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Centre-to-centre traffic signal priority request protocol

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Status of this document

This document is **Published**.

If there are any comments or feedback arising from the review or use of this document please contact us at secretariat@rtig.org.uk

1 Introduction

1.1 About this document

1.1.1 This document has been produced by RTIG as a specification for a set of messages that can be communicated between a bus management centre and a traffic control centre, in order to request and grant priority for buses at traffic signals.

1.1.2 This status of this document is published, following completion of industry review within both RTIG and the UTMC Development Group.

1.1.3 We are grateful for the constructive contributions of all those involved; in particular Acis (now Vix), whose work for SYPTE formed the basis of the original version and Trapeze, who coordinated v1.1. This version has been produced by the working group producing RTIGT042 Traffic Light Priority Trigger Position File Format.

1.2 Context

1.2.1 In support of transport policy, it is frequently desirable to give buses preferential access to green time at traffic signals. This can improve both running time and reliability, both potentially significant drivers of passenger happiness, and can therefore contribute to achieving modal shift.

1.2.2 Signal priority is not the only way of achieving bus priority. However other approaches tend to involve significant infrastructure work – bus lanes, gated intersections, or even bus-only roadways. These can be very effective, but they are expensive and time consuming to implement, require sufficient real estate to be available, and involve substantial disruption during works. While signal priority cannot provide as much benefit, it is much simpler and cheaper to implement.

1.2.3 There are two ways of achieving signal priority. The approach generally adopted is for a system local to the traffic signals to be triggered by the approach of a bus. Either a device on the roadside (or in the road) detects a bus and directs the signal controller to grant priority, or a device in the bus communicates its presence to a roadside receiver[1]. Figure 1.1a overleaf shows this diagrammatically. An existing RTIG protocol (RTIGT008) provides an open specification for this solution, where the trigger is generated actively by the bus[2].

1.1

[1] There are several ways in which priority may be granted, and in any case the traffic signal controller may elect not to grant the request. The algorithm for deciding how to react is a traffic management function, and is outside the scope of this document.

[2] “Radio Link Specification for RTI-driven Traffic Light Priority and Display Cleardown”, reference RTIGT008-1.6, January 2021.

1.2.4 This approach is not always desirable. It requires work on the traffic signal controllers directly, which may be expensive (particularly if many junctions are affected). It often also requires buses to be specially equipped in order to activate the trigger.

1.2.5 In many areas, particularly town and city centres, traffic signals are already connected in to a central “urban traffic control” (UTC) computer which facilitates flow on an area-wide basis. A local priority request would either have to override the UTC control, potentially disrupting flows across a wide area; or wait for the signal controller to pass the request to the UTC system for granting or rejecting.

1.2.6 An alternative way of achieving priority is possible where there is both centralised UTC and a centralised vehicle tracking system, namely, to negotiate for priority on a centre-to-centre basis (Figure 1 b). On-vehicle and street side equipment is much less affected in this approach. However, it is less effective than local triggering if the AVL communications are not robust, or if the communications latency is too high.

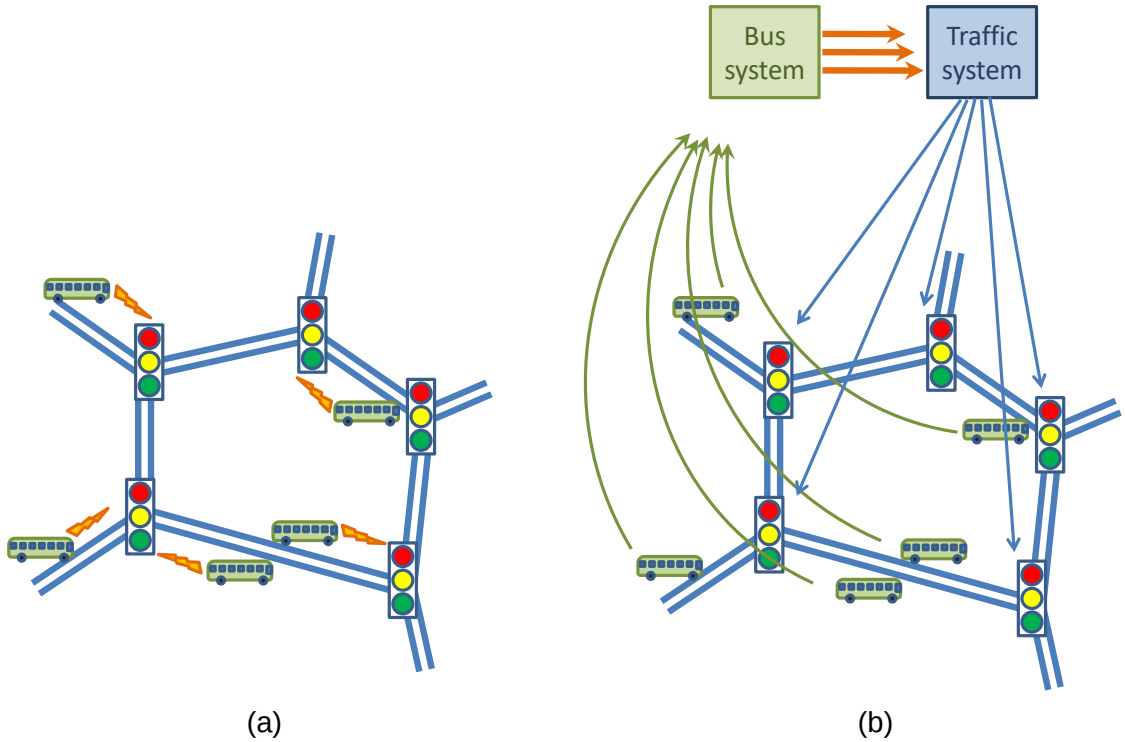

Figure 1 Two ways of triggering bus priority: (a) locally, and (b) centrally

1.2.7 An additional benefit of the centre-to-centre approach is that it allows for much more sophisticated tuning of the priority “business rules” – algorithms can readily be tweaked, both:

- within the AVL central system – e.g. which buses the operator wants to be granted priority, based on lateness, occupancy etc., without passing all the data to the traffic management system;
- within the UTC – e.g. on which signals are included in the priority network, how much priority is given, even how much “downstream” junctions are pre-prepared for the arrival of a bus.

1.2.8 It is not necessary to have only one bus management centre. It is possible for multiple centres (for example those of different operators, or those from neighbouring regions) to submit priority requests to the traffic system. The decision about which to grant lies with the traffic system.

1.2.9 In this architecture, all that will normally be required from the vehicle management system is a sufficiently frequent update on each vehicle’s location. The management centre will normally be able to assess lateness, if this is a factor in whether to request priority or not. If the operator wishes to take into account other factors, such as loading, it is his responsibility to arrange for the collection of any necessary data from his vehicles.

1.2.10 However, a second possibility is available where buses and signal controllers are equipped for local priority triggers (Figure 2). In this, the priority message received at the controller is passed not to the signal, but back to the centre, where it is passed to the appropriate bus control system. Although this requires investment in on-bus and on-street systems, it does allow operators better control over their priority requests, while retaining the integrity of the UTC’s area control. It also avoids any problems with wide are radio communications.

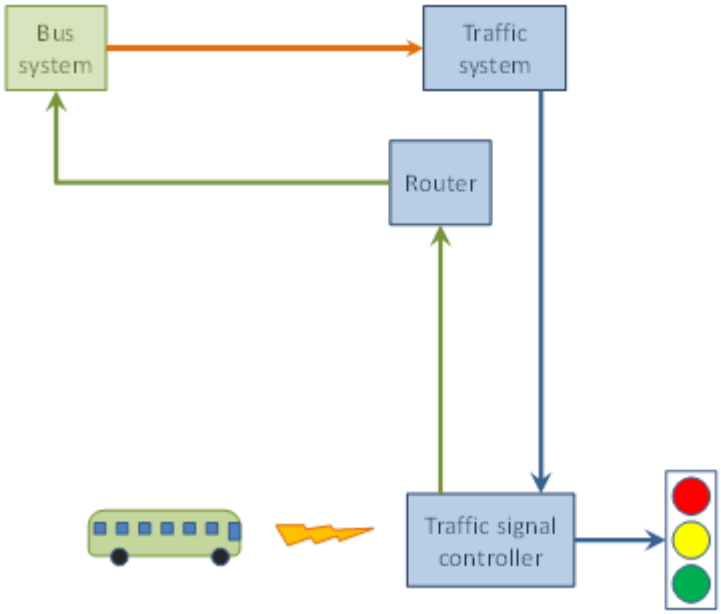

Figure 2 Using local priority triggers with an area-wide UTC

1.3 Scope

1.3.1 The existing RTIG document RTIGT008 provides a specification for local trigger messages (the orange flashes on Figure 1a and Figure 2). This specification builds on the same request semantics, but applies to the central trigger requests (the orange arrows on Figure 1b and Figure 2).

1.3.2 In Figure 2, this specification can also be used for the allocation message from the traffic manager's router out to the bus system.

1.3.3 This specification does not impose functional requirements of this nature on either the vehicle management system or the UTC. These must be agreed within each scheme, between the owners of the two relevant systems.

1.3.4 This specification presents a schema and models for an interface based on XML messages. The channel by which these messages are conveyed is not defined; the expectation is that in most cases this will be over a fixed internet link, but alternatives (for instance, direct Ethernet, WiFi, or 3G/4G) are possible.

1.3.5 The current version of the specification allows for the transfer of information on schedule deviation, but also a separate indication of level of priority requested. It also provides information on the identity of the bus, and its desired movement at the signal.

1.3.6 The current version of the specification does not indicate whether priority has been granted. “Priority” may encompass anything from flexing green times by a second or two, to the configuration of a green wave over several junctions. Moreover, whether the driver can actually safely make the junction depends on factors other than whether priority was granted. It is therefore expected that reporting on priority requests granted would be done in “batch mode”, say once a month, rather than in real time. Again, this becomes part of the UTC system functionality and is excluded from this document.

1.3.7 It is expected that this approach will cover the majority of needs, but the specification may be revised if it proves necessary.

2 Priority request specification

2.1 Definition

2.1.1 The PriorityRequest service message has the following structure

PriorityRequest				**Request for priority through a signalised junction for a specific vehicle**
	sequence	1:1	0..65535	Sequence number for request message, generated by source system. Used to de-duplicate requests and as a reference for acknowledgements.
	date_time	1:1	*xsd:dateTime*	DateTime reference for the request, generated by source system using W3C compatible date-time (which is based on ISO8601 date and time) and specifying timezone offset, YYYY-MM-DDThh:mm:ssTZD This timestamp indicates the time at which the vehicle triggered the relevant junction trigger point. Standard XML construct.
	traffic_signal	1:1	xsd:nonNegativeInteger 1 ... 65535	Enumerated. Depends on a common database of traffic signals. See 2.1.3 for details. Default = 0 (Unknown)
	movement	1:1	0..31	Enumerated. Depends on a common database of movement definitions. Default = 0. If vehicle position information is available through other channels, straight ahead may be assumed (if possible).

PriorityRequest				**Request for priority through a signalised junction for a specific vehicle**
	trigger_point	1:1	0..9	Enumerated. The enumeration must follow that described in T008 Type 3 namely: 0 = Registration (default) 1 = Request 2 = Clear 3 = Reserved Default = 0. This will indicate a registration, and will (by itself) likely to result in no UTC action.
	priority	1:1	0..6	Enumerated. 0 = No Operation 1 = Very Low 2 = Low 3 = Normal 4 = High 5 = Very High (Reserved) 6 = Emergency (Reserved)
	schedule_deviation	1:1	0..31	Enumerated. Default/on time or early = 0 *n* minutes late = *n* (n=1..29) 30 or more minutes late = 30, Unknown = 31
	local_vcc	1:1	0..15	Enumerated. Depends on a common database of local VCCs. Vehicles other than buses may be given priority with an “effective LVCC” (e.g. “Fire service”) or a default LVCC. Default = 0.
	operator	1:1	<string>	Operator reference or equivalent. This field used together with <vehicle> can be used to provide a unique vehicle reference. Maximum 31 characters

PriorityRequest				Request for priority through a signalised junction for a specific vehicle
	vehicle	1:1	xsd:nonNegativeInteger 1 ... 2147483647	Fleet number or equivalent. This field used together with <operator> can be used to provide a unique vehicle reference. Positive integer Minimum Value = 1

2.1.2 Most fields are enumerated for ease of message construction. This imposes a need to agree and share a number of different databases between systems.

2.1.3 In version 1.2 of the schema the maximum value for traffic_signal has been increased from 16383 to 65535. This is to allow large systems involving multiple traffic control centres increased flexibility with numbering of signals. This requires the system(s) providing triggers to the traffic control centre to support 16 bit numbering and this will not always be the case. The standards RTIGT008 ‘Radio Link Specification for RTI-driven Traffic Light Priority and Display Cleardown’ and RTIGT030 ‘Digital Air Interface Protocol’ only support 8 bit numbering for traffic_signal providing a maximum value for traffic_signal of 16383. The capability of systems supplying priority requests needs to be taken into account when designing the overall system to ensure the desired behaviour is achieved.

2.1.4 The two fields, `date_time` and `sequence`, are not defined in RTIGT008, but are also mandatory and must be supplied by the source system. The receiving (UTC) system must be able to handle possible duplicate sequence numbers from distinct sources and report back correct sequence numbers to respective sources where required.

2.1.5 The format of date_time is a standard W3C compatible date-time (which is based on ISO8601 date and time) specifying TimeZone offset (eg 2009-06-15T13:45:30+00:00). This is designed to be easy to validate and process using standard XML libraries.

2.1.6 Where priority requests are generated by a real-time tracking system, it is the responsibility of the central system to:

- from the reported vehicle location, and the route being served, determine which `traffic_signal` is being approached, the location of the `trigger_point`, and which movement the bus requires through it

- from the reported vehicle location, and the timetable for the journey being operated, determine the `schedule_deviation`
- translate vehicle tracking identity into the format used here (operator plus vehicle, and `local_vcc` (where applicable))
- identify whether a priority request is required, and if so with what `priority` level
- send a request message at the appropriate time, accurately timestamped. It is a responsibility of the central system to filter messages so that stale messages are not sent.

2.1.7 The field `schedule_deviation` is mandatory, but can be defaulted. If the agreement is that the UTC does not need to know this field, the real-time tracking system will not need to match the vehicle against its schedule and can simply insert a 31 here, indicating that schedule deviation is not known. Note that the UTC can still be set up to grant priority even for on-time buses[3].

2.1.8 The `<priority>` field is enumerated and designed to match UTC signal priority enumeration. While values 5, and 6 exist they should be treated as reserved and avoided. Values of 0–4 are suitable for modelling day-to-day request priorities, with 3 (normal) being recommended for a typical request.

2.2 Message structure

2.2.1 Exploiting the simple structure for the data, the basic form of the XML output is as follows. The data values in this are fabricated.

```
<?xml version="1.0" encoding="UTF-8"?>
<rtig_tlp xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:noNamespaceSchemaLocation="RTIGT031_Centre-centre_TLP_1.2.xsd"
 version="1.2" traffic_signal="5824" movement="2" trigger_point="0" priority="2"
schedule_deviation="2"
 local_vcc="0" operator="abc" vehicle="463" date_time="2009-06-
15T13:45:30+00:00" sequence="12"/>
```

1.1

[3] In addition, the operator can insert a priority level, which may be based on other factors. For example express routes, park and ride, school services or rail replacement vehicles might be granted higher or lower priority than residential services.

2.3 Schema

2.3.1 The associated schema element describing the above is as follows:

```
<xsd:element name="rtig_tlp">
    <xsd:complexType>
      <xsd:attribute fixed="1.2" name="version" use="required">
        <xsd:simpleType>
          <xsd:restriction base="xsd:string"/>
        </xsd:simpleType>
      </xsd:attribute>
      <xsd:attribute name="sequence" use="required">
        <xsd:annotation>
          <xsd:documentation>Unique sequence number as a reference for
request, generated by source system</xsd:documentation>
        </xsd:annotation>
        <xsd:simpleType>
          <xsd:restriction base="xsd:nonNegativeInteger">
            <xsd:maxInclusive value="65535"/>
          </xsd:restriction>
        </xsd:simpleType>
      </xsd:attribute>
      <xsd:attribute name="date_time" type="xsd:dateTime" use="required">
        <xsd:annotation>
          <xsd:documentation>Date and time indicating when the particular
vehicle reached the relevant junction trigger point </xsd:documentation>
        </xsd:annotation>
      </xsd:attribute>
      <xsd:attribute name=" traffic_signal" use="required">
        <xsd:annotation>
          <xsd:documentation>Agreed (source system) reference for traffic
signal</xsd:documentation>
        </xsd:annotation>
        <xsd:simpleType>
          <xsd:restriction base="xsd:nonNegativeInteger">
            <xsd:maxInclusive value="65535"/>
          </xsd:restriction>

        </xsd:simpleType>
      </xsd:attribute>
      <xsd:attribute name="movement" use="required">
        <xsd:annotation>
          <xsd:documentation>Agreed (source system) reference for traffic
movement</xsd:documentation>
```

```
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="31"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="trigger_point" use="required">
            <xsd:annotation>
               <xsd:documentation>0 = Registration</xsd:documentation>
               <xsd:documentation>1 = Request</xsd:documentation>
               <xsd:documentation>2 = Clear</xsd:documentation>
               <xsd:documentation>3 = Reserved</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="9"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="priority" use="required">
            <xsd:annotation>
               <xsd:documentation>0 = No Operation</xsd:documentation>
               <xsd:documentation>1 = Very Low</xsd:documentation>
               <xsd:documentation>2 = Low</xsd:documentation>
               <xsd:documentation>3 = Normal</xsd:documentation>
               <xsd:documentation>4 = High</xsd:documentation>
               <xsd:documentation>5 = Very High
(reserved)</xsd:documentation>
               <xsd:documentation>6 = Emergency
(reserved)</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="6"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="schedule_deviation" use="required">
            <xsd:annotation>
               <xsd:documentation>0 = On-time, or Early</xsd:documentation>
               <xsd:documentation>1-29 = n minutes late</xsd:documentation>
               <xsd:documentation>30 = 30 (or more) minutes
late</xsd:documentation>
               <xsd:documentation>31 = Schedule Deviation
```

```
Unknown</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="31"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="local_vcc" use="required">
            <xsd:annotation>
               <xsd:documentation>Agreed (source system) vehicle
type</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="15"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="operator" use="required">
            <xsd:annotation>
               <xsd:documentation>Agreed (source system) operator
reference</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:string">
                  <xsd:maxLength value="31"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="vehicle" use="required">
            <xsd:annotation>
               <xsd:documentation>Agreed (source system) vehicle
id</xsd:documentation>
               <xsd:documentation>Must be a unique (within source
system)</xsd:documentation>
               <xsd:documentation>Mininum value = 1</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:minInclusive value="1"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
```

```
    </xsd:complexType>
</xsd:element>
```

3 Priority request acknowledgement

3.1 Definition

3.1.1 The PriorityRequestAcknowledgement service message is required to be used as an immediate quasi-synchronous response to a PriorityRequest. This message is **not** designed to carry information regarding whether priority was actually granted.

3.1.2 Simple validation is permitted prior to response, but comprehensive validation should not be attempted if it would delay the acknowledgement through excessive processing time.

3.1.3 The PriorityRequestAcknowledgement service message has the following structure.

PriorityRequestAcknowledgement				**Simple Acknowledgement to a request for priority through a signalised junction for a specific vehicle**
	sequence	1:1	0..65535	Sequence number for request message that is being acknowledged.
	quality	1:1	0..3	Enumerated. Indicates meaning (or “quality”) of response as follows: 0 = Standard XML schema validation only 1 = Request content successfully validated 2 = Validation failed Default = 0
	date_time	1:1	*xsd:dateTime*	DateTime reference for request receipt. Standard XML construct.

3.1.4 Any `<sequence number>` field sent must be relevant to the source that sent the request. In situations where a receiver is receiving multiple RTIG T031 feeds from different sources, care must be taken to return the correct sequence numbers in acknowledgements back to the different sources.

3.1.5 The `<quality>` field allows the request receiver to qualify what the acknowledgement means. Using a default value of 0 simply acts as a positive proof of receipt, with no indication of any validation over and above basic XML parsing and schema validation.

3.1.6 The `<date_time>` field contains the date and time generated by the receiver to indicate when the request was received, and allows for transfer time statistics to be calculated.

3.2 Message structure

3.2.1 Exploiting the simple structure for the data, the basic form of the XML output is as follows. The numerical values in this are fabricated.

```
<?xml version="1.0" encoding="UTF-8"?>
<rtig_tlpack xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:noNamespaceSchemaLocation="RTIGT031_Centre-centre_TLP_1.2.xsd"
 version="1.2" sequence="12" quality="0" date_time="2020-06-
15T13:45:31+00:00"/>
```

3.3 Schema

3.3.1 The associated schema element describing the above is included as text below:

```
<xsd:element name="rtig_tlpack">
      <xsd:complexType>
         <xsd:attribute fixed="1.2" name="version" use="required">
            <xsd:simpleType>
               <xsd:restriction base="xsd:string"/>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="sequence" use="required">
            <xsd:annotation>
               <xsd:documentation>Sequence number of original request with
which this acknowledgement is associated</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="65535"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
```

```
            <xsd:attribute name="quality" use="required">
               <xsd:annotation>
                  <xsd:documentation>0 = Standard XML schema validation
only</xsd:documentation>
                  <xsd:documentation>1 = Request content successfully
validated</xsd:documentation>
                  <xsd:documentation>2 = Validation failed</xsd:documentation>
               </xsd:annotation>
               <xsd:simpleType>
                  <xsd:restriction base="xsd:nonNegativeInteger">
                     <xsd:maxInclusive value="3"/>
                  </xsd:restriction>
               </xsd:simpleType>
            </xsd:attribute>
            <xsd:attribute name="date_time" type="xsd:dateTime" use="required">
               <xsd:annotation>
                  <xsd:documentation>Date and time indicating when request was
received </xsd:documentation>
               </xsd:annotation>
            </xsd:attribute>
         </xsd:complexType>
      </xsd:element>
```

4 Priority request result

4.1 Definition

4.1.1 The PriorityRequestResult service message is optional and designed to be used as an asynchronous response to a PriorityRequest with a trigger_point value of 1 (“Request”). A PriorityRequestResult service message should **not** be sent in response to “Registration” or “Clear” messages.

4.1.2 The PriorityRequestResult service message includes fields that are used to indicate how the UTC handled the request with respect to whether priority was actually granted. In practice the PriorityRequestResult service message is often deferred until the UTC decides that the vehicle has cleared the junction.

4.1.3 The PriorityRequestResult service message has the following structure.

PriorityRequestResult				**Deferred result response to a request for priority through a signalised junction for a specific vehicle**
	sequence	1:1	0..65535	Sequence number for request message that is being acknowledged.
	result	1:1	*0 .. 2*	Enumerated Indicates whether or not the priority request was granted: 0 = No priority action necessary 1 = Priority granted 2 = Priority denied Default = 0
	detail	1:1	*0 .. 31*	Enumerated Provides detail to qualify result: 0 = No detail available 10 = Extension 11 = Recall 12 = Stay 13 = Skip 20 = Insufficient priority 21 = Unable to grant Default = 0 Values in range not enumerated above are reserved

PriorityRequestResult				Deferred result response to a request for priority through a signalised junction for a specific vehicle
	decision_date_time	1:0	*xsd:dateTime*	DateTime reference for when priority result was decided Standard XML construct.
	clear_date_time	1:0	*xsd:dateTime*	DateTime reference for when bus cleared the junction. This can be based on UTC modelling or on a “Clear” message from bus via RT System. Standard XML construct.

4.1.4 Any `<sequence>` field sent must be relevant to the source that sent the request. In situations where a receiver is receiving multiple RTIG T031 feeds from different sources, care must be taken to return the correct sequence numbers in acknowledgements back to the different sources.

4.1.5 The `<result>`, `<detail>`, `<decision_date_time>`, and <clear_date_time> provide enhanced information regarding the UTC handling of the associated request.

4.1.6 The `<result>` field provides a basic indication of whether priority was granted or denied. A value of 0 for this field has a very specific meaning. It indicates that the UTC analysis of the junction flow (at the time of the request) identified that there was no action it could reasonably take that would improve the progress of the vehicle, given the other constraints on its operation.

4.1.7 The `<detail>` field qualifies the value returned for the result field.

4.1.8 Detail values to qualify a “priority granted” result from UTC have the following meaning and use:

10 = Extension – extend the current stage

11 = Recall – move to required stage using the normal sequence

12 = Stay – keep to the planned duration of this stage

13 = Skip – move to required stage by omitting some stages

4.1.9 Detail options to qualify a “priority denied” result from UTC are as follows:

20 = Insufficient priority – a higher priority request was granted at the expense of this request

21 = Unable to comply – UTC does not have authority (or capability) to grant this request

4.1.10 Values in the range 0..31 other than 0 and those described above are reserved in this version of the specification, and should be treated as erroneous if observed.

4.1.11 The `<decision_date_time>` field is an optional timestamp indicating when the UTC made its decision regarding whether priority should be granted.

4.1.12 The `<clear_date_time>` field is an optional timestamp indicating when the UTC deemed that the vehicle had cleared the junction. This timestamp will either reflect the UTC modelling of the progress of the vehicle, or be generated as a result of the UTC receiving a “Clear” message.

4.2 Message structure

4.2.1 Exploiting the simple structure for the data, the basic form of the XML output is as follows. The numerical values in this are fabricated.

```
<?xml version="1.0" encoding="UTF-8"?>
<rtig_tlpresult xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:noNamespaceSchemaLocation="RTIGT031_Centre-centre_TLP_1.2.xsd"
version="1.2" sequence="12" result="1" detail="10" decision_date_time="2020-
06-15T13:45:32+00:00" clear_date_time="2020-06-15T13:45:35+00:00"/>
```

4.3 Schema

4.3.1 The associated schema element describing the above is as follows:

```
<xsd:element name="rtig_tlpresult">
      <xsd:complexType>
         <xsd:attribute fixed="1.2" name="version" use="required">
            <xsd:simpleType>
               <xsd:restriction base="xsd:string"/>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="sequence" use="required">
```

```
            <xsd:annotation>
               <xsd:documentation>Sequence number of original request with
which this result is associated</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="65535"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="result" use="required">
            <xsd:annotation>
               <xsd:documentation>0 = No Action (progress of bus through
junction could not be improved)</xsd:documentation>
               <xsd:documentation>1 = Priority Granted</xsd:documentation>
               <xsd:documentation>2 = Priority Denied</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="2"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="detail" use="required">
            <xsd:annotation>
               <xsd:documentation>0 = No detail available </xsd:documentation>
               <xsd:documentation>10 = Extension</xsd:documentation>
               <xsd:documentation>11 = Recall</xsd:documentation>
               <xsd:documentation>12 = Stay</xsd:documentation>
               <xsd:documentation>13 = Skip</xsd:documentation>
               <xsd:documentation>20 = Higher priority request took
precedence</xsd:documentation>
               <xsd:documentation>21 = Unable to grant
priority</xsd:documentation>
            </xsd:annotation>
            <xsd:simpleType>
               <xsd:restriction base="xsd:nonNegativeInteger">
                  <xsd:maxInclusive value="31"/>
               </xsd:restriction>
            </xsd:simpleType>
         </xsd:attribute>
         <xsd:attribute name="decision_date_time" type="xsd:dateTime"
use="optional">
            <xsd:annotation>
               <xsd:documentation>Date and time indicating when priority result
```

```
was decided </xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
            <xsd:attribute name="clear_date_time" type="xsd:dateTime"
use="optional">
                <xsd:annotation>
                    <xsd:documentation>Date and time indicating when bus cleared
junction </xsd:documentation>
                </xsd:annotation>
            </xsd:attribute>
        </xsd:complexType>
    </xsd:element>
```