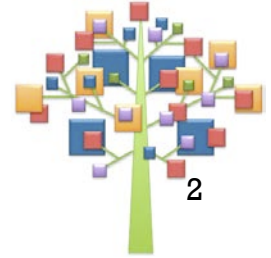


Best Practices in Using and Extending FIBO for Data Governance: A Cook's Tour and Applications for Rules

Elisa Kendall, Thematix Partners LLC



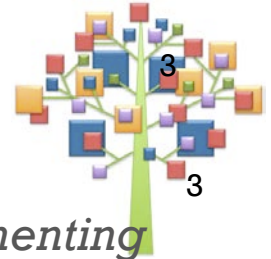
Data governance requirements for banking



- Numerous rules and regulations, imposed after the 2007 global financial crisis
 - Dodd-Frank in the US
 - Basel III in the EU
- One of the most important of these is the “Principles for effective risk data aggregation and risk reporting”, from the Bank for International Settlements (BIS), for the Basel Committee on Banking Supervision, more commonly known as BCBS 239, issued in 2013
 - <https://www.bis.org/publ/bcbs239.pdf>
- BIS produces an annual update on the state of compliance with respect to the largest, globally and systemically important banks (GSIB) around the world
 - 2018 update is available at <https://www.bis.org/bcbs/publ/d443.htm>

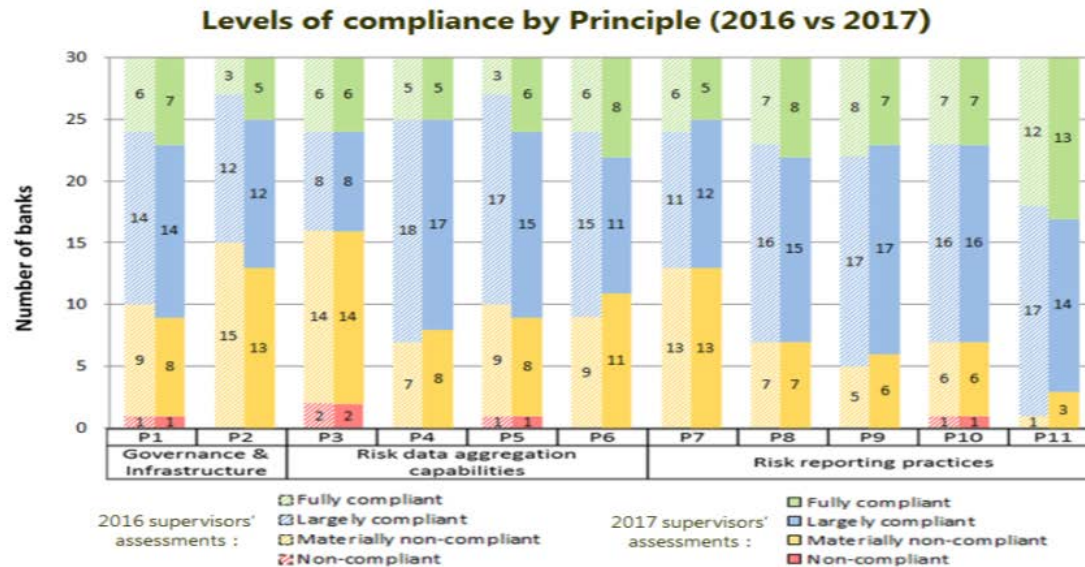


Out of runway ...

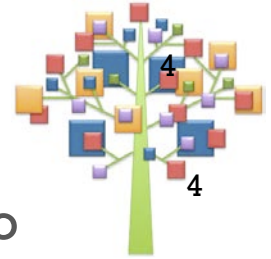


- *As of 2017, “most G-SIBs made, at best, marginal progress in implementing the Principles. G-SIBs have found it challenging to comply with the Principles, due mainly to the complexity and interdependence of IT improvement projects. As a result, the expected date of compliance has slipped back for many banks.”*

Graph 1 – Levels of compliance by Principle



+ Trouble spots

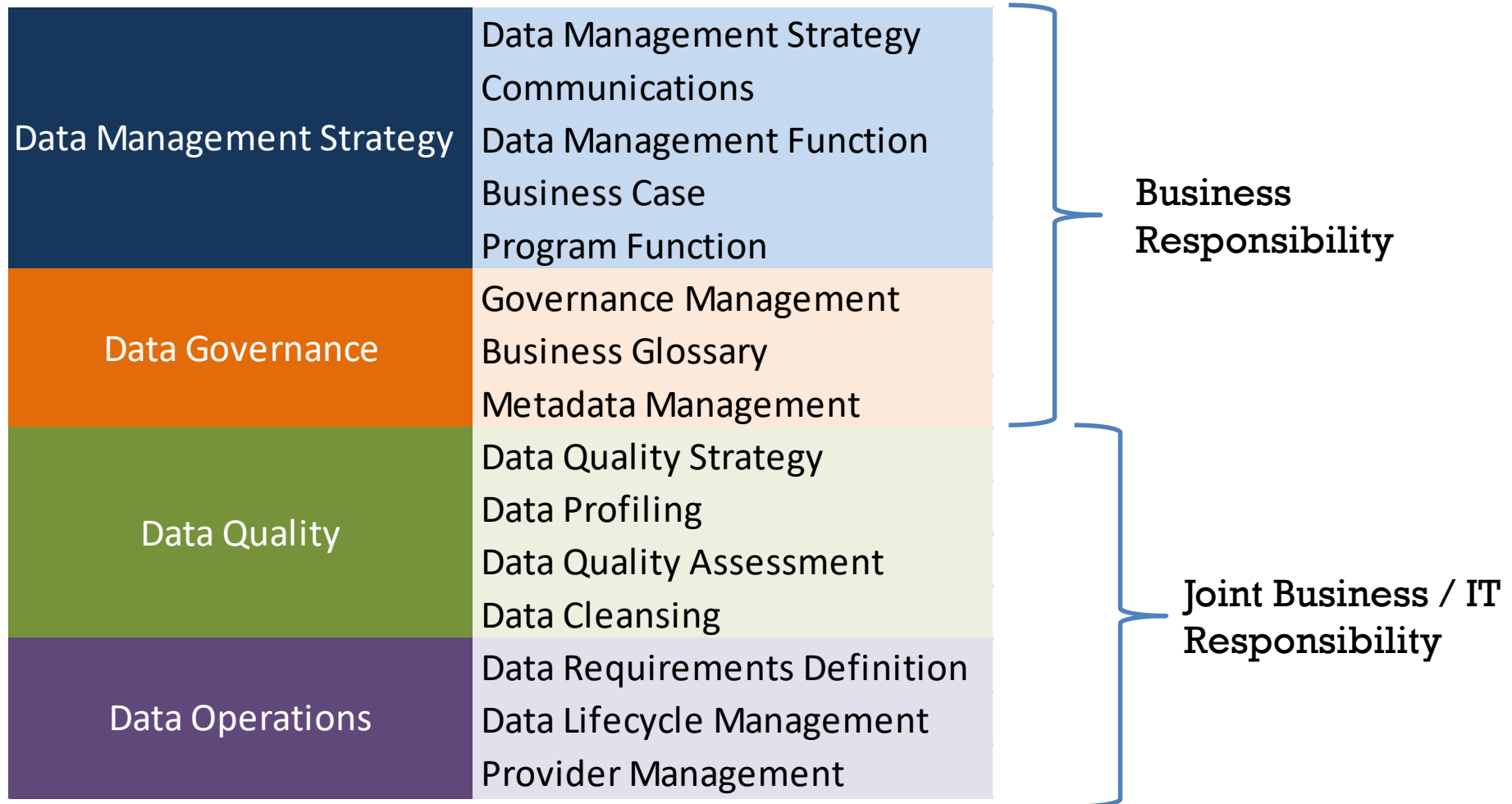
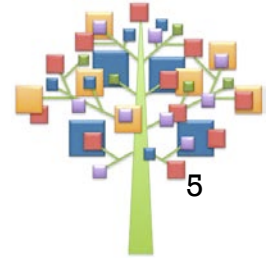


- The areas where the least compliance has been achieved to date (on a scale of 1-4, with 4 meaning full compliance and 1 meaning no compliance), across all 30 banks assessed, include
 - data architecture and IT infrastructure
 - accuracy and integrity in data aggregation
 - accuracy in reporting
 - governance in general
 - adaptability

Table 1 – Average compliance ratings of banks, 2016 and 2017⁵

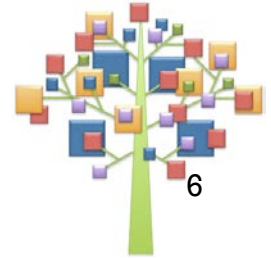
Assessments	Governance & infrastructure		Risk data aggregation capabilities				Risk reporting practices				
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
2017	2.90	2.73	2.60	2.90	2.87	2.90	2.73	3.03	3.03	2.97	3.33
2016	2.83	2.60	2.60	2.93	2.73	2.90	2.77	3.00	3.10	2.97	3.37
Differential	0.07	0.13	0.00	-0.03	0.13	0.00	-0.03	0.03	-0.07	0.00	-0.03

+ Business facing aspects of data management





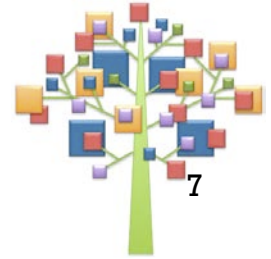
Data governance objectives



- Establish effective principles and procedures to support business data owners in their data governance duties
- Create and support maintenance and management of a knowledge base (metadata) that facilitates data governance activities
 - Ensure that the metadata complies with the principles set out in BCBS 239 – Principles for effective risk data aggregation and risk reporting.
- Collaborate with IT to insure that the metadata is complete and accurate with respect to existing and planned data schemas and datasets.



Governance metadata strategy



Reuse of standard terminology
where feasible

Terminology (ISO 1087),
Financial Instruments
Business Ontology (FIBO),
Financial Instrument Global
Identifiers (FIGI), Legal
Entity Identifiers (GLEIF),
other ISO standards

Structure and
content derived
from the
business
architecture

Business
Architecture

Governance
Metadata

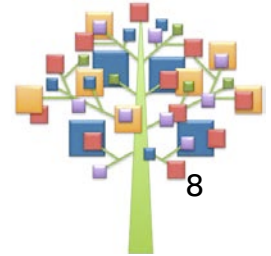
CMMI
DMM®
Model

Policies and
principles
derived from
best practices

Application and data
architecture



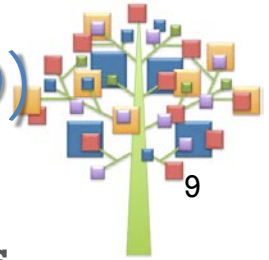
Nordea data governance metadata program



	Data Asset Owner High-Level Activities	Metadata
1	Provide stakeholders analysis	Value streams and stakeholders (Biz Arch, DMM)
2	Describe business capabilities and business processes (upstream/downstream data flows)	Capability-Information map Value stream – Capability map (Biz Arch)
3	Create/update glossary for data elements identified via business architecture, maps, and flows (vocabulary + metadata)	ISO 704/1087 conformant glossary; terms linked to capability, information (FIBO, FIGI, GLEIF...)
4	Review relationships between terms	Information entity details and entity-entity relationships (FIBO, Biz Arch, and existing schema)
5	Documentation of business rules/business requirements (to ensure Data Quality)	BPMN/DMN, RuleML or related semantics standards as appropriate
6	Contribute to Business Logical Data Model	Links to logical schema, applications
7	Implement Data Quality standards (Controls, SLAs , Data security, etc...)	Prioritize by value stream impact of quality changes (Biz Arch, DMM)

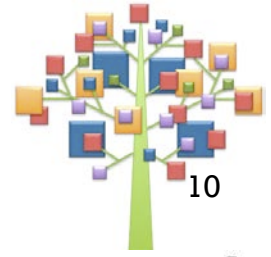


Financial Industry Business Ontology (FIBO)



- Standardizes terminology for internal use as well as use across institutions and for regulatory reporting
 - Many of the top 30 banks identified in BCBS 239 are regular participants, together with smaller institutions, vendors and consultants
 - Content is developed by the EDM Council (<https://edmcouncil.org/default.aspx>) and standardized at by the Object Management Group (OMG) (<https://www.omg.org/>)
 - Modular structure, designed to support capital markets and wholesale banking initially, (focus on financial contracts and instruments), with increasing retail support such as for loans
 - Ontologies are OWL 2 DL compliant, published quarterly by EDM Council at <https://spec.edmcouncil.org/fibo> in a number of forms, including RDF/XML serialized OWL for both the released ontologies and those under development
 - Released ontologies that have been through the OMG standards process are published at <https://www.omg.org/spec/>, with a broad revision planned for later this year
 - Overview presentation by Wells Fargo is available at https://edmcouncil.org/global_engine/download.asp?fileid=CBB2E69C-17F6-4885-8661-FEE77EBC6B4E&ext=pdf

+ Foundational Concepts



10

ALIFND (https://spec.edmcouncil.org/fibo/ontology/master/2018Q2/FND/ALIFND/) : [C:\Users\ekend\Documents\GitHub\fibofnd\ALIFND.rdf]

File Edit View Reasoner Tools Refactor Window Help

ALIFND (https://spec.edmcouncil.org/fibo/ontology/master/2018Q2/FND/ALIFND/) Search...

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy Class hierarchy (inferred)

Class hierarchy (inferred): fibo-fnd-agr-ctr:Contract

owl:Thing

- dct:LicenseDocument
- fibo-fnd-aap-agt:AutonomousAgent
- fibo-fnd-acc-aeq:Capital
- fibo-fnd-acc-aeq:Equity
- fibo-fnd-acc-cur:Currency
- fibo-fnd-agr-agr:Agreement
 - fibo-fnd-agr-agr:MutualAgreement
 - fibo-fnd-agr-ctr:Contract**
 - fibo-fnd-agr-ctr:MutualContractualAgreement
 - fibo-fnd-agr-ctr:UnilateralContract
 - fibo-fnd-agr-ctr:VerbalContract
 - fibo-fnd-agr-ctr:WrittenContract
 - fibo-fnd-law-icap:License
 - fibo-fnd-agr-agr:Commitment
 - fibo-fnd-agr-ctr:ContractualElement
 - fibo-fnd-arr-arr:Arrangement \sqsubseteq lcc-lr:Arrangement
 - fibo-fnd-arr-arr:CollectionConstituent
 - fibo-fnd-arr-doc:Document
 - fibo-fnd-dt-bd:Convention
 - fibo-fnd-dt-bd:AdHocScheduleEntry
 - fibo-fnd-dt-fd:TimeDirection
 - fibo-fnd-dt-fd:TimeInstant
 - fibo-fnd-dt-fd:TimeInterval
 - fibo-fnd-dt-oc:Occurrence
 - fibo-fnd-dt-oc:OccurrenceKind
 - fibo-fnd-gao-gl:Goal
 - fibo-fnd-gao-obj:Objective
 - fibo-fnd-law-cor:Constitution
 - fibo-fnd-law-cor:Law
 - fibo-fnd-law-jur:Jurisdiction
 - fibo-fnd-law-jur:LegalSystem

Individuals by type Annotation property hierarchy Datatypes

Object property hierarchy Data property hierarchy

Object property hierarchy: Asserted

owl:topObjectProperty

fibo-fnd-agr-ctr:Contract — https://spec.edmcouncil.org/fibo/ontology/FND/Agreements/Contracts/Contract

Class Annotations Class Usage

Annotations: fibo-fnd-agr-ctr:Contract

Annotations

- rdfs:label
 - contract
- skos:definition
 - a voluntary, deliberate, and legally binding agreement between two or more competent parties
- fibo-fnd-utl-av:definitionOrigin [type: xsd:anyURI]
 - <http://www.businessdictionary.com/definition/contract.html>
- fibo-fnd-utl-av:explanatoryNote
 - Contracts are usually written but may be spoken or implied, and generally have to do with employment, sale or lease, or tenancy.

Description: fibo-fnd-agr-ctr:Contract

Equivalent To

SubClass Of

- fibo-fnd-agr-agr:Agreement
- fibo-fnd-agr-ctr:hasContractParty **min** 2 fibo-fnd-agr-ctr:ContractParty
- fibo-fnd-agr-ctr:hasContractualElement **some** fibo-fnd-agr-ctr:ContractualElement
- fibo-fnd-agr-ctr:hasEffectiveDate **exactly** 1 fibo-fnd-dt-fd:Date
- fibo-fnd-agr-ctr:hasExecutionDate **only** fibo-fnd-dt-fd:Date
- fibo-fnd-agr-ctr:isAssignable **exactly** 1 xsd:boolean

General class axioms

SubClass Of (Anonymous Ancestor)

- fibo-fnd-pty-pty:hasPartyInRole **min** 2 fibo-fnd-pty-pty:PartyInRole
- fibo-fnd-rel-rel:confers **some** fibo-fnd-agr-agr:Commitment

Instances

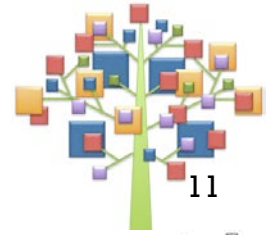
Target for Key

Disjoint With

Disjoint Union Of



Business / Legal Entities



11

AlIBE (https://spec.edmcouncil.org/fibo/ontology/BE/20180601/AlIBE/) : [C:\Users\ekend\Documents\GitHub\fibob\be\AlIBE.rdf]

File Edit View Reasoner Tools Refactor Window Help

< > AlIBE (https://spec.edmcouncil.org/fibo/ontology/BE/20180601/AlIBE/)

Search...

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy Class hierarchy (inferred)

Class hierarchy (inferred): fibo-be-le-lp:LegalEntity

- owl:Thing
 - dct:LicenseDocument
 - fibo-be-fct-fct:CommercialActivity
 - fibo-fnd-aap-agt:AutonomousAgent
 - fibo-be-le-lp:LegalPerson
 - fibo-be-ge-ge:Polity
 - fibo-be-le-lei:LEIEligibleEntity
 - fibo-be-le-lei:LEIRegisteredEntity
 - fibo-be-le-lp:LegalEntity**
 - fibo-be-le-lp:JuridicalPerson
 - fibo-be-ge-ge:Instrumentality
 - fibo-be-le-cb:Corporation
 - fibo-be-le-lp:CharteredLegalPerson
 - fibo-be-le-lp:StatutoryBody
 - fibo-be-plc-plc:PrivateCompanyWithLimitedLiability
 - fibo-be-ptr-ptr:Partnership
 - fibo-be-tr-tr:Trust
 - fibo-be-le-lp:NaturalPerson
 - fibo-fnd-aap-agt:AutomatedSystem
 - fibo-fnd-aap-ppl:Person
 - fibo-fnd-org-org:Organization
 - fibo-be-le-lei:LEIRegisteredEntity
 - fibo-fnd-org-fm:FormalOrganization
 - fibo-be-ge-ge:GovernmentBody
 - fibo-be-le-fbo:FormallyConstitutedOrganization
 - fibo-be-le-fbo:NotForProfitOrganization
 - fibo-be-le-fbo:OrganizationalSubUnit
 - fibo-be-le-lp:BusinessEntity
 - fibo-be-le-lp:JuridicalPerson
 - fibo-fnd-law-cor:CourtOfLaw
 - fibo-fnd-org-fm:InformalOrganization
 - fibo-fnd-org-ig:IllegalOrganization

Individuals by type Annotation property hierarchy Datatypes

Object property hierarchy Data property hierarchy

Object property hierarchy:

owl:topObjectProperty

fibo-be-le-lp:LegalEntity — https://spec.edmcouncil.org/fibo/ontology/BE/LegalEntities/LegalPersons/LegalEntity

Class Annotations Class Usage

Annotations: fibo-be-le-lp:LegalEntity

- Annotations
- rdfs:label
legal entity
 - skos:definition
a partnership, corporation, or other organization having the capacity to negotiate contracts, assume financial obligations, and pay off debts, organized under the laws of some Jurisdiction
 - fibo-fnd-utl-av:adaptedFrom
Barron's Dictionary of Banking Terms, Sixth Edition, 2012, definition of legal entity
 - fibo-fnd-utl-av:adaptedFrom [type: xsd:anyURI]
<https://www.gleif.org/en/about-lei/common-data-file-format/lei-cdf-format/lei-cdf-format-version-2-1>
 - fibo-fnd-utl-av:adaptedFrom
ISO 17442, Financial services - Legal Entity Identifier (LEI), first edition, 2012-06-01, section 3.1
 - skos:example
Examples of eligible legal entities include, without limitation:
 - all financial intermediaries;
 - banks and finance companies;
 - all entities that issue equity, debt or other securities for other capital structures;
 - all entities listed on an exchange;
 - all entities that trade stock or debt, investment vehicles, including mutual funds, pension funds and alternative investment vehicles constituted as corporate entities or collective investment agreements (including umbrella funds as well as funds under an umbrella structure, hedge funds, private equity funds, etc.);
 - all entities under the purview of a financial regulator and their affiliates, subsidiaries and holding companies;
 - counterparties to financial transactions.

Description: fibo-be-le-lp:LegalEntity

Equivalent To

SubClass Of

- fibo-be-le-lei:hasAddressOfLegalFormation **exactly** 1 fibo-be-le-fbo:RegisteredAddress
- fibo-be-le-lei:hasLegalForm **max** 1 fibo-be-le-lei:EntityLegalForm
- fibo-be-le-lei:hasTransliteratedName **min** 0 xsd:string
- fibo-be-le-lp:isOrganizedIn **exactly** 1 fibo-fnd-law-jur:Jurisdiction
- fibo-be-le-lp:LegalPerson
- fibo-fnd-aap-agt:hasName **min** 0 xsd:string
- fibo-fnd-rel-rel:hasLegalName **some** xsd:string

General class axioms

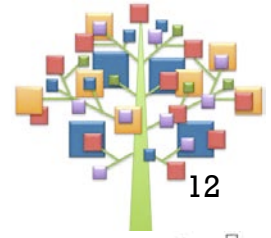
SubClass Of (Anonymous Ancestor)

- fibo-fnd-aap-agt:hasName **min** 0 xsd:string
- fibo-be-le-lp:isRecognizedIn **some** fibo-fnd-law-jur:Jurisdiction
- fibo-fnd-law-lcap:hasCapacity **some** fibo-fnd-law-lcap:LiabilityCapacity

Instances



Financial Instruments



12

AlIFBC (https://spec.edmcouncil.org/fibo/ontology/FBC/20180601/AlIFBC/) : [C:\Users\ekend\Documents\GitHub\fibo\fb\AlIFBC.rdf]

File Edit View Reasoner Tools Refactor Window Help

< > AlIFBC (https://spec.edmcouncil.org/fibo/ontology/FBC/20180601/AlIFBC/) Search...

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy Class hierarchy (inferred)

Class hierarchy (inferred): fibo-fbc-fi-fi:FinancialInstrument

- owl:Thing
 - dt:LicenseDocument
 - fibo-be-fct-fct:CommercialActivity
 - fibo-fbc-dae-dbt:Principal
 - fibo-fbc-pas-caa:Account
 - fibo-fbc-pas-fpas:Exposure
 - fibo-fnd-aap-agt:AutonomousAgent
 - fibo-fnd-acc-aeg:Capital
 - fibo-fnd-acc-aeg:Equity
 - fibo-fnd-acc-cur:Currency
 - fibo-fnd-agr-agr:Agreement
 - fibo-fnd-agr-agr:MutualAgreement
 - fibo-fnd-agr-ctr:Contract
 - fibo-fbc-dae-dbt:CreditAgreement
 - fibo-fnd-agr-ctr:MutualContractualAgreement
 - fibo-fnd-agr-ctr:UnilateralContract
 - fibo-fnd-agr-ctr:VerbalContract
 - fibo-fnd-agr-ctr:WrittenContract
 - fibo-be-le-fbo:OrganizationCoveringAgreement
 - fibo-be-oac-opty:InvestorContract
 - fibo-fbc-fi-fi:FinancialInstrument**
 - fibo-fbc-fi-fi:CashInstrument
 - fibo-fbc-fi-fi:CommodityInstrument
 - fibo-fbc-fi-fi:CurrencyInstrument
 - fibo-fbc-fi-fi:DebtInstrument
 - fibo-fbc-fi-fi:DerivativeInstrument
 - fibo-fbc-fi-fi:Security
 - fibo-fnd-agr-ctr:PromissoryNote
 - fibo-fnd-agr-ctr:TransferableContract
 - fibo-fnd-pas-pas:ServiceAgreement
 - fibo-fnd-law-icap:License
 - fibo-fnd-agr-agr:Commitment

Individuals by type Annotation property hierarchy Datatypes

Object property hierarchy Data property hierarchy

Object property hierarchy: Asserted

- owl:topObjectProperty

Class Annotations Class Usage

Annotations: fibo-fbc-fi-fi:FinancialInstrument

Annotations

- rdfs:label
 - financial instrument
- skos:definition
 - a written contract that gives rise to both a financial asset of one entity and a financial liability or equity instrument of another entity
- fibo-fnd-uti-av:adaptedFrom [type: xsd:anyURI]
 - http://ec.europa.eu/internal_market/accounting/docs/consolidated/ias32_en.pdf
- fibo-fnd-uti-av:explanatoryNote
 - A financial instrument can be thought of as a template that defines an arrangement structure that remains to be fleshed out with terms and parameters in order to establish a specific instance of the contract.
- skos:example
 - Examples of financial instruments include: cash, evidence of an ownership interest in an entity, or a contractual right to receive (or deliver) cash, or another financial instrument.

Description: fibo-fbc-fi-fi:FinancialInstrument

Equivalent To

SubClass Of

- fibo-fbc-fi-fi:isLegallyRecordedIn min 0 fibo-fnd-law-jur:Jurisdiction
- fibo-fbc-fi-fi:isNegotiable exactly 1 xsd:boolean
- fibo-fnd-aap-agt:isIdentifiedBy min 0 fibo-fbc-fi-fi:FinancialInstrumentIdentifier
- fibo-fnd-agr-ctr:WrittenContract
- fibo-fnd-rel-rel:isIssuedBy some fibo-fbc-fi-fi:Issuer

General class axioms

SubClass Of (Anonymous Ancestor)

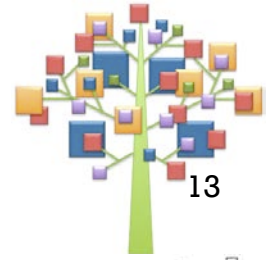
- fibo-fnd-pty-pty:hasPartyInRole min 2 fibo-fnd-pty-pty:PartyInRole
- fibo-fnd-rel-rel:confers some fibo-fnd-agr-agr:Commitment
- fibo-fnd-agr-ctr:isEvidencedBy some fibo-fnd-agr-ctr:ContractDocument
- fibo-fnd-agr-ctr:hasEffectiveDate exactly 1 fibo-fnd-dt-fd:Date
- fibo-fnd-agr-ctr:isAssignable exactly 1 xsd:boolean
- fibo-fnd-agr-ctr:hasExecutionDate only fibo-fnd-dt-fd:Date
- fibo-fnd-agr-ctr:hasContractParty min 2 fibo-fnd-agr-ctr:ContractParty
- fibo-fnd-agr-ctr:hasContractualElement some fibo-fnd-agr-ctr:ContractualElement

Instances

Target for Key

Reasoner active ☒ Show Inferences

+ Financial Service Providers



13

ALIFBC (https://spec.edmcouncil.org/fibo/ontology/FBC/20180601/ALIFBC/) : [C:\Users\ekend\Documents\GitHub\fibo\fb\ALIFBC.rdf]

File Edit View Reasoner Tools Refactor Window Help

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy Class hierarchy (inferred)

Class hierarchy (inferred): fibo-fbc-fct-fse:FinancialInstitution

- fibo-fnd-plc-fac:Capability
- fibo-fnd-pty-ri:Role
- fibo-fnd-pty-ri:ThingInRole
- fibo-be-fct-fct:FunctionalEntity
- fibo-be-fct-fct:FunctionalBusinessEntity
- fibo-be-ge-ge:Government
- fibo-fbc-pas-fpas:BrokerDealer
- fibo-fnd-pas-pas:ServiceProvider
- fibo-fbc-fct-ra:RegistrationAuthority
- fibo-fbc-fct-rga:RegulatoryAgency
- fibo-fbc-pas-caa:AccountProvider
- fibo-fbc-pas-fpas:Dealer
- fibo-fbc-pas-fpas:FinancialServiceProvider
- fibo-fbc-fct-fse:BankHoldingCompany
- fibo-fbc-fct-fse:CentralSecuritiesDepository
- fibo-fbc-fct-fse:ClearingHouse
- fibo-fbc-fct-fse:FinancialInstitution**
- fibo-fbc-fct-fse:DepositoryInstitution
- fibo-fbc-fct-fse:Bank
- fibo-fbc-fct-fse:SavingsAssociation
- fibo-fbc-fct-fse:InvestmentBank
- fibo-fbc-fct-fse:NonDepositoryInstitution
- fibo-fbc-fct-fse:Underwriter
- fibo-fbc-pas-fpas:ThirdPartyAgent
- fibo-fbc-pas-fpas:Trader
- fibo-fbc-dae-dbt:Accrual
- fibo-fbc-dae-dbt:Amortization
- fibo-fbc-pas-fpas:BasketConstituent
- fibo-fnd-oac-ctl:ControlledThing
- fibo-fnd-oac-own:Asset
- fibo-fnd-plc-fac:Facility
- fibo-fnd-nlc-fac:Site

Class Annotations Class Usage

Annotations: fibo-fbc-fct-fse:FinancialInstitution

Annotations

- rdfs:label
financial institution
- skos:definition
a financial service provider identified as either a government agency or privately owned entity that collects funds from the public and from other institutions, and invests those funds in financial assets, such as loans, securities, bank deposits, and income-generating property
fibo-fnd-utl-av:adaptedFrom
Barron's Dictionary of Banking Terms, Sixth Edition, 2012
fibo-fnd-utl-av:explanatoryNote
Financial institutions are differentiated by the way they obtain and invest funds. Depository institutions accept public deposits, which are insured by the government against loss, and channel those deposits into lending activities. Non-depository institutions, such as brokerage firms, life insurance companies, pension funds, and investment companies, fund their investment activities directly from financial markets by selling securities to the public or by selling insurance policies, in the case of insurance companies.
fibo-fnd-utl-av:synonym
financial intermediary

Description: fibo-fbc-fct-fse:FinancialInstitution

Equivalent To

SubClass Of

- fibo-fbc-fct-rga:isRegulatedBy some fibo-fbc-fct-rga:RegulatoryAgency
- fibo-fbc-pas-fpas:FinancialServiceProvider
- fibo-fnd-rel-rel:provides some fibo-fbc-pas-fpas:FinancialService

General class axioms

SubClass Of (Anonymous Ancestor)

- fibo-fnd-pty-ri:hasRole some fibo-fnd-pty-ri:Role
- fibo-fnd-rel-rel:hasIdentity exactly 1 owl:Thing
- fibo-fnd-rel-rel:provides some fibo-fbc-pas-fpas:FinancialService
- fibo-fnd-rel-rel:hasIdentity exactly 1 (fibo-be-le-fbo:FormallyConstitutedOrganization and fibo-be-le-lp:LegalEntity)
- fibo-fnd-rel-rel:provides some fibo-fnd-pas-pas:Service
- fibo-fnd-pas-pas:provisions min 0 fibo-fnd-plc-fac:Facility
- fibo-fnd-pas-pas:provisions some fibo-fnd-pas-pas:Service
- fibo-fnd-rel-rel:hasIdentity exactly 1 fibo-fnd-aap-agt:AutonomousAgent

Instances

Target for Key

owl:topObjectProperty

Annotation property hierarchy

Data types

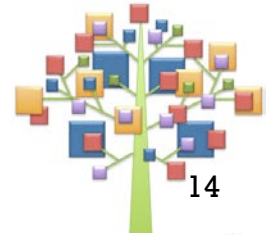
Object property hierarchy

Data property hierarchy

Object property hierarchy: Asserted



Market Indicators



14

File Edit View Reasoner Tools Refactor Window Help

File Edit View Reasoner Tools Refactor Window Help

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy Class hierarchy (inferred)

Class hierarchy (inferred): fibo-ind-ei-ei:EconomicIndicator

- fibo-fnd-utl-alk:Measure
 - fibo-fnd-acc-cur:MonetaryMeasure
 - fibo-fnd-qt-qtu:ParticularQuantity
 - fibo-fnd-qt-qtu:Quantity
 - fibo-fnd-qt-qtu:QuantityValue
 - fibo-fnd-utl-alk:StatisticalMeasure
 - fibo-ind-ei-ei:Difference
 - fibo-ind-ei-ei:Dispersion
 - fibo-ind-ei-ei:AverageAbsoluteDeviation
 - fibo-ind-ei-ei:MedianAbsoluteDeviation
 - fibo-ind-ei-ei:StandardDeviation
 - fibo-ind-ei-ei:Variance
 - fibo-ind-ind-ind:Volatility
 - fibo-ind-ei-ei:EconomicIndicator
 - fibo-ind-ei-ei:AverageEarnings
 - fibo-ind-ei-ei:CivilianLaborForceParticipationRate
 - fibo-ind-ei-ei:ConsumerPriceIndex
 - fibo-ind-ei-ei:EmploymentPopulationRatio
 - fibo-ind-ei-ei:EstablishmentEmployment
 - fibo-ind-ei-ei:GrossDomesticProduct
 - fibo-ind-ei-ei:InflationRate
 - fibo-ind-ei-ei:PersonalConsumptionExpenditures
 - fibo-ind-ei-ei:ProducerPriceIndex
 - fibo-ind-ei-ei:InputProducerPriceIndex
 - fibo-ind-ei-ei:OutputProducerPriceIndex
 - fibo-ind-ei-ei:ValueAddedProducerPriceIndex
 - fibo-ind-ei-ei:Productivity
 - fibo-ind-ei-ei:UnemploymentRate
 - fibo-ind-ei-ei:Mean
 - fibo-ind-ei-ei:Median
 - fibo-ind-ei-ei:NumericIndex
 - fibo-ind-ei-ei:Ratio

Individuals by type Annotation property hierarchy Datatypes

Object property hierarchy Data property hierarchy

Object property hierarchy:

Asserted

owl:topObjectProperty

fibo-ind-ei-ei:EconomicIndicator — <https://spec.edmcouncil.org/fibo/ontology/IND/EconomicIndicators/EconomicIndicators/EconomicIndicator>

Class Annotations Class Usage

Annotations: fibo-ind-ei-ei:EconomicIndicator

- Annotations
- rdfs:label
 - economic indicator
 - skos:definition
 - a statistical measure of economic activity that is regular and comparable in the context of a statistical area (region), used for analysis of economic performance and predictions of future performance
 - fibo-fnd-utl-av:adaptedFrom
 - Barron's Dictionary of Business and Economic Terms, Fifth Edition, 2012
 - fibo-fnd-utl-av:explanatoryNote
 - The two main features of any indicator are the regularity with which they are measured and published, and the fact that they are comparable from one release to the next.
 - skos:example
 - Example indicators include the average work week, weekly claims for unemployment insurance, new orders, vendor performance, stock prices, and changes in the money supply.

Description: fibo-ind-ei-ei:EconomicIndicator

Equivalent To

SubClass Of

- fibo-fnd-arr-doc:hasReportingPeriod **exactly** 1 fibo-fnd-dt-fd:ExplicitDatePeriod
- fibo-fnd-rel-rel:appliesTo **some** fibo-ind-ei-ei:StatisticalArea
- fibo-fnd-utl-alk:StatisticalMeasure
- fibo-ind-ei-ei:hasIndicatorValue **exactly** 1 fibo-fnd-qt-qtu:QuantityValue
- fibo-ind-ei-ei:hasPeriodicity **only** fibo-fnd-dt-fd:RecurrenceInterval
- fibo-ind-ei-ei:hasReleaseDateTime **min** 0 (xsd:dateTime **or** xsd:dateTimeStamp **or** xsd:string)
- fibo-ind-ei-ei:hasSeriesOrigin **only** fibo-fnd-dt-fd:Date
- fibo-ind-ei-ei:isSeasonallyAdjusted **only** xsd:boolean

General class axioms

SubClass Of (Anonymous Ancestor)

- fibo-ind-ei-ei:isCalculatedViaMethodology **min** 0 xsd:string

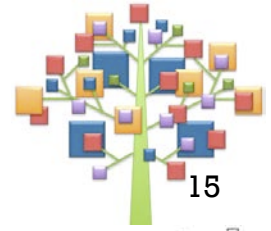
Instances

Target for Key

Disjoint With

Disjoint Union Of

Reasoner active ☒ Show Inferences



AIISec (https://spec.edmcouncil.org/fibo/ontology/SEC/20180601/AIISec/) : [C:\Users\ekend\Documents\GitHub\fibosec\AIISec.rdf]

File Edit View Reasoner Tools Refactor Window Help

< > AIISec (https://spec.edmcouncil.org/fibo/ontology/SEC/20180601/AIISec/) Search...

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy Class hierarchy (inferred) fibo-sec-ec-ec:Share

- fibosec-ec-ec:Contract
 - fibosec-ec-ec:CreditAgreement
 - fibosec-ec-ec:MutualContractualAgreement
 - fibosec-ec-ec:UnilateralContract
 - fibosec-ec-ec:VerbalContract
 - fibosec-ec-ec:WrittenContract
- fibosec-ec-ec:OrganizationCoveringAgreement
 - fibosec-ec-ec:InvestorContract
- fibosec-ec-ec:FinancialInstrument
 - fibosec-ec-ec:CashInstrument
 - fibosec-ec-ec:CommodityInstrument
 - fibosec-ec-ec:CurrencyInstrument
 - fibosec-ec-ec:DebtInstrument
 - fibosec-ec-ec:DerivativeInstrument
 - fibosec-ec-ec:Security
 - fibosec-ec-ec:EquityInstrument
 - fibosec-ec-ec:Share
 - fibosec-ec-ec:CommonShare
 - fibosec-ec-ec:PrivatelyHeldShare
 - fibosec-ec-ec:PubliclyTradedShare
 - fibosec-ec-ec:NegotiableSecurity
 - fibosec-ec-ec:NonNegotiableSecurity
 - fibosec-ec-ec:TradableDebtInstrument
 - fibosec-ec-ec:ConvertibleSecurity
 - fibosec-ec-ec:RegisteredSecurity
 - fibosec-ec-ec:SecuritiesPoolConstituent
- fibosec-ec-ec:PromissoryNote
- fibosec-ec-ec:TransferableContract
- fibosec-ec-ec:ServiceAgreement
- fibosec-ec-ec:SecuritiesOffering
- fibosec-ec-ec:License
- fibosec-ec-ec:Commitment

Individuals by type Annotation property hierarchy Datatypes

Object property hierarchy Data property hierarchy

Object property hierarchy:

owl:topObjectProperty Asserted

fibosec-ec-ec:Share — https://spec.edmcouncil.org/fibo/ontology/SEC/Equities/EquityInstruments/Share

Class Annotations Class Usage

Annotations: fibosec-ec-ec:Share

Annotations

rdfs:label [language: en]

share

skos:definition [language: en]

a financial instrument that signifies a unit of equity ownership in a corporation, or a unit of ownership in a mutual fund, or interest in a general or limited partnership, or a unit of ownership in a structured product, such as a real estate investment trust

Description: fibosec-ec-ec:Share

Equivalent To

SubClass Of

- fibosec-ec-ec:EquityInstrument
- fibosec-ec-ec:confers some fibosec-ec-ec:VotingRight
- fibosec-ec-ec:confersOwnershipOf some fibosec-ec-ec:ShareholdersEquity

General class axioms

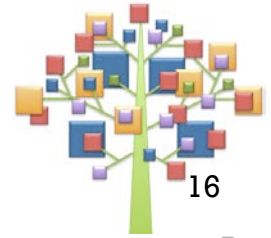
SubClass Of (Anonymous Ancestor)

- fibosec-ec-ec:isIssuedBy some fibosec-ec-ec:Issuer
- fibosec-ec-ec:isIdentifiedBy min 0 fibosec-ec-ec:FinancialInstrumentIdentifier
- fibosec-ec-ec:isNegotiable exactly 1 xsd:boolean
- fibosec-ec-ec:isLegallyRecordedIn min 0 fibosec-ec-ec:Jurisdiction
- fibosec-ec-ec:isLegallyRecordedIn exactly 1 fibosec-ec-ec:Jurisdiction
- fibosec-ec-ec:hasPartyInRole min 2 fibosec-ec-ec:PartyInRole
- fibosec-ec-ec:confers some fibosec-ec-ec:Commitment
- fibosec-ec-ec:hasRestriction min 0 fibosec-ec-ec:SecuritiesRestriction
- fibosec-ec-ec:defines min 0 fibosec-ec-ec:ContractualRestriction
- fibosec-ec-ec:isClassifiedBy min 0 fibosec-ec-ec:FinancialInstrumentClassifier
- fibosec-ec-ec:isClassifiedBy min 0 fibosec-ec-ec:IndustrySectorClassifier
- fibosec-ec-ec:isEvidencedBy some fibosec-ec-ec:ContractDocument
- fibosec-ec-ec:hasEffectiveDate exactly 1 fibosec-ec-ec:Date
- fibosec-ec-ec:isAssignable exactly 1 xsd:boolean
- fibosec-ec-ec:hasExecutionDate only fibosec-ec-ec:Date
- fibosec-ec-ec:hasContractParty min 2 fibosec-ec-ec:ContractParty
- fibosec-ec-ec:hasContractualElement some fibosec-ec-ec:ContractualElement
- fibosec-ec-ec:hasFinancialInstrumentShortName min 0 fibosec-ec-ec:FinancialInstrumentShortName

Instances



Complex Derivatives



16

AIIDER (https://spec.edmouncil.org/fibo/ontology/DER/20180601/AIIDER/) : [C:\Users\ekend\Documents\GitHub\fibo\der\AIIDER.rdf]

File Edit View Reasoner Tools Refactor Window Help

Active Ontology x Entities x Individuals by class x DL Query x

Class hierarchy (inferred) Class hierarchy (inferred)

Class hierarchy (inferred): fibo-der-rtd-irswp:InterestRateSwap

- fibo-der-agr-ctr:ContractDocument
 - fibo-be-le-fbo:OrganizationCoveringAgreement
 - fibo-be-oac-opty:InvestorContract
 - fibo-der-drc-bsc:OTCTransactionConfirmation
 - fibo-der-drc-swp:SwapConfirmation
 - fibo-fbc-fi-fi:FinancialInstrument
 - fibo-der-drc-bsc:OTCIInstrument
 - fibo-fbc-fi-fi:CashInstrument
 - fibo-fbc-fi-fi:CommodityInstrument
 - fibo-fbc-fi-fi:CurrencyInstrument
 - fibo-fbc-fi-fi:DebtInstrument
 - fibo-fbc-fi-fi:DerivativeInstrument
 - fibo-der-drc-bsc:OTCDerivativeContract
 - fibo-der-drc-swp:Swap
 - fibo-der-drc-swp:BasisSwap
 - fibo-der-rtd-irswp:FloatFloatInterestRateSwap
 - fibo-der-rtd-irswp:InterestRateSwap
 - fibo-der-rtd-irswp:CrossCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FixedFloatCrossCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FloatFloatCrossCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FixedFloatInterestRateSwap
 - fibo-der-rtd-irswp:FixedFloatCrossCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FixedFloatSingleCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FloatFloatInterestRateSwap
 - fibo-der-rtd-irswp:FloatFloatCrossCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FloatFloatSingleCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:SingleCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FixedFloatSingleCurrencyInterestRateSwap
 - fibo-der-rtd-irswp:FloatFloatSingleCurrencyInterestRateSwap
 - fibo-der-rtd-rtd:RateBasedDerivativeInstrument
 - fibo-fbc-fi-fi:Entitlement
 - fibo-fbc-fi-fi:Future

Individuals by type Annotation property hierarchy Datatypes

Object property hierarchy Data property hierarchy

Object property hierarchy: Asserted

owl:topObjectProperty

fibo-der-rtd-irswp:InterestRateSwap — https://spec.edmouncil.org/fibo/ontology/DER/RateDerivatives/IRSwaps/InterestRateSwap

Class Annotations Class Usage

Annotations: fibo-der-rtd-irswp:InterestRateSwap

Annotations +

rdfs:label
interest rate swap

skos:definition
a swap in which the underlier for one or both legs is an interest rate

rdfs:isDefinedBy
fibo-der-rtd-irswp:

Description: fibo-der-rtd-irswp:InterestRateSwap

Equivalent To +

fibo-der-drc-swp:Swap
and (fibo-der-drc-swp:hasLeg exactly 2 fibo-der-rtd-irswp:InterestRateSwapLeg)

SubClass Of +

fibo-der-drc-swp:exchanges exactly 2 fibo-der-rtd-irswp:InterestRateSwapLeg
fibo-der-drc-swp:Swap
fibo-der-rtd-rtd:InterestRateDerivativeInstrument

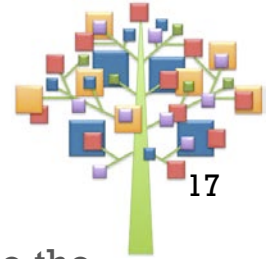
General class axioms +

SubClass Of (Anonymous Ancestor)

 - fibo-fnd-agr-ctr:isEvidencedBy some fibo-fnd-agr-ctr:ContractDocument
 - fibo-fnd-agr-ctr:hasEffectiveDate exactly 1 fibo-fnd-dt-fd:Date
 - fibo-fnd-agr-ctr:isAssignable exactly 1 xsd:boolean
 - fibo-fnd-agr-ctr:hasExecutionDate only fibo-fnd-dt-fd:Date
 - fibo-fnd-agr-ctr:hasContractParty min 2 fibo-fnd-agr-ctr:ContractParty
 - fibo-fnd-agr-ctr:hasContractualElement some fibo-fnd-agr-ctr:ContractualElement
 - fibo-fnd-rel-rel:isIssuedBy some fibo-fbc-fi-fi:Issuer
 - fibo-fnd-aap-agt:isIdentifiedBy min 0 fibo-fbc-fi-fi:FinancialInstrumentIdentifier
 - fibo-fbc-fi-fi:isNegotiable exactly 1 xsd:boolean
 - fibo-fbc-fi-fi:isLegallyRecordedIn min 0 fibo-fnd-law-jur:Jurisdiction
 - fibo-fnd-pty-pty:hasPartyInRole min 2 fibo-fnd-pty-pty:PartyInRole
 - fibo-fnd-rel-rel:confers some fibo-fnd-agr-agr:Commitment
 - fibo-sec-sec-rst:hasRestriction min 0 fibo-sec-sec-rst:SecuritiesRestriction
 - fibo-fnd-rel-rel:defines min 0 fibo-sec-sec-rst:ContractualRestriction
 - fibo-fnd-agr-ctr:hasContractualElement some fibo-fbc-pas-fpas:SettlementTerms
 - fibo-fnd-agr-ctr:hasContractualElement some fibo-der-drc-bsc:DerivativeTransactionTerms
 - fibo-der-drc-bsc:hasUnderlier some fibo-der-drc-bsc:Underlier
 - fibo-fnd-rel-rel:isClassifiedBy min 0 fibo-sec-sec-cls:FinancialInstrumentClassifier
 - fibo-fnd-rel-rel:isClassifiedBy min 0 fibo-fnd-arr-cls:IndustrySectorClassifier
 - fibo-sec-sec-iss:hasFinancialInstrumentShortName min 0 fibo-sec-sec-iss:FinancialInstrumentShortName



Tooling challenges in PoCs to date



- Few tools follow ISO 704 for terminology development
 - SMEs tend to be comfortable with Excel, which tends to be too rigid to create the connections we need
 - Terminology extraction tools either construct their own taxonomy, without FIBO / relevant context, or created lists of terms with relevance factors but no hierarchy
 - Resulted in construction of a prototype Access-based tool for vocabulary management and review
- Few ontology tools / triple stores provide decent support for integrated, collaborative definition, annotation, provenance editing and review by SMEs
 - Resulted in extensions to Stardog to generate dynamic, linked vocabulary pages that SMEs can search, review, and annotate in a controlled way in the corporate intranet (for Nordea)
 - Now several different views are available from the EDM Council, including online navigable web pages, Excel, data dictionaries, a Widoco view by ontology, etc. at <https://spec.edmcouncil.org/fibo/>
- Additional tooling for logical data schema mapping and validation using ontologies is sorely needed
 - Prototyped process for schema validation via a series of SPARQL queries against Stardog
 - Current PoCs use a combination of data profiling, R2RML, production quality tools such as Stardog, Cambridge Semantics, Franz Allegrograph and custom code, plus manual work to glue it together

+ Terminology tool prototype



18

Term Entry Form

Term Entry Type Excerpted

ID 178 Term Agreement sub accounts

Definition

5

If collateral positions are grouped into Margin accounts top down rather than bottom up, it will be easier to understand the different margin balances than (as current) aggregating individual positions. The current data has grown too complex for the single column in algo positions that it inhabits.

Harmonized 360 Clear Harmonized

Agreement sub accounts

Create Harmonized Search Harmonized

Status

Extended

Issues

BusArch

Facts

Notes

Document Source

Person Source

Category

Concept

10/16/2015 7:36:27

09 PL Risk and MV05062012

NASDAQOMX definitions.pdf

https://en.wikipedia.org/wiki/Liquidity_risk

<http://www.boerse-frankfurt.de/en/glossary/b/bobl+future+584>

Wikipedia [https://en.wikipedia.org/wiki/Margin_\(finance\)](https://en.wikipedia.org/wiki/Margin_(finance))

<http://www.boerse-frankfurt.de/en/glossary/s/schatz+future+994>

<http://www.boerse-frankfurt.de/en/glossary/b/bund+future+616>

https://en.wikipedia.org/wiki/International_Monetary_Market

https://en.wikipedia.org/wiki/IMM_dates

<http://www.investopedia.com/terms/p/position.asp>

Daily Settlement.pdf

Swedish Bankers Association

Finance Norway

Oxford Dictionary of Finance and Banking

<http://www.investment-and-finance.net/derivatives/f/futures-style->

"Calculation" from Oxford Dictionary. "Market Value" from Barrons Dic

Term Type

Definition

Document Source Requerv Sources

Add Document Source

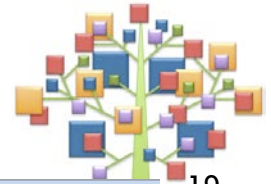
Person Source

Create New Collected Term Entry

© Thematrix Partners 2018



Harmonized terminology entry for trade



19



Harmonized Term Entry Form

ID Term

Definition
 a basic agreement between parties participating in a voluntary negotiation and the exchange of goods and/or services for some consideration (e.g., desired goods and services that someone else possesses); a commercial transaction involving the sale and purchase of a good, service, or information

Explanatory Note

Example

Concept URI

Concept Publisher Link

Show Term Issues

Show Linked Capabilities

Status

10/19/2015 3:11:31 AM

jrhyne

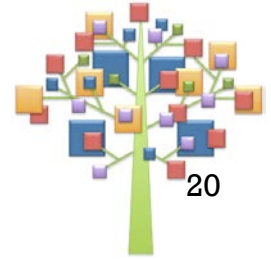
Collected Terms

Term	<input type="text" value="Trade"/>	<input type="text" value="1"/>	<input type="text" value="401"/>
Definition	<input type="text" value="400"/> <input type="text" value="205"/>	Explanatory Note	
<input type="text" value="a basic agreement between parties participating in a voluntary negotiation and the exchange of goods and/or services for some consideration (e.g., desired goods and services that someone else possesses); a commercial transaction involving the sale and purchase"/>		<input type="text"/>	
Example <input type="text"/>			

Record:



But data aggregation and reporting requires even more ...



- Rules are essential to integrating many, many stores, aggregating across gold sources, leveraging FIBO and other standard and internal institution-specific ontologies to normalize terminology where possible
- Integrity checking and data quality analysis cannot be done with SPARQL alone
- Rule-driven analytics are needed to perform transformations of the aggregated content for reporting purposes, but they also must carry provenance metadata required for regulations such as BCBS 239
- Even better tools are needed for decision support at the executive level in large institutions, far more than what the regulators are asking for, and in anticipation of additional compliance rules to come