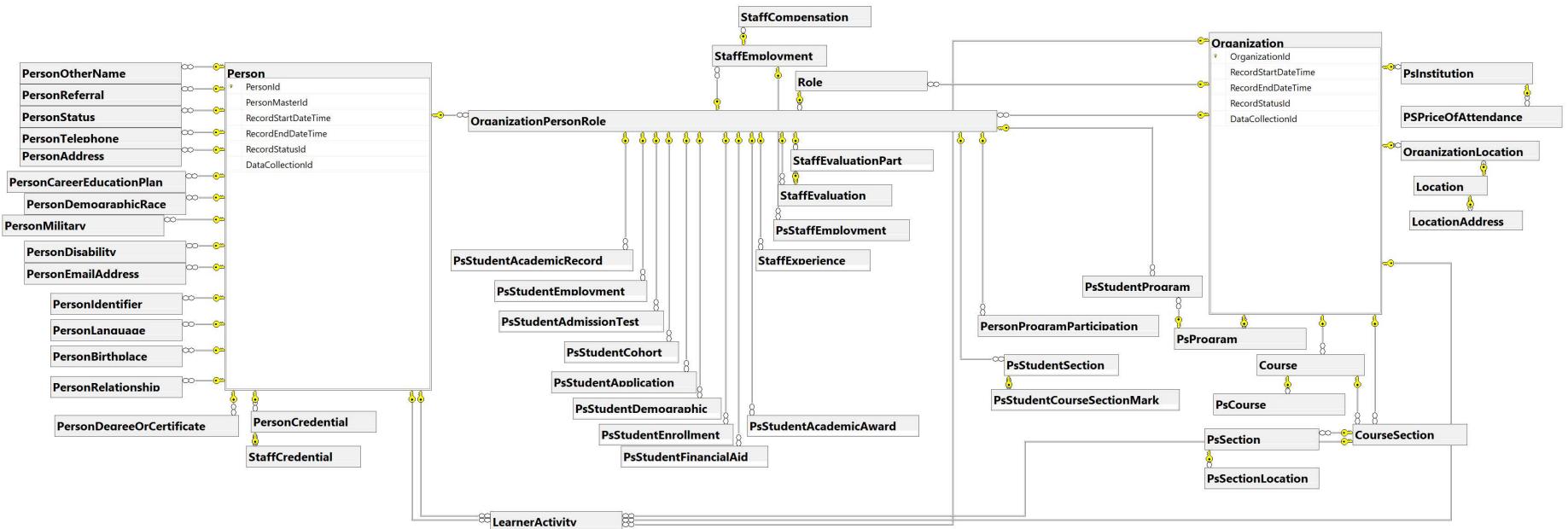
**NOTE:** Default values in some "Ref" tables referenced in "FinancialAccount" may not apply to postsecondary. For example, the foreign key "RefFinancialAccountBalanceSheetCodeId" links to a table defined by a CEDS element "Financial Account Balance Sheet Code" which has options based on the NCES Handbook "Financial Accounting for Local and State School Systems." For postsecondary reporting uses, the IPEDSFinance table has all of the relevant IPEDS categories. More granular PS finance implementations could use the Ref table structure with FinancialAccount, but with code sets from a standard IHE chart of accounts. P-20W uses may use the RefJurisdictionId in Ref tables to handle multiple code sets applicable to different organization types. OrganizationCalendarSession may be used to link the Fiscal Reporting Period to an Academic Session.



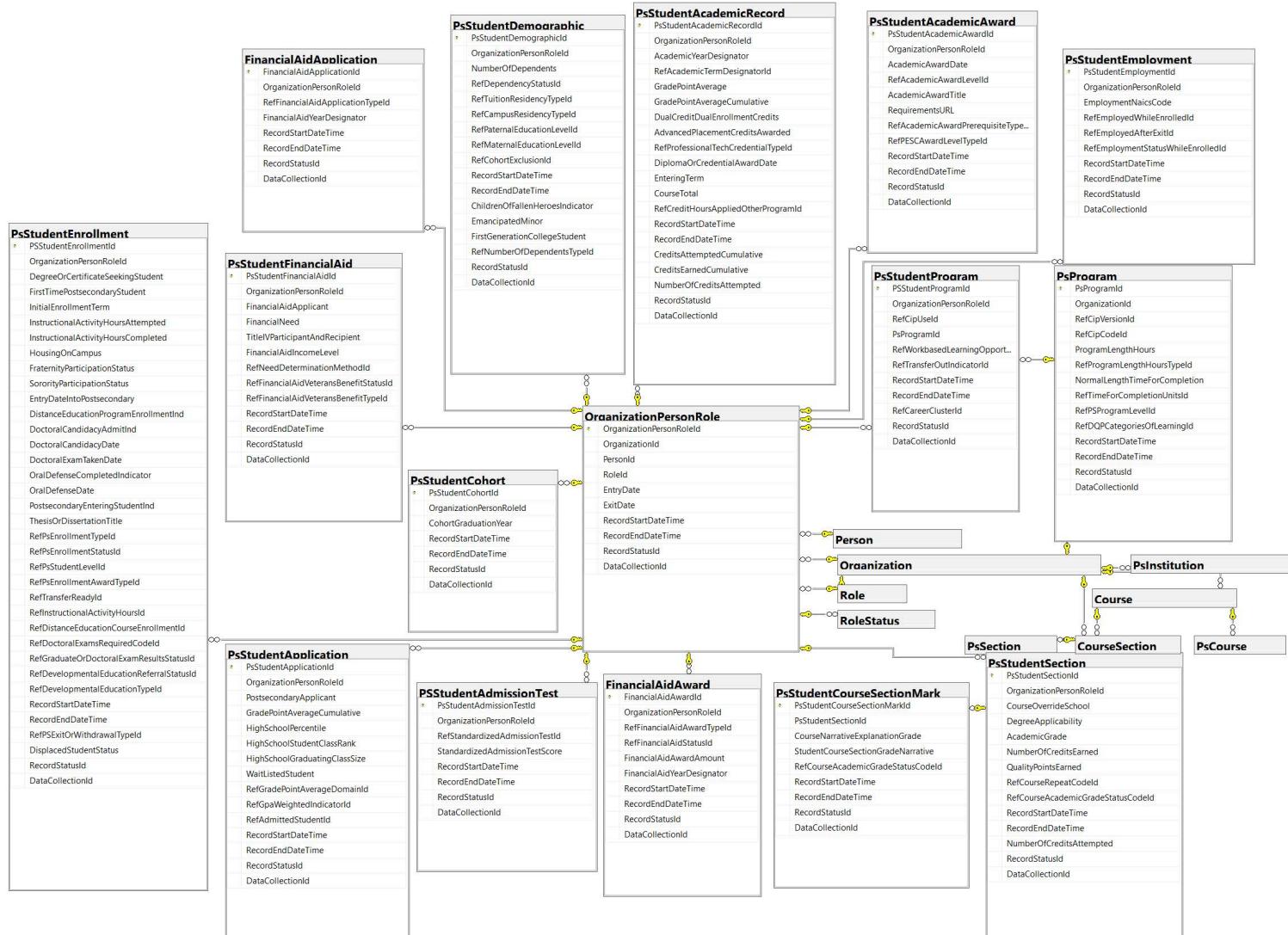
## Postsecondary: Institution



## Postsecondary: Overview

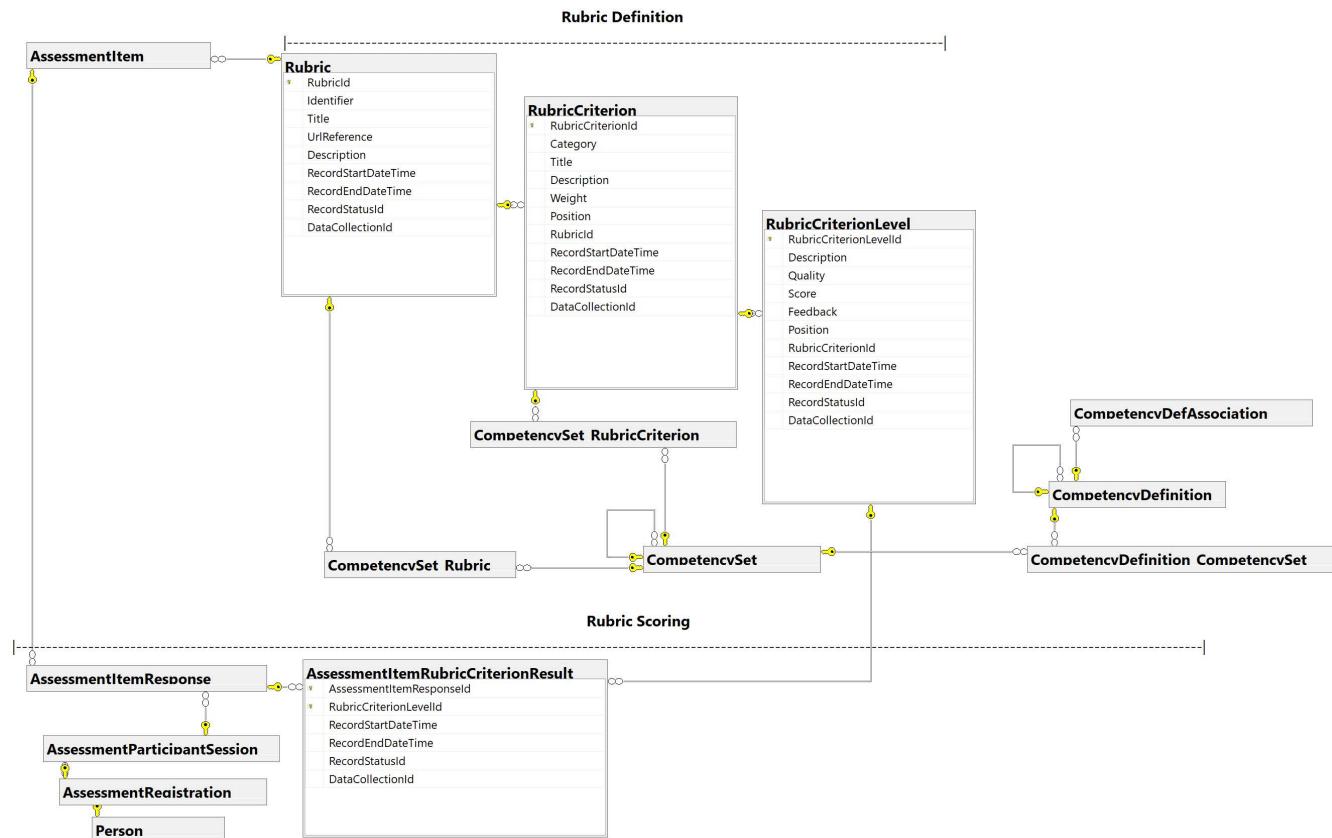


## Postsecondary: Student



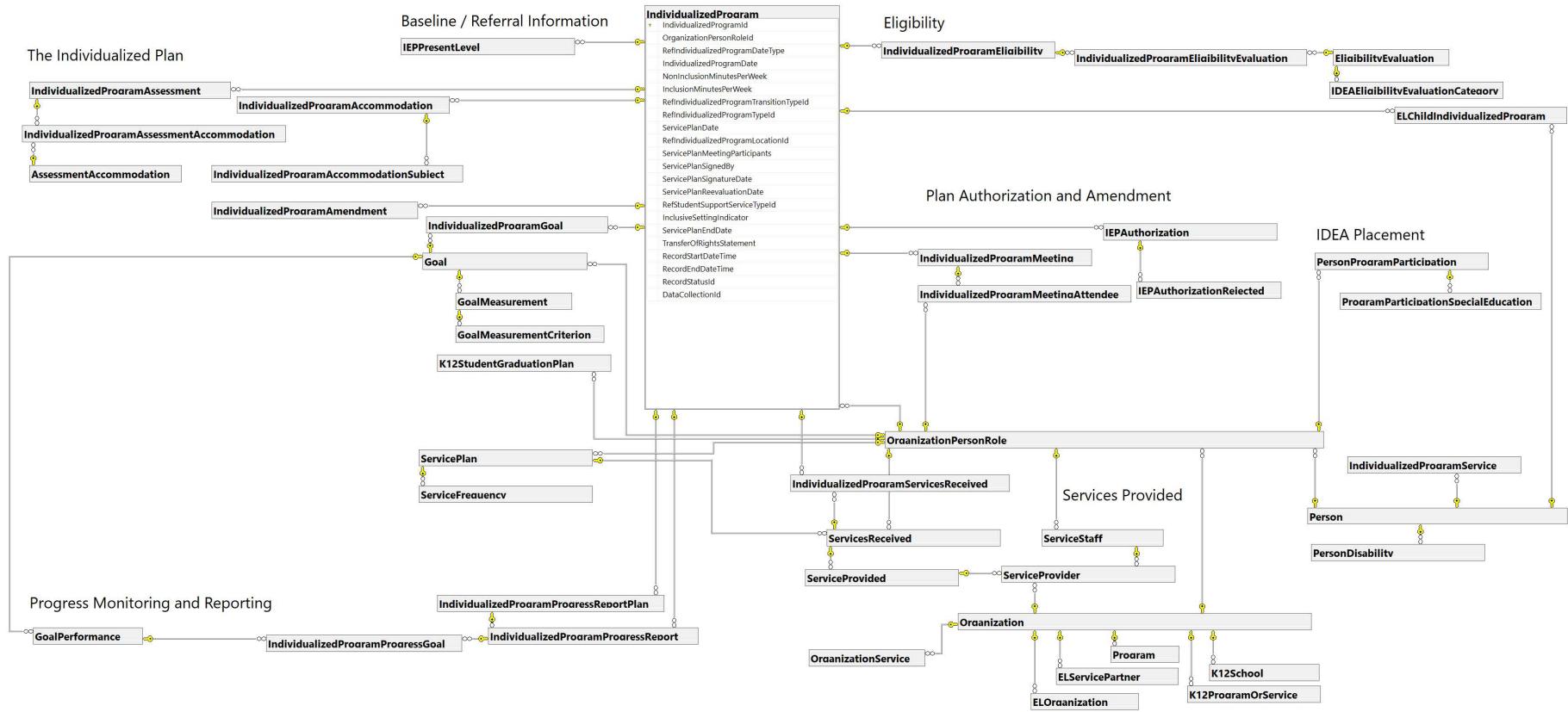
## Rubric

An Assessment Item may represent different kinds of measurement such as a rubric-scorable item on a written test or an observation that is part of a performance evaluation. A Rubric may be related to one or more learning standards or competencies via CompetencyDefAssociation. A Rubric Criterion may be related to one or more competencies via CompetencyDefAssociation. AssessmentRubricCriterionResult can capture the details of the results for each Criterion (the quality level or score for each row in a tabular rubric) when scoring a learner response to an assessment item. AssessmentParticipationSession and AssessmentRegistration provide the context of who is being assessed and when.

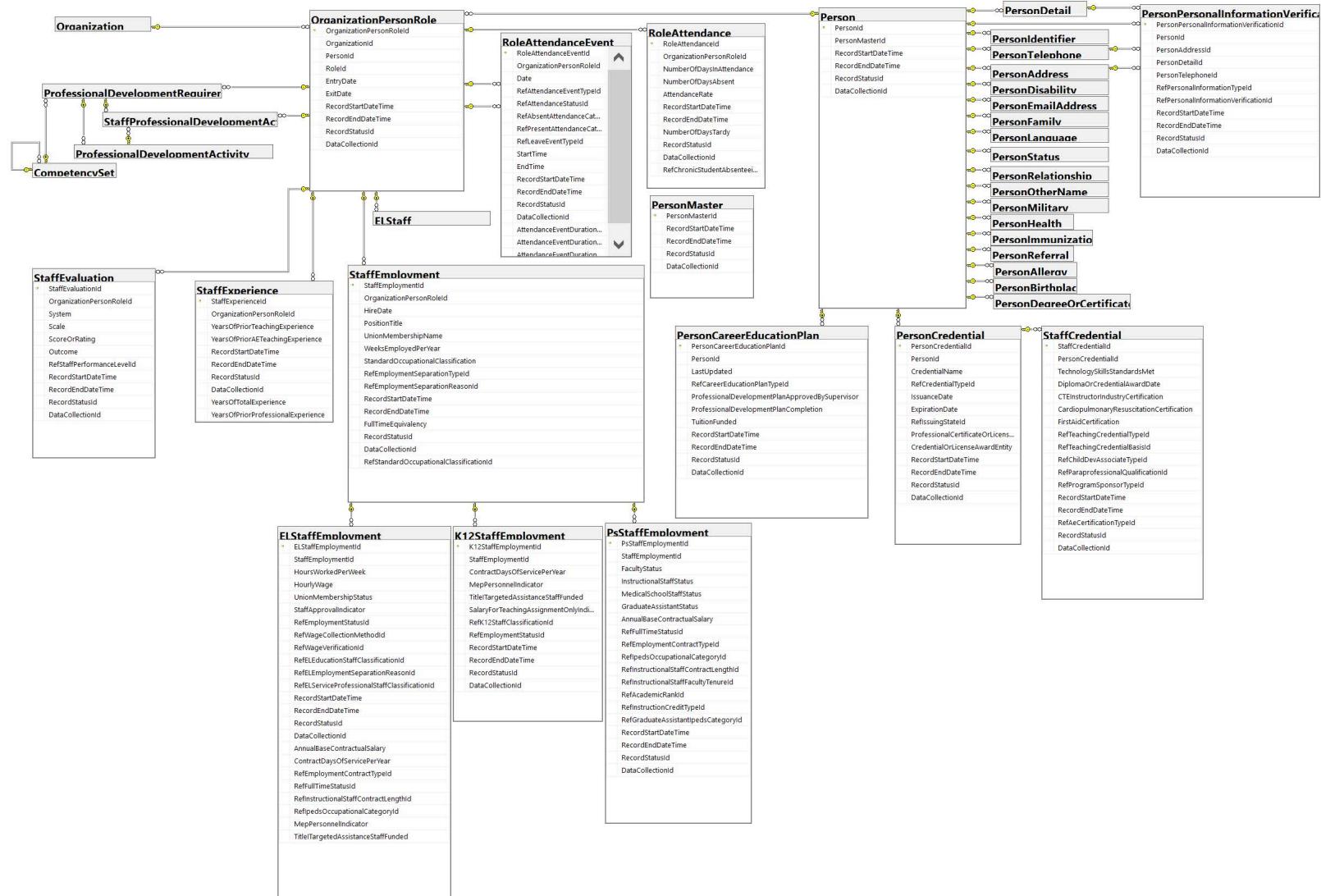


## Special Education – Individualized Education Program

OrganizationPersonRole is extended to handle various person-roles within this model. For example, it is extended by PersonProgramParticipation to represent a child's participation in a special education program. It also handles things like a person's role as a staff member in an organization providing special education services and a person's role when attending a meeting about a child's individualized program, for example, parent, staff, specialist, etc.

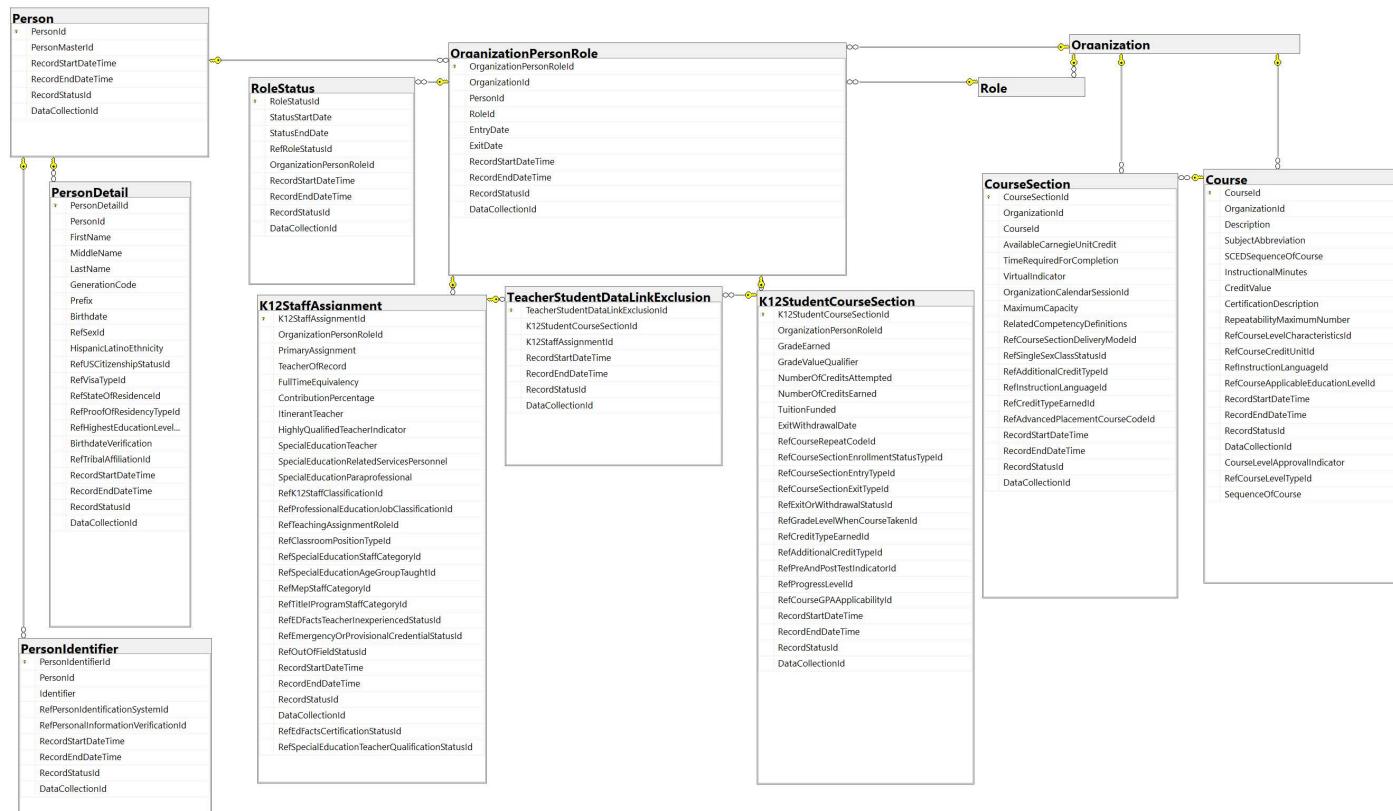


## Staff



## Teacher-Student Data Link

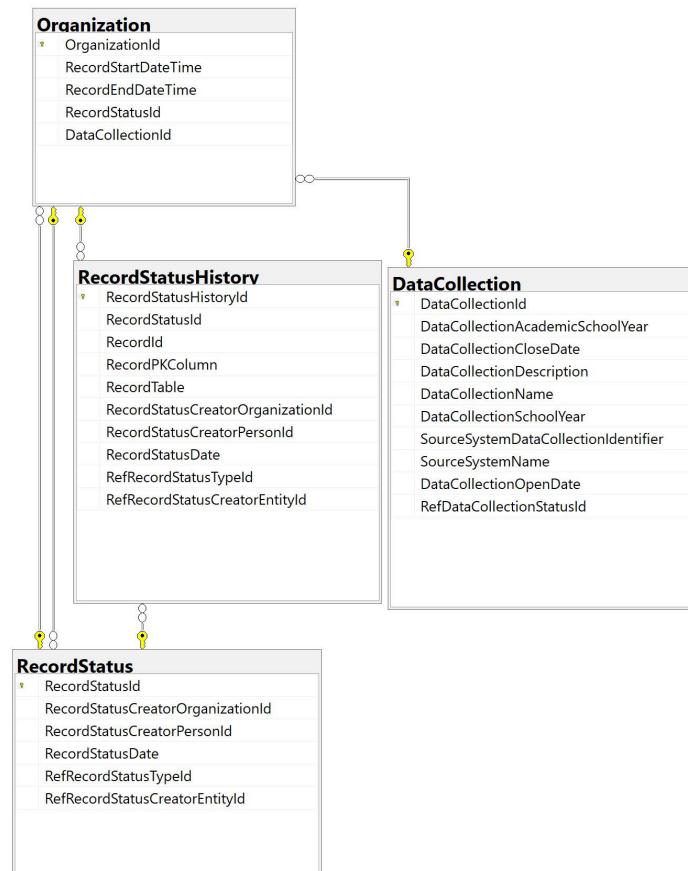
This model supports teacher-student links through the link between a student enrolled in a CourseSection and a teacher assigned to that CourseSection. In this model, CourseSection is a subclass of Organization. RoleStatus may reflect exceptions, such as a teacher on medical leave for a period of time while still assigned to a lead teacher role. TeacherStudentDataLinkExclusion supports some state policies that exclude specific instances of teacher-student links when the data are used for evaluation or reporting. See Attendance (Course Section) diagram for insights on actual versus scheduled teacher-student contact time.



See *Forum Guide to the Teacher-Student Data Link: A Technical Implementation Resource* (<http://nces.ed.gov/pubs2013/2013802.pdf>) for additional examples of the teacher-student data link using CEDS elements.

## Versioning Collection and Reporting of Data (Implementation Variables)

The CEDS IDS includes tables and properties for supporting the collection and reporting of data including metadata about the relationship between a record and a data collection, when a record was created in the database, and information about changes to the status of a records for maintaining version histories of all records in the database. Every table in the database includes properties for RecordStartTime, RecordEndDateTime (the time when a record is expired, such as when it is replaced by a more current record), RecordStatusId, and DataCollectionId. In the example shown below, the Organization table is linked to DataCollection and RecordStatus tables. The RecordStatusHistory table maintains the version history of all changes to the database.



## Workforce

