

**Project:****SPOTLIGHTS**

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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	26 <sup>th</sup> January 2000
Distributed at the workshop DG/TREN 5 <sup>th</sup> 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.	4 <sup>th</sup> 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.	6 <sup>th</sup> 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.	8 <sup>th</sup> December 2000
Update after BCN meeting 11 <sup>th</sup> – 12 <sup>th</sup> October 2001	5	/p/spotlights/DataFormats/ComparisonFormats/GTF_Specification.doc	GTF Conceptual Model	Update of specification document after Barcelona workshop	28 <sup>th</sup> November 2001
Update after BCN meeting 11 <sup>th</sup> – 12 <sup>th</sup> October 2001	6	/p/spotlights/DataFormats/ComparisonFormats/GTF_overview.doc	GTF Overview, an executive summary of the GTF vision, task and the GTF CM	Update after Barcelona workshop	28 <sup>th</sup> November 2001

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Update after BCN meeting 11 <sup>th</sup> – 12 <sup>th</sup> October 2001	7	/p/spotlights/DataFormats/ComparisonFormats/GTF_adhocXML.doc	GTF ad hoc XML, an ad hoc specification for an XML mapping of the GTF CM structures	Update of specification document	28 <sup>th</sup> November 2001
Update after BCN meeting 11 <sup>th</sup> – 12 <sup>th</sup> October 2001	8	/p/spotlights/DataFormats/ComparisonFormats/GTF_draftTIP.doc	draft GTF TIP, a draft for a specification for a run&command language for remote transportation models	Update of specification document	28 <sup>th</sup> November 2001

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*GTF Conceptual Model (ad hoc XML)*

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## 1 AD-HOC-FORMAT

A simple ad-hoc format is defined based on XML to be able to describe some examples of how to use the GTF conceptual model.

This is an ad-hoc format, because the development of the GTF Specification did not have the goal of defining a universally accepted computer exchange format for the conceptual model. An ad-hoc format was defined in order to make concrete examples of how to use the conceptual model. It is based on XML, but is not a valid and formally correct specification of a format in XML.

The mapping from a GTF class defined in the “GTF Specification” document to the XML entity defined in this document was done according to following rules:

- \* Each GTF class is represented by an XML entity.
- \* Each attribute of the corresponding GTF class is represented by an attribute of the corresponding XML entity.
- \* Each association of a GTF class with another GTF class is represented by an attribute in the corresponding XML entity. The value of this kind of attribute is an identifier of the XML entity corresponding to the associated GTF class.
- \* Derived ‘child’ classes are represented enclosed in the corresponding XML entity representation tags of the XML representation of the ‘parent’ class.

The next two lists define 1. the elements of the format and 2. the organisational structure. It is assumed that the XML format and syntax are known. In short, the syntax of the XML entity instance E and its attributes a1, a2 is

```
<E a1="value" a2="value"> ... </E>
```

The attributes can be omitted if they are not required by the specification.

Some XML entities can contain other XML entities

```
<E a1="value">  
  <F f1="value">  
  
</E>
```

Others may not contain other XML entities as can be seen in the example above with the <F> XML entity instance. These are not required to have a closing tag, e.g. </F>.

The textual representation of an XML entity is called a “tag”, e.g. <E> </E>.

(An introduction to XML can be found at [XML].)

In the following please refer to the “GTF Specification” document for more details concerning the “Item from enumeration code list” entries.

The following is the list of default attributes for all XML entities. These are necessarily default, because during the transformation of the object-oriented GTF Conceptual Model into XML entity definitions, the attributes from GTFObject, which is the basis of all GTF classes, are automatically inherited by them. Therefore the set of attributes of GTFObject are the set of default attributes for all XML entities.

Attribute	Comment
id	Unique identifier. The value is given by the generator of the GTF data set.
name	Non-unique textual identifier.
super	Id of the XML entity of which this XML entity is a part. This is the counter part of sub.
sub	The value of this attribute is a comma-separated list of ids of XML entity instances from this GTFDB data set that make up the grouping of XML entity instances representing the internal structure or dis-aggregation of this XML entity instance.
sub_type	Type of the grouping of objects associated through the sub association. The value is an item from an enumeration list.
comments_list	The value of this attribute is a comma-separated list of ids of Comment XML entity instances.
kif_expression	<p>An ASCII Text representing a KIF expression (see [KIF]). The length of the ASCII text for the expression is not delimited, that is, this text can represent even a complete KIF knowledge base (i.e. many KIF expressions).</p> <p>The object names in the KIF expressions must match the Class/Relationship/Member names from this conceptual model to be valid expression.</p> <p>Example of a KIF expression: (Junction London 3578). This would define a Junction named London with the identifier 3578.</p>
ogis_ptr	The value of this attribute is a comma-separated list of ids of OGISPointer XML entity instances.

Attribute	Comment
associations	The value of this attribute is a comma-separated list of ids of XML entity instances of this GTFDB.
table	A textual pointer to the table of an external database system.

List of XML Classes for the GTF:

Class (Object)	XML Tag	Attributes	Comment
Toplevel classes			
GTFDB	<GTFDB>  </GTFDB>		Top most element. Hierarchical starting object of the GTF data set information represented by this XML encoding.  All other XML entity instances corresponding to the GTF objects in the data set must be enclosed by these tags.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Node	<N>  </N>		XML entity representing a Node.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes

Class (Object)	XML Tag	Attributes	Comment
		start_of	The value of this attribute is a comma-separated list of ids of Link XML entity instances of which this XML entity instance is the start.
		end_of	The value of this attribute is a comma-separated list of ids of Link XML entity instances of which this XML entity instance is the end.
		type	Item from enumeration code list
Junction	<JU>		XML entity representing a Junction GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		turn_from	Id of Link XML entity instance of which this XML entity instance is 'from' point of the turn.
		turn_at	Id of Link XML entity instance of which this XML entity instance is 'at' point of the turn.
		turn_to	Id of Link XML entity instance of which this XML entity instance is 'to' Link of the turn.
		type	Item from enumeration code list

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Class (Object)	XML Tag	Attributes	Comment
Terminator	<TE>		XML entity representing a Terminator GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		centroid_of	Id of Zone XML entity instance of which this XML entity instance is the centroid.
		type	Item from enumeration code list
Zone	<ZO>		XML entity representing a Zone GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		barrier	Ids of the Zone XML entities instance that is are obstacles to the free flow of this Zone to the other Zones.
		historical_group	Item from enumeration code list
		political_group	Item from enumeration code list
		has_activities_list	The value of this attribute is a comma-separated list of ids of Factor XML entity instances that are active in this Zone.

Class (Object)	XML Tag	Attributes	Comment
		has_regulations_list	The value of this attribute is a comma-separated list of ids of LinkAttributes XML entity instances that define administrative regulations.
		localises	The value of this attribute is a comma-separated list of ids of Terminator XML entity instances of that connects the Zone to an infrastructure network.
Factor	<F>  </F>		XML entity representing a Factor GTF object.  It encloses the Factor children, e.g. Population, XML entities.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		is_active_in	The value of this attribute is a comma-separated list of ids of Zone XML entity instances where this Factor factor is active, i.e. generating movement.
		statistical_source	Item from enumeration code list
		indicator_name	Item from enumeration code list
		indicator_definition	Item from enumeration code list

Class (Object)	XML Tag	Attributes	Comment
		indicator_value	A Value representing the actual data
		in_category	Item from enumeration code list
		economic_sector	Item from enumeration code list
		gender	Item from enumeration code list
		type	Item from enumeration code list
EconomyAndLandUse	<EAL>		XML entity representing an EconomyAndLandUse GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		accessibility	Indicator of the accessibility of the Zone
		value_of_time	Indicator of the value of time for travellers in this Zone
		infrastructure_consumption	Indicator of the area covered by infrastructure in this Zone
		infrastructure_expenditure	Indicator of the expenditures made for the infrastructure in this Zone
		type	Item from enumeration code list

Class (Object)	XML Tag	Attributes	Comment
EconomyCharacteristics	<ECH>		XML entity representing an EconomyCharacteristics GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		GAV	Indicator of the gross added value in the Zone
		GDP	Indicator of the gross domestic product in the Zone
		production_level	Indicator of the production level in the Zone
		purchasing_power	Indicator of the purchasing power of the inhabitants of the Zone
		vehicles	Indicator of the number of vehicles in the Zone
		consumption	Indicator of the consumption in the Zone
		tourism_capacity	Indicator of the hotel & accommodations capacity in the Zone
		school_places	Indicator of the number of school places in the Zone
		tons	Indicator of the tons handled in the Zone
		type	Item from enumeration code list

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Class (Object)	XML Tag	Attributes	Comment
EnvironmentAndPublicHealth	<EAP>		XML entity representing an EnvironmentAndPublicHealth GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		energy_consumption	Indicator of the consumption of energy in the Zone
		accidents	Indicator of the number of accidents in the Zone
		injuries	Indicator of the number of injuries in the Zone
		emission	Indicator of the emission rates of gases, dust & particles (in general) in the Zone
		emissionCO	Indicator of the emission rates of CO in the Zone
		emissionHC	Indicator of the emission rates of HC in the Zone
		noise_exposition	Indicator of the number of people exposed to noise above a certain level in the Zone
		type	Item from enumeration code list
Population	<POP>		XML entity representing an Population GTF object.
		id, name, super, sub, sub_type, comments_list,	Default attributes

Class (Object)	XML Tag	Attributes	Comment
		kif_expression, ogis_ptr, associations, table	
		number	<p>A flag / qualifier that specifies that the information of this Factor pertains to the population of the associated Zone.</p> <p>If used (i.e. non Null) must contain an entry 'total' specifying a total population.</p> <p>The segmentation by gender &amp; age group must be coded using associated Meta objects. These define the classification (e.g. Meta-Gender 'male / female') and the value of the classification entry (e.g. male = 0, female = 1).</p> <p>The segmentation by life cycle group must be coded using associated Meta objects. These define the classification.</p> <p>The segmentation by car availability group must be coded using associated Meta objects. These define the classification.</p>
		working	<p>A flag / qualifier that specifies that the information of this Factor pertains to the population.</p> <p>If used (i.e. non Null) must contain an entry 'total' specifying a total population.</p> <p>The segmentation by gender &amp;</p>

Class (Object)	XML Tag	Attributes	Comment
			<p>age group sector must be coded using associated Meta objects. These define the classification (e.g. male / female) and the value of the classification entry (e.g. male = 0, female = 1).</p> <p>The segmentation by gender &amp; economic sector must be coded using associated Meta objects.</p> <p>The table can contain an entry 'average working hours per week'.</p>
		households	<p>A flag / qualifier that specifies that the information of this Factor pertains to the population.</p> <p>If used (i.e. non Null) must contain an entry 'total' specifying a total population.</p> <p>The table can contain an entry 'household size'. The table can contain an entry 'income'. Average income etc. must be computed from these values or the entry 'average income' must be present.</p> <p>The segmentation by number of cars owned must be coded using associated Meta objects. These define the classification (e.g. Meta-Cars owned) and the value of the classification entry (e.g. enumeration values 0,1,2, many).</p>

Class (Object)	XML Tag	Attributes	Comment
		household_budget	A flag / qualifier that specifies that the information of this Factor pertains to the population.  If used (i.e. non Null) must contain an entry 'total' specifying a total population.  The table can contain an entry share devoted to transport in percent.
		type	Item from enumeration code list
SocialImpact	<SIM>		XML entity representing a SocialImpact GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		complaints	Indicator of the complaints from the population caused by traffic in the Zone
		satisfaction	Indicator of the stated degree of satisfaction with the current traffic conditions
		attitudes	Indicator of transport-related attitudes (in general) in the Zone
		household_budget	Budget of households in the Zone
		type	Item from enumeration code

Class (Object)	XML Tag	Attributes	Comment
			list
SocietyCharacteristics	<SOC>		XML entity representing a SocietyCharacteristics GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		ecological_knowledge	Indicator of the level of ecological knowledge of the population in the Zone
		attitude_towards_mobility	Indicator of the attitude towards mobility of the population in the Zone
		importance_of_mobility	Indicator of the importance of mobility for the personal living standard and quality of life of the population in the Zone
		satisfaction_with_conditions	Indicator of the satisfaction of the population with the conditions of transport and traffic in the Zone
		rediness_to_reduce_usage	Indicator of the rediness of the population in the Zone to reduce the usage of a certain vehicle type
		age_group	Age group characterisation of the population
		trips	Indicator of the trips made by Zonal population

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Class (Object)	XML Tag	Attributes	Comment
		type	Item from enumeration code list
SpatialAndLandUse	<SAL>		XML entity representing a SpatialAndLandUse GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		area	Area of the Zone
		land_use	Indicator of the land use in the Zone
		type	Item from enumeration code list
Link	<L> </L>		XML entity representing a Link GTF object
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		starts_in	Id of the Node XML entity instance that is the starting point of this Link.
		ends_in	Id of the Node XML entity instance that is the ending point of this Link.

Class (Object)	XML Tag	Attributes	Comment
		is_of_mode	Id of a Mode XML entity instance specifying the fundamental type of immobile infrastructure of the Link
		allowed_alternatives_list	The value of this attribute is a comma-separated list of ids of Alternative XML entity instances.
		allowed_services_list	The value of this attribute is a comma-separated list of ids of Service XML entity instances.
		part_of_path	The value of this attribute is a comma-separated list of ids of Path XML entity instances.
		direction	Item from enumeration code list
		transit_tons	Number of transit tons
		transit_passengers	Number of transit passengers
		type	Item from enumeration code list
Connector	<CO>		XML entity representing a Connector GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		avg_speed	Average speed between the Zone and the Terminator
		avg_capacity	Average capacity between the

Class (Object)	XML Tag	Attributes	Comment
			Zone and the Terminator
		avg_cost	Average cost between the Zone and the Terminator
Segment	<SEG>		XML entity representing a Segment GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		curvature	curvature of this Segment
		slope	slope of this Segment
		type	Item from enumeration code list
MatrixElement	<ME>		XML entity representing a Flow GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		home_based	Item from enumeration code list
		trip	Private trip information or transport / transshipment information.
		type	Item from enumeration code list

Class (Object)	XML Tag	Attributes	Comment
Mode	<MO> </MO>		XML entity representing a Mode GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		specifies_mode	The value of this attribute is a comma-separated list of ids of Link XML entity instances.
		allows	The value of this attribute is a comma-separated list of ids of Vessel XML entity instances.
		in_definition_of	The value of this attribute is a comma-separated list of ids of Alternative XML entity instances.
		type	Item from enumeration code list
Air	<AI>		XML entity representing an Air GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list

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Class (Object)	XML Tag	Attributes	Comment
Rail	<RA>		XML entity representing a Rail GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
Road	<RO>		XML entity representing a Road GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
Water	<WA>		XML entity representing a Water GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list

Class (Object)	XML Tag	Attributes	Comment
Vessel	<V> </V>		XML entity representing a Vessel GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		can_carry	The value of this attribute is a comma-separated list of ids of Unit XML entity instances.
		used_by	The value of this attribute is a comma-separated list of ids of Service XML entity instances.
		in_definition_of	The value of this attribute is a comma-separated list of ids of Alternative XML entity instances.
		allowed_on	The value of this attribute is a comma-separated list of ids of Mode XML entity instances.
		weight	Weight of this type of Vessel.
		height	Height of this type of Vessel.
		length	Length of this type of Vessel.
		capacity	Capacity of Units of this type of Vessel.
		consumption	Consumption of this type of Vessel.
		speed	Speed of this type of Vessel.
		max_speed	Maximum speed of this type

Class (Object)	XML Tag	Attributes	Comment
			of Vessel.
		type	Item from enumeration code list
Airplane	<AP>		XML entity representing an Airplane GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		make	Item from enumeration code list or plain TEXT
		num_engines	Number of engines
		type	Item from enumeration code list
Body	<BO>		XML entity representing a Body GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
Car	<CA>		XML entity representing a Car GTF object.

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Class (Object)	XML Tag	Attributes	Comment
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		make	TEXT, name of car make
		type	Item from enumeration code list
Pipeline	<PI>		XML entity representing a Pipeline GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		diametre	Diametre of person this XML entity instance represents
		type	Item from enumeration code list
Ship	<SH>		XML entity representing a Ship GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		tons_loaded	Tons loaded

Class (Object)	XML Tag	Attributes	Comment
		tons_unloaded	Tons unloaded
		ratio	Loading factor, ratio ton-km/capacity-km for Goods
		type	Item from enumeration code list
Wagon	<WG>		XML entity representing a Wagon GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		electrified	Item from enumeration code list
		high_speed	Item from enumeration code list
		type	Item from enumeration code list
Chain	<C> </C>		XML entity representing a Chain GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list

Class (Object)	XML Tag	Attributes	Comment
Service	<SE> </SE>		XML entity representing a Service GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		carrier	Name of carrier
		security	Security level
		total	A total number of something, e.g. direct flights
		reliability	Level of reliability
		toll	Toll to pay while using this Service
		num_facilities_of_type	Number of facilities of this type of service, e.g. 5 cranes available for loading / unloading
		travel_time	Travel time of this Service on the associated Link
		commodity_cost	Cost per ton-km by associated Good (commodity)
		delay	Delay time when using this Service
		num_interruptions	Number of interruptions while using this Service
		check_in_time	Check-in time for the Service
		check_out_time	Check-out time for the Service
		time_table	Timetable of the services

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Class (Object)	XML Tag	Attributes	Comment
		cost	Transportation price per ton-km
		uses_vessels_list	The value of this attribute is a comma-separated list of ids of Vessel XML entity instances.
		schedule	Id of a Unit XML entity instance specifying schedule information
		carries	Id of a Vessel XML entity instance specifying the Unit type that can be transported by this Vessel.
		type	Item from enumeration code list
ServiceFacility	<SEF>		XML entity representing a ServiceFacility GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		loading_time	Loading time of Goods
		fixed_costs	Fixed cost for using this facility
		capacity	Total capacity of Goods
		type	Item from enumeration code list
Path	<PA>		XML entity representing a Path GTF object.

Class (Object)	XML Tag	Attributes	Comment
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		duration	Specifies how long a trip is undertaken . This is not the time it takes to go from A to B, because e.g. for a vacation trip moving from A to B might entail sight seeing etc.
		milepost	
		groups	List of XML Ids
DynamicSegmentation	<D> </D>		XML entity representing a DynamicSegmentation GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		distance_from_beginning	Distance of this point of dynamical segmentation from the beginning (not defined explicitly, but implicitly: the DynamicSegmentation point with a value for this attribute of 0 is the beginning of the dynamically segmented line.
		distance_from_ending	Distance of this point of dynamical segmentation from the ending (not defined

Class (Object)	XML Tag	Attributes	Comment
			explicitly, but implicitly: the DynamicSegmentation point with a value for this attribute of 0 is the ending of the dynamically segmented line.
		type	Item from enumeration code list
Milepost	<MI>		XML entity representing a Milepost GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Alternative	<A>		XML entity representing a LinkAttributes GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		definition_services_list	The value of this attribute is a comma-separated list of ids of Service XML entity instances.
		uses_in_definition	The value of this attribute is a comma-separated list of ids of Vessel XML entity instances.
		allowed_on	The value of this attribute is a comma-separated list of ids of Link XML entity instances.

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Class (Object)	XML Tag	Attributes	Comment
		definition_units_list	The value of this attribute is a comma-separated list of ids of Unit XML entity instances.
		type	Item from enumeration code list
Unit	<U> </U>		XML entity representing a Unit GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		can_travel_with	The value of this attribute is a comma-separated list of ids of Vessel XML entity instances.
		defines	The value of this attribute is a comma-separated list of ids of Alternative XML entity instances.
		travels_with	The value of this attribute is a comma-separated list of ids of Service XML entity instances.
		information	A Value representing the actual data
		type	Item from enumeration code list
Good	<GO>		XML entity representing a Good GTF object.
		id, name, super, sub,	Default attributes

Class (Object)	XML Tag	Attributes	Comment
		sub_type, comments_list, kif_expression, ogis_ptr, associations, table	
		stage	Item from enumeration code list
		type	Item from enumeration code list
Information	<IN>		XML entity representing an Information GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		status	Item from enumeration code list
		type	Item from enumeration code list
Person	<PE>		XML entity representing a Person GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		purpose	The purpose of a Person during the entire movement from A to B.  Item from enumeration code

Class (Object)	XML Tag	Attributes	Comment
			list
		type	Item from enumeration code list
Meta	<M> </M>		XML entity representing a Meta GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		information	A Value representing the actual data
		type	Item from enumeration code list
GTFMatrix	<MA>		XML entity representing a GTFMatrix GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Date	<DA> </DA >		XML entity representing a Date GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression,	Default attributes

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Class (Object)	XML Tag	Attributes	Comment
		ogis_ptr, associations, table	
		type	Item from enumeration code list
Quarterly	<QUA>	id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
Schedule	<SCH>		XML entity representing a Schedule GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		information	Schedule information
		type	Item from enumeration code list
Yearly	<YEA>	id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code

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Class (Object)	XML Tag	Attributes	Comment
			list
Dimension	<DI> </DI>		XML entity representing a Dimension GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		SI_unit	Item from enumeration code list
		prefix	Item from enumeration code list
		type	Item from enumeration code list
Measure	<ME>		XML entity representing a Measure GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
LinkAttributes	<LA> </LA >		XML entity representing a LinkAttributes GTF object.
		id, name, super, sub,	Default attributes

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Class (Object)	XML Tag	Attributes	Comment
		sub_type, comments_list, kif_expression, ogis_ptr, associations, table	
		regulates	The value of this attribute is a comma-separated list of ids of Zone XML entity instances.
		definition_vessels_list	The value of this attribute is a comma-separated list of ids of Vessel XML entity instances.
		defines	Id of the Link XML entity defined by this LinkAttributes XML entity instance.
		cost	Cost for travelling on associated Link
		distance	Geographical distance between both Nodes
		load	Load on associated Link
		max_capacity	Maximum capacity on associated Link
		min_capacity	Minimum capacity on associated Link
		max_speed	Maximum speed on associated Link
		min_speed	Minimum speed on associated Link
		time	Travel time on associated Link
		length	Transport model relevant length of associated Link
		type	Item from enumeration code list

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Class (Object)	XML Tag	Attributes	Comment
Computed	<COM>		XML entity representing a Computed GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		flow	Current computed movement in Units.
Statistical	<STA> </STA >		XML entity representing a Statistical GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
Observed	<OBSE>		XML entity representing an Observed GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		flow	Observed number of

Class (Object)	XML Tag	Attributes	Comment
			movements
		type	Item from enumeration code list
Technical	<TEC> </TEC>		XML entity representing a Technical GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		type	Item from enumeration code list
Engineered	<ENGI> </ENGI>		XML entity representing an Engineered GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		frequency_indicator	Allowed frequency of the associated type of Vessels (vehicles) XML entity instance
		number_lanes	Number of lanes of the associated Link XML entity instance
		electrified	Item from enumeration code list

Class (Object)	XML Tag	Attributes	Comment
		signalling_system	Item from enumeration code list
		level_crossings	Item from enumeration code list
		telematic_services	Telematic services available on this Link XML entity instance
		type	Item from enumeration code list
Regulation	<REGU>		XML entity representing a Regulation GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		toll	Toll according to the administrative regulations of the Zone
		type	Item from enumeration code list
LinkRestrictions	<LINKR>		XML entity representing a LinkRestrictions GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes

Class (Object)	XML Tag	Attributes	Comment
		num_lanes	Change the number of lanes defined in the associated Link XML entity instance to this number. The distance from the beginning / ending of the Link is marked by a Milestone XML entity instance
		type	Item from enumeration code list
NodeRestrictions	<NODER>		XML entity representing a NodeRestrictions GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		turn_from	Id of a Node XML entity instance
		turn_at	Id of a Node XML entity instance
		turn_to	Id of a Node XML entity instance
		capacity	Capacity restriction of the associated Node
		type	Item from enumeration code list
Turn	<TURN>		XML entity representing a Turn GTF object.
		id, name, super, sub, sub_type,	Default attributes

Class (Object)	XML Tag	Attributes	Comment
		comments_list, kif_expression, ogis_ptr, associations, table	
		turn_from	Id of a Node XML entity instance
Switch	<SWITCH>		XML entity representing a Turn GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		turn_from	Id of a Node XML entity instance
UserDefined	<UD>		XML entity representing a UserDefined GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		turn_from	Id of a Node XML entity instance
Group	<G>  </G>		XML entity representing a Meta GTF object.
		id, name, super, sub,	Default attributes

Class (Object)	XML Tag	Attributes	Comment
		sub_type, comments_list, kif_expression, ogis_ptr, associations, table	
		type	Item from enumeration code list
Scenario	<SC>		XML entity representing a Scenario GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Organisation	<OR>		XML entity representing an Organisation GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Bundle	<BU>		XML entity representing a Bundle GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes

Class (Object)	XML Tag	Attributes	Comment
Sheaf	<SHE>		XML entity representing a Sheaf GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Spider	<SP>		XML entity representing a Spider GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
Catchment	<CT>		XML entity representing a Catchment GTF object.
		id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
<b>Framework classes</b>			
Comment	<COMT> </COMT>	id, name, super, sub, sub_type, comments_list,	A textual comment, about the associated class object. The comment text is enclosed

Class (Object)	XML Tag	Attributes	Comment
		kif_expression, ogis_ptr, associations, table	between the start and ending tags <C> ... </C>.
Shape	<SHAP>	id, name, super, sub, sub_type, comments_list, kif_expression, ogis_ptr, associations, table	Default attributes
		shape	Item from enumeration code list
		coords	coordinates of region.
OGISInfoPointer	<OGPO>		A pointer to an OpenGIS object (Feature, Relationship etc.). See OpenGIS specification.
		value	<p>The value of this member must be a valid identifier of a class in an external OpenGIS Feature catalogue.</p> <p>The value table must contain an entry "Catalogue", naming an OpenGIS Feature catalogue.</p> <p>The value table must contain an entry "ID" of a valid identifier from the external OpenGIS Feature catalogue referred to by the "Catalogue" entry.</p>
		shape	The value of this attribute is a comma-separated list of ids of

Class (Object)	XML Tag	Attributes	Comment
			Shape XML entity instances.
XML Comment	<!-- -->		The textual comment is enclosed between the tags.

Organisational Structure of XML classes for the GTF:

Class (Object)	XML Tag	Sub-Tags	Comment
<b>Toplevel</b>			
GTFDB	<GTFDB>		block class, Toplevel class enclosing all other class objects of one data base
		<N></N>	
		<F></F>	
		<L></L >	
		<MO></MO>	
		<V></V>	
		<C></C>	
		<D></D>	
		<A></A>	
		<U></U>	
		<M></M>	
		<G></G>	
	</GTFDB>		
Node	<N>		block class

Class (Object)	XML Tag	Sub-Tags	Comment
		<JU>	inline class
		<TE>	inline class
		<ZO>	inline class
	</N>		
Factor	<F>		block class
		<EAL>	Inline class
		<ECH>	Inline class
		<EAP>	Inline class
		<POP>	Inline class
		<SIM>	Inline class
		<SOC>	Inline class
		<SAL>	Inline class
	</F>		
Link	<L>		block class
		<CO>	inline class
		<ME>	inline class
		<SE>	inline class
	</L>		
Mode	<MO>		
		<AI>	inline class
		<RA>	inline class

Class (Object)	XML Tag	Sub-Tags	Comment
		<RO>	inline class
		<WA>	inline class
	</MO>		
Vessel	<V>		block class
		<AP>	inline class
		<BO>	inline class
		<CA>	inline class
		<PI>	inline class
		<SH>	inline class
	</V>		
Chain	<C>		block class
		<SE></SE>	
		<PA>	inline class
	</C>		
DynamicSegmentation	<D>		block class
		<MI>	Inline class
	</D>		
Alternative	<A>		Inline class

Class (Object)	XML Tag	Sub-Tags	Comment
Unit	<U>		block class
		<GO>	Inline class
		<IN>	Inline class
		<PE>	Inline class
	</U>		
Meta	<M>		block class
		<MA>	Inline class
		<DA></DA>	
		<DI>	Inline class
		<ME>	Inline class
		<LA></LA>	
		<UD>	Inline class
	</M>		
Date	<DA>		block class
		<QUA>	Inline class
		<SCH>	Inline class
		<YEA>	Inline class
	</DA>		
LinkAttributes	<LA>		block class
		<COM>	Inline class
		<STA><STA>	

Class (Object)	XML Tag	Sub-Tags	Comment
		<TEC></TEC>	
	</LA>		
Statistical	<STA>		block class
		<OBSE>	Inline class
	</STA>		
Technical	<TEC>		block class
		<ENGI></ENGI>	
		<REGU>	inline class
	</TEC>		
Engineered	<ENGI>		block class
		<LINKR>	inline class
		<NODER></NODER>	
	</ENGI>		
NodeRestrictions	<NODER>		block class
		<TURN>	Inline class
		<SWITCH>	Inline class
	</NODER>		
UserDefined	<UD>		inline class

Class (Object)	XML Tag	Sub-Tags	Comment
Group	<G>		block class
		<SC>	Inline class
		<OR>	Inline class
		<BU>	Inline class
		<SH>	Inline class
		<SP>	Inline class
		<CT>	Inline class
	</G>		
<b>Framework</b>			
Shape	<SHAP>		Inline class
OGISPointer	<OGPO>		Inline class
Comment	<COMT>		Inline class, it is only allowed to enclose TEXT
	</COMT>		

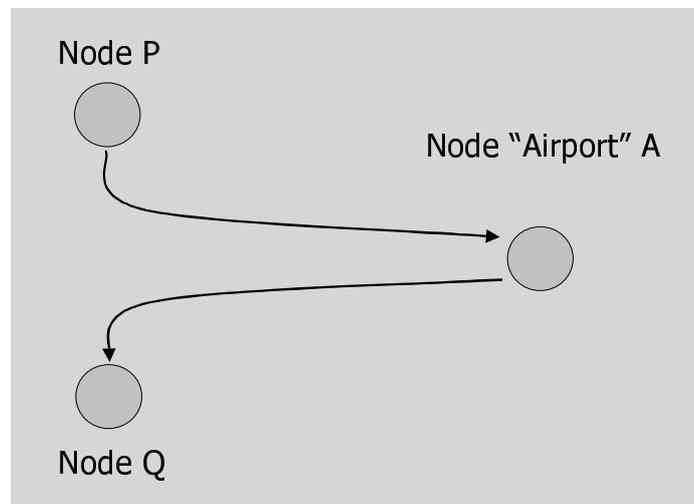
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## 2 NETWORK EXAMPLE

An infrastructure network consists of Node classes, Link classes and other classes.

Nodes and Links are basic classes, which can be used (through aggregation using the super/sub association) to describe interchanges, terminals etc., e.g. airports or ‘airport nodes’. This kind of Node is not atomic, because there is relevant information contained in the Node.

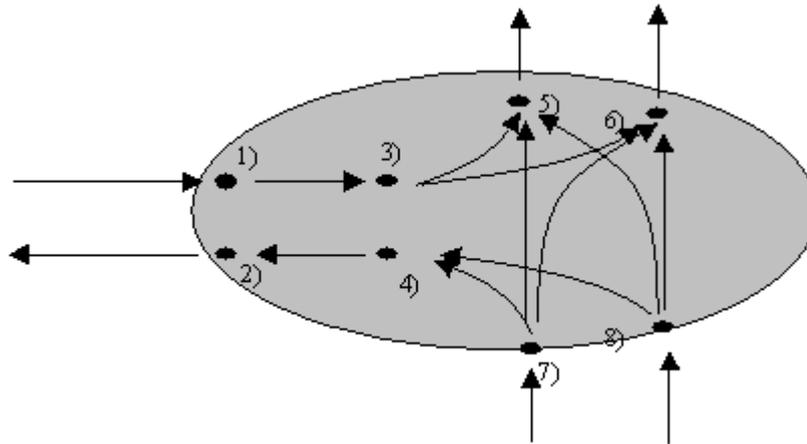
As an example to focus on, look at the information that an airport might contain. An airport that is (very simply) topologically modelled as a single Node would be something like this:



**Diagram: Simple Node**

### *Modelling with the super/sub association*

An airport that is modelled as a non-atomic point, i.e. modelled as a grouping of objects, would explicitly model the airport’s access, egress, check-in / -out counters, and the arrival and departure gates for domestic & international flights. The connections between these are depicted below.



*Diagram of internal structure of airport*

The Nodes within the grouping representing an airport have the following meanings:

1. airport access
2. airport egress
3. check-in counter
4. check-out counter
5. departure national
6. departure international
7. arrival national
8. arrival international

The departure of a passenger is simplified in the model of an airport with two steps: the Link between airport access and check-in counter describes the activity of a passenger parking at the airport (or arrival at the airport's railway station) and walking to the check-in counter; the actual checking-in and waiting until departure of the flight is modelled by the Link between the check-in counter and a departure node. Since the check-in times differ by purpose (e.g. business passengers can check-in more quickly) there are Links between the check-in / out counter and the arrival / departure Nodes for each purpose. The Links between the arrival and departure Nodes are also differentiated by purpose.

This way of modelling has the advantage that information relating to an airport, like the movement between access and egress can be captured on the specific Link that models the relation between the access and egress Nodes. In consequence, to extract information, e.g. total passengers in the airport, from an airport Node, the system has to sum up some or all of the Flows on the Links between the atomic airport Nodes.

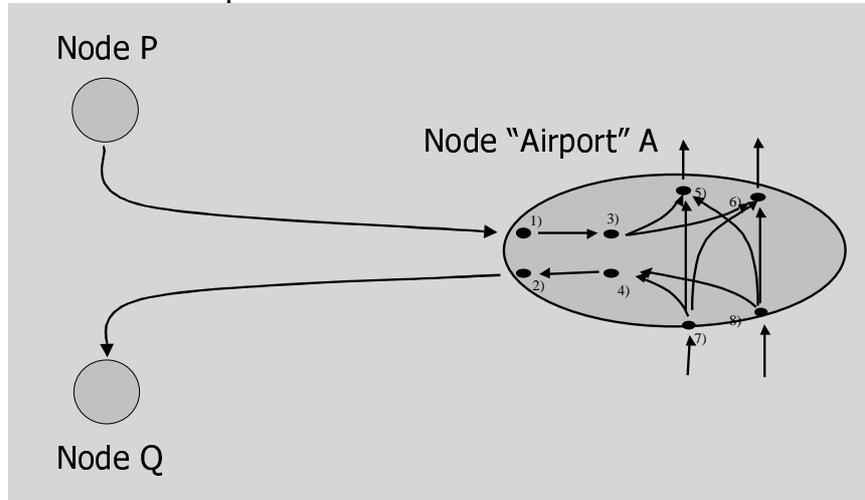
In a more general case, one can inflate a Node, so that the connections between all the incoming Links and the outgoing Links, to and from this Node, are represented explicitly within. This is done, for example, with representations of railway stations, where one needs to assign transition times between the railway tracks in the railway station. If a railway station has  $a$  access Links and  $e$  egress Links, the grouping would consist of  $e+a$  Nodes and  $e*a$  Links. Every  $e$  Node is connected to all  $a$  Nodes in only one direction to make sure that a shortest path does not reverse its direction within the group.

The transition times needed are then assigned to each  $e \rightarrow a$  Link as a transition travel time. This makes the model more realistic, because it can differentiate between small

railway stations –where this kind of detail is not relevant – and large railway stations – where the transition times between the tracks are significant to the model.

*Example: "Airport Network"*

The example below shows how a network consisting of an origin Node O a destination Node D both linked to an airport Node A.



*Diagram of "Example Airport Network"*

This structure would be represented in a GTF Conceptual Model using the ad hoc XML format as:

```
<!-- definition of the Airport Node-Network example-->
```

```
<GTFDB id=1 name="Airport Network Example">
```

```
<N id="1" name="O">
```

```
</N>
```

```
<N id="2" name="D">
```

```
</N>
```

```
<!-- definition of the internal Nodes -->
```

```
<N id="3" name="Airport A">
```

```
<N id="4" name="A1 airport access">
```

```
</N>
```

```
<N id="5" name="A2 airport egress">
```

```
</N>
```

```
<N id="6" name="A3 check-in counter">
```

```

</N>
<N id="7" name="A4 check-out counter">
</N>
<N id="8" name="A5 departure national">
</N>
<N id="9" name="A6 departure international">
</N>
<N id="10" name="A7 arrival national">
</N>
<N id="11" name="A8 arrival international">
</N>
</N>
<!-- definition of the link from Node O to Airport A -->
<L id="10000" name="Route 66 to Airport A" starts_in="1" ends_in="4">
</L>
<!-- definition of the link from Airport A to Node D -->
<L id=20000 name="Highway 928" starts_in="5" ends_in="2">
</L>
<!-- definition of the internal links of Node Airport A-->
<L id=30000 name="to check-in" starts_in="4" ends_in="6">
</L>
<L id=30001 name="from check-out " starts_in="7" ends_in="5">
</L>
<L id=30010 name="to departure national" starts_in="6" ends_in="8">
</L>
<L id=30011 name="to departure international" starts_in="6" ends_in="9">

```

</L>

<L id=30020 name="from arrival national" starts\_in="10" ends\_in="7">

</L>

<L id=30021 name="from arrival international" starts\_in="11" ends\_in="7">

</L>

<L id=30030 name="from arrival national transfer to departure national"  
starts\_in="10" ends\_in="8">

</L>

<L id=30031 name="from arrival national transfer to departure international"  
starts\_in="10" ends\_in="9">

</L>

<L id=30040 name="from arrival international transfer to departure national"  
starts\_in="11" ends\_in="8">

</L>

<L id=30041 name="from arrival international transfer to departure  
international" starts\_in="11" ends\_in="9">

</L>

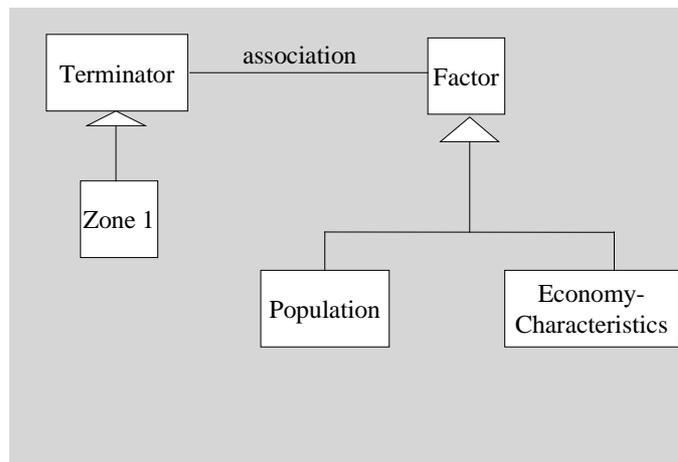
<GTFDB>

### 3 SOCIO-ECONOMIC DATA EXAMPLE

The following example demonstrates the encoding of some simple socio-economic data.

Zone	Population	Income [EURO / pers.]	GDP [bill. EURO]	...
1	150000	10000	5,7	
2	67000	11300	6,3	
3	82000	9500	5,2	
...				

In GTF terms this table is represented using the following classes from the GTF-CM:



Translated into “live” objects, e.g. in the memory space of a computer program of a GTF Translator performing this translation from the proprietary table data (the former) into the GTF representation (the latter), this means:

GTFDB	
id	0
name	Socio-Economy Example

Zone	
id	1
name	

Zone	
id	2
name	

Zone	
id	3
name	

.

.

Population	
id	30000
key	number
value	150000
key	income
value	10000

Population	
id	30001
key	number
value	67000
key	income
value	11300

Population	
id	30002
key	number
value	82000
key	income
value	9500

.

.

.

EconomyCharacteristics	
id	685902
key	GDP
value	5,7

EconomyCharacteristics	
id	685903
key	GDP
value	6,3

EconomyCharacteristics	
id	685904
key	GDP
value	5,2

.

.

.

Now a GTF Translator needs to encode the objects into XML resulting in this file:

```

<!-- definition of the Socio-Economic data Example-->
<GTFDB id=1 name="Socio-Economy Example">
  <N id= "2">
    <TE id= "3">
      <ZO id= "4" name= "1">
    </TE>
    <TE id= "5">
      <ZO id= "6" name= "2">
    </TE>
    <TE id= "7">
      <ZO id= "8" name= "3">
    </TE>
  </N>
</F>

```

<POP id= "30000" number = "150000" income= "10000"  
associations= "4">

<ECH id= "685902" GDP= "5.7" associations= "4">

<POP id= "30001" number = "67000" income= "13000" associations=  
"6">

<ECH id= "685903" GDP= "6.3" associations= "6">

<POP id= "30002" number = "82000" income= "9500" associations=  
"8">

<ECH id= "685904" GDP= "5.2" associations= "8">

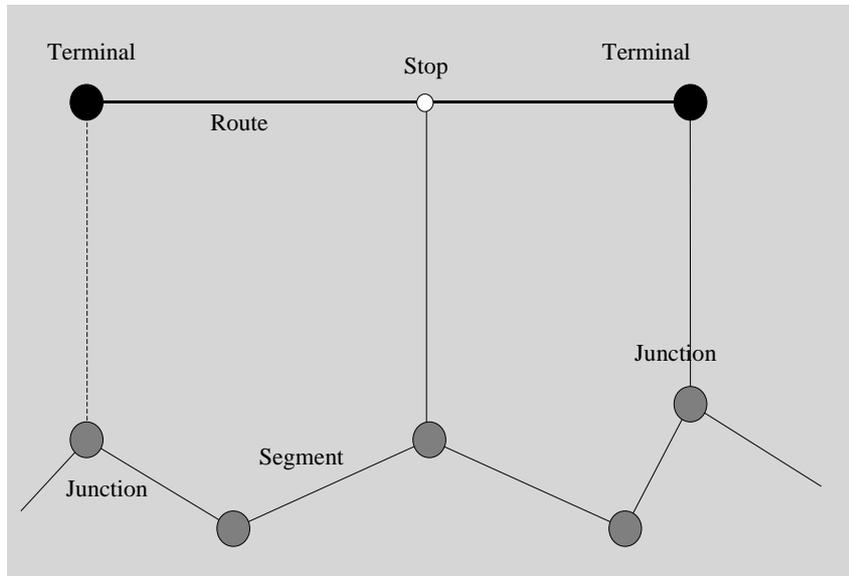
</F>

<GTFDB>

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## 4 PUBLIC TRANSPORT EXAMPLE

This example demonstrates the encoding of a public transport route in GTF.



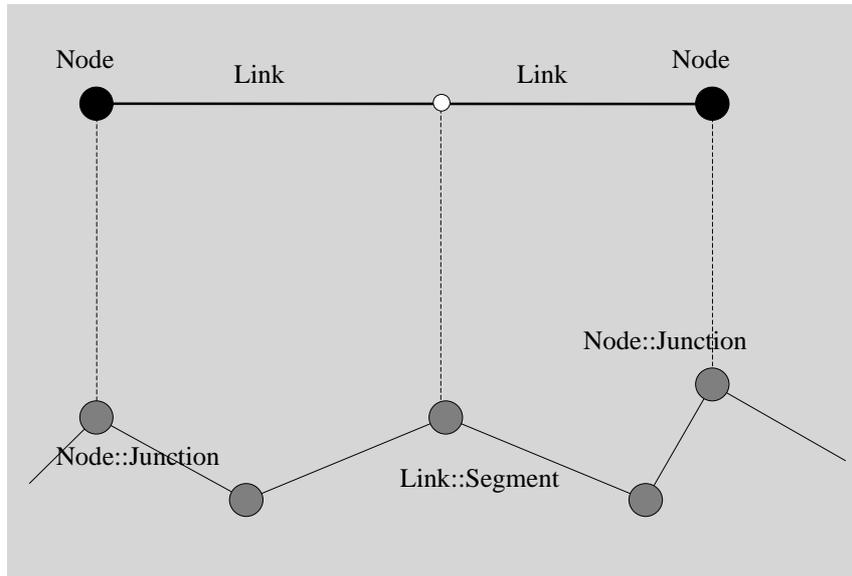
The route has one stop between two terminals as depicted above. The route is along the depicted road (along the segments) and the two junctions.

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In GTF terms this is represented as



Encoded in the adhoc XML format this is

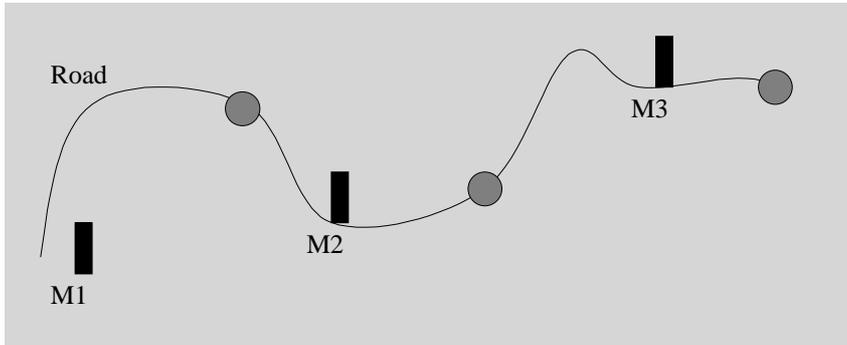
```
<!-- definition of the Public Transport example-->  
<GTFDB id= "0" name= "Public Transport Example">  
  <N id= "1">  
  </N>  
  <N id= "2" type= "stop">  
  </N>  
  <N id= "3">  
  </N>  
  <N id= "4">  
    <JU id= "5" associations= "1">  
    <JU id= "6">  
    <JU id= "7" associations= "2">  
    <JU id= "8">
```

<JU id= "9" associations= "3">  
</N>  
<L id= "10" starts\_in="1" ends\_in="2">  
</L>  
<L id= "11" starts\_in="2" ends\_in="3">  
</L>  
<L id= "12">  
    <SEG id= "13" starts\_in= "5" ends\_in= "6">  
</L>  
<L id= "14">  
    <SEG id= "15" starts\_in= "6" ends\_in= "7">  
</L>  
<L id= "16">  
    <SEG id= "17" starts\_in= "7" ends\_in= "8">  
</L>  
<L id= "18">  
    <SEG id= "19" starts\_in= "8" ends\_in= "9">  
</L>  
<GTFDB>

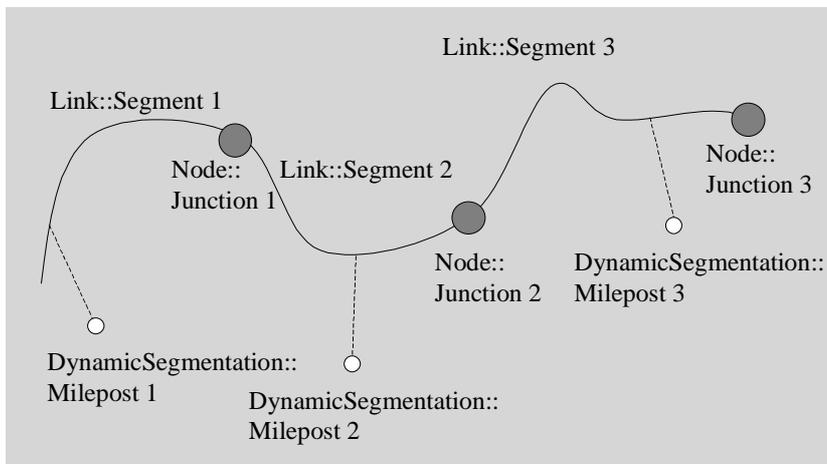
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## 5 DYNAMIC SEGMENTATION EXAMPLE

This example demonstrates the encoding of dynamic segmented road data in GTF.



In GTF terms this is represented as



The line that the each segment takes along the road would be encoded as x/y/z coordinates in Shape classes associated to the appropriate segment. This is left out in this example.

Encoded in the adhoc XML format this is

```
<!-- definition of the Public Transport example-->
```

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```

<GTFDB id= "0" name= "Public Transport Example">
  <N id= "1">
  </N>
  <N id= "2">
  </N>
  <N id= "3">
  </N>
  <L id= "7">
    <SEG id= "8" name= "Link::Segment 1" starts_in= "?" ends_in= "1">
  </L>
  <L id= "9">
    <SEG id= "10" name= "Link::Segment 2" starts_in= "1" ends_in=
    "2">
  </L>
  <L id= "11">
    <SEG id= "12" name= "Link::Segment 3" starts_in= "2" ends_in=
    "3">
  </L>
  <D>
    <MI id= "4" distance_from_beginning= "234" distance_from_ending=
    "15" associations= "8">
    <MI id= "5" distance_from_beginning= "126" distance_from_ending=
    "124" associations= "10">
    <MI id= "6" distance_from_beginning= "96" distance_from_ending=
    "53" associations= "12">
  </D>
</GTFDB>

```

## 6 REFERENCES

**XML** Marchal, Benoit (1998) *XML by Example*, Que; ISBN: 0789722429

**KIF** <http://logic.stanford.edu/kif/kif.html>

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