WAYFLOW – MOBILITY IN THE RHEIN-MAIN REGION

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SUMMARY

The Rhein-Main Region is the decentralised conurbation around Frankfurt am Main with a huge and modern traffic network. To improve mobility in this region, the WAYflow project develops a comprehensive mobility and traffic management scheme using new innovative techniques. Important aspects are the co-operation of all responsible traffic authorities and the creation of regional intermodal traffic management strategies. An information pool with multiple agent technology connects the existing decentralised databases of different traffic information suppliers. A so called "MobiChip" works as an interface between the user and the mentioned pool of traffic information to ease access to information and to gain individual mobility advice. The project is funded partly by the German Ministry of Research and Education. It has started in the end of 1998 and will last 4 years.

GENERAL SITUATION

The Rhein-Main Region, shown in **Figure 1**, is the conurbation around Frankfurt am Main (Germany) with about 3,8 million inhabitants. Having an excellent location in the networks of all interregional means of transport (motorway, railway, aviation, waterborne transport network), the region is one of the most important and prosperous economic areas in Europe.

The concentration of industry, trade and service providers causes great demands on the capacity of all traffic systems. It has been recognised that mobility plays an important role, especially as the region has a polycentric structure with historically developed functional concentrations (for example Frankfurt for banking and insurance business, Wiesbaden for administration, Darmstadt for sciences and Offenbach/Hanau for innovative industry).

Major investments have been made in the regions infrastructure to improve mobility by advanced traffic information and traffic control systems (e.g. mobility information, computerised control systems for public transport, collective route guidance, local traffic control centres). As a side effect, the Rhein-Main Region became an outstanding test area for new ITS developments. In several projects (some of them supported by the European Commission) first approaches for a regional traffic management have already been realised.

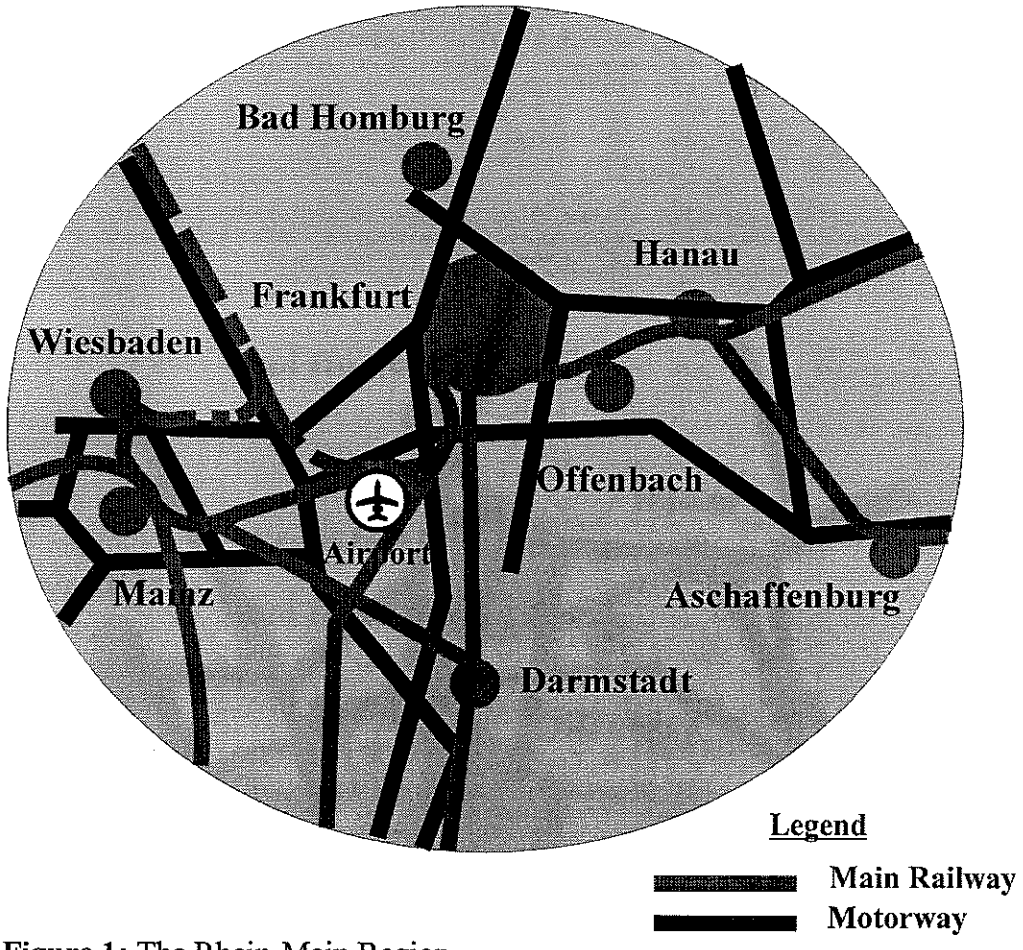

Figure 1: The Rhein-Main Region

The region does not form an administrative integrated unit. Corresponding to the polycentric structure, it is governed by different administrative bodies, and there is no single transport planning authority either. Nevertheless, all responsible institutions are aware that only co-operation will lead to a successful and a custom-designed mobility management. After some years of heading for an overall institution being responsible for traffic management in the whole region and for all modes, the region is now aiming at an organisational structure that allows intensive co-operation with competences and responsibilities remaining at the different local institutions and transport authorities.

A first step towards a regional mobility management has been the foundation of the RMV (Rhein-Main Public Transport Authority) in 1994. The RMV is responsible for all public transport supply in the region involving 15 counties and 11 cities and as many as 135 public transport operators. Another important progress towards better co-operation was gained in 1998 by founding the ZIV - Zentrum für integrierte Verkehrssysteme (Institute for Integrated Traffic and Transport Systems) and the FIV - Förderverein für integrierte Verkehrssysteme e.V. (Association for Promoting Integrated Traffic and Transport Systems). The FIV offers a platform to exchange information and to co-operate for communities, transport operators, industrial partners, consultants and other institutions. Shareholders of the ZIV are Frankfurt Airport Authority, RMV – Rhein-Main Public Transport Authority and FIV. German Rail (DB Region AG) is expected to

become shareholder in 1999. The ZIV is an institute at Darmstadt University of Technology and supported by the Hessen State Ministry for Economics, Transportation, Urban and Regional Development. As a competence centre for traffic and transport research the ZIV will support transfer between research and practice, co-ordinate activities in the Rhein-Main Region and initiate new developments.

Although the region already gained significant progress in the past, there are still major problems remaining to be addressed in the next years:

- Strategies for mobility and traffic management are not sufficiently developed, clearly defined and concerted amongst regional partners.
- An intermodal, regional, decentralised organisation for traffic management is not yet established sufficiently. There are still some problems in public-private co-operation, e.g. conflicts of interest in data providing.
- The smaller cities and districts of the region do not participate sufficiently in traffic management. In may cases, there are not enough financial resources and staff dedicated to traffic management (and because of this, partly necessary additional activities are not possible).
- Data from many traffic detectors are not used. Aged technology (e.g. for signal controlling and data transmission) and missing standards for interfaces are hindrances to integrate data and to realise control strategies. Locally recorded data are not shared sufficiently with other institutions, not at least because of compatibility problems.
- There is no sufficient knowledge about the impacts of many measures and of bundles of measures.
- The information offered to travellers in may cases is still insufficient, too difficult to access and not supporting intermodal trips.

THE WAYFLOW APPROACH

The WAYflow project will elaborate and realise a new and comprehensive concept of regional traffic management. The project is funded partly by the German Ministry of Research and Education. It has started in the end of 1998 and will last 4 years. In order to reach a high efficiency of the project, the following aspects will be considered:

- iterative processing to react optimally to changing political, economic and technological conditions,
- integration of existing know-how and other new approaches like City-FCD (Floating Car Data) and microscopic simulation of road networks,
- extensive Public Private Partnership,
- consideration to the individual wishes and expectations of the relevant user groups,
- field tests to examine the functionality of technical components and of the developed traffic management (organisational structures, implemented control strategies and comprehensive information) in order to optimise them according to the needs of the users,
- practical realisation and durable operation of WAYflow systems,

- evaluation of the results (acceptance, effects on traffic and environment,...),
- compatibility with other regions and problems.

Main partners in the WAYflow project are:

- RMV (Rhein-Main Public Transport Authority),
- HLSV (Hessen State Road and Traffic Authority),
- Philips Semiconductors,
- debis IT Services.

Further partners are DB Regio AG (German Rail), FAG (Frankfurt Airport Authority), the City of Frankfurt am Main, Adam Opel AG and others. The scientific support is provided by ZIV.

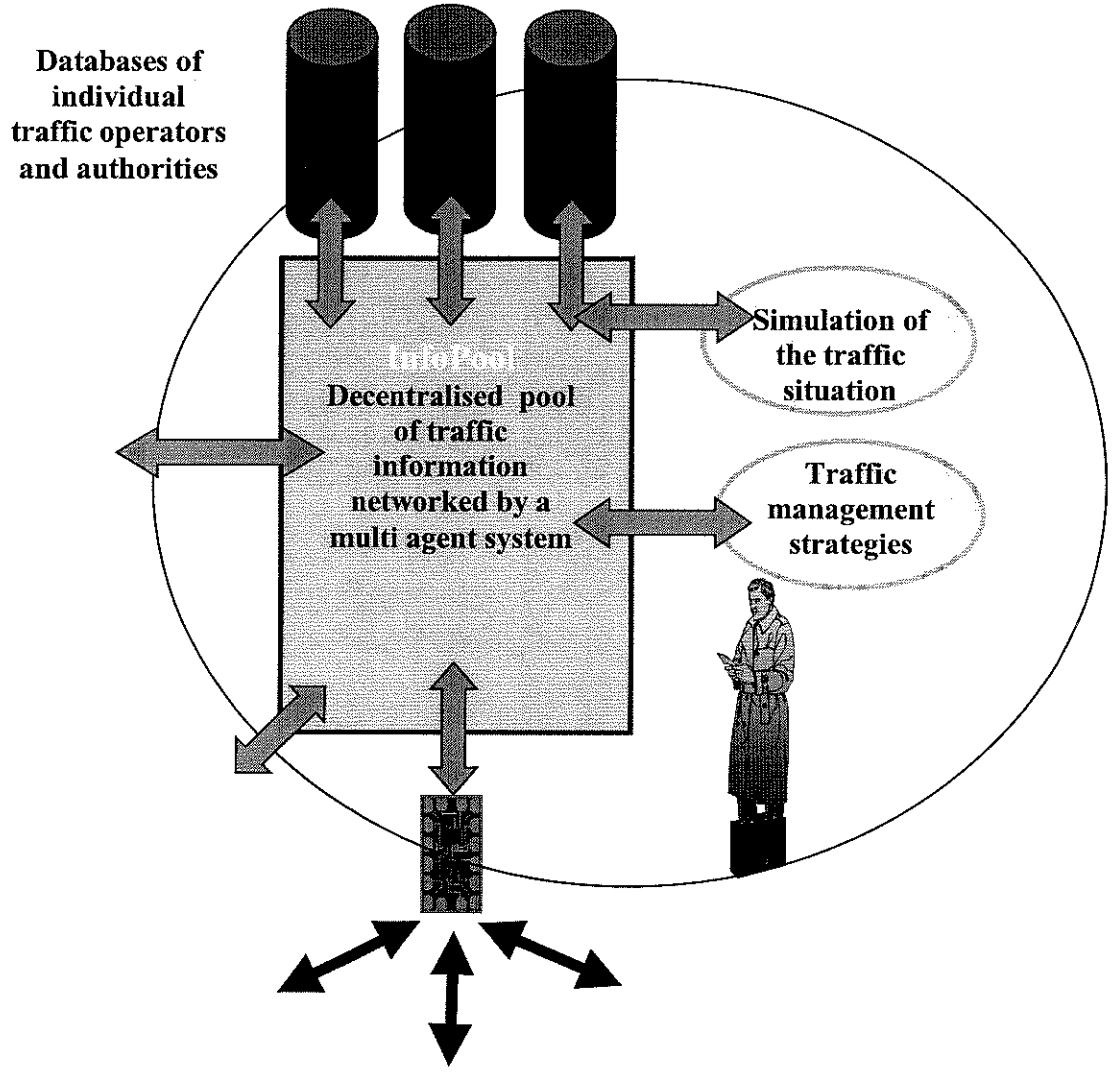

Figure 2: Main parts of the project WAYflow

MAIN PARTS OF THE PROJECT

OVERALL VIEW

The project WAYflow covers comprehensive work, and not every work package can be described here. **Figure 2** shows the main parts of WAYflow:

- MobiManagement, the comprehensive intermodal, regional traffic management,
- InfoPool, the interconnection and integration of existing traffic databases,
- MobiChip, the expert system for user-friendly access to the InfoPool.

MOBIMANAGEMENT

In this part of WAYflow, a concept for a regional and intermodal traffic management will be elaborated. Existing organisational structures for co-operation of traffic operators, local authorities and other relevant institutions are analysed. Various possible organisational structures and forms of public private partnership are considered, and the optimal one is finally selected.

Development of Dynamic Traffic Management Strategies

WAYflow develops short-term effective intermodal control strategies for a dynamic traffic management.

Strategies basically are against problems like congestion, delays in public transport, lack of parking spaces or environmental problems such as smog. As a first step, those problems have to be identified and analysed systematically in the Rhein-Main Region.

Strategies for traffic management consist of one or more measures (for example influencing traffic speed, diversion of traffic streams, advice to use public transport). Therefore, as the second step, suitable measures are collected and analysed concerning their fundamental impacts on traffic and on their specific contribution to solve the identified problem.

As the third step, systems have to be identified which can put the measures into action. Such systems may be variable message signs, broadcasting, passenger information systems and other ITS systems. Different systems may be used to realise one measure (e.g. variable message signs and radio broadcasting for a diversion of traffic). Systems are also evaluated for each case. The chosen systems are systematically integrated in a concept of actions, including the timing of measures and a flow diagram with decisions and actions. Of course, such strategies have to be actualised permanently. In case of occurring problems or incidents, the corresponding actions (traffic control and transmission of information) will then be activated, as described in the example of **Figure 3**. If it is possible, this process shall run automatically.

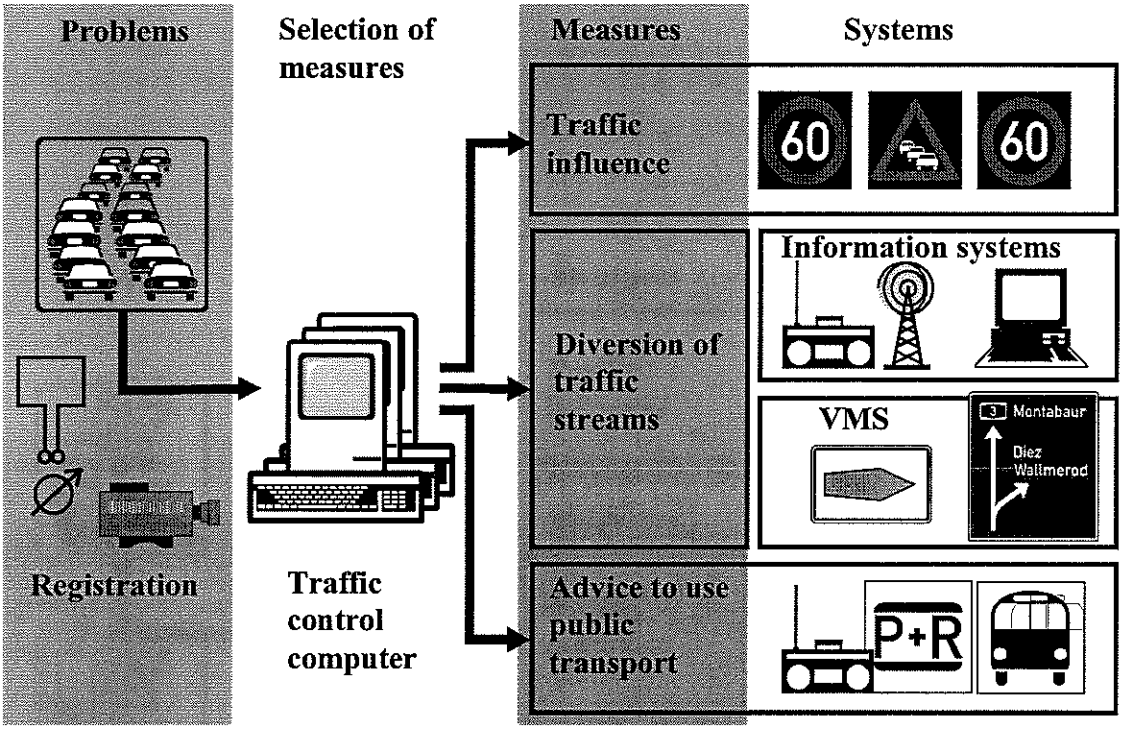

Figure 3: Realisation of dynamic traffic management strategies

Within the strategy planning process, needs concerning data detection and traffic management systems become obvious. Therefore, the strategy development is an important basis (and should be the starting point) of ITS implementation planning.

Microscopic Simulation of Traffic Flow

Microscopic simulation of traffic flow has had a fast and substantial development during the last years. Today, the grown performance of computers already allows a microscopic simulation of large networks. Based on such positive experience, microscopic simulation is actually leaving the research laboratories to become a very strong and useful tool for traffic engineers in practice. In WAYflow, the abilities of microscopic simulation for data completion, traffic forecasts and verification of chosen traffic management strategies will be examined.

First, existing data detection and processing in the Rhein-Main Region is analysed. Then, possible simulation tools are compared and evaluated. At least one simulation tool will be chosen and tested for a part of Frankfurt's urban and regional traffic network. As shown in **Figure 4**, the simulation tool shall consider on-line traffic data from local detection loops. On the other hand, it supplies the InfoPool with simulated traffic data for the whole network and important outputs like best routes, corresponding

travel time, expected density and queue lengths. These simulated data can be processed by traveller information services or used as parameters for traffic control centres.

Another aspect of data completion in WAYflow is to analyse the quality of the simulated results with regard to the quality and extent of input data. A procedure is developed which optimises the number and position of needed detectors in order to reach a sufficient quality of simulation with a minimum of expensive local data detectors.

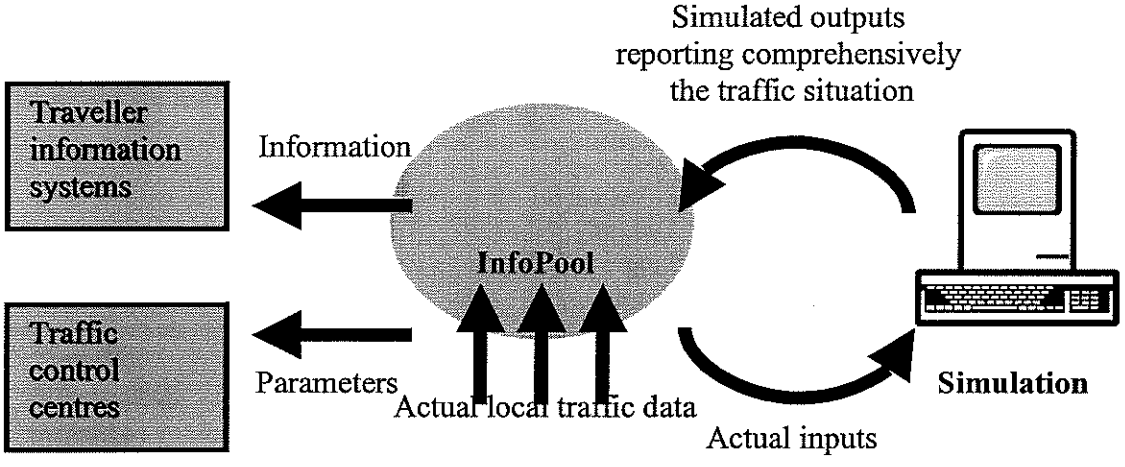

Figure 4: Interfaces between simulation and real traffic situation

INFOPOOL

Instead of collecting the multimodal traffic data centrally in a huge database, a new innovative "multi agent system" will be developed. It arranges the necessary connections in a decentralised network to existing suppliers of traffic information in order to enable a data exchange in spite of different data formats.

Figure 5 shows the basic structure of the InfoPool: The access to individual suppliers of traffic data is realised by the corresponding "Interface agents". Comprehensive "System agents" collect and adjust those data. Adjustable traffic management strategies influence the processing of this data concerning further basic services like routing and booking. The traveller can start his inquiry via several media (internet, ticket machines, public information terminal etc.). A special "User agent" transmits his demand to the InfoPool. There, different "Task agents" take care of the required service (routing, price-information, booking,...), arrange the relevant data and give the generated information back to the user via the corresponding "User agent".

The multitude of connected subsystems (dynamic motorway information, parking guidance systems in different cities, passenger information systems with timetables and actual delays at public transport operators,...) result in a comprehensive and intermodal

information for the travellers. Responsibility and updating of the data remain at the local authorities and suppliers of traffic data. New databases and systems can be added easily by the "system agents" and appropriate new "interface agents". Even very complex systems can be handled easily because of the clear modular structure with different agent types.

A big challenge in the development of this "multi agent system" are the different standards of the existing local systems, the safety of data and partly conflicting interests of involved partners which make it necessary to define different grades of data access.

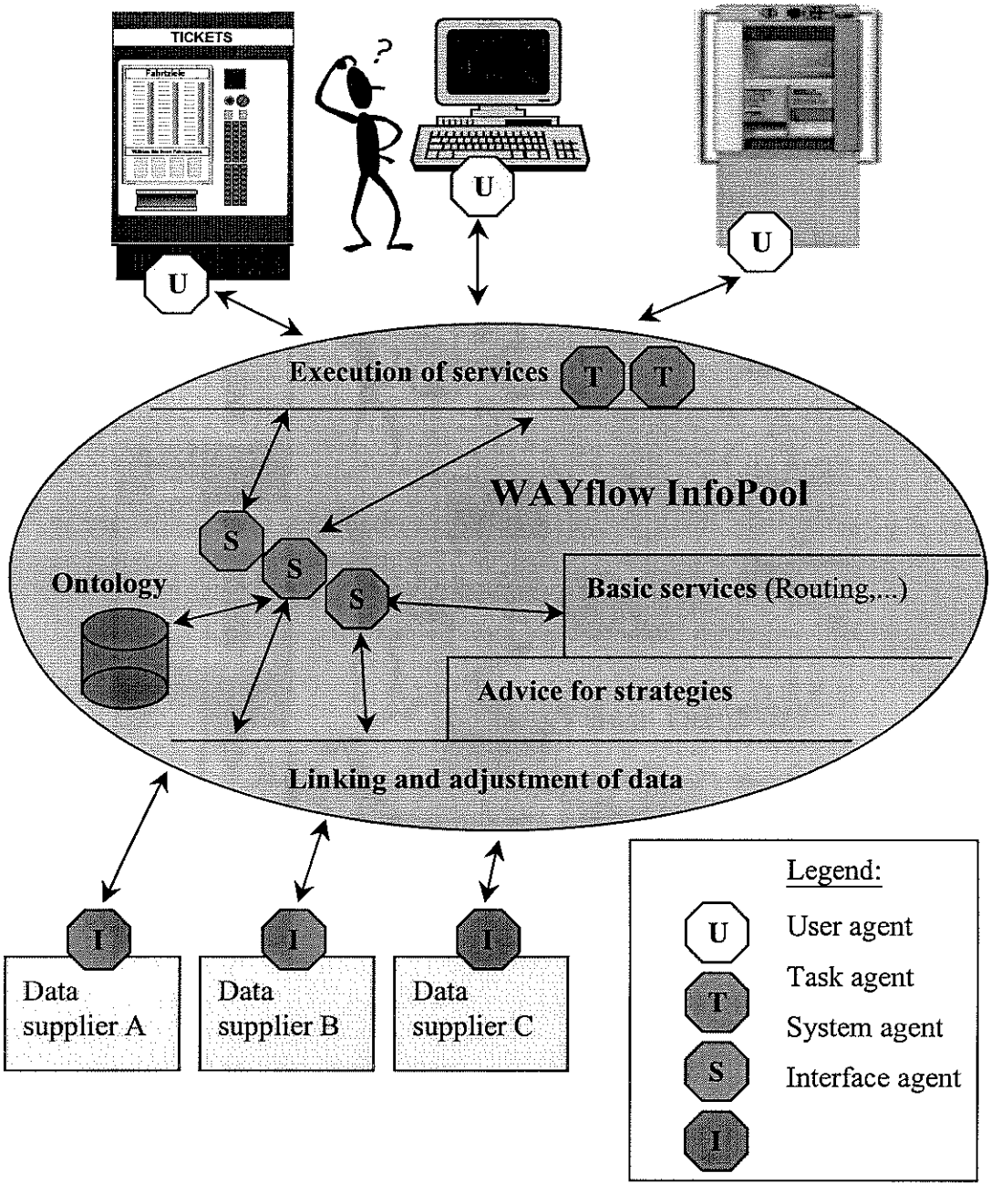

Figure 5: Basic Structure of the InfoPool **[2]**

MOBICHIP

The MobiChip is a portable medium which saves and processes data representing the traveller's personal preferences concerning his mobility. It is placed on smart cards (for example telephone cards, credit cards,...) as an additional function. Future applications like electronic ticketing and e-purse can be integrated. The MobiChip is the user-friendly interface between the traveller and the above-mentioned InfoPool. It supplies the user with individually relevant data and actualises automatically the profile of its user's traffic behaviour.

In public transport for example, the chip analyses the ordinary ticket bookings (daily destinations, individual preferences concerning means of transport, 1st or 2nd class, restrictions,...). When booking a ticket again or searching for information with the MobiChip, the traveller needs simply to confirm or to modify the suggested inputs. This saves time and makes travelling with public transport much easier. As another example, the retrieval of traveller information for this journey may be supported by the individual knowledge available on the MobiChip.

The interface technology of the contactless smart card is based on MIFARE ®, a registered trademark of Royal Philips Electronics with which already good experiences have been made **[3]**. Possible MobiChip terminals are laptops, portable phones or public terminals like ticket machines.

OUTLOOK

WAYflow is a very ambitious project. The success of such complex work programme depends on a lot of factors and of course, includes some risks. In a brainstorming at the beginning of the project, WAYflow partners came up with the following "critical factors of success":

- User acceptance of offered systems and services.
- Intentions of partners to co-operate.
- Working public-private partnerships.
- Realisation of technical and organisational interfaces.

Only if these factors are considered sufficiently, it will be possible to develop ITS systems for better mobility and for the wealth of people in the Rhein-Main Region.

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