The DDI4 Collections Pattern

DDI4 has a pattern used to describe collections of a variety of, possibly heterogeneous, objects. These collections may be described as a simple “bag” having no structure or even order, or as an ordered list. Collections may also be assigned multiple more complex structures, including hierarchies and cyclical networks.

## Examples of Collections

#### A Simple CodeList

A common example of a collection is a code list. The DDI CodeList class realizes the collection archetype (has all of its properties and relationships). A simple code list might be, for example:

a, n = never

b = some of the time

c = always

This list is ordered. The collection is modeled as a list of CodeItems (e.g. 1 = never), having a Code (the string “1” denotes the concept described as “never”). The DDI4 expressed as YAML might look like:

CodeList:

 agency: example.org

 id: CodeListSimple1

 version: 1

 hasMember:

 - "URN:DDI:example.org:IDCodeItem1:1"

 - "URN:DDI:example.org:IDCodeItem2:1"

 - "URN:DDI:example.org:IDCodeItem3:1"

 hasMemberIsList: true

CodeItem:

 agency: example.org

 id: IDCodeItem1

 version: 1

 contains:

 - "URN:DDI:example.org:IDCodea:1

 - "URN:DDI:example.org:IDCoden:1

 takesMeaningFrom: "URN:DDI:example.org:IDCategory1:1"

CodeItem:

 agency: example.org

 id: IDCodeItem2

 version: 1

 contains:

 - "URN:DDI:example.org:IDCodeb:1

 takesMeaningFrom: "URN:DDI:example.org:IDCategory2:1"

CodeItem:

 agency: example.org

 id: IDCodeItem3

 version: 1

 contains:

 - "URN:DDI:example.org:IDCodec:1

 takesMeaningFrom: "URN:DDI:example.org:IDCategory3:1"

Code:

 agency: example.org

 id: IDCodea

 version: 1

 token: a

 denotes: "URN:DDI:example.org:IDCategory1:1"

Code:

 agency: example.org

 id: IDCoden

 version: 1

 token: n

 denotes: "URN:DDI:example.org:IDCategory1:1"

Code:

 agency: example.org

 id: IDCodeb

 version: 1

 token: b

 denotes: "URN:DDI:example.org:IDCategory2:1"

Code:

 agency: example.org

 id: IDCodec

 version: 1

 token: c

 denotes: "URN:DDI:example.org:IDCategory3:1"

Category:

 agency: example.org

 id: IDCategory1

 isUniversallyUnique: False

 version: 1

 displayLabel:

 languageSpecificStructuredString:

 -

 content:

 - never

 isPlainText: True

 language:

Category:

 agency: example.org

 id: IDCategory2

 isUniversallyUnique: False

 version: 1

 displayLabel:

 languageSpecificStructuredString:

 -

 content:

 - some of the time

 isPlainText: True

 language:

Category:

 agency: example.org

 id: IDCategory3

 isUniversallyUnique: False

 version: 1

 displayLabel:

 languageSpecificStructuredString:

 -

 content:

 - always

 isPlainText: True

 language:

#### A More Complex CodeList

CodeLists may be structured as a hierarchy. In the example below the second category can be subdivided. Changes from the simple case are shown in bold below

a, n = never

b = some of the time

 b.L = less than half of the time

 b.H = half of the time or more, but less than always

c = always

CodeList:

 agency: example.org

 id: **CodeListComplex1**

 version: 1

 hasMember:

 - "URN:DDI:example.org:IDCodeItem1:1"

 - "URN:DDI:example.org:IDCodeItem2:1"

 **- "URN:DDI:example.org:IDCodeItem2L:1"**

 **- "URN:DDI:example.org:IDCodeItemI2H:1"**

 - "URN:DDI:example.org:IDCodeItem3:1"

 **hasMemberIsList: false**

CodeItem:

 agency: example.org

 id: IDCodeItem1

 version: 1

 contains:

 - "URN:DDI:example.org:IDCodea:1

 - "URN:DDI:example.org:IDCoden:1

 takesMeaningFrom: "URN:DDI:example.org:IDCategory1:1"

CodeItem:

 agency: example.org

 id: IDCodeItem2

 version: 1

 contains:

 - "URN:DDI:example.org:IDCodeb:1

 takesMeaningFrom: "URN:DDI:example.org:IDCategory2:1"

CodeItem:

 agency: example.org

 id: IDCodeItem3

 version: 1

 contains:

 - "URN:DDI:example.org:IDCodec:1

 takesMeaningFrom: "URN:DDI:example.org:IDCategory3:1"

**CodeItem:**

 **agency: example.org**

 **id: IDCodeItem2L**

 **version: 1**

 **contains:**

 **- "URN:DDI:example.org:IDCodebL:1**

 **takesMeaningFrom: "URN:DDI:example.org:IDCategory2L:1"**

**CodeItem:**

 **agency: example.org**

 **id: IDCodeItem2H**

 **version: 1**

 **contains:**

 **- "URN:DDI:example.org:IDCodebH:1**

 **takesMeaningFrom: "URN:DDI:example.org:IDCategory2H:1"**

Code:

 agency: example.org

 id: IDCodea

 version: 1

 token: a

 denotes: "URN:DDI:example.org:IDCategory1:1"

Code:

 agency: example.org

 id: IDCoden

 version: 1

 token: n

 denotes: "URN:DDI:example.org:IDCategory1:1"

Code:

 agency: example.org

 id: IDCodeb

 version: 1

 token: b

 denotes: "URN:DDI:example.org:IDCategory2:1"

Code:

 agency: example.org

 id: IDCodec

 version: 1

 token: c

 denotes: "URN:DDI:example.org:IDCategory3:1"

**Code:**

 **agency: example.org**

 **id: IDCodeb**

 **version: 1**

 **token: b,L**

 **denotes: "URN:DDI:example.org:IDCategory2L:1"**

**Code:**

 **agency: example.org**

 **id: IDCodeb**

 **version: 1**

 **token: b.HH**

 **denotes: "URN:DDI:example.org:IDCategory2:1"**

Category:

 agency: example.org

 id: IDCategory1

 isUniversallyUnique: False

 version: 1

 displayLabel:

 languageSpecificStructuredString:

 -

 content:

 - never

 isPlainText: True

 language:

Category:

 agency: example.org

 id: IDCategory2

 isUniversallyUnique: False

 version: 1

 displayLabel:

 languageSpecificStructuredString:

 -

 content:

 - some of the time

 isPlainText: True

 language:

Category:

 agency: example.org

 id: IDCategory3

 isUniversallyUnique: False

 version: 1

 displayLabel:

 languageSpecificStructuredString:

 -

 content:

 - always

 isPlainText: True

 language:

**Category:**

 **agency: example.org**

 **id: IDCategory2L**

 **isUniversallyUnique: False**

 **version: 1**

 **displayLabel:**

 **languageSpecificStructuredString:**

 **-**

 **content:**

 **- less than half of the time**

 **isPlainText: True**

 **language:**

**Category:**

 **agency: example.org**

 **id: IDCategory2**

 **isUniversallyUnique: False**

 **version: 1**

 **displayLabel:**

 **languageSpecificStructuredString:**

 **-**

 **content:**

 **- half of the time or more, but less than always**

 **isPlainText: True**

 **language:**

**RelationshipStructure:**

 **structures: "URN:DDI:example.org: CodeListComplex1:1"**

 **hasRelationsSpecification: List**

 **semantics: Hierarchy**

 **totality: Total**

 **hasMemberRelationships:**

 **- "URN:DDI:example.org: MemberRelationshipsCodeListComplexA:1"**

 **- "URN:DDI:example.org: MemberRelationshipsCodeListComplexB:1"**

 **- "URN:DDI:example.org: MemberRelationshipsCodeListComplexC:1"**

 **- "URN:DDI:example.org: MemberRelationshipsCodeListComplexD:1"**

**MemberRelationships: # b follows a,n**

 **agency: example.org**

 **id: MemberRelationshipsCodeListComplexA**

 **version: 1**

 **hasRelationsSpecification: List**

 **semantic:**

 **associationType:**

 **atLevel: "URN:DDI:example.org:Level1:1"**

 **sourceMamber: "URN:DDI:example.org:CodeItem1:1"**

 **targetMembers: "URN:DDI:example.org:TargetMemberA:1"**

**TargetMembers:**

 **agency: example.org**

 **id: TargetMemberA**

 **version: 1**

 **atLevel: "URN:DDI:example.org:Level1:1"**

 **hasMember: "URN:DDI:example.org:CodeItem2:1"**

**MemberRelationships: # c follows b**

 **agency: example.org**

 **id: MemberRelationshipsCodeListComplexB**

 **version: 1**

 **hasRelationsSpecification: List**

 **semantic:**

 **associationType:**

 **sourceMamber: "URN:DDI:example.org:CodeItem2:1"**

 **targetMembers: "URN:DDI:example.org:TargetMemberB:1"**

**TargetMembers:**

 **agency: example.org**

 **id: TargetMemberB**

 **version: 1**

 **atLevel: "URN:DDI:example.org:Level1:1"**

 **hasMember: "URN:DDI:example.org:CodeItem3:1"**

**MemberRelationships: # b is Parent of b.L and b.H**

 **agency: example.org**

 **id: MemberRelationshipsCodeListComplexB**

 **version: 1**

 **hasRelationsSpecification: ParentChild**

 **semantic:**

 **associationType:**

 **hasMembersIsList" true**

 **sourceMamber: "URN:DDI:example.org:CodeItem2:1"**

 **targetMembers: "URN:DDI:example.org:TargetMemberBLH:1"**

**TargetMembers:**

 **agency: example.org**

 **id: TargetMemberBLH**

 **version: 1**

 **atLevel: "URN:DDI:example.org:Level2:1"**

 **hasMember:**

 **- "URN:DDI:example.org:CodeItem2.L:1"**

 **- "URN:DDI:example.org:CodeItem2.H:1"**

**Level: # Level 1 is a,n b c**

 **agency: example.org**

 **id: Level1**

 **version: 1**

 **depth: 1**

 **ContainsList: true**

 **hasMember:**

 **- "URN:DDI:example.org:CodeItem1:1"**

 **- "URN:DDI:example.org:CodeItem1:2"**

 **- "URN:DDI:example.org:CodeItem1:3"**

 **Level: # Level 2 is 2.L 2.H**

 **agency: example.org**

 **id: Level2**

 **version: 1**

 **depth: 2**

 **ContainsList: true**

 **hasMember:**

 **- "URN:DDI:example.org:CodeItem1:2.L"**

 **- "URN:DDI:example.org:CodeItem1:2.H"**

#### A Network Structure

Relationships among concepts may be described in a hierarchy as with SKOS or XKOS, or in a more general graph. Developing the latter is one of the activities supported in qualitative data analysis packages. In the example below segments of an interview might be marked up with a set of seven codes ("Praise" etc.). Relationships among the codes might be described in a network combining directed and undirected elements.



The YAML below describes the relationships in the figure above.

ConceptSystem:

 agency: example.org

 id: ConSys1

 isUniversallyUnique: False

 hasMembersList: False # has a complex strucure, the order

 version: 1

 concept:

 - "URN:DDI:example.org:1Desc:1"

 - "URN:DDI:example.org:2Stmt:1"

 - "URN:DDI:example.org:3Pra:1"

 - "URN:DDI:example.org:4Comp:1"

 - "URN:DDI:example.org:5Crit:1"

Concept:

 agency: example.org

 id: 1Desc

 isUniversallyUnique: False

 version: 1

 name:

 content:Description

Concept:

 agency: example.org

 id: 2Stmt

 isUniversallyUnique: False

 version: 1

 name:

 content:Statement

Concept:

 agency: example.org

 id: 3PRA

 isUniversallyUnique: False

 version: 1

 name:

 content:Praise

Concept:

 agency: example.org

 id: 4Comp

 isUniversallyUnique: False

 version: 1

 name:

 content:Compliment

Concept:

 agency: example.org

 id: 5Crit

 isUniversallyUnique: False

 version: 1

 name:

 content:Criticism

RelationshipStructure:

 structures: "URN:DDI:example.org:ConSys1:1"

 semantics: mixed relationships

 hasMemberRelationships:

 - "URN:DDI:example.org:MemberRelationships1:1"

 - "URN:DDI:example.org:MemberRelationships2:1"

 - "URN:DDI:example.org:MemberRelationships3:1"

 - "URN:DDI:example.org:MemberRelationships4:1"

 - "URN:DDI:example.org:MemberRelationships5:1"

MemberRelationships: # Description, Praise, Criticism narrower than Statment

 agency: example.org

 id: MemberRelationships1

 version: 1

 hasRelationsSpecification: ParentChild

 semantic: skos:narrower

 associationType: directed

 sourceMamber: "URN:DDI:example.org:2Stmt:1"

 targetMembers: "URN:DDI:example.org:TargetMember1:1"

TargetMembers:

 agency: example.org

 id: TargetMember1

 version: 1

 hasMember:

 - "URN:DDI:example.org:1Desc:1"

 - "URN:DDI:example.org:3PRA:1"

 - "URN:DDI:example.org:5Crit:1"

 MemberRelationships: # Criticism employs Description

 agency: example.org

 id: MemberRelationships2

 version: 1

 hasRelationsSpecification: ParentChild

 semantic: employs

 associationType: directed

 sourceMamber: "URN:DDI:example.org:5Crit:1"

 targetMembers: "URN:DDI:example.org:TargetMember2:1"

TargetMembers:

 agency: example.org

 id: TargetMember2

 version: 1

 hasMember:

 - "URN:DDI:example.org:1Desc:1"

MemberRelationships: # Praise employs Description

 agency: example.org

 id: MemberRelationships3

 version: 1

 hasRelationsSpecification: ParentChild

 semantic: employs

 associationType: directed

 sourceMamber: "URN:DDI:example.org:3PRA:1"

 targetMembers: "URN:DDI:example.org:TargetMember2:1" # reuse of TargetMembers

MemberRelationships: # Praise and Compliment are antonyms to Criticism

 agency: example.org

 id: MemberRelationships4

 version: 1

 hasRelationsSpecification: Unordered

 semantic: antonym

 associationType: undirected

 sourceMamber: "URN:DDI:example.org:5Crit:1"

 targetMembers: "URN:DDI:example.org:TargetMember4:1"

TargetMembers:

 agency: example.org

 id: TargetMember4

 version: 1

 hasMember:

 - "URN:DDI:example.org:3PRA:1"

 - "URN:DDI:example.org:4Comp:1"

MemberRelationships: # Praise and Compliment are related as a match

 agency: example.org

 id: MemberRelationships5

 version: 1

 hasRelationsSpecification: Equivalence

 semantic: skos:relatedMatch

 associationType: undirected

 sourceMamber: "URN:DDI:example.org:3PRA:1"

 targetMembers: "URN:DDI:example.org:TargetMember5:1"

TargetMembers:

 agency: example.org

 id: TargetMember5

 version: 1

 hasMember:

 - "URN:DDI:example.org:4Comp:1"