Agenda Item: 16.3

Source: Motorola

Title: Block and Unblock Resource

Discussion for: Decision

1   Introduction

This contribution proposes the following:

1) A modification to the Block Resource procedure to prevent a timed shutdown from postponing the execution of subsequent NBAP procedures until after the shutdown timer, $T_{shutdown}$, has expired.
2) An Unblock Resource procedure to support the X.731 administrative state transitions Lock $\rightarrow$ Unlock and Shutting Down $\rightarrow$ Unlocked (Figure 2.)

2   Discussion
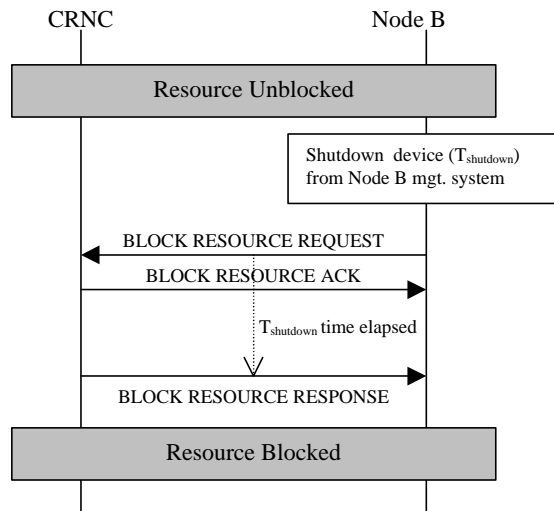
2.1   Block Resource with Timed Shutdown

Currently, when a timed shutdown Block Resource procedure is initiated, the Node B must wait until the requested resource has been blocked before the RNC sends a Block Resource Response. This algorithm poses several problems.

If an NBAP procedural error were to occur after the Node B sent the Block Resource Request such that the RNC would never respond to the Node B, the Node B must wait at least until the shutdown timer, $T_{shutdown}$, expires before taking any recovery type actions. Depending on the length of $T_{shutdown}$, the Node B could be wasting valuable time waiting for a response when it could be recovering from the error.

Additionally, according to the serial nature of NBAP procedures, the Node B must wait until the Block Resource procedure has completed before it may initiate another NBAP procedure. In a worst case scenario, the Node B must wait until after the shutdown timer $T_{shutdown}$ has expired before it may initiate another NBAP procedure. This could potentially delay and/or prevent a substantial number of NBAP procedures from executing.

To prevent these situations, a modification to the timed shutdown Block Resource procedure is proposed. After a RNC receives a timed shutdown Block Resource Request, it should immediately respond to the requesting Node B with a Block Resource Ack. This message is an indication to the Node B that the request has been received. After the logical resource has been blocked, the RNC shall send a Block Resource Response to the Node B to signify the completion of the procedure (Figure 1.)

```
           CRNC                          Node B
        ┌──────────────────────────────────────┐
        │          Resource Unblocked          │
        └──────────────────────────────────────┘
                              ┌─────────────────────────────┐
                              │ Shutdown device (T_shutdown) │
                              │ from Node B mgt. system      │
                              └─────────────────────────────┘

              BLOCK RESOURCE REQUEST
            ◄──────────────────────────
              BLOCK RESOURCE ACK
            ──────────────────────────►

                  T_shutdown time elapsed

              BLOCK RESOURCE RESPONSE
            ──────────────────────────►
        ┌──────────────────────────────────────┐
        │          Resource Blocked            │
        └──────────────────────────────────────┘
```

Figure 1: Timed Shutdown Block Resource

When the Node B receives a Block Resource Ack for a shutdown request, it may initiate subsequent NBAP procedures. For example, the Node B may initiate an overriding Block Resource procedure to expedite the lock of the resource and override the current shutdown procedure.

The following sections detail the proposed modifications to [1] in support of the new Block Resource Ack message.

2.1.1 Block Resource

~~Node B requests that logical resources in the RNC are taken out of service, due to an O&M action (i.e. manual intervention for example due to that a piece of equipment, that supports a logical resource in the RNC, shall be upgraded). The RNC answers when the logical resource is taken out of service and the O&M action can continue in Node B.~~
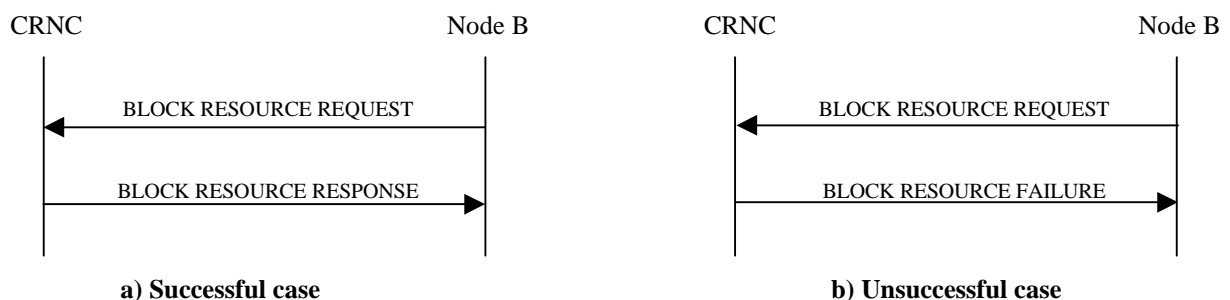
The Block Resource procedure is used by the Node B to request that logical resources at the RNC be taken out of service due to an O&M action (e.g. manual intervention due to the upgrade of a piece of equipment that supports a logical resource at the RNC).
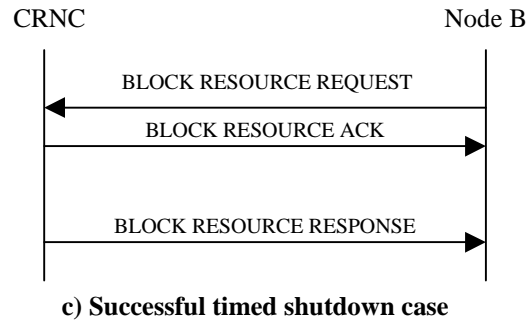
The Node B sends a Block Resource Request to the RNC for the logical resources to be blocked. The RNC responds with a Block Resource Response message when the logical resource is taken out of service. For a Block Resource with a shutdown timer, the RNC responds with a Block Resource Ack immediately after receiving the request. The CRNC sends a Block Resource Response message after the logical resource is blocked. The Node B may initiate subsequent NBAP procedures upon receipt of the Block Resource Ack for a timed shutdown.

 For the procedure to be executed successfully the following is needed:
- A configured cell exists in Node B (downlink and uplink common channels can be defined in the cell).
- A Node B control port is available for communication between the RNC and the Node B.

The Node B shall use the following procedure to request a logical resource block from the RNC:


```
    CRNC               Node B          CRNC               Node B

         BLOCK RESOURCE REQUEST              BLOCK RESOURCE REQUEST
       ◄──────────────────────            ◄──────────────────────

         BLOCK RESOURCE RESPONSE             BLOCK RESOURCE FAILURE
       ──────────────────────►            ──────────────────────►

          a) Successful case                 b) Unsuccessful case
```

```
                CRNC                            Node B

                      BLOCK RESOURCE REQUEST

                      BLOCK RESOURCE ACK


                      BLOCK RESOURCE RESPONSE
```

c) Successful timed shutdown case

The BLOCK RESOURCE REQUEST message contains the following information:
- UC-Id (allows the Node B to block a resource in the correct cell where a Node B supports multiple cells)
- Resource Identifier (e.g. resource type and identifier)
- Priority Indicator (enables the Node B to request an immediate block instead of allowing the RNC the option to suspend) – definition FFS
- Transaction Id (identifies the procedure)

The BLOCK RESOURCE ACK message contains the following information:
- Transaction Id (identifies the procedure)

The BLOCK RESOURCE RESPONSE message contains the following information:
- Transaction Id (identifies the procedure)

The BLOCK RESOURCE FAILURE message contains the following information:
- Transaction Id (identifies the procedure)

2.1.2   Block Resource Response

This message is sent from CRNC to Node B in response to a Block Resource Request to indicate a successful/pending attempt to block a resource.

| Information Element	Reference	Type
Message Discriminator		M
Message Type		M
Transaction ID		M

2.1.3   Block Resource Ack

This message is sent from CRNC to Node B in response to a Block Resource Request to indicate a pending attempt to block a resource.

| Information Element	Reference	Type
Message Discriminator		M
Message Type		M
Transaction ID		M

2.2   Lock → Unlock and Shutting Down → Unlocked

The current NBAP specification does not contain all procedures needed to support X.731. Figure 2 below illustrates the administrative state transitions supported by X.731. Each transition is labeled with the NBAP procedure used for that transition. Note that there is no NBAP procedure supporting the Lock → Unlock or the Shutting Down → Unlocked transitions.
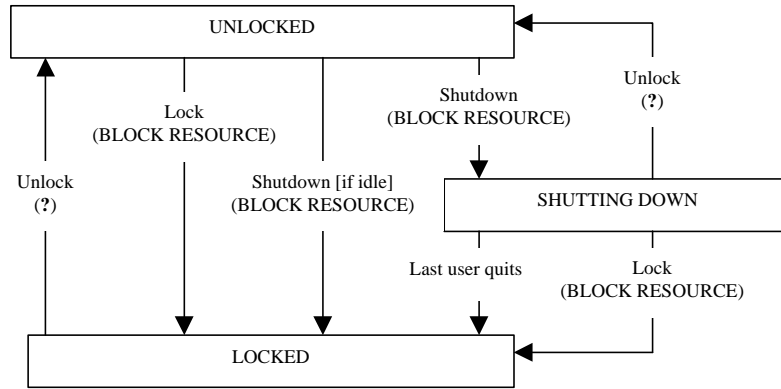
Figure 2: X.731 Administrative State Transitions

When the Node B management system requests that a device be unlocked, an Unblock Resource procedure is needed such that the Node B can request that the corresponding logical resource be brought back into service (Figure 3.)
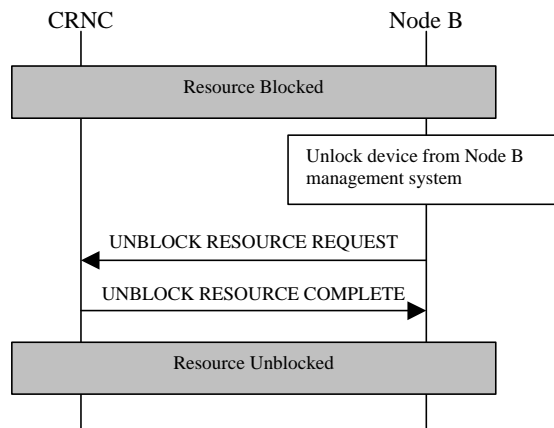

Figure 3: Unblock of Blocked Resource

Similarly, if a Node B requests a timed shutdown Block Resource of a resource, an Unblock Resource procedure is needed if the Node B is to have the ability to override the shutdown. Figure 4 illustrates a resource shutdown with an overriding unblock. Figure 5 illustrates a resource shutdown with an overriding block.
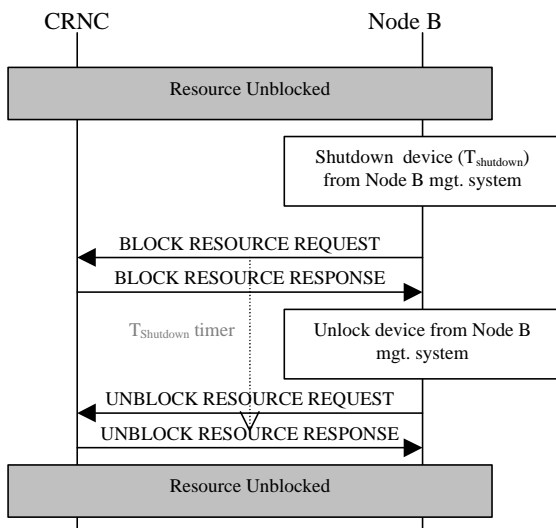
Figure 4: Resource Shutdown with overriding Unblock
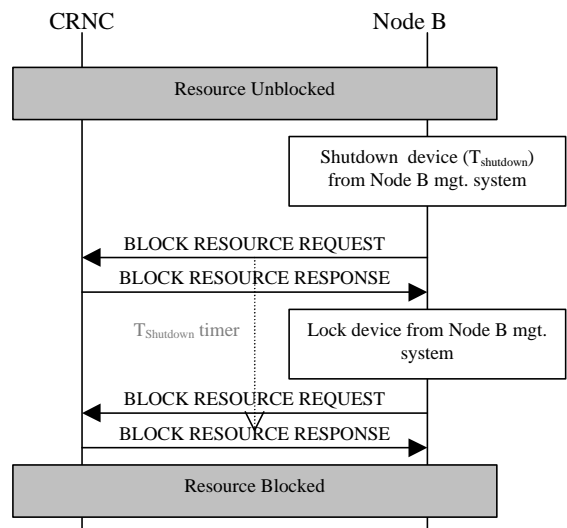
Figure 5: Resource Shutdown with overriding Block

The following sections detail the proposed modifications to [1] in support of the new Unblock Resource procedure
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2.2.1 Unblock Resource

The Unblock Resource procedure is used to request that logical resources be brought back into service as a result of an O&M action (e.g. after a piece of equipment that supports a logical resource at the RNC is upgraded.)

The Node B sends an Unblock Resource Request to the RNC for the logical resources to be unblocked. The RNC responds with an Unblock Resource Response when the logical resource is unblocked. After the Node B receives the response, O&M action can continue at the Node B.

For the procedure to be executed successfully the following is needed:
- A configured cell exists in Node B (downlink and uplink common channels can be defined in the cell).
- A Node B control port is available for communication between the RNC and the Node B.
  The Node B shall use the following procedure to request a logical resource block from the RNC:

CRNC   Node B

|←————— UNBLOCK RESOURCE REQUEST ————|

|————— UNBLOCK RESOURCE RESPONSE ————→|
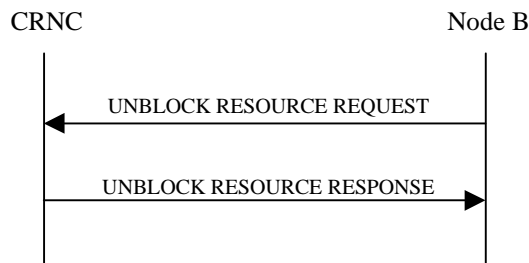
The UNBLOCK RESOURCE REQUEST message contains the following information:
- UC-Id (allows the Node B to unblock a resource in the correct cell where a Node B supports multiple cells)
- Resource Identifier (e.g. resource type and identifier)
- Transaction Id (identifies the procedure)

The UNBLOCK RESOURCE RESPONSE message contains the following information:
- Transaction Id (identifies the procedure)

2.2.2 Unblock Resource Request

This message is sent from Node B to the CRNC to request the unblock of a logical resource supported at the CRNC.

Information Element	Reference	Type
Message Discriminator		M
Message Type		M
Transaction ID		M
UC-Id		C1

C1 The information element is present when Node B supports multiple cell ID's.

2.2.3 Unblock Resource Response

This message is sent from CRNC to Node B in response to an Unblock Resource Request to indicate a successful attempt to unblock a resource.

Information Element	Reference	Type
Message Discriminator		M
Message Type		M
Transaction ID		M

3   Proposal

The following changes to TS 25.433 [1] are proposed -
1. Replace Block Resource section 8.1.2.1 with section 2.1.1
2. Replace Block Resource Response section 9.1.64 with section 2.1.2
3. Create a new Block Resource Ack section in 9.1 with the contents of section 2.1.3
4. Create a new Unblock Resource section in 8.1.2 with the contents of section 2.2.1
5. Create two new sections for Unblock Resource Request and Response in 9.1 with the message contents of 2.2.2 and 2.2.3

4   References

[1] 3GPP TS 25.433 – NBAP Specification V 1.3.1beta