Singapore Drug Dictionary and Dose Forms

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MOH Holdings, Singapore

14 October 2011 (3:30 – 4:15 pm)

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Agenda

- Background
- SDD Model and Examples
- Dose Form Hierarchy
- Implementation and Tooling
- Conclusions

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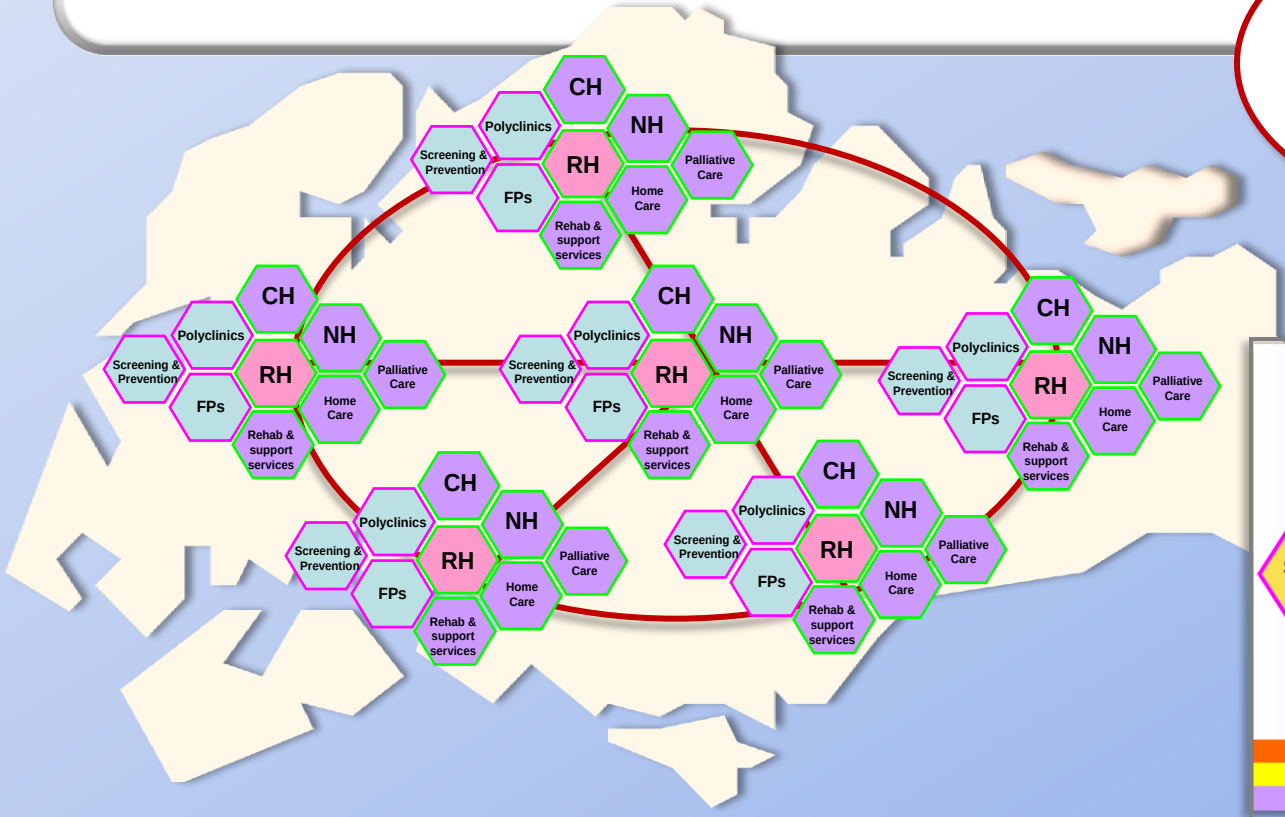
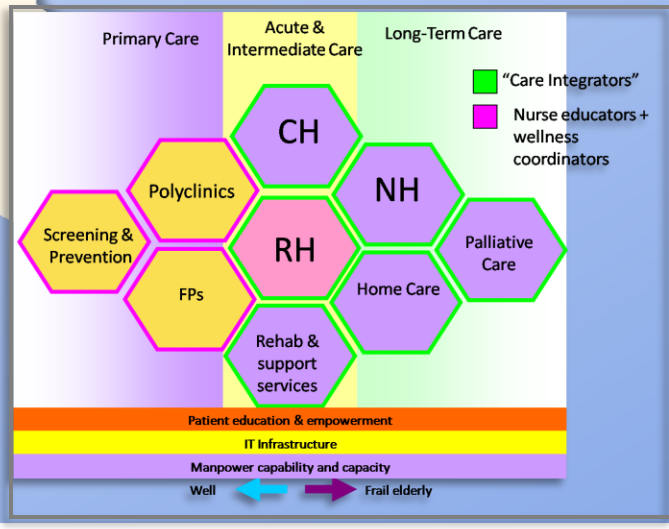
Background

Healthcare landscape of the future

Strategic vision of patients moving seamlessly across the healthcare system, receiving coordinated patient-centric care at the most appropriate settings.

Enabled by the National Electronic Health Record (EHR)





Background

- Different in-house drug terminologies, codes and IT systems
- Limits the extent to which information can be exchanged– for post-market monitoring, integrated care, healthcare efficiency, decision support and patient safety;

Singapore Drug Dictionary

- A national standard to unambiguously identify, code & interpret medicines
- Includes standardised, consistent descriptions for each drug
- Facilitates seamless exchange
- Needs to meet diverse requirements of different users and cater for new innovative products

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Objectives of Singapore Drug Dictionary

Improvements in clinical care activities, patient management and safety

- Semantic interoperability across use cases
- Semantic interoperability across care settings
- National / international decision support rules
- Medication safety initiatives including:
  - ✓ Medication management
  - ✓ Adverse drug event surveillance.
- Data mining, analysis and research

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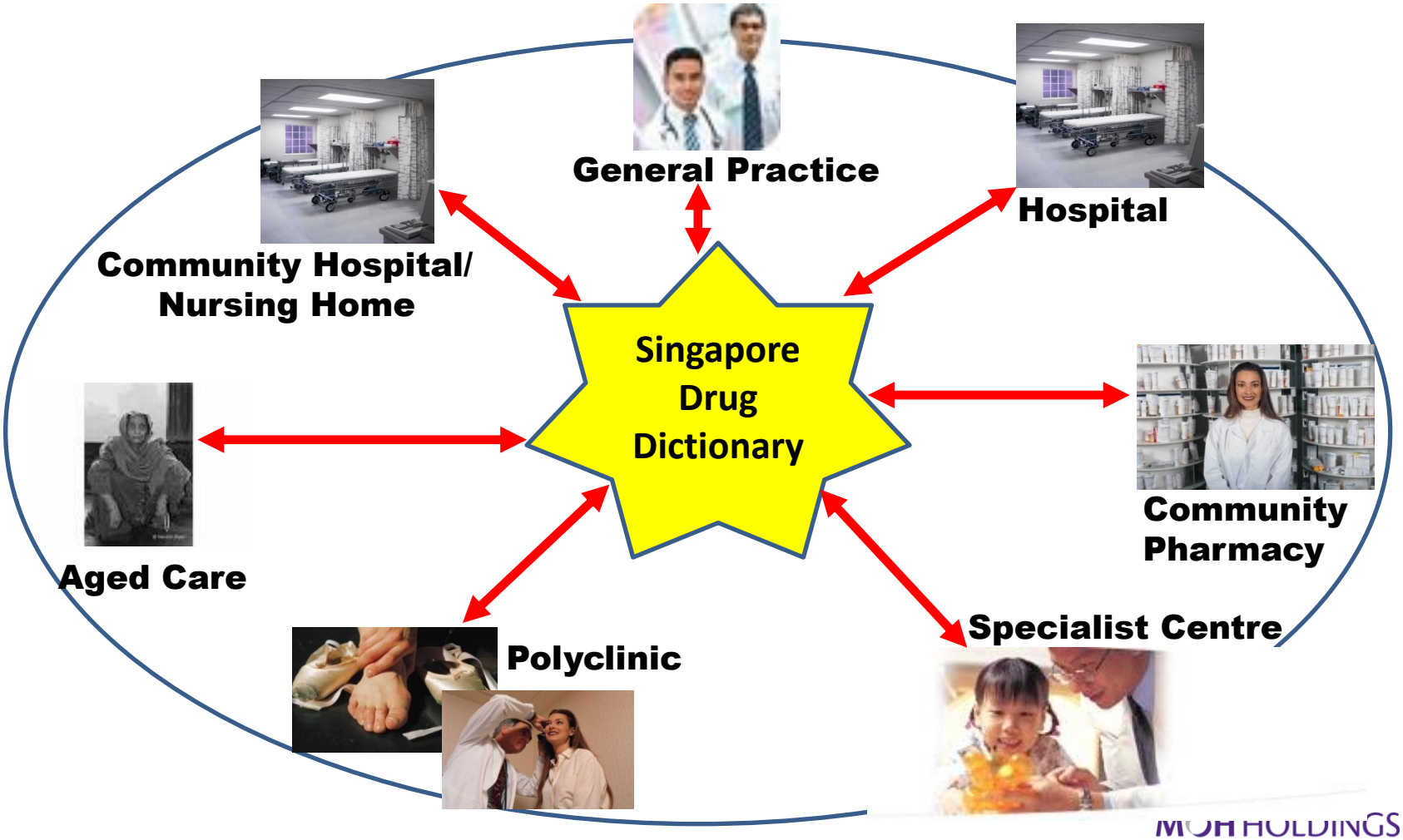
Interoperability Across Care Settings



Interoperability Across Use Cases

HSA Health Sciences Authority

Registration

Inventory Management

Supply Chain

Prescribing

Dispensing

Administration

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Medication Lists / Allergies / Research / Decision Support etc

SDD Principles

The SDD has been developed with the following principles in mind:

- **Extensibility**
  In both the drug content and data model to allow for innovations in pharmaceutical and device technology over time.
- **Ontology**
  Based on ontological principles to support Singapore's growing need for Biomedical research.
- **Patient Safety, Semantic Interoperability and Decision Support**
  These must be facilitated by the SDD and be the focus of clinician review and initial EMR vendor uptake.
- **Hide Complexity**
  Complexity to be hidden from clinicians and most Electronic Medical Record (EMR) vendors.
- **Informed by Existing Clinical Practice**
  Models tested against several thousand existing medication terms from hospital and GP prescribing/dispensing systems, PRIOR to finalisation of model.

Model and
Examples

Core Medication Classes

Singapore Medicinal Product (SG product)

is a

Medicinal Product (MP)

is a

Medicinal Trade Product (MTP)

Brand

Medicinal Product Form (MPF)

Medicinal Trade Product Form (MTPF)

Medicinal Product Preparation (MPR)

Medicinal Trade Product Preparation (MTPR)

20 tablets

Medicinal Product Quantity (MPQ)

Medicinal Trade Product Quantity (MTPQ)

2 x 10 tablets

Medicinal Product Pack (MPP)

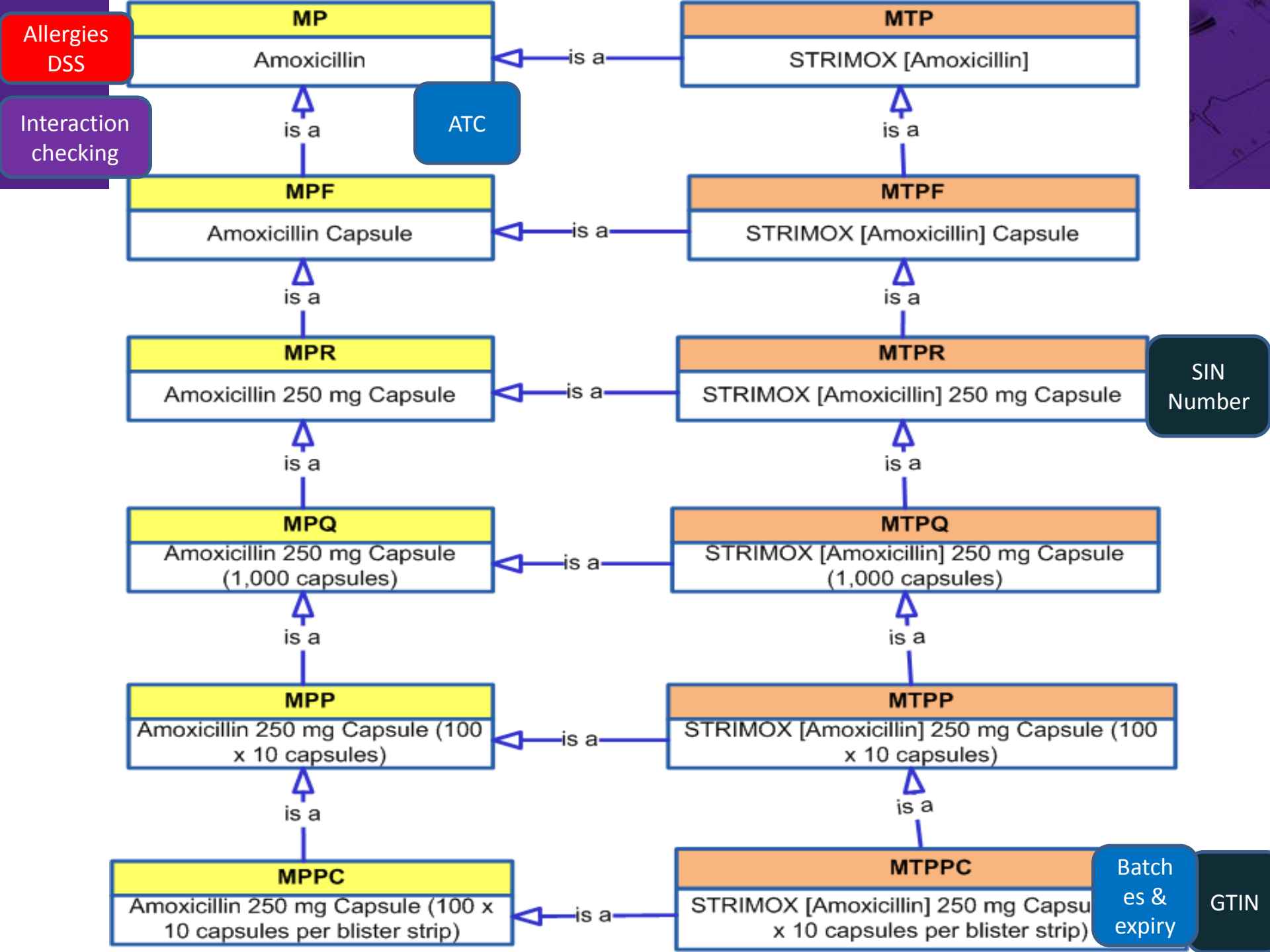
Medicinal Trade Product Pack (MTPP)

2 x 10 tablets per blister strip

Medicinal Product Pack in Container (MPPC)

Medicinal Trade Product Pack in Container (MTPPC)

OL


Allergies DSS
Interaction checking
MP
Amoxicillin
is a
MTP
STRIMOX [Amoxicillin]
ATC
is a
is a
MPF
Amoxicillin Capsule
is a
MTPF
STRIMOX [Amoxicillin] Capsule
is a
is a
MPR
Amoxicillin 250 mg Capsule
is a
MTPR
STRIMOX [Amoxicillin] 250 mg Capsule
SIN Number
is a
is a
MPQ
Amoxicillin 250 mg Capsule (1,000 capsules)
is a
MTPQ
STRIMOX [Amoxicillin] 250 mg Capsule (1,000 capsules)
is a
is a
MPP
Amoxicillin 250 mg Capsule (100 x 10 capsules)
is a
MTPP
STRIMOX [Amoxicillin] 250 mg Capsule (100 x 10 capsules)
is a
is a
MPPC
Amoxicillin 250 mg Capsule (100 x 10 capsules per blister strip)
is a
MTPPC
STRIMOX [Amoxicillin] 250 mg Capsu
x 10 capsules per blister strip)
Batches & expiry
GTIN

The Structure of an SDD Drug

Multi Pack (e.g. 2 packs)

(Super) Pack

Subpack in Container (e.g. blister strip)

Component

Ingredient

+

Ingredient

&

Component

Ingredient

+

Ingredient

Subpack in Container (e.g. bottle)

Component

Ingredient

Use Case Driven Abstractions – based on:

- **Ingredient Level**
  - Specific (S) — E.g. Amoxicillin Trihydrate
  - Clinically Relevant (CR) — E.g. Amitriptyline Hydrochloride
  - Clinically Significant (CS) — E.g. Amitriptyline, Calcium Carbonate
  - Base — E.g. Calcium
- **Dose Form Level**
  - Specific (S) — E.g. Intramuscular Injection Solution
  - Clinically Relevant (CR) — E.g. Intramuscular Injection
  - Top (T) — E.g. Injection
- **Other Defining Information**
  - Flavour — E.g. Strawberry flavour
  - Freeness — E.g. Preservative-free
  - Other — E.g. Southern Hemisphere
- **Ingredient Qualifiers** — E.g. Bovine, Micronised

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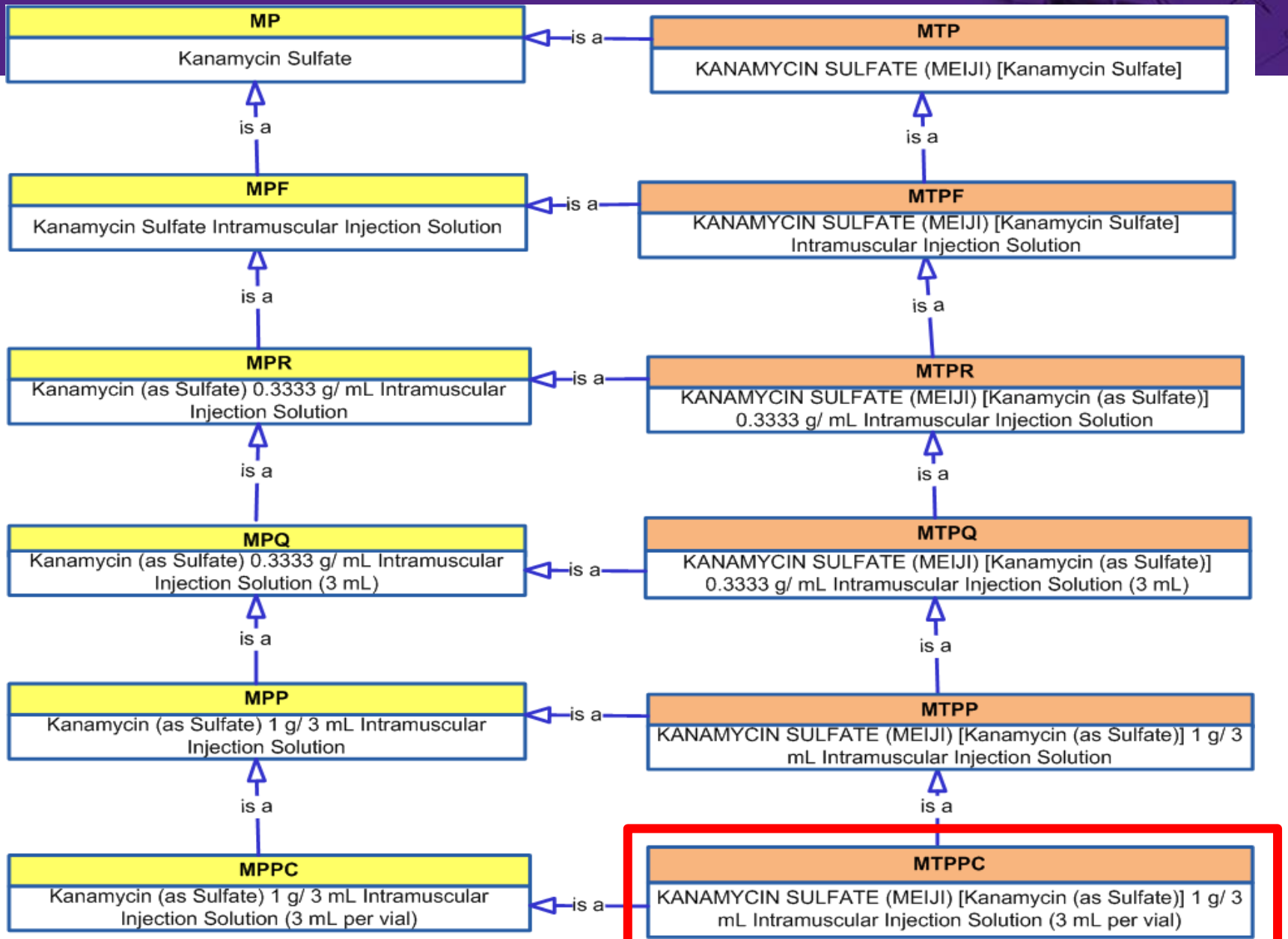
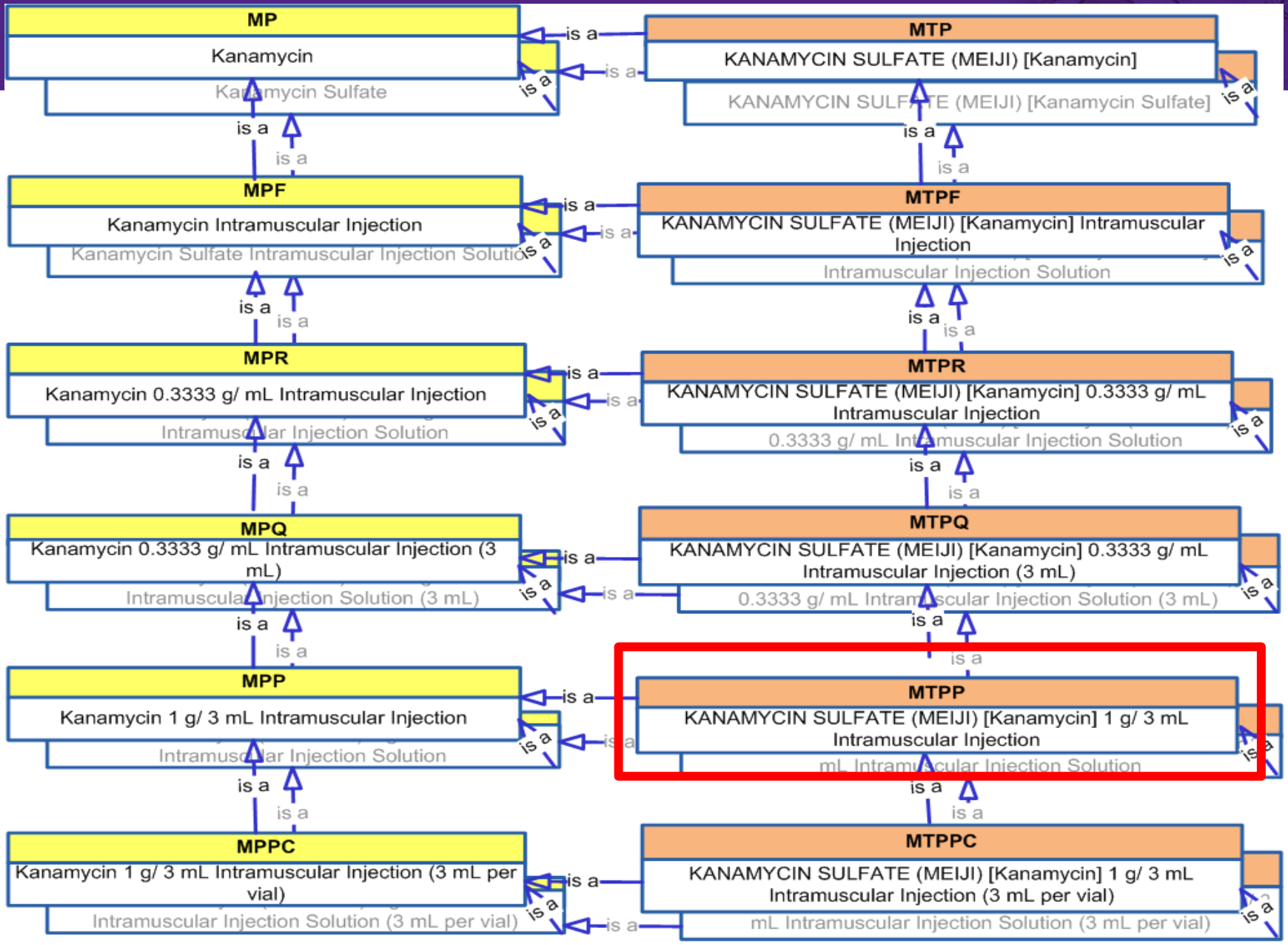
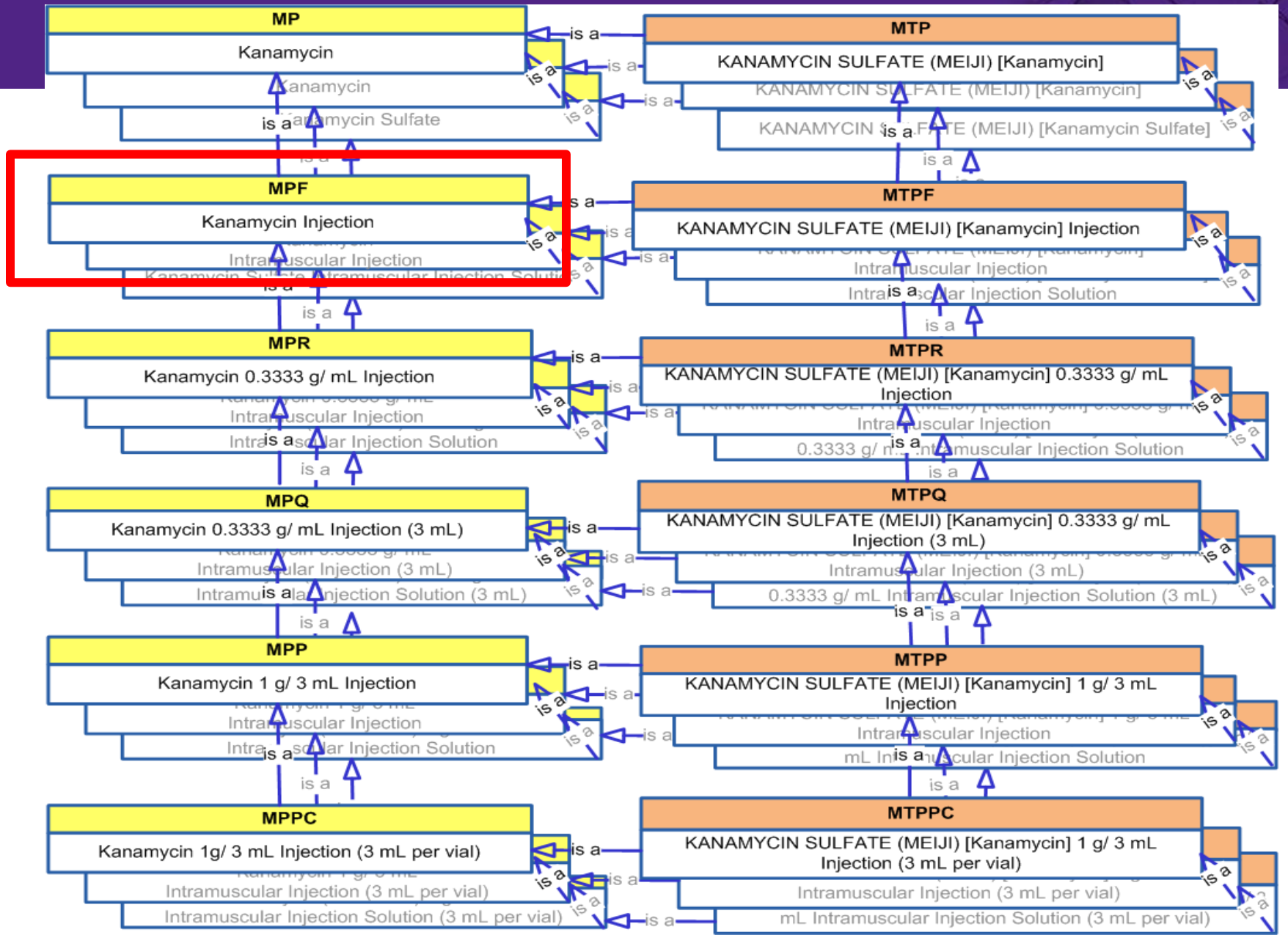
Specific ING – Specific DF



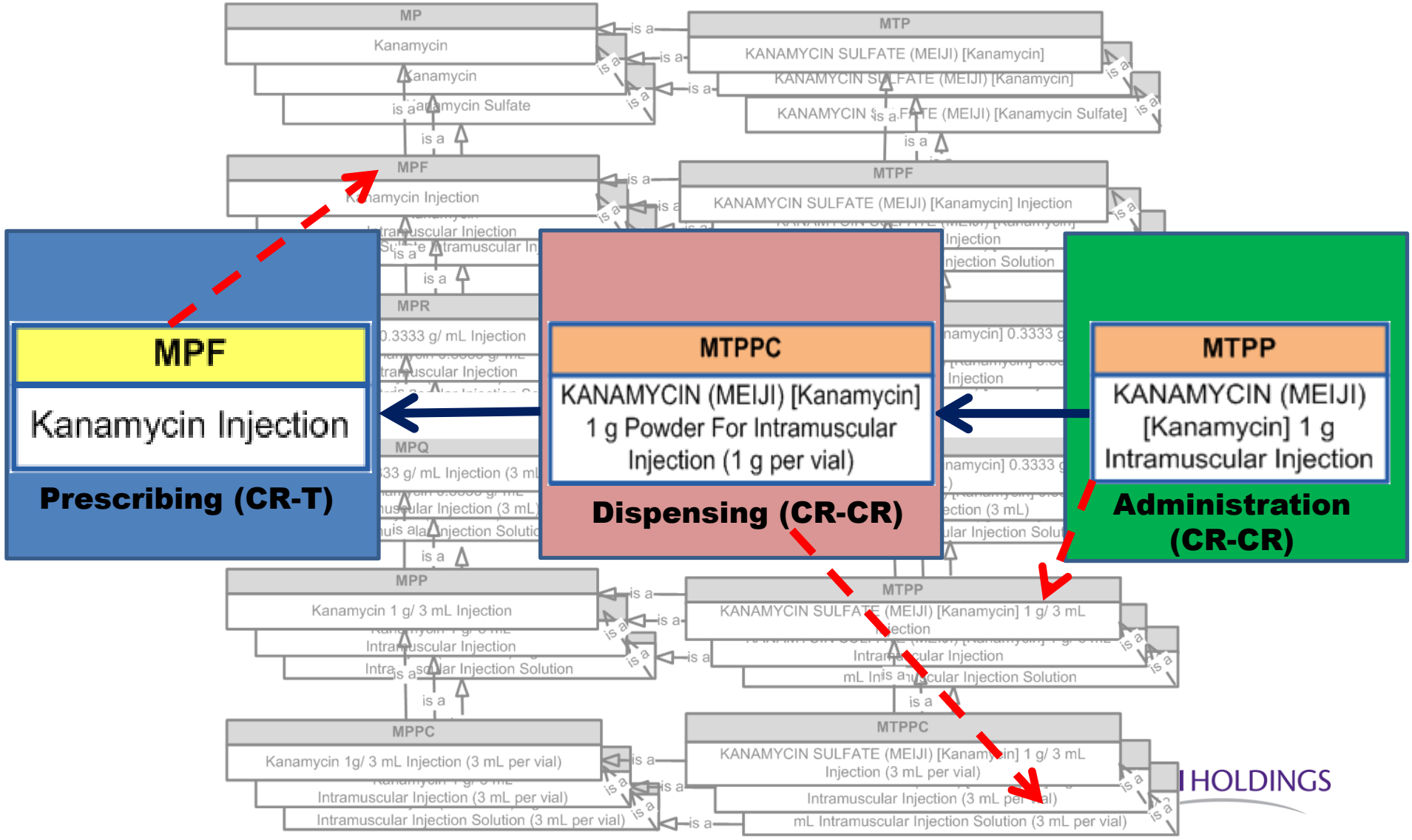
Clinically Relevant ING – Clinically Relevant DF



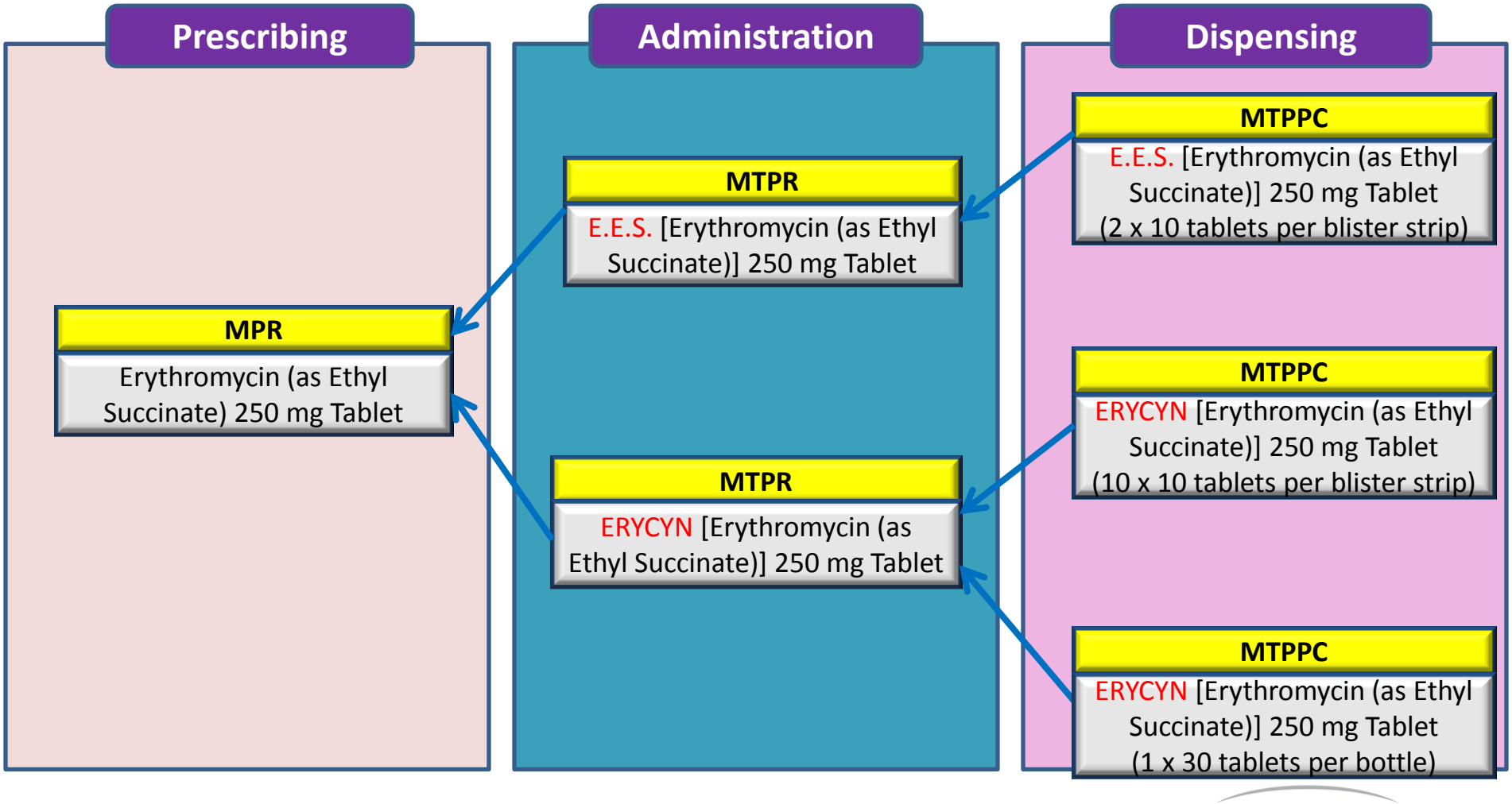
Clinically Relevant ING – Top Level DF

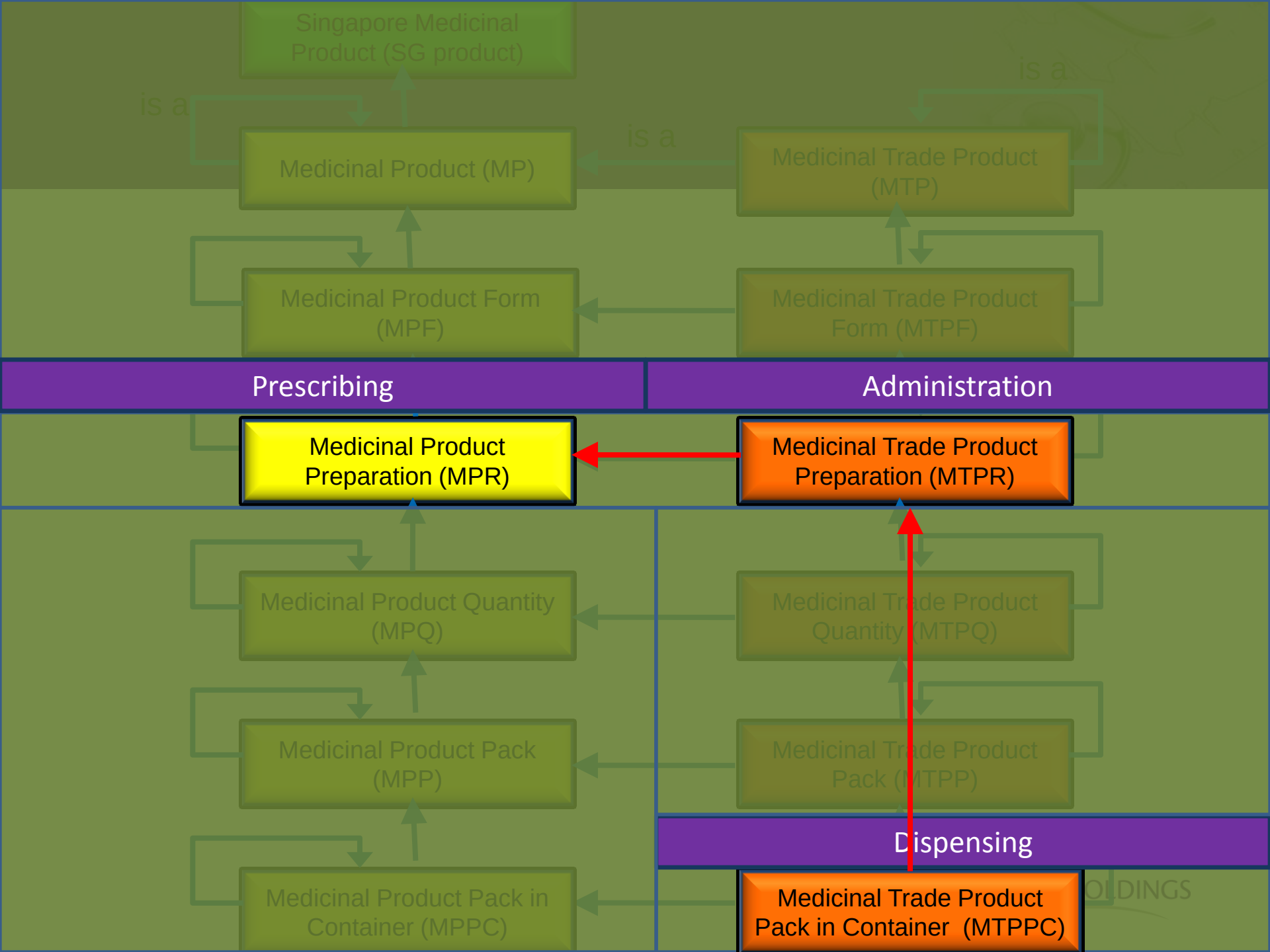


Interoperability Across Use Cases

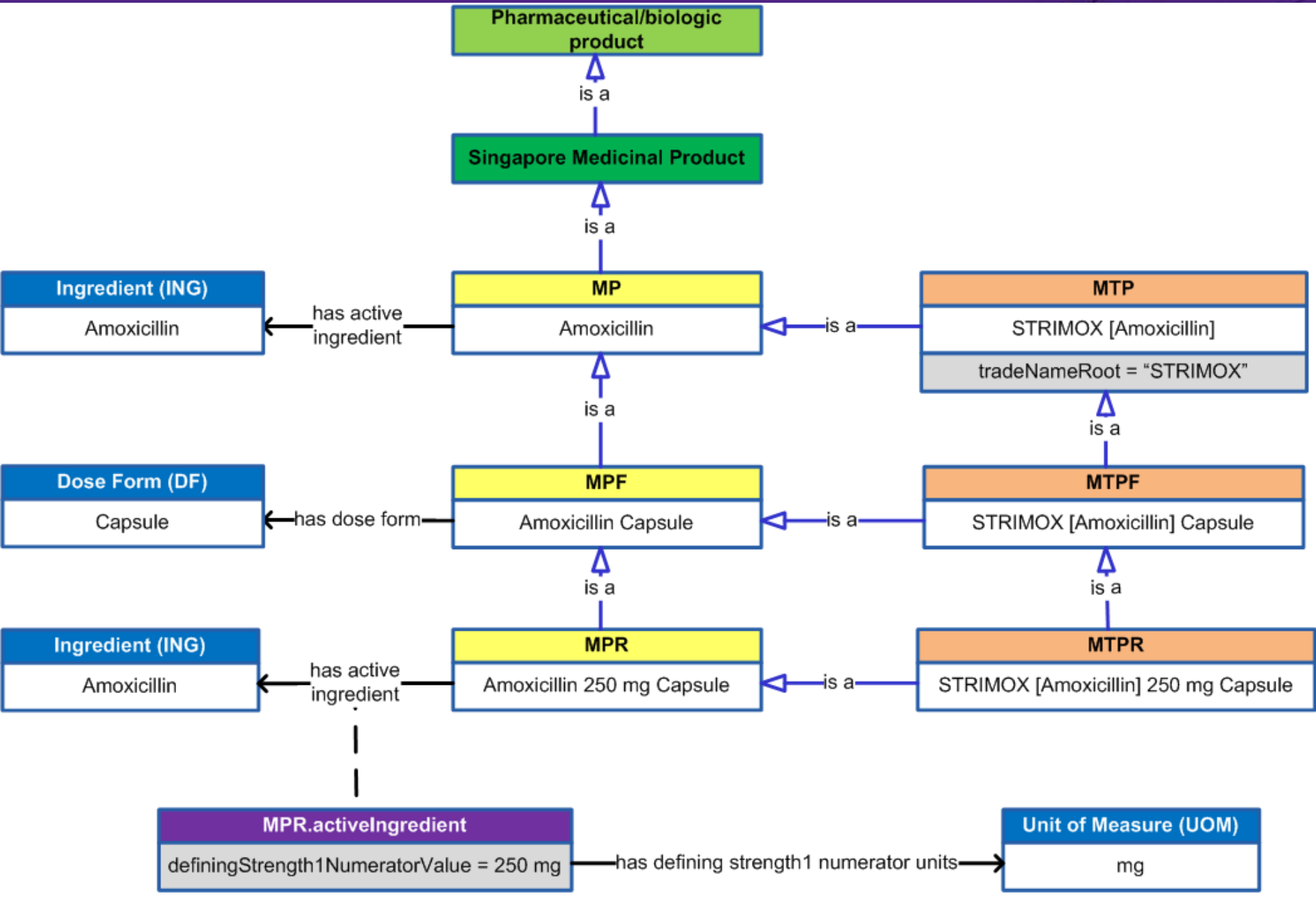


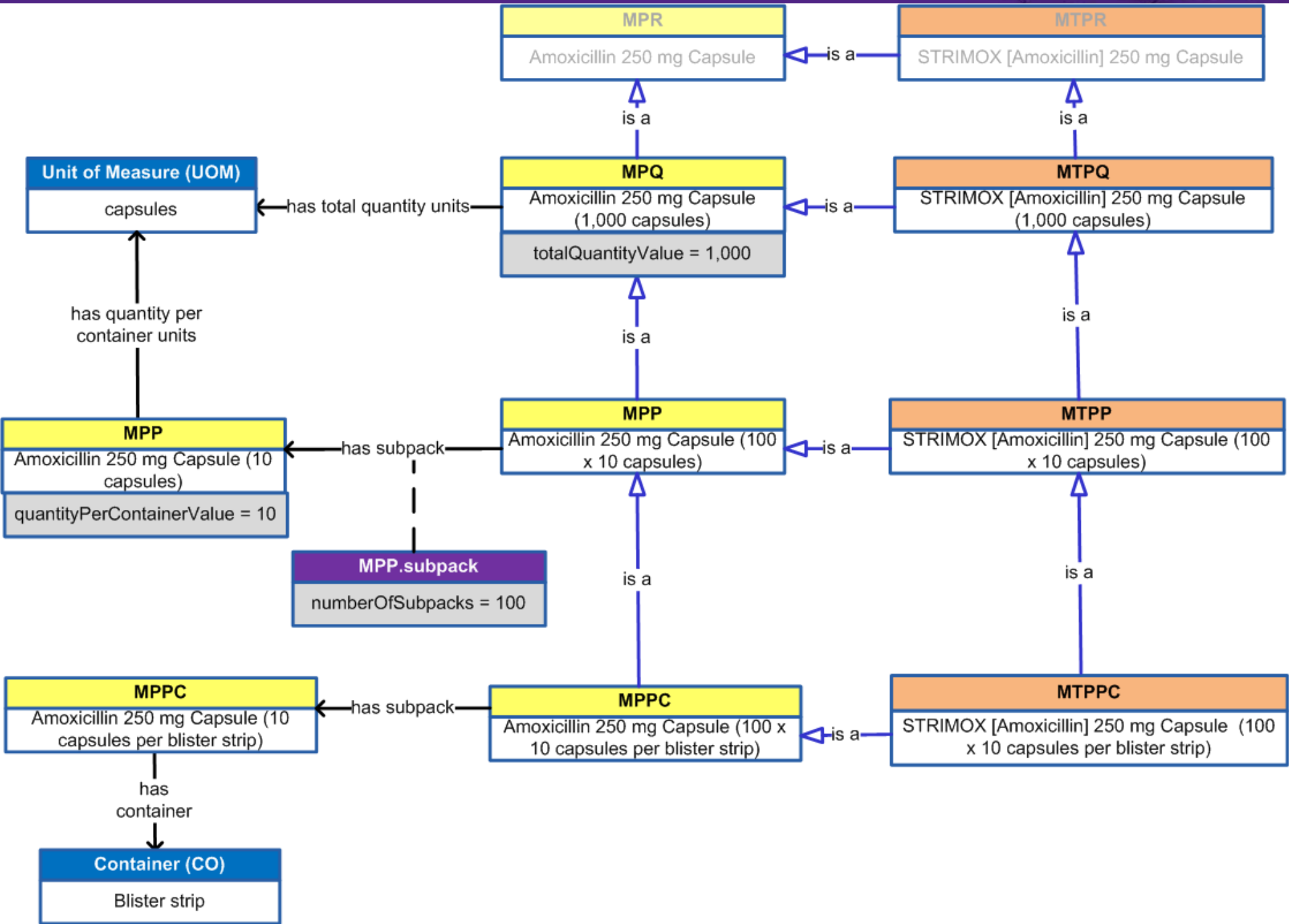
Use Case Reference Sets (and Linkages)




Singapore Medicinal Product (SG product)
is a
is a
is a
Medicinal Product (MP)
Medicinal Trade Product (MTP)
Medicinal Product Form (MPF)
Medicinal Trade Product Form (MTPF)
Prescribing
Administration
Medicinal Product Preparation (MPR)
Medicinal Trade Product Preparation (MTPR)
Medicinal Product Quantity (MPQ)
Medicinal Trade Product Quantity (MTPQ)
Medicinal Product Pack (MPP)
Medicinal Trade Product Pack (MTPP)
Dispensing
Medicinal Product Pack in Container (MPPC)
Medicinal Trade Product Pack in Container (MTPPC)

Defining Medications in SDD




MPR
Amoxicillin 250 mg Capsule
is a
MTPR
STRIMOX [Amoxicillin] 250 mg Capsule
is a
is a
Unit of Measure (UOM)
capsules
has total quantity units
MPQ
Amoxicillin 250 mg Capsule (1,000 capsules)
totalQuantityValue = 1,000
is a
MTPQ
STRIMOX [Amoxicillin] 250 mg Capsule (1,000 capsules)
has quantity per container units
is a
is a
MPP
Amoxicillin 250 mg Capsule (10 capsules)
quantityPerContainerValue = 10
has subpack
MPP
Amoxicillin 250 mg Capsule (100 x 10 capsules)
is a
MTPP
STRIMOX [Amoxicillin] 250 mg Capsule (100 x 10 capsules)
MPP.subpack
numberOfSubpacks = 100
is a
is a
MPPC
Amoxicillin 250 mg Capsule (10 capsules per blister strip)
has subpack
MPPC
Amoxicillin 250 mg Capsule (100 x 10 capsules per blister strip)
is a
MTPPC
STRIMOX [Amoxicillin] 250 mg Capsule (100 x 10 capsules per blister strip)
has container
Container (CO)
Blister strip

Additional Classes and Relationships

- **Containered Classes**
  - Introduced to support clinical terms that use Container at all levels of hierarchy – e.g.
    - ✓ Salbutamol Powder Inhaler
    - ✓ Salbutamol Injection Ampoule
    - ✓ Salbutamol 2 mg/ mL Ampoule
- **Groupers**
  - Introduced to support clinical prescribing terms that group specific products:
    - ✓ Ingredient Group – e.g. Analgesic, Influenza Virus Vaccine, Chlorhexidine Salt
    - ✓ Dose Form – e.g. Aspirin Tablet/Capsule
    - ✓ Strength – e.g. Methyl Salicylate 10 - 20 % Cream
    - ✓ Strength Units – e.g. Tetanus Immunoglubulin 250 unit Injection
    - ✓ Total Pack Size
    - ✓ Container Quantity/Size – e.g. Aqueous Cream (15 g; 30 g)
    - ✓ Container
    - ✓ Trade Name Root/Group – e.g. PANADOL Tablet, TRIDERM/ COMBIDERM [Betamethason Diproprianate + Clotrimazole + Gentamicin] Cream
- **Relationships**
  - Manufactured vs Administrable Products
    - ✓ Has administrable product
  - Formulations – recipe linked to resulting drug
    - ✓ Formulates
  - In device vs With device
    - ✓ Has loaded product

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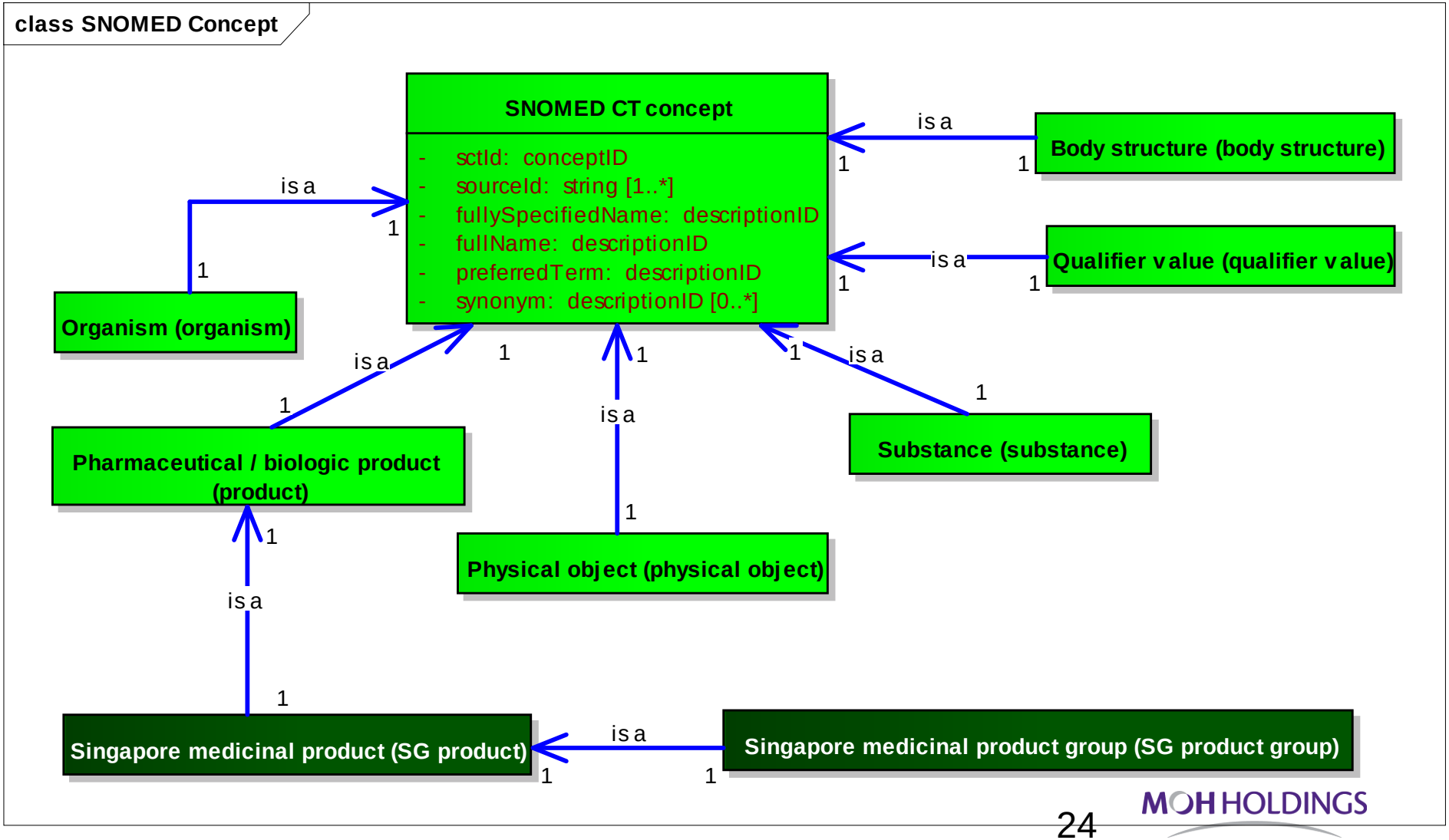
SNOMED CT Hierarchies



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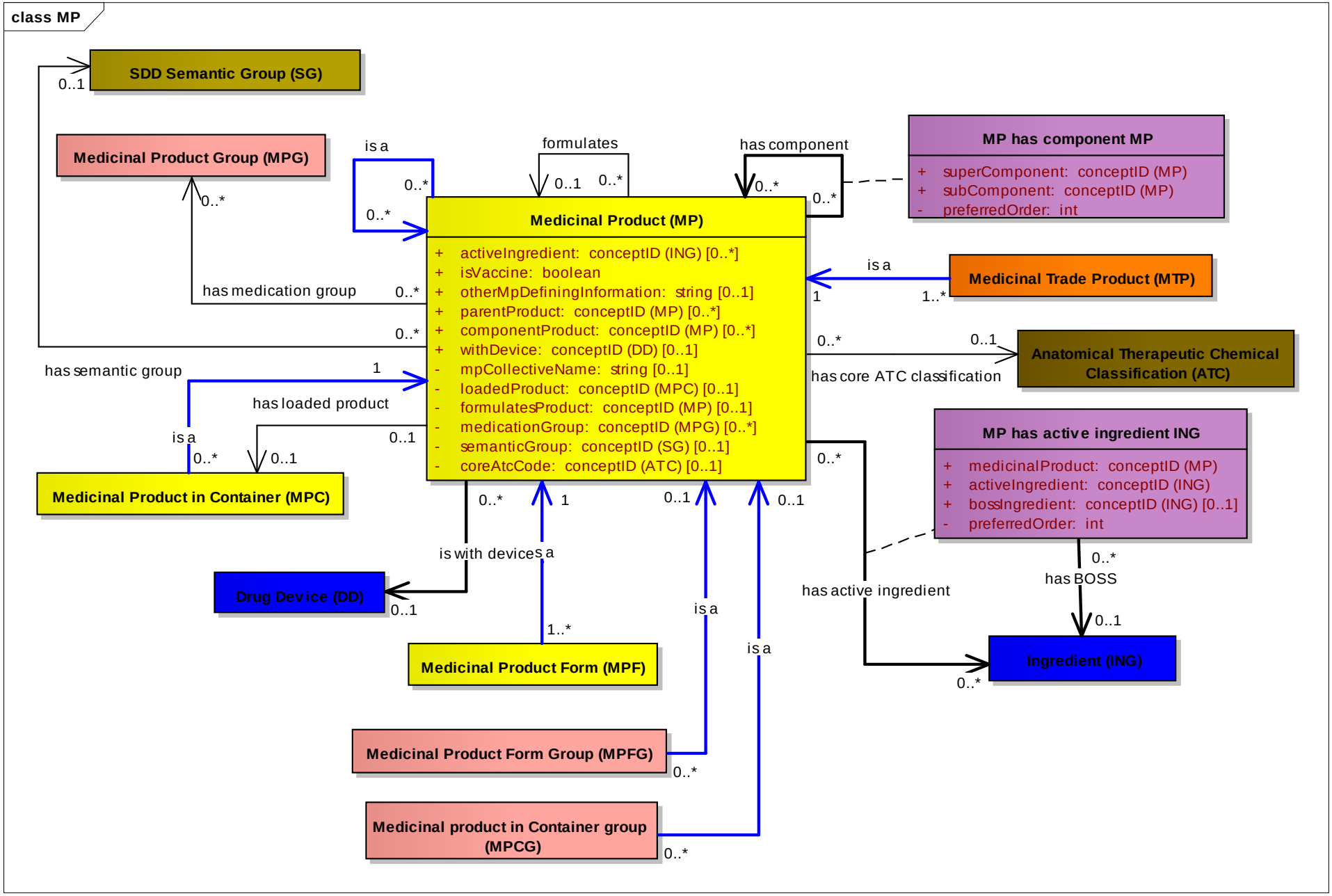
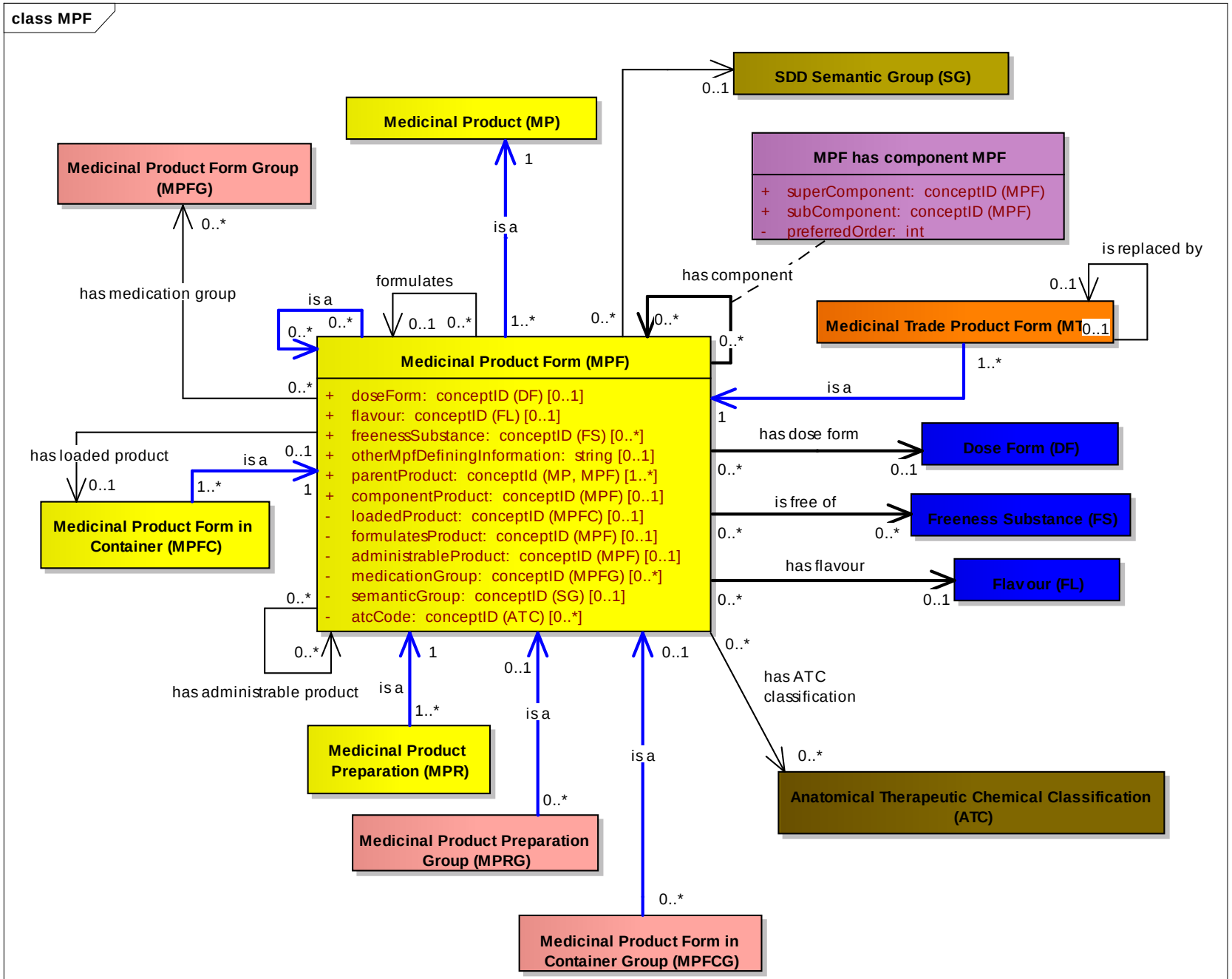
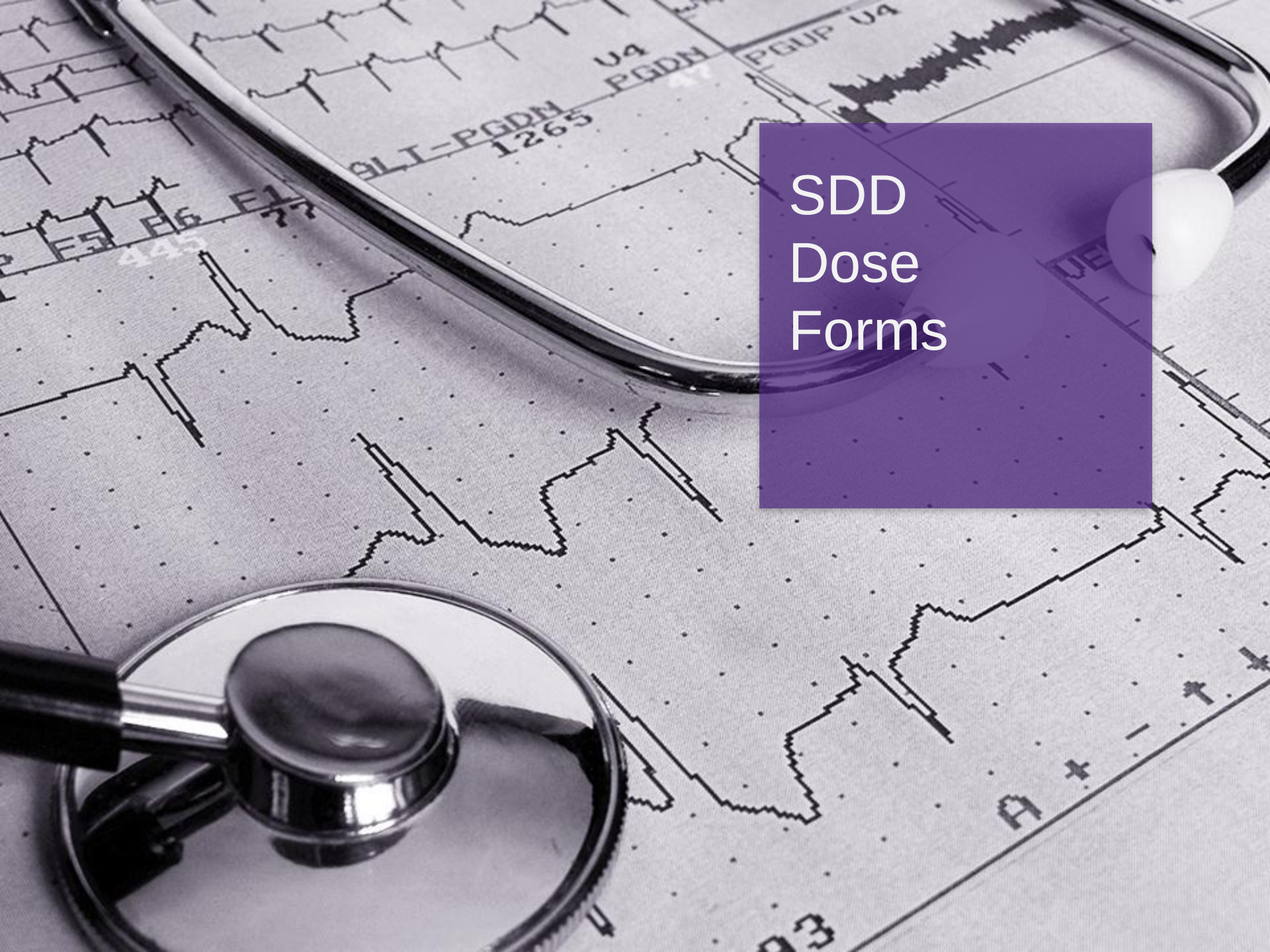
MP Class Diagram



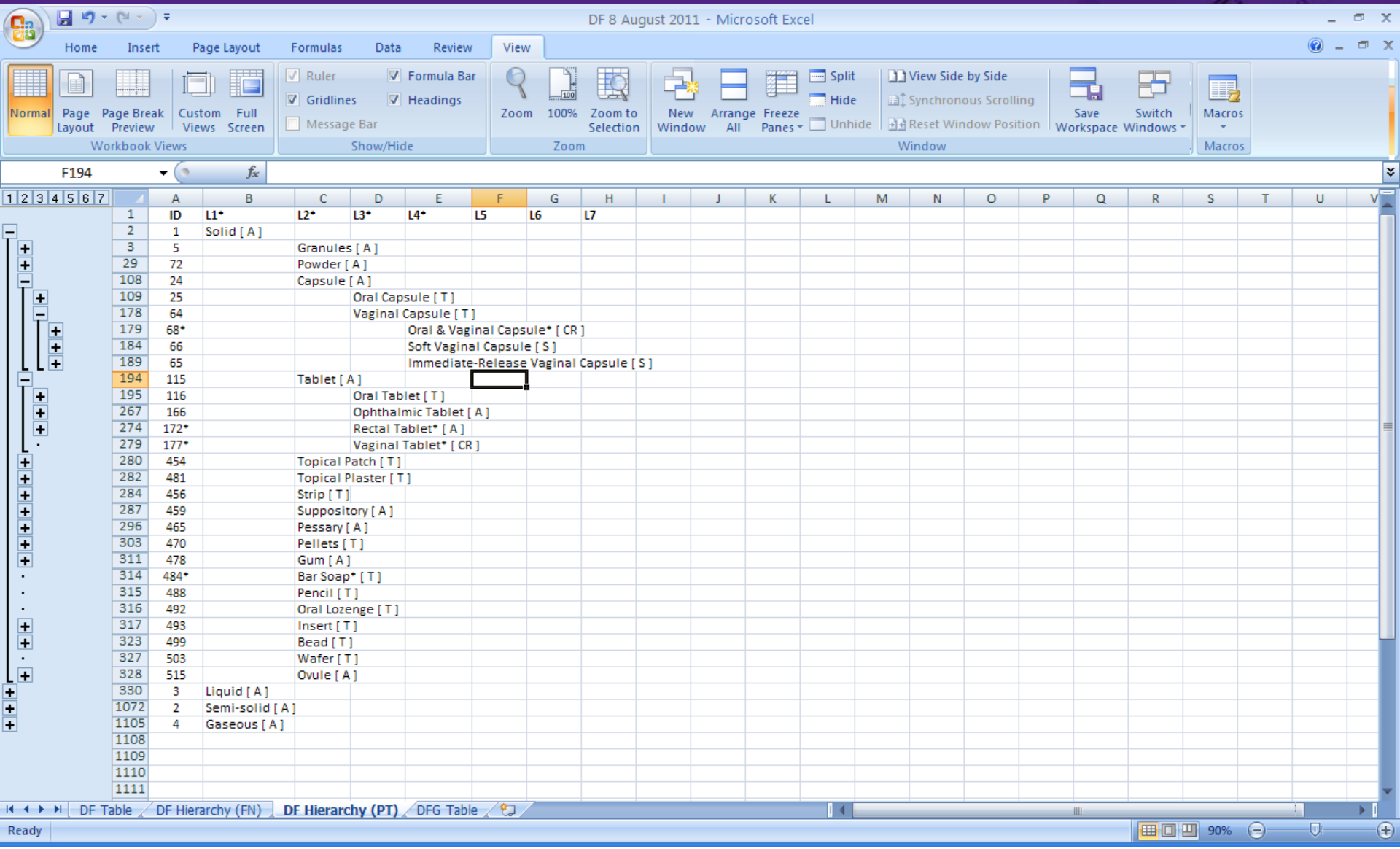
MPF Class Diagram




SDD
Dose
Forms

SDD Dose Form Hierarchy

[Dose Form Hierarchy]



DF 8 August 2011 - Microsoft Excel

ID	L1*	L2*	L3*	L4*	L5	L6	L7
1	Solid [A]						
5		Granules [A]					
72		Powder [A]					
24		Capsule [A]					
25			Oral Capsule [T]				
64			Vaginal Capsule [T]				
68*				Oral & Vaginal Capsule* [CR]			
66				Soft Vaginal Capsule [S]			
65				Immediate-Release Vaginal Capsule [S]			
115		Tablet [A]					
116			Oral Tablet [T]				
166			Ophthalmic Tablet [A]				
172*			Rectal Tablet* [A]				
177*			Vaginal Tablet* [CR]				
454		Topical Patch [T]					
481		Topical Plaster [T]					
456		Strip [T]					
459		Suppository [A]					
465		Pessary [A]					
470		Pellets [T]					
478		Gum [A]					
484*		Bar Soap* [T]					
488		Pencil [T]					
492		Oral Lozenge [T]					
493		Insert [T]					
499		Bead [T]					
503		Wafer [T]					
515		Ovule [A]					
3	Liquid [A]						
2	Semi-solid [A]						
4	Gaseous [A]						

Dose Form – Defining Characteristics

- **State of Matter** — *e.g. Solid, Semi-Solid, Liquid, Gas*
- **Primitive Dose Form** — *e.g. Tablet, Capsule, Solution*
- **Release Characteristic** — *e.g. Extended-Release*
- **Delivery Device** — *e.g. Powder Inhaler*
- **Administration Method** — *e.g. Injection, Nebulisation*
- **Transformation Method** — *e.g. Reconstitution, Dispersion*
- **Formulated Route** — *e.g. Oral, Rectal, Intramuscular*
- **Site Prepared For** — *e.g. Eye, Scalp*
- **Administrable Dose Form** — *e.g. Oral Suspension*
- **Dose Form Qualifier** — *e.g. Film-Coated, Soft*
- **Proprietary Name** — *e.g. TESTOCAP, DIVULE*

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DF Example: ***Prolonged-Release Film-Coated Oral Tablet***

Product: HARNAL OCAS [Tamsulosin]

- **State of Matter** — ***Solid***
- **Primitive Dose Form** — ***Tablet***
- **Release Characteristic** — ***Prolonged-Release***
- **Delivery Device**
- **Administration Method**
- **Transformation Method**
- **Formulated Route** — ***Oral***
- **Site Prepared For** — ***Mouth***
- **Administrable Dose Form**
- **Dose Form Qualifier** — ***Film-Coated***
- **Proprietary Name**

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DF Example: *Intramuscular Injection Solution*

Product: KANAMYCIN MEIJI [Kanamycin]

• **State of Matter**	***Liquid***
• **Primitive Dose Form**	***Liquid ← Solution***
• **Release Characteristic**	
• **Delivery Device**	
• **Administration Method**	***Injection***
• **Transformation Method**	
• **Formulated Route**	***Intramuscular***
• **Site Prepared For**	***Muscle***
• **Administrable Dose Form**	
• **Dose Form Qualifier**	
• **Proprietary Name**	

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DF Example: ***Vaginal & Rectal Suppository***

Product: CYCLOGEST [Progesterone]

• **State of Matter**	***Solid***	
• **Primitive Dose Form**	***Suppository***	
• **Release Characteristic**		
• **Delivery Device**		
• **Administrable Dose Form**		
• **Transformation Method**		
• **Formulated Route**	***Vaginal***	***Rectal***
• **Site Prepared For**	***Vagina***	***Rectum***
• **Administration Method**		
• **Dose Form Qualifier**		
• **Proprietary Name**		

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DF Example: *Intravenous Infusion & Nebulisation Solution*

Product: RELENZA [Zanamivir]

• State of Matter	***Liquid***	
• Primitive Dose Form	***Liquid ← Solution***	
• Release Characteristic		
• Delivery Device		***Nebuliser***
• Administrable Dose Form		
• Transformation Method		
• Formulated Route	***Intravenous***	
• Site Prepared For	***Vein***	
• Administration Method	***Infusion***	***Nebulisation***
• Dose Form Qualifier		
• Proprietary Name		

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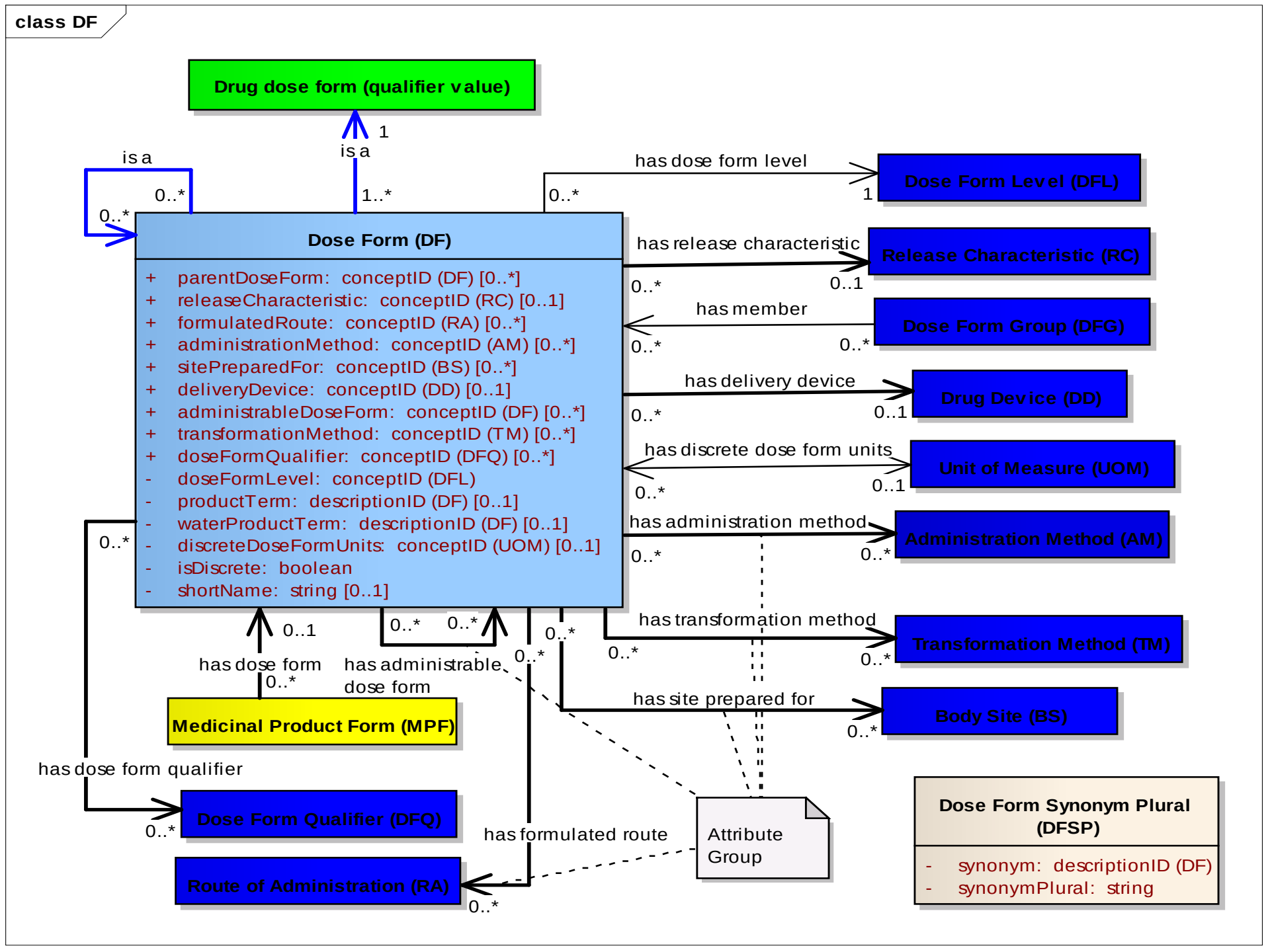
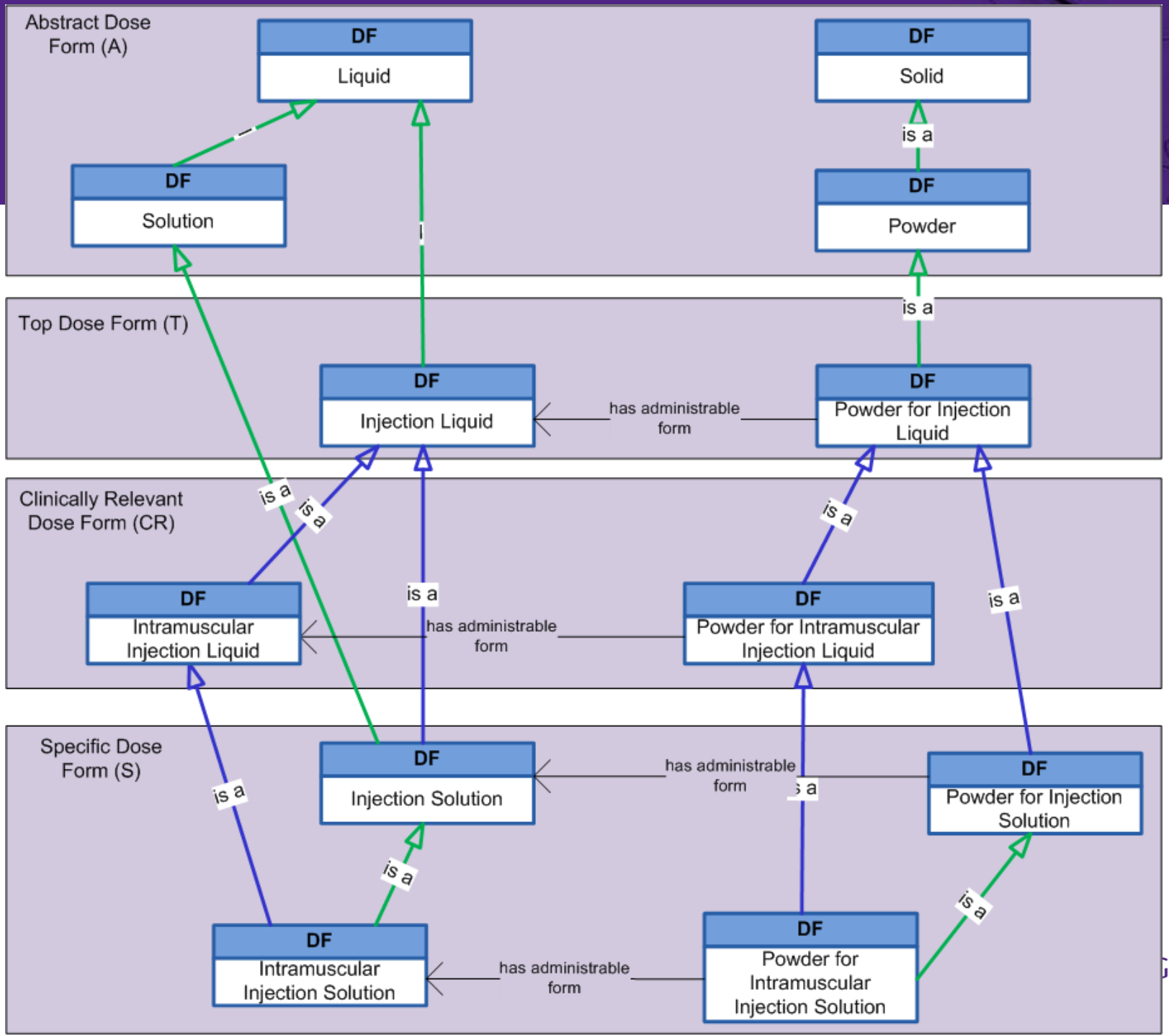
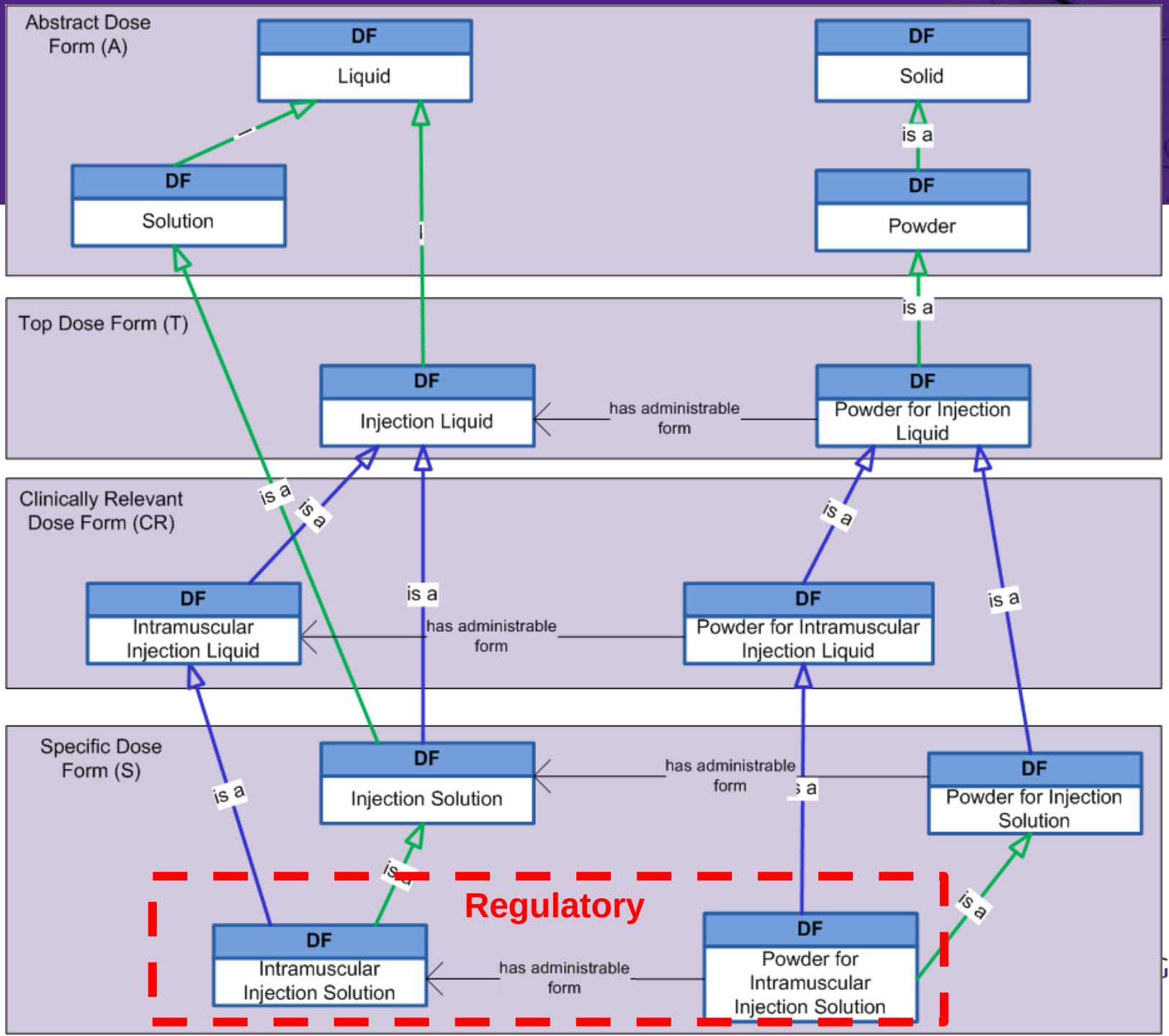
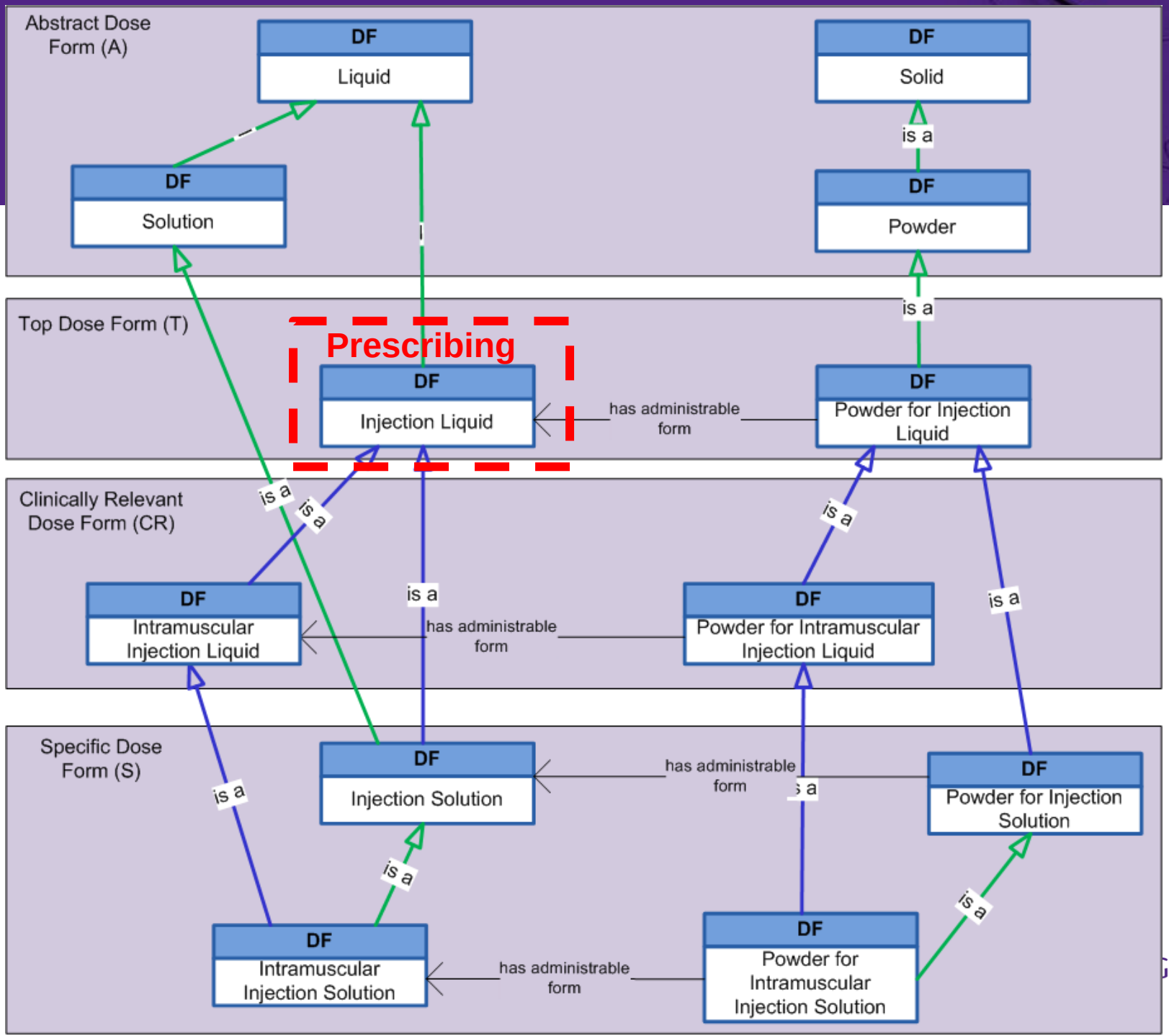

class DF
Drug dose form (qualifier value)
1
is a
is a
0..*
1..*
0..*
has dose form level
1
Dose Form Level (DFL)
Dose Form (DF)
+ parentDoseForm: conceptID (DF) [0..*]
+ releaseCharacteristic: conceptID (RC) [0..1]
+ formulatedRoute: conceptID (RA) [0..*]
+ administrationMethod: conceptID (AM) [0..*]
+ sitePreparedFor: conceptID (BS) [0..*]
+ deliveryDevice: conceptID (DD) [0..1]
+ administrableDoseForm: conceptID (DF) [0..*]
+ transformationMethod: conceptID (TM) [0..*]
+ doseFormQualifier: conceptID (DFQ) [0..*]
- doseFormLevel: conceptID (DFL)
- productTerm: descriptionID (DF) [0..1]
- waterProductTerm: descriptionID (DF) [0..1]
- discreteDoseFormUnits: conceptID (UOM) [0..1]
- isDiscrete: boolean
- shortName: string [0..1]
has release characteristic
0..*
0..1
Release Characteristic (RC)
has member
0..*
0..*
Dose Form Group (DFG)
has delivery device
0..*
0..1
Drug Device (DD)
has discrete dose form units
0..*
0..1
Unit of Measure (UOM)
has administration method
0..*
0..*
Administration Method (AM)
has transformation method
0..*
0..*
Transformation Method (TM)
has site prepared for
0..*
Body Site (BS)
0..1
has dose form
0..*
Medicinal Product Form (MPF)
0..*
0..*
has administrable dose form
0..*
0..*
has dose form qualifier
0..*
Dose Form Qualifier (DFQ)
has formulated route
0..*
Route of Administration (RA)
Attribute Group
Dose Form Synonym Plural (DFSP)
- synonym: descriptionID (DF)
- synonymPlural: string

Dose Form Descriptions

Fully Specified Name	Full Name	Preferred Term	Product Term	Short Name
Oral Tablet dose form (qualifier value)	Oral Tablet	Oral Tablet	**Tablet**	Tab
Ophthalmic Liquid: Drops dose form (qualifier value)	Ophthalmic Liquid: Drops	Ophthalmic Drops	**Eye drops**	Eye/d
Liquid: For Intravenous Injection dose form (qualifier value)	Liquid: For Intravenous Injection	Intravenous Injection Liquid	**Intravenous Injection**	IV Inj
Powder: For Reconstitution To Liquid: For Injection dose form (qualifier value)	Powder: For Reconstitution To Liquid: For Injection	Powder For Injection Liquid	**Injection Powder**	Inj Pwdr
Oral Capsule: For Oral Inhaler dose form (qualifier value)	Oral Capsule: For Oral Inhaler	Oral Inhaler Capsule	**Inhaler Capsule**	INH Cap


Abstract Dose Form (A)
DF
Liquid
DF
Solid
is a
DF
Solution
DF
Powder
Top Dose Form (T)
is a
DF
Injection Liquid
has administrable form
DF
Powder for Injection Liquid
Clinically Relevant Dose Form (CR)
is a
is a
is a
is a
is a
DF
Intramuscular Injection Liquid
has administrable form
DF
Powder for Intramuscular Injection Liquid
Specific Dose Form (S)
is a
DF
Injection Solution
has administrable form
DF
Powder for Injection Solution
is a
is a
is a
DF
Intramuscular Injection Solution
has administrable form
DF
Powder for Intramuscular Injection Solution


Abstract Dose Form (A)
DF
Liquid
DF
Solid
is a
DF
Solution
DF
Powder
Top Dose Form (T)
is a
DF
Injection Liquid
has administrable form
DF
Powder for Injection Liquid
Clinically Relevant Dose Form (CR)
is a
is a
is a
is a
is a
DF
Intramuscular Injection Liquid
has administrable form
DF
Powder for Intramuscular Injection Liquid
Specific Dose Form (S)
is a
DF
Injection Solution
has administrable form
DF
Powder for Injection Solution
is a
is a
Regulatory
DF
Intramuscular Injection Solution
has administrable form
DF
Powder for Intramuscular Injection Solution
is a


Abstract Dose Form (A)
DF
Liquid
DF
Solid
is a
DF
Solution
DF
Powder
Top Dose Form (T)
Prescribing
is a
DF
Injection Liquid
has administrable form
DF
Powder for Injection Liquid
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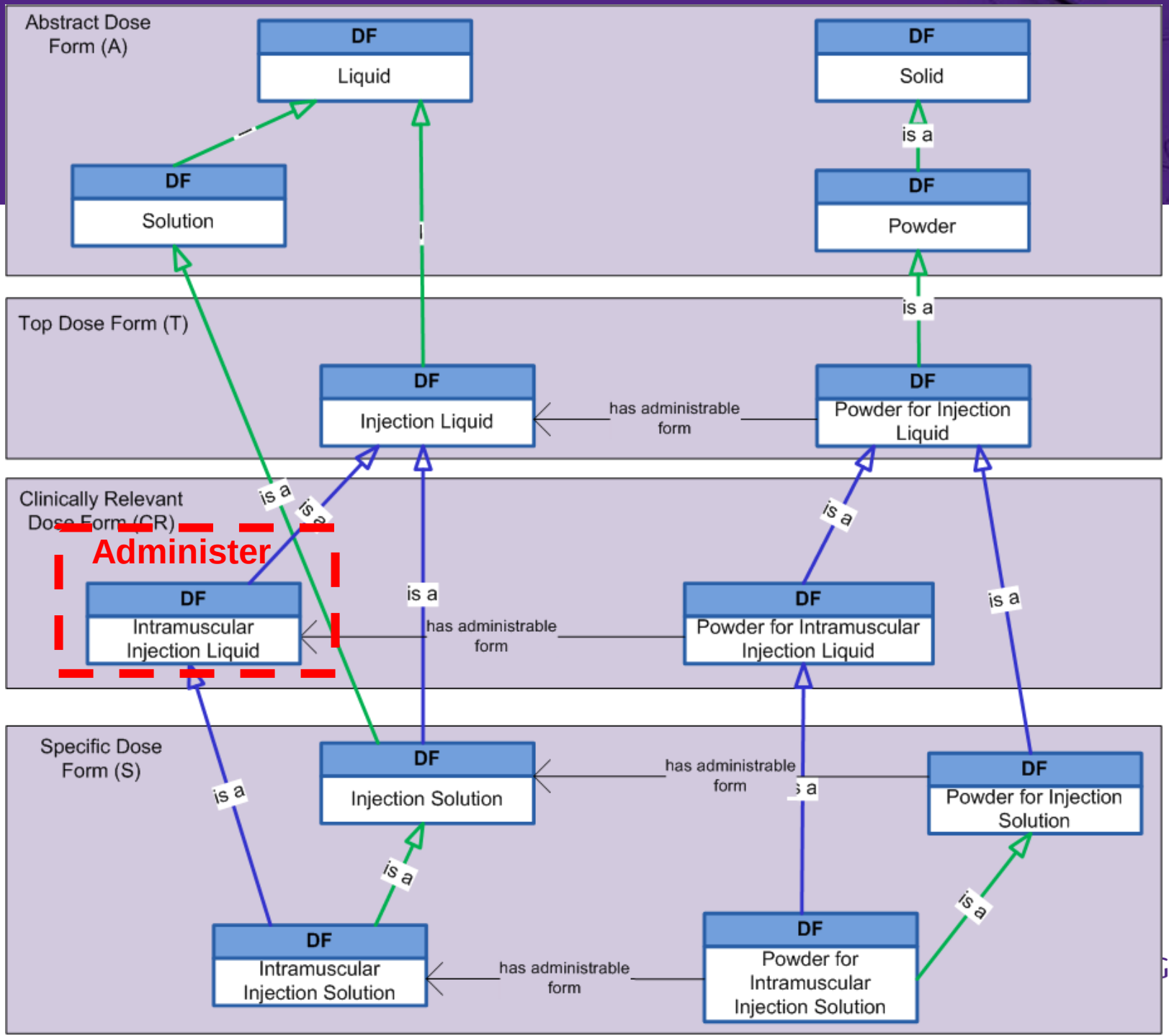
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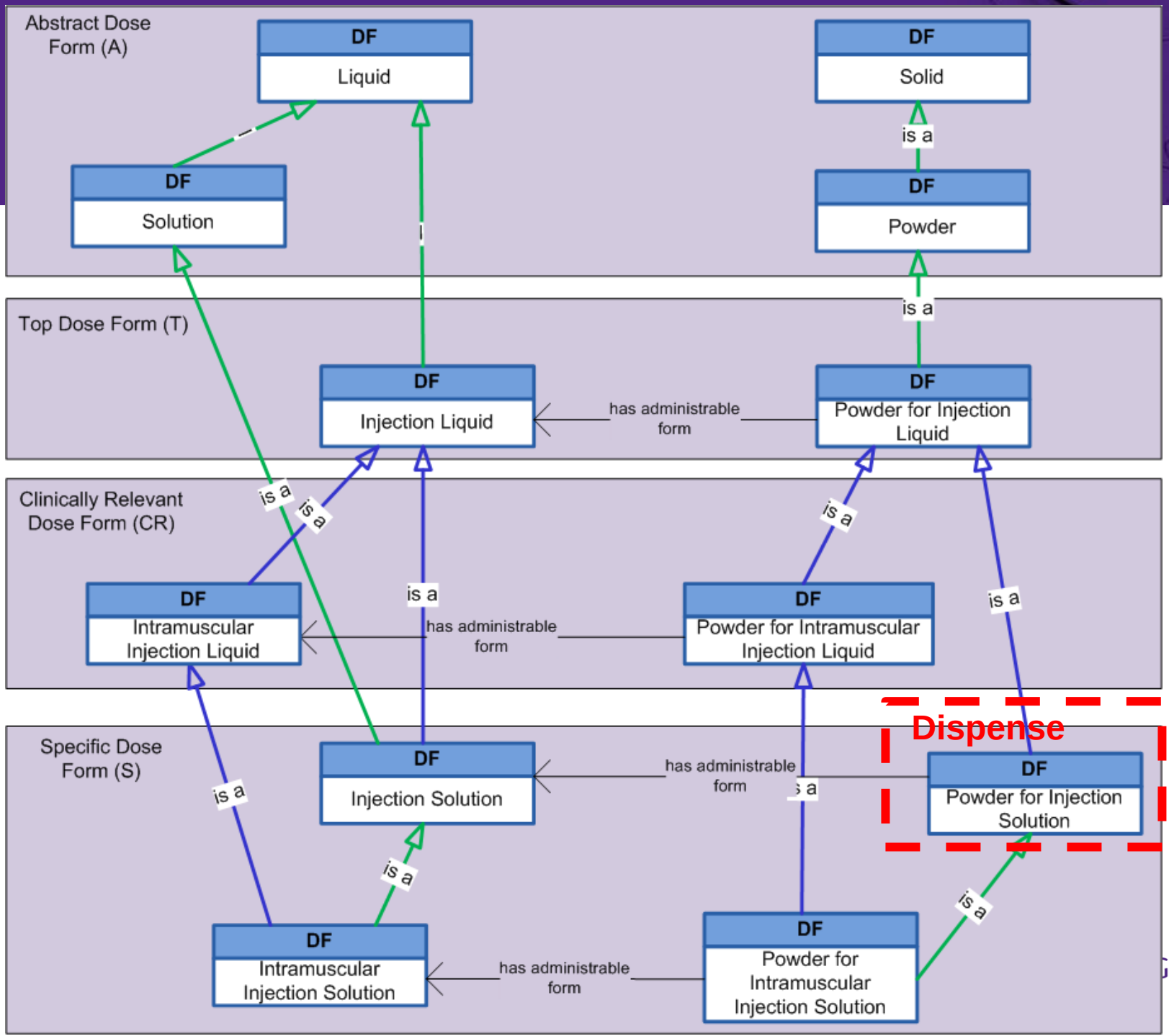
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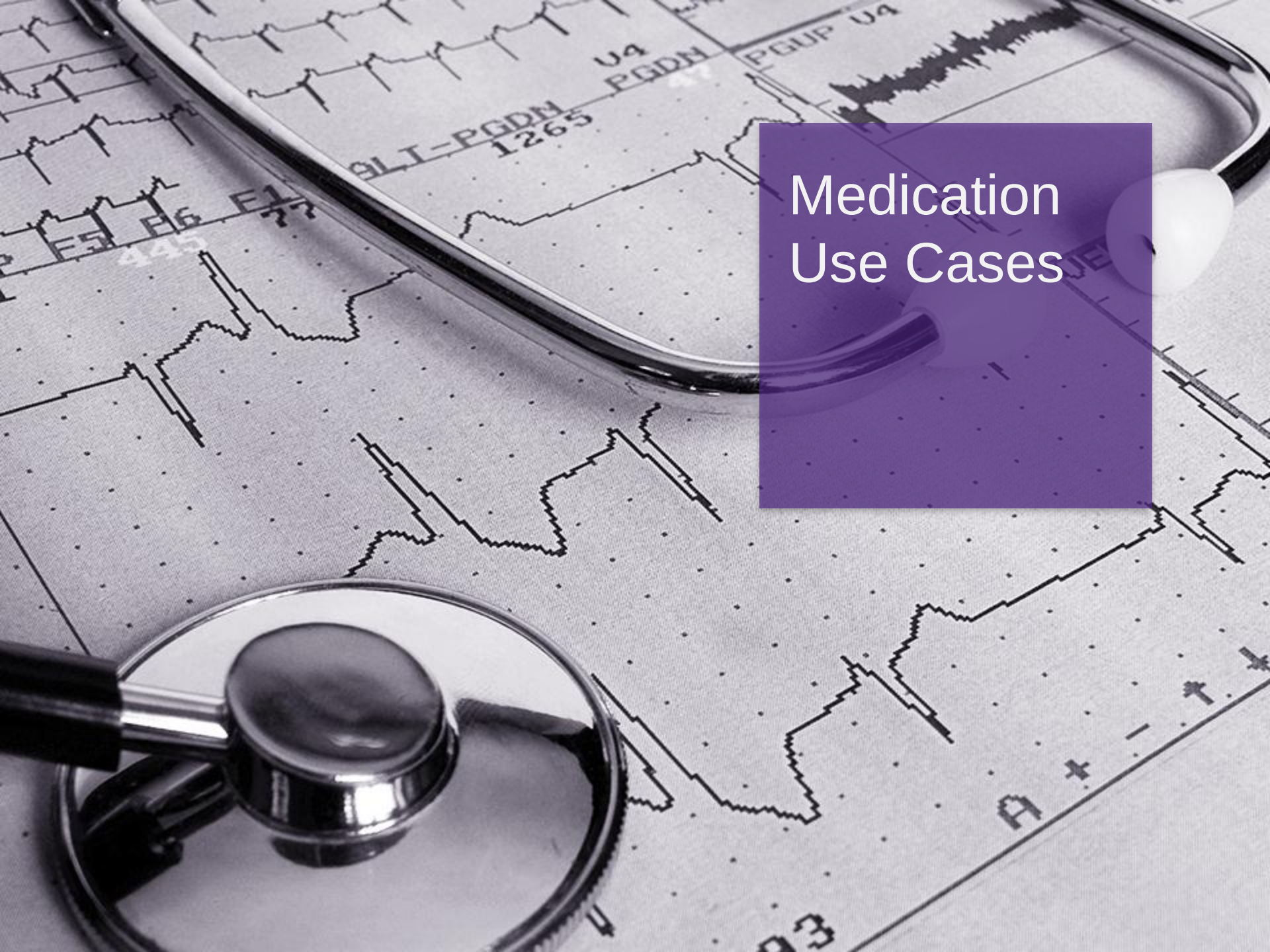

Medication
Use Cases

Linking Prescribing with Dispensing

Prescribing System
Patient: 1234567
Drug: Amoxicillin Capsule
Route: Oral
Dose: 500 mg
Frequency: Three times per day
Duration: 10 days

Dispensing System
?

Prescribing

Dispensing

Linking Prescribing with Dispensing

Prescribing System

Patient: 1234567
Drug: Amoxicillin Capsule
Route: Oral
Dose: 500 mg
Frequency: Three times per day
Duration: 10 days

Dispensing System

Patient: 1234567
Item: AMOXICAP [Amoxicillin] 500 mg Capsule
Quantity: 30 capsules
Route: Oral
Dose: 1 capsule
Frequency: Three times per day
Dose Duration: 10 days

Dispensing System

Patient: 1234567
Item: STRIMOX [Amoxicillin] 250 mg Capsule
Quantity: 60 capsules
Route: Oral
Dose: 2 capsules
Frequency: Three times per day
Dose Duration: 10 days

Prescribing

Dispensing

Linking Prescribing with Dispensing

Prescribing System

Patient: 1234567
Drug: Amoxicillin Capsule
Route: Oral
Dose: 500 mg
Frequency: Three times per day
Duration: 10 days

?

Dispensing System

Patient: 1234567
Item: AMOXICAP [Amoxicillin] 500 mg Capsule
Quantity: 30 capsules
Route: Oral
Dose: 1 capsule
Frequency: Three times per day
Dose Duration: 10 days

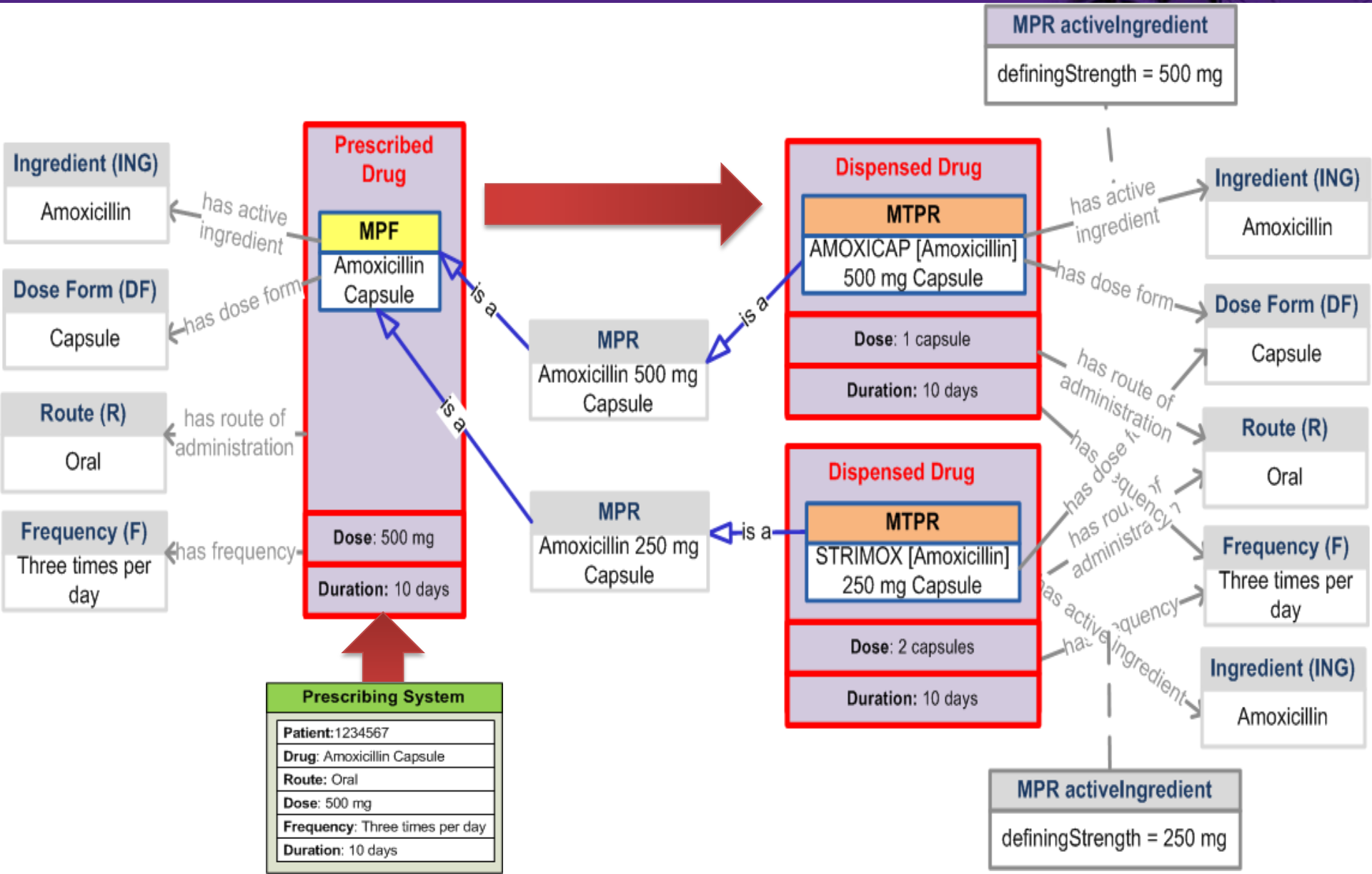
Dispensing System

Patient: 1234567
Item: STRIMOX [Amoxicillin] 250 mg Capsule
Quantity: 60 capsules
Route: Oral
Dose: 2 capsules
Frequency: Three times per day
Dose Duration: 10 days

Prescribing

Dispensing

Linking Prescribing with Dispensing



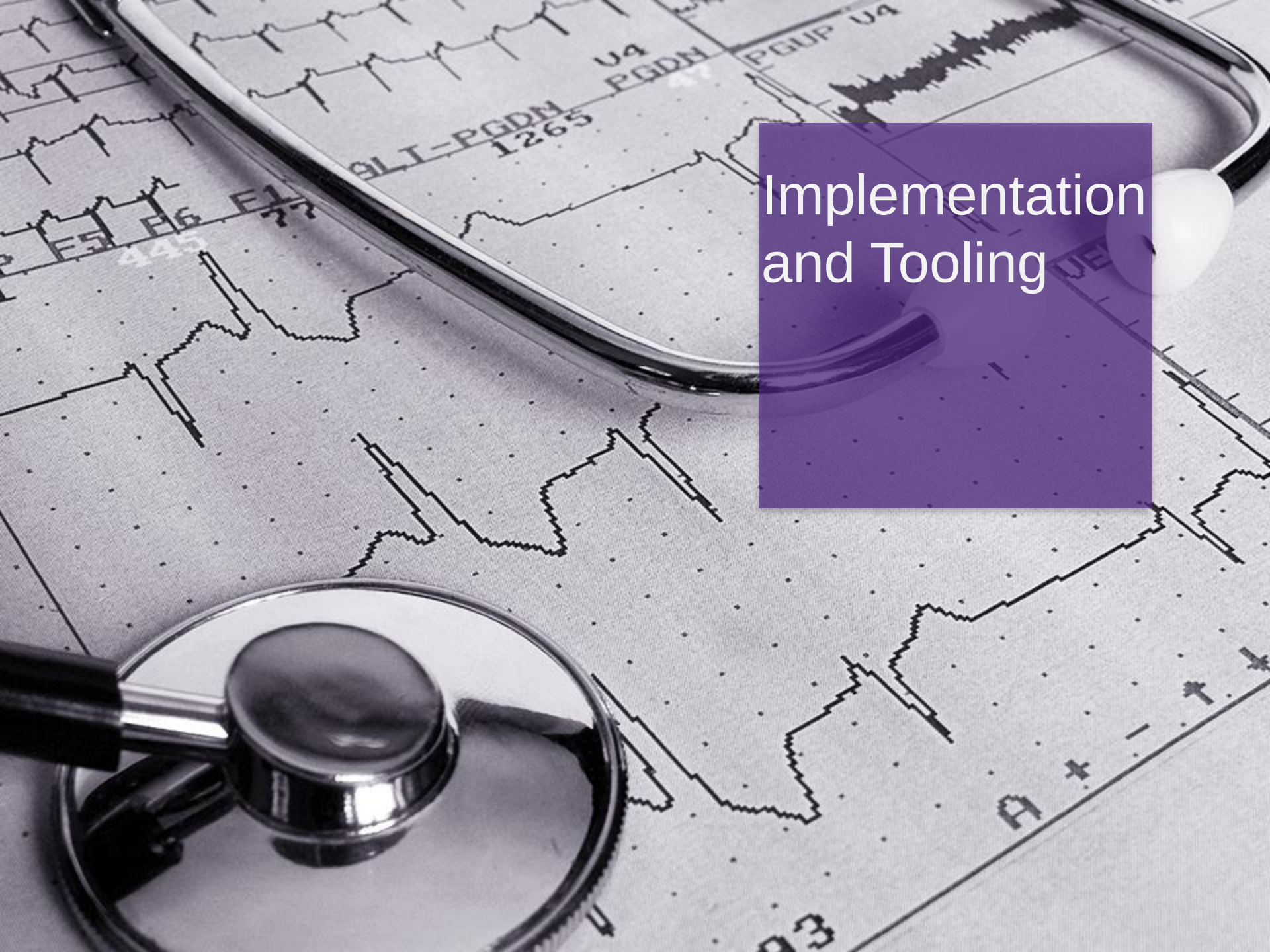
Linking Prescribing with Dispensing

Prescribing System
Patient: 1234567
Drug: Amoxicillin Capsule
Route: Oral
Dose: 500 mg
Frequency: Three times per day
Duration: 10 days

Dispensing System
Patient: 1234567
Item: AMOXICAP [Amoxicillin] 500 mg Capsule
Quantity: 30 capsules
Route: Oral
Dose: 1 tablet
Frequency: Three times per day
Dose Duration: 10 days

Prescribing

Dispensing


Implementation
and Tooling

Implementation

Currently

- Agency for Integrated Care (AIC)
  - Step-down-care from hospitals to nursing homes
  - Used for documentation of medication lists
- Medication Advancement Fund (MAF)
  - Used for submission of subsidy data

In Development

- National Electronic Health Record (NEHR)
  - Mapping from source systems to SDD for consistency
- General Practice System (CLEO)
  - SDD reference sets for prescribing, dispensing and inventory (+trans closure)
- Community Hospitals (CHCS)
  - SDD reference sets for prescribing, dispensing and inventory (+trans closure)
- Acute Care Use
  - Prescribing and dispensing reference sets (based on automated rules)
- Standard Drugs List (SDL)
  - To standardise descriptions for publishing list of subsidized drugs
  - Analysis of data submitted by institutions will use SDD

MOH HOLDINGS

Tooling Journey (1 of 2)

- AT FIRST we:
  - Used Excel spreadsheets
  - For internal data development (e.g. dose forms)
  - NOT for producing releases (limited ability to safely create/maintain SNOMED CT extension ids)
- CURRENTLY we:
  - Use an internally developed Access database
  - Have developed processes to:
    - Create SDD concepts, relationships and descriptions
    - Perform dual-independent reviews
    - Map existing drug terms to SDD concepts
    - Create and maintain SNOMED CT extension ids
    - Support versioning of codes and releases
    - Perform quality checks on data prior to release
  - However, concepts, descriptions and relationships created manually!

Tooling Journey (2 of 2)

- NEXT we will move to:
  - Import data from a number of sources (including regulatory data)
  - Allow source data for each product to be edited and cleaned
  - Automatically create/update hierarchies
  - Automatically create descriptions (e.g. FSN, FN, PT, SN)
  - Perform more sophisticated quality checks
  - Provide extended support for mapping of existing drug terms
  - Automatically generate use-case-specific reference sets
  - Automatically build transitive closures to link use-case-specific reference sets
  - Allow healthcare orgs to add local extemporaneous drugs

Demonstration
and
Questions