

SoNAR: Facet and Data Model. Draft

Inhalt

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Overview

SoNAR supports the analysis of Historical Social Networks. The service is aggregating data on agents from heterogeneous sources, particularly library and archival union catalogs (**core data set**). Libraries and archives will be also enabled to transfer data on agents from digital repositories (**supplement**). Merged data on agents will be accessible via an API, or a UI to search and to explore the data set.

This paper comprises a preliminary draft of both a facet model to explore agents and a data model for historical network data. It is part of an implementation and operating concept worked out during a proof of concept project¹. Core concepts of the data model will be borrowed from Records-in-Context (RiC-O)² and ontologies of the Integrated Authority File (GND-O/-AgRelOn³). Thus, the data model also documents the range of information about agents that library and archival information systems could provide in line with international cataloging guidelines and descriptive standards.

The data model consists of classes, properties, and relations: classes name entity types and properties describe entities. The relation types describe relations between entity classes. In RDF both properties and relations will be treated as a property (= predicate between subject and object)⁴.

¹ <https://gepris.dfg.de/gepris/projekt/414792379>

² https://www.ica.org/standards/RiC/RiC-O_v0-2.html

³ <https://d-nb.info/standards/elementset/gndo>, <https://d-nb.info/standards/elementset/agrelon>

⁴ The data model will be encoded in the Web Ontology Language, OWL: <https://www.w3.org/OWL/>

This outline is a solid starting point for an implementation of the models. They are comprehensive, but yet not exhaustive. They are, however, expandable with little efforts, as needed with any kind of statements about agents and relations between agents.

Facet model

Facets are a mean to explore data sets. Table 1 groups proposed facets by headings: (1) entities, (2) demographics, (3) subjects, (4) dates, (5) places, (6) social relations, (7) resources. The “ID data model” links to tables of the subsequent chapters: entities (E*), properties (P*), relations (R*).

| ID Filter | Filter group | ID data model | Filter Name |
|-----------|------------------|---------------|---|
| F01 | Entity | E01-E21 | Entity class (Entitätenklasse) |
| F02 | Entity | P02/P03 | Entity Name (Name eines Akteurs) |
| F03 | Demographics | P04 | Title of Nobility (Adelstitel) |
| F04 | Demographics | P05 | Academic Degree (Akademischer Grad) |
| F05 | Demographics | P06 | Profession and Occupation (Beruf und Tätigkeit) |
| F06 | Demographics | P08 | Gender (Geschlecht) |
| F07 | Demographics | P09 | Language (verwendete Sprache) |
| F08 | Demographics | P12 | Age (Alter einer Person) |
| F09 | Demographics | P13 | Country of Origin (Herkunftsland) |
| F10 | Demographics | P14 | Characteristic Place (Familiensitz) |
| F11 | Subjects | P10 | Topic (Themen) |
| F12 | Subjects | P11 | Field of Study (Studienfach) |
| F13 | Subjects | P07 | Instrument (Musikinstrument) |
| F14 | Subjects | P26 | Work Titles (Werke) |
| F15 | Subjects | P27 | Conferences (Konferenzen) |
| F16 | Date | R46-R51 | Type of date relation (Agent to Date) |
| F17 | Date | E26 | Date |
| F18 | Place | R39-R45 | Type of place relation (Agent to Place) |
| F19 | Place | E22 | Place |
| F20 | Social Relations | R01-R38 | Type of social relation (Agent to Agent) |
| F21 | Social Relations | E01 | Agent |
| F22 | Resources | R52-R54 | Type of resource relation (Agent to Resource) |
| F23 | Resources | E35 | Resource ⁵ |

Table 1: Facets based on entity types, properties, and relations defined by the data model

The exploration of the data set must enable customers to identify agents and groups of agents linked by shared attributes, e.g.: Who else was born in a city and belongs to the same cohort? Who else was in exile and born in the same country? Who else was in a city a conference took place? There are more data elements available to group agents, e.g. by holding organizations⁶ or data provenance:

- PROV-01: Data Repository (Datenquelle, e.g.: DE-588, DE-611, DE-600)
- PROV-02: Type of Data Creator (Datenerzeuger, e.g.: human, machine)
- PROV-03: Collection, or Archival Fonds (Sammlung, Archivbestand)

With an implementation of SoNAR, both the facet and data model will be considered in more detail to provide an ideal user experience and data set for historical network analysis.

Data model

List of Classes and Sub-Classes

Table 2 focuses on sub-classes of agents. The entity classes date, place, and resource supplement the list, but they are considered primarily as objects of agents. The prefix “rico:” is used for the namespace of concepts borrowed from the records in context ontology. The prefix “gndo:” represents concepts

⁵ Resources are record sets that describe personal papers, manuscripts collections, or archival fonds.

⁶ Represented by an International Standard Identifier for Libraries and Related Organizations, ISIL

of the integrated authority file ontology, and “agrelon:”, used in the table “types of relationships”, is the namespace for concepts of the Agent-Relations-Ontology. Each concept is linked with a definition of the respective ontology. Equal concepts of the ontologies are grouped by the same ID.

| ID | Entity Classes and Sub-Classes | | |
|-----|---|---|--|
| E01 | rico:#Agent | | |
| E02 | | rico:#Person | |
| | | gndo:#Person | |
| E03 | | - | gndo:#DifferentiatedPerson |
| E04 | | - | gndo:#CollectivePseudonym |
| E05 | | - | gndo:#Gods |
| E06 | | - | gndo:#LiteraryOrLegendaryCharacter |
| E07 | | - | gndo:#Pseudonym |
| E08 | | - | gndo:#RoyalOrMemberOfARoyalHouse |
| E09 | | - | gndo:#Spirits |
| E10 | | rico:#Group | |
| E11 | | | rico:#Family |
| | | | gndo:#Family |
| E12 | | | rico:#CorporateBody |
| | | | gndo:#CorporateBody |
| E13 | | | gndo:#Company |
| E14 | | | gndo:#FictiveCorporateBody |
| E15 | | | gndo:#MusicalCorporateBody |
| E16 | | | gndo:#OrganOfCorporateBody |
| E17 | | | gndo:#ProjectOrProgram |
| E18 | | | gndo:#ReligiousAdministrativeUnit |
| E19 | | | gndo:#ReligiousCorporateBody |
| E20 | | | gndo:#AdministrativeUnit |
| E21 | | | gndo:#TerritorialCorporateBodyOrAdministrativeUnit |
| E22 | rico:#Date | | |
| | gndo:#associatedDate | | |
| E23 | | rico:#SingleDate | |
| E24 | | rico:#DateRange | |
| E25 | | rico:#DateSet | |
| E26 | rico:#Place | | |
| | gndo:#PlaceOrGeographicName | | |
| E27 | | gndo:#BuildingOrMemorial | |
| E28 | | gndo:#Country | |
| E29 | | gndo:#ExtraterrestrialTerritory | |
| E30 | | gndo:#FictivePlace | |
| E31 | | gndo:#MemberState | |
| E32 | | gndo:#NameOfSmallGeographicUnitLyingWithinAnotherGeographicUnit | |
| E33 | | gndo:#NaturalGeographicUnit | |
| E34 | | gndo:#WayBorderOrLine | |
| E35 | rico:#RecordResource | | |
| E36 | | rico:#RecordSet | |
| E37 | | rico:#Record | |
| E38 | | rico:#RecordPart | |

List of Properties (Overview)

Table 3 is an overview of properties used to describe agents. The properties are a result of the analysis of the aforementioned ontologies as well as real data of the Integrated Authority File, Kalliope Union Catalog, Union Catalog of Serials, and the catalog of the Berlin State Library / GBV⁷. Metadata provide

⁷ GBV Common Library Network, <https://www.gbv.de/>

information about agents: The language used by a person, topics someone worked on, collaborations between agents, dates or range of dates of activities, etc. Some properties will be modelled as sub classes of an additional class “[gndo:SubjectHeadings](#)”, e.g. profession, field of study, topics,

| | | |
|--------------|---|--------------------------------|
| ID: P01 (ID) | Property: Identifier | Scales of Measurement: N/A |
| ID: P02 (NA) | Property: Name | Scales of Measurement: N/A |
| ID: P03 (VA) | Property: Variant Name | Scales of Measurement: N/A |
| ID: P04 (TN) | Property: Title of Nobility | Scales of Measurement: nominal |
| ID: P05 (AD) | Property: Academic Degree | Scales of Measurement: nominal |
| ID: P06 (PO) | Property: Profession or Occupation | Scales of Measurement: nominal |
| ID: P07 (IN) | Property: Instrument | Scales of Measurement: nominal |
| ID: P08 (GN) | Property: Gender | Scales of Measurement: nominal |
| ID: P09 (LU) | Property: Language | Scales of Measurement: nominal |
| ID: P10 (TO) | Property: Topic | Scales of Measurement: nominal |
| ID: P11 (FS) | Property: Field of Study | Scales of Measurement: nominal |
| ID: P12 (OC) | Property: Age | Scales of Measurement: ratio |
| ID: P13 (CO) | Property: Country of Origin | Scales of Measurement: nominal |
| ID: P14 (CP) | Property: Characteristic Place | Scales of Measurement: nominal |
| ID: P15 (SG) | Property: Social Group | Scales of Measurement: nominal |
| ID: P16 (WT) | Property: Work Title | Scales of Measurement: nominal |
| ID: P17 (CN) | Property: Conferences | Scales of Measurement: nominal |
| ID: P18 (CH) | Property: History | Scales of Measurement: nominal |
| ID: P19 (AB) | Property: Abbreviation | Scales of Measurement: N/A |
| ID: P20 (DE) | Property: Duration of Existence | Scales of Measurement: ratio |
| ID: P21 (CF) | Property: Country (Office, Headquarter) | Scales of Measurement: nominal |
| ID: P22 (CL) | Property: Legal Status | Scales of Measurement: nominal |
| ID: P23 (CT) | Property: Certainty | Scales of Measurement: nominal |
| ID: P24 (DQ) | Property: Date qualifier | Scales of Measurement: N/A |
| ID: P25 (DS) | Property: Date standard | Scales of Measurement: N/A |
| ID: P26 (DE) | Property: Expressed Date | Scales of Measurement: N/A |
| ID: P27 (DN) | Property: Normalized Date | Scales of Measurement: Ratio |
| ID: P28 (CA) | Property: Coordinates | Scales of Measurement: Ratio |

Table 2: Short list of properties of the data model for historical social networks

List of Properties (Persons)

Tables 4 to 7 specify properties of entity classes (persons, groups, dates, and places). Each property is assigned an ID and a name. The scale of measurements indicates statistical operations that could be applied on values. Some properties of the aforementioned ontologies have same meanings. They are “merged” under an ID. Definitions of properties of persons (table 4) come with information about the origination of values. Some origin from statements about resources (metadata) and are expressed as a chain of statements to infer explicit statements about agents. Some originate from authority records that are explicit statements (asserted triples) provided by data provider.

| | | |
|--|-----------------------------|--------------------------------|
| ID: P01 (ID) | Property: Identifier | Scales of Measurement: N/A |
| gndo:#gndolIdentifier ; rico: #Identifier | | |
| Unique identification of a reified entity (URI). Missing identifier are marked by “?”. | | |
| ID: P02 (NA) | Property: Name | Scales of Measurement: N/A |
| gndo:#preferredName ; rico: #Name | | |
| A person’s name. A name is a human readable representation of the URI (rdf:label). | | |
| ID: P03 (VA) | Property: Variant Name | Scales of Measurement: N/A |
| gndo:#variantName | | |
| A person’s variant names. <i>Asserted triple</i> | | |
| ID: P04 (TN) | Property: Title of Nobility | Scales of Measurement: nominal |
| gndo:#titleOfNobility | | |
| A person’s nobility title. <i>Asserted triple (s. social group, P15)</i> | | |
| ID: P05 (AD) | Property: Academic Degree | Scales of Measurement: nominal |
| gndo:#academicDegree | | |
| A person’s academic degree. <i>Asserted triple</i> | | |

| | | |
|--|---|---------------------------------------|
| ID: P06 (PO) | Property: Profession or Occupation | Scales of Measurement: nominal |
| gndo:#professionOrOccupation ; rico: #OccupationType | | |
| A person's profession. Asserted triple; inferred triple: {Agent} gndo:#professionOrOccupation {Historikerin} agrelon:#broaderTermGeneral {Wissenschaftlerin} = Agent gndo:#professionOrOccupation {Wissenschaftlerin} | | |
| ID: P07 (IN) | Property: Instrument | Scales of Measurement: nominal |
| gndo:#instrument | | |
| An instrument a person played. Asserted triple; inferred triple: {Agent} gndo:#instrument {Klarinette} gndo:#broaderTermGeneral {Rohrblattinstrument} gndo:#broaderTermGeneral {Holzblasinstrument} gndo:#broaderTermGeneral {Blasinstrument} gndo:#broaderTermGeneral {Aerophon} gndo:#broaderTermGeneral {Musikinstrument} = Agent gndo:#instrument {Holzblasinstrument} (etc.) | | |
| ID: P08 (GN) | Property: Gender | Scales of Measurement: nominal |
| gndo:#gender ; rico: #DemographicGroup ⁸ | | |
| The gender of a person. Asserted triple | | |
| ID: P09 (LU) | Property: Language | Scales of Measurement: nominal |
| gndo:#language ; rico: #Language | | |
| The language used by a person, family, or corporate body. Asserted triple; inferred triple: {Agent} rico:#isCreatorOf {Resource} rico:#language {Language} = Agent rico:#language {Language} | | |
| ID: P10 (TO) | Property: Topic | Scales of Measurement: nominal |
| gndo:#topic ; rico: #hasOrHadSubject | | |
| Topics a person, family, or corporate body is identified with. Asserted triple: authority file; inferred triple: {Agent} rico:#isCreatorOf {Resource} rico:#hasOrHadSubject {Subject} = {Agent} rico:#hasOrHadSubject {Subject} | | |
| ID: P11 (FS) | Property: Field of Study | Scales of Measurement: nominal |
| gndo:#fieldOfStudy | | |
| The subject of a person. Asserted triple; inferred triple: {Agent} gndo:#fieldOfStudy {Gräzistik} gndo:#broaderTermGeneral {Philologie} = Agent gndo:#fieldOfStudy {Philologie} | | |
| ID: P12 (OC) | Property: Age | Scales of Measurement: ratio |
| rico: #DemographicGroup | | |
| Difference of a person's death and birth date (YYYY-YYYY=Age). Property P12 is analog P20. | | |
| ID: P13 (CO) | Property: Country of Origin | Scales of Measurement: nominal |
| rico: #DemographicGroup | | |
| Country of the city asserted as birthplace. Inferred Triple: {Agent} gndo:#placeOfBirth {Linden (Hannover)} agrelon:geographicAreaCode {XA-DXDE} = {Agent} sonar:countryOfOrigin {XA-DXDE = Deutsches Reich} | | |
| ID: P14 (CP) | Property: Characteristic Place | Scales of Measurement: nominal |
| gndo:#characteristicPlace | | |
| Place a person's family is identified with. Inferred Triple: {Agent} gndo:#familialRelationship {Family} gndo:#characteristicPlace {Place} = Agent gndo:#characteristicPlace {Place} | | |
| ID: P15 (SG) | Property: Social Group | Scales of Measurement: nominal |
| P03 (nobility), P04 (academics), P05 (occupational category), P06 (= occupation: {musician}) From linked controlled vocabularies (broader terms). Inferred Triple: {Agent} gndo:#P03 04 05 06 {value} gndo:#broaderTermGeneral {value} = {Agent} sonar:#SocialGroup {value} | | |
| ID: P16 (WT) | Property: Work Title | Scales of Measurement: nominal |
| gndo:#Work | | |
| A work (title) an agent is identified with. Asserted triple; inferred triple: {Agent} marcRole:ctb {Resource} bf:title {Das Ich und sein Gehirn} = Agent gndo:#Work {Das Ich und sein Gehirn} (resources should be looked up with culturegraph to identify same titles ⁹) | | |
| ID: P17 (CN) | Property: Conferences | Scales of Measurement: nominal |
| gndo:#affiliation | | |
| Conference a person participated in. Asserted triple | | |
| ID: P18 (CH) | Property: History | Scales of Measurement: nominal |
| gndo:#biographicalOrHistoricalInformation ; rico: #history | | |

⁸ Age, gender, country of origin etc. will be sub-classes of rico:#DemographicGroup.

⁹ [http://hub.culturegraph.org/search?mode=cluster&id=\(DE-101\)946653739](http://hub.culturegraph.org/search?mode=cluster&id=(DE-101)946653739)

Biography of a person described with a finding aid (metadata) or an authority record. *Asserted Triple*;
inferred triple: {Agent} rico:#isProvenanceOf {Resource} rico:#history {History}
= {Agent} rico:#history {History}

Table 3: Properties of Persons

List of Properties (Groups)

| | | |
|---|--|---------------------------------------|
| ID: P01 (ID) | Property: Identifier | Scales of Measurement: N/A |
| gndo:#gndIdentifier ; rico:#Identifier | | |
| Unique identification of a class entity (URI). Missing identifier are marked by “?”. | | |
| ID: P02 (NA) | Property: Name | Scales of Measurement: N/A |
| gndo:#preferredName ; rico:#Name | | |
| A group's name. | | |
| ID: P03 (VA) | Property: Variant Name | Scales of Measurement: N/A |
| gndo:#variantName | | |
| A group's variant name (authority record only). | | |
| ID: P19 (AB) | Property: Abbreviation | Scales of Measurement: N/A |
| gndo:#abbreviatedNameForTheCorporateBody | | |
| Abbreviation of a group. | | |
| ID: P09 (LU) | Property: Language | Scales of Measurement: nominal |
| gndo:#language ; rico:#Language | | |
| The language used by a person, family, or corporate body. | | |
| ID: 10 (TO) | Property: Topic | Scales of Measurement: nominal |
| gndo:#topic ; rico:#hasOrHadSubject | | |
| Topics a person, family, or corporate body is related to. | | |
| ID: P20 (DE) | Property: Duration of Existence | Scales of Measurement: ratio |
| rico:#DemographicGroup | | |
| Difference between Termination and Establishment. Property P20 is analog P12. | | |
| ID: P21 (CF) | Property: Country (Office, Headquarter) | Scales of Measurement: nominal |
| rico:#DemographicGroup | | |
| Extracted from the main location of a corporate body or a characteristic place of a family. | | |
| ID: P16 (WT) | Property: Work Title | Scales of Measurement: nominal |
| gndo:#Work | | |
| A work (title) an agent is identified with. | | |
| ID: P17 (CN) | Property: Conferences | Scales of Measurement: nominal |
| gndo:#affiliation | | |
| Conferences an agent is associated with. Declared with authority records or extracted from metadata describing a resource a person has created. | | |
| ID: P18 (CH) | Property: History | Scales of Measurement: nominal |
| gndo:#biographicalOrHistoricalInformation ; rico:#history | | |
| Biography of a group described with a finding aid (metadata) or an authority record. | | |
| ID: P22 (CL) | Property: Legal Status | Scales of Measurement: nominal |
| gndo:#broaderTermGeneral ; rico:#LegalStatus | | |
| Rechtlicher Status, e.g.: NGO, association, | | |

Table 4: Properties of Groups

List of Properties (Dates)

| | | |
|--|----------------------------------|---------------------------------------|
| ID: P01 (ID) | Property: Identifier | Scales of Measurement: N/A |
| gndo:#gndIdentifier ; rico:#Identifier | | |
| Unique identification number of an entity and sameAs URI representations (of authority records). | | |
| ID: P23 (CT) | Property: Certainty | Scales of Measurement: nominal |
| List of Values: certain, uncertain, ascertained | | |
| ID: P24 (DQ) | Property: Date qualifier | Scales of Measurement: N/A |
| List of Values: circa, exact | | |
| ID: P25 (DS) | Property: Date standard | Scales of Measurement: N/A |
| List of Values: ISO 8601, Gregorian, French Revolution Calendar | | |
| ID: P26 (DE) | Property: Expressed Date | Scales of Measurement: N/A |
| Textual representation of a date, e.g. 9. November 1989, Weihnachten 1896 | | |
| ID: P27 (DN) | Property: Normalized Date | Scales of Measurement: ratio |
| Standard based representation of a date, e.g. 2001-02-12 | | |

Table 5: Properties of Dates

List of Properties (Places)

| | | |
|---|-------------------------------|-------------------------------------|
| ID: P01 (ID) | Property: Identifier | Scales of Measurement: N/A |
| gndo:#gndIdentifier ; rico:#Identifier | | |
| Unique identification number for an entity from the source data set, e.g. GNDO. | | |
| ID: P02 (NA) | Property: Name | Scales of Measurement: N/A |
| gndo:#preferredName ; rico:#Name | | |
| A place's name. | | |
| ID: P03 (VA) | Property: Variant Name | Scales of Measurement: N/A |
| gndo:#variantName | | |
| A place's variant name (from authority record only) | | |
| ID: P28 (CA) | Property: Coordinates | Scales of Measurement: ratio |
| gndo:#typeOfCoordinates | | |
| Geographical coordinates of a place (from authority record only). | | |

Table 6: Properties of Places

Types of Relationships

Indented lines are hierarchical specifications of relations. Same IDs indicate at least a similar meaning of relationships between concepts of RiC- and Agent Relations Ontology:

| ID | o | Entity | hasRelation | Entity |
|-----|---------|--------|--|--------|
| R01 | rico | Agent | is agent associated with agent (Rico-R044) (#isAgentAssociatedWithAgent) | Agent |
| R01 | agrelon | Agent | related Agent (#RelatedAgent) | Agent |
| R02 | rico | Agent | has or had subordinate (Rico-R045) - is or was subordinate to (#isOrWasSubordinateTo) | Agent |
| R03 | rico | Agent | is or was controller of (Rico-R041) - has or had controller (#isOrWasControllerOf) | Agent |
| R04 | rico | Person | is or was leader of (Rico-R042) - has or had leader (#isOrWasLeaderOf) | Group |
| R04 | agrelon | Person | Is Chief of - has Chief (#isChiefOf , #hasChief) | Group |
| R05 | rico | Group | has or had subdivision (Rico-R005) - is or was Subdivision of (#hasOrHadSubdivision) | Group |
| R06 | rico | Agent | has or had work relation with (Rico-R046) (#hasOrHadWorkRelationWith) | Agent |
| R06 | agrelon | Agent | has professional contact (#HasProfessionalContact) | Agent |
| R07 | agrelon | Person | has Colleague (#HasColleague) | Person |
| R08 | agrelon | Person | has Collaborator (#HasCooperator) | Person |
| R09 | agrelon | Group | has Employee - Employer (#HasEmployeeEmployer) | Person |
| R10 | rico | Agent | has successor (Rico-R016) - is Successor of (#hasSuccessor) | Agent |
| R11 | rico | Person | has descendant (Rico-R017) - s. below (#hasDescendant) | Person |
| R12 | rico | Person | has child (Rico-R018) - s. below (#hasChild) | Person |
| R13 | rico | Person | has family association with (Rico-R047) (#hasFamilyAssociationWith) | Person |
| R13 | agrelon | Person | has relative (#hasRelative) | Person |
| R14 | rico | Person | has descendant (Rico-R017) - has Ancestor (#hasDescendant) | Person |
| R14 | agrelon | Person | has Ancestor / Offspring (#HasOffspringAncestor) | Person |
| R15 | rico | Person | has Child (Rico-R018) - is Child Of | Person |

| | | | | |
|-----|---------|----------|---|----------|
| | | | (#hasChild) | |
| R15 | agrelon | Person | has Child / Parent (#HasChildParent) | Person |
| R16 | agrelon | Person | has Grandchild / Grandparent (#HasGrandChildParent) | Person |
| R17 | rico | Person | has Sibling (Rico-R048) (#hasSibling) | Person |
| R17 | agrelon | Person | has Sibling (#HasSibling) | Person |
| R18 | rico | Person | has or had Spouse (Rico-R049) (#hasOrHadSpouse) | Person |
| R18 | agrelon | Person | has Spouse (#HasSpouse) | Person |
| R19 | agrelon | Person | has Cousin (#HasCousin) | Person |
| R20 | agrelon | Person | has Child / Parent in Law (#HasChildParentInlaw) | Person |
| R21 | agrelon | Person | has Fiancée or Fiancé (#HasFianceeFiance) | Person |
| R22 | agrelon | Person | has sibling-in-law (#HasSiblingInlaw) | Person |
| R23 | agrelon | Person | has acquaintance (#HasAcquaintance) | Person |
| R24 | agrelon | Person | has cohabitee (#HasCohabitee) | Person |
| R25 | agrelon | Person | has friend (#HasFriend) | Person |
| R26 | agrelon | Person | has lover (#HasLover) | Person |
| R27 | agrelon | Person | has aunt or uncle / niece or nephew (#HasNieceNephewAuntUncle) | Person |
| R28 | agrelon | Person | has Godchild / Godparent (#HasGodChildParent) | Person |
| R29 | rico | Person | knows of (Rico-R050) - known by (#knowsOf) | Person |
| R30 | rico | Person | knows (Rico-R051) (#knows) | Person |
| R31 | rico | Person | has or had correspondent (Rico-R052) (#hasOrHadCorrespondent) | Person |
| R31 | agrelon | Person | has Correspondent (#hasCorrespondent) | Person |
| R32 | rico | Person | has or had teacher (Rico-R053) / has or had student (#hasOrHadTeacher) | Person |
| R32 | agrelon | Person | has Student / Teacher (#HasStudentTeacher) | Person |
| R33 | agrelon | Person | has Physician / is Physician of (#IsHasPhysician) | Person |
| R34 | agrelon | Person | has Murder victim / murderer (#HasMurdereeMurderer) | Person |
| R35 | rico | Person | occupies or occupied (Rico-R054) (#occupiesOrOccupied) | Position |
| R36 | rico | Group | has or had member (Rico-R055) / is or was member of (#hasOrHadMember) | Person |
| R36 | agrelon | Group | has Member / is Member of (#isMemberOf, #hasMember) | Person |
| R37 | agrelon | Group | has Founder / is Founder of (#isFounderOf, #hasFounder) | Person |
| R38 | rico | Position | exists or existed in (Rico-R056) (#existsOrExistedIn) | Group |
| R39 | rico | Agent | has or had location (Rico-R075) (#hasOrHadLocation) | Place |
| R40 | agrelon | Person | place of exile | Place |

| | | | | |
|-----|---------|----------------|---|----------|
| | | | (#placeOfExile) | |
| R41 | agrelon | Family | characteristic place (#characteristicPlace) | Place |
| R42 | agrelon | Corporate Body | main office (#place) | Place |
| R43 | agrelon | Corporate Body | place of business (#placeOfBusiness) | Place |
| R44 | agrelon | Family | characteristic place (#characteristicPlace) | Place |
| R45 | rico | Agent | has or had jurisdiction (Rico-R076i) (#hasOrHadJurisdiction) | Place |
| R46 | rico | Agent | has beginning date (Rico-R069i) (#hasBeginningDate) | Date |
| R47 | rico | Person | has birth date (Rico-R070i) (#hasBirthDate) | Date |
| R47 | agrelon | Person | date of birth (#dateOfBirth) | Date |
| R48 | agrelon | Corporate Body | date of establishment (Rico-R070i) (#dateOfEstablishment) | Date |
| R49 | rico | Agent | has End date (Rico-R071i) (#hasEndDate) | Date |
| R50 | rico | Person | has death date (Rico-R072i) (#hasDeathDate) | Date |
| R50 | agrelon | Person | date of death (#dateOfDeath) | Date |
| R51 | agrelon | Corporate Body | date of termination (#dateOfTermination) | Date |
| R52 | rico | Agent | has provenance of (Rico-R026i) (#isProvenanceOf) | Resource |
| R53 | rico | Agent | is creator of (Rico-R027i) (#isCreatorOf) | Resource |
| R54 | rico | Agent | is addressee of (Rico-R072i) (#isAddresseeOf) | Resource |

Table 7: Types of Relationships

The agent relations ontology provides similar terms for both classes and properties, e.g. #hasRelative = property and #HasRelative = class (n-ary concept). Application of either or both approaches will be specified in detail with the preparation of an implementation of SoNAR.

Properties of Relations

The RDF standard unlike property-graph-databases does not yet provide means to declare properties of relations. However, an extension (RDF*¹⁰) is being prepared, though not yet released by the W3C. The SoNAR data model will benefit of the extension, e.g. to trace an agents activities which is a relation between an agent, a place, and a date:

- {Agent} rico:#isCreatorOf {Resource}
 - {Resource} rico:#isAssociatedWithPlace {Place}
 - {Resource} rico:#isAssociatedWithDate {Date}
- = <<{Agent} rico:#isAssociatedWithPlace {Place}>> rico:#isAssociatedWithDate {Date}

RDF Triplestores like Blazegraph have already implemented the RDF-Star approach. When starting the implementation of SoNAR, its sustainability will be re-evaluated for a historical network data model.

¹⁰ <https://w3c.github.io/rdf-star/> (s. also "From RiC-CM to RiC-O: <https://www.ica.org/standards/RiC/ontology.html>)

Data provenance

SoNAR will provide further information about the provenance of all statements to enable researcher to track back the source of a statement. The data model will thus reuse concepts of PROV-O¹¹. It will be specified in detail with the implementation of the data model. It will include information about:

- Entity that was created, modified, or deleted by an action ([prov:Entity](#))
- Action that caused creation, modification, or deletion of an entity ([prov:Activity](#))
- Agent who created, modified, or deleted an entity ([prov:Agent](#))

Summary

Building SoNAR on RDF will significantly enhance capabilities to integrated data from heterogeneous data sources. It is “a very simple model of merging data”, and there “is no need to arrange the columns of tables so that they ‘match up’ or to worry about data ‘missing’ from a particular column”¹². Working with data in RDF is mainly working with models.

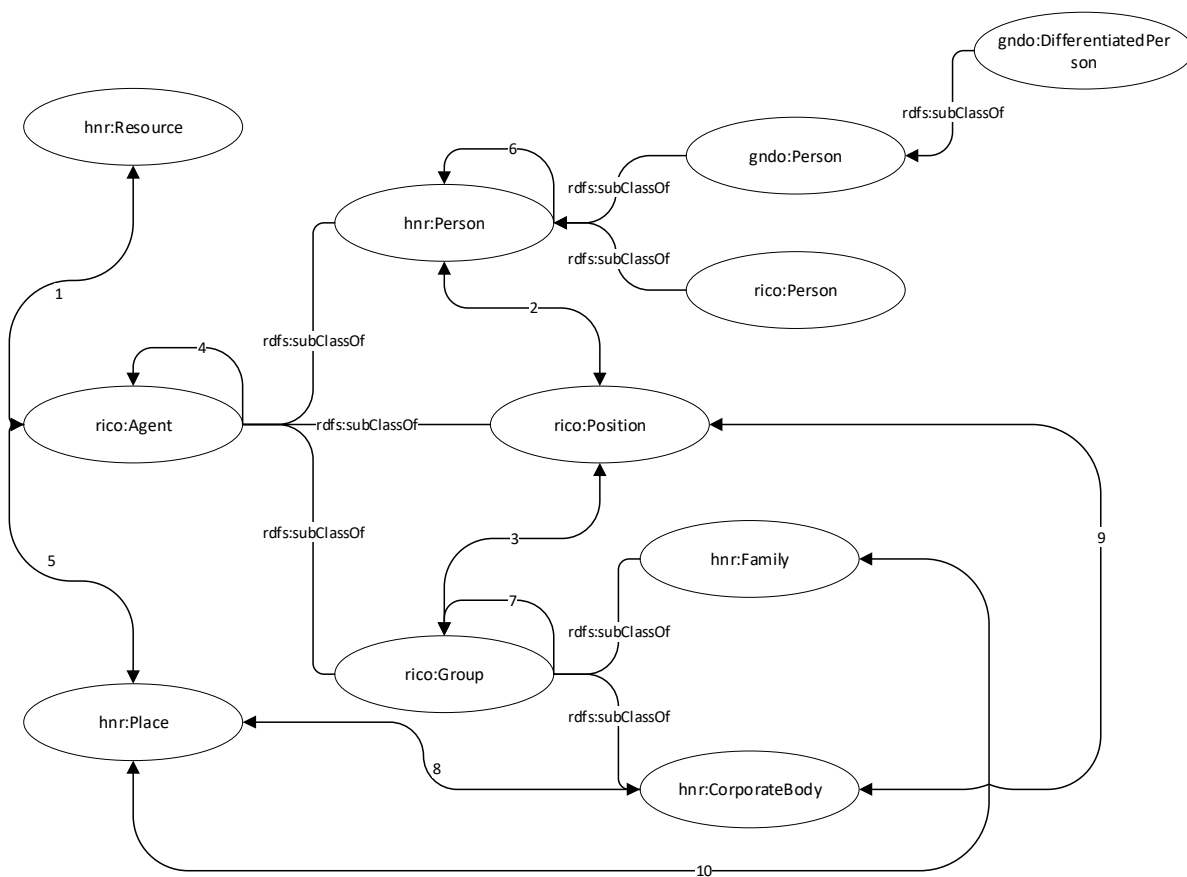


Figure 1: selected set of entity classes of Historical Network Research ontology

Figure 1 illustrates an extract of entity classes (numbers on edges are a placeholder for properties / predicates) of a Historical Network Research ontology as outlined in this paper. The prefixes “rico:”, “gndo:”, and “hnr:” demonstrate the flexibility of RDF to integrate data from heterogeneous sources with a new ontology. The numbers indicate one or many types of relationships that could be stated in statements about agents and agent relations gathered from multiple sources. Number 3, for instance,

¹¹ <https://www.w3.org/ns/prov>

¹² Allemang, Dean/Hendler, Jim: Semantic Web for the Working Ontologist. Amsterdam, 2011

represents relation types between an entity position and an entity group, e.g. {Position} rico#existsOrExistedIn {Group}.

The data model will be built on classes of agents as well as related properties and relations, but also resources, places, dates, subjects, and data provenance. The data provenance provides the necessary information to track back the origination of an RDF triple.

Examples

Example 1: inferring social relations from archival metadata record

Classical XML data snippet (EAD3 draft, Kalliope Union Catalog):

```
<ead:c
  identifier="http://kalliope-verbund.info/DE-611-HS-3729227">
    <ead:unittitle>Korrespondenz von Konrad Adenauer, Parlamentarischer Rat, mit Werner Heisenberg,
    Max-Planck-Gesellschaft</ead:unittitle>
    <ead:genreform
      identifier="http://d-nb.info/gndo/4008240-4"
      source="http://lobid.org/organisations/DE-588">Korrespondenz</ead:genreform>
    <ead:persname
      identifier="http://d-nb.info/gndo/118548670"
      source="http://lobid.org/organisations/DE-588"
      relator="https://www.ica.org/standards/RiC/ontology#hasAddressee"
      normal="Heisenberg, Werner">Werner Heisenberg</ead:persname>
    <ead:corpname
      identifier="http://d-nb.info/gndo/55567-8"
      source="http://lobid.org/organisations/DE-588"
      relator="https://www.ica.org/standards/RiC/ontology#hasAddressee"
      normal="Max-Planck-Institut für Physik">Max-Planck-Institut für Physik</ead:corpname>
    <ead:persname
      identifier="http://d-nb.info/gndo/11850066X"
      source="http://lobid.org/organisations/DE-588"
      relator="https://www.ica.org/standards/RiC/ontology#hasCreator"
      normal="Adenauer, Konrad">Konrad Adenauer</ead:persname>
    <ead:corpname
      identifier="http://d-nb.info/gndo/35114-3"
      source="http://lobid.org/organisations/DE-588"
      relator="https://www.ica.org/standards/RiC/ontology#hasCreator"
      normal="Deutschland. Parlamentarischer Rat (Gebiet unter Alliiierter Besatzung)">Deutschland.
      Parlamentarischer Rat (Gebiet unter Alliiierter Besatzung)</ead:corpname>
  </ead:c>
```

1: RDF representation (Resource – Agent):

<http://kalliope-verbund.info/DE-611-HS-3729227> (@label="Brief von Adenauer and Heisenberg")
 rdf:type [rico#RecordResource](#);
 rico#hasDocumentaryFormType <http://d-nb.info/gndo/4008240-4> (@label="Korrespondenz");
 rico#hasCreator <http://d-nb.info/gndo/11850066X> (@label="Adenauer, Konrad");
 rico#hasCreator <http://d-nb.info/gndo/35114-3> (@label="Parlamentarischer Rat");
 rico#hasAddressee <http://d-nb.info/gndo/118548670> (@label="Heisenberg, Werner");
 rico#hasAddressee <http://d-nb.info/gndo/55567-8> (@label="Max-Planck-Institut für Physik") .

2: Inferred information about agents (Agent – Agent)

Relationship between Konrad Adenauer and Werner Heisenberg
<http://d-nb.info/gndo/11850066X> (@label="Adenauer, Konrad")

[rico#hasOrHadCorrespondent](#) <http://d-nb.info/gndo/118548670> (@label="Heisenberg, Werner")

Relationship between Konrad Adenauer and Parlamentarischer Rat

<http://d-nb.info/gndo/11850066X> (@label="Adenauer, Konrad")

[rico#hasOrHadWorkRelationWith](#) <http://d-nb.info/gndo/35114-3> (@label="Parlamentarischer Rat")

Relationship between Werner Heisenberg and Max-Planck-Institut für Physik

<http://d-nb.info/gndo/118548670> (@label="Heisenberg, Werner")

[rico#hasOrHadWorkRelationWith](#) <http://d-nb.info/gndo/55567-8> (@label="MPI für Physik")

Rule 1.1 {Agent} rico:#hasOrHadCorrespondent {Agent}

- {Agent X} rico:#isCreatorOf {Resource} rico:hasAddressee {Agent Y}
- = {Agent X} rico:#hasOrHadCorrespondent {Agent Y}

Rule 1.2 {Agent} rico:#hasOrHadWorkRelationWith {Agent Y}

- {Agent X} rico:#isCreatorOf {Resource} rico:hasCreator {Agent Y}
- = {Agent X} rico:#hasOrHadWorkRelationWith {Agent Y}

Information are declared explicitly (asserted), e.g.: Hannah Arendt [agrelon:hasParent](#) Paul Arendt, or implicitly (inferred), e.g.: Letter A [rico:hasCreator](#) Hannah Arendt + Letter A [rico:hasAddressee](#) Paul Arendt = Hannah Arendt [rico:hasCorrespondent](#) Paul Arendt.

Furthermore, meta- and authority records link controlled terms, e.g.: {PersonX} [agrelon:titleOfNobility](#) {Baron ([4122878-9](#))}. Controlled terms in turn are linked with broader terms, e.g.

- {Baron ([4122878-9](#))} [agrelon:broaderTermGeneral Nobility](#) {([4000464-8](#))}
- {Nobility ([4000464-8](#))} [agrelon:broaderTermGeneral Elite](#) {([4042976-3](#))}

Therefore, we know that an agent is member of barons, but also of the broader set of nobles etc.

Example 2: inferring social relations (provenance, descriptions)

This example is based on an assumption: The creator of personal papers or archival fonds has some knowledge about any person or groups having created, accumulated, sent, or is addressee of a record part of the personal papers or archival fonds (= records set). RIC-O combines relations "hasCreator", "hasAddressee", "hasSender", and "has Accumulator" as sub-classes of "hasProvenance". This leads to another rule to infer social relations from archival finding aids:

{Agent X} rico:#isCreatorOf {Record Set}

rico:#hasPart {Record}

rico:#hasProvenance {Agent Y}

= {Agent X} [rico:#knowsOf](#) {Agent Y}