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# Introduction

This document proposes the use case model of the “Automatic Line switching” COSMIC Case study v. 1.1 (see <https://cosmic-sizing.org/publications/automatic-line-switching-v1-1/>).

## Case study

This section describes the context and functional requirements, as described in sections 1.2 and 1.4 of the case study. The measurement analysis can be found on the COSMIC website at the following URL <https://cosmic-sizing.org/publications/automatic-line-switching-v1-1/>.

### Context

The functional requirements of the software of the ALS system below describe the control of two lines - a Work Line and a Backup Line - provided for a communication channel. If the Work Line degrades or fails the Backup Line is used instead. The decision to switch from one Line to another is made either automatically by the ALS software or by a technician at the receiving side. The switch to the Backup Line will remain in effect even after the Work Line becomes fully operational.

A standard redundancy method is used to continuously check the accuracy of the transmissions. Error correction, however, is not part of the software and is carried out externally. The error rate of a line signal will determine if the quality of a line is normal, degraded, or has failed. Since the lines are monitored continuously by their Quality Level Change Monitors (QLCMs) a complete loss of signal will initially be detected as a degraded quality. The expected response to a degraded or failed signal on the working line is to automatically switch to the backup line, if that line is in better condition.

### Requirements

1. The quality of a line has four levels:
   1. “normal” (<10-9 error rate),
   2. “degraded” (10-5 to 10-9 error rate),
   3. “failed” (>10-5 error rate, or no signal), and
   4. “out of service.”
2. One and only one of the two lines is selected for communication at any given time.

The next four requirements describe what must happen to the quality of a line when a command

is entered by a technician from the Channel Configuration Software on the PC.

1. When a “remove Work Line” event (command) occurs:

if the Work Line is not out of service then it goes out of service, otherwise the Work Line remains out of service. (The behaviour on a “remove Backup Line” event is analogous).

1. When a “restore Work Line” event (command) occurs:

if the Work Line is out of service then it becomes normal otherwise the level of the Work Line does not change. (The behaviour on a “restore Backup Line” event is analogous.)

1. When a “forced switch to Work Line” event (command) occurs:

if the Work Line is not out of service then it becomes the selected line, otherwise the selection of the lines remains unchanged. (The behaviour on a “forced switch to Backup Line” event is analogous.)

1. When a “conditional switch to Work Line” event (command) occurs:

if the Work Line is not out of service and is not of poorer quality than the Backup Line then the Work Line becomes the selected line, otherwise, the selection of the lines remains unchanged. (The behaviour on a “conditional switch to Backup Line” event is analogous.)

The next three requirements describe what must happen to the current quality level of a Line

when its QLCM detects certain conditions that may result in the need to change the Line’s

quality level.

1. When a “Work Line degraded” event occurs: if the quality of the Work Line is “normal” then it will change to “degraded”, otherwise, the quality of the Work Line remains unchanged. (The behaviour on a “Backup Line degraded” event is analogous.)
2. When a “Work Line failed” event occurs: if the quality of the Work Line is “degraded” then it will change to “failed”, otherwise, the quality of the Work Line remains unchanged. (The behaviour on a “Backup Line failed” event is analogous.)
3. When a “Work Line cleared” (i.e. quality is ‘normal’) event occurs: if the quality of the Work Line is “degraded” or “failed” then it is set to “normal”, otherwise, the quality of the Work Line remains unchanged. (The behaviour on a “Backup Line cleared” event is analogous.)
4. If a “remove line”, “restore line”, "line degraded”, “line failed”, or “line cleared” event occurs (i.e. one of the events of requirements c), d), g), h) and i) occurs), and the currently unselected line becomes of a higher quality than the selected line, then the selection will be switched, triggered by the ALS software.
5. Removing, restoring, deterioration, or clearing of a line does not affect the quality of the other line.
6. Switching the selected line does not affect the quality of either line.
7. It is forbidden to switch to a line that is out of service, except when both lines are out of service.
8. The selected line will only change as a result of one of the following:
9. the selection is changed with a switch command (provided, in the case of a conditional switch, that the quality of the other line is not out-of-service or of poorer quality than that of the currently selected line),
10. the currently selected line deteriorates to a quality inferior to the other line,
11. the currently selected line goes out of service, or
12. the currently un-selected line clears (or is restored) to a quality better than the selected line.

*Note. There is overlap between requirements j) and n).*

*On first reading, it may appear from the requirements that each line needs two status indicators*

* *its current ‘quality’ (from a)) and whether or not it is currently ‘selected’ to be used for communication (from b)). But with one exception, any decision by the system to switch depends only on the relative quality of the two lines - the current selection status does not matter in the system’s decision to switch. The exception is a ‘forced switch’ which is determined wholly by the Technician, ignoring the relative quality of the two lines.*

# Use case models

## UC.1– Remove line

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.1* | | *Remove line* |
| **Description** | | This procedure allows to remove a specific line so that it is out of service. if the Work Line is not out of service then it goes out of service, otherwise the Work Line remains out of service. |
| **Primary actor** | | **CC Panel** |
| **Supporting actors** | | **Switch device** |
| **Entry Condition** | | The given line is not out of service |
| **Exit condition**  On success | | The given line is out of service |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **CC Panel** | The CC Panel enters the 'Remove line command' regarding a specific line. |
| **2** | **System** | The system reads the Work/Back-up Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Remove line’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |

## UC.2- Restore line

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.2* | | *Restore line* |
| **Description** | | This procedure allows to restore a specific line. if the Work Line is out of service then it becomes normal otherwise the level of the Work Line does not change |
| **Primary actor** | | **CC Panel** |
| **Supporting actors** | | **Switch device** |
| **Entry Condition** | | The line is out of service. |
| **Exit condition**  On success | | The line is restored. |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **CC Panel** | The CC Panel enters the ‘Restore line command’ regarding a specific line. |
| **2** | **System** | The system reads the Work/Back-up Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Restore line’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |

## UC.3 – Forced Line switch

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.3* | | *Forced Line switch* |
| **Description** | | This procedure allows to force a line switch. if the Work Line is not out of service then it becomes the selected line,  otherwise the selection of the lines remains unchanged. |
| **Primary actor** | | **CC Panel** |
| **Supporting actors** | | **Switch device** |
| **Entry Condition** | | The line is not online. |
| **Exit condition**  On success | | The line is switched. |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **CC Panel** | The CC Panel enters the ‘Forced switch’ command regarding a specific line. |
| **2** | **System** | The system reads the Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Forced switch’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |

## UC.4 – Conditional Line switch

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.4* | | *Conditional Line switch* |
| **Description** | | This procedure allows to switch a line conditionally. if the Work Line is not out of service and is not of poorer quality than the Backup Line then the Work Line becomes the selected line, otherwise, the selection of the lines remains unchanged. |
| **Primary actor** | | **CC Panel** |
| **Supporting actors** | | **Switch device** |
| **Entry Condition** | | The line is not online. |
| **Exit condition**  On success | | The line is switched. |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **CC Panel** | The CC Panel enters the ‘Conditional switch’ command regarding a specific line. |
| **2** | **System** | The system reads the Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Conditional switch’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |

## UC.5 – Handle QLCM Line failed

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.5* | | *Handle QLCM Line failed* |
| **Description** | | This procedure handles the QLCM Line failed. if the quality of the Work Line is “degraded” then it will change to “failed”, otherwise, the quality of the Work Line remains unchanged. |
| **Primary actor** | | **QLCM** |
| **Supporting actors** | | **Switch device, CC Panel** |
| **Entry Condition** | | The quality if the work line is “degradated”. |
| **Exit condition**  On success | | The line status changes to “Failed”. |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **QLCM** | The QLCM enters the ‘QLMC Line failed’ command regarding a specific line. |
| **2** | **System** | The system reads the Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Line switch’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |

## UC.6 – Handle QLCM Line degraded signal

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.6* | | *Handle QLCM Line degraded signal* |
| **Description** | | This procedure handles the QLCM Line degraded. if the quality of the Work Line is “normal” then it will change to “degraded”, otherwise, the quality of the Work Line remains unchanged. |
| **Primary actor** | | **QLCM** |
| **Supporting actors** | | **Switch device, CC Panel** |
| **Entry Condition** | | The quality if the work line is “normal”. |
| **Exit condition**  On success | | The line status changes to “Degraded”. |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **QLCM** | The QLCM enters the ‘QLMC Line degraded’ command regarding a specific line. |
| **2** | **System** | The system reads the Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Line switch’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |

## UC.7 – Handle QLCM Line cleared signal

|  |  |  |
| --- | --- | --- |
| **ID**  *UC.7* | | *Handle QLCM Line cleared signal* |
| **Description** | | This procedure handles the QLCM Line cleared scenario. if the quality of the Work Line is “degraded” or “failed” then it is set to “normal”, otherwise, the quality of the Work Line remains unchanged. |
| **Primary actor** | | **QLCM** |
| **Supporting actors** | | **Switch device, CC Panel** |
| **Entry Condition** | | The quality if the work line is “degraded”. |
| **Exit condition**  On success | | The line status changes to “Nomal”. |
| **Exit condition**  On failure | | N/A |
| **Priority** | | High |
| **Extension points** | | N/A |
| **Generalization of** | | N/A |
| **MAIN SCENARIO** | | |
| **1** | **QLCM** | The QLCM enters the ‘QLMC Line cleared’ command regarding a specific line. |
| **2** | **System** | The system reads the Line status. |
| **3** | **System** | The system writes the new Line status. |
| **4** | **Switch device** | The system requests the Switch device to process the ‘Line switch’ command. |
| **5** | **CC Panel** | The CC Panel displays the new Line status. |