



**EULYNX Initiative**

## **Guideline for network architecture**

Document number: Eu.Doc.25  
Version: 1.3 (3.A)

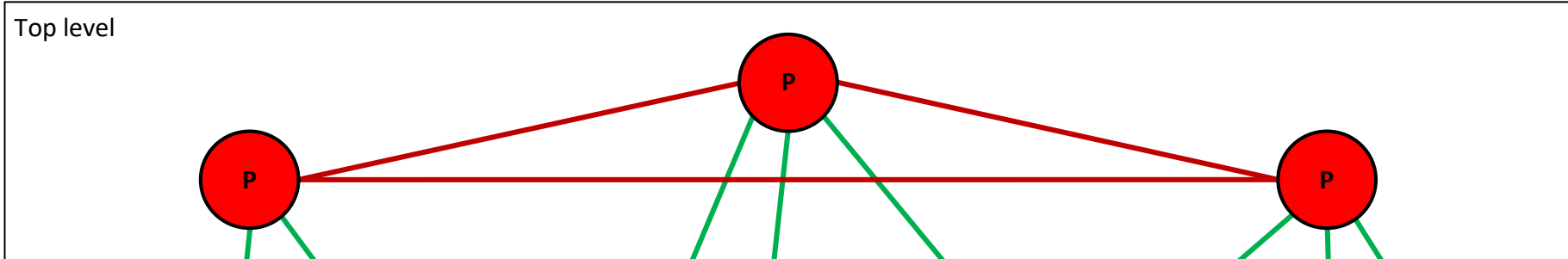
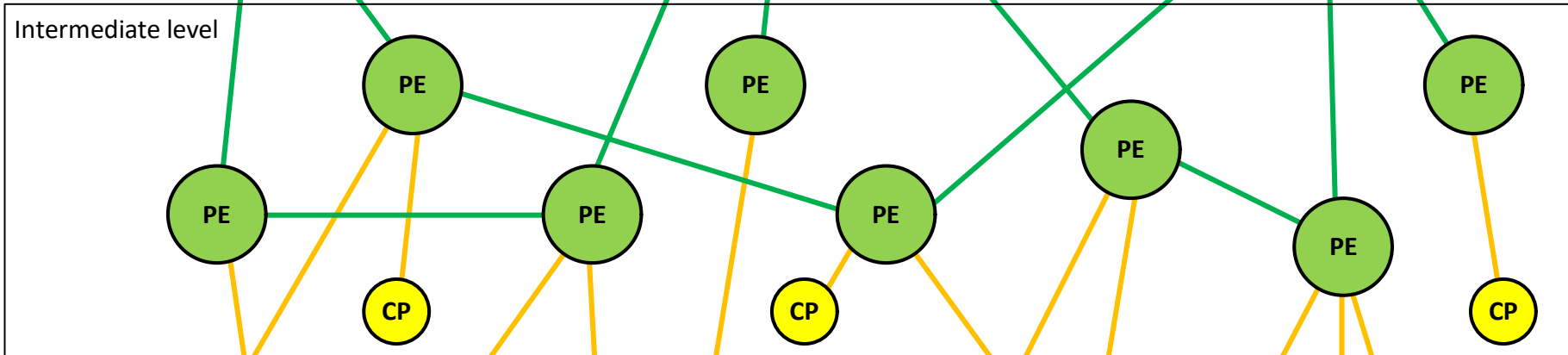
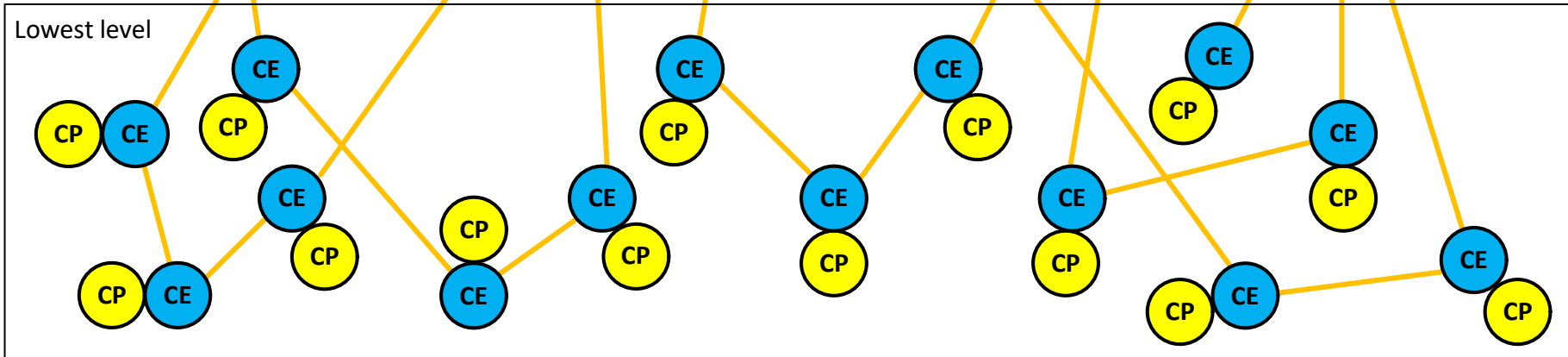
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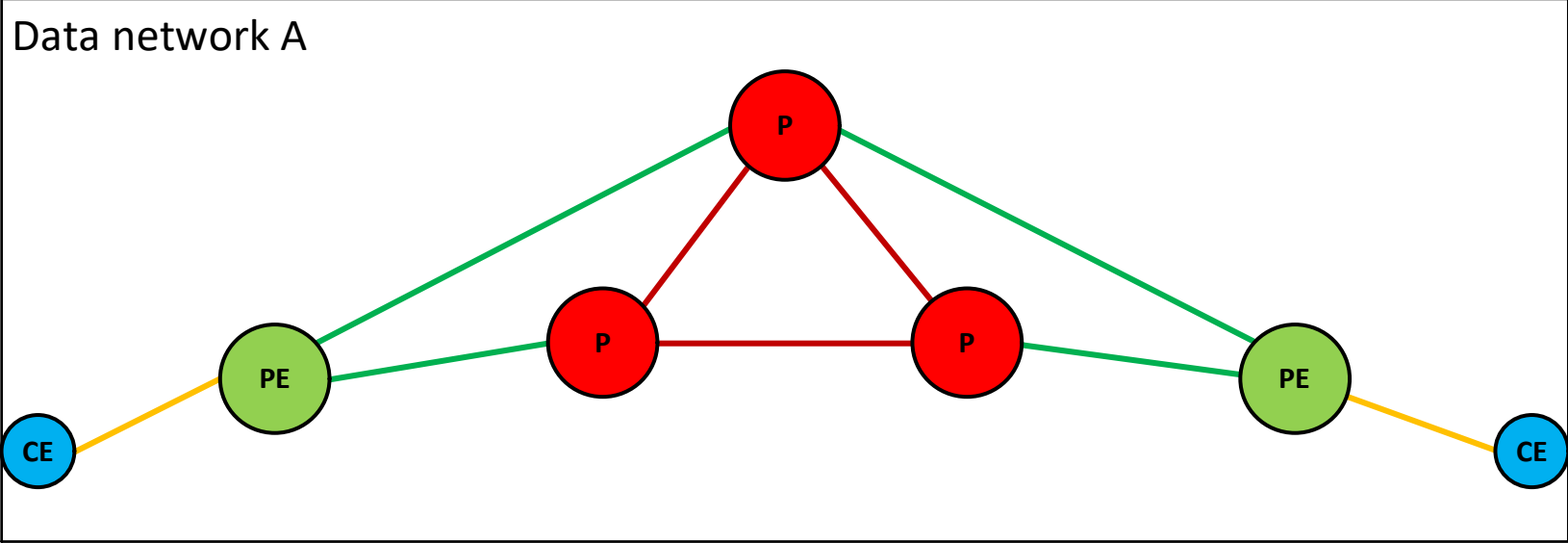
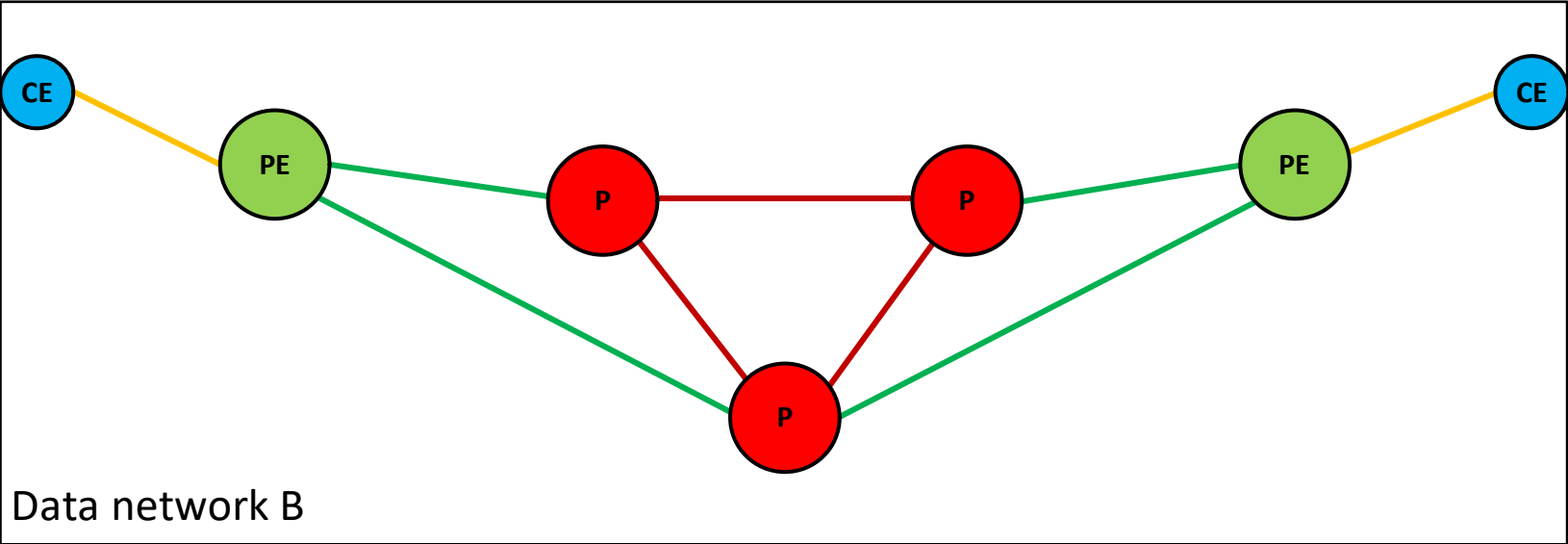
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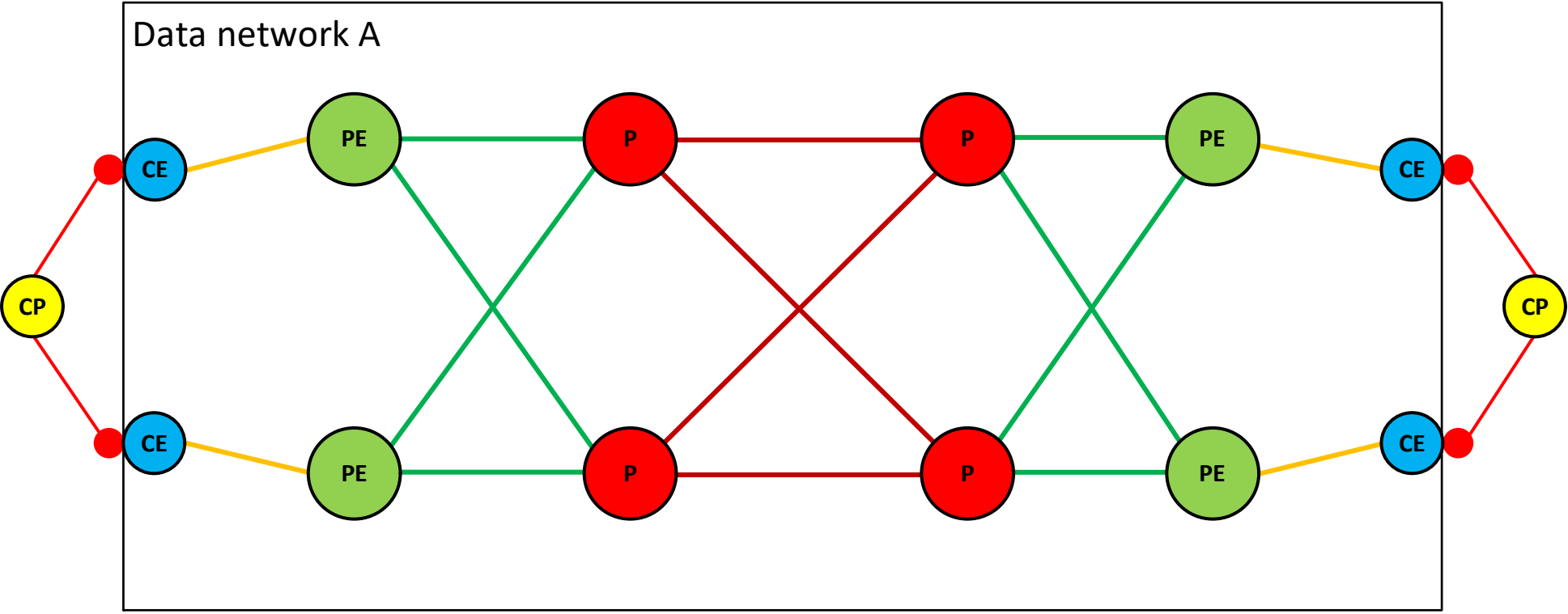
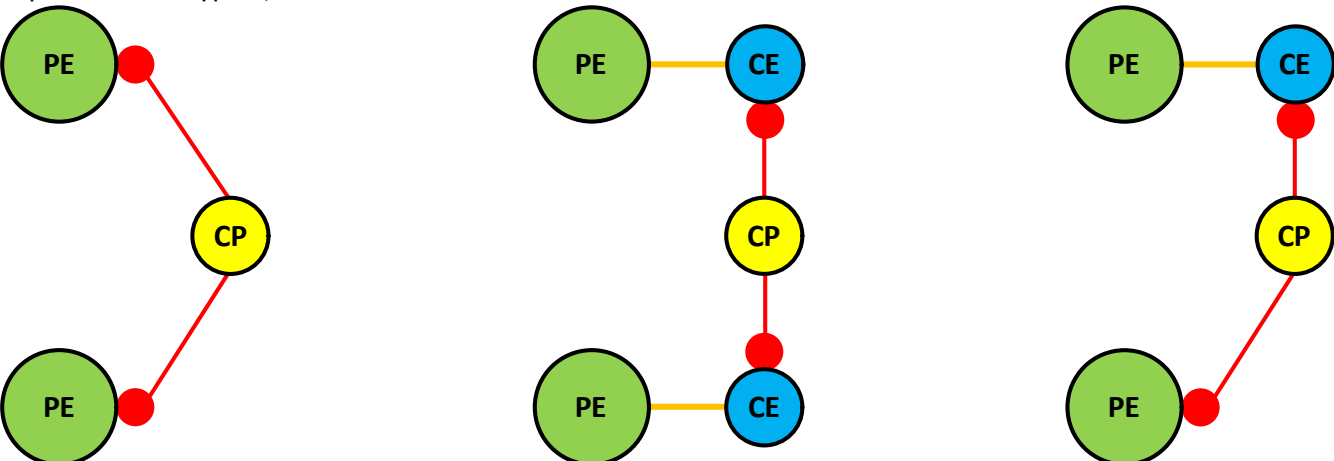
| ID          | Type | Requirement   | JIRA | V 1.3 (3.A) > V 1.3 (1.A)  |
|-------------|------|---|------|--|
| Eu.Net.9    | Head | <b>1 Introduction</b>   |      |  |
| Eu.Net.848  | Head | <b>1.1 Release information</b>  |      |  |
| Eu.Net.948  | Info | [Eu.Doc.25]<br>Guideline for network architecture<br>CENELEC Phase: 4<br>Version: 1.3 (3.A)<br>Approval date: 02.06.2025  |      | <b>Object Text:</b><br>[Eu.Doc.25]<br>Guideline for network architecture<br>CENELEC Phase: 4<br>Version: 1.3 ( <del>1</del> 3.A)<br>Approval date:<br><del>29</del> 02. <del>05</del> 06. <del>2024</del> 2025 |
| Eu.Net.967  | Info | <b>Version history</b>  |      |  |
| Eu.Net.1071 | Info | version number: 1.0 (0.A)<br>date: 13.12.2019<br>author: Nico Huurman, Jaco Schoonen<br>review: CCB<br>changes: EUAR-333, EUAR-335, EUAR-341                        |      |  |
| Eu.Net.1072 | Info | version number: 1.1 (0.A)<br>date: 24.03.2022<br>author: Nico Huurman, Ulrich Meier<br>review: cluster<br>changes: EUAR-416, EUAR-461, EUAR-470, EUAR-483, EUAR-517 |      |  |
| Eu.Net.1089 | Info | version number: 1.2 (0.A)<br>date: 16.05.2022<br>author: Nico Huurman, Ulrich Meier<br>review: CCB<br>changes: EUAR-533   |      |  |
| Eu.Net.1090 | Info | version number: 1.2 (1.A)<br>date: 31.03.2023<br>author: Nico Huurman, Ulrich Meier<br>review:<br>changes: EUAR-540, EUAR-564                                       |      |  |
| Eu.Net.1091 | Info | version number: 1.2 (2.A)<br>date: 27.06.2023<br>author: Nico Huurman, Ulrich Meier<br>review: CCB<br>changes: EUAR-604, EUAR-613                                   |      |  |
| Eu.Net.1092 | Info | version number: 1.3 (0.A)<br>date: 29.04.2024<br>author: Nico Huurman<br>review: cluster<br>changes: EUAR-225, EUAR-681   |      |  |
| Eu.Net.1098 | Info | version number: 1.3 (1.A)<br>date: 18.06.2024<br>author: Nico Huurman<br>review: CCB<br>changes: EUAR-746   |      |  |

| ID          | Type | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A)               |
|-------------|------|--|------|---|
| Eu.Net.1099 | Info | version number: 1.3 (2.A)<br>date: 05.05.2025<br>author: Nico Huurman<br>review: -<br>changes: EUAR-766  |      | object created after baseline 1.3 (1.A) |
| Eu.Net.1100 | Info | version number: 1.3 (3.A)<br>date: 20.06.2025<br>author: Nico Huurman<br>review: CCB<br>changes: EUAR-791  |      | object created after baseline 1.3 (1.A) |
| Eu.Net.847  | Head | <b>1.2 Impressum</b>   |      |   |
| Eu.Net.946  | Info | Publisher:<br><b>EULYNX Initiative</b><br><br>A full list of the <b>EULYNX Partners</b> can be found on <a href="https://eulynx.eu/">https://eulynx.eu/</a> .  |      |   |
| Eu.Net.945  | Info | Responsible for this document:<br>EULYNX Project Management Office<br><a href="http://www.eulynx.eu">www.eulynx.eu</a>   |      |   |
| Eu.Net.949  | Info | Copyright EULYNX Partners<br>All information included or disclosed in this document is licensed under the European Union Public Licence EUPL, Version 1.2 or later.  |      |   |
| Eu.Net.846  | Head | <b>1.3 Purpose</b>   |      |   |
| Eu.Net.989  | Info | This document is an informational guideline describing possible options and some of their properties to implement the data networks that form the Subsystem – Communication System.  |      |   |
| Eu.Net.990  | Info | The implementation of the Subsystem - Communication System shall be defined by national specifications.<br>The concrete implementation may differ significantly from the options presented herein.   |      |   |
| Eu.Net.991  | Info | The national specific implementation of the Subsystem – Communication System consists of one or more data networks. This guideline can serve as input for infrastructure managers to define their requirements for the data networks that form the Subsystem - Communication System.   |      |   |
| Eu.Net.1088 | Info | The Specification of Point of Service-Signalling [Eu.Doc.100] contains the list of requirements for the Subsystem - Communication System and is the baseline to assess whether the concrete network implementation is compliant or not.  |      |   |
| Eu.Net.845  | Head | <b>1.4 Applicable standards and regulations</b>  |      |   |
| Eu.Net.940  | Info | A list of applicable standards and regulations used in EULYNX is listed in the EULYNX Reference Document List [Eu.Doc.12].   |      |   |
| Eu.Net.969  | Head | <b>1.5 Applicable documents</b>  |      |   |
| Eu.Net.970  | Info | The current versions of documents used as input or related to this document are listed in the EULYNX Documentation Plan [Eu.Doc.11]. The relationships between the documents are displayed in the Appendix A1 Documentation plan and structure [Eu.Doc.11_A1].   |      |   |
| Eu.Net.844  | Head | <b>1.6 Terms and abbreviations</b>   |      |   |
| Eu.Net.893  | Info | The terms and abbreviations are listed in the EULYNX Glossary [Eu.Doc.9].  |      |   |
| Eu.Net.976  | Head | <b>1.7 Variability management</b>  |      |   |
| Eu.Net.977  | Info | This document is valid for the complete EULYNX System. Variability management is not used in this document. The specific applicability of requirements is captured in individual Requirements specifications. In implementation projects that apply the EULYNX specifications, it is possible to implement only parts of the architecture of the EULYNX System described in this document. The Infrastructure Manager initiating an implementation project, can use project documentation to indicate which parts of the architecture of the EULYNX System are applicable in a specific project. |      |   |
| Eu.Net.972  | Head | <b>1.8 Definition of object types</b>  |      |   |

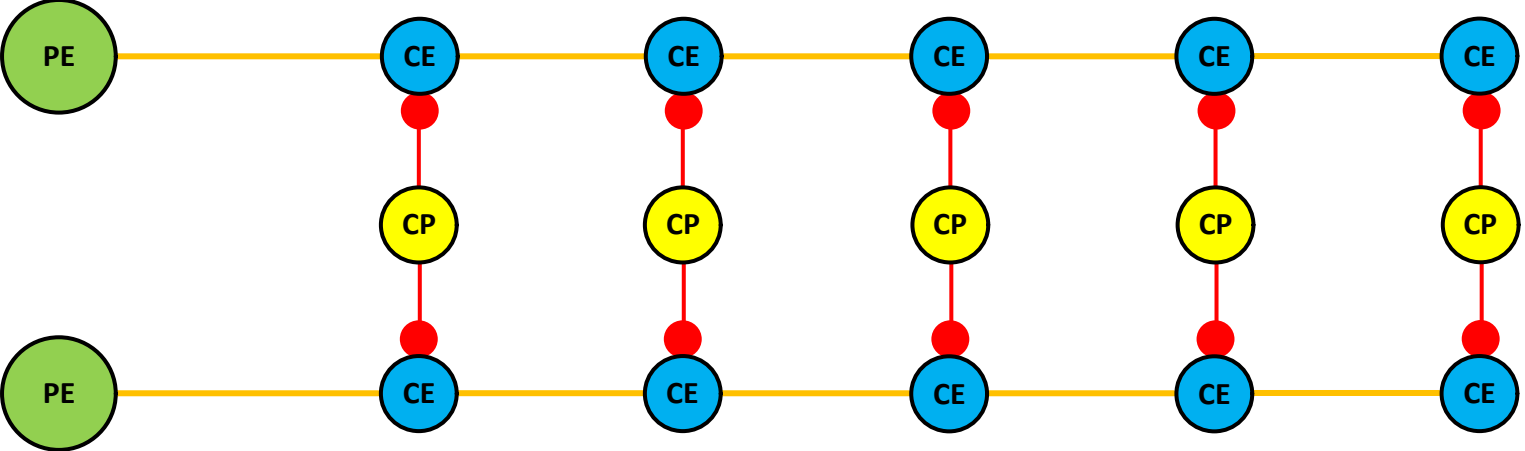
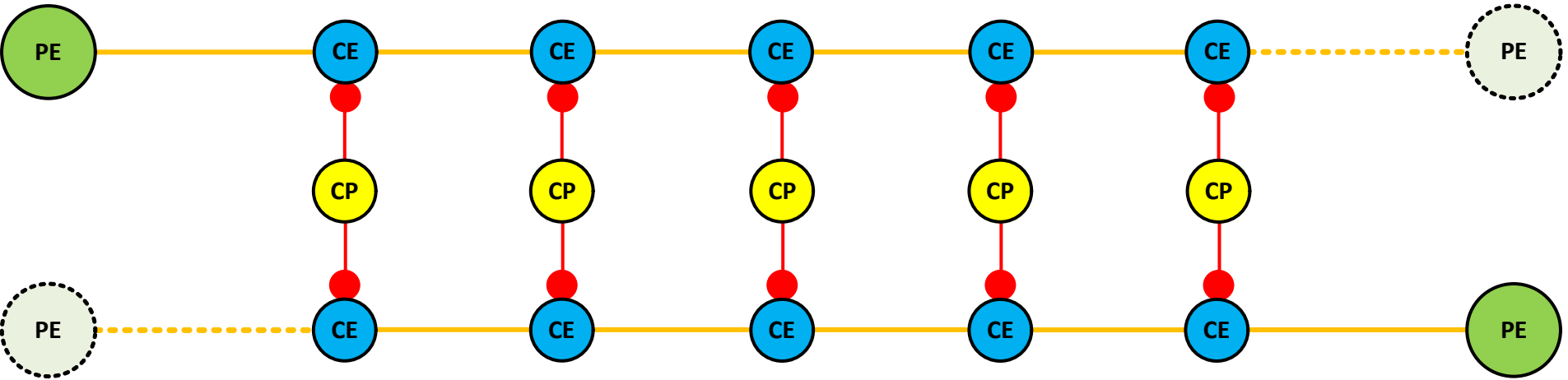
| ID         | Type | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|------------|------|--|------|---------------------------|
| Eu.Net.947 | Info | The following definition for object types is applied in this document:   |      |                           |
| Eu.Net.973 | Info | • "Req" - This denotes a mandatory requirement.  |      |                           |
| Eu.Net.974 | Info | • "Info" - This denotes additional information to help understand the specification. These objects do not specify any additional requirements.   |      |                           |
| Eu.Net.975 | Info | • "Head" - This denotes chapter headings.  |      |                           |
| Eu.Net.992 | Head | <b>2 Network hierarchy</b>   |      |                           |
| Eu.Net.993 | Info | A data network contains hierarchy in its architecture.   |      |                           |
| Eu.Net.994 | Info | The highest layer of the network hierarchy is recommended for large scale networks. This consists of provider nodes (P-nodes), which forms interconnections on a geographical scale for the data network that serves the IMs rail network.   |      |                           |
| Eu.Net.995 | Info | An intermediate layer of the network hierarchy connects P-nodes to provider edge nodes (PE-nodes). It also connects PE-nodes to each other.  |      |                           |
| Eu.Net.996 | Info | The lowest layer of the network hierarchy connects PE-nodes to customer edge nodes (CE-nodes). It may also connect CE-nodes to each other.   |      |                           |
| Eu.Net.997 | Info | A network architecture may also contain more than three hierarchy layers, having more than one intermediate layer or more than one customer edge layer. Traffic flow must never go down a layer and back up, e.g. traffic flow between PE-nodes must not traverse any CE-nodes.  |      |                           |
| Eu.Net.998 | Info | Communication participants (CP) are usually connected to CE-nodes at the lowest level of the network hierarchy.  |      |                           |
| Eu.Net.999 | Info | Communication participants that are located on central locations may be connected to the network on hierarchy layers that are above the lowest layer, e.g. directly to a PE-node. This may be valid for an electronic interlocking, that is located inside a data centre, not along a railway line.<br><br>Note: National network specification may allow or disallow directly connecting communication participants to PE-nodes. If this is not allowed, a CE-node can be put in between a single communication participants and the PE-node. |      |                           |

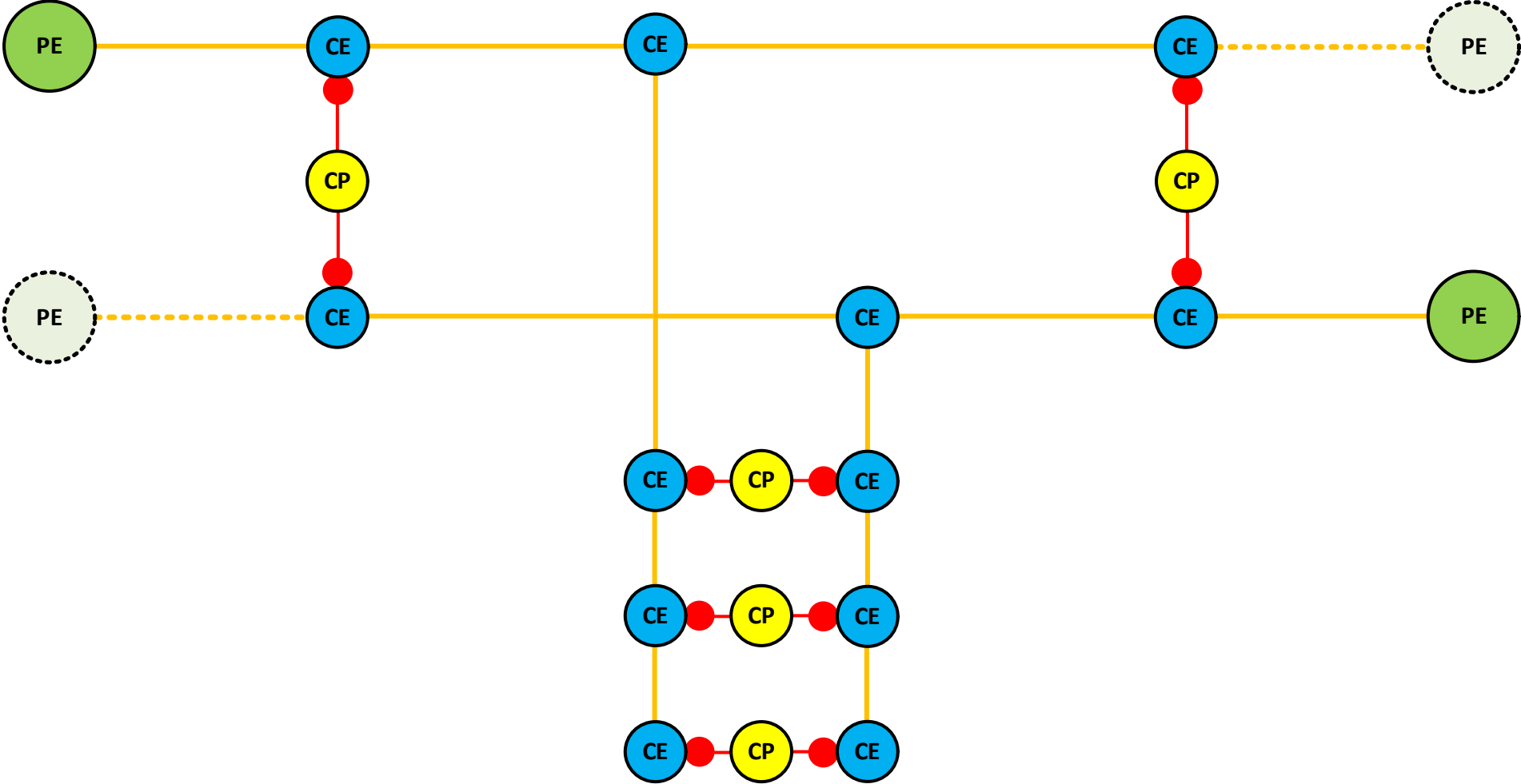
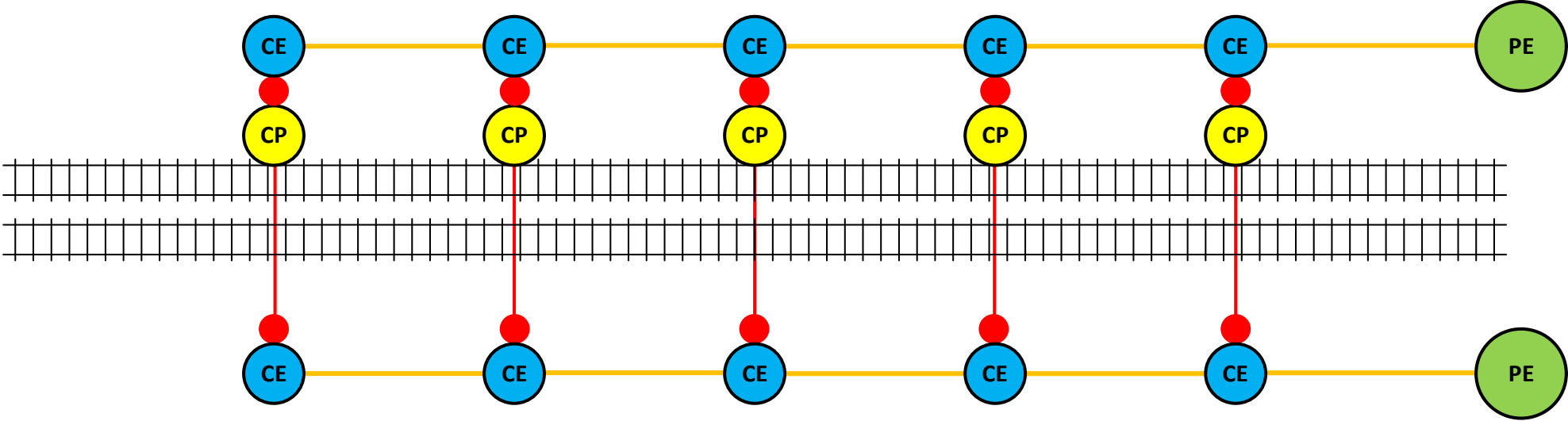
| ID          | Type | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|--|------|---------------------------|
| Eu.Net.1000 | Info | <div>Schematic representation of multi-layer network architecture</div> <div><div>Top level</div></div> <div><div>Intermediate level</div></div> <div><div>Lowest level</div></div> |      |                           |
| Eu.Net.1001 | Head | <b>3 Network plane redundancy</b>  |      |                           |
| Eu.Net.1004 | Info | As required in [Eu.Doc.100], the network architecture must ensure that the Subsystem - Communication System can provide two independent network interfaces to each communication participant.  |      |                           |
| Eu.Net.1005 | Info | To ensure independent network interfaces, the network architecture must enable independent paths through the data network between two PoS-Signalling.  |      |                           |
| Eu.Net.1006 | Info | The independence of paths can be reached by providing two physically separated data networks or by providing one data network with internal redundancy.  |      |                           |
| Eu.Net.1007 | Info | Both principles can also be mixed in the network architecture. For example one data networks with internal redundancy can be provided on the highest hierarchy layer, while two physically separated data networks exist on the lower hierarchy layers.  |      |                           |
| Eu.Net.1002 | Head | <b>3.1 Two physically separated data networks</b>  |      |                           |
| Eu.Net.1008 | Info | In this implementation, each communication participant has a diverse connection to two independent data networks via a redundant implementation of the PoS-Signalling.   |      |                           |
| Eu.Net.1009 | Info | There is no connection between the active components of the two separated data networks.   |      |                           |
| Eu.Net.1010 | Info | Active components and connections inside one of the two data network nodes don't need to be implemented redundantly.   |      |                           |

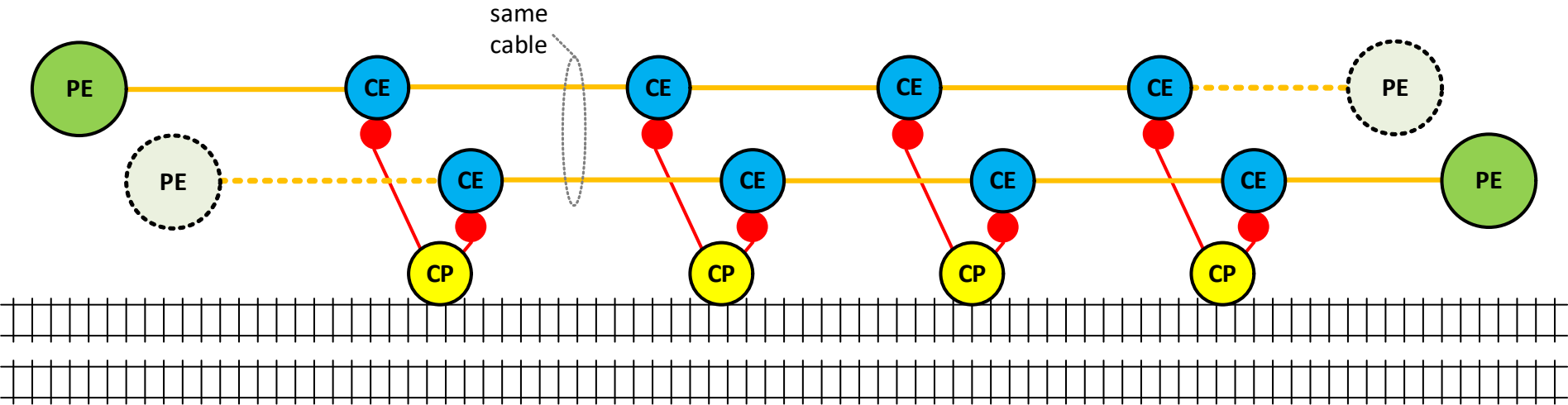
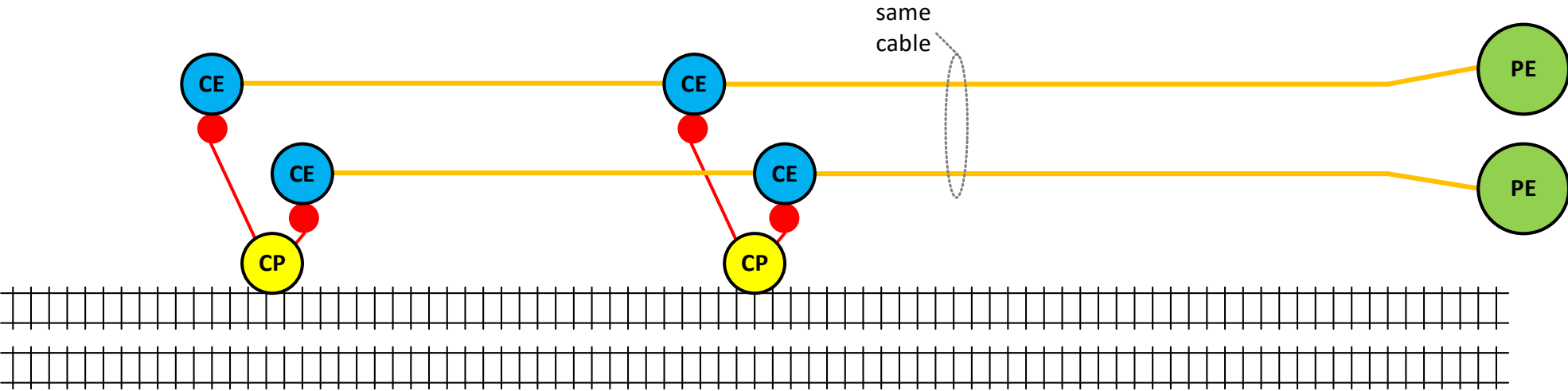
| ID          | Type | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|--|------|---------------------------|
| Eu.Net.1011 | Info | It is acceptable that the failure of a single active component or connection inside one of the two data network interrupts the logical connection between two communication participants in that data network. The logical connection via the other data network remains undisturbed.                                      |      |                           |
| Eu.Net.1012 | Info | <div>Schematic representation of two physically separated data networks<div><div><div>Data network A</div><div>Data network B</div></div></div></div> |      |                           |
| Eu.Net.1003 | Head | <b>3.2 One data network with internal redundancy</b>   |      |                           |
| Eu.Net.1013 | Info | In this implementation, at least the highest hierarchy level of the network architecture consists of only one data network.  |      |                           |
| Eu.Net.1014 | Info | The topology of active components and connections between them is such, that at least two independent paths can be provided between any two communication participants.  |      |                           |
| Eu.Net.1015 | Info | If an active component or connection fails, at least one alternative path through the data network must remain undisturbed.  |      |                           |

| ID          | Type | Requirement   | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|---|------|---------------------------|
| Eu.Net.1016 | Info | <div>Schematic representation of data network with internal redundancy</div> <div></div>  |      |                           |
| Eu.Net.1017 | Head | <b>4 Connecting communication participants</b>  |      |                           |
| Eu.Net.1018 | Info | Communication participants must be connected to the network via two independent network interfaces, as described in Eu.Net.1004. The upstream network must provide at least two independent paths, as described in Eu.Net.1014.   |      |                           |
| Eu.Net.1019 | Info | The implementation of the connection of a communication participant to the Subsystem - Communication System depends on the geographical location of the communication participant.  |      |                           |
| Eu.Net.1020 | Info | <p>1. Communication participants that are located in the direct vicinity of PE-nodes (i.e. inside the same room or building), may be connected to these intermediate nodes directly. To ensure redundancy, they must be connected to two independent nodes (PE/PE or PE/CE).</p> <p>Note: National network specification may allow or disallow directly connecting communication participants to PE-nodes. If this is not allowed, a CE-node can be put in between a single communication participants and the PE-node.</p> |      |                           |
| Eu.Net.1023 | Info | This type of connection is usually applicable for central communication participants, like the Subsystem - Electronic Interlocking, the Subsystem - Maintenance and Data Management or adjacent systems.  |      |                           |
| Eu.Net.1021 | Info | <div>Implementation type 1, without or with intermediate CE-nodes.</div> <div></div>  |      |                           |
| Eu.Net.1022 | Info | 2. Communication participants that are located in the station area of a station that also contains a PE-node, may be connected via a local sub-network for this station. To ensure redundancy, the sub-network must be connected to two independent PE-nodes.   |      |                           |













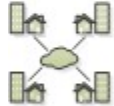

















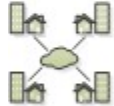

















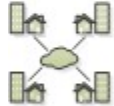







| ID          | Type | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|--|------|---------------------------|
| Eu.Net.1024 | Info | This type of connection is usually applicable for object controllers of field elements in station areas of bigger stations.  |      |                           |
| Eu.Net.1025 | Info | <div>Implementation type 2</div>   |      |                           |
| Eu.Net.1026 | Info | 3. Communication participants that are located along a railway line, may be connected via a sub-network that runs along the railway line (see section 'Cabling redundancy'). This sub-network starts at a station with a PE-node and runs until the next station with a PE-node, thereby connecting to two independent PE-nodes.                 |      |                           |
| Eu.Net.1027 | Info | To further increase the redundancy, the sub-network may be connected to two PE-nodes on each end. In this case, only one of the two connections to PE-nodes is in active use in normal situations. Only when the network is interrupted somewhere along the railway line, traffic can be re-routed to also use the second PE-nodes on both ends. |      |                           |
| Eu.Net.1028 | Info | This type of connection is usually applicable for object controllers of remotely located single field elements.  |      |                           |
| Eu.Net.1029 | Info | <div>Implementation type 3</div>  <div>Connection to second PE-node usually idle. Only used for rerouting</div>  |      |                           |
| Eu.Net.1030 | Info | 4. Communication participants that are located in the station area of a remote station, may be connected via a local sub-sub-network for this station, connected to the sub-network that runs along the railway line.  |      |                           |
| Eu.Net.1031 | Info | This type of connection is usually applicable for object controllers of a group of remotely located field elements.  |      |                           |

| ID          | Type | Requirement   | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|---|------|---------------------------|
| Eu.Net.1032 | Info | <div>Implementation type 4</div>   |      |                           |
| Eu.Net.1033 | Head | 4.1 Cabling redundancy  |      |                           |
| Eu.Net.1034 | Info | The independence of two network interfaces must also be maintained when connecting communication participants that are located on remote locations along railway lines (e.g. object controllers of signals or points located far away from stations). |      |                           |
| Eu.Net.1035 | Info | The cabling configuration to connect these remote communication participants must be redundant. This can be realised in different ways.   |      |                           |
| Eu.Net.1036 | Info | 1. Two cables can be used between a redundant intermediate network node and remote communication participants, with one on each side of the railway line.   |      |                           |
| Eu.Net.1037 | Info | If the cable on one side would get damaged on a certain spot, the cable on the other side of the railway line still ensures the connection.   |      |                           |
| Eu.Net.1038 | Info | <div>Cabling configuration 1</div>    |      |                           |

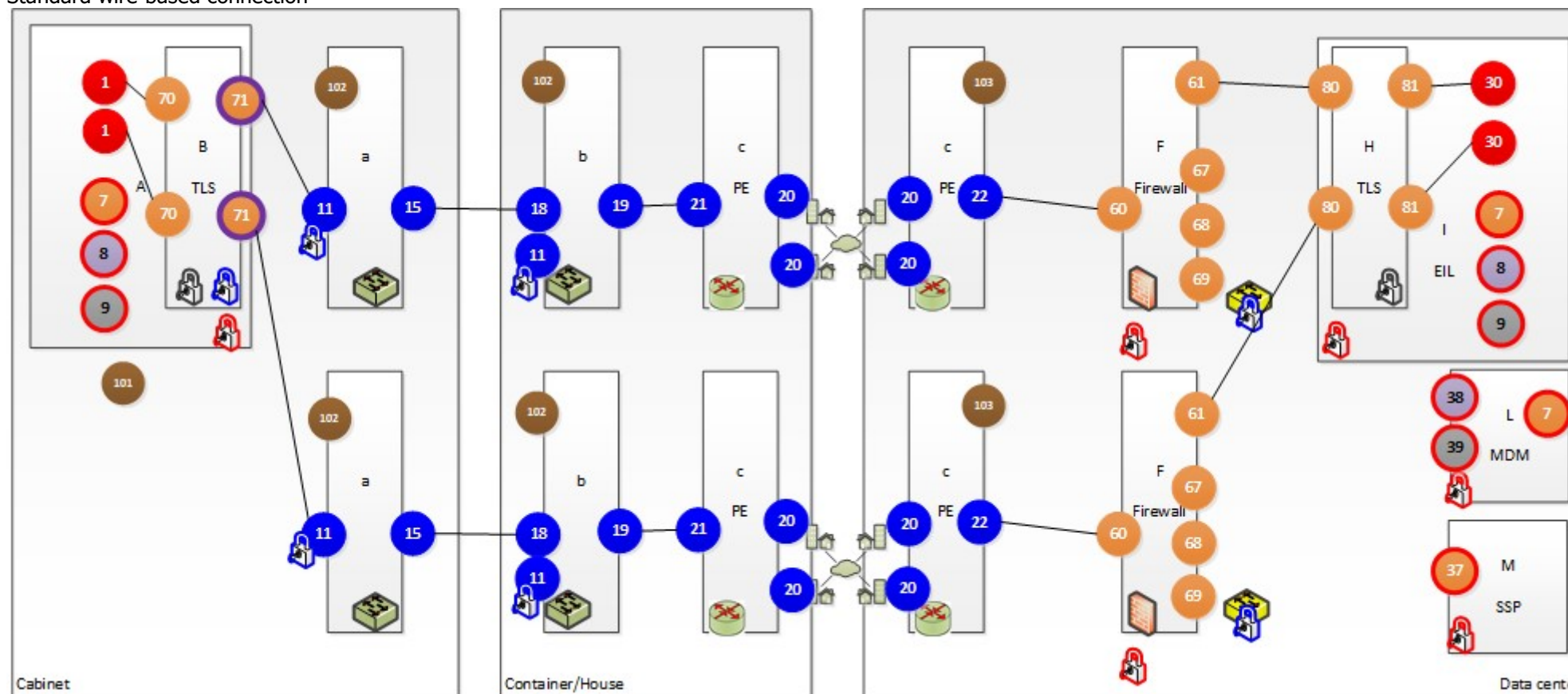
| ID          | Type | Requirement   | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|---|------|---------------------------|
| Eu.Net.1039 | Info | 2. One cable can be used on one side of the railway line. This cable connects an intermediate network node to communication participants and continues along the railway line until reaching another intermediate network node.   |      |                           |
| Eu.Net.1040 | Info | If the cable would get damaged on a certain spot, the continuation of the cable towards the next intermediate network node still ensures the connection.  |      |                           |
| Eu.Net.1041 | Info | <p>Cabling configuration 2</p>  <p>The diagram illustrates a network topology for 'Cabling configuration 2'. It shows a horizontal railway line represented by two parallel tracks. Above the tracks, there are two rows of nodes. The top row consists of a solid green circle labeled 'PE', followed by four blue circles labeled 'CE', and then a dashed green circle labeled 'PE'. The bottom row consists of a dashed green circle labeled 'PE', followed by four blue circles labeled 'CE', and then a solid green circle labeled 'PE'. Below the tracks, there are four yellow circles labeled 'CP'. Each 'CE' node in the bottom row is connected to a 'CP' node by a red line. Each 'CP' node is connected to a 'CE' node in the top row by a red line. A yellow line connects the 'PE' nodes in the top row, passing through the 'CE' nodes. A yellow line connects the 'PE' nodes in the bottom row, passing through the 'CE' nodes. A dashed yellow line connects the 'PE' nodes in the top row and bottom row. A label 'same cable' with a bracket indicates that the yellow lines represent the same cable. The diagram is divided into two sections by a vertical dashed line.</p> |      |                           |
| Eu.Net.1042 | Info | 3. Both logical connections can be using different fibres all placed in a single cable, to reach remote communication participants. National specifications regarding availability must determine the maximum length for which such a configuration is acceptable.  |      |                           |
| Eu.Net.1043 | Info | If the fibres of one of the two logical connections inside the cable would get damaged, the fibres of the other logical connection can still ensure the communication. If the cable itself would get damaged, the affected communication participants are no longer connected to the network.   |      |                           |
| Eu.Net.1044 | Info | <p>Cabling configuration 3</p>  <p>The diagram illustrates a network topology for 'Cabling configuration 3'. It shows a horizontal railway line represented by two parallel tracks. Above the tracks, there are two rows of nodes. The top row consists of two blue circles labeled 'CE' and then two green circles labeled 'PE'. The bottom row consists of two blue circles labeled 'CE' and then two green circles labeled 'PE'. Below the tracks, there are two yellow circles labeled 'CP'. Each 'CE' node in the bottom row is connected to a 'CP' node by a red line. Each 'CP' node is connected to a 'CE' node in the top row by a red line. A yellow line connects the 'CE' nodes in the top row, passing through the 'CE' nodes. A yellow line connects the 'CE' nodes in the bottom row, passing through the 'CE' nodes. A label 'same cable' with a bracket indicates that the yellow lines represent the same cable. The diagram is divided into two sections by a vertical dashed line.</p>  |      |                           |
| Eu.Net.1045 | Head | <b>5 Layer 2 vs. layer 3 connectivity</b>   |      |                           |
| Eu.Net.1046 | Info | Connectivity may be provided at both layer 2 (Data link layer) and layer 3 (Network layer).   |      |                           |
| Eu.Net.1067 | Info | Layer 3 connectivity is the common way to build a geographically distributed network. This may, however, require additional routing information to be configured in the application to fully support redundant connections.   |      |                           |
| Eu.Net.1068 | Info | Layer 2 connectivity is easier to configure. However, providing layer 2 connectivity on a geographically distributed network may make it more difficult to maintain a stable network. To avoid address resolution issues, layer 2 domains should not be too large.  |      |                           |
| Eu.Net.1069 | Info | The EULYNX communication participants support both layer 2 and 3 connectivity. The connectivity provided by the Subsystem - Communication System may be defined by national specifications.   |      |                           |
| Eu.Net.1047 | Head | <b>5.1 Routing in different hierarchy levels</b>  |      |                           |

| ID                   | Type   | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
|----------------------|--|--|------|---------------------------|---------|---|---------------------------------------|--|---|--|--|---|--------------------------------------|--|---|---|--|---|-------------------------|--|---|---|--|---|--------------------|--|---|-----------------|--|---|-----|--|---|-----|--|---|---------------------------------|--|--|--|--|----------------------|--|--|---|---------------------------------|--|---|--|--|---|--|--|--|--|--|---|-----------------------------|--------------------------------------|---|---|--|---|---|--|---|---|--|---|---|--|--|--|
| Eu.Net.1048          | Info   | In a layer 2 network all communication participants are connected at the data link layer. Therefore, no routing has to be configured in the network stack of the communication participants. Typically, this is only used in local area networks. There are nowadays techniques (e.g. EVPN or PBB-EVPN) that provide the behaviour of LAN-connectivity also on a geographically distributed network.   |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| Eu.Net.1070          | Info   | If a layer 3 network is used, typically a default gateway is used to route traffic to unknown addresses. However, by doing this the communication participant routes all traffic over a single interface as there can only be one default gateway. This is not in line with having two independent communication channels and can be solved by adding static routing configuration in the communication participant to route certain IP-ranges to different network interfaces.  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| Eu.Net.1073          | Head   | <b>6 Decomposition of communication paths</b>  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| Eu.Net.1074          | Info   | The purpose of the following figures is to have a common setting and identification of points related to communication.  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| Eu.Net.1075          | Info   | <div><b>Explanation of IDs used in the figures:</b><table><tr><th>ID</th><th>Description</th><th>Remarks</th></tr><tr><td>A</td><td>EULYNX field element Subsystem (EfeS)</td><td></td></tr><tr><td>B</td><td colspan="2">TLS hardware board or software component (variant B/C)</td></tr><tr><td>C</td><td>Crypto box (variant A): EfeS version</td><td></td></tr><tr><td>D</td><td colspan="2">Crypto box (variant A): data centre version</td></tr><tr><td>E</td><td>Firewall "complex": ALG</td><td></td></tr><tr><td>F</td><td colspan="2">Firewall "simple": ports, addresses, standard protocols</td></tr><tr><td>G</td><td>Connection Manager</td><td>terminates TLS in front of EIL (cleartext or TLS between G and I); SCI protocol translation between multiple EULYNX base lines; may terminate RaSTA (proprietary protocol between G and I)</td></tr><tr><td>H</td><td colspan="2">TLS termination</td></tr><tr><td>I</td><td colspan="2">EIL</td></tr><tr><td>L</td><td colspan="2">MDM</td></tr><tr><td>M</td><td colspan="2">Security Service Platform (SSP)</td></tr><tr><td></td><td colspan="2"></td></tr><tr><td colspan="2">Communication system</td><td></td></tr><tr><td>a</td><td colspan="2">Switch in cabinet ("last mile")</td></tr><tr><td>b</td><td colspan="2">Switch in container, house ("last mile")</td></tr><tr><td>c</td><td colspan="2">Provider Edge (PE) component ("entry to regional or core network")</td></tr><tr><td></td><td colspan="2"></td></tr><tr><td>d</td><td>Mobile Network access point</td><td>includes switch and VLAN/QoS support</td></tr><tr><td>e</td><td colspan="2">Radio base station / RAN (Mobile Network A)</td></tr><tr><td>f</td><td colspan="2">Interconnection mobile network A to communication network</td></tr><tr><td>g</td><td colspan="2">Radio base station / RAN (Mobile Network B)</td></tr><tr><td>h</td><td colspan="2">Interconnection mobile network B to communication network</td></tr></table></div> | ID   | Description               | Remarks | A | EULYNX field element Subsystem (EfeS) |  | B | TLS hardware board or software component (variant B/C) |  | C | Crypto box (variant A): EfeS version |  | D | Crypto box (variant A): data centre version |  | E | Firewall "complex": ALG |  | F | Firewall "simple": ports, addresses, standard protocols |  | G | Connection Manager | terminates TLS in front of EIL (cleartext or TLS between G and I); SCI protocol translation between multiple EULYNX base lines; may terminate RaSTA (proprietary protocol between G and I) | H | TLS termination |  | I | EIL |  | L | MDM |  | M | Security Service Platform (SSP) |  |  |  |  | Communication system |  |  | a | Switch in cabinet ("last mile") |  | b | Switch in container, house ("last mile") |  | c | Provider Edge (PE) component ("entry to regional or core network") |  |  |  |  | d | Mobile Network access point | includes switch and VLAN/QoS support | e | Radio base station / RAN (Mobile Network A) |  | f | Interconnection mobile network A to communication network |  | g | Radio base station / RAN (Mobile Network B) |  | h | Interconnection mobile network B to communication network |  |  |  |
| ID                   | Description  | Remarks  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| A                    | EULYNX field element Subsystem (EfeS)                              |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| B                    | TLS hardware board or software component (variant B/C)             |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| C                    | Crypto box (variant A): EfeS version                               |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| D                    | Crypto box (variant A): data centre version                        |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| E                    | Firewall "complex": ALG  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| F                    | Firewall "simple": ports, addresses, standard protocols            |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| G                    | Connection Manager   | terminates TLS in front of EIL (cleartext or TLS between G and I); SCI protocol translation between multiple EULYNX base lines; may terminate RaSTA (proprietary protocol between G and I)   |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| H                    | TLS termination  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| I                    | EIL  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| L                    | MDM  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| M                    | Security Service Platform (SSP)                                    |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
|                      |  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| Communication system |  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| a                    | Switch in cabinet ("last mile")                                    |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| b                    | Switch in container, house ("last mile")                           |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| c                    | Provider Edge (PE) component ("entry to regional or core network") |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
|                      |  |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| d                    | Mobile Network access point  | includes switch and VLAN/QoS support   |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| e                    | Radio base station / RAN (Mobile Network A)                        |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| f                    | Interconnection mobile network A to communication network          |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| g                    | Radio base station / RAN (Mobile Network B)                        |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| h                    | Interconnection mobile network B to communication network          |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |
| Eu.Net.1076          | Info   |  |      |                           |         |   |                                       |  |   |  |  |   |                                      |  |   |   |  |   |                         |  |   |   |  |   |                    |  |   |                 |  |   |     |  |   |     |  |   |                                 |  |  |  |  |                      |  |  |   |                                 |  |   |  |  |   |  |  |  |  |  |   |                             |                                      |   |   |  |   |   |  |   |   |  |   |   |  |  |  |

| ID          | Type | Requirement        |   | JIRA                 | V 1.3 (3.A) > V 1.3 (1.A) |  |  |
|-------------|------|--------------------|---|----------------------|---------------------------|--|--|
| Eu.Net.1076 |      | ID                 | Description   | Remarks              |                           |  |  |
|             |      | Interfaces / Ports |   |                      |                           |  |  |
|             |      | 1                  | SCI, EfeS: RaSTA to transport adaption using TLS/TCP                        |                      |                           |  |  |
|             |      | 2                  | SCI, EfeS: RaSTA to transport adaption using UDP                            |                      |                           |  |  |
|             |      | 7                  | SSI: EIL, EfeS, MDM   |                      |                           |  |  |
|             |      | 8                  | SMI: EfeS, EIL  |                      |                           |  |  |
|             |      | 9                  | SDI: EfeS, EIL  |                      |                           |  |  |
|             |      |                    |   |                      |                           |  |  |
|             |      | 10                 | SCS: used for variant A (Crypto box, EfeS version)                          |                      |                           |  |  |
|             |      | 11                 | SCS: used for TLS (variant B/C)   |                      |                           |  |  |
|             |      | 12                 | SCS: fixed mobile, used for TLS (variant B/C)                               |                      |                           |  |  |
|             |      | 14                 | SCS: used for cat 2 network   |                      |                           |  |  |
|             |      | 15                 | SCS: cabinet, trackside network   |                      |                           |  |  |
|             |      | 16                 | SCS: mobile network interface (radio), terminal                             |                      |                           |  |  |
|             |      | 17                 | SCS: mobile network interface (radio), base station                         |                      |                           |  |  |
|             |      | 18                 | SCS: concentrator, trackside network "last mile"                            |                      |                           |  |  |
|             |      | 19                 | SCS: trackside network "last mile" to provider edge                         |                      |                           |  |  |
|             |      |                    |   |                      |                           |  |  |
|             |      | 20                 | SCS: provider edge interface to core network                                |                      |                           |  |  |
|             |      | 21                 | SCS: provider edge to trackside network "last mile"                         |                      |                           |  |  |
|             |      | 22                 | SCS: Interface to data centre   |                      |                           |  |  |
|             |      | 25                 | SCS: base station to mobile core network provider A                         |                      |                           |  |  |
|             |      | 26                 | SCS: base station to mobile core network provider B                         |                      |                           |  |  |
|             |      | 27                 | SCS: mobile core network provider A to interconnection to wire-base network |                      |                           |  |  |
|             |      |                    |   |                      |                           |  |  |
|             |      | 28                 | SCS: mobile core network provider B to interconnection to wire-base network |                      |                           |  |  |
|             |      |                    |   |                      |                           |  |  |
|             |      | 30                 | SCI, EIL: RaSTA to transport adaption using TLS/TCP                         |                      |                           |  |  |
|             |      | 31                 | SCI, EIL: RaSTA to transport adaption using UDP                             |                      |                           |  |  |
|             |      | 32                 | SCI, EIL: SCI to RaSTA  | pure SCI, non-EULNYX |                           |  |  |
|             |      | 37                 | SSI, SSP  |                      |                           |  |  |
|             |      | 38                 | SMI, MDM  |                      |                           |  |  |
|             |      | 39                 | SDI, MDM  |                      |                           |  |  |
|             |      |                    |   |                      |                           |  |  |
|             |      | 40                 | Crypto box to EfeS  |                      |                           |  |  |
|             |      | 41                 | Crypto box to communication system  |                      |                           |  |  |
|             |      |                    |   |                      |                           |  |  |
|             |      | 50                 | Crypto box to communication system  |                      |                           |  |  |
|             |      | 51                 | Crypto box to data centre   |                      |                           |  |  |
|             |      | Eu.Net.1077        | Info  |                      |                           |  |  |

| ID  | Type  | Requirement  |  |   | JIRA  | V 1.3 (3.A) > V 1.3 (1.A)   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|---|---|--|--|---|---|---|--|--|---|-----------------|--|--|---|--|--|--|---|--|--|--|--|--|--|----|---|---|--|---------------------------|--|----|------------------------------|--|----|---|---|--|--|--|----|----------------|--|----|---------------------------------------|--|--|--|--|----|---------------------------------|-----------------------------|----|---------------------------------|-----------------------------|----|--|-------------------------|----|--|-------------------------|----|---|--|--|--|--|-----|----------------------------|--|-----|------------------------------------|--|-----|------------------------------------|--|--|--|
| Eu.Net.1077   |   | <table><thead><tr><th>ID</th><th>Description</th><th>Remarks</th></tr></thead><tbody><tr><td>60</td><td>Firewall from external</td><td></td></tr><tr><td>61</td><td>Firewall to SCI</td><td></td></tr><tr><td>67</td><td>Firewall to SSI</td><td></td></tr><tr><td>68</td><td>Firewall to SMI</td><td></td></tr><tr><td>69</td><td>Firewall to SDI</td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td>70</td><td>RaSTA: Transport adaption, OC side</td><td></td></tr><tr><td>71</td><td>TLS/TCP to SCS, wire base</td><td></td></tr><tr><td>72</td><td>TLS/TCP to SCS, fixed mobile</td><td></td></tr><tr><td>73</td><td>TLS/TCP to SCS, using integrated mobile</td><td>for assurance/certification this must be observable</td></tr><tr><td></td><td></td><td></td></tr><tr><td>80</td><td>SCS to TLS/TCP</td><td></td></tr><tr><td>81</td><td>Transport adaption to RaSTA, EIL side</td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td>90</td><td>SCI, towards SCS; TLS encrypted</td><td>SCI over RaSTA over TLS/TCP</td></tr><tr><td>91</td><td>SCI, towards EIL; TLS encrypted</td><td>SCI over RaSTA over TLS/TCP</td></tr><tr><td>92</td><td>SCI, towards SCS; not encrypted (requires cat 2)</td><td>SCI over RaSTA over UDP</td></tr><tr><td>93</td><td>SCI, towards EIL; not encrypted (requires cat 2)</td><td>SCI over RaSTA over UDP</td></tr><tr><td>94</td><td>SCI, towards EIL; not encrypted, non-EULYNX</td><td>SCI, not using RaSTA (connection controller terminates RaSTA, connection manager is part of EIL for safety assessment)</td></tr><tr><td></td><td></td><td></td></tr><tr><td>101</td><td>generic use device with IP</td><td>e.g. climate control, energy management, intrusion detection, fire alarm,...</td></tr><tr><td>102</td><td>non-EULYNX to communication system</td><td></td></tr><tr><td>103</td><td>non-EULYNX to communication system</td><td></td></tr></tbody></table>  | ID   | Description   | Remarks   | 60  | Firewall from external   |  | 61  | Firewall to SCI |  | 67   | Firewall to SSI   |  | 68   | Firewall to SMI  |   | 69   | Firewall to SDI  |  |  |  |  | 70 | RaSTA: Transport adaption, OC side  |   | 71   | TLS/TCP to SCS, wire base |  | 72 | TLS/TCP to SCS, fixed mobile |  | 73 | TLS/TCP to SCS, using integrated mobile | for assurance/certification this must be observable |  |  |  | 80 | SCS to TLS/TCP |  | 81 | Transport adaption to RaSTA, EIL side |  |  |  |  | 90 | SCI, towards SCS; TLS encrypted | SCI over RaSTA over TLS/TCP | 91 | SCI, towards EIL; TLS encrypted | SCI over RaSTA over TLS/TCP | 92 | SCI, towards SCS; not encrypted (requires cat 2) | SCI over RaSTA over UDP | 93 | SCI, towards EIL; not encrypted (requires cat 2) | SCI over RaSTA over UDP | 94 | SCI, towards EIL; not encrypted, non-EULYNX | SCI, not using RaSTA (connection controller terminates RaSTA, connection manager is part of EIL for safety assessment) |  |  |  | 101 | generic use device with IP | e.g. climate control, energy management, intrusion detection, fire alarm,... | 102 | non-EULYNX to communication system |  | 103 | non-EULYNX to communication system |  |  |  |
|   |   | ID   | Description  | Remarks   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 60   | Firewall from external   |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 61   | Firewall to SCI  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 67   | Firewall to SSI  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 68   | Firewall to SMI  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 69   | Firewall to SDI  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   |  |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 70   | RaSTA: Transport adaption, OC side   |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 71   | TLS/TCP to SCS, wire base  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 72   | TLS/TCP to SCS, fixed mobile   |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 73   | TLS/TCP to SCS, using integrated mobile  | for assurance/certification this must be observable |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   |  |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 80   | SCS to TLS/TCP   |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 81   | Transport adaption to RaSTA, EIL side  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   |  |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 90   | SCI, towards SCS; TLS encrypted  | SCI over RaSTA over TLS/TCP                         |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 91   | SCI, towards EIL; TLS encrypted  | SCI over RaSTA over TLS/TCP                         |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 92   | SCI, towards SCS; not encrypted (requires cat 2)   | SCI over RaSTA over UDP                             |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   | 93   | SCI, towards EIL; not encrypted (requires cat 2)   | SCI over RaSTA over UDP                             |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
| 94  | SCI, towards EIL; not encrypted, non-EULYNX   | SCI, not using RaSTA (connection controller terminates RaSTA, connection manager is part of EIL for safety assessment)   |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |   |  |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
| 101   | generic use device with IP  | e.g. climate control, energy management, intrusion detection, fire alarm,...   |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
| 102   | non-EULYNX to communication system  |  |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
| 103   | non-EULYNX to communication system  |  |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
| Eu.Net.1079   | Info  | <p>All figures use the following colour schema and the following symbols</p> <table><tbody><tr><td> SCI</td><td> SSI</td><td> non-EULYNX</td><td> physical</td></tr><tr><td> SMI</td><td></td><td> Communication System</td><td> NAC: EAP-TLS or SIM card</td></tr><tr><td> SDI</td><td></td><td> Security</td><td> Encryption</td></tr><tr><td> Network (SCS)</td><td> Router (SCS)</td><td> Switch (not SCS)</td><td></td></tr><tr><td></td><td> Switch (SCS)</td><td> Firewall</td><td></td></tr><tr><td> Network (mobile operator)</td><td> Gateway (mobile operator)</td><td> Mobile</td><td></td></tr></tbody></table> |  |   |  SCI |  SSI   |  non-EULYNX |  physical |  SMI |                 |  Communication System |  NAC: EAP-TLS or SIM card |  SDI |  |  Security |  Encryption |  Network (SCS) |  Router (SCS) |  Switch (not SCS) |  |  |  Switch (SCS) |  Firewall |    |  Network (mobile operator) |  Gateway (mobile operator) |  Mobile |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|  SCI                       |  SSI                       |  non-EULYNX   |  physical                 |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|  SMI                       |   |  Communication System   |  NAC: EAP-TLS or SIM card |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|  SDI                       |   |  Security   |  Encryption               |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|  Network (SCS)             |  Router (SCS)              |  Switch (not SCS)   |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|   |  Switch (SCS)              |  Firewall   |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
|  Network (mobile operator) |  Gateway (mobile operator) |  Mobile   |  |   |   |   |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |
| Eu.Net.1078   | Info  | <p>For situation using [TLS]/[TCP] variants multiple figures apply.</p> <p>a) standard wire-based connection</p> <p>b) combined wire-based and mobile connection of EfeS (fixed mobile access point is used)</p> <p>c) mobile only for EfeS with fixed mobile (access points)</p>  |  |   | EUAR-766<br>EUAR-791  | <b>Object Text:</b><br>For situation using [TLS]/[TCP] variants multiple figures apply.<br>a) <del>without</del> <u>standard</u> <u>using wire-</u> |  |  |   |                 |  |  |   |  |  |  |   |  |  |  |  |  |  |    |   |   |  |                           |  |    |                              |  |    |   |   |  |  |  |    |                |  |    |                                       |  |  |  |  |    |                                 |                             |    |                                 |                             |    |  |                         |    |  |                         |    |   |  |  |  |  |     |                            |  |     |                                    |  |     |                                    |  |  |  |

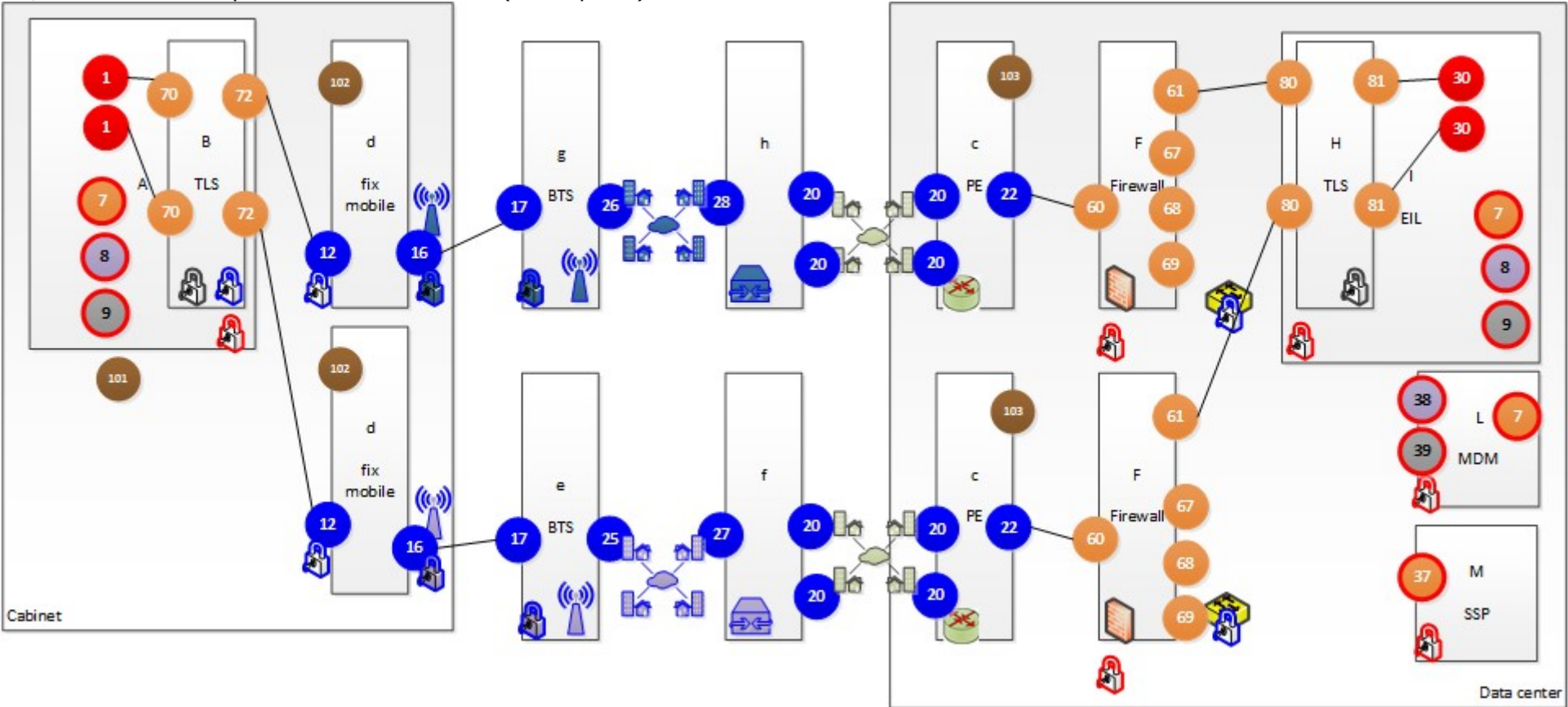
| ID          | Type | Requirement  | JIRA                 | V 1.3 (3.A) > V 1.3 (1.A)   |
|-------------|------|--|----------------------|---|
| Eu.Net.1078 |      | d) mobile only for EfeS with integrated mobile   |                      | <p>based <del>"connection-manager"</del><br/> b) <del>using "connection-manager"</del><br/> e) combined wire-based and mobile connection of EfeS (fixed mobile access point is used)<br/> d) mobile only for EfeS with fixed mobile (access points)<br/> ed) mobile only for EfeS with integrated mobile</p> <p><b>a_JIRA-Ticket BL4R4:</b><br/> <a href="#">EUAR-766</a><br/> <a href="#">EUAR-791</a></p> |
| Eu.Net.1082 | Info | Details on [TLS]/[TCP] variants are documented in [SP-SEC-CommSpec] and [SP-SEC-CompSpec]. | EUAR-766<br>EUAR-791 | <p><b>Object Text:</b><br/> Details on [TLS]/[TCP] variants are documented in <del>the EULYNX Security Concept [Eu.Doc.15]</del>, <del>the EULYNX Security Specifications [Eu.Doc.114SP-SEC-CommSpec]</del> and <del>the EULYNX Security Parameter Specification [Eu.Doc.115SP-SEC-CompSpec]</del>.</p> <p><b>a_JIRA-Ticket BL4R4:</b><br/> <a href="#">EUAR-766</a><br/> <a href="#">EUAR-791</a></p>      |
| Eu.Net.1084 | Info | Standard wire-based connection   | EUAR-766             | <p><b>Object Text:</b><br/> <del>TLS/TCP</del> <del>Standard without wire-based "connection-manager"</del></p> <p><b>a_JIRA-Ticket BL4R4:</b><br/> <a href="#">EUAR-766</a></p>   |



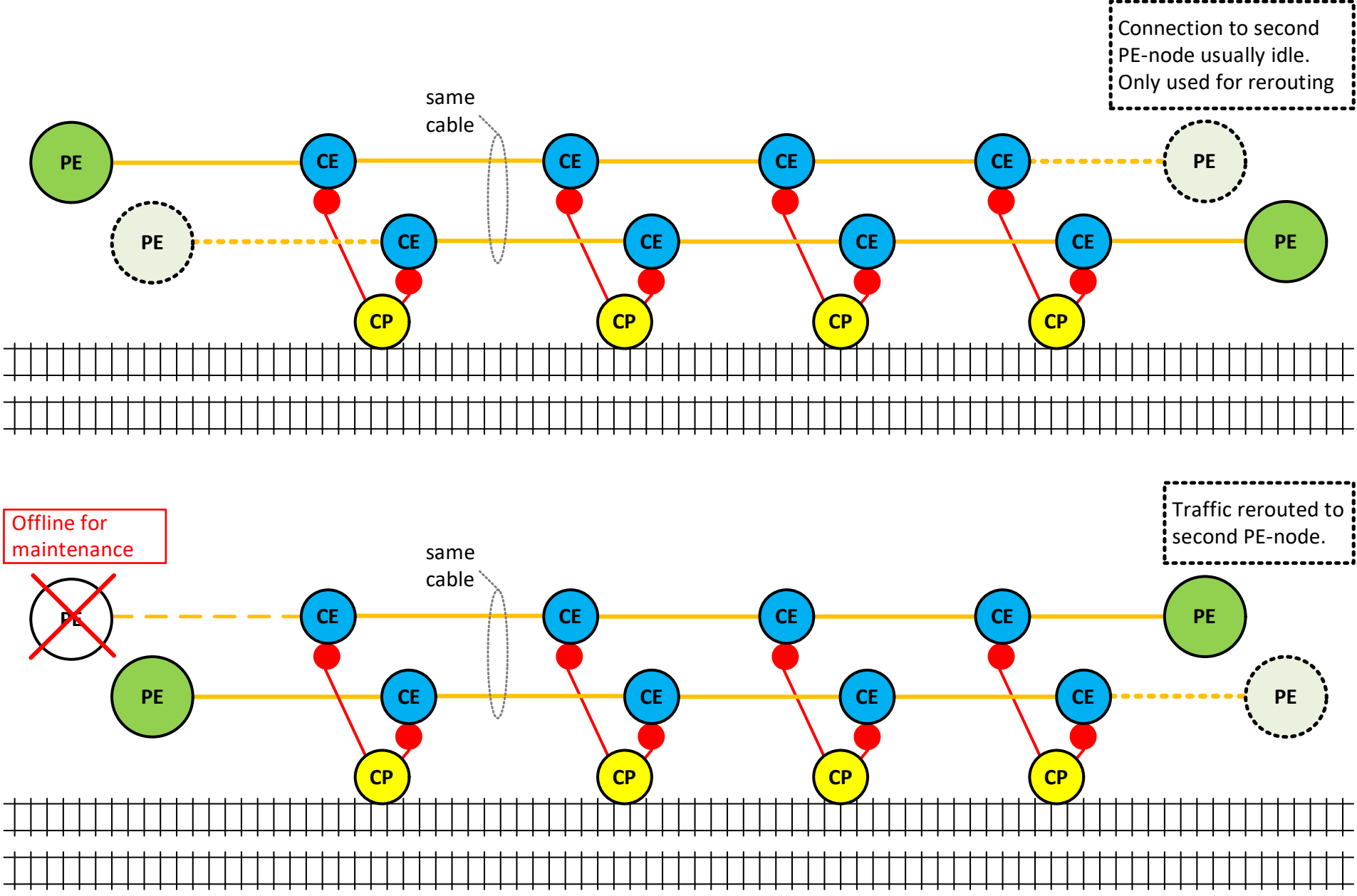


| ID          | Type | Requirement   | JIRA     | V 1.3 (3.A) > V 1.3 (1.A)   |
|-------------|------|---|----------|---|
| Eu.Net.1085 | Info | <div><p>TLS/TCP with combined wire-based and mobile connection of EfeS (fixed mobile access point is used).</p><p>The diagram illustrates a network architecture for EfeS. It shows a 'Cabinet' on the left with components A, B, and TLS. A 'Container/House' in the middle contains components b, c, and PE. A 'BTS' (Base Transceiver Station) is labeled 'e' and 'fix mobile'. A 'Data center' on the right contains components F, H, L, M, and SSP. The diagram uses various icons to represent different types of connections and components, including locks for security and arrows for data flow. The components are interconnected, showing a complex network topology.</p></div> | EUAR-766 | <p><b>Object Text:</b><br/>TLS/TCP with combined wire-based and mobile connection of EfeS (fixed mobile access point is used). <del>Note: May be combined with connection manager.</del><br/><b>a_JIRA-Ticket BL4R4:</b><br/><a href="#">EUAR-766</a></p> |



| ID          | Type | Requirement  | JIRA     | V 1.3 (3.A) > V 1.3 (1.A)  |
|-------------|------|--|----------|--|
| Eu.Net.1086 | Info | <div><p>TLS/TCP with mobile only for EfeS with fixed mobile (access points).</p></div> | EUAR-766 | <p><b>Object Text:</b><br/>TLS/TCP with mobile only for EfeS with fixed mobile (access points). <del>Note: May be combined with connection manager.</del><br/><b>a_JIRA-Ticket BL4R4:</b><br/><a href="#">EUAR-766</a></p> |

| ID          | Type | Requirement  | JIRA     | V 1.3 (3.A) > V 1.3 (1.A)   |
|-------------|------|--|----------|---|
| Eu.Net.1087 | Info | <p>TLS/TCP with mobile only for EfeS with integrated mobile.</p>   | EUAR-766 | <p><b>Object Text:</b><br/>         TLS/TCP with mobile only for EfeS with integrated mobile.<br/> <del>Note: May be combined with connection manager.</del><br/> <b>a_JIRA-Ticket BL4R4:</b><br/> <a href="#">EUAR-766</a></p> |
| Eu.Net.1093 | Head | <b>6.1 Security considerations related to communication paths</b>  |          |   |
| Eu.Net.1094 | Info | The security risk assessment for EULYNX does not include direct communication paths between two EULYNX field element Subsystems. It assumes that all communication paths have a centrally located device as at least one of the two communication partners. This can be e.g. the Subsystem - Electronic Interlocking, the Subsystem - Maintenance and Data Management or adjacent systems. |          |   |
| Eu.Net.1095 | Info | Use of direct communication paths between two EULYNX field element Subsystems requires the consent of the operator, after a review of the security risk analysis.  |          |   |
| Eu.Net.1096 | Info | An example of a communication patch between two EULYNX field element Subsystems can be the exchange of information between two object controllers handling axle counters.  |          |   |
| Eu.Net.1097 | Info | <p>Measures addressing security hazards may be needed to ensure compliance with the security risk assessment for EULYNX. This may include e.g.:</p> <ul style="list-style-type: none"> <li>• Protocol stack used for the communication</li> <li>• Hardening of the communication partners</li> <li>• Routing of the communication path</li> </ul>  |          |   |
| Eu.Net.1049 | Head | <b>7 Responsibilities</b>  |          |   |
| Eu.Net.1050 | Info | The Subsystem - Communication System plays an important role in the EULYNX architecture of a signalling system.  |          |   |
| Eu.Net.1051 | Info | The signalling system logically falls under the responsibility of the signalling department of an IM.  |          |   |
| Eu.Net.1052 | Info | The data network(s) that implement the Subsystem - Communication System usually fall under the responsibility of the communication department of an IM.  |          |   |
| Eu.Net.1053 | Info | To ensure smooth cooperation between these two department, enabling effective design, operation and maintenance of the Subsystem - Communication System, a clear division of responsibilities has to be agreed upon.   |          |   |

| ID          | Type | Requirement  | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|--|------|---------------------------|
| Eu.Net.1054 | Info | The Point of Service - Signalling can be used as a physical limit of responsibilities. Its basic physical and functional properties are defined in the Specification of Point of Service - Signalling [Eu.Doc.100].  |      |                           |
| Eu.Net.1055 | Info | Additional national specifications can be used to complete the requirements contained in [Eu.Doc.100].   |      |                           |
| Eu.Net.1056 | Head | <b>8 Maintenance strategy</b>  |      |                           |
| Eu.Net.1057 | Info | The redundancy that must be included in the network architecture of the Subsystem - Communication System can also be used to facilitate maintenance.   |      |                           |
| Eu.Net.1058 | Info | The network architecture can be designed such that it contains more than minimum level of redundancy that is necessary to provide a redundant and diverse implementation of the PoS-Signalling to communication participants [see Eu.Doc.100].   |      |                           |
| Eu.Net.1059 | Info | A network component can be taken offline for maintenance purposes without limitations, if the network architecture can still provide two diverse paths through the data network(s) that implement the Subsystem - Communication System without that network component.   |      |                           |
| Eu.Net.1060 | Info | Example of rerouting during maintenance, using additional redundancy. <div></div>   |      |                           |
| Eu.Net.1061 | Info | The network architecture probably can't provide sufficient additional redundancy to enable unlimited maintenance for all network components. The desired degree of unlimited maintenance is a complex cost vs. efficiency calculation and should be considered when designing the network.                         |      |                           |
| Eu.Net.1062 | Info | Under appropriate conditions, it is still possible to take network components offline, even if this means it is no longer possible to provide two diverse paths through the data network(s). This can only be allowed when the affected communication participants have a functioning redundant network interface. |      |                           |

| ID          | Type | Requirement   | JIRA | V 1.3 (3.A) > V 1.3 (1.A) |
|-------------|------|---|------|---------------------------|
| Eu.Net.1063 | Info | An analysis that takes into account the national specifications for availability of the PoS-Signalling will define the acceptable boundary conditions for such network components offline.  |      |                           |
| Eu.Net.1064 | Info | Examples of boundary conditions can be: <ul style="list-style-type: none"><li>• Limited duration of offline time</li><li>• Offline time only allowed during low traffic periods</li><li>• Offline time only allowed when additional repair teams are on standby</li></ul> |      |                           |