Isode Approach to Data Centric Security using NATO Confidentiality Labels

Isode

The white paper looks at Isode product support for STANAG 4774/4778, and interoperability results. This paper sets out Isode's vision for DCS, showing both current and planned capabilities.

Data Centric Security

Data Centric Security (DCS) essentially means that access to data is controlled by the data. It contrasts with Network Centric Security, where access to a network gives access to data. DCS is seen as vital protection for a modern, secure network. The broad DCS concept is that access to every piece of data is controlled. More details on DCS are provided in the NATO "Data-Centric Security Reference Architecture".

CWIX

Coalition Warrior Interoperability Exercise (CWIX) is the NATO premier annual interoperability testing event, which has performed DCS testing over a number of years. Isode supports partners at CWIX using Isode products. This paper notes interoperability testing results for CWIX25 and describes capabilities planned for CWIX26.

Security Labels and DCS

DCS needs a flexible mechanism to control access to data which works in a large scale federated environment. Security Labelling provides this mechanism and is central to DCS. The model of security labelling has been well established for physical documents. Electronic security labels clearly identify the rights needed to access associated data.

Details on electronic security labels and their use is provided in the Isode white paper "Access Control using Security Labels & Security Clearance".

NATO Labelling

For DCS to work effectively, it is necessary to have a widely adopted security label standard. NATO is moving to mandate use of NATO Confidentiality Labels specified in STANAG 4774 "CONFIDENTIALITY METADATA LABEL SYNTAX", published as ADatP-4774. Isode anticipates that STANAG 4774 will be widely adopted, and this paper is primarily focused on STANAG 4774, which is expected to rapidly replace older security label standards.

STANAG 4774 is based on the SDN.801c model developed by NSA. This leads to a flexible security label structure with classification (Secret, Top Secret, etc) plus an extensible category mechanism that allows a security policy to associate information with a label. For example, the "Additional Sensitivity" restrictive category in the NATO policy allows indications such as ATOMAL, which restricts access to those cleared for atomic information access; the permissive category "Release To" allows distribution to other domains.

This is an example security label following the policy of CWIX 2025:

```
<ConfidentialityLabel xmlns="urn:nato:stanag:4774:confidentialitymetadatalabel:1:0"
ReviewDateTime="2034-04-18T09:26:56Z">

    <ConfidentialityInformation>
```

```
        <PolicyIdentifier
URI="urn:oid:1.3.6.1.4.1.31778.102.25">CWIX25</PolicyIdentifier>

        <Classification>SECRET</Classification>

        <Category URI="urn:oid:1.3.6.1.4.1.31778.103.15" Type="PERMISSIVE"
TagName="Releasable To">

            <GenericValue>AUS</GenericValue>

        </Category>

    </ConfidentialityInformation>

    <CreationDateTime>2025-04-18T09:27:52Z</CreationDateTime>

</ConfidentialityLabel>
```

Some points to note:

1. This label is XML-encoded, noting that STANAG 4774 supports other encodings, including JSON and CBOR.
2. The label contains label lifecycle information (creation data and review date), which is a key feature of STANAG 4774.
3. The security policy, which defines label structure is identified by an object identifier (globally unique reference) and a string ("CWIX25").
4. The security classification is SECRET.
5. The CWIX 2025 policy has one security category (releasable to). This label shows releasable to Australia (AUS).

Access Control

Access Control using security labels is provided by checking a security label against a security clearance in the context of a security policy. Further details are provided in the white paper referenced above.

Use of this access control is fundamental to DCS and control of which users can access information. For messaging and XMPP, this is expected to be enforced by servers and cross domain. Clients may also be access control aware, which is considered as "capability checking" rather than "security enforcement" provided by servers. Examples:

1. Ensure that messages are only delivered to mailboxes with clearance matching message label.
2. In an XMPP MUC room, to control that messages with a security label are only sent to users with matching message clearance.
3. When messages (email, military messaging or XMPP) are sent over a channel with a given clearance, that only messages with matching security label are sent.

STANANG 4774 defines a clearance format. Here is an example:

```
<sclr:ConfidentialityClearance
xmlns="urn:nato:stanag:4774:confidentialitymetadatalabel:1:0"
    xmlns:sclr="urn:nato:stanag:4774:confidentialityclearance:1:0">
     <PolicyIdentifier URI="urn:oid:1.3.6.1.4.1.453.25.5.13">NATO</PolicyIdentifier>
   <sclr:ClassificationList>
      <Classification>UNCLASSIFIED</Classification>
      <Classification>RESTRICTED</Classification>
      <Classification>CONFIDENTIAL</Classification>
      <Classification>SECRET</Classification>
      <Classification>TOP SECRET</Classification>
   </sclr:ClassificationList>
      <Category URI="urn:oid:1.3.6.1.4.1.453.25.5.13.1.6" Type="PERMISSIVE"
TagName="Context">
         <GenericValue>EAPC</GenericValue>
      </Category>
   </sclr:ConfidentialityClearance>
```

This label has a value for the permissive category “Context” that constrains message distribution. It can be seen that this syntax has similarities to the label syntax. A key difference is that a label has a single classification, whereas clearance contains a list of classifications.

Labels and Clearances are always compared in the context of a Security Policy specified in a Security Policy Information File (SPIF). Isode uses the industry standard Open XML SPIF. CWIX25 identified some issues with the older 2.1 version, so Isode is moving to 3.0 of Open XML SPIF.

NATO specifications make use of Open XML SPIF, and it is anticipated that NATO will standardize a SPIF format based on Open XML SPIF 3.0.

Security labels can be compared for exact match against other security labels, but not any other type of comparison. This is useful for products such as Isode’s XMPP and messaging cross-domain products, which enable the configuration of a specific list of labels to be allowed through. For most other situations, this method would not be manageable. It is helpful to give each user a single security clearance.

A SPIF specifies how a security label is displayed. Open XML SPIF includes markings for different languages, a standard marking for UIs, and a restricted character marking for use in protocol scenarios such as First Line Of Text (FLOT) marking.

The SPIF controls how labels are matched against security clearances, which is non-trivial. STANAG 4774 refers to this access control check as Confidentiality Metadata-Based Access Control (CMBAC – pronounced "come back"). CMBAC is a central DCS capability.

In a local environment, labels, clearances, and SPIFs all have the same policy. There is a need to deal with labels with other policies, which is handled by "equivalences" in the SPIF, which configures how to map other labels to local ones. This mapping is particularly important for mapping policy in cross-domain systems.

Label Binding

It is important to explicitly associate security labels and other meta-data with data being handed. STANAG 4778 "METADATA BINDING MECHANISM" formalizes this binding for STANAG 4774 labels and other data such as meta data specified in STANAG 5636. STANAG 4778 specifies generic mechanisms, with specific bindings for a number of data formats and protocols. The bindings of most interest to Isode are for XMPP and SMTP, which are discussed later.

STANAG 4778 allows association of multiple labels with data and can associate labels with different parts of the information – an approach historically termed "portion marking". This is important in more complex scenarios when associating a single label with the entire object does not suffice.

As well as defining the basic binding, STANAG 4778 provides an option for cryptographic binding using digital signature mechanisms. This binding provides digital signature verification, which is important to validate:

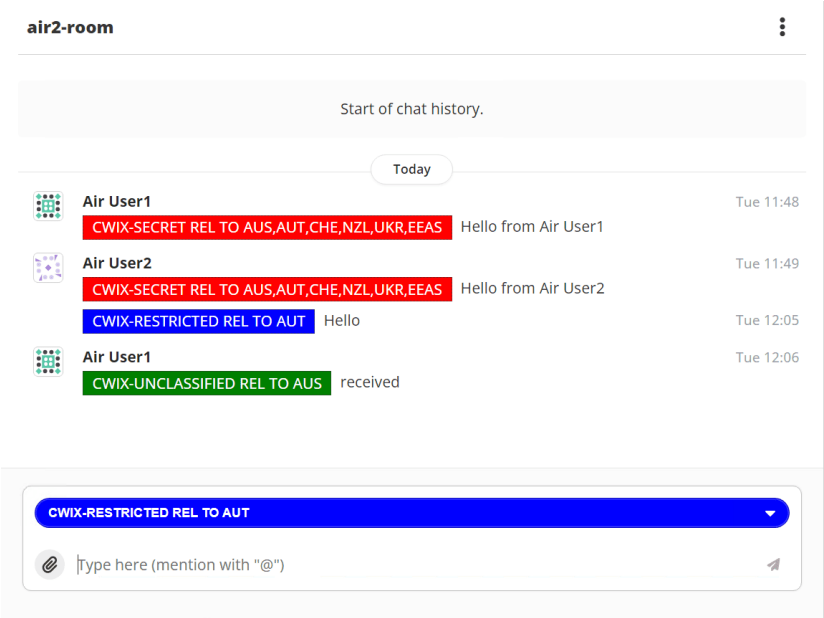
- That a valid label is provided.
- That the label is correctly associated with the data
- That the data has not been modified since the label binding (content integrity).

The digital signature can usually also be used to validate the originator.

Isode STANAG 4774 Infrastructure

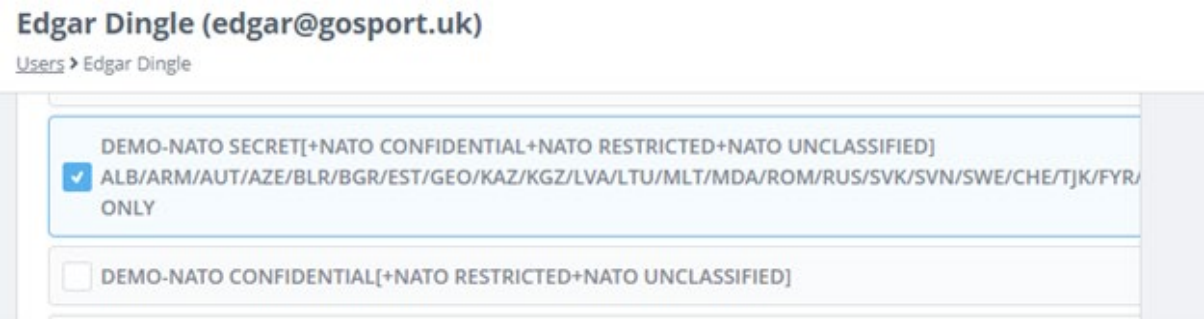
Isode provides a number of applications with STANAG 4774 support. These all rely on a common infrastructure. For a given deployment of STANAG 4774, label structure is specified by a security policy. More information is provided in the Isode white paper "Creating and Managing a Security Label Policy". A security policy is represented as a Security Policy Information File (SPIF). Isode uses the Open XML SPIF format, which is described above.

SPIFs are too complex to manipulate manually, and so an editor is important. Isode provides a SPIF editor as part of its product set. This is shown below, editing the CWIX 2025 SPIF. It can handle more complex SPIFs.



SPIFs managed by SPIF Editor are used by Isode applications to create and validate STANAG 4774 labels. The SPIF editor can also create STANAG 4774 label catalogs from a SPIF, including setting the review date and setting the default label. The catalog is useful for product configuration tools to conveniently set labels. It is also important for end-user UIs to allow convenient drop-down selection of commonly used labels.

SPIF Editor can also generate STANAG 4774 clearance catalogs for use with Isode tools, for example, with Cobalt provisioning to assign a clearance to a user. A screenshot of Cobalt doing this is shown below:



A sample catalog with two STANAG 4774 labels following CWIX 2025 SPIF is shown below:

```
<catalog xmlns="urn:xmpp:sec-label:catalog:2">
   <item selector="CWIX25|SECRET">
      <securitylabel xmlns="urn:xmpp:sec-label:0">
         <displaymarking bgcolor="red" fgcolor="white">CWIX-
SECRET</displaymarking>
         <label>
            <ConfidentialityLabel
xmlns="urn:nato:stanag:4774:confidentialitymetadatalabel:1:0" ReviewDateTime="2036-
05-19T11:51:02Z">
               <ConfidentialityInformation>
```

```
                <PolicyIdentifier
URI="urn:oid:1.3.6.1.4.1.31778.102.25">CWIX25</PolicyIdentifier>
                <Classification>SECRET</Classification>
            </ConfidentialityInformation>
            <CreationDateTime>2025-05-19T11:52:10Z</CreationDateTime>
        </ConfidentialityLabel>
    </label>
  </securitylabel>
</item>
<item selector="CWIX25|SECRET|REL TO  AUS">
  <securitylabel xmlns="urn:xmpp:sec-label:0">
    <displaymarking bgcolor="red" fgcolor="white">CWIX-UNCLASSIFIED REL TO
AUS</displaymarking>
    <label>
        <ConfidentialityLabel
xmlns="urn:nato:stanag:4774:confidentialitymetadatalabel:1:0" ReviewDateTime="2036-
05-19T11:51:02Z">
            <ConfidentialityInformation>
                <PolicyIdentifier
URI="urn:oid:1.3.6.1.4.1.31778.102.25">CWIX25</PolicyIdentifier>
                <Classification>SECRET</Classification>
                <Category URI="urn:oid:1.3.6.1.4.1.31778.103.15" Type="PERMISSIVE"
TagName="Releasable To">
                    <GenericValue>AUS</GenericValue>
                </Category>
            </ConfidentialityInformation>
            <CreationDateTime>2025-05-19T11:52:10Z</CreationDateTime>
        </ConfidentialityLabel>
    </label>
  </securitylabel>
</item>
</catalog>
```


Things to note:

1. The catalog follows the format specified in XEP-0258. There was no requirement to design a new format, as this one can be used with STANAG 4774 labels.
2. Each label has a Selector, which is a short string suitable for use in a drop-down menu selection. This value can be edited when creating the catalog.
3. Each label has a display marking, derived from the SPIF, comprising a string and a colour. This enables UIs to correctly display the labels.

Application Integration Points

There are three points in the application architecture where STANAG 4774 support is relevant. These are common to both messaging and XMPP:

1. Client support is central and critical. There are two basic functions needed:

- Assigning labels to messages, either by selection from the catalog or by label creation.
- Display of received labels. The labels are transferred in protocol as XML. The client must use a SPIF to validate and correctly display a label.
- The client may also check recipient clearance to prevent the sender from sending a message to a recipient not allowed to receive it (capability checking).

2. Server support is also important, and three functions may be provided:
    - Authorisation of local delivery. The server is expected to perform ACDF on arriving messages and only deliver messages to users with the right to see them. This is a key enforcement point for DCS.
    - Authorisation of onward transfer, to prevent transfer to recipients not allowed to receive the message or over channels without suitable clearance.
    - Label transformation. This might include mapping to legacy label formats or mapping to a different security policy. The latter is often important in conjunction with cross-domain.
3. Cross domain. When transferring messages across domains, secure validation of security labels is a vital check.

Isode Messaging Support

Isode provides STANAG 4774 support for both email and formal military messaging. This follows the SMTP Binding specified in ADatP-4778.2 “PROFILES FOR BINDING METADATA TO A DATA OBJECT”.

Harrier

Harrier is Isode’s messaging client, which provides full military messaging support, but may also be used for email. Primary selection of label is from a drop-down selection based on two catalogs:

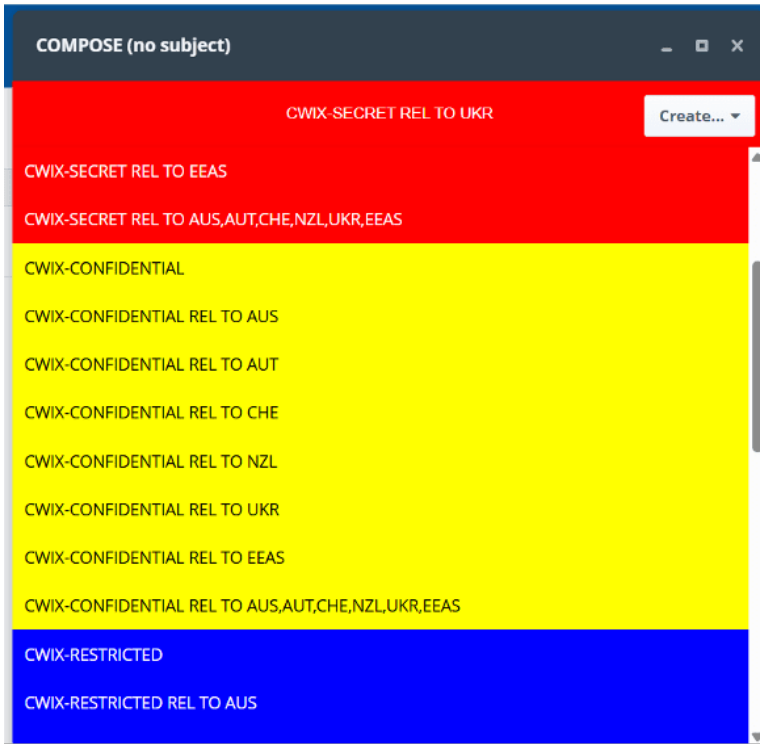
- A system catalog of labels available to all users and roles; and
- A personal catalog of additional labels that can be managed from Harrier.

An example using a CWIX 2025 catalog is shown below:

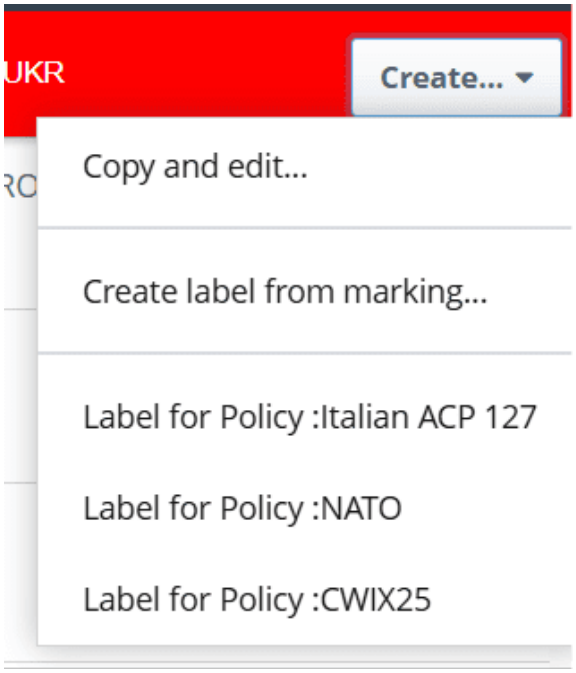
```
<catalog xmlns="urn:xmpp:sec-label:catalog:2">
   <item selector="CWIX25|SECRET">
      <securitylabel xmlns="urn:xmpp:sec-label:0">
         <displaymarking bgcolor="red" fgcolor="white">CWIX-
SECRET</displaymarking>
         <label>
            <ConfidentialityLabel
xmlns="urn:nato:stanag:4774:confidentialitymetadatalabel:1:0" ReviewDateTime="2034-
04-18T09:26:56Z">
               <ConfidentialityInformation>
```

```
                <PolicyIdentifier
URI="urn:oid:1.3.6.1.4.1.31778.102.25">CWIX25</PolicyIdentifier>
                <Classification>SECRET</Classification>
            </ConfidentialityInformation>
            <CreationDateTime>2025-04-18T09:27:52Z</CreationDateTime>
        </ConfidentialityLabel>
    </label>
  </securitylabel>
</item>
<item selector="CWIX25|UNCLASSIFIED|REL TO
AUS/AUT/CHE/GEO/MOL/NZL/TUN/UKR/EEAS">
  <securitylabel xmlns="urn:xmpp:sec-label:0">
    <displaymarking bgcolor="green" fgcolor="white">CWIX-UNCLASSIFIED REL TO
AUS,AUT,CHE,GEO,MOL,NZL,TUN,UKR,EEAS</displaymarking>
    <label>
        <ConfidentialityLabel
xmlns="urn:nato:stanag:4774:confidentialitymetadatalabel:1:0" ReviewDateTime="2034-
04-18T09:26:56Z">
            <ConfidentialityInformation>
                <PolicyIdentifier
URI="urn:oid:1.3.6.1.4.1.31778.102.25">CWIX25</PolicyIdentifier>
                <Classification>UNCLASSIFIED</Classification>
                <Category URI="urn:oid:1.3.6.1.4.1.31778.103.15" Type="PERMISSIVE"
TagName="Releasable To">
                    <GenericValue>AUS</GenericValue>
                    <GenericValue>AUT</GenericValue>
                    <GenericValue>GEO</GenericValue>
                    <GenericValue>MOL</GenericValue>
                    <GenericValue>NZL</GenericValue>
                    <GenericValue>CHE</GenericValue>
                    <GenericValue>TUN</GenericValue>
                    <GenericValue>UKR</GenericValue>
                    <GenericValue>EEAS</GenericValue>
                </Category>
            </ConfidentialityInformation>
            <CreationDateTime>2025-04-18T09:27:52Z</CreationDateTime>
        </ConfidentialityLabel>
    </label>
  </securitylabel>
</item>
</catalog>
```

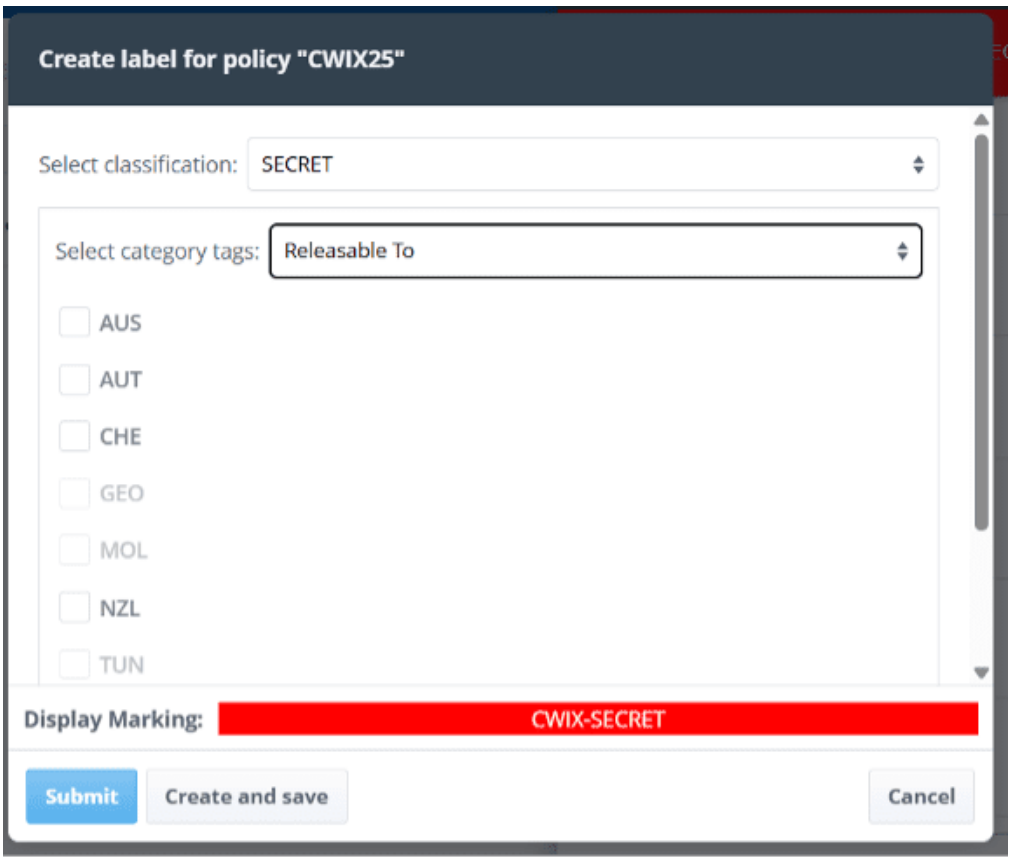

You can see the available security labels a user can set via the dropdown menu when composing a new message within Harrier. The image below shows the security label options created for CWIX25.



If the desired label is not in the catalog drop down, any valid label can be created. The user is given a number of options to create the label, including selection of any security policy that Harrier is aware of:



When a policy is selected, a straightforward UI is presented to configure the label. The following screenshot is from CWIX 2025 SPIF.



Note:

1. Classification is chosen as SECRET from the drop-down selection.
2. "Releasable To" values are chosen by check box.
3. Some values are greyed out, as these are valid tag values not permitted for use with SECRET.
4. A label can be used once for the current message or also saved in a personal catalog for future use.

Harrier accesses an ACP 133 directory using M-Vault (Isode's Directory Server), to look up recipients and to check clearances (capability checking). Harrier will only allow the selection of labels that the originator is allowed to access. Harrier will only allow sending of messages to recipients cleared to receive the label.

Harrier digitally signs messages using S/MIME, including signing the message header. This provides content integrity checking and securely binds the STANAG 4774 label to the message.

M-Switch

M-Switch security label capabilities are described in detail in the Isode white paper "Security Label Capabilities in M-Switch Products", which will be extended to support STANAG 4774. M-Switch supports a wide range of security label formats, all driven from a core Isode SPIF. It is anticipated that many security label deployments will migrate to STANAG 4774, but some legacy usage, such as ACP 12,7 will be used for a long while. A key M-Switch capability is conversion between STANAG 4774 labels and other label formats.

M-Switch also uses CMBAC checking against security clearances to provide Security Enforcing Functionality (SEF). Key elements of this:

1. Only delivering messages to mailboxes with clearance to receive the label on the message. This is DCS enforcement.
2. Checking messages against clearance of message routes, to prevent inappropriate transfer over a channel not cleared for all traffic.
3. Using security labels and clearances to determine the correct channel, for example to send NATO-labelled messages over channel with NATO crypto and national messages over a channel with national crypto.

M-Switch can also provide protocol conversion with security label mappings. The following mappings are supported:

1. To STANAG 4774 with a different security policy
2. To legacy email, which is sometimes called "half gateway". Label options include:
    1. First Line of Text (FLOT)
    2. RFC 7444 – SIO Label
3. To other military messaging protocols and label formats, in particular:
    1. ACP 127
    2. STANAG 4406

These mappings are critical for supporting multiple domains.

Cross Domain

Isode's messaging cross domain solution is described in the white paper "Cross Domain Military Messaging". The key components from a security label perspective:

1. M-Guard, Isode's XML Guard that provides secure unidirectional validation of XML messages, suitable for use across a domain boundary.
2. Military Messaging Application Profile which specifies XML message formats and checking rules for use with an XML Guard. This includes STANAG 4774 label checking, using exact match of allowed labels.
3. M-Switch Edge, which converts standard messages to the XML messages needed by M-Guard and following the Military Messaging Application Profile.

4. M-Switch providing conversion of STANAG 4774 labels between different policies. This is important cross domain, as typically different security policies will be used in each domain.

This provides secure checking of STANAG 4774 labels in email and military messaging over a cross domain boundary.

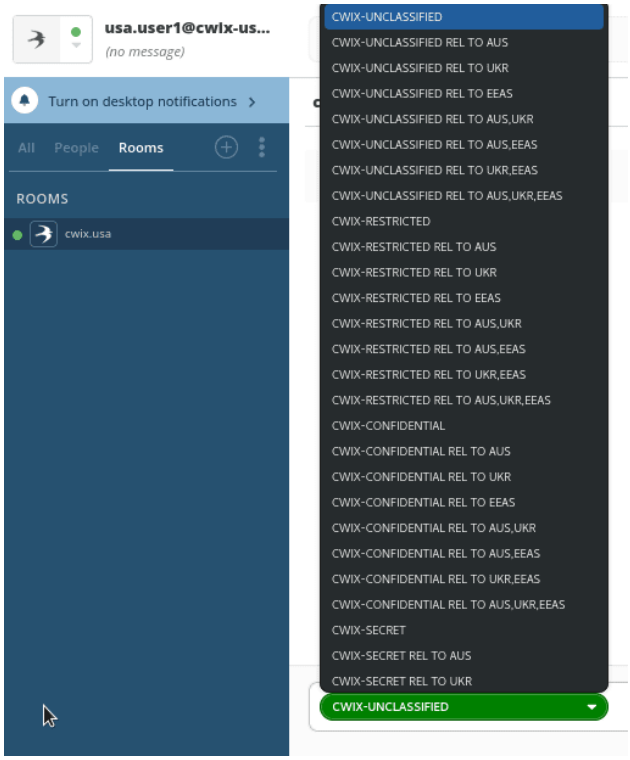
Isode XMPP Support

XMPP is the open standard for presence and chat used by NATO.

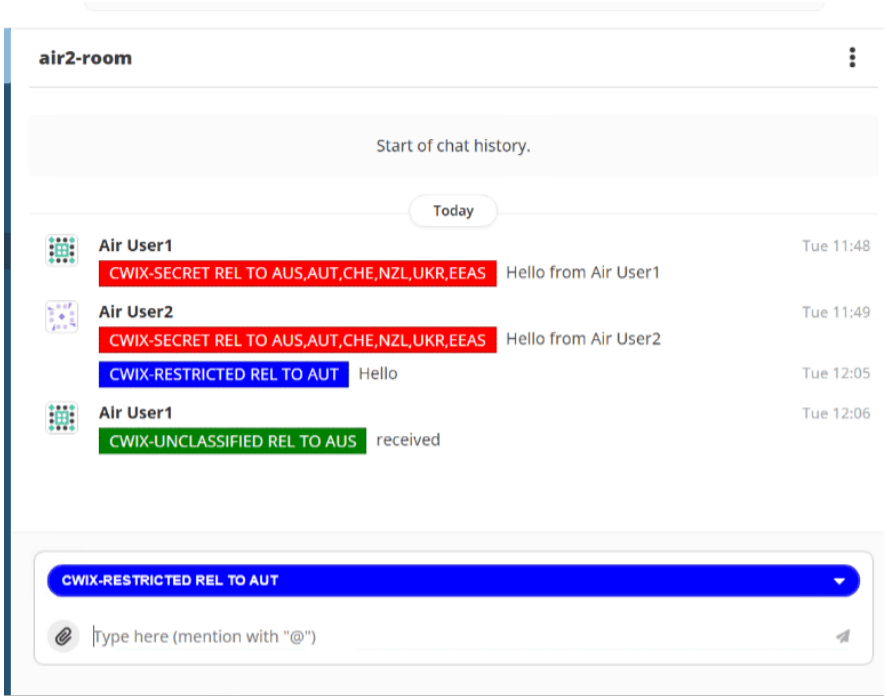
Swift

Historically, Swift has used XEP-0258 "Security Labels in XMPP", which provides a flexible security label mechanism that enables a simple, lightweight client implementation. This approach is not possible with STANAG 4774, which needs support in the client.

Swift uses an Isode STANAG 4774 label catalog to provide a convenient drop-down selection of STANAG 4774 labels. Label selection from a CWIX 2025 catalogue is shown in the following screenshot.



On message reception, Swift uses a configured SPIF to validate incoming labels and generate a correct display marking to present to the user. An example is shown below, which shows different labels in a MUXC room and the label selected to compose a new message.



Swift will also display the Label Display Marking for a MUC room based on the MUC default label configured in M-Link, described below. It also enables a more compact display, as the per-stanza security labels are not shown when the security label matches that for the MUC room. This is described in more detail with M-Link.

M-Link

M-Link security provides flexible security label/security clearance controls using CMBAC described in the Isode white paper "Using Security Labels to Control Message Flow in XMPP Services". Security Labels and Security Clearances can be configured to provide controls at the server, domain, MUC room, and user level. Controls message delivery based on user clearance, provides DCS enforcement. It is planned to extend this capability to support STANAG 4774.

M-Link controls which messages are allowed in a MUC room by use of a security clearance, which is the DCS access control. M-Link can configure a Security Label Display Marking for each MUC room, which is used by Swift. This will generally be configured to match the Security Clearance and provides a helpful user experience.

M-Link can transform security labels, which is useful to map to systems running XEP-0258 and to provide STANAG 4774 policy transformation

Cross Domain

Isode's XMPP cross domain solution is described in the white paper "Isode's XMPP Cross Domain Solution". The key components from a security label perspective:

1. M-Guard, Isode's XML Guard that provides secure unidirectional validation of XML messages, suitable for use across a domain boundary.

2. XMPP Application Profile, which specifies the XMPP standards allowed in stanzas sent over M-Guard and rules to constrain those standards. This includes the XMPP message formats specified in ADatP-4778.2 and rules for STANAG 4774 label checking, using exact match of labels allowed and other options.
3. M-Link Edge, which transfers XMPP stanzas to and from M-Guard. It can also perform STANAG 4774 label conversion between different policies.

This provides secure checking of STANAG 4774 labels in XMPP over a cross domain boundary.

Product Status / Plans

This section lists Isode products which have or have planned STANAG 4774 support.

Product	**Version/Status**
SPIF Editor	Shipped with M-Vault 19.1
Harrier	Planned for Harrier 4.2 (Q1 2026)
M-Switch	Planned for M-Switch 19.2 (Q1 2026)
M-Switch Edge (for mapping to M-Guard)	M-Switch Edge 19.1
MMHS Application Profile	Profile Available to run with M-Guard 1.5
Swift	Planned for Q1 2026
M-Link	Planned for M-Link 19.5 (preview in Q2 2026)
XMPP Application Profile	Profile Available to run with M-Guard 1.5

CWIX26 Check list

Isode is anticipating that partners will be using some or all Isode DCS capabilities for CWIX 2026. This section gives a list of things that are available or expected to be available to partners.

- SPIF Editor (19.2 – planned)
    - Support for Open XML SPIF 3.0 and CWIX26 SPIF
- Cobalt (1.6 – planned) – provisioning
    - Provision users with STANG 4774 clearances
- Swift (6.2 – update planned)
    - STANAG 4774 label selection from catalog

    - SPIF driven display of any label valid in the configured policy
- M-Link (19.5 – planned)
    - CMBAC control of message stanzas at Server, Domain and MUC level
    - CMBAC control of user access to server, domain and MUC
    - CMBAC generation of XEP-0258 catalogs so that clients only see valid labels
    - Mapping to XEP-0258 system
    - STANAG 4774 mapping to different policies
- M-Link Edge (19.4) and M-Guard (1.5) – XMPP cross-domain
    - Enforcement of STANAG 4774 label presence
    - Allow only stanzas with STANAG 4774 labels that match the configured list
- Harrier (4.2 – planned)
    - STANAG 4774 label selection from the system and user catalog
    - Creation of custom
    - SPIF-driven display of any label valid in the configured policy

Conclusion

This white paper has shown how NATO Labelling, including STANAG 4774 Confidentiality Labels are central to providing DCS and shows current and planned support in the Isode product set.

Isode

www.isode.com

14 Castle Mews, Hampton
Middlesex, TW12 2NP

Secure, Seamless Communication Solutions