Navigation Service Framework

Candidate Version 1.0 – 14 Mar 2018

Open Mobile Alliance

OMA-ER-NavSe-V1_0-20180314-C

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1. Scope

This document is a combined document that includes requirements and architecture of the Navigation Service Framework (NavSe) v1.0 enabler. The interfaces and functionalities of NavSe enabler are specified in a separate document according to RESTful network API approach.

The NavSe enabler provides an overall framework (mechanisms, functionalities, APIs, and etc.) to enable delivering route information for navigation services.

The following areas will be covered as part of the scope of the enabler.

- Delivering route information to the navigation application
- Delivering traffic information for driving to the navigation application
- Providing functionalities for public safety usages
- Security and privacy aspects

NavSe enabler will reuse as much as possible existing technologies. In particular, with respect to an interface specification, these are in the scope of this enabler:

- To reuse traffic information data formats defined by TPEG in [ISO TTI]

2. References

2.1 Normative References

[ISO BIN] "Traffic and Travel Information (TTI)" ISO/TS 18234, URL:http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=54706

[ISO TTI] "Traffic and Travel Information (TTI)" ISO/TS 24530, URL:http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=54706

[OMNA] URL:http://www.openmobilealliance.org/Tech/OMNA/

[RFC2119] "Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997, URL:http://www.ietf.org/rfc/rfc2119.txt

2.2 Informative References

[OMADICT] "Dictionary for OMA Specifications", Version 2.9, Open Mobile Alliance™, OMA-ORG-Dictionary-V2_9, URL:http://www.openmobilealliance.org/

3. Terminology and Conventions

3.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

3.2 Definitions

Location URI	A URI that enables the current location of a device to be obtained from a particular location server using a particular dereferencing protocol.
Navigation Device (ND)	An entity that, using the GNSS service, assists the user showing correct route to reach the final destination. This entity may process real-time and forecast traffic information and dynamically estimates the optimal route, according to user preferences.
NavSe Application/ Client	An entity that is in charge of interacting with a NavSe Server to get route information and/or real-time and forecast traffic information. Throughout this document client and application can be used interchangeably.
NavSe Server	An entity that is in charge of providing the NavSe Application with route information or real-time and forecast traffic information.
Network Performance Parameter	Information regarding the performances (i.e. speed, delay and travel time) of road segments related to an area or a route.
Route Information	Sequence of road segments, each of them defined with end points coordinates and road name, from an origin to a destination.
Shared Route Information	Route information provided to two NavSe applications at opposite ends of the route. Provided routes to two NavSe applications are opposite direction.
Traffic Event	Information regarding events related to an area or a route that are either imposed or planned by the road network operator (i.e. roadwork leading to lane closures) or events that occur outside the control of the network operator (i.e. accidents).
Traffic Information	Information which consists of traffic events and network performance parameters related to an area or a route.
Unusable Route Information	Information regarding the route which is blocked or destroyed in an emergency area that there is a fire, an earthquake, a flood, etc.

3.3 Abbreviations

API	Application Programming Interface
GNSS	Global Navigation Satellite System
ISO	International Organization for Standardization
NavSe	Navigation Service framework
ND	Navigation Device
OMA	Open Mobile Alliance
REST	REpresentational State Transfer
SUPL	Secure User Plane Location
TLS	Transport Layer Security
TPEG	Transport Protocol Expert Group
TTI	Traffic and Travel Information
URI	Uniform Resource Identifier

XSD	XML Schema Definition

4. Introduction

The user of navigation services such as driving navigation services, pedestrian navigation services are increasing continuously. In the navigation service, dynamic navigation functionalities, based on real-time traffic information and additional information, is the most valuable features, being the reason for the popularity: reduction of the driving time, reduction of the fuel consumption, safety improvement, etc.

The standardization forum ISO TPEG (Transport Protocol Expert Group) already defined a service for delivering real-time traffic information to navigation devices, publishing a complete set of technical specifications [ISO BIN] .

The aim of the Navigation Service Framework (NavSe) enabler is to support dynamic navigation functionalities using TPEG information over the mobile network. Additionally the NavSe enabler also supports the navigation functionalities for a public safety usage.

4.1 Version 1.0

The version 1.0 of the NavSe Enabler defines an overall framework that enables dynamic navigation service based on traffic information over a mobile network.

The core functionalities exposed by the NavSe Enabler include the following operations:

- Request and provide a set of routes based on the journey parameters defined by the user
- Request and provide traffic information related to the route and an area defined by the ND
- Request and provide route information for a public safety usage
- Request and provide unusable route information related to an emergency area
- Request and provide shared route information for a public safety usage
- Manage subscriptions to notification services for receiving updates on information and alternative route proposal

5. Requirements (Normative)

The following subsections group the requirements in functional areas for the sake of document's readability. There is no architecture implication derived from the requirements grouping.

5.1 High-Level Functional Requirements

This section identifies the high-level functional requirements for the NavSe enabler.

Label	Description	Release
NavSe-HLF-001	The NavSe enabler SHALL be able to provide a user with a set of proposed routes and related traffic information to reach a final destination, based on following journey parameters: • Origin • Destination • Waypoints • Time • Road preferences (e.g. highways) • Vehicle type description (e.g. car, coach, walk).	1.0
NavSe-HLF-002	The NavSe enabler SHALL allow a user to request traffic information related to a set of routes estimated by the ND, in the following scenarios: • Real-time (for dynamic routing) • Forecast (for journey planning).	1.0
NavSe-HLF-003	The NavSe enabler SHALL allow a user to request traffic information related and limited to a specific area (e.g. a neighbourhood, a metropolitan area, a region, etc.) in the following scenarios: • Real-time (for dynamic routing) • Forecast (for journey planning).	1.0
NavSe-HLF-004	Traffic information delivered to the ND SHALL include at least traffic events (i.e. accidents, constructions, etc.) and network performance parameters (i.e. delay, speed for road segments) as defined in [ISO TTI].	1.0
NavSe-HLF-005	The NavSe enabler SHALL allow a user to select a set of routes for which being notified of related traffic information updates**.** **Informational Note**: The route is selected among the ones proposed by the server or the ND.	1.0
NavSe-HLF-006	The NavSe enabler SHALL allow a user to be notified of an alternative route when specific conditions are met along previously selected routes. **Informational Note:** Example of conditions that trigger notification of alternative route is traffic blockage.	1.0
NavSe-HLF-007	The NavSe enabler SHALL allow a user to disable location tracking procedure for the defined journey. **Informational Note:** The way of executing the location tracking procedure is out of scope of NavSe enabler.	1.0
NavSe-HLF-008	The NavSe enabler SHALL allow a user to provide the server with a location URI in order to allow the server to access, if authorized, user's position information.	1.0
NavSe-HLF-009	The NavSe enabler SHALL allow a user to request re-routing information as the user is deviating from the predetermined route.	1.0

NavSe-HLF-010	The NavSe enabler SHALL be able to encode the proposed routes in two different approaches: • Full • Summarized. **Informational Note**: Route information in summarized format is used in a preliminary stage to allow a user to select one preferred route out of a set of proposed routes. Thereafter the NavSe Server will provide the selected route information in full format to the NavSe client.	1.0
NavSe-HLF-011	The NavSe enabler SHALL provide different services based on the specific capabilities of the ND. **Informational Note**: For example the ND may make different requests to the NavSe Server on the basis if it is able to calculate routes or not.	1.0
NavSe-HLF-012	The NavSe enabler SHALL allow a user to request road congestion information according to data format defined by ISO TPEG in [ISO BIN](part 8)	1.0
NavSe-HLF-013	The NavSe enabler SHALL allow a user to request the route information and/or destination information (e.g. shelter, police stations, etc.) for public safety usage.	1.0
NavSe-HLF-014	The NavSe enabler SHALL allow a user to request the unusable route information related to a specific area (e.g. disaster area) for public safety.	1.0
NavSe-HLF-015	The NavSe enabler SHALL allow a user to request the shared route information for public safety usage.	1.0

Table 1: High-Level Functional Requirements of NavSe 1.0 Enabler

5.2 Security & Privacy Requirements

Label	Description	Release
NavSe-PRI-001	The NavSe Enabler SHALL support mechanisms to ensure confidentiality of data transferred between the Principals.	1.0
NavSe-PRI-002	The NavSe Enabler SHALL support mechanisms to ensure data integrity of data transferred between the Principals.	1.0
NavSe-PRI-003	The NavSe Enabler SHALL support mechanisms to authenticate the Principals.	1.0

Table 2: Security and Privacy Requirements of NavSe 1.0 Enabler

6. Architectural Model

This section defines the functional components and the interfaces of the NavSe enabler, thus providing its architecture, in alignment with the requirements that have been captured in the Requirements Section of this document. The architecture is described in the following sections.

6.1 Dependencies

Not Applicable

6.2 Architectural Diagram

The following figure represents the NavSe architecture, showing the NavSe interface and the NavSe components.

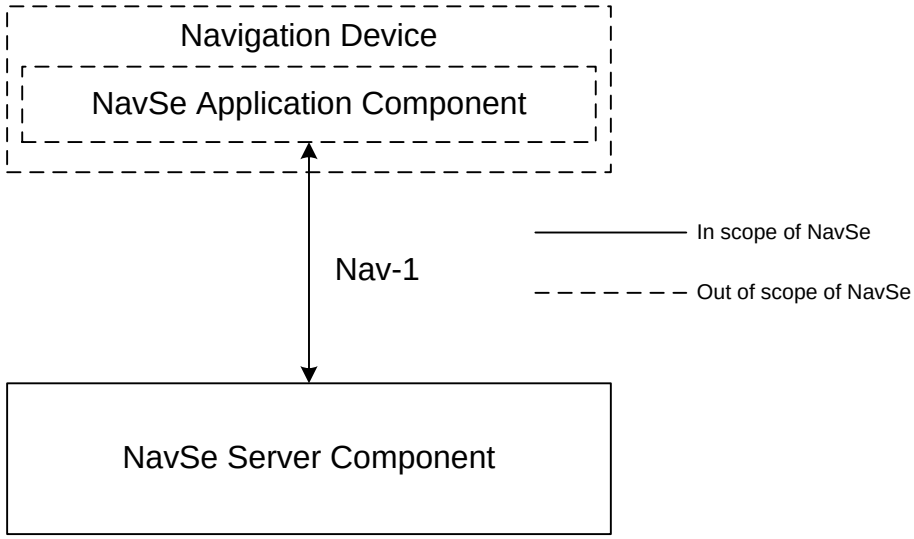

Figure 1: NavSe Enabler Architectural Diagram

6.3 Functional Components and Interfaces

6.3.1 NavSe Server Component Description

The role of this component is to provide route and traffic information to the NavSe Application component. In addition, the NavSe Server component allows the NavSe Application component to be notified about updated traffic information, and the NavSe Application component will be notified about alternative routes in case the performances of proposed routes become degraded

The NavSe Server component performs the following functions:

1. Analysis of journey parameters defined by the NavSe Application component and proposal of a set of routes, based on real-time and forecast traffic information. For bandwidth optimization, in a preliminary stage routes may be encoded according to a summarized format: full route information is delivered only for the route selected by the ND, out of proposed set. The route information at server level may be updated using user's current position information.
2. Provision of real-time and forecast traffic information related to a set of routes proposed by the NavSe Application component or by the NavSe Server itself.
3. Provision of real-time and forecast traffic information related to one or more areas defined by the NavSe Application component.
4. New route proposition, in the following conditions:
    - Performances of current route become degraded
    - User diverts and deviates from the on-going route

5. Notification service for the user of traffic information updates related to the set of routes defined in function #2.
6. Notification service for the user of traffic information updates for areas defined in function #3.
7. Notification service for the user of new routes estimated in function #4.
8. Using the IP address or a location URI, provided by the NavSe Application component, to access the position information of the NavSe Application component, the NavSe Server component shall not access location procedures if disabled by the user.
9. Provision of route and notification service of updated information for the public safety usage.
10. Provision of disable route information for the public safety usage.
11. Provision of shared route information to two NavSe applications for the public safety usage.

Note that user tracking procedures are implemented through an enabler external to NavSe Server component.

Note that the user may access NavSe application data such as route information through 3rd party application server, for instance for planning a journey. In this scenario the user just requests routing information based on forecast traffic information and it is not interested in real-time notification services.

6.3.2 Nav-1 Interface

This interface is the entry point to NavSe enabler for traffic and route information.

It operates in a request/response model and notification procedures for real-time information updates are also available.

This interface supports the following type of procedures:

- Proposal of a set of routes based on journey parameters (origin, destination, time, waypoints) defined by the user, routes may be encoded according to summarized format or full format
- Delivery of traffic information related to a set of routes defined by the NavSe Server components
- Delivery of traffic information related to a set of routes defined by the NavSe Application component
- Delivery of traffic information related to an area defined by the NavSe Application component
- Delivery of unusable route information related to an area for public safety usage
- Delivery of shared route information for public safety usage
- Notification service for the following kind of events:
    - updates on traffic information related to a route
    - updates on traffic information related to an area
    - alternative routes proposal for the defined journey
    - updates on unusable route information related to an area for public safety usage
    - updates on destination information and/or position information of the other NavSe application related to a shared route
- Disabling the access at server level to user's location information through an external location application

Note that definition of the data is specified at the TS stage.

6.4 Security Considerations

Nav-1 interface is expected to be provided over secure connections, e.g. as secured by TLS (e.g. HTTPS), to ensure that the interface operations are only visible to the appropriate NavSe Application component.

NavSe SHOULD allow a service provider's deployment to perform the specific security features below:

- Mutual authentication of the NavSe Application component and NavSe Server component
- Confidentiality and integrity protection in communication between NavSe Application component and NavSe Server component

Note that how to achieve access control is implementation specific.

7. Release Information

7.1 Supporting File Document Listing

Doc Ref	Permanent Document Reference	Description
Supporting Files		
[REST_SUP_NAVSE]	OMA-SUP-XSD_rest_NavSe-V1_0-20180314-C	XSD schema for XML data structure definition Working file in Schema directory: File: rest_navse-V1_0.xsd Path: http://www.openmobilealliance.org/tech/profiles

Table 3: Listing of Supporting Documents in NavSe Release

7.2 OMNA Considerations

The OMNA portal [OMNA] needs to maintain the following schema namespace into Schema Namespace Registry

Description	Registered URN	Schema Links
Navigation Service Framework	urn:oma:xml:rest:netapi:navse:1.0	http://www.openmobilealliance.org/tech/profiles/rest_netapi_navse-v1_0.xsd

Table 4: OMNA Namespaces

Appendix A. Change History (Informative)

A.1 Approved Version History

Reference	Date	Description
n/a	n/a	No prior version

A.2 Draft/Candidate Version 1.0 History

Document Identifier	Date	Sections	Description
Draft Versions OMA-ER-NavSe-V1_0	12 Oct 2016	All	First Draft
	01 Nov 2016	1, 3, 5, 6, Appendix B, Appendix C	Incorporated CRs: OMA-LOC-2016-0037-CR_NavSe_1_0_ER_Scope OMA-LOC-2016-0038-CR_NavSe_1_0_ER_definitions_and_Abbreviations_baseline OMA-LOC-2016-0040-CR_NavSe_1_0_ER_Requirements_Baseline OMA-LOC-2016-0041-CR_NavSe_1_0_ER_Architectural_Model_Baseline OMA-LOC-2016-0042-CR_NavSe_1_0_ER_Use_Cases_Baseline OMA-LOC-2016-0043-CR_NavSe_1_0_ER_Call_Flows_Baseline
	02 Jan 2017	3	Incorporated CR: OMA-LOC-2016-0055-CR_NavSe_1_0_ER_Adding_Abbreviation
	14 Feb 2017	5, 6	Incorporated CR: OMA-LOC-2017-0007-CR_NavSe_1_0_ER_Emergency_Supporting
	21 Apr 2017	5, 6	Incorporated CR: OMA-LOC-2017-0019-CR_Emergency_Area_Supporting
	26 Sep 2017	2, Appendix B, Appendix C, Appendix D	Incorporated CRs: OMA-LOC-2017-0022-CR_NavSe_1_0_ER_Emergency_Area_Use_Case_Call_Flow OMA-LOC-2017-0024-CR_NavSe_1_0_ER_Reference OMA-LOC-2017-0025-CR_NavSe_1_0_ER_Deployment_Diagram
	08 Nov 2017	3, 4, 5, 6, 7, Appendix B, Appendix C	Incorporated CRs: OMA-LOC-2017-0032-CR_NavSe_1_0_ER_Introduction OMA-LOC-2017-0037-CR_NavSe_1_0_ER_Emergency_Area_Definition OMA-LOC-2017-0041-CR_NavSe_1_0_ER_Release_Information OMA-LOC-2017-0046R01-CR_NavSe_1_0_ER_Collaborative_Route_Support
	27 Feb 2018	1, 2, 3, 4.1, 6.3	Incorporated CR: OMA-LOC-2017-0051-CR_NavSe_1_0_ER_Comment_Resolution_A2_A3_A4_A5

Appendix B. Use Cases (Informative)

B.1 Dynamic vehicle routing – routing information delivery

This scenario aims at enabling users to interconnect the NavSe Application with the NavSe Server infrastructure that provides routing information and associated traffic information. The NavSe Application provides journey parameters and the NavSe Server replies with optimal route information for that journey.

B.1.1 Short Description

The NavSe Application requests routing information from the NavSe Server, sending information about the journey, in terms of origin/its current position, final destination, road preferences and vehicle type. The NavSe Server, based on available real-time and forecast traffic data, estimates the optimal route(s) with related network performance parameters and traffic events, and then the data are sent to the NavSe Application. From the proposed set of routes, the user deletes the ones it is not interested in and subscribes to notification service to receive updated information about:

- Network performance parameters and traffic events for the set of route(s)
- Alternative routes in case of traffic anomalies (e.g. delay or blockage) on current selection, if available

In a different implementation, a preliminary set of routes is proposed by the NavSe Application without access to real-time traffic information. For those routes, the NavSe Server is requested to provide estimated performance parameters and traffic events. As in the previous scenario, the user may then remove the routes he is not interested and he may subscribe to notification service to receive updated traffic information and/or alternative routes proposals.

If the NavSe Server tracks a position of the NavSe Application or the NavSe Application periodically updates its current position, the NavSe Server can update in real-time the route information related to the a specific navigation session, deleting routes not consistent with the DynNav Application current position and deleting road segments already travelled from the routes description.

B.1.2 Market benefits

The user may benefit from this application in terms of travelling time optimization, cost saving and safety.

B.2 Dynamic vehicle routing – traffic information delivery

This scenario aims at enabling users to interconnect a NavSe Application with a NavSe Server infrastructure that provides real-time and forecast traffic information. The users request traffic information (real-time and/or forecast) related to a specific area (e.g., in a city neighbourhood, or metropolitan area, a region, etc.) from the server. In this scenario the route estimation procedure is executed by the ND.

B.2.1 Short Description

The NavSe Application communicates to the NavSe Server the area of interest (e.g., a city neighbourhood, or metropolitan area, a region, etc.) for which it wishes to obtain information correlated with time information. The NavSe Application may optionally specify a set of preferences (e.g., no toll roads, vehicle type etc.). The NavSe Server selects the information related to the specified area and sends it to the NavSe Application. Traffic information includes performance parameters for road segments and traffic events. With this information the ND can estimate the optimal route(s) for the user. The user can subscribe to notification service. At a later stage the NavSe Server will send updated traffic information to keep the NavSe Application aligned with real-time traffic flows and traffic events in the specified area.

B.2.2 Market benefits

The user may benefit from this use case in terms of travelling time, cost saving and safety.

B.3 Re-route request

This scenario aims at enabling a NavSe Application to re-route when the vehicle which has the ND is diverting and deviating from the on-going route.

B.3.1 Short Description

When a user is guided by the predetermined route provisioned by the NavSe Server, the user may change the route by turning the wrong direction or on purpose while driving. Under the circumstances, the NavSe Application is able to recognize the situation that the vehicle is deviating from the route (e.g. the algorithm for detecting deviations is the out of scope of this enabler), and then, the NavSe Application may request re-route information to the NavSe Server simply based on the current position of the vehicle and the preset destination.

B.3.2 Market benefits

Using the re-route request, the service provider is able to optimize the use of network bandwidth and the overload of the NavSe Server can be also reduced since the NavSe enabler does not need to create a new trip and other subsequent procedures (e.g. subscription).

B.4 Summarized route delivery

This scenario aims at enabling a NavSe Server to provide the summarized routing information for saving the network bandwidth.

B.4.1 Short Description

Since only a selected or preferred route, out of a set of routes proposed by the NavSe Server to the user, is used as routing information for a journey, full format encoding of the all set of routes represents redundant information from the network standpoint. In a preliminary stage, the NavSe Server should provide to the user a set of summarized routes and only the selected route will be provided to the user encoded in the full format.

The summarized route allows reducing the size of the route data provided because the summarized route may consist of the small number of high significant segments out of full road segments.

Normal Flow:

1. The user defines the journey parameters and the NavSe Application submits a request from the NavSe Server to acquire a set of proposed routes.
2. The NavSe Server estimates a set of routes and summarizes the estimated routes and sends the set of summarized routes to the NavSe Application (which are much lighter than full format routes).
3. The user can see the summarized routes on the screen and selects a route out of the proposed routes it is interested in and the NavSe Application reports the route selection to the NavSe Server.
4. The NavSe Server sends only the selected route in full format providing detailed information for the route.

B.4.2 Market benefits

The method allows the service provider to save its bandwidth and reduce the time to transmit the potentially unused set of fully described routes.

B.5 Unusable route information delivery

This scenario aims at enabling a NavSe server to provide the unusable route information related to a specific area for a public safety usage.

B.5.1 Short Description

When the fire or collapse occurs indoors such as the building, shopping centre, stadium, etc., some routes are destroyed or blocked. Since the traffic information is not needed for indoor navigation and the smart ND calculates the route information itself, the NavSe server needs to provide the unusable route information. Since the unusable route information in the disaster area is common information to the user who is in that area, the NavSe server provides the identical information to users, in other words, the NavSe server creates the only one resource to provide the information. Additionally the user may upload the unusablee route information occurred newly. Using the uploaded information the NavSe server updates the unusable route information and then provides the updated information to the user.

B.5.2 Market benefits

The service provider will benefit from this use cases in terms of reducing the resource created for services.

B.6 Shared route information delivery

This scenario aims at enabling a NavSe server to provide the shared route information for a public safety usage.

B.6.1 Short Description

Under the emergency situation, the rescue requester calls the national public safety agency (e.g. the fire department, the police, etc.) for rescue services. After receiving the call from the rescue requester, the rescue worker requests the route information to reach the rescue requester from the NavSe server. After the NavSe server provides the route information to the rescue worker, the NavSe server provides the route information to reach the rescue worker to the rescue requester as well. In other words, the NavSe server provides the shared route information to the rescue requester and rescue worker. Through the shared route information, the rescue requester may moves to the rescue worker for the quick rescue service.

B.6.2 Market benefits

The user will benefit from this use cases in terms of providing quick and rescue services.

Appendix C. Call Flows (Informative)

C.1 Routing Information Delivery Call Flow

The figure below describes the message flow for a possible implementation of use case B.1 (Routing information delivery) and B.3 (Re-route Request).

In the example, the NavSe Application asks for navigation data (e.g. route information) to the NavSe Server. The user sets journey parameters, (starting point, destination and other preferences), and then those parameters are sent to the NavSe Server. The NavSe Server will reply with a set of routes matching up with journey parameters and related traffic information (network performance parameters and traffic events). The user then selects one or more proposed routes, and subscribes to notification service for receiving updated traffic information and alternative routes proposals.

The NavSe Server will then provide the user with real-time and forecast traffic information updates for the proposed routes, over the notification procedure.

Due to a traffic jam on the selected route, the NavSe Server proposes an alternative route to the NavSe Application. The NavSe Server will automatically update its subscription settings related to the NavSe Application adding the alternative route in the subscribed resources set. This implicit subscription procedure is recommended for safety reason in automotive applications.

Afterwards, the user diverted from the selected route by turning the wrong direction or on purpose. The NavSe Application will request new routing information and related traffic information to the NavSe Server.

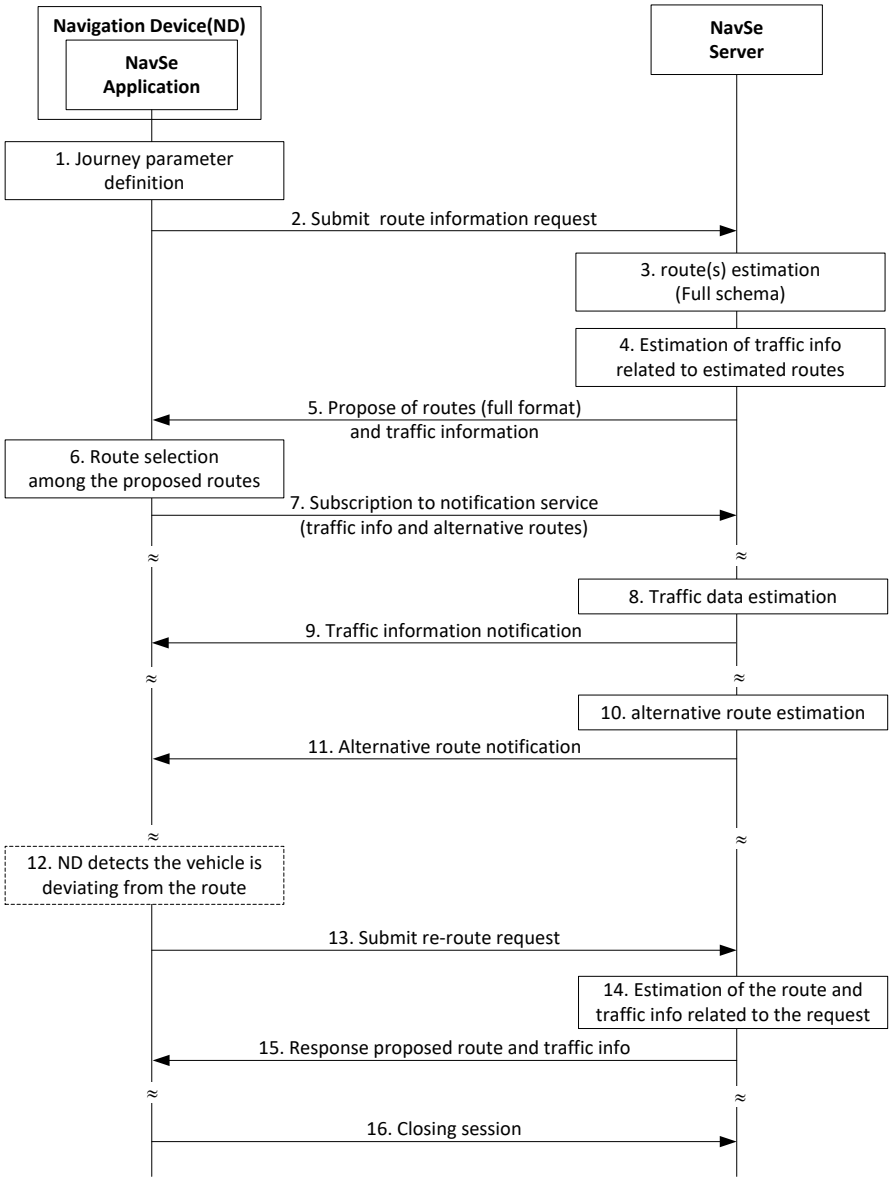

Figure 2: Data Operation Call Flow (B.1 and B.3)

This call flow is triggered by a request to access real-time routing information and related traffic data as described in [B.1 and B.3].

1. The user defines the journey parameters.
2. The NavSe Application submits a query to the NavSe Server to access route information and related traffic information, providing the server with journey parameters.
3. The NavSe Server estimates a set of routes for the defined journey.
4. The NavSe Server generates performance parameters and traffic events related to the estimated routes previously.
5. The NavSe Server proposes a set of routes with related traffic information encoded in the full format to the client.
6. The user selects the routes it is interested in.
7. The NavSe Application subscribes to notification service to receive real-time information about:
   a) Traffic information for the route the user has selected
   b) Alternative route proposal, whenever performance of proposed routes becomes degraded.

In this procedure, the NavSe Application may provide the NavSe Server with a location URI that is used by an external location application for tracking procedures based on the consensus of the user.

8. For the selected route, the NavSe Server estimates real-time and forecast traffic information (traffic events and network performance parameters).
9. The NavSe Server updates on traffic information related to selected route are notified to the NavSe Application.
10. When performances of a proposed route become degraded, the NavSe Server estimates alternative route proposal, if available.
11. The alternative route is provided to the NavSe Application by the NavSe Server. The subscription settings are implicitly updated in the server in order to provide real-time traffic information for the alternative route.
12. The ND detects that the vehicle is diverting and deviating from the predetermined route.
13. The NavSe Application automatically submits the re-route request to update the route accordingly to current position.
14. The NavSe Server re-estimates the route and traffic information related to the re-route request, based on the current position of the user.
15. The NavSe Server proposes a route with related traffic information to the NavSe Application. The subscription settings are also implicitly updated in the NavSe Server.
16. The session is closed by the NavSe Application.

C.2 Traffic Information Delivery Call Flow

The figure below describes the message flow for a possible implementation of use case B.2 (traffic information delivery) and use case B.3 (Re-route Request) in case the routes are proposed by the NavSe Application.

In this scenario, the NavSe Application calculates a route that matches journey parameters defined by the user and it requests related traffic information from the NavSe Server. Based on traffic information provided by the NavSe Server, the NavSe Application assumes the route as the reference one. Then the NavSe Application subscribes to notification service for receiving traffic information updates related to the route, confirming that it allows to be tracked by the NavSe Server.

At a given point, an accident on the reference route will trigger a notification message from the NavSe Server toward the NavSe Application. Upon updated traffic information, the NavSe Application estimates an alternative route and asks for traffic information to the NavSe Server. Since the new route appears to be rather congested, the NavSe Application estimates a second alternative route and asks again traffic information to the NavSe Server. At the moment, the answer satisfies the user and the NavSe Application removes the old route not to receive related notifications.

Furthermore, the user diverts from the route and the NavSe Application will automatically estimates a new route and submit it to the NavSe Server and the NavSe Server provides the real-time traffic information regarding the re-estimated route and the subscription parameters are updated by the NavSe Application.

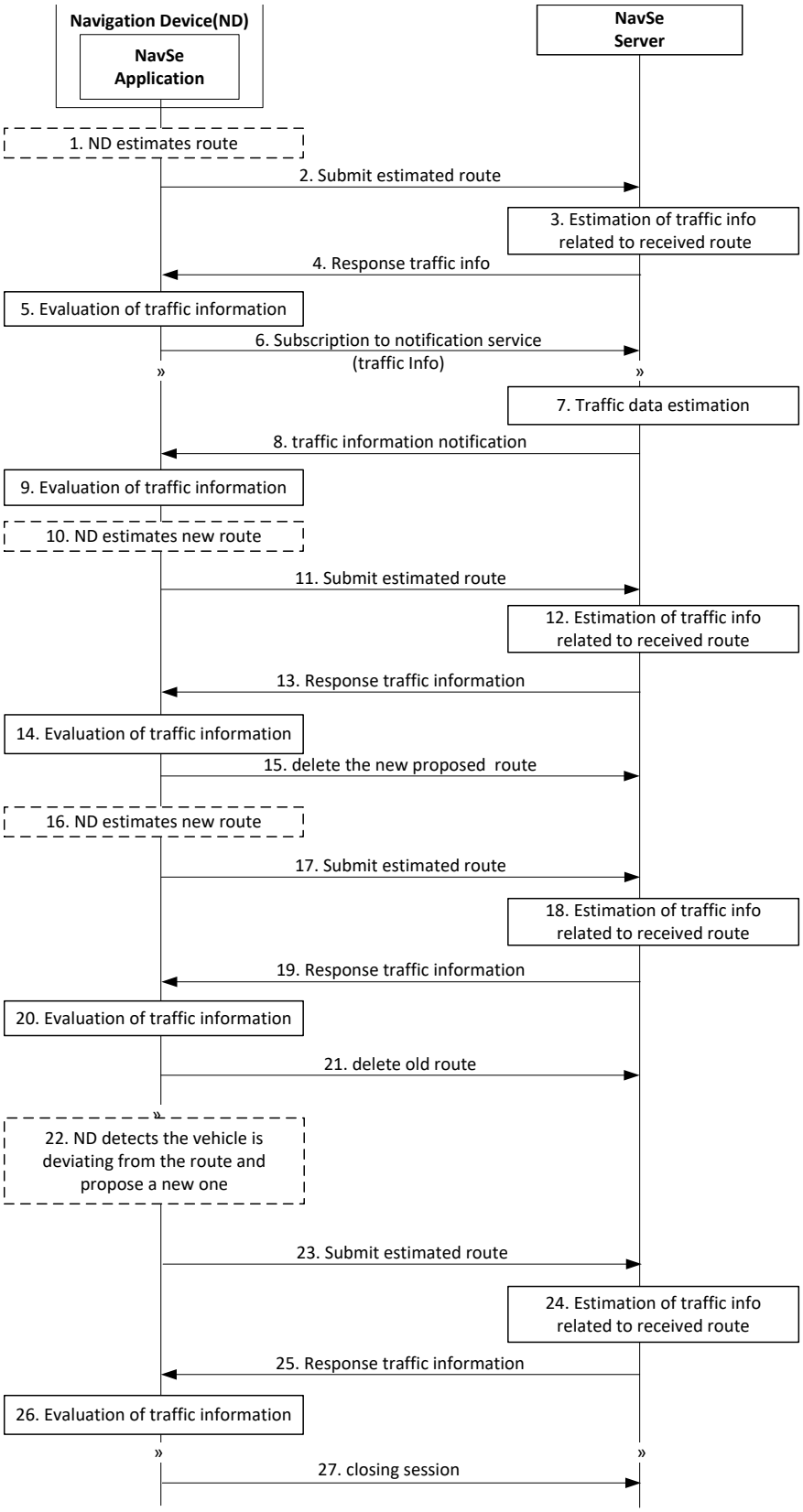

Figure 3: Data Operation Call Flow (B.2 and B.3)

This call flow is triggered by a request to access real-time traffic data related to a set of routes proposed by the ND as described in [B.2 and B.3].

1. The ND estimates a route.
2. The NavSe Application submits a query to the NavSe Server to access traffic information related to the estimated route.
3. The NavSe Server generates network performance parameters and traffic events related to the received route.
4. The NavSe Server sends the NavSe Application the traffic information related to the proposed route.
5. The NavSe Application evaluates the received traffic information and assumes the route as reference one.
6. The NavSe Application subscribes to notification service to receive real-time information about traffic information for the reference route. In this procedure, the NavSe Application also provides the NavSe server with a location URI that is used by an external location application for tracking procedures.
7. An accident occurs along the reference route, the NavSe Server estimates updated traffic information for the route (e.g. delays for each road segments).
8. The NavSe Server notifies to the NavSe Application updated traffic information along the reference route.
9. The ND evaluates the received traffic information.
10. If the NavSe Application reckons that performances are heavily degraded, it estimates alternative route.
11. The NavSe Application submits a query to the NavSe Server to access traffic information related to the alternative route.
12. The NavSe Server generates performance parameters and traffic events related to the received route.
13. The NavSe Server sends the NavSe Application the estimated traffic information.
14. The ND evaluates the received information and reckons that performances of the new routes do not have any advantage over to previous one.
15. The NavSe Application deletes the last proposed route since there is no interested in.
16. The ND estimates a second alternative route.
17. The NavSe Application submits a query to the NavSe Server to access traffic information related to the second alternative route.
18. The NavSe Server generates performance parameters and traffic events related to the received route.
19. The NavSe Server sends the ND the estimated traffic information.
20. The NavSe Application evaluates the received traffic information and reckons that the last proposed route has advantage over the previous ones and the NavSe Application assumes this alternative route as the reference one. The NavSe Application will automatically receive traffic information updates related to the new route.
21. The previously proposed route is deleted since it is no more the reference one.
22. The ND detects the vehicle is deviating from the reference route. The ND automatically estimates a new route based on the current position of the ND.
23. The NavSe Application submits a query to the NavSe Server to access traffic information, providing the NavSe Server with the estimated route.
24. The NavSe Server generates performance parameters and traffic events related to the received route.
25. The NavSe Server sends the NavSe Application the estimated traffic information.
26. The NavSe Application evaluates the received traffic information and it assumes the new route as the reference one. The ND will automatically receive traffic information updates related to the new route.
27. The session is closed by the ND.

C.3 Summarized Route Delivery Call Flow

This section describes the message flow for delivering a set of summarized routes to the NavSe Application (use case B.4).

In this flow, the NavSe Server uses the summarized encoding format for the first delivery of route information to the ND. This choice allows optimization of bandwidth and response time with respect of full encoding approach. The NavSe Server may choose the encoding format based on journey parameters (i.e. journey length) and implementation dependant conditions.

When the NavSe Application has received the set of summarized routes, it selects the ones it is interested in. And then it will request from the server the full description of the selected routes.

The remaining part of NavSe application call flow remains the same as the flow C.1.

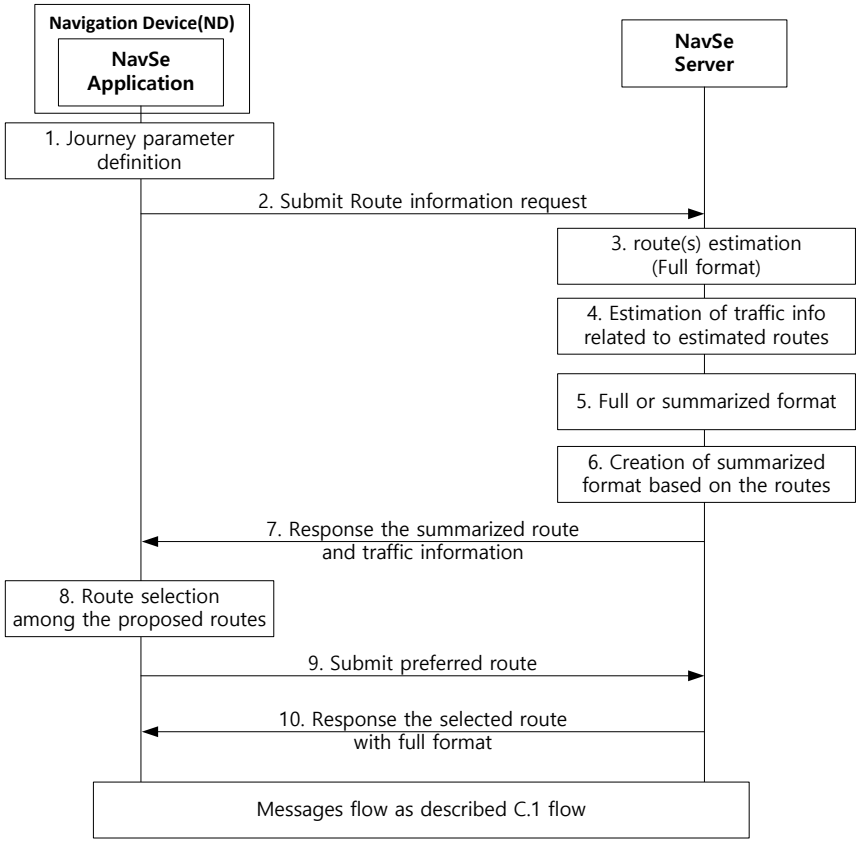

Figure 4: Data Operation Call Flow (B.4)

This call flow is triggered by a request to access real-time routing information and related traffic data, in the first stage of the information is encoded according to summarized format described in [B.4].

1. The user defines journey parameters.
2. The NavSe Application submits a query to the NavSe Server to access route information and related traffic information providing the NavSe Server with the journey parameters.
3. The NavSe Server estimates a set of routes according to full format based on the defined journey parameters.
4. The NavSe Server generates performance parameters and traffic information related to the set of proposed routes.
5. The NavSe Server determines that the summarized route format is sent to the NavSe Application.
6. The NavSe Server encodes the set of proposed routes according to the summarized format.
7. The NavSe Server sends the summarized routes and related traffic information to the NavSe Application.
8. The user selects a preferred route among the proposed set.
9. The NavSe Application requests the full description of the selected route from the NavSe Server.
10. The NavSe Server sends the full description of the route to the NavSe Application.

The message flow of a typical application should continue as described in flow C.1, (in the steps from 7 to 16).

C.4 Unusable Route Delivery Call Flow

The figure below describes the message flow for possible implementation for delivering unusable route information related to a specific area for an emergency to the NavSe application (use case B.5).

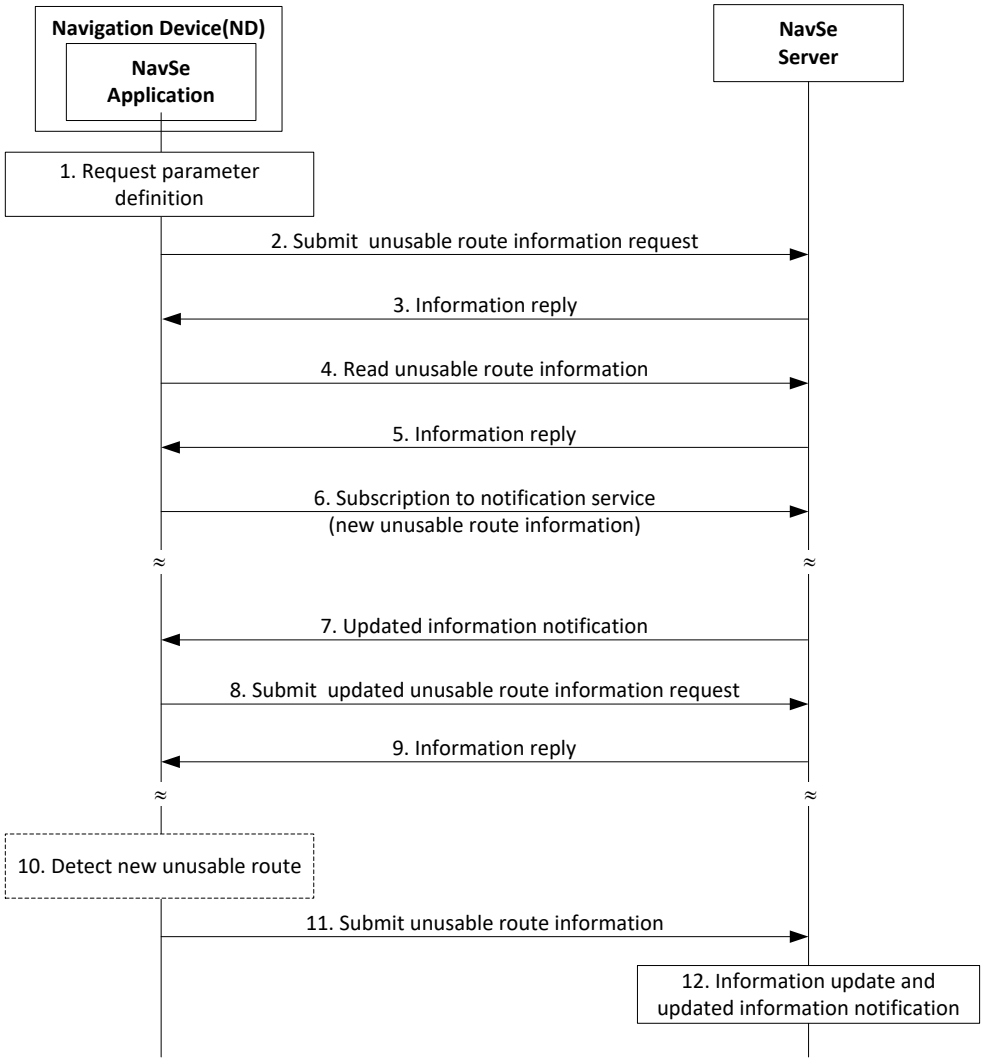

Figure 5: Data Operation Call Flow (B.5)

This call flow is triggered by a request to access unusable route information as described in [B.5].

1. The user defines the journey parameters to request the unusable route information related to an emergency area.
2. The NavSe application submits a query to the NavSe server to receive a link to access the unusable route information.
3. The NavSe server replies with the link.
4. The NavSe application submits the query to receive unusable route information through the link received in step 3.
5. The NavSe server provides the unusable route information related to an emergency area.
6. The NavSe application subscribes to notification services to receive the updated unusable route information.
7. When the unusable route information updated, the NavSe server notifies to the NavSe application updated unusable route information related to an emergency area.
8. The NavSe application submits a query to receive updated unusable route information.

9. The NavSe server provided the updated unusable route information.
10. The user detects the new unusable route occurs.
11. The NavSe application submits the new unusable route information to the NavSe server.
12. The NavSe server updates the unusable route information related to the emergency area and notifies to the other NavSe applications subscribed.

C.5 Shared Route Delivery Call Flow

The figure below describes the message flow for possible implementation for delivering shared route information for an emergency to NavSe applications (use case B.6).

According to the journey parameter defined by the NavSe application 1, the NavSe server calculates and provides the route information to the NavSe application 1. The destination of the route for the NavSe application 1 is the position of the NavSe application 2. And then the NavSe server calculates the route information for the NavSe application 2 which the destination is the position of the NavSe application 1, and provides the calculated route information to the NavSe application 2.

Due to a traffic jam on the selected route, the NavSe Server proposes and provides an alternative route to the NavSe Application 1 and 2.

Afterwards, the user 1 or 2 diverted from the route by turning the wrong direction or on purpose. The NavSe Application 1 or 2 will request new routing information and related traffic information to the NavSe Server.

When the NavSe application 1 subscribes the notification services to receive real-time information, the NavSe application 2 is subscribed automatically.

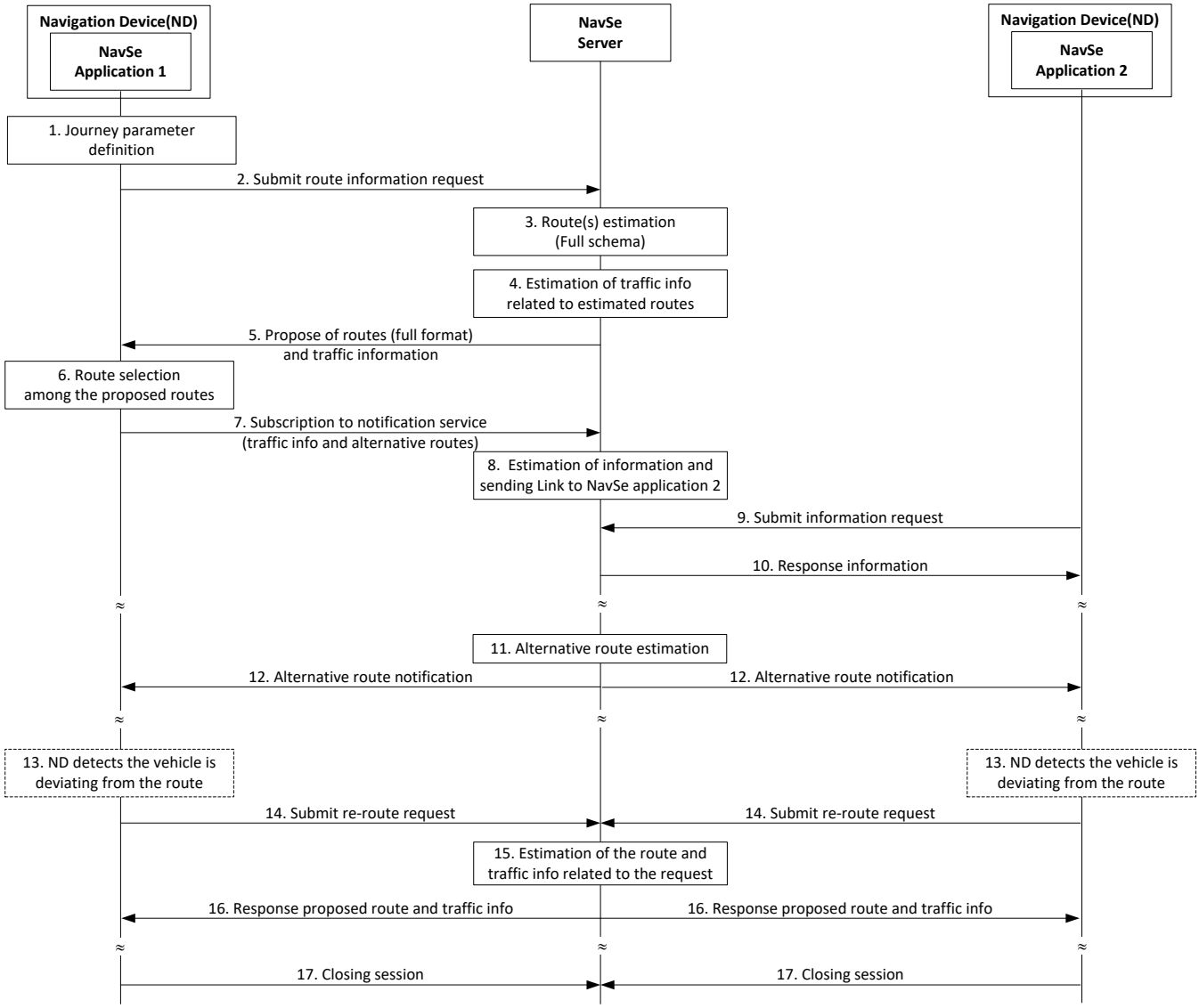

Figure 6: Data Operation Call Flow (B.6)

This call flow is triggered by a request to access shared route information and related traffic data as described in [B.6].

1. The user 1 defines the journey parameters to request the shared route information related with the user 2.
2. The NavSe Application 1 submits a query to the NavSe Server to access route information and related traffic information, providing the server with journey parameters.
3. The NavSe Server estimates a set of routes for the defined journey.
4. The NavSe Server generates performance parameters and traffic events related to the estimated routes previously.
5. The NavSe Server proposes a set of routes with related traffic information encoded in the full format to the client.
6. The user 1 selects the routes it is interested in.
7. The NavSe Application 1 subscribes to notification service to receive real-time information about:
   a) Traffic information for the route the user has selected
   b) Alternative route proposal, whenever performance of proposed routes becomes degraded or the position of the NavSe application deviates from the route

In this procedure, the NavSe Application may provide the NavSe Server with a location URI that is used by an external location application for tracking procedures based on the consensus of the user.

8. The NavSe server estimates a route and generates performance parameters and traffic events for the NavSe application 2 without an interaction with the NavSe application 2. And the NavSe server sends the link to the NavSe application 2 to access the information using MMS, SMS, OMA Push, etc.
9. The NavSe Application 2 submits a query to the NavSe Server to access information.
10. The NavSe Server provides the information.
11. When performances of a proposed route become degraded, the NavSe Server estimates alternative route proposal, if available.
12. The alternative route is provided to the NavSe Application 1 and 2 by the NavSe Server. The subscription settings are implicitly updated in the server in order to provide real-time traffic information for the alternative route.
13. The ND 1 or 2 detects that the vehicle is diverting and deviating from the predetermined route.
14. The NavSe Application 1 or 2 automatically submits the re-route request to update the route accordingly to current position.
15. The NavSe Server re-estimates the route and traffic information related to the re-route request, based on the current position of the user 1 and 2.
16. The NavSe Server provides a route with related traffic information to the NavSe Application 1 and 2. The subscription settings are also implicitly updated in the NavSe Server.
17. The session is closed by the NavSe Application 1 or 2.

Appendix D. Deployment Diagram (Informative)

The following figure presents a possible deployment scenario. The NavSe Application may reside in a Navigation Device or in a 3rd party application server as part of the Navigation AppServer, the network element providing the navigation service to the final user.

The main application related to the case where the NavSe Application resides in the Navigation Device is turn-by-turn vehicle navigation. In this application, firstly, the user requests route and traffic information and then subscribes to notification service to receive real-time traffic information and alternative route proposal. Furthermore, the NavSe Application may provide real-time position information to the Navigation AppServer, updating journey information or through an external application (e.g. SUPL), and the NavSe Server uses location information in order to

2. Update the set of proposed routes created for a specific user,

3. Estimate network performance parameters on the roads on the basis of the NDs tracking information.

On the other side, the main application related to the case where the NavSe Application resides in an 3rd party application server is represented by journey planning tools offered through the web: the end user will access real-time traffic information and routing information, and/or disable route information in a specific area through an web interface exposed by the 3rd party application server, the 3rd party application server will access the requested route and traffic information, and/or disable route information, through the NavSe interface(DyN-1), acting as a NavSe Application. In this scenario, the user is not interested in notification services.

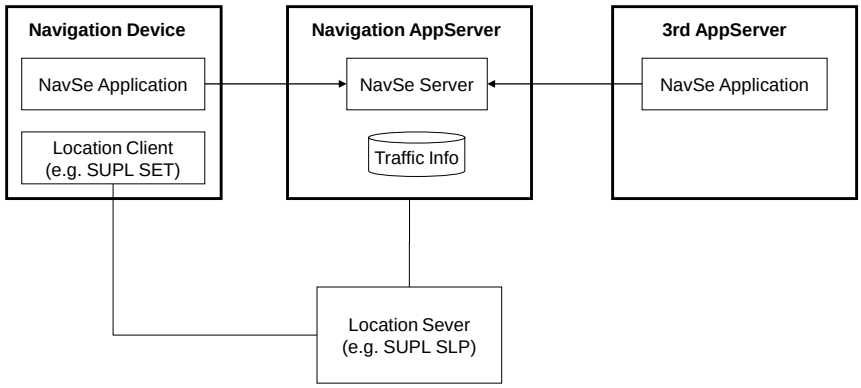

Figure 7: Deployment Diagram