

*Standards Requirements Package 10:
Information Service Provider Subsystem
To Other Centers*

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1. Introduction to Standards Requirements Documentation

The Standards Requirements Packages are intended to be used in conjunction with the other architecture documents. In particular, the introductory chapters of the Standards Requirements Document provide contextual material and explanations/justifications of some of the methods used to evaluate and rate architecture flows. However, it is recognized that many people may initially only receive a given Standards Requirements Package, without the associated supporting material. To aid these individuals, we offer some generic introductory material to promote understanding of the context and approach used to create a Standards Requirements Package. Ultimately, any standards development organization pursuing an ITS-related standard should ensure that they have access to a complete set of the architecture documents as a reference source.

1.1. Standards Requirements Document Executive Summary

The executive summary of the Standards Requirements Document is reproduced here, to provide a sense of the overall goals and content of the document.

The Standards Requirements Document ("SRD") collects information from the other National ITS Architecture program documents and reorganizes it in a manner intended to support the development of critical ITS standards. The key results in the SRD are a reference model for the National ITS Architecture, a rating scheme for evaluating the standardization issues associated with individual data flows that make up the architecture interfaces, and then a set of priority groupings of interfaces into standards requirements "packages". These results and the major conclusions are summarized below.

The introductory section explains the structure of the SRD and its intended usage. The strategy is that the reference model provides the overall context for a standards development organization ("SDO"). A given SDO can pull a particular package of standards requirements out of the document and then use the reference model as a quick reference to the overall architecture. More detailed needs will require going to the original source documents, such as the Logical or Physical Architectures.

The next section provides the rationale for several different ratings schemes applied to the architecture interconnects and flows. These include interoperability requirements, technology maturity assessments, stakeholder interest. All architecture interconnects were examined with respect to these measures. The stakeholder interest and interoperability requirements in particular were then used as the basis for selecting the standards requirements packages. In general, interfaces associated with mobile systems had both the greatest stakeholder interest and the most stringent interoperability requirements. Following close behind were interfaces associated with Traffic Management and Information Service Provider subsystems.

The Architecture Reference Model is provided next as a high level definition of the components that form the National ITS Architecture. It depicts the interconnectivity of the subsystems and terminators, their definitions, and suitable types of communications strategies. This reference model is an important tool for communicating the full breadth of the architecture at an abstracted level. In the SRD it is intended as a contextual reference, but, as a separate document, the reference model has received international circulation through the International Standards Organization (ISO) as a basis for documenting and comparing ITS architectures.

The "meat" of the SRD is the set of standards requirements packages. Each package is a special grouping of standards requirements and contextual information intended to be used in a nearly standalone fashion by an SDO. Thus, packages have been selected that cover the key ITS priorities, maintain the integrity and vision of the National ITS Architecture, and also are perceived as having an interested stakeholder

constituency that will help drive standardization. This is a difficult balancing act, but the following 13 packages were identified as covering the high priority standardization needs for the architecture program:

1. Dedicated Short Range Communications (DSRC, formerly “VRC”)
2. Digital Map Data Exchange and Location Referencing Formats
3. Information Service Provider Wireless Interfaces
4. Inter-Center Data Exchange for Commercial Vehicle Operations
5. Personal, Transit, and HAZMAT Maydays
6. Traffic Management Subsystem to Other Centers (except EMS)
7. Traffic Management Subsystem to Roadside Devices and Emissions Monitoring
8. Signal Priority for Transit and Emergency Vehicles
9. Emergency Management Subsystem to Other Centers
10. Information Service Provider Subsystem to Other Centers (except EMS and TMS)
11. Transit Management Subsystem Interfaces
12. Highway Rail Intersections (HRI)
13. Archived Data Management Subsystem Interfaces

These 13 areas cover much of the National ITS Architecture and represent the distillation of stakeholder interests and architecture interoperability requirements. If standardization can be achieved in the near term for all or most of these packages, then ITS will be a long ways towards achieving the original vision captured in the user service requirements.

1.2. Constructing a Standards Requirements Package

The intent of creating a Standards Requirements Package is to facilitate efforts to standardize some subset of the National ITS Architecture. The “packaging” process involves abstracting and reorganizing information from other documents, primarily the Logical and Physical Architectures. We have gone through a number of iterations to try and achieve a format that is understandable and useful for SDO's; in the end, while there is not a universal consensus, we have tried to address the substance of most of the comments received.

This Standards Requirements Package has the following main components:

- General introduction to the scope and intent of this package
- Message transaction sets
- Decomposition of the interfaces
- Communications Considerations
- Constraints
- Leveled Data Item definitions

The general introduction is self-explanatory, but the other items require some explanation. We will address them one at a time:

Message Transaction Sets: In order to accomplish a given activity, a series of messages usually have to be exchanged between two or more subsystems. These messages, as a group, constitute a message transaction set. The sequencing of the messages is shown via an ISO-style message sequence chart. Typically the physical architecture flow or highest level logical architecture data flows represent individual messages.

Interface Decomposition: This is the hierarchy of items that constitute an interface. It starts with the interface between two subsystems itself, which is then decomposed into physical architecture flows. Each of the physical architecture flows is then decomposed into a set of Leveled Architecture Flows. These sets of flows have been created in order to capture the essential information described by the National ITS Architecture on each Subsystem interface of interest. The Leveled Architecture Flows can be thought of as a simplified view of the logical architecture information, removing aggregation of data which does not add value to describing the essential information on the interface, and removing some of the lower level details in the existing data flows. These leveled architecture flows are traceable to flows in the logical architecture. The physical architecture data flows are labeled with the type of communications technology appropriate for that flow. Figure 1 shows an example of an interface decomposition. The leveled data items represent a simplification of the logical architecture information to focus on the essential data on each subsystem interface. They have been developed in order to provide traceability between the ITS standards being developed and the National ITS Architecture. Once a draft standard has been developed, the question that must be addressed is whether the standard addresses completely all elements of the National ITS Architecture interface. Due to the complex hierarchical nature of the Logical Architecture data flows, comparison with standards outputs is very difficult. By creating a simplified view of each interface, it is possible to more effectively trace the standards outputs to the National ITS Architecture.

Communications Considerations provides a discussion of the basic nature of the communications modalities that are suitable for supporting the interfaces in the particular standards requirements package. This section identifies some high level requirements, but the primary focus is to provide information that is viewed as useful to the initiation of the standardization process.

Constraints lists the architecture flows and any constraints placed upon them.

Leveled Data Items: This section provides a set of definitions for each of the leveled data elements included in the Interface Decomposition section. These definitions are simplified versions of the definitions contained in the Logical Architecture Data Dictionary, providing just the essential information to define the key elements of a subsystem interface.

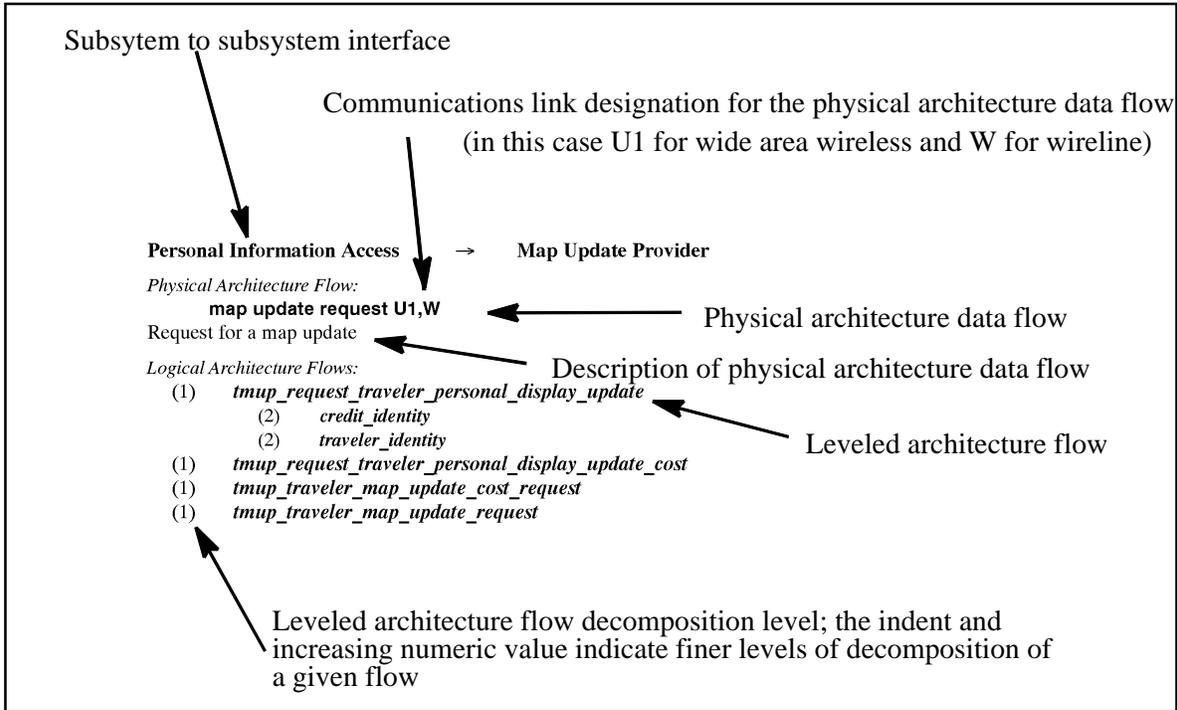


Figure 1. Example of the parts of an interface decomposition

As a final clarification, it is useful to remind readers of the distinction between the layers in the ISO OSI communications reference model and the layers in the National ITS Architecture. For purposes of analysis and discussion, the National ITS Architecture has been portrayed as having three layers: *the transportation, the communications, and the institutional layer*. The first two are of concern here. The transportation layer contains all the functionality of the National ITS Architecture. As a consequence, any discussion of interfaces, messages, data dictionary entries, etc., is drawn from the information in the transportation layer. The communications layer describes the technology required to support the information exchange needs of the transportation layer. These National ITS Architecture layers can be roughly mapped to the ISO OSI reference model; the transportation layer is typically at or above the application layer and the communications layer is most often concerned with the lowest four layers of the ISO OSI reference model. The interested reader is directed to the Communications Analysis Document for a more substantial explanation of this relationship.

This explanation of the layers is offered here because the terminology can be confusing. Every effort has been made to clarify when the “layered model” is the National ITS Architecture and when it is the OSI reference model. In general, when the term “communications layer” is used in the Standards Requirements Document, it refers to the National ITS Architecture “layer”.

2. Introduction: Information Service Provider Subsystem to Other Centers Standards Requirements Package

The ISP is either a private or public sector entity providing travel information and other services. In order to create useful information products, it is necessary for the ISP to have connections to the various information sources. This would include transit, traffic management, emergency management and other subsystems as well as specific terminators (entities external to ITS but that interface with ITS). As ISPs gain subscribers for their services, they may also build their own information repositories, which could be usefully provided to other centers. An example would be vehicle probe data on traffic conditions or user reports of incidents.

The ISP Wireless package defines the ISP to vehicle interface. This package focuses on the wireline interfaces that allow the ISP to coordinate with other centers. Absent from this package are the ISP to emergency management and the ISP to traffic management interfaces, both of which are addressed in other standards requirement packages. Standardization of this package should consider and coordinate with these other efforts. Figure 2 shows the ISP, the other subsystem and terminator entities and relevant interfaces that this document addresses.

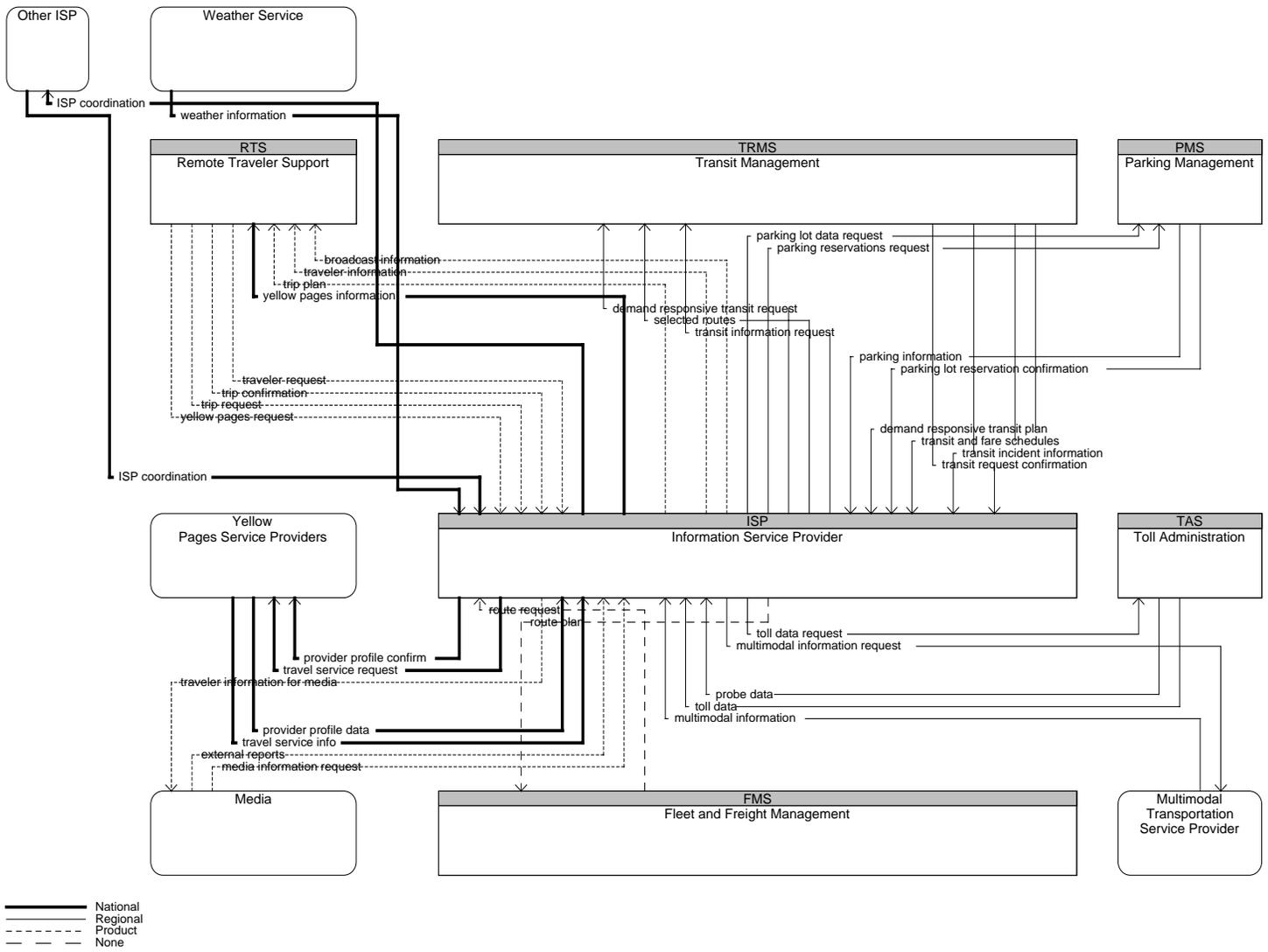


Figure 2 - ISP and ITS Wireline Interfaces to Other Subsystems and Terminators Architecture Flows

3. Transaction Sets for the Information Service Provider to Other Centers Interfaces

In this section we define the transaction sets needed to accomplish different ITS tasks. A message sequence chart format along the lines of those defined under ISO standardization is used for clarity of presentation. The following subsections each discuss the interactions between the ISP and a center subsystem or terminator.

The transaction set figures used in this chapter identify the messages that go between the Information Service Provider (ISP) subsystem and the entity in the title of the associated subsection. Where messages follow each other top to bottom, they represent a transaction sequence or protocol. Where messages are separated by a horizontal dotted line, the messages are distinct, and not related in any particular sequence. Notes to the right of the messages or in some cases groups of messages amplify on details of the message protocols and sometimes a number in a circle identifies an associated numbered section in the text which also describes the particular message or message sequence function.

The names labeling the flows are in general the physical architecture flow names found in the next chapter. In some cases, only a portion of the identified physical architecture flow is relevant for a particular message. In those cases the relevant logical architecture flows are identified in parentheses after the physical architecture flow name.

3.1. Fleet and Freight Management Subsystem (FMS)

The commercial Fleet and Freight Management Subsystem interacts with the ISP for route selection. The method of providing Route Selection in the fully developed architecture to a FMS is by the ISP. The architecture also supports the autonomous mode of guidance (route selection processing in the Vehicle or Personal Information Access subsystems) or the mode of route selection in the Vehicle where the ISP provides link and queue transit times to the mobile route selection processes. The sequence of messages is shown in Figure 3.

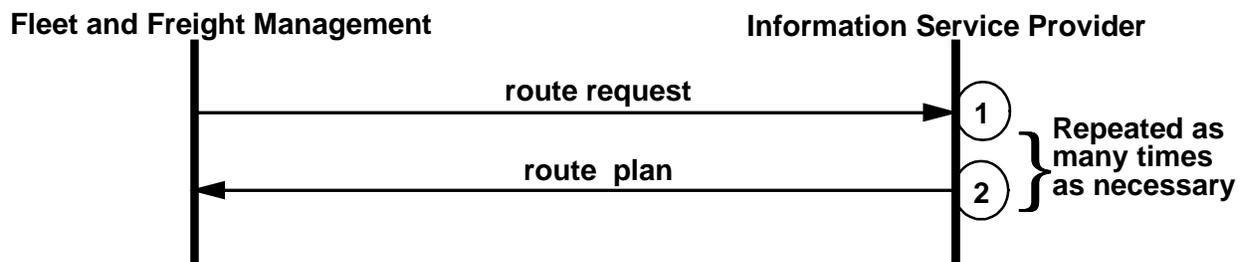


Figure 3 - Fleet and Freight Management and ISP Transaction Set

1. The FMS issues a Route Request message to the ISP.

The ISP issues, if necessary, appropriate traffic data requests to the Traffic Management Subsystem(s). These requests (and waiting for the corresponding response) may not be necessary if the ISP has recently requested (and stored) this information or if the ISP has its own proprietary traffic data surveillance processes.

2. The ISP processes a route and sends it as a route plan message to the FMS. The route sent to the FMS can include a route ID number (the *commerical_route_number* data entry in the leveled data) associated with the computed route, so that the FMS can efficiently refer to the selected route in the next step, route confirmation.

The FMS decides to accept or reject the provided route and may change the route request, going back to step 1 above.

3.2. Multimodal Transportation Service Provider Terminator

The ISP interacts with the Multimodal Transportation Service Provider (MTSP) terminator for Pre-Trip Travel Information services. The message sequence is shown in Figure 4.

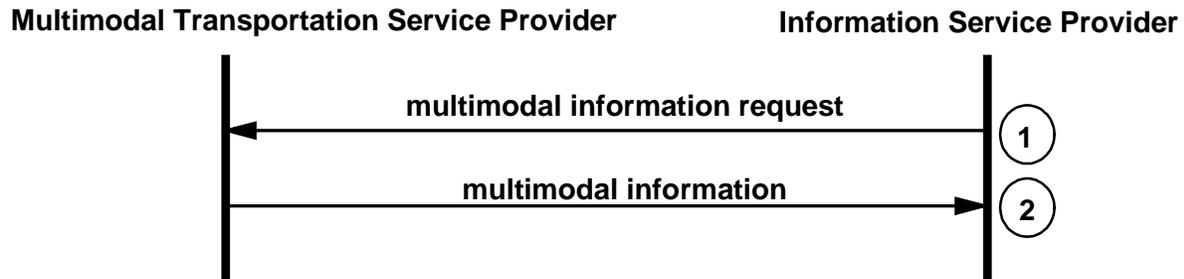


Figure 4 - Multimodal Transportation Service Provider Terminator and ISP Transaction Sets

1. In the process of supporting Pre-Trip Travel Information, the ISP may receive a trip request where other travel service provider modes are an option (e.g., rail, plane, ship, ferry, taxi, shuttle). In this case a request is sent to the appropriate “Multimodal Transportation Service Provider” external system interface.
2. The response message is sent to the ISP.

3.3. Media Terminator

The National ITS Architecture supports dissemination to the media of traffic and incident information and collection from the media of incident and traveler information. The media interface represents a data interface with another system (vs. a voice interface with some media operator). A media enterprise may include some elements of surveillance, such as listeners calling into a radio station or private surveillance deployments. Media is intended to be the radio, tv, cable, on-line data services, or print media that are outside of ITS.

The Media terminator to ISP message sequences are shown in Figure 5.

1. The Media sends external reports (which may contain incident Information) to the ISP on an event driven basis. Similarly, as a part of external reports, the Media may send event information or other tourist related information.
2. The Media may issue a request for current transportation information (media information request) to the ISP. This message may specify the level of detail and scope of travel information that the Media is interested in being informed about. The message can be a real time request for data, or a one time profile submission to request certain types of data be sent on a regular or incident event driven basis.
3. The ISP prepares and distributes customized traffic information and incident information messages to the Media terminators. Note that the ISP gets this information from its fusion of data from all transportation sources.

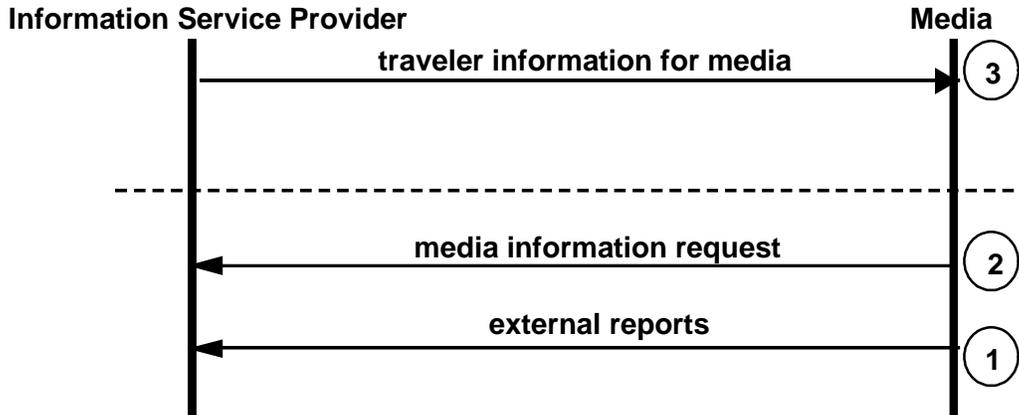


Figure 5 - Media Terminator and ISP Transaction Sets

3.4. Other ISP Subsystem

The ISP coordination data flow can contain the full range of data available at one ISP. This includes traffic and incident information (current and/or predicted), transit information, pollution data, and definitions of the road network covering the local geographic area of one ISP for use by an ISP covering another geographic area. The flow has a request and response mechanism, originating with the ISP or with the Other ISP (terminator). This interface allows one ISP to act as a wholesaler of information to other ISPs.

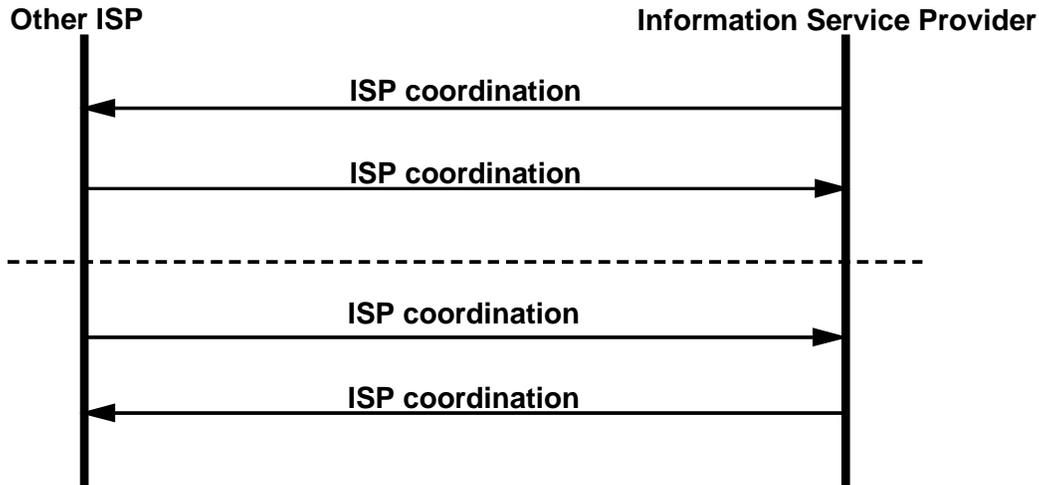


Figure 6 - Other ISP Terminator and ISP Transaction Sets

3.5. Parking Management Subsystem

The interface between the Parking Management Subsystem and the ISP supports the Pre-Trip Planning functions (Parking Lot Data Request/Parking Information) and Route Selection (Parking Reservations Request/Parking Lot Reservation Confirmation). The message transaction sets for these two services is shown in Figure 7.

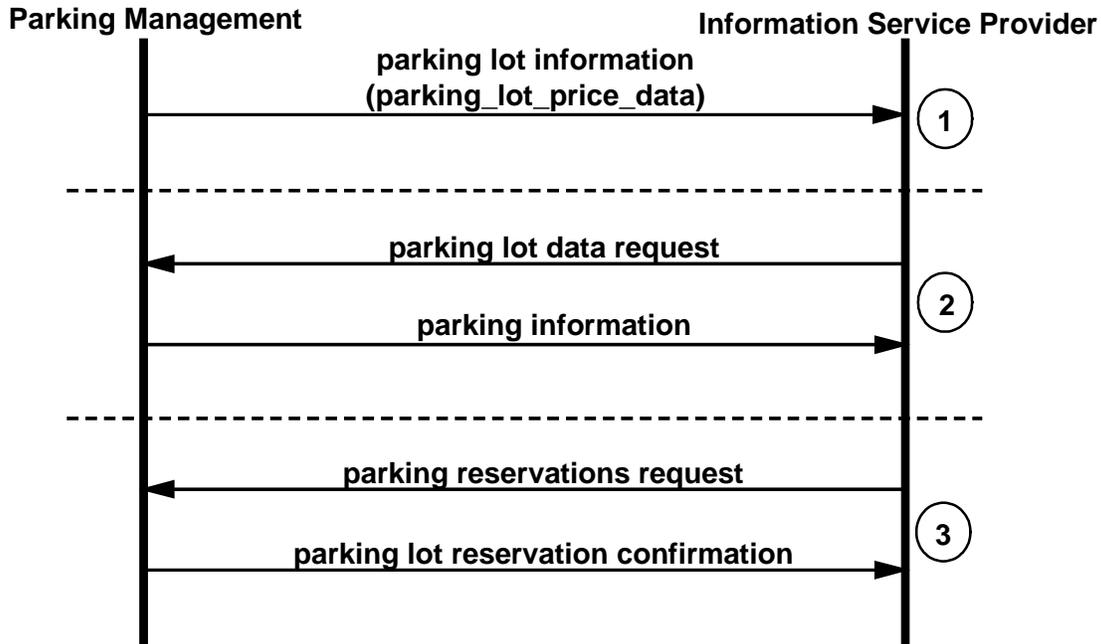


Figure 7 - Parking Management Subsystem and ISP Transaction Sets

1. The Parking Management Subsystem broadcasts pricing data for use by ISPs in trip planning (the leveled data item `parking_lot_price_data`, which is contained in the physical architecture flow `parking lot information`).
2. In order to prepare pre-trip travel information, the ISP issues appropriate parking information requests. These requests (and waiting for the corresponding response) may not be necessary if the ISP has recently requested (and stored) this information and if the ISP is reasonably confident that the information (or lack thereof) is not likely to have changed state. The ISP receives current and predicted parking information relevant to the trip request.
3. After a traveler has selected a prepared route which involves parking, the ISP sends the selected parking reservations request to the Parking Management Subsystem. Parking confirmation is received by the ISP (as part of the architecture flow `parking lot reservation confirmation`). This transaction will generally be optional and will find most application in dense urban centers where parking is in short supply, and where the travelers schedule cannot tolerate the uncertainty associated with “hunting” for a parking space.

3.6. Remote Traveler Support Subsystem

The ISP interface with the Remote Traveler Support (RTS) Subsystem has three mechanisms shown in Figure 8:

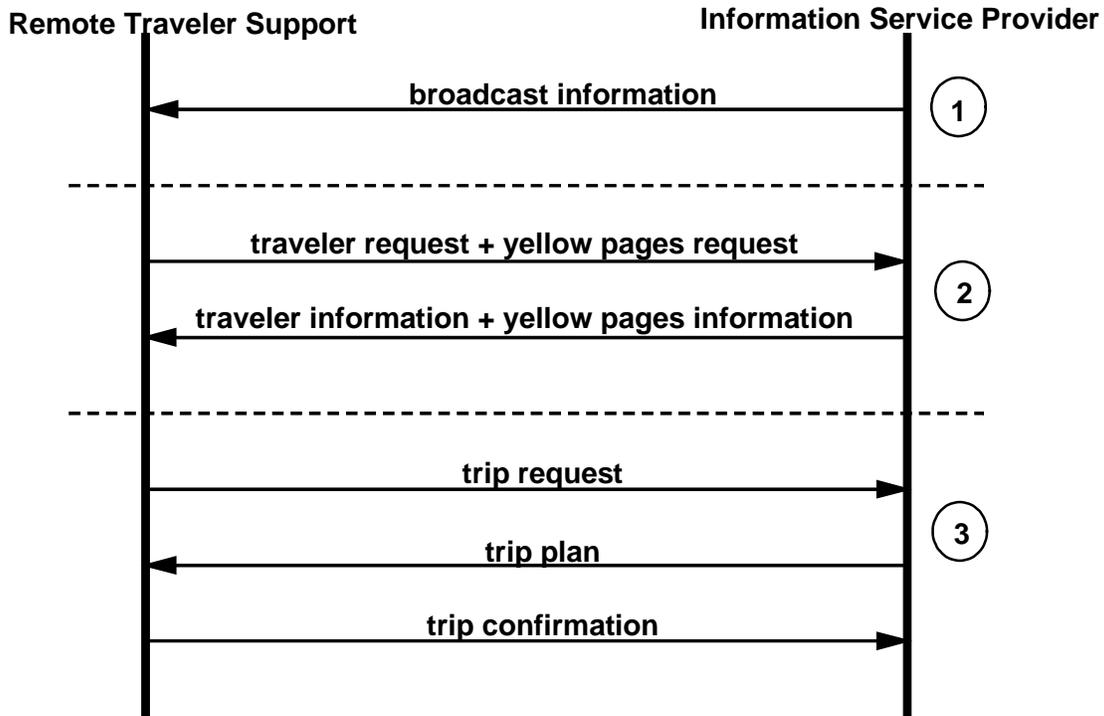


Figure 8 - Remote Traveler Support Subsystem and ISP Transaction Sets

1. One-way broadcast of travel information from ISP to RTS.

These broadcasts are received by the RTS and made available to local RTS processes for general traveler information. This broadcast information can include incident data, link state data, parking lot data, transit system data, and environmental conditions (including air quality),

2. Request/response transaction for traveler information.

Travelers can use local RTS processes to request information of a general nature, such as traffic and transit conditions or yellow pages information. They can also initiate transactions which are specific to their travel needs (make yellow pages reservations or advanced payments for parking). The ISP responds with the traveler information or yellow pages information (which in addition to the traffic and transit information, can contain confirmation of the transactions requested).

3. Specific traveler trip selection/confirmation.

The traveler can use the local RTS processes to request a specific trip plan. Inclusion of traveler constraints and preferences allows the ISP to customize to best meet the needs of the traveler. The ISP returns the trip plan, with its specific traveler route. If the trip plan calls for paratransit or rideshare, the traveler can confirm these portions of the trip (with the trip confirmation architecture flow).

1. The messages are broadly configured to support a variety of user services which use the following mechanisms from Figure 8:

- Pre-Trip Travel Information and advisories 1 or 2
- RTS based Route Selection 1 and optionally 3

- ISP-based Route Selection 3
- Ridematching and Reservation 3
- Traveler Information Services 2
- En Route Transit Information 1 or 2
- Pre-payments 2 and 3

3.7. Toll Administration Subsystem

The interface between the Toll Administration Subsystem and the ISP supports the Pre-Trip Planning functions and Route Selection. The message transaction sets for these two services is shown in Figure 9.

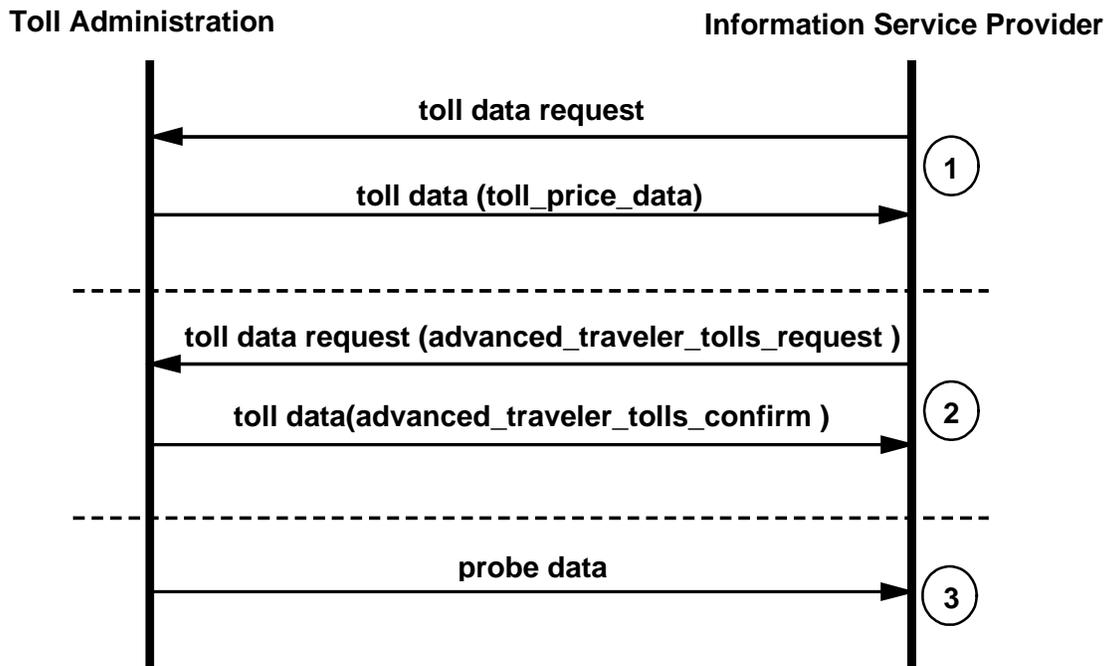


Figure 9 - Toll Administration Subsystem and ISP Transaction Sets

1. The Toll Administration Subsystem sends pricing data for use by ISPs on request.
2. Optionally, tolls can be prepaid by an ISP for a client and payment confirmed by the Toll Administration subsystem. (Note that this model of toll payment is very different than the “first come, first served” model currently deployed or planned by Toll Agencies. The proposed benefit of this mechanism is to reduce congestion on toll roads by instituting an equitable kind of toll road reservation system, analogous to a common carrier reservation system, for dynamic traffic assignment management of toll road statistical occupancy. Alternative schemes that are currently being deployed utilize congestion pricing for the same goal. The congestion pricing mechanism is exposed to concerns of equity.)
3. The Toll Administration subsystem can send toll probe data to ISPs for use in traveler information and trip planning.

3.8. Transit Management Subsystem

For clarity in the message transaction sets for the ISP to Transit Management (TRMS) Subsystem shown in Figure 10 and continued in Figure 11, sometimes the physical flow is further specified as the relevant high level logical architecture flow component for a particular transaction.

1. Demand Responsive Transit (formerly known as “Paratransit”) Information and Reservations. The ISP acts as an “agent” for a traveler to iterate on identifying an acceptable demand responsive route, and then assists the traveler in confirming that selected route with the TRMS.
2. ISP requests transit fare data (transit_fare_data_list as part of architecture flow transit and fare schedules) for the entire transit schedule from TRMS. Used for trip planning and advisories.
3. Enable “reserved seating” services, e.g. for demand responsive transit, to be purchased.
4. Enable transit users on transit vehicles to make parking and other reservations.
5. ISP requests Transit Services and timings for the entire transit schedule from TRMS. Used for trip planning and advisories.
6. TRMS provides a custom transit route in response to a specific origin/destination request from the ISP.
7. Sending schedule deviations from the TRMS to the ISP:
 - The ISP may request the transit deviation details.
 - In response, the TRMS sends the ISP the deviation details.
8. The TRMS notifies the ISP of a transit incident with details.

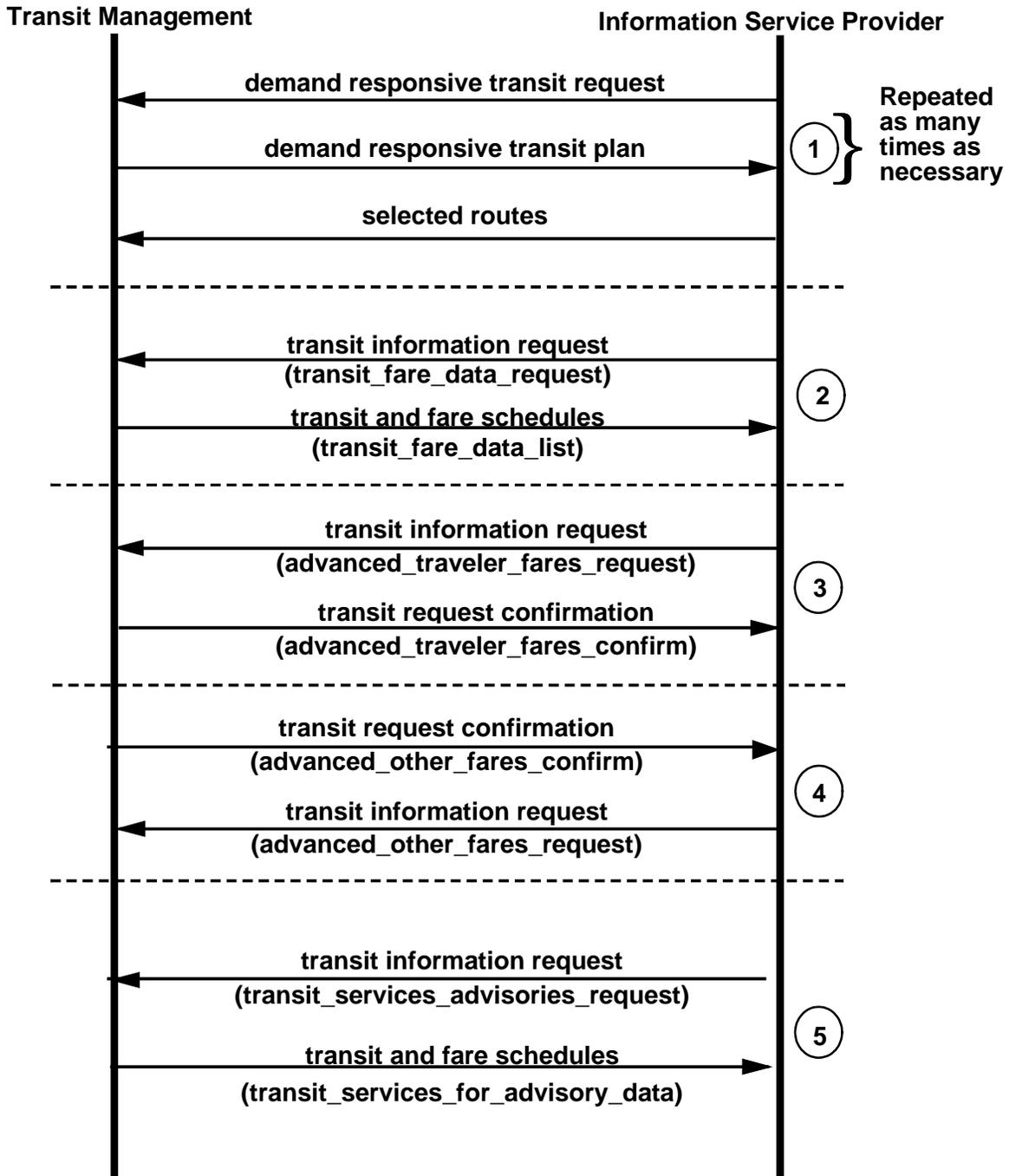


Figure 10 - Transit Management Subsystem and ISP Transaction Sets

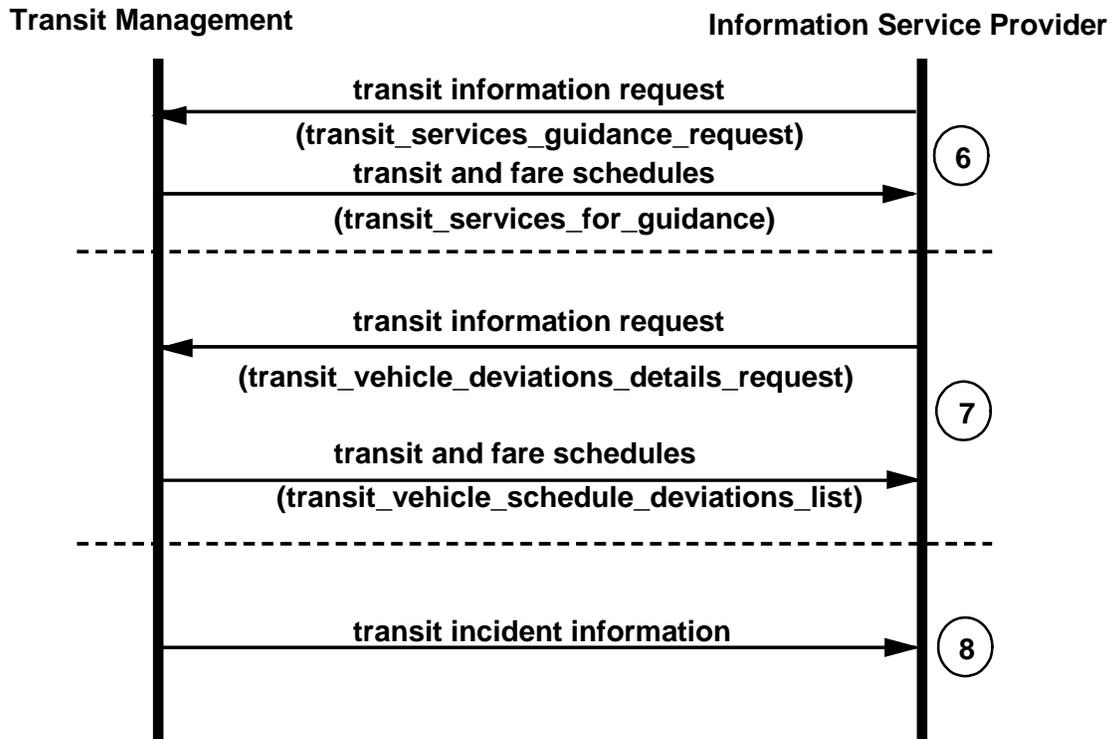


Figure 11 - Transit Management Subsystem and ISP Transaction Sets (continued)

3.9. Weather Service Terminator

Current and predicted weather data are sent to the ISP. The ISP uses this data for routing and traveler advisories.



Figure 12 - Weather Service Terminator and ISP Transaction Sets

3.10. Yellow Pages Service Provider Terminator

The Yellow Pages Services Provider (YPSP) Terminator transaction sets with the ISP, shown in Figure 13, has the following three functions:

1. Registration of the YPSP with the ISP for future transactions and update of the registration or YPSP information.
2. Transmission of Yellow Pages data to the ISP for rapid access for travel information. This transmission only takes place if the ISP does not have the data it needs, or it has been a long time since the data was last requested.
3. Transactions allowing purchase of yellow pages goods or services with confirmation.

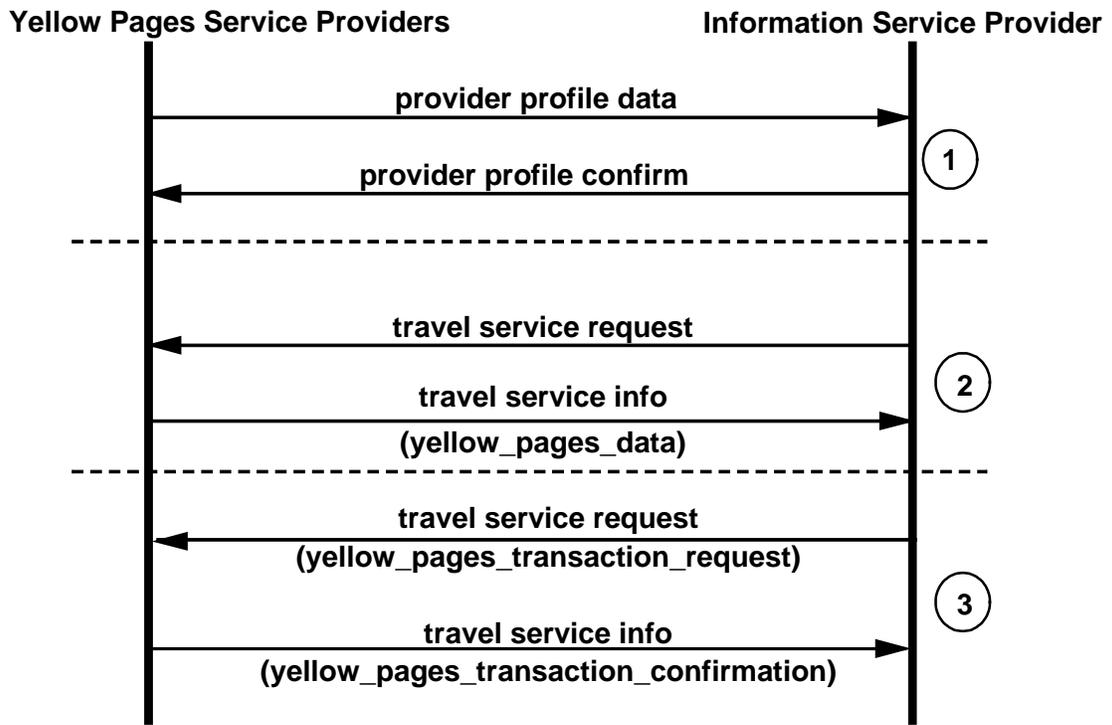


Figure 13 - Yellow Pages Service Provider Terminator and ISP Transaction Sets

4. Interface Decomposition

This section shows the interface decomposition for the interfaces covered in this package. The format shows the interface followed by the first physical architecture data flow in the interface and its description. Each of the physical architecture flows is then decomposed into its constituent leveled data items, which in turn are decomposed hierarchically into more basic leveled architecture flows. The leveled data items are numbered and indented to indicate which are top level flows (1) and which are constituent data flows (numbered 2 and lower). The description of the top level leveled data item is given. The full leveled data item definition for the top level flows and for all the constituent flows is given in Section 7. That section contains the leveled data item entries, listed in alphabetical order, for all of the leveled data items contained in this package. The leveled data items represent a simplification of the logical architecture information to focus on the essential data on each subsystem interface. They are traceable to the original logical architecture data elements, and have been developed in order to provide traceability between the ITS standards being developed and the National ITS Architecture. Once a draft standard has been developed the question that must be addressed is whether the standard completely addresses all elements of the National ITS Architecture interface. Due to the complex hierarchical nature of the Logical Architecture data flows, comparison with standards outputs is very difficult. By creating a simplified view of each interface, it is possible to more effectively trace the standards outputs to the National ITS Architecture.

4.1. Information Service Provider -> Fleet and Freight Management

Physical Architecture Flow: route plan W

Tailored route provided by ISP in response to a specific request.

Leveled Data Items:

(1) *commercial_route*

This data item contains details of a route. This will have been produced to fit the origin, destination, preferences and constraints requirements provided by a traveler through the trip request data. The route segment(s) will be in sets, one for a primary route (the nearest fit to the traveler's requirements), plus one or more alternates that may give a better modal split, or improved journey time, etc. There may be one or many route segments depending on the length of the route.

4.2. Fleet and Freight Management -> Information Service Provider

Physical Architecture Flow: route request W

Request for a tailored route based on given constraints.

Leveled Data Items:

(1) *commercial_route_request*

This data item is used to request the preparation of a dynamic route for a commercial vehicle and originates with the commercial vehicle fleet manager.

(2) *commercial_route_number*

(2) *constraint_on_acceptable_travel_time*

(2) *constraint_on_ahs_lanes*

(2) *constraint_on_eta_change*

(2) *constraint_on_interstate*

- (2) *constraint_on_load_classification*
- (2) *constraint_on_urban*
- (2) *constraint_on_vehicle_type*
- (2) *departure_time*
- (2) *desired_arrival_time*
- (2) *destination*
- (2) *modes*
- (2) *origin*
- (2) *preferred_alternate_routes*
- (2) *preferred_route_segments*
- (2) *preferred_routes*
- (2) *preferred_weather_conditions*
- (2) *vehicle_identity*

4.3. Media -> Information Service Provider

Physical Architecture Flow: external reports

W

Traffic and incident information that is collected by the media through a variety of mechanisms (e.g., radio station call-in programs, air surveillance).

Leveled Data Items:

(1) *from_media_incident_details*

This data item contains data about an incident that has been reported by a member of the traveling public to the media by mechanisms that are outside of ITS, e.g. car phone.

- (2) *incident_duration*
- (2) *incident_location*
- (2) *incident_severity*
- (2) *incident_start_time*
- (2) *incident_type*
- (2) *media_identity*

(1) *from_media_traveler_information*

This data item contains information that the media has that might be of interest to travelers planning trips. This may include but not be limited to such things as sports or special events.

Physical Architecture Flow: media information request

W

Request from the media for current transportation information.

Leveled Data Items:

(1) *from_media_incident_information_request*

This data item contains a request for data on incidents to be sent to the Media. The request must specify

whether all, current incidents or planned events are required, in the latter case state the time period by date and hour range, and the geographic area(s) to which it should relate.

(1) *from_media_traffic_information_request*

This data item contains a request from the Media for traffic information. The request must specify the type of information required (flow/congestion) and the geographic area(s) to which it should relate.

(1) *from_media_transit_vehicle_deviations_request*

This data item contains a request for data on schedule deviations of specific transit vehicles or routes.

4.4. Multimodal Transportation Service Provider -> Information Service Provider

Physical Architecture Flow: multimodal information

W

Schedule information for alternate mode transportation providers such as train, ferry, air and bus.

Leveled Data Items:

(1) *air_services*

This data item contains details of the regular and charter air services available to travelers.

(1) *ferry_services*

This data item contains details of the sea and river ferry services available to travelers.

(1) *multimodal_service_confirmation*

This data item contains confirmation that a previous request from a traveler for an alternate mode service has been accepted.

(1) *rail_services*

This data item contains details of the heavy rail services (i.e. those which do not form part of a transit operation) available to travelers.

4.5. Other ISP -> Information Service Provider

Physical Architecture Flow: ISP coordination

W

Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.

Leveled Data Items:

(1) *isp_traffic_data_request*

This data item contains a request (either as a subscription or as individual request) to another ISP for available traffic data to be provided. This allows an ISP to act as a wholesaler and send data from an Other ISP to the process.

(1) *isp_traffic_information*

This data item contains a complete (or partial) set of the traffic data which has been created through fusion of available data sources.

(2) *current_other_routes_use*

(3) *route_segment_guided_travelers*

(3) *route_segment_identity*

(3) *route_segment_journey_time*

(3) *route_segment_total_number*

- (2) *current_road_network_use*
 - (3) *route_segment_identity*
 - (3) *route_segment_journey_time*
 - (3) *route_segment_total_number*
 - (3) *route_segment_use_prediction*
 - (4) *route_segment_guided_vehicles*
- (2) *hov_lane_data*
 - (3) *hov_lane_vehicle_count*
 - (3) *hov_lane_violation_count*
- (2) *incident_data*
 - (3) *incident_description*
 - (3) *incident_duration*
 - (3) *incident_location*
 - (3) *incident_number*
 - (3) *incident_severity*
 - (3) *incident_start_time*
 - (3) *incident_traffic_impact*
 - (3) *incident_type*
 - (3) *incident_vehicles_involved*
- (2) *link_data_from_avl_list*
 - (3) *link_queue_time*
 - (3) *link_speed*
 - (3) *link_travel_time*
- (2) *link_data_from_tags_list*
 - (3) *link_queue_time*
 - (3) *link_travel_time*
- (2) *link_state_data*
 - (3) *link_list*
 - (3) *vehicle_count*
 - (3) *vehicle_headway*
 - (3) *vehicle_occupancy*
 - (3) *vehicle_queue_length*
 - (3) *vehicle_speed*
- (2) *parking_lot_storage_data_list*
 - (3) *parking_lot_current_occupancy*
 - (4) *parking_lot_calculated_occupancy*
 - (4) *parking_lot_identity*
 - (3) *parking_lot_identity*
 - (3) *parking_lot_state*

- (2) *planned_events*
 - (3) *incident_description*
 - (3) *incident_location*
 - (3) *incident_severity*
 - (3) *incident_traffic_impact*
 - (3) *incident_type*
- (2) *predicted_highway_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_highways*
 - (3) *link_occupancy*
 - (3) *link_speed*
 - (3) *link_travel_time*
- (2) *predicted_hov_lane_data*
 - (3) *hov_lane_vehicle_count*
 - (3) *hov_lane_violation_count*
- (2) *predicted_other_routes_use*
 - (3) *route_segment_guided_travelers*
 - (3) *route_segment_identity*
 - (3) *route_segment_journey_time*
 - (3) *route_segment_total_number*
- (2) *predicted_parking_lot_data*
 - (3) *parking_lot_identity*
 - (3) *parking_lot_occupancy*
 - (3) *parking_lot_state*
- (2) *predicted_road_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_roads*
 - (3) *link_occupancy*
 - (3) *link_speed*
 - (3) *link_travel_time*
- (2) *predicted_road_network_use*
 - (3) *route_segment_guided_vehicles*
 - (3) *route_segment_identity*
 - (3) *route_segment_journey_time*
 - (3) *route_segment_total_number*
- (2) *ramp_signal_state_list*
 - (3) *ramp_controls*
 - (3) *ramp_identity_list*

(1) *isp_transit_data_request*

This data item contains a request (either as a subscription or as individual request) to another ISP for available transit data to be provided.

(1) *isp_transit_information*

This data item provides data on the current state of transit operations (regarding both incidents and transit vehicle schedule status) for use by the Other ISP (information service provider).

(2) *transit_vehicle_eta*

(3) *transit_route_number*

(3) *transit_vehicle_identity*

(3) *transit_vehicle_time*

(2) *transit_vehicle_passenger_loading_list*

(3) *transit_route_number*

(3) *transit_route_segment_number*

(3) *transit_vehicle_identity*

(3) *transit_vehicle_passengers*

(2) *transit_vehicle_running_times_list*

(3) *transit_route_number*

(3) *transit_route_segment_number*

(3) *transit_stop_scheduled_time*

(2) *transit_vehicle_schedule_deviations_list*

(3) *transit_route_number*

(3) *transit_route_segment_number*

(3) *transit_vehicle_achieved_time*

(3) *transit_vehicle_identity*

(1) *road_data*

This data item contains definitions of the road network in the local geographic area.

(1) *source_identity*

This data item defines the logical identifier of a source of information.

(1) *wide_area_pollution_data*

This data item contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center (TMC).

(2) *pollution_state_area_collection*

(3) *area_air_quality_index*

(3) *current_pollution_data*

(3) *current_pollution_location*

(2) *pollution_state_roadside_collection*

(3) *current_pollution_data*

(3) *current_roadside_pollution_location*

4.6. Parking Management -> Information Service Provider

Physical Architecture Flow: parking information

W

General parking information and current parking availability.

Leveled Data Items:

(1) *parking_lot_availability*

This data item contains details of the number of spaces available in the lot in response to a previous request for this data.

(2) *handicap_access_information*

(2) *parking_lot_hours_of_operation*

(2) *parking_lot_identity*

(2) *parking_lot_spaces*

(2) *traveler_identity*

(1) *parking_lot_price_data*

This data item contains the prices being charged by each parking lot for each of its spaces, together with the time and date for which they apply.

(2) *parking_lot_charge_application_time*

(2) *parking_lot_identity_list*

(2) *parking_lot_price*

(2) *vehicle_type_for_charges*

Physical Architecture Flow: parking lot reservation confirmation

W

Confirmation for parking lot reservation.

Leveled Data Items:

(1) *advanced_other_charges_confirm*

This data item shows whether or not an advanced parking lot payment transaction has been confirmed or not.

(2) *confirmation_flag*

(2) *credit_identity*

(2) *parking_lot_cost*

(2) *stored_credit*

(2) *vehicle_identity*

(1) *advanced_traveler_charges_confirm*

This data item contains data about an advanced parking lot charge transaction requested by a traveler.

(2) *confirmation_flag*

(2) *parking_lot_cost*

(2) *stored_credit*

(2) *traveler_identity*

(1) *confirmation_flag*

This data item indicates the success or failure of a request or transaction

(1) *credit_identity*

This data item contains the identity number of a credit card which is to be used to secure preclearance from paying dues, taxes, and other commercial vehicles charges, or by a traveler or driver for payment of current or advanced tolls, fares, parking lot charges, or for yellow pages services.

(1) *parking_lot_cost*

This data item defines the cost of particular vehicle using a space in a parking lot for a particular time period.

(1) *parking_lot_identity_list*

This data item contains a list of parking lots to which a particular strategy is to be applied. The strategy will either promote or discourage the use of the parking lots to generally improve traffic flow conditions in the geographic area controlled by the TMC.

(1) *parking_lot_reservation_confirm*

This data item contains the confirmation that a previously requested reservation of a space at a parking lot has been confirmed and can be included in a traveler's confirmed trip plan.

(2) *parking_lot_identity_list*

(2) *reservation_status*

(3) *confirmation_flag*

(2) *traveler_identity*

(1) *stored_credit*

This data item contains the value of the credit currently stored by the payment instrument.

(1) *traveler_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

(1) *vehicle_identity*

This data item contains the identity of a vehicle.

4.7. Remote Traveler Support -> Information Service Provider

Physical Architecture Flow: traveler request

W

Request by a traveler to summon assistance, request information, make a reservation, or initiate any other traveler service.

Leveled Data Items:

(1) *advanced_charges*

This data item contains data to enable an advanced parking lot charge to be calculated and billed, and can be input by either a driver from a vehicle, or a transit user from on-board a transit vehicle or at the roadside, i.e. a transit stop.

(2) *credit_identity*

(2) *parking_lot_identity_list*

(2) *parking_space_requirements*

(2) *stored_credit*

(2) *traveler_identity*

(2) *vehicle_identity*

(1) *advanced_tolls*

This data item contains data to enable an advanced toll to be calculated and billed.

(2) *credit_identity*

(2) *stored_credit*

(2) *toll_route_segment_list*

(2) *vehicle_identity*

(1) *traffic_data_kiosk_request*

This data item contains the request for the provision of traffic data for output at a kiosk.

(2) *kiosk_identity*

(1) *transit_deviation_kiosk_request*

This data item requests for data on current transit service deviations for output to a kiosk.

(2) *kiosk_identity*

(2) *transit_vehicle_deviation_request*

(1) *traveler_current_condition_request*

This data item contains a request for details of the current conditions, e.g. weather, events, incidents, etc. The request includes the identity of the kiosk from which the request was input by the traveler so that the response can be correctly returned.

(2) *kiosk_identity*

(1) *traveler_payment_information*

This data item contains details of the components of a trip which a traveler has obtained from the input of data to a kiosk.

(2) *credit_identity*

(2) *kiosk_identity*

(2) *parking_space_requirements*

(2) *stored_credit*

(2) *toll_route_segment_list*

(2) *transit_route_segment_list*

(3) *link_identity_list*

(3) *transit_route_segment_cost*

(3) *transit_route_segment_number*

(1) *traveler_transaction_request*

This data item contains data input by the traveler at a kiosk to make reservations for various other (yellow pages) services.

(2) *yellow_pages_dining_reservation*

(2) *yellow_pages_lodging_reservation*

(2) *yellow_pages_ticket_purchase*

(1) *traveler_yellow_pages_information_request*

This data item contains a request for data on other (yellow pages) services to be provided to a traveler at the identified kiosk. As no filtering components are included, all the data currently available will be provided.

(2) *kiosk_identity*

Physical Architecture Flow: trip confirmation

W

Acknowledgement by the driver/traveler of acceptance of a route.

Leveled Data Items:

(1) *paratransit_service_confirmation*

This data item confirms that the traveler wants to use the previously identified paratransit service.

(2) *paratransit_service_identity*

(2) *transit_confirmation_flag*

(2) *traveler_identity*

(1) *traveler_rideshare_confirmation*

This data item contains a traveler's request to confirm a rideshare based trip.

(2) *credit_identity*

(2) *reservation_status*

(3) *confirmation_flag*

(2) *rideshare_selection_number*

(2) *traveler_identity*

Physical Architecture Flow: trip request

W

Request by a driver/traveler for special routing.

Leveled Data Items:

(1) *constraints*

This data item contains the constraints being placed on the choice of route and which will override any preferences that are also specified. Unless a default value is specifically defined, a value giving the least severe requirement will be used. Some parameters will have to be supplied by the traveler or driver (or provided by a process as a default value) before the route selection process can proceed.

(2) *constraint_on_acceptable_travel_time*

(2) *constraint_on_ahs_lanes*

(2) *constraint_on_eta_change*

(2) *constraint_on_interstate*

(2) *constraint_on_load_classification*

(2) *constraint_on_number_of_mode_changes*

(2) *constraint_on_number_of_transfers*

(2) *constraint_on_special_needs*

(2) *constraint_on_urban*

(2) *constraint_on_vehicle_type*

(1) *departure_time*

This data item defines the time at which a driver or traveler's planned or requested trip is to start.

(1) *desired_arrival_time*

This data item specifies the target time for arrival at the end of a driver or traveler's planned or requested trip.

(1) *destination*

This data item defines the destination point for a trip request or a route to be used by a traveler or a vehicle.

(1) *origin*

This data item defines the origin point for a trip request or a route to be used by a traveler or a vehicle.

(1) *preferences*

This data item is part of the data needed to request a route involving automatic highway system (ahs) lanes. It contains the preferences being placed on the choice of a route being requested by a driver or traveler.

(2) *modes*

(2) *preferred_alternate_routes*

(2) *preferred_ridesharing_options*

(2) *preferred_route_segments*

(2) *preferred_routes*

(2) *preferred_transit_options*

(2) *preferred_weather_conditions*

(1) *traveler_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

Physical Architecture Flow: yellow pages request

W

Request for information through a yellow pages type service.

Leveled Data Items:

(1) *traveler_yellow_pages_information_request*

This data item contains a request for data on other (yellow pages) services to be provided to a traveler at the identified kiosk. As no filtering components are included, all the data currently available will be provided.

(2) *kiosk_identity*

4.8. Toll Administration -> Information Service Provider

Physical Architecture Flow: probe data

W

Aggregate data from probe vehicles including location, speed for a given link or collection of links.

Leveled Data Items:

(1) *route_segment_identity*

This data item identifies a route segment by name, location, or other standard location reference.

(1) *route_segment_journey_time_from_tolls*

This data item contains the smoothed average vehicle journey times for the route segment between two toll collection points, obtained from the passing times of those vehicles equipped for electronic toll collection.

(1) *route_segment_type*

This data item defines the type of route segment and indicates any special restrictions associated with its use. The route segment type may indicate the class of road, railway, or walkway. Special restrictions can indicate vehicle type or mode restrictions for the segment.

(1) *vehicle_toll_probe_data*

This data item contains the smoothed average vehicle journey times for the route segment between two toll collection points, and the identity of the route segment. The data is used to calculate link journey times for in-vehicle guidance purposes.

Physical Architecture Flow: toll data

W

Current toll schedules for different types of vehicles as well as advanced toll payment information.

Leveled Data Items:

(1) *advanced_other_tolls_confirm*

This data item is used to confirm the advanced payment of tolls by a driver.

(2) *confirmation_flag*

(2) *credit_identity*

(2) *stored_credit*

(2) *toll_cost*

(2) *vehicle_identity*

(1) *advanced_traveler_tolls_confirm*

This data item contains data about an advanced toll transaction requested by a traveler.

(2) *confirmation_flag*

(2) *stored_credit*

(2) *toll_cost*

(2) *traveler_identity*

(1) *toll_price_data*

This data item contains the price for each road segment to which a toll applies, with the time and date for when it applies.

(2) *toll_price_application_time*

(1) *vehicle_type_for_tolls*

This data item contains the vehicle type and identity as determined from processing of the vehicle's characteristics for the purpose of charging for tolls.

(2) *commercial_carrier_information*

(2) *commercial_driver_information*

(2) *commercial_vehicle_characteristics*

(3) *commercial_vehicle_configuration*

(3) *commercial_vehicle_size*

- (3) *commercial_vehicle_weight*
- (2) *commercial_vehicle_information*
- (2) *vehicle_identity*
- (2) *vehicle_type*

4.9. Transit Management -> Information Service Provider

Physical Architecture Flow: demand responsive transit plan **W**
 Plan regarding overall demand responsive transit schedules and deployment.

Leveled Data Items:

(1) *paratransit_arrival_time*

This data item contains the time at which the requested paratransit service will get the traveler to the requested destination.

(1) *paratransit_availability_time*

This data item contains a time window of availability of the requested paratransit service. If the traveler does not confirm the use of the service within this time frame, the details will no longer be valid, and the traveler will have to re-request the service.

(1) *paratransit_destination*

This data item contains the destination of the requested paratransit service, which may not be the traveler's final destination, since the remainder of the trip may be completed by other means, e.g. regular public transit.

(1) *paratransit_pickup_location*

This data item contains the location at which the requested paratransit service will pick up the traveler.

(1) *paratransit_pickup_time*

This data item contains the time at which the requested paratransit service will pick up the traveler.

(1) *paratransit_service_cost*

This data item contains the cost of the requested paratransit service.

(1) *paratransit_service_identity*

This data item provides a unique identity number for a requested paratransit service.

(1) *traveler_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

Physical Architecture Flow: transit and fare schedules **W**
 Specific transit and fare schedule information including schedule adherence.

Leveled Data Items:

(1) *transit_deviation_data_received*

This data item contains an indication that new data about transit service deviations has been received and is now in the local store of this data.

(1) *transit_fare_data_list*

This data item contains a list of details of the fares being currently charged for transit services.

- (2) *transit_route_number*

- (2) *transit_route_segment_list*
- (3) *link_identity_list*
- (3) *transit_route_segment_cost*
- (3) *transit_route_segment_number*
- (2) *transit_route_use_time*
- (2) *transit_user_category*

(1) *transit_services_for_advisory_data*

This data item contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested, for use in the preparation of driver and traveler advisory information for output on-board vehicles.

- (2) *map_transit_data*
- (2) *transit_routes_data_list*
- (3) *transit_route_number*
- (3) *transit_route_segment_list*
- (4) *link_identity_list*
- (4) *transit_route_segment_cost*
- (4) *transit_route_segment_number*
- (3) *transit_route_stop_number*
- (2) *transit_schedule_data_list*
- (3) *transit_route_number*
- (3) *transit_route_segment_list*
- (4) *link_identity_list*
- (4) *transit_route_segment_cost*
- (4) *transit_route_segment_number*
- (3) *transit_route_stop_list*
- (4) *transit_route_stop_data_list*
- (5) *transit_route_schedule_number*
- (5) *transit_stop_scheduled_time*
- (4) *transit_route_stop_number*
- (3) *transit_schedule_identity*

(1) *transit_services_for_guidance*

This data item contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested, for use in the preparation of data for output as on-line driver and traveler guidance data.

- (2) *transit_services_for_output_list*
- (3) *transit_route_number*
- (3) *transit_route_segment_cost*
- (3) *transit_route_segment_number*
- (3) *transit_stop_scheduled_time*
- (2) *traveler_identity*

(1) *transit_vehicle_deviation_update_list*

This data item contains the estimated time of arrival of several transit vehicles at stop(s) along their route(s) plus the route and service number on which they are operating. It is used for multiple transit vehicle deviations where one or more routes are affected.

(2) *transit_route_number*

(2) *transit_route_segment_number*

(2) *transit_vehicle_identity*

(2) *transit_vehicle_time*

(1) *transit_vehicle_eta*

This data item contains the estimated time of arrival of a transit vehicle at the end of a transit route segment, which is usually a stop, plus the route and service number on which it is operating.

(2) *transit_route_number*

(2) *transit_vehicle_identity*

(2) *transit_vehicle_time*

(1) *transit_vehicle_location*

This data item provides the exact location of the transit vehicle. It contains the transit vehicle location plus its identity.

(2) *transit_vehicle_identity*

(2) *transit_vehicle_location_data*

(1) *transit_vehicle_passenger_loading_list*

This data item contains the number of passengers (transit users) carried by a transit vehicle on each part of its route, i.e. each transit route segment.

(2) *transit_route_number*

(2) *transit_route_segment_number*

(2) *transit_vehicle_identity*

(2) *transit_vehicle_passengers*

(1) *transit_vehicle_running_times_list*

This data item contains a list of the times at which it is expected that a transit vehicle will reach the end of each transit route segment on its route and is used to determine any schedule deviations. The end of a transit route segment is usually a transit stop and the data is thus the expected arrival time of a transit vehicle at each of the transit stop(s) along the transit route.

(2) *transit_route_number*

(2) *transit_route_segment_number*

(2) *transit_stop_scheduled_time*

(1) *transit_vehicle_schedule_deviations_list*

This data item contains a list of the deviations of transit vehicles from their published routes and schedules at transit route segments that have already been completed, i.e. at transit stops that have been passed by the vehicle. The data is used to provide information about the current state of the transit service operation to a traveler.

(2) *transit_route_number*

(2) *transit_route_segment_number*

(2) *transit_vehicle_achieved_time*

(2) *transit_vehicle_identity*

Physical Architecture Flow: transit incident information

W

Information on transit incidents that impact transit services for public dissemination.

Leveled Data Items:

(1) *transit_incident_data*

This data item contains information about an incident that has occurred within part of the transit operations network, e.g. a transit stop or mode interchange point. The location and details of the incident will be included in the information, subject to any constraints applied by the transit agency on providing information to outside sources.

Physical Architecture Flow: transit request confirmation

W

Confirmation of a request for transit information or service.

Leveled Data Items:

(1) *advanced_charges*

This data item contains data to enable an advanced parking lot charge to be calculated and billed, and can be input by either a driver from a vehicle, or a transit user from on-board a transit vehicle or at the roadside, i.e. a transit stop.

(2) *credit_identity*

(2) *parking_lot_identity_list*

(2) *parking_space_requirements*

(2) *stored_credit*

(2) *traveler_identity*

(2) *vehicle_identity*

(1) *advanced_other_fares_confirm*

This data item is used to confirm the advanced payment of a transit fare by a transit user.

(2) *credit_identity*

(2) *stored_credit*

(2) *transit_fare*

(2) *traveler_identity*

(1) *advanced_tolls*

This data item contains data to enable an advanced toll to be calculated and billed.

(2) *credit_identity*

(2) *stored_credit*

(2) *toll_route_segment_list*

(2) *vehicle_identity*

(1) *advanced_traveler_fares_confirm*

This data item shows whether advanced fare payment by a traveler planning a trip has been refused or

cleared. The traveler will be using ITS facilities to generate the trip request.

(2) *stored_credit*

(2) *transit_fare*

(2) *traveler_identity*

4.10. Weather Service -> Information Service Provider

Physical Architecture Flow: weather information

W

Accumulated forecasted and current weather data (e.g., temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.).

Leveled Data Items:

(1) *current_weather_from_weather_service*

This data item contains details of the current weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

(1) *predicted_weather_from_weather_service*

This data item contains details of the predicted weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

4.11. Yellow Pages Service Providers -> Information Service Provider

Physical Architecture Flow: provider profile data

W

Information supplied by a service provider (e.g., a hotel or restaurant) that identifies the service provider and provides details of the service offering. This flow covers initial registration of a service provider and subsequent submittal of new information and status updates so that data currency is maintained.

Leveled Data Items:

(1) *yellow_pages_provider_profile_update*

This data item is used to update the current yellow pages service provider profile.

(1) *yellow_pages_request_provider_registration*

This data item requests registration as a provider of yellow pages data for another process within this function.

Physical Architecture Flow: travel service info

W

Reservation information or yellow pages data.

Leveled Data Items:

(1) *yellow_pages_data*

This data item provides information on yellow pages services in three forms comprising that of general interest, more specific items and transaction information.

(2) *yellow_pages_dining_information*

(2) *yellow_pages_lodging_reservations*

(2) *yellow_pages_service_contact*

(2) *yellow_pages_service_cost*

(2) *yellow_pages_service_date*

(2) *yellow_pages_service_description*

- (2) *yellow_pages_service_location*
- (2) *yellow_pages_service_time*
- (2) *yellow_pages_service_type*
 - (3) *yellow_pages_food*
 - (3) *yellow_pages_gas_stations*
 - (3) *yellow_pages_history*
 - (3) *yellow_pages_hospitals*
 - (3) *yellow_pages_lodging*
 - (3) *yellow_pages_parking*
 - (3) *yellow_pages_people*
 - (3) *yellow_pages_private_vehicle_parts_shops*
 - (3) *yellow_pages_private_vehicle_repair_shops*
 - (3) *yellow_pages_rest_areas*
 - (3) *yellow_pages_special_events*
 - (3) *yellow_pages_tourist_activities*
 - (3) *yellow_pages_tourist_services*
- (2) *yellow_pages_ticket_information*

(1) *yellow_pages_transaction_confirmation*

This data item contains confirmation that a transaction requested by a traveler has (or has not) successfully taken place.

4.12. Information Service Provider -> Media

Physical Architecture Flow: traveler information for media W

General traveler information regarding incidents, unusual traffic conditions, transit issues, or other advisory information that has been desensitized and provided to the media.

Leveled Data Items:

(1) *media_incident_information*

This data item contains data on current incidents in a form which will be readily understood by the media.

(1) *media_traffic_information*

This data item gives information on a particular current traffic situation in a form which will be readily understood by Media Systems .

(1) *media_transit_vehicle_deviations*

This data item contains details of deviations from schedule of specific transit vehicles, or routes.

(1) *media_traveler_information_request*

This data item contains a request for any information that the media has that might be of interest to travelers planning trips.

4.13. Information Service Provider -> Multimodal Transportation Service Provider

Physical Architecture Flow: multimodal information request W

Information request for alternate mode transportation providers such as train, ferry, air and bus.

Leveled Data Items:

(1) *air_services_request*

This data item contains a request for details of the regular and charter air services available to travelers.

(1) *confirm_multimodal_service*

This data item contains a request for provision of an alternate mode service as part of a traveler's proposed trip.

(1) *ferry_services_request*

This data item contains a request for details of the sea and river ferry services available to travelers.

(1) *rail_services_request*

This data item contains a request for details of the heavy rail services (i.e. those which do not form part of a transit operation) available to travelers.

4.14. Information Service Provider -> Other ISP

Physical Architecture Flow: ISP coordination

W

Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients.

Leveled Data Items:

(1) *isp_traffic_data_request*

This data item contains a request (either as a subscription or as individual request) to another ISP for available traffic data to be provided. This allows an ISP to act as a wholesaler and send data from an Other ISP to the process.

(1) *isp_traffic_information*

This data item contains a complete (or partial) set of the traffic data which has been created through fusion of available data sources.

(2) *current_other_routes_use*

(3) *route_segment_guided_travelers*

(3) *route_segment_identity*

(3) *route_segment_journey_time*

(3) *route_segment_total_number*

(2) *current_road_network_use*

(3) *route_segment_identity*

(3) *route_segment_journey_time*

(3) *route_segment_total_number*

(3) *route_segment_use_prediction*

(4) *route_segment_guided_vehicles*

(2) *hov_lane_data*

(3) *hov_lane_vehicle_count*

(3) *hov_lane_violation_count*

(2) *incident_data*

(3) *incident_description*

- (3) *incident_duration*
- (3) *incident_location*
- (3) *incident_number*
- (3) *incident_severity*
- (3) *incident_start_time*
- (3) *incident_traffic_impact*
- (3) *incident_type*
- (3) *incident_vehicles_involved*
- (2) *link_data_from_avl_list*
 - (3) *link_queue_time*
 - (3) *link_speed*
 - (3) *link_travel_time*
- (2) *link_data_from_tags_list*
 - (3) *link_queue_time*
 - (3) *link_travel_time*
- (2) *link_state_data*
 - (3) *link_list*
 - (3) *vehicle_count*
 - (3) *vehicle_headway*
 - (3) *vehicle_occupancy*
 - (3) *vehicle_queue_length*
 - (3) *vehicle_speed*
- (2) *parking_lot_storage_data_list*
 - (3) *parking_lot_current_occupancy*
 - (4) *parking_lot_calculated_occupancy*
 - (4) *parking_lot_identity*
 - (3) *parking_lot_identity*
 - (3) *parking_lot_state*
- (2) *planned_events*
 - (3) *incident_description*
 - (3) *incident_location*
 - (3) *incident_severity*
 - (3) *incident_traffic_impact*
 - (3) *incident_type*
- (2) *predicted_highway_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_highways*
 - (3) *link_occupancy*

- (3) *link_speed*
- (3) *link_travel_time*
- (2) *predicted_hov_lane_data*
 - (3) *hov_lane_vehicle_count*
 - (3) *hov_lane_violation_count*
- (2) *predicted_other_routes_use*
 - (3) *route_segment_guided_travelers*
 - (3) *route_segment_identity*
 - (3) *route_segment_journey_time*
 - (3) *route_segment_total_number*
- (2) *predicted_parking_lot_data*
 - (3) *parking_lot_identity*
 - (3) *parking_lot_occupancy*
 - (3) *parking_lot_state*
- (2) *predicted_road_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_roads*
 - (3) *link_occupancy*
 - (3) *link_speed*
 - (3) *link_travel_time*
- (2) *predicted_road_network_use*
 - (3) *route_segment_guided_vehicles*
 - (3) *route_segment_identity*
 - (3) *route_segment_journey_time*
 - (3) *route_segment_total_number*
- (2) *ramp_signal_state_list*
 - (3) *ramp_controls*
 - (3) *ramp_identity_list*

(1) *isp_transit_data_request*

This data item contains a request (either as a subscription or as individual request) to another ISP for available transit data to be provided.

(1) *isp_transit_information*

This data item provides data on the current state of transit operations (regarding both incidents and transit vehicle schedule status) for use by the Other ISP (information service provider).

- (2) *transit_vehicle_eta*
 - (3) *transit_route_number*
 - (3) *transit_vehicle_identity*
 - (3) *transit_vehicle_time*
- (2) *transit_vehicle_passenger_loading_list*

- (3) *transit_route_number*
- (3) *transit_route_segment_number*
- (3) *transit_vehicle_identity*
- (3) *transit_vehicle_passengers*
- (2) *transit_vehicle_running_times_list*
 - (3) *transit_route_number*
 - (3) *transit_route_segment_number*
 - (3) *transit_stop_scheduled_time*
- (2) *transit_vehicle_schedule_deviations_list*
 - (3) *transit_route_number*
 - (3) *transit_route_segment_number*
 - (3) *transit_vehicle_achieved_time*
 - (3) *transit_vehicle_identity*

(1) *road_data*

This data item contains definitions of the road network in the local geographic area.

(1) *source_identity*

This data item defines the logical identifier of a source of information.

(1) *wide_area_pollution_data*

This data item contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center (TMC).

- (2) *pollution_state_area_collection*
 - (3) *area_air_quality_index*
 - (3) *current_pollution_data*
 - (3) *current_pollution_location*
- (2) *pollution_state_roadside_collection*
 - (3) *current_pollution_data*
 - (3) *current_roadside_pollution_location*

4.15. Information Service Provider -> Parking Management

Physical Architecture Flow: parking lot data request

W

Request for parking lot occupancy, fares, and availability. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Leveled Data Items:

(1) *advanced_other_charges_request*

This data item requests that a parking lot charge be paid for in advance by either a driver who is paying a toll or a traveler (as a transit user) who is paying a transit fare.

- (2) *credit_identity*
- (2) *parking_lot_identity_list*
- (2) *parking_space_requirements*

(2) *stored_credit*

(2) *vehicle_identity*

(1) *advanced_traveler_charges_request*

This data item initiates the transaction to pay for a parking fee or other transportation fee.

(2) *credit_identity*

(2) *parking_space_requirements*

(2) *stored_credit*

(2) *vehicle_identity*

(1) *parking_lot_data_request*

This data item contains a request for data about the number of spaces that are available in a particular parking lot at the specified data and time.

(2) *date*

(2) *parking_lot_identity_list*

(2) *time*

(1) *parking_lot_price_data_request*

This data item contains a request for the current parking lot price data to be provided from the store that is being used to calculate parking lot charges.

Physical Architecture Flow: parking reservations request

W

Reservation request for parking lot.

Leveled Data Items:

(1) *date*

This data item specifies a calendar date that is normally used to indicate currency or effectivity of other data.

(1) *parking_lot_identity_list*

This data item contains a list of parking lots to which a particular strategy is to be applied. The strategy will either promote or discourage the use of the parking lots to generally improve traffic flow conditions in the geographic area controlled by the TMC.

(1) *time*

This data item contains the current time of day and will be associated with other data items and (possibly) a date.

(1) *traveler_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

4.16. Information Service Provider -> Remote Traveler Support

Physical Architecture Flow: broadcast information

W,U1b

General broadcast information that contains link travel times, incidents, advisories, transit services and a myriad of other traveler information.

Leveled Data Items:

(1) *traffic_data_for_broadcast_to_kiosks*

This data item is used to provide broadcast data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output at a kiosk.

- (2) *area_air_quality_index*
- (2) *current_highway_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_highways*
 - (3) *link_travel_time*
- (2) *current_road_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_roads*
 - (3) *link_travel_time*
- (2) *incident_data*
 - (3) *incident_description*
 - (3) *incident_duration*
 - (3) *incident_location*
 - (3) *incident_number*
 - (3) *incident_severity*
 - (3) *incident_start_time*
 - (3) *incident_traffic_impact*
 - (3) *incident_type*
 - (3) *incident_vehicles_involved*
- (2) *link_state_data_for_broadcast*
 - (3) *link_delay*
 - (3) *link_list*
 - (3) *link_travel_time*
 - (3) *vehicle_occupancy*
 - (3) *vehicle_speed*
- (2) *parking_lot_storage_data_list*
 - (3) *parking_lot_current_occupancy*
 - (4) *parking_lot_calculated_occupancy*
 - (4) *parking_lot_identity*
 - (3) *parking_lot_identity*
 - (3) *parking_lot_state*
- (2) *predicted_highway_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_highways*
 - (3) *link_occupancy*
 - (3) *link_speed*

- (3) *link_travel_time*
- (2) *predicted_parking_lot_data*
 - (3) *parking_lot_identity*
 - (3) *parking_lot_occupancy*
 - (3) *parking_lot_state*
- (2) *predicted_road_network_data*
 - (3) *link_delay*
 - (3) *link_list_for_roads*
 - (3) *link_occupancy*
 - (3) *link_speed*
 - (3) *link_travel_time*
- (2) *roadway_environment_conditions*
 - (3) *link_environment_conditions*
 - (3) *link_list_identities*
- (2) *source_identity*

(1) *transit_deviations_for_broadcast_to_kiosks*

This data item contains current transit service deviations for a particular route to be broadcast to a kiosk.

- (2) *transit_vehicle_schedule_deviations_list*
 - (3) *transit_route_number*
 - (3) *transit_route_segment_number*
 - (3) *transit_vehicle_achieved_time*
 - (3) *transit_vehicle_identity*

Physical Architecture Flow: traveler information

W,U1t

Traveler information comprised of traffic status, advisories, incidents, payment information and many other travel-related data updates and confirmations.

Leveled Data Items:

(1) *area_air_quality_index*

This data item contains a code for the area wide air quality level.

(1) *current_highway_network_data*

This data item contains data about traffic conditions on links in the highway network.

- (2) *link_delay*
- (2) *link_list_for_highways*
- (2) *link_travel_time*

(1) *current_road_network_data*

This data item contains data about traffic conditions on links in the road network served by the function. This data is used for determining traffic management strategies and is also sent for storage in both the long term and current data stores.

- (2) *link_delay*
- (2) *link_list_for_roads*

(2) *link_travel_time*

(1) *incident_data*

This data item contains current incident information.

(2) *incident_description*

(2) *incident_duration*

(2) *incident_location*

(2) *incident_number*

(2) *incident_severity*

(2) *incident_start_time*

(2) *incident_traffic_impact*

(2) *incident_type*

(2) *incident_vehicles_involved*

(1) *kiosk_identity*

This data item identifies a particular kiosk.

(1) *link_state_data_for_broadcast*

This data item contains speed and occupancy on each link within the road (surface street) and highway network in the geographic area relevant to the user.

(2) *link_delay*

(2) *link_list*

(2) *link_travel_time*

(2) *vehicle_occupancy*

(2) *vehicle_speed*

(1) *parking_lot_storage_data_list*

This data item contains a list of occupancy and state data for one or more parking lots in a local geographic area.

(2) *parking_lot_current_occupancy*

(3) *parking_lot_calculated_occupancy*

(3) *parking_lot_identity*

(2) *parking_lot_identity*

(2) *parking_lot_state*

(1) *predicted_highway_network_data*

This data item contains data about predicted traffic conditions on links in the highway network served by the function.

(2) *link_delay*

(2) *link_list_for_highways*

(2) *link_occupancy*

(2) *link_speed*

(2) *link_travel_time*

(1) *predicted_parking_lot_data*

This data item contains predicted parking lot states produced by the predictive model process.

(2) *parking_lot_identity*

(2) *parking_lot_occupancy*

(2) *parking_lot_state*

(1) *predicted_road_network_data*

This data item contains data about predicted traffic conditions on links in the road network served by the function.

(2) *link_delay*

(2) *link_list_for_roads*

(2) *link_occupancy*

(2) *link_speed*

(2) *link_travel_time*

(1) *roadway_environment_conditions*

This data item contains processed environment sensor information which provides a summary of environment conditions referenced to a link.

(2) *link_environment_conditions*

(2) *link_list_identities*

(1) *source_identity*

This data item defines the logical identifier of a source of information.

(1) *transit_deviations_for_kiosks*

This data item contains current transit service deviations for output to a kiosk.

(2) *kiosk_identity*

(2) *transit_vehicle_schedule_deviations_list*

(3) *transit_route_number*

(3) *transit_route_segment_number*

(3) *transit_vehicle_achieved_time*

(3) *transit_vehicle_identity*

(1) *traveler_payment_confirmation*

This data item contains the information that the payment for a confirmed trip has been successfully completed, or that the total cost can now be deducted from the credit stored on the traveler's payment instrument.

(2) *advanced_fares_confirm*

(2) *advanced_tolls_confirm*

(3) *credit_identity*

(3) *stored_credit*

- (3) *toll_cost*
- (2) *credit_identity*
- (2) *kiosk_identity*
- (2) *stored_credit*
- (2) *traveler_total_trip_cost*

(1) *traveler_transaction_confirmation*

This data item confirms any reservations made by the traveler.

- (2) *credit_identity*
- (2) *kiosk_identity*
- (2) *yellow_pages_cost*
- (2) *yellow_pages_dining_reservation_confirmation*
- (2) *yellow_pages_lodging_reservation_confirmation*
- (2) *yellow_pages_ticket_purchase_confirmation*

Physical Architecture Flow: trip plan

W,UIt

A sequence of links and special instructions comprising of a trip plan indicating efficient routes for navigating the links. Normally coordinated with traffic conditions, other incidents, preemption and prioritization plans.

Leveled Data Items:

(1) *kiosk_identity*

This data item identifies a particular kiosk.

(1) *traveler_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

(1) *traveler_route*

This data item describes all the details of a specific traveler's route. This data item includes the information required to provide an initial route or a route change while enroute.

- (2) *route_cost*
- (2) *route_identity*
- (2) *route_start_time_date*
- (2) *route_statistics*
- (2) *traveler_route_list*
 - (3) *route_segment_description*
 - (3) *route_segment_end_point*
 - (3) *route_segment_estimated_arrival_time*
 - (3) *route_segment_estimated_condition*
 - (3) *route_segment_mode*

- (3) *route_segment_predicted_weather*
- (3) *route_segment_report_position_points_list*
- (3) *route_segment_start_point*

(1) *traveler_total_trip_cost*

This data item contains the total cost of a traveler's trip. This will be a trip that has been previously confirmed by the traveler from either a personal device or a kiosk, and for which where necessary, reservations have been made.

(1) *traveler_trip_information*

This data item contains information about a proposed trip that the traveler has requested earlier.

- (2) *current_conditions*
 - (3) *current_weather_from_weather_service*
 - (3) *incident_duration*
 - (3) *incident_location*
 - (3) *incident_start_time*
 - (3) *incident_type*
 - (3) *predicted_weather_from_weather_service*
- (2) *paratransit_personal_schedule*
- (2) *rideshare_response*
 - (3) *rideshare_details*
 - (3) *rideshare_selection_number*
 - (3) *traveler_identity*

Physical Architecture Flow: yellow pages information

W,UIt

Travel service information covering tourist attractions, lodging, restaurants, service stations, emergency services, and other services and businesses of interest to the traveler.

Leveled Data Items:

(1) *traveler_yellow_pages_data*

This data item contains details of other (yellow pages) services which is to be sent to the traveler interface facility.

- (2) *kiosk_identity*
- (2) *yellow_pages_general_information*
 - (3) *yellow_pages_history*
 - (3) *yellow_pages_local_customs*
 - (3) *yellow_pages_people*
- (2) *yellow_pages_specific_information*
 - (3) *yellow_pages_food*
 - (3) *yellow_pages_gas_stations*
 - (3) *yellow_pages_hospitals*
 - (3) *yellow_pages_lodging*
 - (3) *yellow_pages_parking*

- (3) *yellow_pages_private_vehicle_parts_shops*
- (3) *yellow_pages_private_vehicle_repair_shops*
- (3) *yellow_pages_rest_areas*
- (3) *yellow_pages_special_events*
- (3) *yellow_pages_tourist_activities*
- (3) *yellow_pages_tourist_services*
- (2) *yellow_pages_transaction_information*
- (3) *yellow_pages_dining_information*
- (3) *yellow_pages_lodging_reservations*
- (3) *yellow_pages_ticket_information*

4.17. Information Service Provider -> Toll Administration

Physical Architecture Flow: toll data request

W

Request made to obtain toll schedule information or pay a toll in advance. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Leveled Data Items:

(1) *advanced_traveler_tolls_request*

This data item is a request that a toll be paid for in advance by a traveler who is planning a trip.

(2) *credit_identity*

(2) *stored_credit*

(2) *toll_route_segment_list*

(2) *vehicle_identity*

(1) *toll_price_data_request*

This data item contains a request for the current toll price data to be provided from the store that is being used to calculate toll costs.

4.18. Information Service Provider -> Transit Management

Physical Architecture Flow: demand responsive transit request

W

Request for paratransit support.

Leveled Data Items:

(1) *departure_time*

This data item defines the time at which a driver or traveler's planned or requested trip is to start.

(1) *desired_arrival_time*

This data item specifies the target time for arrival at the end of a driver or traveler's planned or requested trip.

(1) *destination*

This data item defines the destination point for a trip request or a route to be used by a traveler or a vehicle.

(1) *origin*

This data item defines the origin point for a trip request or a route to be used by a traveler or a vehicle.

(1) *paratransit_constraints*

This data item contains the constraints being placed on the choice of route for demand responsive transit requests and which will override any preferences that are also specified. Unless a default value is specifically defined, a value giving the least severe requirement will be used. Some parameters will have to be supplied by the traveler or driver (or provided by a process as a default value) before the route selection process can proceed.

- (2) *constraint_on_acceptable_travel_time*
- (2) *constraint_on_eta_change*
- (2) *constraint_on_interstate*
- (2) *constraint_on_number_of_mode_changes*
- (2) *constraint_on_number_of_transfers*
- (2) *constraint_on_special_needs*
- (2) *constraint_on_urban*
- (2) *constraint_on_vehicle_type*

(1) *preferences*

This data item is part of the data needed to request a route involving automatic highway system (ahs) lanes. It contains the preferences being placed on the choice of a route being requested by a driver or traveler.

- (2) *modes*
- (2) *preferred_alternate_routes*
- (2) *preferred_ridesharing_options*
- (2) *preferred_route_segments*
- (2) *preferred_routes*
- (2) *preferred_transit_options*
- (2) *preferred_weather_conditions*

(1) *traveler_identity*

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

Physical Architecture Flow: selected routes

W

Routes selected based on route request criteria.

Leveled Data Items:

(1) *advanced_charges_confirm*

This data item shows whether the payment for advanced parking lot charges has been confirmed or not.

- (2) *credit_identity*
- (2) *parking_lot_cost*
- (2) *stored_credit*

(1) *advanced_tolls_confirm*

This data item shows whether the payment for an advanced toll has been confirmed or not.

(2) *credit_identity*

(2) *stored_credit*

(2) *toll_cost*

(1) *paratransit_service_confirmation*

This data item confirms that the traveler wants to use the previously identified paratransit service.

(2) *paratransit_service_identity*

(2) *transit_confirmation_flag*

(2) *traveler_identity*

Physical Architecture Flow: transit information request

W

Request for transit operations information including schedule and fare information. The request can be a subscription that initiates as-needed information updates as well as a one-time request for information.

Leveled Data Items:

(1) *advanced_other_fares_request*

This data item contains data that a transit fare be paid for in advance by a driver who is paying either a parking lot charge or a toll.

(2) *credit_identity*

(2) *stored_credit*

(2) *transit_journey_date*

(2) *transit_route_destination*

(2) *transit_route_origin*

(2) *traveler_identity*

(1) *advanced_traveler_fares_request*

This data item is used to request that a transit fare be paid for in advance by a traveler who is planning a trip.

(2) *credit_identity*

(2) *stored_credit*

(2) *transit_journey_date*

(2) *transit_route_destination*

(2) *transit_route_origin*

(2) *traveler_identity*

(1) *transit_fare_data_request*

This data item contains a request for the current transit fare price data to be provided from the store that is being used to calculate transit fares.

(1) *transit_services_advisor_request*

This data item is a request for supply of details of the services being currently provided by the transit fleet

and will be used in the preparation of on-line driver and traveler advisory data for output to vehicles.

(1) *transit_services_guidance_request*

This data item is a request for supply of details of the services being currently provided by the transit fleet and will be used in the preparation of on-line traveler guidance data.

(2) *destination*

(2) *origin*

(2) *traveler_identity*

(1) *transit_vehicle_deviations_details_request*

This data item contains a request for output of the details of the deviations of transit vehicles from their published routes and schedules.

4.19. Information Service Provider -> Yellow Pages Service Providers

Physical Architecture Flow: provider profile confirm

W

Confirmation of profile information received by a service provider (e.g. for a hotel or restaurant).

Leveled Data Items:

(1) *yellow_pages_provider_update_confirm*

This data item requests for registration or update of the yellow pages service provider's profile has been successfully completed.

Physical Architecture Flow: travel service request

W

Request for reservation or other service (e.g., yellow pages).

Leveled Data Items:

(1) *yellow_pages_info_request*

This data item contains requests for information of a general nature, or specific information, or information an available transactions.

(1) *yellow_pages_transaction_request*

This data item contains a request that payment for the associated yellow pages services is transacted.

5. Communications Layer Considerations

This chapter describes relevant requirements on the Communications Layer for the portion of the ITS National Architecture covered by this package. In general the Communications Layer supports the four lower layers of the OSI model (transport, network, data link and physical layer). A complete description of the Communications Layer is contained in the ITS National Architecture Communications Analysis Document. In addition to actual requirements the section contains some informational notes which are included in brackets.

5.1. Communications Services: Wireline and Wireless

The communication services define the exchange of information between two points and are independent of media and application (i.e., ITS user service). In essence, they are a specified set of user-information transfer capabilities provided by the communication layer to a user in the transportation layer.

Communication services consist of two broad categories, *interactive* and *distribution*. Interactive services allow the user to exchange data with other users or providers in real or near real time, asking for service or information and receiving it in the time it takes to communicate or look up the information. Distribution services allow the user to send the same message to multiple other users.

Interactive services may be either *conversational* or *messaging*. Conversational implies the use of a two-way connection established before information exchange begins and terminated when the exchange is completed. Messaging, on the other hand, works more like electronic mail being exchanged between users. The messages are exchanged without establishing a dedicated path between the two sites. Each message is addressed and placed on the network for transmission, intermixed with messages from other users. The communications community labels this mode of communication a “datagram” service.

Distribution services may be either *broadcast* or *multicast* and may be used over wireline and/or wireless communication links. Broadcast messages are those sent to all users while multicast messages are sent only to a subset of users. Multicast differs from broadcast in its use of a designated address for all users and user groups. Examples of broadcast information might include current weather or road conditions, whereas multicast information might be information sent to all drivers working for a specific company. A changing group membership could be the set of users traveling between two locations or with a certain destination, for which unique information must be transmitted. The services that can be supported using circuit or packet connection mode include voice, video, image and data. (see Appendix A-1 of the communication document for a complete description.)

An additional class of communications services is location services. These fall in two categories: (1) the services that do not use the communication network (i.e., GPS, and stand alone terrestrial systems); (2) location services that use the network for providing the service (e.g., cellular based systems). In the latter case, the location services fall under the interactive services. The service will be rendered by a service provider in response to a request for information or help.

The class of communications service for each Architecture Flow in this standards package is defined in a table in the following section.

5.2. Wireline Communication Elements (w)

The interfaces of this standards package are all wireline interfaces. The primary requirements on the wireline communications layers are that open standards be utilized for the communications protocols. The following paragraphs provide a discussion of wireline considerations for ITS.

The wireline links represent wide area network communications elements, which can take a number of forms. Typically it will be a data network of some kind. Physically the network can be fiber, coaxial, twisted pair, or even microwave. It can be an ITS dedicated network, such as a communication system installed by a public agency to pass messages between a Traffic Management subsystem and associated Roadway subsystems distributed across a region. Alternatively it can be a privately deployed network owned and operated by a communication service provider, where operators of ITS subsystems pay a service fee for connection to and use of the network or lease the lines. More than one network used for ITS may coexist in a region, and these networks will be connected (or internetworked) to support ITS message communication between subsystems that are attached to different networks.

It is expected that the current trend toward ubiquitous internetworking of public and private data networks, as currently embodied in for example the "Internet", will continue. This will enable inter-subsystem messaging across local, regional and national distances. What the Internet is rapidly evolving to (as security and reliability issues of today's Internet are addressed) has been referred to as the "National Information Infrastructure" or "NII".

In the near term, we expect that many communication elements will be dedicated, as they primarily are today. As commercial data networks are deployed, interconnected, and mature, and the cost of access and use of these private data networks drops, we expect more and more wireline networks for ITS to be supplied from Communication Service Providers (CSPs). The time when the transition from private data networks to commercial data networks becomes practical and economical will vary by region. We expect this transition to be analogous to the transition that was made early in this century from private phone networks to the Public Switched Telephone Network (PSTN). Our expectation is that in the 20-year timeframe most ITS communication will be provided by CSPs.

In the area of center to center communications there are several existing and developing communications standards to choose from. These include ATM, Frame Relay, MAN (IEEE 802.6), and FDDI. At the network layers TCP/IP is a widespread standardized protocol. The key is that by using standard communication protocol suites the regional integration of the wireline data shown above will most readily be accomplished. One of the developing ITS standards for wireline communications is the National Transportation Communications for ITS Protocol (NTCIP). This standard is being developed for the transmission of data and messages between ITS elements. The initial version of the NTCIP is being developed to support the interface from the TMS to traffic controllers and VMS signs. Work is underway to extend this to other roadside equipment. Plans are also in place to extend the protocol for center to center communications.

5.3. Wireless Communication Elements (u1 and u2)

There are no wireless interfaces in this standards requirements package.

6. Constraints

This chapter identifies constraints placed upon Physical Architecture flows.

6.1 Assessment Categories

The following categories have been used in rating the constraints that exist on the physical data flows.

1. Performance

a. Emergency Priority (E)

Essentially "real-time" requirements. Emergency data that is time critical must be received by a certain absolute time, or it is useless. For these flows the communication channel may require priority in emergencies. The data channels require must be operational even when there is an emergency which might place other loads on the interface. A private communication channel or frequency may be required to satisfy the requirement.

b. Reliability(R)

This category encompasses both the concepts of reliability and availability. Data must be delivered reliably. Loss can not be tolerated. The communications link must also have high availability. Failure of the communication medium may result in severe accident. This communication channel may require redundant paths or extra attention paid to potential failure modes. For wireline cases, this may indicate alternate phone or other connections are required. For wireless cases (e.g. for AHS applications), special attention will be paid to the transmitters, receivers, and potential interference for these connections.

c. Timing (T)

The timing constraints are critical. If communication does not occur within set limits system failures can occur. Timing for most ITS communication services is based on the response to a request for data. Because of this, common communication media designed to handle voice data will likely support these requirements. The beacon interface has special requirements of identifying the vehicle as well as exchanging information before the vehicle gets out of range. This is more of a problem with vehicles travelling at speed. The architecture constrains such time critical access to data such that the data is available at the beacon site. This obviates the need for explicit specification of other timing information to support data transfer over a short range beacon.

This timing constraint is related to (but not the same as) another attribute often discussed in specifying systems: latency. Latency is used to quantify end-to-end processing and transmission time (round trip delays). Data with a latency requirement must be handled within a certain time interval. This differs from "time criticality" in that it is a relative rather than absolute time requirement (i.e. latency: interface screen must update every 2 seconds; time criticality: route instructions must be received 30 seconds prior to first turning action). Because latency requirements are greatly affected by the implementation of the subsystem elements, it can not be specified directly when discussing only the interface between two subsystems.

2. Data Sensitivity

a. Security (S)

Access to the data must be restricted. Data itself must be secure during transmission. This is typically used for financial information.

b. Privacy (P)

Anonymity of the data source or recipient must be protected. This is typically used for personal information.

6.2 Architecture Flow Constraints

Table 1 - Architecture Flow Constraints

Source	Destination	Architecture Flow	Interconnects	Communication Service	Special Constraints
Fleet and Freight Management	Information Service Provider	route request	W	Conversational data, Messaging data	P
Information Service Provider	Fleet and Freight Management	route plan	W	Messaging data	P
Information Service Provider	Parking Management	parking lot data request	W	Messaging data	P
Information Service Provider	Parking Management	parking reservations request	W	Messaging data	P
Information Service Provider	Remote Traveler Support	traveler information	W,U1t	Broadcast data,Multicast data	P
Information Service Provider	Remote Traveler Support	trip plan	W,U1t	Conversational Data	P
Information Service Provider	Transit Management	demand responsive transit request	W	Messaging data	P
Information Service Provider	Transit Management	selected routes	W	Conversational data, Messaging data	P
Information Service Provider	Yellow Pages Service Providers	provider profile confirm	W	Messaging data	P
Information Service Provider	Yellow Pages Service Providers	travel service request	W	Messaging data	P
Remote Traveler Support	Information Service Provider	traveler request	W	Messaging data	P
Remote Traveler Support	Information Service Provider	trip confirmation	W	Messaging data	P
Remote Traveler Support	Information Service Provider	trip request	W	Conversational Data	P
Remote Traveler Support	Information Service Provider	yellow pages request	W	Conversational data, Messaging Data	P
Transit Management	Information Service Provider	demand responsive transit plan	W	Conversational data, Messaging data	P
Transit Management	Information Service Provider	transit request confirmation	W	Messaging data	P

7. Leveled Data Items

This section contains the leveled data item (LDI) definitions for all the leveled data item elements listed in this standards requirements package.

The LDIs are given in alphabetical order.

advanced_charges

This data item contains data to enable an advanced parking lot charge to be calculated and billed, and can be input by either a driver from a vehicle, or a transit user from on-board a transit vehicle or at the roadside, i.e. a transit stop.

advanced_charges_confirm

This data item shows whether the payment for advanced parking lot charges has been confirmed or not.

advanced_fares_confirm

This data item shows that payment for advanced transit fares has been confirmed or not.

advanced_other_charges_confirm

This data item shows whether or not an advanced parking lot payment transaction has been confirmed or not.

advanced_other_charges_request

This data item requests that a parking lot charge be paid for in advance by either a driver who is paying a toll or a traveler (as a transit user) who is paying a transit fare.

advanced_other_fares_confirm

This data item is used to confirm the advanced payment of a transit fare by a transit user.

advanced_other_fares_request

This data item contains data that a transit fare be paid for in advance by a driver who is paying either a parking lot charge or a toll.

advanced_other_tolls_confirm

This data item is used to confirm the advanced payment of tolls by a driver.

advanced_tolls

This data item contains data to enable an advanced toll to be calculated and billed.

advanced_tolls_confirm

This data item shows whether the payment for an advanced toll has been confirmed or not.

advanced_traveler_charges_confirm

This data item contains data about an advanced parking lot charge transaction requested by a traveler.

advanced_traveler_charges_request

This data item initiates the transaction to pay for a parking fee or other transportation fee.

advanced_traveler_fares_confirm

This data item shows whether advanced fare payment by a traveler planning a trip has been refused or cleared. The traveler will be using ITS facilities to generate the trip request.

advanced_traveler_fares_request

This data item is used to request that a transit fare be paid for in advance by a traveler who is planning a trip.

advanced_traveler_tolls_confirm

This data item contains data about an advanced toll transaction requested by a traveler.

advanced_traveler_tolls_request

This data item is a request that a toll be paid for in advance by a traveler who is planning a trip.

air_services

This data item contains details of the regular and charter air services available to travelers.

air_services_request

This data item contains a request for details of the regular and charter air services available to travelers.

area_air_quality_index

This data item contains a code for the area wide air quality level.

commercial_carrier_information

This data item contains information describing the commercial vehicle carrier.

commercial_driver_information

This data item contains information describing the commercial vehicle driver.

commercial_route

This data item contains details of a route. This will have been produced to fit the origin, destination, preferences and constraints requirements provided by a traveler through the trip request data. The route segment(s) will be in sets, one for a primary route (the nearest fit to the traveler's requirements), plus one or more alternates that may give a better modal split, or improved journey time, etc. There may be one or many route segments depending on the length of the route.

commercial_route_number

This data item identifies a commercial vehicle route. It can be used to associate other items of data such as taxes and duties, route details, classes, etc.

commercial_route_request

This data item is used to request the preparation of a dynamic route for a commercial vehicle and originates with the commercial vehicle fleet manager.

commercial_vehicle_characteristics

This data item contains the characteristics of a commercial vehicle as determined from data provided by roadside sensors.

commercial_vehicle_configuration

This data item contains a character code that defines the commercial vehicle configuration.

commercial_vehicle_information

This data item contains information that will provide the identity of the commercial vehicle.

commercial_vehicle_size

This data item contains the commercial vehicle size as measured by roadside sensors. The data will include details such as the length, width and height of the vehicle.

commercial_vehicle_weight

This data item contains the commercial vehicle weight as measured by roadside sensors, such as weigh-in-motion detectors.

confirm_multimodal_service

This data item contains a request for provision of an alternate mode service as part of a traveler's proposed trip.

confirmation_flag

This data item indicates the success or failure of a request or transaction.

constraint_on_acceptable_travel_time

This data item contains the maximum total travel time which the traveler or driver will allow for the selected route.

constraint_on_ahs_lanes

This data item indicates whether the route can include automated highway segments.

constraint_on_eta_change

This data item contains the value by which the estimated time of arrival (ETA) at the destination

must change for a new route to be automatically sent to the vehicle, or used for autonomous guidance with long journey and queue times being obtained from a central source.

constraint_on_interstate

This data item indicates whether interstate freeways are not acceptable, acceptable, or preferred in a route.

constraint_on_load_classification

This data item specifies the load type. This is principally aimed at hazardous material (HAZMAT) type loads that may require special routing restrictions.

constraint_on_number_of_mode_changes

This data item contains the maximum number of changes between different modes of transport which the traveler or driver wishes to see used in the planned trip.

constraint_on_number_of_transfers

This data item contains the maximum number of mode changes that a traveler or driver will allow when a multimodal route is being specified.

constraint_on_special_needs

This data item covers physical and/or mental disabilities which may affect the choice of mode, route, etc., e.g. blind and will be accompanied, blind with a guide dog, deaf, mute, uses crutches, wheelchair bound, etc.

constraint_on_urban

This data item contains a flag which if set to one (1) means avoid all urban roads except for when they are needed for access.

constraint_on_vehicle_type

This data item specifies the route suitable for a particular type or types of vehicle.

constraints

This data item contains the constraints being placed on the choice of route and which will override any preferences that are also specified. Unless a default value is specifically defined, a value giving the least severe requirement will be used. Some parameters will have to be supplied by the traveler or driver (or provided by a process as a default value) before the route selection process can proceed.

credit_identity

This data item contains the identity number of a credit card which is to be used to secure preclearance from paying dues, taxes, and other commercial vehicles charges, or by a traveler or driver for payment of current or advanced tolls, fares, parking lot charges, or for yellow pages services.

current_conditions

This data item contains data about current incidents and weather conditions relevant to the traveler's personal trip.

current_highway_network_data

This data item contains data about traffic conditions on links in the highway network.

current_other_routes_use

This data item contains data about the non-vehicle portion(s) of routes that have been requested by travelers.

current_pollution_data

This data item contains the current pollution data detected. The pollution data includes ozone pollution, nitrous oxide pollution, sulfur dioxide pollution, hydrocarbon pollution, carbon monoxide pollution, particulate pollution, and roadside pollution.

current_pollution_location

This data item gives the location coordinates from which a set of current pollution levels have been obtained.

current_road_network_data

This data item contains data about traffic conditions on links in the road network served by the function. This data is used for determining traffic management strategies and is also sent for storage in both the long term and current data stores.

current_road_network_use

This data item contains information about how many vehicles are being guided down each route segment and the average journey time for each route segment provided by guided vehicles.

current_roadside_pollution_location

This data item contains the location at which an associated set of current roadside atmospheric pollution values have been obtained from sensors.

current_weather_from_weather_service

This data item contains details of the current weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

date

This data item specifies a calendar date that is normally used to indicate currency or effectivity of other data.

departure_time

This data item defines the time at which a driver or traveler's planned or requested trip is to start.

desired_arrival_time

This data item specifies the target time for arrival at the end of a driver or traveler's planned or requested trip.

destination

This data item defines the destination point for a trip request or a route to be used by a traveler or a vehicle.

ferry_services

This data item contains details of the sea and river ferry services available to travelers.

ferry_services_request

This data item contains a request for details of the sea and river ferry services available to travelers.

from_media_incident_details

This data item contains data about an incident that has been reported by a member of the traveling public to the media by mechanisms that are outside of ITS, e.g. car phone.

from_media_incident_information_request

This data item contains a request for data on incidents to be sent to the Media. The request must specify whether all, current incidents or planned events are required, in the latter case state the time period by date and hour range, and the geographic area(s) to which it should relate.

from_media_traffic_information_request

This data item contains a request from the Media for traffic information. The request must specify the type of information required (flow/congestion) and the geographic area(s) to which it should relate.

from_media_transit_vehicle_deviations_request

This data item contains a request for data on schedule deviations of specific transit vehicles or routes.

from_media_traveler_information

This data item contains information that the media has that might be of interest to travelers planning trips. This may include but not be limited to such things as sports or special events.

handicap_access_information

This data item is used to indicate the handicap access level for a business, event, or any other establishment.

hov_lane_data

This data item contains the data obtained from processing the inputs from traffic sensors located on High Occupancy Vehicle (HOV) lanes around the road network.

hov_lane_vehicle_count

This data item contains a count of the number of vehicles legitimately using High Occupancy Vehicle (HOV) lanes in the road and highway network.

hov_lane_violation_count

This data item contains the count of the number of vehicle illegally using High Occupancy Vehicle (HOV) lanes in the road and highway network.

incident_data

This data item contains current incident information.

incident_description

This data item contains the description and other free form information associated with an incident.

incident_duration

This data item contains the expected duration of an incident from its start time until the time at which it is expected that it will have no further effect on traffic conditions.

incident_location

This data item contains the location at which an incident will take place (for planned events) or is taking place (for current incidents).

incident_number

This data item identifies a specific incident.

incident_severity

This data item identifies the severity of an incident.

incident_start_time

This data item contains the incident start time.

incident_traffic_impact

This data item contains details of the impact that a particular incident will have on traffic flows.

incident_type

This data item uniquely defines the type of incident.

incident_vehicles_involved

This data item defines the number of vehicles involved in an incident at the time of the report.

isp_traffic_data_request

This data item contains a request (either as a subscription or as individual request) to another ISP for available traffic data to be provided. This allows an ISP to act as a wholesaler and send data from an Other ISP to the process.

isp_traffic_information

This data item contains a complete (or partial) set of the traffic data which has been created through fusion of available data sources.

isp_transit_data_request

This data item contains a request (either as a subscription or as individual request) to another ISP for available transit data to be provided.

isp_transit_information

This data item provides data on the current state of transit operations (regarding both incidents and transit vehicle schedule status) for use by the Other ISP (information service provider).

kiosk_identity

This data item identifies a particular kiosk.

link_data_from_avl_list

This data item contains the link journey and queue times calculated by processing the times at which AVL data was collected from vehicles on the road (surface street) and highway network served by the function.

link_data_from_tags_list

This data item contains the link journey and queue times calculated by processing the times at which tag data was collected from vehicles on the road (surface street) and highway network served by the function.

link_delay

This data item contains the calculated delay for vehicles driving along a particular link in the road and highway network served by the function.

link_environment_conditions

This data item contains environment conditions (e.g. rain, wind, sun, etc) computed for a single link .

link_identity_list

This data item contains a list of the links in the road and freeway network that are covered by a transit route segment. The data may contain up to four (4) links to be part of a segment in all three scenarios (urban, inter-urban and rural).

link_list

This data item contains a list of links for which data is being provided.

link_list_for_highways

This data item contains a list of links for which data is being provided. These links will comprise all of those on the highway network served by the function.

link_list_for_roads

This data item contains a list of links for which data is being provided.

link_list_identities

This data item contains a list of links for which data is being provided. These links will comprise all of those on both the road (surface street) and highway network served by the function. It contains the unique identity of each link, which is a short segment typically less than one mile, e.g. a segment of freeway between off-ramps or a street segment between two intersections.

link_occupancy

This data item contains predictions of the occupancy for route segments on the road and highway network served by the Manage Traffic function.

link_queue_time

This data item contains the current queuing time for vehicles on a particular link.

link_speed

This data item contains the calculated average speed of vehicles traveling on the link.

link_state_data

This data item contains data about traffic conditions on each link within the road (surface street) and highway network in the geographic area served by the TMC.

link_state_data_for_broadcast

This data item contains speed and occupancy on each link within the road (surface street) and highway network in the geographic area relevant to the user.

link_travel_time

This data item contains the current journey time for vehicles on a particular link.

map_transit_data

This data item forms part of the store of digitized map data. It contains data which enables maps of the transit route network to be produced. These will be produced to suit the geometry of the actual display unit on which the data will be shown in either visual or hardcopy format.

media_identity

This data item contains the identity of the media that is reporting an incident.

media_incident_information

This data item contains data on current incidents in a form which will be readily understood by the media.

media_traffic_information

This data item gives information on a particular current traffic situation in a form which will be readily understood by Media Systems .

media_transit_vehicle_deviations

This data item contains details of deviations from schedule of specific transit vehicles, or routes.

media_traveler_information_request

This data item contains a request for any information that the media has that might be of interest to travelers planning trips.

modes

This data item forms part of the data used for route requests and trip plans. It defines the mode(s) of transport to be used on a requested route or proposed trip.

multimodal_service_confirmation

This data item contains confirmation that a previous request from a traveler for an alternate mode service has been accepted.

origin

This data item defines the origin point for a trip request or a route to be used by a traveler or a vehicle.

paratransit_arrival_time

This data item contains the time at which the requested paratransit service will get the traveler to the requested destination.

paratransit_availability_time

This data item contains a time window of availability of the requested paratransit service. If the traveler does not confirm the use of the service within this time frame, the details will no longer be valid, and the traveler will have to re-request the service.

paratransit_constraints

This data item contains the constraints being placed on the choice of route for demand responsive transit requests and which will override any preferences that are also specified. Unless a default value is specifically defined, a value giving the least severe requirement will be used. Some parameters will have to be supplied by the traveler or driver (or provided by a process as a default value) before the route selection process can proceed.

paratransit_destination

This data item contains the destination of the requested paratransit service, which may not be the traveler's final destination, since the remainder of the trip may be completed by other means, e.g. regular public transit.

paratransit_personal_schedule

This data item provides a personalized paratransit schedule specifying an itinerary and cost.

paratransit_pickup_location

This data item contains the location at which the requested paratransit service will pick up the traveler.

paratransit_pickup_time

This data item contains the time at which the requested paratransit service will pick up the traveler.

paratransit_service_confirmation

This data item confirms that the traveler wants to use the previously identified paratransit service.

paratransit_service_cost

This data item contains the cost of the requested paratransit service.

paratransit_service_identity

This data item provides a unique identity number for a requested paratransit service.

parking_lot_availability

This data item contains details of the number of spaces available in the lot in response to a previous

request for this data.

parking_lot_calculated_occupancy

This data item contains the current occupancy of a parking lot, i.e. the number of vehicles present, calculated from traffic sensors located at its entrance(s) and exit(s).

parking_lot_charge_application_time

This data item contains the time at which a parking lot charge applies for a particular toll segment.

parking_lot_cost

This data item defines the cost of particular vehicle using a space in a parking lot for a particular time period.

parking_lot_current_occupancy

This data item contains the parking lot identity and current occupancy.

parking_lot_data_request

This data item contains a request for data about the number of spaces that are available in a particular parking lot at the specified data and time.

parking_lot_hours_of_operation

This data item contains data on the hours of operation of parking lots. This data is used in transactions requiring electronic payment of parking lot services, as well as for a traveler making a parking lot reservation.

parking_lot_identity

This data item contains the identity of an individual parking lot so that its charges can be defined and a control strategy applied to its use.

parking_lot_identity_list

This data item contains a list of parking lots to which a particular strategy is to be applied. The strategy will either promote or discourage the use of the parking lots to generally improve traffic flow conditions in the geographic area controlled by the TMC.

parking_lot_occupancy

This data item contains the current occupancy of a parking lot, i.e. the number of vehicles present.

parking_lot_price

This data item is data about the prices to be charged for parking lot spaces.

parking_lot_price_data

This data item contains the prices being charged by each parking lot for each of its spaces, together with the time and date for which they apply.

parking_lot_price_data_request

This data item contains a request for the current parking lot price data to be provided from the store that is being used to calculate parking lot charges.

parking_lot_reservation_confirm

This data item contains the confirmation that a previously requested reservation of a space at a parking lot has been confirmed and can be included in a traveler's confirmed trip plan.

parking_lot_spaces

This data item contains the number of spaces available in a parking lot. This may be either currently or at some point in the future depending on accompanying data. accommodated.

parking_lot_state

This data item contains the current state of a parking lot. It indicates whether the parking lot is open and has spaces available.

parking_lot_storage_data_list

This data item contains a list of occupancy and state data for one or more parking lots in a local geographic area.

parking_space_requirements

This data item specifies the time, location, and specific parking space requirements for a particular user.

planned_events

This data item contains details of known events due to take place in the future.

pollution_state_area_collection

This data item contains the current states of the various types of pollution within the atmosphere in the geographic area served by the function. It also contains a summary indication of the area air quality.

pollution_state_roadside_collection

This data item contains the digitized values of pollution levels obtained from roadside sensors in the geographic area served by the function.

predicted_highway_network_data

This data item contains data about predicted traffic conditions on links in the highway network served by the function.

predicted_hov_lane_data

This data item contains prediction of the numbers of both legal and illegal vehicles using High Occupancy Vehicle (HOV) lanes in the road and highway network served by the function.

predicted_other_routes_use

This data item contains information about how many travelers it is predicted will be guided down each non-vehicle and non-transit route segment and the average journey time for each route segment.

predicted_parking_lot_data

This data item contains predicted parking lot states produced by the predictive model process.

predicted_road_network_data

This data item contains data about predicted traffic conditions on links in the road network served by the function.

predicted_road_network_use

This data item contains information about how many vehicles it is predicted will be guided down each route segment and the average journey time for each route segment.

predicted_weather_from_weather_service

This data item contains details of the predicted weather conditions, e.g. temperature, pressure, wind speed, wind direction, humidity, precipitation, visibility, light conditions, etc.

preferences

This data item is part of the data needed to request a route involving automatic highway system (ahs) lanes. It contains the preferences being placed on the choice of a route being requested by a driver or traveler.

preferred_alternate_routes

This data item contains the number of alternate routes that are to be provided to the driver or traveler making the route request. These alternate routes will be in addition to the primary route, which will be the one that most nearly meets the specified preferences and constraints.

preferred_ridesharing_options

This data item contains preferred ridesharing options.

preferred_route_segments

This data item contains a list of preferred route segments.

preferred_routes

This data item contains a list of waypoints or other preferred route information that constrains the selected route.

preferred_transit_options

This data item contains preferred transit options.

preferred_weather_conditions

This data item contains the preferred weather conditions on the road segment at the time which it will be used.

rail_services

This data item contains details of the heavy rail services (i.e. those which do not form part of a transit operation) available to travelers.

rail_services_request

This data item contains a request for details of the heavy rail services (i.e. those which do not form part of a transit operation) available to travelers.

ramp_controls

This data item contains the actual control data to be passed to a ramp meter controller.

ramp_identity_list

This data item contains a list of the ramps (ramp metering equipment) to which a particular traffic control strategy is to be applied.

ramp_signal_state_list

This data item is used to indicate the state of the ramp meter controllers at the entrance to the highway ramps controlled by the TMC.

reservation_status

This data item shows the status of a reservation that is being or has been requested. If the flag is set to true the reservation was accepted, but if set to false, then the reservation was denied.

rideshare_details

This data item contains a list of potential ridesharing matches. This data will provide information on the other participants in the proposed rideshare, pick-up and drop-off points, etc.

rideshare_response

This data item provides the response to travelers' rideshare request.

rideshare_selection_number

This data item provides the identification number for a rideshare selection that has been made in response to a traveler's request.

road_data

This data item contains definitions of the road network in the local geographic area.

roadway_environment_conditions

This data item contains processed environment sensor information which provides a summary of environment conditions referenced to a link.

route_cost

This data item contains the cost of using a particular route. This is made up of some or all of such things as tolls, fares, port charges, plus the cost of commercial vehicle credential filing and tax payments.

route_identity

This data item contains the identity of a route that is to be used for either on-line vehicle or traveler guidance. The data is for internal use within the function and identifies the route when the driver or traveler subsequently accepts it for use.

route_segment_description

This data item contains a description of the physical details for the entire route segment. This data is used to provide information from which guidance can be produced in a form which is understandable by the driver, e.g. lane selection, right/left turns, etc.

route_segment_end_point

This data item contains the location of the end of a route segment.

route_segment_estimated_arrival_time

This data item contains the estimated time at which the route segment end point will be reached.

route_segment_estimated_condition

This data item contains the traffic conditions expected on the route segment at the time at which it will be used.

route_segment_guided_travelers

This data item contains the number of travelers being guided along a route segment in one minute of real time.

route_segment_guided_vehicles

This data item contains the number of vehicles being guided along a route segment in one minute of real time.

route_segment_identity

This data item identifies a route segment by name, location, or other standard location reference.

route_segment_journey_time

This data item contains the average route segment journey time calculated from data being provided by guided vehicles.

route_segment_journey_time_from_tolls

This data item contains the smoothed average vehicle journey times for the route segment between two toll collection points, obtained from the passing times of those vehicles equipped for electronic toll collection.

route_segment_mode

This data item contains the mode that has been selected for use within the route segment. The choice of mode is made as part of the trip planning process. Only one mode can be used in any single route segment.

route_segment_predicted_weather

This data item contains the weather conditions expected on the road segment at the time at which it will be used.

route_segment_report_position_points_list

This data item contains a list of any points other than those at the route segment start and end where the vehicle's position is to be reported.

route_segment_start_point

This data item contains the location of the start of a route segment.

route_segment_total_number

This data item defines the total number of route segments in the road (surface street) and highway network in an area of responsibility.

route_segment_type

This data item defines the type of route segment and indicates any special restrictions associated with its use. The route segment type may indicate the class of road, railway, or walkway. Special restrictions can indicate vehicle type or mode restrictions for the segment.

route_segment_use_prediction

This data item contains data about the number of guided vehicles that will be using a route segment over a set of time periods.

route_start_time_date

This data item contains the date and time at which a route will start taken from the time specified in the request for the route.

route_statistics

This data item contains the overall predicted statistics associated with a route which may assist the traveler in making a final route selection. The statistics will include such things as itinerary, estimated net travel time, time of arrival, total distance, anticipated delays/congestion, etc.

source_identity

This data item defines the logical identifier of a source of information.

stored_credit

This data item contains the value of the credit currently stored by the payment instrument.

time

This data item contains the current time of day and will be associated with other data items and (possibly) a date.

toll_cost

This data item defines the cost of the toll for a particular vehicle through a toll plaza, thus giving it the ability to use the toll segment governed by the toll plaza.

toll_price_application_time

This data item contains the time at which a toll price applies for a particular toll segment. The time is held as the number of seconds since a fixed reference point, from which the actual time and date can be easily computed.

toll_price_data

This data item contains the price for each road segment to which a toll applies, with the time and date for when it applies.

toll_price_data_request

This data item contains a request for the current toll price data to be provided from the store that is being used to calculate toll costs.

toll_route_segment_list

This data item contains a list of the identities of toll segments for which toll payment is being provided or requested. Toll segments occur in about the same frequency as the percentage of toll road miles to total freeway miles.

traffic_data_for_broadcast_to_kiosks

This data item is used to provide broadcast data on the traffic flowing in the road network, plus that which is predicted to flow in the network for output at a kiosk.

traffic_data_kiosk_request

This data item contains the request for the provision of traffic data for output at a kiosk.

transit_confirmation_flag

This data item indicates whether a paratransit service is to be used.

transit_deviation_data_received

This data item contains an indication that new data about transit service deviations has been received and is now in the local store of this data.

transit_deviation_kiosk_request

This data item requests for data on current transit service deviations for output to a kiosk.

transit_deviations_for_broadcast_to_kiosks

This data item contains current transit service deviations for a particular route to be broadcast to a kiosk.

transit_deviations_for_kiosks

This data item contains current transit service deviations for output to a kiosk.

transit_fare

This data item contains the actual cost for the transit user to travel over a route in the transit network, i.e. the cost of going from a particular origin on a transit route to a particular destination on (possibly another) transit route.

transit_fare_data_list

This data item contains a list of details of the fares being currently charged for transit services.

transit_fare_data_request

This data item contains a request for the current transit fare price data to be provided from the store that is being used to calculate transit fares.

transit_incident_data

This data item contains information about an incident that has occurred within part of the transit operations network, e.g. a transit stop or mode interchange point. The location and details of the incident will be included in the information, subject to any constraints applied by the transit agency on providing information to outside sources.

transit_journey_date

This data item gives the date and time at which a transit journey is to be made by a traveler as a transit user and is used for trip planning purposes only.

transit_route_destination

This data item contains the destination of a transit route. The destination will be defined as the name of a transit stop

transit_route_number

This data item identifies a regular transit route.

transit_route_origin

This data item contains the origin of a transit route to be used by a traveler (advanced fares) or transit user. The origin will be defined as the name of a transit stop.

transit_route_schedule_number

This data item contains the number of the transit service that is operating on a particular route.

transit_route_segment_cost

This data item contains the cost of the use of a particular transit route segment. It can only be used in association with the segment number, the category of the transit user and the time at which the route is used.

transit_route_segment_list

This data item contains a list of the transit route segments that make up a particular transit route, plus the cost to a transit user for using each segment and the identity of the road or freeway link(s) over which the route segment runs.

transit_route_segment_number

This data item identifies a transit route segment within the transit route on which it lies.

transit_route_stop_data_list

This data item contains a list of data for each of the transit stops that make up a particular transit route.

transit_route_stop_list

This data item contains a list of the transit stops that make up a particular transit route and the time at which services on the route will arrive at each stop.

transit_route_stop_number

This data item contains the identity number of a transit stop on a transit route.

transit_route_use_time

This data item contains the time at which the associated transit fare will apply, e.g. weekday morning peak, Sunday, public holiday, etc.

transit_routes_data_list

This data item contains a list of the details of the routes being provided by the transit operation. The list of route segments contains the identity of each link in the road and freeway network associated with the segment to enable them to be output on top of a display of digitized map data.

transit_schedule_data_list

This data item contains a list of the schedule of services on each transit vehicle route and the cost to the transit user of the use of each route segment.

transit_schedule_identity

This data item contains the identity of a particular set of transit schedules. This identity may include a short description of when (day and/or period) the schedule is expected to apply.

transit_services_advisorics_request

This data item is a request for supply of details of the services being currently provided by the transit fleet and will be used in the preparation of on-line driver and traveler advisory data for output to vehicles.

transit_services_for_advisory_data

This data item contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested, for use in the preparation of driver and traveler advisory information for output on-board vehicles.

transit_services_for_guidance

This data item contains a complete set of all the transit routes and the services that run upon them, including timings, etc. that are provided by the transit fleet from which the data was requested, for use in the preparation of data for output as on-line driver and traveler guidance data.

transit_services_for_output_list

This data item contains a list of details of the transit route(s) that fulfill the origin-destination requirements of a particular transit user or traveler's request.

transit_services_guidance_request

This data item is a request for supply of details of the services being currently provided by the transit fleet and will be used in the preparation of on-line traveler guidance data.

transit_stop_scheduled_time

This data item contains the time at which a transit vehicle is scheduled to reach each stop on a transit route. This will thus be the scheduled time of arrival at the end of a transit route segment.

transit_user_category

This data item contains the category of transit user to which the associated transit fare applies, e.g. adult, child, senior citizen, disabled, etc.

transit_vehicle_achieved_time

This data item contains the time at which a transit vehicle actually reached the end of a transit route segment. This point is usually a transit stop and the data is thus the arrival time of a transit vehicle at each of the transit stop(s) along the transit route.

transit_vehicle_deviation_request

This data item contains a request for the provision of data on the current transit service deviations for output to a traveler at a kiosk.

transit_vehicle_deviation_update_list

This data item contains the estimated time of arrival of several transit vehicles at stop(s) along their route(s) plus the route and service number on which they are operating. It is used for multiple transit vehicle deviations where one or more routes are affected.

transit_vehicle_deviations_details_request

This data item contains a request for output of the details of the deviations of transit vehicles from their published routes and schedules.

transit_vehicle_eta

This data item contains the estimated time of arrival of a transit vehicle at the end of a transit route segment, which is usually a stop, plus the route and service number on which it is operating.

transit_vehicle_identity

This data item contains the identity of an individual transit vehicle. This data is used to identify the source and/or ownership of other data.

transit_vehicle_location

This data item provides the exact location of the transit vehicle. It contains the transit vehicle location plus its identity.

transit_vehicle_location_data

This data item provides the exact location of the transit vehicle. It is based on the standard vehicle

location data supplemented with additional data that is only relevant to transit vehicles.

transit_vehicle_passenger_loading_list

This data item contains the number of passengers (transit users) carried by a transit vehicle on each part of its route, i.e. each transit route segment.

transit_vehicle_passengers

This data item contains a count of the number of passengers (transit users) that were on-board a transit vehicle on a particular transit route segment.

transit_vehicle_running_times_list

This data item contains a list of the times at which it is expected that a transit vehicle will reach the end of each transit route segment on its route and is used to determine any schedule deviations. The end of a transit route segment is usually a transit stop and the data is thus the expected arrival time of a transit vehicle at each of the transit stop(s) along the transit route.

transit_vehicle_schedule_deviations_list

This data item contains a list of the deviations of transit vehicles from their published routes and schedules at transit route segments that have already been completed, i.e. at transit stops that have been passed by the vehicle. The data is used to provide information about the current state of the transit service operation to a traveler.

transit_vehicle_time

This data item contains the estimated time of arrival of a transit vehicle at the end of the next transit route segment not so far reached during its journey along the transit route.

traveler_current_condition_request

This data item contains a request for details of the current conditions, e.g. weather, events, incidents, etc. The request includes the identity of the kiosk from which the request was input by the traveler so that the response can be correctly returned.

traveler_identity

This data item contains the identity of the traveler who is making a request for information or guidance, so that the results of the request can be sent back to the originating traveler.

traveler_payment_confirmation

This data item contains the information that the payment for a confirmed trip has been successfully completed, or that the total cost can now be deducted from the credit stored on the traveler's payment instrument.

traveler_payment_information

This data item contains details of the components of a trip which a traveler has obtained from the input of data to a kiosk.

traveler_rideshare_confirmation

This data item contains a traveler's request to confirm a rideshare based trip.

traveler_route

This data item describes all the details of a specific traveler's route. This data item includes the information required to provide an initial route or a route change while enroute.

traveler_route_list

This data item describes a specific traveler's route and includes all information intended for en-route traveler guidance.

traveler_total_trip_cost

This data item contains the total cost of a traveler's trip. This will be a trip that has been previously confirmed by the traveler from either a personal device or a kiosk, and for which where necessary, reservations have been made.

traveler_transaction_confirmation

This data item confirms any reservations made by the traveler.

traveler_transaction_request

This data item contains data input by the traveler at a kiosk to make reservations for various other (yellow pages) services.

traveler_trip_information

This data item contains information about a proposed trip that the traveler has requested earlier.

traveler_yellow_pages_data

This data item contains details of other (yellow pages) services which is to be sent to the traveler interface facility.

traveler_yellow_pages_information_request

This data item contains a request for data on other (yellow pages) services to be provided to a traveler at the identified kiosk. As no filtering components are included, all the data currently available will be provided.

vehicle_count

This data item contains a count of the number of vehicles which have been detected at a point location over unit time.

vehicle_headway

This data item contains the measure of time between two successive vehicles in a traffic lane as they pass a point on the roadway. Measurements are taken from front bumper of vehicle to front bumper of other vehicle in seconds.

vehicle_identity

This data item contains the identity of a vehicle.

vehicle_occupancy

This data item contains a count of the time for which a vehicle occupied the point in the surface street or highway at which a detector is located.

vehicle_queue_length

This data item contains a measure of the length of queue as measured by a traffic sensor.

vehicle_speed

This data item contains the speed of a vehicle which has been detected by a detector located on the highway, as the vehicle flowed over its sensor.

vehicle_toll_probe_data

This data item contains the smoothed average vehicle journey times for the route segment between two toll collection points, and the identity of the route segment. The data is used to calculate link journey times for in-vehicle guidance purposes.

vehicle_type

This data item contains an identifier for the type of vehicle for which pollution violations have been detected.

vehicle_type_for_charges

This data item contains the vehicle type as determined from processing of the vehicle's characteristics for the purpose of paying for parking lot charges.

vehicle_type_for_tolls

This data item contains the vehicle type and identity as determined from processing of the vehicle's characteristics for the purpose of charging for tolls.

wide_area_pollution_data

This data item contains data about the current levels of pollution obtained from the store of pollution data in the area covered by the Traffic Management Center (TMC).

yellow_pages_cost

This data item contains the cost of other (yellow pages) services such as hotels, restaurants, theaters, etc. that have been requested and/or confirmed by the traveler.

yellow_pages_data

This data item provides information on yellow pages services in three forms comprising that of

general interest, more specific items and transaction information.

yellow_pages_dining_information

This data item contains details of those restaurants, diners, etc. that meet the specified location (and other) criteria.

yellow_pages_dining_reservation

This data item contains a request for the information and service providers to make a dining reservation at a restaurant, hotel, etc. The reservation will be based on the data already provided to the traveler through a previous request.

yellow_pages_dining_reservation_confirmation

This data item contains a dining reservation confirmation and includes a confirmation number.

yellow_pages_food

This data item contains details of restaurants, fast food outlets that meet the specified location (and other) criteria.

yellow_pages_gas_stations

This data item contains details of gas stations that meet the specified location (and other) criteria. The data item will also define the facilities available at the gas station, e.g. toilets, shop, food, the type(s) of fuel supplied, etc.

yellow_pages_general_information

This data item contains the following items the contents of which will be specific to the area covered by the function and which will include contact telephone numbers, etc.

yellow_pages_history

This data item contains details of any sites of historic interest, etc. in the area served by the function. It will define the type of site, e.g. Civil War battle site and the description will define the address of the site.

yellow_pages_hospitals

This data item contains details of location(s), available facilities and visiting hours of hospitals in the area served by the function.

yellow_pages_info_request

This data item contains requests for information of a general nature, or specific information, or information an available transactions.

yellow_pages_local_customs

This data item contains details of local customs, etc. in the area served by the function. The description will define the customs themselves, e.g. the days on which shops close early, etc.

yellow_pages_lodging

This data item contains details of hotels, motels, etc. in the area served by the function. It will define the type of hotel and the description will define the hotel chain (if applicable) and the address.

yellow_pages_lodging_reservation

This data item contains a request for the information and service providers to make a lodging reservation at a hotel or motel etc. from the information already provided to the traveler through a previous request.

yellow_pages_lodging_reservation_confirmation

This data item contains a lodging reservation confirmation and includes a confirmation number.

yellow_pages_lodging_reservations

This data item contains details of those hotels, motels, with dates and prices of available rooms. It will define the type of hotel and identify the hotel chain (if applicable) and the address.

yellow_pages_parking

This data item contains details of parking lots, on-street parking arrangements, etc. in the area served by the function. It will define the type parking, e.g. privately managed lot, municipally owned lot, free parking, on-street parking, etc. and the address.

yellow_pages_people

This data item contains details of local officials in the area served by the function. It will specify the office and define the part(s) of the area served and the address of the person's office.

yellow_pages_private_vehicle_parts_shops

This data item contains details of vehicle parts shops in the area served by the function. It will define the type of vehicle parts available, e.g. engines, brakes, tires, mufflers, etc. and define the repair shop chain (if applicable) and the address.

yellow_pages_private_vehicle_repair_shops

This data item contains details of repair shops in the area served by the function. It will define the type of repair shop, the type(s) of repair facilities that are available, e.g. general servicing, engines, brakes, tires, mufflers, etc. and will identify the business name and address.

yellow_pages_provider_profile_update

This data item is used to update the current yellow pages service provider profile.

yellow_pages_provider_update_confirm

This data item requests for registration or update of the yellow pages service provider's profile has been successfully completed.

yellow_pages_request_provider_registration

This data item requests registration as a provider of yellow pages data for another process within this function.

yellow_pages_rest_areas

This data item contains details of rest areas adjacent to roads and highways in the area served by the function. It will define the facilities available at the rest area, e.g. toilets, food, etc. and the location.

yellow_pages_service_contact

This data item define the telephone, fax or e-mail contact information for the yellow pages service that is being provided.

yellow_pages_service_cost

This data item contains the cost of an associated yellow pages service which is currently available.

yellow_pages_service_date

This data item contains the date on which an associated yellow pages service will be available.

yellow_pages_service_description

This data item describes the yellow pages service that is being provided. This may be the name of a hotel, theater or concert hall, the address of a sports stadium, the address of a garage, etc.

yellow_pages_service_location

This data item contains the geographic location at which an associated yellow pages service will be available.

yellow_pages_service_time

This data item contains the time at which an associated yellow pages service will be available.

yellow_pages_service_type

This data item defines the type of yellow pages service that is being provided.

yellow_pages_special_events

This data item contains details of special events such as parades, fairs, exhibitions, conventions, etc. in the area served by the function. It will define the type of event and the description will define the organizer(s) and address at which the event will take place.

yellow_pages_specific_information

This data item contains information which will be specific to the area covered by the function and which will include details of what facilities are currently available for purchase, etc.

yellow_pages_ticket_information

This data item contains details of those activities, services etc. for which tickets are required in the area served by the function, with dates and prices. It will define the type of activity or service and the

description will define the address.

yellow_pages_ticket_purchase

This data item contains a request for the information and service providers to make a ticket purchase for a special event, theater, tourist attraction, etc. from the information already provided to the traveler through a previous request.

yellow_pages_ticket_purchase_confirmation

This data item contains a ticket purchase confirmation and includes a confirmation number.

yellow_pages_tourist_activities

This data item contains details of tourist specific activities in the area served by the function. It will define the type of activity and define the address at which the activity will take place.

yellow_pages_tourist_services

This data item contains details of travel agents in the area served by the function. It will define the service(s) provided by the agent and the agent's address and contact information.

yellow_pages_transaction_confirmation

This data item contains confirmation that a transaction requested by a traveler has (or has not) successfully taken place.

yellow_pages_transaction_information

This data item contains information which will be specific to the area covered by the function and which will include details of what facilities are currently available for purchase, etc.

yellow_pages_transaction_request

This data item contains a request that payment for the associated yellow pages services is transacted.