Pseudocode update in 802.1CB-2017 format
Fejes Ferenc, Balázs Varga – Ericsson
2025-09-15

CBec amendment refines the sequence generation/recovery functions. This contribution contains an initial pseudocode update in 802.1CB-2017 format. Diffs from current .1CB are highlighted with color. Green means new added code. ~~Red~~ means deleted code.

Note: this pseudocode does not contain all the discussed functional additions. For example it misses, PostResetTimeGuard related code, definition of new variables, etc.

SEQUENCE GENERATION

7.4.1.3 SequenceGenerationReset

```
void SequenceGenerationReset () {
    GenSeqNum = 0;
    InitGenSeqNum = InitGenSeqStart;
    SendResetFlagNum = 3;              // it may be frerSeqRcvyHistoryLength ??
    frerCpsSeqGenResets = frerCpsSeqGenResets + 1;
}
```

7.4.1.4 SequenceGenerationAlgorithm

```
void SequenceGenerationAlgorithm () {
    unsigned int sequence_number = GenSeqNum;
    unsigned int init_flag = 0;
    unsigned int reset_flag = 0;
    ~~if (GenSeqNum >= (GenSeqSpace - 1))~~
    // Using InitSeqNumSpace
    if (UseInitSeqNum && InitGenSeqNum <= (GenSeqSpace - 1)) {
        sequence_number = InitGenSeqNum;
        init_flag = 1;
        InitGenSeqNum = InitGenSeqNum + 1;
        if (SendResetFlagNum > 0) {
            reset_flag = 1;
            SendResetFlagNum = SendResetFlagNum - 1;
        }
    }
    // Using normal SeqNumSpace
    else if (GenSeqNum >= (GenSeqSpace - 1))
        GenSeqNum = 0;
    else
        GenSeqNum = GenSeqNum + 1;
    SEND_DATA;  // Pass packet & sequence_number subparameter down stack
}
```

SEQUENCE RECOVERY

```
-------------------------------------------------------------------------------
7.4.3.3 SequenceRecoveryReset
-------------------------------------------------------------------------------

void SequenceRecoveryReset () {
    int i;
    RecovSeqNum = RecovSeqSpace - 1;
    for (i = 0; i < frerSeqRcvyHistoryLength; i = i + 1)
        SequenceHistory[i] = 0; // Set all bits 0 (packet not seen)
    TakeAny = true;
    SuppressLostUntilPacket = true;
    frerCpsSeqRcvyResets = frerCpsSeqRcvyResets + 1;
}


-------------------------------------------------------------------------------
7.4.3.6 ShiftSequenceHistory
-------------------------------------------------------------------------------

void ShiftSequenceHistory (int newZeroValue) {
    int i;
    if (0 == SequenceHistory[frerSeqRcvyHistoryLength - 1])
    if (SuppressLostUntilPacket) {
        if (1 == SequenceHistory[frerSeqRcvyHistoryLength - 1])
            SuppressLostUntilPacket = false;  // a 1 has crossed the window
    }
    else if (0 == SequenceHistory[frerSeqRcvyHistoryLength - 1])
        frerCpsSeqRcvyLostPackets = frerCpsSeqRcvyLostPackets + 1;
    for (i = frerSeqRcvyHistoryLength - 1; i != 0; i = i - 1)
        SequenceHistory[i] = SequenceHistory[i - 1];
    SequenceHistory[0] = newZeroValue;
}

-------------------------------------------------------------------------------
X.X.X.X InitShiftSequenceHistory
-------------------------------------------------------------------------------

void InitShiftSequenceHistory (int newZeroValue) {
    int i;
    if (InitSuppressLostUntilPacket) {
        if (1 == InitSequenceHistory[frerSeqRcvyHistoryLength - 1])
            InitSuppressLostUntilPacket = false;  // a 1 has crossed the window
    }
    else if (0 == InitSequenceHistory[frerSeqRcvyHistoryLength - 1])
        frerCpsSeqRcvyLostPackets = frerCpsSeqRcvyLostPackets + 1;
    for (i = frerSeqRcvyHistoryLength - 1; i != 0; i = i - 1)
        InitSequenceHistory[i] = InitSequenceHistory[i - 1];
    InitSequenceHistory[0] = newZeroValue;
}

-------------------------------------------------------------------------------
X.X.X.X InitSequenceRecoveryReset
-------------------------------------------------------------------------------

void InitSequenceRecoveryReset () {
    int i;
    InitRecovSeqNum = InitRecovSeqStart - 1;
    for (i = 0; i < frerSeqRcvyHistoryLength; i = i + 1)
        InitSequenceHistory[i] = 0;
    InitTakeAny = true;
    InitSuppressLostUntilPacket = true;
}
```

```
-------------------------------------------------------------------------------
X.X.X.X  InitVectorRecoveryAlgorithm
-------------------------------------------------------------------------------

void InitVectorRecoveryAlgorithm () {
    unsigned int sequence_number;
    // Check that sequence number is present in the packet
    if (sequence_number == frerSeqRcvyInvalidSequenceValue) {
        frerCpsSeqRcvyTaglessPackets = frerCpsSeqRcvyTaglessPackets + 1;
        if (frerSeqRcvyTakeNoSequence) {
            frerCpsSeqRcvyPassedPackets = frerCpsSeqRcvyPassedPackets + 1;
            frerCpSeqRcvyPassedPackets = frerCpSeqRcvyPassedPackets + 1;
            InitRemainingTicks =
                    ((frerSeqRcvyResetMSec*TicksPerSecond)+999)/1000;
            PRESENT_DATA;
        } else {
            frerCpsSeqRcvyDiscardedPackets =
                    frerCpsSeqRcvyDiscardedPackets + 1;
            frerCpSeqRcvyDiscardPackets = frerCpSeqRcvyDiscardPackets + 1;
        }
        return;
    }
    // After timeout/reset, accept any packet
    if (InitTakeAny) {
        if (sequence_number < InitRecovSeqStart) {
            // Packet is out-of-range. Count and discard it.
            frerCpsSeqRcvyRoguePackets = frerCpsSeqRcvyRoguePackets + 1;
            frerCpSeqRcvyDiscardPackets = frerCpSeqRcvyDiscardPackets + 1;
            if (frerSeqRcvyIndividualRecovery)
                InitRemainingTicks =
                        ((frerSeqRcvyResetMSec*TicksPerSecond)+999)/1000;
        } else {
            // Packet is accepted due to TakeAny.
            InitTakeAny = false;
            InitSequenceHistory[0] = 1; // Shift, adding a "seen" bit
            InitRecovSeqNum = sequence_number;
            frerCpsSeqRcvyPassedPackets = frerCpsSeqRcvyPassedPackets + 1;
            frerCpSeqRcvyPassedPackets = frerCpSeqRcvyPassedPackets + 1;
            InitRemainingTicks =
                ((frerSeqRcvyResetMSec*TicksPerSecond)+999)/1000;
            PRESENT_DATA;
        }
    }
    // Compute signed difference in the linear init space
    int delta = sequence_number - InitRecovSeqNum;
    if ((sequence_number < InitRecovSeqStart) ||
        (delta > frerSeqRcvyHistoryLength) ||
        (delta <= -frerSeqRcvyHistoryLength))
    {
        // Packet is out-of-range. Count and discard it.
        frerCpsSeqRcvyRoguePackets = frerCpsSeqRcvyRoguePackets + 1;
        frerCpSeqRcvyDiscardPackets = frerCpSeqRcvyDiscardPackets + 1;
        if (frerSeqRcvyIndividualRecovery)
            InitRemainingTicks =
                    ((frerSeqRcvyResetMSec * TicksPerSecond) + 999) / 1000;
    }
    else if (delta <= 0) {
        if (0 == InitSequenceHistory[-delta]) {
            // Packet has not been seen. Take it.
            InitSequenceHistory[-delta] = 1;
            frerCpsSeqRcvyOutOfOrderPackets =
                    frerCpsSeqRcvyOutOfOrderPackets + 1;
            frerCpsSeqRcvyPassedPackets = frerCpsSeqRcvyPassedPackets + 1;
```

```
            frerCpSeqRcvyPassedPackets = frerCpSeqRcvyPassedPackets + 1;
            InitRemainingTicks =
                    ((frerSeqRcvyResetMSec * TicksPerSecond) + 999) / 1000;
            PRESENT_DATA;
        } else {
            // Packet has been seen. Do not forward. Count the discard.
            frerCpsSeqRcvyDiscardedPackets =
                    frerCpsSeqRcvyDiscardedPackets + 1;
            frerCpSeqRcvyDiscardPackets = frerCpSeqRcvyDiscardPackets + 1;
            if (frerSeqRcvyIndividualRecovery)
                InitRemainingTicks =
                        ((frerSeqRcvyResetMSec * TicksPerSecond) + 999) / 1000;
        }
    } else {
        // Packet is not too far ahead of the one we want.
        if (delta != 1)
            frerCpsSeqRcvyOutOfOrderPackets =
                    frerCpsSeqRcvyOutOfOrderPackets + 1;
        // Shift the history until bit 0 refers to sequence_number.
        while (0 != (delta = delta - 1))
            InitShiftSequenceHistory(0);  // Shift, adding a "not seen" bit
        InitShiftSequenceHistory(1);  // Shift, adding a "seen" bit
        InitRecovSeqNum = sequence_number;
        frerCpsSeqRcvyPassedPackets = frerCpsSeqRcvyPassedPackets + 1;
        frerCpSeqRcvyPassedPackets = frerCpSeqRcvyPassedPackets + 1;
        InitRemainingTicks =
                ((frerSeqRcvyResetMSec * TicksPerSecond) + 999) / 1000;
        PRESENT_DATA;
    }
}
```

7.4.3.1 Events for sequence recovery

...

c) RECOVERY_TIMEOUT: The event that occurs when the RemainingTicks (7.4.3.2.4) variable reaches 0. It triggers the execution of the ~~SequenceRecoveryReset~~ SetVariablesDueTimeout routine (~~7.4.3.3~~ X.X.X.X).

X.X.X.X SetVariablesDueTimeout

```
void SetVariablesDueTimeout () {
    if (frerSeqRcvyAlgorithm == Vector_Alg) {
        int i;
        for (i = 0; i < frerSeqRcvyHistoryLength; i = i + 1) {
            if (SequenceHistory[i] == 0)
                frerCpsSeqRcvyLostPackets = frerCpsSeqRcvyLostPackets + 1;
            SequenceHistory[i] = 0;  // Set all bits 0 (packet not seen)
        }
    }
    TakeAny = true;
    SuppressLostUntilPacket = true;
}
```

X.X.X.X InitSetVariablesDueTimeout

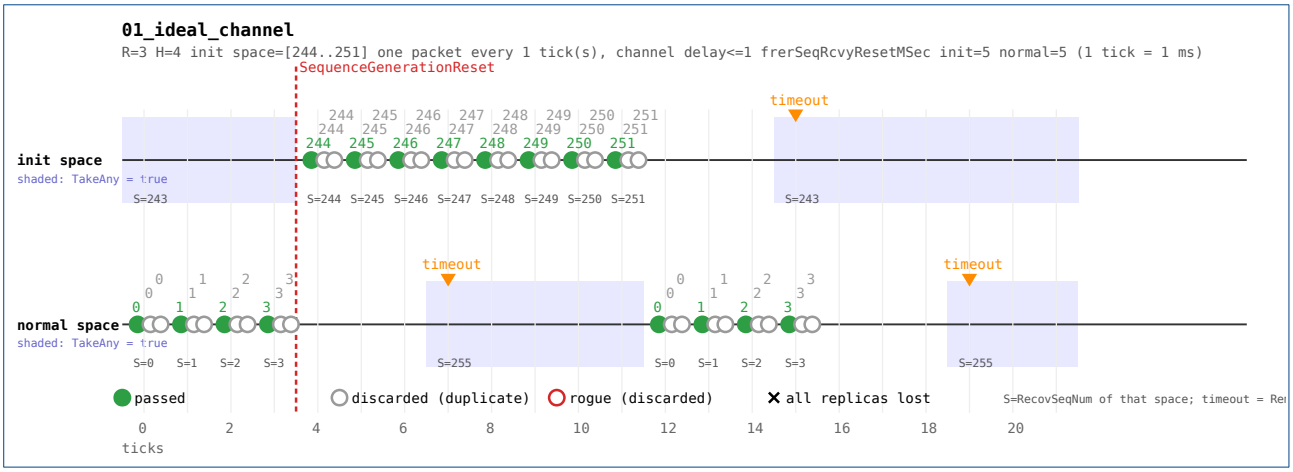
```
void InitSetVariablesDueTimeout () {
    if (frerSeqRcvyAlgorithm == Vector_Alg) {
        int i;
        for (i = 0; i < frerSeqRcvyHistoryLength; i = i + 1) {
            if (InitSequenceHistory[i] == 0)
                frerCpsSeqRcvyLostPackets = frerCpsSeqRcvyLostPackets + 1;
            InitSequenceHistory[i] = 0;  // Set all bits 0 (packet not seen)
        }
    }
    InitTakeAny = true;
    InitSuppressLostUntilPacket = true;
}
```

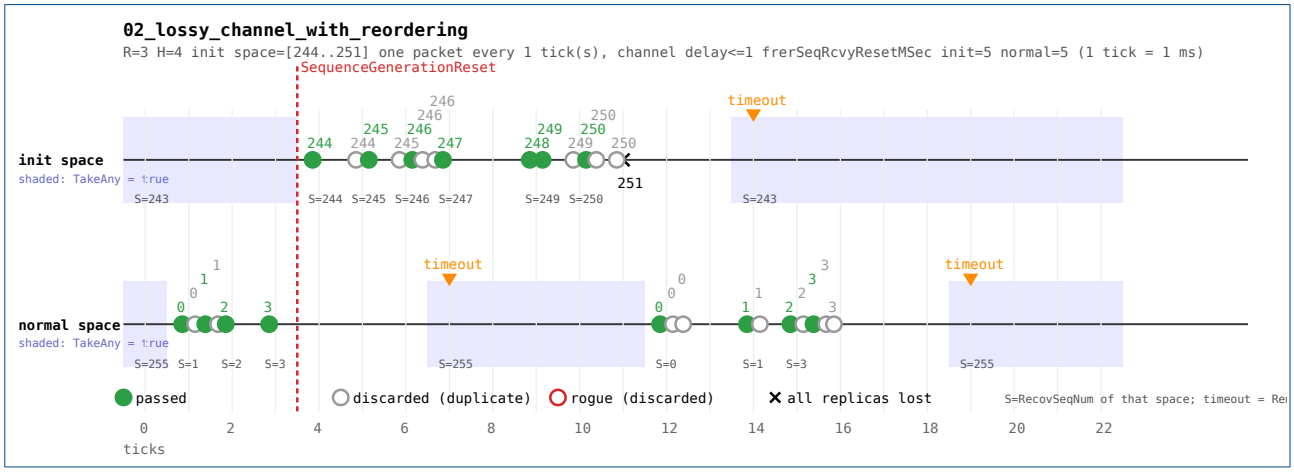
CBec SIMULATOR

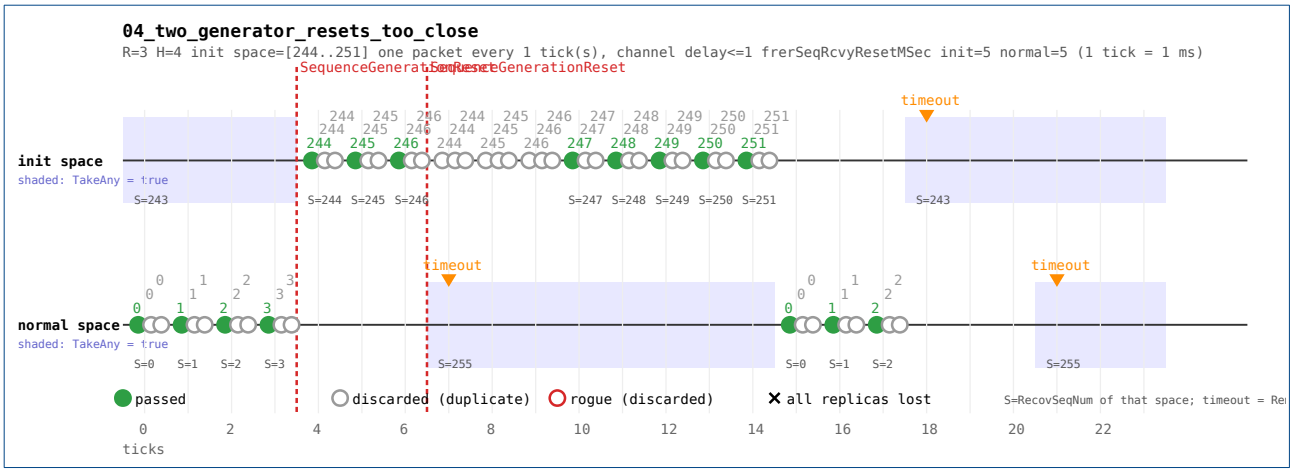
To help the brainstorming and the discussions, we would like to create a simulator to try out different CBec scenarios. This is done by a discrete event simulation of the vector recovery and the proposed improved version with the init sequence number space.

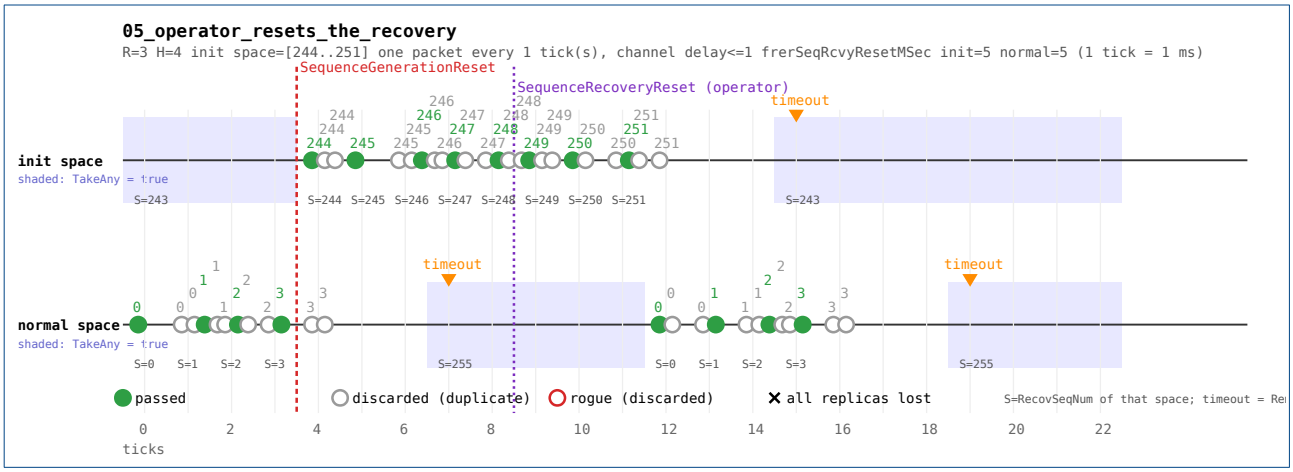
Right now the simulator is WIP. It is written in python language which is almost syntactically equivalent with the pseudocode from the standard. It can simulate scenarios like transitions between init and normal number spaces, admin resets, etc. Those scenarios can be saved and replayed from text based format. There will be an interactive web based version which execute the python code under the hood, and visualize the counters, states, etc.

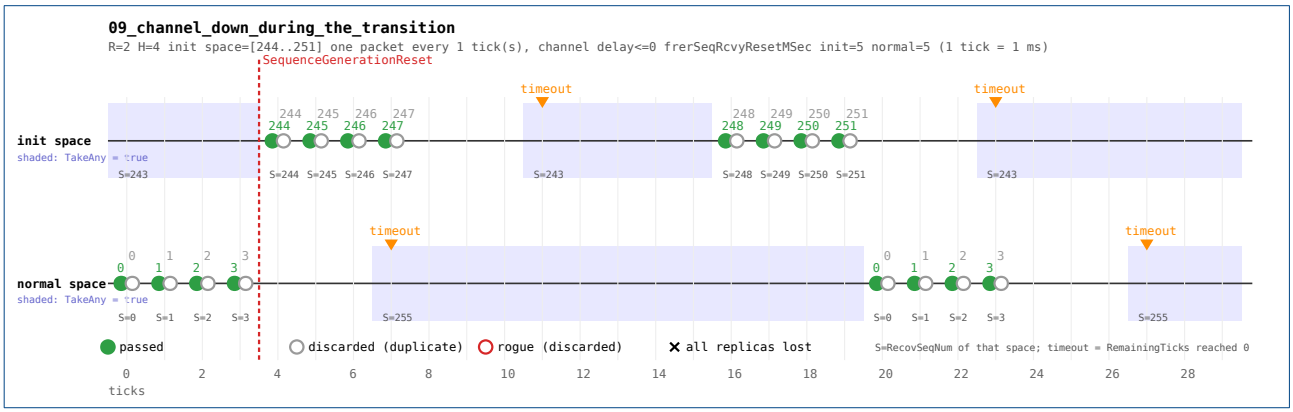
Below are selected example visualizations of the text based scenarios created by a script. This script is generated by AI and used to create SVG visuals for different scenarios.

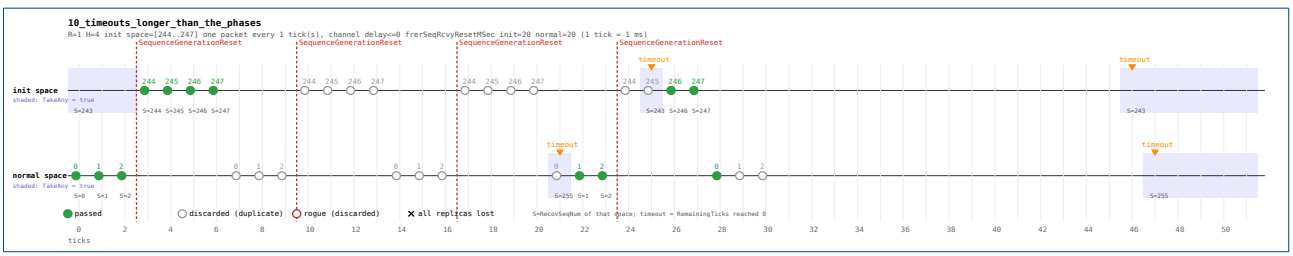





04_two_generator_resets_too_close
R=3 H=4 init space=[244..251] one packet every 1 tick(s), channel delay<=1 frerSeqRcvyResetMSec init=5 normal=5 (1 tick = 1 ms)
SequenceGenerationReset
SequenceGenerationReset
timeout
init space
shaded: TakeAny = true
timeout
timeout
normal space
shaded: TakeAny = true
passed
discarded (duplicate)
rogue (discarded)
all replicas lost
S=RecovSeqNum of that space; timeout = Re
ticks


05_operator_resets_the_recovery
R=3 H=4 init space=[244..251] one packet every 1 tick(s), channel delay<=1 frerSeqRcvyResetMSec init=5 normal=5 (1 tick = 1 ms)
SequenceGenerationReset
SequenceRecoveryReset (operator)
timeout
init space
shaded: TakeAny = true
timeout
timeout
normal space
shaded: TakeAny = true
passed
discarded (duplicate)
rogue (discarded)
all replicas lost
S=RecovSeqNum of that space; timeout = Re
ticks


09_channel_down_during_the_transition
R=2 H=4 init space=[244..251] one packet every 1 tick(s), channel delay<=0 frerSeqRcvyResetMSec init=5 normal=5 (1 tick = 1 ms)
SequenceGenerationReset
timeout
timeout
init space
shaded: TakeAny = true
timeout
timeout
normal space
shaded: TakeAny = true
passed
discarded (duplicate)
rogue (discarded)
all replicas lost
S=RecovSeqNum of that space; timeout = RemainingTicks reached 0
ticks


10_timeouts_longer_than_the_phases
R=1 H=4 init space=[244..247] one packet every 1 tick(s), channel delay<=0 frerSeqRcvyResetMSec init=20 normal=20 (1 tick = 1 ms)
SequenceGenerationReset
SequenceGenerationReset
SequenceGenerationReset
SequenceGenerationReset
timeout
timeout
init space
shaded: TakeAny = true
timeout
timeout
normal space
shaded: TakeAny = true
passed
discarded (duplicate)
rogue (discarded)
all replicas lost
S=RecovSeqNum of that space; timeout = RemainingTicks reached 0
ticks