Project:	SPOTLIGHTS
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Description	**GTF Conceptual Model (**draft **TIP)**
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Title:	GTF Specification
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List of Technical Notes

Comments	#	Doc. name	Title	Contents description	Updated
Distributed/handout to all partners	1	/p/spotlights/MKmetric/MKmetricTasks.doc	List of envisaged MKmetric Tasks	List of MKmetric's involvement in SPOTLIGHTS	26th January 2000
Distributed at the workshop DG/TREN 5th April 2000 in BXL	2	/p/spotlights/MKmetric/gtf/gtf.rtf	GTF Data Model Specification (Draft)	UML diagram and specification of GTF Data Model Objects and relationships.	4th April, 2000
Inception document, start-up discussion document between NEA, MKmetric (and partners)	3	/p/spotlights/MKmetric/gtfdocu/gtfoov02_r1.rtf	GTF Data Model Specification (Draft for Scientific Committee)	UML diagram and specification of GTF Data Model Objects and relationships.	6th April 2000
Initial preparatory discussion document	4	/p/spotlights/DataFormats/ComparisonFormats/GTF_Part1.doc	GTF Data Model	Evaluation and Comparison of data models and formats pertaining to modelling and exchanging of information. Suggestions for homogenisation & implementation.	8th December 2000
Last update for project finish	5	/p/spotlights/D13/D13.rtf	GTF Conceptual Model	Update for final conference	5th February 2002
Last update for project finish	6	/p/spotlights/D13/GTF_overview.doc	GTF Overview, an executive summary of the GTF vision, task and the GTF CM	Update for final conference	5th February 2002
Last update for project finish	7	/p/spotlights/D13/GTF_adhocXML.doc	GTF ad hoc XML, an ad hoc specification for an XML mapping of the GTF CM structures	Update for final conference	5th February 2002

Last update for project finish	8	/p/spotlights/D13/GTF_draftTIP.doc	draft GTF TIP, a draft for a specification for a run&command language for remote transportation models	Update for final conference	5th February 2002

GTF Conceptual Model (draft **TIP**)

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TRANSPORTATION–DATA INTERCHANGE PROTOCOL (TIP)

The ‘GTF Specification’ document established the specification for a ‘Generalised Transportation–data Format’. Now a specification concerning the available commands to issue to a ‘TIP enabled’ computer system is required. These commands will be attached to a GTF transmission file and will enable a transportation model provider to process the GTF data file so that the requested answers are computed. This is necessary, because a GTF data file alone doesn’t contain any information on what shall be done with the data, because a GTF data file basically can be seen as an ‘input’ file for a transportation model. This is where TIP is necessary. TIP is a generalisation of ‘usual’ commands to a transportation model, these can be seen as ‘request for a certain output’ (- nevertheless TIP can do much more than that, e.g. also manipulate the input).

The development of TIP is based on the classic four step transportation model: generation, distribution, modal split and assignment. Within these four stages, a number of commands (independent of the actual transport model or the transport model’s philosophy) can be issued to the transport model in order to produce intermediate data or final transport model results. These results can then be distilled through a filter (also defined in a TIP command file that is attached to a GTF data file). The filter extracts out of the transport model results the data relevant to the user’s query and notifies the user’s computer system that the requested results are available on the transport model provider’s computer system (or in the user’s account).

1.1. Classification of possible queries

The categories of possible (transportation–)information exchange are:

- pricing policies
- regulatory policies
- investment policies
- co–operation of transport models

The following types (per category) are defined:

modification of transport model input

- input modification, e.g.
  - proportional modification of a variable's value on a whole network or a specific sub–set (for pricing policies, regulatory policies)
  - modifications of networks (for investment policies)
- output queries, e.g.
  - modal split effects (e.g. high speed train vs. air; alternative i vs. alternative j)
  - generation and distribution effects on airport choice results

communication between transport models

- Transport Model A → Transport Model B: output of transport model A (e.g. passenger movements or OD–flow matrix) as input to transport model B
- Transport model B → Transport model A: output of transport model B (e.g. modal split matrix) transport model B as input to transport model A

In respect to scenario definitions and future projections the described options fit into the following framework (please refer to 'TRANSPORT RESEARCH APAS – Transport strategic modelling' for further information). For each of the components in the last level of the hierarchy two commands must be available:

Input modification:

1. Explicit change of variable values, e.g. variable X = 100

2. Functional change of variable values, e.g. variable X = (variable Y * 2) + variable Z

(all mathematical standard operators and functions are allowed for manipulation, e.g. log(), sin(), +,–,*,/, exp() etc.)

Output query:

3. Output matrix to be calculated, e.g. modal split for all available modes, assigned road infrastructure network – Germany

4. Definition of extracted variables, e.g. modal split of mode road and air, travel–time on Link 1152, travel–time of shortest path between Zone 51 and Zone 894

The variables available in 1., 2. and 4. are the attributes of class instances (objects) defined in the GTF conceptual model, e.g. “transit_tons” of Link 1152.

1.2. TIP commands

The commands needed are split into two categories:

- manipulation of variables (selecting & setting / updating)
- creating, requesting matrices (selecting & calculating)

The variables available for manipulation are those defined in the GTF conceptual model (see “GTF Specification” document), e.g. ‘class TransportProduction-Population ID=34923’ for a *single* manipulation or ‘class TransportProduction-Population’ for manipulation of *all* instances. The semantics for the manipulation commands is loosely based on SQL. **The manipulation commands** (i.e. manipulation of transport model input data) **always refer to data already located at the transport model provider.** To manipulate data located in the GTF file does not make too much sense, as the result of the manipulation can be computed beforehand, at the user’s site. The commands have the following syntax:

UPDATE <class|class.object id> SET <variable>=<value>

UPDATE < class|class.object id > SET <variable>=<function>

UPDATE <matrix>

Where ‘function’ is a mathematical function of any variables in the GTF data already at the transport model provider. Where id is a n objects numerical id or unique name. “update” requests the newest computations, if necessary a complete new run of the transportation model will have to be done.

A user can either modify single data elements (e.g. travel–time on Link 22561 between Node 42873 and Node 42192 multiplied by 1.2) or lists of data elements (e.g. all the travel–times in an infrastructure network in multiplied by 1.1). The command would be

UPDATE Link.22561 SET travel_time *= 1.2

UPDATE Link SET travel_time *= 1.1

Where "*=" means "multiply the current value of the variable".

<matrix> is one of those specified in the following paragraph.

The requests for calculation are related to the phases that a classic transportation model comprises:

- generation (production / attraction),
- distribution,
- mode choice (modal split),
- traffic conversion,
- route choice and
- assignment.

The request commands (i.e. transport model output data) are introduced by the keyword 'CREATE'. Command syntax:

CREATE <matrix> {MODE|PURPOSE|SEGMENT|PRODUCT}

For example:

CREATE GENERATION BUSINESS

CREATE PRODUCTION/ATTRACTION VACATION

CREATE DISTRIBUTION VACATION

CREATE MODAL SPLIT

CREATE TRAFFIC CONVERSION

CREATE ASSIGNMENT

The output matrix contents are:

CREATE GENERATION:

Zone Id	Number of trips
1	2343
2	4
...	...

or

Zone Id	Amount of Freight
1	2343
2	4
...	...

CREATE PRODUCTION:

Zone Id From	Zone Id To	Number of trips
1	2	1982
1	3	312
...	...	

or

Zone Id From	Zone Id To	Amount of Freight
1	2	2343
1	3	4
	...	...

CREATE DISTRIBUTION:

Zone Id From	Zone Id To	Number of trips
1	2	1982
1	3	312
...	...	

or

Zone Id From	Zone Id To	Amount of Freight
1	2	2343
1	3	4
	...	...

CREATE MODAL SPLIT:

Trips	ROAD	
Zone Id From	Zone Id To	%
1	2	79
1	3	63
...	...	

or

Freight			
Zone Id From	Zone Id To	Mode	%
1	2	ROAD	78
1	2	RAIL	17
...	...		

CREATE TRAFFIC CONVERSION:

Zone Id From	Zone Id To	Number of Vehicles
1	2	23845
1	3	5813
...	...	

CREATE ASSIGNMENT:

Node Id From	Node Id To	Cost	Distance	Length	Time	Load
1001	1002	241	100	230	62	1237
1001	1003	283	120	130	73	892
...	...					

The same more formally:

KEYWORD	**Matrix contents dimensions**
GENERATION	List: ZONE (x PURPOSE or SEGMENT / PRODUCT) Cell: number of TRIPS or amount of FREIGHT for a Zone
PRODUCTION / ACTTRACTION	Matrix: ZONE x ZONE (x PURPOSE or SEGMENT / PRODUCT) Cell: number of TRIPS or amount of FREIGHT for Zone – Zone
DISTRIBUTION	Matrix: ZONE x ZONE (x PURPOSE or SEGMENT / PRODUCT) Cell: number of TRIPS or amount of FREIGHT for Zone – Zone
MODAL SPLIT	Matrix: ZONE x ZONE x MODE (x PURPOSE or SEGMENT / PRODUCT) Cell: amount of FLOW / PERCENTAGE (trips / tons) for Zone –

	Zone by Mode
TRAFFIC CONVERSION	Matrix: ZONE x ZONE x MODE (x PURPOSE or SEGMENT / PRODUCT)
	Cell: number of Vehicles for Zone – Zone by Mode
ASSIGNMENT	Matrix: (loaded) network NODE x NODE
	Cell: Link attribute(s) for all Links

The keyword defines which output matrix shall be computed and transmitted (after filtering) back to the user.

The specification of Mode, Purpose, Segment / Product is optional. If one is specified it must follow the keywords preceding, e.g. 'CREATE DISTRIBUTION BUSINESS'.

The output filter is defined with

FILTER <matrix> <variable 1> ... <variable N>

The meaning of this line is:

'Filter from the output matrix <matrix> the variables <variable 1> through <variable N>'.

Where <variable> is the fully–qualified name of an class attribute, e.g. "Link::transit_tons".