

Agenda Item: 9.1
Source: Ericsson
Title: Protocol states for Iu User Plane
Document for: Decision

1 Introduction

This contribution proposes protocol states for Iu user plane transparent mode and support mode for predefined SDU sizes.

2 Description

2.1 Protocol state model for transparent mode

Figure 1 illustrates the state model for transparent mode Iu UP instances (both RNC and CN). A transparent mode instance can be in one of following states.

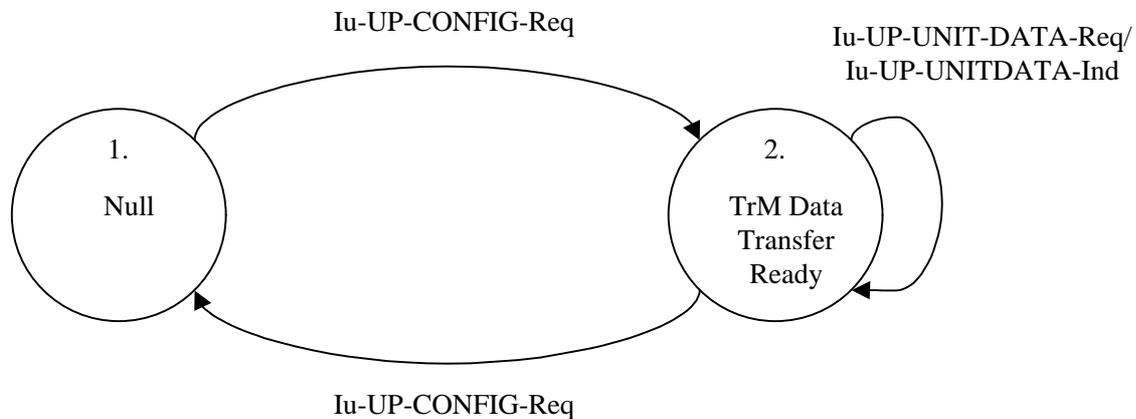


Figure 1: Protocol state model for transparent mode.

2.1.1 Null State

In the null state the Iu UP instance does not exist and therefore it is not possible to transfer any data through it.

Upon reception of a Iu-UP-CONFIG-Req from higher layer the Iu UP instance is created and transparent mode data transfer ready state is entered. The mode information is received either through RANAP signalling or directly in the CN node. In the Iu-UP-CONFIG-Req e.g. the following information will be indicated:

- Transparent mode

2.1.2 Transparent Mode Data Transfer Ready State

In the transparent mode data transfer ready state, transparent mode data can be exchanged between the entities.

Upon reception of Iu-UP-CONFIG-Req indicating release from higher layer, the Iu UP instance is terminated and the null state is entered.

2.2 Protocol state model for support mode for predefined SDU sizes in RNC

Figure 2 illustrates the state model for support mode Iu UP instances in the RNC. A support mode instance can be in one of the following states.

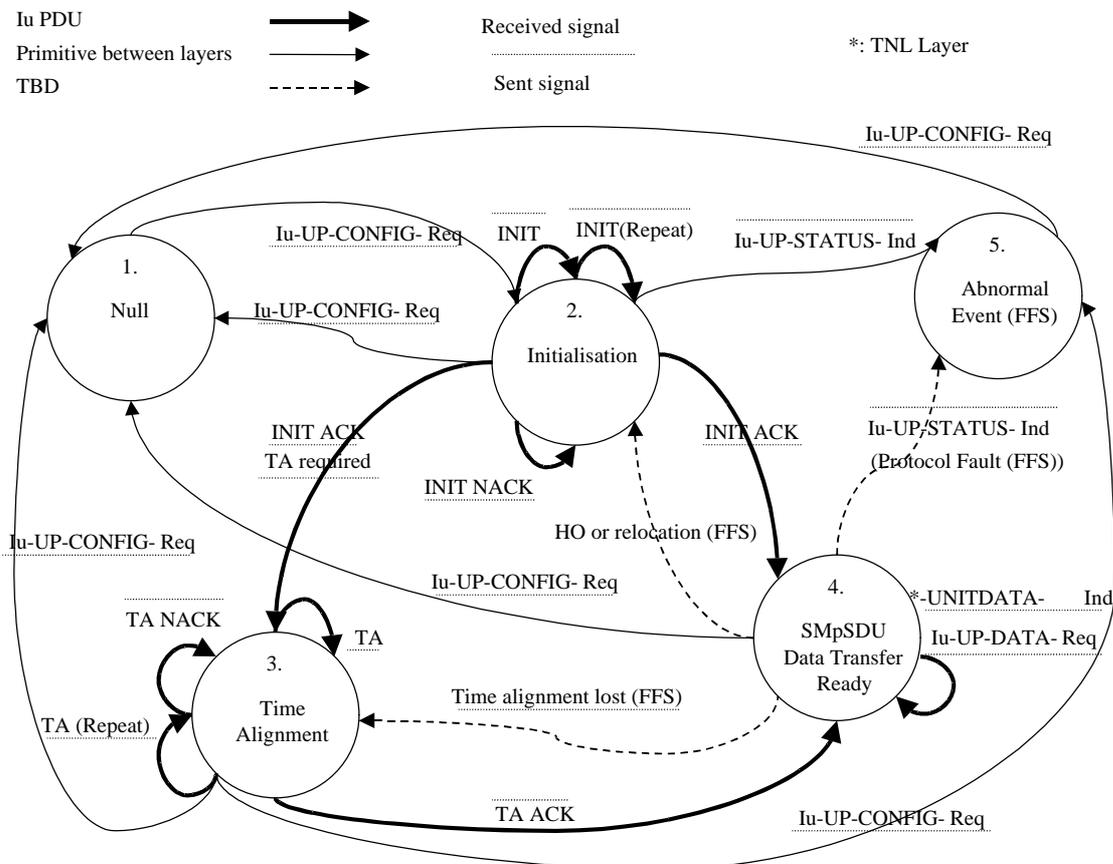


Figure 2: Protocol state model for support mode in RNC.

2.2.1 Null State in RNC

In the null state the Iu UP instance does not exist and therefore it is not possible to transfer any data through it.

Upon reception of a Iu-UP-CONFIG-Req from higher layer the Iu UP instance is created and initialisation state is entered. In the Iu-UP-CONFIG-Req e.g. the following information will be indicated:

- Support mode for predefined SDU sizes
- Time alignment
- Indication of delivery of erroneous SDUs
- Periodicity

2.2.2 Initialisation State in RNC

In the initialisation state the instance exchanges initialisation information with its peer Iu UP instance.

Upon reception of Iu-UP-CONFIG-Req indicating release from higher layer, the Iu UP instance is terminated and the null state is entered.

Upon sending of an initialisation frame (INIT) to the peer Iu UP instance, a supervision timer T_{INIT} is started. The Iu UP remains in initialisation state.

Upon reception of an initialisation acknowledgement frame (INIT ACK), the supervision timer T_{INIT} is stopped and the Iu UP instance enters SmpSDU data transfer ready state.

If time alignment is required for the RAB and it is indicated in the Iu-UP-CONFIG-Req, the Iu UP instance enters time alignment state when the initialisation procedure has been completed, (i.e. when CN Iu UP instance has sent the initialisation acknowledgement (INIT ACK) and RNC Iu UP instance has received it.)

Upon reception of an initialisation negative acknowledgement frame (INIT NACK) or at the expiry of timer T_{INIT} , the initialisation frame is repeated and the timer T_{INIT} is restarted. The initialisation frame can be repeated $VT(Init)$ times.

If after $VT(Init)$ repetitions, the initialisation procedure is unsuccessfully terminated (due to $VT(Init)$ negative acknowledgements or timer expiries), Iu-UP-Status-Indication primitive is sent to the higher layers and abnormal event state is entered.

2.2.3 Time Alignment State in RNC

Note1: The details of the time alignment state and respective procedures are TBD. However, it is assumed that CN side starts the time alignment procedure. Below is a description of possible events.

In the time alignment state the Iu UP instance exchanges time alignment information with its peer Iu UP instance.

Upon reception of Iu-UP-CONFIG-Req indicating release from higher layer, the Iu UP instance is terminated and the null state is entered.

Upon reception of TA from the peer Iu UP instance, the TA frame is processed and the instance remains in time alignment state.

Upon sending of a time alignment acknowledgement frame (TA ACK) to the peer Iu UP instance, the Iu UP instance enters SMpSDU data transfer ready state.

If the RNC Iu UP instance can not respond with an TA ACK to the time alignment frame (TA), it sends an TA NACK and remains in the time alignment state.

If after VT(TimeAlign) repetitions, the time alignment procedure is unsuccessfully terminated (due to VT(TimeAlign) negative acknowledgements or timer expiries), Iu-UP-Status-Indication primitive is sent to the higher layers and abnormal event state is entered.

2.2.4 Support Mode Data Transfer Ready State in RNC

In the support mode data transfer ready state, support mode data can be exchanged between the peer Iu UP instances.

Upon reception of Iu-UP-DATA-Request or UNITDATA-Indication from TNL layer, appropriate user data transfer procedures are performed. Iu UP instance remains in the SMpSDU data transfer ready state

Upon reception of Iu-UP-CONFIG-Req from higher layer the Iu UP instance is terminated and the null state is entered.

Upon detection of a protocol fault (FFS), Iu-UP-STATUS-Indication is sent to upper layer and abnormal event state is entered.

TBD event (FFS): In case that time alignment is lost, it has to be achieved again and Iu UP instance may have to enter the time alignment state.

TBD event (FFS): In case of handover or relocation, initialisation procedures may have to be performed and Iu UP instance may have to enter the initialisation state.

2.2.5 Abnormal Event State in RNC

Abnormal event state is FFS and it will be described in a later contribution. However, an assumption can be made that upon reception of Iu-UP-CONFIG-Req from higher layer the Iu UP instance is terminated and the null state is entered.

2.3 Protocol state model for support mode for predefined SDU sizes in CN

Figure 3 illustrates the state model for support mode Iu UP instances in the CN. A support mode instance can be in one of the following states.

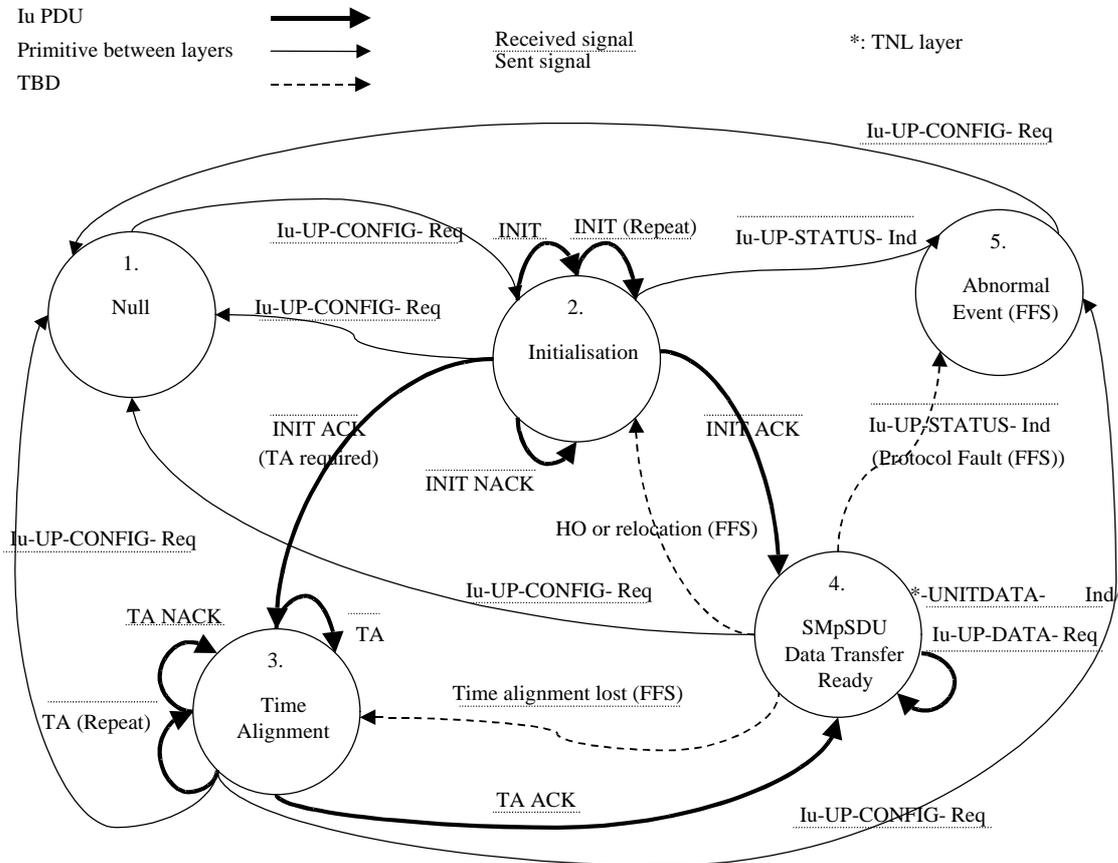


Figure 3: Protocol state model for support mode in CN.

2.3.1 Null State in CN

In the null state the Iu UP instance does not exist and therefore it is not possible to transfer any data through it.

Upon reception of a Iu-UP-CONFIG-Req from higher layer the Iu UP instance is created and initialisation state is entered. In the Iu-UP-CONFIG-Req e.g. the following information will be indicated:

- Support mode for predefined SDU sizes
- Time alignment
- Indication of delivery of erroneous SDUs
- Periodicity

2.3.2 Initialisation State in CN

In the initialisation state the instance exchanges initialisation information with its peer Iu UP instance.

Upon reception of Iu-UP-CONFIG-Req indicating release from higher layer, the Iu UP instance is terminated and the null state is entered.

Upon reception of INIT from the peer Iu UP instance, the INIT frame is processed and the instance remains in initialisation state.

Upon sending of an initialisation acknowledgement frame (INIT ACK) to the peer Iu UP instance, the Iu UP instance enters SMpSDU data transfer ready state.

If time alignment is required for the RAB and it is indicated in the Iu-UP-CONFIG-Req, the Iu UP instance enters time alignment state when the initialisation procedure has been completed (i.e. when CN Iu UP instance has sent the initialisation acknowledgement and RNC Iu UP instance has received it.)

If the CN Iu UP instance can not respond with an INIT ACK to the initialisation frame (INIT), it sends an INIT NACK and remains in the initialisation state.

If after VT(Init) repetitions, the initialisation procedure is unsuccessfully terminated (due to VT(Init) negative acknowledgements or timer expiries), Iu-UP-Status-Indication primitive is sent to the higher layers and abnormal event state is entered.

2.3.3 Time Alignment State in CN

Note2: The details of the time alignment state and respective procedures are TBD. However, it is assumed that CN side starts the time alignment procedure. Below is a description of possible events.

In the time alignment state the Iu UP instance exchanges time alignment information with its peer Iu UP instance.

Upon reception of Iu-UP-CONFIG-Req indicating release from higher layer, the Iu UP instance is terminated and the null state is entered.

Upon sending of a time alignment request (TA) to the peer Iu UP instance, a supervision timer $T_{\text{TIME_ALIGN}}$ is started. The Iu UP remains in time alignment state.

Upon reception of a time alignment acknowledgement frame (TA ACK), the supervision timer $T_{\text{TIME_ALIGN}}$ is stopped and the Iu UP instance enters SMpSDU data transfer ready state.

Upon reception of a time alignment negative acknowledgement frame (TA NACK) or at the expiry of timer $T_{\text{TIME_ALIGN}}$, the time alignment request is repeated and the timer $T_{\text{TIME_ALIGN}}$ is restarted. The time alignment frame can be repeated VT(TimeAlign) times.

If after VT(TimeAlign) repetitions, the time alignment procedure is unsuccessfully terminated (due to VT(TimeAlign) negative acknowledgements or timer expiries), Iu-UP-Status-Indication primitive is sent to the higher layers and abnormal event state is entered.

2.3.4 Support Mode Data Transfer Ready State in CN

In the support mode data transfer ready state, support mode data can be exchanged between the peer Iu UP instances.

Upon reception of Iu-UP-DATA-Request or UNITDATA-Indication from TNL layer, appropriate user data transfer procedures are performed. Iu UP instance remains in the SMpSDU data transfer ready state

Upon reception of Iu-UP-CONFIG-Req from higher layer the Iu UP instance is terminated and the null state is entered.

Upon detection of a protocol fault (FFS), Iu-UP-STATUS-Indication is sent to upper layer and abnormal event state is entered.

TBD event (FFS): In case that time alignment is lost, it has to be achieved again and Iu UP instance may have to enter the time alignment state.

TBD event (FFS): In case of handover or relocation, initialisation procedures may have to be performed and Iu UP instance may have to enter the initialisation state.

2.3.5 Abnormal Event State in CN

Abnormal event state is FFS and it will be described in a later contribution. However, an assumption can be made that upon reception of Iu-UP-CONFIG-Req from higher layer the Iu UP instance is terminated and the null state is entered.

2.4 State Variables

VT(TimeAlign)

This state variable determines the number of repetitions of time alignment procedure.

VT(Init)

This state variable determines the number of repetitions of the initialisation procedure.

2.5 Timers

T_{INIT}

This timer is used to supervise the reception of the initialisation acknowledgement frame from the peer Iu UP instance.

T_{TIME_ALIGN}

This timer is used to supervise the reception of the time alignment acknowledgement frame from the peer Iu UP instance.

3 Proposal

- It is proposed to the editor update chapter 7 with the new primitive Iu-UP-Config-Req
- It is proposed that chapter 2.1 is included into TS 25.415 [1] as a new section 5.5
- It is proposed that chapter 2.2 is included into TS 25.415 [1] as a new section 6.8
- It is proposed that chapter 2.3 is included into TS 25.415 [1] as a new section 6.9
- It is proposed that chapter 2.4 is included into TS 25.415 [1] as a new section 6.10
- It is proposed that chapter 2.5 is included into TS 25.415 [1] as section 6.6.14

4 References

- [1] TS 25.415 (V1.0.2) Iu Interface CN-UTRAN User Plane Protocol