

# *PROSPER*

Procedures for Rolling Stock Procurement with Environmental Requirements

## PROSPER Project Information

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ANNEX: ECO - PROCUREMENT GLOSSARY

## 1 Executive Summary

The UIC project PROSPER aims at harmonised environmental requirements for the procurement of new rolling stock amongst European railways. The project started in January 2002 and will end in June 2003. PROSPER is funded by UIC Technical and Research Commission.

The results of the project will be

- a guideline to assist in setting up environmental requirements and evaluating tenders
- a set of recommended qualitative environmental specifications (without defining performance values)
- a reference document for experience, examples and state of the art of environmental relations and their economic cost/benefit aspects

The outcome will be compiled as a *UIC Environmental Guideline for the Procurement of new Rolling Stock* which serves all steps in the procurement process where environmental aspects have to be considered to enhance the environmental performance.

PROSPER will together with the EU funded REPID project and the network being built on this meeting in Paris constitute the basis for a better environmental performance of rolling stock.

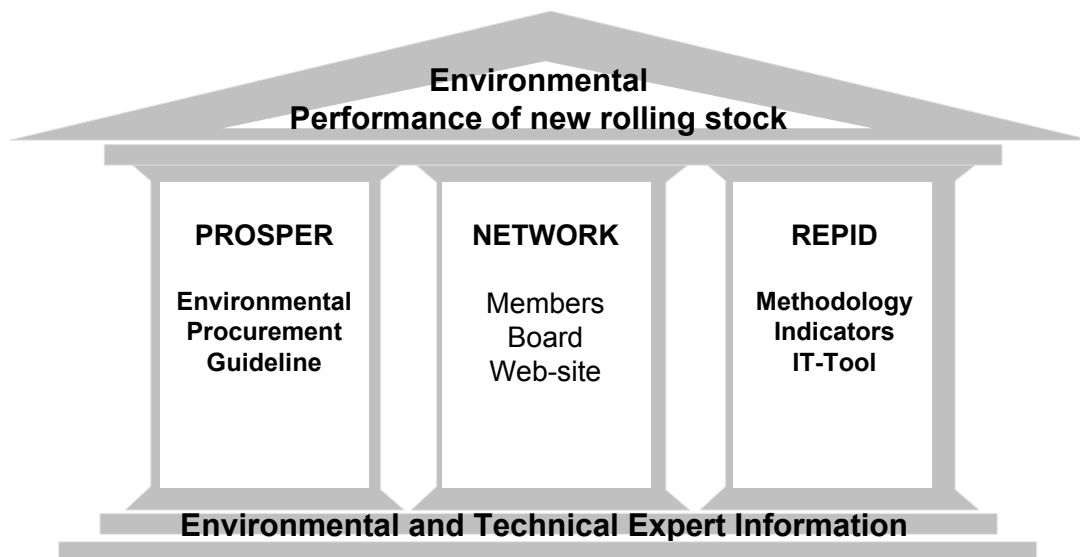


Figure 1: The house of Eco-Procurement

## 2 Introduction

The environmental performance of transport has come to increasing interest of public discussion in the last two decades. Railway transport is still one of the most environmentally sound modes of transport. To keep this position and further enhance environmental performance as a competition factor towards other modes of transport railways have already done a serious effort so far and will bring this topic forward in the future. With the Strategic Rail Research Agenda 2020, submitted by the European Rail Research Advisory Council (ERRAC), railway industry has defined priorities of research activities up to the year 2020 – environment is one of them.

In this context the PROSPER project was approved by UIC Technical and Research Commission (CTR). PROSPER is the acronym for “**P**rocedures for **R**olling **S**tock **P**rocurement with **E**nvironmental **R**equirements” and addresses environmental requirements in the procurement process of new rolling stock.

The PROSPER project started in February 2002 and has as objectives to

- harmonise environmental requirements for the procurement of new rolling stock amongst European railways
- assist in setting up environmental specifications and assessing tenders in the tendering phase for the procurement of rolling stock.

The outcome of the project will be an *UIC Environmental Guideline for the Procurement of new Rolling Stock* including a set of recommended environmental specifications.

In view of that, the main tasks for the project team are

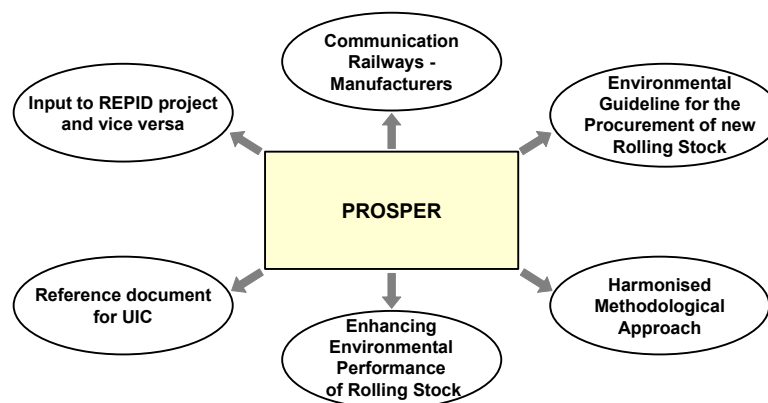
- to analyse the degree of integration of environmental aspects into the procurement process at railways
- to co-ordinate a set of qualitative environmental specifications to be used in invitations to tender (in PROSPER no performance values will be defined)
- to co-ordinate a harmonised methodological approach how to set up environmental requirements and evaluate tenders (here PROSPER co-operates very closely with the EU funded REPID project) and
- to give an overview of the cost/ benefit relation of enhancing environmental performance of rolling stock in order to apply the methodology also in a cost efficient way

In addition to these efforts another main objective of the project is to improve the dialogue between railways and manufacturers to obtain a common “environmental language”. Given that close co-ordination with manufacturers is a distinct success factor for the project, an international workshop with experts both from manufacturers and railways was held in November 2002 in order to obtain further comments and opinions of different players in the procurement process.

Starting points for PROSPER were, as many would know, the Nordic Environmental Manual adopted by the Nordic Railways in 1999 and the EU funded RAVEL project which ended in November 2001. PROSPER definitely benefits from these projects as they are milestones on the way to an integrated and life cycle oriented approach to a better environmental performance of railway rolling stock. The final result of PROSPER will be the *UIC Environmental Guideline for the Procurement of new Rolling Stock* – a reference document for experience, examples and state of the art of environmental relations and their economic cost/benefit aspects. The overall impact of PROSPER is shown in the following figure.

The approach of PROSPER during the project duration of 16 months has been to

1. identify the most relevant environmental aspects
2. co-ordinate a set of environmental specifications for the procurement of rolling stock
  - list of harmonised environmental specifications
  - use of environmental performance indicators
3. work together with the EU funded REPID project
4. evaluate the qualitative economic aspects of enhancing environmental performance
5. recommend a proceeding for the integration of environmental aspects into the procurement process and
6. elaborate the *UIC Environmental Guideline for the Procurement of new Rolling Stock*



**Figure 2: Overall impact of the PROSPER project**

Further main tasks of PROSPER until project end in June 2003 are

- to finalise the investigation on economic aspects and
- to elaborate the *UIC Environmental Guideline for the Procurement of new Rolling Stock* (including the list of recommended environmental specifications)

### 3 Environmental key areas and list of environmental specifications

The most relevant environmental areas for railways at the moment are Noise and Exhaust Emissions as legislation has come into force (e.g. TSI, national laws) or further regulations are in discussion in these two environmental fields.

In the case of energy consumption railway transport has very clear advantages compared to other modes of transport. Nevertheless competitors are making many efforts to reduce energy consumption as well. In view of that, Energy Efficiency also has priority for railways due to fact that cutting energy consumption

- strengthens the competitive position of railways against other modes of transport
- helps to cut Life Cycle Costs of railway operation and
- serves international agreements on climate protection, such as the Kyoto Protocol

The environmental aspect of Materials/ Recycling and Waste also gained priority over the last decade. Since the concept of an integrated product policy (IPP) is becoming more and more relevant in the EU, resource consumption and the ability of re-integration of materials into the material cycle appeared on the agenda. The meaning for railways is to improve especially the knowledge about forbidden and restricted materials used in the vehicles to prevent hazardous waste and to improve recyclability of vehicles to cut resource consumption.

An upcoming environmental aspect that is being intensively discussed in several European countries is Electromagnetic Fields. Even though there is no scientific evidence that electromagnetic fields from railway lines and the rolling stock have impact on human health, the PROSPER project decided to integrate this issue into the project to serve the precautionary principle. A UIC study has been approved to further investigate the impact of electromagnetic fields on human health.

The following list with proposed environmental specifications for use in invitation to tenders is a result of discussions and priority setting in the project team and feedback on the PROSPER Workshop held on November 12<sup>th</sup> 2002 in Berlin. The list comprises altogether 39 environmental specifications that can be considered in invitation to tenders for the procurement of new rolling stock.

**Table 1: Proposed Environmental Specifications in invitation to tenders**

No.	Environmental Specifications
<b>General requirements</b>	
1	The manufacturer ensures that at the moment of procurement the applicable legislation (national/European/international) with respect to the environment has been observed
<b>Energy Efficiency</b>	
2	Defined value for traction section efficiency
3	Limit/target values for vehicle mass
4	Limit values for k-value (standstill/max. speed), specified for different areas of the vehicle
5	Limit values for average diesel consumption referring to EN ISO 8178-4, F-cycle (test bench)
6	Energy management / control system for comfort functions at longer standstills
7	Energy meter / diesel flow meter for permanent information of the driver
8	Equipment of the train with energy recovery / storage
9	Specification of on board energy consumption by manufacturer for defined conditions
10	Calculation of traction energy consumption by manufacturer for specified route
<b>Noise Emissions</b>	
11	Limit values for passing by noise (according to applicable legislation, e.g. TSI)
12	Limit values for accelerating noise from standstill
13	Limit values for braking noise
14	Limit values for stationary noise with all equipment running (e.g. Diesel engine, compressors, ventilators)
15	All noise measurements shall be carried out according to prEN ISO 3095

<b>Exhaust Emissions</b>	
16	Limit values for NOx, CO, HC, PM –emissions (according to UIC Leaflets 623-2 / 624)
17	Emission limit values for diesel mechanical engines < 560kW according to EURO III - IV
18	Lower emission limit values (e.g. for special applications)
19	Requirements for emissions from heating equipment (according to national laws)
20	Integrate measures to reduce the necessity of running engines at standstills (e.g. integration of separate on board energy supply or connection to external electrical supply)
21	Diesel-engine with the possibility to use fuels with low sulphur contents, options for the use of biological fuels
22	Emission factors for NOx, CO, HC, PM for different load conditions (at least referring to EN ISO 8178-4, F-cycle, test bench)
23	It should be possible to choose between two modes of train operation: a “clean” one (low Nox, higher fuel consumption) and a more efficient one
<b>Emissions to Soil and other Emissions</b>	
24	Measures to prevent shedding oil, grease, coolant, and other substances
25	Limit/ target values for dripping losses of locomotives
26	The manufacturer verifies that emissions from brake pads are not harmful to health
<b>Materials / Recycling / Waste</b>	
27	Provision of a list with prohibited materials used in construction (black list) with defined weights/ratios (also exclusions of certain substances)
28	Provision of a list with restricted materials used in construction (grey list) with defined weights/ratios
29	Defined value for material recycling rate after use
30	Defined value for use of recycled materials (in manufacturing process)
31	Defined value for use of renewable materials
32	Verification of no toxic emissions in case of fire (passenger transport only)
33	Waste concept for passengers wastes (separation into different fractions)
34	Provision of a manual for recycling/ scrap manual (passenger transport only)
35	Construction to recycling (e.g. according to VDI 2243, modular construction for easy maintenance and low waste) should be followed
<b>Electromagnetic Fields</b>	
36	The installation parts have to be constructed so that no railway nor other systems are disturbed. The installation parts have to be protected against influences of railway or other systems.
37	The ICNIRP limit values have to be fulfilled at all locations where people, also just for short time, can stay.
38	Electromagnetic compatibility to pace makers has to be assured (DIN VDE 0848-3-1)
39	Measurements to prove the compliance with the limit values should be done while high train service in an accelerated train in the passenger rooms near critical radiating elements at floor until 1.8 meter above floor and at walls.

## 4 Integration of environmental aspects in the procurement process

During the analysis of the current situation for the procurement of rolling stock it became obvious that a structured approach for the integration of environmental aspects is needed to enhance the environmental performance significantly. The following figure proposes how to implement environmental aspects in the procurement process.

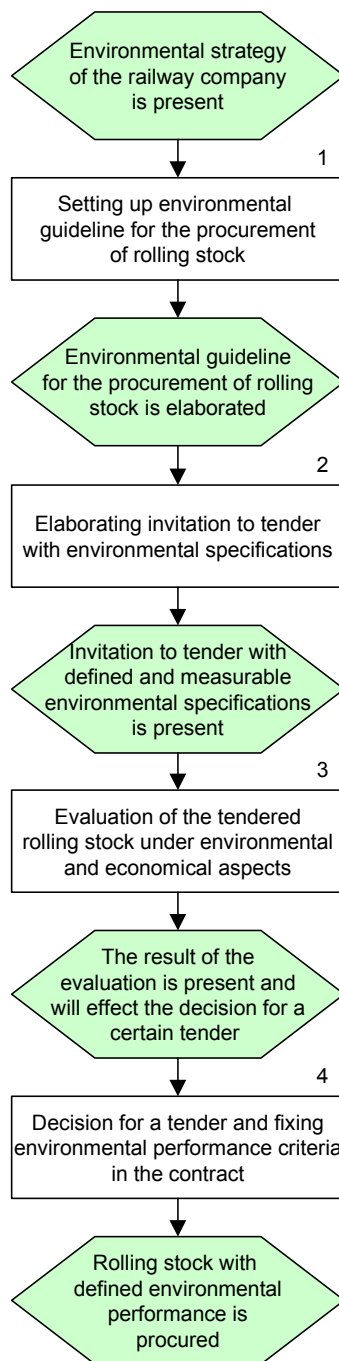


Figure 3: Proceedings for the integration of environmental aspects into the procurement process

### Step 1: Environmental Guideline

In the first step the railway should elaborate an environmental guideline for the procurement of new rolling stock that is directly connected to the environmental strategy of the railway. It should address the core targets of the environmental strategy and which strategic fields of action result for the environmental performance of rolling stock.

In the guideline the proceedings for the elaboration of the invitation to tender and the evaluation of tenders have to be laid down. It should contain:

- Proceedings for the elaboration of environmental specifications (such as use of environmental performance indicators (EPIs))
- Proceedings for the evaluation of tenders (such as prioritisation of EPIs or economical aspects)
- Proceedings for the impact on the decision for a certain tender and implementation of environmental performance criteria in the contract

### Step 2: Invitation to tender

According to the environmental guideline the environmental specifications for the invitation to tender have to be elaborated.

Therefore the environmental specifications of the environmental guideline have to be concretised and adapted to the special procurement project. The environmental specifications have to be

- functional
- measurable
- possible to validate and
- comply with legal aspects and cost efficiency

In order to obtain functional and measurable specifications Environmental Performance Indicators should be used and filled with values for the environmental performance.

Close co-ordination between technical, environmental and purchasing departments is needed for the elaboration of the invitation to tender.

### Step 3: Evaluation of tenders

Before evaluating tenders under environmental aspects the evaluation methodology has to be concretised and adapted to the special procurement project (see also Step 1). The methodology for the evaluation should express

- how will environmental specifications be prioritised
- how will the impact on investment costs and life cycle costs (LCC) be assessed and
- how will the result of the evaluation influence the decision for a certain tender

The evaluation should then again be conducted in close co-ordination of the technical, environmental and purchasing departments. The result of the environmental evaluation should be documented and be part of the decision for a certain tender.

### Step 4: The contract

In the negotiations with the tenderer the defined environmental performance of the offered rolling stock has to be fixed in the contract. In addition milestones for the follow up on environmental performance have to be settled.

## 5 Evaluation of environmental specifications in tenders

The evaluation of environmental aspects in tenders is as important as setting certain environmental specifications in invitation to tenders. A result of the investigation on invitation to tenders was, that it is not sufficient to set up requirements which cannot be evaluated due to lack of measurable indicators. It is necessary to have well defined and agreed indicators how to measure environmental performance.

For the case of noise or diesel emissions the indicators dB (A) and NOx etc. and measuring methods are applicable. But especially for materials and recycling a defined methodology how to apply indicators and how to assess material characteristics was lacking in the past. The EU funded project REPID will provide such methodology by

- defining Eco-efficiency using Environmental Performance Indicators
- standardising material lists and
- developing an IT-Tool for easy application of this methodology

In principle the environmental performance of the respective specifications in the different tenders should be weighted according to company priorities, as this is more appropriate and due to the fact no international accepted impact assessment methodology exists.

### Materials, Recycling and Waste

For the environmental aspect of Materials, Recycling and Waste the REPID project defined EPIs that cover the aspects of

- forbidden and restricted materials
- recycling
- renewable materials
- waste and
- Life Cycle Analysis

In the whole process the EPIs and methodology proposed by REPID should be used for setting up specifications as well as for evaluating tenders. (For more information regarding the REPID project please see the REPID project information document).

### Noise Emissions

Noise emission values can be set for different train categories according to applicable European and, if in force, national legislation for:

- passing by noise
- stationary noise, with all equipment running (e.g. diesel engine, compressors, ventilators)
- accelerating noise from stand still
- braking noise

Noise measurements are done according to the PrEN ISO 3095. This European pre standard specifies the conditions for obtaining reproducible and comparable measurement results of levels and spectra of noise emitted by all kinds of vehicles operating on rails or other types of defined track. For sound level determination and measurement methods reference is made to this standard. If a TSI for the vehicle in question exists or if another measurement procedure is prescribed, then the latter should be used.

The tenderer should be responsible for the execution of the prescribed measurements by an organism recognised by the Railway Company.

### Energy Efficiency

Evaluation of energy consumption of a tendered rolling stock is characterised through a large variety of calculation methods used by railways as well as by manufacturers. The difficulty is that energy consumption not only depends on the train itself but most of all on the operation pattern in service of the train. Indicators for energy efficiency of the train can be e.g.

- Mass (or mass per seat)
- Efficiency of traction section at payload
- K-value for defined areas of the vehicle etc.

But these indicators do not say much about the energy consumption in operation. To be able to evaluate tenders under energy efficiency aspects the railway should require the calculation of energy consumption by the manufacturer for a specified route, with specified speeds and stops and a specified calculation method. After that energy consumption should be assessed by Life Cycle Costs (LCC) to make a decision which tendered train has the best cost/ benefit relation.

This approach helps to tackle the problem for the individual case, but it makes it hard to compare energy consumption with other procured trains. A solution could be to develop

- standard operation cycles which should represent the most common application cases in railway operation and
- a standardised calculation method to make calculation transparent

Whether standardised operation cycles and calculation methods are a solution to assess the energy consumption in operation of a train should be further investigated.

### Exhaust Emissions

The UIC-leaflets 623-2 and 624 prescribe emission values for exhaust emissions from diesel engines for CO, NO<sub>x</sub>, HC and particles. The emissions have to be measured according to EN ISO 8178 on a test bench and refer to the F-cycle. On the basis of these guidelines it is possible to compare emission values from diesel engines of different providers. It is also important to consider, if the measurement was made by an approved institution (e.g. ERRI) If legislation on EU level for exhaust emissions exists in the future, these values and the prescribed method for measurement must be used.

### Electromagnetic Fields

Measurements to prove the compliance with the limit values should be done while high train service in an accelerated train in the passenger rooms near critical radiating elements at floor until 1.8 meter above floor and at walls. For the moment there still does not exist an international standard such as ISO.

The tenderer is responsible for the execution of the prescribed measurements by an organism recognised by the Railway Company.

## 6 Economic aspects

The relation of an enhanced environmental performance of rolling stock and the impact on investment costs and Life Cycle Costs (LCC) is of vital interest for railways. Aim of the efforts to optimise the environmental performance must be to integrate environmental requirements into the procurement process in the most efficient way.

The PROSPER project makes a first step towards a better understanding of the cost relation by investigating the qualitative impact of environmental specifications on costs. Therefore a questionnaire has been submitted to railways and manufacturers to assess qualitatively the impact of the proposed environmental specifications on investment costs and life cycle costs (LCC) for a certain rolling stock. The results of this investigation will be ready at the end of the project and will be used to prioritise the proposed environmental specifications.

## 7 The relation of PROSPER with REPID and other Projects

### REPID

The REPID project will provide a user friendly IT solution for professional application of Environmental Performance Indicators (EPIs) as well as a network framework with a juridical body for managing standardisation of EPIs and data formats within the railway industry. Especially relevant for PROSPER are:

- a set of well defined EPIs which regard all environmental aspects relevant for environmental performance of rolling stock
- well defined and co-ordinated material lists for restricted and forbidden materials that are accepted by railway industry

REPID will provide the methodology and the IT-Tool that can be applied to require the environmental specifications recommended by the PROSPER project.

Since the start of REPID in June 2002 there have been several team meetings where especially the proposed EPIs have been discussed and co-ordinated between the two projects. Further co-ordination will be done in the next months especially for the IT-Solution and user requirements from railways point of view.

### Nordic Environmental Manual

The Nordic Environmental Manual is one of the bases for the PROSPER project. All relevant environmental fields that define the environmental performance of rolling stock are mentioned in the Manual. However, in some cases it was criticised that the manual is not strictly functional but recommends design solutions. The conclusions for the PROSPER project was to define, whenever possible, functional environmental requirements to give the manufacturer the freedom to develop the best design solution.

## 8 Looking ahead – PROSPER phase II

The PROSPER project will finalise its work end of May 2003 leaving some of the environmental and procurement aspects not investigated. To solve this, a two-year follow-up project PROSPER II has been approved by UIC in autumn last year.

Starting point for PROSPER II is the PROSPER project as well as the EU-funded project REPID. Project start will be in June 2003. The results of PROSPER and REPID will provide a co-ordinated methodology how to handle environmental requirements in the procurement process of railway rolling stock. What is still missing then is a common understanding amongst railways and manufacturers about the values for environmental performance of new rolling stock.

### Objectives of PROSPER II are

- Co-ordinating agreed minimum values for the environmental performance of rolling stock amongst railways and manufacturers
- Documenting environment related legal aspects for the procurement of new rolling stock (state of the art) and
- Disseminating the results made in PROSPER and PROSPER II and REPID as a UIC Technical Leaflet.

The projects PROSPER and PROSPER II will provide together with the EU funded REPID project the agreement on environmental requirements and the methodology to enhance the whole process of rolling stock procurement regarding environmental performance. This will benefit both railways and manufacturers to face the challenges of the future for railway transport.

### The expected results of PROSPER II are:

1. Recommended values for the environmental performance of new rolling stock.
2. Documentation of environment related legal aspects concerning procurement of new rolling stock.
3. UIC Technical Leaflet "*Environmental Guideline for the Procurement of new Rolling Stock*".

### Participants of the project are so far

- SNCF
- NMBS/SNCB
- DSB
- SBB
- Trenitalia SPA
- DB
- UNIFE

### Duration of PROSPER II

Project start: June 2003  
Project end: March 2005

## ANNEX: Eco-Procurement Glossary

**Table 2: Eco-Procurement Glossary**

CO	Carbon Monoxide (exhaust emission from e.g. diesel engines)
CO <sub>2</sub>	Carbon Dioxide (exhaust emission from e.g. diesel engines)
dB(A)	Decibel (A), measuring unit of noise, additional conditions need to be applied like Max or average value, L <sub>DEN</sub> (day, evening, night, etc.)
DFE	Design for Environment
EPI	Environmental Performance Indicator (defined in ISO 14031)
HC	Hydro carbons (exhaust emission from e.g. diesel engines)
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IPP	Integrated Product Policy
ITT	Invitation to Tender
K-value	The scientific value for the insulation ability of a material
LCA	Life Cycle Assessment, environmental assessment of a product or a system
LCC	Life Cycle Costs
NO <sub>x</sub> ,	Nitrogen oxides (exhaust emission from e.g. diesel engines)
PM	Particulate matter (particle emission from e.g. diesel engines)
PROSPER	UIC project acronym for "Procedures for <u>R</u> olling <u>S</u> tock <u>P</u> rocurement with <u>E</u> nvironmental <u>R</u> equirements"
REPID	EU funded project Acronym for "Rail sector framework and tools for standardising and improving usability of <u>E</u> nvironmental <u>P</u> erformance <u>I</u> ndicators and <u>D</u> ata formats"
SO <sub>2</sub>	Sulphur dioxide (exhaust emission from e.g. diesel engines)
TSI	Technical Specification on Interoperability
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
XML	IT software language