UIC Asset Management
Global Conference 2015

How to organize data on assets to feed the different phases to the process and tool

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Putting your assets on the right track

The AM of a railway network: an integrated system

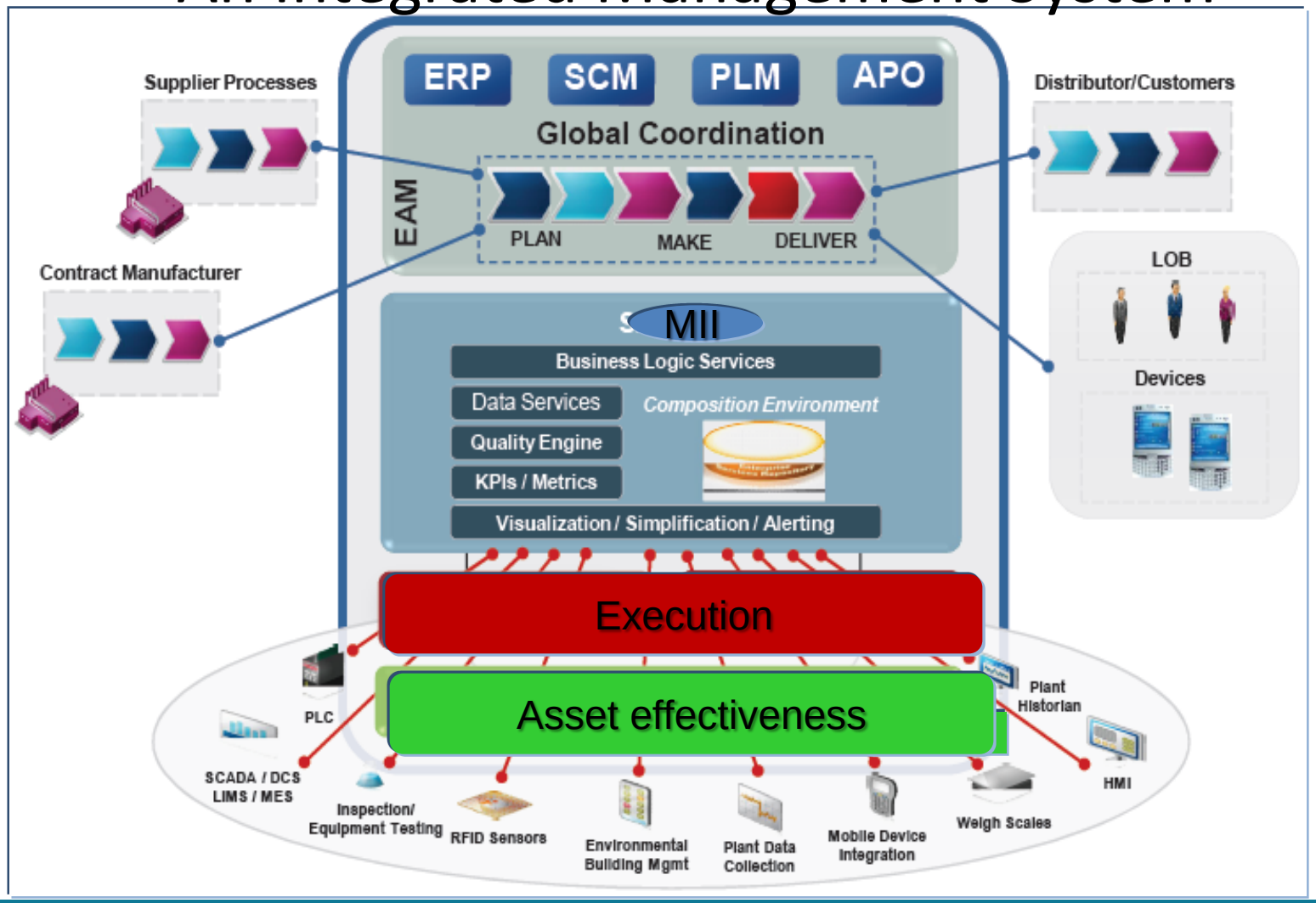
Assets Management includes all the systems, methods, processes and tools to optimize costs, performance and risks during the whole life cycle of railway infrastructure.

The goal is to achieve the best value for money, such optimizations should cover all infrastructure activities (construction, maintenance and renewal, including construction machines, machines and materials) for the life cycle.

Requirements:

- **to know what are the requirements of the parties concerned regarding maintainability, availability and reliability.** In order to specify the realistic requirements, assets performance are determined in terms of Key Performance Indicators, trend analysis, etc.; moreover, adequate maintenance systems should be realized and maintained to manage all the activities;
- **the asset Manager must be able to perform risk analysis for maintenance planning;**
- **must be established a method of maintenance management** that takes into account the different aspects of cost / risk / revenue, in the different scenarios considered, taking into consideration the maintenance activities, the frequencies of maintenance, inspection frequencies, etc…

An Integrated Management System



Overview

A railways infrastructure manager company has to manage a high number of objects and resources in different areas (technological, mechanical, electrical, structures, human resources, machines) optimizing the company goals in the most profitable and sustainable level possible; this implies a systemic approach that in RFI led to:

- integration of processes and tools in order to feed the practices that preserve and increase asset value.

……. therefore requests that the infrastructure manager so to understand how it can practically integrate processes……

…….how do I get an integration between the different processes …..?

……. how do I get a single view of the infrastructure to handle ….?

A good common railways objects data model that ensures data internal consistency and reliability.

……”An asset that is not in the database does not exist“……..

the basis for the integration of all processes is a common data base for the whole company

Our primary objective is to develop a unique database containing all asset data concerning all business processes in such a way that the data are useful for all processes. All the tools that I developed have realized a modular system that integrated a variety of tools with maximum coverage of all assets and processes

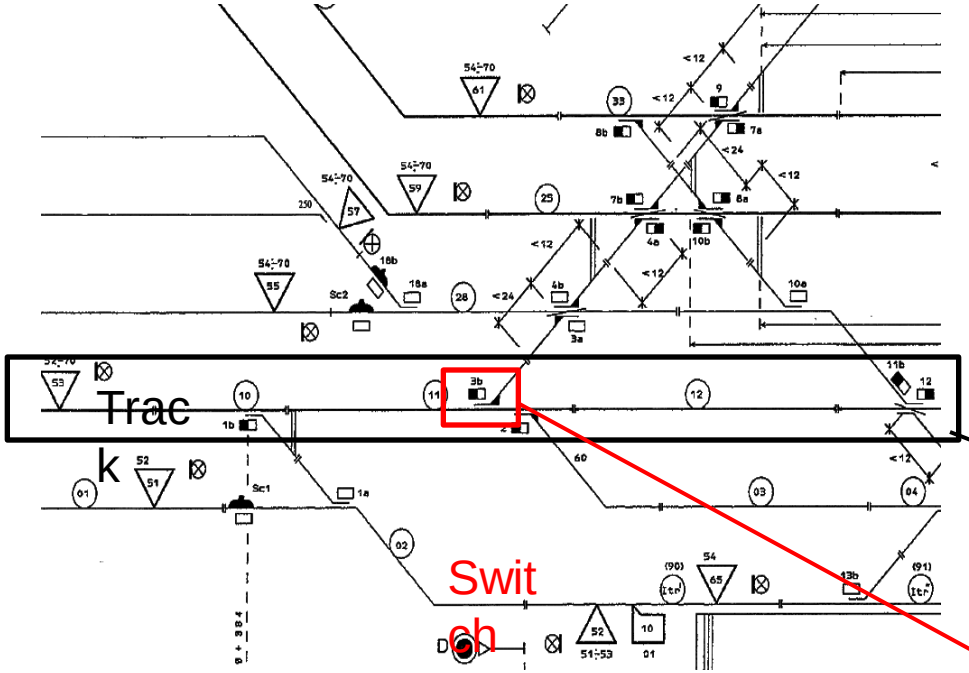
……how do I build a good database of objects of the infrastructure……?

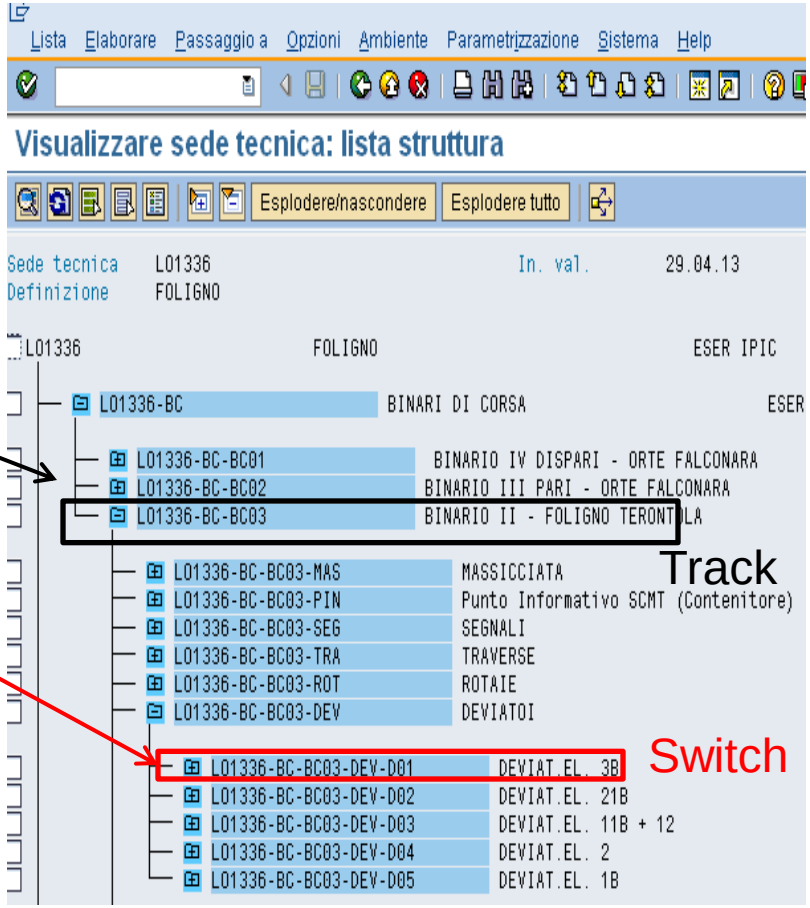
….. I cannot upset everything every time that change the organization, or introduction new objects, or introduce new tools, or change something …..

……. how do you answer to the different views in society (business, technical, functional)……?

A good data model is required to put the objects and their characteristics in their mutual dependencies and relationships and make them accessible at the right level and for the right purposes.

Data base organization



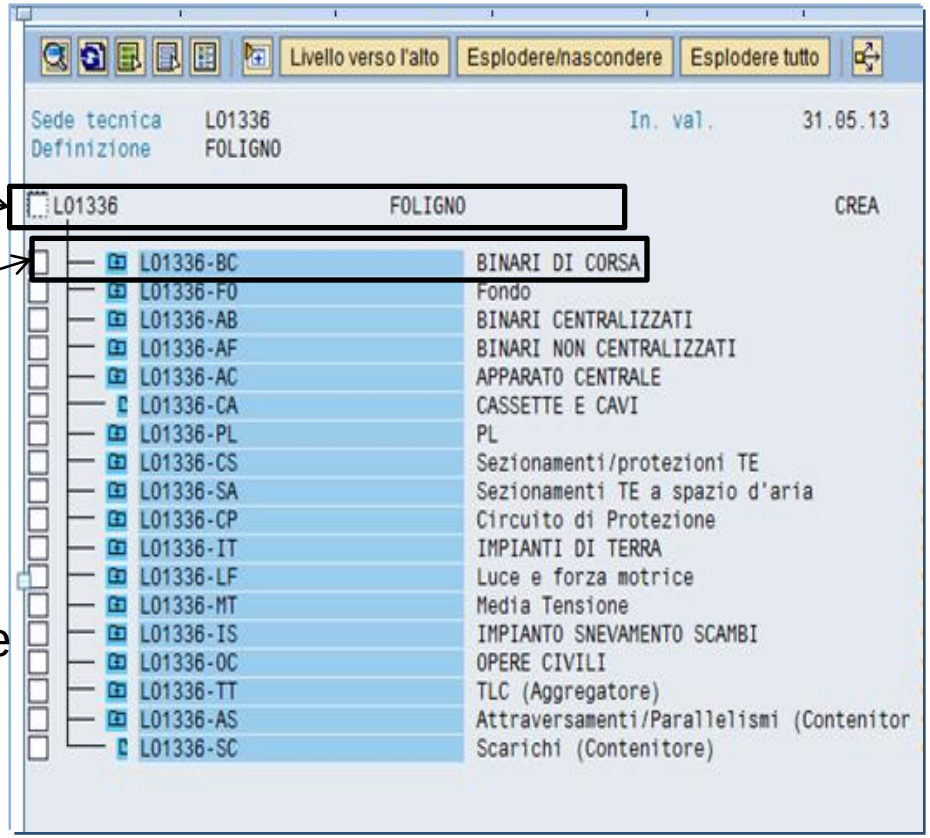


To locate correctly objects in the model taking in account their hierarchy and mutual dependencies is necessary a good functional location code, able to ensure flexibility in case of organizational changes

Objects and their representation

1th Level : station

2nd level: Group of tracks in station



Functional Location code

Every object should be represented into the system by an <u>univocal</u> code; The functional location code should be a speaking code giving information about

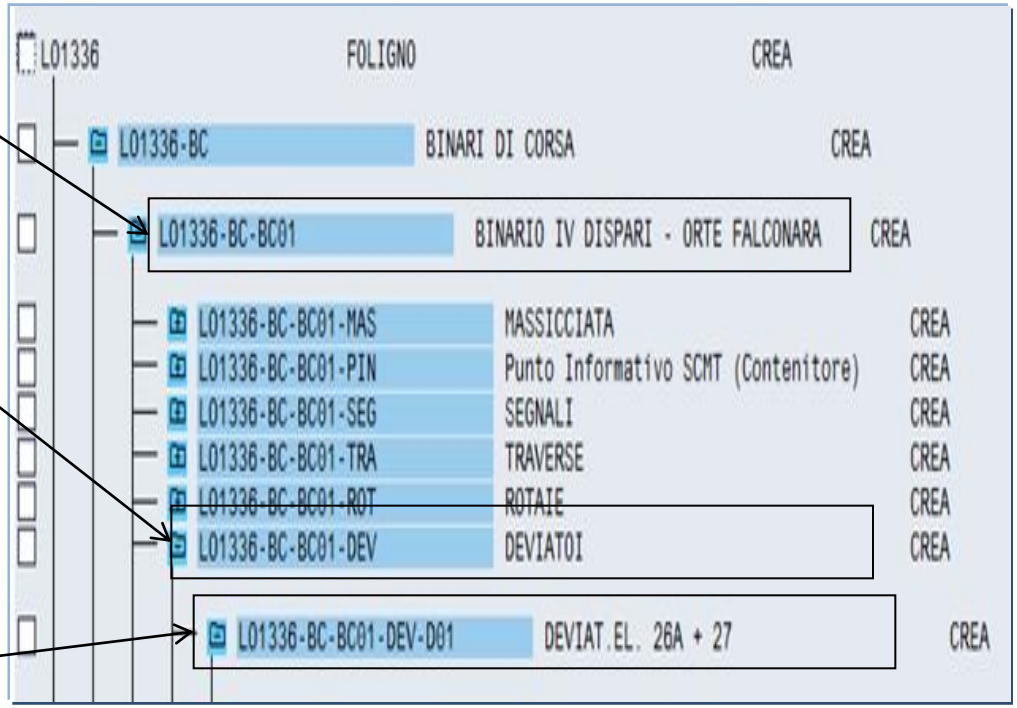
The hierarchycal level of the object

Objects and their representation

3th level :
The first odd running track in Foligno station

4th level:
Group of switch under the first odd running track in Foligno station

5th level:
First switch under the first odd running track
in Foligno station



Basic Data

Functional Location Code

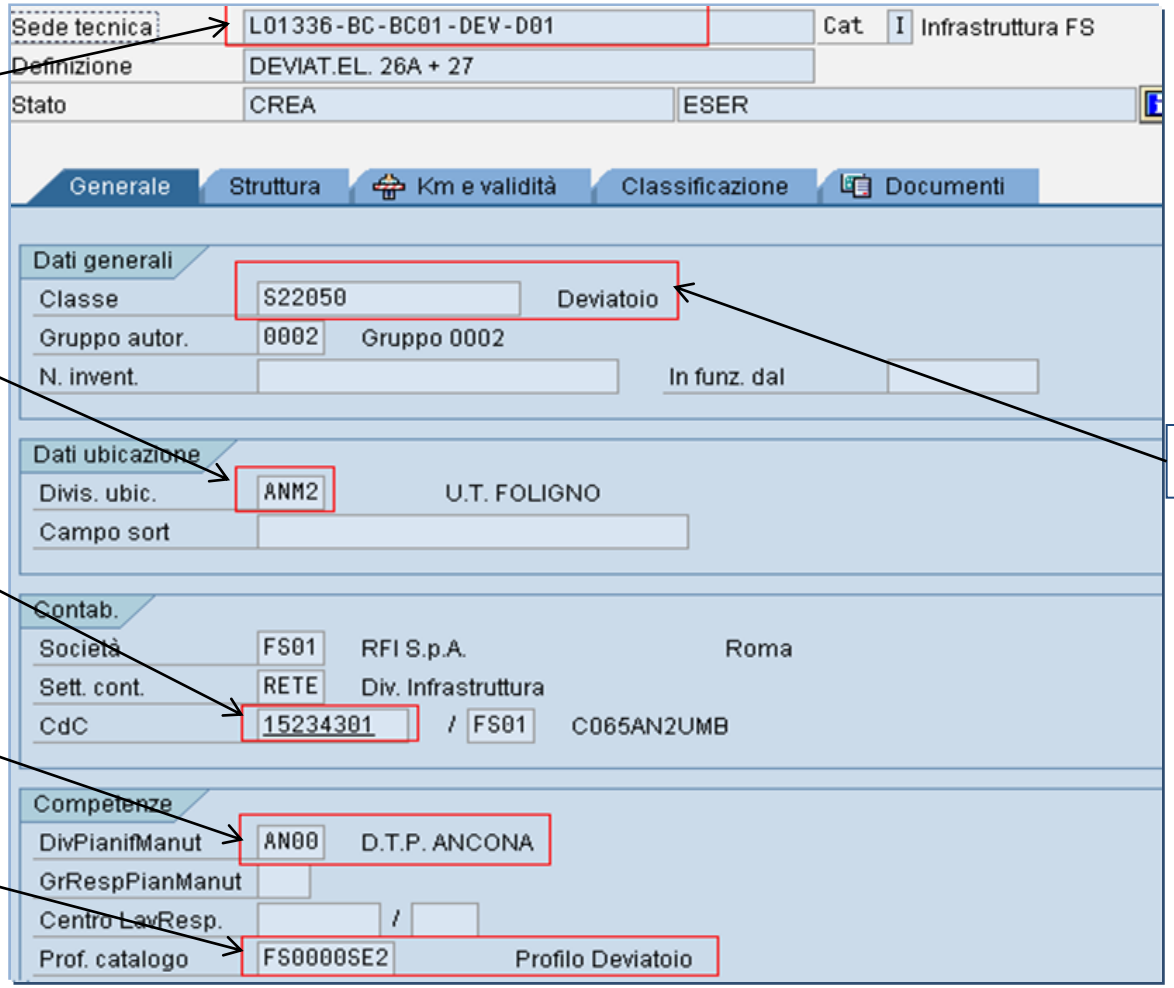
Maintenance Plant Code

Cost Centre

Planning Plant Code

Failure catalogue

Class

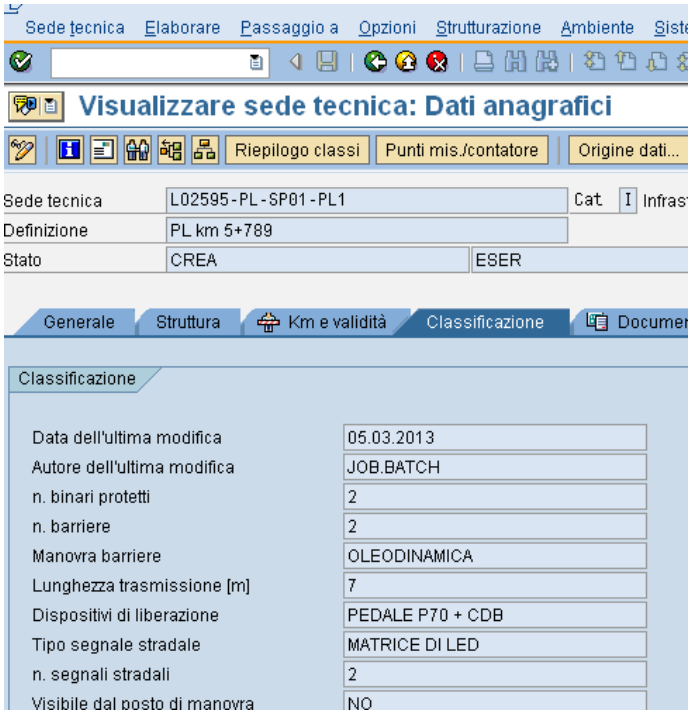


Class and Characteristics

Functional Location class
Class is a homogeneous object family and the technical file of the object.
Every class has its own set of **characteristics (technical information fields)**
Every object is related at least to a class, so Every objects is related to the characteristics of the class it belongs to

Values inside characteristics vary from object to object

Characteristics may have mutual dependencies and some Characteristic values could be calculated starting from others.



In the example it's possible to see some technical characteristics of a level crossing (number of tracks, type of level crossing, type of Signals and so on).

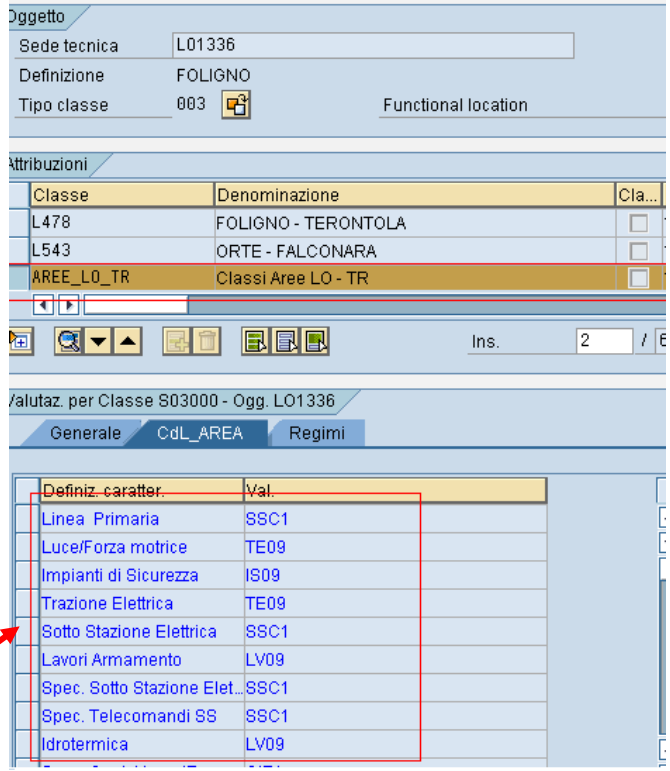
Centre Class: Working centres

The concept of class is very flexible; it may be used also in order to create a map of the working centres that, for each specialization, do maintenance on that object.

This ensure the best flexibility in case of change of organizational configuration

This is very important in the authomatization of work orders creation too. A job will put into them the right working centre, taking the information from here.

In the example it is possibile to see a special work centre class whose characteristics are the specializations e their values are the working centres



…….from organization to the utilitation…..

If every object associate the diagnostic data and fault, I can then feed the various systems that support us in different analysis:

1. To plan in the medium-long time, program in a short time in an optimized maintenance operations;

1. Optimizing maintenance policies with failure analysis and a review of the risks associated with individual objects.

…….other questions that the manager makes are inherent to the process of analysis of the myriad of data with the need to correlate with each other …

"... The analysis of data that do not lead to action are ends in themselves ...“

"... I have a sophisticated system of monitoring, but I make the data volume or obtain information? ...“

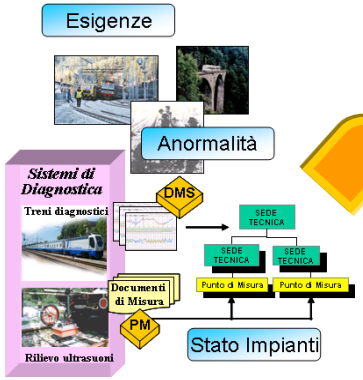
"... How can I drive maintenance with diagnostic data and faults (state of infrastructure) ...?"

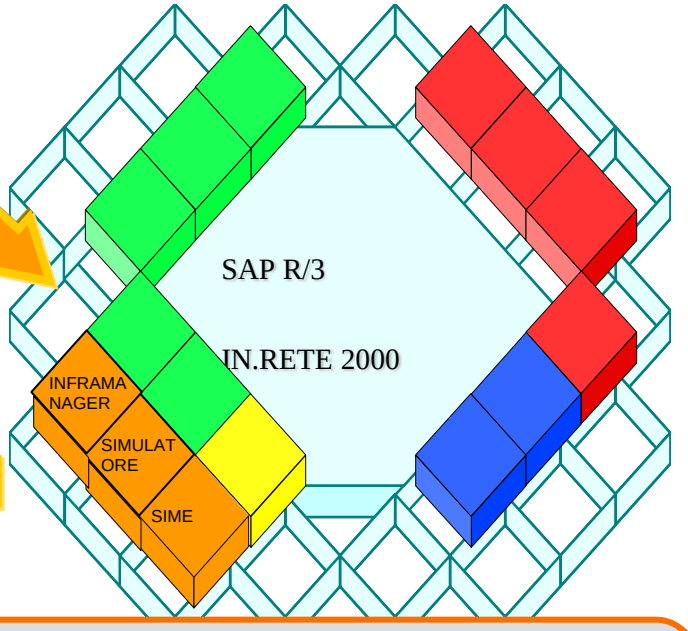
"How do I ... maintenance planning more objective and less subjective….?“

"... And 'possible" codify "the experience of planning and make it available...?"

Planning and Programming: Inframanager

Inframanager





Advanced tool of analysis of the Data and it turns them into useful Information to the activity of the Planner:

- It individualizes and proposes the correct activities
- It individualizes and proposes the priorities
- It optimizes the interventions rationalizing the resources

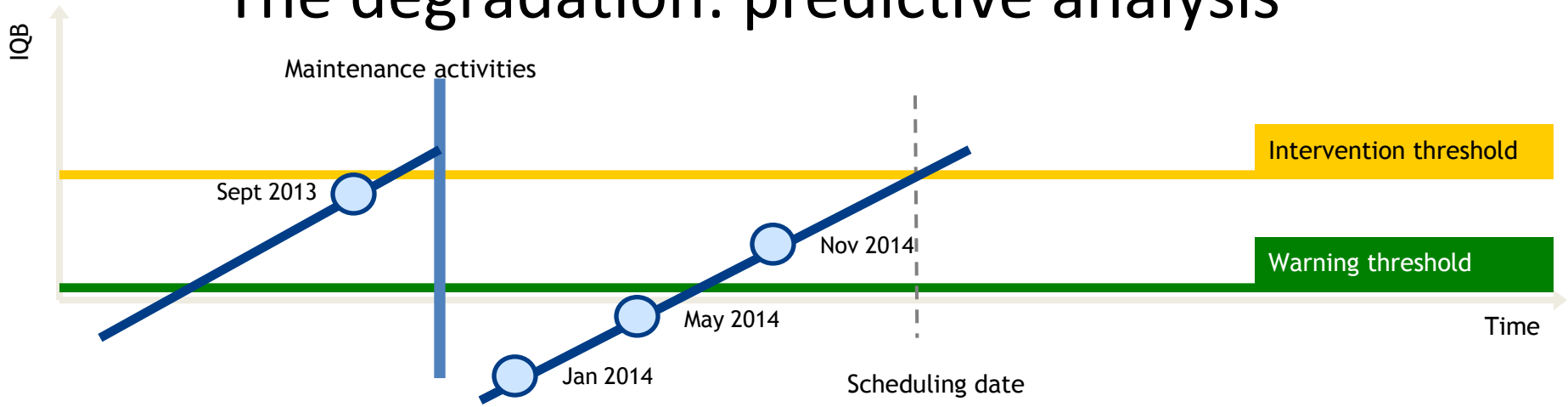
Through algorithms, elaborated from the experts and in tuning with the technical legislation, that they keep in mind of all the fundamental technical parameters,

The tool activates an efficient and effective maintenance

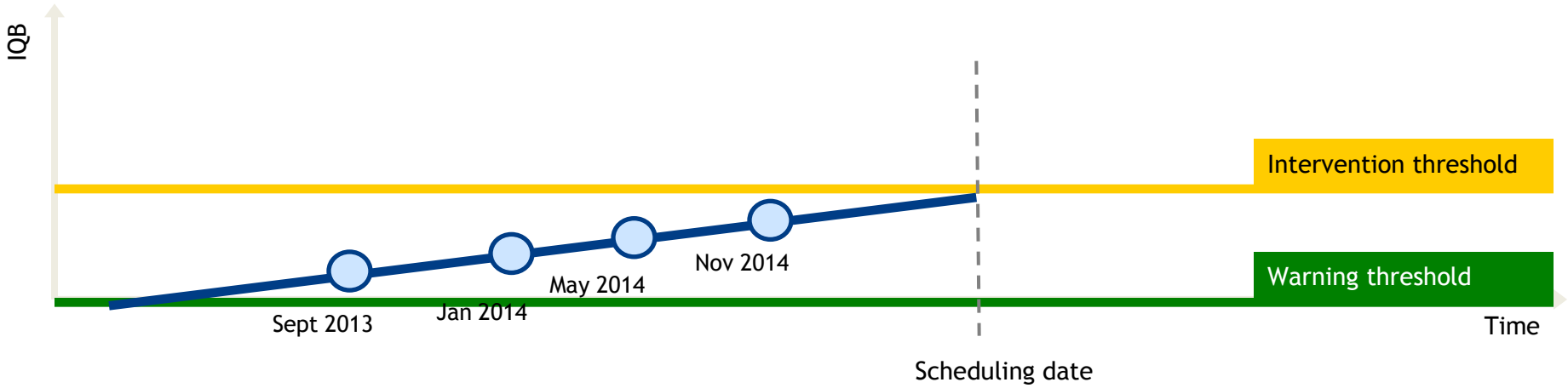
rules → The policy of maintenance

The degradation: predictive analysis

TRACK 1

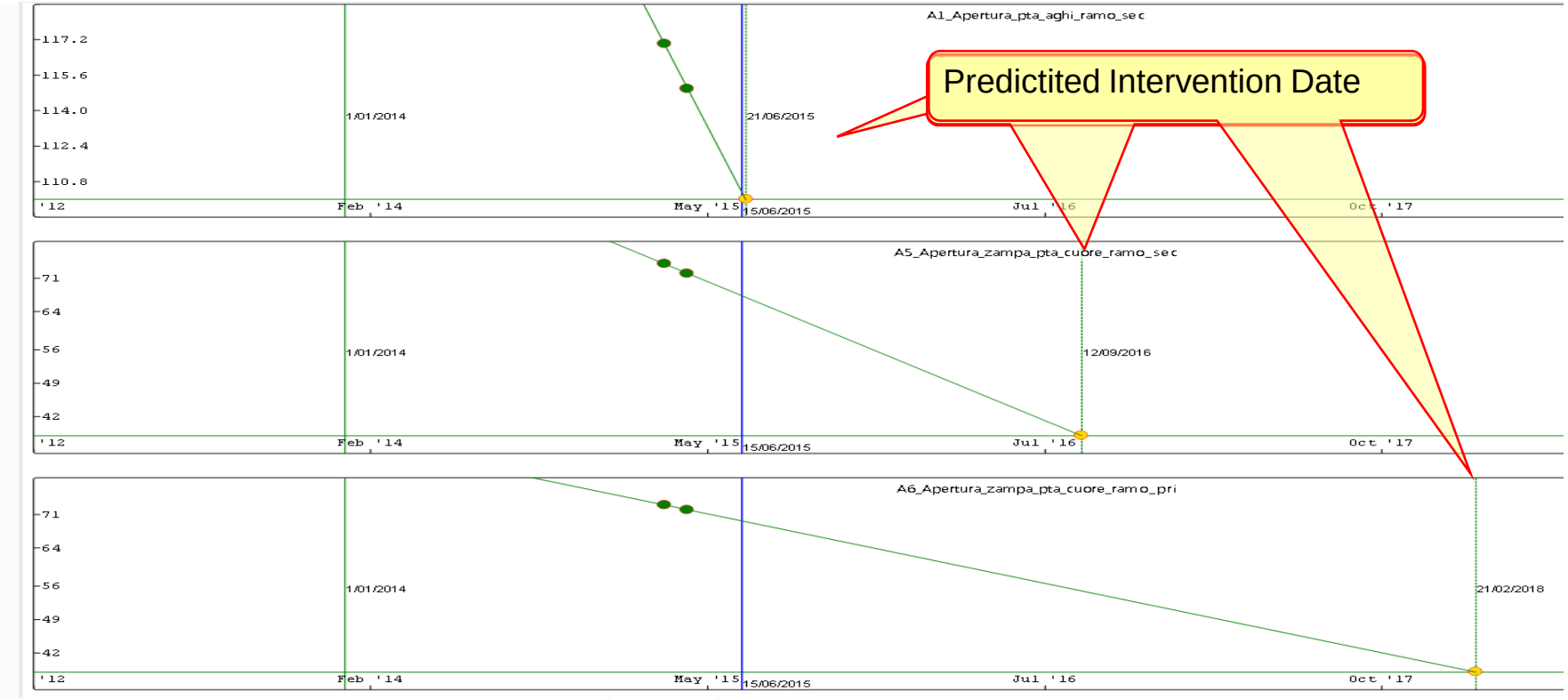


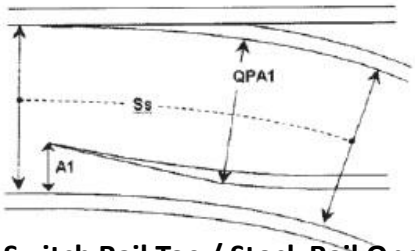
TRACK 2



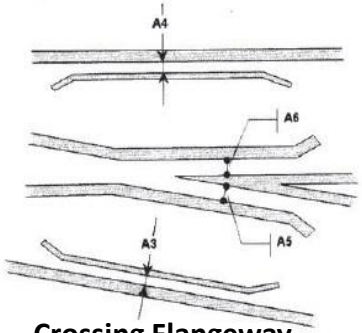
TRACK 2

InfraSwitch: Trending Switches & Crossings Parameters





Switch Rail Toe / Stock Rail Open Throw



Crossing Flangeway

Maintenance Risk: Failure's Catalogue

These catalogues are used in case of failure and, for a given object class, supply information about all the possibile object parts, problem codes,failure causes.

These information, together with train delay information and suppresed trains, enrich and feed failure notifications.

That is the basis of every reliability analysis

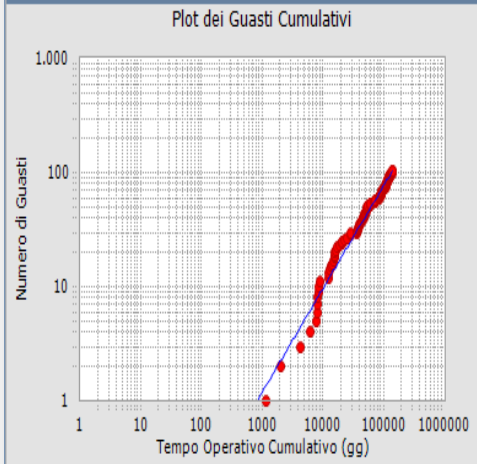
Avviso	Testo cd.parte ogg.	Testo gruppo codici parte oggetto	Testo cd. causa	Testo gr. codici probl.	Testo gruppo cd. causa
10510122	Lampada a filamento	Relè Schermo	Utilizzo - Invecchiamento	Modi guasto elettrici	Intrinseche non rilevabili in manut.
10510123	Unità H.Disk	C.T.A. di tipo elettronico OFFICE 1000	Utilizzo-Invecchiamento	Modi guasto meccanici	Intrinseche non rilevabili
10510125	Filo di tallonamento	Barriera	Urti e danneggiamenti improwisi	Modi guasto elettrici	Altre non rilev in manut improwise
10510126	Saldatura alluminotermica	Saldatura	Variazione Termica eccezionale	Modi guasto meccanici	Altre non rilev in manut improwise
10510127	Lampada alogena	Relè Schermo	Utilizzo - Invecchiamento	Modi guasto elettrici	Intrinseche non rilevabili in manut.
10510128	Pertinenze	Pertinenze			
10510129	Nessuna	Nessuna			
10510130	Nessuno	Nessuno	Ingombro da veicoli	Modi guasto generali	Avaria senza guasto

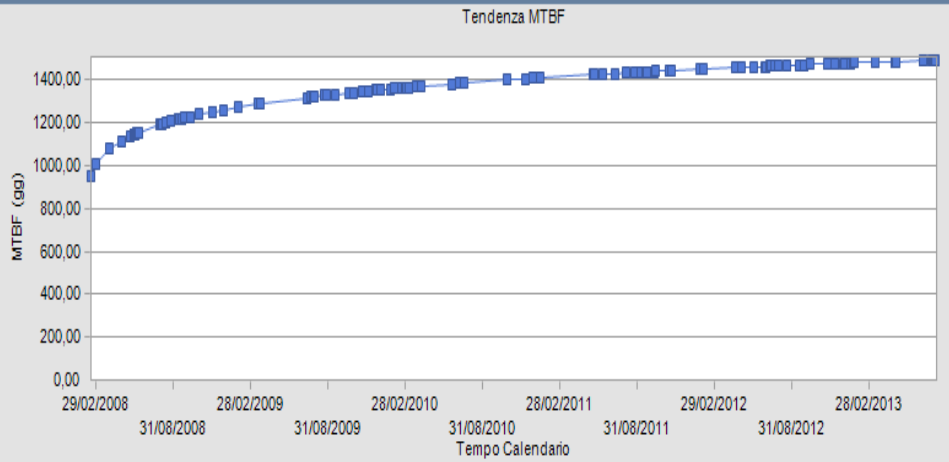
Reliability Analytics: Growth Analysis

Also on the selected family, let's make an analysis of the trend growth to get to know the family in recent years:

Periodo Analisi: Il tempo totale di esecuzione per il periodo tra 31/01/2008 15:30:00 e 04/08/2013 13:00:08 è 140829,61 gg. Un totale di 104 guasti è stato osservato in una popolazione di 70 asset. Durante quel periodo, il MTBF è aumentato da 953,34 a 1494,20. L'ultimo guasto è stato osservato su 04/08/2013 13:00:08 e il prossimo guasto si verificherà molto probabilmente intorno 25/08/2013.

Template Crescita di Affidabilità





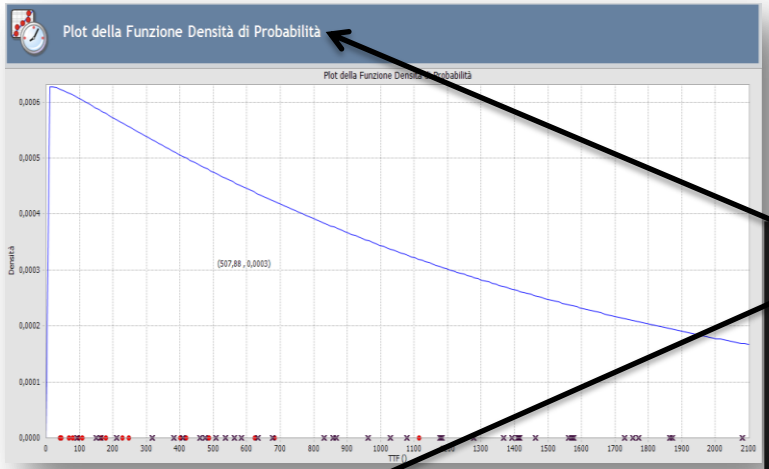
Segment	Data Inizio	Data Fine	Tipo Terminazione	Beta	Lambda	Statistica GOF	Valore Critico	GOF Passato
1	31/01/2008 15:30:00	04/08/2013	Basato sul Guasto	0,906255498967758	0,00224388764444205	0,136590103995156	0,173	☑

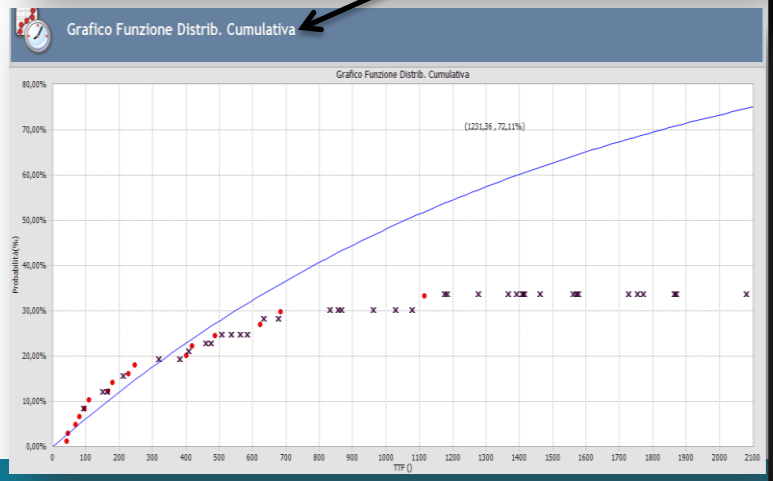
The analysis shows a good **'Goodness of Fit'** and a **β** value close to 1. You may then proceed to the failure mode "bad contact" analysis of distribution (Weibull).

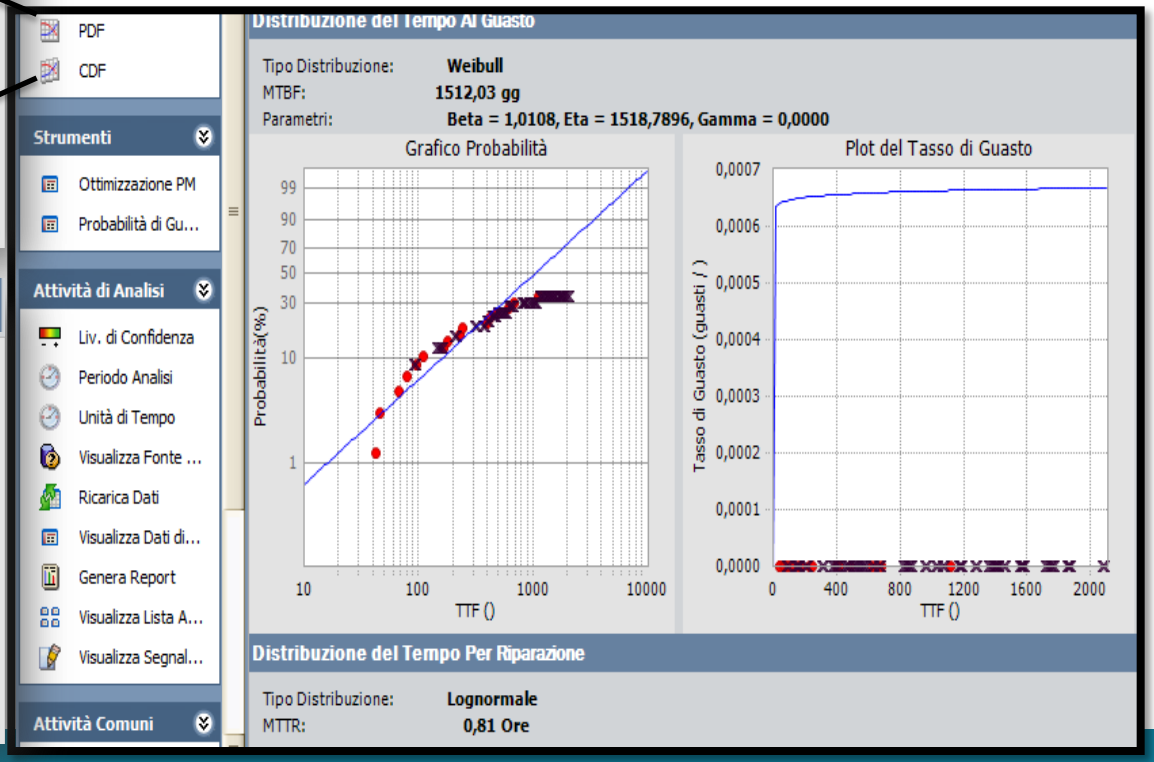
You can make the first evaluations on the effectiveness of maintenance policies, noting that their application has given a trend led to an increasing MTBF equal final at 1494 days. (This value should be compared with respect to the target value)

Reliability Analytics: Reliability distribution analysis

Distribution Analysis: - Family of objects useful life
- MTBF= 1512 days







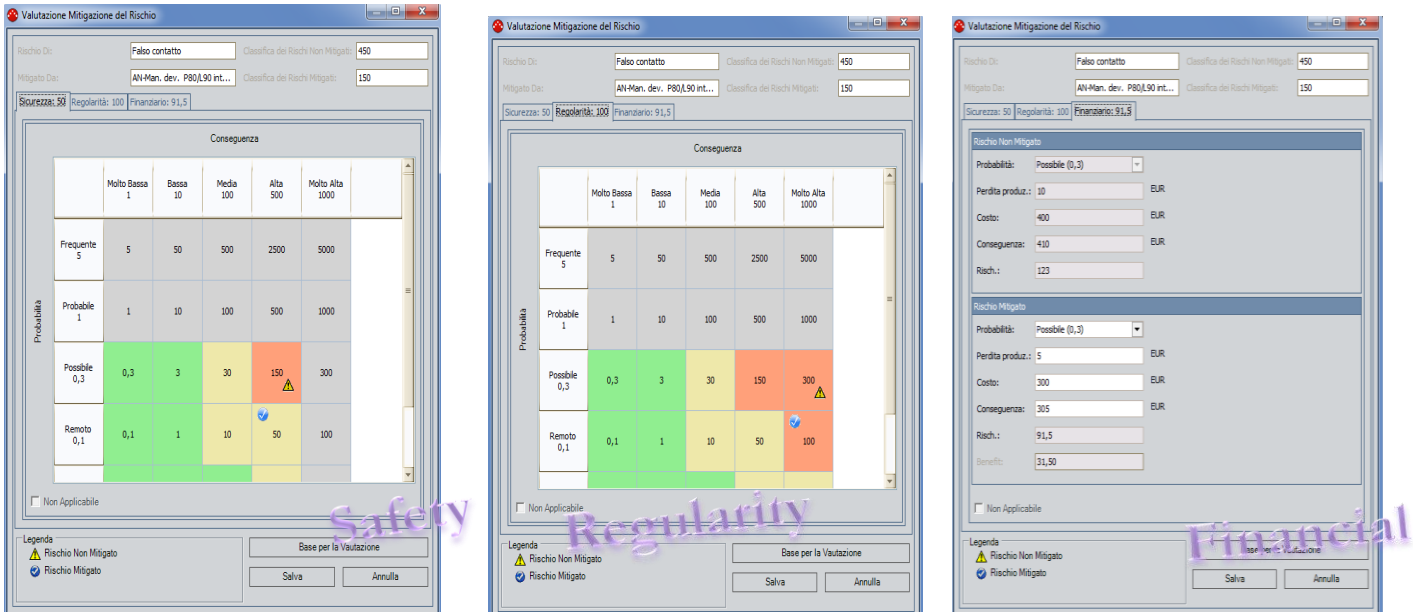
Asset Strategy Management (ASM)

*3. Definition of levels of mitigated risk by each **maintenance activity** for each failure mode.*

The last step will be the allocation for each asset maintenance standards in use, the level of risk mitigated, then measuring the impact that each activity has on the specific standard critical failure mode according to the category of risk considered.

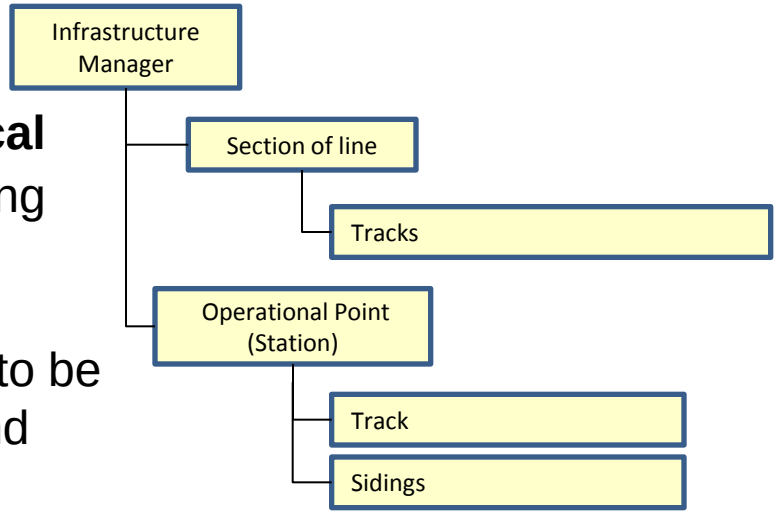
Finally, once defined the mitigating actions, the next steps will focus on the definition of mitigated risk by a similar procedure to that mentioned above in the unmitigated risk level definition.

e.g. Subsequently be assessed maintenance activities (tasks) mitigating the risk **'bad contact',** indicating, for each task and for the views, the level of impact and risk mitigation in respect of:



RINF: Register of infrastructure

Due to UE Decision 2014/880/EU Member States must develop an infrastructure Register.



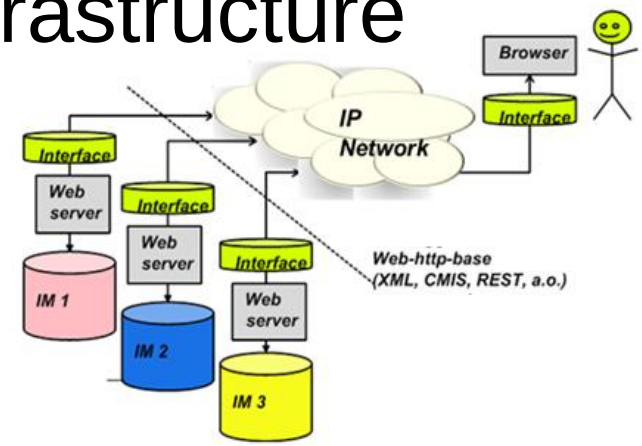
The primary purpose of RINF is to **support technical compatibility** between fixed installations and rolling stock within the European community.

For that purpose the railway network is considered to be at the **macro-level** a series of operational points and sections of line.

At the **micro-level**, subsystem features are assigned to infrastructure elements, such as tracks and sidings. Ultimately macro- and micro-level should be presented in terms of digital maps.

RINF: Register of infrastructure

Member States will ensure RINF publication in xml format, and therefore information will be arranged at the highest level per Member State. A **common interface** for digital data should ensure a common output accessible for users across the European community.

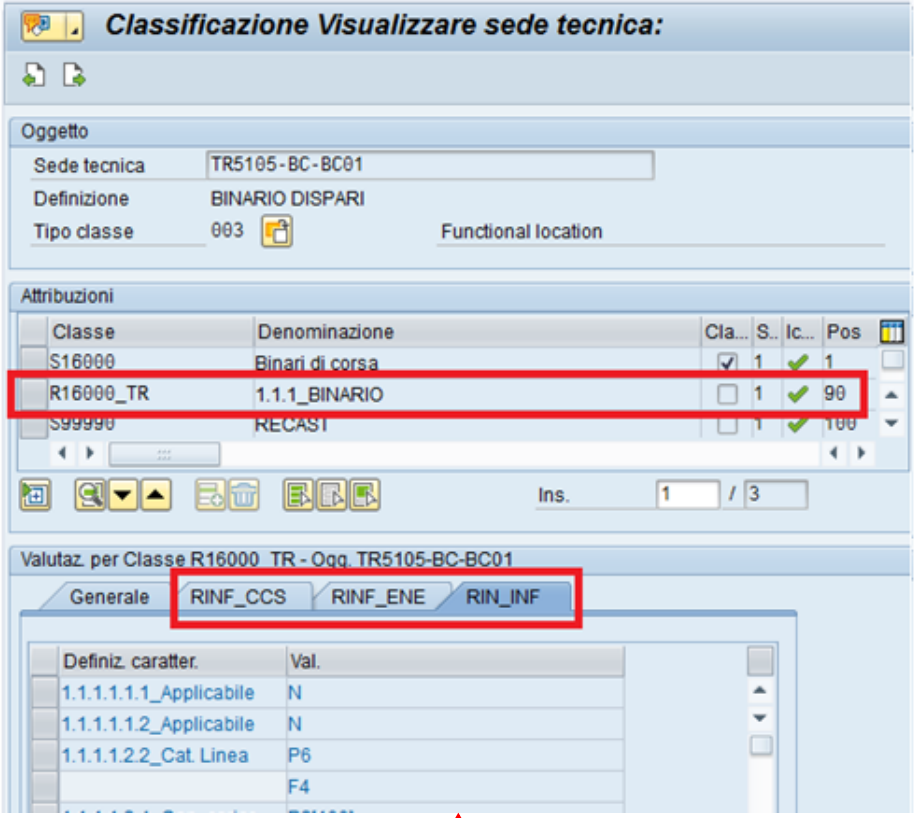


Member State must provide information related to 171 items Those items come from Technical Specifications for Interoperability (STI)

This common specifications are going more and more in the direction of linear asset management data, in example they foresee the use of the location points, that is point along the line (at track level) where some attributes changes (CE declaration of verification for tunnels, energy, ccs, infrastructure, for example).

RINF: Register of infrastructure

- New classes were developed for each of the object family involved in RINF
- 107 automatic control rules were devoloped; they are based on European Railways Agency Application Guide and on business and national rules.
- Declaration of verification for tunnels, energy, ccs, infrastructure will be linearized on RFI systems.



In the example it is possibile to see a special RINF class whose characteristics are the items required by the decision