The Smithsonian Institution Conceptual Design Document(CDD)

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This document contains a detailed and concise Conceptual Design Document (CDD) for the existing web site for the Smithsonian Institution. The url of the Smithsonian is si.edu.

Contents

1 The Smithsonian Institute

The Smithsonian Institute (TSI) is a large organization that can be broken into 4 main parts - *Research Center, Cultural Center, Education Center* and *Components*. A component is the part of the organization that is visited by the community for various reasons. Museums, zoos, galleries and gardens are all types of components. The cultural center and components are responsible for the creation and holding of *exhibitions* and *events*. The research center conducts research on *objects* which leads to *publications*. Anyone can support the organization by becoming a *member*. Each member must purchase a *membership* which has various *benefits*.

The purpose of this database is to hold information about the various parts of TSI. Emphasis is placed on visiting TSI and what a visitor can expect to see/do. This database can be utilized to find events and exhibits, keep track of inventory and publications, and provide historical information about objects and world cultures. It can also be used to provide a range of statistics about the organization.

Anyone will have access to the general information about visiting TSI including schedules and locations. This general information includes details about events, exhibitions, current education programs and the latest research. Due to privacy, most information relating to members of TSI will be restricted to specific users depending on their responsibilities within the organization.

2 Notation and definitions

The notation used: all upper case for the entity names, lower case for the relationship names, and the first letter capitalized for attribute names.

The description of the entities starts with a sentence which explains their meaning. Then the attributes to describe the instances are included. The relationships are also described by a sentence and a list of attributes, if the relationship has attributes.

Each attribute name is followed by a four-letter code which describes the type of attribute according to the four classification criteria for attributes. The format for this code is: $(XYZW)$, where

X use **S** for a simple attribute or **C** for a composite one

Y use **S** for a single valued or **M** for a multivalued,

Z use **P** for a primitive (stored) attribute or **D** if derived; in the latter case, explain how to deduce it from other attributes or provide a formula/procedure to derive it, and

W use **F** for a fixed attribute, i. e. must have a value that is not null, or **O** for optional, i.e. the domain of the attribute allows the *null* value.

For example, an attribute that has the $SSPF$ code is a simple attribute with a single value which is primitive and fixed. An example of this kind of attribute could be the Social Security Number (SSN). On the other hand, an attribute with the ($CSPO$) code is a composite attribute with a single value, primitive and optional. In this case, the date of birth could be an attribute with this code; optional means that its domain contains the NULL value.

3 Conceptual Schema of the Database

The order of presentation of the conceptual schema is:

1. Entities: description and attributes.
2. Relationships: description and attributes (if they have them).
3. EER diagram
4. Explicit Integrity Constraints

3.1 Entities

The entities defined for this database are as follows:

- BENEFIT
- EDUCATION_CENTER
- EVENT
- EXHIBITION

- COMPONENT
- CULTURAL_CENTER
- MEMBER
- MEMBERSHIP
- OBJECT
- PUBLICATION
- RESEARCH_CENTER

A detailed description of each entity follows.

BENEFIT: Perks that members receive from buying the membership at a certain level.

Attributes:	BDescription	(SSPF)

EDUCATION_CENTER: Education initiatives and programs organized by TSI.

Attributes:	EDDescription	(SSPO)
	EDURL	(SSPF)
	EDProgram	(SSPF)
	EDImage	(SMPF)
	EDVideo	(SMPO)
	EDLocation (Street, City, State)	(CSPO)

EVENT: Events and activities including talks, tours, performances and more.

Attributes:	EVAccessURL	(SSPO)
	EVAccessibility (pertains to disabilities)	(SSPO)
	EVCategory	(SMPF)
	EVEndDate (Month/Day/Year)	(CSPF)
	EVCost	(SMPF)
	EVDescription	(SSPO)
	EVLocation (Street, City, State)	(CSPF)
	EVName	(SSPF)
	EVURL	(SSPF)
	EVFlag (One time event, NYC event)	(SSPO)
	EVStartDate (Month/Day/Year)	(CSPF)
	EVStatus(Current, Upcoming, Past)	(SSDF)
	EVTickets_Register	(SSPF)
	EVTime (StartTime, EndTime)	(CSPF)
	EVImage	(SMPF)
	EVVideo	(SMPO)

EXHIBITION: Presentation of objects displayed by TSI.

Attributes:	EXName	(SSPF)
	EXStartDate (Month/Day/Year)	(CSPF)
	EXEndDate (Month/Day/Year)	(CSPO)
	EXStatus(Current,Upcoming,Past)	(SSDF)
	EXCategory	(SMPF)
	EXHours (Day, OpenTime, CloseTime)	(CMPO)
	EXDescription	(SSPO)
	EXLocation (Street, City, State)	(CSPF)
	EXURL	(SSPF)
	EXMapLocation	(SSPF)
	EXFloorPlan	(SSPO)
	EXImage	(SMPF)
	EXVideo	(SMPO)
	EXRestrictions	(SSPF)
	EXHours (Day, OpenTime, CloseTime)	(CMPO)
	EXPhone (Area, Number)	(CMPO)

COMPONENT: Museums, zoos, galleries and gardens that can be visited.

Attributes:	CName	(SSPF)
	CType (Museum, Garden, Zoo)	(SMPF)
	CRestrictions	(SSPF)
	CURL	(SSPF)
	CFloorPlan	(SSPO)
	CDescription	(SSPO)
	CHighlights	(SMPF)
	CLocation (Street, City, State)	(CSPF)
	CMapLocation	(SSPF)
	CCost	(SMPF)
	CHours (Day, OpenTime, CloseTime)	(CMPF)
	CDining	(FMPO)
	CParking (Location, FloorLevel, ParkingSpot)	(CMPF)
	CTransport (Name, Location)	(CMPO)
	CTimedEntryPass (Day, EntryTime, ExitTime)	(CSPF)
	CImage	(SMPF)
	CVideo	(SMPO)
	CPhone (Area, Number)	(CMPO)

CULTURAL_CENTER: One of the organizational units of TSI dedicated to understanding diversity of American and world cultures.

Attributes:	CCName	(SSPF)
	CCURL	(SSPF)
	CCDescription	(SSPO)
	CCImage	(SMPF)
	CCVideo	(SMPO)
	CCLocation (Street, City, State)	(CSPO)
	CCRestrictions	(SSPF)
	CCHours (Day, OpenTime, CloseTime)	(CMPO)
	CCPhone (Area, Number)	(CMPF)

MEMBER: A person who supports the organization in various ways.

Attributes:	MName (FirstName, LastName)	(CSPF)
	Email	(SSPF)
	Address (Street, City, State, PostalCode)	(CSPF)
	Payment (Name, Number, ExpirationDate, CVV)	(CSPF)

MEMBERSHIP: Formal way to support TSI. It is purchased by a mem-

ber and has a range of benefits.

Attributes:	Level	(SSPF)
	Fee	(SSPF)

OBJECT: An item owned or held by TSI for purposes of research and display. Eg. includes flora, fauna, paintings, sculptures, artifacts, documents and more.

Attributes:	Artist	(SMPO)
	OCreator	(SMPO)
	OSubject	(SMPO)
	ODate	(CSPO)
	OnView (Component, Floor_Room_Concourse)	(CMPO)
	Medium	(SMPO)
	Dimension (Width, Length, Height)	(CSPO)
	Weight (Value, Units)	(CSPO)
	ODescription	(SSPO)
	Citation (Name, Collection, Center)	(CSPO)
	Classification	(SMPO)
	OCategory	(SMPO)
	OType	(SMPO)
	OTopic	(SMPO)
	CreditLine	(SMPO)
	RecordId	(SSPO)
	Restrictions	(SMPO)
	Usage	(SSPO)
	GUID	(SSPO)
	OName	(SSPO)
	OTitle	(SSPO)
	Geography	(SSPO)
	RecordID	(SSPO)
	Provenance	(SMPO)
	Manufacturer	(SSPO)
	OriginCountry	(SSPO)
	School	(SSPO)
	CollectionTitle	(SSPO)
	Parentage	(SSPO)
	LifeForm	(SSPO)
	OColor	(SMPO)

CommonName	(SMPO)
Group	(SSPO)
Class	(SSPO)
Family	(SSPO)
Genus	(SSPO)
OImage	(SMPF)
OVideo	(SMPO)

PUBLICATION: Various types of documents published by the research center.

Attributes:		
	PTitle	(SSPF)
	PType	(SSPF)
	PDepartment	(SSPF)
	PAuthor (FirstName, LastName)	(CMPF)
	PImage	(SMPF)
	PVideo	(SMPO)

RESEARCH_CENTER: Facilities dedicated to research in science, the arts and the humanities.

Attributes:		
	RName	(SSPF)
	RURL	(SSPF)
	RDescription	(SSPO)
	RImage	(SMPF)
	RVideo	(SMPO)
	RLocation (Street, City, State)	(CSPF)
	Restrictions	(SSPF)
	RHours (Day, OpenTime, CloseTime)	(CMPO)
	RPhone (Area, Number)	(CMPF)

3.2 Relationships

The relationships in this schema are listed and described below.

host indicates which cultural center hosts the event. A cultural center may host one or more events.
No atrributes.

create cultural centers create exhibitions based on elements of the cultural center's views. A cultural center may create one or more exhibitions.
No atrributes.

sponsor a component sponsors an event by supplying resources for the event. If a component is a sponsor, then the event is usually held at that component. A component can sponsor one or more events.
No atrributes.

show a component showcases one or more exhibitions.
No attributes.

display different components display objects which includes flora and fauna. Flora and fauna can be displayed in multiple components ie. multiple gardens. A component displays many objects.
No attributes.

research research center conducts research on objects held by TSI which is added to each object's profile. Objects can be researched multiple times.
No atrributes.

publish the research center publishes various publications including articles, journals and books. A publication can only be published once.
Attributes: Date (Month/Day/Year) (CSPF)

buy supporters of TSI must buy a membership to become a member. Not every membership will be bought due to the levels available.
Attributes: Date (Month/Day/Year) (CSPF)
Fee (LowAmount, HighAmount) (CSPF)

has each membership has many benefits. Benefits are repeated accross membership levels.
No attributes.

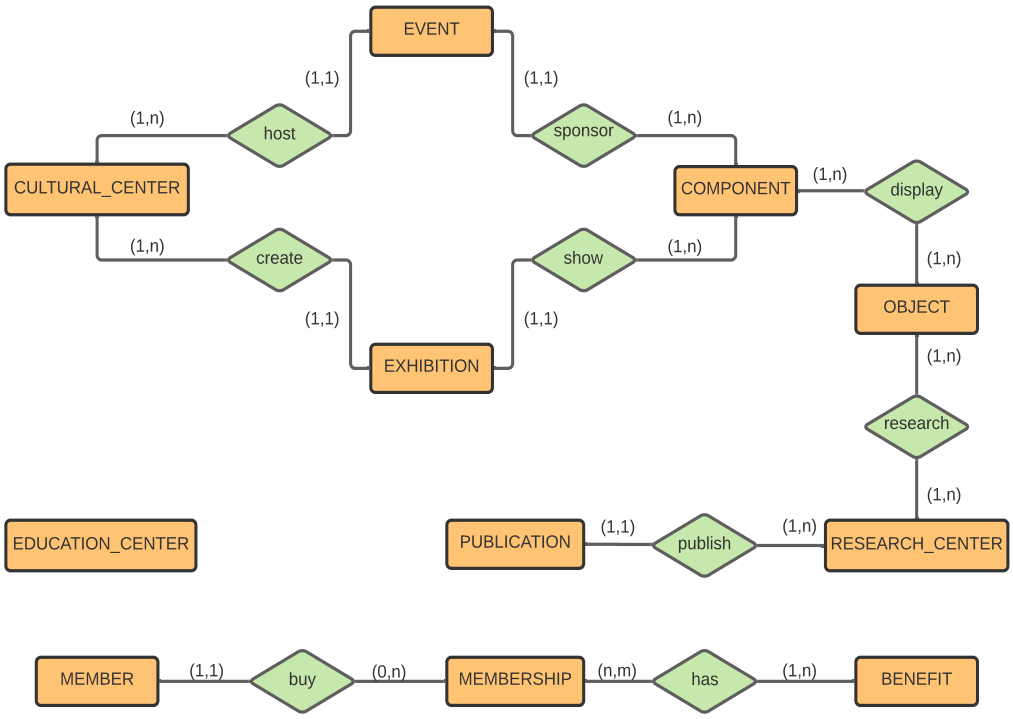

Figure 1: A Conceptual Database Diagram of The Smithsonian Institute

3.3 Explicit Integrity Constraints

Some integrity constraints associated with TSI database are listed in this subsection.

1. COMPONENT.Type can only be chosen from Museum, Garden, Gallery and Zoo.

2. Any URL attribute must not contain the space character.

3. *EndDate* > *StartDate*. This restriction holds for every pair of attributes with this semantics.

3.4 Formulas for Derived Attributes

Formulas for each derived attribute are as follows.

EVENT.EVStatus
$SystemDate < StartDate = Upcoming$
$StartDate \leq SystemDate \leq End\ Date = Current$
$SystemDate > EndDate = Past$
where SystemDate is the current system date.

EXHIBITION.EStatus
$SystemDate < StartDate = Upcoming$
$StartDate \leq SystemDate \leq End\ Date = Current$
$SystemDate > EndDate = Past$
where SystemDate is the current system date.

4 Example Queries

A list of some important queries follows.

1. What are the names of all the components of a specific type, i.e. museums, galleries, gardens, the zoo, research centers, and cultural centers?
2. Briefly describe all of the education initiatives.
3. What is the name of all the museums contained in the Smithsonian? Give details of each one.
4. What are the current events at a specific component of the TSI?
5. What is the physical address of a component and directions to get there?
6. Provide visit details and current restrictions for each of the components.
7. Does the component have maps and floor plans? If so, provide them.
8. How does someone become a member or donate to TSI?
9. List of current members and their details.

10. Statistical information about the members. Eg. number of members per year.

11. Statistical information about TSI. Visitor statistics, for example. Enough data to fill out the "Smithsonian at a Glance" section at the bottom on the right in the About section of the website.

4.1 Possible extensions and additional comments

TSI has employees and a leadership hierarchy including a Board of Regents and General Counsel. Due to the target audience of this database, these aspects of TSI are outside of the scope.

5 The Logical Relational Schema (LRS) for TSI Database

The conceptual schema described for TSI Database is mapped into the Relational Schema presented in this section. Primary keys are underlined. All the attributes underlined in the same Relation belong to the primary key.

BENEFIT *(BDescription, Level,)*

Level is foreign key, references *MEMBERSHIP*

MEMBER *(Email, FirstName, LastName, Street, City, State, Zip, BillingName, CardNum, CardExp, CVV, Level, Fee, JoinMonth, JoinDay, JoinYear)*

Level is foreign key, references *MEMBERSHIP*

MEMBERSHIP *(Level, FeeMin, FeeMax)*

EDUCATION_CENTER *(EDProgram, EDDescription, EDURL, EDStreet, EDCity, EDState, EDRestrictions, EDOpenDay, EDOpenTime, EDCloseTime, EDAreaCode, EDPhoneNum)*

EVENT *(EVName, EVStartYear, EVAccessURL, EVAccessibility, EVCategory, , EVStartMonth, EVStartDay, EVEndMonth, EVEndDay, EVEndYear,*

EVCost, EVDescription, EVStreet, EVCity, EVState, EVURL, EVFlag, EVStatus, EVTicketsRegister, EVStartTime, EVEndTime, EVVenueComponent, EVVenueRoom, EVCulturalCenter)

EVVenueComponent is foreign key, references *COMPONENT*
EVCulturalCenter is foreign key, references *CULTURAL_CENTER*

EXHIBITION *(EXName, EXStartYear, EXStartMonth, EXStartDay, EXEndMonth, EXEndDay, EXEndYear, EXStatus, EXCategory, EXOpenDay, EXOpenTime, EXCloseTime, EXDescription, EXStreet, EXCity, EXState, EXURL, EXMapLocation, EXFloorPlan, EXCulturalCenter, EXVenueComponent)*

EXVenueComponent is foreign key, references *COMPONENT*
EXCulturalCenter is foreign key, references *CULTURAL_CENTER*

COMPONENT *(CName, CType, CRestrictions, CURL, CFLoorPlan, CDescription, CHighlights, CStreet, CCity, CState, CMapLocation, CCost, CHours, CDining, CParking, CTransport, CPassDay, CPassEntryTime, CPassExitTime, CAreaCode, CPhoneNum)*

CULTURAL_CENTER *(CCName, CCURL, CCDescription, Image, Video, Street, City, State, Restrictions, OpenDay, OpenTime, CloseTime, AreaCode, PhoneNum)*

PUBLICATION *(PTitle, PMonth, PDay, PYear, PType, PDepartment, PAuthor First, PAuthorLast, RName)*

RName is foreign key, references *RESEARCH_CENTER*

RESEARCH_CENTER *(RName, RURL, RDescription, RStreet, RCity, RState, RRestrictions, ROpenDay, ROpenTime, RCloseTime, RAreaCode, RPhoneNum)*

OBJECT *(RecordID, OCategory, OName OMonth, ODay, OYear, Creator, Subject, CitationName, CitationCollection, CitationCenter, OnViewComponent, OnViewFloor, OnViewRoom, OnViewConcourse, Medium, Width, Height, Length, ODescription, Classification, OType, OTopic, CreditLine, Usage, Provenance, Exhibition History, Movement)*

CitationCenter is foreign key, references *RESEARCH_CENTER*
OnViewComponent is foreign key, references *COMPONENT*

ARTIFACT *(RecordID, OCategory, CollectionTitle, OriginCountry, Geography, GUID, LabelText, Manufacturer)*

(RecordID, OCategory) is foreign key, references *OBJECT*

WORK_OF_ART *(RecordID, OCategory, Caption, PlaceDepicted, School, Series, PublishedReferences)*

(RecordID, OCategory) is foreign key, references *OBJECT*

LIFE *(Genus, Species, LCategory Class, Family, Order, LName, OnDisplay)*

OnDisplay is foreign key, references *COMPONENT*

FLORA *(Genus, Species, LCategory, CommonName, FlowerColor, Group, LifeForm, Parentage, FLProvenance, Range, Subclass, SuperOrder, FLTopic, FLUsage)*

(Genus, Species, LCategory) is foreign key, references *LIFE*

FAUNA *(Genus, Species, LCategory, Communication, FDescription, Food, Habitat, Reproduction, FSize, FWeight, Sleep, Social)*

(Genus, Species, LCategory) is foreign key, references *LIFE*

Note: To allow for the creation of primary keys and avoid an abundance of null values, the OBJECT entity has been broken up into two superclasses. The first is OBJECT with subclasses ARTIFACT and WORK_OF_ART, and the second is LIFE with subclasses FLORA and FAUNA. This change allows for a better translation into the relational model for TSI database.

5.1 Additional Integrity Constraints for the relational schema

The integrity constraints that must hold for TSI database and that are not guaranteed by the relation schemas described above are listed in this subsection.

1. PassExitTime > PassEntryTime. This restriction holds for every pair of attributes with this semantics.

2. CloseTime > OpenTime. This restriction holds for every pair of attributes with this semantics.

3. The combination of EndMonth + EndDay + EndYear > StartMonth + StartDay + StartYear. This restriction holds for every pair of attributes with this semantics.

4. COMPONENT.Type can only be chosen from Museum, Garden, Gallery, Zoo. Cannot be null.

5. OBJECT.OCategory can only be chosen from A,W. Cannot be null.

6. LIFE.LCategory can only be chosen from FL, FA. Cannot be null.

7. Every RecordID in the tuples of ARTIFACT and WORK_OF_ART must exist in the relation OBJECT. OBJECT is the superclass of ARTIFACT and WORK_OF_ART.

8. If a RecordID exists in the tuples of ARTIFACT then it cannot exist in the tuples of WORK_OF_ART and vice versa. These relations are disjoint.

9. Every (Genus, Species) in the tuples of FLORA and FAUNA must exist in the relation LIFE. LIFE is the superclass of FLORA and FAUNA.

10. If (Genus, Species) exists in the tuples of FLORA then it cannot exist in the tuples of FAUNA and vice versa. These relations are disjoint.