MANAGING RISK

Reference Data in action

An overview of ISO 15926 representation and (possible) operation

Tore R. Christiansen

Vestforsk, Sogndal, Friday 12 September 2008

This presentation has five parts

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- Motivation for Information Standards and Reference Data
- Structure of the ISO 15926 standard
- Operation and Maintenance of Reference Data Libraries
- Reference Data in Offshore Field Development and Operation
- Reference Data in Concurrent Space Engineering

This presentation is an informal and enjoyable (?) tour

There will be more formal tours (?) in subsequent presentations

Please ask and give feedback underways

Information integration in action

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- Complex installations with long life-times
- Large cost of production and operation
- Large volume and cost of documentation

- Many interdependent players
- Cost effective cooperation requires correct information
- Great demands for and coordination and collaboration

- Demand for effective information exchange
- Demand for accurate description
- Great need for common languages

The challenge is to (know how to) do the right thing

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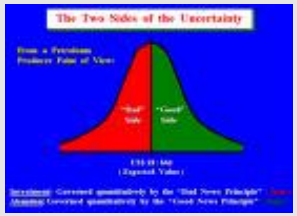
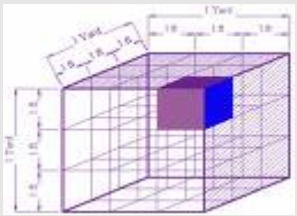
The ambiguity of learning

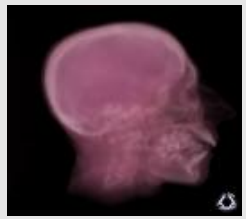


The uncertainty of knowledge

The complexity of information



The volume of data



Data exchange and integration

How can we be sure that we
send and receive correct data and
understand it in the way it was intended?

External experts

Vendor's onshore operation centre

Trondheim

Analyse

Transform

External experts

Bergen

Process

Stavanger

Receive

Control room

Transmit

Analyse

Aberdeen

Store

Collect

Real time data

Real time

Collaboration rooms

Operator's onshore operation centre

- Better and faster decisions
- Streamlined delivery chains

Ambiguity starts in requirement specification

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Owner

I need a ”pipeline” with these functional characteristics

Send XML-message specifying ”pipeline”

Designer

What does he actually mean by the word ”pipeline”?

Agreement about terms and definitions is required

The POSC/Caesar RDL

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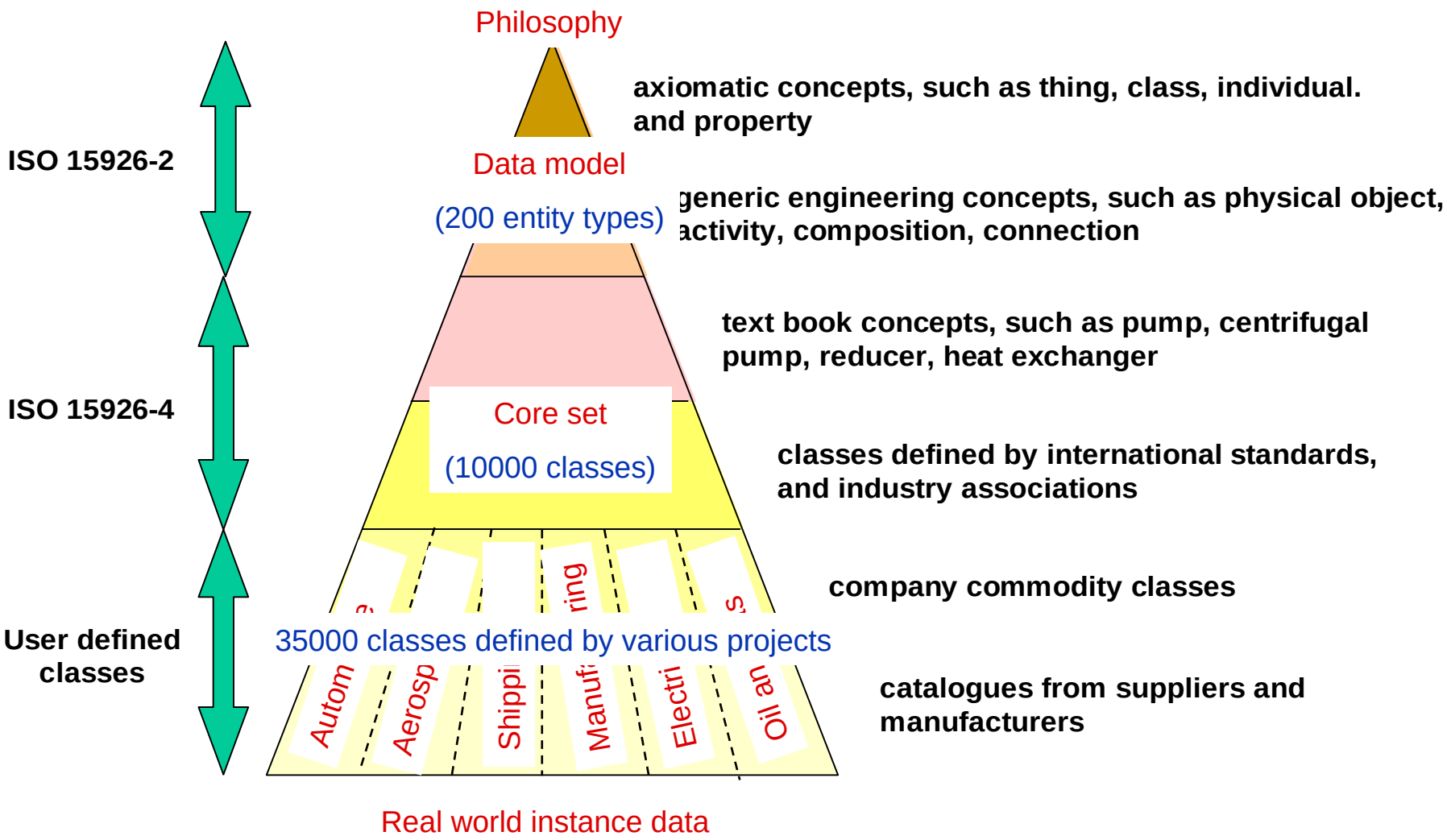


The structure of the ISO 159256 standard

International Organization for Standardization

User system (proprietory format) and Users

Per User

Instances in Facades

Per Use

Propri… …Cl…s

ISO 15

ISO 15

ISO 1

…ence Data

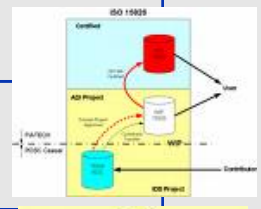
ISO

Data Model

ISO 10303 Express

Implementation model

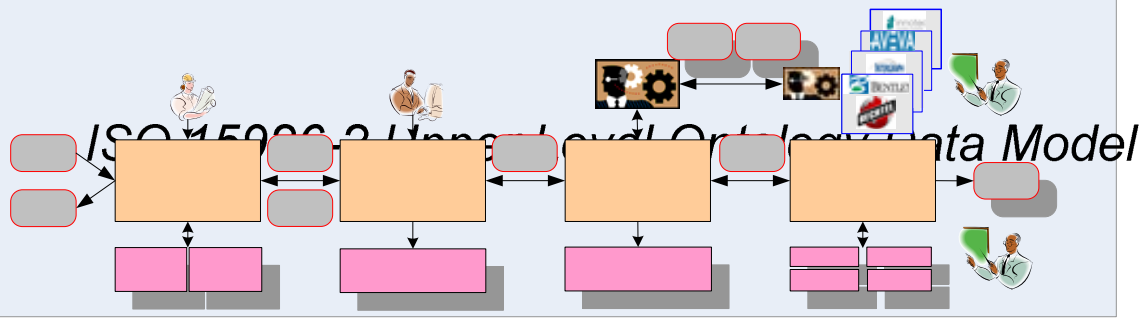
Agreed scope and structure



standardization

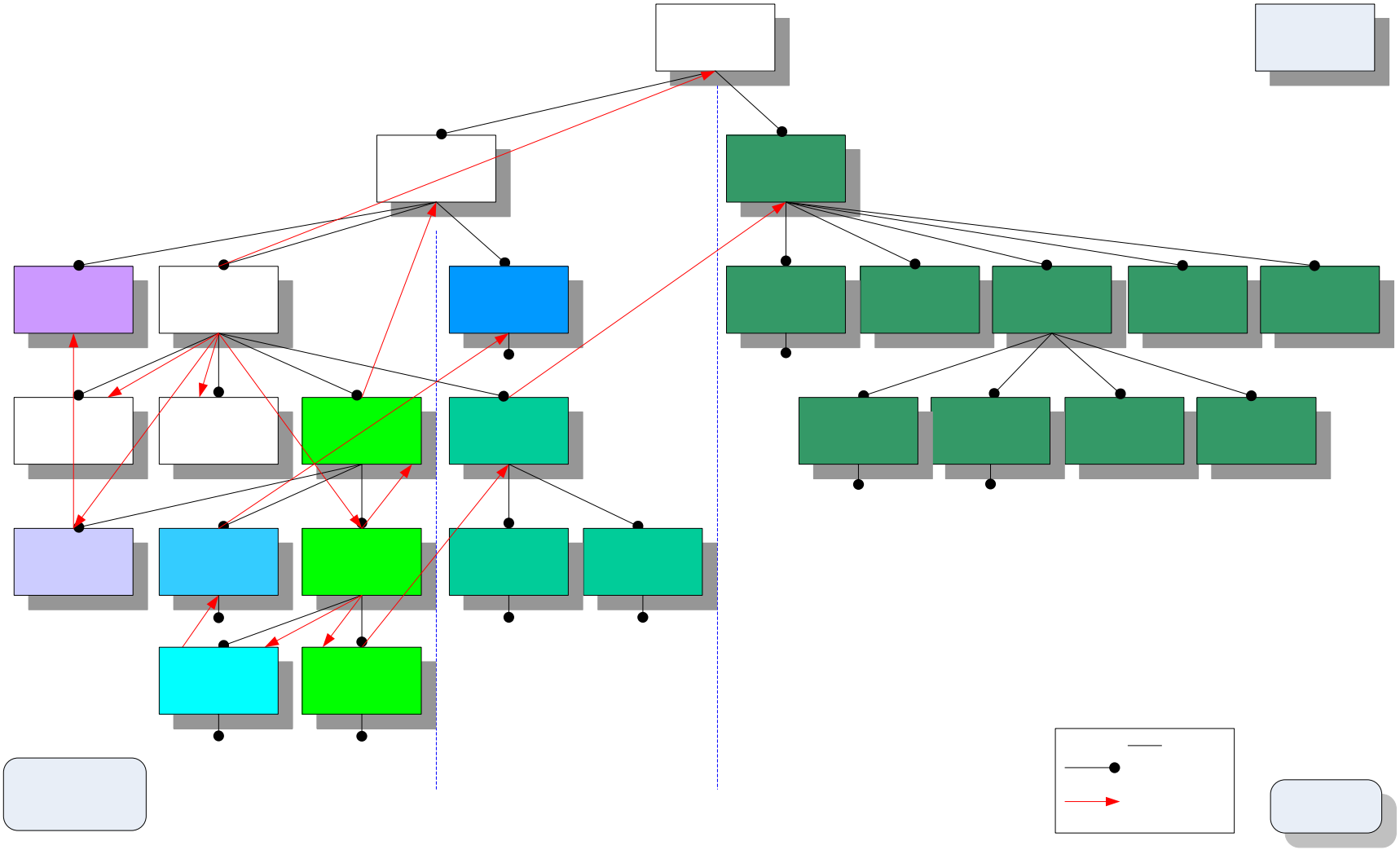
POSC Caesar

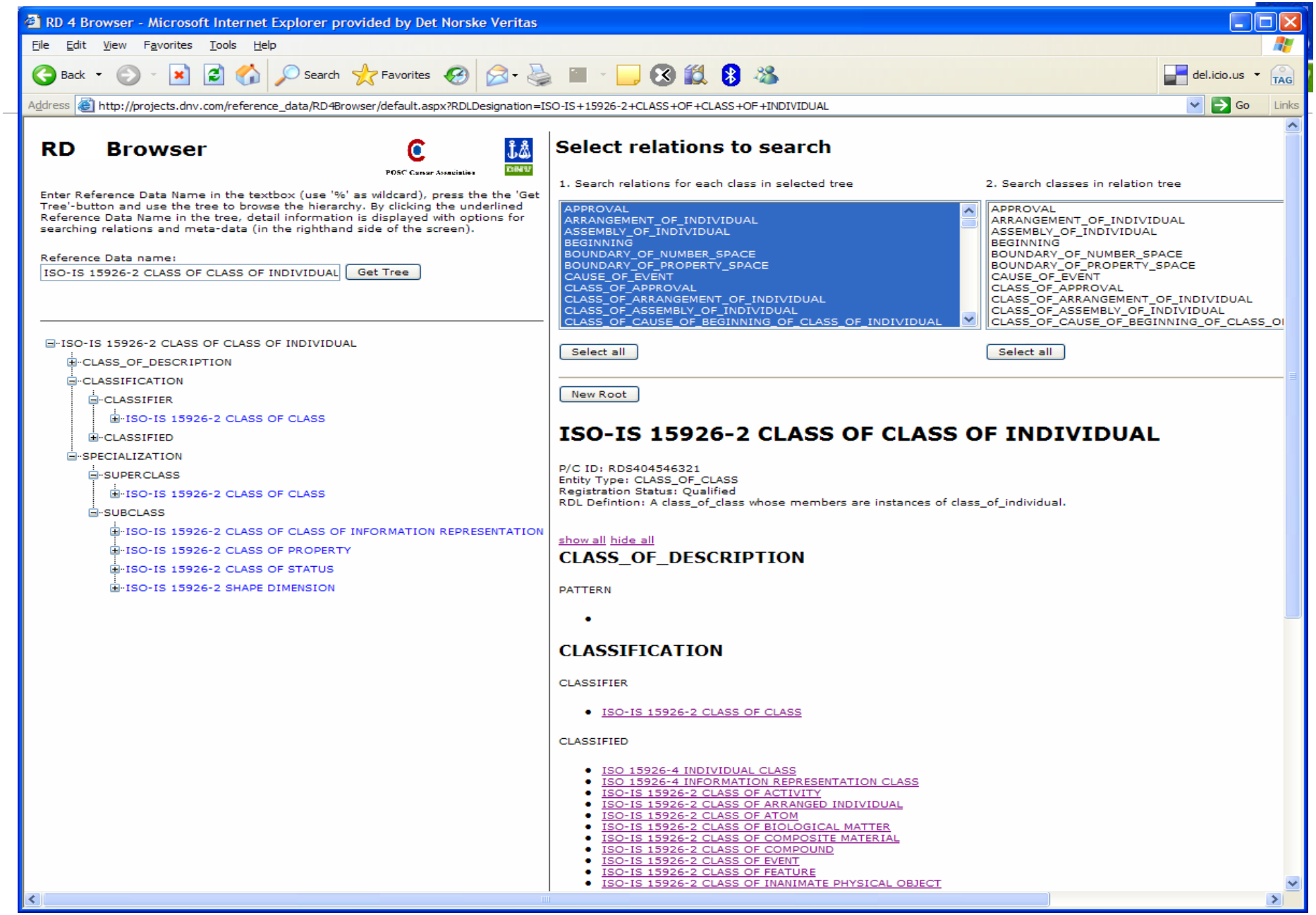
SIO

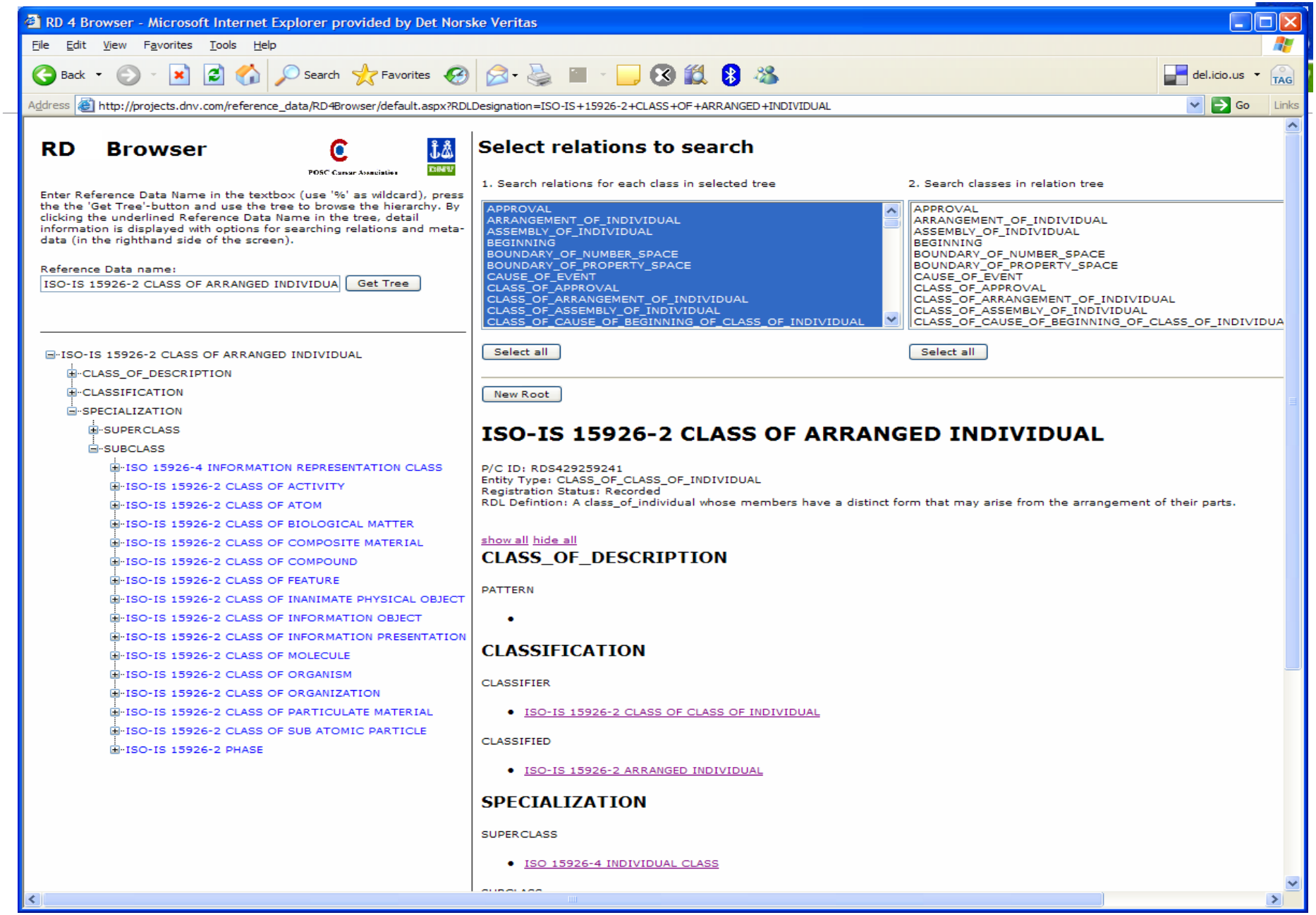


ISO 15926-2 Upper level Ontology Data Model

Level 2 entity types







The structure of product information models

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Specific products

Ap[illegible]tions

C[illegible]

R[illegible]

R[illegible]ce classes

Names and numbers

In[illegible]

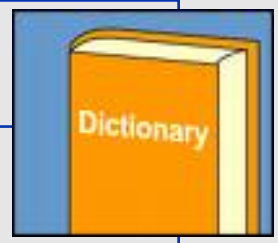
[illegible]de

[illegible]us

Taxonomies

Vocabularies

Signs



p p l i c a t i o n

Agreed content and context

ISO

Organization

ISO TS
(2007) I
CLA

Reference Data Browser

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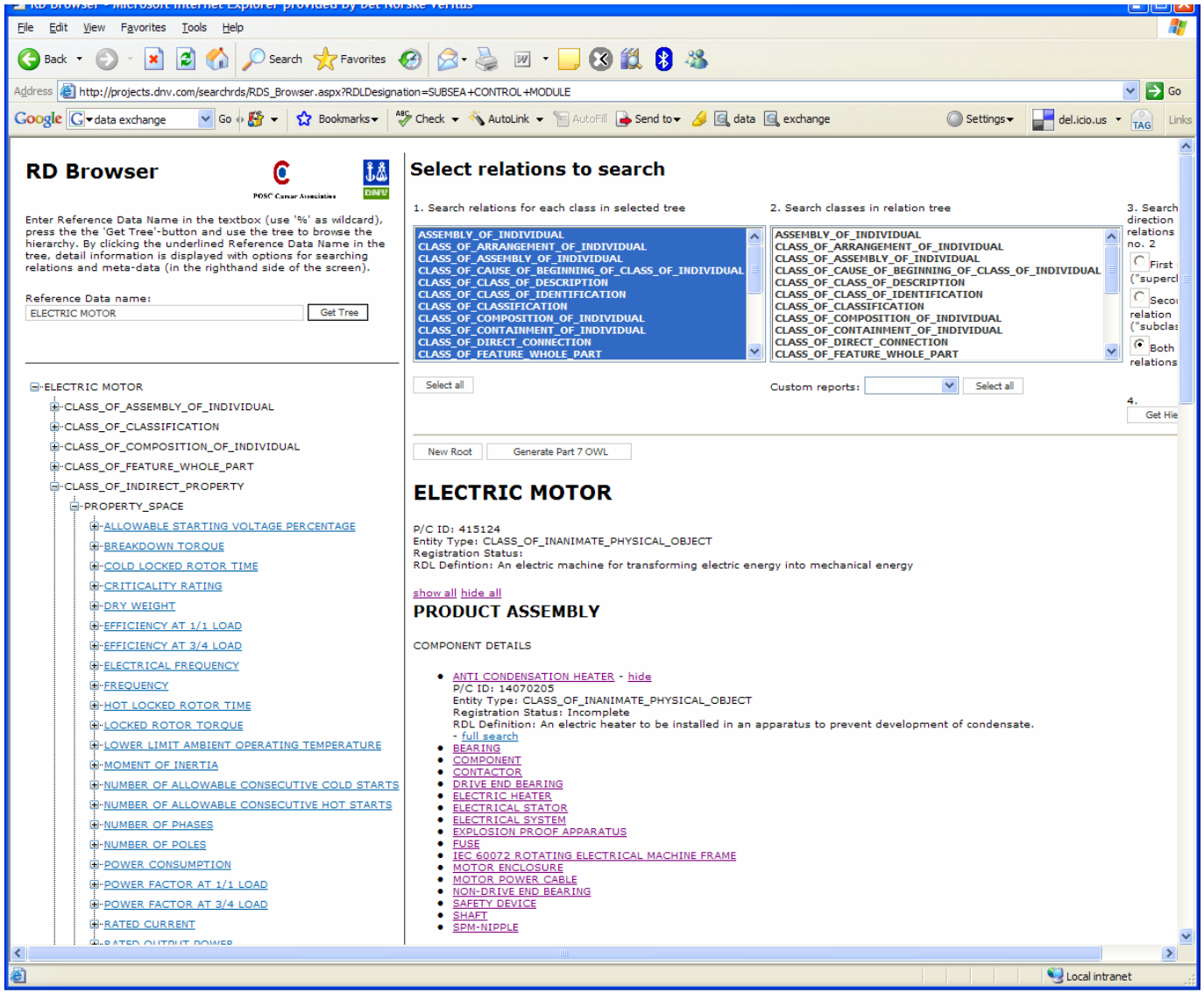

Reference Data Editor

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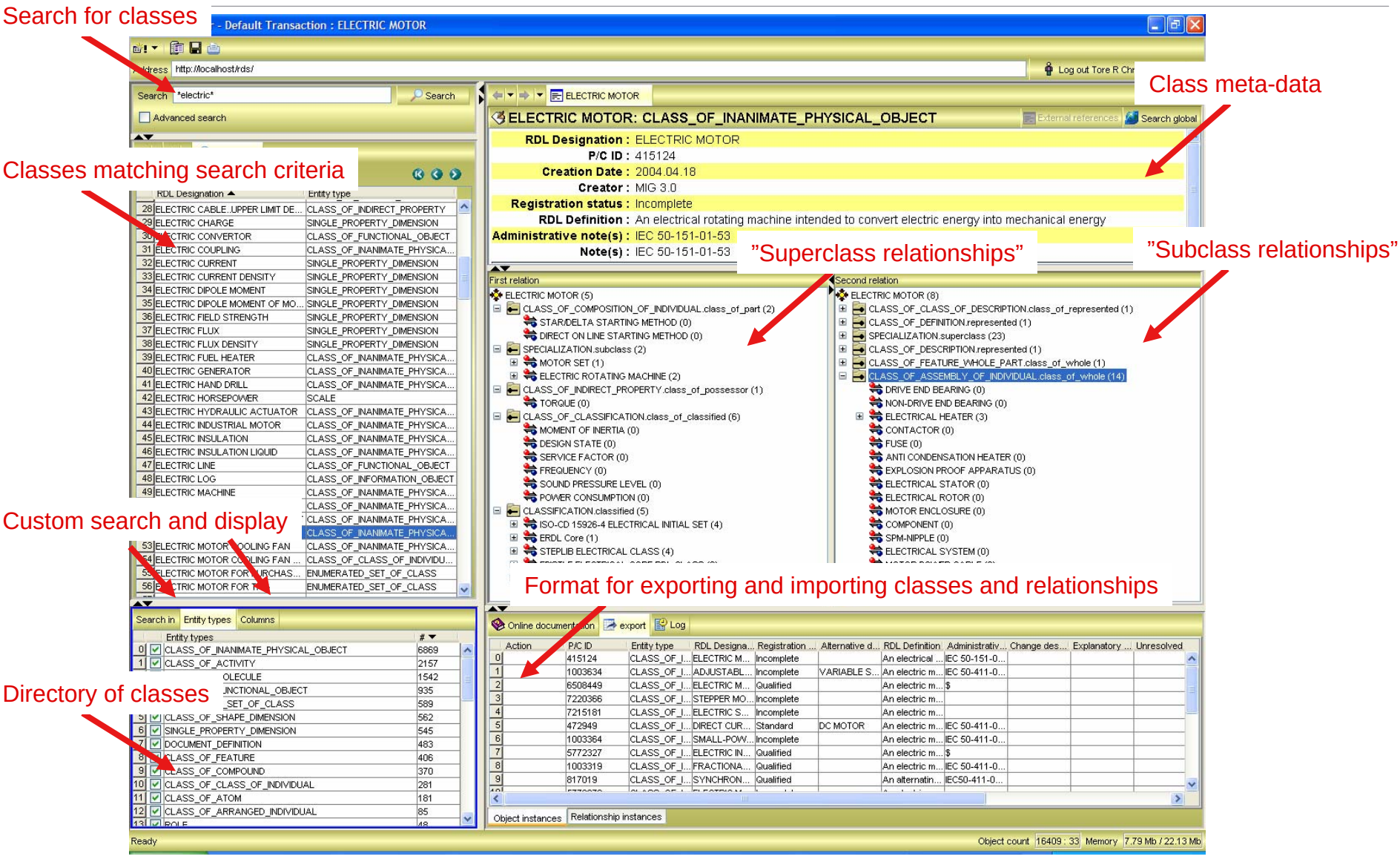

The semantic technology stack

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SWRL, SPARQL

Rules and conditi

OWL

RDF

RDF

XSL

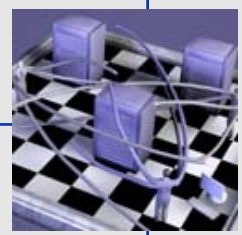
Da and document models

XML, XSLT

Syntax and structure

Unicode, URL/URN, XMLns

Tokens and references



Security

Agreed representation logics

Reference Data Services - representation and conversion

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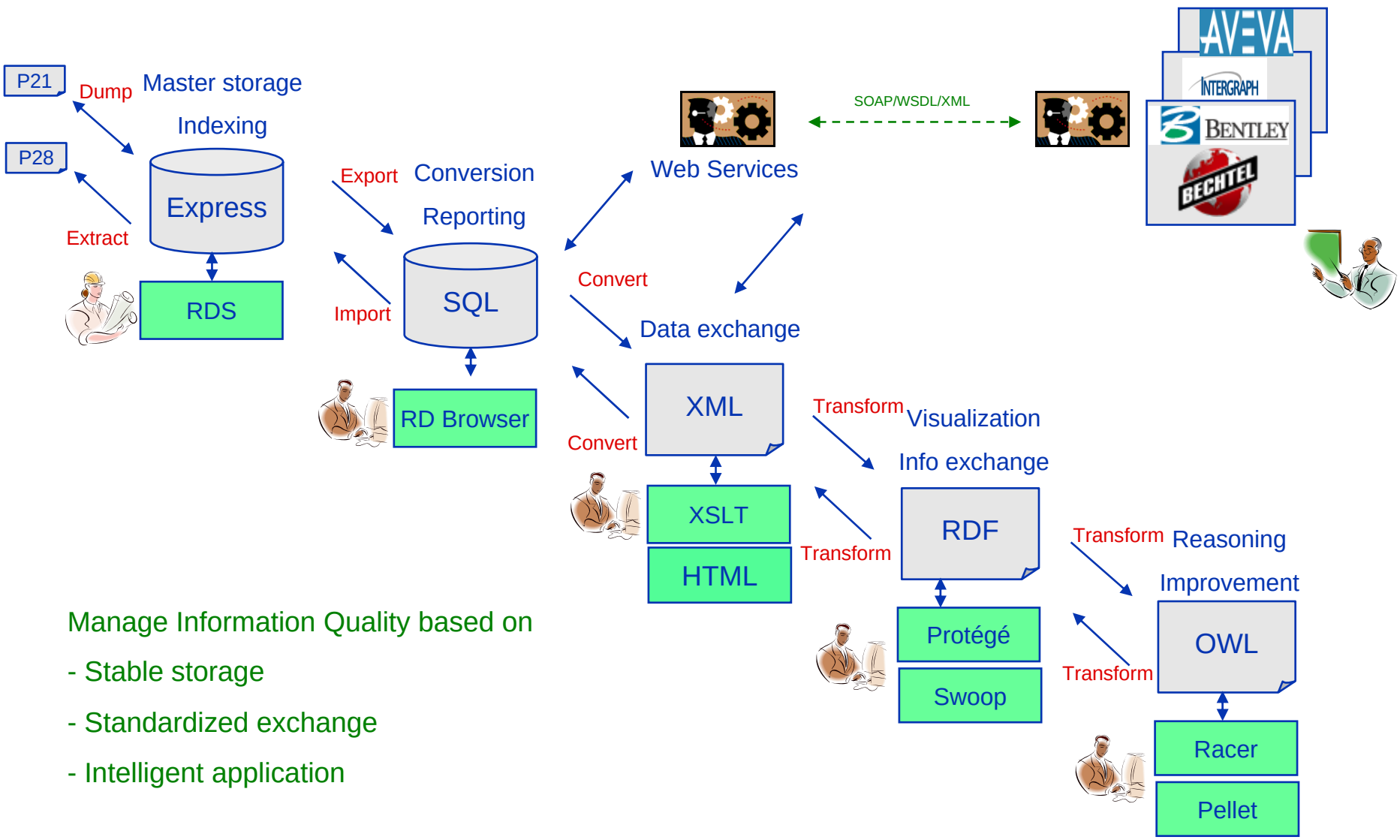
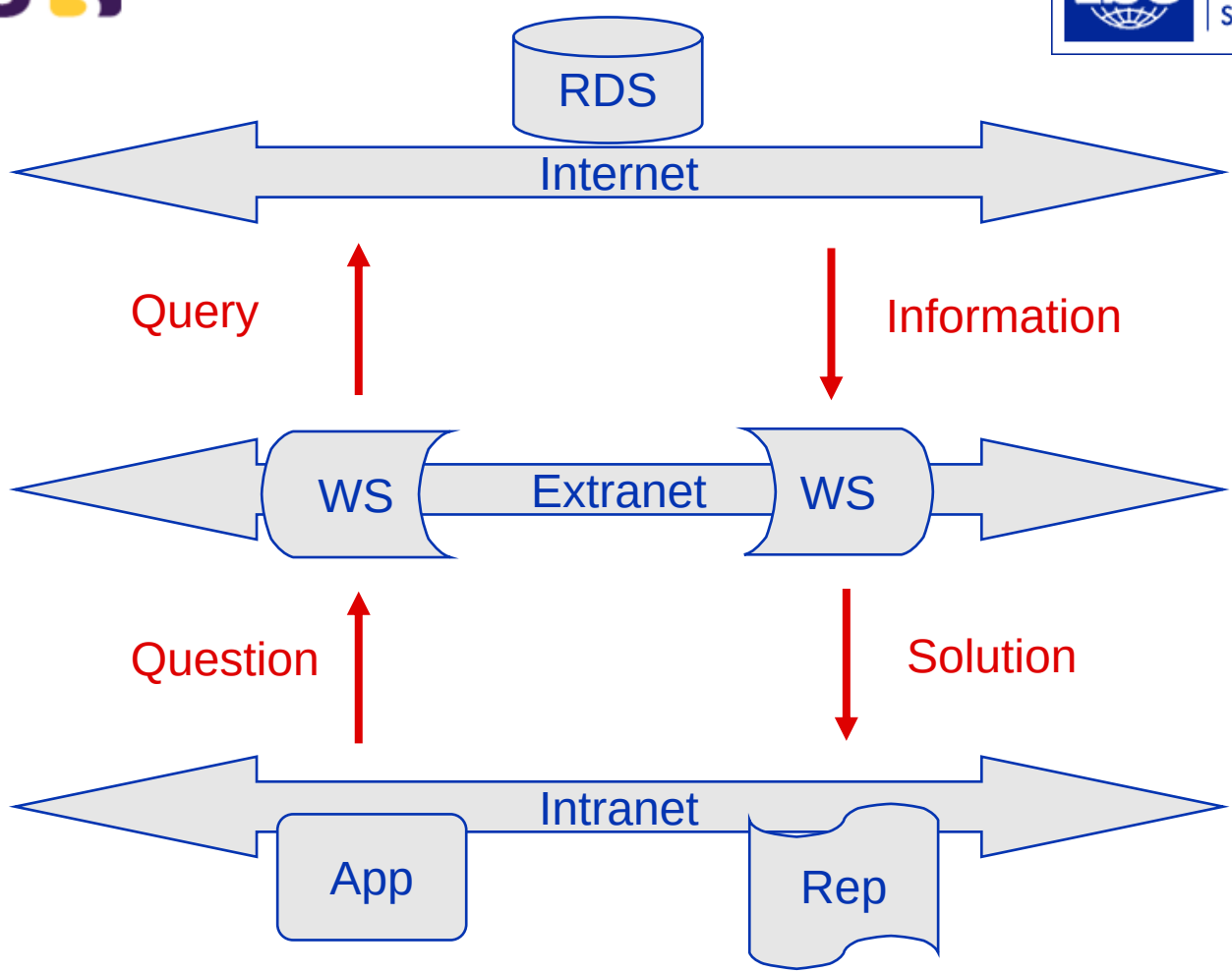
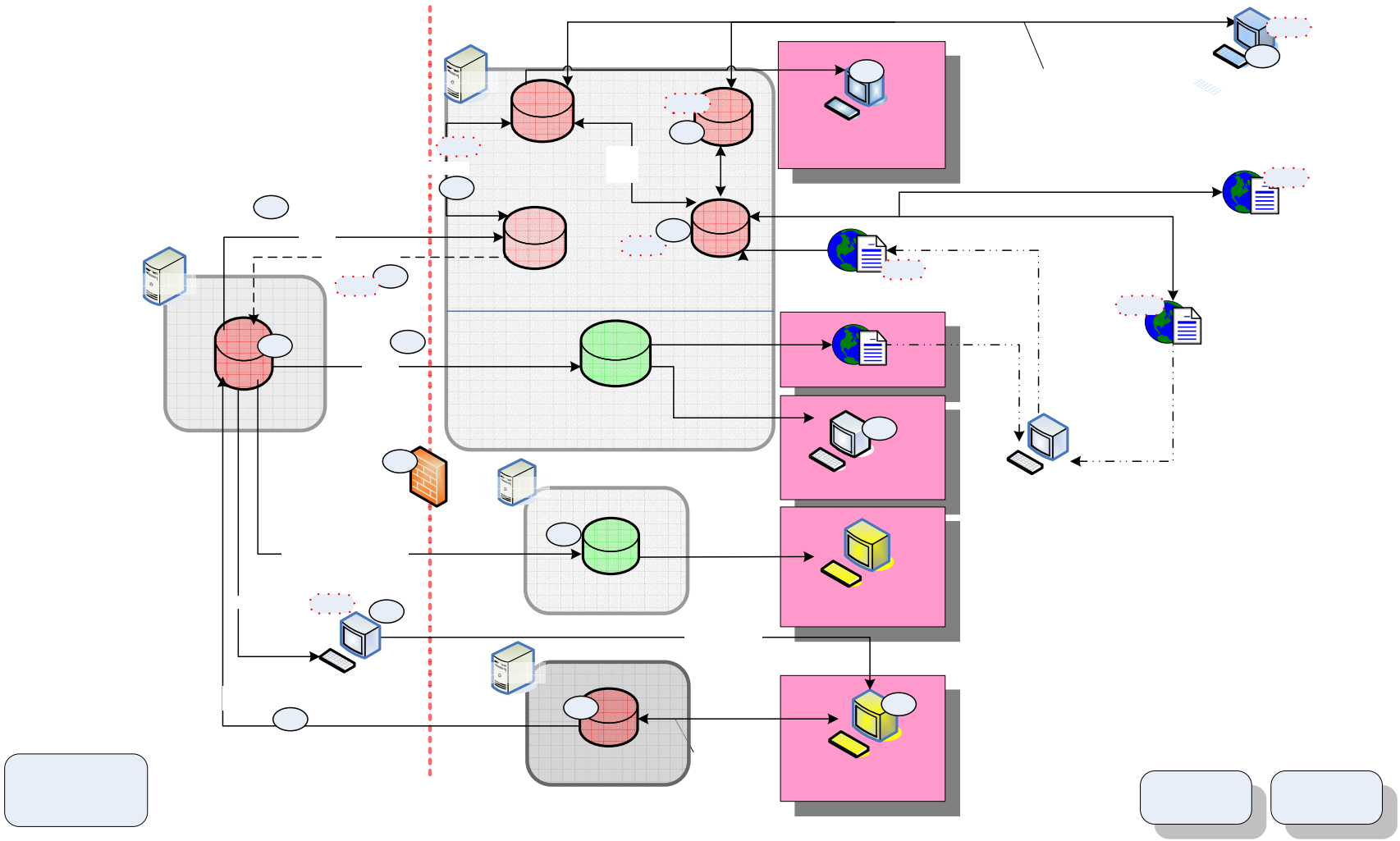


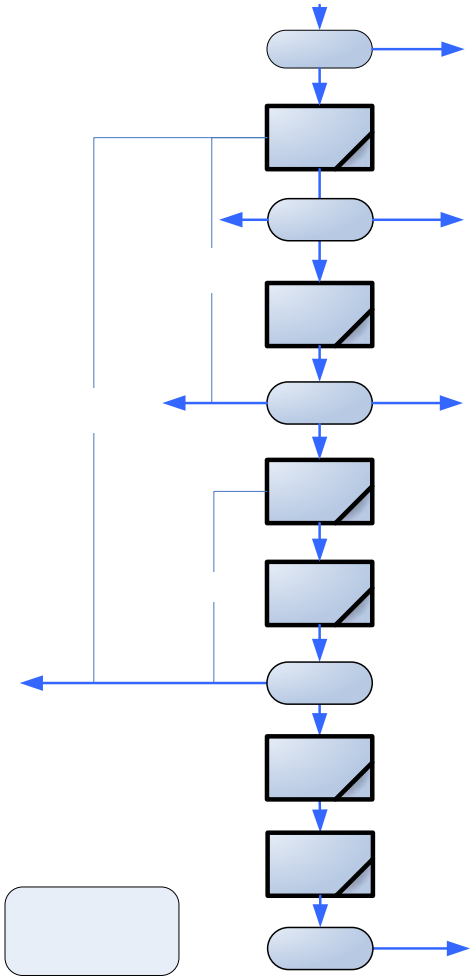
Manage Information Quality based on

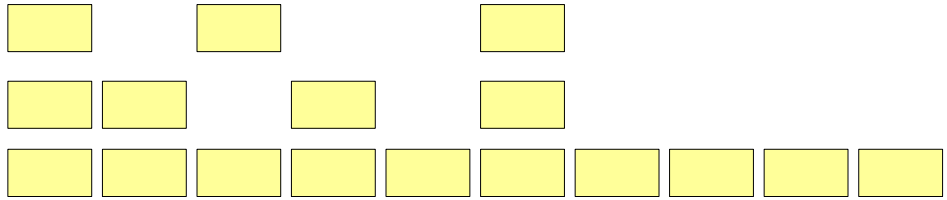
- Stable storage
- Standardized exchange
- Intelligent application

Semantic web Reference Data Services









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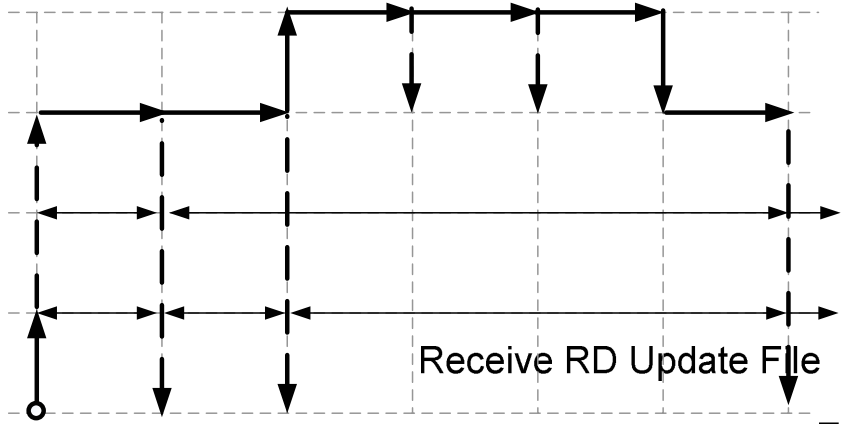

Enter CR in PC

Set status of C

Initiation of CR

Forward CR to

Reference Data in the lifecycle of a pipeline

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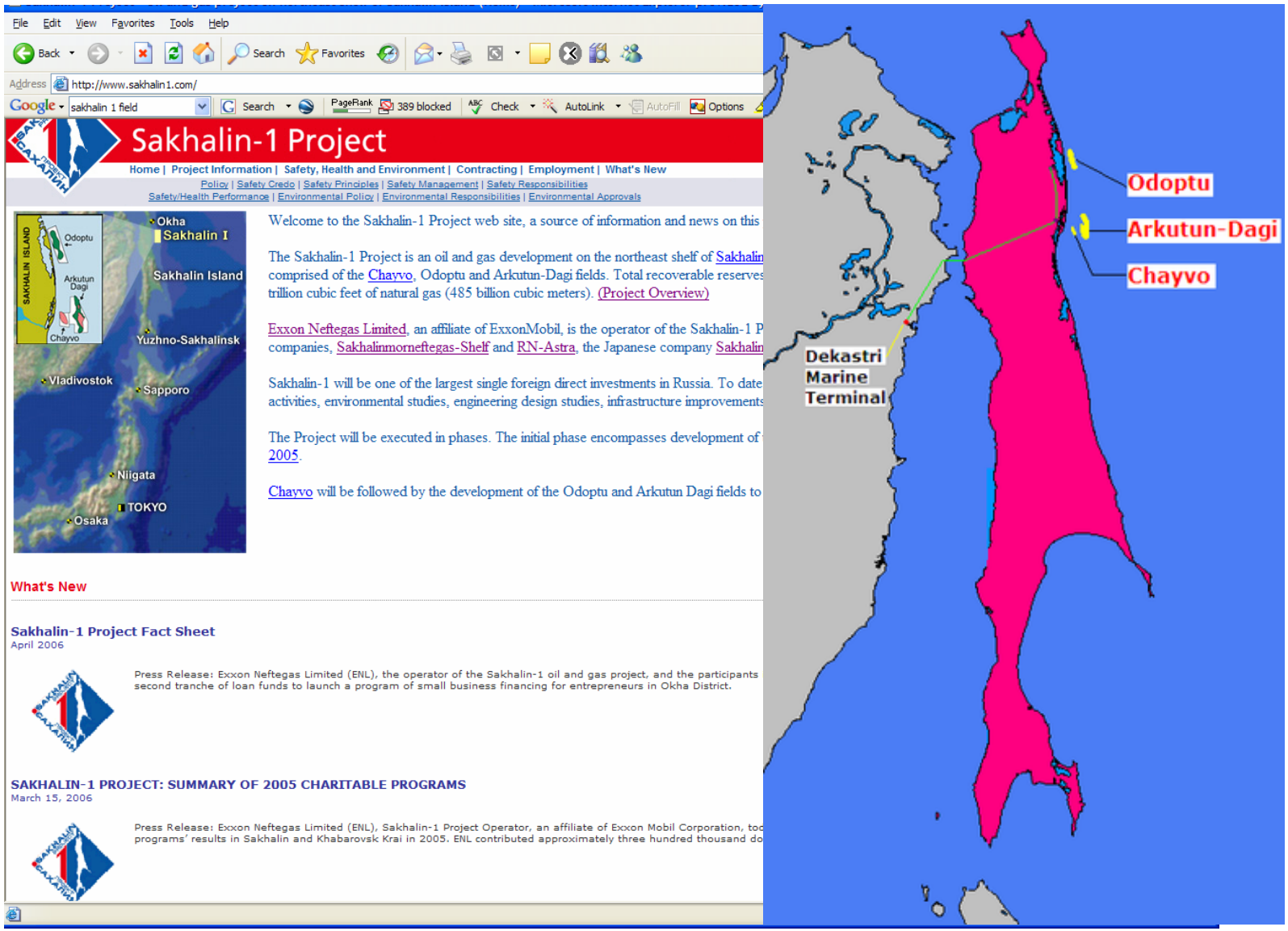
The objective of this example is to illustrate how …

- … definition of Reference Data allows representation of product information with enough detail and breadth of scope for accurate description of real world technical artifacts and installations
- … extension of Reference Data with relations and properties allows construction of product models that can serve as a mechanism for information exchange between application programs used throughout the product lifecycle
- … representation of Reference Data and relations in formal logic-based knowledge bases allows information integration between sources with different coverage and consistency
- … grounding of Reference Data in a standardized upper ontology (meta-model) allows development of formal processes and procedures for lifecycle management of change in structure and behaviour engineering artifacts

The Sakhalin 1 project



This demo illustrates field development and operation

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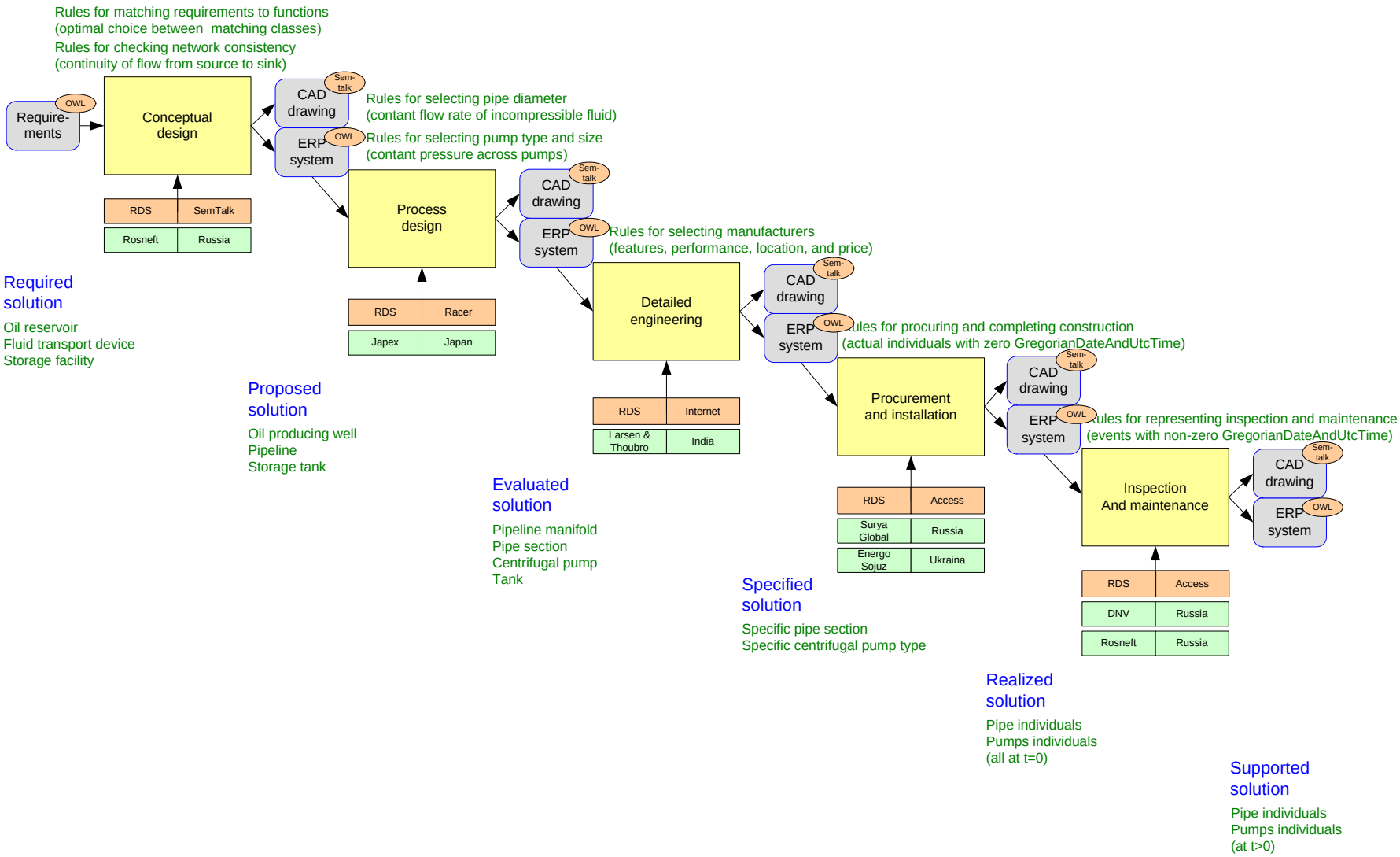
- Offshore oil field development east of Sakhalin island
- Requirement from Russian owner for pipeline transport to loading facility on the Siberian mainland
- Process design of pipeline by Japan oil company in Tokyo
- Detailed engineering by engineering contractor in Mumbai, India
- Procurement of pumps from manufacturer near Kiev, Ukraine
- Procurement of pipe from manufacturer near Delhi, India
- Transportation from manufacturer to site
- Installation on site by local project team from Russian owner
- Inspection of pipe wall thickness on site by surveyor from DNV Vladivostok office
- Procurement and replacement of corroded pipe section

The scenario uses terms and definitions from the Reference Data Library to

- Identify design objects
- Represent design alternatives
- Exchange data between a set of (mock-up) engineering applications
- Manage all real-world artifacts
- Ensure information quality across all life-cycle phases

The lifecycle activities and artifacts



The Real World Web

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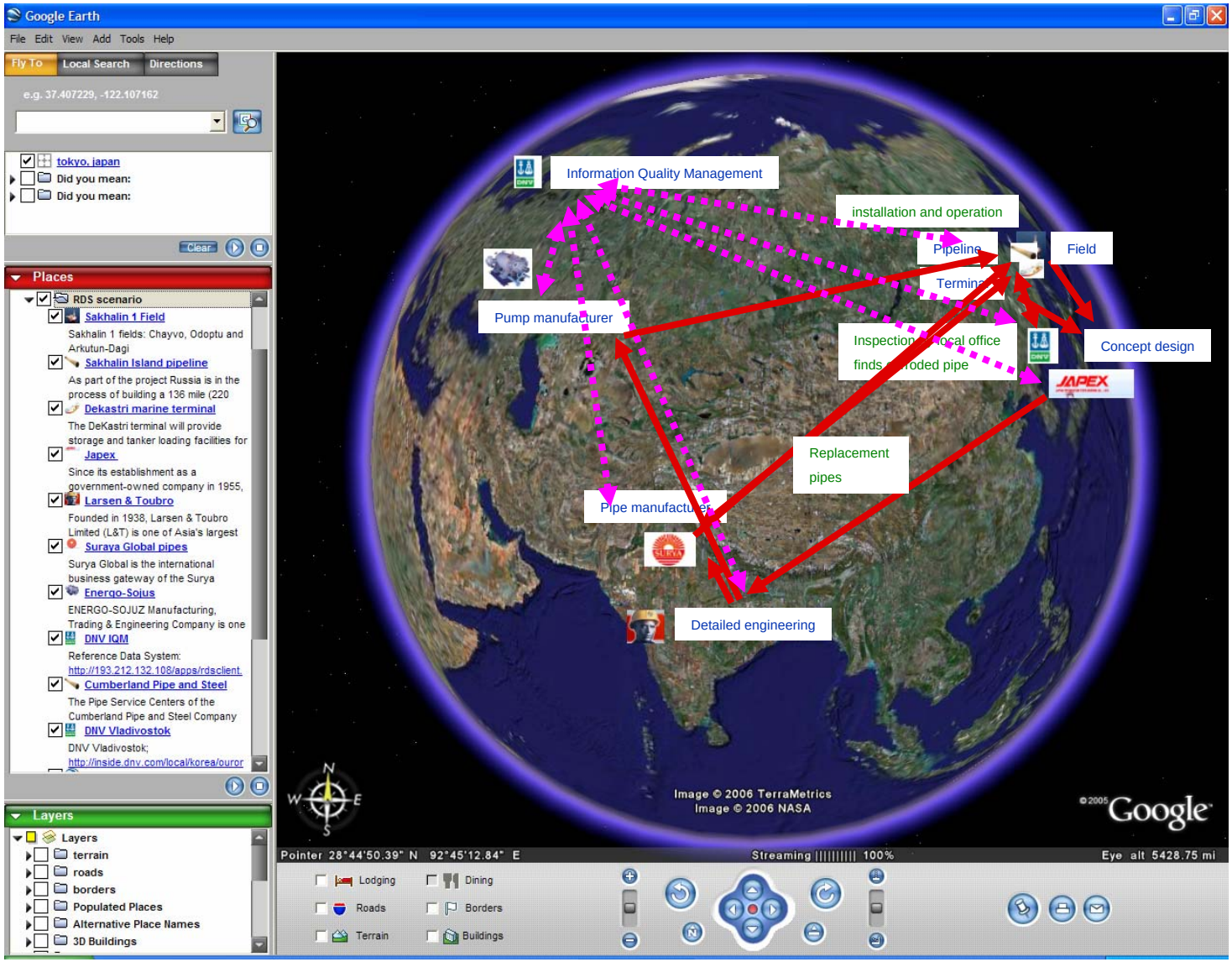
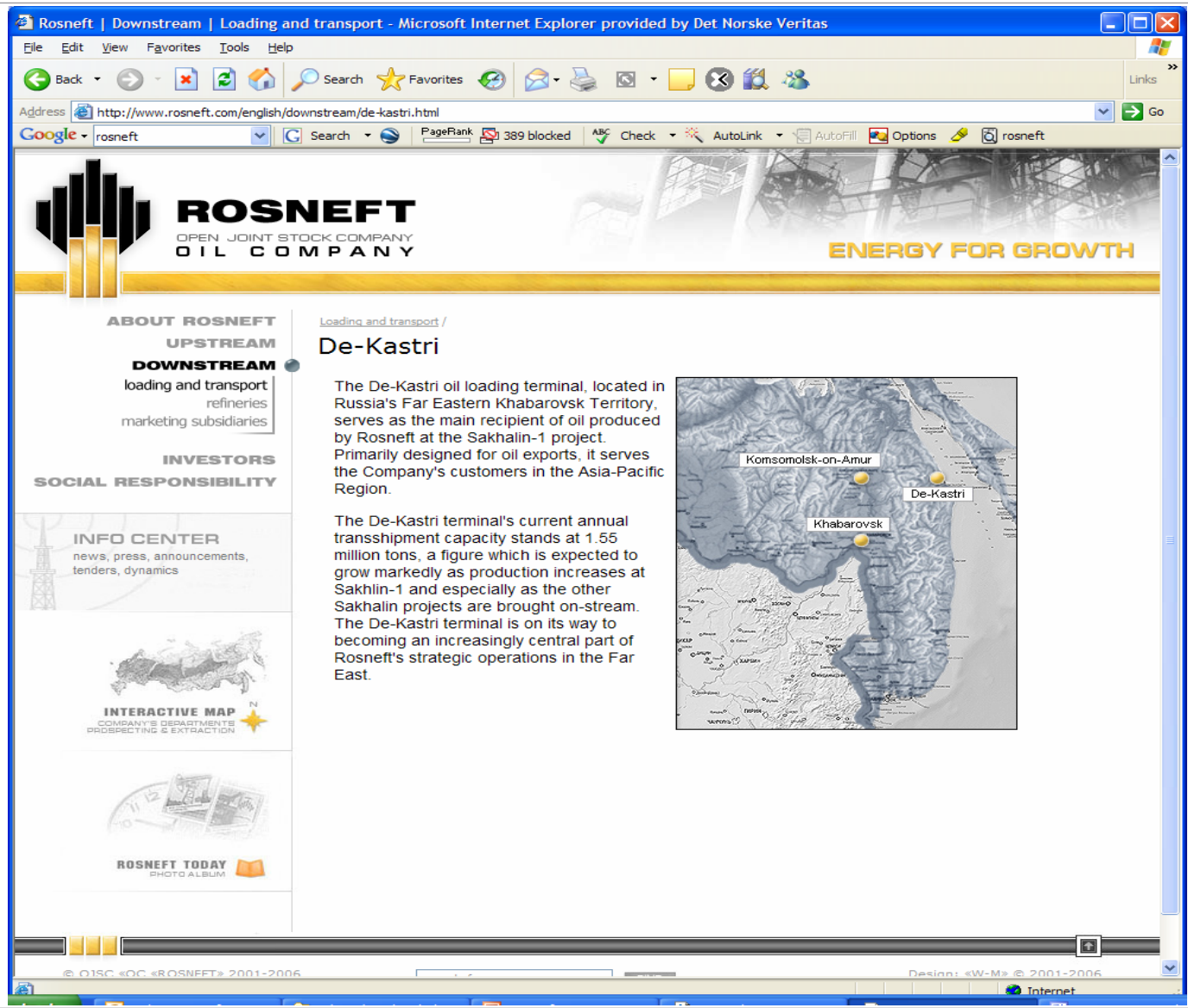
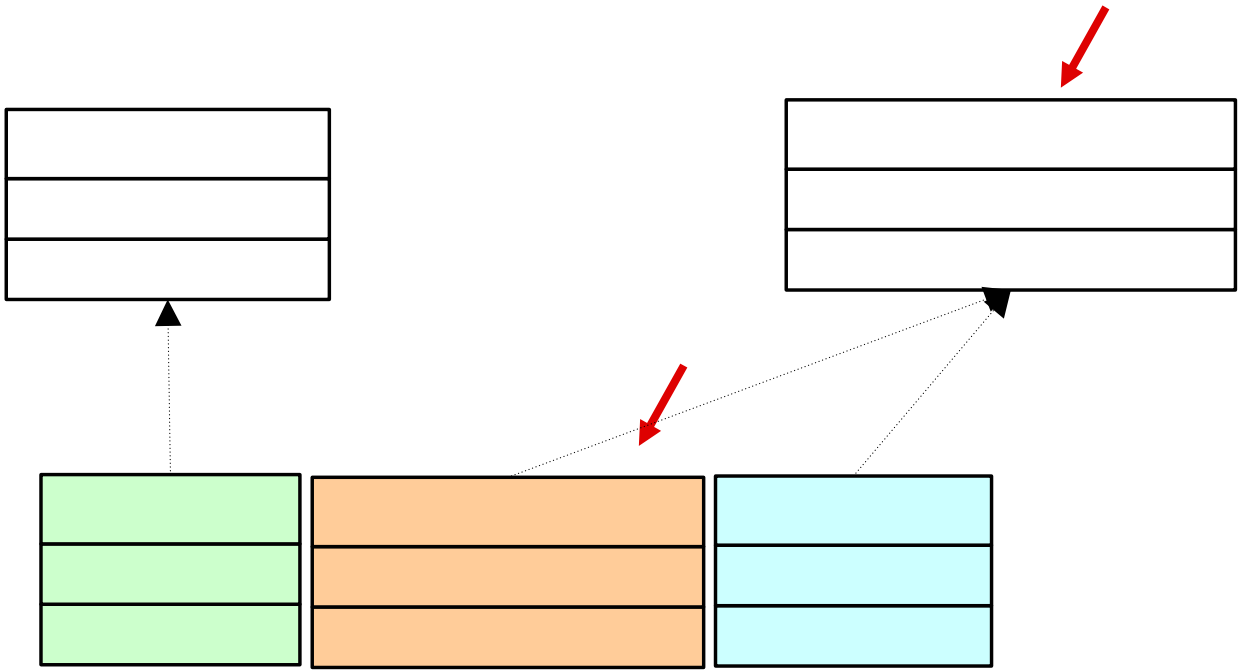


Owner of transport solution

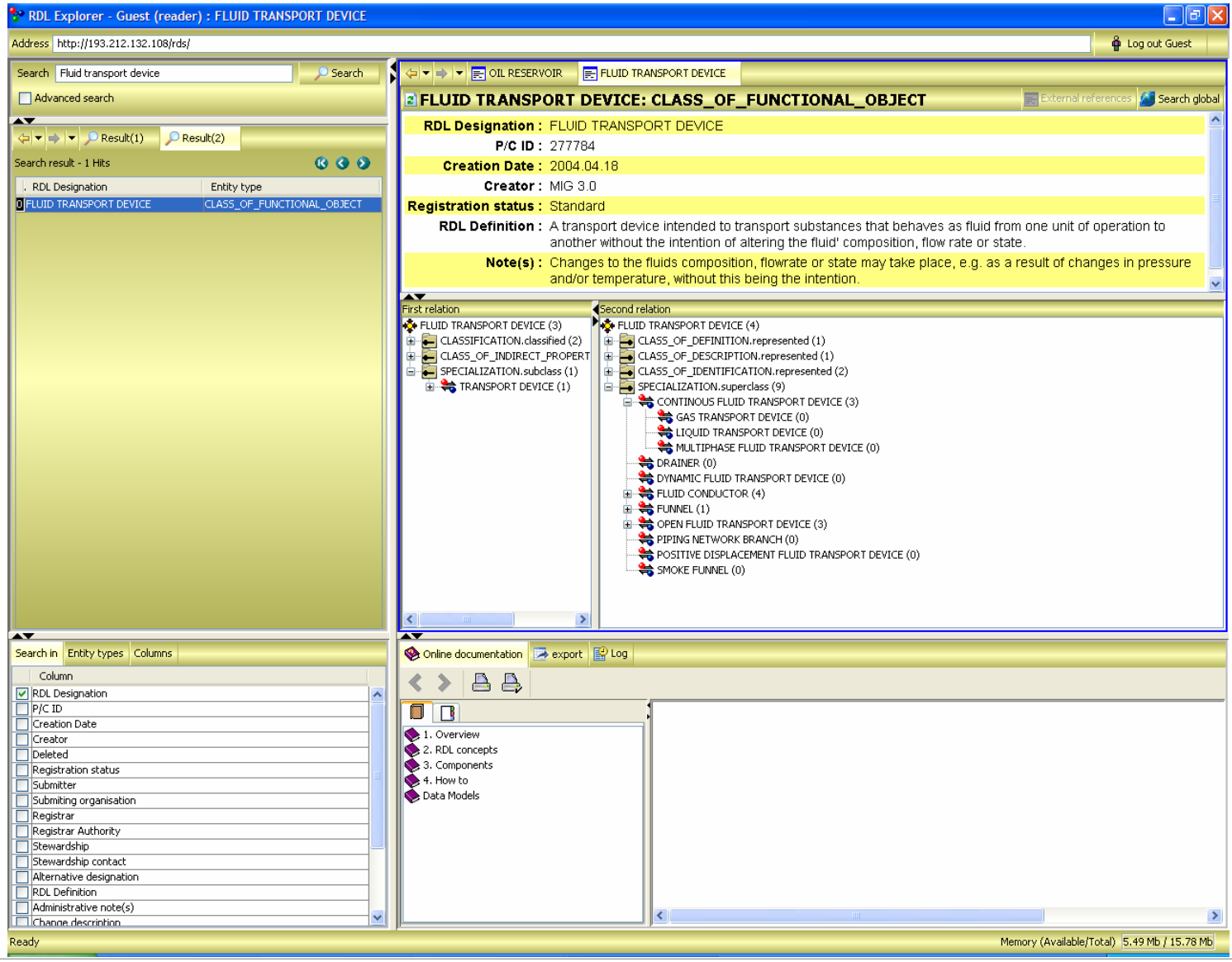


Reference Data for owner requirements



ClassOfIndividual

Fluid transport device in the RDL



The conceptual design phase

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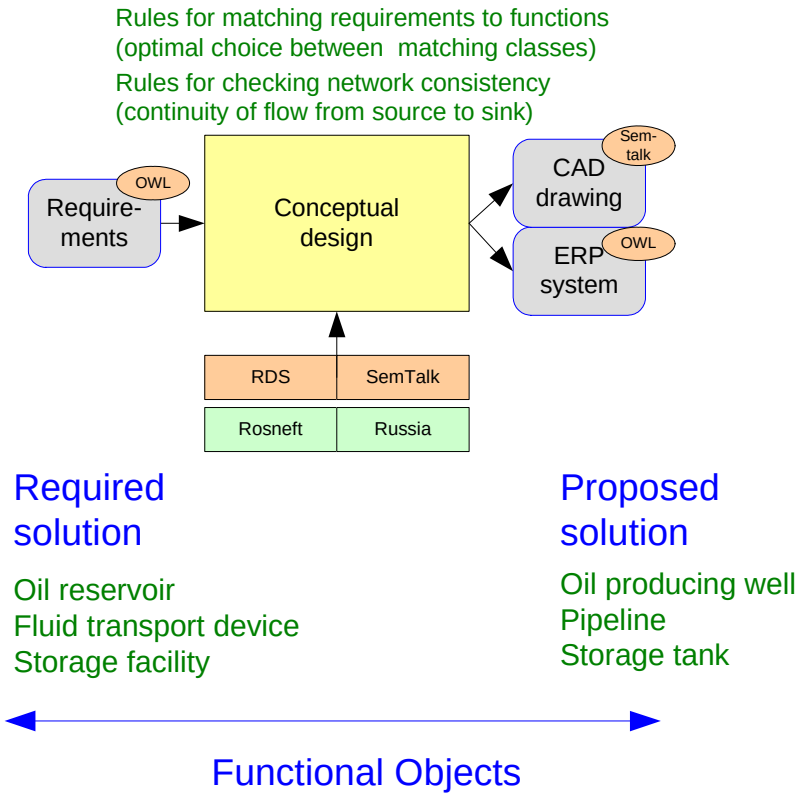
- Given need to transport oil from reservoir to loading facility
- Given that offshore loading is not practical
- Specify use of a pipeline as fluid transport device (pumping oil through pipelines to loading and storage facilities)



Reference Data for conceptual design

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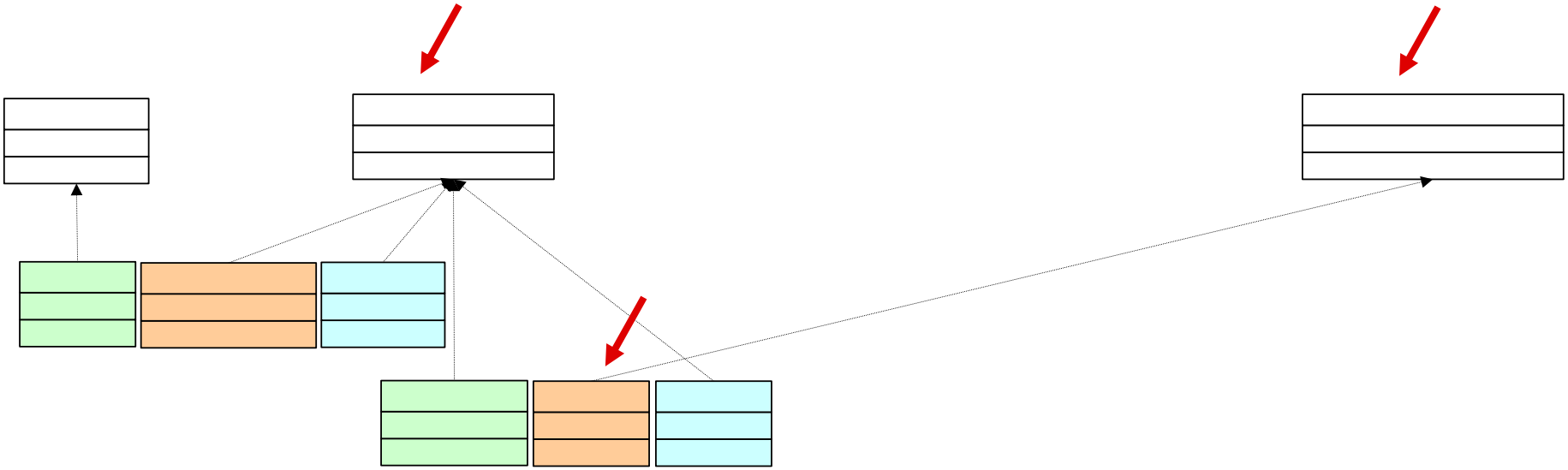

ClassOfIndividual

ClassOf

Pipeline in the RDL

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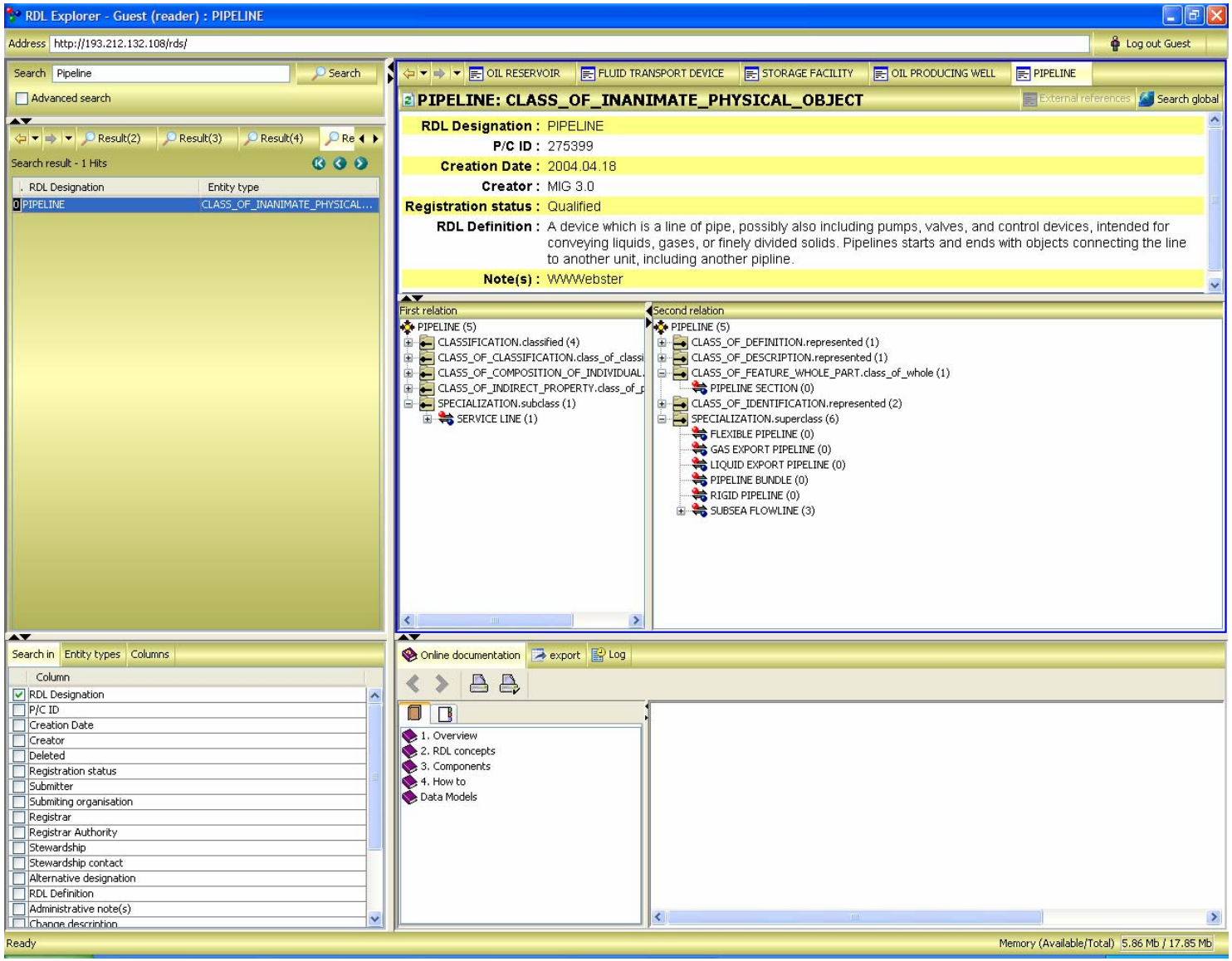

Reference Data Services in hand-over to process design

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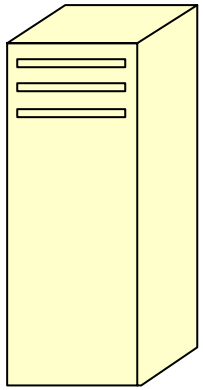
RDS



Conceptual Designer

Process Designer

Link to RDL definition of ”pipeline”

Find RDL definition of ”pipeline”

Send XML-message specifying ”pipeline”

You need to use a ”pipeline” with these particulars

Ah, so this is what he means when he says ”pipeline”

Process design of pipeline

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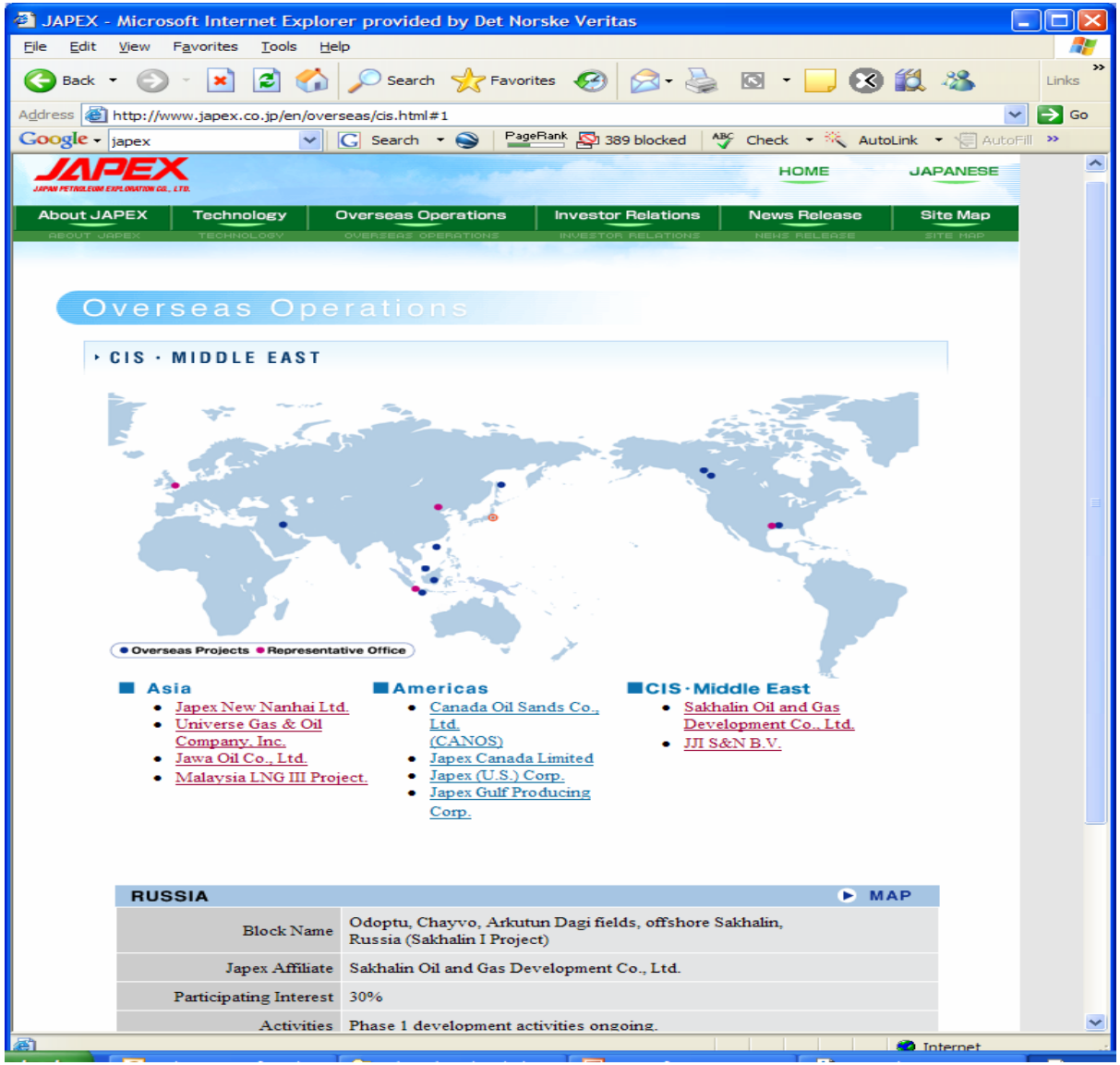

The process design phase

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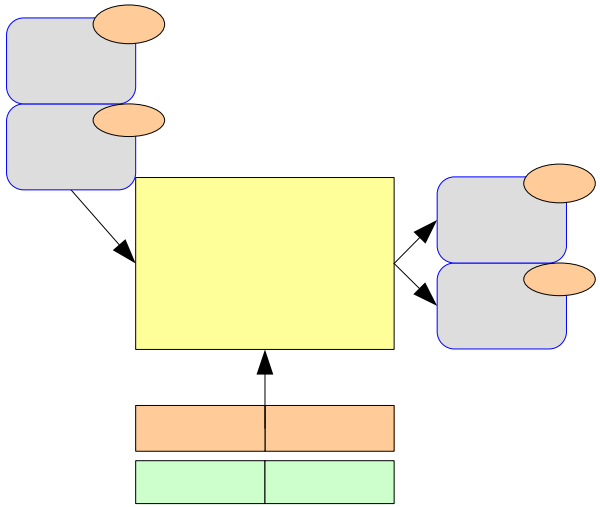
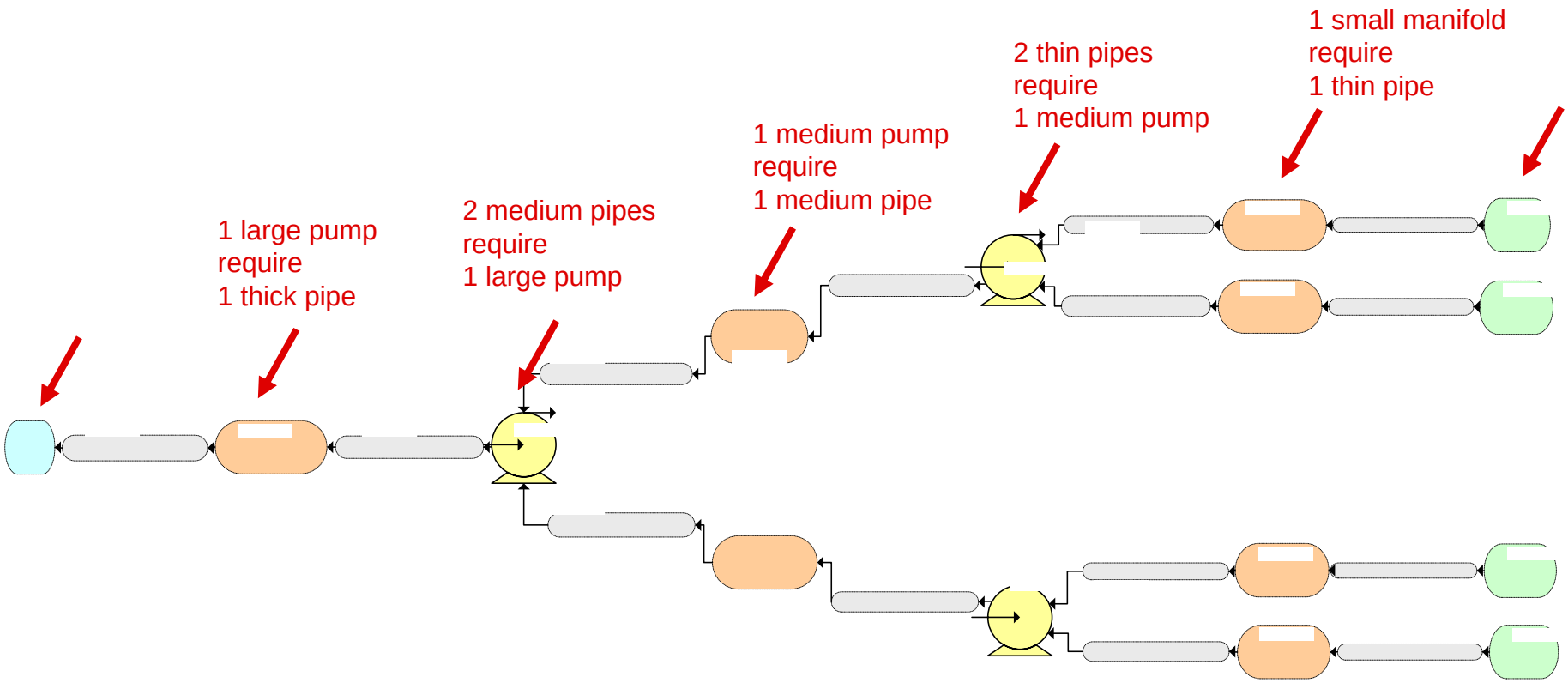
- Given required flow rate
- Dimension pipe diameters
- Given allowable pressure range
- Determine pump capacity and pipe dimensions



Process design analysis for pipeline solution



Reference Data for process design of pipelines

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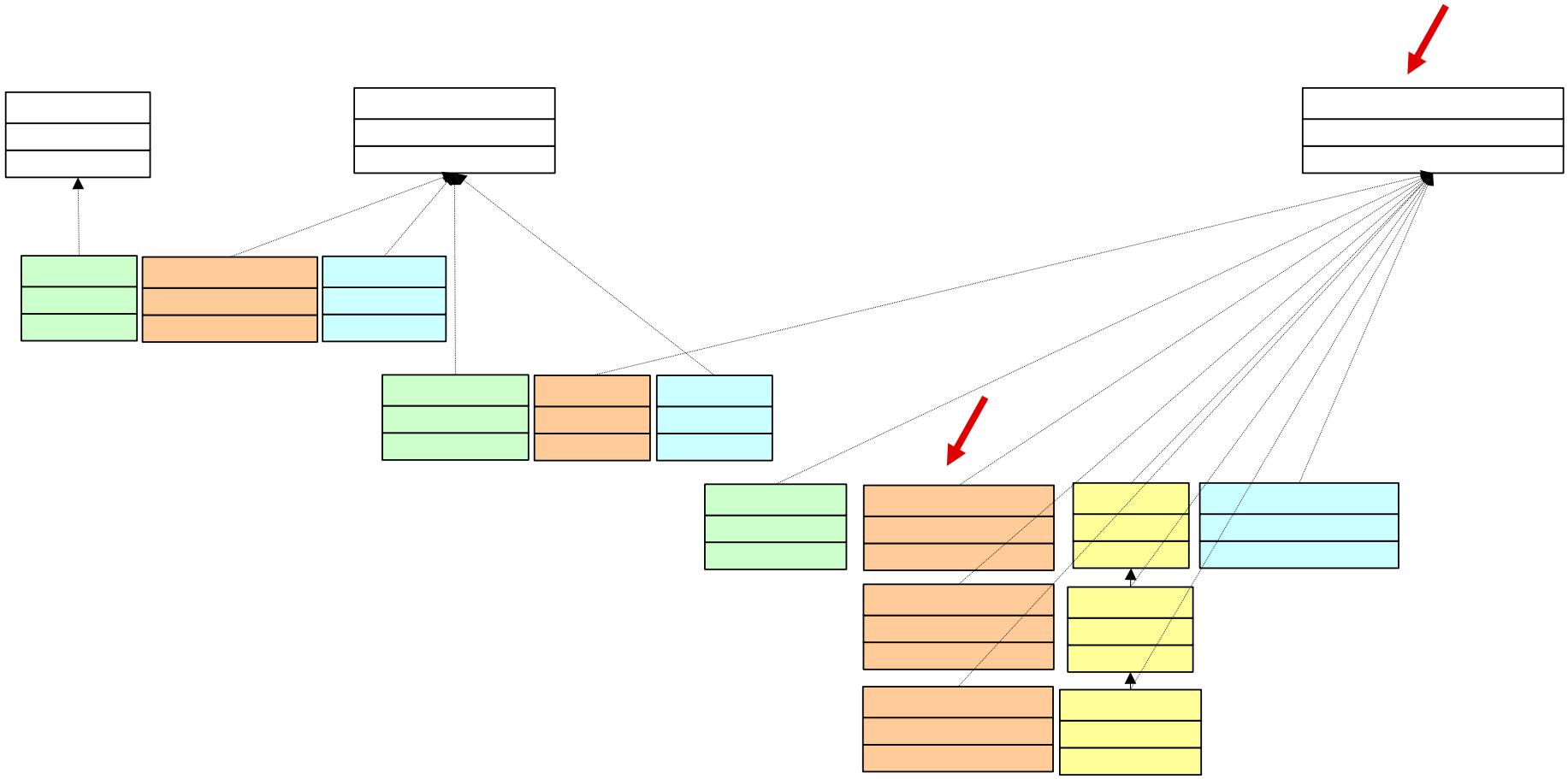
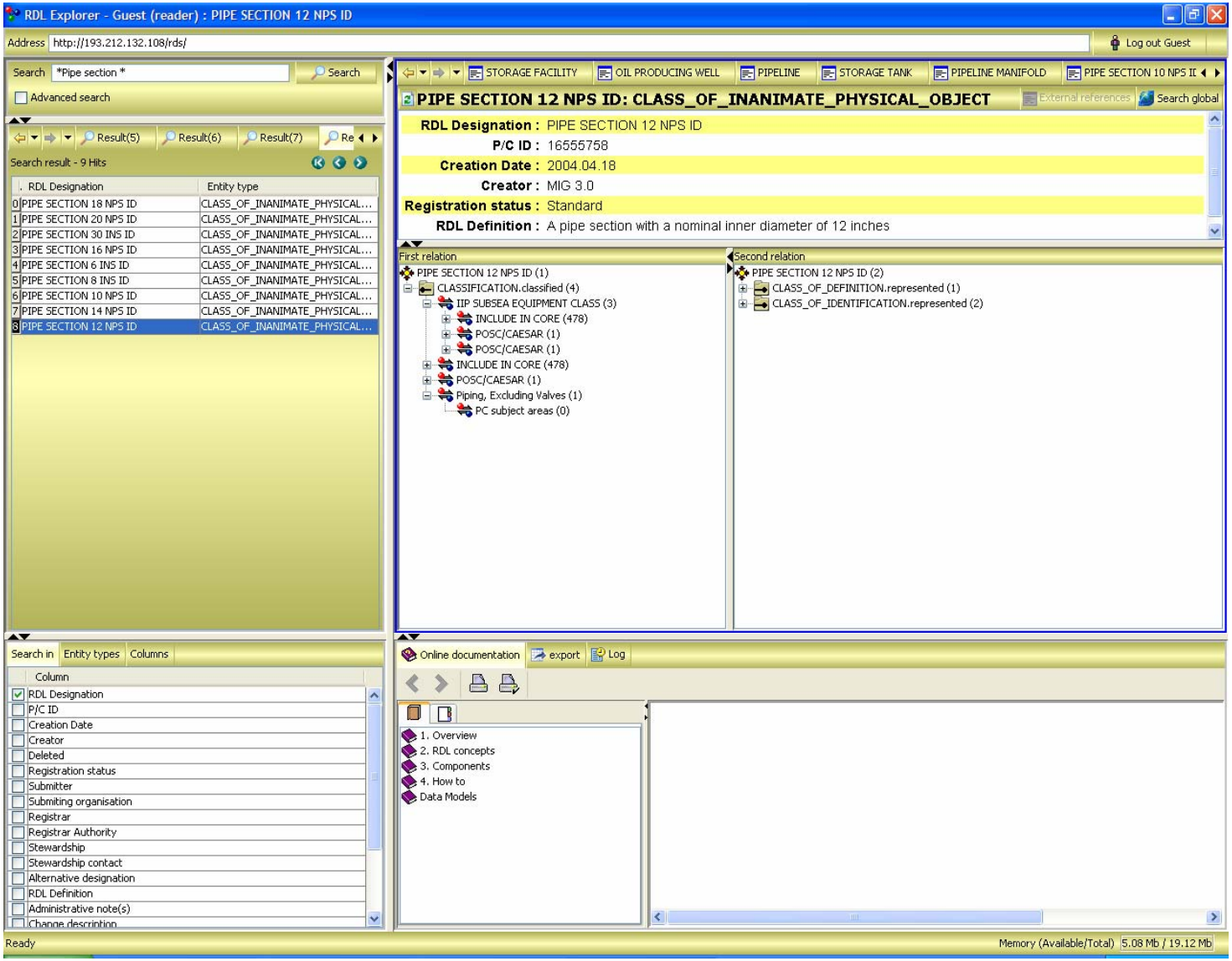


ClassOfIndividual

ClassC

Pipe section 12 NPS ID in the RDL



Reference Data Services in handover to engineering

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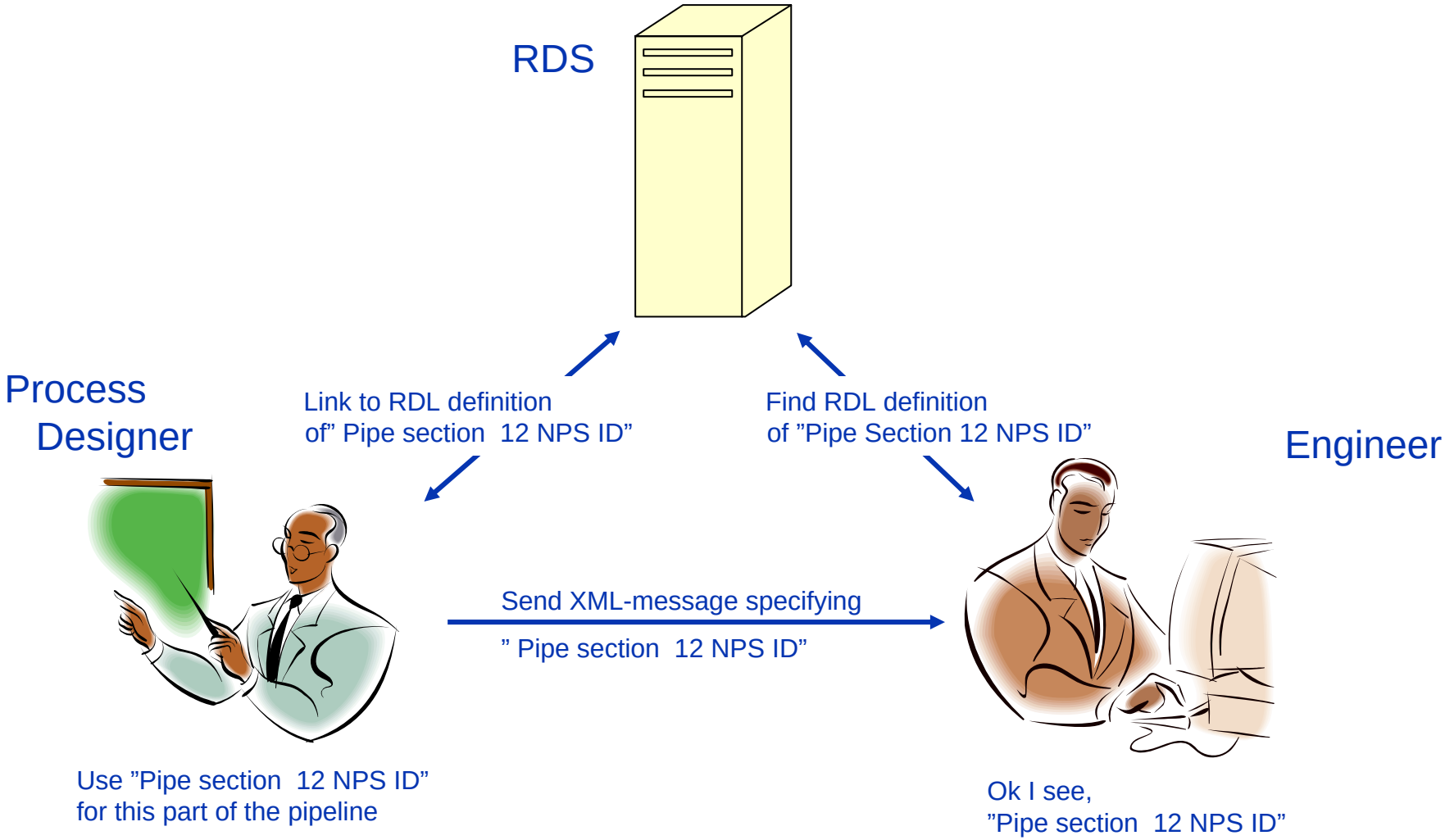

Detailed engineering contractor

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Capabilities - Engineering and Construction Division of Larsen & Toubro Limited - Microsoft Internet Explorer provided by De

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Engineering and Construction Division

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- Engineering and Execution
- Procurement
- Fabrication
- Project Planning, Progress Monitoring & Control
- IT Resources & Communication

The International Business development draws on L&T's in-house strengths & expertise in Front-End Engineering, Design Capabilities, and World-Class Manufacturing Facilities, to offer engineering solution on EPC basis. Due stress on Local fabrication and Global Procurement with tie-ups on case to case basis helps it to be price competitive. Modular Fabrication ensures that the delivery takes place in time and with the least possible time. The E&C division has a Technology Innovation Centre that has the ability to carry out process engineering, product development, mechanical design and analysis, process evaluation, computer-aided design and simulation.

L&T is one of the first companies in the world to implement the Enterprise Resource Planning (ERP) software SAP R/3 in the E&C business application. The company's IT Resources & Communication Facilities is amongst the best and most advanced in the country. The IT system integrates the execution processes for the project and also provides to the Project team the unique access to information at all stages of the project from proposal stage to the project handing over stage by leveraging the features of the SAP R/3 package. The Monitoring of the Project Progress at various stages is done through established and proven project management software like PRIMAVERA and other software duly incorporated in our ERP (SAP R/3) package.

The Company has proved its financial soundness by successfully raising USD 234 million finance through International markets by availing loan from Chase Manhattan Bank, ANZ Grindlays. The company has successfully adopted various structures like BOO, BLO, BOOST in the past. It has made Strategic alliances with world leaders enable L&T to access the technical know how and execute process intensive large scale turnkey projects.

The E&C Division offers a complete range of project services ranging from Basic Engineering, Detailed Engineering, Project Management, Procurement & Construction to Commissioning for Oil & Gas, Petroleum Refining, Chemical & Petrochemical, Fertilizer, Captive & Utility Power, Cement & Food, and Pharmaceutical Sectors.

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Done Internet

The detail engineering phase

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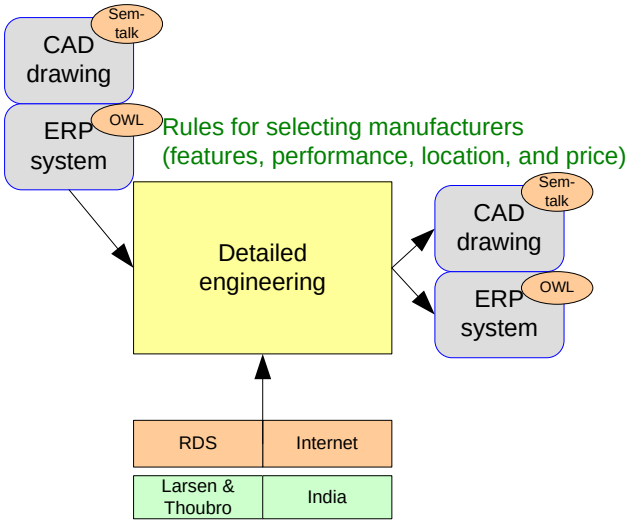
- Given pump capacity
- Select specific pump products according to performance (and price)
- Given pipe diameters
- Select specific pipe products according to price (and performance)



Pump specifications

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Rotary dynamic (centrifugal) pump

This type of pump contains a rotating part called the *impeller* inside a stationary cavity. The cavity may be a *volute*, *diffuser*, or *ring type*. The impeller forces the fluid to rotate, and thereby to move from inlet to outlet under its own momentum. As the fluid travels through the impeller passage its absolute velocity increases. In the volute, diffuser, or ring type cavity the fluid velocity is reduced and its energy converted to pressure energy.

Manual pump used to obtain water in Afghanistan

Examples:

- turbopump: the fluid is moved by the blades of a high-speed turbine.
- submersible pump : the fluid is moved by a pump joined to a sealed motor and submerged in the fluid to be pumped.
- split case centrifugal pump : the fluid is pumped by a horizontal or vertical pump with a split volute to allow maintenance access.
- axial flow pump : the fluid is pumped by a propeller type impeller inside a section of pipe.

[edit]

Linear or reciprocating dynamic pump

The Vortec Transvector is one example of a no-moving-parts dynamic air pump. A film of fast moving air formed by releasing high pressure air through a slit is discharged adjacent a surface, and drags ambient air along with it. The higher the pressure of the primary air supply, the worse the efficiency.

It is an example of an ejector pump. Steam ejectors are used to cool bleach water so it will retain the chlorine. They simply discharge a boiler into a tube, sucking water vapor out from above a sealed tank. The water inside slowly cools. Not very efficient, but it does something useful with waste steam, simply.

A well pump is also a dynamic pump. Since water will boil if any attempt is made to "suck" it more than about thirty feet high, high pressure water is injected in at the bottom of a well, forcing the well water to flow upwards much more than thirty feet.

Ejectors are used to augment the flow in turbojets, near the aft end.

The Coanda effect is the tendency of such a moving stream to cling to a surface, even when the surface deflects the stream away from its original direction. The surface seems to pull the stream. It is a manifestation of Bernoulli's principle: since energy is conserved, a moving fluid has a lower pressure than a static fluid. The ambient fluid is moving more slowly, and so has a higher pressure; it forces the moving stream toward the surface.

The USPTO issued a patent to Henri Coanda for the design of a jet engine using high pressure fuel vapor as the primary fluid supply. The Transvector patent references Coanda's patent. Such engines can be made light in weight but are not very efficient.

Centrifugal Pump Components

Pump Casing - To keep the fluid in the pump.

Impeller - The component that drives the fluid to a higher pressure

Shaft - The rod that connects the motor to the impeller

Motor - The part that powers the pump

Mechanical Seal, labyrinth seal, gasket or Packing - To keep the fluid from leaking out to the atmosphere. There are some magnetically driven centrifugal pumps that do not need such seals or packing.

Bearing - To keep the shaft rotating freely in place.

Outboard bearing - Bearing at motor end of shaft

Inboard bearing - Bearing at impeller side of pump. Need 2 bearing to hold shaft in place

Oiler - To provide oil to lubricate the bearing so it will not jam. May use grease also, if so, grease gun inject grease through nipple to provide lubrication (A nipple is a type of joint with female threads in plumbing practice, but a grease nipple is mushroom shaped male fitting mating with a grease gun head.)

Internet

Pump Manufacturer's website

MANAGING RISK

"Energo-Sojus" - All we do we do for you - Microsoft Internet Explorer provided by Det Norske Veritas

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Back Search Favorites

Address http://www.pumpsland.com/data_e/index.php?url=about_e.htm

Google Search PageRank 354 blocked Check Look for Map AutoFill Options

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Monday
June 12, 2006

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Pipeline Pumps

Multistage Segmental

Designed for transporting crude oil and refined oil products at pumping temperature up to 80°C through long-distance pipelines and products lines and can be installed at oil pumping plants to generate the required head in the long-distance pipelines to match the system requirements. Electrically driven horizontal multistage ring-section centrifugal pumps. Single flow impeller arrangement, with all the impellers facing the same way.

The pump rotor is carried by the plain bearings with forced oil lubrication. Shaft sealing: mechanical seals.

The pumping units are made either in the climatic version У (for areas with a temperate climate) the location category 2 (under roof) at the lowest ambient temperature of minus 29°C or in the climatic version УХЛ (for areas with a temperate and cold climate), the location category 4 (in case of II 500-800, NM 1250-400) according to ГОСТ 15150-69.

NM

Pump make	Capacity, m^3/h	Head, m	Rotational speed, rpm	Power of motor, kW
NM 125-550	125	550	3000	315
NM 125-550	125	550	3000	400
NM 180-500	180	500	3000	400
NM 180-500	180	500	3000	500
NM 250-475	250	475	3000	500
NM 250-475	250	475	3000	630
NM 360-460	360	460	3000	630
NM 360-460	360	460	3000	500
NM 360-460	360	460	3000	800
NM 500-300	500	300	3000	630
NM 500-300	500	300	3000	500
NM 500-300	500	300	3000	800
NM 710-280	710	280	3000	800
NM 710-280	710	280	3000	1000

Radially Split Barrel

Electrically driven horizontal multistage radially split diffuser barrel-casing centrifugal pumps with a withdrawable cartridge of ring-section type. Single flow impeller arrangement, with all the impellers facing the same way. The pump rotor is carried by the plain bearings with forced oil lubrication. Shaft sealing: mechanical seals.

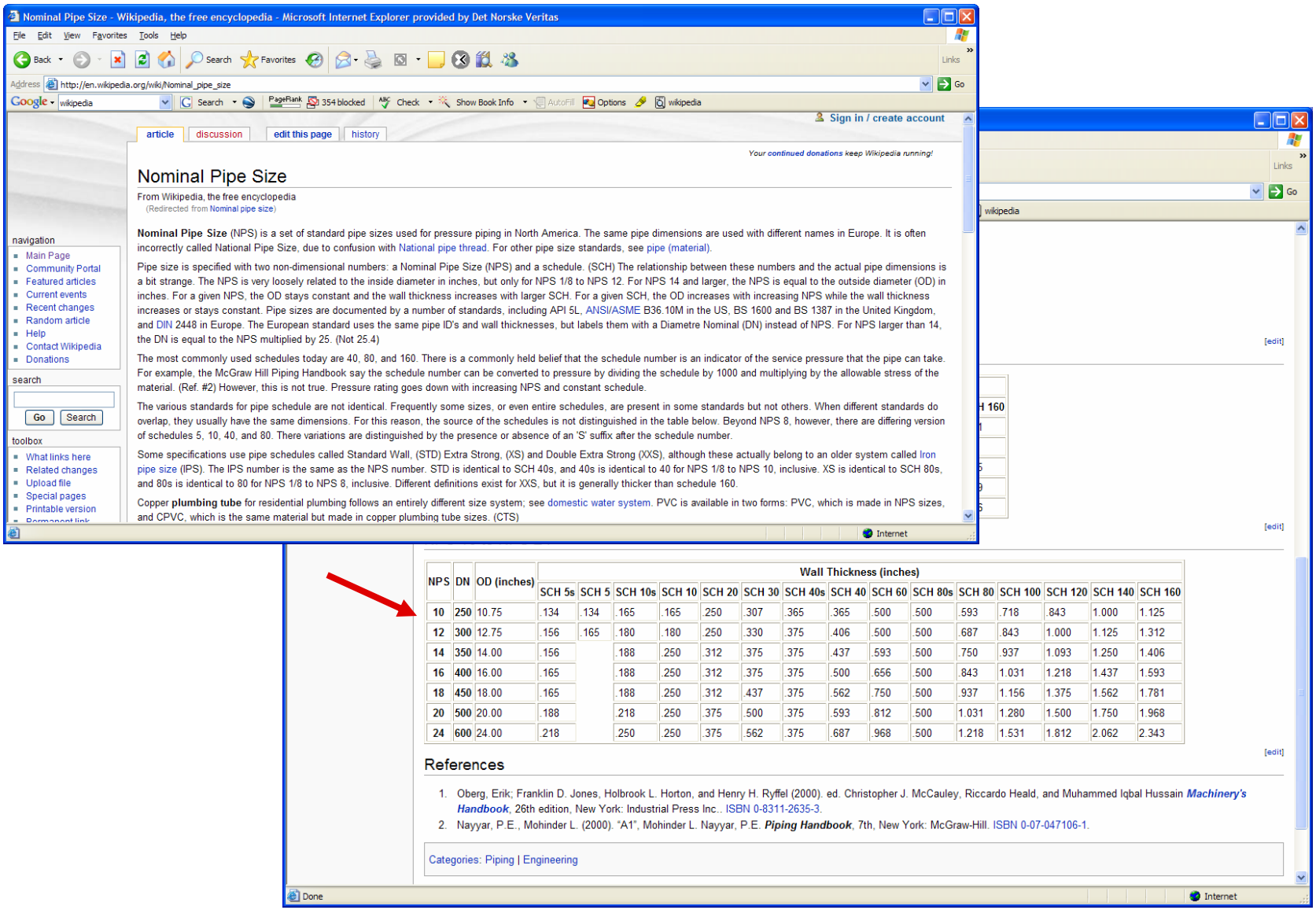
Pump make	Capacity, m^3/h	Head, m	Rotational speed, rpm	Power of motor, kW
NM 500-800	500	300	3000	1600
NM 1250-400	1250	400	3000	1600

Turbine- or motor-driven horizontal barrel-casing centrifugal pumps with a withdrawable cartridge of multistage ring-section type. Single flow impeller arrangement, with all the impellers facing the same way. The pump rotor is carried by the pressure oil lubricated plain bearings. Shaft sealing: mechanical seals with external heat exchangers. By providing an inducer upstream of the first stage impeller a high suction capacity is

Done Internet

Pipe specifications

MANAGING RISK

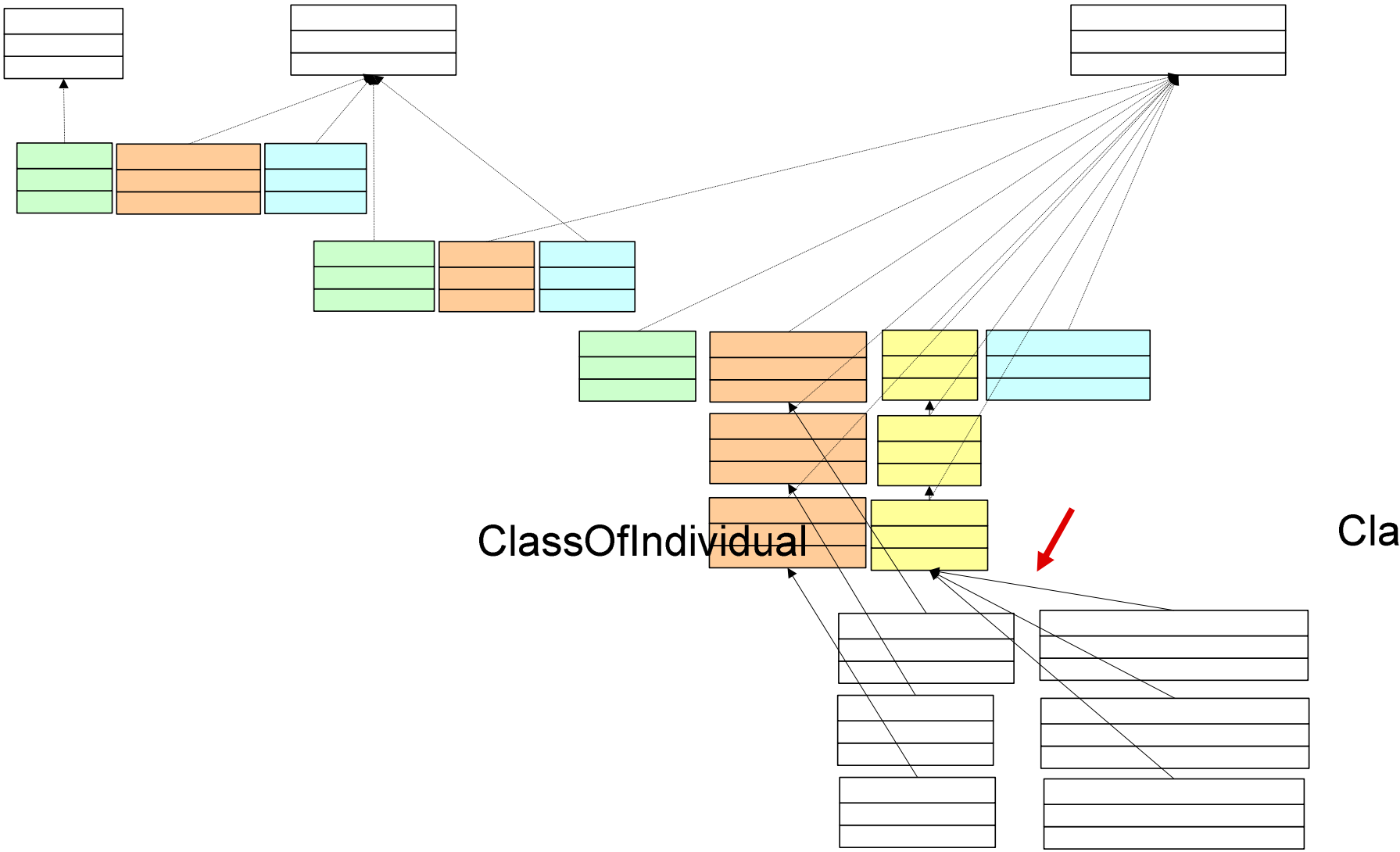


NPS	DN	OD (inches)	Wall Thickness (inches)														
			SCH 5s	SCH 5	SCH 10s	SCH 10	SCH 20	SCH 30	SCH 40s	SCH 40	SCH 60	SCH 80s	SCH 80	SCH 100	SCH 120	SCH 140	SCH 160
10	250	10.75	.134	.134	.165	.165	.250	.307	.365	.365	.500	.500	.593	.718	.843	1.000	1.125
12	300	12.75	.156	.165	.180	.180	.250	.330	.375	.406	.500	.500	.687	.843	1.000	1.125	1.312
14	350	14.00	.156		.188	.250	.312	.375	.375	.437	.593	.500	.750	.937	1.093	1.250	1.406
16	400	16.00	.165		.188	.250	.312	.375	.375	.500	.656	.500	.843	1.031	1.218	1.437	1.593
18	450	18.00	.165		.188	.250	.312	.437	.375	.562	.750	.500	.937	1.156	1.375	1.562	1.781
20	500	20.00	.188		.218	.250	.375	.500	.375	.593	.812	.500	1.031	1.280	1.500	1.750	1.968
24	600	24.00	.218		.250	.250	.375	.562	.375	.687	.968	.500	1.218	1.531	1.812	2.062	2.343

Pipe Manufacturer's website

Industry Standard Data for detailed pipeline engineering

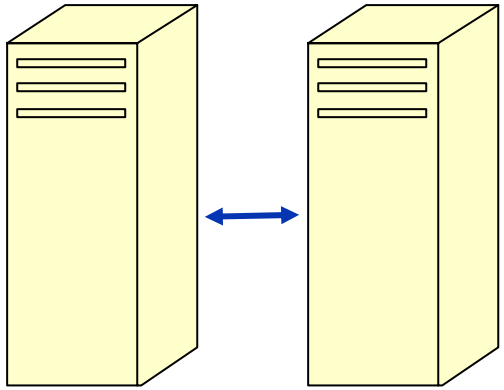
MANAGING RISK



Reference Data Services in hand-over to production

MANAGING RISK

RDS



PDS

Get Product Data Library definition of ”NM 125.500”

Get Product Data Library definition of ”NM 125.500”

Engineer

Send XML-message specifying

4 specimens of ” NM 125.500”

Supplier

Owner

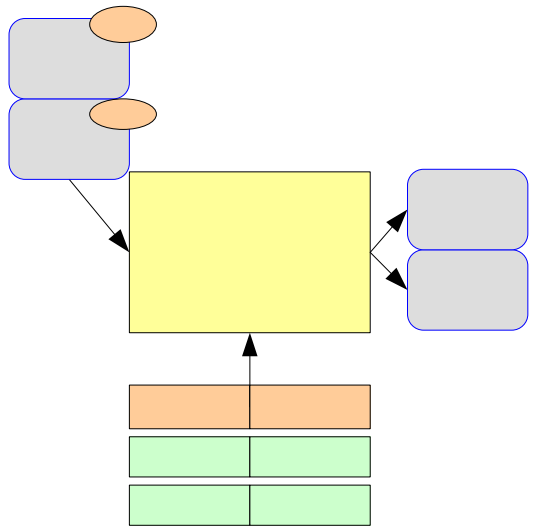
I need to order
- 4 ”NM 125.500”
- 2 ”NM 250.475”
- 1 ”NM 500.300”

He wants four of my ”NM 125.500” pumps

The production and installation phase

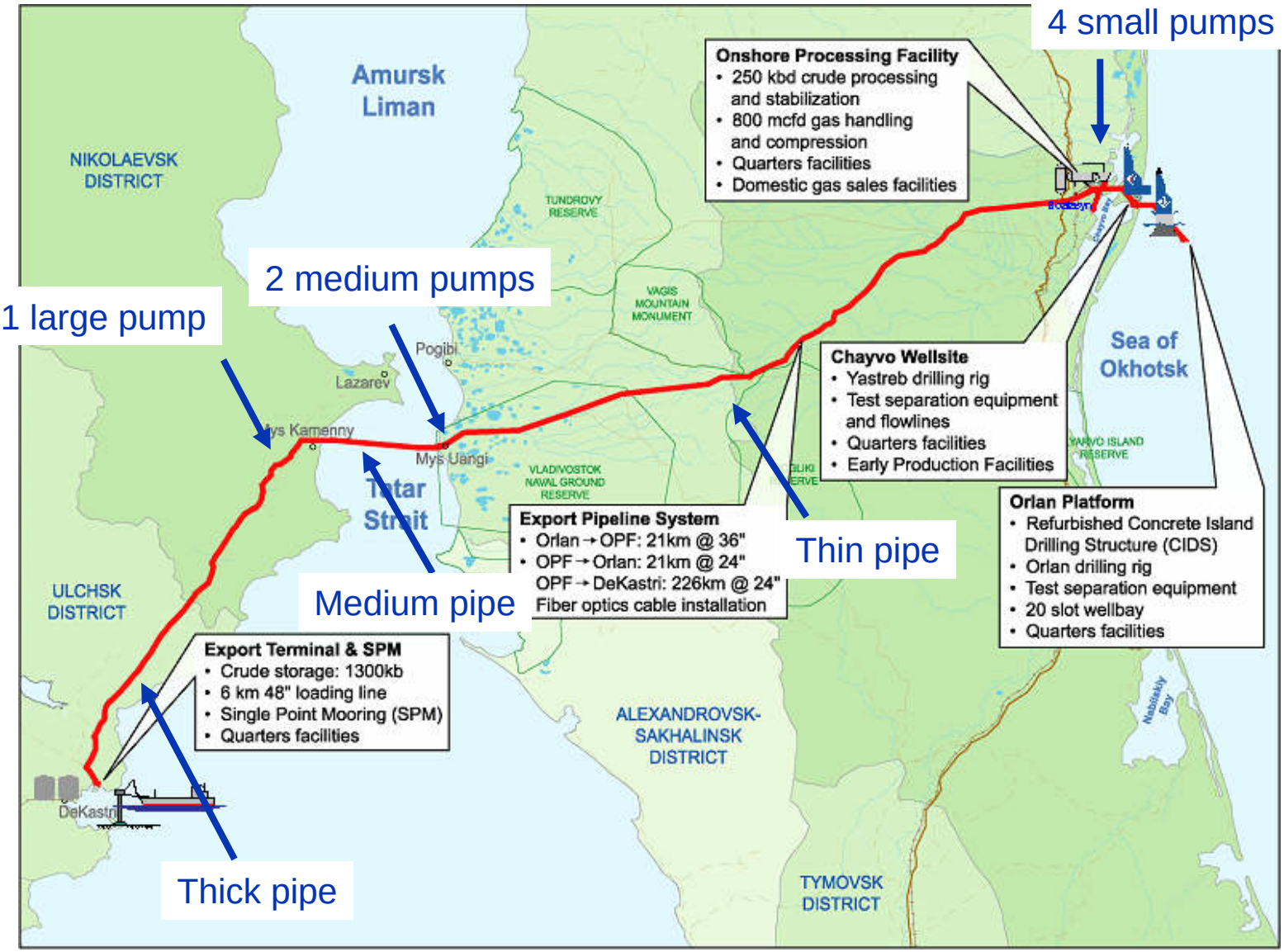
MANAGING RISK

- Given order for specific pipes and pumps
- Produce and deliver pipes and pumps
- Given delivery of acquired product
- Install pipes and pumps



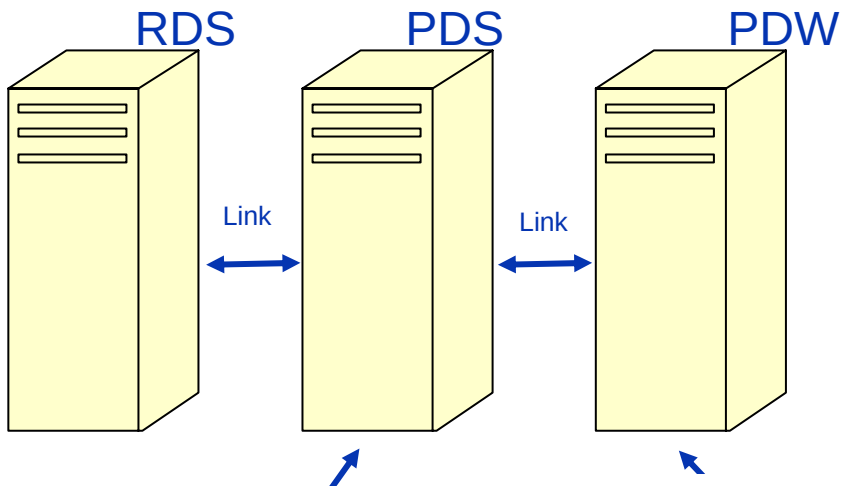
The Sakhalin island pipeline

MANAGING RISK



Reference Data Services in hand-over to commissioning

MANAGING RISK



Get Product Data Library

definition of ”NPS 16 OD 16 SCH 60”

Link to Product Data Library

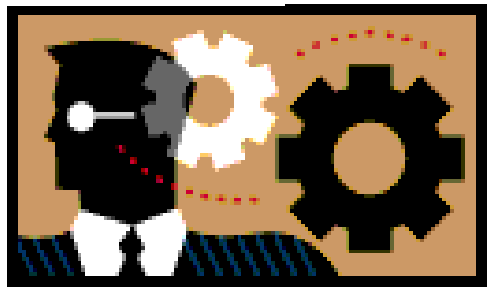
definition of ” NPS 16 OD 16 SCH 60”

Write pipe data into Project Data Warehouse

for locations ”position 0” to ”position 1500”

Supplier

Operator



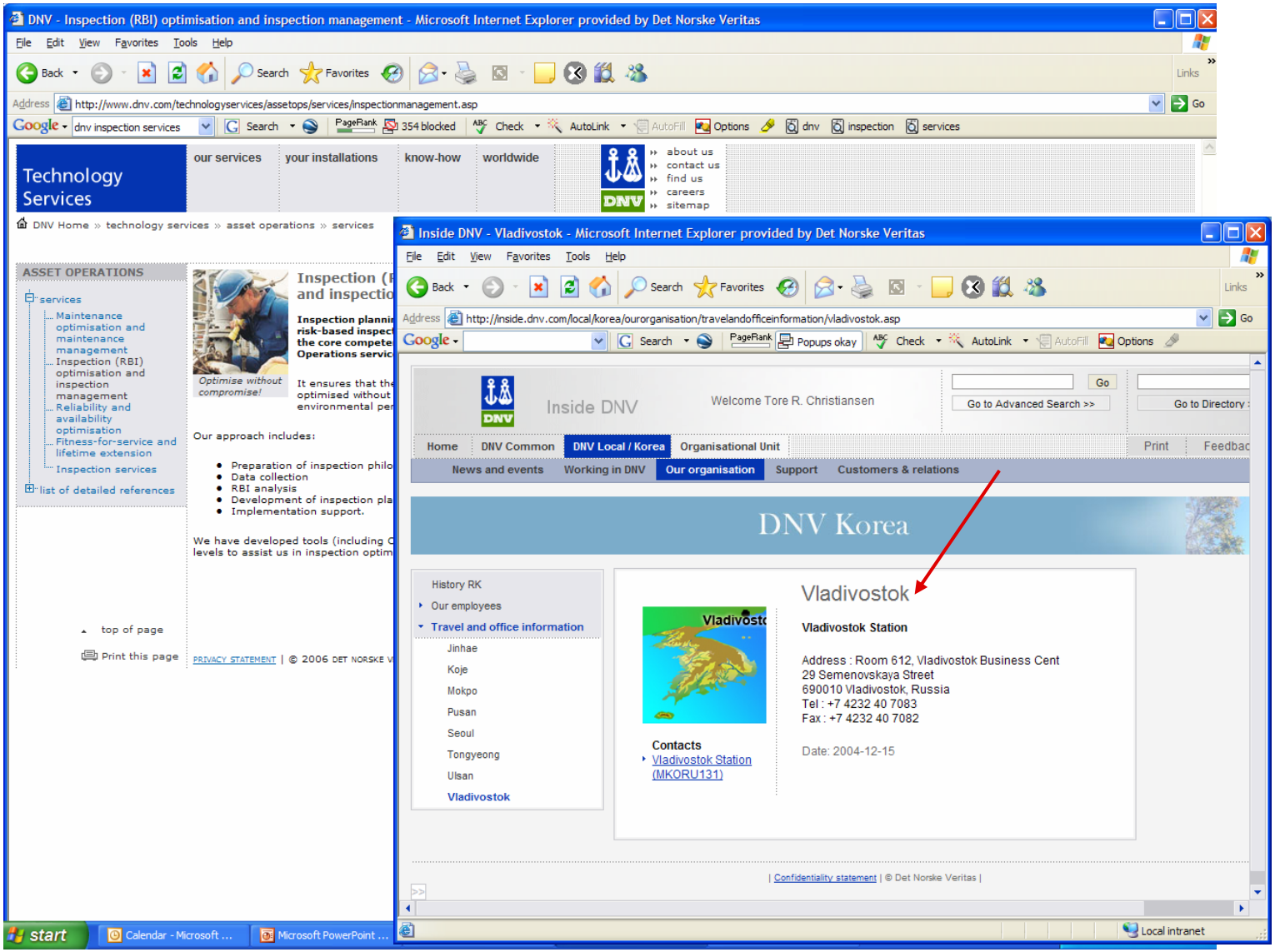
Send XML-message specifying 30.000 pieces of

”NPS 16 OD 16 SCH 60” pipe
from ”position 0” to ”position 1500”

We have delivered 30.000 pieces of
”NPS 16 OD 16 SCH 60” pipe.
Installed from ”position 0” to ”position 1500”

I need to document the pipeline in the PDW with 30.000 pieces of ”NPS 16 OD 16 SCH 60” pipe from ”position 0” to ”position 1500”

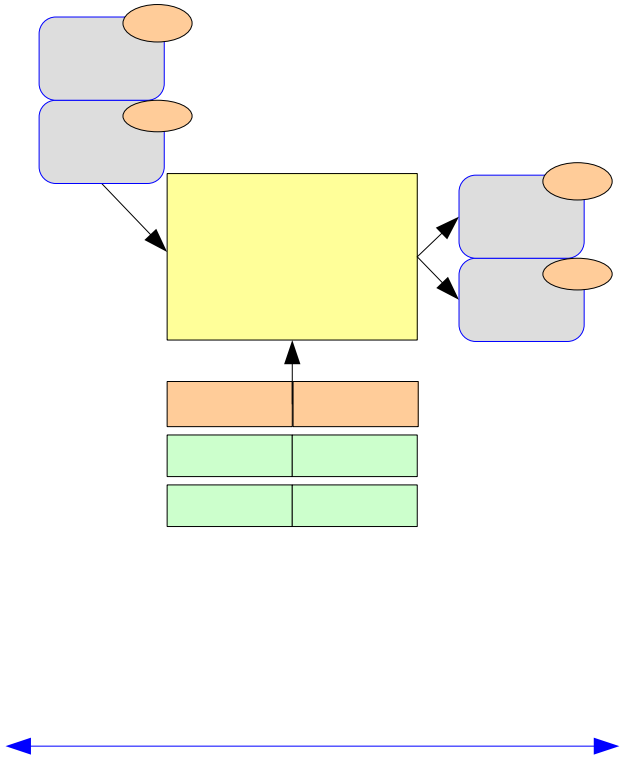
DNV inspection services



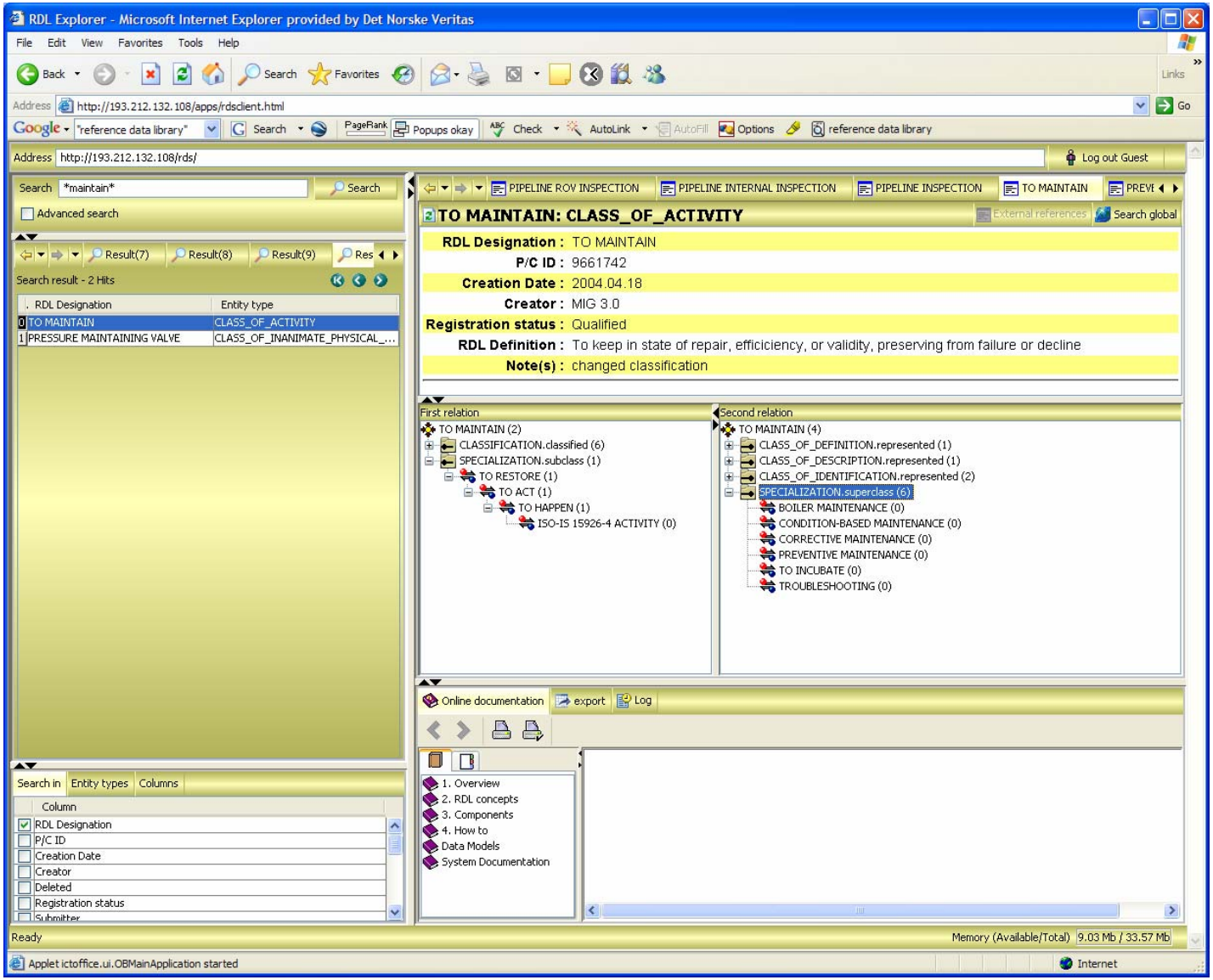
The operational phase

MANAGING RISK

- Given installed pipelines in operation
- Perform DNV inspection of pipe to verify wall thickness
- Replace corroded pipe

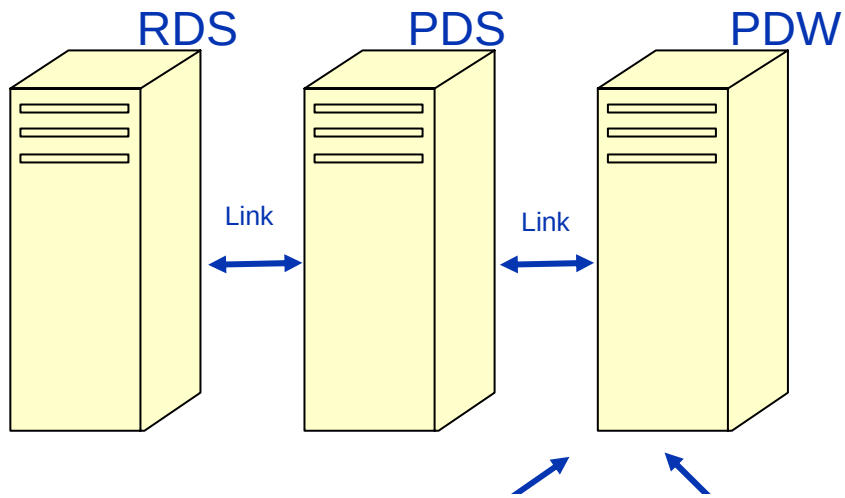


Maintenance in the RDL



Reference Data Services in product support

MANAGING RISK



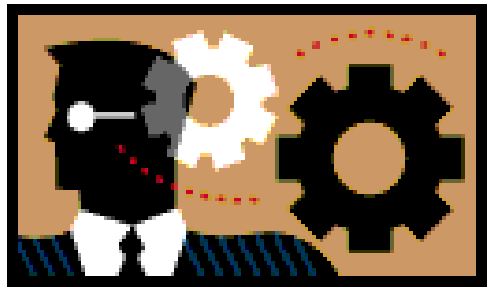
Access Project Data Warehouse
get product data for location ”position 125”
Link to Product Data Library
definition of ”NPS 16 OD 16 SCH 60”

Link to Project Data Warehouse
definition of ” NPS 16 OD 16 SCH 60”
Update Project Data Warehouse
for location ”position 125”

Inspector

Send XML-message specifying 200 meters of
”NPS 16 OD 16 SCH 60” pipe at ”position 125”

Operator



The inspection shows a need to replace
200 meters of ”NPS 16 OD 16 SCH 60”
pipe at ”position 125”

I need to place an order for 200 meters of
”NPS 16 OD 16 SCH 60” with the supplier and
prepare my team for installation at ”position 125”

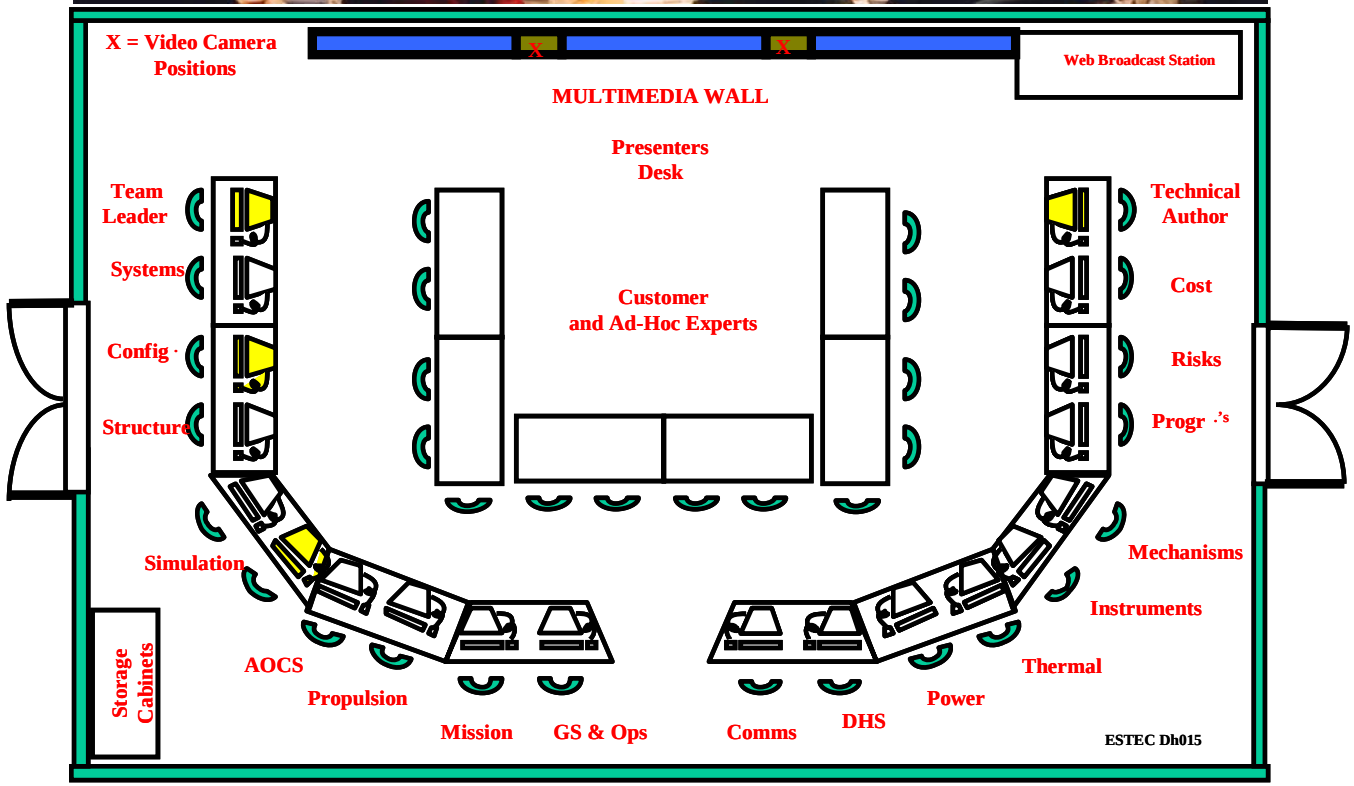
Reference Data in Space Engineering

MANAGING RISK DNV

- The European Space Agency studies many potential space missions
- Early phase engineering Space Mission involves feasibility and functionality
- More than twenty disciplines are mutually dependent
- Need to develop and use advanced collaboration tools
- ESTEC hosts the ESA Concurrent Design Facility
- Currently based on linked set of Excel workbooks
- Currently requires simultaneous on-site presence
- ESA wants to distribute design and work with national partners
- An Open Concurrent Design Server (OCDS) based on Web Services
- Common Space Engineering Information Model (SEIM)
- Shared Space Engineering Reference Data Library (SERDL)

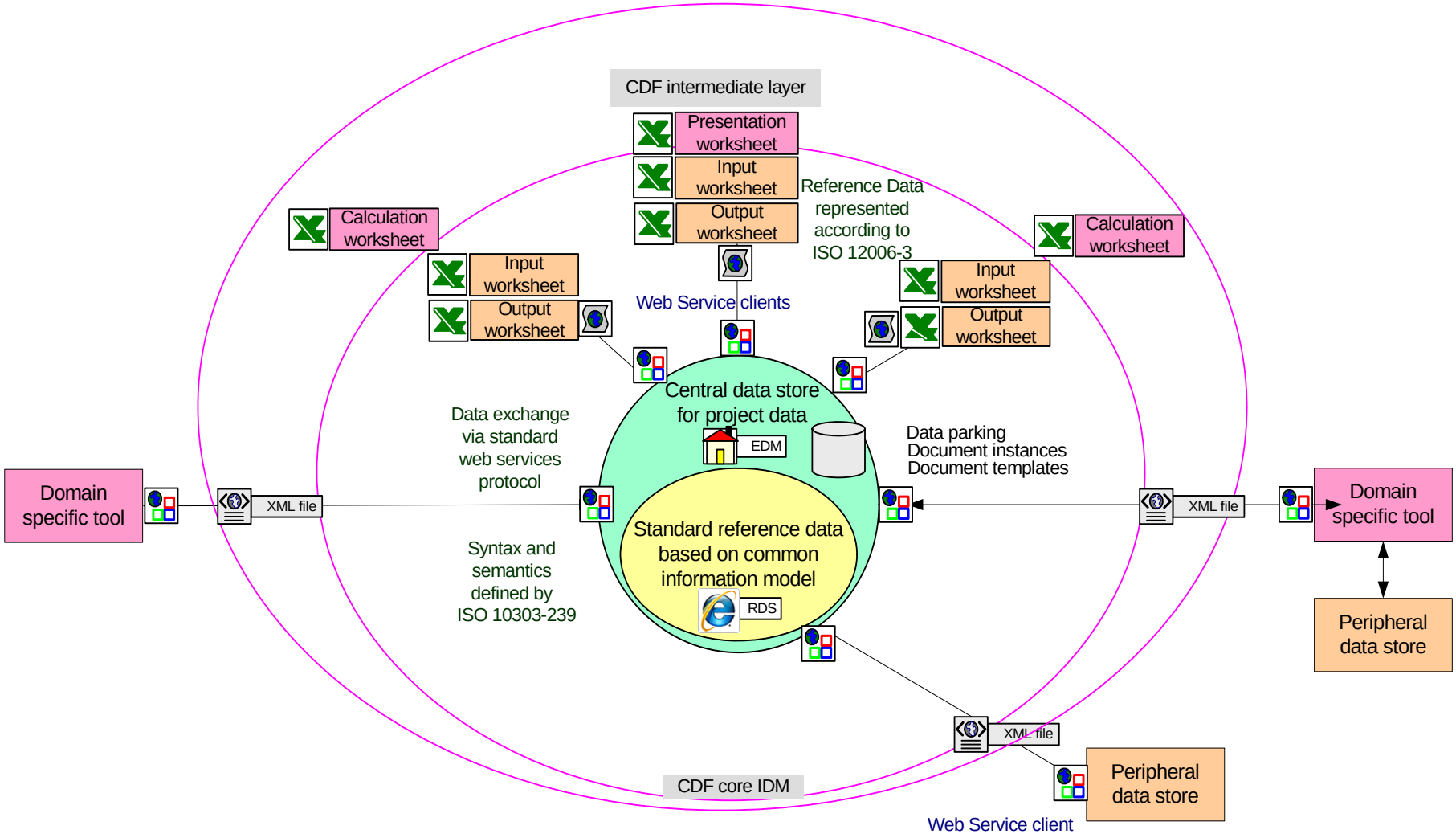
The Concurrent Design Facility at ESTEC

MANAGING RISK



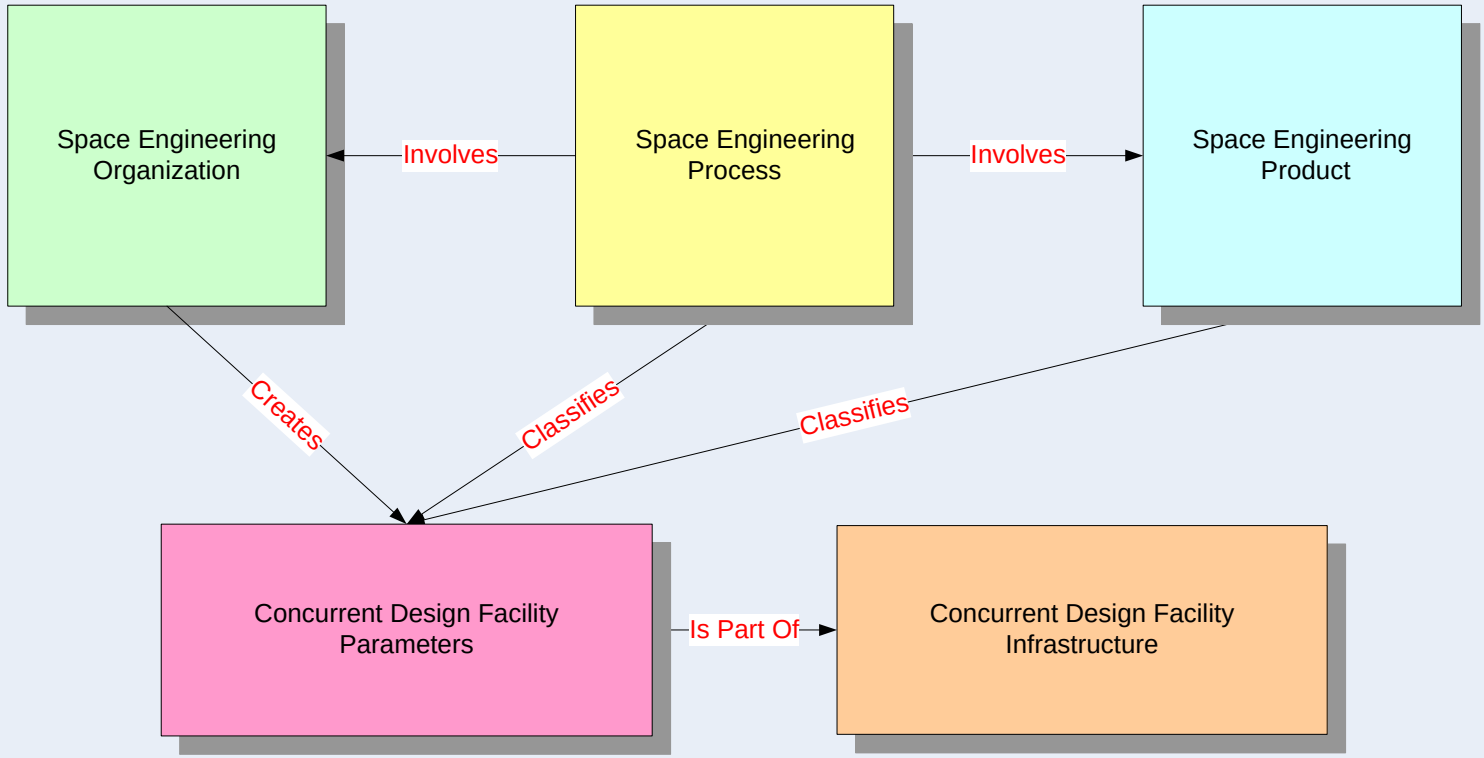
The Open Concurrent Design Server

MANAGING RISK



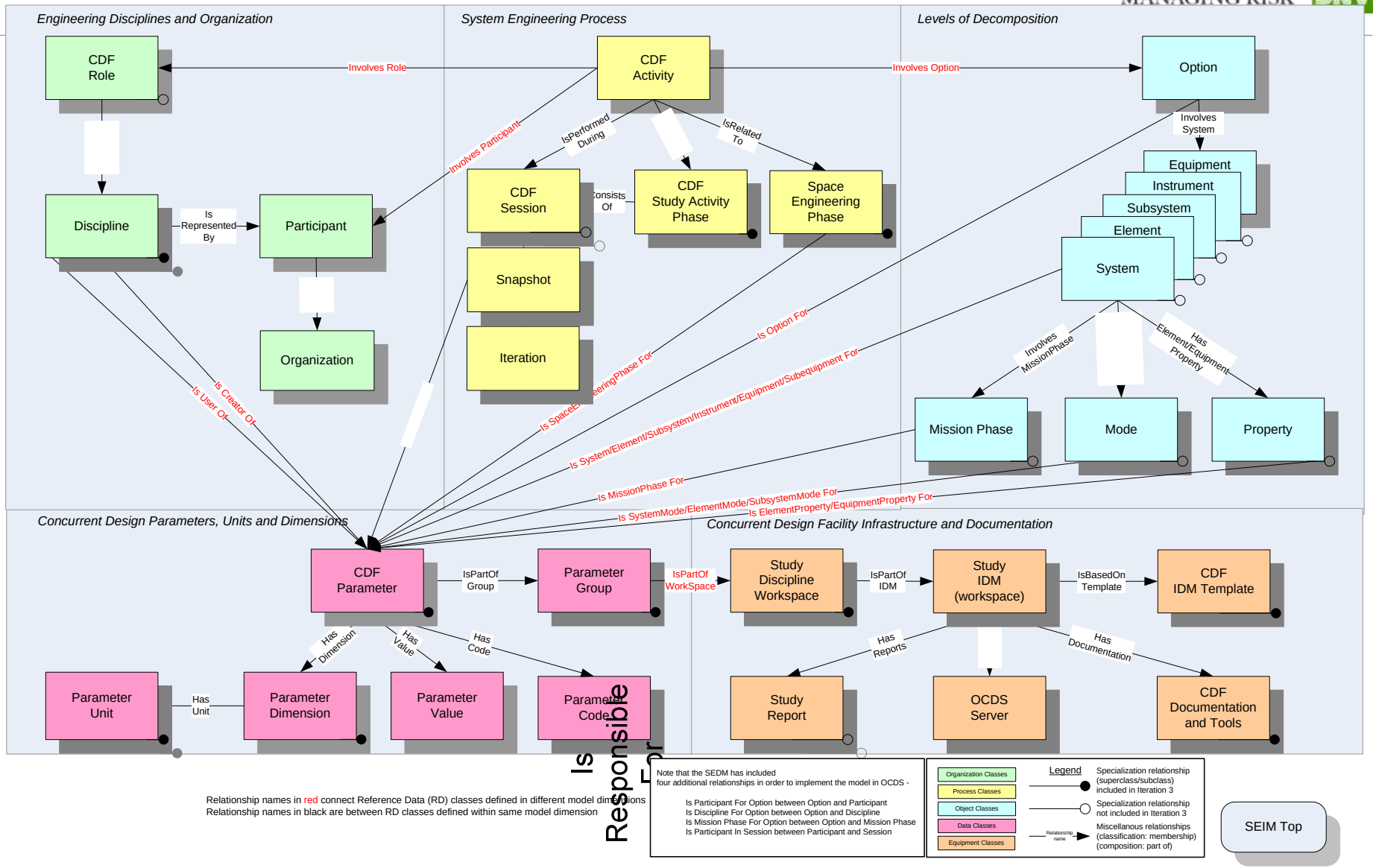
The ESA Space Engineering Information Model

SEIM Main Information Objects and Relationships



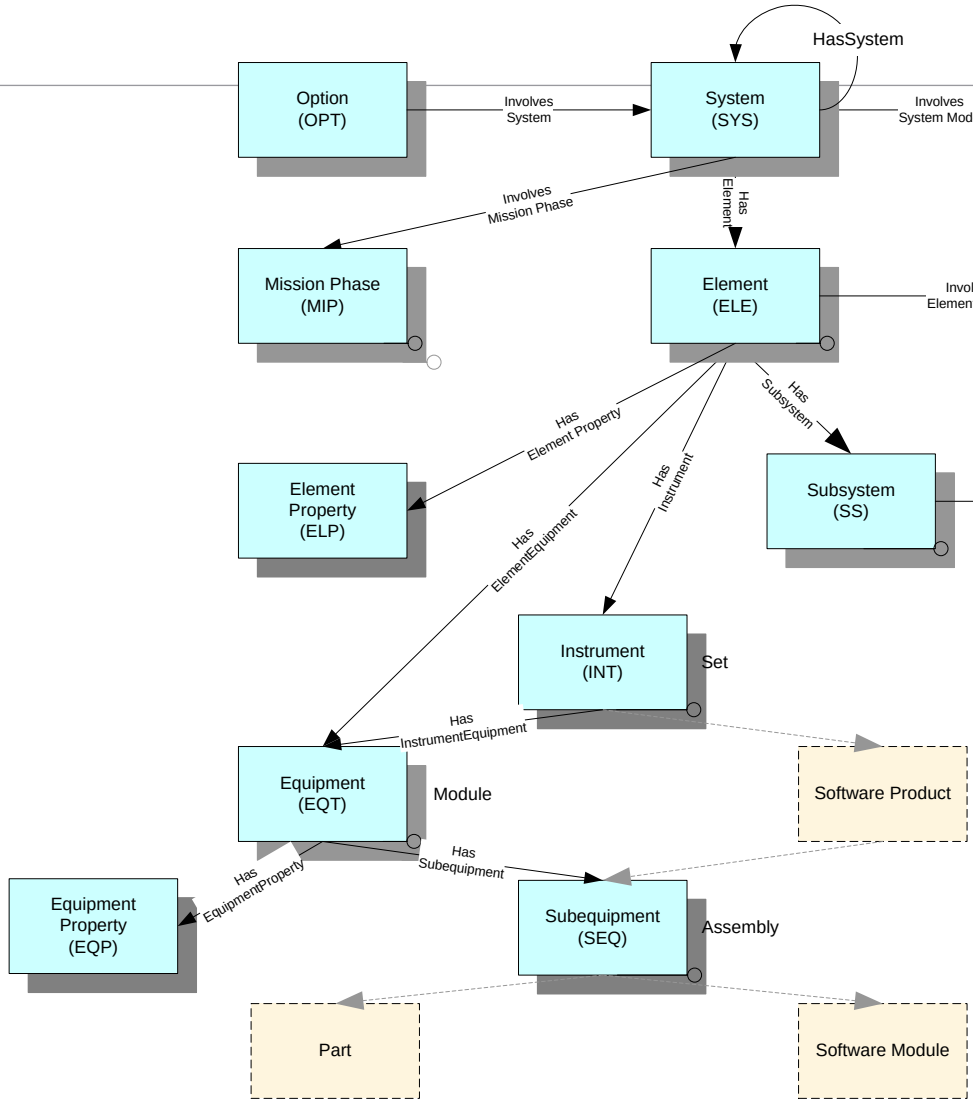
ECSS Standards | ISO 10303-239 Standard | ISO 12006 Standard | OCDS Web Services | SEDM Documentation | SERDL Documentation | SERDL Iteration 3

Main Relationships in the ESA Space Engineering Information Model



Relationship names in red connect Reference Data (RD) classes defined in different model dimensions
Relationship names in black are between RD classes defined within same model dimension

Levels of Decomposition in Space Engineering



The product hierarchy is:
Option + System + Mission Phase + System Mode + Element + Element Mode + Element Property + Subsystem + Subsystem Mode + Instrument + Equipment + Equipment Property + Subequipment

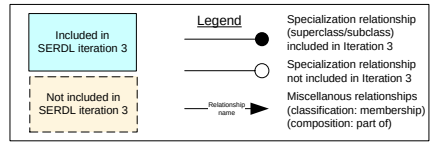
The Space Engineering Reference Data (SERD) values are created from CDF Reference Parameter Types (RTP) by combining Information Object Counters (IOC - e.g., ELE# with value ELE1, etc.) and RTP Names (e.g., mass) to give instantiated values (e.g., OPT1_mass).

The legal ordering and combinations -

OPT#_SYS#_RTPname
OPT#_SYS#_MIP#_RTPname
OPT#_SYS#_MIP#_SYM#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_ELM#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_ELP#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_ss_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_ss_SSM#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_INT#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_INT#_EQT#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_EQT#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_EQT#_EQP#_RTPname
OPT#_SYS#_MIP#_SYM#_ELE#_EQT#_SEQ#_RTPname

All abbreviations for the above IOC's are listed in the SERDL Documentation (which is linked from the SEIM top page)
For instantiated values the # sign in IOC's are replaced by the relevant number for the Information Object
For Parameter Values that apply to all instances the IOC is dropped (most often for OPT# and SYS#)

Note that
The "ss_" is not replaced by the relevant Discipline (instead the SERD instance has Discipline as its Creator)
All Equipment (EQT#) can be part of Elements (ELE#) as well as Instruments (INT#)
Eigenfrequencies are treated as subtypes of Element Property (ELP#)
Ground Station, Solar Array, Battery and Antenna are treated as subtypes of Equipment (EQT#)
Coverglass Thickness and Dose Depth are treated as subtypes of Equipment Property (EQP#)



SEIM Relationships

Note that only parts of the Product break-down structure is in scope for Concurrent Design in the CDF IDM (and thus not all parts of the break-down structure has been included in SERDL Iteration 3)

Mapping